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REVISED FINAL DESIGN
SUPPORT PLANS

ON-SITE DISPOSAL FACILITY

United States Department of Energy
Fernald Environmental Management Project
Fernald, Ohio

prepared by

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under

Fluor Fernald, Inc.
Contract No. 95PS005028

MAY 2000

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BORROW AREA MANAGEMENT AND RESTORATION PLAN

ON-SITE DISPOSAL FACILITY

20100-PL-0003
Revision 1D
May 2000

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INFORMATION ONLY

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FEMP OSDF-BAM&RP
20100-PL-0003
Rev. 1D, May 2000

BORROW AREA MANAGEMENT AND RESTORATION PLAN

ON-SITE DISPOSAL FACILITY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

REVISION 1D
MAY 2000
20100-PL-0003

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ACRONYM LIST

APZ	Acceptable Permeability Zone
ARAR	Applicable or Relevant and Appropriate Requirements
BAMR	Borrow Area Management and Restoration
BASR	Borrow Area Strategy Report
CQA	Construction Quality Assurance
CQC	Construction Quality Control
DCP	Design Criteria Package
DOE	United States Department of Energy
EFBA	East Field Borrow Area
FEMP	Fernald Environmental Management Project
FRL	Final Remediation Level
NRR	Natural Resource Restoration
OSDF	On-Site Disposal Facility
OU2	Operable Unit 2
ROD	Record of Decision
SWMEC	Surface-Water Management and Erosion Control
TBC	To Be Considered Criteria
WAC	Waste Acceptance Criteria

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1.0 INTRODUCTION

1.1 Overview

This *Borrow Area Management and Restoration Plan* (BAMR Plan) presents the requirements for the management and interim restoration activities that will be performed to obtain on-site borrow soils for construction of the liner system, cover system and other components of the On-Site Disposal Facility (OSDF) at the Fernald Environmental Management Project (FEMP), Fernald, Ohio. This BAMR Plan also presents a plan to implement the strategy outlined in the *"On-Site Disposal Facility Borrow Area Strategy Report"* [DOE, 2000], and herein referenced as the BASR. The on-site borrow soils will be obtained from the East Field Borrow Area, herein referenced as the EFBA or the borrow area, located in the southeast corner of the FEMP as shown on Figure 1-1. The EFBA consists of both an east side and a west side. The east side is located east of the South Entrance Road; the west side is located west of the South Entrance Road. This BAMR Plan provides details for management and restoration at the southern portion of the east side of the EFBA, as this area has been designated as the primary borrow source area. The west side of the EFBA and the northern portion of the east side of the EFBA are identified as contingency borrow areas in this BAMR Plan and will be developed only if field conditions dictate that additional borrow source areas need to be developed.

The BAMR Plan addresses management and interim restoration activities at the EFBA throughout construction, management, and closure phases of the OSDF, as prescribed in the *"Final Record of Decision for Remedial Actions at Operable Unit 2"* (OU2 ROD) [DOE, 1995]. This BAMR Plan was used to prepare the Technical Specifications and Construction Drawings. These latter project documents identify specific requirements governing the activities related to the development and restoration of the borrow area. The BAMR Plan does not address maintenance activities beyond interim restoration of the borrow area. If contradictions between the BAMR Plan and other contract documents exist, the contract documents, including the Technical Specifications and Construction Drawings, will take precedence.

1.2 Project Description

The OSDF is being constructed to permanently contain impacted materials derived from remediation of the operable units at the FEMP. Impacted material destined for OSDF disposal will be required to meet OSDF waste acceptance criteria (WAC) as defined in the OU2 ROD.

The estimated total volume of impacted material destined for OSDF disposal is approximately 2.5 million cubic yards. Approximately 80 percent of this material is soil, with the remainder consisting of building demolition rubble, fly ash, lime sludge, municipal solid waste, and small quantities of miscellaneous other materials.

The design approach for the OSDF is presented in the *"Final Remedial Design Work Plan for Remedial Actions at Operable Unit 2"* [DOE, 1995b]. The approved OSDF design is presented in the *"Final Design Package, On-Site Disposal Facility"* [GeoSyntec, 1997 (Rev. 0)]. The design of the OSDF includes a liner system, impacted control placement, final cover system, leachate management system, surface-water management system, and other ancillary features.

The earthwork activities, construction of liner system, impacted material placement activities, surface-water management system construction, and leachate management system construction for the OSDF began in 1997 and is currently in progress. The OSDF has been designed to be constructed, filled, and closed in phases. This BAMR Plan presents a plan to develop the borrow area in phases to support the construction, management and closure phases of the OSDF.

1.3 Scope of the BAMR Plan

The scope of this BAMR Plan is to provide requirements for management and interim restoration of the borrow area to obtain soil materials needed for OSDF construction. Management of the borrow area includes all of the activities to develop the borrow area including: planning, surface-water management and erosion control, clearing, grubbing, topsoil stripping, pre-conformance testing, excavation, and stockpiling. Interim restoration is addressed in this BAMR Plan and consists of grading and establishing vegetation after borrow excavation is completed in each subarea.

1.4 BAMR Plan Organization

The remainder of this BAMR Plan is organized as follows:

- design requirements applicable to this BAMR Plan are presented in Section 2.0;
- the existing conditions in the borrow area, use of borrow soils, and related geotechnical data are described in Section 3.0;

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- borrow area management is described in Section 4.0;
- borrow area restoration is described in Section 5.0; and
- references used in this BAMR Plan are presented in Section 6.0.

The figures identified in this BAMR Plan are compiled in the tabbed section at the end of the narrative report. Supporting calculations related to borrow area management and interim restoration are presented in the *OSDF Phase III Borrow Area Stockpile Area Capacity Calculations* [GeoSyntec, 2000] and *OSDF Phase III Borrow Area Stockpile Area Development Subarea Volume Verification* [GeoSyntec, 2000].

1.5 Related Documents

Several other documents have been prepared for the OSDF that contain information relevant to this BAMR Plan. Other documents which may help the Contractor and which are of direct relevance to this BAMR Plan are listed below along with a brief statement of the relationship of the referenced document to this BAMR Plan. Full reference citations are provided in Section 6 of this BAMR Plan.

- *"Design Criteria Package, On-Site Disposal Facility"* [GeoSyntec, 2000a]: provides a summary and discussion of design parameters required for the OSDF design;
- *"On-Site Disposal Facility Borrow Area Strategy Report"* [DOE, 2000]: provides borrow quantity estimates for subareas within the borrow area and the strategy for developing, managing, and restoring the borrow area;
- *"Final Design Package, On-Site Disposal Facility"* [GeoSyntec, 1997]: provides final design drawings and specifications for the OSDF;
- *"Construction Quality Assurance Plan (CQA), On-Site Disposal Facility"* [GeoSyntec, 2000c]: provides soil construction quality control (CQC) requirements, including pre-conformance testing, testing standards and frequencies that will be implemented to evaluate soils from the borrow area;

- *"Surface-Water Management and Erosion Control Plan, On-Site Disposal Facility"* [GeoSyntec, 2000]: includes requirement for surface-water management and erosion and sedimentation controls for the borrow area;

- *"Geotechnical Investigation Report, On-Site Disposal Facility"* [(Parsons, 1995 (Rev. 0)]: provides geotechnical data for subsurface soils within the OSDF.

- *"Geotechnical Data and Evaluation Report for East and South Field Borrow Area"* [Parsons, 1996]: provides geotechnical data for the EFBA.

- *"OSDF Phase III Borrow Area Stockpile Area Capacity Calculations"* [GeoSyntec, 2000]: provides calculations regarding the borrow area stockpile area capacity.

- *"OSDF Phase III Borrow Area Stockpile Area Development Subarea Volume Verification"* [GeoSyntec, 2000]: provides calculations regarding the borrow area stockpile subarea volumes.

- *"Test Pad Program Final Report, On-Site Disposal Facility"* [GeoSyntec, 1997]: presents results on on-site test pad program.

2.0 APPLICABLE REQUIREMENTS

2.1 Overview

Requirements applicable to borrow area management and restoration are contained in the "*Design Criteria Package, On-Site Disposal Facility*" (DCP) [GeoSyntec, 2000] for the OSDF and in the "*On-Site Disposal Facility Borrow Area Strategy Report*" (BASR) [DOE, 2000]. If any regulatory requirements were applicable to the borrow area, they would take the form of applicable or relevant and appropriate requirements (ARARs) and to be considered criteria (TBCs) as determined by the Record of Decision for each of the various FEMP operable units. Although there are no ARARs, TBCs, or other functional requirements which are related to the management and restoration of the borrow area, regulatory requirements will be applicable for the following construction activities in the EFBA: (i) fugitive dust emissions; (ii) surface-water management; (iii) spill prevention; and (iv) FEMP site procedures (including access to certified areas).

A summary of the applicable requirements related to the borrow area as identified in the DCP is presented in the following section. A brief summary of applicable requirements in the BASR is also presented in the subsequent section. Sections 3, 4 and 5 of this BAMR Plan provide a description of relevant requirements provided in both the DCP and the BASR.

2.2 Design Criteria in the DCP

The DCP identifies general design criteria for the OSDF. The design criteria that the Contractor should follow in managing and restoring the borrow area include:

- the borrow area should be located in the EFBA and developed in a manner that provides easy ingress and egress while not encroaching or interfering with on any existing structures and/or easements;
- the borrow area should be developed in a manner that requires minimal additional earthwork after borrow activities are complete to achieve the required restoration grades;
- the borrow area should be developed incrementally as soil is needed for construction and closure phases of the OSDF; this incremental development should include a soil volume

required for OSDF construction and closure in that construction year plus an additional 15 percent as a contingency volume.

- the borrow area should be as deep as possible so that the size of the borrow area disturbed at any time is minimized;
- the borrow area should not extend vertically into the gray till unit except as noted in the BASR;
- brown till should be excavated, screened, and processed for clay liner and cap material; both brown till and gray till will be excavated for use as ordinary borrow;
- the borrow area should be developed in subareas within the borrow area such that excavation and interim restoration can be completed within a single construction season;
- interim restoration should be performed incrementally, after excavation in each subarea is completed;
- surface-water management and erosion controls should be implemented in the borrow area prior to excavation, during borrow activities, and in conjunction with interim restoration;
- the borrow area should be developed in a manner that produces consistent materials for construction of the OSDF; this development should utilize the existing topography to provide surface-water management by controlling surface-water runoff and runon and preventing surface-water from ponding in the active borrow area;
- processing of borrow area soils, (including blending, screening, and moisture conditioning, should be conducted in the borrow area or any temporary stockpile area in accordance with the applicable requirements of the Technical Specifications;
- prior to the start of construction in the borrow area, the following activities should be performed:
  - install construction fence;
  - establish surface-water management and erosion controls for the borrow area;

- establish access controls for the borrow area;
- establish soil processing facilities as required, and;
- establish topsoil and ordinary borrow stockpiles at the South Stockpile Area for later use during OSDF construction;

- intermediate borrow area slopes should be excavated and maintained at a safe slope;
- design of erosion control measures and permanent channels, culverts, riprap, and sedimentation basins should be in accordance with appropriate Technical Specification and Construction Drawings;
- at the completion of borrow excavation, the Contractor should proceed with interim restoration by grading and establishing vegetation on disturbed areas; the borrow area should be restored to a condition that is consistent with the geomorphological character of the area; if excavation in a specific subarea is complete, the slopes in the subarea should be no steeper than 5 horizontal to 1 vertical (5H:1V); and
- surface-water runoff should be managed so that, after interim restoration of the borrow area, any effects of erosion in the borrow area are minimized.

2.3 Requirements in the BASR

The BASR describes the overall strategy for the development, management and interim restoration of soil borrow areas needed to support OSDF construction activities. The following is a summary of the requirements which are related to the borrow area management strategy specifically identified in the BASR and not explicitly recognized in the DCP. The Contractor is responsible for performing work which meet these requirements:

- based on the current construction schedule, the material for the clay liner and cap will be excavated, screened and stockpiled one year before its placement in the OSDF;
- a minimum of 12 feet of gray till will be maintained below the OSDF and the borrow-area; to accomplish this, no borrow area excavation will be performed in areas where the gray till is estimated to be less than 15 feet thick;

- required volumes of clay liner and cap material, ordinary borrow, and topsoil are based on the soil factors experienced during the construction of OSDF Cells 1, 2 and 3; these estimates may be adjusted in the future based on the soil factors experienced during future OSDF construction.

- non-conforming clay liner and cap material will be stockpiled and may be used as ordinary borrow; the clayey rockfill generated by screening will be stockpiled within the excavation subarea and used primarily for interim restoration of the subarea;

- ordinary borrow will be obtained from the OSDF footprint and supplemented with material from the EFBA;

- the Contractor will manage the soil stockpiles in accordance with the Technical Specifications and will maintain access both to/from and within the borrow area;

- once interim restoration is performed, the subarea will not be re-excavated for additional borrow unless the borrow area needs are changed due to unforeseen conditions;

- topsoil and ordinary borrow material are currently planned to be stockpiled in the South Stockpile Area;

- clay liner and cap material placed in stockpiles will be graded to a stable configuration; if the stockpile is not used (or anticipated to be used) within 45 days, it will be sealed using heavy equipment as approved by the Construction Manager and stabilized using a mulch binder in accordance with the Technical Specifications for the crusting agent;

- pre-conformance testing will be conducted before material is excavated from the borrow area; the testing includes geotechnial tests to determine if the material can meet the pre-conformance requirements for clay liner and cap material;

- the EFBA will be developed in eight subareas; limits and number of subareas may be revised based on the field conditions and construction schedule.

3.0 BORROW AREA DESCRIPTION

3.1 Existing Conditions

The east side of the EFBA described in the BAMR Plan is located in the southeast portion of the FEMP, south of the OSDF, as shown on Figure 1-1. The east side of the EFBA is bounded to the north by the existing 24-inch diameter effluent line from the FEMP advanced wastewater treatment plant, to the west by the South Entrance Road, to the south by Willey Road, and to the east by the Mid-Valley pipeline easement. The size of the east side of the EFBA is approximately 50 acres.

The pre-development topography within the borrow area is gently sloping with surface elevations ranging from 606 feet to 575 feet. Pre-development surface-water flow is generally from east to west along slopes ranging from approximately one to eight percent. Surface-water runoff crosses the South Entrance Road via three culverts and discharges ultimately to Paddys Run.

Approximately 10 acres of the borrow area have already been partially developed to obtain soil for construction of the liner system for Cells 2 and 3 at the OSDF. Several stockpiles and other disturbed areas currently exist within the borrow area. A borrow area sedimentation basin has been constructed in the northwest portion of the EFBA and will be expanded as part of borrow subarea development. This basin is designated as the Borrow Area Sedimentation Basin and accepts runoff from the surrounding catchment areas and potentially disturbed subareas of the borrow area.

The areas that have not been disturbed remain covered with topsoil and vegetation. The existing vegetative cover within these areas consists of long grasses in good condition. Generally, the subsurface material immediately below the topsoil consists of brown till to a depth of 10 to 20 feet. A 10- to 20-foot thick gray till stratum is located below the brown till stratum. The sand and gravel units of the Great Miami Aquifer are located beneath the gray till stratum. Excavation in the borrow area should occur only in the topsoil, brown till and gray till, as described in the remainder of this document. A minimum 12-foot thick layer of gray till should be maintained below the borrow area. Borrow area base grading plans presented in this BAMR Plan were developed to maintain this thickness of gray till.

Perched groundwater has been encountered in the borrow area soils at depths which range from approximately 5 to 15 feet below the existing ground surface. Perched groundwater is stored in sand and gravel lenses in the till units. Due to the stratigraphy of these lenses, the perched groundwater potentiometric levels may locally approach the ground surface after periods of heavy precipitation.

3.2 On-Site Borrow Material

3.2.1 Uses for Borrow Area Soils

Clay liner material for Cell 1 and some of the clay liner material for Cell 2 were obtained from the respective cell excavation areas and the Cell 3 excavation area. Most of the clay liner material for Cell 2 and all of the clay liner material for Cell 3 were obtained from the EFBA. Upcoming construction activities at the OSDF will utilize soils excavated from the cell excavation and the borrow area. These materials will be used primarily to construct the clay liner component of the OSDF liner system for the remaining cells of the OSDF (i.e., Cell 4 and beyond) and the OSDF final cover system for all cells. Material excavated from the borrow area may also be used as fill material for the OSDF Sedimentation Basin and in construction of temporary and permanent roads, as well as in other site work construction activities.

Four different types of material will be obtained from the borrow area for construction of the OSDF: (i) clay liner and cap material; (ii) ordinary borrow material; (iii) topsoil; and (iv) clayey rockfill from the soil screening operation. A brief discussion follows regarding the use of these different materials.

Clay liner and cap material is herein designated as a conforming material and will be obtained by excavating and screening the brown till. Clay liner and cap material will be used for the compacted clay liner and cap, including the intercell berms and the protective clay layer.

Ordinary borrow soil will be obtained from materials that do not meet the requirements for the clay liner and cap, and are herein designated as a non-conforming material. The non-conforming material will be evaluated to establish whether the material meets the material requirements for fill, backfill, non-impacted protective and contouring layers, or vegetative layer as specified in the Technical Specifications. Ordinary borrow soil material may be excavated from the brown till and the underlying gray till and can be used to construct the following

components of the OSDF, if the material is found to meet the appropriate Technical Specification:

- fill for over-excavated unsuitable subgrade;
- compacted fill;
- backfill;
- non-impacted protective and contouring layers; and
- vegetative soil layer.

The topsoil component of the OSDF final cover should be obtained from the topsoil stripped from the surface of the OSDF construction areas, the borrow area and the surface of the borrow material stockpile areas. This material will be stockpiled for use, as needed, for OSDF construction activities.

Clayey rockfill is material that is retained on the screen during soil screening due to the occurrence of larger particles (i.e., rocks and clods larger than 2 inches). Clayey rockfill does not meet the Technical Specifications for ordinary borrow, but may be used for several activities related to OSDF construction, including (but not limited to) the following:

- interim restoration of the borrow area, including pond dike, diversion berms, and flattening of permanent slopes;
- clayey rockfill in earthwork activities to include access corridors and berms;
- in other locations at the site as approved by the Construction Manager.

3.2.2 Geotechnical Data for Borrow Area Soils

The soil profile at the EFBA generally consists of a clay-loam topsoil layer overlying a 10- to 20-foot thick brown till layer, in turn overlying a 10- to 20-foot thick gray till layer. Brown till will be used to construct the clay liner and cap. Portions of the brown till stratum may be found to provide a non-conforming material which subsequently can be used as ordinary borrow

for construction of other components at the OSDF. The brown till layer is a lean clay to sandy lean clay which exhibits the following ranges of properties and characteristics:

- plasticity index (PI): 6 to 32 percent
- clay content: 4 to 36 percent
- in-situ moisture content: 9 to 28 percent
- percent saturation: 56 to 100 percent
- in-situ dry unit weight: 101 to 135 lbs/ft^3

The plasticity index, clay content, and moisture content of the brown till generally decrease with depth. The percent saturation and dry unit weight of the brown till increase with depth. Geotechnical data for the brown till, as obtained from previous field investigations conducted at the EFBA, are summarized in Appendix A. Additional information regarding the geotechnical characteristics of the brown till can be found in Parsons [1996].

The gray till can be used as ordinary borrow for construction of the OSDF components discussed in Section 3.2.1 of this BAMR Plan. The gray till layer is a sandy clay with the following ranges of properties and characteristics:

- plasticity index (PI): 5 to 17 percent
- clay content: 3 to 29 percent
- in-situ moisture content: 9 to 21 percent
- percent saturation: 84 to 100 percent
- in-situ dry unit weight: 114 to 130 lb/ft^3

Geotechnical data for the gray till, as obtained from previous field investigations conducted at the EFBA, are summarized in Appendix A. Additional information regarding the geotechnical characteristics of the gray till from the borrow area can be found in Parsons [1996].

3.2.3 Contingency Borrow Area

Two areas reserved for use as contingency borrow areas are shown on Figure 1-1. One contingency borrow area is located in the northern portion of the east side of the EFBA, where the South Stockpile Area is located. The other contingency area is the west side of the EFBA, located on the west side of the South Entrance Road. As described in the BASR, these areas should only be developed on an as-needed basis if the east side of the EFBA is shown to have an insufficient quantity of specific borrow material needed to support OSDF construction activities.

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4.0 BORROW AREA MANAGEMENT

4.1 General

Borrow area management includes activities that occur prior to, during, and after excavation of the borrow materials from the EFBA. Borrow area management requires that the borrow area be excavated in distinct and separate subareas. Each subarea within the borrow area is to be developed according to the sequence and grades shown in this BAMR Plan and the BASR. The borrow area management activities are presented in detail in this section. The EFBA has been certified to contain no contamination above final remediation levels (FRLs); there is no known impacted material in the borrow area. Therefore, impacted material excavation is not addressed in this BAMR Plan. If impacted material is identified in the borrow area, the impacted material should be excavated as specified in the Technical Specifications and the related area should be certified for borrow area excavation.

Specific details regarding borrow area development and management should be presented in the Contractor's Borrow Area Management and Restoration Work Plan (Work Plan). The Contractor will prepare and deliver this Work Plan in accordance with the Technical Specifications and Construction Drawings. As described in the following sections, the Contractor's Work Plan should include, at a minimum, the following:

- pre-conformance testing;
- surface-water management and erosion controls;
- borrow area haul roads;
- clearing, grubbing, and topsoil removal;
- borrow area excavation;
- stockpiling; and
- development sequencing.

The Contractor's Work Plan should also address interim restoration of the EFBA. This activity is described in detail in Section 5.0 of the BAMR Plan.

The responsibilities of the Contractor regarding borrow area and materials management are identified in several project documents. Specific requirements applicable to borrow area management for each subarea of development are specified in:

- Technical Specifications Sections 02100 – Surveying; 02110 – Clearing, Grubbing, and Stripping; 02200 – Earthwork; 02225 – Compacted Clay Liner or Cap; 02230 – Road Construction; 02240 - Non-impacted Protective and Contouring Layer's; 02250 - Vegetative Soil Layer; 02270 – Surface-Water Management and Erosion Control; 02721 – Culverts; 02920 – Topsoil; 02930 –Vegetation; and 13000 – Borrow Area Management;
- Surface-Water Management and Erosion Control (SWMEC) Plan; and
- Construction Quality Assurance (CQA) Plan.

4.2 Pre-Conformance Testing

4.2.1 General

Pre-conformance testing on borrow area soils will be conducted by the CQC Consultant in accordance with pre-conformance testing requirements specified in the "*OSDF Construction Quality Assurance Plan*" (CQA Plan) [GeoSyntec, 2000]. This testing will be conducted prior to excavation and screening by the Contractor, to confirm the soil's suitability for consideration as a clay liner and cap material. Test pits will be excavated by the Contractor under the direction of the Construction Manager to facilitate the collection of samples for laboratory testing. The number and location of the test pits will be selected in the field by the CQC Consultant based upon the visual appearance of the soil in the specific subarea of the borrow area. The test pit excavations will be advanced to a depth determined by the CQC Consultant who will also make observations during excavation activities regarding moisture content variation with depth and will note stratigraphic changes. These observations will be used to assess the number and locations of the test pits.

4.2.2 Sampling

The CQC Consultant will collect samples from the borrow area test pits. Samples will be collected and evaluated as test pit excavation progresses. Samples will also be tested for moisture contact, sieve analysis, hydrometer analysis, Atterberg limits determination and soil classification as specified in the CQA Plan.

4.2.3 Laboratory Testing

Samples collected by the CQC Consultant during test pit excavation activities will be tested and evaluated for consideration as clay liner and cap material. Pre-conformance testing will include moisture content, particle-size distribution analysis (i.e., sieve and hydrometer), Atterberg limits, and soil classification. The results of the pre-conformance tests will be made available to the Construction Manager who will notify the Contractor as to whether the borrowed soil may be screened for use as clay liner and cap material. The CQC Consultant may conduct additional testing depending on test results and field observations during the excavation and screening for clay liner and cap material. The Contractor should allow time for implementation of the sampling and pre-conformance testing program when establishing the construction schedule.

4.3 Surface-Water Management and Erosion Controls

Surface-water management and erosion controls will be implemented to divert surface-water runon from disturbed areas within the EFBA, minimize sedimentation and erosion within the disturbed areas, and convey all surface water to the Borrow Area Sedimentation Basin located in the northwest corner of the EFBA. The surface-water management and erosion controls include silt fence, temporary diversions, drainage channels, crusting agents and vegetation. Implementation of surface-water management and erosion controls will be in accordance with the Technical Specifications and the SWMEC Plan. Surface-water management and erosion controls will be established in the vicinity of each subarea prior to disturbing the subarea.

4.4 Borrow Area Haul Roads

The approximate location of borrow area haul roads that provide access between the OSDF and each borrow subarea was presented in the BASR. Additional details regarding the location and sequencing of haul roads are presented on the Construction Drawings. The specific layout for the borrow area haul roads within the borrow area will be presented in the Contractor's Borrow Area Management and Restoration Work Plan. This layout will be approved by the Construction Manager prior to commencement of borrow area activities. Haul roads established within the borrow area limits should be suitable for the planned excavation sequences and for transportation of borrow materials to the OSDF. Temporary drainage structures, such as culverts and/or drainage channels, will be established as necessary and in accordance with the requirements of the Technical Specifications and the SWMEC Plan. Temporary drainage structures should be used to prevent surface water from being trapped by the borrow area haul roads.

As required by the Technical Specifications, the Contractor will maintain the haul roads within and around the borrow area and the haul road between the EFBA and the OSDF cell. Once established, the borrow area haul roads should be watered regularly to mitigate fugitive emissions control.

4.5 Clearing, Grubbing, and Topsoil Removal

Clearing and grubbing activities are required in areas that will be stripped for borrow activities or for borrow area haul road construction and in areas where stockpiles will be established. Clearing and grubbing, as well as the disposal and stockpiling of cleared and grubbed material, will be performed in accordance with the Technical Specifications. Topsoil will also be stripped from subareas to be excavated, areas to be used for borrow area haul roads, and areas used for stockpiles as designated on the Construction Drawings. The stripped topsoil will be stockpiled in the South Stockpile Area and should be managed in accordance with the Technical Specifications.

4.6 Borrow Area Excavation

The EFBA will be developed incrementally in subareas designated by the BASR and the Construction Drawings. Activities in each subarea include excavation of soils for clay liner and cap material from the brown till stratum and excavation of ordinary borrow from the brown till and gray till strata.

Borrow material for the clay liner and cap will be obtained from portions of the brown till stratum which meet the pre-conformance testing requirements. Conforming brown till will be excavated, processed (i.e., screened and moisture conditioned), and placed in the designated Screened Material Stockpile Area. The CQC Consultant will collect samples from each stockpile and perform conformance testing on the recovered samples. If the test results indicate that the screened material conforms to the requirements for clay liner and cap, the material will be designated and maintained as clay liner and cap material within the Screened Material Stockpile Area. If the pre-conformance tests results indicate that the excavated material does not conform to the Technical Specifications for clay liner and cap materials, the material will be designated as a non-conforming material. This material can be used as ordinary borrow (discussed subsequently). As part of the conformance testing program, the CQC Consultant will establish an Acceptable Permeability Zone (APZ) for material from each stockpile of material used for the clay liner and cap. Each clay liner and cap material stockpile within the Screened Material Stockpile Area will be labeled and assigned a designated APZ. In accordance with the BASR, the Screened Material Stockpile Area will be developed and maintained in a portion of the EFBA which will not be disturbed for approximately two construction seasons.

Clayey rockfill from the screener should be stockpiled within the active borrow subarea and used for interim restoration of the borrow area. The clayey rockfill may be used for selected OSDF construction activities as identified in the Technical Specifications or as approved by the Construction Manager.

Ordinary borrow will be stockpiled in the South Stockpile Area. It is the responsibility of the Contractor to initially establish the suitability of the borrow material for the proposed end use. The CQC Consultant will test the soil for conformance with the Technical Specifications based on the end use identified by the Contractor. Monitoring and testing by the CQC Consultant will be in accordance with the CQA Plan.

4.7 Stockpiling

4.7.1 General

The Contractor is required to manage the stockpiles generated by clearing, grubbing, stripping, excavation, and screening. The Contractor will address stockpile management in the Contractor's Borrow Area Management and Restoration Work Plan (Contractor's Work Plan) which will be prepared in accordance with the Technical Specifications. This Work Plan will be approved by the Construction Manager prior to commencing work within the EFBA.

4.7.2 Stockpile Area Layout

Stockpiles from subarea development will be placed in one of three designated areas: the, the Screened Material Stockpile Area, the South Stockpile Area, and the clayey rockfill material stockpile area. The clayey rockfill material stockpile area will likely be located in the active borrow subarea, although the Contractor may designate an alternative stockpile area. The Screened Material Stockpile Area will contain only material which has met the pre-conformance testing criteria and passed through the screen. The Screened Material Stockpile Area will be located in the areas shown on the Construction Drawings and in the Figures 4-1 through 4-8 of this BAMR Plan. The South Stockpile Area will contain material from clearing and grubbing and excavated material designated as topsoil or designated as ordinary borrow and will be located in the area shown on the Construction Drawings and in Figures 4-1 through 4-8. The size and location of the Screened Material Stockpile Area and South Stockpile Area are shown on the Construction Drawings and will not be expanded or modified by the Contractor without written approval from the Construction Manager.

4.7.3 Stockpile Area Development

Immediately before a stockpile area is developed, the area will be cleared and grubbed. Topsoil will also be stripped from the area and will be stockpiled at the South Stockpile Area in accordance with the Technical Specifications. Stockpiled topsoil will be segregated from materials which do not meet the Technical Specifications for topsoil. Stockpiles will be stabilized in accordance with the Technical Specifications.

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Surface-water management and erosion controls must be implemented to divert surface-water runon from the stockpile areas to the Borrow Area Sedimentation Basin as described in Section 4.3 of this BAMR Plan. Surface-water management and erosion controls will also be implemented to collect and divert surface-water from the stockpile areas to the sedimentation basin. As described previously in Section 4.3, surface-water management and erosion controls will be established in the vicinity of stockpile areas prior to the commencement of soil disturbance activities in the stockpile area. Surface-water management and erosion controls will be implemented in accordance with the Technical Specifications and the SWMEC Plan.

4.7.4 Stockpile Separation

Each distinct clay liner and cap material stockpile within the Screened Material Stockpile Area will not be allowed to mix with material from adjacent stockpiles. Care must be taken by the Contractor to ensure that material within these stockpiles is not combined. As described in the *"OSDF Test Pad Program Final Report"* [GeoSyntec, 1997], each clay liner and cap material stockpile should contain a volume of at least 5,000 cubic yards but no greater than 10,000 cubic yards of material. If space is limited within the specific stockpile area, a continuous stockpile may be created from the individual 5,000- to 10,000-cubic yard stockpiles by utilizing a separation method that clearly distinguishes the limits of the adjacent stockpiles. Methods proposed by the Contractor to distinguish stockpile limits must be approved by the Construction Manager prior to implementation. If a clay liner and cap material is not expected to be used within 45 days of placement in the stockpile, the material should be graded to a stable configuration. The stockpile must then be sealed using heavy equipment as approved by the Construction Manager and stabilized using a mulch binding and crusting agent in accordance with the Technical Specifications. The ordinary borrow and topsoil material stockpiles within the South Stockpile Area and the clayey rockfill stockpiles do not have the volume restrictions which apply to the clay liner and cap material stockpiles. The stockpiles must be maintained in accordance with the Technical Specifications. For safety and stability considerations, all stockpiles are to be located a minimum of 50 feet from the crest of any cut slope.

4.7.5 Stockpile Labeling

Stockpiles will be categorized into clay liner and cap material, ordinary borrow material, topsoil, or clayey rockfill material. Materials will be placed in the appropriate stockpile area as

described previously. Each clay liner and cap material stockpile will be clearly labeled and identified by a number unique to the specific stockpile. The Contractor should provide the Construction Manager and the CQC Consultant with a list of the stockpiles, the location of the stockpile within the stockpile area after each stockpile is generated, and the designated stockpile number for the clay liner and cap material stockpiles.

4.8 Development Sequencing

4.8.1 Overview

The EFBA will be developed sequentially in eight subareas and in a manner that utilizes the existing topography to control surface-water runon and runoff. The sequential development of the eight subareas is shown in Figures 4-1 through 4-8 of this BAMR Plan. The number of subareas and the size of these subareas is based on the current construction schedule and may be revised based on future construction schedules. This sequential development plan was established to allow each subarea to be excavated to final grade and restored to interim restoration conditions within one construction season.

4.8.2 Steps For Developing Borrow Subareas

The configuration and layout of the EFBA subareas presented in this section are consistent with the strategy presented in the BASR. This sequential development is based on the currently anticipated approach, schedule, and estimated material quantities for construction activities within the OSDF. If the schedule and/or associated quantities change during any subsequent construction activity, the overall borrow area management strategy and concept will remain the same, but the specific size and/or configuration of selected subareas may be modified if approved by the Construction Manager. To develop, manage, and restore a specific subarea, the following activities will be performed by the Contractor:

- assist the CQC Consultant with obtaining soil samples from the test pits for pre-conformance testing;
- stake out the limit of excavation for the borrow subarea; stake out the limit of disturbance for the following stockpiles: topsoil and ordinary borrow stockpiles within

the South Stockpile Area; the clay liner and cap stockpiles within the Screened Material Stockpile Area; and the clayey rockfill stockpile either within or outside of the borrow subarea;

- install and maintain perimeter construction fencing around the borrow subarea and the stockpile areas;
- install surface-water, erosion, and sedimentation control features in accordance with the Technical Specifications and the SWMEC Plan; the surface-water, erosion, and sedimentation control measures should control runon and runoff in the vicinity of the borrow area excavation and the stockpiles;
- construct and maintain borrow area haul roads within the borrow area and to the active OSDF construction areas;
- clear, grub as needed, and strip topsoil from the following areas: the subarea to be excavated, the affected areas within the South Stockpile Area where a stockpile will be staged, and the Screened Material Stockpile Area;
- remove existing stockpiles from the subarea to be excavated and relocate this material to an appropriate stockpile location;
- set up the screening plant within the active borrow subarea or within the Screened Material Stockpile Area;
- begin excavating borrow materials; segregate pre-conforming from non-conforming soils; excavate exterior sideslope of the borrow area boundary to 6H:1V and interior (i.e., within the active subarea) sideslopes to 3H:1V or flatter;
- excavate ordinary borrow material and stockpile the material at the South Stockpile Area;
- screen pre-conforming soils for clay liner and cap material; stockpile and label the clay liner and cap material in the Screened Material Stockpile Area;
- stockpile clayey rockfill within the borrow subarea, whenever possible;

- move screening plant within the borrow subarea or the Screened Material Stockpile area, as necessary;
- excavate the subarea to final grade to obtain material for ordinary borrow and stockpile material in the South Stockpile Area; and
- remove remaining stockpiles from the borrow subarea, except for clayey rockfill stockpiles, and perform interim restoration in the subarea.

BORROW AREA DEVELOPMENT AND RESTORATION PLAN – SUBAREA 1

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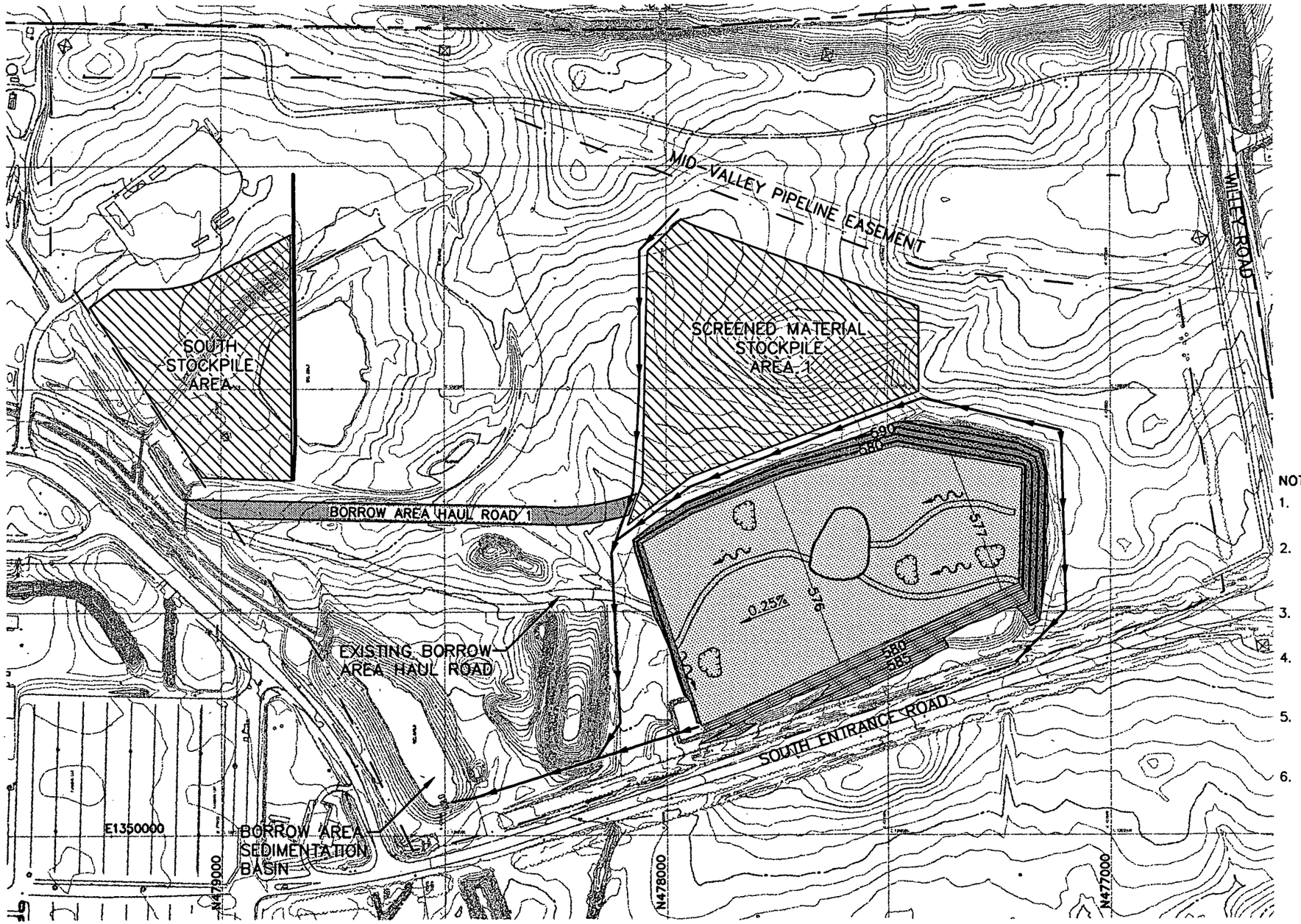

LEGEND

585	EXISTING GROUND ELEVATION (FEET)
585	FINISHED GRADE ELEVATION (FEET)
	EAST FIELD BORROW AREA (EFBA) LIMIT
	PROPERTY BOUNDARY
	TEMPORARY DIVERSION BERM
	DRAINAGE CHANNEL
	SWALE
	DEPRESSION
	SMALL POND
	FLOW DIRECTION
	ACTIVE SUBAREA

NOTES:

1. TOPOGRAPHIC MAP BASED ON JANUARY 2000 FLYOVER PREPARED BY LANDAIR SURVEYING, INC., ROSWELL, GEORGIA.
2. ELEVATIONS ARE IN FEET ABOVE SEA LEVEL DATUM. (NOTE: "SEA LEVEL DATUM" REFERS TO NATIONAL GEODETIC VERTICAL DATUM [NGVD]).
3. GRID COORDINATE SYSTEM CORRESPONDS TO STATE PLANAR NORTH AMERICAN DATUM (NAD) 1983 OHIO SOUTH.
4. SEE OSDF SURFACE-WATER MANAGEMENT AND EROSION CONTROL PLAN FOR REQUIREMENTS RELATING TO TEMPORARY DIVERSIONS, DRAINAGE CHANNELS AND SILT FENCES.
5. SUBAREA BOUNDARIES ARE APPROXIMATE AND MAY BE ADJUSTED TO ENABLE EXCAVATION OF MATERIALS THAT CONFORM WITH THE SPECIFICATIONS.
6. THE LOCATION AND SIZE OF THE INTERIM RESTORATION FEATURES SHOWN ARE APPROXIMATE. FINAL LOCATION AND SIZE WILL BE ESTABLISHED IN THE FIELD BY THE CONSTRUCTION MANAGER BASED ON FIELD CONDITIONS AT THE TIME OF INTERIM RESTORATION.

0 250
SCALE IN FEET

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ATLANTA, GA

PROJECT NO. GQ1001-03	FIGURE NO. 4-1
DOCUMENT NO.F9730020.1C	FILE NO. 1001F001.DWG

BORROW AREA DEVELOPMENT AND RESTORATION PLAN – SUBAREA 2

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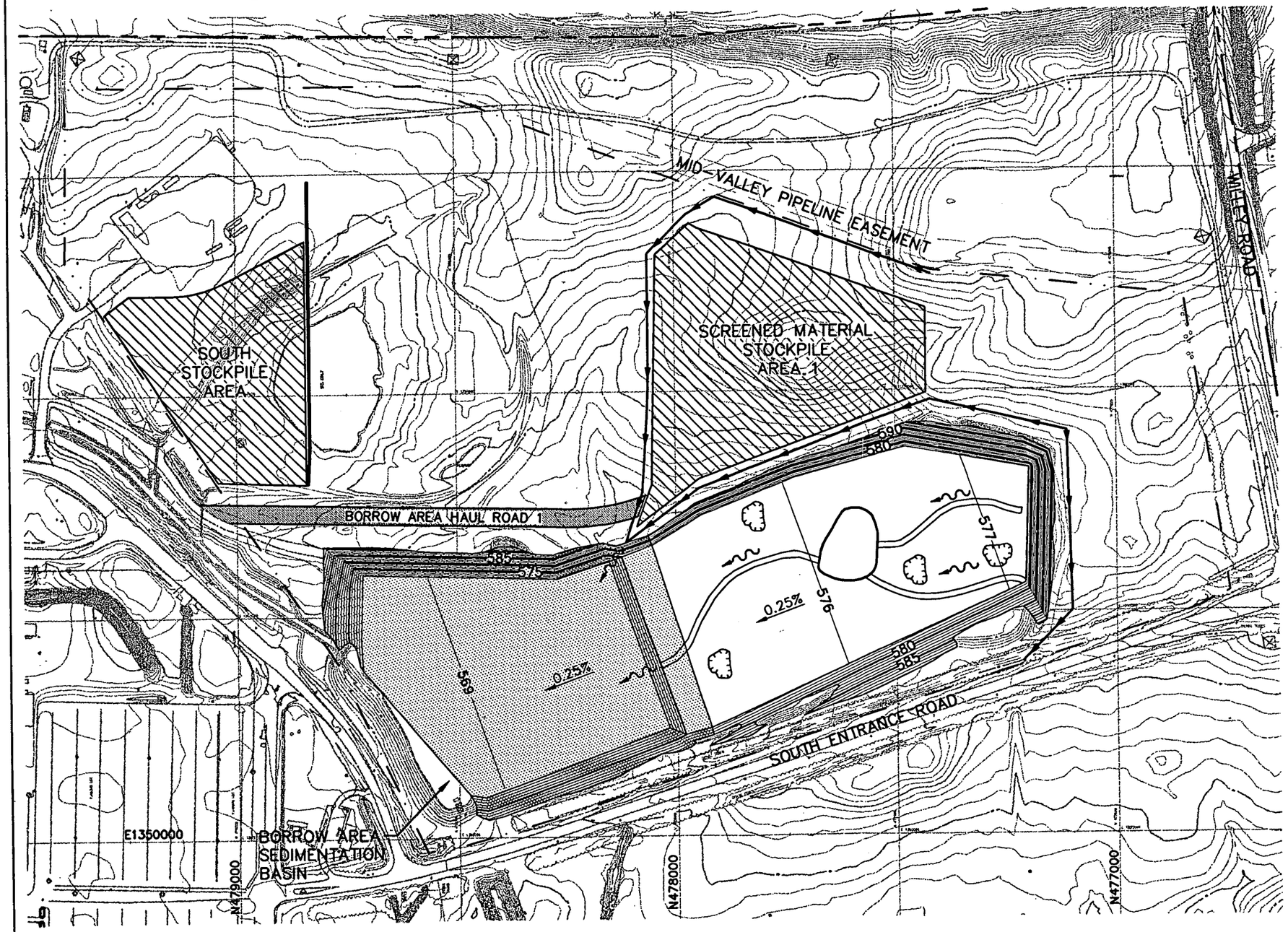

LEGEND

585	EXISTING GROUND ELEVATION (FEET)
585	FINISHED GRADE ELEVATION (FEET)
	EAST FIELD BORROW AREA (EFBA) LIMIT
	PROPERTY BOUNDARY
	TEMPORARY DIVERSION BERM
	DRAINAGE CHANNEL
	SWALE
	DEPRESSION
	SMALL POND
	FLOW DIRECTION
	ACTIVE SUBAREA

NOTES:

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SCALE IN FEET

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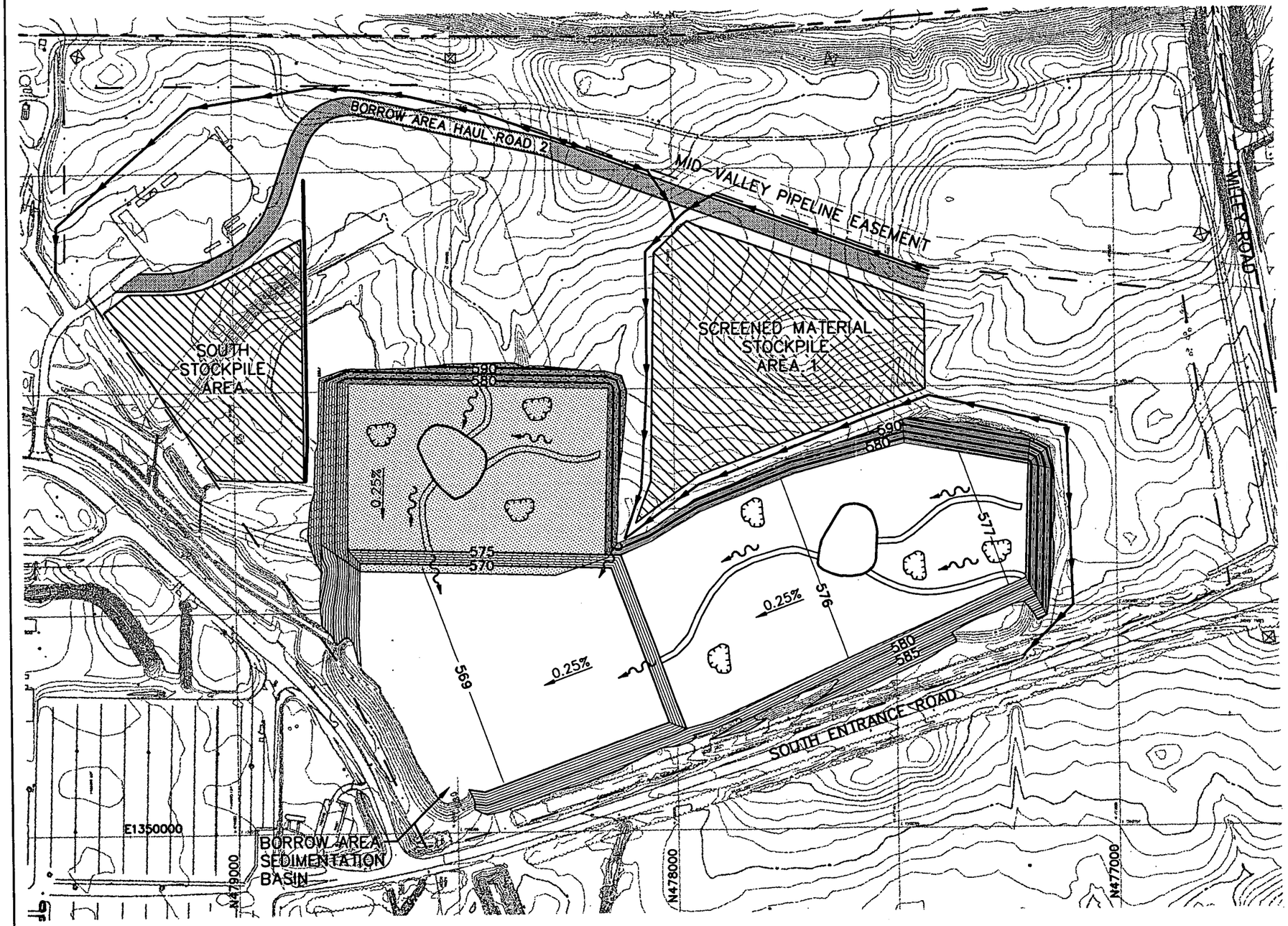
PROJECT NO.	GQ1001-03	FIGURE NO.	4-2
DOCUMENT NO.	F9730020.1C	FILE NO.	1001F002.DWG

BORROW AREA DEVELOPMENT AND RESTORATION PLAN – SUBAREA 3

N 2981



LEGEND

585	EXISTING GROUND ELEVATION (FEET)
585	FINISHED GRADE ELEVATION (FEET)
	EAST FIELD BORROW AREA (EFBA) LIMIT
	PROPERTY BOUNDARY
	TEMPORARY DIVERSION BERM
	DRAINAGE CHANNEL
	SWALE
	DEPRESSION
	SMALL POND
	FLOW DIRECTION
	ACTIVE SUBAREA

NOTES:

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4. SEE OSDF SURFACE-WATER MANAGEMENT AND EROSION CONTROL PLAN FOR REQUIREMENTS RELATING TO TEMPORARY DIVERSIONS, DRAINAGE CHANNELS AND SILT FENCES.
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SCALE IN FEET

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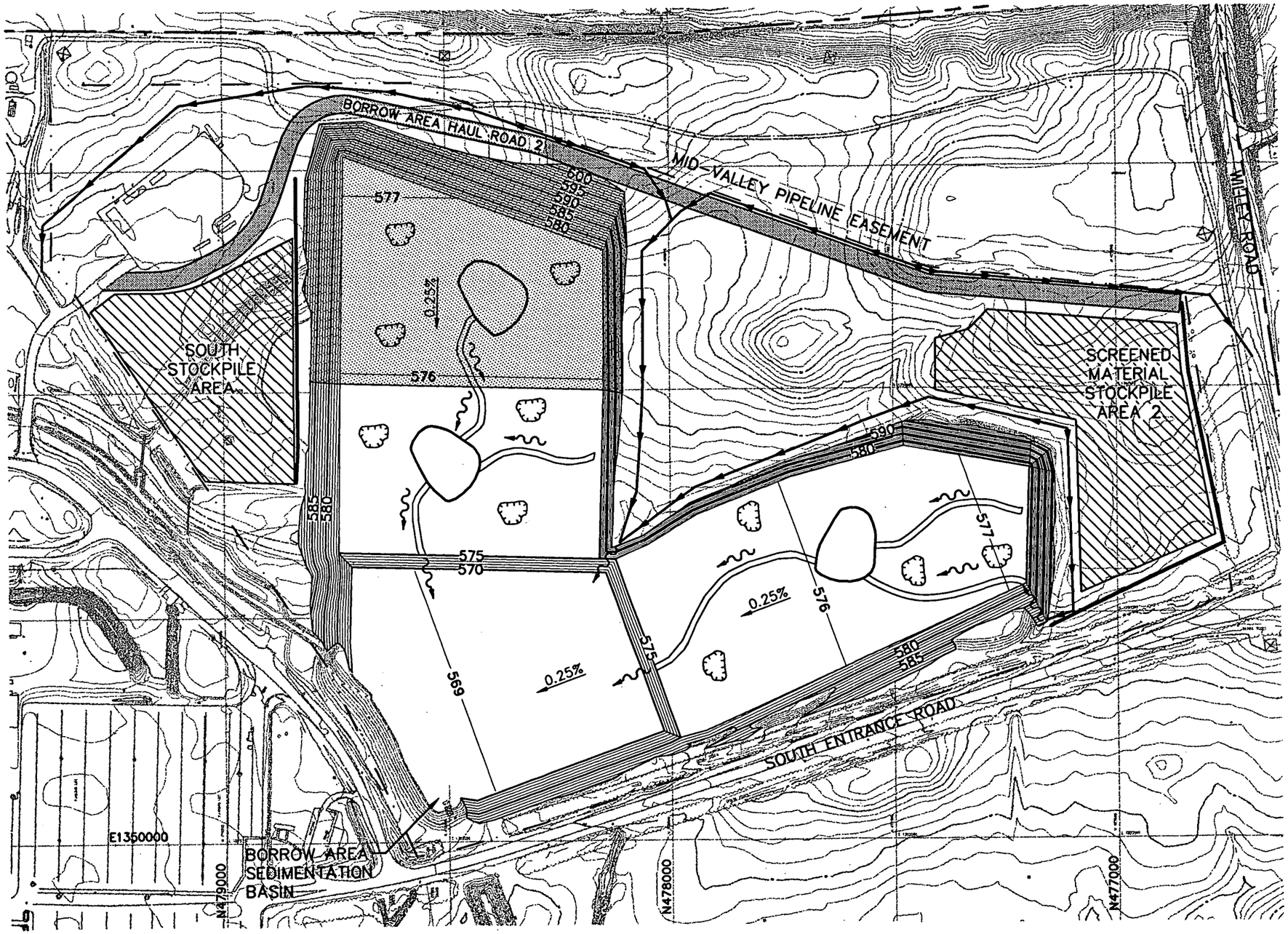
PROJECT NO.	GQ1001-03	FIGURE NO.	4-3
DOCUMENT NO.	F9730020.1C	FILE NO.	1001F003.DWG

BORROW AREA DEVELOPMENT AND RESTORATION PLAN – SUBAREA 4

N 2981



LEGEND

585	EXISTING GROUND ELEVATION (FEET)
585	FINISHED GRADE ELEVATION (FEET)
	EAST FIELD BORROW AREA (EFBA) LIMIT
	PROPERTY BOUNDARY
	TEMPORARY DIVERSION BERM
	DRAINAGE CHANNEL
	SWALE
	DEPRESSION
	SMALL POND
	FLOW DIRECTION
	ACTIVE SUBAREA

NOTES:

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SCALE IN FEET

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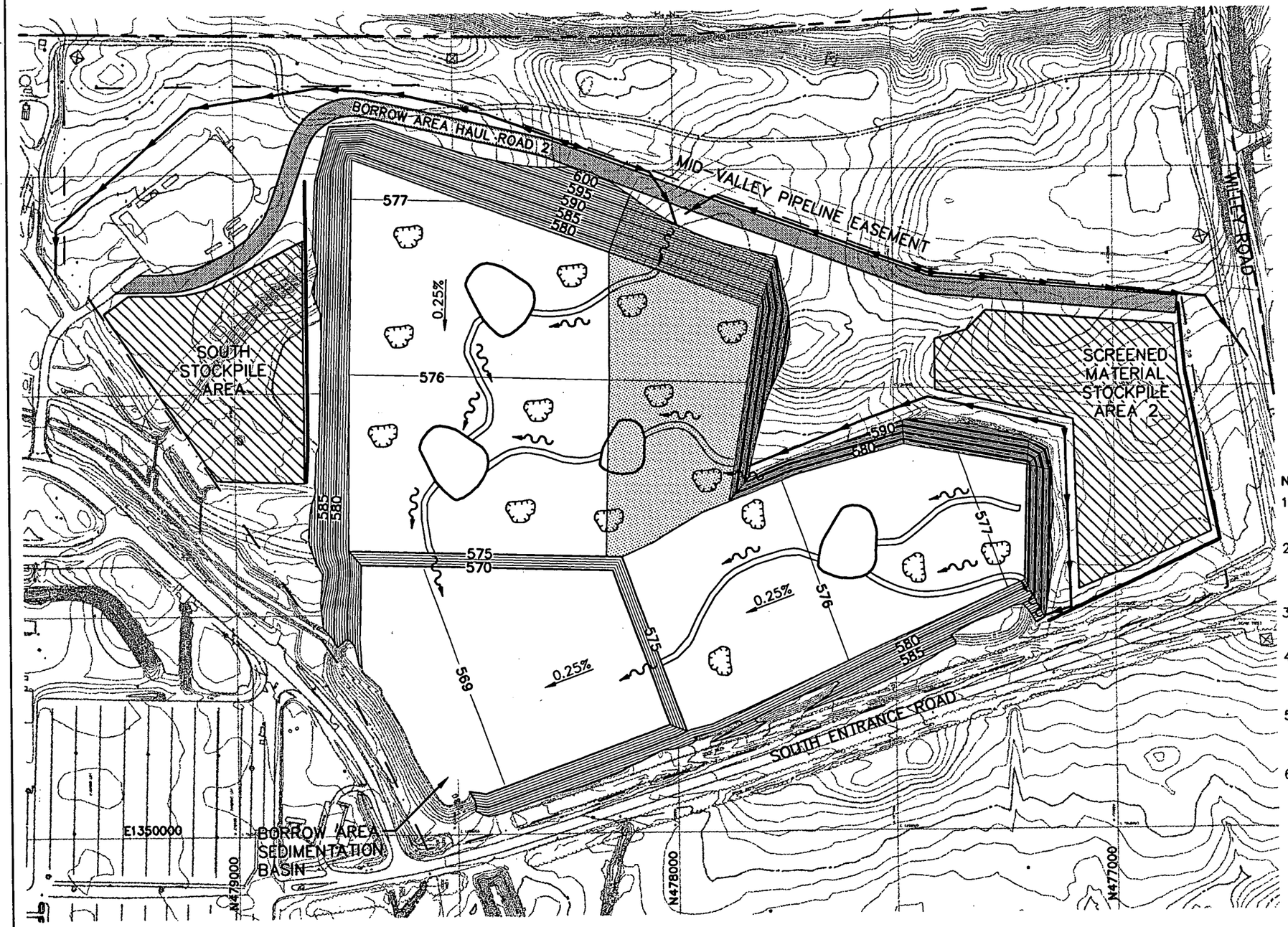
PROJECT NO. GQ1001-03	FIGURE NO. 4-4
DOCUMENT NO.F9730020.1C	FILE NO. 1001F004.DWG

BORROW AREA DEVELOPMENT AND RESTORATION PLAN – SUBAREA 5

N 2981



LEGEND

585	EXISTING GROUND ELEVATION (FEET)
585	FINISHED GRADE ELEVATION (FEET)
	EAST FIELD BORROW AREA (EFBA) LIMIT
	PROPERTY BOUNDARY
	TEMPORARY DIVERSION BERM
	DRAINAGE CHANNEL
	SWALE
	DEPRESSION
	SMALL POND
	FLOW DIRECTION
	ACTIVE SUBAREA

NOTES:

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SCALE IN FEET

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PROJECT NO. GQ1001-03	FIGURE NO. 4-5
DOCUMENT NO. F9730020.1C	FILE NO. 1001F005.DWG

BORROW AREA DEVELOPMENT AND RESTORATION PLAN – SUBAREA 6

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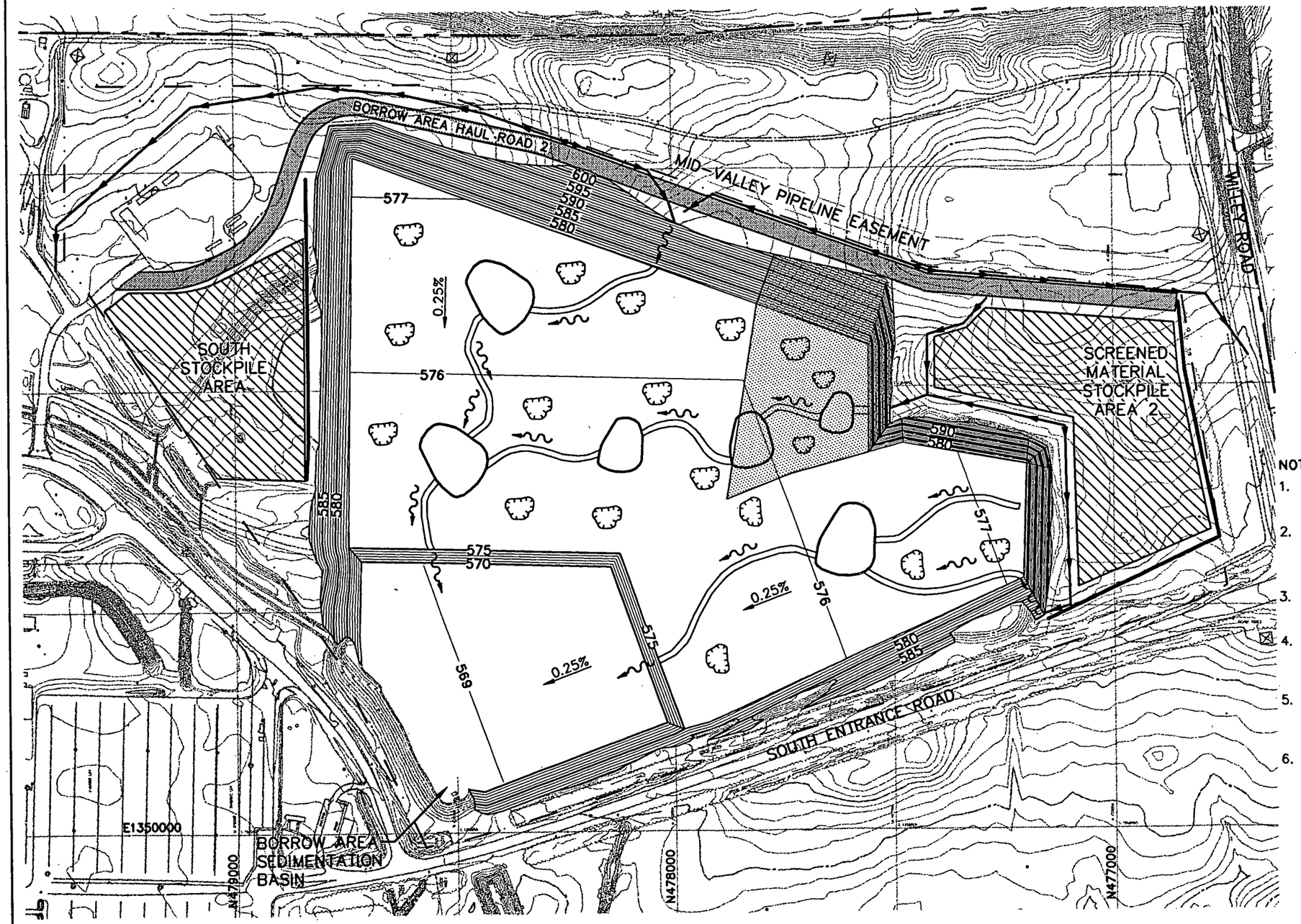

LEGEND

585	EXISTING GROUND ELEVATION (FEET)
585	FINISHED GRADE ELEVATION (FEET)
	EAST FIELD BORROW AREA (EFBA) LIMIT
	PROPERTY BOUNDARY
	TEMPORARY DIVERSION BERM
	DRAINAGE CHANNEL
	SWALE
	DEPRESSION
	SMALL POND
	FLOW DIRECTION
	ACTIVE SUBAREA

NOTES:

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0 250
SCALE IN FEET

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PROJECT NO.	GQ1001-03	FIGURE NO.	4-6
DOCUMENT NO.	F9730020.1C	FILE NO.	1001F006.DWG

BORROW AREA DEVELOPMENT AND RESTORATION PLAN – SUBAREA 7

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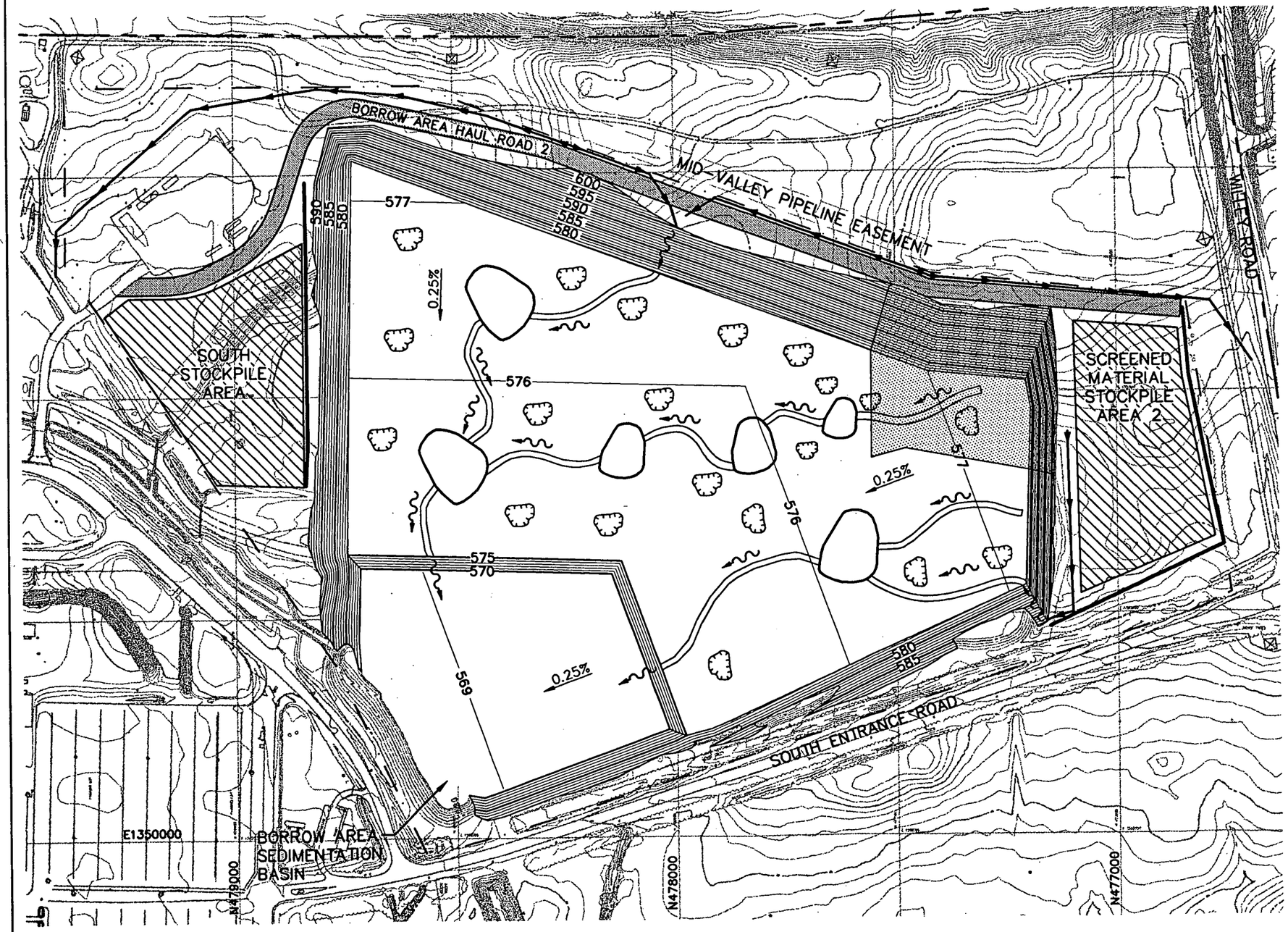

LEGEND

585	EXISTING GROUND ELEVATION (FEET)
585	FINISHED GRADE ELEVATION (FEET)
	EAST FIELD BORROW AREA (EFBA) LIMIT
	PROPERTY BOUNDARY
	TEMPORARY DIVERSION BERM
	DRAINAGE CHANNEL
	SWALE
	DEPRESSION
	SMALL POND
	FLOW DIRECTION
	ACTIVE SUBAREA

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0 250
SCALE IN FEET

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PROJECT NO. GQ1001-03	FIGURE NO. 4-7
DOCUMENT NO.F9730020.1C	FILE NO. 1001F007.DWG

BORROW AREA DEVELOPMENT AND RESTORATION PLAN – SUBAREA 8

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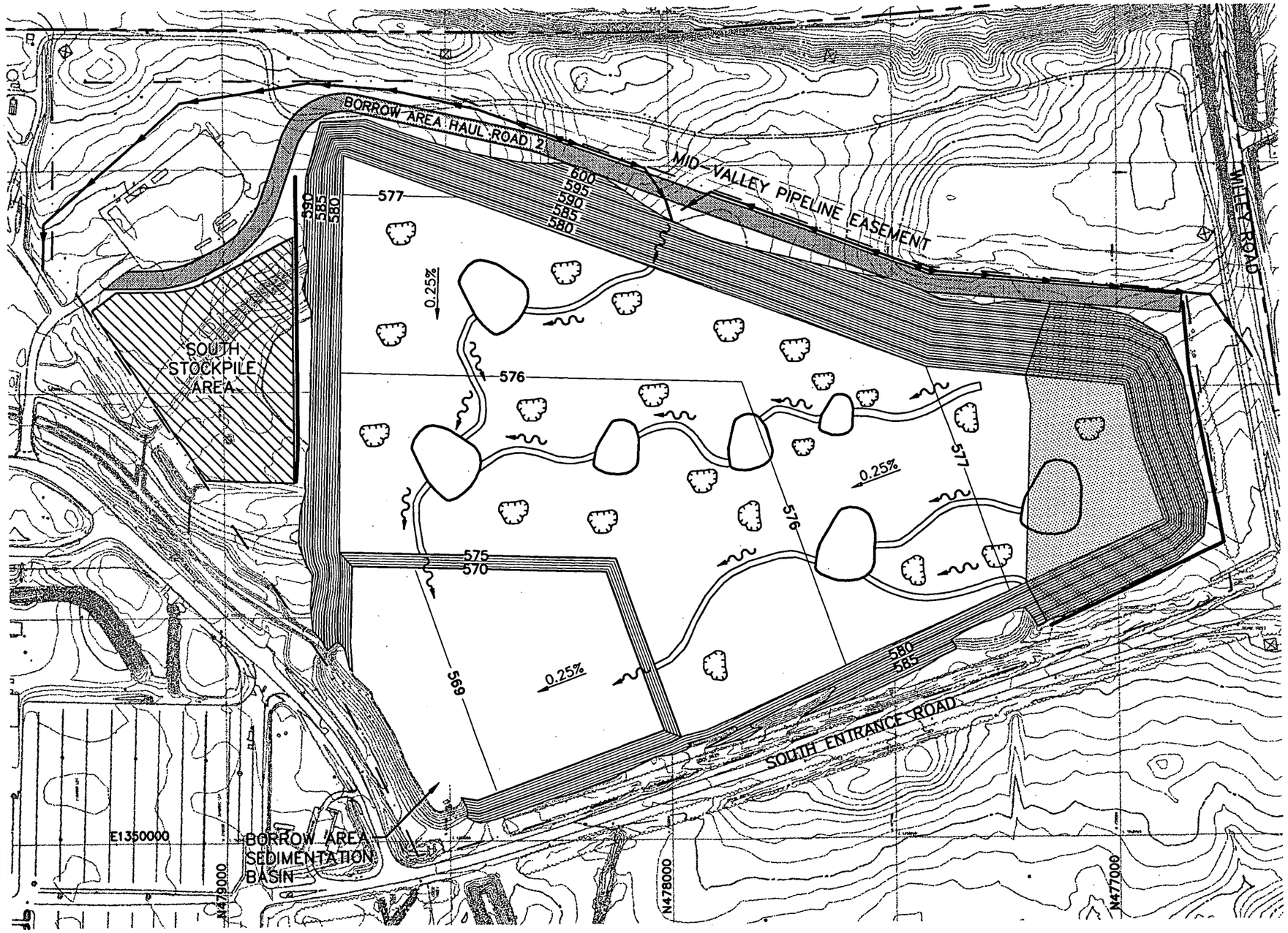

LEGEND

585	EXISTING GROUND ELEVATION (FEET)
585	FINISHED GRADE ELEVATION (FEET)
	EAST FIELD BORROW AREA (EFBA) LIMIT
	PROPERTY BOUNDARY
	TEMPORARY DIVERSION BERM
	DRAINAGE CHANNEL
	SWALE
	DEPRESSION
	SMALL POND
	FLOW DIRECTION
	ACTIVE SUBAREA

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SCALE IN FEET

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GEOSYNTEC CONSULTANTS
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PROJECT NO.	GQ1001-03	FIGURE NO.	4-8
DOCUMENT NO.	F9730020.1C	FILE NO.	1001F009.DWG

5.0 BORROW AREA RESTORATION

5.1 General

Restoration of the EFBA will consist of two major activities: interim restoration and final restoration. Interim restoration will be performed by the Contractor within each subarea as part of each construction season, after borrow excavation is completed within that subarea. Borrow excavation generally should not start in a new subarea until interim restoration is substantially completed within the previously excavated subarea. In any year, if the quantity of non-conforming material encountered is larger than the estimated quantities within the subareas, excavation into the next subarea may be initiated before restoration of the currently active subarea is initiated, if approved by the Construction Manager. Interim restoration in any given year must also include these extended subareas. Final restoration will be performed after borrow excavation and interim restoration are completed in the entire borrow area. The final restoration is specifically excluded from this BAMR Plan.

During borrow excavation activities, the final excavation elevations will be controlled to provide a minimum 12-foot thickness of gray till below the borrow area excavation elevation. Each subarea will be graded to a gently sloping base plane (e.g. approximate slope of 0.25 percent) with approximately 6H:1V to 10H:1V outer excavation slopes at the borrow area boundary.

5.2 Interim Restoration

Interim restoration within each subarea will include grading for construction of small ponds, shallow depressions, and a drainage swale. Specific details regarding interim restoration will be included in the Contractor's Work Plan which must be approved by the Construction Manager. The typical interim restoration grading for each subarea will include the following:

- spreading clayey rockfill to grade the outer excavation slopes to approximately 6H:1V and to grade the base to a gently rolling grade of approximately 0.25 percent; depending on the quantity of the clayey rockfill, the outer excavation slopes may be between 6H:1V to 10H:1V;
- constructing a small pond(s) by excavation and/or dike construction;

- excavating a drainage swale(s) through the subarea;
- excavating shallow depressions within the subarea; and
- performing other grading, based on subarea-specific conditions.

Interim restoration is intended to establish grades which reflect the natural geomorphological conditions in the area and to provide effective low maintenance surface-water, erosion, and sedimentation control. After interim restoration grading is completed, seeding of the area will be initiated to establish vegetation within the subarea. Vegetation will consist of the seed mixes specified in the Technical Specifications.

5.3 Final Restoration

Final restoration plans and requirements will be presented in the "*Natural Resource Restoration Design Plan for the Borrow Area*" (NRR Plan) and is specifically excluded from this BAMR Plan. The NRR Plan is scheduled to be prepared during calendar year 2005 and will describe requirements for final restoration of the borrow area. Although restoration plan details will not be finalized until the NRR Plan is developed, final restoration is expected to include only minor regrading activities. Vegetation will primarily consist of planting trees and final vegetation at the perimeter of the borrow area. Some planting within the subarea and the borrow area sedimentation basin area may also be included.

6.0 REFERENCES

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U.S. Department of Energy, *"Final Remedial Design Work Plan for Remedial Actions at Unit 2"*, Fernald Environmental Management Project, DOE Fernald Area Office, Fernald, OH, 1995b.

U.S. Department of Energy (DOE), *"On-Site Disposal Facility Borrow Area Strategy Report, Revision 0"*, Fernald Environmental Management Project, DOE Fernald Area Office, Fernald, OH, 2000.

APPENDIX A

GEOTECHNICAL DATA SUMMARY

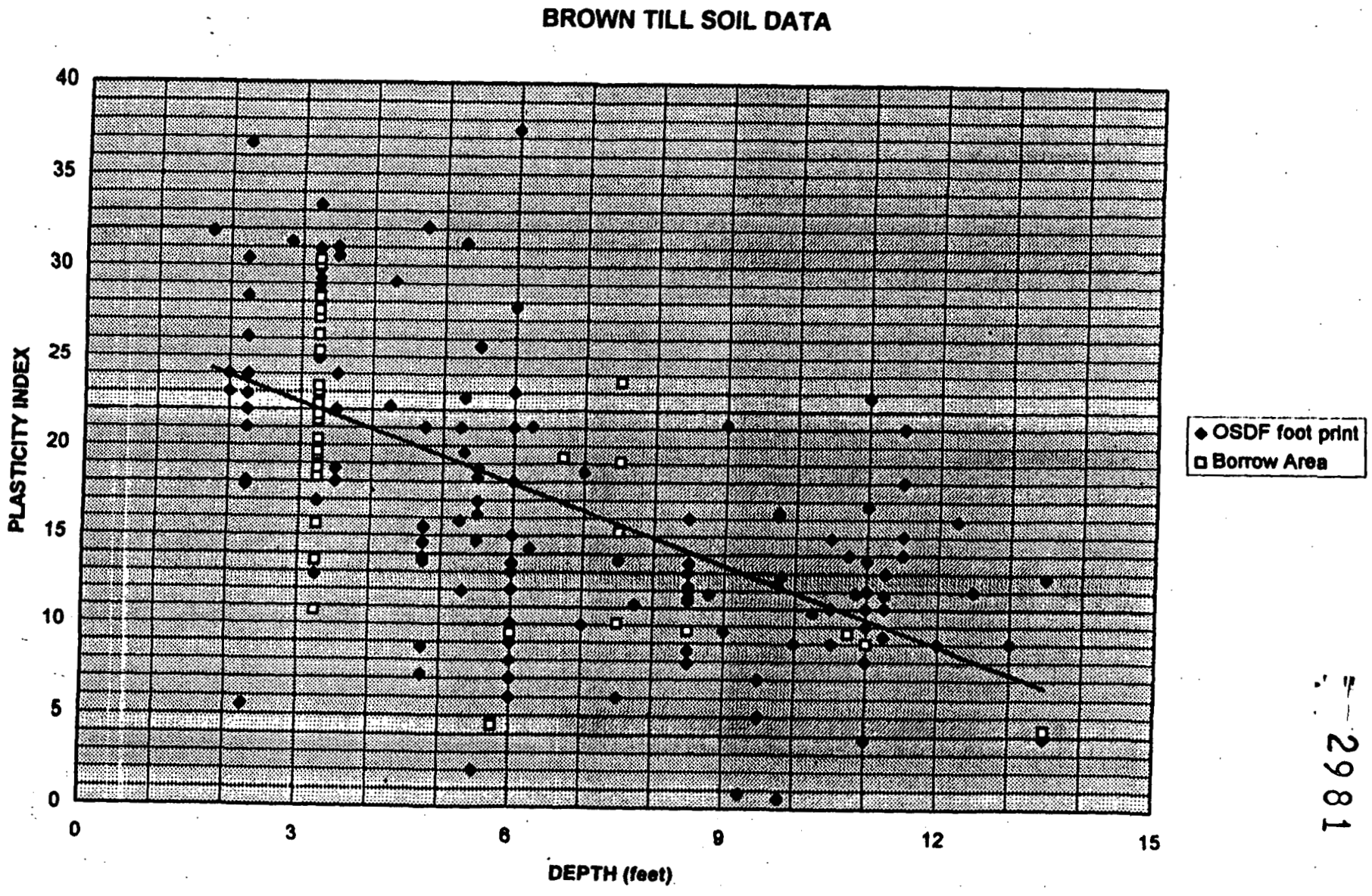

Figure 1. Brown Till Plasticity Index Data

[data obtained from Parsons, 1995 and 1996]

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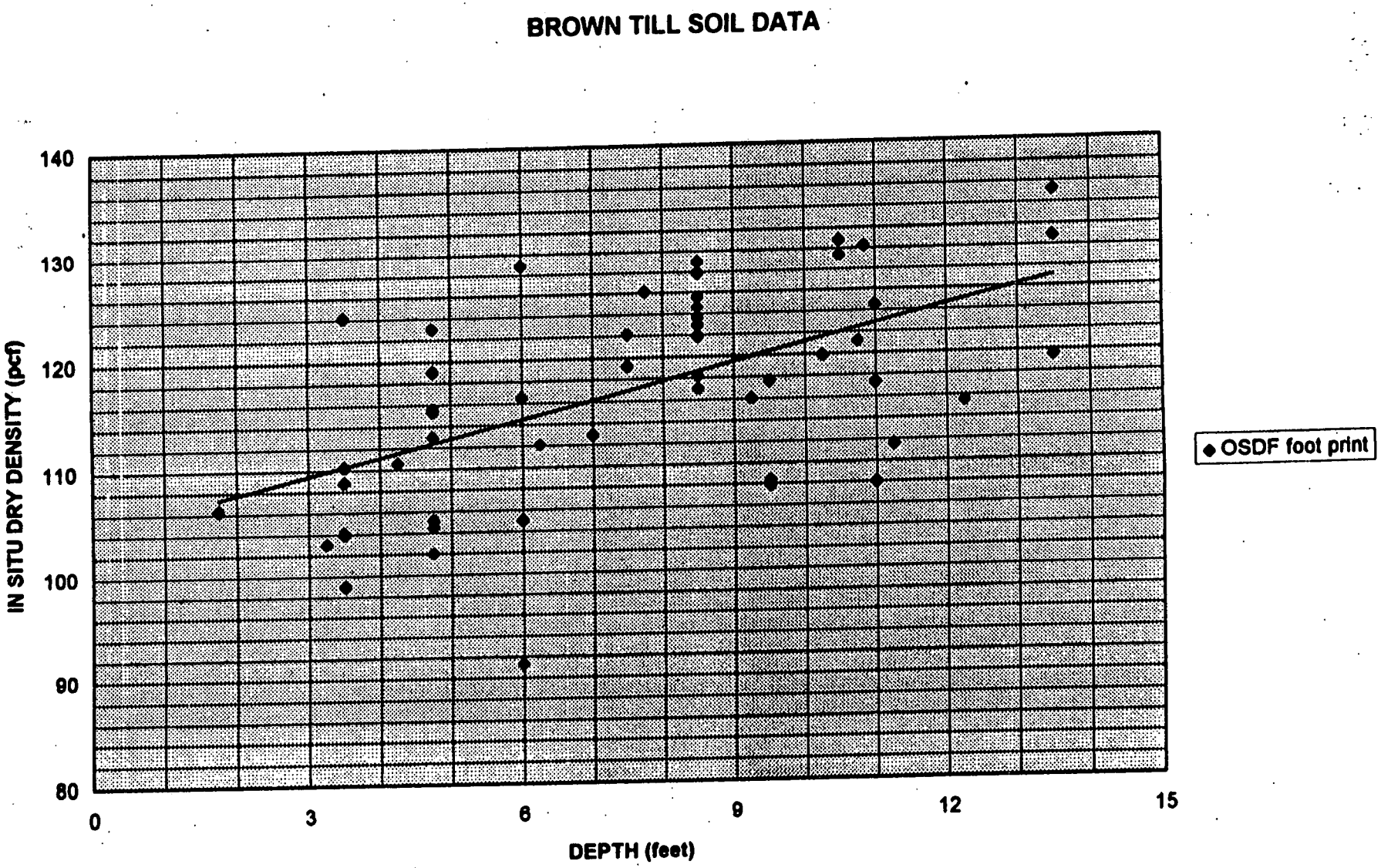

Figure 5. Brown Till [illegible]situ Dry Density Data

[data obtained from P[illegible]s, 1995]

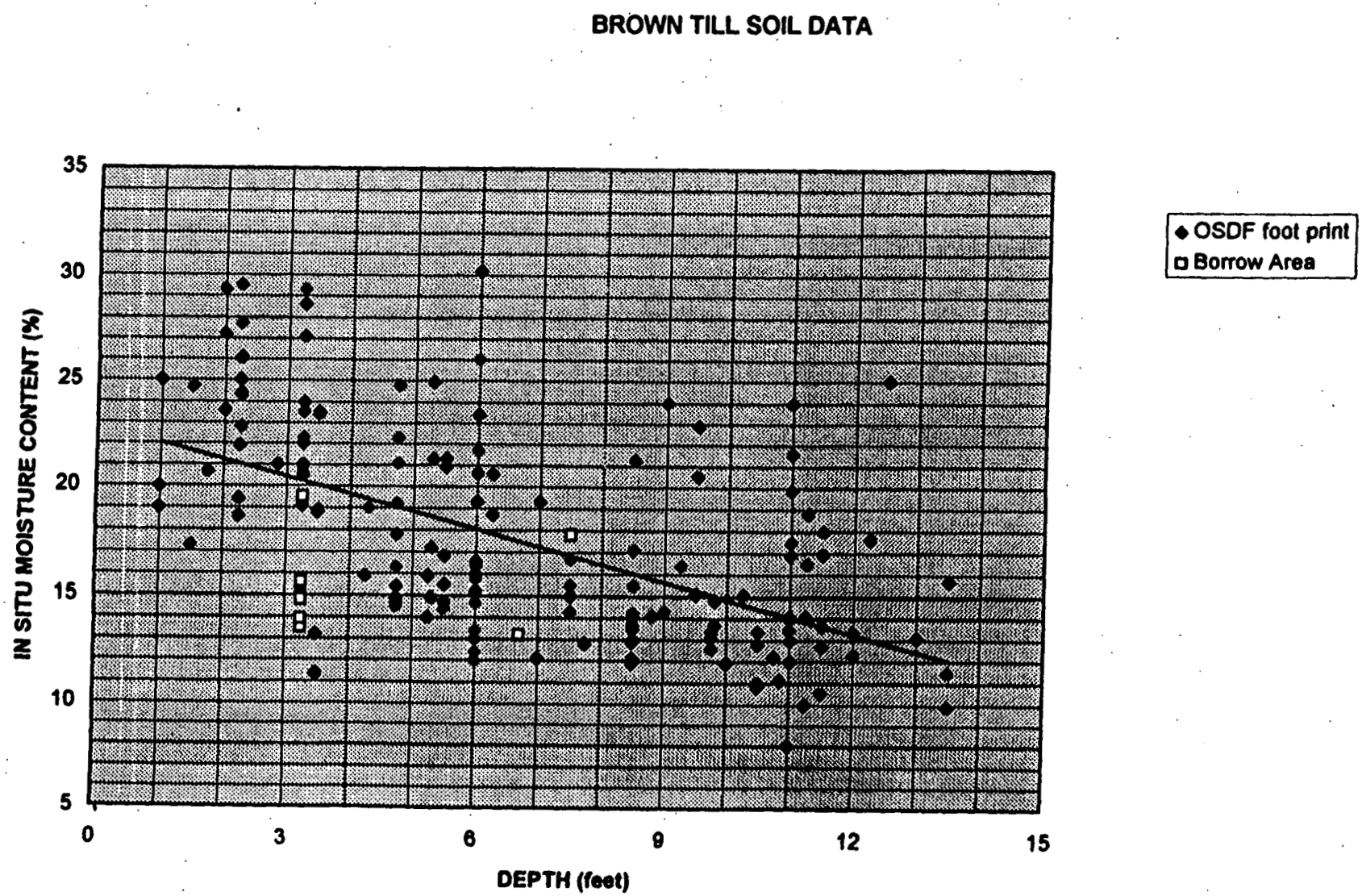

Figure 3. Brown Till In Situ Moisture Content Data

[data obtained from Parsons, 1995 and 1996]

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SURFACE-WATER MANAGEMENT AND EROSION CONTROL PLAN

ON-SITE DISPOSAL FACILITY

Revision 1D
May 2000
20100-PL-004

United States Department of Energy

Fernald Environmental Management Project
Fernald, Ohio

Prepared by

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Atlanta, Georgia 30342

Under

Fluor Fernald, Inc.
Contract 95PS005028

INFORMATION ONLY

REVISION SUMMARY

Revision	Dated	Description of Revision
0	5/97	Initial issuance of Revision 0, *Surface-Water Management and Erosion Control Plan, On-Site Disposal Facility* (20100-PL-004)
1D	5/00	Issuance of Revision 1D to incorporate lessons learned and design change notices from OSDF Phase I and II.

FEMP OSDF-SWMECP
20100-PL-004
REV. 1D, May 2000

SURFACE-WATER MANAGEMENT AND EROSION CONTROL PLAN

ON-SITE DISPOSAL FACILITY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

REVISION 1D
MAY 2000
20100-PL-004

Approved by:

Robert C. Bachus, Ph.D., GeoSyntec, OSDF Technical Evaluation Manager — Date

Reviewed by:

Uday Kumthekar, P.E., Fluor Fernald, Inc., OSDF Area Project Manager — Date

J.D. Chiou, Ph.D., P.E., Fluor Fernald, Inc., Soil & Disposal Facility Project Director — Date

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ACRONYM LIST

ARAR	Applicable or Relevant and Appropriate Requirement
BAMR	Borrow Area Management and Restoration
CFR	Code of Federal Regulations
CQA	Construction Quality Assurance
DCP	Design Criteria Package
DOE	United States Department of Energy
EPLTS	Enhanced Permanent Leachate Transmission System
FEMP	Fernald Environmental Management Project
IMP	Impacted Material Placement
LCS	Leachate Collection System
LTS	Leachate Transmission System
NPDES	National Pollutant Discharge Elimination System
OAC	Ohio Administrative Code
OEPA	Ohio Environmental Protection Agency
ODNR	Ohio Department of Natural Resources
OSDF	On-Site Disposal Facility
OU2	Operable Unit 2
OU5	Operable Unit 5
PCCI	Post-Closure Care and Inspection
ROD	Record of Decision
SWMEC	Surface-Water Management and Erosion Control
TBC	To Be Considered Criteria
USDA	United States Department of Agriculture

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1.0 INTRODUCTION

1.1 Overview

This Surface-Water Management and Erosion Control (SWMEC) Plan describes the surface-water management and erosion control practices to be followed within the battery limit of the Fernald Environmental Management Project (FEMP) On-Site Disposal Facility (OSDF), Fernald, Ohio. The guidance provided in this document applies to the use of engineered features designed to manage surface-water, minimize erosion, and control off-site sedimentation.

This SWMEC Plan (Plan) addresses surface-water management and erosion control practices throughout the construction, impacted material placement, and closure of the OSDF and the development and restoration of the borrow area. This plan does not address surface-water management and erosion control practices during or beyond the 30-year post-closure period prescribed in the "*Final Record of Decision for Remedial Actions at Operable Unit 2*" (OU2 ROD) [DOE, 1995a]. Those activities are addressed in the "*OSDF Post-Closure Care and Inspection (PCCI) Plan*" [FEMP, 1997].

1.2 Project Description

The construction and closure of the OSDF, impacted material placement, and the development and restoration of the borrow area began in 1997 and is currently in progress. Due to the potential for variations in the pace of remedial action activities, the OSDF has been designed to be constructed, have impacted material placed, and subsequently closed, in phases.

The design approach for the OSDF is presented in the document, "*Final Remedial Design Work Plan for Remedial Actions at Operable Unit 2*" [DOE, 1995b]. The currently approved design of the OSDF is presented in the "*Final Design Package, On-Site Disposal Facility*" [GeoSyntec, 1997]. The "*Design Criteria Package, On-Site Disposal Facility*" (DCP) [GeoSyntec, 2000c] for the OSDF requires preparation of a SWMEC Plan to address the work scope identified in Section 1.3 of this plan. This

SWMEC Plan also satisfies the applicable requirements identified in Section 2.0 of this plan.

1.3 SWMEC Plan Scope

This SWMEC Plan establishes the surface-water management and erosion and sediment control practices that the Contractor will follow to maintain the proper performance of the OSDF, and to minimize impacts to surrounding areas and surface-water conveyances from excessive sediment loading. The requirements for surface-water management and erosion controls are specified in the Technical Specifications. The scope of this SWMEC Plan includes a description of engineered features that will handle:

- surface-water runon from outside the battery limit to inside the OSDF battery limit;
- surface-water runoff from areas within the battery limit that will be discharged through the temporary and permanent surface-water management system of the OSDF; and
- wastewater, which includes waters that must be contained, collected, and treated.

Wastewater generated as a result of development of the OSDF area includes:

- leachate from impacted material within each cell of the OSDF; leachate is defined as surface-water that percolates into the leachate collection system (LCS), and will be discharged to the OSDF Enhanced Permanent Leachate Transmission System (EPLTS);
- impacted surface-water runoff retained within the OSDF cells; these wastewaters may be pumped to the FEMP former production area storm drainage control system or the EPLTS;

- surface-water runoff from impacted-material staging areas within the OSDF battery limits; these wastewaters will be contained, collected, and discharged to the FEMP former production area storm drainage control system;

- washwater from the equipment wash and the wheel wash facilities; these wastewaters will be contained, collected, and discharged to the FEMP former production area storm drainage control system;

- surface-water runoff from impacted-material haul roads within the OSDF battery limits; these wastewaters will be contained, collected, and discharged to the FEMP former production area storm drainage control system;

- perched groundwater that seeps into excavations from areas with impacted soil; these wastewaters will be contained, collected, and transferred to the FEMP former production area storm drainage control system.

The engineered features of the surface-water management and erosion control system are described in Sections 4.0, 5.0, and 6.0 of this plan, on the Construction Drawings, and in the Technical Specifications.

1.4 SWMEC Plan Organization

The remainder of this SWMEC Plan is organized as follows.

- A description of other plans related to this SWMEC Plan is presented in the remainder of Section 1.0.

- The requirements from the DCP applicable to this SWMEC Plan are described in Section 2.0.

- General information regarding the development of the OSDF and borrow area as they relate to this SWMEC Plan is presented in Section 3.0.

- Stabilization features are described in Section 4.0.

- Surface-water runon/runoff control structures are described in Section 5.0.
- Sediment control structures are described in Section 6.0.
- Requirements for inspection and corrective action are described in Section 7.0.
- References are presented in Section 8.0.

1.5 Related Plans

Several other support plans and reports have been prepared for the OSDF remedial action project and should be used by the Contractor in conjunction with this SWMEC Plan. The other plans and reports containing information relevant to this SWMEC Plan are listed below with a brief statement of their relationship to this plan. The Contractor will refer to the latest revisions of plans and reports listed below.

- *"Storm Water Pollution Prevention Plan"* [FDF, 1999b]. The Storm Water Pollution Prevention Plan provides the basis for the FEMP site National Pollutant Discharge Elimination System [NPDES] permit.
- *"Permitting Plan and Substantive Requirements for the OSDF"* [FDF, 1997a]. The Permitting Plan and Substantive Requirements for the OSDF report identifies and addresses permitting requirements.
- *"Remedial Action Work Plan for the OSDF"* [FDF, 1999a]. The Remedial Action Work Plan identifies the implementation strategy and preliminary schedule for completion of construction of the OSDF, placement of impacted materials, and long-term maintenance and monitoring of the OSDF.
- *"Final Design Package, On-Site Disposal Facility"* [GeoSyntec, 1997]. The Final Design Package provides calculations, drawings, and specifications for the currently approved design of the OSDF.

- *"Borrow Area Management and Restoration (BAMR) Plan, On-Site Disposal Facility"* [GeoSyntec, 2000a]. The BAMR Plan contains procedures that the Contractor will use to develop, manage, and restore the on-site borrow area.

- *"Construction Quality Assurance (CQA) Plan, On-Site Disposal Facility"* [GeoSyntec, 2000b]. The CQA Plan contains procedures to evaluate and monitor soils compaction and other construction activities of the OSDF project.

- *"Systems Plan"* [FDF, 1997b]. The Systems Plan contains procedures that the Contractor will use to inspect and maintain the OSDF during construction, impacted material placement, and closure.

- *"Impacted Materials Placement (IMP) Plan, On-Site Disposal Facility"* [GeoSyntec, 2000d]. The IMP Plan contains procedures that the Contractor will use to place impacted materials into the OSDF.

- *"Leachate Management Contingency Plan for the OSDF"* [DOE, 1998]. The Leachate Management Contingency Plan for the OSDF identifies and addresses leachate management during the period when the leachate transmission system (LTS) is not operational.

- *"OSDF Post-Closure Care and Inspection (PCCI) Plan"* [FEMP, 1997]. The PCCI Plan contains requirements for inspection and maintenance of the surface-water management and erosion controls during the post-closure period.

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2.0 REGULATORY AND OTHER APPLICABLE REQUIREMENTS

2.1 Overview

Regulatory and other requirements applicable to this SWMEC Plan are contained in the DCP [GeoSyntec, 2000c]. These requirements take the form of applicable or relevant and appropriate requirements (ARARs) and to be considered criteria (TBCs) as determined by the Record of Decision for each of the various FEMP operable units, functional requirements, and general design criteria. The following requirements applicable to the SWMEC Plan were obtained from the DCP.

2.2 Applicable or Relevant and Appropriate Requirements

General ARARs that will be addressed by the Contractor are provided here.

No.	Title	Requirement
1.	Waste Storage Piles OAC 3745-56-51, 54 & 58, and 40 CFR §264.251 through .259	Collection and holding facilities associated with a runon and runoff control system must be inspected weekly and be emptied or otherwise managed expeditiously after storms to maintain design capacity of the system.
2.	Ohio Solid Waste Disposal Regulations OAC 3745-27-19(E)(26)	The integrity of the engineered components of the landfill facility shall be maintained and any damage to, or failure of, the components shall be repaired.
3.	Ohio Solid Waste Disposal Regulations OAC 3745-27-19(J)(1), (4)	Surface water shall be diverted from areas where solid waste is being, or has been, deposited. The facility shall be designed, constructed, maintained, and provided with surface water control structures, as necessary, to control runon and runoff of surface water to ensure minimal infiltration of water

No.	Title	Requirement
		through the cover material and cap system, and minimal erosion of the cover material and cap system. If ponding or erosion occurs on areas of the landfill facility where solid waste is being, or has been, deposited, action will be taken to correct the conditions causing the ponding or erosion.
4.	Ohio Solid Waste Disposal Regulations OAC 3745-27-11(H)	At final closure of a landfill facility, all land surfaces shall be graded to prevent ponding of water where solid waste has been placed. Drainage facilities shall be provided to direct surface water from the landfill facility.
5.	Ohio Solid Waste Disposal Regulations OAC 3745-27-11(O)	Closure of the sanitary landfill facility must be completed in a manner that minimizes the need for further maintenance and minimizes post-closure formation and release of leachate and explosive gases to surface water to the extent necessary to protect human health and the environment.

2.3 Functional Requirements

The DCP contains functional requirements that have been established for the OSDF. The functional requirements which are applicable to this SWMEC Plan, and which the Contractor will meet are:

- route surface-water to designated locations where it can be appropriately managed;
- protect the OSDF from damage caused by precipitation and surface-water runon and runoff; and

- discharge surface-water to existing watercourses in accordance with applicable regulatory and Department of Energy (DOE) requirements.

The Contractor will develop a Contractor's SWMEC Work Plan (work plan) that provides details regarding implementation of surface-water management and erosion control measures that satisfies the requirements of the DCP, the Construction Drawings, the Technical Specifications, and this SWMEC Plan. The Contractor's SWMEC Work Plan will address temporary conditions during construction and closure of the OSDF, impacted material placement, and development and restoration of the borrow area. The work plan will identify specific activities which will prevent surface-water runon to the OSDF and uncontrolled surface-water and impacted runoff from the OSDF. Features of the permanent surface-water management system will be constructed to require minimal monitoring and maintenance. The system will be integrated, to the extent possible, with existing topography, features, and facilities.

2.4 Design Criteria

The DCP also identifies a number of design criteria for the OSDF. The applicable design criteria to manage surface-water and control erosion are:

- temporary surface-water control structures for the OSDF will be designed for the 25-year, 24-hour storm event [ARARs: 40 CFR §258.26 and OAC 3745-27-08(C)(6)(a) and (b)];

- temporary surface-water control structures will be designed to minimize silting and scouring [ARAR: OAC 3745-27-08(C)(6)(c)];

- temporary sediment ponds or basins, if used, will be designed following the criteria of OEPA [ARAR: OAC 3745-27-08(C)(6)(d)]; and

- permanent surface-water runon/runoff control structures for the OSDF will be designed to limit interruption and damage (i.e., washout) of the OSDF in the

2,000-year, 24-hour storm event; surface-water runon should be controlled and diverted away from and around the OSDF using drainage channels or diversion berms.

Sedimentation basins and excavations containing water may pose a drowning risk to personnel. The Contractor will provide for ring buoys around bodies of water in accordance with OSHA 1926.106.

2.5 Other Requirements

In addition to the requirements contained in the DCP, the Contractor will incorporate the following additional requirements into the Contractor's SWMEC Work Plan to manage surface-water and control erosion:

- disturbed areas will be stabilized in accordance with the Technical Specifications;
- general practices for construction, inspection, and maintenance of surface-water management and erosion control features will be in accordance with the Ohio Department of Natural Resources (ODNR) Division of Soil and Water Conservation document entitled "*Rainwater and Land Development*" [ODNR, 1996]; and
- temporary sedimentation basins will be cleaned out to the design capacity when the sediment retained in the basin has reduced one-half of the basin's original storage depth [ODNR, 1996], but at a minimum of once yearly.

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3.0 OSDF AND BORROW AREA DEVELOPMENT RELATED TO SURFACE-WATER MANAGEMENT AND EROSION CONTROL

3.1 Introduction

The OSDF will be developed in phases. Each phase may consist of the construction of cells, placement of impacted material in the cells, and closure of the cells. This plan describes surface-water management and erosion control practices for the following periods:

- preconstruction;
- cell construction;
- impacted material placement; and
- closure.

Surface-water management and erosion control measures within the cells, impacted material transfer areas, and impacted material haul roads will be maintained in accordance with the IMP plan during impacted material placement and winter shutdown. Surface-water management and erosion control is anticipated to be maintained throughout the OSDF post-closure period; however, as stated previously in Section 1.0 of this plan, post-closure activities are outside the scope of this plan and are addressed in the PCCI Plan.

A description is presented of the surface-water management and erosion control measures needed for each of the aforementioned development periods. The construction, inspection, and maintenance activities for the surface-water management and erosion control features are also presented in the remaining sections of this plan.

3.2 Preconstruction Period

The preconstruction period is defined as the period of time prior to the cell construction period. During the preconstruction period, disturbed areas will be kept to a minimum. The first step in minimizing soil erosion and sedimentation is the establishment of stabilization measures. The following stabilization measures will be implemented during the preconstruction period:

- in disturbed areas where additional grading or reworking is necessary prior to reaching final grade and is not scheduled for more than 45 days, interim vegetation will be applied to exposed soils to stabilize the soil and control erosion;
- where additional grading or reworking is not scheduled for a year or more, disturbed areas will be permanently seeded and mulched as soon as possible to stabilize soil and control erosion;
- in disturbed areas, crusting agents may be applied prior to interim or permanent vegetation with the approval of the Construction Manager;
- in areas indicated on the Construction Drawings, erosion mats will be installed following seeding; and
- riprap will be placed as indicated on the Construction Drawings within and along watercourses to prevent soil erosion under the design flow conditions.

Surface-water runon/runoff control structures will be established to minimize erosion and off-site sedimentation. These structures will also be used to divert surface-water away from impacted areas, thus maintaining separation between non-impacted surface-water and potentially impacted surface-water. Surface-water runon to areas under construction will be prevented by constructing diversions and drainage channels to route surface-water away from the disturbed areas and to drainage channels, to the extent feasible. The location of these features will be selected by the Contractor based on the sequence of construction activities and in accordance with the Contractor's SWMEC Work Plan.

The following surface-water runon/runoff and sediment control structures may be used during the preconstruction period:

- temporary sedimentation basins;
- temporary drainage channels;
- check dams;
- temporary diversions;
- silt fence; and
- culverts.

Surface-water runoff from undisturbed areas will be diverted from disturbed areas using temporary drainage channels, culverts, and temporary diversions. Surface-water runoff from disturbed areas will be diverted to a temporary sedimentation basin using temporary drainage channels, culverts, and temporary diversions.

3.3 Cell Construction Period

The cell construction period includes the excavation and construction of the OSDF cells and the excavation of the borrow area, including the construction and winter shutdown periods. The surface-water management and erosion control measures used during this period will be the same as those used for the preconstruction period. The location of these features will be selected by the Contractor based on the sequence of construction activities, in accordance with the Contractor's SWMEC Work Plan and as shown on the Construction Drawings and specified in the Technical Specifications.

Wastewater encountered during the cell construction period will be limited to perched groundwater from impacted areas. Perched groundwater that enters excavations from impacted areas will be collected in a toe drain, or other suitable sump, and pumped or otherwise transferred to the FEMP former production area storm drainage control system.

3.4 Impacted Material Placement Period

The impacted material placement period includes the period during placement of impacted material in the OSDF cells, impacted material shut-down during the construction period, and winter shutdown. Impacted material placement will be in accordance with the Technical Specifications and the Contractor's IMP Work Plan. Measures to manage surface-water and control erosion and off-site sedimentation will be similar to those features used during the construction of the OSDF. The locations of these features will be selected by the Contractor based on the sequence of construction activities and in accordance with the Contractor's IMP Work Plan and as shown on the Construction Drawings and specified in the Technical Specifications.

In addition to these features, the leachate management system will be employed to contain leachate and impacted surface-water runoff within the cells of the OSDF. If these wastewaters percolate into the LCS, they will be discharged to the EPLTS. Specifically, wastewaters that will be encountered in the cell during impacted material placement should be managed as follows.

- *Leachate:* Precipitation or other water that falls into an active (i.e., in the process of having impacted material placed in accordance with the IMP Plan) OSDF cell and percolates into the LCS will be considered leachate and will be discharged to the EPLTS.

- *Impacted Surface-Water Runoff in Cells:* Placement of impacted material in OSDF cells will be performed such that surface-water runoff from active and open portions of a cell can be managed within the cell. Surface-water runoff from the impacted material retained within the Impacted Runoff Catchment Areas may be conveyed to the FEMP former production area storm drainage control system or the EPLTS.

- *Impacted Surface-Water Runoff from Impacted Material Transfer Areas, Haul Road, and Washwater from the Equipment and Wheel Wash Facilities:* Surface-water runoff from impacted material transfer areas should drain to

sumps or impacted runoff sediment control structures and will be discharged to the FEMP former production area storm drainage control system. Surface-water runoff from impacted material haul roads within the battery limit will be contained and directed to the FEMP former production area storm drainage control system. Washwater from the Equipment and Wheel Wash Facilities will drain to a sump and will be discharged to the FEMP former production area storm drainage control system.

3.5 Closure Period

The closure period includes construction of the OSDF final cover system and the interim and final restoration of the borrow area. Features of the final cover system that may discharge surface-water to the permanent drainage structures include the contouring layer, drainage layer, and final cover surface.

Surface-water runoff from impacted material will be diverted to the Impacted Runoff Catchment Area of the adjacent down-gradient cell. For areas with a contouring layer of non-impacted material, surface-water runoff from the compacted clay cap will be diverted to the Impacted Runoff Catchment Area of the adjacent down-gradient cell until two lifts of compacted clay cap are placed in that area, after which surface-water runoff from the compacted clay cap will be diverted to permanent drainage channels as shown on the Construction Drawings and specified in the Technical Specifications. For areas with a contouring layer of impacted material, surface-water runoff from the compacted clay cap will be diverted to the Impacted Runoff Catchment Area of the adjacent down-gradient cell until four lifts of compacted clay cap are placed in that area, after which surface-water runoff from that area will be diverted to permanent drainage channels as shown on the Construction Drawings and specified in the Technical Specifications. Impacted surface-water runoff will be prevented from discharging to areas where non-impacted final cover system components are placed.

During construction of the final cover system and interim and final restoration of the borrow area, the surface-water management and erosion control measures used during the cell construction period will remain in place to the extent possible. The

permanent drainage channels, which are located at the perimeter of the OSDF, are shown on the Construction Drawings.

3.6 Post-Closure Period

As stated previously in Section 1.0, this SWMEC Plan does not address surface-water management and erosion control practices during or beyond the post-closure period as they are outside the scope of this plan; those activities are addressed in the PCCI Plan.

4.0 REQUIREMENTS FOR STABILIZATION FEATURES

4.1 Introduction

A description of the general requirements for construction, inspection, and maintenance of the stabilization features for both temporary and long-term conditions are presented in this section. These features include:

- interim vegetation;
- crusting agents;
- permanent vegetation;
- erosion mat; and
- riprap.

The construction, inspection, and maintenance of these stabilization features will be based on standard engineering and soil conservation practices. The methods presented in this section are taken from ODNR [1996]. Other methods of erosion and sediment control shall be implemented as approved by the Construction Manager.

4.2 Interim Vegetation

4.2.1 Definition

Interim vegetation is a stabilization measure that serves to hold soil in place until permanent vegetation is provided at the time of final grading. Interim vegetation includes fertilizing, seeding, and mulching. Interim vegetation establishes a temporary vegetative cover on disturbed areas by seeding with the appropriate rapid growing vegetation. Mulching involves the application of plant residues and other suitable materials to the soil surface and protects the soil surface against rain, wind, and sun while seeds are germinating and helps to ensure a fully established vegetative stand.

Because the potential for erosion in disturbed areas is high until interim vegetation becomes established, it is essential for the Contractor to preserve the integrity of earthen structures used to control sediment, such as temporary diversions and sedimentation basins during interim vegetation.

4.2.2 Purpose

The Contractor will apply interim vegetation to:

- reduce the erosion and sedimentation by stabilizing disturbed areas;
- reduce problems associated with mud or dust from bare soil surfaces during construction; and
- reduce sediment transport to downstream areas and improve the visual aspects of the construction area.

The Contractor will apply mulch to:

- inhibit erosion by protecting the soil surface from raindrop impact and reducing the velocity of overland flow; and
- foster the growth of vegetation by retaining available moisture and providing insulation against extreme heat and cold.

4.2.3 Application

The Contractor will fertilize, prepare the seedbed, and apply interim vegetation to soil surfaces in accordance with the Technical Specifications. Additional planning considerations and design criteria will be in accordance with guidelines provided in ODNR [1996].

4.2.4 Maintenance

Maintenance of interim vegetation includes repairing eroded areas, revegetating when necessary, watering, and mowing (if applicable). The Contractor will revegetate areas that do not properly germinate or produce an acceptable vegetative stand, in accordance with the Technical Specifications. The cause of the failure will be ascertained and corrected by the Contractor before revegetation. Areas requiring revegetation will be prepared in the same manner as the original installation. Once established, a regular maintenance program will be performed. Physical soil conditions in the area may be unfavorable and may require an alternative approach and/or type of stabilization such as application of crusting agents.

The Contractor will inspect applied mulch at a frequency described in Section 7.0 of this SWMEC Plan, to check for rill erosion or bare spots. Wherever eroded or bare areas are observed, the Contractor will apply additional mulch and revegetate as necessary to ensure a good vegetative cover. Inspection and maintenance of the interim vegetation is the responsibility of the Contractor until acceptance of the vegetation by the Construction Manager.

4.3 Crusting Agents

4.3.1 Definition

Crusting agents will be selected in accordance with the Technical Specifications and will be used only with the approval of the Construction Manager. Crusting agents serve to hold soil in place until interim or permanent vegetation can be applied, such as during the winter and summer seasons and for soil stockpiles.

4.3.2 Purpose

The Contractor will apply crusting agents to:

- inhibit erosion by protecting the soil surface from raindrop impact and overland flow; and
- provide dust suppression for exposed soils and exposed coal fired ash (fly ash).

4.3.3 Application

The Contractor may apply crusting agents as a temporary measure prior to applying interim or permanent vegetation, after approval by the Construction Manager. In each case, however, the crusting agent will be applied in accordance with the Technical Specifications.

4.3.4 Maintenance

The Contractor will inspect the applied crusting agent at a frequency described in Section 7.0 of this SWMEC Plan to check for rill erosion or bare spots. Wherever eroded or bare areas are observed, the Contractor will reapply the crusting agent. Inspections will take place until the area is significantly disturbed or interim or permanent vegetation is applied.

4.4 Permanent Vegetation

4.4.1 Definition

Permanent vegetation will be applied when an area has been brought to final grade. Permanent vegetation will include seeding and mulching.

4.4.2 Purpose

The Contractor will apply permanent vegetation to:

- reduce erosion and decrease sediment yield from overland flow;

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- permanently stabilize disturbed areas where permanent, long-lived vegetation is needed to stabilize soil that is at final grade; and
- permanently stabilize drainage channels where concentrated flow occurs and riprap is not required per the Construction Drawings or the Technical Specifications.

4.4.3 Application

The Contractor will prepare the seedbed and apply permanent vegetation in accordance with the Technical Specifications.

4.4.4 Maintenance

Maintenance of permanent vegetation and mulching will be performed in the same manner as for interim vegetation, as described in Section 4.2.4.

4.5 Erosion Mat

4.5.1 Definition

Erosion mat is used to stabilize areas such as drainage channels and steep slopes where interim or permanent vegetation may be slow to become fully established, or where required per the Construction Drawings or the Technical Specifications.

4.5.2 Purpose

The Contractor will place erosion mat to:

- protect the soil surface from the erosive forces of concentrated flow; and
- stabilize slopes exhibiting erosion susceptibility.

4.5.3 Application

Erosion mats will be installed in accordance with the Technical Specifications. Additional criteria will be in accordance with guidelines provided in ODNR [1996].

4.5.4 Maintenance

The Contractor will inspect the erosion mats at a frequency described in Section 7.0 of this SWMEC Plan to identify washouts or breakage of the erosion mat, until vegetation is fully established. If during inspection vegetation is found to be deficient or absent in specific areas, the Contractor will reinstall erosion mat and revegetate. If washouts or breakage occur, the problem areas will be regraded, reseeded, and new mats will be installed.

4.6 Riprap

4.6.1 Definition

Riprap is an erosion-resistant ground cover consisting of large, loose, angular stone installed wherever conditions are such that soil may erode under design flow conditions in the area. These conditions may include high velocity water flows, channelized flows, etc. Typical uses of riprap may be at culvert inlets and outlets, within drainage channels, or at the toe of slopes.

4.6.2 Purpose

The Contractor will place riprap to:

- protect the soil surface from the erosive forces of concentrated flow;
- slow the velocity of concentrated flow while enhancing the potential for infiltration; and

- stabilize slopes exhibiting seepage problems and/or erosion susceptibility.

4.6.3 Application

The Contractor will place riprap in areas indicated on the Construction Drawings, at soil-water interfaces where the soil conditions, surface-water turbulence and velocity, and expected vegetative cover are such that the soil may erode under the design flow conditions.

The Contractor will place riprap in accordance with the Technical Specifications. The size, thickness, and areal extent of the riprap to be placed is based on surface-water calculations performed to meet the requirements of Section 2.0 of this SWMEC Plan. The following minimum guidelines are from the DCP.

- Riprap used in areas where there is a transition in channel width or a transition of a slope (e.g., at toe of slope) will extend upstream and downstream of the transition a distance of five times the downstream channel depth; the minimum extension should be 15 feet.

- Riprap used at the inlet of temporary culverts will have a length of at least 2 culvert diameters and a width of at least 3 culvert diameters.

- Riprap used at the outlet of temporary culverts will have a minimum length, width, and average particle size diameter based on the calculated design peak flow velocities and design guidelines from USDA-SCS [1987].

- Riprap used at the outlet of permanent culverts will have a minimum width of three times the culvert pipe diameter and a minimum length, lining thickness, and average particle size diameter based on the calculated design peak flow velocities using Figure 2-3 of ODNR [1996].

- The minimum thickness of riprap lining will be two times average particle size diameter.

- Geotextile filter will be used to control piping and erosion beneath riprap as shown on the Construction Drawings. Geotextile filter will meet the requirements of the Technical Specifications.

Additional design criteria will be in accordance with guidelines provided in ODNR [1996] and the DCP.

4.6.4 Maintenance

Once riprap has been installed it should require little maintenance. The Contractor will inspect riprapped areas at a frequency described in Section 7.0 of this SWMEC Plan to determine if high flows have caused scour beneath the riprap or dislodged any of the stone. If corrective actions are needed, the Contractor will accomplish such repairs within the same work day.

4.7 Construction Entrance

4.7.1 General

Construction entrances will be constructed where shown on the Construction Drawings and in accordance with ODNR [1996].

4.7.2 Maintenance

The Contractor will inspect the construction entrances at a frequency described in Section 7.0 of this SWMEC Plan. The Contractor will perform maintenance in accordance with guidelines provided in ODNR [1996].

5.0 SURFACE-WATER RUNON/RUNOFF CONTROL STRUCTURES

5.1 Introduction

A description of the general requirements for construction, inspection, and maintenance of the surface-water runon/runoff control structures for both temporary and long-term conditions is presented in this section. These control structures include:

- temporary diversions;
- temporary drainage channels;
- permanent drainage channels;
- check dams; and
- culverts.

The construction, inspection, and maintenance of these control structures will be based on standard engineering and soil conservation practices. The methods presented in this section are taken from ODNR [1996]. Other methods of erosion and sediment control shall be implemented as approved by the Construction Manager.

5.2 Temporary Diversions

5.2.1 Definition

Temporary diversions include drainage channels and/or diversion berms constructed across a slope. A detail illustrating a constructed temporary diversion is provided in ODNR [1996].

5.2.2 Purpose

In general, temporary diversions are intended to prevent erosion. This is accomplished by diverting surface-water (overland sheet flow) from areas where the water may cause erosion to areas where the water can be used or disposed safely.

The Contractor will use temporary diversions to:

- divert surface-water runon away from impacted areas of the OSDF;
- divert surface-water runoff away from unprotected slopes to a stabilized outlet;
- divert sediment-laden surface-water runoff from a disturbed area to a temporary sedimentation basin;
- divert surface-water runoff around an excavation; and
- shorten the flow length within a long sloping drainage area.

5.2.3 Application

The Contractor will construct temporary diversions in areas where surface-water runoff from higher-lying areas have the potential to damage or is damaging: (i) lower-lying areas; (ii) cut or fill slopes or steeply sloping land; (iii) critical sediment source areas; and (iv) active gullies or other erodible areas.

Temporary diversions will have stable outlets and Contractor will utilize materials and practices, which will provide stability to the diversions throughout their planned life. Guidelines for stability are provided in ODNR [1996]. Diversions are not recommended below high sediment-producing areas unless land treatment practices or structural measures, designed to prevent damaging accumulations of sediment, are installed with or before the diversions. The Contractor will locate the temporary diversions according to outlet condition, topography, land use, soil type, and length of slope. Temporary diversions will be located so that surface-water will discharge to established water disposal areas, a stable watercourse, waterway, or structure.

5.2.4 Maintenance

The Contractor will inspect and maintain temporary diversions as follows:

- check for points of scour or bank failure, rubbish or channel obstruction, rodent holes, breaching or settling of the berm, excessive wear from pedestrian or construction traffic;
- repair damage and remove deposits or sediment from the temporary diversion; and
- restabilize as needed.

Inspection will occur at a frequency described in Section 7.0 of this SWMEC Plan. If the temporary diversion is found to accumulate sediment, the Contractor will periodically clean out accumulated sediment.

5.3 Temporary Drainage Channels

5.3.1 Definition

A temporary drainage channel is a natural or constructed channel or outlet shaped or graded to convey surface-water runon and runoff. The channel may have a protective lining of vegetation or erosion-resistant materials such as concrete, riprap, or erosion mat.

All temporary drainage channels will have stable outlets exhibiting adequate capacity for the design flow. The outlet must discharge in such a manner as not to cause erosion. Outlets should be constructed and stabilized prior to the operation of the temporary drainage channels.

5.3.2 Purpose

The Contractor will construct temporary drainage channels to provide for the conveyance of excess surface-water from diversions and other erosion and sediment control measures, or natural concentrations of flow without causing erosion or flooding.

5.3.3 Application

The Contractor will construct temporary drainage channels as needed to manage surface-water runon and runoff and to control erosion resulting from concentrated runoff. Temporary drainage channels will be designed by the Contractor to meet the requirements of Section 2.0 of this SWMEC Plan. Whenever possible, temporary drainage channels will be used in such a way that preserves the existing and permanent drainage system. Temporary drainage channels will generally be located in existing and permanent drainage ways where surface-water can drain in from all sides. In all situations, drainage channels will be located so that they do not make sharp, unnatural changes in direction of flow.

The proposed locations for temporary drainage channels will be selected by the Contractor based on the Contractor's sequence of construction activities and in accordance with the Contractor's SWMEC Work Plan. Supplemental measures, such as check dams, may be used in conjunction with temporary drainage channels.

5.3.4 Maintenance

The Contractor will inspect and maintain the temporary drainage channels in accordance with the following.

- Inspection will occur at a frequency described in Section 7.0 of this SWMEC Plan.
- Temporary drainage channels will be kept clear of debris.

- Any protective lining vegetation or erosion-resistant materials used in the temporary drainage channel will be maintained in the as-built condition to prevent undermining, scour, or deterioration.

5.4 Permanent Drainage Channels

5.4.1 Definition

Permanent drainage channels consist of a series of channels designed to convey surface-water runon and runoff away from the OSDF. Details of the permanent drainage channels, including the proposed locations, are shown on the Construction Drawings.

5.4.2 Purpose

The permanent drainage channels will be used to prevent surface-water runon and runoff from damaging the OSDF final cover system.

5.4.3 Application

The Contractor will construct the permanent drainage channels at the perimeter of the OSDF as shown on the Construction Drawings. The permanent drainage system will divert surface-water runoff from abutting land north and east of the facility and rejoin the existing drainage channels north and south of the FEMP former production area. The permanent drainage system will be installed in phases as the OSDF is constructed and closed.

5.4.4 Maintenance

The Contractor will inspect and maintain permanent drainage channels in accordance with the following.

- Inspection will occur at a frequency as described in Section 7.0 of this SWMEC Plan to ensure that the channels are free-flowing and not clogged with sediment or debris.
- Permanent drainage channels will be inspected and kept clear of debris.
- Any protective lining of vegetation or erosion-resistant materials used in the permanent drainage channel will be maintained in the as-built condition to prevent undermining, scour, or deterioration.

5.5 Check Dams

5.5.1 Definitions

Check dams consist of a section of rocks placed at the inlet, along the length, or at the outlet of a drainage structure. A detail illustrating a constructed check dam is provided in ODNR [1996].

5.5.2 Purpose

Check dams may be installed in temporary diversions and temporary and permanent drainage channels to reduce the velocity of the discharged surface-water and reduce erosion.

5.5.3 Application

The Contractor will install check dams in accordance with guidelines presented in ODNR [1996].

5.5.4 Maintenance

The Contractor will inspect and maintain check dams in accordance with the following.

- Inspection will occur at a frequency described in Section 7.0 of this SWMEC Plan to ensure that the structures have not been damaged by high energy flows.
- Check dams will be maintained as-built until no longer needed.

5.6 Culverts

5.6.1 Definition

Culverts are temporary or permanent structures used to convey surface-water beneath a road or other embankment.

5.6.2 Purpose

The Contractor will install culverts to provide:

- temporary means to convey surface-water under construction and operation-related roads; and
- permanent means to convey surface-water under OSDF access roads.

5.6.3 Application

The Contractor will install temporary culverts as needed to manage surface-water runon and runoff. The Contractor will design temporary culverts to meet the requirements of Section 2.0 of this SWMEC Plan and the DCP. Temporary culverts will also be designed to withstand construction traffic loading. The size, length, slope,

materials, and locations of permanent culverts will be as shown on the Construction Drawings.

5.6.4 Maintenance

The Contractor will inspect and maintain the culverts as follows.

- Inspection will occur at a frequency described in Section 7.0 of this SWMEC Plan to ensure that the culverts are clear of debris and not damaged.
- Maintenance will be performed to ensure that culverts are functioning as designed. This will include removal and disposal of any trapped sediment or debris.
- Maintenance will be performed to ensure that adequate cover is maintained over the culvert to prevent excessive deflection of the culvert under traffic loading.

6.0 SEDIMENT CONTROL STRUCTURES

6.1 Introduction

A description of the general requirements for construction, inspection, and maintenance of the sediment control structures for temporary conditions are presented in this section. These structures include:

- silt fences; and
- temporary sedimentation basins.

The construction, inspection, and maintenance of the sediment control structures should be based on standard engineering and soil conservation practices. The methods presented in this section are taken from ODNR [1996]. Other methods of erosion and sedimentation control shall be implemented as approved by the Construction Manager.

6.2 Silt Fences

6.2.1 Definition

A silt fence is a temporary sediment barrier constructed of posts and geotextile filter. The geotextile filter is stretched across and attached to the supporting posts and is entrenched. The silt fence is generally placed on the level contour of the land near the toe of a slope, although it can also be placed in a minor drainage way to intercept and detain sediment and decrease flow velocities from drainage areas of limited size.

6.2.2 Purpose

The Contractor will use silt fences to:

- intercept and detain small amounts of sediment from disturbed areas during construction operations to prevent sediment from leaving the site;

- decrease the velocity of sheet flow across the slope and very low level channel flow in the drainage way; and
- prevent sediment from washing into the impacted runoff catchment areas of OSDF active cells.

6.2.3 Application

The Contractor will install silt fences following the contours on the downslope side of areas to be disturbed, near the toe of the slope. A silt fence should not be placed directly at the toe of the slope if it is at all possible to place it several (preferably at least a horizontal distance of 5 feet) away from the toe. Criteria for establishing silt fence locations are provided on ODNR [1996]. These temporary features shall be maintained functional until permanent surface-water and erosion control structures are established.

Silt fences will be placed in the active OSDF cells as described in the IMP Plan. Under no circumstances will silt fences be installed in streams or in drainage channels where flows are likely to exceed 1 cubic foot per second, based on peak flow rates from the applicable design storm event [GeoSyntec, 2000c].

6.2.4 Maintenance

The Contractor will inspect and maintain all silt fences in accordance with the following.

- Inspection will occur at a frequency described in Section 7.0 of this SWMEC Plan to identify areas that require repair or removal of accumulated sediment.
- Accumulated silt and debris will be removed from behind the face of the silt fence when the silt deposits reach approximately one-half the height of the silt fence, taking care not to damage the silt fence when removing the accumulated sediment.

- If surface-water runoff overtops the silt fence, if water flows under or around the ends, or if the flow in the vicinity of the silt fence becomes concentrated, one of the following will be performed by the Contractor, as appropriate: (i) change the layout of the silt fence; (ii) remove the accumulated sediment; or (iii) install a different erosion and sediment control measure.

- Should the geotextile filter on a silt fence decompose, become damaged, or become ineffective and the silt fence is still a necessary erosion and sediment control, the geotextile filter will be replaced promptly.

- Any sediment deposits remaining in place after the silt fence is no longer required will be dressed to conform with the existing grade, prepared to receive interim vegetation as described in Section 4.0 of this SWMEC Plan, and seeded.

- The silt fences within active OSDF cells will be inspected and maintained in accordance with the IMP Plan.

6.3 Temporary Sedimentation basins

6.3.1 Definition

A temporary sedimentation basin is a structure designed to capture and store sediment and other waterborne debris.

6.3.2 Purpose

Temporary sedimentation basins are constructed downgradient of construction activities. Sedimentation basins are not 100 percent effective in trapping sediment which flows into them. Therefore, they should be used in conjunction with erosion control measures such as interim vegetation and/or diversions to reduce the amount of sediment flowing into the basin. Temporary sedimentation basins will receive only surface-water not wastewater.

6.3.3 Application

The Contractor will construct temporary sedimentation basins in accordance with the Construction Drawings and as described in the Technical Specifications. Temporary sedimentation basins will be located to intercept the largest possible amount of surface-water runoff from the disturbed areas. Temporary sedimentation basins will be removed after the exposed areas are adequately protected against erosion by vegetative or mechanical means as directed by the Construction Manager.

Removal of a temporary sedimentation basin will consist of:

- draining the sedimentation basin of all water;
- removing the sediments from the basin;
- removing primary and emergency spillways and appurtenances;
- grading the sedimentation basin to the lines and grades provided by the Construction Manager; and
- revegetating disturbed areas.

6.3.4 Maintenance

The Contractor will inspect and maintain the temporary sedimentation basins. Inspection will occur at a frequency described in Section 7.0 of this SWMEC Plan. Regular maintenance will include repair of eroded areas, replacement of vegetation or riprap around the basins, repair of damaged or clogged spillways in the basins, and removal of sediment from the basins. Sediment will be removed to the design capacity when the sediment retained in the basin storage depth has reduced to one-half of the basin's original storage depth, and at a minimum of once annually.

7.0 INSPECTION AND CORRECTIVE ACTIONS

7.1 Introduction

A description of general requirements for inspection and corrective action common to surface-water management and erosion control measures is presented in this section. Inspection is required to evaluate the effectiveness and need for maintenance of the surface-water management and erosion control measures. These general requirements include:

- frequency of inspection;
- format of inspection records; and
- scheduling of any identified corrective actions.

The inspection and maintenance of surface-water and erosion control measures should be based on standard engineering and soil conversation practices. The methods presented in this and preceding sections are taken from ODNR [1996]. The Contractor will maintain, repair, and replace surface-water management and erosion control measures throughout the duration of the Contractor's contract in accordance with this SWMEC plan and the Technical Specifications.

7.2 Inspections

Inspections by the Contractor of the surface-water and erosion control measures will occur, at a minimum, at the following frequencies:

- weekly;
- daily after each rain event exceeding 0.5 inches; and
- at least daily during prolonged rainfall events.

7.3 Records of Inspection

Records of Inspections will be kept on file in a secured on-site location by the Contractor and will be submitted monthly to the Construction Manager. Records of Inspection will include the following:

- summary of the scope of the inspection;
- name of the inspector;
- inspection date;
- purpose of the inspection (e.g., regular, weekly, following a storm, etc...);
- inspection location;
- observations relative to performance of the surface-water management and erosion and sediment control measures;
- any necessary corrective actions; and
- corrective actions completed and their performance since the previous inspection.

7.4 Corrective Actions

Corrective actions will be performed as required in Technical Specifications and this SWMEC Plan. Required corrective actions to surface-water management and erosion control measures will be initiated by the Contractor upon discovery, but no later than 24 hours after discovery.

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CONSTRUCTION QUALITY ASSURANCE PLAN

ON-SITE DISPOSAL FACILITY

20100-PL-0006
Revision ~~1C~~ 1D
~~April~~ May 2000

United States Department of Energy

Fernald Environmental Management Project
Fernald, Ohio

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Under

INFORMATION ONLY

Fluor Fernald, Inc.
~~Sub~~Contract 95PS005028

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REVISION SUMMARY

Revision	Dated	Description of Revision
0	5/97	Initial issuance of Revision 0, *Construction Quality Assurance Plan, On-Site Disposal Facility* (20100-PL-0006)
1D	5/00	Issuance of Revision 1D to incorporate lessons learned and design change notices from OSDF Phase I and II.

CONSTRUCTION QUALITY ASSURANCE PLAN

ON-SITE DISPOSAL FACILITY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

REVISION 1D
MAY 2000
20100-PL-0006

Approved by:

_____ _____
J.F. Beech, Ph.D., P.E., GeoSyntec, OSDF Principal-In-Charge Date

Reviewed by:

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J.D. Chiou, Ph.D., P.E., Fluor Fernald, Inc., Soil & Disposal Facility Project Director Date

ACRONYM LIST

ALARA	As Low As Reasonably Achievable
APZ	Acceptable Permeability Zone
ARAR	Applicable or Relevant and Appropriate Requirement
ASTM	American Society of Testing and Materials
BAMR	Borrow Area Management and Restoration
CFC	Certified-For-Construction
C~~C~~M	Construction Manager
COE	Corps of Engineers
~~CQC~~CQA	Construction Quality Assurance
CQC	Construction Quality Control
CS	Confirmatory Sampling
CSS	Construction Safety and Security
DCP	Design Criteria Package
DOE	~~United States~~ Department of Energy
DOT	Department of Transportation
FEMP	Fernald Environmental Management Project
FTMS	Federal Testing Method Standards
GCL	Geosynthetic Clay Liner
GCC	Geosynthetic Clay Cap
HDPE	High Density Polyethylene
IMP	Impacted Materials Placement
NSF	National Sanitation Foundation
O&M	Operations and Maintenance
OAC	Ohio Administrative Code
OEPA	Ohio Environmental Protection Agency
OSDF	On-Site Disposal Facility
OU1	Operable Unit 1
OU2	Operable Unit 2
OU3	Operable Unit 3
OU4	Operable Unit 4

OU5	Operable Unit 5
PE	Polyethylene
QA	Quality Assurance
QC	Quality Control
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
SDFP	Soil and Disposal Facility Project
SWMEC	Surface Water Management and Erosion Control
TPP	Test Pad Program
TPPFR	Test Pad Program Final Report
USEPA	United States Environmental Protection Agency
WAC	Waste Acceptance Criteria
WAO	Waste Acceptance Organization

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1. INTRODUCTION

1.1 Overview

This Construction Quality Assurance (CQA) Plan ~~describes the quality assurance and~~ provides requirements for the construction quality control (CQC) activities that will be ~~undertaken~~ performed during construction of the On-Site Disposal Facility (OSDF) at the Fernald Environmental Management Project (FEMP) near Fernald, Ohio. The purpose of this document is to define the scope, formal organization, and ~~procedures~~ activities necessary to achieve a high level of quality in the OSDF and ~~assure~~ confirm that the OSDF components are constructed in compliance with the ~~approved~~ Construction Drawings and Technical Specifications. This plan addresses the ~~CQA and~~ CQC activities to be performed during construction of the OSDF.

The OSDF CQA Plan ~~will~~ addresses CQC activities for the following elements of the OSDF construction:

- general earthwork;
- liner system;
- final cover system;
- leachate collection, leak detection, and leachate transmission systems;
- electrical and mechanical work; ~~and~~
- roads and concrete work; and
- other general site work.

It should be noted that this CQA Plan does not cover CQC requirements for placement of impacted materials into the OSDF. CQC requirements for placement of impacted materials into the OSDF are contained in the *Impacted Materials Placement Plan.*

The ~~quality assurance and~~ quality control monitoring, ~~and~~ testing, and confirmation of compliance ~~procedures~~, along with the required frequency of tests, are provided in this Plan. Also detailed ~~in this plan~~ are the organization and minimum qualifications of the CQC personnel and other key parties to be involved in the construction of the OSDF as well as the minimum standards for construction testing and documentation to ~~assure~~ confirm quality.

1.2 Project Description

The design approach for the OSDF is presented in the document, "*Final Remedial Design Work Plan for Remedial Actions at Operable Unit 2*". The design of the OSDF, ~~as currently developed,~~ is presented in the "*Final Design Package, On-Site Disposal Facility*". The OSDF Design Criteria Package (DCP) component of the Final Design Package requires preparation of a CQA Plan to address, at a minimum, the following~~;~~:

- construction of the double composite liner system;
- construction of the leachate management system;
- construction of the final cover system; ~~and~~
- general site work including roads and concrete; and
- ~~general site work including~~ installation of various appurtenances such as ~~general earthwork,~~ mechanical and electrical systems, ~~roads, and concrete~~ valve house, and piping.

This CQA Plan ~~presented in this document~~ has been prepared to address these items and to satisfy the applicable requirements identified in Section 2 of this plan. The interface of the CQA Plan with other related plans is discussed in Section 1.6.

1.3 Major Components of the OSDF

The major components of the OSDF include the liner system, final cover system, leachate management system, surface-water management system, support elements, utilities, and temporary support facilities. A summary of these major components is presented below:

- *Liner and Final Cover Systems.* The liner and final cover systems ~~will be~~ are constructed using both soil and geosynthetic components (refer to Figure 1-1). The liner system consists of a double-composite liner that will have a leachate collection system (LCS) above the primary liner and a leak~~age~~ detection system (LDS) between the primary and secondary liners. The final cover system includes a composite cap overlain by the following layers: drainage layer; biointrusion barrier; granular filter layer; vegetative soil layer; and topsoil.

- *Leachate Management System.* The leachate management system collects leachate generated by the OSDF and conveys it to a treatment facility. Components of the leachate management system within the battery limit include: double-walled gravity drain pipes from each OSDF cell, ~~detection and collection manholes~~ valve houses for collection and transmission of liquids from the LCS and LDS, double-walled gravity transmission pipe, control valve house and permanent lift station.

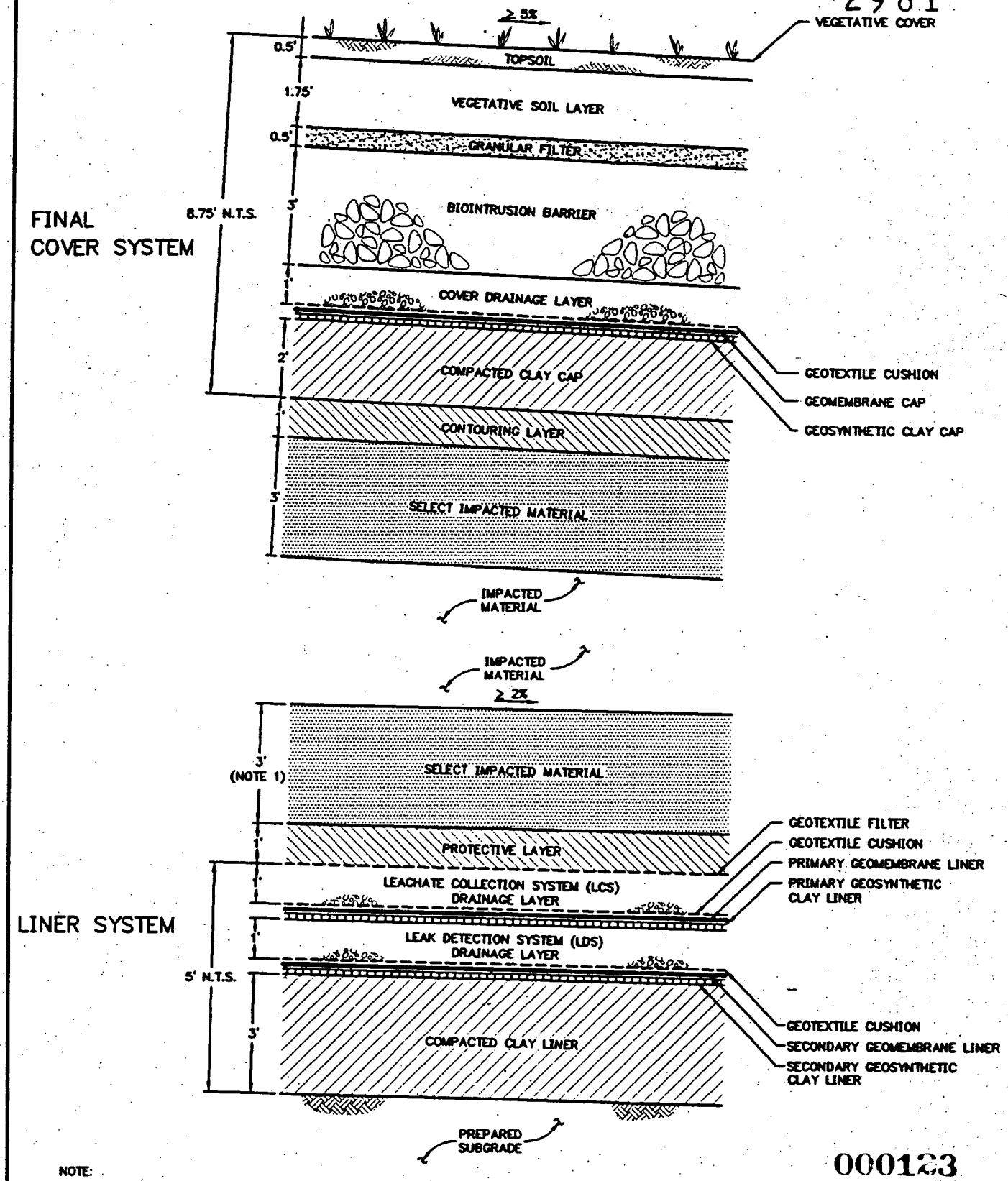
- *Surface-Water Management System.* The surface-water management system manages surface water under both short-term (i.e., during construction and impacted material placement) and long-term (i.e., after OSDF closure) conditions. The design addresses the management of stormwater ~~runon~~run-on

and runoff, perched ground water, other construction waters, and wastewaters from various sources such as the equipment ~~decontamination~~ wash facility.

- *Support ~~Elements~~ Facilities and Utilities.* Both permanent and temporary support facilities ~~elements~~ are included in the OSDF design. Permanent support ~~elements~~ facilities include survey benchmarks, security fencing, a perimeter access corridor, and a facility access road. Temporary support ~~elements~~ facilities include construction and radiological control ~~security~~ fencing, Contractor's administrative support facilities, equipment ~~decontamination~~ wash facility, impacted material staging areas, temporary haul roads and construction materials stockpile areas. Utilities to support OSDF construction include electrical, water, telephone, and wastewater ~~lines~~ for the Contractor's administrative support areas and temporary support facilities. The Contractor's administrative support areas ~~offices~~ are also provided with parking, ~~security fencing~~, and ~~all-weather ingress and egress~~ a construction access road.

LINER AND COVER SYSTEM DESIGN
ON-SITE DISPOSAL FACILTY

- 2981



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NOTE:

1. SELECT IMPACTED MATERIAL THICKNESS ABOVE LINER SYSTEM MAY BE DECREASED TO 2 FEET IF THE FIRST LIFT OF MATERIAL TO BE PLACED OVER THE SELECT IMPACTED MATERIAL CONSISTS OF SOIL OR RELATIVELY SMALL SIZE DEBRIS THAT CAN BE PLACED IN CONTROLLED LIFTS.

GEOSYNTEC CONSULTANTS
ATLANTA, GEORGIA

FIGURE NO.	1-1
PROJECT NO.	GE3900-16.4
DOCUMENT NO.	F9650002.CDO

1.4 CQA Plan Scope

The CQA Plan establishes ~~the quality assurance and~~ quality control ~~procedures~~ activities and monitoring requirements to be implemented during construction of the OSDF. The CQA Plan was developed to conform ~~with~~to the Ohio Environmental Protection Agency (OEPA) requirements ~~(~~[ARAR: Ohio Administrative Code (OAC) 3745-27-08(F)~~)~~]] and relevant U.S. Environmental Protection Agency (USEPA) guidance. The scope of the CQA Plan includes:

- defining the responsibilities of parties involved with the construction of the OSDF;
- providing guidance in the proper construction of liner and cover system components;
- establishing testing protocols for the evaluation of ~~lining~~ liner and cover system components;
- establishing ~~procedures~~ methods for construction documentation; and
- providing the means for ~~assuring~~ confirming that the facilities constructed conform to the Applicable or Relevant and Appropriate Requirements (ARARs), specifications, and construction drawings.

The CQA Plan is intended to give guidance to the CQC Consultant and the ~~Subcontractor~~ Contractor during the construction of the OSDF and to supplement the specifications of the OSDF Construction ~~Sub~~Contract. This plan is part of the construction ~~sub~~contract. In the case of any conflicts between the CQA ~~procedures described in this plan~~ Plan and the requirements of the ~~project~~ technical specifications, the technical specifications will govern.

~~It should be noted that the scope of this CQA Plan does not cover procedures for CQA/CQC for placement of impacted materials into the OSDF. CQA/CQC procedures~~

~~for placement of impacted materials into the OSDF are contained in the *Impacted Materials Placement Plan.*~~

1.5 CQA Plan Organization

The remainder of this CQA Plan is organized as follows:

- other OSDF plans related to this CQA Plan are summarized in the remainder of Section 1;
- the requirements from the OSDF DCP applicable to the CQA Plan are presented in Section 2;
- the definitions of key terms are presented in Section 3;
- the project organization and definitions, responsibilities, and qualifications of key parties involved with the construction of the OSDF are presented in Section 4;
- the requirements for CQC documentation are described in Section 5;
- the CQC activities for the soil components of the OSDF ~~lining~~ liner and final cover systems and general earthwork are presented in Section 6;
- the CQC activities for geomembranes, including electric leak detection testing, geosynthetic clay liner and cap, and geotextiles are presented in Sections 7 through 9, respectively;
- the CQC activities for the installation of valve houses and control valve house, including pre-engineered building ~~HDPE manholes~~ concrete protective liner, HDPE pipes, and fittings~~, and valves~~ are presented in Section 10;

- the CQC activities for appurtenant work items such as mechanical and electrical systems, and concrete appurtenances are described in Sections 11 and 12, respectively;

- the CQC activities for road construction are presented in Section 13; and

- the CQC activities for general site work are presented in Section 14.

1.6 Related Plans

Several other plans have been prepared for the OSDF and contain information relevant to the CQA Plan. These other plans are listed below along with a brief statement of the relationship of the plan to this CQA Plan.

- *OSDF Impacted Materials Placement (IMP) Plan.* The *IMP Plan* contains information regarding the placement, compaction, and testing of impacted materials within the OSDF.

- *OSDF Systems Plan.* The *Systems Plan* contains information regarding the OSDF and various support elements and utilities.

- *OSDF Surface-Water Management and Erosion Control (SWMEC) Plan.* The *SWMEC Plan* addresses stormwater runon and runoff and various aspects of erosion and sediment control.

- *OSDF Borrow Area Management and Restoration (BAMR) Plan.* The *BAMR Plan* addresses the development, operation, and subsequent restoration of the on-site borrow area.

- *OSDF Remedial Action Work Plan.* The plan identifies the implementation strategy and schedule for completion of construction of the OSDF.

- *Permitting Plan and Substantive Requirements for the OSDF.* This plan identifies and address permitting requirements.

- *Leachate Management Contingency Plan for the OSDF.* This plan identifies and addresses leachate management during periods when the Leachate Transmission System is not operational.

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2. ~~APPLICABLE~~ REQUIREMENTS

2.1 Overview

Regulatory and other requirements applicable to the CQA Plan are contained in the DCP. These requirements take the form of Applicable or Relevant and Appropriate Requirements (ARARs) for the various FEMP operable units, functional requirements, and general design considerations. The following requirements applicable to the CQA Plan were obtained from the DCP.

2.2 Applicable or Relevant and Appropriate Requirements

Various ARARs provide criteria for the selection and installation of materials to be used in the OSDF liner and final cover systems. Many of the CQA standards described herein were ~~derived~~ developed from the requirements of the Ohio Administrative Code (OAC) 3745-27-08. Specific criteria for the OSDF are presented in the following sections.

2.2.1 Liner System

The function of the liner system is to isolate impacted material from the environment while containing and collecting leachate generated by the material. As shown on Figure 1-1, the liner system will contain two liners (i.e., primary and secondary liners), separated by a leak detection system, with the primary liner overlain by a leachate collection system (ARAR: 40 CFR § 265.301(a)). Both the primary and secondary liners will consist of a geomembrane liner overlying a geosynthetic clay liner; in addition, the geosynthetic components of the secondary liner will be underlain by a 3-ft (0.9-m) thick layer of compacted~~,~~ low-permeability clay (i.e., a clay with a hydraulic conductivity not more than 1×10^{-7} cm/s (ARAR: OAC 3745-27-08(C)(1)(j)(ii)).

2.2.1.1 Compacted Clay Liner

The compacted clay liner shall satisfy the requirements of OAC 3745-27-08(C)(1). Specifically, the compacted clay liner shall be constructed:

- using loose lifts 8 in. thick, or less, to achieve uniform compaction; each lift shall have a maximum hydraulic conductivity of 1×10^{-7} cm/s (ARAR: OAC 3745-27-08(C)(1)(a));
- of a soil with a maximum clod size of 3 in., or half the compacted lift thickness, whichever is less (ARAR: OAC 3745-27-08(C)(1)(b)); and
- of a soil with:
  - 100 percent of the particles having a maximum dimension not greater than 2 in.;
  - not more than 10 percent of the particles, by weight, having a dimension greater than 0.75 in.;
  - not less than 50 percent of the particles, by weight, passing through the standard U.S. No. 200-mesh sieve; and
  - not less than 25 percent of the particles, by weight, having a maximum dimension not greater than 0.002 mm (ARAR: OAC 3745-27-08(C)(1)(c)).

OAC 3745-27-08(C) states that alternatives to the prescriptive requirements for soil liner materials may be used: *"if it is demonstrated to the satisfaction of the Director that materials and techniques will result in each lift having a maximum permeability of 1×10^{-7} cm/s."* As a result of the test pad program described in this CQA Plan the percentage of particles, by weight, having a maximum dimension not greater than 0.002 mm was changed from *"not less than 25 percent"* to *"not less than 15 percent."* A copy of the approval letter is included in Appendix A.

As part of the OSDF design, a compacted clay liner test pad program (TPP) was conducted using soil obtained from the area of OSDF excavation. During the TPP, two test pads were constructed using equipment and techniques that ~~are~~ were suitable for use in construction of the OSDF clay liner and cap. Laboratory and field permeability testing was performed during the TPP to define the compaction conditions that yield a soil liner or cap with a hydraulic conductivity of not greater than 1 x 10^{-7} cm/s. The TPP was organized to comply with the requirements set forth in OAC 3745-27-08(C)(1)(m).

The results of the TPP, including ~~all~~ laboratory and field hydraulic conductivity test results from the program, are presented in a report entitled *Test Pad Program Final Report (TPPFR) and Addendum*. The TPPFR Addendum outlines moisture/compaction requirements for developing a hydraulic conductivity window for each screened clay material stockpile. This report specifies construction equipment types and construction requirements ~~procedures~~ that result in a compacted clay liner and cap satisfying the hydraulic conductivity performance criterion of OAC 3745-27-08(C)(1). The report is available for reference by the ~~Subcontractor~~ Contractor and should be consulted for the information contained therein.

During construction of the OSDF liner and cap systems, a detailed ~~CQA~~ CQC program must be implemented in accordance with OAC 3745-27-08(F). The ~~CQA~~ CQC activities will include moisture/density testing of soil liner materials at the frequency required by OAC 3745-27-08(C)(1)(o) (i.e., no less than five tests per acre per lift) to ~~verify~~ confirm that the compaction conditions are consistent with those established during the TPP, and monitoring activities in accordance with 40 CFR § 264.303(C). In so doing, a high level of quality control ~~assurance~~ will be provided to confirm that the hydraulic conductivity of the soil liner material is not greater than 1 x 10^{-7} cm/s.

In addition to the foregoing, the compacted clay liner shall:

- be compacted to at least 95 percent of the maximum standard Proctor dry density (ASTM D 698), or at least 90 percent of the maximum modified Proctor dry density (ASTM D 1557) (ARAR: OAC 3745-27-08(C)(1)(d));

- be compacted at a moisture content at or wet of optimum (ARAR: OAC 3745-27-08(C)(1)(e));

- not be comprised of solid waste (ARAR: OAC 3745-27-08(C)(1)(f));

- be constructed using the number of passes and lift thickness, and the same or similar type and weight of compaction equipment, used to obtain acceptable results during the soil liner test pad program (ARAR: OAC 3745-27-08(C)(1)(g));

- be placed on the bottom and excavated exterior slope of the OSDF and have a minimum bottom slope of 2 percent and a maximum slope based on: (i) compaction equipment limitations; (ii) slope stability; (iii) maximum shear strength between soil-geosynthetic and geosynthetic-geosynthetic interfaces; and (iv) resistance of geosynthetics and geosynthetic seams to tensile stresses (ARAR: OAC 3745-27-08(C)(1)(h));

- be constructed on a prepared surface that is: (i) free of debris, foreign material, and deleterious material; (ii) be able to bear the weight of the OSDF without causing or allowing a failure of the compacted clay liner to occur through settling; and (iii) without abrupt changes in grade that could cause damage to the geosynthetics (ARAR: OAC 3745-27-08(C)(1)(i)); and

- be adequately protected from damage due to desiccation, freeze/thaw cycles, wet/dry cycles, and the intrusion of objects during construction, filling, and closure (ARAR: OAC 3745-27-08(C)(1)(l)).

OAC 3745-27-08(D)(1) indicates that the following conformance tests shall be performed on representative samples of the clay to be used for liner construction at a frequency not less than one test per 1,500 yd^3 of in place ~~of~~ soil, except for the

hydraulic conductivity testing, which shall be performed at a frequency not less than one test per 10,000 yd^3 of in place material:

- hydraulic conductivity on specimens compacted to achieve the conditions described in the construction specifications;
- moisture content and dry density using an approved ASTM method;
- ~~grain~~ particle size distribution using the test method ASTM D 422 for sieve and hydrometer analyses; and
- Atterberg limits using the test method ASTM D 4318.

2.2.1.2 Geosynthetic Clay Liner

The geosynthetic clay liner (GCL) shall satisfy the requirements of OAC 3745-27-08(C)(3). Specifically, the GCL shall:

- be negligibly permeable to fluid migration (interpreted herein to require that the GCL have a maximum ~~a~~ hydraulic conductivity of 5×10^{-9} cm/s);
- be installed having a minimum overlap of 6 in., or, for end of panel seams, a minimum overlap of 12 in. (overlap shall be increased in accordance with manufacturers specifications or to account for shrinkage due to weather conditions);
- have a bentonite mass per unit area of at least one pound per square foot;
- be installed in accordance with the manufacturer's specifications in regard to handling, overlap, and the use of granular or powdered bentonite to enhance bonding at the seams; and
- be installed above the compacted clay liner for the secondary liner GCL, and above the LDS granular drainage layer for the primary liner GCL.

- ~~be constructed above the compacted clay liner.~~

2.2.1.3 Geomembrane Liner

The geomembrane component of the liner and final cover systems shall satisfy the requirements of OAC 2745-27-08(C)(2). Specifically the geomembrane shall:

- be placed on a GCL which has been previously placed over a compacted clay liner (ARAR: OAC 3745-27-08(C)(2));
- be manufactured of at least 60-mil thick high density polyethylene (ARAR: OAC 3745-27-08(C)(2));
- be protected from the drainage layer by a cushion layer (ARAR: OAC 3745-27-08(C)(2));
- be negligibly permeable to fluid migration (ARAR: OAC 3745-27-08(C)(2)(a));
- be physically and chemically resistant to attack by solid waste, leachate, or other materials which may come in contact with the geomembrane (ARAR: OAC 3745-27-08(C)(2)(b));
- be seamed to allow no more than negligible amounts of leakage; the seaming material shall be physically and chemically resistant to attack by solid waste, leachate, or other materials that may come in contact with the seams (ARAR: OAC 3745-27-08(C)(2)(c));
- have acceptable properties for installation and use (ARAR: OAC 3745-27-08(C)(2)(d)); and
- as necessary, be protected from the overlying leachate collection system by a cushion layer (ARAR: OAC 3745-27-08(C)(2)(e)).

Geomembrane seams shall be tested by the Installer in accordance with the following, unless the geomembrane manufacturer's specifications for testing are more stringent, in which case the manufacturer's specifications shall be used:

- for the purpose of testing every seaming apparatus in use each day, peel and shear tests shall be performed on scrap pieces of geomembrane at the beginning of the seaming period and every 4 hours thereafter (ARAR: OAC 3745-27-08(C)(2)(g)(i));
- nondestructive testing shall be performed on 100 percent of the geomembrane seams (ARAR: OAC 3745-27-08(C)(2)(g)(ii)); and
- destructive testing for peel and shear shall be performed at least once every 500 ft of seam length (ARAR: OAC 3745-27-08(C)(2)(g)(iii)).

2.2.2 Leachate Collection System

The functions of the leachate collection system (LCS) are to collect leachate, route it from the OSDF to the leachate transmission system, and limit the buildup of hydraulic head on the underlying primary composite liner (functional requirements). The LCS shall extend over all areas that will subsequently be used for impacted material disposal and function with minimal maintenance and monitoring.

In accordance with OAC 3745-27-08(D)(2) the following conformance tests shall be performed on representative samples of the granular drainage components of the LCS:

- permeability (ASTM D 2434);
- soil classification (ASTM D 2487);
- particle-size analysis (ASTM C 136); and
- calcium carbonate content (ASTM D 3042).

The conformance tests described above shall be performed at a frequency of not less than one test per 3,000 yd^3 with the exception of calcium carbonate testing which will be performed at a frequency of one test per 5,000 yd^3.

2.2.3 Leak Detection System

The function of the leak detection system (LDS) is to detect leakage through the overlying primary composite liner system. The LDS shall be designed to collect leakage, should it occur, and route it from the OSDF to the leachate management system. The LDS shall extend over all areas that will subsequently be used for impacted material disposal and as with the LCS, function with minimal maintenance and monitoring.

In accordance with the ARAR OAC 3745-27-08-(D)(2), the following conformance tests shall be performed on representative samples of the granular drainage components of the LDS:

- permeability (ASTM D 2434);
- soil classification (ASTM D 2487);
- particle size analysis (ASTM C 136); and
- calcium carbonate content (ASTM D 3042).

The conformance tests described above shall be performed at a frequency of not less than one test per 3,000 yd^3 with the exception of calcium carbonate testing which will be performed at a frequency of one test per 5,000 yd^3.

2.2.4 Final Cover System

The final cover system must isolate impacted material in the OSDF, protect the OSDF from inadvertent intrusion, promote vegetative growth, and greatly limit

infiltration of precipitation into the facility after closure. The final cover system must also be designed to minimize requirements for long-term monitoring, maintenance, and repair. The components of the final cover system are shown in Figure 1-1 and include (in descending order), topsoil, vegetative soil layer, granular filter layer, biointrusion barrier, cover drainage layer, geotextile cushion layer, and composite cap~~, and impacted-material contouring layer~~.

2.2.4.1 Topsoil

A vegetated topsoil layer will form the uppermost component of the OSDF final cover system. The topsoil shall satisfy the requirements of OAC 3745-27-08-(C)(15)(e).-The topsoil layer shall have healthy grasses or other vegetation that form a complete and dense vegetative cover (ARAR: OAC 3745-27-08(C)(15)(e)). ~~The topsoil shall satisfy the requirements of OAC 3745-27-08-(C)(15)(e).~~

2.2.4.2 Vegetative Soil Layer

A vegetative soil layer will underlie the topsoil component of the OSDF final cover system. The vegetative soil layer shall satisfy the requirements of OAC 3745-27-08-(C)(15)(e). The vegetative soil layer shall be a well-graded mixture of clayey, silty, and sandy material, at least 1.75 ft thick and have sufficient thickness to support vegetative growth and to protect the ~~geomembrane~~ geosynthetics and compacted clay components of the ~~geo~~composite cap from damage due to root penetration (ARAR: OAC 3745-27-08(C)(15)(e)).

2.2.4.3 Granular Filter

A granular filter will underlie the vegetative soil layer component of the OSDF final cover system. The granular filter shall satisfy the requirements of the specifications and comply with the following design criteria:

- be at least 6 in. thick; and
- prevent migration of soil from the vegetative ~~support~~ soil layer through the filter to the biointrusion barrier layer.

2.2.4.4 Biointrusion Barrier

A biointrusion barrier layer shall underlie the granular filter component of the OSDF final cover system. The purpose of this layer is to prevent intrusion of plant roots and burrowing animals into the OSDF. The biointrusion barrier layer shall satisfy the requirements of the technical specifications and consist of durable cobbles (possibly with gravel and boulder size fractions), be at least 3 ft thick and extend at least 40 ft laterally beyond the limit of impacted material disposed in the OSDF.

2.2.4.5 Cover Drainage Layer

A cover drainage layer shall underlie the biointrusion barrier component of the OSDF final cover system and overlie the geomembrane cap component of the OSDF final cover system (OAC 3745-27-08(C)(15)(a)). The cover drainage layer shall consist of a 12 in. thick~~ness of~~ granular drainage material, with the cover drainage layer meeting the requirements of OAC 3745-27-08(C)(4)(a) (ARAR: OAC 3745-27-08(C)(16)(b)(i)).

2.2.4.6 Geotextile Cushion Layer

A geotextile cushion layer shall satisfy the requirements of the technical specifications. The geotextile shall be installed above the geomembrane cap component of the OSDF final cover system to protect the geomembrane from puncture by particles in the overlying cover ~~granular filter~~ drainage layer and resist the effects of construction (i.e., termed construction survivability).

2.2.4.7 Composite Cap

The OSDF final cover system shall contain three low-permeability infiltration barrier layers designed to isolate impacted material from the surrounding environment while minimizing ~~liquid~~ precipitation infiltration into the OSDF. These three layers are, from top to bottom (Figure 1-1):

- 60-mil thick geomembrane cap;
- geosynthetic clay cap; and
- 2-ft thick compacted clay cap.

Taken together, these three layers are called the "composite cap". Applicable criteria for the composite cap are as follows:

- The composite cap shall overlie all areas where impacted material has been placed (ARAR: OAC 3745-27-08(C)(15)).
- The composite cap shall have a permeability less than or equal to the permeability of the liner system (ARAR: 40 CFR §265.310).
- The compacted clay component of the composite cap shall satisfy the requirements of the specifications and have a minimum thickness of 24 in. and a maximum hydraulic conductivity of 1×10^{-7} cm/s (ARAR: OAC 3745-27-08(C)(15)(ii)). In addition, the compacted clay cap must satisfy the requirements of OAC 3745-27-08(C)(1)(a) to (C)(1)(g) and (C)(1)(m) to (C)(1)(o) (ARAR: OAC 3745-27-08(C)(16)(a)(ii)).
- The HDPE geomembrane component of the composite cap shall have a minimum thickness of 60 mils, be negligibly permeable to fluid migration, and satisfy the requirements of OAC 3745-27-08(C)(2) (ARAR: OAC 3745-27-08(C)(16)(a)(ii)).

- The composite cap shall be constructed at a slope between 5 and 25 percent (ARAR: OAC 3745-27-08(C)(15)(f)(ii)).

- Any penetrations through the composite cap system shall be sealed so that the integrity of the compacted clay component of the cap is maintained (ARAR: OAC 3745-27-08(C)(15)).

2.3 Other Considerations

This CQA Plan also reflects the guidance of the Hazardous and Solid Waste Amendments of 1984 to the Resource Conservation and Recovery Act (RCRA), as well as the following Technical Guidance Documents:

- "Construction Quality Assurance for Hazardous Waste Land Disposal Facilities", EPA/530-SW-86- 031, October 1986; and

- "Quality Assurance and Quality Control for Waste Containment Facilities", EPA/600/R-93/182, September 1993.

3. CQA PLAN DEFINITIONS

3.1 Construction Quality Assurance and Construction Quality Control

In the context of this document, construction quality assurance and construction quality control are defined as follows:

- *Construction Quality Assurance (CQA)* - The planned and systematic means and actions designed to assure adequate confidence that materials and/or services meet contractual and regulatory requirements, and will perform satisfactorily in service. For the OSDF project, CQA refers to means and actions employed by Fluor Fernald, Inc. to assure conformity of the liner and final cover system components production and confirm installation with this CQA Plan, the Construction Drawings and Technical Specifications.

- *Construction Quality Control (CQC)* - Those actions which provide a means to measure and ~~regulate~~ confirm the characteristics of an item or service in relation to contractual and regulatory requirements. For the OSDF project, CQC refers to those actions taken by the CQC Consultant, Contractor, Manufacturers, or Installers to confirm that the materials and the workmanship meet the requirements of the Construction Drawings and Technical Specifications. In the case of the geosynthetic components of these systems, CQC is provided by the CQC Consultant and the Manufacturers, Fabricators, and Installers of the various geosynthetics.

~~In the context of this document:~~

~~CQA refers to means and actions employed by FDF DOE's prime contractor to assure conformity of the lining liner and final cover system component production and installation with this CQA Plan, the Construction Drawings and Technical Specifications.~~

~~CQC refers to those actions taken by the CQC Consultant, Subcontractor, Manufacturers, or Installers to ensure that the materials and the workmanship meet the requirements of the Construction Drawings and Technical Specifications. In the case of the geosynthetic components of these systems, CQC is provided by the CQC Consultant and the Manufacturers, Fabricators, and Installers of the various geosynthetics.~~

3.2 Geosynthetics

Geosynthetics is the generic term for ~~all~~ synthetic materials used in geotechnical engineering applications; the term includes geotextiles, geogrids, geonets, geomembranes, geosynthetic clay liners (GCLs), ~~and~~ geocomposites, and HDPE pipes. There are four types of geosynthetic products referenced in this CQA ~~Plan which~~Plan, which are included in the OSDF ~~lining~~ liner and final cover systems. These geosynthetics include (i) textured HDPE geomembranes used in the composite liner and cap; (ii) GCLs used in the composite liner and cap; (iii) geotextiles used as filters or cushions or separators; and (iv) concrete protective liner; and~~high density polyethylene manholes and~~ (v) HDPE pipes used to collect and convey leachate.

3.3 CQA Lines of Communications

The CQA lines of communication between the Construction Manager, ~~Subcontractor~~~~Construction Contractor~~Contractor, and CQC Consultant are defined in the *OSDF Remedial Action Work Plan.*

4. PROJECT ORGANIZATION AND PERSONNEL

4.1 Overview

The OSDF construction organization chart is shown in Figure 4-1. Day-to-day construction activities at the OSDF will be managed through the direct interaction of several parties below ~~FDF~~ the Soil & Disposal Facility Project (SDFP) Project Director ~~OSDF Project Manager~~ level including but not limited to the Construction Manager, Project Engineer, Resident Engineer, ~~Subcontractor~~Contractor, and CQC Consultant. The organization chart for the OSDF CQC Consultant is presented in Figure 4-2. The definitions, qualifications, and responsibilities of the parties responsible for construction, Resident Engineering and CQC of the OSDF are described below.

4.~~1~~2 Construction Manager

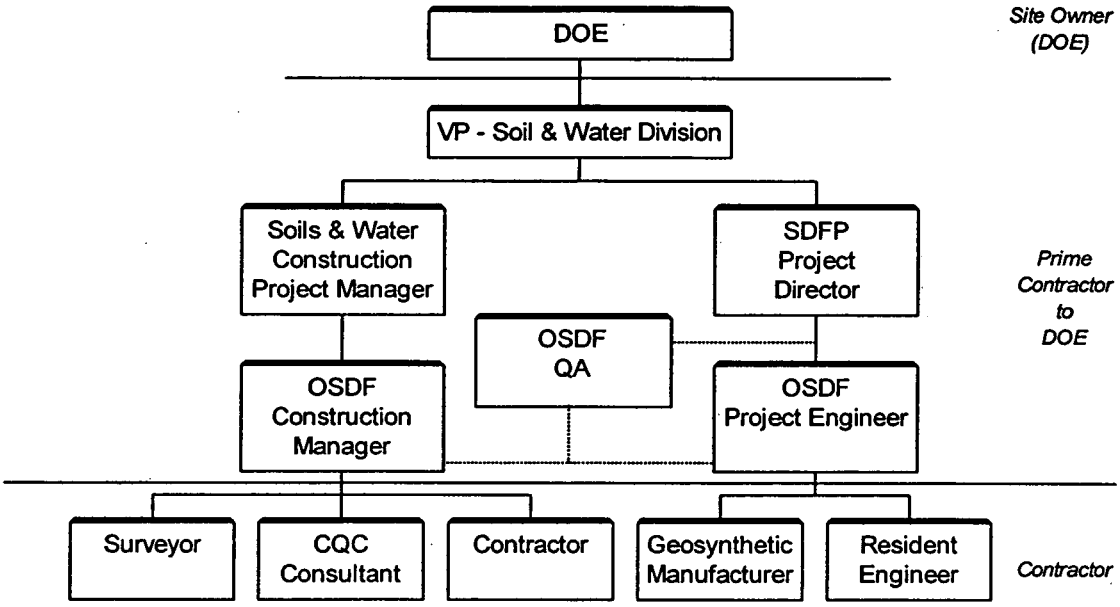
The Construction Manager is the authorized representative of Fluor Fernald, Inc. who has overall technical responsibility for construction of OSDF project. The Construction Manager may delegate responsibilities, duties, and receipt of correspondence and documents as necessary.

~~4.1.1 Definition~~

~~The Construction Manager shall be an individual responsible for site operations and overall management of the construction. In this CQA plan the term "Construction Manager" shall refer specifically to an authorized representative of the Department of Energy for the OSDF at the FEMP (i.e., a part of DOE's Prime Contractor's organization).~~

Figure 4-1

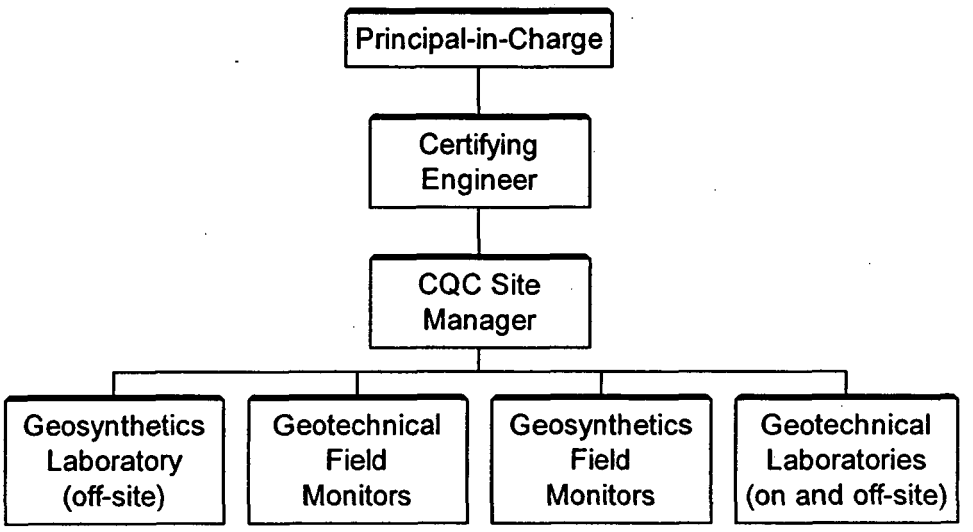
OSDF Construction
Organization Chart



SDFP = Soil & Disposal Facility Project

Figure 4-2

OSDF CQC Consultant Organization Chart



NOTE: Certifying Engineer and Resident Engineer may be the same individual if CQC Consulting contractor and the OSDF Design contractor are the same.

~~4.1.2 Qualifications~~

~~The Construction Manager will hold a baccalaureate degree in construction management, engineering, or related field or have 10 years of construction management experience. The Construction Manager will also have 3 years of environmental restoration plus 1 year of government experience.~~

~~4.1.3 Responsibilities~~

~~The Construction Manager shall be responsible for coordination and oversight of all construction activities including: (i) subcontract administration; (ii) construction management; (iii) review and approval of any modifications or changes to the subcontract documents; and (iv) final approval authority for subcontract submittals.~~requestAgency

4.3 Contractor

The Contractor is the person or organization entering into contract for construction of the OSDF project with Fluor Fernald, Inc.

4.~~1~~4 Resident Engineer

4.~~1~~4.1 Definition

The Resident Engineer is the individual representing the ~~firm having responsibility for~~ OSDF design Contractor during construction.

4.~~1~~4.2 Qualifications

The Resident Engineer will hold a minimum of a baccalaureate degree in engineering and be registered as a Professional Engineer in the State of Ohio and have a minimum of ten ~~10~~ years experience in construction management, engineering, or related fields. The Resident Engineer ~~shall~~ will have ~~expertise which~~expertise that demonstrates significant familiarity with geosynthetics and soils, as appropriate, including design and construction experience related to ~~lining~~ liner and cover systems.

4.~~2~~4.3 Responsibilities

The Resident Engineer is responsible for approving ~~all~~ design and specification changes, and making design ~~clarifications which~~clarifications that may be required during construction of the OSDF. The Resident Engineer ~~shall~~ will assist the Construction Manager in reviewing and approving the ~~Subcontractor's Constructor Construction~~Contractor's shop drawings and submittals as necessary. The Resident Engineer will be present on-site and attend the project coordination meetings. The Resident Engineer will be capable of discussing and interpreting ~~all~~ elements of the OSDF design. The Resident Engineer ~~shall~~ will have the authority to recommend changes or modifications to the Construction Drawings and Technical Specifications for approval by the Construction Manager.~~acceptance concurrence.~~

~~4.3 Subcontractor~~

~~4.3.1 Definition~~

~~The Subcontractor is the firm or corporation having a legally binding agreement to construct the OSDF. The Subcontractor is represented on-site by a qualified individual who is authorized to act on behalf of the Subcontract in all matters pertaining to the construction of the OSDF.~~

~~4.3.2 Qualifications~~

~~The Subcontractor shall be qualified as required by the subcontract to perform all aspects of work required to successfully construct the project. The Subcontractor shall be registered in accordance with applicable local, state, and federal requirements and shall demonstrate significant prior related experience. The Subcontractor's field representative shall be a qualified individual who is able to perform all tasks associated with OSDF construction activities. The Subcontractor's field representative shall demonstrate prior education and experience similar to the Construction Manager. The Subcontractor's field representative shall have the authority to direct and instruct the Subcontractor's crews and its lower tier Subcontractors.~~

~~4.3.3 Responsibilities~~

~~The Subcontractor is responsible for all construction materials and activities. The Subcontractor is also responsible for scheduling and coordination of the required work with its lower tier Subcontractors to complete the project within the construction schedule approved by the Construction Manager. The Subcontractor shall provide an experienced supervisory representative at all times during any construction activity on site. The Subcontractor is responsible for furnishing as-built record drawings and a copy of all documentation required during the construction of the OSDF. The Subcontractor is also responsible for updating all construction drawings for any deviations from the original plans and specifications on a daily basis.~~

~~The Subcontractor's field representative is responsible for coordinating and supervising the work of all lower tier Subcontractors on site as required by the contract. At a minimum, the Subcontractor's field representative will be responsible for the following:~~

- ~~informing the Construction Manager of any discrepancies between the plans and specifications and the field conditions;~~

- ~~distributing all documentation required by the Construction Drawings and Technical Specifications in a timely manner;~~
- ~~attending all project coordination meetings held on site;~~
- ~~scheduling all phases of the construction;~~
- ~~maintaining a daily log of all construction activities on site;~~
- ~~implementing and verifying all QC procedures required of the Subcontractor and/or lower-tier Subcontractors; and~~
- ~~submitting proposed alternative materials or construction methods to the Construction Manager for approval prior to acquisition and use.~~

4.~~3~~5CQC Consultant

4.~~3~~5.1 Definition

The CQC Consultant is the party, independent from the Construction Manager and the ~~Subcontractor~~Contractor, responsible for ~~observing~~monitoring, testing, confirming compliance and documenting activities related ~~to the CQC of the soil and geosynthetic components of the OSDF lining liner and final cover systems and other activities related~~ to the construction ~~and closure~~ of the OSDF. Construction of the OSDF includes but is not limited to: liner and final cover systems, impacted material placement, and other support facilities.

4.~~3~~5.2 Qualifications

~~The CQC Consultant shall be a well-established firm specializing in liner and final cover system design, construction management, and CQC. The CQC Consultant shall demonstrate its capability to perform CQC. This shall include possession of adequate (in number, qualifications, and applicability) possess the equipment, personnel, and~~

~~licenses necessary to conduct the monitoring and testing activities required by the OSDF Construction Drawings and Technical Specifications. The CQC Consultant shall also be experienced in the installation and CQC of soil and geosynthetic materials similar to those materials to be used for the lining liner and final cover systems.~~ The CQC Consultant will be a firm specialized in performing CQC for the construction of disposal facilities including liner and final cover systems, impacted material placement, and support facilities. The CQC consultant will have minimum of ten years experience in performing CQC activities for the construction of disposal facilities. The CQC Consultant will demonstrate its capabilities to perform CQC activities and to provide equipment, qualified personnel, and licenses required to perform CQC for the construction of OSDF. The CQC Consultant will also ~~be~~ demonstrate experienced in the preparation of CQC documentation including CQC plans, field documentation, field testing ~~procedures~~methods, laboratory testing ~~procedures~~methods, and Construction Quality Assurance (CQA) certification reports; and interpretation of ~~construction~~ technical specifications, construction drawings, and support plans for ~~lining~~ liner and cover systems, and material placement. ~~construction plans, and certification reports. The CQC Consultant shall provide qualified staff for the project.~~

In addition, the CQC Consultant ~~shall~~ will provide the following documentation~~, in writing,~~ to the Construction Manager:

- corporate background and information;
- a detailed summary of the firm's CQC capabilities;
- a detailed summary of the firm's CQC experience; and
- a representative list of at least 10 completed facilities for which the CQC Consultant has provided CQC monitoring and testing services for the construction of soil and ~~installation of the corresponding~~ geosynthetic liner or cover system~~material~~; for each facility, the following information will be provided:
  - name and purpose of facility, its location, and date of installation;

- name of owner;
- surface area of each soil and geosynthetic liner construction ~~material installed~~; and
- name and telephone number of contact person familiar with the project.

- résumés of CQC personnel to be ~~involved in~~assigned to the project including the ~~CQC Project Manager~~ Principal-in-Charge~~,~~ ~~Managing~~ CQC Certifying Engineer, CQC Site Manager, and CQC Lead Field Monitors; and
- proof of Ohio Professional Engineering registration ~~(or ability to be registered)~~ for the engineer to be the designated CQC ~~Managing~~ Resident/Certifying Engineer.

The CQC Consultant's personnel ~~shall~~ will include:

- the ~~CQC Project Manager~~ Principal-in-Charge, who may operate from the office of the CQC Consultant and visiting the site periodically as required;
- the ~~CQC Managing~~ Certifying Engineer, who will be located on site ~~who operates from the office of the CQC Consultant and who conducts periodic visits to the site as required~~;
- the CQC Site Manager, who ~~is~~ will be located at the site; and
- the CQC Field Monitors, who will be located at the site.

~~At a minimum, The lead geosynthetics Field Monitor shall have performed CQC activities for the installation of at least 5,000,000 ft^2 of HDPE geomembrane and hold current certification by the National Institute for the Certification of Engineering Technicians (NICET) [or approved by the Construction Manager on a case by case basis] for the Installation Inspection of Geosynthetic Materials.The lead soils Field Monitor shall have performed CQC activities for the installation of at least 2,500,000 ft^2~~

~~of low-permeability clay liner and cover systems.Other Field Monitors will be personnel who are specifically trained in the CQC of geosynthetics and low permeability clays and have documented CQC monitoring experience~~.

The CQC Consultant ~~shall~~ will establish an on-site soils laboratory having qualifications as specified in this Section ~~4.5.2 of this~~ the CQA Plan.

4.~~3~~5.3 Responsibilities

The CQC Consultant ~~shall~~ will be responsible for monitoring, testing, confirmation of compliance, and documenting the activities of the ~~Subcontractor~~ Contractor relative to the ~~installation of the liner and cover system components as well as various appurtenances related to the construction of the OSDF~~ construction of the OSDF. The CQC Consultant will be responsible for monitoring, testing, and confirming the compliance of construction materials delivered to the site with the submittals and/or shop drawings previously reviewed and approved by the ~~Construction Manager~~ Resident Engineer. The CQC Consultant will monitor, confirm and document ~~shall assure~~ that the ~~Subcontractors'~~ OSDF construction ~~methods and workmanship are~~ is performed in accordance with the Construction Drawings, ~~and~~ Technical Specifications, and this CQA Plan. The CQC Consultant ~~shall~~ will be responsible for obtaining samples of the various construction materials in accordance with the testing frequencies identified in this plan. The CQC Consultant ~~shall~~ will also be responsible for obtaining, labeling, and shipping samples for off-site laboratory testing in accordance with the requirements of this plan. ~~and appropriate specifications.~~

The CQC Consultant ~~shall~~ will be responsible for soils quality control testing to be performed by ~~both~~ the on-site and off-site testing laboratories. The CQC Consultant will ~~shall~~ be responsible for operating and staffing the on-site and off-site soils laboratory. Test results from the on-site and off-site laboratories ~~shall~~ will be submitted to the Construction Manager within a time ~~frame which~~frame, which will not impede or delay construction activities.

The on-site soils laboratory ~~shall~~ will be equipped to perform routine index testing, including:

- standard or modified Proctor (ASTM D 698 or D 1557);
- particle-size analysis (ASTM D 422 and ASTM C 136);
- Atterberg limits (ASTM D 4318);
- moisture content (ASTM D 2216 and ASTM D 4643);
- soils classification (ASTM D 2487); and
- percent passing No. 200 sieve (ASTM D 1140).

The CQC Consultant ~~shall~~ will also be responsible for ~~conducting~~ performing routine field performance tests during construction of the OSDF liner and final cover ~~systems which~~systems, which ~~shall~~ will include:

- in-situ surface moisture content (ASTM D 3017);
- in-~~place~~ situ density by nuclear methods (ASTM D 2922);
- lift thickness by direct measurement; and
- in-place density by sand cone (ASTM D 1556), or drive cylinder (ASTM D 2937).

The CQC Consultant will be responsible for the quality control of its on-site laboratory testing program and for documenting the calibration of the soils laboratory testing equipment. Equipment calibration certificates ~~shall~~ will be maintained in the CQC Consultant's on-site project file. ~~All~~ Tests will be ~~conducted~~ performed in accordance with ASTM or other ~~applicable state or federal~~ relevant and recognized standards. Test results ~~shall~~ will be submitted to the Construction Manager within a

time ~~frame which~~ frame, ~~which~~ that will not impede or delay construction of the liner and cover systems.

~~The duties of the CQC personnel are discussed in the following subsections.~~

The CQC Consultant will monitor, perform or observe testing, confirm compliance with the Construction Drawings, Technical Specifications, Support Plans, and other related documents during construction of the OSDF and support facilities.

4.6 Principal-In-Charge

4.6.1 Definition

The Principal-in-Charge is the corporate official of the CQC Consultant at the grade of principal given responsibility and authority to direct project professionals in performance of their duties.

4.6.2 Qualifications

The Principal-in-Charge will have a minimum of ten years experience related to the design and construction of waste disposal systems. The Principal-in-Charge will be a registered professional engineer.

4.6.3 Responsibilities

The Principal-in-Charge has overall corporate responsibility for the work performed by the CQC Consultant. The Principal-in-Charge is responsible for project resource loading and review of key project documents, including the certification report prepared by the Certifying Engineer. The Principal-in-Charge will provide technical support for the Certifying Engineer when required.

4.7 Certifying Engineer

4.7.1 Definition

The Certifying Engineer has overall authority for field monitoring, testing, certification-of-compliance, documentation, and construction certification.

4.7.2 Qualifications

The Certifying Engineer will have a minimum of ten years experience in certifying similar waste disposal facilities and be a registered professional engineer in the State of Ohio. The Certifying Engineer will demonstrate knowledge of CQC activities including monitoring, testing, confirmation for compliance, and documentation.

4.7.3 Responsibilities

The responsibilities of the Certifying Engineer include but are not limited to, as follows. Certifying Engineer will:

- review the OSDF construction plans and Construction Drawings and Technical Specifications;
- review liner and cover system soils and geosynthetics-related documents (such reviews are for familiarization and for evaluation of constructibility only);
- attend project meetings related to construction activities;
- administer the CQC program including but not limited to assignments and management of on-site CQC personnel; review field reports; and review of CQC related activities;

- monitor, confirm compliance, and document construction of the OSDF and related field activities;
- provide quality assurance of CQC documentation;
- review appropriate certification and documentation from the Contractor, vendors for the construction materials, and Installer to confirm compliance to the Technical Specifications;
- review changes to the OSDF design, Construction Drawings, and Technical Specifications;
- assist the CQC Site Manager in preparing CQA Certification report; and
- sign and seal the CQA Certification report.

4.8 CQC Site Manager

4.8.1 Definition

The CQC Site Manager is in charge of day to day performance of field monitoring, testing, and documentation.

4.8.2 Qualifications

The CQC Site Manager will have a minimum of ten years experience in CQC activities on similar waste disposal facilities. The CQC Site Manager will have performed CQC activities on the construction of soil and geosynthetic liner and cover system components for at least three projects; including the construction of a minimum 100,000 cubic yards of low-permeability clay liner or cap, and the installation of at least 5,000,000 square feet of HDPE geomembrane liner and cap. The CQC Site Manager

will demonstrate experience in managing CQC activities, including monitoring, testing, confirmation of compliance, and documentation.

4.8.3 Responsibilities

The responsibilities of the CQC Site Manager include but are not limited to as follows. CQC Site Manager will:

- act as the on-site representative of the CQC Consultant;
- familiarize CQC Field Monitors with the conditions, project documents (including Technical Specifications, Construction Drawings and Support Plans), and the CQC requirements;
- manage the daily activities of the CQC Field Monitors;
- attend regularly-scheduled CQC-related meetings on-site;
- review the ongoing preparation of the construction record drawings;
- review test results provided by the Field Monitors, Contractor, and vendor for construction materials;
- verify the calibration and condition of on-site testing equipment;
- review the CQC Field Monitors' daily reports and logs;
- report to the Certifying Engineer/Construction Manager, and documents in a daily report any reported relevant observations by the CQC Field Monitors;
- prepare a daily report for the project;
- oversee the collection and shipping of laboratory test samples;

- review results of laboratory testing and confirming compliance ;
- report any deviations from the CQA Plan, Support plans, Construction Drawings, and Technical Specifications to the Construction Manager and Certifying Engineer;
- review and confirming compliance appropriate certifications and documentation from the Contractor, vendors for the construction materials, and Installer;
- assist with the preparation of the CQA Certification report;
- review appropriate certification and documentation from the Contractor, vendor for the construction materials, and Installer to confirm compliance with the Technical Specifications;
- review the materials vendor's QC documentation;
- review required qualification for the Geosynthetics Installer's personnel and confirms compliance; and
- perform duties of CQC Field Monitor as needed.

4.9 Lead Field Monitors

4.9.1 Lead Soils Monitor

4.9.1.1 Definition

The Lead Soils Field Monitor is the individual in charge of field monitoring, testing, and documentation for the earthwork component of the OSDF.

4.9.1.2 Qualification

The Lead Soils Field Monitor will have a minimum of two years experience in CQC activities or similar waste disposal facilities, and will have performed CQC activities on at least two similar projects. The Lead Soils Field Monitor will have performed CQC activities for the installation of at least 100,000 inplace cubic yards of low-permeability clay liner or cap on one project or 40,000 inplace cubic yards of low permeability clay liner or cap each on two projects.

4.9.1.3 Responsibilities

The Lead Soils Field Monitor may perform some or all of the activities related to earthwork, which are described in Section 4.9.3.3.

4.9.2 Lead Geosynthetics Field Monitor

4.9.2.1 Definition

The Lead Geosynthetics Field Monitor is the individual in charge of field monitoring, testing, and documentation for the geosynthetic components of the OSDF.

4.9.2.2 Qualification

The Lead Geosynthetics Field Monitor will have a minimum of two years experience in CQC activities on similar waste disposal facilities and will have performed CQC activities on at least two similar projects. The Lead Geosynthetics Field Monitor will have performed CQC activities for the installation of at least 2,500,000 square feet (ft^2) of HDPE geomembrane and may hold current certification by the National Institute for the Certification of Engineering Technicians (NICET) for the Installation Inspection of Geosynthetic Materials.

4.9.2.3 Responsibilities

The Lead Geosynthetics Field Monitor may perform some or all of the activities related to geosynthetics which are described in Section 4.9.3.3.

4.9.3 Field Monitors

4.9.3.1 Definition

Field Monitors support the Lead Soil and Geosynthetic Field Monitors.

4.9.3.2 Qualification

Field Monitors are personnel who are specifically trained in the CQC of geosynthetics and low permeability clays liner or cap and have documented CQC monitoring experience or a technical degree.

4.9.3.3 Responsibilities

The duties of the CQC Field Monitors are monitoring, testing, confirming, compliance and documenting construction of the OSDF including soils and geosynthetics components of the liner and cover systems, impacted material placement, and other support-activities, as assigned by the CQC Site Manager.

The duties of the Field Monitors includes but are not limited to:

- performing tests on completed earthwork activities (e.g., in-situ moisture/density tests, etc.);
- monitoring material stockpiles for non-compliant materials;

- monitoring surface-water drainage in the areas of soil and geosynthetic material stockpiles;
- preparing daily field reports;
- recording CQC activities on field logs;
- collection of soils samples from site work activities in accordance with the CQA Plan;
- monitoring soil placement and compaction to confirm compliance with the Technical Specifications;
- monitoring the unloading, on-site handling, and storage of the geosynthetics;
- monitoring repairs;
- monitoring geosynthetic material deployment and installation operations;
- monitoring and documenting of testing activities;
- collecting pre-conformance and conformance samples for testing by CQC laboratories; and
- reporting deviations to the CQC Site Manager

~~4.4.3.1 CQC Managing Certifying Engineer~~

~~The CQC Managing Certifying Engineer:~~

~~□reviews the liner and cover systems construction plans and Construction Drawings and Technical Specifications;~~

- ~~reviews liner and cover system soils and geosynthetics related documents (such reviews are for familiarization and for evaluation of constructiibility only);~~
- ~~attends project meetings related to construction quality activities;~~
- ~~administers the CQC program (i.e., assigns and manages all on-site CQC personnel, reviews all field reports, and provides engineering review of all CQC related activities);~~
- ~~provides quality control of CQC documentation;~~
- ~~reviews changes to the liner and cover system design, Construction Drawings, and Technical Specifications; and~~
- ~~with the CQC Site Manager, prepares the final report.~~

~~4.4.3.2 CQC Site Manager~~

~~The CQC Site Manager:~~

- ~~acts as the on-site representative of the CQC Consultant;~~
- ~~familiarizes all CQC Field Monitors with the site, project documents, and the CQC requirements;~~
- ~~manages the daily activities of the CQC Field Monitors;~~
- ~~attends regularly scheduled CQC-related meetings on-site;~~
- ~~reviews the ongoing preparation of the construction record drawings;~~
- ~~reviews test results provided by the Subcontractor;~~
- ~~verifies the calibration and condition of on-site testing equipment;~~

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- ~~reviews the CQC Field Monitors' daily reports and logs;~~
- ~~reports to the Construction Manager, and documents in a daily report any reported relevant observations by the CQC Field Monitors;~~
- ~~prepares a daily report for the project;~~
- ~~oversees the collection and shipping of all laboratory test samples;~~
- ~~reviews results of laboratory testing and makes appropriate recommendations;~~
- ~~reports any unresolved deviations from the CQA Plan, construction plans, and Construction Drawings and Technical Specifications to the Construction Manager;~~
- ~~~~
- ~~assists with the preparation of the final report;~~
- ~~reviews appropriate certifications and documentation from the Subcontractor and the Geosynthetics Manufacturer and Installer, and makes appropriate recommendations;~~
- ~~reviews the Geosynthetics Manufacturer's QC documentation;~~
- ~~reviews the Geosynthetics Installer's personnel qualifications for conformance with those pre-approved for work on site; and~~
- ~~performs duties of CQC Field Monitor as needed.~~

~~4.4.3.3 CQC Field Monitors~~

~~The duties of the CQC Field Monitors are monitoring and documenting construction of all soils and geosynthetics components of the liner and cover systems and other OSDF appurtenances, as assigned by the CQC Site Manager.~~

~~The duties of the Field Monitors may include:~~

- ~~monitoring material stockpiles for any deterioration of materials;~~
- ~~monitoring surface water drainage in the areas of soil and geosynthetic material stockpiles;~~
- ~~preparing daily field reports;~~
- ~~recording CQC activities on field logs;~~
- ~~reporting problems to the CQC Site Manager;~~
- ~~assisting with collection of samples from the constructed soil components in accordance with the CQA Plan;~~
- ~~monitoring soil placement and compaction operations to assure compliance with the Technical Specifications;~~
- ~~monitoring the unloading and on-site handling and storage of the geosynthetics;~~
- ~~monitoring geosynthetic repair operations;~~
- ~~monitoring geosynthetic material deployment and installation operations; and~~
- ~~collecting conformance samples for testing by CQA laboratories.~~

~~In addition to these specific duties, all CQC Field Monitors will document any on-site activities that could result in damage to the soils or geosynthetic components of the~~

~~liner and cover systems. This is particularly true during the placement and compaction of the initial lift of soil on top of the underlying geosynthetic material. Any observations so noted by the CQC Field Monitors shall be reported immediately to the CQC Site Manager.~~

4.10 Geotechnical CQC Laboratory

4.4.10.1 Definition

The ~~Soils CQC~~ Geotechnical CQC Laboratory is the party, independent from the Construction Manager and ~~Subcontractor~~Contractor, responsible for ~~conducting~~ performing geotechnical laboratory tests in accordance with standards referenced in the Construction Drawings, ~~and~~ Technical Specifications, and this CQA Plan. The testing results provided ~~generated~~ by the ~~Soils~~ Geotechnical CQC Laboratory ~~shall~~ will be used by the CQC Consultant to confirm ~~verify~~ compliance of the soils construction materials with the ~~plans and~~ construction drawings, technical specifications, and CQA Plan. ~~and submittals previously approved by the Construction Manager.~~

~~It is anticipated that the Soils~~ Geotechnical CQC ~~Geotechnical~~ Laboratory will be required to perform ~~the~~ pre-conformance conformance ~~evaluation testing~~ of the various soils components of the OSDF and ~~more sensitive~~ performance testing. ~~required during construction such as hydraulic conductivity testing which require tightly controlled laboratory conditions.~~

4.10.2 Qualifications

The ~~Soils~~ Geotechnical CQC ~~Geotechnical~~ Laboratory will have a minimum three years ~~be~~ experienced in testing of soils similar to those proposed for use in the construction of the OSDF in accordance with ASTM and other applicable soil test standards. The ~~Soils~~ Geotechnical CQC ~~Geotechnical~~ Laboratory will be capable of providing test results within a maximum of 7 days of receipt of samples and will maintain that capability throughout the duration of the earthwork construction.

Prior to construction, the ~~Soils~~ Geotechnical CQC ~~Geotechnical~~ Laboratory, ~~if different from the CQC Consultant, shall~~ will submit their qualifications and QA/QC procedures to the Construction Manager for review and approval. The qualifications presented by the ~~Soils CQC~~ Geotechnical CQC Laboratory ~~shall~~will, as a minimum, include:

- corporate background and statement of qualifications;
- equipment and list of testing capabilities including reference to ASTM or other applicable test methods;
- a laboratory QA/QC plan:
- information on staff size and experience; and
- information regarding test result turnaround time.

4.10.3 Responsibilities

The ~~Soils~~ Geotechnical CQC ~~Geotechnical~~ Laboratory will be responsible for testing various soils components of the OSDF liner and final cover systems and support facilities. These tests will include, but not be limited to, pre-conformance, ~~material qualification (conformance) tests~~ and ~~material construction quality control (performance)~~ tests ~~as described~~ performed in accordance with the Construction Drawings, ~~and~~ Technical Specifications, and CQA Plan. The CQC Consultant will be responsible for ~~coordinating~~ the ~~Soils~~ Geotechnical CQC ~~Geotechnical~~ Laboratory testing.

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4.~~5~~11 Geosynthetics CQC Laboratory

4.~~5~~11.1 Definition

The Geosynthetics CQC Laboratory is the party independent from the Construction Manager, ~~Subcontractor~~Contractor, ~~and~~ Geosynthetics Manufacturer, and Geosynthetics Installer~~,~~. This laboratory is responsible for ~~conducting~~ performing laboratory conformance and geomembrane seam tests on samples of geosynthetic materials ~~used in construction of the OSDF liner and cover systems~~ in accordance with ~~standards referenced in~~ the Construction Drawings, ~~and~~ Technical Specifications, and this CQA Plan. The testing results provided confirm ~~generated~~ by the Geosynthetics CQC Laboratory ~~shall~~ will be used by the CQC Consultant to ~~verify~~ confirm compliance ~~of the geosynthetic materials~~ with Construction Drawings, Technical ~~plans and~~ Specifications, and ~~submittals previously approved by the Construction Manager~~ CQA Plan.

The Geosynthetic CQC Laboratory will be required to perform conformance and performance testing on geosynthetic material samples.

~~It is anticipated that the Geosynthetics CQC Laboratory will be required to perform the conformance evaluation testing of the various geosynthetic components of the OSDF and the performance testing required during construction such as destructive seam testing.~~

4.11.2 Qualifications

The Geosynthetics CQC Laboratory ~~shall~~ will hold current accreditation by the Geosynthetic ~~Research~~ Accreditation Institute (~~GRI~~GAI) for each test method performed and have a minimum of three years experience in testing geosynthetics similar to those proposed for use during construction of the OSDF. The Geosynthetics CQC Laboratory will be familiar with ASTM and other applicable geosynthetic test ~~standards~~methods. The Geosynthetics CQC Laboratory will be capable of providing destructive test results for geomembrane field seams within 24 hours of receipt of

samples and will maintain that capability throughout the duration of geosynthetic material installation.

Prior to construction, the Geosynthetics CQC Laboratory, ~~if different from the CQC Consultant~~, will submit their qualifications to the Construction Manager for review and approval. The qualifications presented by the Geosynthetics CQC Laboratory will, as a minimum, include:

- corporate background and statement of qualifications;
- equipment and listing of testing capabilities including reference to ASTM or other applicable test methods;
- a laboratory QA/QC plan:
- information on staff size and experience; ~~and~~
- information regarding test result turnaround time~~.~~; and
- proof of current GAI accreditation.

4.11.3 Responsibilities

The Geosynthetics CQC Laboratory will be responsible for testing various geosynthetic components of the liner and cover systems. These tests will include, but not be limited to, geosynthetic conformance ~~tests~~ and ~~destructive~~ performance testing in accordance with Construction Drawings, Technical Specifications, and CQA Plan. ~~of the geomembrane field seams as described in the Construction Drawings and Technical Specifications.~~ The CQC Consultant will be responsible for ~~coordinating~~ the Geosynthetics CQC Laboratory testing.

4.612 Geosynthetics Manufacturers

4.612.1 Definition

The Geosynthetics Manufacturers are the firms or corporations responsible for production of the geosynthetic materials to be used in construction of the OSDF.

4.612.2 Qualifications

The Geosynthetics Manufacturers ~~shall~~ will be able to provide sufficient production capacity and qualified personnel to meet ~~the demands of~~ the project schedule. ~~Prior to shipment of any material to the site, each Geosynthetics Manufacturer shall be pre-qualified and approved by the Construction Manager.~~ The ~~geotextile, geomembrane, and GCL~~ geosynthetic manufacturers ~~shall~~ will meet the qualifications outlined in Sections 02714P, 02770P, and 02772P of the Technical Specifications, respectively.

4.612.3 Responsibilities

Each Geosynthetics Manufacturer ~~is~~ will be responsible for the production and quality control of its respective geosynthetic product. In addition each Geosynthetics Manufacturer ~~is~~will be responsible for the ~~condition of the~~ geosynthetic ~~until the~~ material ~~is accepted~~ until final acceptance by Fluor Fernald, Inc. ~~the Subcontractor Project QA.~~ Each Geosynthetics Manufacturer ~~shall~~ will provide ~~produce~~ a ~~consistent high quality product which~~ products which shall meet ~~all~~ the requirements of the technical specifications. Each Geosynthetics Manufacturer ~~shall~~ will submit quality control documentation to the Construction Manager for its respective products as required by the Technical Specifications.

4.8~~1~~3 Geosynthetics Installer

~~4.8.1 Definition~~

The Geosynthetics Installer will be experienced and qualified to install the geosynthetic materials of the type specified for this project. The Geosynthetics Installer will be approved and/or licensed by the Geosynthetics Manufacturer. A copy of the approval letter or license will be submitted by the ~~Subcontractor~~ Contractor to the Construction Manager as required by the Technical Specifications.

~~4.8.2 Qualifications~~

~~The Geosynthetics Installer shall meet the qualifications outlined in Section 02770 of the Technical Specifications.~~

~~The Geosynthetics Installer will designate one representative as its supervisor, who will be responsible for acting as the Geosynthetics Installer's spokesman on site. The Geosynthetics Installer will provide the Construction Manager with a list of proposed seaming personnel and their qualifications. This document will be reviewed by the CQC Consultant. Final approval of the Geosynthetic Installer's seaming personnel will be the responsibility of the Construction Manager. Any proposed seaming personnel deemed insufficiently experienced will not be accepted. The most experienced seamer, the "master seamer", shall provide direct supervision, as required, over less experienced seamers. No field seaming shall take place without the master seamer being present.~~

~~4.8.3 Responsibilities~~

~~The Geosynthetics Installer's supervisor will be responsible for handling installation of the geosynthetics used in construction of the OSDF and for providing supervision and guidance to the installation crew. The Geosynthetics Installer's supervisor is also responsible for the following: (i) obtaining samples, as required by the CQA Plan and the Technical Specifications; (ii) field testing; (iii) documenting~~

~~quality control testing activities; and (iv) coordinating the geosynthetics installation activities with the Construction Manager. The Geosynthetics Installer's supervisor will be responsible for documenting the geosynthetics installation activities, including, but not limited to, on-site personnel, material inventories, production figures, test results, installation deficiencies, and resolution of construction problems.~~

~~4.9 Surveyor~~

~~4.9.1 Definition~~

~~The Surveyor is responsible for lines and grades required for control of the work on an ongoing basis during all phases of the OSDF construction. Close interaction between the Surveyor, Subcontractor, and the CQC Consultant is essential to ensure that construction of the OSDF is completed in accordance with the Construction Drawings and Technical Specifications.~~

~~4.9.2 Qualifications~~

~~The project Surveyor shall be a licensed Professional Land Surveyor who shall sign and seal all construction survey record as-built drawings. All surveying personnel shall be experienced in the provision of surveying services, including detailed accurate documentation as required in Section 02100 of the Technical Specifications.~~

~~4.9.3 Responsibilities~~

~~The Surveyor is responsible for all surveying activities and products in accordance with Section 02100 of the Technical Specifications.~~

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5. DOCUMENTATION

~~An effective CQA Plan depends largely on recognition of all construction activities that should be monitored and the assignment of responsibilities for the monitoring of each activity. This is most effectively accomplished and verified by the documentation of quality assurance and quality control activities. The CQC Consultant shall be responsible for assuring that the Subcontractor's Contractor's quality control requirements have been addressed and satisfied.~~

The CQC ~~Site Manager~~Consultant ~~shall~~ will complete field forms including ~~make available to the Construction Manager descriptive~~ daily field reports and CQC forms, test result, and monitoring, ~~data sheets,~~ and ~~logs which~~logs, ~~which document~~documenting CQC ~~that monitoring~~ activities. Examples of some of the forms that will be used to document CQC activities are included in Appendix B. ~~have been carried out.~~ The CQC Site Manager will submit weekly reports to the Construction Manager ~~covering significant~~summarizing daily field reports for construction activities ~~and observations~~ during the proceeding week. Monitoring and data forms will be provided to the Construction Manager as testing is completed or at a frequency directed by the Construction Manager. All field forms, including daily reports, will be available for review by the Construction Manager. ~~Examples of some of the forms which will be used to document CQC activities~~~~forms that will be used to document CQC activities are included in Appendix A.~~ The CQC Site Manager shall also maintain at the job site a complete file of Construction Drawings, ~~and~~ Technical Specifications, this CQA Plan, the ~~Subcontractor's~~ Contractor's Quality ~~Control~~ Assurance and Work Plans, any checklists, test ~~procedures~~ methods, completed field forms, daily and weekly field reports~~logs~~, and other pertinent construction and CQC documents.

5.1 Daily ~~Recordkeeping~~Record keeping

The CQC Consultant's daily field reporting ~~procedures shall~~ will include: (i) ~~daily summary~~ field ~~report~~CQC activities; (ii) monitoring ~~logs~~forms; (iii) and ~~testing~~ data ~~sheets~~forms.~~; and (iv) when appropriate, problem identification and corrective measures reports.~~

5.1.1 Daily ~~Summary~~ Field Reports

The CQC Consultant's daily ~~summary~~ field reports ~~shall~~ will include the following information as applicable:

- an identifying sheet number for cross referencing and document control;
- date, project name, location, and other pertinent project identification;
- ~~data on weather conditions;~~
- summary on meetings held and their results;
- ~~process~~ description(s) and location(s) of construction ~~underway during the time frame of report~~;
- descriptions and specific locations of areas, or units, of work being tested and/or ~~observed~~ monitored and documented;
- description of locations where tests and samples were taken;
- a narrative summary of field test results;
- off-site materials received, including quality control documentation;

- decisions made regarding acceptance of units of work, and/or corrective actions to be taken in instances of substandard testing results;

- identifying sheet numbers of data sheets and/or ~~problem~~ nonconformance identification ~~reporting~~ and corrective measures reports used to substantiate the decisions described above; and

- signature of ~~the respective~~ CQC Site Manager and/or the CQC Field Monitor.~~;~~ ~~and~~

~~any~~ Corrections to the Daily ~~Summary~~ Field Reports ~~shall~~ will be single line crossed out, initialed by the correcting personnel, CQC Site Manager, and dated. Documentation of field activities will also be included on monitoring logs and test data sheets. When appropriate, the Daily Field Reports can reference information recorded on these logs or data sheets instead of reporting information in the daily field report.

5.1.2 ~~CQA~~ CQC Monitoring ~~Logs~~ and ~~Test~~ Data ~~Sheets~~Forms

~~Monitoring observations~~Field monitoring reports, sampling information, and test results ~~shall~~ will be recorded on ~~an~~ appropriate monitoring ~~logs~~ and ~~test~~ data ~~sheets~~forms. The CQC Consultant ~~shall~~ will use the monitoring ~~logs~~ and ~~test~~ data ~~sheets~~ forms to ~~ensure~~ confirm completeness of the required CQC activities. Any corrections to the monitoring ~~logs~~ and ~~test~~ data ~~sheets~~ forms ~~shall~~ will be single line crossed out, initialed by the CQC personnel responsible for the correction and dated. Examples of relevant monitoring ~~logs~~ and data forms that may be used during the OSDF construction are presented in Appendix ~~A~~B.

The CQC Consultant's monitoring ~~logs~~ and ~~test~~ data ~~sheets~~ forms ~~shall~~ will include the following information as applicable:

- project specific information such as project name, and location;

- the date the CQC activity was performed;
- a unique identifying sheet number for cross-referencing and document control;
- ~~description or title of the CQC activity or test procedure;~~
- location of the CQC activity or location from which the sample ~~increment~~ was obtained;
- type of CQC activity or ~~procedure~~ method used (reference to standard method when appropriate);
- ~~recorded observation or~~ test ~~data~~results, with all necessary calculations;
- results of the CQC activity and comparison with specification requirements (pass/fail); and
- the initials or signature of personnel involved in the CQC ~~inspection~~ monitoring activity.

5.1.3 Nonconformance Identification and Reporting

A nonconformance is defined herein as material or workmanship that does not meet the specified requirement(s). Nonconformance identification and corrective measures reports should be cross-referenced to specific summary reports, ~~logs~~monitoring forms, or ~~test~~ data ~~sheets~~ forms where the nonconformance was identified. The CQC Consultant will notify the Construction Manager of any known nonconformance within one hour of discovery and will transmit a nonconformance report within 24 hours of discovery. The reports ~~should~~ will include the following information as applicable:

- a unique identifying sheet number for cross-referencing and document control;
- detailed description of the problem;

- location of the problem;
- probable cause;
- how and when the problem was located;
- estimation of how long problem has existed;
- suggested corrective ~~measure~~action;
- documentation of correction (e.g., reference to ~~inspection~~ data ~~sheets~~form);
- final results;
- suggested methods to prevent similar problems; and
- signature of the appropriate CQC Field Monitor and concurrence by the CQC Site Manager.

~~In some cases, not all of the above information will be available or obtainable. However, when available, such efforts to document nonconformances could help to avoid similar nonconformances in the future. The CQC Site Manager shall distribute copies of the report to the Construction Manager for further actions.~~

5.2 Photographic Documentation

The ~~Construction Manager~~CQC Consultant will be responsible for obtaining photographic documentation of the ~~Subcontractor's~~ Contractor's activities, materials installation methods, and testing ~~procedures~~methods. Photographs will serve as a pictorial record of work progress, problems, and corrective measures. The photographic log included with the field forms in Appendix D ~~reporting data sheets should~~ will be utilized to organize and document photographs taken during construction of the OSDF ~~also may prove useful~~. Such data sheets could be cross-referenced or appended to

summary reports, CQC monitoring ~~logs~~forms, or ~~test~~ data ~~sheets~~ forms and/or ~~problem~~ nonconformance identification and corrective measures reports. At a minimum, photographic logs ~~reporting data sheets~~ should include the following information:

- a unique identifying number on data sheets and photographs for cross-referencing and document control;
- the date and location where the photograph was taken; and
- location and description of the work;

These photographs will serve as a pictorial record of work progress, problems, and corrective measures. Color prints ~~shall~~ will be organized chronologically and kept in a permanent protective file. Negatives ~~shall~~ will be stored in a separate protective file and will be submitted to the Construction Manager with the Construction Quality Assurance Certification Report or at the end of the construction year which ever comes first..

5.3 Design and/or Specifications Changes

Design and/or specifications changes may be required during construction. In such cases, ~~the Subcontractor must~~ the individual identifying the change will submit written requests for such changes to the Construction Manager. The Resident Engineer ~~shall~~ will review and respond to these ~~requests in a timely manner. Design and/or specifications changes will be made only with~~requests with the ~~approval~~ concurrence of the ~~Construction Manager~~ Project Engineer in accordance with FEMP site procedures. Such changes will take the form of a design change notice (DCN) to ~~the Subcontract~~the Construction Contract. DCNs will have concurrence of Regulatory Agency prior to implementation.

5.4 Nonconformances

The Construction Manager will be informed in writing of any significant recurring nonconformance with the Construction Drawings, Technical Specifications, or CQA Plan by the CQC Consultant. The cause of the nonconformance will be determined by the CQC Consultant. The ~~Subcontractor~~ Contractor will be directed by the Construction Manager to make appropriate changes in materials or procedures in order to correct the nonconformance. When this type of evaluation is made, the results will be documented, and ~~any revision to~~ deviation from procedures, plans, specifications, drawings, or contract documents ~~or specifications~~ must be approved by the Construction Manager. Redline drawings shall be developed by the Contractor to show deviations from design document.

5.5 CQC Certification Report

At the completion of construction phases the CQC Consultant will submit a construction phase final report to the Construction Manager. This report will acknowledge: (i) that the work has been performed in compliance with the Construction Drawings and Technical Specifications; (ii) physical sampling and testing ~~has~~ have been conducted at the appropriate frequencies; and (iii) that the summary document provides the necessary supporting information.

At a minimum, this report will include:

- summaries of CQC activities;
- CQC monitoring ~~logs~~ forms and ~~testing~~ data ~~sheets~~ forms including sample location plans;
- laboratory test results;
- problem identification and corrective measures reports;

- a descriptive summary of any changes from Construction Drawings and Technical specifications; and

- a summary statement indicating compliance with Construction Drawings and Technical Specifications which is signed and sealed by the CQC ~~Managing~~ Certifying Engineer.

The ~~Subcontractor's~~ Contractor's ~~record~~ as-built drawings, which include scale drawings depicting the location of the construction and details pertaining to the extent of construction (e.g., depths, plan dimensions, elevations, soil component thicknesses, pipe elevations, etc.), and a geomembrane panel record drawings prepared by the CQC Consultant ~~and~~ will be included as part of the final certification report.

5.6 Storage of Records

The CQC Site Manager will be responsible for all facility CQC document storage during the construction of the OSDF. This includes the CQC Consultant's copy of the Construction Drawings and Technical Specifications, the CQA Plan, and the originals of all the data sheets and reports. When the OSDF construction is complete (i.e., closure of the final cell) and upon issuance of the final certification report, the CQC document originals will be organized and submitted to the Construction Manager. Records ~~shall~~ will be filed in accordance with the subject file index and will be retained for 30 years after closure of the OSDF. Required records ~~shall~~ will include, but not be limited to, field logbooks, other data collections forms, equipment calibration records, costs data, drawings, maintenance records, and all associated reports.

6. SOILS CONSTRUCTION

6.1 Introduction

CQC monitoring and testing will be performed during installation of the various soil components of the OSDF, including the soil components of the liner and final cover systems. Criteria to be used for determination of acceptability of the various soil layers are identified in the Construction Drawings, Technical Specifications, Support Plans, and this CQA Plan.

This CQA Plan includes CQC requirements for the non-impacted protective layer and contouring layer as part of the CQC requirements for the liner and final cover systems. The CQC requirements for the impacted material protective layer and contouring layer will be as specified in the IMP Plan.

6.2 Related Construction Drawings, Technical Specifications and Support Plans

Several sections of the Construction Drawings, Technical Specifications, and Support Plans will be referenced by the CQC Consultant for pertinent soil materials physical properties and construction requirements. Related specifications and support plans include the following:

- Section 02100 – Surveying;
- Section 02200 – Earthwork;
- Section 02215 – Trenching and Backfilling;
- Section 02225 – Compacted Clay Liner and Cap;
- Section 02240 – Non-Impacted Protective and Contouring Layers;

- Section 02250 – Vegetative Soil Layer;
- Section 02710 – Granular Drainage Layer;
- Section 02712 – Granular Filter Material;
- Section 02280 – Biointrusion Barrier;
- Section 02920 – Topsoil;
- Section 13000 – Borrow Area Management (BAMR);
- Section 13010 – Impacted Material Placement;
- Borrow Area Management and Restoration Plan; and
- Impacted Material Placement (IMP) Plan.

6.3 ~~Record Drawings and As-Built Surveys~~ Acceptance of Surveys

During construction of the soil components of the OSDF, the CQC Consultant ~~shall~~ will routinely review ~~record drawings~~ Construction Drawings submitted by the ~~Subcontractor~~Contractor. The Construction Drawings ~~drawings~~ are used to verify location of work, ~~percent of work completed,~~ layer thickness, or final grades, and for determination of acceptability of the various soil layers in the liner and final cover systems. Prior to the placement of successive soil or geosynthetic layers, the CQC Consultant ~~shall~~ will review for acceptance the Contractor's survey results for each layer. The survey results will indicate ~~certified as-built surveys which indicate compliance of~~ the preceding layer thickness, lines, and grades. ~~Once an as-built~~After the survey results ~~has~~ have been reviewed and accepted in writing by the CQC Consultant it will be the responsibility of the Construction Manager to ~~review the information in a timely manner and~~ notify the ~~Subcontractor~~ Contractor of acceptance or any noncompliance.

6.4 ~~Earthwork~~General Soil Construction

6.4.1 Overview

General soil construction includes earthwork and trenching and backfilling. Earthwork consists of construction of subgrade, compacted fill, clayey rockfill and top of contouring layer preparation. Trenching and backfilling consists of construction of embedment fill and trench backfill. Prior to the start of general soil construction, the CQC Consultant ~~shall~~ will review and understand the Related Construction Drawings, Technical Specifications, and Support Plans. ~~the information required by Section 02200 of the Technical Specifications. Compliance of the submittals with the Technical Specifications shall be determined by the Construction Manager.~~

During construction, conformance ~~and~~ testing, construction monitoring, and performance testing of the fill materials ~~subgrade soil materials shall~~ will be performed by the CQC Consultant. Pre-conformance testing ~~may be performed as described subsequently~~will be performed on potential clay liner sources. Certification testing will be performed by the Contractor on materials from off-site borrow sources. The testing and monitoring activities associated with the general soil construction of the OSDF are described subsequently. Monitoring and testing activities associated with the ~~top of~~ subgrade and top of contouring preparation are also described. ~~The CQC Consultant shall monitor proofrolling proofrolling of areas that are cut to achieve grade. Material placed to achieve grades indicated on the Construction Drawings shall be tested by the CQC Consultant in accordance with the tests methods and frequencies shown in Table 6-1 and 6-3, to verify that the compacted fill material used by the Subcontractor complies with the Technical Specifications. Areas of proofrollingproof rolling or compacted fill that do not meet the Technical Specifications will be delineated and reported to the Construction Manager. The areas will be retested after any reworking by the Subcontractor. This process will be repeated until passing results are achieved.~~

~~The CQC Consultant will monitor the repair and rework of subgrade whichsubgrade, which is damaged by excess moisture (causing softening) and insufficient moisture (causing desiccation and shrinkage), or by freezing. If such conditions are found to exist, the CQC Consultant shall evaluate the suitability of the subgrade by the following methods as applicable:~~

~~moisture/density testing;~~

~~continuous visual inspection during proof-rolling;~~

~~checking the consistency of cohesive soils using a penetrometer, hand-held vane shear device, or other suitable field expedient measurement device in suspect weak soil areas; and/or~~

~~other tests identified in Tables 6-1 through 6-.~~

6.4.2 Pre-conformance and Certification Testing

~~All~~ Materials used for general soils construction, with the exception of pipe embedment fill, will be obtained from ~~the on-site borrow area~~the on-site sources including but not limited to OSDF excavation, trenching, stockpiles, OSDF borrow area or other on-site borrow sources approved by the Construction Manager. Pre-conformance testing of the ~~borrow area~~material will be conducted to identify materials suitable for clay liner and cap material, which is described in Section 6.5.2. Generally, material from the on-site borrow area that is not suitable for clay liner and cap material is candidate material for general soil construction. Therefore, the pre-conformance testing for the clay liner and cap material can be used to identify candidate material for general soil construction. Additional pre-conformance testing of candidate materials may be requested by the Construction Manager.

The Contractor will provide certification test results for proposed off-site sources of materials, including pipe embedment fill as specified in the Technical Specifications.

The Construction Manager may require the CQC Consultant to perform tests on samples of material from the proposed sources as part of the approval process.

6.4.3 Conformance Testing

The conformance testing requirements ~~the~~ for general soil construction ~~must conform to~~ are summarized in Table 6-1. These requirements are based on the Technical Specifications and in case of conflict between these tables and Technical Specifications, the Technical Specifications control. During general soil construction, conformance tests will be used to evaluate the ~~suitability~~ compliance of materials with the Technical Specification. ~~during general soil construction~~ Tests will be performed in accordance with the current ASTM or other applicable test method indicated in Table 6-2. The properties of the various soil materials required by the Technical Specifications are included in Table 6-1 ~~and 6-2~~.

~~The standard Proctor Test (ASTM D 698) will be used for the determination of moisture/density relationships unless otherwise indicated. In-place surface moisture/density nuclear test methods (ASTM D 3017 and D 2922) will be used for in-situ field testing. The sand cone test method (ASTM D 1556) or drive cylinder test method (ASTM D 2937) will be used to establish correlations of moisture and density in cases of uncertainty, and as a check of the nuclear surface moisture/density gauge calibration.~~

The frequency of conformance tests will conform to the minimum frequencies presented in Table 6-2. The frequency of testing may be increased at the discretion of the Construction Manager or if variability of the materials is observed and reported by the CQC Consultant. The testing frequencies described herein for compacted fill will also apply to materials used by the Contractor in areas outside the limits of the final cover system of the OSDF.

6.4.4 Construction Monitoring

During placement of the various soil components, the CQC Consultant will visually monitor and document the Contractor's activities during earthwork and other general soil construction ~~of the soil components of the liner and cover systems~~ for the following:

- changes in the soil consistency;
- the thickness of lifts as loosely placed;
- soil-moisture conditioning prior to placement including general observations regarding moisture distribution, clod size, etc.;
- the action of the compaction and heavy hauling equipment on the construction surface (e.g., sheepsfoot penetration, pumping, cracking, etc.);
- the number of passes used to compact each lift;
- ~~desiccation cracks or~~ the presence of ponded water; and
- final lift or layer thickness.

6.4.5 Performance Testing

Performance testing during general soil construction will be conducted in accordance with the Technical Specifications and this CQA Plan. The CQC field testing methods, used to confirm compliance ~~the conformance of soils~~ during general soil construction, will be performed by the CQC Consultant in accordance with current ASTM or other applicable test. ~~procedures indicated in Table 6-3. The ASTM standard in effect at the time of contract award will be used unless otherwise specified or approved by the Construction Manager.~~ Test results will be documented and reported to the Construction Manager.

Performance testing will be conducted during the progress of the work. The minimum construction performance testing frequencies are presented in Table 6-3. The frequency may be increased at the discretion of the Construction Manager or if variability of the materials is observed by the CQC Consultant. Sampling locations will be selected by the CQC Consultant. If necessary, the location of routine in-place density tests will be determined using a non-biased sampling approach.

The standard compaction Proctor Test (ASTM D 698) will be used for the determination of moisture/density relationships unless otherwise indicated. In-place surface moisture/density nuclear test methods (ASTM D 3017 and D 2922) will be used for in-situ field testing. The sand cone test method (ASTM D 1556) or drive cylinder test method (ASTM D 2937) will be used to establish correlations of moisture and density in cases of uncertainty, and as a check of the nuclear surface moisture/density gauge calibration.

Additional testing may be performed at the discretion of the Construction Manager when visual observations of construction performance indicate a potential problem. Additional testing for suspected areas will be considered when:

- rollers slip during rolling operation;
- lift thickness is greater than specified;
- soil is at non-compliant and/or variable moisture content;
- ~~it is suspected that less than the specified number of roller passes are made;~~
- dirt-clogged rollers are used to compact the material;
- ~~rollers may not have used optimum ballast;~~
- fill materials differ substantially from those specified;
- the degree of compaction is doubtful; and

- as directed by the Construction Manager.

During construction, the frequency of testing may also be increased in the following situations:

- adverse weather conditions;
- breakdown of equipment;
- at the start and finish of grading;
- material fails to meet technical specifications; and
- the work area is reduced.

6.5 Liner System Construction

6.5.1 Overview

There are several soil components included in the OSDF liner system as shown on Figure 1-1. The soil components or layers of the OSDF liner system include the following, from top to bottom:

- granular LCS drainage layer and LCS drainage corridor having a hydraulic conductivity of 1×10^{-1} cm/s or greater and 10 cm/s, respectively;
- granular LDS drainage layer and LDS drainage corridor having a hydraulic conductivity of 1×10^{-1} cm/s or greater and 10 cm/s, respectively; and
- compacted clay liner having a hydraulic conductivity of 1×10^{-7} cm/s or less.

Prior to the start of liner system construction, the CQC Consultant will review and understand the related Construction Drawings, Technical Specifications, and Support

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Plans. During construction, preconformance and conformance testing, construction monitoring , and performance testing of the above soil components will be performed. These activities are described subsequently.

The prepared subgrade that will support the OSDF liner system will be as specified in the Technical Specifications prior to the installation of the liner system materials. The subgrade preparation will be monitored and tested in accordance with Section 6.4 of this CQA Plan.

6.5.2 Pre-conformance Testing

Pre-conformance testing of soils from the on-site borrow area will be performed to identify candidate materials to be screened and stockpiled for potential use as compacted clay liner and cap material. The CQC Consultant will collect samples from test pits excavated by the Contractor. Approximately 1 test pit will be excavated for every 1.5 acres of on-site borrow area to be developed. Samples will be collected to assess moisture content variation with depth as test pit excavation progresses. Moisture content measurements will be made on grab samples collected at approximately 2-ft depth intervals. A minimum of two bulk samples will be collected from each test pit. Moisture content measurements, Atterberg limits, and particle size (sieve) analysis will be performed on bulk samples. Hydrometer tests will be performed on approximately 25 percent of the bulk samples to determine clay content. Hydrometer tests will be performed on marginal samples that appear to just meet the requirements for compacted clay liner and cap material.

The Contractor will provide certification test results for proposed off-site sources of materials (e.g., granular LCS drainage layer). The Construction Manager may require the CQC Consultant to perform tests on samples of material from the proposed off-site sources as part of the approval process.

6.5.3 Conformance Testing

The conformance testing requirements for the soil components of the OSDF liner system ~~must conform to~~ and non-impacted protective layer are summarized in Table 6-4. Conformance tests used to evaluate the suitability of soil materials during construction of OSDF liner system will be performed in accordance with the current ASTM or other applicable test method indicated in Table 6-5. The properties of the various soil materials are included in Table 6-4.

~~The standard Proctor Test (ASTM D 698) will be used for the determination of moisture/density relationships unless otherwise indicated. In-place surface moisture/density nuclear test methods (ASTM D 3017 and D 2922) will be used for in-situ field testing. The sand cone test method (ASTM D 1556) or drive cylinder test method (ASTM D 2937) will be used to establish correlations of moisture and density in cases of uncertainty, and as a check of the nuclear surface moisture/density gauge calibration.~~

The frequency of conformance tests will conform to the minimum frequencies presented in Table 6-5. The frequency of testing may be increased at the discretion of the Construction Manager or if variability of the materials is observed and reported by the CQC Consultant. ~~The testing frequencies described herein for compacted fill will also apply to materials used by the Contractor in areas outside the limits of the final cover system of the OSDF.~~

As shown in Table 6-5, hydraulic conductivity (permeability) tests will be conducted on screened materials proposed for use as the compacted clay liner ~~and cap~~ material as well as the ~~soil~~ granular materials~~,~~ ~~which will comprise~~ for the LDS and LCS drainage layers and corridors.

The stockpile specific acceptable permeability zone (APZ) for clay liner material will be established as described in the TPPFR Addendum. Permeability testing of clay liner ~~and cap~~ materials will be accomplished in accordance with ASTM D 5084 at a

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confining stress of 5 psi. Laboratory remolded samples will be used for conformance ~~evaluation~~ testing and confirmation of compliance of the compacted clay liner ~~and cap~~ materials prior to construction. ~~The stockpile specific acceptable permeability zone (APZ) for clay liner and cap material will be established as described in the TPPFR Addendum.~~ Acceptance of clay stockpiles will be documented by submitting an approval letter to the Construction Manager.

Permeability testing of the LDS and LCS drainage layers and corridors will be performed in accordance with ASTM D 2434.

The CQC Consultant will be responsible for documenting pertinent sampling information including the date the sample was obtained, sample identification number, and location.

6.5.4 Construction Monitoring

During placement of the various OSDF liner system soil components and the non-impacted protective layer, the CQC Consultant will visually monitor and document the Contractor's activities during earthwork and construction of the soil components of the liner ~~and cover~~ systems for the following:

- changes in the soil consistency;
- the thickness of lifts as loosely placed;
- soil-moisture conditioning prior to placement including general observations regarding moisture distribution, clod size, etc.;
- the action of the compaction and heavy hauling equipment on the construction surface (sheepsfoot penetration, pumping, cracking, etc.);
- equipment ground pressure;

- the number of passes used to compact each lift;
- desiccation cracks or the presence of ponded water; and
- final lift or layer thickness.

~~The prepared subgrade and top of contouring layer that will support the OSDF liner and cover system will be as specified in the technical specifications prior to the installation of the liner and cover systems materials. The soil subgrade and contouring layers will be comprised of in-situ materials or borrow area fill materials, will be and monitored and tested in accordance with the Construction Drawings and Technical Specifications and this CQA Plan.~~

6.5.5 Performance Testing

Performance testing during construction of the soil components of the OSDF ~~final cover~~liner system will be conducted in accordance with the Technical Specifications and CQA Plan. The CQC field testing methods, used to confirm ~~the conformance~~compliance of soils during construction, will be performed by the CQC Consultant in accordance with current ASTM or other applicable test ~~procedures~~ methods indicated in Table 6-6. ~~The ASTM standard in effect at the time of contract award will be used unless otherwise specified or approved by the Construction Manager.~~ Test results will be documented and reported to the Construction Manager.

Performance testing will be conducted during the progress of the work. The minimum construction performance testing frequencies are presented in Table 6-6. The frequency may be increased at the discretion of the Construction Manager or if variability of the materials is observed by the CQC Consultant. Sampling locations will be selected by the CQC Consultant. If necessary, the location of routine in-place density tests will be determined using a non-biased sampling approach.

The standard compaction Proctor Test (ASTM D 698) will be used for the determination of moisture/density relationships unless otherwise indicated. In-place surface moisture/density nuclear test methods (ASTM D 3017 and D 2922) will be used for in-situ field testing. The sand cone test method (ASTM D 1556) or drive cylinder test method (ASTM D 2937) will be used to establish correlations of moisture and density in cases of uncertainty, and as a check of the nuclear surface moisture/density gauge calibration.

Additional testing may be performed at the discretion of the Construction Manager when visual observations of construction performance indicate a potential problem. Additional testing for suspected areas will be considered when:

- rollers slip during rolling operation;
- lift thickness is greater than specified;
- earthfill is at non-compliant and/or variable moisture content;
- it is suspected that less than the specified number of roller passes are made;
- dirt-clogged rollers are used to compact the material;
- rollers may not have used optimum ballast;
- ~~fill~~ soil materials differ substantially from those specified;
- the degree of compaction is doubtful; and
- as directed by the Construction Manager.

During construction, the frequency of testing may also be increased in the following situations:

- adverse weather conditions;

- breakdown of equipment;
- at the start and finish of grading;
- material fails to meet technical specifications; and
- the work area is reduced.

6.6 Final Cover System Construction

6.6.1 Overview

These are several soil components in the OSDF final cover system as shown on Figure 1-1. The soil components or layers of the OSDF final cover system include the following, from top to bottom:

- topsoil layer;
- vegetative soil layer;
- granular filter layer;
- biointrusion barrier with choking layer;
- cover drainage layer having a hydraulic conductivity of 1×10^{-1} cm/s or greater; and
- compacted clay cap having a hydraulic conductivity of 1×10^{-7} cm/s or less.

Prior to the start of final cover system construction, the CQC Consultant will review and understand the related Construction Drawings, Technical Specifications, and Support Plans. During construction, preconformance and conformance testing,

construction monitoring, and performance testing of the above soil components will be performed. These activities are described subsequently.

The prepared top of contouring layer that will support the OSDF final cover system will be as specified in the Technical Specifications prior to the installation of the final cover system materials. The top of contouring layer preparation will be monitored and tested in accordance with Section 6.4 of this CQA Plan.

6.6.2 Pre-conformance Testing

Pre-conformance testing of the borrow area will be conducted to identify materials suitable for the clay liner and cap material. This pre-conformance testing is described in Section 6.5.2.

The Contractor will provide certification test results for the proposed off-site sources of materials. The Construction Manager may require the CQC Consultant to perform tests on samples of material from the proposed off-site sources as part of the approval process.

6.6.3 Conformance Testing

The conformance testing requirements for the soil components of the OSDF final cover system ~~must conform to~~ and non-impacted contouring layer are summarized in Table 6-7. Conformance tests used to evaluate the suitability of soil materials during construction will be performed in accordance with the current ASTM or other applicable test method indicated in Table 6-8. The properties of the various soil materials are summarized in Table 6-7.

~~The standard Proctor Test (ASTM D 698) will be used for the determination of moisture/density relationships unless otherwise indicated. In-place surface moisture/density nuclear test methods (ASTM D 3017 and D 2922) will be used for in-~~

~~situ field testing. The sand cone test method (ASTM D 1556) or drive cylinder test method (ASTM D 2937) will be used to establish correlations of moisture and density in cases of uncertainty, and as a check of the nuclear surface moisture/density gauge calibration.~~

The frequency of conformance tests will conform to the minimum frequencies presented in Table 6-8. The frequency of testing may be increased at the discretion of the Construction Manager or if variability of the materials is observed and reported by the CQC Consultant. The testing frequencies described herein for compacted fill will also apply to materials used by the Contractor in areas outside the limits of the final cover system of the OSDF.

As shown in Table 6-8, hydraulic conductivity (permeability) tests will be conducted on screened materials proposed for use as the compacted clay ~~liner and~~ cap material as well as the ~~soil~~ granular material that will comprise the cover drainage layer.

Permeability testing of clay ~~liner and~~ cap materials will be accomplished in accordance with ASTM D 5084 at a confining stress of 5 psi. Laboratory remolded samples will be used for conformance evaluation of the compacted clay ~~liner and~~ cap materials prior to construction. The stockpile specific acceptable permeability zone (APZ) for clay ~~liner and~~ cap material will be established as described in the TPPFR Addendum.

Permeability, ~~testing~~ sieve analysis, and carbonate content tests of the cover drainage layer will be performed in accordance ~~with ASTM D 2434~~to the test methods listed in Table 6-9.

For the biointrusion barrier, the CQC Consultant may visit, with the approval of the Construction Manager, the proposed quarry.

The CQC Consultant will be responsible for documenting pertinent sampling information including the date the sample was obtained, sample identification number, and location.

6.6.4 Construction Monitoring

During placement of the various soil components of the OSDF final cover system and non-impacted contouring layer, the CQC Consultant will visually monitor and document the Contractor's activities during earthwork and construction of the soil components of the ~~liner and~~ final cover systems for the following:

- changes in the soil consistency;
- the thickness of lifts as loosely placed;
- soil-moisture conditioning prior to placement including general observations regarding moisture distribution, clod size, etc.;
- the action of the compaction and heavy hauling equipment on the construction surface (sheepsfoot penetration, pumping, cracking, etc.);
- the number of passes used to compact each lift;
- desiccation cracks or the presence of ponded water; and
- final lift or layer thickness.

~~The prepared subgrade and top of contouring layer that will support the OSDF liner and cover system will be as specified in the technical specifications prior to the installation of the liner and cover systems materials. The soil subgrade and contouring layers will be comprised of in-situ materials or borrow area fill materials, will be and monitored and tested in accordance with the Construction Drawings and Technical Specifications and this CQA Plan.~~

6.6.5 Performance Testing

Performance testing will be conducted in accordance with the Technical Specifications and CQA Plan. The CQC field testing methods, used to confirm ~~the conformance~~compliance of soils during construction, will be performed by the CQC Consultant in accordance with current ASTM or other applicable test ~~procedures~~ method indicated in Table 6-9. ~~The ASTM standard in effect at the time of contract award will be used unless otherwise specified or approved by the Construction Manager.~~ Test results will be documented and reported to the Construction Manager.

Performance testing will be conducted during the progress of the work. The minimum construction performance testing frequencies are presented in Table 6-9. The frequency may be increased at the discretion of the Construction Manager or if variability of the materials is observed by the CQC Consultant. Sampling locations will be selected by the CQC Consultant. If necessary, the location of routine in-place density tests will be determined using a non-biased sampling approach.

The standard compaction Proctor Test (ASTM D 698) will be used for the determination of moisture/density relationships unless otherwise indicated. In-place surface moisture/density nuclear test methods (ASTM D 3017 and D 2922) will be used for in-situ field testing. The sand cone test method (ASTM D 1556) or drive cylinder test method (ASTM D 2937) will be used to establish correlations of moisture and density in cases of uncertainty, and as a check of the nuclear surface moisture/density gauge calibration.

Additional testing may be performed at the discretion of the Construction Manager when visual observations of construction performance indicate a potential problem. Additional testing for suspected areas will be considered when:

- rollers slip during rolling operation;
- lift thickness is greater than specified;

- earthfill is at non-compliant and/or variable moisture content;
- it is suspected that less than the specified number of roller passes are made;
- dirt-clogged rollers are used to compact the material;
- rollers may not have used optimum ballast;
- ~~fill~~ soil materials differ substantially from those specified;
- the degree of compaction is doubtful; and
- as directed by the Construction Manager.

During construction, the frequency of testing may also be increased in the following situations:

- adverse weather conditions;
- breakdown of equipment;
- at the start and finish of grading;
- material fails to meet technical specifications; and
- the work area is reduced.

6.7 ~~Clay Liner and Cap~~ Perforations in Soil Components

Perforations that must be filled with soil-bentonite mix will include, but not be limited to, the following:

- in-place density test probe locations;

- sand cone or drive cylinder test locations;
- survey stake locations; and
- test pit locations.

Perforations in the compacted clay liner and cap resulting from field tests or other construction activities, as described above, ~~shall~~ will be filled in accordance with the requirements of Section 02225 of the Technical Specifications and this CQA Plan. ~~Additional density and moisture testing of these areas, if required, shall be conducted at the discretion of the Construction Manager.~~ In addition, perforations in the subgrade and contouring layer will be filled in accordance with the requirements of Sections 02200 and 02240, respectively. Perforations in other soil layers will be filled in accordance with the requirements of the respective section of the Technical Specification.

6.8 Field Equipment Decontamination

The CQC Consultant ~~shall~~ will perform decontamination of field equipment used in the sampling and testing of soils known or suspected of containing low-level radioactive wastes in accordance with the procedures outlined in ASTM D 5608. Fluor Fernald, Inc. site procedures shall be followed when decontaminating and moving equipment out of radiological controlled areas. The practice of decontamination is applicable to most conventional sampling or field testing equipment constructed of metallic and hard, smooth synthetic materials. Materials with rough or porous surfaces, or having a sorption rate, should not be used due to the difficulties with decontaminations.

6.9 Deficiencies

If a defect is discovered in the soils construction, the CQC Consultant ~~shall~~ will immediately determine the extent and nature of the defect. If the defect is indicated by

an unsatisfactory test result, the CQC Consultant ~~shall~~ will determine the extent of the deficient area by additional tests, observations, a review of records, or other means that the CQC Consultant deems appropriate. The CQC Consultant ~~shall~~will take steps to ~~ensure~~confirm that measurement error (either human or instrument) is checked and eliminated as a source of error before requiring corrective action. If the defect is related to adverse site conditions, such as overly wet soils or surface desiccation, the CQC Consultant ~~shall~~ will define the limits and nature of the defect.

~~As soon as possible,~~ After determining the extent and nature of ~~substandard~~ non-conforming condition~~materials, noncompliant construction practice, or other such deficiency in materials or workmanship which cannot be immediately resolved on the spot~~, the CQC Consultant ~~shall~~ will verbally notify the Construction Manager and ~~Subcontractor~~ Contractor within 1 hour and schedule appropriate retests when the work deficiency is to be corrected within 1 hour of deficiency discovery. ~~(Appendix A). See Appendix A.~~

The CQC Consultant ~~shall~~ will verify that the ~~Subcontractor~~ Contractor has corrected ~~all~~ noted deficiencies to the satisfaction of the Construction Manager. If a specified criterion cannot be met, or unusual weather conditions hinder work, the ~~Subcontractor~~ Contractor shall submit suggested ~~solutions or alternatives~~repair methods to the Construction Manager for review.

At locations where the field testing indicates in-situ conditions which do not comply with the requirements of the Technical Specifications, the failing area shall be reworked to the satisfaction of the Construction Manager. ~~Alternatively, at the Construction Manager's option, undisturbed samples of in-place material shall be obtained for hydraulic conductivity or other appropriate testing.~~ All retests performed by the CQC Consultant must verify that the deficiency has been corrected before any additional work is performed by the ~~Subcontractor~~ Contractor in the area of the deficiency.

The CQC Consultant will monitor the repair and rework of subgrade and top of contouring layer which may contain excess or insufficient moisture. If such conditions are found to exist, the CQC Consultant will confirm the suitability of the subgrade and top of contouring layer by the following methods as applicable:

- moisture/density testing; and
- continuous visual inspection during proof-rolling;

6.10 Documentation

~~The documentation of soils CQC testing activities is an important factor in assuring the successful construction, performance, and approval of the OSDF soil liner and closure finalsystem components.~~ The CQC monitoring ~~observations~~reports, sample location descriptions, ~~field~~ test results, and ~~on-site~~ laboratory test results will be documented by the CQC Consultant on forms similar to the examples included in Appendix A. Reports and forms ~~shall~~ will be provided to the Construction Manager as requested. Weekly reports will be ~~regularly~~ submitted to the Construction Manager within 7-calendar days from the last working day of the reported week. Test data sheet including test results and supporting information will be submitted to the Construction Manager within 3 calendar days from the completion of test(s).

Initial evaluation of various soil types by CQC personnel during construction will be visual; CQC personnel will monitor changes in color or texture indicative of a change in soil type. The CQC personnel will monitor soils for deleterious materials (e.g., roots, stumps, glass, and large objects). When necessary, the visual-methods for the description and identification of soils will be conducted by the CQC Consultant in accordance with test method ASTM D 2488.

TABLE 6-1
CONFORMANCE TESTING, MONITORING, AND PERFORMANCE TESTING REQUIREMENTS FOR GENERAL SOIL CONSTRUCTION

GENERAL SOIL CONSTRUCTION (TRENCHING AND EARTHWORK)			
DESCRIPTION OF COMPONENT	CONFORMANCE TESTING REQUIREMENTS	MONITORING REQUIREMENTS	PERFORMANCE TESTING REQUIREMENTS
SUBGRADE (SECTION 02200)	Fill for areas where unsuitable subgrade has been removed shall be Classified as GC, SC, SM, ML, CL, or CH per ASTM D 2487;	Monitor subgrade work activities to confirm compliance to Construction drawings, support plans, and Section 02200.	1. Fill area from which subgrade has been removed with fill material compacted to at lease 95% standard Proctor maximum dry density per ASTM D 698. Compact the uppermost lift of compacted fill beneath road and access corridor alignments to a minimum 98 percent of standard Proctor maximum dry density per ASTM D 698; 2. Proofroll by driving a loaded dump truck (minimum weight of 10 tons per axle and minimum loaded weight of 20 tons) back and forth across an area. Soils shall not exhibit pumping or develop ruts more than 2 inches in depth. 3. Tolerance for subgrade shall be –0.3 to +0.1 feet of the grades indicated on the Construction drawings.
COMPACTED FILL (SECTION 02200)	1. Classified as GC, SC, SM, ML, CL 9or CH per ASTM D 2487; 2. Maximum visible rock particle size is 5 inches for a 8-inch (+/- 1-inch) thick loose lift; 3. Maximum visible rock particle size is 2-inches for a 4-inch (+/- 1-inch) thick loose lift and; 4. Maximum clod size is 3-inch.	Monitor material, placement, and compaction for compacted fill activities to confirm compliance to Construction Drawings, support plans, and Section 02200.	1. Compacted fill material in each lift to at least 95 percent of standard Proctor maximum dry density per ASTM D 698; 2. Compact fill at a moisture content within 3 +/- 1 percent of the standard Proctor optimum moisture content per ASTM D 698. 3. Tolerance for earthwork construction shall be +/- 0.3 feet of the grades indicated on the Construction Drawings.
PERFORATIONS (SECTION 02200) (SECTION 02225)	Backfill for perforations shall be 10 percent by weight bentonite mixed with clay liner or cap material by weight basis.	Monitor mixing and placement activities for perforations to confirm compliance to Section 02200 and 02225.	NOT APPLICABLE
CLAYEY ROCK FILL (SECTION 02200)	Clayey rock fill with rock particles that are less than 12-inch.	Monitor material, placement, and compaction for clayey rock fill to confirm compliance to Construction Drawings and Section 02200.	Soils shall not exhibit pumping or develop ruts more than 2 inches in depth.

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TABLE 6-1 (cont.)

GENERAL SOIL CONSTRUCTION (TRENCHING AND EARTHWORK)			
DESCRIPTION OF COMPONENT	CONFORMANCE TESTING REQUIREMENTS	MONITORING REQUIREMENTS	PERFORMANCE TESTING REQUIREMENTS
PIPE EMBEDMENT FILL (SECTION 02215)	Gradation testing shall be in accordance to ASTM C 136 and the gradation shall meet the requirements of Section 703.6of the Ohio DOT specifications. This gradation is as follows: SIEVE SIZE — TOTAL PERCENT PASSING No. 4 — 90-100 No. 50 — 70-40 No. 200 — 0-10	Monitor material, placement, and compaction of embedment fill to confirm compliance to Construction Drawings, support plans and Part 3 of Technical Specification Section 02215.	The tolerance for the depth of embedment fill for pipes and culverts shall be within 0 to +0.2 feet of the depth indicated on the Construction Drawings.
TRENCH BACKLFILL (SECTION 02215)	Conformance requirements are the same as compacted fill.	Monitor material, placement, and compaction of trench backfill to confirm compliance to Construction Drawings, support plans, and Part 3 of Technical Specification Section 02215.	1. Compact fill material in each lift to at least 95 percent of standard Proctor maximum dry density per ASTM D 698; 2. Compact fill at a moisture content within 3 +/- 1 percent of the standard Proctor optimum moisture content per ASTM D 698. 3. The tolerance for the trench bottom shall be 0 + 0.2 feet of the depth indicated on the Construction Drawings.

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TABLE 6-2
MINIMUM CONFORMANCE TESTING FREQUENCIES FOR GENERAL SOIL CONSTRUCTION

TEST NAME/TEST METHOD	SOIL TYPE[3, 4]			
	COMPACTED FILL	EMBEDMENT FILL	CLAYEY ROCK FILL	TRENCH BACKFILL
SPECIFICATION SECTION	02200	02215	02240	02215
Particle Size Analysis/ASTM D 422 (sieve only)	1 test per 5,000 yd^3	N/A	1 test per 5,000 yd^3	1 test per 5,000 yd^3
Particle Size Analysis/ASTM C 136	N/A	1 test per 1,000 yd^3		
Atterberg Limits/ASTM D 4318	1 test per 5,000 yd^3	N/A	1 test per 5,000 yd^3	1 test per 5,000 yd^3
Moisture Content/ASTM D 2216 or ASTM D 4643	1 test per 5,000 yd^3		1 test per 5,000 yd^3	1 test per 5,000 yd^3
Soil Classification/ASTM D 2487	1 test per 5,000 yd^3	1 test per 1,000 yd^3	1 test per 5,000 yd^3	1 test per 5,000 yd^3
Standard Proctor/ASTM D 698	1 test per 5,000 yd^3	N/A	1 test per 5,000 yd^3	1 test per 5,000 yd^3
Hydraulic Conductivity/ASTM D 5084	N/A	N/A	N/A	N/A
Hydraulic Conductivity/ASTM D 2434	N/A	N/A	N/A	N/A
Carbonate Content/ASTM D 3042[2]	N/A	N/A	N/A	N/A
Organic Content/ASTM D 2974	N/A	N/A	N/A	N/A

NA = Not Applicable

NOTE:
1. Also perform hydrometer analysis once every tenth test.
2. Sample to be tested at pH of 4.
3. More frequent testing may be directed by the Construction Manager when indicated by soil variability.
4. Volumes for test frequency is based on in-place volume of material after compaction to specified density.

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TABLE 6-3
MINIMUM PERFORMANCE TESTING FREQUENCIES FOR GENERAL SOIL CONSTRUCTION

TEST NAME/TEST METHOD	SOIL TYPE [3,4]				
	COMPACTED FILL	TRENCH BACKFILL	ANCHOR TRENCH BACKFILL	CLAYEY ROCK FILL	EMBEDMENT FILL
SPECIFICATION SECTION	02200	02215	02215	02200	02215
In-situ Moisture/ASTM D 3017	2 tests per acre per lift(1)	1 test per 250 lineal ft per lift	1 test per 250 lineal ft per lift	N/A	N/A
In-situ Density/ASTM D 2922	2 tests per acre per lift(1)	1 test per 250 lineal ft per lift	1 test per 250 lineal ft per lift	N/A	N/A
Sand Cone/ASTM D 1556__or Drive Cylinder/ASTM D 2937	1 test per 25 nuclear tests	N/A	N/A	N/A	N/A

N/A = Not Applicable

NOTE: 1. A minimum of two nuclear moisture and density tests each day of active soils construction.
2. Non-impacted protective layer performance requirements are in Section 02440 of the Technical Specifications.
3. Subgrade performance requirements are in Table 6-1.

TABLE 6-4
CONFORMANCE TESTING, MONITORING, AND PERFORMANCE TESTING REQUIREMENTS FOR LINER SYSTEM CONSTRUCTION

LINER SYSTEM			
DESCRIPTION OF COMPONENT	CONFORMANCE TESTING REQUIREMENTS	MONITORING REQUIREMENTS	PERFORMANCE TESTING REQUIREMENTS
SUBGRADE (SECTION 02200)	Fill for areas where unsuitable subgrade has been removed shall be Classified as GC, SC, SM, ML, CL, or CH per ASTM D 2487;	Monitor subgrade work activities to confirm compliance to Construction Drawings, support plans, and Technical Specification Section 02200.	1. Fill area from which subgrade has been removed with fill material compacted to at lease 95% standard Proctor maximum dry density per ASTM D 698. 2. Proofroll by driving a loaded dump truck (minimum weight of 10 tons per axle and minimum loaded weight of 20 tons) back and forth across an area. Soils shall not exhibit pumping or develop ruts more than 2 inches in depth. 3. Tolerance for subgrade shall be –0.3 to +0.1 feet of the grades indicated on the Construction drawings.
CLAY LINER SECTION 02225	PRECONFORMANCE REQUIEMENTS 1. Clay liner shall be Classified as CH or CL per ASTM D 2487; 2. Clay liner shall be sleeved in accordance with ASTM D 422 and the results shall meet the particle size requirements: • 100 percent of the particles, by weight, having a maximum dimension of not less than 2 inches; • not more than 10 percent of the particles, by weight, having a dimension greater than 0.75 inches; • not less than 50 percent of the particles, by weight, passing through the standard U.S. sieve No. 200; • not less than 15 percent of the particles, by weight, having a maximum dimension not greater than .002 mm.	Monitor clay liner screening, placement, moisture conditioning, and compaction, to confirm compliance support plans, Construction Drawings, and Technical Specification Section 02225.	1. The moisture and dry unit weight of clay liner placed shall be within the acceptable permeability zone (APZ) defined as those combinations of moisture content and dry unit weight that meet the following criteria: • Moisture content that is on or to the right (in the direction of increasing moisture content) of the line of optimums determined by connecting the optimum moisture contents from the standard and modified proctor tests (ASTM D 698 and ASTM D 1567 respectively); • Moisture content not greater than 3 percentage points wet of the standard Proctor optimum moisture content (ASTM D 698) • Dry unit weight of at least 95% of the standard Proctor maximum dry unit weight (ASTM D 598)

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TABLE 6-4 (CONT.)

LINER SYSTEM			
DESCRIPTION OF COMPONENT	CONFORMANCE TESTING REQUIREMENTS	MONITORING REQUIREMENTS	PERFORMANCE TESTING REQUIREMENTS
	3. Plasticity index (ASTM D422) of at least 10 percent, but less than 40 percent. CONFORMANCE REQUIREMENTS 1. Hydraulic conductivity (ASTM D 5084) not more than $1x10^{-7}$ cm/sec at a confining pressure of 5 pounds per square inch.		2. Clay liner shall be constructed to within 0.0 to +0.3 feet of the thicknesses shown on the Construction Drawings; 3. Clay liner shall be constructed to within +/- 0.2 feet of the grades indicated on the Construction Drawings.
LEACHATE DETECTION SYSTEM (SECTION 02710) LEACHATE COLLECTION SYSTEM (SECTION 02710)	1. Granular drainage material shall be tested in accordance to ASTM C 138 and the gradation shall meet the following gradation requirement for No. 78 stone: SIEVE SIZE PASSING — TOTAL PERCENT ¾-inch — 100 ½-inch — 90-100 8/8-inch — 40-75 No. 4 — 5-25 No. 8 — 0-10 No. 168 — 0-5 No. 200 — 0-2 2. Granular drainage material shall have a minimum hydraulic conductivity of $1x10^{-1}$ cm/sec when tested to ASTM D 2434; 3. Granular drainage corridor material shall be tested in accordance to ASTM C 136 and the gradation shall meet the following gradation requirement for No. 57 stone; SIEVE SIZE PASSING — TOTAL PERCENT 1-1/2-inch — 100 1-inch — 95-100 1/2-inch — 25-60 No. 4 — 0-5 No. 200 — 0-2	Monitor the placement and compaction of the granular drainage material to confirm compliance to support plans, Construction Drawings and Part 3 of Technical Specification Section 02710.	LDS drainage layer, LCD drainage layer, LDS drainage corridor, and LCS drainage corridor shall be constructed within 0.0 to +/-0.1 feet of the thickness indicated on the Construction Drawings.

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TABLE 6-4 (cont.)

LINER SYSTEM			
DESCRIPTION OF COMPONENT	CONFORMANCE TESTING REQUIREMENTS	MONITORING REQUIREMENTS	PERFORMANCE TESTING REQUIREMENTS
	4. Granular drainage corridor material shall have a minimum hydraulic conductivity of 10 cm/sec when tested to ASTM D 2434; 5. Granular drainage material including the corridor material shall be classified a GP when classified in accordance to ASTM D 2487; 6. Granular drainage material including the corridor material shall have less than 5 percent by weight loss when tested in accordance to ASTM D 3042 at a pH of 4;		
NONIMPACTED PROTECTIVE LAYER (SECTION 02240)	1. In the Impacted Runoff catchment area shall meet the material and testing requirements for granular drainage layer specified in Technical Specification Section 02710. 2. Shall be compacted fill with rock particles that are less than 3-inch.	Monitor the placement and compaction of the nonimpacted protective layer to confirm compliance to support plans, Construction Drawings, and Part 7 of the Impacted Material Placement Plan.	The nonimpacted protective layer shall be constructed to within 0.0 to +0.1 feet of the thickness shown on the Construction Drawings.

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TABLE 6-5
MINIMUM CONFORMANCE TESTING FREQUENCIES FOR OSDF LINER SYSTEM COMPONENTS AND NON-IMPACTED PROTECTIVE LAYER

TEST NAME/TEST METHOD	SOIL TYPE (4)		
	COMPACTED CLAY LINER	GRANULAR DRAINAGE MATERIAL	NON-IMPACTED PROTECTIVE LAYER
SPECIFICATION SECTION	02225	02710	02240
Particle Size Analysis/ASTM D 422 (sieve only)	1 test per 1,500 yd^3 (1)	N/A	1 test per 5,000 yd^3
Particle Size Analysis/ASTM C 136	N/A	1 test per 3,000 yd^3	
Atterberg Limits/ASTM D 4318	1 test per 1,500 yd^3	N/A	1 test per 5,000 yd^3
Moisture Content/ASTM D 2216 or ASTM D 4643	1 test per 1,500 yd^3	N/A	1 test per 5,000 yd^3
Soil Classification/ASTM D 2487	1 test per 1,500 yd^3	1 test per 3,000 yd^3	1 test per 5,000 yd^3
Standard Proctor/ASTM D 698	1 test per 1,500 yd^3	N/A	1 test per 5,000 yd^3
Hydraulic Conductivity/ASTM D 5084	1 test per 10,000 yd^3 (remold sample)(3)	N/A	N/A
Hydraulic Conductivity/ASTM D 2434	N/A	1 test per 3,000 yd^3	N/A
Carbonate Content/ASTM D 3042(2)	N/A	1 test per 5,000 yd^3	N/A
Organic Content/ASTM D 2974	N/A	N/A	N/A

NA = Not Applicable

NOTE:
1. Also perform hydrometer analysis once every tenth test.
2. Sample to be tested at pH of 4.
3. For Phase I, this frequency was revised to 1 test per 10,000 yd^3 based on the TPPFR addendum.
4. More frequent testing may be directed by the Construction Manager when indicated by soil variability.
5. Volumes for test frequency is based on in-place volume of material after compaction to specified density.

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TABLE 6-6
MINIMUM PERFORMANCE TESTING FREQUENCIES FOR OSDF LINER SYSTEM COMPONENTS AND NON-IMPACTED PROTECTIVE LAYER

TEST OT TEST METHOD	COMPACTED CLAY LINER	GRANULAR DRAINAGE MATERIAL	PROTECTIVE LAYER (2)
SPECIFICATION SECTION	02225	02710	02240
In-situ Moisture/ASTM D 3017	5 tests per acre per lift[1]	N/A	N/A
In-situ Density/ASTM D 2922	5 tests per acre per lift[1]	N/A	N/A
Sand Cone/ASTM D 1556 or Drive Cylinder/ASTM D 2937	1 test per 25 nuclear tests	N/A	N/A

N/A = Not Applicable

NOTE: 1. A minimum of two nuclear moisture and density tests each day of active soils construction.
2. Non-impacted protective layer performance requirements are in Table 6-4.
3. Subgrade performance requirements are in Section 02200 of the Technical Specifications.

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TABLE 6-7
CONFORMANCE TESTING, MONITORING, AND PERFORMANCE TESTING REQUIREMENTS FOR CONSTRUCTION FINAL COVER SYSTEM

COVER SYSTEM			
DESCRIPTION OF COMPONENT	CONFORMANCE TESTING REQUIREMENTS	MONITORING REQUIREMENTS	PERFORMANCE TESTING REQUIREMENTS
NONIMPACTED CONTOURING LAYER (SECTION 02240)	Shall be compacted fill with rock particles that are less than 4 inches.	Monitor the placement and compaction of the nonimpacted protective layer to confirm compliance to Part 7 of the Impacted Material Placement Plan.	Place the non-impacted contouring layer in two loose lifts. The first lift is 10 in. thick ±1 in. thick. Dry unit weight of at least 75 percent of standard Proctor maximum dry density per ASTM D 698. Moisture content within 3 +/- 1 percent of the standard Proctor optimum moisture content per ASTM D 698.
CLAY LINER (SECTION 02225)	PRECONFORMANCE REQUIEMENTS 1. Clay liner shall be Classified as CH or CL per ASTM D 2487; 2. Clay liner shall be sieved in accordance with ASTM D 422 and the results shall meet the particle size requirements: • 100 percent of the particles, by weight, having a maximum dimension of not less than 2 inches; • not more than 10 percent of the particles, by weight, having a dimension greater than 0.75 inches; • not less than 50 percent of the particles, by weight, passing through the standard U.S./sieve No. 200; • not less than 15 percent of the particles, by weight, having a maximum dimension not greater than .002 mm. 3. Plasticity index (ASTM D422) of at least 10 percent, but less than 40 percent.	Monitor clay liner screening, placement, moisture conditioning, and compaction, to confirm compliance support plans, Construction Drawings, and Technical Specification Section 02225.	1. The moisture and dry unit weight of clay liner placed shall be within the acceptable permeability zone (APZ) defined as those combinations of moisture content and dry unit weight that meet the following criteria: • Moisture content that is on or to the right (in the direction of increasing moisture content) of the line of optimums determined by connecting the optimum moisture contents from the standard and modified proctor tests (ASTM D 698 and ASTM D 1557 respectively); • Moisture content not greater than 3 percentage points wet of the standard Proctor optimum moisture content (ASTM D 698) 2. Dry unit weight of at least 95% of the standard Proctor maximum dry unit weight (ASTM D 698) 3. Clay CAP shall be constructed to within 0.0 to +0.3 feet of the thicknesses shown on the Construction Drawings;

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TABLE 6-7 (cont.)

COVER SYSTEM			
DESCRIPTION OF COMPONENT	CONFORMANCE TESTING REQUIREMENTS	MONITORING REQUIREMENTS	PERFORMANCE TESTING REQUIREMENTS
	CONFORMANCE REQUIREMENTS Hydraulic conductivity (ASTM D 5084) not more than $1x10^{-7}$ cm/sec at a confining pressure of 5 pounds per square inch.		4. Clay cap shall be constructed to within +/- 0.2 feet of the grades indicated on the Construction Drawings.
COVER DRAINAGE LAYER (SECTION 02710)	1. The granular drainage material will be tested in accordance to ASTM C 136 and the gradation shall meet the following gradation requirement: SIEVE SIZE PASSING — TOTAL PERCENT ¾-inch — 100 ½-inch — 90-100 3/8-inch — 40-75 No. 4 — 5-25 No. 8 — 0-10 No. 16 — 0-5 No. 200 — 0-2 2. The minimum hydraulic conductivity shall be $1x10^{-1}$ cm/sec when tested to ASTM D 2434. 3. Granular drai8nage material shall be classified as GP per ASTM D 2487. 4. Granular drainage material shall have less than 5 percent by weight loss when tested per ASTM D 3042 at a pH of 4.	Monitor the placement and compaction of the cover drainage layer to confirm compliance to support plans, Construction Drawings, and Part 3 of Technical Specification Section 02710.	The cover drainage layer shall be constructed within 0.0 to +/-0.1 feet of the thickness indicated on the Construction Drawings.
BIOINTRUSION LAYER (SECTION 02280)	1. Shall be Type C Riprap that shall meet the requirements of Item 601.7 of the Ohio DOT specifications; 2. Shall be tested for soundness in accordance with AASHTO T 130 and have a maximum loss of 5 percent; 3. Shall be tested for maximum absorption in accordance with ASTM C 137 and shall have a maximum absorption of 0.83 percent.	Monitor the placement of the biointrusion barrier to confirm compliance to support plans, Construction Drawings, and Part 3 of Technical Specification Section 02280.	The biointrusion barrier shall be constructed to within –0.1 to +0.3 feet of the thickness shown on the Construction Drawings.

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TABLE 6-7 (cont.)

COVER SYSTEM			
DESCRIPTION OF COMPONENT	CONFORMANCE TESTING REQUIREMENTS	MONITORING REQUIREMENTS	PERFORMANCE TESTING REQUIREMENTS
BIOINTRUSION CHOKESTONE LAYER (SECTION 2280)	1. Shall be tested in accordance to ASTM C 136 and shall meet the requirements of AASHTO M 43 for No. 1 course aggregate; 2. Shall be tested for soundness in accordance with AASHTO T 130 and have a maximum loss of 5 percent; 3. Shall be tested for maximum absorption in accordance with ASTM C 137 and shall have a maximum absorption at 0.83 percent.	Monitor the placement of the biointrusion chokestone layer to confirm compliance to support plans, Construction Drawings, and Part 3 of Technical Specification Section 02280.	Survey tolerances are not specified.
GRANULAR FILTER LAYER (SECTION 02712)	1. Shall be classified as SW in accordance to ASTM D 2487; 2. Shall have the following gradation when tested in accordance to ASTM C 136; SIEVE — TOTAL PERCENT PASSING 2 in — 100 3/4 in — 80-100 1/2 in — 70-85 No. 4 — 55-70 No. 8 — 50-65 No. 50 — 15-35 No. 60 — 0-30 No. 200 — 0-5	Monitor the placement and compaction of the granular filter layer to confirm compliance support plans, Construction Drawings, and Part 3 of Technical Specification Section 02712.	The granular filter shall be constructed within 0.0 to +0.1 feet of the thickness shown on the Construction Drawings.
VEGETATIVE SOIL LAYER (SECTION 02250)	1. Shall be relatively free of debris, foreign objects, large rock fragments, and organics. Also shall be free of visible rock particles larger than 4 inches in maximum dimension when tested in accordance to ASTM D 422. 2. Shall be classified CL, SC, or GC in accordance to ASTM D 2487 and ASTM D4316.	Monitor the placement and compaction of the vegetative soil layer to confirm compliance to Construction Drawings, support plans, and Part 3 of Technical Specification Section 02250.	1. Shall be compacted to 92 percent of maximum dry unit weight (ASTM D 698); 2. Shall have a moisture content within 3 +/- percent of the standard Proctor optimum moisture content (ASTM D 698).

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TABLE 6-7 (cont.)

COVER SYSTEM			
DESCRIPTION OF COMPONENT	CONFORMANCE TESTING REQUIREMENTS	MONITORING REQUIREMENTS	PERFORMANCE TESTING REQUIREMENTS
TOP SOIL (SECTION 02920)	1. Shall be a loam, clay loam, silty clay loam, silt loam, or sandy clay loam, as classified by the U.S. Department of Agriculture Soil Conversation Service Agriculture Handbook 436 and be loose and friable; 2. Fraction passing the U.S. Standard No. 10 sieve shall contain not more than 40 percent clay-sized fraction as determined in accordance with ASTM D 422; 3. Shall be free of metal, debris, foreign objects, large rock fragments, and stumps and other deleterious material; 4. Shall contain not less than 2 percent organic matter as determined by loss on ignitions of samples oven dried to constant weight (per ASTM D 2974 Method A for moisture content determination and method C for ash content determination)	Monitor the placement of the topsoil to confirm compliance to Construction Drawings, support plans, and Part 3 of Technical Specification Section 02920.	3. The topsoil layer shall be constructed to within +/-0.1 feet of the thickness shown on the Construction Drawings. 4. The topsoil layer shall be constructed to within 0.0 to +0.5 feet of the grades indicated on the Construction Drawings.

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TABLE 6-8
MINIMUM CONFORMANCE TESTING FREQUENCIES FOR OSDF FINAL COVER SYSTEM COMPONENTS AND NON-IMPACTED CONTOURING LAYER

TEST NAME/TEST METHOD	SOIL TYPE[4]							
	COMPACTED CLAY CAP	COVER DRAINAGE LAYER	BIOINTRUSION BARRIER		GRANULAR FILTER	VEGETATIVE SOIL LAYER	TOPSOIL	NON-IMPACTED CONTOURING LAYER
			PRIMARY BIOINTRUSION BARRIER	CHOKE STONE				
SPECIFICATION SECTION	02225	02710	02280	02280	02712	02250	02920	02240
Particle Size Analysis/ASTM D 422 (sieve only)	1 test per 1,500 yd^3 [1]	N/A	N/A	N/A	N/A	1 per 5,000 yd^3	1 per 5,000 yd^3 [3]	1 test per 5,000 yd^3
Particle Size Analysis/ASTM C 136	N/A	1 test per 3,000 yd^3	N/A	1 test per 10,000 yd^3	1 test per 5,000 yd^3	N/A	N/A	N/A
Atterberg Limits	1 test per 1,5000 yd^3	N/A	N/A	N/A	N/A	1 test per 5,000 yd^3	N/A	1 test per 5,000 yd^3
Moisture Content/ASTM D 2216 or ASTM D 4643	1 test per 1,500 yd^3	N/A	N/A	N/A	N/A	N/A	N/A	1 test per 5,000 yd^3
Soil Classification/ASTM D 2487	1 test per 1,500 yd^3	1 test per 3,000 yd^3	N/A	N/A	1 test per 5,000 yd^3	1 test per 5,000 yd^3	1 test per 5,000 yd^3	1 test per 5,000 yd^3
Standard Proctor/ASTM D 698	1 test per 1,500 yd^3	N/A	N/A	N/A	N/A	1 test per 5,000 yd^3	N/A	1 test per 5,000 yd^3
Hydraulic Conductivity/ASTM D 5084	1 test per 10,000 yd^3 [4] (remold)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Hydraulic Conductivity/ASTM D 2434	N/A	1 test per 3,000 yd^3	N/A	N/A	N/A	N/A	N/A	N/A
Carbonate Content/ASTM D 3042[2]	N/A	1 test per 5,000 yd^3				N/A	N/A	N/A
Organic Content/ASTM D 2974	N/A	N/A	N/A	N/A	N/A	N/A	1 test per 5,000 yd^3	N/.A
Bulk Specific Gravity/ASTM C 127	N/A	N/A	1 test per 10,000 yd^3	1 test per 10,000 yd^3	N/A	N/A	N/A	N/A
Maximum Absorption/ASTM C 127	N/A	N/.A	1 test per 10,000 yd^3	1 test per 10,000 yd^3	N/A	N/A	N/S	N/A

NA = Not Applicable

NOTE:
1. Also perform hydrometer analysis once every tenth test.
2. Sample to be tested at pH of 4.
3. For Phase I, this frequency was revised to 1 test per 10,000 yd^3 based on the TPPFR addendum.
4. More frequent testing may be directed by the Construction Manager when indicated by soil variability.
5. Volumes for test frequency is based on in-place volume of material after compaction to specified density.

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TABLE 6-9
MINIMUM PERFORMANCE TESTING FREQUENCIES FOR OSDF COVER SYSTEM COMPONENTS AND NON-IMPACTED CONTOURING LAYER

000218

TEST NAME/TEST METHOD	SOIL TYPE							
	CONTOURING LAYER[2]	COMPACTED CLAY CAP	COVER DRAINAGE LAYER	BIOINTRUSION BARRIER		GRANULAR FILTER	VEGETATIVE SOIL LAYER	TOPSOIL
				PRIMARY BIOINTRUSION BARRIER	CHOKE STONE[3]			
SPECIFICATION SECTION	02240	02225	02710	02280	02280	02712	02250	02920
In-situ Moisture/ASTM D 3017	1 test per 10,000 ft^2 per lift	5 tests per acre per lift[1]	N/A	N/A	N/A	N/A	2 tests per acre per lift[1]	N/A
In-situ Density/ASTM D 2922	1 test per 10,000 ft^2 per lift[4]	5 tests per acre per lift[1]	N/A	N/A	N/A	N/A	2 tests per acre per lift[1]	N/A
Sand Cone/ASTM D 1556 or Drive Cylinder/ASTM D 2937	1 test per 25 nuclear tests	1 test per 25 nuclear tests	N/A	N/A	N/A	N/A	1 test per 25 nuclear tests	N/A

N/A = Not Applicable

NOTE
1. A minimum of two nuclear moisture and density tests each day of active soils construction.
2. A minimum of 1 in-situ moisture (ASTM D 3017) and 1 in-situ density (ASTM D 2922) will be performed for each 100 ft. x 100 ft. (30m x 30m) grid element per lift.
3. Compact with 4 pass of bull dozer as specified in Section 02280 of Technical Specifications.
4. Nuclear density probe depth for the first lift of contouring layer shall be 4".

7. GEOMEMBRANE LINER AND ~~COVER~~ CAP

7.1 Introduction

The CQC Consultant ~~shall~~ will perform conformance testing and ~~shall~~ will monitor the installation of geomembranes as required by Section 02770 of the Technical Specifications and this CQA Plan. The testing used to evaluate the conformance of the geomembrane with the requirements of the Technical Specifications will be carried out by the CQC Consultant in accordance with the current versions of the ASTM or other applicable test procedures indicated in Tables 7-1 and 7-2 which are in effect at the time of award of construction contract, unless otherwise specified or approved by the Construction Manager.

7.2 Related Construction Drawings and Technical Specifications

The ~~Subcontractor~~ Contractor and Geosynthetics Installer shall comply with the Construction Drawings and Section 02770 of the Technical Specifications. This specification shall be referenced for the various ~~physical~~ properties, manufacturing quality control, and installation requirements of the geomembrane materials.

7.3 Manufacturing Plant Visit

~~The Construction Manager~~~~Project QA, or authorized representative (i.e.,~~ Representatives from Fluor Fernald, Inc. and the CQC Consultant will visit the ~~plant of the Geomembrane Manufacturer for the purpose of verifying~~ plant that will be used to manufacture geomembrane to confirm manufacturing quality control ~~procedures~~ methods are in ~~conformance~~ compliance with Section 02770P of the Technical Specifications. If possible, such a visit will be performed prior to or during the manufacturing of the geomembrane rolls for the OSDF project. The ~~Construction~~

~~Manager~~ review party ~~shall~~ will review the manufacturing process, quality control procedures, laboratory facilities, and testing procedures.

During the project specific plant visit, ~~the Construction ManagerProject Qa~~ the review party will ~~shall~~:

- ~~verify~~ confirm that properties ~~guaranteed~~ in the procurement specification provided in writing by the Geosynthetics Manufacturer meet all specifications;
- ~~verify~~ confirm that the measurements of properties by the Geosynthetics Manufacturer are properly documented and test methods used are acceptable;
- spot inspect the rolls and ~~verify~~ confirm that they are free of holes, blisters, or any sign of contamination by foreign matter;
- review packaging and transportation ~~procedures~~ methods to ~~verify~~ confirm that these ~~procedures~~ methods are not damaging the geomembrane;
- ~~verify~~ confirm that all rolls are properly labeled; and
- ~~verify~~ confirm that extrusion rods and/or beads manufactured for the field seaming of the geomembrane are derived from the same base resin type as the geomembrane.

Upon completion of the manufacturing plant visit, a report describing the findings and observations ~~Project QA~~ FFQADP ~~shall~~ will be ~~completed~~ prepared by Fluor Fernald, Inc.~~and submitted to the Construction Manager~~.

7.4 Transportation, Handling and Storage

The CQC Consultant ~~shall~~ will monitor the transportation, handling, and storage of the geomembrane on-site. The ~~Construction Manager~~ Contractor shall designate a laydown area for the geomembrane storage location. Rolls of geomembrane shall not

be stacked upon one another to the extent that deformation of the core occurs, to the point where accessibility for sampling is inhibited, or ~~higher than~~the height of the stack exceeds ~~recommended~~recommendation ~~by~~of the Manufacturer. It will be the responsibility of the ~~Subcontractor~~ Contractor to protect the geomembrane stored on-site from theft, vandalism, and damage.

Upon delivery at the site, the ~~Subcontractor~~Contractor~~,~~ ~~Geosynthetics Installer,~~ and CQC Consultant ~~shall~~ will ~~conduct an inspection of~~monitor the rolls for defects and damage. This ~~inspection shall~~monitoring will be conducted without unrolling the materials unless defects or damages are found or suspected. The CQC Consultant ~~shall~~ will indicate to the Construction Manager:

- rolls, or portions thereof, which should be rejected and removed from the site because they have severe or nonrepairable flaws which may compromise geomembrane quality; and
- ~~rolls which~~rolls, which include minor or repairable ~~flaws which~~ flaws, which do not compromise geomembrane quality.

The CQC Consultant ~~shall~~ will also monitor that equipment used to handle the geomembrane on-site is adequate and does not pose any risk of damage to the geomembrane when used properly.

7.5 Conformance Testing

~~7.5.1 Sampling Procedures~~7.5.1 Sampling Requirements

Before or upon delivery of the geomembrane rolls to the OSDF, the CQC Consultant ~~shall ensure~~ will ~~assure~~ confirm that representative geomembrane conformance samples are obtained at the specified frequency and forwarded to the Geosynthetics CQC Laboratory for testing. Geomembrane conformance samples ~~shall~~ will be taken across the entire width of the roll and ~~shall~~ will not include the first 3 ft of

material. ~~Unless otherwise directed by the Construction Manager or Project QA, samples shall be 3 ft long by the roll width.~~ The required minimum geomembrane conformance sampling frequencies are provided in Table 7-1. The CQC Consultant ~~shall~~ will mark the machine direction on the samples with an arrow and affix a label, tag, or otherwise mark each sample with the following information:

- date sampled;
- project number;
- lot/batch number and roll number;
- conformance sample number; and
- CQC personnel identification.

~~7.5.2 Testing Procedures~~7.5.2 Testing Requirements

Conformance testing of the geomembrane materials delivered to the site will be conducted to ~~ensure~~ confirm compliance with both the Technical Specifications and the manufacturer's list of minimum average roll values. As a minimum, the geomembrane conformance test ~~procedures~~ requirements listed in Table 7-1 will be performed by the Geosynthetics CQC laboratory.

7.5.3 Test Results

All conformance test results will be reviewed, accepted, and reported by the CQC Consultant before ~~deployment~~ delivery of the geomembrane. Any nonconformance of the material's ~~physical~~ properties with the requirements of the Technical Specifications will be reported to ~~the~~ Construction Manager~~Project QA~~. In all cases, the test results

will meet~~,~~ or exceed~~,~~ the property values listed in ~~Appendix B.~~Table 02770P-1 of the Technical Specifications.

7.5.4 Conformance Test Failure

In the case of failing test results, ~~the Subcontractor or~~ the CQC Consultant, Project QA, or Manufacturer may request that another sample from the failing roll be retested by the Geosynthetics CQC Laboratory with the manufacturer's technical representative present during the test ~~procedure~~. If the retest fails or if the option to retest is not exercised, then two isolation conformance samples will be obtained by the CQC Consultant. These isolation samples ~~shall~~ will be taken from rolls, which have been determined by correlation with the manufacturer's roll number, to have been manufactured prior to and after the failing roll. This method for choosing isolation rolls for testing should continue until passing tests are achieved. All rolls which ~~fail~~ fall numerically between the passing roll numbers will be rejected by the Construction Manager. The CQC Consultant will verify that the ~~Subcontractor~~ Manufacturer has replaced all rejected rolls. The CQC Consultant ~~shall~~ will document ~~all~~ actions taken in conjunction with geomembrane conformance test failures.

7.6 Anchorage Trench

The CQC Consultant ~~shall~~ will ~~verify~~ confirm and document that the anchor trench has been constructed ~~according~~ in accordance to Construction Drawings. ~~The amount of anchor trench open at any time shall be limited to one day of geomembrane installation capacity unless a variance approved by the . The anchor trench shall be constructed with proper drainage to prevent ponding.~~ Geosynthetic materials in the anchor trench ~~shall~~ shall be temporarily anchored with sand bags or other suitable methods approved by the Construction Manager. The anchor trench ~~shall~~ shall be backfilled with suitable material as indicated in the Construction Drawings and Technical Specifications. In-place moisture/density by nuclear methods testing of the

compacted anchor trench backfill ~~shall~~ will be performed at the frequencies given in Table 6-3.

The anchor trench ~~shall~~ shall be constructed with a slightly rounded inside corner where the geosynthetics enter the trench. No loose soil ~~shall~~ shall be allowed to underlie the geosynthetics in the anchor trench. The CQC Consultant ~~shall~~ ~~verify~~ will confirm that all temporary ballast (i.e., sandbags) and deleterious materials are removed from the anchor trench prior to backfilling. Backfilling of the anchor trench shall be performed when the geomembrane is in its most contracted state to prevent stress inducement and using extreme care to prevent any damage to the geosynthetic materials.

7.7 Geomembrane Placement

7.7.1 Field Panel Identification

A field panel is the unit area of ~~geomembrane which~~geomembrane, which is to be seamed in the field, i.e., a field panel is a roll or a portion of roll cut in the field.

The CQC Consultant ~~shall assure~~ will confirm that each field panel is given an "identification code" (number or letter-number) consistent with the layout plan. This identification code shall be agreed upon by the Construction Manager, Geosynthetics Installer, and CQC Consultant. This field panel identification code shall be as simple and logical as possible. The Geosynthetic Manufacturer's roll numbers shall be traceable to the field panel identification code.

The CQC Consultant ~~shall~~ will document the correspondence between roll numbers~~,~~ ~~factory panels,~~ and field panel identification codes. The field panel identification code will be used for ~~all~~ quality assurance/quality control records.

7.7.2 Field Panel Placement

The CQC Consultant ~~shall~~ will monitor that field panels are installed at the location indicated in the Geosynthetics Installer's layout plan, as approved or modified. The CQC Consultant ~~shall~~ will record the field panel identification code, manufacturer's roll number, location, date of installation, and dimensions of each field panel.

Geomembrane placement shall not proceed at an ambient temperature below 40°F or above 104°F unless authorized in writing by the Construction Manager. Geomembrane placement shall not proceed during any precipitation, in the presence of excessive moisture (e.g., fog, dew), in an area of ponded water, or in the presence of excessive winds. The CQC Consultant ~~shall~~ will monitor that the above conditions are fulfilled and that the supporting soil has not been damaged by adverse weather conditions.

The CQC Consultant ~~shall~~ will monitor geomembrane deployment for the following:

- any equipment used does not damage the geomembrane by handling, trafficking, excessive heat, leakage of hydrocarbons or other means;
- the prepared surface underlying the geomembrane has not deteriorated since previous acceptance, and is still acceptable immediately prior to geomembrane placement;
- adjacent geomembrane panels are shingled in the direction of slope;
- any geosynthetic elements immediately underlying the geomembrane are clean and free of foreign objects or debris;
- ~~all~~ personnel working on the geomembrane do not smoke, wear damaging shoes, or engage in other activities which could damage the geomembrane;

- the method used to unroll the panels does not cause scratches or crimps in the geomembrane and does not damage the supporting soil;

- the method used to place the panels minimizes wrinkles (especially differential wrinkles between adjacent panels);

- adequate temporary loading and/or anchoring (e.g., sandbags~~, tires~~), not likely to damage the geomembrane, has been placed to prevent uplift by wind. ~~(in case of high winds,~~ Continuous loading, ~~e.g.,~~ by adjacent sand bags~~,~~ or other approved objects is recommended along edges of panels to minimize risk of wind ~~flow under~~ uplifting the panels; and

- direct contact with the geomembrane is minimized; i.e., the geomembrane is protected by geotextiles, extra geomembrane, or other suitable materials, in areas where excessive traffic may be expected.

The CQC Consultant ~~shall observe~~ will monitor the geomembrane panels, after placement and prior to seaming, for damage. The CQC ~~Site Manager~~Consultant ~~shall~~ will advise the Construction Manager which panels, or portions of panels, should be rejected, repaired, or accepted. Damaged panels or portions of damaged ~~panels which have been rejected~~panels that have been rejected will be marked and their removal from the work area recorded by the CQC Consultant. Repairs shall be made according to procedures described in this Section.

7.8 Field Panel Seaming

7.8.1 Panel Layout

The CQC Consultant ~~shall~~ will review the panel layout drawing previously submitted to the Construction Manager by the Geosynthetics Installer and verify that it is consistent with accepted state of practice. In general, seams ~~should~~ shall be oriented parallel to the line of maximum slope, i.e., oriented along, not across, the slope. In

corners and odd-shaped geometric locations, the number of seams should be minimized. No horizontal seam ~~should~~ shall be ~~less than~~ within 10 ft from the toe of the slope, or areas of potential stress concentrations, unless otherwise authorized by the Construction Manager. A seam numbering system compatible with the field panel identification numbering system shall be agreed upon prior to any seaming.

7.8.2 Seaming Equipment and Products

Approved processes for field seaming are extrusion welding and fusion welding. Proposed alternate processes shall be documented and submitted to the Construction Manager for approval. Only ~~equipment which~~equipment, which have been specifically recommended by the Manufacturer by make and model shall be used. ~~All~~ Seaming equipment shall be permanently marked with an identification number.

7.8.2.1 Filet Extrusion Process

The filet extrusion-welding apparatus shall be equipped with gauges ~~giving~~ showing the ~~temperature~~ preheat and extrudate temperatures. ~~in the apparatus and at the nozzle.~~ The CQC Consultant will establish where the temperature sensors are located and record the information on a daily field report. The CQC Consultant ~~shall verify~~ will confirm that the extrudate is comprised of the same resin as the geomembrane sheeting. The CQC Consultant ~~shall~~ will monitor ~~temperatures, extrudate temperatures,~~ ambient temperatures;~~,~~ ~~and geomembrane surface temperatures~~ When ambient temperature is below 50°F the CQC Consultant will monitor the geomembrane surface temperature at appropriate intervals but not to exceed four hours of welding.

The CQC Consultant ~~shall~~ will also monitor that:

- the number of spare operable seaming apparatus agreed by the Construction Manager are maintained on site;

- equipment used for seaming is not likely to damage the geomembrane;
- the extruder is purged prior to beginning a seam until all heat-degraded extrudate has been removed from the barrel;
- the electric generator is placed ~~on a smooth base such that no~~ in a drip pan to contain spillage from the fuel tank and to prevent damage ~~occurs~~ to the geomembrane; and
- a smooth insulating plate or fabric is placed beneath the hot welding apparatus after usage.

7.8.2.2 Fusion Process

The fusion-welding apparatus must be automated, self-propelled devices. The fusion-welding apparatus shall be equipped with gauges giving the applicable temperatures and welding speed. The CQC Consultant ~~shall~~ will monitor ambient temperatures and apparatus temperatures.

The CQC Consultant ~~shall~~ will also monitor that:

- the number of spare operable seaming apparatus agreed by the Construction Manager are maintained on site;
- equipment used for seaming will not damage the geomembrane;
- the electric generator is placed ~~on a smooth base such that no~~in a drip pan to contain spillage from the fuel tank and to prevent damage ~~occurs~~ to the geomembrane;
- ~~for cross seams, the edge of the cross seam is ground to a smooth incline (top and bottom) prior to welding;~~

- a smooth insulating plate or fabric is placed beneath the hot welding apparatus after usage; and
- a movable protective layer is used as necessary directly below each overlap of geomembrane that is to be seamed to prevent build-up of moisture between the sheets.

7.8.3 Seam Preparation

The CQC Consultant ~~shall~~ will monitor that:

- prior to seaming, the seam area is clean and free of moisture, dust, dirt, debris of any kind, and foreign material;
- seams are overlapped a minimum of 4 inches;
- if seam overlap grinding is required, the process is completed according to the ~~Geomembrane Manufacturer's instructions or Section 02770 of the~~ Technical Specifications, ~~whichever is the more stringent,~~ prior to the seaming operation, and in a way that does not damage the geomembrane;
- the grind depth shall not exceed 10 percent of the geomembrane thickness;
- grinding marks shall not appear beyond the extrudate after it is placed; and
- seams are aligned with the fewest possible number of wrinkles and "fishmouths".

7.8.4 Weather Conditions for Seaming

The normally required weather conditions for seaming are as follows:

- Between ambient temperatures of 40°F and 50°F, seaming is possible if the geomembrane is preheated by either sun or hot air device, and if there is no cooling of the geomembrane to below 50°F resulting from wind.

- Unless authorized in writing by the Construction Manager, no seaming shall be attempted at an ambient temperature below 40°F or above 104°F.

- In all cases, the geomembrane seam areas shall be dry and protected from wind.

The CQC Consultant ~~shall verify~~ will confirm that methods used by the ~~Subcontractor~~ Geosynthetic Installer for seaming at ambient temperatures below 40°F or above 104°F will produce seams ~~which~~ that are ~~entirely~~ equivalent to seams produced at ambient temperatures between 40°F and 104°F and protect the overall quality of the geomembrane. The CQC Consultant ~~shall~~ will monitor that seaming conducted during abnormal weather conditions is performed in accordance with the methods approved by the Construction Manager.

7.8.5 Overlapping and Temporary Bonding

The CQC Consultant ~~shall~~ will monitor that:

- the panels of geomembrane have a finished overlap of a minimum of 4 in. for both extrusion and fusion welding, but in any event sufficient overlap shall be provided to allow peel tests to be performed on the seam;

- no solvent or adhesive is used unless the product is approved in writing by the Construction Manager (samples shall be submitted to the Construction Manager for testing and evaluation); and

- the ~~procedure~~ method used to temporarily bond adjacent panels together does not damage the geomembrane; in particular, the temperature of hot air at the

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nozzle of any spot welding apparatus is controlled such that the geomembrane is not damaged.

7.8.6 Trial Seams

The CQC Consultant ~~shall verify~~ will confirm that the Geosynthetics Installer performs trial seam tests in accordance with Section 02770 of the Technical Specifications. The CQC ~~Consultant shall observe~~ will monitor and document the Geosynthetic Installer's trial seam testing procedures. The trial seam samples will be assigned an identification number and marked accordingly by the CQC Consultant. Each sample will be marked with the date, time, machine temperature(s) and setting(s), number of seaming unit, and name of seaming technician. Trial seam samples shall be maintained by the ~~Subcontractor~~ Geosynthetics Installer until a passing destructive test is achieved on seam represented by the trial seam sample.

~~7.8.7 General Seaming Procedures~~7.8.7 General Seaming Methods

No geomembrane seaming shall be performed unless the CQC Consultant is on-site. The CQC Consultant ~~shall~~ will monitor the general seaming ~~procedure~~ methods used by the Geosynthetics Installer as follows:

- ~~For fusion welding, a movable protective layer of plastic may be required to be placed directly below each overlap of geomembrane that is to be seamed. This is to prevent any moisture build-up between the sheets to be welded.~~
- If required, a firm substrate shall be provided by using a ~~flat board, a~~ conveyor belt, or similar hard surface directly under the seam overlap to achieve proper support.
- Fishmouths or wrinkles at the seam overlaps shall be cut along the ridge of the wrinkle in order to achieve a flat overlap. The cut fishmouths or wrinkles shall

be seamed and any portion where the overlap is inadequate shall then be patched with an oval or round patch of the same geomembrane extending a minimum of 6 in. beyond the cut in all directions.

- If seaming operations are carried out at night, adequate illumination shall be provided by the ~~Subcontractor~~ Contractor to the satisfaction of the Construction Manager.

- Seaming shall extend to the outside edge of panels to be placed in the anchor trench.

7.9 Nondestructive Seam Continuity Testing

The CQC Consultant ~~shall~~ will monitor that the Geosynthetics Installer ~~shall~~ nondestructively test ~~all~~ field seams over their full length using a vacuum test unit or air pressure test (for double fusion seams only). Spark testing may be performed when specifically approved by the Construction Manager ~~and the Resident Engineer~~ if the seam cannot be tested using the vacuum or air pressure test methods. The purpose of nondestructive tests is to check the continuity of seams. ~~Continuity~~ The nondestructive seam testing shall be carried out as the seaming work progresses, not at the completion of all field seaming. The CQC Consultant will:

- monitor nondestructive testing;

- document the results of the nondestructive testing and the method of testing; and

- inform the ~~Subcontractor~~ Geosynthetic Installer, Contractor, and Construction Manager of any noncompliance.

Any required seam repairs shall be made in accordance with the Technical Specifications. The CQC Consultant will:

- ~~observe~~ monitor the repair ~~procedures~~ methods;
- ~~observe~~ monitor the retesting ~~procedures~~methods; and
- document the results.

The seam number, date of observation, dimensions and/or descriptive location of the seam length tested, name of person performing the test, and outcome of the test will be recorded by the CQC Consultant.

7.10 Destructive Testing

Destructive seam testing shall be performed during the geomembrane installation. The purpose of this testing is to evaluate seam strength. Destructive seam testing shall be done as the seaming work progresses, not at the completion of all field seaming.

7.10.1 Location and Frequency

The CQC Consultant ~~shall~~ will select all destructive seam test sample locations. Sample locations will be established as follows.

- A minimum frequency of one test location per 500 ft of seam length. This minimum frequency is to be determined as an average taken throughout the entire facility.
- Test locations ~~shall~~ will be determined during seaming at the CQC Consultant's discretion. Selection of such locations may be prompted by suspicion of excess crystallinity, contamination, offset welds, or any other potential cause of imperfect welding.

The Geosynthetics Installer ~~shall~~ will not be informed in advance of the locations where the seam samples will be taken.

~~7.10.2 Sampling Procedures~~7.10.2 Sampling Requirements

Destructive seam testing shall be performed as the seaming progresses in order to obtain the Geosynthetics CQC Laboratory test results before the geomembrane is covered by overlying materials. The CQC Consultant ~~shall~~will:

- observe sample cutting;
- assign a number to each sample, and mark it accordingly; and
- record sample location on layout drawing.

~~All~~ Holes in the geomembrane resulting from destructive seam test sampling shall be ~~immediately~~ repaired in accordance with repair ~~procedures~~ methods described in Section 02770 of the Technical Specifications. The continuity of the new seams in the repaired area shall be nondestructively tested according to Section 7.9~~.8~~.

7.10.3 Size of Samples

At a given sampling location, two types of samples (field test samples and laboratory test samples) shall be taken. First, a minimum of two field samples or test strips ~~should~~ shall be taken for field testing. Each of these test strips shall be 1 in. wide by 12 in. long, with the seam centered parallel to the width. The distance between these two specimens shall be 42 in. If both specimens pass the field test described in this Section, a second full laboratory destructive sample ~~shall~~ will be taken for testing by the Geosynthetics CQC Laboratory.

The full destructive sample shall be located between the two field test strips. The sample shall be 12 in. wide by 42 in. long with the seam centered lengthwise. The sample ~~shall~~ will be cut into three parts and distributed as follows:

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- one 12 in. by 12 in. portion to the Geosynthetics Installer;
- one 12 in. by 12 in. portion to the Construction Manager for archive storage; and
- one 12 in. by 18 in. portion for Geosynthetics CQC Laboratory testing.

7.10.4 Field Testing

The test strips shall be tested in the field, for peel adhesion, using a calibrated gauged tensiometer. In addition to meeting the strength requirements as specified ~~outlined~~ in ~~Appendix B~~ Section 02770 of the Technical Specifications, ~~all~~ specimens shall exhibit a Film Tear Bond and shall not fail in the weld. If any field test sample fails to meet these requirements, the destructive sample has failed.

The CQC Consultant will witness ~~all~~ field tests and mark ~~all~~ samples and portions with their number. The CQC Consultant will also log the date, number of seaming unit, seaming technician identification, destructive sampling, and pass or fail description.

7.10.5 Geosynthetics CQC Laboratory Testing

Destructive test samples will be tested by the Geosynthetics CQC Laboratory. Testing will include "Bonded Seam Strength" and "Peel Adhesion" (ASTM D 4437). The minimum acceptable values to be obtained in these tests are presented in ~~Appendix B~~ Section 02770 of the Technical Specifications. At least five specimens will be tested for each test method. Specimens will be selected alternately by test from the samples (i.e., peel, shear, peel, shear...). Both the inside and outside tracks of the double track fusion seams will be tested for peel adhesion. A passing test will meet the minimum required values in at least four out of five specimens.

The Geosynthetics CQC Laboratory ~~shall~~ will provide test results no more than 24 hours after they receive the samples. The CQC Site Manager ~~shall~~ will review laboratory test results as soon as they become available, and make appropriate recommendations to the Construction Manager.

7.10.6 ~~Procedures~~ Requirement for Destructive Test Failure

The following ~~procedures~~ requirements will ~~shall~~ apply whenever a sample fails a destructive test, whether that test was conducted in the field or by the Geosynthetics CQC Laboratory. The CQC Consultant will monitor that the Geosynthetics Installer follow one of two options:

- The Geosynthetics Installer can reconstruct the seam (e.g., remove the old seam and reseam) between any two passed destructive test locations.
- The Geosynthetics Installer can trace the welding path to an intermediate location a minimum of 10 ft from the point of the failed test in each direction and take a small sample for ~~an~~ additional field testing in accordance with the destructive test procedure at each location. If these additional isolation samples pass the field test, then full laboratory samples are taken at both locations. If these laboratory samples meet the specified strength criteria, then the seam is reconstructed between these locations. If either sample fails, then the process is repeated to establish the zone in which the seam should be reconstructed.

~~All~~ Failed seams ~~must~~ will be bounded by two locations from which samples passing laboratory destructive tests have been taken. In cases exceeding 150 ft of reconstructed seam, a sample taken from the zone in which the seam has been reconstructed must pass destructive testing. Repairs shall be made in accordance with this Section. The CQC Consultant will document all actions taken in conjunction with destructive test failures.

7.11 Defects and Repairs

7.11.1 Identification

~~All~~ Seams and ~~non-seam~~ panel areas of the geomembrane ~~shall~~ will be examined by the CQC Consultant for identification of defects, holes, blisters, undispersed raw materials and any sign of contamination by foreign matter. Because light reflected by the geomembrane helps to detect defects, the surface of the geomembrane will be clean at the time of examination. The Construction Manager will require the geomembrane surface to be broomed or washed by the ~~Subcontractor~~ Contractor if the amount of dust or mud inhibits examination.

~~7.11.2 Repair Procedures~~7.11.2 Repair Requirements

Any portion of the geomembrane exhibiting a flaw, or failing a destructive or nondestructive test, shall be repaired by the Geosynthetics Installer in accordance with Section 02770 of the Technical Specifications. Several ~~procedures~~ methods exist for the repair of these areas. The final decision as to the appropriate repair ~~procedure~~ methods shall be agreed upon between the ~~Subcontractor~~ Contractor and Construction Manager.

In addition, the following conditions ~~shall~~ will be monitored by the CQC Consultant:

- surfaces of the geomembrane which are to be repaired shall be abraded no more than one hour prior to the repair;
- ~~all~~ surfaces must be clean and dry at the time of the repair;
- ~~all~~ seaming equipment used in repairing ~~procedures~~ methods must be approved;

- ~~the repair procedures, materials, and techniques shall be approved by the Construction Manager in advance of the specific repair;~~
- patches or caps shall extend at least 6 in. beyond the edge of the defect, and all corners of patches shall be rounded with a radius of at least 3 in.; and
- the geomembrane below large caps should be appropriately cut to avoid water or gas collection between the two sheets.

7.11.3 Verification of Repairs

Each repair shall be numbered and logged. Each repair shall be non-destructively tested using approved methods. ~~Repairs which pass the non-destructive test~~Repairs that pass the non-destructive test shall be taken as an indication of an adequate repair. Large caps may be of sufficient extent to require destructive test sampling, at the discretion of the Construction Manager or as specified in Table 7-2. The CQC Consultant will observe ~~all~~ non-destructive testing of repairs and will record the number of each repair, date, and test outcome.

7.12 Electrical Leak Detection Testing

Electrical leak detection testing of the primary geomembrane liner and the geomembrane cap shall be conducted as supplemental CQC testing by the Contractor. This testing shall be conducted in a manner to protect the installation of geomembrane and GCL components of the liner and final cover system. The Contractor shall perform the work, document the results of the work, and delineate and repair detected leaks.

The CQC Consultant will monitor the Contractor's electrical leak detection testing of primary geomembrane liner and the geomembrane cap. The CQC Consultant will:

- confirm adequate water supply and pressure during the testing;

- maintain a location map delineating areas completed by electrical leak detection testing;
- document monitoring of the electrical leak detection testing; and
- inform the Contractor and Construction Manager of any non-compliance.

The CQC Consultant will confirm that any required repairs are made in accordance with Section 02770 of the Technical Specifications and Section 7.11 of this CQA Plan.

7.13 Liner and ~~Cover~~ Cap System Acceptance

The ~~Subcontractor~~ Contractor shall retain all responsibility for the geosynthetics from site delivery until in place acceptance by the Construction Manager. The terms for liner and cap systems acceptance are described in Section 02770 of the Technical Specifications.

7.14 Materials in Contact with the Geomembrane

The ~~procedures~~ methods outlined in this section are intended to ~~assure~~ confirm that the installation of materials in contact with the geomembrane do not cause damage. Additional ~~quality assurance and~~ quality control ~~procedures~~ methods are necessary to ~~assure~~ confirm that systems built with these materials will be constructed in ~~such~~ a way ~~to~~ that ~~ensure~~ proper performance is achieved.

7.14.1 Soils

The CQC Consultant ~~shall~~ will monitor that the ~~Subcontractor~~ Contractor takes ~~all~~ necessary precautions to ~~ensure~~ prevent damage to ~~that~~ the geomembrane ~~is not damaged~~ during ~~its~~ installation or during the installation of other components of the

liner or cover system or by other construction activities. The CQC Consultant ~~shall~~ will monitor the following:

- placement of granular drainage materials above the geomembrane which shall not proceed at an ambient temperature below 40°F or above 104°F unless otherwise approved by the Construction Manager;
- ~~soil~~ granular drainage material placement operations above the geomembrane which shall be made by the ~~Subcontractor~~ Contractor to minimize wrinkles in the geomembrane;
- equipment ~~used for placing soil~~ shall not be driven directly on the geomembrane;
- ~~a~~ the specified minimum granular drainage material or protective layer ~~soil~~ thickness ~~of 1 ft~~ is used between a light track-mounted dozer ~~(e.g., having a maximum ground pressure of 5 psi)~~ and the geomembrane;
- ~~a~~the specified minimum granular drainage material, protective layer, or select impacted material thickness ~~of 3 ft of soil~~ is used between rubber-tired vehicles and the geomembrane; and
- the specified minimum soil thickness ~~shall be greater than 3 ft~~ is used in heavily trafficked areas such as access ramps.

7.14.2 Appurtenances

The CQC Consultant ~~shall~~ will monitor that:

- installation of the geomembrane in appurtenant areas, and connection of geomembrane to sumps and appurtenances have been made in accordance with the Construction Drawings and Technical Specifications;

- extreme care is taken by the Geosynthetics Installer when seaming around appurtenances since neither non-destructive nor destructive testing may be feasible in these areas; and

- the geomembrane has not been visibly damaged when making connections to sumps and appurtenances.

TABLE 7-1:

GEOMEMBRANE CONFORMANCE TESTING REQUIREMENTS

TEST NAME	TEST METHOD	MINIMUM TESTING FREQUENCY[1]
~~Specific Gravity~~Density	ASTM D792 Method A or ASTM D1505	1 test per 100,000 ft^2
Thickness	ASTM D ~~519 or GRI-GM8~~5994	1 test per 100,000 ft^2
Tensile Strength at Yield	ASTM D638	1 test per 100,000 ft^2
Tensile Strength at Break	ASTM D638	1 test per 100,000 ft^2
Elongation at Yield	ASTM D638	1 test per 100,000 ft^2
Elongation at Break	ASTM D638	1 test per 100,000 ft^2
Carbon Black Content	ASTM D1603	1 test per 100,000 ft^2
Carbon Black Dispersion	ASTM D5596	1 test per 100,000 ft^2

Notes:
1. Test shall be performed at a frequency of one per lot or at listed frequency, whichever is greater. A lot shall be as defined by ASTM D 4354.
2. Test procedure for test method ASTM D 638 will be as modified by NSF 54 Annex A.

TABLE 7-2:

GEOMEMBRANE SEAM TESTING REQUIREMENTS

TEST NAME	TEST METHOD	MINIMUM TESTING FREQUENCY
Peel Adhesion[5]	ASTM D 4371[1,3,4]	1 test every 500 ft of seam length
Bonded Seam Strength[5]	ASTM D 4437[2,3,4]	1 test every 500 ft of seam length
Vacuum Testing	—	100 percent of extrusion welded seams
Air Pressure Testing	—	100 percent of fusion welded seams
Electrical Leak Detection		See Note 6

Notes:

1. For peel adhesion, seam separation shall not extend more than 10 percent into the seam interface. Testing shall be discontinued when the sample has visually yielded.
2. For shear tests, the sheet shall yield before failure of the seam.
3. For either test, sample failure shall be a Film Tear Bond (FTB) as outlined in NSF 54, Appendix A.
4. Where conditioning of the test sample is required, conditioning shall be minimum 1 hr. at standard laboratory atmosphere.
5. Minimum values for peel adhesion and bonded seam strength are included in technical specification Section 02770.
6. Electrical leak detection testing of all fusion and extrusion welded seams is required for the primary geomembrane liner and cap.

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8. GEOSYNTHETIC CLAY LINER AND CAP

8.1 Introduction

The CQC Consultant ~~shall~~ will perform conformance testing and ~~shall~~ will monitor the installation of the geosynthetic clay liner (GCL) and geosynthetic clay cap (GCC) as required by Section 02772 of the Technical Specifications and this CQA Plan. The testing used to evaluate the conformance of the GCL and GCC with the requirements of the Technical Specifications will be performed by the CQC Consultant in accordance with the current versions of the ASTM or other applicable test ~~procedure~~ method indicated in Table 8-1, ~~which are in effect at the time of award of the construction contract, unless otherwise directed or approved by the Construction Manager.~~

8.2 Related Construction Drawings and Technical Specifications

The ~~Subcontractor~~ Contractor and Geosynthetics Installer shall comply with the Construction Drawings and ~~with~~ Section 02772 of the Technical Specifications. ~~This specification shall be~~ The CQC Consultant will referenced these documents for the various ~~physical~~ properties, manufacturing quality control, and installation requirements of the GCL and GCC materials.

8.3 Manufacturing Plant Visit

The Fluor Fernald, Inc. and the CQC Consultant, will visit the plant of the GCL and GCC Manufacturer for the purpose of confirming that manufacturing quality control procedures are in conformance with Section 02770P of the Technical Specifications. If possible, such a visit will be performed prior to or during the manufacturing of the geomembrane rolls for the SDFP project. The review party will review the

manufacturing process, quality control methods, laboratory facilities, and testing procedures.

During the project specific plan visit, the review party will:

- confirm that properties in the procurement specifications provided in writing by the GCL and GCC Manufacturer meet specifications;
- confirm that the measurements of properties by the GCL and GCC Manufacturer are properly documented and test methods used are acceptable;
- spot inspect the rolls and confirm that they are free of defects, or any sign of contamination by foreign matter;
- review packaging and transportation methods to confirm that these methods are not damaging the GCL and GCC; and
- confirm that all rolls are properly labeled.

Upon completion of the manufacturing plant visit, a report describing the findings and observations by the review party will be prepared by Fluor Fernald, Inc.

8.~~4~~3 Transportation, Handling, and Storage

The CQC Consultant ~~will~~ will monitor the transportation, handling, and storage of the GCL and GCC on-site. Handling of the rolls shall be performed in a competent manner such that damage does not occur to the GCL and GCC or its protective wrapping. ~~Any~~ Protective wrapping that is damaged or stripped off the rolls shall be repaired immediately to the satisfaction of the Construction Manager. Rolls of GCL or GCC shall not be stacked upon one another to the extent that deformation of the core occurs, to the point where accessibility is inhibited, or the height of the stack exceeds the Manufacturer's recommendation, ~~can cause damage in handling, or higher than~~

~~recommended by the Manufacturer.~~ During transportation, handling, and storage the GCL and GCC rolls will be protected from ultraviolet light exposure, precipitation or ~~other inundation~~ ponding water, mud, dirt, dust, puncture, cutting or any other damaging or deleterious conditions. Stored GCL or GCC shall be covered with tarp.

Upon delivery at the site, the ~~Subcontractor~~ Contractor~~,~~ ~~Geosynthetics Installer~~~~Project QA,~~ and CQC Consultant ~~shall~~ will ~~conduct an inspection of~~ monitor the rolls for defects and damage. This ~~inspection~~ monitoring will be conducted without unrolling the materials unless defects or damages are found or suspected. The CQC Consultant ~~shall~~ will indicate to the Construction Manager:

- rolls, or portions thereof, which should be rejected and removed from the site because they have severe flaws; and
- ~~rolls which~~rolls, which include minor repairable flaws.

The CQC Consultant ~~shall~~ will also monitor that equipment used to handle the geosynthetics on-site is adequate and does not pose any risk of damage to the geosynthetics when used properly.

~~8.5~~8.5 Conformance Testing

~~8.4.1 Sampling Procedures~~8.5.1 Sampling Requirements

Before or upon delivery of the rolls of GCL and GCC, the CQC Consultant ~~will~~ will ~~assure~~ confirm that representative conformance samples are removed and forwarded to the Geosynthetics CQC Laboratory for testing. ~~of conformance to both the design specifications and the list of guaranteed properties provided by the Manufacturer. Unless otherwise directed by the Construction Manager,~~ Conformance samples will be a minimum of 3 ft long by the roll width. The CQC Consultant will mark the machine direction on the samples ~~with a waterproof maker~~ and tape or

otherwise secure the cut edges of the sample to eliminate the loss of the granular bentonite. The required minimum GCL and GCC sampling frequencies are provided in Table 8-1. The rolls shall be immediately re-wrapped and replaced in their shipping trailers or in the temporary field storage area. The CQC Consultant will mark the machine direction on the samples with an arrow and affix a label, tag, or otherwise mark each sample with the following information:

- date sampled;
- project number;
- lot/batch number and roll number;
- conformance sample number; and
- CQC personnel identification.

~~8.4.2 Testing Procedure~~8.5.2 Testing Requirements

Conformance testing of the GCL and GCC materials delivered to the site will be conducted to ~~ensure~~ confirm compliance with ~~both the Technical Specification~~Section 02770P of the Technical Specifications ~~and the manufacturer's list of minimum average roll values~~. As a minimum, the GCL and GCC conformance test ~~procedures~~ methods listed in Table 8-1 will be performed by the Geosynthetics CQC Laboratory.

~~8.45.3~~8.5.3 Test Results

The CQC Consultant ~~will~~ will ~~examine~~ review ~~all~~ results from laboratory conformance testing and ~~will~~ report any nonconformance to the Construction Manager. The GCL and GCC conformance test result ~~shall~~ will meet or exceed the minimum

~~physical~~ property values presented in ~~Appendix C~~ Section 02772P of the Technical Specifications.

~~8.4~~5.~~4~~8.5.4 Conformance Test Failure

In the case of failing test results, the ~~Subcontractor~~ Manufacturer or CQC Consultant ~~Project QA~~ may request that another sample from the failing roll be retested by the Geosynthetics CQC Laboratory with the manufacturer's technical representative present during the test. ~~procedure.~~ If the retest fails or if the option to retest is not exercised, then two isolation conformance samples will be obtained by the CQC Consultant. These isolation samples will be taken from rolls, which have been determined by correlation with the manufacturer's roll number, to have been manufactured prior to and after the failing roll. This method for choosing isolation rolls for testing should continue until passing tests are achieved. ~~All~~ Rolls which ~~fail~~ fall numerically between the passing roll numbers will be rejected by the Construction Manager. The CQC Consultant will verify that the ~~Subcontractor~~ Manufacturer has replaced all rejected rolls. The CQC Consultant ~~shall~~ will document ~~all~~ actions taken in conjunction with GCL and GCC conformance test failures.

8.~~6~~5 Surface Preparation

The GCL and GCC shall not be placed on surfaces which are softened due to high water content ~~or cracked due to desiccation~~ or have desiccation cracks as defined in Technical Specification Section 02225. The CQC Consultant and the Geosynthetics Installer will jointly verify that the surface on which the GCL and GCC will be installed is acceptable. The ~~Subcontractor~~ Contractor shall comply with the compacted clay liner surface preparation and acceptance requirements identified in Section 02225 of the Technical Specifications. The CQC Consultant ~~shall~~ will notify the Construction Manager of any observed change in the supporting soil condition that may require repair work and verify that compacted clay liner repair work is completed in accordance

with the requirements of the Technical Specifications and this CQA Plan. ~~Generally, the Contractor should maintain a firm smooth surface with no loose angular stones and only minimal crusting and dessication cracking (i.e., typically dessication cracks up to ¼ inch wide by 1 inch deep are allowable).~~

8.~~6~~7Placement

The CQC Consultant ~~shall verify~~ will confirm that the Geosynthetics Installer has taken all necessary precautions to protect the underlying subgrade and top of contouring layer during GCL and GCC installation ~~deployment~~ operations and that placement of GCL and GCC are in accordance ~~to~~ with Manufacturer's ~~standards~~ recommendations and/or Technical Specifications, whichever is most stringent. The CQC Consultant ~~shall verify~~will confirm that ~~all~~ GCL and GCC are handled in such a manner ~~as to ensure~~that they are not damaged ~~in any way~~, and the following conditions are met:

- on slopes, the GCL and GCC are secured and then rolled down the slope in such a manner as to continually keep the GCL and GCC panel in tension and prevent loss of bentonite;
- in the presence of wind, ~~all~~ GCL and GCC are weighted with sandbags or the equivalent;
- adjacent GCL panels are shingled in the direction of the slope;
- GCL and GCC are kept continually under tension to minimize the presence of wrinkles;
- GCL and GCC are cut using a utility blade in a manner recommended by the Manufacturer;
- during placement, care is taken not to entrap fugitive clay, sand, stones, ~~other~~ or debris under the GCL and GCC;

- the exposed GCL and GCC are protected from damage in heavily trafficked areas;
- a visual examination of the GCL and GCC is carried out over the entire surface, after installation, to ~~assure~~ confirm that damaged areas, if any, are identified and repaired; and
- if a white colored GCL and GCC is used, ~~precautions are taken~~take appropriate measures to protect against "snowblindness" of personnel.

8.~~7~~8 Overlaps

The CQC Consultant ~~shall~~ will monitor and ~~verify~~ confirm the GCL and GCC overlapping procedures conform to the requirements of Section 02772 of the Technical Specifications and manufacturer's recommendations, ~~edrocedures~~whichever is more stringent. ~~GCL and GCC panels shall be overlapped at a minimum of 6 inches along panel sides and a minimum of along panel ends. Dry bentonite powder shall be applied to seams per manufacturer's recommendations and at a minimum rate of one pound per lineal foot, around pipe penetrations or other perforations of GCL and GCC, at a minimum rate of one pound per lineal footwhich may be required.~~

8.~~8~~9 Repair

The CQC Consultant ~~shall~~ will monitor the repair of any holes or tears in the GCL and GCC or the geotextile backing. Patching requirements ~~shall~~ will conform to the most stringent of manufacturer's recommendations and Technical Specification Section 02772 requirements.~~, or the instructions provided in the following paragraph.~~

The CQC Consultant will monitor for hydrated GCL. Any GCL hydrated to a moisture content in excess of 40 percent, when measured in accordance with ASTM D 4643, will be marked for removal and replacement by the Contractor.

~~Repairs shall be made by placing a patch made from the same type GCL and GCC over the damaged area. On slopes greater than 5 percent, the patch shall overlap the edges of the hole or tear by a minimum of 2 ft in all directions. On slopes, 5 percent or flatter, the patch shall overlap the edges of the hole or tear by a minimum of 1 ft in all directions. The patch shall be secured to the satisfaction of the Construction Manager to avoid shifting during backplacing with soil or covering with another geosynthetic.~~

TABLE 8-1:

GCL AND GCC CONFORMANCE TESTING REQUIREMENTS

TEST NAME	TEST METHOD	MINIMUM TESTING FREQUENCY[1]
Direct Shear[2]	ASTM D ~~5321~~6243	1 test per 100,000 ft^2
Hydraulic Conductivity[3]	~~GRI GCL-2~~ASTM D 5887	1 test per 100,000 ft^2

Notes:

1. Testing shall be performed at a frequency of one per lot or at listed frequency, whichever is greater. A lot is defined by ASTM D 4354.

~~2.~~ Each sample ~~shall~~ will be tested using the most recent version of the ASTM for the following: (i) internal shear strength; and (ii) interface shear strength of geosynthetic clay liner and the geomembrane liner and the geosynthetic clay cap and the geomembrane cap~~; and (iii) the interface shear strength of the geosynthetic clay liner and compacted clay liner and the geosynthetic clay cap and the compacted clay cap~~.

3. Section 10 of ASTM D 5887 provides the equations to calculate the index flux. Hydraulic conductivity will also be calculated using average of three thickness measurements on the clay component of the GCL. The thickness measurements will be taken at the completion of the test within 30 minutes after dismounting the test specimen.

Calipers or similar devices will be used for measuring after carefully cutting the test specimen with a sharp razor knife and folding back the geotextile backing. The hydraulic conductivity will be calculated in accordance with the applicable method presented in Section 9 of the referenced ASTM D 5084, noting the length of the specimen is the average of the three thickness measurements (cm) and the hydraulic conductivity (cm/sec) along with the items required in Section 11 of ASTM D 5887.

9. GEOTEXTILES

9.1 Introduction

The CQC Consultant ~~shall~~ will perform conformance testing and ~~shall~~ will monitor the installation of geotextile filters, cushions, and separators (geotextiles) as required by Section 02714 of the Technical Specifications and this CQA Plan. The testing used to evaluate the conformance of the geotextiles with the requirements of the Technical Specifications ~~shall~~ will be performed by the CQC Consultant in accordance with the ~~current versions of the~~ ASTM or other applicable test ~~procedure~~ methods indicated in Tables 9-1 and 9-2. ~~which are in effect at the time of award of the Construction Contract, unless otherwise directed or approved by the Construction Manager.~~

9.2 Related Construction Drawings and Technical Specifications

The ~~Subcontractor~~ Contractor and Geosynthetics Installer shall comply with Section 02714 of the Technical Specifications. The CQC Consultant will reference this specification ~~shall be referenced~~ for specific details of the geotextile material properties, manufacturing quality control, and installation requirements of the geotextiles.

9.3 Transportation, Handling and Storage

The CQC Consultant ~~shall~~ will monitor the transportation, handling, and storage of the geotextile on-site. The Construction Manager ~~shall~~ will designate a geotextile storage location. During transportation, handling, and storage, the geotextile shall be protected from ultraviolet light exposure, precipitation or other inundation, mud, dirt, dust, puncture, cutting or any other damaging or deleterious conditions.

Handling of the geotextiles rolls shall be performed in a ~~competent~~ manner such that damage does not occur to the geotextile nor to its protective wrapping. Rolls of

geotextiles shall not be stacked upon one another to the extent that deformation of the core occurs, ~~or~~ to the point where accessibility can cause damage in handling, or ~~higher than~~ to a height that exceeds the recommendation~~ed~~ ~~by~~ of the Manufacturer. Furthermore, geotextile rolls shall be stacked in such a way that access for conformance sampling is possible. Protective wrappings shall be removed less than one hour prior to unrolling the geotextile. After unrolling, a geotextile shall not be exposed to ultraviolet light for more than 10 calendar days or in accordance with Manufacturer's recommendations, unless otherwise ~~specified~~ authorized in writing by the Construction Manager.

Outdoor storage of rolls shall not exceed the manufacturers recommendations or longer than 6 months whichever is less. For storage periods longer than 6 months a temporary enclosure shall be placed over the rolls, or they shall be moved to an enclosed facility. The location of temporary field storage shall not be in areas where water can accumulate. The rolls shall be elevated off the ground to prevent runoff-run-on water ~~from ponding.~~ from soaking the geotextile rolls.

Upon delivery at the site, the ~~Subcontractor~~Contractor, Geosynthetics Installer, and CQC Consultant ~~shall~~ will monitor ~~conduct an inspection of~~ the rolls for defects and damage. ~~This inspection shall be~~ Monitoring will be conducted without unrolling the materials unless defects or damages are found or suspected. The CQC Consultant ~~shall~~ will indicate to the Construction Manager:

- rolls, or portions thereof, ~~which~~ that should be rejected and removed from the site because they have severe flaws; and
- ~~rolls which~~rolls that include minor repairable flaws.

The CQC Consultant ~~shall~~ will also monitor that equipment used to handle the geotextiles on-site is adequate and does not pose any risk of damage to the geotextiles when used properly.

9.4 Conformance Testing

~~9.4.1 Sampling Procedures~~9.4.1 Sampling Requirements

Samples ~~shall~~ will be taken across the entire width of the roll and will not include the first 3 feet. Unless otherwise specified, samples will be 3 feet long by the roll width. The required minimum geotextile conformance sampling frequencies are provided in Tables 9-1 and 9-2. The CQC Consultant ~~shall~~ will mark the machine direction on the samples with an arrow and affix a label, tag, or otherwise mark each sample with the following information:

- date sampled;
- project number;
- lot/batch number and roll number;
- conformance sample number; and
- CQC personnel identification.

The geotextile ~~rolls which are sampled~~rolls that are sampled shall be immediately rewrapped in their protective coverings to the satisfaction of the Construction Manager.

~~9.4.2 Testing Procedure~~9.4.2 Testing Requirements

Conformance testing of the geotextile materials delivered to the site will be conducted to ~~ensure~~ confirm compliance with both the Technical Specifications and the manufacturer's list of minimum average roll values. As a minimum, the geotextile conformance test ~~procedures~~ requirements listed in Tables 9-1 and 9-2 will be performed by the Geosynthetics CQC Laboratory.

9.4.3 Test Results

The CQC Consultant ~~shall~~ will review ~~all~~ laboratory conformance test results and verify compliance of the test results with the ~~specification shown~~ property valves in ~~Appendix D~~ Section 02714P of the Technical Specifications prior to deployment of the geotextiles. Any nonconformance will be reported to the Construction Manager ~~Project QA~~.

9.4.4 Conformance Test Failure

In the case of failing test results, the ~~Subcontractor~~ Manufacturer or CQC Consultant ~~Project QA~~ may request that another sample from the failing roll be retested by the Geosynthetics CQC Laboratory with the manufacturer's technical representative present during the test. ~~procedure.~~ If the retest fails or if the option to retest is not exercised, then two isolation conformance samples will be obtained by the CQC Consultant. These isolation samples will be taken from rolls, which have been determined by correlation with the manufacturer's roll number, to have been manufactured prior to and after the failing roll. This method for choosing isolation rolls for testing should continue until passing tests are achieved. All rolls which ~~fail~~ fall numerically between the passing roll numbers will be rejected by the Construction Manager. The CQC Consultant ~~will~~ will verify that the ~~Subcontractor~~ Manufacturer has replaced all rejected rolls. The CQC Consultant will document ~~all~~ actions taken in conjunction with geotextile conformance failures.

9.5 Placement

The CQC Consultant ~~shall~~ will monitor the placement of ~~all~~ geotextiles to ~~assure~~ confirm they are not damaged in any way, and the following conditions are met.

- On slopes, the geotextiles shall be securely anchored in the anchor trench and then rolled down the slope in such a manner as to continually keep the geotextile sheet in tension.

- In the presence of wind, ~~all~~ geotextiles shall be weighted with sandbags or the equivalent. Such sandbags shall be installed during placement and shall remain until replaced with earth cover material.

- Trimming of the geotextiles shall be performed using only an upward cutting hook blade. Special care must be taken to protect other materials from ~~damage which~~ damage that could be caused by the cutting of the geotextiles.

- The CQC Consultant ~~shall~~ will monitor that the Geosynthetics Installer is taking necessary precautions to prevent damage to underlying layers during placement of the geotextile.

- During placement of geotextiles, care shall be taken not to entrap in the geotextile stones, excessive dust, or moisture that could damage the geomembrane, generate clogging of drains or filters, or hamper subsequent seaming.

- A visual examination of the geotextile shall be carried out over the entire surface, after installation, to ensure that no potentially harmful foreign objects, (e.g., stones, sharp objects, small tools, sandbags, etc.) are present.

9.6 Seams and Overlaps

~~All~~ Geotextiles shall be continuously sewn (i.e., spot sewing is not allowed). ~~Geotextiles shall be overlapped 6 in. prior to seaming. No horizontal seams shall be allowed on side slopes that are steeper than 10 horizontal to 1 vertical (i.e. seams shall be along, not across, the slope), except as part of a patch.~~

~~Any sewing shall be done using polymeric thread with chemical and ultraviolet resistance properties equal to or exceeding those of the geotextile. The seams shall be sewn using a single row type "401" two thread chainstitch~~~~chain stitch~~. The CQC Consultant ~~shall~~ will monitor ~~the~~ seaming of geotextile seaming procedures to ~~verify~~ confirm that seams and overlaps are in accordance with Section 02714 of the Technical Specifications.

9.7 Repair Requirements

The CQC Consultant ~~shall~~ will monitor that ~~any~~ holes or tears in the geotextile are repaired ~~as follows~~ in accordance with Section 02714 of the Technical Specifications.~~:~~ The CQC Consultant will observe repairs and assure that any noncompliance with the above requirements is corrected.

- ~~On slopes:~~ ~~A patch made from the same geotextile is double seamed into place (with each seam 1/4 in. to 3/4 in. apart and no closer than 1 in. from any edge) with a minimum 12 in. overlap. Should any tear exceed 50 percent of the width of the roll, that roll shall be removed from the slope and replaced.~~

- ~~Non-slopes:~~ ~~A patch made from the same geotextile is sewn in place (a single seam no closer than 1 in from any edge is acceptable) with a minimum of 12 in. overlap in all directions away from the repair area.~~

~~Care shall be taken to remove any soil or other material which~~~~material that may have penetrated the torn geotextile. The CQC Consultant shall observe all repairs and assure that any noncompliance with the above requirements is corrected.~~

9.8 Placement of Soil Materials

The CQC Consultant ~~shall~~ will monitor the ~~Subcontractor's~~ Contractor's placement of ~~all~~ soil materials located on top of a geotextile, to verify:

- that no damage occurs to the geotextile;
- that no shifting of the geotextile from its intended position occurs and underlying materials are not exposed or damaged; ~~and~~
- that on side slopes, soil backfill are placed over the geotextile from the bottom of the slope upward; and
- that excess tensile stress does not occur in the geotextile.

Soil backfilling or covering of the geotextile with another geosynthetic shall be completed within 10 days of ~~unwrapping~~ unrolling the geotextile, or in accordance with the Manufacturer's recommendations, unless otherwise authorized in writing by the Construction Manager. ~~or as otherwise directed by the Construction Manager. On side slopes soil backfill shall be placed over the geotextile from the bottom of the slope upward.~~

TABLE 9-1:

GEOTEXTILE FILTER CONFORMANCE TESTING REQUIREMENTS

TEST NAME	TEST METHOD	MINIMUM TESTING FREQUENCY1[4]
Mass per Unit Area	ASTM D5261	1 test per 100,000 ft^2
Grab Strength	ASTM D4632[1]	1 test per 100,000 ft^2
Trapezoidal Tear Strength	ASTM D4533[2]	1 test per 100,000 ft^2
Puncture Resistance	ASTM D4833[3]	1 test per 100,000 ft^2
Burst Strength	ASTM D3786	1 test per 100,000 ft^2
Apparent Opening Size	ASTM D4751	1 test per 100,000 ft^2
Permittivity	ASTM D4491	1 test per 100,000 ft^2

Notes:

1. Minimum of values measured in machine and cross machine directions with 1 inch clamp on Constant Rate of Extension (CRE) machine.
2. Minimum value measured in machine and cross machine direction.
3. Tension testing machine with a 1.75-inch diameter ring clamp, the steel ball being replaced with 0.31-inch diameter solid steel cylinder with a flat tip centered within the ring clamp.
4. Testing shall be performed at a frequency of one per lot or at listed frequency, whichever is greater. A lot is defined by ASTM D 4354.

TABLE 9-2:

GEOTEXTILE CUSHIONS AND SEPARATOR CONFORMANCE TESTING REQUIREMENTS

TEST NAME	TEST METHOD	MINIMUM TESTING FREQUENCY[4]
Mass per Unit Area	ASTM D5261	1 test per 100,000 ft^2
Grab Strength	ASTM D4632[1]	1 test per 100,000 ft^2
Trapezoidal Tear Strength	ASTM D4533[2]	1 test per 100,000 ft^2
Puncture Resistance	ASTM D4833[3]	1 test per 100,000 ft^2
Burst Strength	ASTM D3786	1 test per 100,000 ft^2

NOTES:

1. Minimum of values measured in machine and cross machine directions with 1 inch clamp on Constant Rate of Extension (CRE) machine.
2. Minimum value measured in machine and cross machine direction.
3. Tension testing machine with a 1.75-inch diameter ring clamp, the steel ball being replaced with 0.31-inch diameter solid steel cylinder with a flat tip centered within the ring clamp.
4. Testing shall be performed at a frequency of one per lot or at listed frequency, whichever is greater. A lot is defined by ASTM D 4354.

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10. HDPE PIPE AND FITTINGS, CONCRETE PROTECTIVE LINER, AND PRE-ENGINEERED BUILDINGS

10.1 Introduction

The CQC Consultant will ~~monitor~~ confirm compliance of the materials and equipment ~~used in,~~ and monitor installation of the HDPE pipes and fittings, concrete protective liner, and pre-engineered buildings to confirm compliance with the Construction Drawings and Technical Specifications. The CQC Consultant will review and be familiar with the Construction Drawings and Technical Specifications related to these work elements prior to the Contractor beginning this work.

10.2 Related Construction Drawings and Technical Specifications

The work performed by the Contractor will comply with the Construction Drawings and relevant Sections of Divisions 2, 3, and 13 of the Technical Specifications. Specifications within these Divisions will be referenced by the CQC Consultant for specific details and requirements for transporting, handling, and installation of HDPE pipes and fittings, concrete protective liner, and pre-engineered buildings.

10.3 Transportation, Handling and Storage

10.3.1 HDPE Pipe and Fittings

The pipe is to be placed on wooden pallets and bundled together with plastic straps for bulk handling and shipment. The packing will be such that either fork lifts or cranes equipped with slings can be used for safe handling. The pipe will be segregated by wall thickness or standard dimension ratio (SDR) and inside diameter.

The CQC Consultant ~~and Project QA~~ will monitor the offloading of the palletized pipe to confirm that handling of the pallets is done in a competent manner and that the pallets are not placed in areas where water can accumulate. A numbering system will be agreed upon between the CQC Consultant and ~~Project QA~~Construction Manager and each pipe individually numbered at the time of off loading. The pallets will not be stacked more than three high or in such a manner that could cause damage to the pipe. ~~Furthermore, the pipe will be stacked in such a manner that access for conformance sampling is possible.~~ Outdoor storage should be no longer than 12 months. For outdoor storage periods longer than 12 months will confirm a temporary cover is ~~a temporary covering will be~~ placed over the pipes and fittings, or they ~~will be~~have been moved to within an enclosed facility.

The maximum allowable depth of cuts, gouges, or scratches on the exterior surface of the HDPE pipe or fittings is 10 percent of the wall thickness. The interior of the pipes will be free of cuts, gouges, and scratches. ~~Contractor will replace~~ Any HDPE pipe and fittings that become excessively gouged, twisted, or crimped, will be identified by CQC Consultant and replaced in accordance with the Technical Specifications.

CQC Consultant will monitor the ~~Contractor will provide~~ proper handling and storage of the HDPE pipe and fittings and ~~protecting from~~ protection of the HDPE pipe and fittings from excessive heat or cold, dirt or other damaging or deleterious conditions and ~~provide~~ that any additional storage measures required by the Manufacturer are provided by the Contractor.

10.3.2 Concrete Protective Liner

Transportation, handling, and storage of concrete protective liner will be in accordance with Manufacturer's recommendations. ~~The Contractor shall~~CQC Consultant will confirm that the materials are transported, handled, and stored ~~the components~~ in such a manner that ~~materials~~ they are not damaged~~.~~; and the material

~~shall be~~ are delivered bearing the Manufacturer's labels identifying material type, project name, and lot production information.

10.3.3 Pre-Engineered Building

~~The Contractor will~~CQC Consultant will confirm that the pre-engineered building pre-fabricated components, sheets, panels, and other manufactured items transport, handle, and store ~~the pre-engineered building pre-fabricated components, sheets, panels, and other manufactured items~~ in such a manner that materials are not damaged.; and that ~~the Contractor will stock~~ materials will be stocked on platforms or pallets above grade or on concrete slab, covered with opaque tarpaulins or other approved weather-resistant ventilated covering. Metal sheets and panels ~~shall~~ will be stored in a manner to allow drainage of any potential water accumulation. ~~Contractor will not store~~ Sheets and panels will not be stored such that ~~so~~ they are in contact with other materials that might cause staining.

10.4 Installation Requirements

10.4.1 HDPE Pipe and Fittings

Care will be taken during installation of the HDPE pipe and fittings such that they will not be cut, kinked, or otherwise damaged. Fabric or rubber-protected slings and straps will be used by the Contractor when installing HDPE pipe and fittings. The use of chains, cables, or hooks inserted into the pipe ends is not permitted.

The Contractor will install the HDPE pipe and fittings in such a manner that the materials are not damaged. Slings for handling the pipeline will not be positioned at butt-fused joints. Sections of the pipes with deep cuts and/or gouges exceeding the allowance, as identified in Section 02605 of the Technical Specifications, will be

removed and the ends of the pipeline rejoined. Care shall be exercised when lowering pipe into the trench to prevent damage or twisting of the pipe.

Contractor will not lay any pipe until the Construction Manager has approved the bedding conditions.

CQC Consultant will be present during HDPE pipe and fittings installation to ~~evaluate~~ confirm compliance with Section 02605 of technical specification and Contract drawings.

10.4.2 Concrete Protective Liner

The CQC Consultant will ~~monitor~~ confirm the materials used meet the requirement of the Technical Specification and installation of the concrete protective liner to confirm proper installation and welding as required by Section 03110 of the Technical Specifications. The concrete protective liner installation includes but is not limited to:

- valve house foundation excavation, rebar placement, and wooden forming with concrete protective liner sheeting construction;
- placing concrete for the foundation walls and floor and the addition of concrete protective sheeting on the floor slab; and
- extrusion welding sheeting together at the joint and spark testing extrusion welds.

~~Contractor will conform to Manufacturer's installation requirements to avoid damage during the installation of the concrete protective liner. Construction Manager shall be notified immediately of any damage.~~ Installation of concrete protective liner will conform to Manufacturer's installation requirements. CQC Consultant will monitor the installation and document any damages, necessary repairs and/or replacements ~~shall be~~will made ~~immediately~~during installation.

~~Contractor will perform~~ CQC Consultant will monitor a trial weld performed at the beginning of each day. Trial weld coupon ~~shall~~ will be accepted by passing spark test as defined by the Manufacturer at the recommended voltages provided by the Manufacturer. In the event of humidity in excess of 80 percent, ~~the Contractor shall perform~~ a "cold strength" test as indicated in the Technical Specifications will be performed. If the weld breaks, ~~Contractor shall suspend~~ welding operations will be suspended until relative humidity drops and a successful "cold strength" test is performed.

Prior to any welding of protective liner panels, ~~Contractor~~ CQC Consultant will verify and document: (i) the absence of moisture on or behind the joining surfaces; (ii) climate conditions are conducive to joining panel sections per the Manufacturer's instructions; (iii) joining surfaces are clean; and (iv) beveled edges have been prepared where required.

~~Contractor will perform the~~ Spark tests will be performed as ~~defined~~ recommended by the Manufacturer at the recommended voltages provided by the Manufacturer on the root pass of the weld. Any portions of the weld that display failure through the spark test shall be reworked and re-tested until passing results are achieved. Additionally, this test will be repeated on completed welds. Spark testing will be required on 100 percent of all welds.

~~During~~ CQC Consultant will confirm and document ~~installation,~~ the concrete protective liner installation ~~will be~~is supervised ~~and quality control~~ by the approved Manufacturer's installer ~~as specified~~ in accordance with Section 03110 of the Technical Specifications.

10.4.3 Pre-Engineered Building

CQC Consultant will monitor installation and performance verification to confirm compliance with Section 13120 of the Technical Specifications and the Contract Documents.

~~Contractor will~~ Installation will conform to the Manufacturer's requirements for installation and erection of the pre-engineered building.

Completed work will be free of rattles and loose components and allow for expansion and contraction to prevent damage to components.

Work will be plumb and level, true to line and plane, rigid and weathertight.

- The allowances for framing members: 1/4 inch from level, 1/8 inch from plumb;
- The allowance for siding and roofing: 1/8 from true position.

10.5 HDPE Pipe Joining Requirements

10.5.1 Butt-Fusion Joining

The CQC Consultant will monitor the assembling of lengths of HDPE pipe into suitable installation lengths by the butt-fusion process. All pipes and fittings shall be joined by the butt-fusion process unless an alternate method is specifically approved by the Construction Manager. Butt-fusion means the butt-joining of the pipe by softening the aligned faces of the pipe ends in a suitable apparatus and pressing them together under controlled pressure. Butt-fusion joining of the HDPE pipes and fittings shall be performed by the Contractor in accordance with the pipe manufacturer's recommendations as to equipment and technique.

The CQC Consultant will be familiar with the approved butt-fusion joining installation procedures submitted by the Contractor. Any conflicts between the approved joining procedures and these CQC methods are to be brought to the immediate attention of the Construction Manager. The CQC methods to be followed during butt-fusion joining are summarized below.

- Trial fusion joints will be monitored in the same manner as production joints.
- Each butt fusion joint will be assigned a number. The number will be recorded on the pipe using either a crayon or other approved marker. The number will be recorded on both sides of the joint and on the Butt-Fusion Welding Log.
- CQC Consultant will monitor the joining of all butt fusion joints. The following information will be recorded on the Butt-Fusion Joining Log:
  - joint number;
  - pipe diameter and SDR;
  - machine identification number;
  - operator identification;
  - gauge pressure during fusion;
  - gauge pressure during cool down;
  - joining plate temperature;
  - pipe alignment; and
  - approximate amount of "roll-back".

- Any joints that are not acceptable will be cut out and rewelded. Documentation of the rewelding procedures will be recorded on the Butt-Fusion Joining Log.
- The approximate location of the butt-fusion joints relative to bounding structures such as pre-engineered buildings or valves will be recorded.

10.5.2 Electrofusion Joining

When specifically approved in writing by the Construction Manager, pipes may be joined using an electrofusion coupling. Electrofusion couplings shall be installed by the Contractor using approved written procedures in strict compliance with Manufacturer's recommendations.

The CQC Consultant will be familiar with approved electrofusion joining procedures submitted by the pipe installer and approved by the Construction Manager. Any conflicts between approved installation procedures and these CQC methods are to be brought to the immediate attention of the Construction Manager. The CQC methods to be followed during electrofusion joining are summarized below:

- Electrofusion joining will be fully monitored.
- The CQC Consultant will review and be familiar with the approved joining procedures submitted by the Contractor.
- Electrofusion couplings will be assigned a number. The number will be recorded using a crayon or other approved marker on the coupling.
- The CQC Consultant will document the pipe is fully installed into the coupling before joining commences.
- The following joining information will be recorded on the Electrofusion Joining Log:

- joint number;
- pipe diameter and SDR;
- machine identification number;
- operator identification;
- serial and model number on coupling;
- joint preparation includes scraping and cleaning;
- seating of pipe at center of coupling;
- alignment of pipe;
- heating time;
- cool down time;
- joint not disturbed during cool down time; and
- acceptability of joint as shown on computer output (i.e., Weld OK, Abort, etc.).

- Any extrusion welding of the coupling to the pipe will be noted on the form.
- The approximate location of the electrofusion joints relative to bounding structures such as pre-engineered buildings or valves will be recorded. The approximate locations will be shown on the as-built drawings for the pipe.

10.5.3 Extrusion Welded Sleeves

When specifically approved in writing by the Construction Manager, pipes may be welded using extrusion welded sleeves. Extrusion welded sleeves shall be installed by the Contractor using written procedures approved in advance by the Construction Manager.

The CQC Consultant will be familiar with the extrusion welded sleeves installation procedures submitted by the pipe installer and approved by the Construction Manager. Any conflicts between approved installation procedures and these CQC methods are to be brought to the immediate attention of the Construction Manager. The CQC methods to be followed during pipe joining using extrusion welded sleeves are summarized below:

- All extrusion welds will be fully monitored.
- The CQC Consultant will review and be familiar with the approved installation procedures.
- All extrusion welded sleeves will be assigned a number. The number will be recorded using a crayon or other approved marker on the sleeve and adjoining pipe and on the Extrusion Welded Sleeve Log (see Appendix A).
- Check to see the pipe ends are free and sufficient space beneath pipe has been excavated.
- Document diameter and SDR of sleeve.
- Check the length of sleeve and beveling of sleeve ends.
- Document pipe has been cleaned, properly ground and cleaned again.
- Check to see sleeve is centered and aligned vertically and horizontally.

- Check to see moisture is removed and observe welding procedure.
- The CQC Consultant will document the pipe is fully installed into the sleeve before welding commences.
- The following welding information will be recorded on the Extrusion Welded Sleeve Log:
  - joint number;
  - pipe diameter and SDR;
  - machine identification number;
  - operator identification;
  - joint preparation including scraping, grinding and cleaning;
  - seating of pipe at center of sleeve;
  - preheat and extrude temperature;
  - joint not disturbed during cool down time; and
  - acceptability of weld (i.e., Accept or Reject)
- The approximate location of the sleeve relative to bounding structures such as pre-engineered buildings or valves will be recorded.

10.6 Pressure Testing Requirement

The Contractor shall conduct field testing and inspection of installed HDPE pipes, fittings and valves as specified in Section 02605 of the Technical Specifications.

Hydrostatic pressure testing shall be the preferred method of pressure testing. A pneumatic pressure testing method may be used when approved in writing by the Construction Manager.

The CQC Consultant will be familiar with the pressure testing procedures submitted by the Contractor and approved by the Construction Manager. Any conflicts between approved testing procedures and these CQC methods are to be brought to the immediate attention of the Construction Manager. The CQC methods to be followed during pressure testing are summarized below:

- Prior to testing, the CQC Consultant will become familiar with the testing requirements.
- Pressure testing will be fully monitored.
- A separate pressure test log will be completed for each section of pipe to be tested.
- Prior to filling, make sure valves are closed and fittings are in place.
- Observe location of pressure gauge.
- Observe pressure build-up in pipe.
- Check to see that target pressure is applied.
- Observe and document that pressure is stable.
- Record pressure at least every 30 minutes during course of test.
- Indicate on form if pipe section passed or failed.

11. MECHANICAL AND ELECTRICAL

11.1 Introduction

The CQC Consultant will ~~monitor~~ confirm the materials used in and installation of mechanical and electrical systems ~~to confirm compliance~~comply with the Construction Drawings and Technical Specifications. CQC Consultant will review and become familiar with the Construction Drawings and Specifications related to these work elements prior to Contractor beginning the Work. The mechanical and electrical systems include, but are not limited to, the following:

- process piping and appurtenances;
- tanks and appurtenances;
- valves;
- heating;
- fans;
- valve house and control valve house control panels and associated instrumentation, alarm lights, and all other work;
- overhead power distribution system, power wiring, including power circuit connections for pump motors, and equipment mounting boards; and

11.2 Related Construction Drawings and Technical Specifications

The mechanical work performed by the Contractor shall comply with Division 15 of the Technical Specifications. These specifications will be referenced for specific

details of the mechanical equipment requirements and installation. The electrical work performed by the Contractor shall comply with Construction Drawings and Division 16 of the Technical Specifications. These specifications shall be referenced for specific details of the electrical requirements and installation.

11.3 Transportation, Handling, and Storage

11.3.1 Process Piping and Appurtenances

CQC Consultant will confirm and document the delivery of process piping and appurtenances to the site without any damage. Pipes shall arrive with plastic end caps on each length of pipe. Storage and on-site handling shall be in accordance with Manufacturer's Recommendations and Section 15060 of the Technical Specifications.

11.3.2 Tanks and Appurtenances

CQC Consultant will confirm and document delivery of materials in original, unbroken pallets, packages, containers or bundles bearing the label of the Manufacturer. Storage of materials shall be in an enclosed area free from extreme temperatures and free from contact with soil and water and in accordance with Manufacturer's recommendation, and Section 15070 of the Technical Specifications.

11.3.3 Valves

CQC Consultant will confirm and document delivery of materials in original, unbroken, pallets, packages, containers, or bundles bearing the label of the Manufacturer and storage of materials are in an enclosed area free from contact of soil and water and in accordance with Section 15080 of the Technical Specifications.

11.3.4 Heating

CQC Consultant will confirm and document delivery of heaters and associated equipment free from any apparent physical damage and on-site storage is provided in accordance with Manufacturer's recommendation, and Section 01550 of the Technical Specifications.

11.3.5 Fans

CQC Consultant will confirm and document delivery of ceiling fans and cabinet fans and associated equipment free from any apparent physical damage and on-site storage is provided in accordance with Manufacturer's recommendation.

11.3.6 Installation and Testing Requirements

The CQC Consultant will monitor the work of the Contractor in the installation of all mechanical and electrical appurtenances in accordance with national codes and other regulations or authorities having jurisdiction over the work. The CQC Consultant will verify the applicable mechanical and electrical codes are current before work is begun, and once every two months thereafter, until work is completed or otherwise interrupted. The CQC Consultant will observe and document construction acceptance testing procedures performed by the Contractor. The CQC Consultant will also observe and document operational testing procedures performed by the Contractor.

11.4 Installation and Testing Requirements

11.4.1 Process Piping and Appurtenances

The CQC Consultant will monitor the assembling joints between process piping and HDPE to confirm compliance with Sections 02605 and 15060 of the Technical Specifications.

The CQC Consultant will confirm that the Contractor provided a qualified inspector certified to inspect welds in accordance with ASME B 31.3 or otherwise approved by the Construction Manager. CQC Consultant will confirm Contractor's weld inspection in accordance with Section 15060 of the Technical Specifications.

CQC Consultant will monitor the installation of the process piping and appurtenances to confirm installation in accordance with Section 15060 of the Technical Specifications and Construction Drawings.

CQC Consultant will be familiar with the pressure testing procedures submitted by the Contractor and their conformance with ASME B 31.9. The CQC methods to be followed during pressure testing are summarized below:

- Prior to testing, the CQC Consultant will become familiar with the testing requirements;
- Confirm valves that may be directional/flow sensitive are installed correctly and tank HDPE piping is isolated from carbon steel piping being tested;
- Pressure testing will be fully monitored;
- Confirm calibration of pressure gauge in accordance with NIST standards within one year of test data in accordance with Section 02605 of the Technical Specifications;

- Observe pressure build-up in pipe;
- Confirm hydrostatic pressure ~~maintains 60 psi for a period of 3 hours~~testing in accordance with the Technical Specification;
- Observe and document that test pressure is stable and indicate on form if pipe section passed or failed.

11.4.2 Tanks and Appurtenances

CQC Consultant will confirm that tanks, material and equipment identified in Section 15070 are installed in accordance with the Manufacturer's written installation instructions and recommendations.

CQC Consultant will confirm that the connections are free of leaks and the system functions in accordance with Section 15070 of the Technical Specifications.

11.4.3 Valves

CQC Consultant will confirm that valves are installed in accordance with the Manufacturer's written installation instructions and recommendations and Section 15080 of the Technical Specifications.

CQC Consultant will monitor the ~~stroking~~ working of each valve to confirm it is functional.

CQC Consultant will monitor pressure testing (as identified in 11.3.1 of this Plan), of valves and confirm valves are free of leaks.

CQC Consultant will be present during installation and testing of valves.

11.4.4 Heating

CQC Consultant will confirm unit heaters are installed in accordance with Manufacturer's installation instructions and Section 15500 of the Technical Specifications. After completion of installation, CQC Consultant will monitor the testing of each unit heater as specified in Section 15500 of the Technical Specifications.

11.4.5 Fans

CQC Consultant will confirm ceiling fans and cabinet fans are installed in accordance with Manufacturer's installation instructions and Section 15865.

CQC Consultant will confirm Contractor's testing that evaluates required operation and performance as defined in Section 15865 of the Technical Specifications.

11.4.6 Instrumentation

CQC Consultant will monitor installation to confirm and document compliance with Section 16900 of the Technical Specifications.

After completion of installation, CQC Consultant will confirm and document that Contractor has calibrated instrument equipment to Manufacturer's Standards.

11.4.7 Overhead Service and Ground

Testing and inspection will be monitored by CQC Consultant and CQC Consultant will confirm and document that inspection and testing conforms to the requirements of NETA ATS.

CQC Consultant will monitor grounding installation to confirm and document compliance with Section 16450 of the Technical Specifications.

11.5 Record Drawings

The CQC Consultant will monitor the maintenance by the Contractor of redline drawings on which the actual installation of all mechanical and electrical work shall be accurately shown, indicating any variation from Construction Drawings. Changes in layout or circuitry shall be clearly and completely indicated as the work progresses. These redline drawings shall be reviewed by the Resident Engineer and Construction Manager and used to determine the progress of mechanical and electrical work.

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12. CONCRETE

12.1 Introduction

This CQC Consultant will monitor the construction and perform conformance testing of all concrete materials and finished products to confirm compliance with Construction Drawings and Technical Specifications. CQC Consultant will review and be familiar with the Construction Drawings and Technical Specifications related to this work prior to Contractor beginning the work.

12.2 Monitoring

The CQC Consultant will monitor prepared subgrade, formwork, reinforcing steel layout and other scheduled structures specified in Section 03100 of the Technical Specifications and in the Construction Drawings. ~~CQA~~ CQC Consultant will monitor concrete workmanship to confirm that the Contractor does not place concrete until foundations, forms, reinforcing steel, pipes, conduits, sleeves, anchors, hangers, inserts, and other work required to be built into concrete has been inspected and approved by the Construction Manager. The CQC Consultant will also monitor concrete curing times, curing temperatures, and placement methods on delivery and during placement of concrete. The Contractor is required to notify the Construction Manager and CQC Consultant at least 24 hours in advance of concrete placement activities and scheduling the inspections activities described above.

12.3 Field Quality Control Testing

Concrete conformance testing will be the responsibility of the CQC Consultant. The concrete test program will meet the following requirements:

- Concrete samples will be obtained by the CQC Consultant at a frequency of one set of standard cylindrical test specimens for every 100 cubic yards of concrete or any portion of thereafter for each work shift and for each concrete mix design. For each work shift, when concrete is delivered, at least one set of specimens will be made. A set of test specimens will consist of at least three standard cylinders. Each set of test specimens will be tested for 7-day and 28-day compressive strength.

- Compressive strengths will be determined from the standard test specimens taken according to ASTM C 31 and ASTM C 172, and cured and tested in accordance with ASTM C 39. Core drilling, if required, and testing will be in accordance with ASTM C 42.

- Slump and air content will be determined with no less frequency than that of concrete strength specimen sets. Air content and slump will be determined in accordance with ASTM C 231 and ASTM C 143, respectively.

The CQC Consultant will be responsible for reporting test results to the Contractor and the Construction Manager. Materials determined by the Construction Manager to fail the requirements of the Construction Drawings and Technical Specifications will be rejected.

13. PERMANENT ROAD CONSTRUCTION

13.1 Introduction

The CQC Consultant ~~shall~~ will monitor and test materials used in the construction of the various roads and paved surfaces to assure compliance with Construction Drawings and Technical Specifications.

13.2 Subgrade Preparation

In-place moisture/density testing by nuclear methods (ASTM D3017 and D2922) will be performed by the CQC Consultant for ~~all~~ compacted fill materials. Fill placement and compaction will be ~~conducted~~ performed in accordance with Section 02200 of the ~~Construction Drawings and~~ Technical Specifications. For access corridor ~~road~~ subgrades, nuclear moisture/density tests ~~shall~~ will be performed at a minimum frequency of 1 test per 500 lineal ft per lift. The CQC Consultant ~~shall~~ will monitor the ~~Subcontractor's~~ Contractor's proofrolling of cut sections in accordance with the requirements in Section 6.4 of this CQA Plan.

13.3 Geotextile Conformance Testing and Placement

Conformance testing of the geotextile separator ~~shall~~ will be in accordance with the Section 02714 of the Technical Specifications. The CQC Consultant ~~shall~~ will monitor the ~~Subcontractor's~~ Contractor's geotextile installation methods and procedures in accordance with the requirements of Section 9 of this CQA Plan. ~~The CQC Consultant shall monitor the overlapping and sewing of the geotextile seams. All holes in the geotextile shall be patched in accordance with Section 02714 of the Technical Specifications. The CQC Consultant shall monitor that the minimum overlap between adjacent geotextile panels is maintained during placement of overlying materials.~~

~~13.4 SubbaseSub-base Layer~~

~~The CQC Consultant shall monitor the subbasesub-base aggregate to ensure it is constructed to the thickness, grades, and limits shown on the Construction Drawings. The CQC Consultant shall monitor the test section required in Section 02230 of the Technical Specifications.~~

13.~~5~~4 Base Layer

The CQC Consultant ~~shall~~ will monitor the ~~subbase~~ base aggregate for the access corridor to ~~ensure~~ confirm it is constructed to the thickness, grades, and limits shown on the Construction Drawings. The CQC Consultant ~~shall~~ will monitor the test strip ~~section~~ required in Section 13.6 of this CQA Plan. ~~02230 of the Technical Specifications.~~

13.~~6~~5 Quality Control Testing

Quality control testing of the materials used in construction of the roads and paved surfaces ~~shall~~ will be the responsibility of the CQC Consultant. The frequency of CQC testing for the ~~subbase aggregate and~~ base aggregate materials is as follows:

- Particle-size analysis (ASTM C136) at a frequency of one test per 5,000 yd^3; and
- density and moisture (ASTM D 2922 and ASTM D 3017) at a frequency of one test per 100 lineal feet per lift.

Requirements for in-situ density of ~~sub-base and~~ base aggregates used in access corridor roads shall be defined during the compaction of a test strip~~.~~ The test strip for ~~subbase~~sub-base aggregate ~~shall be in accordance with the requirements of Item 310.03~~

~~of the Ohio DOT Specifications. The base aggregate~~ shall be compacted in accordance with the requirements of Item 304.0~~5~~4 of the Ohio DOT Specifications.

13.~~7~~6 Repairs

If a defective area is discovered, the CQC Consultant will evaluate the extent and nature of the defect. After this determination the ~~Subcontractor~~ Contractor shall correct the deficiency to the satisfaction of the Construction Manager. The ~~Subcontractor~~ Contractor shall not perform additional work in the area until the Construction Manager approves the correction of the defect. In the event of damage, the ~~Subcontractor~~ Contractor shall immediately make repairs and replacements as necessary to the satisfaction of the Construction Manager.

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14. GENERAL SITE WORK

14.1 Introduction

The CQC Consultant ~~shall~~ will monitor the activities which are to be performed for various general site work items including, but not limited to rip rap, ~~erosion and sediment control,~~ culverts, and chain link fences and gates, ~~and vegetation~~ for compliance with Construction Drawings and Technical Specifications.

14.2 Rip Rap

14.2.1 Conformance Testing

Conformance testing of Type D rip rap used for temporary applications is not required. Conformance testing of Type C rip rap used for permanent systems will be performed, and will include measurement of specific gravity and maximum absorption in accordance with ASTM C 127. The required properties are presented in Section 02271 of the Technical Specifications.

The CQC Consultant will, with the approval of the Construction Manager, visit the quarry to observe the proposed material to be used as Type C rip rap.

14.2.2 Performance Test and Monitoring

Performance testing of rip rap is not required. The CQC Consultant will monitor placement of the rip rap to confirm that the placement requirements of Section 02271 of the Technical Specifications are met.

14.3 Culverts

14.3.1 Conformance Testing

Conformance test of culverts is not required. Conformance testing of backfill material will be in accordance with the requirements of Section 02215.

14.3.2 Performance Testing and Monitoring

Performance testing is required of only material used to backfill culverts. Performance testing will be in accordance with the requirements of Section 02215. The CQC Consultant will confirm and document the culverts are of the type and size shown on the Construction Drawings.

14.4 Chain Link Fence

14.4.1 Conformance Testing

Conformance testing of the chain link fence is not required.

14.4.2 Performance Testing and Monitoring

Performance testing of chain link fence is not required. The CQC Consultant will randomly monitor the installation of the chain link fence. Monitoring will include, but is not limited to, plumbness of posts, embedment of posts, post dimensions, connection of fabric to posts, installation of barbed wire. If deficiencies are found, the CQC Consultant will increase the frequency of monitoring and notify the Construction Manager.

~~14.2 Conformance Testing~~

~~Conformance testing of materials to ensure compliance with the Construction Drawings and Technical Specifications shall be performed by the CQC Consultant at the discretion of the Construction Manager. If nonconformances or other deficiencies are found by the CQC Consultant in the Subcontractors materials or completed work, the Subcontractor will be required to repair or replace the deficiency at not cost. Any noncompliant items shall be reported to the Construction Manager.~~

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APPENDIX A

APPROVAL LETTER

5767

OhioEPA

State of Ohio Environmental Protection Agency

Southwest District Office 2981

401 East Fifth Street
Dayton, OH 45402-2911

TELE: (937) 285-6357 FAX: (937) 285-6249

George V. Voinovich, Governor
Nancy P. Hollister, Lt. Governor
Donald R. Schregardus, Director

June 18, 1997

RE: DOE FEMP
APPROVAL TEST PAD
FINAL REPORT

Mr. Johnny Reising
U.S. Department of Energy, Fernald Area Office
P.O. Box 538705
Cincinnati, OH 45253-8705

Dear Mr. Reising:

This letter provides Ohio EPA approval of the "Draft Test Pad Program Final Report for the On-Site Disposal Facility".

If you have any questions, please contact Tom Ontko or me.

Sincerely,

for Tom Ontko

Thomas A. Schneider
Fernald Project Manager
Office of Federal Facilities Oversight

cc: Jim Saric, U.S. EPA
Terry Hagen, FDF
Ruth Vandergrift, ODH
Mike Proffitt, DD&GW
Bob Geiger, PRC
Manager, TPSS/DERR,CO
Dave Ward, HSIGeoTrans

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Co.	Co.
Dept.	Phone #
Fax # 404-705-9400	Fax #

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action responses
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(10396)

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APPENDIX B

EXAMPLES OF CQC FORMS

GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC.

DAILY FIELD REPORT

2981

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0904 TASK NO.: 04

DESCRIPTION: _____ DATE: _____ day _____ month _____ year

CONTRACTOR: _____

WEATHER: _____

000298

COPY TO: _____ PER: _____ HRS: _____

GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC.

DAILY FIELD REPORT

DATE: _____ day _____ month _____ yea

000299

COPY TO: _____ PER: _____

GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC.

DAILY WEATHER LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0409 TASK NO.: 04

DESCRIPTION: _____ DATE: _____ day _____ month _____ year

TIME PERIOD: AM QA ID: _____

GENERAL CONDITIONS: _____ CLEAR _____ LIGHT CLOUD COVER _____ OVERCAST

WIND: _____ LIGHT _____ MODERATE _____ STRONG _____ GUSTY

TEMPERATURE RANGE: _____ °F °C

PRECIPITATION: _____ NONE _____ DRIZZLE/FOG _____ RAIN

COMMENTS: _____

TIME PERIOD: PM QA ID: _____

GENERAL CONDITIONS: _____ CLEAR _____ LIGHT CLOUD COVER _____ OVERCAST

WIND: _____ LIGHT _____ MODERATE _____ STRONG _____ GUSTY

TEMPERATURE RANGE: _____ °F °C

PRECIPITATION: _____ NONE _____ DRIZZLE/FOG _____ RAIN

COMMENTS: _____

TIME A.M.	AMBIENT TEMPERATURE °F °C	GEOMEMBRANE LINER TEMPERATURE °F °C	COMMENTS

TIME P.M.	AMBIENT TEMPERATURE °F °C	GEOMEMBRANE LINER TEMPERATURE °F °C	COMMENTS

NOTE: (1) AMBIENT TEMPERATURE LOCATIONS TAKEN AT APPROXIMATELY _____ ABOVE GROUND LEVEL.

©GEO SYNTEC CONSULTANTS FILE NO. 1-06-DWL

SHEET NO. _____ OF _____

000300

2981

GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC

PERSONNEL/EQUIPMENT DAILY LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0904 TASK NO.: 04

DESCRIPTION: WEEK BEGINNING:

ITEM	REF ID	COMPANY	MON	TUES	WED	THURS	FRI	SAT	SUN

000301

GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC.

WEEKLY FIELD REPORT

2981

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0904 TASK NO.: 04

DESCRIPTION: WEEK ENDING:

000302

COPY TO: PER:

GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC.

WEEKLY FIELD REPORT

DATE: _____ day _____ month _____ year

000303

COPY TO: _____ PER: _____

GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC.

TRANSMITTAL LETTER

2981

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0904 TASK NO.: 04

DESCRIPTION: _____ DATE: _____ day _____ month _____ year

ATTENTION: _____

ADDRESS: _____

- ☐ FOR APPROVAL
- ☐ FOR COMMENTS
- ☐ AS REQUESTED
- ☐ DRAWINGS
- ☐ PHOTOS
- ☐ LOGS
- ☐ TEST RESULTS
- ☐ DOCUMENTS
- ☐ CONTRACTS
- ☐ _____
- ☐ _____
- ☐ _____

NO. OF COPIES	DRAWING NUMBER	DESCRIPTION	DATE

REMARKS

000304

COPY TO: _____ FROM: _____

GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC.

CLARIFICATION FORM

REFERENCE NO.: _____

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0904 TASK NO.: 04

DESCRIPTION: _____ DATE: _____ day _____ month _____ year

OWNER: _____

REFERENCES:

SPECIFICATION SECTION: CQA PLAN SECTION:

CLARIFICATION:

REQUESTED BY: _____

(SIGNATURE AND TITLE) (day/mo/year)

RESPONSE:

RESPONDED BY: _____

000305 (SIGNATURE AND TITLE) (day/mo/year)

COPY TO: _____

GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC.

SUBMITTAL COVER SHEET REFERENCE NO.: 2981

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0904 TASK NO.: 04

DESCRIPTION: YEAR:

CONTRACTOR:

SUBMITTAL NO.: REVISION NO.:

SUBMITTAL TITLE:

SPECIFICATION SECTION: CQA PLAN SECTION:

DATE SUBMITTED: (day/ month/ year) DATE REVIEWED: (day/ month/ year)

RESUBMITTAL REQUIRED: ☐ YES ☐ NO

DATE APPROVED: (day/ month/ year)

COMMENTS:

DISTRIBUTION:

PREPARED BY:

APPROVED BY:

000306

GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC.

SUBMITTAL LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0409 TASK NO.: 04

DESCRIPTION: YEAR:

CONTRACTOR:

REFERENCE NO.	SUBMITTAL TITLE	REVISION	DATE SUBMITTED (day/mo)	DATE REVIEWED (day/mo)	RE-SUBMIT YES	RE-SUBMIT NO	DATE APPROVED (day/mo)	COMMENTS

000307

GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC.

MEETING SIGN-IN SHEET

2981

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0904 TASK NO.: 04

DESCRIPTION: _____ DATE: _____ day _____ month _____ year

SUBJECT: _____ REFERENCE NO. _____

NAME	ORGANIZATION	TELEPHONE

000308

NOTE: FOR FIRST TIME ATTENDEES, PLEASE ATTACH A BUSINESS CARD.

©GEO SYNTEC CONSULTANTS FILE NO. 1-14-MSS

SHEET NO. _____ OF _____

GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC.

PHOTOGRAPHIC LOG

ROLL REFERENCE NO.: _____

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO

PROJECT NO.: GQ0904 TASK NO.: 04

DESCRIPTION: _____ YEAR: _____

REFERENCE NO.	DATE (day/month)	DESCRIPTION

000309

GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC.

SURVEY DATA LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0409 TASK NO.: 04

DESCRIPTION: DATE: ____ day ____ month ____ year

SURVEYOR: ALLOWABLE TOLERANCE: QA ID:

SURVEY POINT NO.	LOCATION		ELEVATION (TOP OF)						DEPTH OF ZONE			
	NORTH	EAST							___ in. MIN	___ in. MIN	___ in. MIN	___ in. MIN

000340

2981

©GEOSYNTEC CONSULTANTS FILE NO. 1-16-SDL CHECKED BY: ____ SHEET NO. ____ OF ____

GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC.

CONCRETE PLACEMENT FORM

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0409 TASK NO.: 04

DESCRIPTION: _____ DATE: _____ day _____ month _____ year

DESIGN MIX DATA: DESIGN MIX NO.: _____

COMPRESSIVE STRENGTH: _____ (psi) AT _____ (days) SLUMP RANGE (in.): _____ to _____ AIR CONTENT (%): _____

FIELD AND LABORATORY: CONCRETE SUPPLIER: _____ TESTING LABORATORY _____

TRUCK NO.	TICKET NO.	SIZE OF LOAD (yd^3)	TIME				LOCATION	TEMPERATURE		TESTING					
			LOAD BATCHED	BEGIN PLACEMENT	FINISH PLACEMENT	SAMPLED		AMBIENT (F/C)	ASTM C 1064 CONCRETE (F/C)	WATER ADDED (gal)	ASTM C 143 SLUMP (in.)	ASTM C 173 AIR CONTENT (%)	PASS/ FAIL	QA ID	NO. OF CYLINDERS

LOCATION NOTES: _____

000311

GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC.

COMPRESSIVE STRENGTH TEST OF CONCRETE SPECIMENS

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0904 TASK NO.: 04

DESCRIPTION: _____ DATE: _____ day _____ month _____ year

DESIGN MIX DATA: DESIGN MIX NO.: _____ AIR CONTENT(%): _____

COMPRESSIVE STRENGTH: _____ (psi) AT _____ (days) SLUMP RANGE(in.): _____ to _____

FIELD AND LABORATORY: CONCRETE SUPPLIER: ..... CONTRACTOR: .....

LOCATION OF PLACEMENT: .....

CONCRETE TRUCK NO.: ..... TICKET NUMBER: .....

SIZE OF LOAD (yd^3): ..... AMBIENT TEMPERATURE (°F/C): .....

DATE SAMPLED: ..... CONCRETE TEMPERATURE (°F/C): .....

TIME BATCHED: ..... SLUMP (in.): .....

TIME SAMPLED: ..... AIR CONTENT (% by Vol.): .....

TIME COMPLETED: ..... WET WEIGHT (lb/ft^3): .....

TESTING LABORATORY: ..... WATER ADDED (gal.): ..... QA ID .....

Field Sample No.	Laboratory Sample No.	Age (days)	TOTAL LOAD (lbs.)	Area (in^2)	Compressive Strength (psi)	Pass/Fail

000312

COPY TO: _____

GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC.

FIELD RELEASE FORM

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0904 TASK NO.: 04

DESCRIPTION: _____ YEAR: _____

As of .....(day).....(month).....(year), the field services operation provided by Geosyntec Consultants for the ..... project is complete, except for the following: .....

.....

.....

.....

.....

The Owner's representative authorizes GeoSyntec Consultants to demobilize its on-site personnel providing the following conditions are met:

.....

.....

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OWNER'S REPRESENTATIVE day/mo/yr

CQA REPRESENTATIVE day/mo/yr

000313

PROJECT MANAGER day/mo/yr

COPY TO: _____

GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC.

SOIL SAMPLE LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0409 TASK NO.: 04

DESCRIPTION: DATE: YEAR:

SITE SAMPLE NO.	OFF-SITE LAB SAMPLE NO.	VISUAL DESCRIPTION	SOURCE (LOCATION/DEPTH)	MATERIAL TYPE	DATE SAMPLED (day/mo)	TEST METHODS	QA ID

NOTES:

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SHEET NO. ____ OF ____

000314

2981

GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC.

PERCENT OF SOIL FINER THAN NO. 200 SIEVE (ASTM D 1140)

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0904 TASK NO.: 04

DESCRIPTION: _____ DATE: _____ day _____ month _____ year

MATERIAL TYPE: _____

SOIL SAMPLE SIZE ASTM D 1140 SAMPLE NO.: _____

NOMINAL DIAMETER OF LARGEST PARTICLE (SIEVE)	NO. 10	NO. 4	3/4 in.
APPROXIMATE MINIMUM WT. OF SAMPLE (g)	200	500	1500

QA ID: _____

A	WT. OF TARE NO. _____	(g)	
B	WT. OF DRY SOIL BEFORE WASH PLUS TARE	(g)	
C	WT. OF DRY SOIL BEFORE WASH = B − A	(g)	
D	WT. OF DRY SOIL AFTER WASH PLUS TARE	(g)	
E	WT. OF DRY SOIL AFTER WASH = D − A	(g)	
F	WT. OF DRY SOIL WASHED THROUGH NO. 200 = C − E	(g)	
G	PERCENT OF SOIL FINER THAN NO. 200 SIEVE = (F/C)x100	(%)	

NOTES:

000315

GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC.

LABORATORY DETERMINATION OF MOISTURE CONTENT OF SOIL - 2981

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0904 TASK NO.: 04

DESCRIPTION: _____ DATE: _____ day _____ month _____ year

MATERIAL TYPE: _____ SAMPLE NO.: _____

OVEN METHOD (ASTM D 2216): Recommended Mass Of Moist Sample Weight QA ID: _____

100% PASING THE NO. 10 (2-mm) SIEVE	20 grams
100% PASSING THE NO. 4 (4.75-mm) SIEVE	100 grams
100% PASSING THE NO. 3/8-in. (9.5-mm) SIEVE	500 grams
100% PASSING THE NO. 3/4-in. (19-mm) SIEVE	2.5 kilograms

	TARE NO. _____					
A	WT. OF TARE					
B	WT. OF WET SOIL & TARE					
C	WT. OF DRY SOIL & TARE					
D	WT. OF WATER = B-C					
E	WT. OF DRY SOIL = C-A					
F	MOISTURE CONTENT = (D/E) X 100					

MICROWAVE METHOD (ASTM D 4643): Recommended Mass Of Moist Sample Weight QA ID: _____

90% PASSING THE NO. 10 (2-mm) SIEVE	100 TO 200 grams
90% PASSING THE NO. 4 (4.75-mm) SIEVE	200 TO 500 grams
90% PASSING THE 3/4-in. (19-mm) SIEVE	500 TO 1000 grams

INITIAL SETTING TO BE AT 3.0 MINUTES, CONTINUE DRYING SAMPLE AT 1.0 MINUTE SETTING UNTIL MOISTURE CONTENT VARIATION BETWEEN SETTINGS IS LESS THAN 0.1%

	TARE NO.					
A	WT. OF TARE					
B	WT. OF WET SOIL & TARE					
C	WT. OF DRY SOIL & TARE					
D	WT. OF WATER = B-C					
E	WT. OF DRY SOIL = C-A					
F	MOISTURE CONTENT = (D/E) X 100					

000316

GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC.

FIELD LABORATORY COMPACTION TEST (ASTM D 698 METHOD A)

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0409 TASK NO.: 04

DESCRIPTION: _____ DATE: _____ day _____ month _____ year

MATERIAL TYPE: _____ SAMPLE NO.: _____

THIS METHOD WILL BE USED IF THE MATERIAL RETAINED ON THE NO. 3/4-in. (19-mm) SIEVE IS LESS THAN 30%,
AND IF THE MATERIAL RETAINED ON THE NO. 4 (4.75-mm) SIEVE IS LESS THAN 20%
ALL MATERIAL RETAINED ON THE NO. 4 (4.75-mm) SIEVE IS DISCARDED.
USE OVERSIZE CORRECTION IF MORE THAN 5% IS DISCARDED ACCORDING TO ASTM D 4718.
USE A 4-in. DIAMETER MOLD / 5.5-lb RAMMER / 12-in. DROP / 3 LAYERS / 25 BLOWS PER LAYER.

COMPACTION OF SOIL

QA ID: _____

	WATER ADDED	(ml)					
A	WT. OF SOIL & MOLD	(grams)					
B	WT. OF MOLD	(grams)					
C	WT. OF SOIL = A - B	(grams)					
D	WET UNIT WT.(1) = C X 0.066	(pcf)					
E	DRY UNIT WT. = D / [1 + (K/100)]	(pcf)					

NOTE: IF CALIBRATED MOLD OF 1/30 FT^3 IS USED, THE WET DENSITY IS CALCULATED FROM THE WEIGHT OF SOIL, THE VOLUME OF THE MOLD AND THE CONVERSION FROM GRAMS TO POUNDS (I.E., CONVERSION FACTOR = (30 / 453.6) = 0.066). THE MOLD MUST BE CALIBRATED TO VERIFY A CAPACITY OF 1/30 ± 0.0005 FT^3 ON INTERVALS NOT TO EXCEED 1000 TIMES THAT THE MOLD IS FILLED.

MOISTURE CONTENT - ASTM D 2216

QA ID: _____

	TARE NO.						
F	WT. OF TARE	(grams)					
G	WT. OF WET SOIL & TARE	(grams)					
H	WT. OF DRY SOIL & TARE	(grams)					
I	WT. OF WATER = G - H	(grams)					
J	WT. DRY SOIL = H - F	(grams)					
K	MOISTURE CONTENT = (I/J) X 100	(%)					

GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC.

FIELD LABORATORY COMPACTION TEST (ASTM D 698 METHOD B)

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0409 TASK NO.: 04

DESCRIPTION: _____ DATE: _____ day _____ month _____ year

MATERIAL TYPE: _____ SAMPLE NO.: _____

THIS METHOD WILL BE USED IF THE MATERIAL RETAINED ON THE NO. 3/4-in. (19-mm) SIEVE IS LESS THAN 30%, IF THE MATERIAL RETAINED ON THE NO. 4 (4.75-mm) SIEVE IS GREATER THAN 20%, AND IF THE MATERIAL RETAINED ON THE NO. 3/8-in. (9.5-mm) SIEVE IS LESS THAN 20%.
ALL MATERIAL RETAINED ON THE NO. 3/8-in. (9.5-mm) SIEVE IS DISCARDED.
USE OVERSIZE CORRECTION IF MORE THAN 5% IS DISCARDED ACCORDING TO ASTM D 4718.
USE A 4-in. DIAMETER MOLD / 5.5-lb RAMMER / 12-in. DROP / 3 LAYERS / 25 BLOWS PER LAYER.

COMPACTION OF SOIL

QA ID: _____

	WATER ADDED	(ml)					
A	WT. OF SOIL & MOLD	(grams)					
B	WT. OF MOLD	(grams)					
C	WT. OF SOIL = A - B	(grams)					
D	WET UNIT WT.(1) = C X 0.066	(pcf)					
E	DRY UNIT WT. = D / [1 + (K/100)]	(pcf)					

NOTE: IF CALIBRATED MOLD OF 1/30 FT^3 IS USED, THE WET DENSITY IS CALCULATED FROM THE WEIGHT OF SOIL, THE VOLUME OF THE MOLD AND THE CONVERSION FROM GRAMS TO POUNDS (I.E., CONVERSION FACTOR = (30 / 453.6) = 0.066). THE MOLD MUST BE CALIBRATED TO VERIFY A CAPACITY OF 1/30 ± 0.0005 FT^3 ON INTERVALS NOT TO EXCEED 1000 TIMES THAT THE MOLD IS FILLED.

MOISTURE CONTENT - ASTM D 2216

QA ID: _____

	TARE NO.						
F	WT. OF TARE	(grams)					
G	WT. OF WET SOIL & TARE	(grams)					
H	WT. OF DRY SOIL & TARE	(grams)					
I	WT. OF WATER = G - H	(grams)					
J	WT. DRY SOIL = H - F	(grams)					
K	MOISTURE CONTENT = (I/J) X 100	(%)					

000318

2981

GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC.

FIELD LABORATORY COMPACTION TEST (ASTM D 698 METHOD C)

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0409 TASK NO.: 04

DESCRIPTION: _____ DATE: _____ day _____ month _____ year

MATERIAL TYPE: _____ SAMPLE NO.: _____

000319

THIS METHOD WILL BE USED IF THE MATERIAL RETAINED ON THE NO. 3/4-in. (19-mm) SIEVE IS LESS THAN 30%,
AND IF THE MATERIAL RETAINED ON THE NO. 3/8-in. (9.5-mm) SIEVE IS GREATER THAN 20%,
ALL MATERIAL RETAINED ON THE NO. 3/4-in. (19.0-mm) SIEVE IS DISCARDED.
USE OVERSIZE CORRECTION IF MORE THAN 5% IS DISCARDED ACCORDING TO ASTM D 4718.
USE A 6-in. DIAMETER MOLD / 5.5-lb RAMMER / 12-in. DROP / 3 LAYERS / 56 BLOWS PER LAYER.

COMPACTION OF SOIL

QA ID: _____

	WATER ADDED	(ml)					
A	WT. OF SOIL & MOLD	(grams)					
B	WT. OF MOLD	(grams)					
C	WT. OF SOIL = A - B	(grams)					
D	WET UNIT WT.(1) = C X 0.029	(pcf)					
E	DRY UNIT WT. = D / [1 + (K/100)]	(pcf)					

NOTE: IF CALIBRATED MOLD OF 1/3.333 FT^3 IS USED, THE WET DENSITY IS CALCULATED FROM THE WEIGHT OF SOIL. THE VOLUME OF THE MOLD AND THE CONVERSION FROM GRAMS TO POUNDS (I.E., CONVERSION FACTOR = (13.333/453.6) = 0.029). THE MOLD MUST BE CALIBRATED TO VERIFY A CAPACITY OF 1/13.333 ± 0.0009 FT^3 ON INTERVALS NOT TO EXCEED 1000 TIMES THAT THE MOLD IS FILLED.

MOISTURE CONTENT - ASTM D 2216

QA ID: _____

	TARE NO.						
F	WT. OF TARE	(grams)					
G	WT. OF WET SOIL & TARE	(grams)					
H	WT. OF DRY SOIL & TARE	(grams)					
I	WT. OF WATER = G - H	(grams)					
J	WT. DRY SOIL = H - F	(grams)					
K	MOISTURE CONTENT = (I/J) X 100	(%)					

GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC.

FIELD LABORATORY COMPACTION TEST (ASTM D 1557 METHOD A)

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0409 TASK NO.: 04

DESCRIPTION: DATE: ____ day ____ month ____ year

MATERIAL TYPE: SAMPLE NO.:

THIS METHOD WILL BE USED IF THE MATERIAL RETAINED ON THE NO. 3/4-in. (19-mm) SIEVE IS LESS THAN 30% AND IF THE MATERIAL RETAINED ON THE NO. 4 (4.75-mm) SIEVE IS LESS THAN 20%.
ALL MATERIAL RETAINED ON THE NO. 3/8-in. (9.5-mm) SIEVE IS DISCARDED.
USE OVERSIZE CORRECTION IF MORE THAN 5% IS DISCARDED ACCORDING TO ASTM D 4718.
USE A 4-in. DIAMETER MOLD / 10-lb RAMMER / 18-in. DROP / 5 LAYERS / 25 BLOWS PER LAYER.

COMPACTION OF SOIL

QA ID: ____

	WATER ADDED	(ml)					
A	WT. OF SOIL & MOLD	(grams)					
B	WT. OF MOLD	(grams)					
C	WT. OF SOIL = A − B	(grams)					
D	WET UNIT WT.(1) = C X 0.066	(pcf)					
E	DRY UNIT WT. = D / [1 + (K/100)]	(pcf)					

NOTE: IF CALIBRATED MOLD OF 1/30 FT^3 IS USED, THE WET DENSITY IS CALCULATED FROM THE WEIGHT OF SOIL, THE VOLUME OF THE MOLD AND THE CONVERSION FROM GRAMS TO POUNDS (I.E., CONVERSION FACTOR = (30 / 453.6) = 0.066). THE MOLD MUST BE CALIBRATED TO VERIFY A CAPACITY OF 1/30 @ 0.0005 FT^3 ON INTERVALS NOT TO EXCEED 1000 TIMES THAT THE MOLD IS FILLED.

MOISTURE CONTENT − ASTM D 2216

QA ID: ____

	TARE NO.						
F	WT. OF TARE	(grams)					
G	WT. OF WET SOIL & TARE	(grams)					
H	WT. OF DRY SOIL & TARE	(grams)					
I	WT. OF WATER = G − H	(grams)					
J	WT. DRY SOIL = H − F	(grams)					
K	MOISTURE CONTENT = (I/J) X 100	(%)					

2981

000320

GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC.

FIELD LABORATORY COMPACTION TEST (ASTM D 1557 METHOD B)

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0409 TASK NO.: 04

DESCRIPTION: _____ DATE: _____ day _____ month _____ year

MATERIAL TYPE: _____ SAMPLE NO.: _____

000321

THIS METHOD WILL BE USED IF THE MATERIAL RETAINED ON THE NO. 4-in. (4.75-mm) SIEVE IS GREATER THAN 20%, AND THE MATERIAL RETAINED ON THE NO. 3/8-in. (9.5-mm) SIEVE IS LESS THAN 20%.
ALL MATERIAL RETAINED ON THE NO. 3/8-in. (9.5-mm) SIEVE IS DISCARDED.
USE OVERSIZE CORRECTION IF MORE THAN 5% IS DISCARDED ACCORDING TO ASTM D 4718.
USE A 4-in. DIAMETER MOLD / 10-lb RAMMER / 18-in. DROP / 5 LAYERS / 25 BLOWS PER LAYER.

COMPACTION OF SOIL QA ID: _____

	WATER ADDED	(ml)					
A	WT. OF SOIL & MOLD	(grams)					
B	WT. OF MOLD	(grams)					
C	WT. OF SOIL = A - B	(grams)					
D	WET UNIT WT.(1) = C X 0.066	(pcf)					
E	DRY UNIT WT. = D / [1 + (K/100)]	(pcf)					

NOTE: IF CALIBRATED MOLD OF 1/30 FT^3 IS USED, THE WET DENSITY IS CALCULATED FROM THE WEIGHT OF SOIL, THE VOLUME OF THE MOLD AND THE CONVERSION FROM GRAMS TO POUNDS (I.E., CONVERSION FACTOR = (30 / 453.6) = 0.066). THE MOLD MUST BE CALIBRATED TO VERIFY A CAPACITY OF 1/30 ± 0.0005 FT^3 ON INTERVALS NOT TO EXCEED 1000 TIMES THAT THE MOLD IS FILLED.

MOISTURE CONTENT - ASTM D 2216 QA ID: _____

	TARE NO.						
F	WT. OF TARE	(grams)					
G	WT. OF WET SOIL & TARE	(grams)					
H	WT. OF DRY SOIL & TARE	(grams)					
I	WT. OF WATER = G - H	(grams)					
J	WT. DRY SOIL = H - F	(grams)					
K	MOISTURE CONTENT = (I/J) X 100	(%)					

GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC.

FIELD LABORATORY COMPACTION TEST (ASTM D 1557 METHOD C)

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0409 TASK NO.: 04

DESCRIPTION: DATE: ____ day ____ month ____ year

MATERIAL TYPE: SAMPLE NO.:

THIS METHOD WILL BE USED IF THE MATERIAL RETAINED ON THE NO. 3/8-in. (9.5-mm) SIEVE IS GREATER THAN 20% AND THE MATERIAL RETAINED ON THE NO. 3/4 (19.0-mm) SIEVE IS LESS THAN 30%.
ALL MATERIAL RETAINED ON THE NO. 3/4-in. (19.0-mm) SIEVE IS DISCARDED.
USE OVERSIZE CORRECTION IF MORE THAN 5% IS DISCARDED ACCORDING TO ASTM D 4718.
USE A 6-in. DIAMETER MOLD / 10-lb RAMMER / 18-in. DROP / 5 LAYERS / 56 BLOWS PER LAYER.

COMPACTION OF SOIL

QA ID: ____

	WATER ADDED	(ml)					
A	WT. OF SOIL & MOLD	(grams)					
B	WT. OF MOLD	(grams)					
C	WT. OF SOIL = A − B	(grams)					
D	WET UNIT WT.(1) = C X 0.029	(pcf)					
E	DRY UNIT WT. = D / [1 + (K/100)]	(pcf)					

NOTE: IF CALIBRATED MOLD OF 1/3.333 FT^3 IS USED, THE WET DENSITY IS CALCULATED FROM THE WEIGHT OF SOIL, THE VOLUME OF THE MOLD AND THE CONVERSION FROM GRAMS TO POUNDS (I.E., CONVERSION FACTOR = (13.333/453.6) = 0.029). THE MOLD MUST BE CALIBRATED TO VERIFY A CAPACITY OF 1/13.333 ± 0.0009 FT^3 ON INTERVALS NOT TO EXCEED 1000 TIMES THAT THE MOLD IS FILLED.

MOISTURE CONTENT – ASTM D 2216

QA ID: ____

	TARE NO.						
F	WT. OF TARE	(grams)					
G	WT. OF WET SOIL & TARE	(grams)					
H	WT. OF DRY SOIL & TARE	(grams)					
I	WT. OF WATER = G − H	(grams)					
J	WT. DRY SOIL = H − F	(grams)					
K	MOISTURE CONTENT = (I/J) X 100	(%)					

2981

000322

GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC.

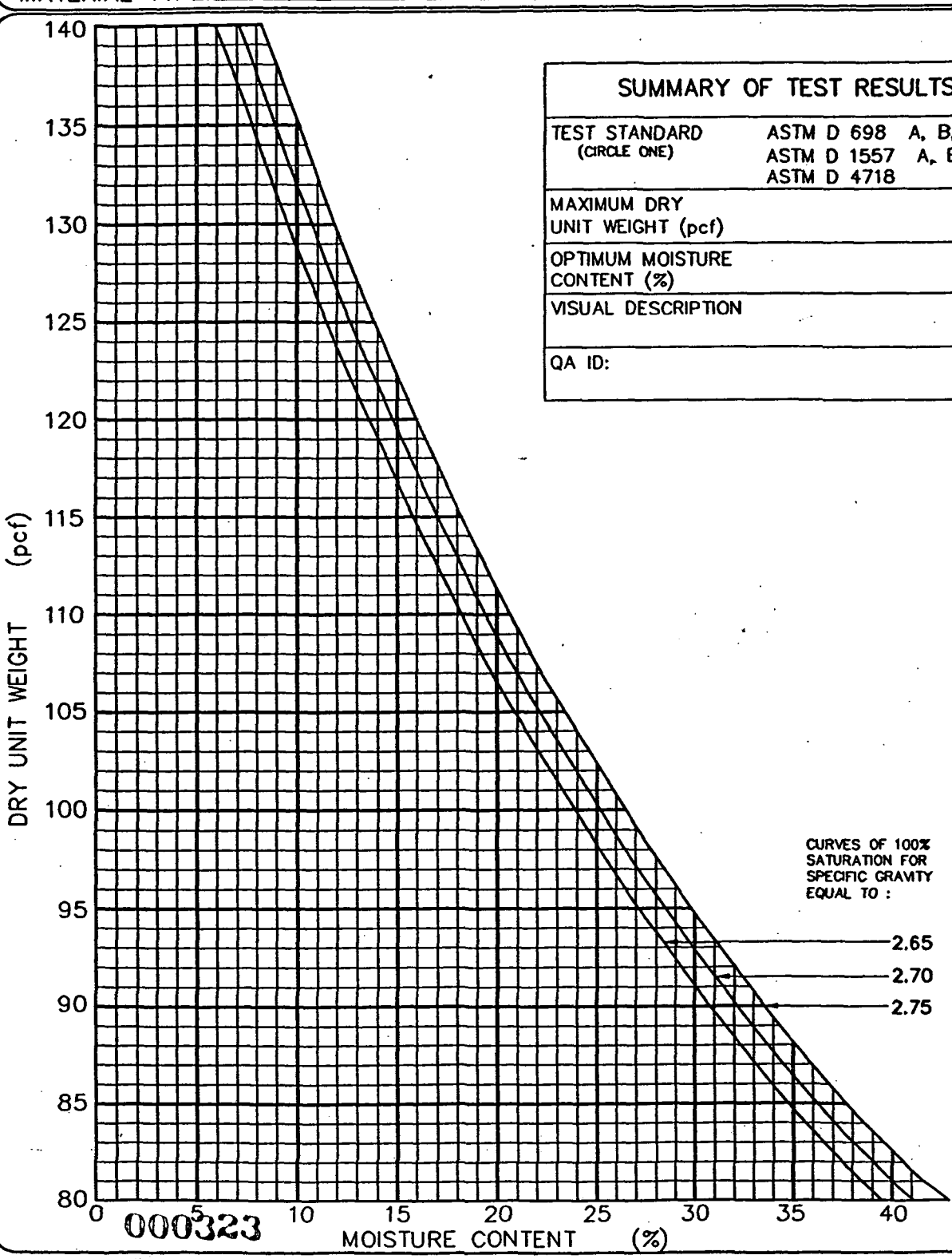
MOISTURE-DENSITY RELATIONSHIP

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0904 TASK NO.: 04

DESCRIPTION: _____ DATE: ____ day ____ month ____ year

MATERIAL TYPE: _____ SAMPLE NO.: _____



SUMMARY OF TEST RESULTS	
TEST STANDARD (CIRCLE ONE)	ASTM D 698 A, B, C ASTM D 1557 A, B, C ASTM D 4718
MAXIMUM DRY UNIT WEIGHT (pcf)	
OPTIMUM MOISTURE CONTENT (%)	
VISUAL DESCRIPTION	
QA ID:	

000323

GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC.

ATTERBERG LIMITS TEST (ASTM D 4318)

2981

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0904 TASK NO.: 04

DESCRIPTION: _____ DATE: ____ day ____ month ____ year

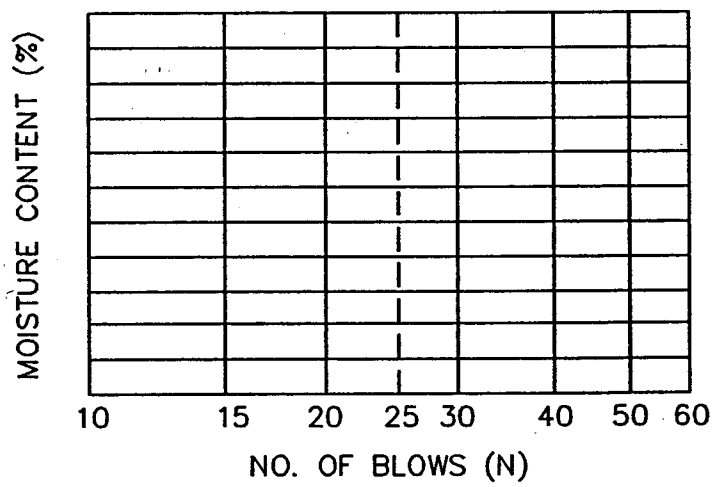
MATERIAL TYPE: _____ SAMPLE NO.: _____

LIQUID LIMIT DETERMINATION

QA ID: _____

	TARE NO.					
A	WT. OF TARE	(grams)				
B	WT. OF WET SOIL & TARE	(grams)				
C	WT. OF DRY SOIL & TARE	(grams)				
D	WT. OF WATER = B-C	(grams)				
E	WT. OF DRY SOIL = C-A	(grams)				
F	MOISTURE CONTENT = (D/E)X100	(%)				
N	NUMBER OF BLOWS					

DRYING TARE NO.



CURING TARE NO.

PLASTIC LIMIT DETERMINATION

QA ID: _____

	TARE NO.					
A	WT. OF TARE	(grams)				
B	WT. OF WET SOIL & TARE	(grams)				
C	WT. OF DRY SOIL & TARE	(grams)				
D	WT. OF WATER = B-C	(grams)				
E	WT. OF DRY SOIL = C-A	(grams)				
F	MOISTURE CONTENT = (D/E)X100	(%)				

000324

LIQUID LIMIT (LL) = _____ PLASTIC LIMIT (PL) = _____ PLASTICITY INDEX (PI) = _____

GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC.

PARTICLE SIZE ANALYSIS MECHANICAL SIEVE METHOD (ASTM D 422)

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0904 TASK NO.: 04

DESCRIPTION: _____ DATE: ____ day ____ month ____ year

MATERIAL TYPE: _____ SAMPLE NO.: _____

SOIL SAMPLE SIZE

	SAND	FINE GRAIN
APPROXIMATE MINIMUM WT. OF SAMPLE (PASSING NO. 10 SIEVE) (grams)	115	65

	BEFORE WASH	AFTER WASH
TARE NO.		
WT. OF DRY SAMPLE PLUS TARE (grams)		
WT. OF TARE (grams)		
WT. OF DRY SAMPLE (grams)		

SIEVE ANALYSIS

QA ID: _____

SIEVE NO.	DIAMETER (mm)	WT. RETAINED (grams)	% RETAINED	% FINER	PROJECT SPECIFICATION

000325

%FINER = 100 − Σ% RETAINED

GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC.

PARTICLE SIZE ANALYSIS HYDROMETER METHOD (ASTM D 422) F-2981

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0904 TASK NO.: 04

DESCRIPTION: _____ DATE: ____ day ____ month ____ year

MATERIAL TYPE: _____ SAMPLE NO.: _____

HYDROMETER ANALYSIS QA ID: _____

TARE NO.: _____ PERCENT PASSING NO. 200 SIEVE = _____

DISPERSING AGENT: _____ AMOUNT: 125 ml from 40 grams/liter batch

ORIGINAL WEIGHT OF SOIL: _____ MOISTURE CONTENT: _____

DATE (day/mo)	TIME OF READING	ELAPSED TIME (MIN)	OBSERVED TEMP. (°F/°C)	TOTAL CORRECTION	ORIGINAL HYD. READING	CORRECTED HYD. READING	MEAN PARTICLE DIAM., From Chart (mm)	% FINER	PROJECT SPECIFICATIONS

000326

©GEO SYNTEC CONSULTANTS FILE NO. 2-15-PHM CHECKED BY: _____ SHEET NO. ____ OF ____

GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC.

PARTICLE SIZE DISTRIBUTION AND SOIL CLASSIFICATION TEST RESULTS

(ASTM C 136/D 422) (ASTM D 2487)

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO

PROJECT NO.: GQ0409 TASK NO.: 04

DESCRIPTION:

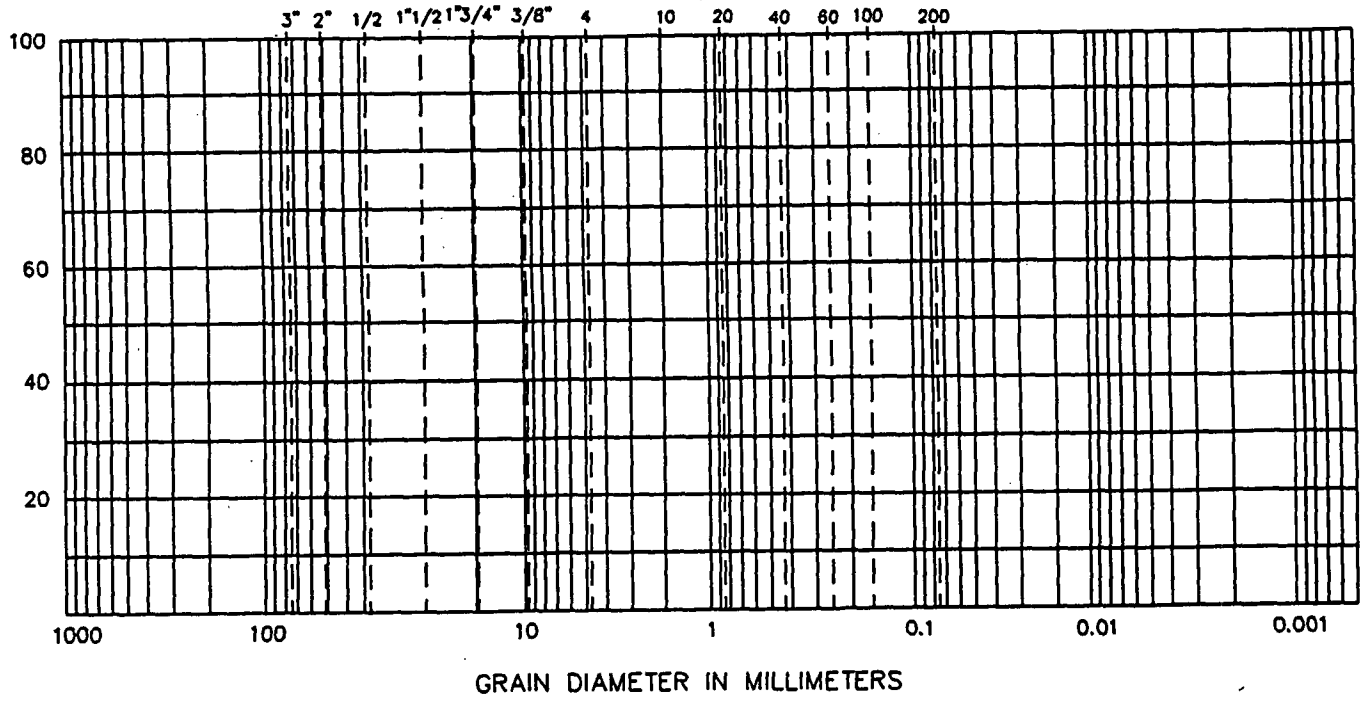
DATE: _____ day _____ month _____ year

MATERIAL TYPE:

SAMPLE NO.: _____ QA ID: _____

CURVE COEFFICIENTS: (C_u) = ... (C_c) = ...

BOULDERS	COBBLES	GRAVEL		SAND			FINE	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT SIZES	CLAY SIZES
U.S. STANDRARD SIEVE SIZES								



ATTERBERG LIMITS

(LL) .....

(PL) .....

(PI) .....

SIEVE RESULTS

SIEVE SIZE	% FINER
3-in.	
2-in.	
1 1/2-in.	
1-in.	
3/4-in.	
1/2-in.	
3/8-in.	
NO. 4	
NO. 10	
NO. 20	
NO. 40	
NO. 60	
NO. 100	
NO. 200	

HYDROMETER RESULTS

PARTICLE DIA.	% FINER

SOIL CLASSIFICATION (ASTM D 2487):

SHEET NO. [redacted] OF _____

000327

GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC.

2981

FIELD SAND CONE DENSITY TEST (ASTM D 1556)

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0904 TASK NO.: 04

DESCRIPTION: _____ DATE: _____ day _____ month _____ year

SOURCE: _____

SPECIFICATION REQUIREMENTS:

MATERIAL TYPE: (CIRLCLE ONE) FILL / SUBGRADE / SUBBASE / CLAY / OTHER: _____

% COMPACTION: _____ MOISTURE CONTENT RANGE: _____

TEST LOCATION: _____ TEST NO.: _____

FIELD TEST DATA – ASTM D 1556

QA ID: _____

A	BULK UNIT WT. OF SAND (USE CALIBARTION FORM)	(pcf)		H	WT. OF WET SOIL & TARE FROM HOLE	(lbs)	
B	INITIAL WT. OF SAND & JAR	(lbs)		I	WT. OF TARE NO.: _____	(lbs)	
C	FINAL WT. OF SAND & JAR	(lbs)		J	WT. OF WET SOIL FROM HOLE = H–I	(lbs)	
D	WT. OF SAND IN FUNNEL & HOLE = B–C	(lbs)		K	WET UNIT WT. = J/G	(pcf)	
E	WT. OF SAND IN FUNNEL (1)	(lbs)		M	DRY UNIT WT. = K/[1+(T/100)]	(pcf)	
F	WT. OF SAND IN HOLE = D–E	(lbs)		N	PERCENT COMPACTION = M/L	(%)	
G	VOLUME OF HOLE = F/A	(ft^3)					

NOTE: THE WEIGHT OF SAND IN FUNNEL (E) IS OBTAINED BY WEIGHING THE SAND, A MINIMUM OF THREE TIMES, IN THE APPARATUS BEFORE AND AFTER THE APPARATUS HAS BEEN TURNED OVER ON THE BASE PLATE ALONG A FLAT SURFACE WITH THE SAND BEING EXPENDED.

FIELD MOISTURE CONTENT – ASTM D 2216

QA ID: _____

O	WT. OF TARE NO. _____	(grams)		R	WT. OF WATER = P–Q	(grams)	
P	WT. OF WET SOIL & TARE	(grams)		S	WT. OF DRY SOIL = Q–O	(grams)	
Q	WT. OF DRY SOIL & TARE	(grams)		T	MOISTURE CONTENT = (R/S)X100	(%)	

PROCTOR TEST DATA _____ [L] MAXIMUM DRY UNIT WT. (pcf) _____ OPTIMUM MOISTURE CONTENT (%) _____

COMPARISON WITH NUCLEAR GAUGE – ASTM D 2922 AND D 3017

QA ID: _____

TEST NO.			U	MOISTURE CONTENT	(%)
WET UNIT WT.	(pcf)		V	DRY UNIT WT.	(pcf)
DELTA DRY UNIT WT. = M – V				DELTA MOISTURE CONTENT = T – U	

COMMENTS:

000328

GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC.

DETERMINATION OF DENSITY (DRIVE CYLINDER) (ASTM D 2937)

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0904 TASK NO.: 04

DESCRIPTION: _____ DATE: _____ day _____ month _____ year

SOURCE: _____ QA ID: _____

SPECIFICATION REQUIREMENTS:

MATERIAL TYPE: (CIRLCLE ONE) FILL / SUBGRADE / SUBBASE / CLAY / OTHER: _____

% COMPACTION: _____ MOISTURE CONTENT RANGE: _____

TEST LOCATION: _____ TEST NO.: _____

FIELD TEST DATA – ASTM D 2937 QA ID: _____

A	CYLINDER NO. _____ VOLUME[1] (cf)		E	WET UNIT WEIGHT = D/A (lbs)	
B	WEIGHT OF SAMPLE & CYLINDER (lbs)		F	DRY UNIT WEIGHT = E/[1+(T/100)] (pcf)	
C	WEIGHT OF CYLINDER (lbs)		G	PERCENT COMPACTION = F\L (%)	
D	WEIGHT OF WET SAMPLE = B–C (lbs)			PASS\FAIL	

NOTE: CYLINDER VOLUME IS OBTAINED BY MEASURING THE HEIGHT AND DIAMETER, OF FOUR EQUALLY SPACED POINTS, TO AN ACCURACY OF 0.01-in., AND CALCULATING VOLUME USING AVERAGE HEIGHT AND DIAMET

FIELD MOISTURE CONTENT – ASTM D 2216 QA ID: _____

O	WT. OF TARE NO. _____ (grams)		R	WT. OF WATER = P–Q (grams)	
P	WT. OF WET SOIL & TARE (grams)		S	WT. OF DRY SOIL = Q–O (grams)	
Q	WT. OF DRY SOIL & TARE (grams)		T	MOISTURE CONTENT = (R/S)X100 (%)	

PROCTOR TEST DATA _____ [L] MAXIMUM DRY UNIT WT. (pcf) _____ OPTIMUM MOISTURE CONTENT (%) _____

COMPARISON WITH NUCLEAR GAUGE – ASTM D 2922 AND D 3017 QA ID: _____

TEST NO.			U	MOISTURE CONTENT (%)	
WET UNIT WT. (pcf)			V	DRY UNIT WT. (pcf)	
DELTA DRY UNIT WT. = F – V				DELTA MOISTURE CONTENT = T – U	

COMMENTS:

000329

2981

GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC.

NUCLEAR GAUGE STANDARD COUNT LOG

(ASTM D 2922 & ASTM D 3017)

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0904 TASK NO.: 04

DESCRIPTION: YEAR:

NUCLEAR GAUGE MODEL: SERIAL NO.:

DATE ARRIVED ON SITE: DATE DEPART SITE:

DATE OF MOST RECENT LEAK TEST:

DATE (day/mo)	MOISTURE COUNT	DENSITY COUNT	PASS/ FAIL	QA ID	DATE (day/mo)	MOISTURE COUNT	DENSITY COUNT	PASS/ FAIL	QA ID

000330

NOTE: A COPY OF THIS FORM SHOULD ACCOMPANY GAUGE WHEN SHIPPED FROM SITE.

©GEO SYNTEC CONSULTANTS FILE NO. 2-19-NGS

SHEET NO. ____ OF ____

GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC.

FIELD NUCLEAR MOISTURE/DENSITY TEST LOG (ASTM D 3017 AND ASTM D 2922)

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0409 TASK NO.: 04

DESCRIPTION: _____ DATE: ____ day ____ month ____ year

SPECIFICATION REQUIREMENTS

SOURCE: _____ MATERIAL TYPE: (CIRCLE ONE) FILL / SUBGRADE / SUBBASE / CLAY / OTHER: _____ LIFT THICKNESS (LOOSE/COMPACTED): ____

% COMPACTION: _____ MOISTURE RANGE: _____ ASTM D 698: / ASTM D 1557 (CIRCLE ONE)

NUCLEAR GAUGE TYPE: _____ NUCLEAR GAUGE SERIAL NO. _____ COR. FACTOR: _____ QA ID: _____

TEST NO.	TEST LOCATION	PROBE DEPTH/ LIFT NO.	LAB RESULTS			FIELD TEST RESULTS						RETEST NO.	RETEST	
			SAMPLE NO.	OMC (%)	MAX DRY UNIT WT (PCF)	FMC (%)	WET UNIT WT (PCF)	DRY UNIT WT (PCF)	PERCENT COMPACT (%)	PASS	FAIL		PASS	FAIL

COMMENTS: .....

SHEET NO. ____ OF ____

000331

GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC.

LABORATORY TEST SUMMARY

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0409 TASK NO.: 04

DESCRIPTION: DATE: ____ day ____ month ____ year

MATERIAL TYPE: QA ID: ____

SITE SAMPLE NO.	LAB SAMPLE NO.	MOISTURE CONTENT ASTM D 2216/ D 4643 (%)	GRAIN SIZE			ATTERBERG LIMITS ASTM D 4318			SOIL CLASS. ASTM D 2487	LOI	CARBO CONT.	COMPACTION ASTM D 698 (or) ASTM D 1557		PERMEABILITY ASTM D 2434(1) (or) ASTM D 5084(2)			PASS/ FAIL	ACUMUL. QUANT. PLACED (APPROX)
			PASSING NO. 200 SIEVE ASTM D 1140 (%)	ASTM D 422		LL (%)	PL (%)	PI		ASTM C311 (%)	ASTM D3042 (%)	MAX. DRY UNIT WT. (pcf)	OPT. MOIST. CONT. (%)	DRY UNIT WT. (pcf)	MOIST. CONT. ASTM D 2216 (%)	HYDRAULIC COND'VITY (cm/sec)		(yd^3)
				SIEVE	HYDR.													

2981

0003332

COMMENTS:

NOTES: (1) HYDRAULIC CONDUCTIVITY DETERMINED AT A HYDRAULIC GRADIENT OF ____.

(2) HYDRAULIC CONDUCTIVITY DETERMINED AT AN EFFECTIVE CONFINING STRESS OF ____.

©GEOSYNTEC CONSULTANTS FILE NO. 2-22-LTS

SHEET NO. ____ OF ____

GEOSYNTEC CONSULTANTS

LABORATORY TEST REQUEST

PROJECT: _____ PROJECT NO.: _____ TASK NO. _____

SOURCE: _____ APPLICATION: _____ LAB SAMPLE NO.: _____

SHIPPER: _____ REQUESTED BY: _____ DATE: _____ SITE SAMPLE ID.: _____

000033 TASK	AS RECEIVED MOISTURE CONTEST ASTM D 2216 (%)	PERCENT PASSING NO. 200 ASTM D 1140 (%)	GRAIN SIZE ASTM D 422		ATTEBERG LIMITS ASTM D 4318			SOIL CLASSIFICATION ASTM D 2487	LOI ASTM C 311 (%)	CARBO CONT. ASTM D3042 (%)	COMPACTION ASTM D 698 ☐ ASTM D 1557 ☐ A B C D ASTM D 4710		HYDRAULIC CONDUCTIVITY ASTM D 5084 ☐ ASTM D 2434 ☐ TUBE SAMPLE ☐ REMOLDED SAMPLE ☐ REL.COMP= ___% W=W_{opt} ___(%) γ_d= ___ (pcf); W= ___(%)			
			SIEVE	HYDROMETER	LL (%)	PL (%)	PI ( )				MAX DRY UNIT WT. (pcf)	OPT. MOIST. CONT. (%)	DRY UNIT WT. (pcf)	MOIST. CONT. (%)	K (cm/sec) at σ'_c = ___(psi) I= ___	
DEADLINE																

REMARKS: PERFORMANCE TEST ☐ CONFORMANCE TEST ☐

DISTRIBUTE RESULTS TO: _____ CLIENT _____ SITE _____ OFFICE

2981

GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC.

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0409 TASK NO.: 4.1

DESCRIPTION: YEAR:

CONTRACTOR:

TEST DESCRIPTION: HYDROSTATIC: ☐ PNEUMATIC (ATTACH WRITTEN AUTHORIZATION): ☐

PASS/FAIL CRITERION:

MATERIAL DESCRIPTION: FORCEMAIN: ☐ CONTAINMENT: ☐ CARRIER ☐ OTHER: ☐

TARGET PRESSURE: TEST DURATION: GAUGE NO.: GAUGE LOCATION:

TEST LOCATION: TO

FOR CONTAINMENT PIPE TESTING, CARRIER PIPE PRESSURIZED FIRST: ☐ YES ☐ NO

READING NO.	STABILIZATION TEST PERIOD	DATE (day/mo)	TIME	READING	CHANGE IN READING	QA ID

PASS: ☐

FAIL: ☐

VISUAL MONITORING:

CONTRACTOR'S REPRESENTATIVE day/mo/yr CQA REPRESENTATIVE day/mo/yr

000334

FINAL APPROVAL:

CONTRACTOR'S REPRESENTATIVE day/mo/yr CQA REPRESENTATIVE day/mo/yr

COPY TO:

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GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC.

BUTT FUSION JOINING LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0409 TASK NO.: 4.1

DESCRIPTION: YEAR:

CONTRACTOR:

MATERIAL DESCRIPTION: FORCEMAIN: ☐ CONTAINMENT: ☐ CARRIER: ☐ OTHER: ☐

PIPE DIAMETER: SDR:

JOINT NO.	DATE (day/mo)	OPER. ID	MACH. ID	GAUGE PRESSURE ( )		PLATE TEMPERATURE (°F)	PIPE ALIGNMENT ACCEPT/REJECT	ROLL BACK DIMENSION	PASS/ FAIL	QA ID
				WELDING	COOL DOWN					

000335

COPY TO:

SHEET NO. ____ OF ____

GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC.

EXTRUSION WELDED SLEEVE LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0409 TASK NO.: 4.1

DESCRIPTION: DATE: ____ day ____ month ____ year

CONTRACTOR:

MATERIAL DESCRIPTION: FORCEMAIN: ☐ CONTAINMENT ☐ CARRIER: ☐ OTHER: ____

PIPE DIAMETER: SDR:

JOINT NO.	DATE (day/mo)	CAP LENGTH	SLEEVE LENGTH	SURFACE PREPARATION		SLEEVE CENTERED	SLEEVE ALIGNED	TRIAL WELD P/F	PERFORM HOT AIR DRYING	OPERATOR ID	MACHINE ID	EXTRUSION WELD COMPLETED	ACCEPT/ REJECT	QA ID
				GRIND/CLEAN	ACCEPTANCE									

000336

2981

COPY TO:

CHECKED BY: ____ SHEET NO. ____ OF ____

GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC.

ELECTROFUSION JOINING LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0409 TASK NO.: 4.1

DESCRIPTION: YEAR:

CONTRACTOR:

MATERIAL DESCRIPTION: FORCEMAIN: ☐ CONTAINMENT: ☐ CARRIER: ☐ OTHER:

PIPE DIAMETER: SDR:

JOINT NO.	DATE (day/mo)	OPERATOR ID	COUPLING SERIAL/MODEL NUMBER	SURFACE PREPARATION		JOINT SEATED	JOINT CENTERED	PROCESSOR ID	COMPUTER READOUT		COMPUTER READOUT WELD ACCEPTANCE	ACCEPT/ REJECT	QA ID
				GRIND/SCRAPE	ACCEPTANCE				HEAT/ TIME	COOL DOWN TIME			
000337													

COPY TO:

GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC.

MATERIAL INVENTORY

2981

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0904 TASK NO.: 04

DESCRIPTION: YEAR:

PRODUCT TYPE: MANUFACTURER:

INVENTORY			Q.A. CONFORMANCE				Q.C. DOCUMENTS			
DATE (day/mo)	BATCH / ROLL NO.	QA ID	DATE SAMPLED (day/mo)	SAMPLE NO.	PASS/ FAIL	QA ID	DATE RECEIVED (day/mo)	DATE CHECKED (day/mo)	PASS/ FAIL	QA ID

AVG. ROLL WIDTH: AVG. ROLL LENGTH: 000338

NUMBER OF ROLLS ABOVE: ACCUMULATIVE NUMBER OF ROLLS:

CUMULATIVE AREA: NO. OF CONFORMANCE TESTS (page/total): /

GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC.

GEOSYNTHETIC CLAY LINER TEST REQUEST FORM

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0409 TASK NO.: 04

DESCRIPTION: _____ YEAR: _____

SAMPLED: _____ day _____ mo SAMPLER ID: _____ SHIPPED: _____ day _____ mo SHIPPER ID: _____ RECEIVED: _____ day _____ mo LAB ID: _____

MANUFACTURED BY: _____ SAMPLE SHIPPED VIA: _____

SITE CONTACT: _____ SITE PHONE: _____ SITE FAX: _____

SAMPLE NO. GCL-	BATCH NO./ ROLL NO.	MASS PER UNIT WEIGHT ASTM D3776	MOISTURE CONTENT ASTM D2216	FREE SWELL A.P.I. TEST NO. 1010	HYDRAULIC CONDUCTIVITY ASTM D5084	THICKNESS ASTM D5199	OTHER

REINFORCED OR NONREINFORCED MATERIAL

COMMENTS/SPECIAL INSTRUCTIONS/DISTRIBUTION: Strikeout nonapplicable items

SHEET NO. _____ OF _____

000339

GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC.

GEOMEMBRANE TEST REQUEST FORM

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0409 TASK NO.: 04

DESCRIPTION: _____ YEAR: _____

SAMPLED: _____ day _____ mo SAMPLER ID: _____ SHIPPED: _____ day _____ mo SHIPPER ID: _____ RECEIVED: _____ day _____ mo LAB ID: _____

MANUFACTURED BY: _____

SITE CONTACT: _____ SITE PHONE: _____ SITE FAX: _____

SAMPLE NO. GM-	BATCH NO./ ROLL NO.	TENSILE ASTM D638	DENSITY ASTM D792	MELT INDEX ASTM D1238	THICKNESS ASTM D5199/D751 D3342/D1593 GM-B	CARBON BLACK CONTENT ASTM D1603	SPECIFIC GRAVITY CARBON DISP. ASTM D5596	TEAR RESISTANCE ASTM D1004	PUNCTURE RESISTANCE FTMS 101C METHOD 2065	ESCR/NCTL SINGLE POINT ASTM D1693 D5397	OTHER

SMOOTH OR TEXTURED MATERIAL

COMMENTS/SPECIAL INSTRUCTIONS/DISTRIBUTION: Strikeout nonapplicable items

0003340

2681

GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC.

GEOTEXTILE TEST SUMMARY REQUEST FORM

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0409 TASK NO.: 04

DESCRIPTION: _____ YEAR: _____

SAMPLED: _____ day _____ mo SAMPLER ID: _____ SHIPPED: _____ day _____ mo SHIPPER ID: _____ RECEIVED: _____ day _____ mo LAB ID: _____

MANUFACTURED BY: _____ SAMPLE SHIPPED VIA: _____

SITE CONTACT: _____ SITE PHONE: _____ SITE FAX: _____

SAMPLE NO. GT-	ROLL NO./ BATCH NO.	MASS/ AREA ASTM D3776 D5261	THICKNESS ASTM D1777 D5199	GRAB TENSILE ASTM D4632	TRAP TEAR ASTM D4533	MULLEN BURST ASTM D3786	AOS ASTM D4751	PERMITIVITY ASTM D4491	WIDE-WIDTH TENSILE ASTM D4595	WIDE-STRIP SEAM ASTM D4884	STRIP TENSILE ASTM D1682 D5035	PUNCTURE ASTM D4833	OTHER

WOVEN OR NONWOVEN MATERIAL

COMMENTS/SPECIAL INSTRUCTIONS/DISTRIBUTION: Strikeout nonapplicable items

SHEET NO. _____

000341

CERTIFICATE OF ACCEPTANCE
SUBGRADE SURFACE

2981

INSTALLER	PROJECT
NAME: _____	NAME: _____
ADDRESS: _____	_____
_____	LOCATION: _____
_____	_____
INSTALLER AUTHORIZED REPRESENTATIVE: _____	_____
	OWNER: _____

I, The undersigned, duly authorized representive of _____ do hereby accept the surface on which the geosynthetics will be installed and shall be responsible for maintaining the suitability of this surface, in accordance with the project specifications. (i.e., The contractor shall not install the geosynthetics until the subgrade surface is acceptable. Installation of the geosynthetics will be considered acceptance of the subgrade.)

PRIMARY: ☐ SECONDARY: ☐ OTHER: ☐ _____

DATE	PANEL NOS.	SIGNATURES		
		INSTALLER	GEOSYNTHETIC	FDF

000342

GEOSYNTEC CONSULTANTS FILE NO. F-CAS REVIEWED BY: _____ SHEET NO. _____ OF _____

GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC.

PANEL PLACEMENT LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0904 TASK NO.: 04

DESCRIPTION: YEAR:

PRIMARY: ☐ SECONDARY: ☐ OTHER: PRODUCT TYPE:

PANEL NO.	BATCH / ROLL NO.	DATE (day/mo)	TIME	PLACEMENT LOCATION COMMENTS	APPROX WIDTH (ft)	APPROX LENGTH (ft)	QA ID
				TOTALS:(1)			

NOTE: (1) APPROXIMATE AREA: THIS PAGE: (ft^2) ACCUMULATED: (ft

NOTES:

000343

2981

GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC.

TRIAL SEAM LOG - EXTRUSION

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0904 TASK NO.: 04

DESCRIPTION: YEAR:

SPECIFICATIONS: TENSIOMETER DESCRIPTION:

TRIAL SEAM NO.	DATE (day/mo)	TIME	MACHINE NO.	OPER ID	(1) MATERIAL DESCRIPTION	EXTRUSION		TEST RESULTS				RE-TEST NO.	QA ID
						PREHEAT (SET/°C/°F)	BARREL (°C/°F)	PEEL (ppi/psi)	SHEAR (ppi/psi)	PASS	FAIL		

NOTE: (1) MATERIAL DESCRIPTION REFERS TO EITHER SMOOTH/SMOOTH (S/S); SMOOTH/TEXTURED (S/T); OR TEXTURED/TEXTURED (T/T).

000344

GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC.

TRIAL SEAM LOG - FUSION

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0904 TASK NO.: 04

DESCRIPTION: YEAR:

SPECIFICATIONS: TENSIOMETER DESCRIPTION:

TRIAL SEAM NO.	DATE (day/mo)	TIME	MACHINE NO.	OPER ID	(1) MATERIAL DESCRIPTION	FUSION		TEST RESULTS				QA ID
						WEDGE (SET/°C/°F)	MEASURED SPEED (°C/°F)	PEEL (ppi/psi)	SHEAR (ppi/psi)	PASS	FAIL	

000345

NOTE: (1) MATERIAL DESCRIPTION REFERS TO EITHER SMOOTH/SMOOTH (S/S); SMOOTH/TEXTURED (S/T); OR TEXTURED/TEXTURED (T/T).

GeoSyntec Consultants

FLUOR FERNALD, INC.

PRODUCTION SEAM SUMMARY LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF) PROJECT NO.: GQ0409 TASK NO.: 04

LOCATION: FERNALD, OHIO YEAR: ______

DESCRIPTION: ______

PRIMARY: ☐ SECONDARY: ☐ OTHER: ☐ ______ SPECIFICATIONS: AIR PRESSURE (__ ± __ psi for 5 min.) ______ VACUUM BOX (______ sec.) ______

PRODUCTION SEAM				LOCATION					NONDESTRUCTIVE TEST						
DATE (day/mo)	TIME	MACHINE NO.	OPERATOR ID	SEAM NO.	BEGIN	END	ACTUAL SEAM LENGTH (ft)	QA ID	LOCATION (ft)	TEST DETAILS	OPERATOR ID	PASS/ FAIL	ACTION	QA ID
						TOTAL (1)								

2981

NOTE: (1) SEAM LENGTH: THIS PAGE ______ (ft) ACCUMULATED ______ (ft)

000346

SHEET NO. ____ OF ____

REVIEWED BY: ______

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GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC.

SEAM AND PANEL REPAIR LOCATION LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0904 TASK NO.: 04

DESCRIPTION: _____ DATE: ____ day ____ month ____ year

CONTRACTOR: _____

PRIMARY: ☐ SECONDARY: ☐ OTHER: ☐ PRODUCT TYPE: _____

NORTH

NOTE:
SEE OTHER SIDE FOR SYMBOLS

QA ID: _____

000317

SYMBOLS

2981

S11/P12 — SECONDARY/PRIMARY GEOMEMBRANE PANEL NUMBER

NDT = NONDESTRUCTIVE TEST

VT = VACUUM TEST

AT = AIR TEST

X———X———X — LEACHATE COLLECTION PIPE

— · — · — · — · — TOE OF SLOPE

—— ——— —— CREST OF SLOPE

xxxxxxxxxxxxxxxxxxxxxxx ANCHOR TRENCH

ANCHOR TRENCH

GEOSYNTHETIC CLAY LINER (GCL)

GEOGRID

GEONET

GEOTEXTILE

GEONET COMPOSITE LAYER

CAPPED SEAM (FUSION) — NDT TESTED

DESTRUCTIVE SAMPLE (DS) LOCATION
P=PRIMARY
S=SECONDARY

(FAILED)

(PASSED)

NDT TESTED

EXTRUSION WELD REPAIR — NDT TESTED

COUPON SAMPLE LOCATION — NDT TESTED

PATCH REPAIR LOCATION (EXTRUSION) — NDT TESTED

PIPE PENETRATION

SUMP AREA

60 — THICKNESS MEASUREMENT

ADJACENT PANEL REFERENCE

000348

GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC.

REPAIR SUMMARY LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0409 TASK NO.: 04

DESCRIPTION: YEAR:

PRIMARY: ☐ SECONDARY: ☐ OTHER: ☐ CONTRACTOR:

DATE (day/mo)	LOCATION				REPAIR NO. AND CODE (1)	REPAIR TYPE (2)	SIZE			WELDER ID		QA ID	NON-DESTRUCTIVE TESTING				
	SEAM	PANEL	DIST. (ft)	OFFSET (ft)			LENGTH (ft)	WIDTH (ft)	DIA (ft)	MACH NO.	OPER ID		DATE (day/mo)	OPER ID	PASS/ FAIL	ACTION	QA ID
(15)																	

NOTES: (1) REPAIR NO.: REPAIRS SHOULD BE NUMBERED SEQUENTIALLY.
(1) REPAIR CODES: P = PATCH, C = CAP, S= ANCHOR TRENCH EXTENSION (SKIRT), DS = DESTRUCTIVE SAMPLE, G = GRIND & WELD, T = TOPPING ALONG FUSION SEAM, R = RECONSTRUCTION
(2) REPAIR TYPES: E = EXTRUSION, F = FUSION

SHEET NO. ____ OF ____

000349

GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC.

DESTRUCTIVE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ0409 TASK NO.: 04

DESCRIPTION: YEAR:

CONTRACTOR: TEST REQUIREMENTS:

PRIMARY: ☐ SECONDARY: ☐ RE-TEST: ☐ OTHER: ☐

SAMPLE DISTRIBUTION: LABORATORY: ☐ ARCHIVE: ☐ INSTALLER: ☐ OTHER:

SAMPLE DATA							FIELD DATA						LABORATORY DATA						
D.S. NO.	TRACK (1)		LOCATION		MACH NO.	OPER ID	AVG PEEL (PPI/PSI)		AVG SHEAR (PPI/PSI)	PASS/ FAIL	DATE SAMPLED/ SHIPPED (day/mo)	QA ID	DATE OF RESULTS (day/mo)	AVG PEEL (PPI/PSI)		AVG SHEAR (PPI/PSI)	PASS/ FAIL	RE-TEST	QA ID
	SINGLE	DOUBLE	SEAM	DISTANCE (ft)			INSIDE	OUTSIDE						INSIDE	OUTSIDE				

NOTES: (1) TRACK TYPES: E = EXTRUSION F = FUSION

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IMPACTED MATERIALS PLACEMENT PLAN ON-SITE DISPOSAL FACILITY

Revision 2C
May 2000
20100-PL-007

United States Department of Energy

Fernald Environmental Management Project
Fernald, Ohio

Prepared by

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INFORMATION ONLY

Under

~~Fluor Fernald~~Fluor Fernald, Inc.
~~Subc~~Contract 95PS005028

000353

REVISION SUMMARY

Revision	Dated	Description of Revision
0	1/19/98	Initial issuance of Revision 0, *Impacted Material Placement Plan, On-Site Disposal Facility* (20100-PL-007)
PCN 1	7/7/98	Added Revision Summary page and revised physical waste acceptance criteria for debris (Page 4-1) to reflect that transite panels will not be size reduced before disposal in the On-Site Disposal Facility
0 ADD 1	2/17/99	Addendum 1: Issuance of Revision 0, *Specialized Placement Plan for Bagged Impacted Material* to discuss placement of bagged material into the On-Site Disposal Facility
1	10/99	Issuance of Revision 1 based on page changes approved by the U.S. EPA and OEPA. Addendum 1 incorporated into Appendix C
1ADD2	3/00	Addendum 2: Issuance of Revision 1, *Specialized Placement Plan for Thyorium and Non-Bagged Impacted Material* to discuss placement of thorium debris and non-bagged material into the On-Site Disposal Facility
1ADD3C	3/00	Addendum 3: Issuance of Revision 1, *Alternative Trenching Method for Placement of Category 2 Impacted Material* to discuss placement of Category 2 items by trenching method into the On-Site Disposal Facility
1TBL1	3/00	Added *Placement Restrictions for Specialized Placement Plans* table to be inserted in front of Addendum 1 of Appendix C.
2C	5/00	Issuance of Revision 2C to incorporate lessons learned and design change notices from OSDF Phase I and II. Addenda 2 and 3 incorporated into Appendix C.

FINAL
IMPACTED MATERIAL PLACEMENT PLAN

ON-SITE DISPOSAL FACILITY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

REVISION 2C
MAY 2000
20100-PL-007

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APPENDICES

Appendix A Impacted Materials Placement Quality Assurance Plan

Appendix B Best Available Technology Determination for Remedial Construction Activities on the Fernald Environmental Management Project

Appendix C Addenda to Impacted Materials Placement Plan (see Revision Summary)

ACRONYM LIST

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ACM	Asbestos Containing Material
ALARA	As Low As Reasonably Possible
ARAR	Applicable or Relevant and Appropriate Requirement
ASTM	American Society of Testing and Materials
BAT	Best Available Technology
CFC	Certified-for-Construction
CM	Construction Manager
CQA	Construction Quality Assurance
CQC	Construction Quality Control
D&D	Decontamination and Dismantlement
DOE	Department of Energy
FEMP	Fernald Environmental Project
H&S	Health and Safety
IMP	Impacted Materials Placement
LCS	Leachate Collection System
MTL	Material Tracking Location
OAC	Ohio Administrative Code
ODNR	Ohio Department of Natural Resources
OEAP	Ohio Environmental Protection Agency
OSDF	On-Site Disposal Facility
OU2	Operable Unit 2
OU3	Operable Unit 3
OU5	Operable Unit 5
QA	Quality Assurance
QC	Quality Control
RCRA	Resource Conservation and Recovery Act
RDWP	Remedial Design Work Plan
ROD	Record of Decision
SWMEC	Surface-Water Management and Erosion Control
TBC	To Be Considered Criteria
WAC	Waste Acceptance Criteria
WAO	Waste Acceptance Organization

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1.0 INTRODUCTION

1.1 Overview

This Impacted Materials Placement (IMP) Plan describes the impacted materials acceptance, placement, compaction, and quality assurance/quality control (QA/QC) activities that will be undertaken throughout construction, filling, and closure of the On-Site Disposal Facility (OSDF) at the Fernald Environmental Management Project (FEMP), Fernald, Ohio.

1.2 Project Description

The OSDF will be constructed to contain impacted materials derived from remediation of the operable units at the FEMP. These materials will be required to meet OSDF waste acceptance criteria (WAC) prior to disposal in the OSDF. The estimated total volume of impacted material destined for OSDF disposal is 2.5 million cubic yards (1.9 million cubic meters) bank/unbulked. Approximately 85 percent of this material is impacted soil or soil-like material, with the remainder consisting of building demolition debris, lime sludge, municipal solid waste, and small quantities of miscellaneous other materials.

The construction, filling, and closure of the OSDF is currently scheduled to occur over a period of approximately seven years, as described in the Accelerated Remediation Plan [$276 million case] (276 Plan). However, due to the potential for variations in the pace of remedial action activities, the OSDF has been designed to be constructed, filled, and closed in phases for up to 25 years.

The design approach for the OSDF is presented in the document, *"Final Remedial Design Work Plan for Remedial Actions at Operable Unit 2 (OU2 RDWP)"* [DOE, 1995b]. The design of the OSDF, as currently developed, is presented in the *"Final Design Package, On-Site Disposal Facility"* [GeoSyntec, 1997c]. The design of the OSDF includes a liner system, final cover system, leachate management system, and surface-water management system.

1.3 Plan Scope

This plan establishes the operational procedures to be used by the ~~SubcontractorConstruction ContractorContractor~~ to place~~,~~ and compact ~~and protect~~ impacted material ~~placed~~ in the OSDF in a manner that protects the underlying geosynthetics. The scope of this IMP Plan includes:

- presenting radiological/chemical and physical waste acceptance criteria applicable to OSDF impacted materials;
- categorizing impacted material types based on handling, placement, and compaction requirements;

- developing acceptable proportions of the various impacted material types to be placed within any area of the OSDF to achieve satisfactory OSDF performance;
- developing procedures for placing and compacting impacted materials in the OSDF; and
- developing QA/QC procedures for impacted material placement in the OSDF.

1.4 Plan Organization

The remainder of this plan is organized as follows:

- the criteria used in establishing the requirements of this IMP Plan are presented in Section 2.0;
- the design features of the OSDF applicable to this IMP Plan are presented in Section 3.0;
- impacted material waste acceptance criteria are described in Section 4.0;
- descriptions of the impacted materials to be placed in the OSDF are presented in Section 5.0;
- general procedures for handling, placement, and compaction of impacted materials in the OSDF are presented in Section 6.0;
- specific procedures for handling, placement, and compaction of soil and soil-like impacted materials are presented in Section 7.0;
- specific procedures for handling and placement of special impacted materials are presented in Section 8.0;
- measures to be taken for the control of impacted runoff and fugitive dust related to, or resulting from, the placement of impacted materials are described in Section 9.0;
- required documentation procedures are presented in Section 10.0;
- seasonal cover requirements are presented in Section 11.0; and
- regulatory and technical references cited in this plan are listed in Section 12.0.

Appendix A to this IMP Plan contains an IMP Quality Assurance Plan. The IMP Quality Assurance Plan describes those activities that the Construction Quality Control (CQC) Consultant will undertake to establish that the ~~SubcontractorConstruction Contractor~~Contractor complies with this IMP Plan and approved addenda~~ums~~. Appendix B presents best available technology (BAT) for remediation construction activities. Appendix C presents Addenda to the IMP Plan~~. These addendadescribe~~ that describe specialized placement plans for specific impacted materials.

This IMP Plan uses several key ~~phrases which~~phrases, which are critical to the development of a complete understanding of the Plan. The terms and their usage within this plan are briefly explained as follows:

"lift"	Usage common to earthwork.
"grid"	Refers to a 100 ft~~.~~ by 100 ft~~.~~ ~~(30 m by 30 m)~~ grid system for each cell, which provides the control for management of impacted material placement.
"horizon"	A horizontal stratum limited horizontally to a 100 ft~~.~~ by 100 ft~~.~~ ~~(30 m by 30 m)~~ grid element, and limited vertically by either the maximum thickness~~height~~ of the item(s) therein or by the total thickness of the maximum number of lifts therein.

1.5 Plan Responsibilities

This plan describes work to be conducted by four ~~three~~ separate organizations:

- *Construction Manager (CM)* — Responsibilities include: overall coordination between all parties as it relates to OSDF; ~~the parties to the FEMP;~~ directing the construction management team; technical contractual management responsibility over the ~~SubcontractorConstruction Contractor~~Contractor; coordinating with WAO to specify~~ing~~ the materials requiring OSDF disposal; providing coordination of security for OSDF operations; implementing construction safety; ~~providing~~ coordinating ~~of~~ emergency health and safety response teams; and oversight of the CQC Consultant. ~~OSDF Construction Quality Assurance Plan.~~

- ~~*Subcontractor*~~ Contractor— Responsibilities include: separating impacted materials into categories at the excavation areas; loading and hauling impacted materials to the OSDF; routing impacted materials within the OSDF battery limit; placing impacted material in the OSDF; obtaining final grade lines as shown on the Certified-For-Construction (CFC) Drawings; compacting (or compacting around and over) impacted material in the OSDF; identifying impacted material to be placed as select and protective layers; and controlling the generation of fugitive dust and managing impacted stormwater runoff.

- *Waste Acceptance Organization (WAO)* - Responsibilities include: checking the impacted material category classification at the OSDF battery limit, reviewing manifest, recording placement locations on manifest following communication with CQC Consultant, and signing manifest.

- *CQC Consultant* — Responsibilities include: checking the impacted material category classification as material is placed in the designated OSDF cell grid; spot-checking impacted material shipments for conformance with the OSDF WAC; verifying the ~~Subcontractor~~Contractor's choice of location for impacted material placement; documenting that the ~~Subcontractor~~Contractor followed the placement and compaction procedures required by this IMP Plan; ~~and~~ conducting ~~compaction~~ performance tests ~~of~~ on materials placed in the OSDF~~.~~; and reviewing and signing manifests.

1.6 Related Plans

Several other plans have been prepared and should be used in conjunction with this IMP Plan. The other plans containing information relevant to this IMP Plan are listed below along with a brief statement of the relationship to this plan.

- *"Construction Quality Assurance (CQA) Plan, On-Site Disposal Facility"* [GeoSyntec, 1997a]: describes the quality assurance procedures that will be followed by CQC Consultant during construction, ~~filling~~placement of non-impacted ~~"clean"~~ materials for protective and contouring layers, and closure of the OSDF;

- "*Systems Plan* [FDF, 1997b]: contains procedures for inspecting and monitoring the OSDF including the leachate management system, final cover system, and temporary facilities;

- "*Surface Water Management and Erosion Control (SWMEC) Plan, On-Site Disposal Facility"* [GeoSyntec, 1997d]: provides procedures for the management of surface water in and around the OSDF and details of temporary and permanent erosion and sediment controls for the OSDF; ~~and~~

- *"Waste Acceptance Criteria Attainment Plan for the On-Site Disposal Facility"* [DOE, 1997c]: establishes the strategies for ensuring that the OSDF WAC presented in this IMP Plan are met upon disposal in the OSDF.

- *"Permitting Plan and Substantive Requirements for the OSDF"* ~~-~~*[DOE, 1997a]:* ~~This plan~~ identifies and addresses permitting requirements ~~-~~for the OSDF; and

- *"Leachate Management Contingency Plan for OSDF"*~~,~~ *[DOE, 1998]*: ~~This plan~~ identifies and addresses leachate management during periods when~~re~~ the Leachate Transmission System is not operational.

~~The Subcontractor shall be responsible for preparing an IMP health and safety (H&S) plan that meets all health and safety requirements identified in the FEMP Project Specific Health and Safety Requirements Matrix (PSHSRM). In addition, the FEMP H&S personnel will perform periodic audits of the Subcontractor to ensure compliance; H&S personnel will have stop work authority (in the event of threat to worker and/or public safety) until the proper corrective action is taken. The H&S Officer assigned to the OSDF project will be the single point of contact for all safety, industrial hygiene, fire protection, and radiological issues or concerns.~~

~~In addition to H&S personnel assigned to the project, the Subcontractor will be required to provide a H&S field representative who will be responsible for the Subcontractor's compliance with all H&S requirements. The Subcontractor will be required to report all safety concerns and incidents to the H&S Officer.~~

~~Radiological technician(s) will also be assigned to the OSDF project. In conjunction with the H&S Officer assigned to the project, the radiological technician(s) will help to ensure radiological compliance throughout the project. Radiological compliance includes the radiological monitoring of equipment and materials entering and leaving the job site, radiological monitoring of soil during excavations to help ensure proper segregation, storage, or disposition; radiation work permit compliance, routine inspection, monitoring, and recording of area radiation detection monitors, and radiological monitoring of personnel, if necessary. The PSHSRM will be the basis for the required monitoring and will identify the action levels that will ensure personnel safety by limiting exposure.~~

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2.0 PERTINENT REQUIREMENTS

2.1 Overview

Regulatory and other requirements pertinent to this plan primarily take the form of applicable or relevant and appropriate requirements (ARARs) and to be considered criteria (TBCs) as determined by the record of decision for each of the various FEMP operable units, functional requirements, and general design criteria. In general, these criteria are intended to result in impacted material management activities that: (i) are protective of the OSDF liner system, leachate management system, and final cover system; (ii) result in an OSDF waste mass that is stable and does not undergo unacceptable levels of differential settlement; and (iii) provides acceptable management of the generation of fugitive dust and the routing and containment of impacted runoff.

2.2 ARARs and TBCs

ARARs and TBCs that should be addressed by this plan are provided here, as obtained from the "*Final Record of Decision for Remedial Actions at Operable Unit 2 (OU2 ROD)*" [DOE, 1995a], the "*Final Record of Decision for Remedial Actions at Operable Unit 5 (OU5 ROD)*" [DOE, 1996a], the "*Operable Unit 3 Record of Decision for Final Remedial Action (OU3 ROD)*" [DOE, 1996b], or the "*Permitting Plan and Substantive Requirements for the On-Site Disposal Facility (OSDF Permitting Plan)*" [DOE, 1997a], as identified.

	Citation	Requirement	OU2 ROD	OU5 ROD	OU3 ROD	OSDF Permitting Plan
1	Ohio Particulate Matter Standards—Restriction of Emission of Fugitive Dust OAC 3745-17-08	Requires the use of reasonably available dust control measures to prevent fugitive dust from becoming airborne and defines "reasonably available control measures".	✓	✓	✓	
2	Ohio Permit to Install New Sources of Air Pollution—Best Available Technology (BAT)	Requires the installation or modification and operation of an air contaminant source to employ the best available technology for pollution control.	✓	✓	✓	
3	Ohio Solid Waste and Infectious Waste Regulations—Operational Criteria for a Sanitary Landfill Facility OAC 3745-27-19(E)(30)	Prohibits disposal of whole scrap tires and shredded whole scrap tires in a sanitary landfill facility.			✓	✓

4	Ohio Asbestos Emission Control—Standard for Active Asbestos Waste Disposal Sites OAC 3745-20-06	Prohibits visible emissions from asbestos-containing materials during placement, and requires at least 12 inches of cover of compacted non-asbestos containing material over that asbestos-containing material as soon as practicable but no less often than at the end of each operating day.			✓	✓
5	Ohio Asbestos Emission Control—Standard for Inactive Asbestos Waste Disposal Sites OAC 3745-20-07(A)&(C)	Prohibits visible emissions from asbestos-containing materials from an inactive asbestos waste disposal site, and requires at least 6 inches of cover of compacted non-asbestos containing material over that asbestos-containing material and growth and maintenance of a cover of vegetation on an area adequate to prevent exposure of the asbestos-containing waste material, or at least 2 feet of cover of compacted non-asbestos containing material, and maintenance of that cover to prevent exposure to the asbestos-containing waste material.	✓		✓	✓
6	Ohio Solid Waste and Infectious Waste Regulations—Sanitary Landfill Facility Construction OAC 3745-27-08(C)(6)	Requires placement of impacted materials to be performed such that the cell always stores runoff from active and open portions of the cell resulting from the 25-year, 24-hour storm event.	✓	✓	✓	✓
7	Radiation Protection of the Public and the Environment DOE Order 5400.5, Chapter I(4) and II(2)	Requires application of "As Low As Reasonably Achievable" (ALARA) goals to all activities in the excavation, removal, handling, and placement of impacted materials.	✓	✓	✓	

2.3 Functional Requirements

A variety of functional requirements have been established by DOE for the OSDF. The functional requirements applicable to this plan are given below:

- Facilities for impacted material management should:
  - be located in areas that can easily and efficiently accommodate receipt of impacted material from the various FEMP operable units;
  - be separated from non-impacted ~~clean~~ areas;
  - limit the uncontrolled discharge of fugitive dust to acceptable levels;
  - limit the generation of wastewaters to acceptable levels;
  - comply with project health and safety requirements;
  - be removed at the completion of impacted material management activities, with the disposal of affected materials in the OSDF; and
  - be designed to minimize the generation of new impacted material.
- Impacted materials should be placed in the OSDF in a safe and cost-effective manner that prevents the uncontrolled release of impacted materials to the environment.
- This plan, in conjunction with the various operable unit remedial action planning documents, must only allow the placement of material satisfying the OSDF WAC.

2.4 General Design Criteria

A number of general design criteria have also been identified for the OSDF. The general design criteria applicable to this plan are:

- To the extent the stockpiling of impacted soil is necessary, the soil should be stockpiled in the FEMP former production area in order to use the existing storm drainage control system.
- Procedures should be employed that reduce the need for the use of respirators by on-site workers.

- Material transport procedures should cause minimal disturbance to the site and work area and be coordinated with impacted material removal and placement activities.

- Material transport equipment requirements should address the need to transport a variety of materials so that the number of pieces of equipment required to implement the design is minimized and should address the control of airborne particulate emissions.

- The ~~Subcontractor~~Contractor must control the release of fugitive emissions (including dust, radiological, chemical, and asbestos materials) so that air quality standards are not violated on the site and so that releases are controlled to acceptable levels at the fence line. The Contractor shall control emissions to assist in controlling airborne exposures to personnel.

- Fugitive dust ~~will~~ should be controlled through the implementation of the Best Available Technology (BAT) determination for remedial construction activities on the FEMP site. The BAT is presented in Appendix B.

- Acceptable emission control methods during placement operations include:

  - transporting in dump trucks;

  - using closed containers with metal or tarp lids;

  - keeping impacted material moist; and

  - spraying earthen material with a crusting agent when necessary.~~;~~

- Impacted material placement procedures should take into account:

  - the rate and time at which impacted material will be available for placement in the cell;

  - the types of impacted material available for disposal (*i.e.*, soil, flyash, lime sludge, solid waste, or building demolition debris);

  - the potential for bulking/shrinkage of impacted material during placement;

  - the availability of temporary stockpile capacity;

- the extent to which the disposal cell is constructed and available to receive impacted material; and

- the need for suspended or reduced impacted material placement activities during winter and the need for seasonal (winter) cover.

- Impacted material placement activities should be organized to achieve the following design objectives:

  - Impacted material should be placed in the OSDF in such a manner that the OSDF will achieve design life goal of 1,000 years to the extent reasonable, and in any case at least 200 years.

  - Impacted material should be placed in a manner that is protective of the liner system and final cover system.

  - Impacted material should be placed to minimize differential settlement to the extent reasonably achievable.

  - Impacted material should be placed so that it will remain stable under both static and earthquake loading conditions.

  - A minimum of 3 ft~~. (0.9 m)~~ thickness of select impacted material should be placed directly over the protective layer component of the liner system, and beneath the contouring layer component ~~layer~~ of the final cover system, to provide protection of these systems from damage by impacted materials. The thickness of select impacted material over the protective layer may be decreased to 2 ft ~~(0.6 m)~~ with approval from Construction Manager, if the first lift of material to be placed over the select impacted material consists of Category 1 ~~soil~~material ~~or small size debris~~ that can be placed in controlled lifts.

  - To limit particulate emissions, generation of wastewaters, and erosion of impacted material, the sequence of placement should minimize the area of exposed impacted material.

  - Materials should be placed in a manner that results in a disposal pile with relatively homogenous large-scale mechanical properties (*i.e.*, compressibility and shear strength), to the extent possible. Homogeneity should be achieved by distributing impacted materials throughout the OSDF to avoid large pockets or distinct concentrations of any one type of impacted material in a particular area.

In particular, building demolition debris and other material with solids should be mixed with impacted soils as much as practicable during placement activities. The objective is to minimize the potential for differential settlement.

- At the end of each work day, the impacted material surface should be graded and maintained to control precipitation runoff and impacted material erosion.

3.0 OSDF FEATURES

3.1 General

The primary features of the OSDF related to the placement of impacted materials are the liner and final cover systems and certain support elements. These features are briefly described in this section. The ~~SubcontractorConstruction ContractorContractor~~ shall be responsible for implementing the requirements of this section and for the protection and safety of the systems described in this section during OSDF construction, filling, and closure.

3.2 Impacted Materials Placement Zones

Control of the placement of impacted material in the OSDF during construction, filling, and closure is required in order to: (i) protect the OSDF liner system, final cover system, and leachate management system from damage; (ii) maintain the impacted material in a stable configuration; (iii) limit fugitive dust to an acceptable level; (iv) allow containment of impacted runoff within the active OSDF cell; and (v) limit differential settlement of the OSDF final cover system to an acceptable level. Details of the liner system and final cover system proposed for the OSDF are shown on the CFC Drawings.

Within each OSDF cell, four zones exist in which impacted material may be placed. These zones and their relative locations with respect to the OSDF liner system and final cover system are shown in Figure 3-1. The four zones are as follows:

- *Protective layer* — a protective layer of impacted or non-impacted soil material, according to Technical Specifications, shall be placed directly over the ~~primary~~ geotextile filter overlying the leachate collection system (LCS) on the base of each OSDF cell; the soil used for the protective layer shall be either: (i) on-site till or fly-ash material with a maximum particle size not exceeding 3 in. ~~(75 mm)~~ (ASTM C 136 or D 422); or (ii) granular drainage material meeting the material requirements of the project specifications and placed in specified areas of each cell to facilitate vertical percolation of impacted runoff into the underlying ~~leachate collection system~~ LCS;

- *Select impacted material layer* — select impacted material shall be placed both on top of the protective layer and beneath the contouring layer to provide a physical barrier between debris and other "large-size" impacted material and the OSDF liner and final cover systems; the select impacted material shall consist of impacted soil or soil-like material with a maximum particle size not exceeding 6 in. ~~(150 mm)~~ (ASTM C 136 or D 422); ~~and~~

- *Impacted material layers* — a variety of different impacted materials can be placed on top of the select impacted material layer in the central portions of an OSDF cell; the impacted

material in this zone need only meet the radiological/chemical waste acceptance criteria established for the OSDF, the physical waste acceptance criteria established in this IMP Plan, and the placement and compaction criteria established in this IMP Plan; and

- *Contouring layer* — a contouring layer of ~~clean or~~ non-impacted soil material shall be placed directly over the select impacted material layer, prior to installation of the OSDF final cover system; the soil used for the contouring layer shall be a till material with a maximum particle size not exceeding ~~3~~ 4 in. ~~(75 mm)~~ (ASTM C 136 or D 422). An impacted soil material may also be used if approved by the Construction Manager. The Contractor shall submit an alternative placement plan if impacted material is selected for the contouring layer.

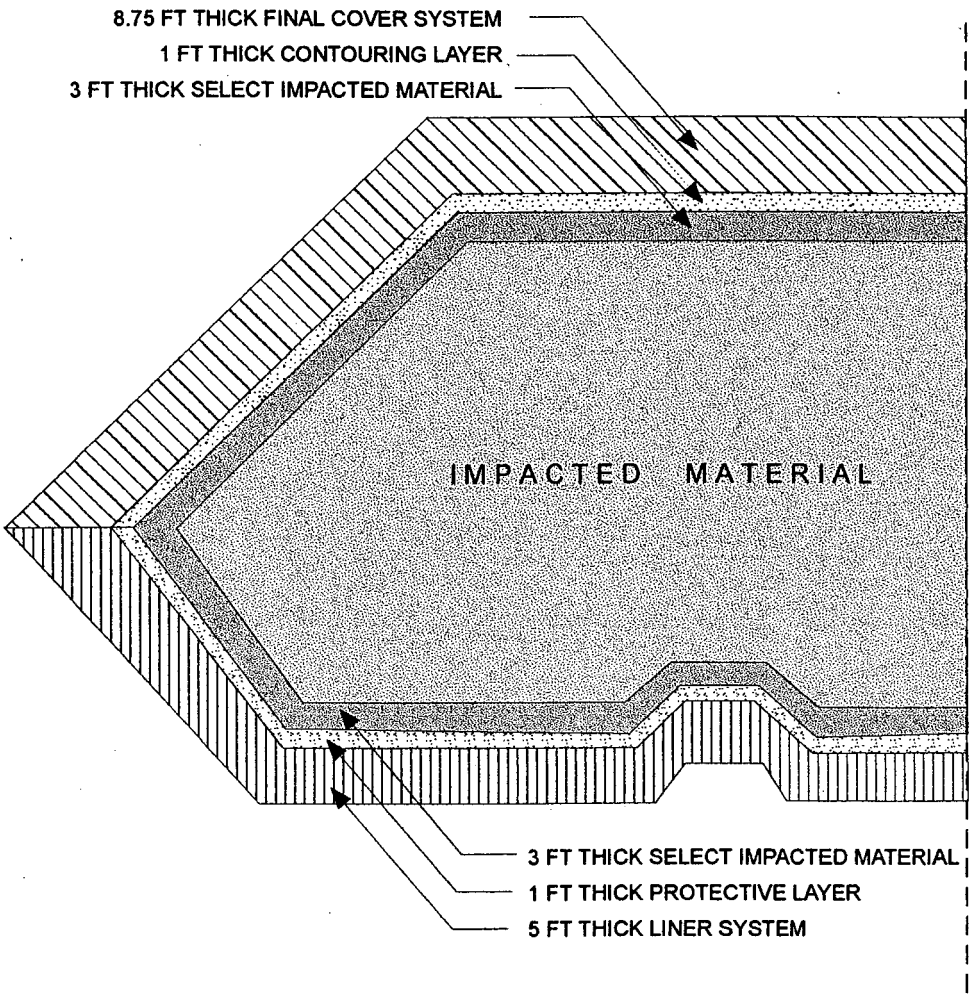
3.3 OSDF Support Facilities

3.3.1 Impacted Material Haul Roads

The impacted material haul roads within the OSDF battery limit are designed to laterally contain material that may spill from trucks during transportation and also impacted runoff resulting from precipitation falling onto the roads. Trucks used for impacted material transport shall be suitable for the roadway design. Surfacing for the impacted material haul roads is designed to provide adequate support to the hauling units and a relatively tight texture to promote runoff. Surfacing materials used in the construction of impacted material haul roads shall be removed and disposed in the OSDF when the segment of roadway is no longer needed for impacted material placement activities.

Runoff from impacted material haul roads within the OSDF battery limit shall be managed as impacted runoff (*i.e.*, a form of wastewater). This water shall be contained, collected, and discharged to the storm drainage control system of the FEMP former production area, or to other on-site wastewater collection/conveyance points acceptable to the ~~CM~~ Construction Manager. Impacted material haul roads outside the OSDF battery limit are addressed as part of other plans prepared for the integrated FEMP remediation.

IMPACTED MATERIAL ZONES
(NORTH - SOUTH CROSS SECTION SHOWN)



NOTE: THIS FIGURE FOR ILLUSTRATION ONLY. CONSTRUCTION CONTRACTOR SHALL PLACE IMPACTED MATERIAL LAYERS TO THE LIMITS SHOWN ON CONSTRUCTION DRAWINGS

GEOSYNTEC CONSULTANTS
ATLANTA, GEORGIA

FIGURE NO.	3 - 1
PROJECT NO.	GQ1001-03
DOCUMENT NO.	F9620002.2B
FILE NO.	FIGS.cdr

3.3.2 Impacted Soil Stockpile Areas

During initial construction of the OSDF, and periodically during filling and closure, it will be necessary to temporarily stockpile impacted soil resulting from OSDF excavation activities. An impacted soil stockpile area shall be developed to temporarily stockpile this material. The area used for stockpiling shall be graded flat and separated from surrounding areas by a 2-ft~~. (0.6-m)~~ high soil berm. At the end of each day's work, the impacted soil stockpile shall be lightly compacted and rolled smooth to reduce precipitation infiltration into the pile and control fugitive dust. Any stockpile that will remain inactive for more than 30 days shall be covered with either a crusting agent or geosynthetic cover. ~~Grassing~~ Vegetation of impacted soil stockpile areas may be considered if the soil is suitable for establishment of a vegetative cover. Runoff from the stockpile shall be controlled and routed to the FEMP former production area storm drainage control system, or to other on-site wastewater collection/conveyance points acceptable to the ~~CM~~Construction Manager.

Impacted soil excavated during construction of the first and subsequent OSDF cells and related support facilities shall be used for construction of the liner system protective layer and the select impacted material layer for those cells if meeting the requirements for those layers. Any geosynthetic cover used in the impacted soil stockpile area and other impacted soils from the operation shall be disposed in the OSDF as part of the impacted material placement activities described later in this plan.

3.3.3 ~~Impacted Material Transfer Areas~~On-Site Disposal Facility Material Transfer Area (OMTA)

Impacted material transfer areas consist of gravel or concrete hardstands constructed to temporarily store impacted structural members and other building demolition debris. These areas ~~will~~ shall be used to temporarily stage any material not able to go directly from the material source to an active OSDF cell. Impacted material staging areas constructed outside the limits of the FEMP former production area shall have positive runoff control. Any runoff from these areas ~~will~~ shall be directed to the storm drainage control system of the FEMP former production area, or to other on-site wastewater collection/conveyance points acceptable to the ~~CM~~Construction Manager.

4.0 WASTE ACCEPTANCE CRITERIA

4.1 General

This section of the IMP Plan presents information regarding the waste acceptance criteria applicable to the OSDF. Radiological/chemical waste acceptance criteria developed by the individual operable units at the FEMP are identified and made a part of this plan. Other physical criteria are established in this plan.

4.2 OSDF Chemical/Radiological Waste Acceptance Criteria

The OU2 ROD has established a radiological waste acceptance criteria of 346 picoCuries/gram (pCi/g) of uranium-238 or 1,030 milligrams per kilogram (mg/kg) of total uranium for operable unit remediation materials destined for the OSDF. Similarly, the OU5 ROD has established additional radiological and chemical waste acceptance criteria for Operable Unit 5 remediation soils destined for the OSDF. Similarly, the OU3 ROD has established a radiological waste acceptance criteria of 105 grams technetium-99 for Operable Unit 3 remediation debris materials. These waste acceptance criteria have been compiled and are presented in Table 4-1. The remediation materials sent to the OSDF from Operable Unit 3 (see Table 5-1) may also include small material contributions from Operable Units 1 and 4; any structural debris material resulting from decontamination and dismantlement of the remediation facilities from these latter operable units destined for the OSDF must meet the Operable Unit 3 waste acceptance criteria.

4.3 Physical Criteria

The physical criteria (dimensions given are considered nominal) that shall be applied to material destined to the OSDF are:

- materials from various building components (*i.e.*, steel, concrete, masonry rubble, finish components, *etc.*) shall be segregated at the staging area by the ~~Subcontractor~~~~Construction Contractor~~Contractor;

- due to health and safety considerations associated with generating friable asbestos, size reduction of transite panels will not be required; transite shall be bundled, wrapped or encapsulated, and banded to a pallet;

- the maximum length of irregularly shaped metals or other components of a building superstructure or finish component shall be 10 ft~~. (3 m)~~;

- the maximum width of irregularly shaped metals or other components of a building superstructure or finish component shall be 10 ft;

- the maximum thickness of irregularly shaped metals or other components of a building superstructure or finish component shall be 18 in. ~~(450 mm)~~;

- ~~the maximum thickness of concrete or other components of a building slab or substructure shall be 18 in. (450 mm) when the materials are part of a load of similar material;~~

- when the materials are part of a load of similar material, the maximum ~~dimensions~~ thickness of concrete or other components of a building slab or substructure shall be 18 in. ~~thick, and a width by length area of 40 ft²~~ and having a maximum length of 10 ft;

- the maximum cross-sectional dimension of an individual concrete member or other component of a building slab or substructure shall be 4 ft. ~~(1.2 m)~~ when the item is handled individually and is a regular, rectangular shape having no concrete protrusions greater than 18 in. ~~(450 mm)~~;

- concrete reinforcement bars shall be cut within a nominal 12 in. ~~(300 mm)~~ of the concrete mass;

- the maximum thickness of uniform pallets of building cladding (*e.g.*, transite panels) properly banded into rectangular shapes shall be 4 ft. ~~(1.2 m)~~;

- regulated asbestos containing material (ACM) shall be double-bagged at the source and delivered unmixed with other materials;

- ACM brick and commingled debris shall be double-contained and segregated at the source;

- piping having insulation of ACM shall be segregated at the source and delivered unmixed with other materials;

- general building rubble consisting of wood, drywall, HVAC systems, electrical systems, plumbing systems, and minor equipment shall be sufficiently reduced in size to be gradeable into a 21 in. ~~(533 mm)~~ ±3 in. ~~(76 mm)~~ lift by equipment similar to a Caterpillar D-8 bulldozer;

- the maximum thickness ~~dimension~~ of general building rubble consisting of concrete, masonry, and other similar materials shall be 18 in. ~~(450 mm)~~;

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- equipment and equipment parts shall be drained of all oils and liquids;

- process piping with a nominal diameter of 12 in. ~~(300 mm)~~ or greater ~~will~~ shall be split in half; and

- piping used as a surface water drainage conduit (*e.g.*, corrugated metal pipe, concrete pipe, vitrified clay pipe) and non-process piping ~~will~~ shall be crushed or split in half in length to reduce void space; maximum size ~~will~~ shall be 10 ft. ~~(3.0 m.)~~ in length and 18 in. ~~(450 mm)~~ thickness.

- ~~the maximum dimension of general building rubble consisting of concrete, masonry, and other similar materials shall be 18 in. (450 mm).~~

Impacted materials brought to the OSDF should not be at such a high moisture content that impacted material placement and compaction activities are impeded. Generally, Category 1 soil should have a moisture content that allows the material to be compacted to the required relative compaction using standard soil compaction equipment and procedures. Soil should also have a moisture content that does not result in excessive "bleeding" of liquids. As necessary, the ~~CM~~Construction Manager will direct the ~~Subcontractor~~Contractor to dry the soil by disking and air drying, by blending with drier soil, or by other means so that the soil can be compacted to the required percent of standard Proctor maximum dry density. The ~~Subcontractor~~Contractor shall limit the use of in-cell drying to the extent necessary to not restrict the placement of impacted material in the OSDF.

4.4 Prohibited Items

The following are specifically prohibited from disposal in the OSDF:

- impacted material exceeding WAC presented in Table 4-1;

- impacted material that is "characteristically hazardous" ("RCRA characteristic waste"), as defined in the OU2, OU3, and OU5 ROD (Excluded from this prohibition is impacted material that has been treated so that it is no longer "characteristically hazardous".);

- material from any off-site source, including any other DOE site, except as provided in the *OU5 ROD*, which states *"Specifically excluded from this prohibition are laboratory wastes generated at off-site facilities resulting directly from the chemical, radiological and engineering analysis of FEMP waste materials/contaminated media or wastes generated at off-site facilities during the conduct of treatability or demonstration type studies on FEMP material"*;

- pressurizable gas cylinders;

Table 4-1
ON-SITE DISPOSAL FACILITY
WASTE ACCEPTANCE CRITERIA

	Constituent of Concern	Soil[a]		Debris[b]
		OU2	OU5[d]	OU3
	Radionuclides:			
1	Neptunium-237		3.12×10^{9} pCi/g	
2	Strontium-90		5.67×10^{10} pCi/g	
3	Technetium-99		29.1 pCi/g	105 g
4	Uranium-238	346 pCi/g		
	Total Uranium	1,030 mg/kg	1,030 mg/kg	
	Inorganics:			
5	Boron		1.04×10^{3} mg/kg	
6	Mercury[c]		5.66×10^{4} mg/kg	
	Organics:			
7	Bromodichloromethane		9.03×10^{-1} mg/kg	
8	Carbazole		7.27×10^{4} mg/kg	
9	Alpha-chlordane		2.89 mg/kg	
10	Bis(2-chloroisopropyl)ether		2.44×10^{-2} mg/kg	
11	Chloroethane		3.92×10^{5} mg/kg	
12	1,1-Dichloroethene[c]		11.4 mg/kg	
13	1,2-Dichloroethene[c]		11.4 mg/kg	
14	4-Nitroaniline		4.42×10^{-2} mg/kg	
15	Tetrachloroethene[c]		128 mg/kg	
16	Toxaphene[c]		1.06×10^{5} mg/kg	
17	Trichloroethene[c]		128 mg/kg	
18	Vinyl chloride[c]		1.51 mg/kg	

NOTES:
[a] maximum concentration
[b] maximum total mass
[c] RCRA-based constituent of concern
[d] constituents which have established maximums which serve as Waste Acceptance Criteria; other compounds which will not exceed designated Great Miami Aquifer action levels within 1000-year performance period, regardless of starting concentration in the OSDF, are not listed.

SOURCES:
OU2 ROD [DOE, 1995a]
OU5 ROD [DOE, 1996a]
OU3 ROD [DOE, 1996b]

- process-related metals (OU3-ROD Category C materials);
- product, residues, and other special materials (a subset of OU3-ROD Category J materials);
- materials containing free liquids (The intent of the exclusion of free liquids is to prevent contaminated liquid waste from being directly disposed of in the OSDF (e.g., drum of solvent). Materials that contain rainwater or that have an inherent moisture content like sludges are not excluded from disposal in the OSDF. If a material that arrives at the OSDF for disposal is too wet for proper placement and compaction, the material will be mechanically processed before placement.);
- intact drums (*i.e.*, drums must be empty and crushed);
- acid brick (OU3-ROD Category F materials);
- transformers, which have not been either crushed or had their void spaces filled with grout (or other material approved by the ~~CM~~Construction Manager);
- whole or shredded scrap tires (as defined by Ohio Environmental Protection Agency);
- ~~used oils; and~~
- materials not accompanied by the transportation "manifest" information specified in this plan.

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5.0 IMPACTED MATERIAL DESCRIPTIONS

5.1 General

The OSDF will be the final repository for a majority of the impacted material from the five operable units of the integrated FEMP remediation. Construction debris (*i.e.*, waste originating during the construction of the OSDF) will also be disposed in the OSDF. The materials requiring OSDF disposal are expected to vary considerably in their composition, handling, placement, and compaction characteristics. Given this variability, it is useful to develop a categorization framework wherein materials with similar characteristics are assigned to the same category. The purpose of this section of the IMP Plan is to describe and categorize the various impacted materials using a common categorization framework.

5.2 Impacted Material Categories

Impacted materials to be disposed in the OSDF shall be assigned to one of five categories, depending on the procedures that will be used to place them into the OSDF:

Category 1 - Category 1 impacted materials are soils and soil-like materials that do not contain hard agglomerations greater than 12 in. ~~(300 mm)~~ in greatest dimension. Category 1 soil and soil-like materials that contain a minimum of 80 percent, by volume, of soil, and soil-like materials that are finer than 1 in. particle size can also contain a maximum of 20 percent, by volume, of non-soil-like Category 2 and/or Category 4 materials that are not greater than 12 in. in greatest dimension. If the material is other than till or ash, it must also have at least 80 percent of its particles finer than a 1 in. ~~(25 mm)~~ particle size. If this latter criterion is not met, the material should be classified as a Category 2 material. These impacted materials are expected to be readily ~~compactible~~compactable using standard construction equipment.

Category 2 - Category 2 impacted materials are materials that can be transported, placed, spread, and compacted *en masse*. These materials can be spread in loose lifts of 21 in. ~~(533 mm)~~ ±3 in. ~~(25 mm)~~ thick and are moderately ~~compactible~~compactable under the action of equipment similar to the Caterpillar 826 landfill compactor or approved equal. Examples of these materials include broken-up concrete foundations or impacted soil mixed with broken-up concrete. This category also includes general building rubble and debris of irregularly shaped metals or other components of the superstructure or substructure with a maximum length of 10 ft ~~(3 m)~~ and a maximum thickness of 18 in. ~~(450 mm)~~ which can be transported, placed, spread, and compacted *en masse*.

Category 3 - Category 3 impacted materials are materials that must be individually handled and placed in the OSDF, and that are suitable for having Category 1 material placed

around and against them. These impacted materials have maximum cross-sectional dimension of no more than 4 ft~~. (1.2 m)~~, are shaped such that Category 1 material ~~to~~ can be compacted around and against them, and are essentially incompressible using standard compaction equipment. Examples of these materials include bundles of transite panels, and broken concrete foundation members that meet the physical criteria defined in Section 4.3 of this IMP Plan.

Category 4 - Category 4 impacted materials are high in organic content and/or very compressible. Examples of these materials are municipal solid wastes from the Solid Waste Landfill, and green waste from clearing, stripping, and grubbing operations around the FEMP.

Category 5 - Category 5 impacted materials are materials that require special handling due to their specific nature. Examples of these materials include double-bagged asbestos and sludges.

The categories given above shall be used by the ~~SubcontractorConstruction ContractorContractor~~ to categorize each load of impacted material to be brought to the OSDF for disposal. The ~~CM~~Construction Manager will use this categorization in establishing disposal limitations and instructions for each truck load of material destined for the OSDF.

5.3 Specific Impacted Materials

5.3.1 General

This section of the IMP Plan contains background information on the types and approximate quantities of specific impacted materials that may require special handling and/or placement activities. These impacted materials primarily consist of landfill waste, water treatment plant sludge, and demolition debris. The purpose of this section of the IMP Plan is to provide the ~~SubcontractorConstruction ContractorContractor~~ with a physical description of these specific materials.

5.3.2 Solid Waste Landfill

The Solid Waste Landfill is a rectangular disposal area of approximately 1 acre ~~(0.4 ha)~~ that has been inactive since 1986. A soil cover has been placed over the disposal area. A drainage ditch serving the northwest portion of the former production area is located in the northern portion of the Solid Waste Landfill. The volume of waste material in the landfill is estimated to be approximately 14,400 yd^3 ~~(11,000 m^3)~~.

The operational history of the Solid Waste Landfill is not well documented. It is thought that the landfill was organized with one to five individual waste disposal cells and an evaporation ~~pond which~~pond,

which also served as a surface-water management basin. Materials reportedly buried at the Solid Waste Landfill include non-burnable and nonradioactive solid waste~~d~~ generated on FEMP property, nonradioactive construction-related rubble, and double-bagged and bulk quantities of nonradioactive asbestos. Field investigation results, however, indicate that some process waste may have been placed in the landfill. The following wastes were encountered during a trenching investigation in 1992:

- burnable wastes - bagged trash and wood;
- potentially burnable wastes - respirator cartridges, asphalt roofing materials, medical wastes, fire hoses, and rubber hoses/belts; and
- non-burnable wastes - unidentified high-activity waste, medicine vials, bagged asbestos, ceramic tiles, possible magnesium fluoride, glass acid bottles, steel cables/cans, paint cans, and copper tubing.

5.3.3 Lime Sludge Ponds

The Lime Sludge Ponds are two unlined, rectangular ponds, each measuring approximately 125 by 225 ft~~. (38 x 69 m)~~. Wastes that were disposed in the Lime Sludge Ponds originated from water treatment plant operations, coal pile stormwater runoff, and boiler plant blowdown. Although this waste is from three distinct waste streams, the bulk of the slurry is lime sludge from the water treatment process. Over time, the solids in the slurry settled in the Lime Sludge Ponds and the remaining decant was pumped from the ponds. The lime sludge is, therefore, considered to be relatively homogenous.

The volume of sludge and berm material contained within the two lime sludge ponds is estimated to be approximately 16,500 yd^3 ~~(12,500 m^3)~~ of lime sludge and 5,600 yd^3 ~~(4,300 m^3)~~ of berm material making a total of 22,100 yd^3 ~~(17,100 m^3)~~ of material. The South Lime Sludge Pond is full and has been inactive since the mid-1960's~~; it is now overgrown with grasses and shrubs~~. The North Lime Sludge Pond is not currently active, but was in use as late as January 1995. The west side of the North Lime Sludge Pond is usually covered with 1 to 2 ft~~. (0.3 to 0.6 m)~~ of water, depending mainly on precipitation. The remaining area is dry and covered with sparse vegetation.

5.3.4 Building Debris

Debris from demolition of buildings in the FEMP former production area is expected to constitute the largest volume of impacted material for OSDF disposal after soil and soil-like material. The OU3 ROD indicates that impacted debris can be assigned to one of ten material categories. The OU3 ROD indicates that material from seven of these categories will be disposed in the OSDF; material from three other categories (C, F, and J) are to be dispositioned off-site (*i.e.*, expressly prohibited in total from on-site disposal), while a subset of a fourth category (D) cannot be disposed in the OSDF without first undergoing treatment (lead flashing). Description of the seven OU3 debris material categories resulting from

decontamination and dismantlement (D&D) of the former production and associated process facilities that can be disposed of in the OSDF are defined in Table 5-1.

5.3.5 Inactive Flyash Pile

The Inactive Flyash Pile is located approximately 2,000 ft ~~(610 m)~~ southwest of the former production area. The Inactive Flyash Pile received flyash and bottom ash from boiler plant operations starting in 1951. It has been inactive since the mid-1960s and is covered with soil and natural vegetation.

The total quantity of ash disposed in this area has been estimated at 43,600 yd^3 ~~(33,300 m^3)~~. Materials such as building rubble, concrete, asphalt, steel rebar, and asbestos-containing transite were also discarded in this area. These materials are visible at the surface along the Inactive Flyash Pile's western and southern edge.

5.3.6 South Field

The South Field disposal area is located approximately 2,000 ft ~~(610 m)~~ southwest of the former production area and covers approximately 11 ac ~~(4.5 ha)~~. The South Field was used as a burial site for construction rubble and as a disposal area for soil excavated from the former production area. Disposal activity ceased during the mid 1960s. Soil, building rubble, concrete, asphalt, flyash, and steel rebar were encountered during sampling operations within the soil fill in the South Field. The estimated volume of fill disposed in the South Field is approximately 120,000 yd^3 ~~(91,800 m^3)~~.

5.3.7 Active Flyash Pile

The Active Flyash Pile disposal area is located about 3,000 ft ~~(914 m)~~ southwest of the former production area and east of the South Field. Past operations at the FEMP have relied on boiler-produced steam. Ash waste is comprised primarily (70 percent) of bottom ash collected below the boilers. Precipitator ash collected from pollution control devices and flyash removed from the middle levels of the boiler comprise the remaining 30 percent of the ash waste. Until recently, ash waste has been loaded into dump trucks and transported to the Active Flyash Pile disposal area. Estimates established indicate that approximately 65,000 yd^3 ~~(49,700 m^3)~~ of ash have been disposed in this area. The pile has a surface area of approximately 4 ac ~~(1.6 ha)~~.

Table 5-1
OU3 MATERIAL CATEGORIES/DESCRIPTIONS

Category A Accessible Metals	Category B Inaccessible Metals	Category D Painted Light-Gauge Metals	Category E Concrete	Category G Non-Regulated ACM	Category H Regulated ACM	Category I Miscellaneous Materials
Structural & miscellaneous steel	•Doors •Conduit/wire/ cable tray •Electrical wiring & fixtures •Electrical transformers •Miscellaneous electrical items •HVAC equipment •Material handling equipment •Process equipment •Miscellaneous equipment •Piping	•Ductwork •Louvers •Metal wall & roof panels	•Asphalt •Slabs •Columns •Beams •Foundations •Walls •Masonry •Clay piping	•Ceiling demolition •Feeder cable •Fire brick •Floor tile •Transite wall & roof panels	•Ductwork insulation •Piping insulation •Personal protective equipment •Copper scrap metal pile	•PVC conduit •Basin liners •Fabric •Drywall •Building insulation •Miscellaneous debris •Personal protective equipment •PVC piping •Roofing build-up •Process trailers •Non-process trailers •Windows •Wood

SOURCE: Table 4-2, OU3 Material Categories/Description, *OU3 ROD* [DOE, 1996b].
NOTE: Only those OU3 material categories allowed for on-site disposal per the *OU3 ROD* are presented.

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6.0 GENERAL PLACEMENT PROCEDURES

6.1 Introduction

This section of the IMP Plan describes the general procedures that the ~~SubcontractorConstruction ContractorContractor~~ shall follow for placement of impacted material in the OSDF. Specific procedures for placement of Category 1 materials (soils and soil-like materials) are presented in Section 7.0 of this IMP Plan. Specific placement procedures for Category 2 through 5 materials (non soil-like materials) are addressed in Section 8.0 of this IMP Plan.

6.2 Contractor's Safe Work Plan

The Contractor shall be responsible for preparing a Contractor's Safe Work Plan (SWP) defining placement methods, and safety controls, and other appropriate safety standards that meets all health and safety requirements identified in the FEMP Project Specific Health and Safety Requirements Matrix (PSHSRM) and Technical Specifications. In addition, FEMP H&S personnel will perform periodic audits of the Contractor to ensure compliance. Personnel will have stop-work authority (in the event of threat to worker and/or public safety) until the proper corrective action is taken. The H&S Officer assigned to the OSDF project will be the single point of contact for all safety, industrial hygiene, fire protection, and radiological issues or concerns.

In addition to H&S personnel assigned to the project, the Contractor shall be required to provide an H&S field representative who shall be responsible for the Contractor's compliance with all H&S requirements. The Contractor shall be required to report all safety concerns and incidents to the H&S Officer.

Radiological technician(s) will also be assigned to the OSDF project. In conjunction with the H&S Officer assigned to the project, the radiological technician(s) will help to ensure radiological compliance throughout the project. Radiological compliance includes the radiological monitoring of equipment and materials entering and leaving the job site, radiological monitoring of soil during excavations to help ensure proper segregation, storage, or disposition; radiation work permit compliance, routine inspection, monitoring, and recording of area radiation detection monitors, and radiological monitoring of personnel, if necessary. The PSHSRM, Technical Specifications, and other appropriate safety standards will be the basis for the required monitoring and will identify the action levels that will ensure personnel safety by limiting exposure.

6.3 Manifesting

The Waste Acceptance Organization (WAO) ~~remediation project originating the impacted material~~ shall prepare an impacted material transportation "manifest" for each load of material to be transported to the OSDF. The purpose of the "manifest" is to provide a tracking mechanism for impacted material from

the remediation project of origin to placement in the OSDF. ~~The~~ WAO ~~originating remediation project shall~~ will be responsible for providing the required information on the "manifest" as detailed in Section 10.2 of this IMP Plan.

Upon entering the OSDF battery limits, WAO will check that the impacted materials are accompanied by a "manifest", if a special concerns form is attached, and that the hauling unit has been properly identified as to the impacted material category, ~~A visual inspection of the impacted material will be performed upon entering the OSDF battery limit by WAO~~ in accordance with Section A.3 of Appendix A of this IMP Plan. WAO will review the "manifest" for completeness prior to releasing the hauling unit to the cell for placement and inform OSDF personnel of special concerns. The CQC Consultant will be required to verify accuracy and sign the "manifest" at the end of the day following placement and retain a copy. The CQC Consultant verifies accuracy of manifest and placement location based on field notes from ~~radio~~ communication ~~coordination~~ with WAO who receives impacted material and signs the manifest at the OSDF battery limit. The ~~Subcontractor~~Contractor shall fully comply with these quality control activities and account for them in its planning and scheduling.

After trucks/containers are cleared at the OSDF battery limit by WAO, the ~~Subcontractor~~Contractor shall route the impacted material to a location within the OSDF (*e.g.*, the active face, a stockpile area, or designated grid~~an area where further screening will take place~~) for disposal. The ~~Subcontractor~~~~Construction Contractor~~Contractor ~~will~~ shall be provided with flexibility in routing trucks/containers for efficient operations. However, the ~~CM~~Construction Manager will provide the ~~Subcontractor~~~~Construction Contractor~~Contractor with specific instructions for routing of impacted materials in Categories 2 through 5. The ~~Subcontractor~~~~Construction Contractor~~Contractor shall be responsible for following these instructions provided by the Construction Manager.

The placement and compaction procedure to be used by the ~~Subcontractor~~~~Construction Contractor~~Contractor for each load of impacted material shall be based on the impacted material category. ~~Placement and compaction equipment appropriate for the impacted material type or category will be used to achieve stability under static and earthquake loading conditions and to minimize differential settlement.~~ Placement and compaction procedures for the five material categories listed in Section 5.2 of this IMP Plan are presented in Sections 7.0 and 8.0 of this plan.

6.4 Protection of Facilities

Impacted material placement activities shall be conducted in a manner that protects and maintains the integrity of the OSDF liner system, leachate management system, ~~and~~ final cover system, and all OSDF ancillary facilities and equipment. Impacted material placement activities shall not commence in a cell until liner system construction has been completed in accordance with the Contract Documents and only after cell construction has been certified in accordance with the requirements of the *OSDF CQA Plan* and all other ~~sub~~contract requirements.

6.5 Placement Oversight and Quality Assurance

Impacted material placement for all categories of material shall be conducted under the direct oversight of ~~Subcontractor~~Contractor personnel versed in all aspects of this plan and having qualifications meeting the requirements of the *OSDF CQA Plan*. The ~~Subcontractor~~Contractor shall provide on-the-ground spotters who shall observe each load that is placed to monitor that the work is performed in compliance with the requirements of this plan. The ~~Subcontractor~~Contractor shall be assisted by surveyors and quality control personnel, as required, to control lift thickness and grades, record the coordinates of the impacted material placement, and perform other necessary functions.

The ~~Subcontractor~~Contractor shall be aware that monitoring of the placement ~~and monitoring~~ and performance testing of impacted material for specified compaction in the OSDF will be performed by the CQC Consultant in accordance with the requirements of the Contract Documents. The Contractor shall also be aware that the CQC Consultant will perform required testing prior to Contractor placing additional lifts above the area being tested.

6.6 Conformance with OSDF Specifications

The ~~Subcontractor~~Contractor shall comply with the ~~project~~ Technical specifications, which shall be used in conjunction with this plan, and these shall be referenced for specific details regarding the labor, material, and supervision at the OSDF.

6.7 Standard Operations Procedures

6.7.1 General

The ~~CM~~Construction Manager will have the authority to halt impacted material placement operations if placement operations are not in accordance with the project specifications and this IMP Plan.

Salvaging of materials being deposited in the OSDF is strictly prohibited. ~~Fluor Daniel Fernald (FDF~~Fluor Fernald, Inc. ~~)~~ personnel will examine, on a random basis, trucks leaving the OSDF for salvaged materials.

Placement of impacted materials shall only occur during daylight hours unless specifically approved by the ~~CM~~Construction Manager. The last unit load of waste typically will not be accepted less than 45 minutes prior to sundown.

Impacted material placement activities shall cease for the winter when the ~~CM~~Construction Manager determines that satisfactory compaction of impacted material and/or safe working conditions are no longer possible due to weather conditions.

6.7.2 Inclement Weather Operations

Placement of impacted material in the OSDF shall cease when the average wind speed measured at or near the working face of the active OSDF cell is in excess of 20 mph ~~(33 kph)~~ or when wind gusts exceed 30 mph ~~(50 kph)~~ for more than 1 minute in the previous 60 minutes. ~~The CQC Consultant or FDF~~Fluor Fernald, Inc., ~~The Construction Manager~~ will provide and maintain a weather station at the FEMP site ~~or near the active working face of the OSDF~~ to provide a continuous record of wind speed and temperature during the working day; the station will also be equipped with a rain gauge. The ~~CM~~Construction Manager will determine when unacceptable wind conditions exist.

Impacted material shall not be placed during periods of significant precipitation. Significant precipitation will be determined by the ~~CM~~Construction Manager in consultation with the CQC Consultant.

The ~~Subcontractor~~Contractor may prepare an inclement weather deck within the OSDF active cell. The purpose of this deck is to provide an area where placement activities can occur when precipitation has left other areas of the OSDF unsuitable (due to mud or soft surfaces) for impacted materials placement activities. The inclement weather deck may be used for placement of Category 2 materials (*en masse* placement).

Impacted material placement activities shall not restart after an inclement weather shutdown until verbal approval to do so is provided by the ~~CM~~Construction Manager. Factors that will be considered by the ~~CM~~Construction Manager in restarting operations include:

- weather forecasts;
- condition of haul roads;
- if operations could lead to additional erosion of impacted materials;
- ability to decontaminate the impacted material hauling trucks;
- nature of impacted materials to be placed; and
- conditions within the OSDF.

6.7.3 As-Placed ~~Plans~~Records

The ~~Subcontractor~~Contractor shall be aware that the CQC Consultant and Fluor Fernald, Inc. will maintain ~~plans~~ records showing the locations of placement of all categories of impacted materials. The ~~plans~~ records will provide locations of the impacted material placement within the cell by grid, lift, and Category. ~~the OSDF cell, grid and lift alphanumeric identifier for each load of Category 2 through 5~~

~~material placed in the OSDF (referenced to the load manifest number), the category of material in the load, and other information.~~ The ~~CM~~Construction Manager ~~(this person is responsible for contractual purposes; see next paragraph for actual operations)~~ will use these ~~plans~~ records to decide where subsequent loads of Category 2 through 5 ~~waste~~ impacted material can be placed. For example, the ~~Subcontractor~~Contractor ~~will~~ shall not be allowed to ~~compact~~ place multiple lifts of Category 4 ~~(organic)~~ impacted material on top of each other so as to avoid creating a compressible zone in the OSDF that could induce future differential settlements in the OSDF final cover system.

As an example, if a load of double-bagged asbestos comes to the OSDF for disposal, the Construction Manager ~~construction engineer~~ will first consult the as-placed records or plans to determine a suitable place to dig a trench for disposal (as required by Section 8.6.3 of this Plan). Consultation of the as-placed records or plans will ensure that placement restrictions are followed and that the trench for asbestos disposal will not be excavated into anything except Category 1 material. Following identification of a suitable location, the trench ~~will~~ shall be excavated, the double-bagged asbestos placed, and the trench backfilled and compacted according to requirements presented in this Plan. The ~~construction engineer~~Contractor ~~will~~ shall then note the location (grid and elevation), depth, and length of the trench ~~on the as-placed plans~~and submit to Construction Manager.

6.8 Spreading and Grading

The ~~Subcontractor~~Contractor shall be aware that an important objective of this IMP Plan is to achieve uniform settlement of the impacted materials placed within the OSDF and to limit the total magnitude of such settlement. Thus, the ~~Subcontractor~~Contractor shall, as much as possible, maintain homogeneity of the physical characteristics of the impacted materials placed across horizons of the OSDF. The ~~Subcontractor~~Contractor will be directed by the ~~CM~~Construction Manager to route impacted materials in such a fashion that each lift is relatively uniform over its lateral extent. To the extent possible, compressible materials (such as green wastes, double-bagged asbestos, and Solid Waste Landfill materials) shall not be piled vertically but shall be spread laterally (except for double bagged asbestos, which shall be handled in accordance with Section 8.6.3). Incompressible materials shall not be placed directly above other incompressible items without appropriate intervening ~~lifts~~ horizons of Category 1 materials. Materials of higher permeability (such as demolition debris) shall not be placed directly above other high permeability materials without appropriate intervening ~~lifts~~ horizons of lower permeability Category 1 materials.

Impacted material placement shall generally proceed from east to west and north to south within each OSDF cell. Vertical slope of an existing grid shall be benched prior to placement of impacted material in an adjacent grid. Maximum compacted lift thicknesses for soil, soil-like-materials, and other impacted materials shall be 1.0 ft. ~~(0.3 m)~~, except as provided in Section 8.0 of this IMP Plan. Each lift of topmost select impacted material shall be controlled to line and grade such that cell perimeter contours are within 0.2 ft. ~~(60 mm)~~ of the design grade for the bottom of the contouring layer.

Figure 6-1 illustrates the sequencing of impacted material placement and slope development within the first OSDF cell, looking west to east. Select impacted material layers on the cell base and sideslopes shall be advanced at least 2 ft~~. (0.6 m)~~ ahead of general impacted material layers. Similarly, Figure 6-2 illustrates the sequencing of impacted material placement and slope development in subsequent cells.

6.9 Compaction

Each lift of Category 1 impacted material placed in the OSDF shall be compacted by the ~~Subcontractor~~Contractor to the minimum criteria given in Sections 7.0 and 8.0 of this IMP Plan. Monitoring and testing activities are described in Appendix A of this IMP Plan.

6.10 Surface Conditions and Drainage

On a daily basis, the ~~Subcontractor~~Contractor shall maintain the impacted material surface in the active OSDF cells to limit fugitive dust and control and ~~detain~~ retain impacted runoff. The ~~Subcontractor~~Contractor shall establish ~~stormwater~~ surface-water runoff routing in each active cell to convey runoff to the impacted runoff catchment area within the cell. The ~~Subcontractor~~Contractor shall use smooth rolling to seal the surface, silt fences, and other means to limit impacted material erosion. At the end of each working day, the uppermost layer of impacted material shall be sloped at a minimum grade of ~~2~~ 0.5 percent ~~to the~~ toward the impacted runoff catchment ~~basin~~ area. The southern impacted material face and faces adjacent to the impacted runoff catchment area shall be constructed to a slope not steeper than 3.5H:1V (horizontal:vertical). The ~~Subcontractor~~Contractor shall perform temporary erosion control requirements in accordance with the *OSDF SWMEC Plan*.

At the end of each working day, the ~~Subcontractor~~~~Construction Contractor~~Contractor shall prepare exposed surfaces of soil and soil like Category 1 and Category 2 material in a manner that satisfactorily controls the generation of fugitive dust. Preparation may include smooth rolling to seal the surface, application of water, application of crusting agents, or covering with geosynthetics. Fugitive dust control actions shall be sufficient to achieve compliance with the BAT determination for remedial construction activities on the FEMP site. At all times, the ~~Subcontractor~~~~Construction Contractor~~Contractor shall be prepared to implement the measures mentioned in this paragraph to reduce fugitive dust based on the ~~Subcontractor~~~~Construction Contractor~~Contractor's approved fugitive dust control plan or as directed by the ~~CM~~Construction Manager.

The following daily surface conditions ~~will~~ shall apply for Categories 2, 3, and 4:

1. Category 2 (D&D) debris not containing soil like material ~~will~~ shall be covered with Category 1 material no later than 5 ~~work~~ calendar days, weather permitting, after initial placement of the Category 2 D&D debris. ~~material.~~

2. Category 3 material ~~will~~ shall not require a daily cover but ~~will~~ shall be covered with Category 1 material on a continuous basis once the Category 3 grid is full. The Contractor shall ~~make every effort to~~ cover the Category 3 material within 5 calendar ~~work~~ days, weather permitting. Banded transite panels that have been "locked down" to mitigate friable asbestos ~~will~~ shall be inspected during placement and daily until covered with soil to ensure the "lock down" integrity is maintained. If exposed friable asbestos is observed, additional "lock down" ~~will~~ shall be applied to the suspected area.

3. Category 4 material ~~will~~ shall require a cover of approximately 12 in. ~~(0.3 m)~~ of Category 1 material, which ~~will~~ shall be sealed with a smooth drum roller daily.

Impacted material slopes shall be protected from excessive material erosion through the use of silt fences spaced at a maximum vertical spacing of 10 ft~~.~~ ~~(3 m)~~ as shown in Figure 6-3. Cell perimeter ditches which contribute runoff to the catchment areas, shall be protected by the use of straw bales, or other approved methods, placed in accordance with Ohio Department of Natural Resources (ODNR) Rainwater and Land Development Standards to impede velocity of runoff. The base of the slope of impacted material, along the perimeter of the impacted runoff catchment area in the cell shall be lined with straw bales to limit the washing of fines into the cell impacted runoff ~~detention~~ catchment area. The impacted runoff catchment area at the southwest corner of each cell has been sized to provide adequate capacity for the detention of the impacted runoff from the 25-year, 24-hour storm event, with 6 in. ~~(150 mm)~~ of freeboard. The catchment area in a current active cell shall be fully maintained until the next active, but adjacent, cell becomes operational and the ~~Sube~~Contractor has routed all impacted runoff from the current active cell such that impacted runoff from the 25-year, 24-hour storm event will always be contained within the cells. Specifically, the catchment area in each active cell shall remain open until: (i) the catchment area in the adjacent downgradient cell is constructed and operational; and (ii) the final cover system for the adjacent upgradient cell is constructed to such an extent that the non-impacted surface water runoff is directed to the OSDF surface water management system. An impacted runoff catchment area in each cell is designed to contain runoff from the drainage areas from two cells.

Runoff in the impacted runoff catchment area may be pumped into the FEMP former production area stormwater management system or be allowed to percolate through the granular protection layer into the underlying cell leachate collection system. Requirements for maintaining unimpeded infiltration from the impacted runoff catchment area into the leachate collection system are given in Section 11.2 of the IMP Plan and the *Systems Plan*.

6.11 Materials Staging

During the active construction season, March through December, Category 2 material that may be staged in the cell(s) ~~so material~~ is readily available for building cell roads and ramps. Only material for road and ramp construction may be staged (e.g., gravel, asphalt, concrete, rock and similar aggregate materials). This Category 2 material shall be staged in one grid per cell to a maximum height of 5 ~~feet~~ ft.

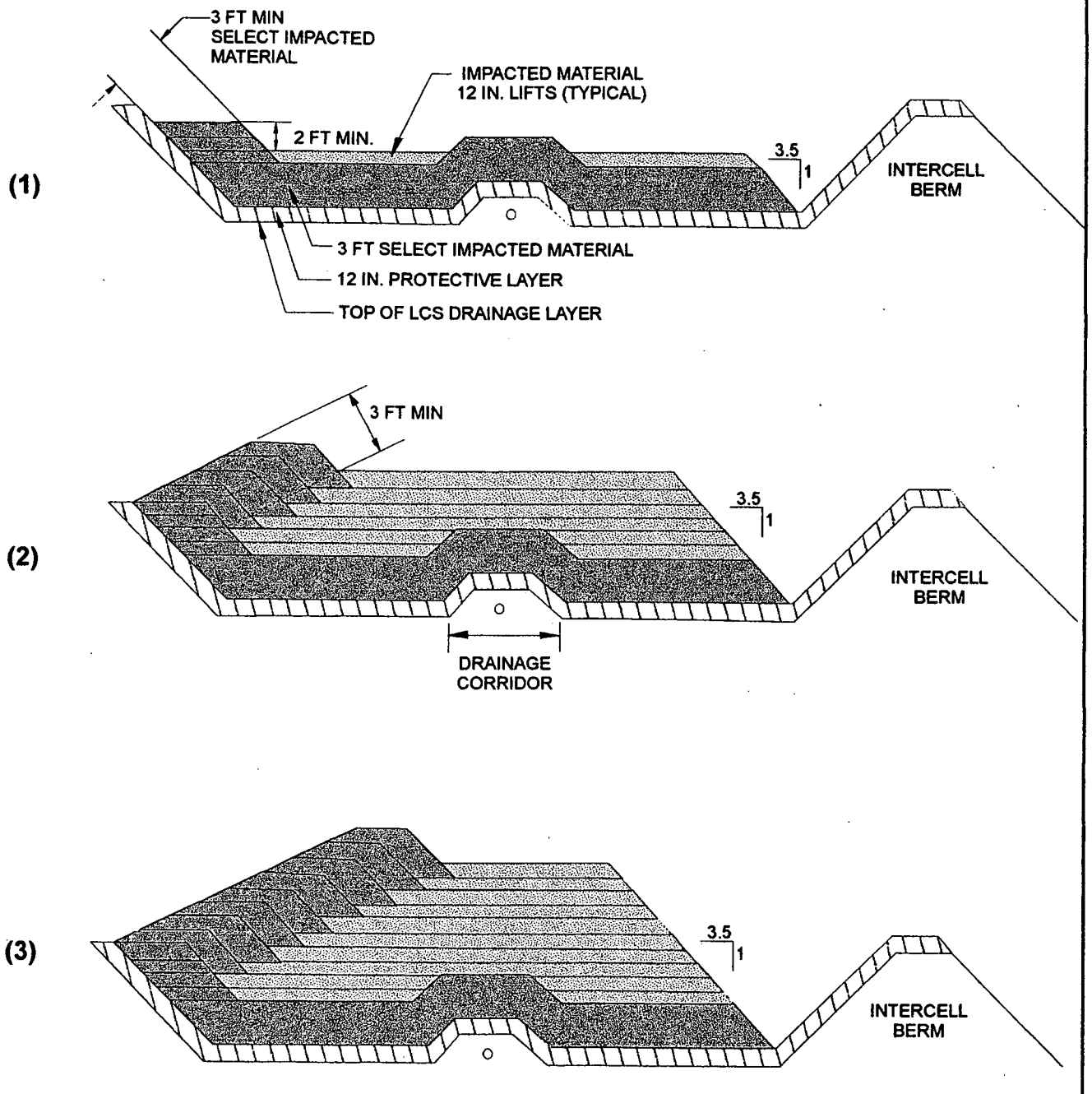
Grids in the cells for staging of this Category 2 material ~~will~~ shall be identified and inspected weekly by the Contractor to assure that the staging configuration has remained the same.

Category 1 material may be temporarily stockpiled in active cells. Stockpiling within the cell will help to achieve optimization of Category 1 material. Stockpiling is warranted~~,~~ when adequate debris is not available for placement, or when Category 1 material is not available for debris cover, for example.

The ~~Construction Contractor~~Contractor shall request and propose location(s) for the Category 1 material stockpile on a written form that will be approved by the Construction Manager. The form will include the proposed location(s) for the stockpiles, placement date, starting and proposed finished elevations for the stockpiles, and estimated volume(s). Approved stockpile forms will be transmitted to the ~~regulating~~ regulatory agencies by Fluor Fernald, Inc. A maximum of two different locations shall be used for stockpiles at one time and the stockpiles shall cover a maximum area of four grids. Total quantity of stockpiles at one time shall not exceed 6,000 cubic yards ~~(4,500 cubic meters)~~. Each stockpile shall be separated by a 2-ft ~~(0.6 m)~~ high soil berm and conform to the requirements of ~~the~~ this IMP Plan. Maximum pile height shall be limited to 10 ~~feet~~ ft ~~(3 m)~~ and sideslopes limited to 4H:1V unless approved in writing by the Construction Manager. A stockpile shall be depleted and placed in a grid within 30 days from the commencement of constructing the stockpile.

Stockpiled areas within the cell shall be surveyed prior to beginning of ~~hauling and~~ stockpiling activities. Slopes (perimeter berm, intercell berm or impacted material working face) shall not be used as the bottom base of stockpiles (safety concerns and IMP Plan non-conformance). No lifts of impacted material shall be placed in a spent stockpile area until a survey showing depletion of the stockpile is completed and reviewed. Approval to place lifts shall be in accordance with ~~the~~ this IMP Plan. Disturbed areas may require re-compaction and re-testing, as determined by the CQC Consultant. Stockpiles shall be removed prior to ~~at~~ the end of each construction season.

IMPACTED MATERIAL PLACEMENT SEQUENCE - CELL1

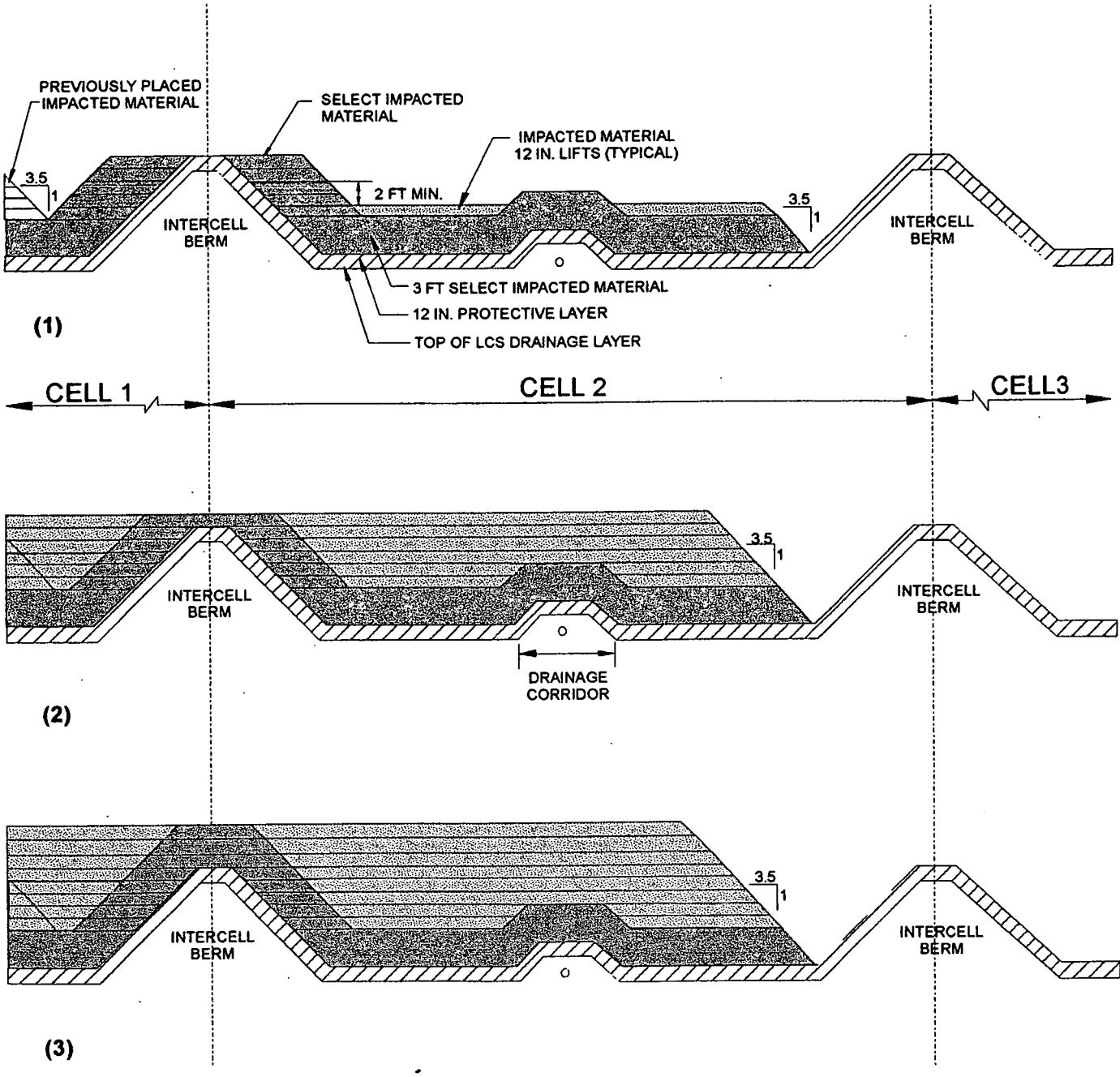


NOTE: THIS FIGURE FOR ILLUSTRATION ONLY. CONSTRUCTION CONTRACTOR SHALL PLACE IMPACTED MATERIAL LAYERS TO THE LIMITS SHOWN ON CONSTRUCTION DRAWINGS

GEOSYNTEC CONSULTANTS
ATLANTA, GEORGIA

FIGURE NO.	6 - 1
PROJECT NO.	GQ1001-03
DOCUMENT NO.	F9620002.2B
FILE NO.	FIGS.cdr

IMPACTED MATERIAL PLACEMENT SEQUENCE - INTERIOR CELLS



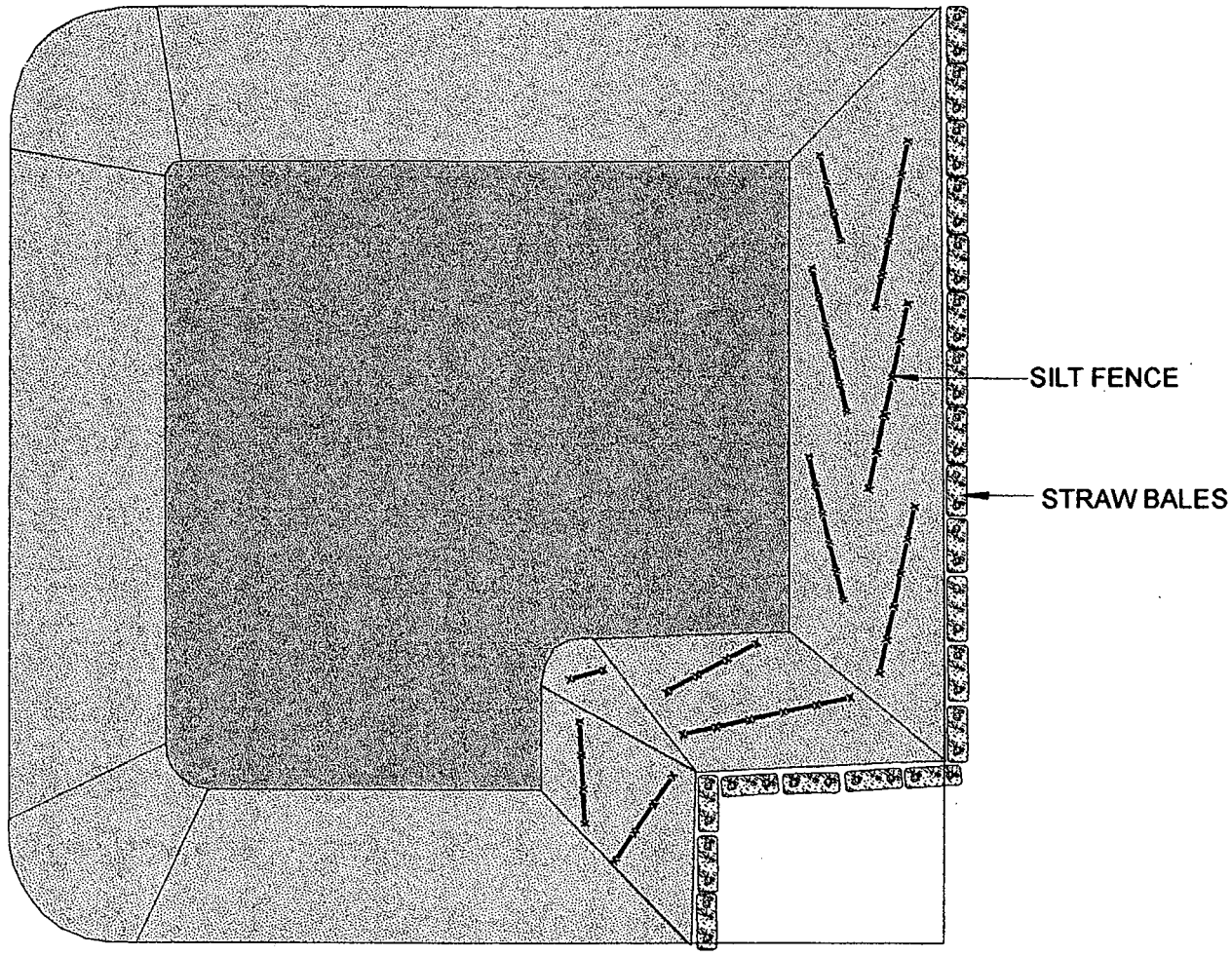
NOTE: THIS FIGURE FOR ILLUSTRATION ONLY. CONSTRUCTION CONTRACTOR SHALL PLACE IMPACTED MATERIAL LAYERS TO THE LIMITS SHOWN ON CONSTRUCTION DRAWINGS

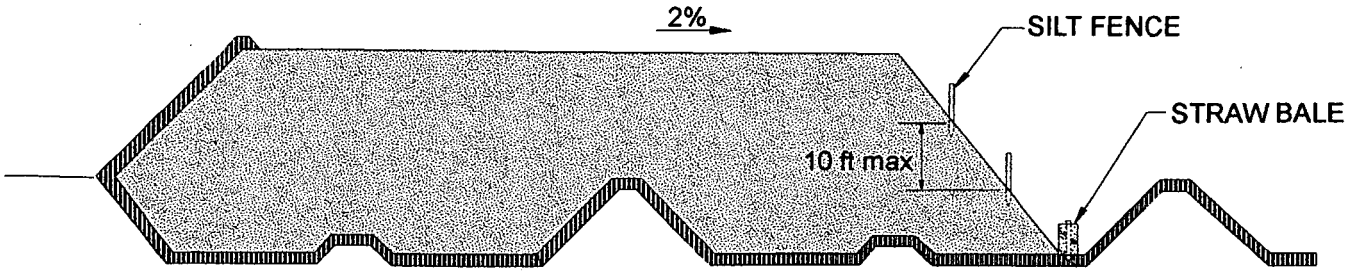
GEOSYNTEC CONSULTANTS
ATLANTA, GEORGIA

FIGURE NO.	6 - 2
PROJECT NO.	GQ1001-03
DOCUMENT NO.	F9620002.2B
FILE NO.	FIGS.cdr

2981

IMPACTED MATERIAL
EROSION PROTECTION AND SEDIMENT CONTROL





NOTE: THIS FIGURE FOR ILLUSTRATION ONLY. CONSTRUCTION CONTRACTOR SHALL PLACE IMPACTED MATERIAL LAYERS TO THE LIMITS SHOWN ON CONSTRUCTION DRAWINGS

GEOSYNTEC CONSULTANTS
ATLANTA, GEORGIA

FIGURE NO.	6 - 3
PROJECT NO.	GQ1001-03
DOCUMENT NO.	F9620002.2B
FILE NO.	FIGS.cdr

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7.0 SOILS AND SOIL-LIKE MATERIAL PLACEMENT

7.1 General

Approximately 85 percent of the impacted material volume to be placed in the OSDF will be Category 1 material (soil and soil-like). Category 1 material may be further divided into: (i) protective and contouring layer ~~soils~~materials; (ii) select impacted material layer ~~soils~~materials; and (iii) general soil and soil-like material. The placement of this material is expected to be accomplished using similar methods for spreading, grading, and compaction associated with earthwork for OSDF construction. This section of the IMP Plan addresses those activities associated with the placement and compaction of these soils and soil-like Category 1 materials within the OSDF.

7.2 Protective and Contouring Layers

7.2.1 Placement Procedures

As indicated in Section 3.2 of this IMP Plan, the protective ~~and contouring layers~~ layer shall consist of on-site impacted till or flyash or non-impacted till having a maximum particle size not exceeding 3 in. ~~(75 mm)~~ (ASTM C 136 or D 422). The contouring layer shall consist of non-impacted till having a maximum particle size not exceeding ~~3~~4 in. (ASTM C 136 or D 422). An impacted soil material may be used in contouring layer construction if approved by the Construction Manager. The protective and contouring layers shall also meet the requirements of the ~~construction~~Technical Sspecifications. Topsoil shall not be used for either the protective or contouring layers. Contractor shall submit plans to construct protective and contouring layers as specified in the Technical Specifications.

The protective layer shall be placed in a 12- to 15-in. ~~(300 to 380 mm)~~ thick loose lift. The contouring layer shall be placed in two loose lifts in accordance with the Technical Specifications.~~,~~ ~~each between 6 to 8 in. (150 to 200 mm) thick.~~

7.2.2 Compaction Procedures

To protect the underlying liner system from construction-induced damage, the protective layer shall not be compacted with conventional compaction equipment but rather shall be tracked with a medium-sized bulldozer with ground pressure less than 5 psi.~~such as a Caterpillar D-5 (or lighter).~~ The protective layer shall be constructed in conformance with the Technical~~construction~~ Sspecifications.

The contouring layer shall be compacted to at least 95 percent of the standard Proctor maximum dry density (ASTM D 698). A standard Proctor maximum dry density and optimum moisture content will be established by the CQC Consultant for ~~impacted or~~ non-impacted ~~Category 1 impacted or clean~~ material used for ~~in~~ the contouring layer. These material types will be composited prior to establishing ~~these~~

compaction parameters. These parameters will be obtained by the CQC Consultant in an on-site geotechnical laboratory established for OSDF construction. ~~Each lift of t~~~~The contouring layer shall be compacted by multiple passes of a self-propelled static pad-foot compactor (*i.e.*, a Caterpillar 815C, or equivalent). It is anticipated that the required compaction moisture content will be within ±3 percentage points of the material's optimum moisture content. Specific requirements for compaction moisture content will be established by the CM during construction.~~ The contouring layer shall be constructed in conformance with the Technical~~construction~~ S~~s~~pecifications~~. and may be Category 1 impacted or clean soil.~~

7.3 Select Impacted Material Layers

7.3.1 Placement Procedures

As indicated in Section 3.2 of this IMP Plan, select impacted material shall have a maximum particle size not exceeding 6 in. ~~(150 mm)~~ (ASTM C 136); for material other than impacted till, at least 80 percent of the material shall be finer than a 1 in. ~~(25 mm)~~ particle size. Impacted topsoil may be included in the select impacted material layer but it should not be placed in quantities that deleteriously affect compaction.

The select impacted material layer at the base of the landfill shall be placed in 12-in. to 15-in. ~~(300 to 380 mm)~~ thick loose lifts and compacted to a minimum total thickness of 3 ft~~.~~ ~~(0.9 m)~~ (*i.e.*, three lifts of roughly equal thickness). The thickness of select impacted material over the protective layer may be decreased to 2 ft ~~(0.6 m)~~ upon approval by the Construction Manager, if the first lift to be placed over the select impacted material is ~~either~~ Category 1 ~~or category 2~~ impacted materials. The select impacted material layer below the final cover system shall be placed in a similar manner to a minimum total thickness of 3 ft~~.~~ ~~(0.9 m)~~ measured perpendicular to the exterior slope (see Figure 6-1).

7.3.2 Compaction Procedures

A standard Proctor (ASTM D 698) maximum dry density and optimum moisture content will be established for impacted material used in the select impacted material layers. These material types will be composited prior to establishing ~~these~~ compaction parameters. These parameters will be obtained by the CQC Consultant in an on-site geotechnical laboratory established for OSDF construction. Each lift of select impacted material shall be compacted to 85 percent of the standard Proctor maximum dry density if adjacent to the protective layer and to 90 percent of the standard Proctor maximum dry density if adjacent to the contouring layer ~~is~~in the final cover system. It is anticipated that the compaction moisture content will be within ±3 percentage points of the optimum moisture content. Specific requirements for compaction moisture content will be established by the ~~CM~~Construction Manager during construction.

7.4 Category 1~~General~~ Soil and Soil-Like Material

7.4.1 Placement Procedures

Category 1 (soil and soil-like) material shall be placed in 12-in. to 15-in. ~~(300 to 380 mm)~~ thick loose lifts and then compacted as indicated below. Prior to placement of a new lift of Category 1 material, the previous lift shall be ~~disked or~~ tracked to leave the surface in a rough condition. The purpose of this preparation is to promote adhesion of the previous and new lifts and to mitigate preferential seepage pathways forming between adjacent lifts.

7.4.2 Compaction Procedures

Category 1 (soil and soil-like) material shall be compacted to at least 85 percent of the maximum dry density ~~compaction~~ based on the standard Proctor compaction test, with a running average of at least 90 percent based on the previous 10 tests ~~samples~~. The CQC Consultant will establish the standard Proctor maximum dry density (ASTM D 698) and optimum moisture content for Category 1 material requiring compaction. These materials will be composited prior to establishing these parameters. These parameters will be obtained by the CQC Consultant in an on-site geotechnical laboratory established for OSDF construction. It is anticipated that the compaction moisture content of the Category 1 material will be within ±3 percentage points of the material's optimum moisture content. Specific requirements for compaction moisture content will be established by the ~~CM~~Construction Manager during construction. These requirements will take into account the workability of the material, the required shear strength to obtain adequate levels of OSDF stability, moisture contents needed to achieve dust and other fugitive dust control, and material traffic ability.

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8.0 SPECIAL PLACEMENT REQUIREMENTS

8.1 Introduction

This IMP Plan requires special procedures for the placement of the non-soil-like materials (Categories 2 through 5). The non-soil-like materials consist primarily of impacted materials from the Solid Waste Landfill, the Lime Sludge Ponds, and impacted debris resulting from demolition of structures within the FEMP former production area. The impacted debris consists primarily of building superstructure (*i.e.*, steel, masonry, transite, and other finish components), concrete floor slabs, and building substructure (*i.e.*, concrete footings, pads, and other components).

8.2 Location Recording and Surveying

The ~~Subcontractor~~Contractor shall identify the locations of placement of each ~~zone or~~ horizon of ~~Categories~~ Category 2 through 5 impacted material as it is placed in the OSDF. For each ~~zone or~~ horizon ~~or other placement unit,~~ the ~~Subcontractor~~Contractor shall establish the horizontal location within 100 ft~~.~~ ~~(30 m)~~ gridlines and the vertical location by lift. The ~~Subcontractor~~Contractor shall survey the ~~surface of~~ impacted material in accordance with the Technical Specifications. ~~compacted in place on a 100 ft. by 100 ft. (30 m by 30 m) grid after each week's placement activities. This survey will locate the grid corners to facilitate testing and record keeping. The coordinates used for this survey shall be with respect to the permanent coordinate system established for the OSDF.~~ Where appropriate, sketches of ~~disposal~~ placement of Category ~~3~~ 2 through 5 materials should be provided by the Contractor to show the general orientation and layout of individual and special items.

The ~~Subcontractor~~Contractor shall maintain the grid markers around the perimeter of the cell(s) receiving impacted material. The grid markers shall be visible from the working face. These grid markers are to be placed to a 1 ft~~.~~ ~~(0.3 m)~~ horizontal tolerance.

8.3 Category 2 Material (*En Masse* Placement)

8.3.1 Placement Procedures

Materials conforming to the Category 2 (*en masse* placement) definition shall be placed in the OSDF in loose lifts not exceeding 21 in. ~~(533 mm)~~ ± 3 in. ~~(76 mm)~~ in thickness. The ±3 in. ~~(76 mm)~~ tolerance is to allow for the occasional piece of rebar, structural steel, or other material that may protrude from the material placed and material that cannot be readily removed or replaced within the 21 in. ~~(533 mm)~~ limit. Prior to placement of a lift of Category 2 material, the placement grid ~~unit~~ shall be designated such that the grid ~~unit~~ can be isolated horizontally on all sides with a minimum of 10 ft~~.~~ ~~(3 m)~~ of Category 1 material. Category 2 material shall then be placed within the designated placement grid ~~unit~~ to a loose thickness of not more than 21 in. ~~(533 mm)~~ ±3 in. ~~(76 mm)~~. Initial compaction shall be accomplished as the material is spread by tracking with a bulldozer of a minimum total weight of 50,000 lbs

~~(220 kN)~~ producing a ground pressure of at least 10 psi ~~(70 kPa)~~ or with a landfill compactor (e.g., Caterpillar 826, or approved equal). After spreading and initial compaction, Category 1 material (of a granular nature when available) shall be spread over the Category 2 material to bring the layer thickness to approximately 24 in. ~~(610 mm)~~. Prior to placement of a second lift of Category 2 material, Category 1 material shall be constructed at the perimeter of Category 2 material to the height of the Category 2 material and to a width of approximately 10 ft ~~(3 m)~~. The Category 1 material shall be placed in 12 to 15 inch thick loose lifts as described in Section 7.4 of this IMP Plan.

As Category 2 material is expected to be less compressible than the majority of the materials contained in the OSDF, the material should be spread laterally prior to placing the material vertically above other Category 2 material. However, as it is also expected to be more permeable than other OSDF material, Category 2 material shall not be spread laterally more than 100 ft~~.~~ ~~(30 m)~~. In all cases, Category 2 material is to be surrounded in the horizontal directions by at least 10 ft~~.~~ ~~(3 m)~~ of less permeable Category 1 material. This will reduce the potential for significant lateral migration of leachate. Not more than one lift of Category 2 material shall be placed on top of another lift of Category 2 material without at least ~~a~~ the required minimum 4 ft ~~(1.2 m)~~ thickness of the intervening horizon of Category 1 material.

The ~~SubcontractorConstruction ContractorContractor~~ ~~should~~ shall mix Category 1 material as much as practicable with the Category 2 material during excavation and placement activities. The objective of this mixing is to fill voids within the Category 2 material, increase the density of the material placed in the OSDF, and aid in the homogenizing of building rubble, demolition debris, and soils.

8.3.2 Compaction Procedures

After each lift of Category 2 material is placed, the material shall be compacted by a minimum four passes of a self-propelled, static pad/blade-foot landfill compactor (*e.g.*, Caterpillar 826, or approved equal). ~~Soil (~~Category 1 material~~)~~ for the 10-ft wide berms surrounding the Category 2 material ~~spread on top of the Category 2 material~~ shall be compacted to at least 90 percent of the standard Proctor maximum dry density determined as described in Section 7.4.2 of this IMP Plan. It is anticipated that the soil compaction moisture content will be within ±3 percentage points of the material's optimum moisture content. Specific requirements for compaction moisture content will be established by the ~~CM~~Construction Manager during construction. These requirements will take into account the workability of the Category 1 material~~soil~~, the required ~~soil~~ shear strength to obtain adequate levels of OSDF stability, moisture contents needed to achieve dust and other fugitive dust control, and material trafficability. After compacting the Category 1 material over the Category 2 material, the Category 1 material shall be proofrolled. Soft spots indicated by tire ruts more than 3 in. ~~(76 mm)~~ in depth or visible deflection under the moving proofrolling equipment shall be stabilized through additional passes of the compactor. The proofrolling equipment shall have a minimum gross vehicle weight of 20 tons ~~(180 kN)~~ and exert a ground pressure of at least 65 psi ~~(450 kPa)~~. The proofrolling passes shall be overlapped such that one set of tires on each pass runs between the two sets of tire tracks from the previous pass. Any soft spot that cannot be stabilized with further

compactive effort shall be cause for additional treatment to the satisfaction of the ~~CM~~Construction Manager. This treatment shall consist of removal, replacement, and recompaction of the ~~soil~~ Category 1 material, and, if needed, infilling soft spots/areas in the Category 2 material with grout or other material approved by the ~~CM~~Construction Manager.

8.4 Category 3 Items (Individual Items)

8.4.1 Placement Procedures

Items not more than 4 ft~~. (1.2 m)~~ in maximum cross-sectional dimension and of regular geometry can be placed as individual members or packages in the OSDF. As much as possible, groups of individual members or packages shall be similarly and regularly sized to enable their placement in the OSDF in regular patterns. Items shall be placed at least 8 ft~~. (2.4 m)~~ apart. Figure 8-1 illustrates the placement of ~~several~~ bundles of packaged transite panels.

Items having voids with a volume larger than 1 ft^3 ~~(0.03 m^3)~~ shall be filled with a quick-set grout, or flowable cohesionless material approved by the ~~CM~~Construction Manager. If a grout is used in this manner, it shall be allowed to set for a minimum of 4 hours prior to the commencement of placement of fill around the item.

Prior to placement of the Category 3 items, the surface of the in-place Category 1 impacted material shall be prepared by rolling with a smooth-drum roller in the area of item placement. The Category 3 items or packages shall be placed on the surface in a regular pattern with an adequate spacing between individual members or packages to allow Category 1 material placement and compaction with available equipment. The space between each member or package shall be filled with Category 1 material placed in ~~maximum 12 in. (300 mm)~~ 12- to 15-in. thick ~~compacted~~ loose lifts. A final 12- to 15-in. ~~(300 mm)~~ thick ~~compacted~~ loose lift of Category 1 material shall be placed over each grouping of Category 3 items. The Category 1 material shall be placed in 12 to 15 in. thick loose lifts as described in Section 7.4 of this IMP Plan.

As the Category 3 materials are expected to be less compressible than the majority of the impacted materials placed in the OSDF, the Category 3 items should be placed toward the center of the cell, at least 50 ft ~~(15 m)~~ horizontally from the bottom of the select impacted material layer in the final cover system, and not in the same horizontal elevation within 100 ft~~. (30.5 m.)~~ laterally of more compressible materials (*i.e.*, Category 4 materials, and sludges and double-bagged asbestos of Category 5 materials). The 100 ft ~~(30.5 m)~~ laterally means a 100 ft ~~(30.5 m)~~ separation distance from all directions (i.e., north-south, east-west, diagonally) of placed Category 3 material. Horizons of Category 3 materials shall be separated by at least ~~a 4 ft. (1.2 m) thick~~ the required minimum 4 ft thickness of the intervening horizon of Category 1 material.

8.4.2 Compaction Procedures

Each lift of soil (Category 1 material) between and above the Category 3 items shall be compacted using equipment capable of achieving compaction to at least 85 percent with rolling average of 90 percent of the standard Proctor maximum dry density, determined as described in Section 7.4.2 of this IMP Plan. It is anticipated that the compaction moisture content for this Category 1 material will be within ±3 percentage points of the material's optimum moisture content. Specific requirements for compaction moisture content will be established by the ~~CM~~Construction Manager during construction. These requirements will take into account the workability of the Category 1 material, ~~soil,~~ the required ~~soil~~ shear strength to obtain adequate levels of OSDF stability, moisture contents needed to achieve dust and other fugitive dust control, and material trafficability.

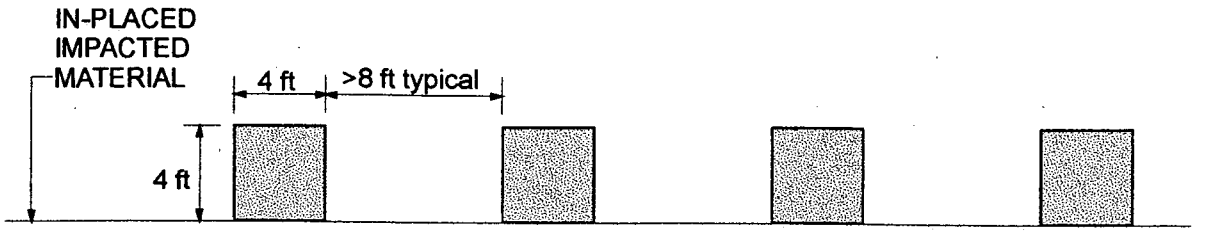
A final 12- to 15-in. ~~(300 mm)~~ thick ~~compacted~~ loose lift of soil (Category 1 material) shall be placed above the Category 3 material. This final compacted lift shall be proofrolled using equipment with a minimum gross vehicle weight of 20 tons ~~(180 kN)~~ and exert a ground pressure of at least 65 psi ~~(450 kPa)~~. Soft spots indicated by tire ruts more than 3 in. ~~(76 mm)~~ in depth or visible deflection under the moving proofrolling equipment shall be stabilized through additional passes of the compactor. Any soft spot that cannot be stabilized with further compactive effort shall be cause for additional treatment to the satisfaction of the ~~CM~~Construction Manager. This treatment shall consist of removal, replacement, and recompaction of the ~~soil (~~Category 1 material~~)~~, and, if needed, infilling soft spots/areas around the Category 3 material with grout or other material approved by the ~~CM~~Construction Manager.

8.5 Category 4 Materials (Highly Compressible

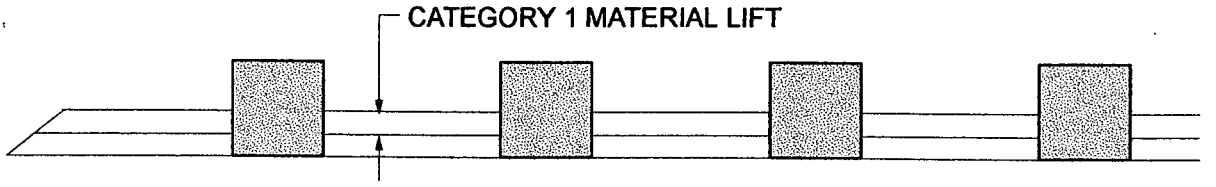
8.5.1 Placement Procedures

~~Soil (~~Category 1 material~~)~~ berms which are a minimum of 12-in. ~~(300 mm)~~ high shall be placed around Category 4 material and placed as described in Section 7.4 of this IMP Plan. The lateral extent of each Category 4 material placement shall not exceed 100 ft. ~~(30 m)~~. Category 4 material shall be placed adjacent to the berms to a loose thickness of approximately 18 in. ~~(450 mm)~~. Green waste shall be reduced in size, as necessary, to enable placement in the lift. Initial compaction shall be accomplished as the material is spread by tracking with a bulldozer of a minimum total weight of 50,000 lbs ~~(220 kN)~~ producing a ground pressure of at least 10 psi ~~(70 kPa)~~, or with a landfill compactor (e.g., Caterpillar 826 or approved equal). Prior to placement of the succeeding lifts of Category 4 material, a minimum 12-in. ~~(300 mm)~~ thick loose lift of ~~soil (~~Category 1 material~~)~~ shall be placed over the Category 4 material and compacted as indicated below. Compaction of the second lift of Category 4 materials shall be identical to the first lift. Not more than two lifts of Category 4 material shall be placed in a horizon. Category 4 horizons shall not be in the same vertical plane as previously placed Category 4 horizons.

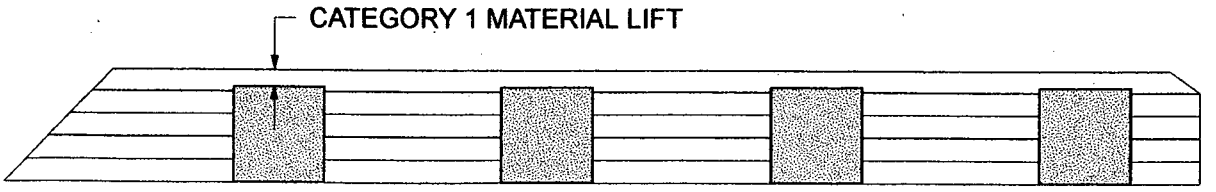
CATEGORY 3 MATERIAL PLACEMENT SEQUENCE



1. PLACED IN A REGULAR PATTERN



2. SPACE FILLED WITH COMPACTED CATEGORY 1 MATERIAL PLACED IN 12 TO 15 INCH THICK LOOSE LIFTS



3. FINAL LIFT OF CATEGORY 1 MATERIAL PLACED ABOVE GROUPS

NOTE: THIS FIGURE FOR ILLUSTRATION ONLY. CONSTRUCTION CONTRACTOR SHALL PLACE IMPACTED MATERIAL LAYERS TO THE LIMITS SHOWN ON CONSTRUCTION DRAWINGS

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ATLANTA, GEORGIA

FIGURE NO.	8-1
PROJECT NO.	GQ1001-03
DOCUMENT NO.	F9620002.2B
FILE NO.	FIGS.cdr

8.5.2 Compaction Procedures

After spreading and initial compaction, the Category 4 material shall be compacted by minimum of four passes of a self-propelled, static pad/blade-foot landfill compactor ~~having a nominal weight of at least 45,000 pounds~~ (*e.g.*, Caterpillar ~~815C~~ 826, or approved equivalent). After each sequence of Category 4 material compaction and ~~covering soil (~~Category 1 cover material~~)~~ placement, the Category 1 cover material ~~cover soil~~ shall be compacted as required, as described in Section 7.4 of this IMP Plan. ~~for the soil cover of Category 2 material.~~ The ~~soil~~ Category 1 cover material shall then be proof-rolled. The proofrolling equipment shall have a minimum gross vehicle weight of 20 tons ~~(180 kN)~~ and exert a ground pressure of at least 65 psi ~~(450 kPa)~~. Soft spots indicated by tire ruts more than 3 in. ~~(76 mm)~~ in depth or visible deflection under the moving proofrolling equipment shall be stabilized through additional passes of the landfill compactor. Any soft spot that cannot be stabilized with further compactive effort shall be cause for additional treatment to the satisfaction of the ~~CM~~Construction Manager. This treatment shall consist of removal, replacement, and recompaction of the ~~soil (~~Category 1 material~~)~~, and, if needed, infilling soft spots/areas in the Category 4 material with grout or other material approved by the ~~CM~~Construction Manager.

8.6 Category 5 Materials (Special Handling, Placement and Compaction

8.6.1 Introduction

Category 5 materials are materials that require special handling, placement and compaction procedures. These materials will be classified and designated in accordance with the approved RODs and the WAC. This section of the IMP Plan establishes procedures for disposal of impacted material that require special handling.

Materials either nominally larger than the physical criteria for the OSDF as identified in Section 4.3 (Physical Criteria) of this IMP Plan, or not reasonably anticipated by the currently identified categories in this IMP Plan, will require specialized placement plans to be developed on an as needed basis. Such plans would be developed by the OSDF project team ~~with the assistance of the Resident Engineer as appropriate,~~ and submitted to the regulatory agencies for review and approval prior to utilization. It is anticipated that such plans would be submitted concurrent with remedial action planning documents, which identify items for special handling, or following the discovery of unexpected materials outside the current categorizations. Once approved, these specialized placement plans either would become addenda to this IMP Plan, as indicated in Appendix C, or the appropriate section(s) of this IMP Plan would be revised accordingly.

8.6.2 General

Impacted materials suitable for placement in the OSDF that require special handling include:

- highly-compressible impacted materials not suitable for lateral spreading as a Category 4 material (*e.g.*, double-bagged asbestos);
- piping insulated with asbestos containing material (ACM); and
- sludges.

Placement and compaction procedures for these types of impacted materials are presented below or in Appendix C.

8.6.3 Highly Compressible Materials

Placement

The volume of highly compressible material, such as double-bagged asbestos, requiring OSDF disposal is very limited. The primary criterion regarding the placement of asbestos is that the material be placed ~~and compacted~~ in a manner protective of the health of OSDF personnel and the public. A secondary criterion is to prevent significant differential settlement of the OSDF final cover system resulting from compression of this material.

Prior to placement of any highly compressible material in the OSDF, a trench shall be dug into previously placed and compacted Category 1 material. Material excavated from this trench shall be stockpiled at least 6 ft~~. (1.8 m)~~ away from the trench opening. No trenches shall be dug into layers containing Category 2 through 5 material, nor through the protective, contouring, or select impacted material layers. Trenches shall be of uniform width (between 2.0 and 3.0 ft~~. (0.6 and 0.9 m)~~ wide) and of a uniform depth (between 3.0 and 4.0 ft~~. (0.9 and 1.2 m)~~ deep). The final sizing of the trench shall depend on the nature and size of the material to be disposed. The trenches shall be at a minimum 6 ft apart from one another. Highly compressible material, such as double-bagged asbestos, shall be deposited in the lower half of the trench.

Compaction

An initial ~~soil (~~Category 1 material~~)~~ cover between 12 and 18 in. ~~(300 and 450 mm)~~ loose thickness shall be placed on top of the highly-compressible material in the trench. The initial ~~soil~~ Category 1 material cover layer shall be compacted with a minimum of four passes of a portable flat-plate or miniature roller compactor. Intermediate 6- to 12-in. ~~(0.15 to 0.3 m)~~ thick loose ~~soil~~ Category 1 material lifts shall be placed in the trench and compacted to at least 90 percent of the standard Proctor maximum dry density determined as described in Section 7.4.2 of this IMP Plan. A final trench ~~soil~~ Category 1 material lift shall

be placed and compacted to ~~a compacted height~~ (at least 90 percent of the standard Proctor maximum dry density~~)~~. ~~and~~ The surface of the compacted final lift shall be at least 2 in. ~~(50 mm)~~ above the trench shoulders. The sequencing of material placement is illustrated in Figure 8-2.

8.6.4 Piping Containing ACM Insulation

Placement

The disposal of ACM-insulated piping in the OSDF shall be performed in a manner protective of the health of OSDF personnel and the public. These materials must be segregated from other demolition debris at the source and delivered to the OSDF in a condition suitable for placement in an excavation dug into previously placed and compacted Category 1 material. The size and shape of the excavation will be based on the predominant dimension and condition of the piping. If the piping comes to the OSDF in relatively straight lengths, the pipes shall be placed in trenches similar to those required for double bagged asbestos. If the piping comes to the OSDF in random shapes, bends, or curvatures, the pipes shall be placed in a rectangular excavation sized to accommodate the pipe but not greater than 20 ft~~.~~ ~~(6 m)~~ by ~~square~~ 20 ft square and 4 ft~~.~~ ~~(1.2 m)~~ deep. Pipe should be cut to lengths allowing placement in the 20~~-foot~~ ft ~~(6 m)~~ square excavation and be placed such that ~~soil~~ Category 1 material ~~-~~can be filled around pipes. The number of pipes placed in the 20~~-foot~~ ft ~~(6 m)~~ square excavation is limited to that number that can be placed such that ~~soil~~Category 1 material in-filling around the pipes is possible. The ACM-insulated piping shall be placed in the lower half of the excavation.

Compaction

An initial ~~soil (~~Category 1 material~~)~~ loose lift between 12 and 18 in. ~~(300 and 450 mm)~~ thick shall be placed on top of the ACM-insulated piping in the excavation. The initial ~~soil~~ Category 1 material cover layer shall be compacted with a minimum of four passes of a portable flat-plate or miniature roller compactor or a pad-foot compactor such as the Caterpillar 815C as appropriate. Intermediate 6 to 12 in. ~~(150 to 300 mm)~~ loose ~~soil~~Category 1 material lifts shall then be placed in the excavation and compacted to at least 90 percent of the standard Proctor maximum dry density, determined as described in Section 7.4.2 of this IMP Plan. A final excavation ~~soil~~Category 1 material lift shall be placed and compacted to at least 90 percent of the standard Proctor maximum dry density. ~~to a compacted height~~ The surface of the compacted final lift shall be at least 2 in. ~~(50 mm).~~ above the excavation shoulders.

8.6.5 Sludges

Placement

The placement, spreading, and compaction of the sludge material from the Lime Sludge Ponds or the AWWT will depend on the water content of the sludge when delivered to the OSDF. Sludge materials from the Lime Sludge Ponds should be mixed with soils from the berms of the ponds or other soil material

as much as practicable during excavation and handling or by drying until excessive moisture is removed. The objective of this activity is to decrease the moisture content of the sludges and thereby improve their handling and subsequent compaction characteristics. The ~~CM~~Construction Manager may specify additional source(s) of materials for mixing with the sludges to achieve the required handling and placement characteristics. The following procedure assumes the sludge can be placed and compacted with conventional construction equipment, either by mixing as above in the case of the Lime Sludge Ponds, or by proper preconditioning (dewatering or drying) in the case of the AWWT sludges. In no case shall mixing and preconditioning be performed in the OSDF active cell to achieve the criteria identified in Section 4.3 of this IMP Plan.

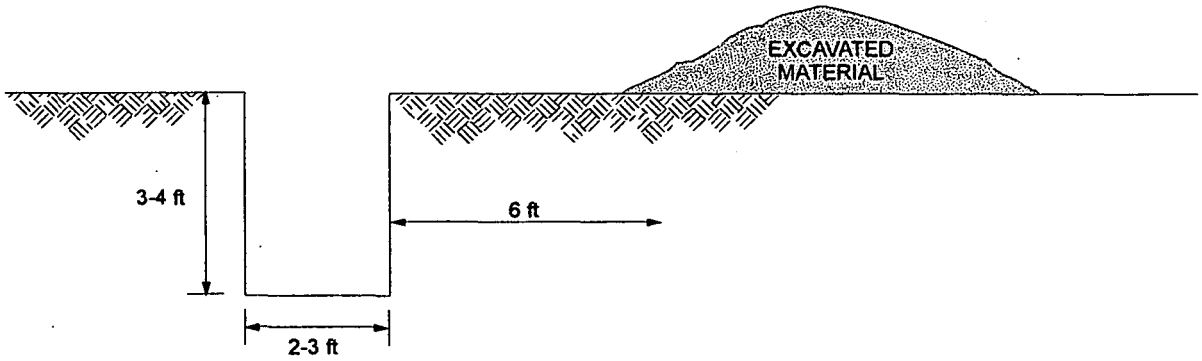
Prior to placement of the first lift of sludge material, the surface of in-place impacted material shall be prepared with Category 1 material starter berms at least 12 in. ~~(300 mm)~~ high. Sludge materials shall be placed within the starter berms to a maximum loose thickness of 12 in. ~~(300 mm)~~.

Compaction

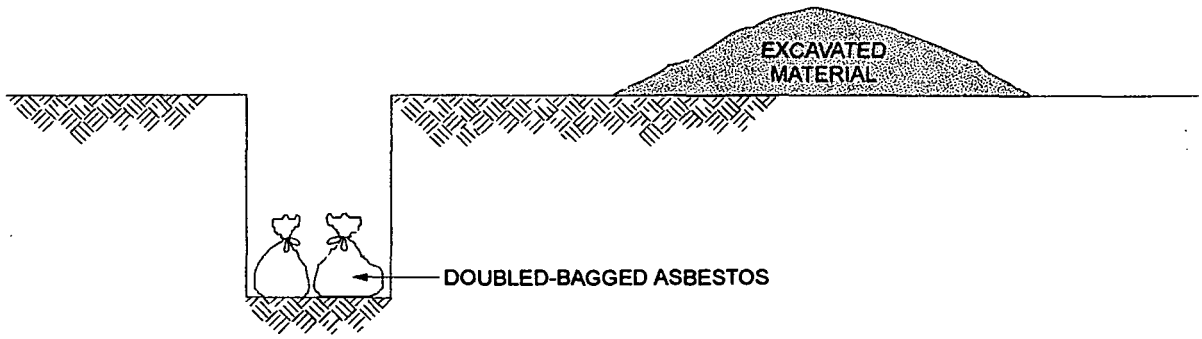
Initial compaction shall be accomplished as the material is spread. After spreading and initial compaction, the material shall be compacted by a minimum of four passes of a bulldozer of a minimum total weight of 50,000 lbs ~~(220 kN)~~ producing a ground pressure of at least 10 psi ~~(70 kPa)~~. Prior to placement of the second and succeeding lifts of sludge materials, a 12-in. to 15-in. ~~12 in. (300 mm)~~ thick lift of ~~soil (~~Category 1 material~~)~~ shall be placed above the sludge lift and compacted to at least 85 percent of the standard Proctor maximum dry density ~~for the soil~~. After placement of the ~~soil~~ Category 1 material lift, another starter berm shall be constructed as with the first lift of sludge material. Compaction of all succeeding lifts of sludge materials shall be identical to the first lift. Not more than two lifts of sludge material shall be placed in a horizon without ~~a~~ at least the minimum 4 ft. ~~(1.2 m)~~ required thickness of intervening horizon of Category 1 material.

After each sequence of sludge and covering ~~soil~~ Category 1 material placement, the cover ~~soil~~ Category 1 material shall be proofrolled. The proofrolling equipment shall have a minimum gross vehicle weight of 20 tons ~~(180 kN)~~ and exert a ground pressure of at least 65 psi ~~(450 kPa)~~. Soft spots indicated by tire ruts more than ~~2~~ 3 in. ~~(50 76 mm)~~ in depth or visible deflection under the moving proofrolling equipment shall be stabilized through additional passes of the compactor. Any soft spot that cannot be stabilized with further compactive effort shall be cause for additional treatment to the satisfaction of the ~~CM~~Construction Manager. This treatment shall consist of removal, replacement, and recompaction of the ~~soil~~ Category 1 material ~~material~~, and, if needed, infilling soft spots/areas in the Category 5 material with grout or other material approved by the ~~CM~~Construction Manager.

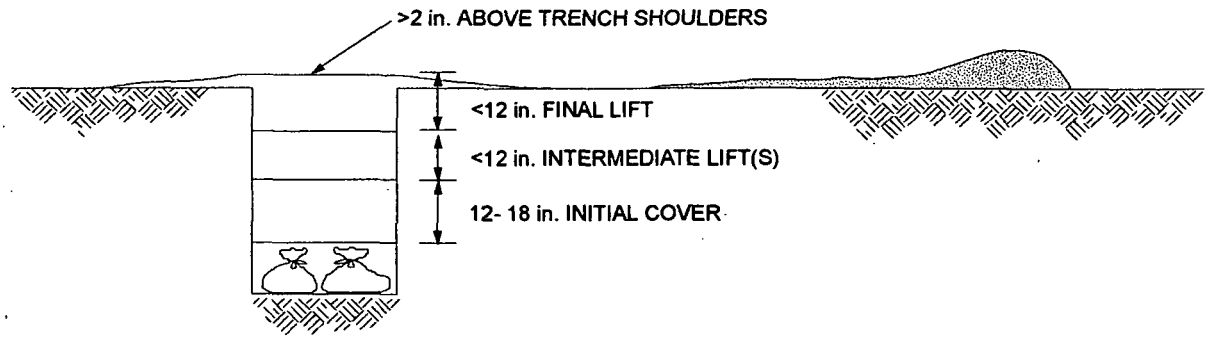
CATEGORY 5 MATERTIAL PLACEMENT SEQUENCE



1. TRENCH DUG AND EXCAVATED MATERIAL STOCKPILED



2. CATEGORY 5 MATERIAL DEPOSITED IN TRENCH



3. FINAL TRENCH LIFT PLACED

NOTE: THIS FIGURE FOR ILLUSTRATION ONLY. CONSTRUCTION CONTRACTOR SHALL PLACE IMPACTED MATERIAL LAYERS TO THE LIMITS SHOWN ON CONSTRUCTION DRAWINGS

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FIGURE NO.	8 - 2
PROJECT NO.	GQ1001-03
DOCUMENT NO.	F9620002.2B
FILE NO.	FIGS.cdr

9.0 IMPACTED RUNOFF AND FUGITIVE DUST CONTROL

9.1 General

This section of the IMP Plan provides the requirements for impacted runoff and fugitive dust control within the OSDF battery limit as it relates to impacted material placement. Within the OSDF battery limit, ~~all~~ impacted material placement activities shall be confined to within the OSDF cell lined area. Activities related to the collection, handling, staging, loading, and transportation of impacted materials outside the OSDF battery limit are addressed as part of other work plans prepared as a part of the integrated FEMP remediation.

9.2 Runoff Control

9.2.1 OSDF Cell

Impacted runoff will be generated whenever precipitation comes in contact with impacted materials. Impacted runoff generated within the OSDF cell shall be managed as stated in Section 6.~~9~~10 of this plan and in general conformance with the requirements of the *OSDF SWMEC Plan*. Impacted runoff shall be conveyed using temporary surface-water management and erosion control structures to the impacted-runoff catchment areas. ~~area in the southwest corner of the most southerly active cell.~~ An impacted runoff catchment area contains storage to handle the drainage area from two active cells. Specifically, if three cells are active, two impacted runoff catchment areas will be open. As previously described in this plan, layers of impacted material shall be placed from north to south and east to west within each cell. As these layers are placed, the impacted-runoff catchment area shall be preserved until a more southerly and adjacent cell is made active.

9.2.2 Impacted Material Haul Road

Impacted runoff from an impacted material haul road west of the cells shall be contained within the boundaries of the road and shall be routed to the storm water drainage system of the FEMP former production area. Because of topography, flow from some small areas in the immediate vicinity of the OSDF ~~E~~equipment wash facility may be directed to the OSDF equipment wash facility; however, these areas will not contribute significant runoff.

9.3 Fugitive Dust Control

9.3.1 General

Fugitive dust may result from impacted material handling and hauling activities. Material handling covers such activities as excavation, dumping, spreading, compacting, and short-term storage. These activities may generate fugitive emissions in the form of particulate matter released to the air (*i.e.*, dust).

These activities will comply with the BAT determination for remedial construction activities on the FEMP site that was developed to control fugitive dust (see Appendix B). The appropriate records shall be kept by the Contractor when visible emissions observations are performed in accordance with Appendix A of 40 CFR Part 60, and the FEMP procedure for fugitive dust control requirements~~, which is currently being developed~~.

The ~~Subcontractor~~Contractor shall also control fugitive dust while hauling impacted materials to the OSDF. A no visible emissions policy is enforced for activity within the battery limit of the OSDF. If visible emissions are observed, ~~in excess of the limit discussed in the BAT determination for remedial construction activities on the FEMP site,~~ the ~~CM~~Construction Manager will direct the ~~Subcontractor~~Contractor to provide a corrective action plan.

As appropriate, the ~~Subcontractor~~Contractor shall use one or more of the following for the control of fugitive dust from the OSDF:

- water sprays;
- crusting agents;
- operational controls; and
- wind screens.

Each of the above controls is briefly discussed in the following subsections.

9.3.2 Water Sprays

The ~~Subcontractor~~Contractor shall use water distributors and or spray trucks to control fugitive dust emissions in active OSDF cells and along impacted-material haul roads within the battery limit. The frequency of water application should be weather dependent and be adjusted based on the appearance of visible dust as described in the BAT determination for remedial construction activities on the FEMP site.

9.3.3 Crusting Agents

The ~~Subcontractor~~Contractor shall consider the use of crusting agents or other suitable dust suppression chemicals whenever water is not effective. Crusting agents may be used on inactive portions of the impacted material placement area. ~~or when a particular area will not be disturbed for long enough to justify the additional cost.~~ The ~~Subcontractor~~Contractor shall demonstrate to the ~~CM~~Construction Manager the compatibility of any crusting agent or other suitable dust suppression chemical with components of the OSDF liner system prior to use.

9.3.4 Operational Controls

The ~~Subcontractor~~~~Construction Contractor~~Contractor may use operational controls to limit fugitive dust. Limiting placement of impacted material to days when the wind is calm, and limiting the speed of hauling equipment, are examples of operational controls. The ~~Subcontractor~~~~Construction Contractor~~Contractor shall work closely with the ~~CM~~Construction Manager in the development and implementation of other beneficial operational controls to be implemented both on a daily and overall basis.

9.3.5 Wind Screens

The OSDF will be elevated above surrounding lands during its operational life. Increased winds at the higher elevation may cause additional fugitive dust during periods of operation at the higher elevations. Silt fence on impacted material slopes installed for the control of surface erosion caused by precipitation may provide a measure of protection from winds. The ~~Subcontractor~~~~Construction Contractor~~Contractor shall consider the use of additional wind screens when other methods of fugitive dust control prove ineffective.

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10.0 REQUIRED DOCUMENTATION

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10.1 General

This section of the IMP Plan contains information on the documentation required for each hauling unit ~~truck~~ load of impacted materials to be placed in the OSDF.

10.2 Manifesting System

No impacted material will be accepted at the OSDF without an accompanying impacted material transportation "manifest". The purpose of the "manifest" is to provide a tracking mechanism for impacted material from the remediation project of origin to placement in the OSDF.

Information required to be included on the "manifest" include:

- project number and name;
- date and time of origination (*e.g.*, loading for debris, excavation for other materials);
- source Material Tracking Location (MTL);
- material type, profile number, and estimated volume of material;
- signature by originating remediation project representative that the material meets the criteria in Section 4.0 of this IMP Plan;
- the OSDF ~~cell identifier for Category 1 material and the~~ cell, grid, and lift identifier for Categories 1~~2~~ through 5 material;
- date and time of receipt; and
- WAO and CQC Consultant signature~~.~~, as described in Section 6.3 of this IMP Plan.
- In addition to the above "manifest" items, any special notes or safety concerns shall be included with the "manifest." Health and Safety information that could result in personnel exposure from unknown materials ~~shall~~ will be noted ~~with~~ on the manifest documentation or included on a WAO special concerns form which will be attached to the manifest.

10.3 Impacted Materials Tracking

To aid in tracking impacted material, each impacted material transportation "manifest" will have a unique serial number and up to five carbon copies. One copy of each manifest shall be given to the CQC Consultant daily. Other copies will be distributed in accordance with ~~FDF~~ the site requirements and Contract Documents.

10.4 Records Procedures

~~FDF~~Fluor Fernald, Inc. ~~The Construction Manager~~ will be responsible for establishing the procedures and requirements for collection, storage, maintenance, and disposition of all OSDF records. Records shall be protected from damage or deterioration by being placed in lockable, fire-proof filing cabinets and by duplication and/or microfilming. Records shall be filed in accordance with the subject file index and shall be retained for 30 years after closure of the OSDF. Required records shall include, but not be limited to, field logbooks, other data collection forms, equipment calibration records, cost data, drawings, impacted material transportation "manifests", maintenance records, and associated reports.

~~All o~~Original data collected in the field shall be considered a permanent record. This includes ~~all~~ field logbooks, other data forms, and photographs. ~~All of t~~These documents shall be ~~authorized~~ authenticated by the signature and date of the originator. Errors shall be corrected by crossing a single line through the error and entering the correct information. Corrections will be initialed and dated by the person making the correction.

11.0 SEASONAL COVER

11.1 Description of System

At the end of each construction season and in any area where impacted material will not be placed for at least ~~30~~ 45 days, a seasonal cover will be required over any area that has not received final cover. The seasonal cover will consist of natural or Category 1 impacted soil ~~with~~ which covers the Category 2 through 5 impacted materials; and is stabilized by suitable surface protection, crusting agents, or geosynthetic erosion control surface matting.

11.2 Seasonal Cover Inspection and Monitoring Activities

The seasonal cover shall be inspected and monitored by the Contractor in accordance with the schedule and activity requirements presented in Table 11-1. The purposes of the inspection and monitoring activities are to: (i) ensure the seasonal cover prevents excessive fugitive dust and slope erosion; (ii) provide adequate and efficient management of impacted runoff within a cell; and (iii) provide adequate protection of liner systems components from freeze/thaw and mechanical damage.

Inspections of the seasonal cover shall consist of a visual survey of the seasonally-covered area. The visual inspection shall be conducted by either traversing the seasonally-covered areas ~~cover systems~~ on a 100 ft~~.~~ ~~(30 m)~~ grid pattern or by using binoculars to inspect areas where surface crusting agents have been applied. Suspect areas shall be delineated on a plan of the site. The inspections shall result in evaluation of the seasonal cover for excessive erosion or gullying. Should such conditions be observed, the ~~SubcontractorConstruction Contractor~~Contractor shall implement activities to reduce such erosion or gullying, including regrading the eroded area, compacting exposed soil surfaces, rerouting runoff from the area to promote sheet flow, applying additional surface crusting agent, or installing geosynthetic erosion-control surface matting.

The seasonal cover inspections shall also include observation of the area within the active OSDF cell being used for impacted runoff catchment. The runoff from the seasonal cover will be collected in the leachate collection system (LCS) or managed as impacted stormwater. The inspection shall confirm that runoff into the impacted runoff catchment area can infiltrate in an unimpeded manner into the cell LCS. Should the depth of sedimentation exceed 6 in. ~~(150 mm)~~ in any portion of this area, the sediment should be excavated and transported to an area of the cell outside of the impacted runoff catchment area. Any excavation of sediment within the cell shall be performed with extreme care so as not to damage the underlying liner systems. Should the granular protective layer or LCS geotextile ~~LCS~~ filter in the ~~stormwater~~ impacted runoff catchment area of the cell become clogged and impede stormwater percolation into the LCS, the ~~CM~~Construction Manager ~~may~~ will instruct the ~~Subcontractor~~Contractor to replace the granular material, and possibly the geotextile filter as well.

Repairs to a cell ~~stormwater~~ impacted runoff catchment area shall not be made unless it is part of a plan ~~reviewed~~ approved by the ~~CM~~Construction Manager. Any repair activity involving any component of the liner systems or final cover systems shall be in full conformance with the ~~construction specification~~Technical Specification for that component.

11.3 Recordkeeping

The ~~Subcontractor~~ Contractor shall maintain written records of ~~all~~ monitoring, inspections, and repairs in accordance with recordkeeping and reporting requirements of Section 10.4 of this IMP Plan.

TABLE 11-1

SEASONAL COVER
INSPECTION AND MONITORING ACTIVITIES

Component	Inspections Seasonal-Closure Period	Condition	Maintenance
Seasonal Cover	Bi-weekly	• unacceptable surface or slope erosion • unacceptable fugitive emissions	• regrade material surfaces; reroute runoff; recompact soil surface, apply crusting agents or geosynthetic erosion control matting • apply surface crushting agent or geosynthetic erosion control matting; install wind screen fencing
Impacted-Runoff Catchment Area (in cell)	Bi-weekly	• excessive sediment deposited on top of catchment area • lack of timely percolation of runoff into the LCS	• remove sediment and deposit outside of catchment area • replace clogged protective layer granular material with new clean material; replace clogged geotextile filter layer
Protection of Liner System	Bi-weekly	• system must be protected against frost and mechanical damage by at least 2 ft Category 1 material above the protective layer	• add suitable soil cover over anchor trench, intercell berm, or temporary liner system termination as required

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12.0 REFERENCES

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GeoSyntec Consultants, *"Design Criteria Package (DCP), On-Site Disposal Facility, Revision 1B)"*; Fernald Environmental Management Project, DOE Fernald Area Office, Fernald, OU.S. Department of Energy (DOE), *"Final Record of Decision for Remedial Actions at Operable Unit 2"*, Fernald Environmental Management Project, DOE Fernald Field Office, Fernald, OH, 1995a.

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APPENDIX A

IMPACTED MATERIALS PLACEMENT QUALITY ASSURANCE PLAN

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A.1 INTRODUCTION

A.1.1 Overview

This IMP Quality Assurance (QA) Plan describes the activities which ~~shall~~ will be undertaken throughout the construction, placement, and closure of the OSDF to ~~assure~~ confirm the acceptance, filling, and compaction of the impacted materials in the OSDF are in ~~accordance~~ compliance with the ~~procedures~~ requirements established in the *IMP Plan, Technical Specifications* and *CQA Plan*. This plan contains requirements and ~~procedures~~ methods specifically applicable to impacted materials after they are brought into the OSDF battery limit.

A.1.2 Plan Scope

This IMP QA Plan establishes the ~~QA/QC procedures~~quality control (QC) requirements and documentation practices to be used to monitor and test impacted materials, which are transported, placed, and compacted by the ~~Construction Contractor~~Contractor within the OSDF battery limits. The scope of this plan includes:

- WAO duties related to impacted materials within the OSDF battery limit; ~~within the OSDF battery limits.~~
- CQC Consultant duties related to impacted materials placement and compaction; and
- monitoring, testing, and documentation procedures to be used in ~~assuring~~ confirming impacted material placement and testing are ~~is~~ in accordance with the requirements of the *IMP Plan*.

A.1.3 Plan Organization

The remainder of this plan is organized as follows:

- the job descriptions, qualifications, and required training of personnel involved in IMP QA are presented in Section A.2;
- specific monitoring procedures are presented in Section A.3;
- specific compaction testing requirements for each impacted material category are presented in Section A.4; and
- requirements for as-placed plans are presented in Section A.5.

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A.2 IMP QA PERSONNEL

A.2.1 Staffing Requirements

Monitoring and testing of the placement and compaction of impacted materials ~~at~~ in the OSDF ~~shall~~ will be the responsibility of the CQC Consultant. The following personnel ~~shall~~ will have responsibilities related to the impacted materials placement QC activities at the OSDF:

- CQC ~~Managing~~ Certifying Engineer;
- CQC Site Manager; and
- CQC Field Monitors.

A.2.2 CQC ~~Managing~~ Certifying Engineer

A.2.2.1 Job Description

The CQC ~~Managing~~ Certifying Engineer ~~shall~~ will be in overall charge of the QC activities related to impacted material placement. In addition to the duties described in the *CQA Plan*, the CQC ~~Managing~~ Certifying Engineer ~~shall~~ will also be responsible for monitoring and testing of the impacted materials placement and compaction in the OSDF.

A.2.2.2 Required Job Qualifications

The required qualifications of the CQC ~~Managing~~ Certifying Engineer are contained in the *CQA Plan*.

A.2.3 CQC Site Manager

A.2.3.1 Job Description

The CQC Site Manager ~~shall~~ will be in direct day-to-day charge of the QC monitoring conducted at the OSDF during impacted materials placement. In addition to the duties described in the *CQA Plan*, the CQC Site Manager ~~shall~~ will also be responsible for:

- monitoring impacted materials suitability for ~~disposition~~ placement in the OSDF;~~.~~
- ~~evaluating~~ monitoring the compaction of the impacted materials in the OSDF;~~.~~
- supervising the compaction testing of impacted materials in the OSDF;~~.~~
- assigning CQC Field Monitors;

- forwarding required documentation to the CQC ~~Managing~~ Certifying Engineer~~.~~; and
- assuring that CQC Field Monitors attend regular health and safety meetings as required in site safe work plan.

A.2.3.2 Required Job Qualifications

The qualifications of the CQC Site Manager are contained in the *CQA Plan*.

A.2.4 CQC Field Monitors

A.2.4.1 Job Description

CQC Field Monitors ~~shall~~ will perform placement monitoring and compaction testing of impacted materials in the OSDF in accordance with this IMP QA Plan. Placement monitoring and compaction testing ~~shall~~ will include documentation that the ~~Subcontractor~~~~Construction Contractor~~Contractor is performing impacted materials placement and compaction in accordance with the procedures specified in the *IMP Plan*. Monitors shall also classify, as necessary, the impacted materials for the purposes of assigning a compaction method to the impacted materials.

A.2.4.2 Required Job Qualifications

~~CQC Field Monitors shall have experience in performing QC in earthwork construction, demolition, or solid waste industries or in an equivalent industry.~~The qualifications of the CQC Field Monitors are contained in the CQA Plan.

A.2.5 Training

Training requirements for personnel employed at the FEMP are contained in the Fernald Site Wide Training Plan - PL-3032 [FERMCO, 1995]. Personnel engaged in impacted materials ~~QA/~~QC activities at the OSDF shall be trained in accordance with this plan.

Each CQC Consultant employee ~~shall~~ will have OSHA 40-Hour Hazardous Waste Workers' Health and Safety Training (HAZWOPER) conducted in accordance with 29 CFR 1910.120. Each employee ~~shall~~ will also take an 8-hour Hazardous Waste Workers' Health and Safety Training refresher course each year, and no more than 1 year from the date of completion of the 40-hour HAZWOPER training. The CQC Site Manager ~~shall~~ will receive 8-hour HAZWOPER Supervisory training.

Each new employee ~~shall~~ will receive 3 days of on-the-job training as required by 29 CFR 1910.120. On-the-job training will include, at a minimum, a discussion of site specific health and safety features, a walk-through of the areas in which the new employees will be working with a discussion of possible hazards in the area, a discussion of job duties and potential hazards associated with the duties and a discussion regarding appropriate personal protective equipment (PPE) including minimum requirements for work clothing in accordance with the site specific health and safety plan.

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A.3 IMPACTED MATERIALS MONITORING

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A.3.1 Required Documentation

Upon entering the OSDF battery limits, ~~the CQC Consultant~~WAO ~~shall~~ will check that the impacted materials are accompanied by a "manifest" and that the hauling unit has been properly identified as to the impacted material category. Impacted material categories are defined in Section 5.2 of the *IMP Plan*. If no material category has been entered onto the manifest, the WAO OSDF representative will contact the WAO excavation or debris source representative to verify the category. The WAO OSDF representative will complete and review the manifest prior to releasing the hauling unit to the placement area. If the category cannot be identified, the hauling unit will be returned ~~shall be turned around and sent back~~ to its point of origin. ~~The CQC Consultant~~ WAO ~~shall~~ will verify that the "manifest" contains all information relating to the impacted material origin as specified by Section 10.2 of the *IMP Plan*. ~~The CQC Consultant~~ WAO ~~shall~~ will complete the "manifest" by recording any pertinent notes, comments, or observations about the load. ~~The CQC Consultant~~WAO ~~shall~~ will finally affix a signature to the "manifest" verifying that the load has been delivered in accordance with the *IMP Plan*.

A.3.2 Visual Inspection

The CQC Consultant ~~shall~~ will perform a visual review of the impacted materials ~~entering the OSDF. The contents of each hauling unit (truck load or containers) shall be viewed~~ after dumping to ~~assure~~ confirm that the contents match the visual description entered on the "manifest" as ~~and~~ communicated ~~by radio to the CQC Consultant~~ by WAO.

A.3.3 Monitoring for Moisture Content

Impacted materials accepted at the OSDF ~~shall~~ will be at a moisture content suitable for placement and compaction in accordance with the *IMP Plan*. If the CQC Consultant determines that impacted materials are too wet, the ~~Subcontractor~~~~Construction Contractor~~Contractor ~~shall~~ dry the material to a condition allowing placement and compaction in accordance with the *IMP Plan*.

A.3.4 Demolition Debris Monitoring

General

The CQC Consultant ~~shall~~ will monitor demolition debris delivered to the OSDF. Additional information regarding waste classification and special handling of specific types of demolition debris is presented in the following sections.

Asbestos

Trucks carrying double-bagged regulated asbestos containing material must display asbestos warning signs. The ~~Subcontractor~~ Contractor shall comply with ~~all~~ regulations relating to the handling and transportation of regulated asbestos containing material.

Broken Concrete

Most concrete demolition debris will fall into Category 2 (*en masse* placement). Loads of concrete containing concrete pieces that cannot be spread into 21 in. ~~(533 mm)~~ ±3 in. ~~(76 mm)~~ loose lifts will be classified as Category 5 materials.

Steel or Transite Sidings

Steel or transite sidings that arrive at the OSDF in neatly packaged stacks not greater than 4 ft. ~~(1.2 m)~~ high will be classified as Category 3 items (individual placement). Loose truck loads of miscellaneous demolition debris containing steel sidings that can be spread in lifts not higher than 21 in. ~~(533 mm)~~ ±3 in. ~~(76 mm)~~ will be classified as Category 2 materials (*en masse* placement).

Steel Beams

Steel beams which can be spread or placed into a lift no higher than 21 in. ~~(533 mm)~~ ±3 in. ~~(76 mm)~~ will be classified as Category 2 materials (*en masse* placement).

Wood

Loads of demolition debris consisting primarily of wood ~~and~~ that can be spread in lifts no higher than 18 in. ~~(450 mm)~~ will be classified as Category 4 materials (highly compressible).

Miscellaneous Demolition Debris

Loads of miscellaneous demolition debris (doors, plumbing, wiring, wood *etc.*) that can be spread in lifts no higher than 21 in. ~~(533 mm)~~ ±3 in. ~~(76 mm)~~ will be classified as Category 2 materials (*en masse* placement). Miscellaneous demolition debris that can be placed individually such that the highest part of the debris is not more than 4 ft. ~~(1.2 m)~~ above the ground surface will be classified as Category 3 items (individual items).

Tanks

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Tanks that cannot be placed such that the void space can be filled and Category 1 material placed and compacted around them shall not be placed in the OSDF. Cylinders that have not been processed to remove pressurized material and processed to eliminate future potential for pressurization will not be accepted at the OSDF. A visual inspection of cylinders shall be performed prior to placement in the OSDF. Cylinders that have either the cylinder cap or valve attached shall be removed and returned to the point of generation. Cylinders with nominal diameter of 12 in. ~~(300 mm)~~ or greater will be split in half. Tanks acceptable for placement in the OSDF and which are less than 5 ft~~.~~ ~~(1.5 m)~~ in diameter and 4 ft~~.~~ ~~(1.2 m)~~ high will be classified as Category 3 items (individual items).

Pipes

Steel pipes which can be spread or placed into a lift no higher than 21 in. ~~(533 mm)~~ ±3 in. ~~(76 mm)~~ will be classified as Category 2 materials (*en masse* placement). Process piping with a nominal diameter of 12 in. ~~(300 mm)~~ or greater will be split in half before disposal. Piping used as surface water drainage conduit (e.g., corrugated metal pipe, concrete pipe, vitrified clay pipe) and non-processing piping will be crushed or split in half in length to reduce void space; maximum size will be 10 ft~~.~~ ~~(3.0 m.)~~ in length and 18 in. ~~(450 mm)~~ thick.

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A.4 IMPACTED MATERIAL PLACEMENT AND COMPACTION

A.4.1 Category 1 Materials (Soils and Soil-Like Materials)

General Monitoring Requirements

Monitoring the placement, and ~~compacting~~ compaction, and testing of impacted soil and soil-like materials includes the following:

- monitoring materials to confirm sizing criteria and content meet criteria specified in Section 5.2 of the IMP Plan;
- testing to determine the ~~water content and other physical properties~~compaction characteristics of the impacted soil materials during processing, placement, and compaction;
- monitoring the thickness of lifts as loosely placed and as compacted; and
- monitoring the action of the compaction and heavy hauling equipment on the construction surface (e.g., sheepsfoot penetration, pumping, cracking, etc.).

Placement and Compaction Quality Control

The standard Proctor test (ASTM D 698) shall be used for the determination of moisture/density relationships ~~on~~ of the Category 1 material to be disposed in the OSDF. The standard Proctor compaction tests will be performed in the on-site geotechnical laboratory established per the *CQA Plan*. ~~Additional~~ The standard Proctor compaction testing will be performed ~~at a minimum frequency of one per 5,000 yd^3 (3,800 m^3) or~~ with each change in material type ~~whichever is less~~.

The dry density and~~,~~ moisture content~~, and loose lift thickness~~ of Category 1 materials shall be measured at a minimum frequency of once per 10,000 ft^2 ~~(930 m^2)~~ or once per 100 ft~~.~~ by 100 ft~~.~~ ~~(30 m by 30 m)~~ grid element per lift; measurement of dry density and moisture content are to be in accordance with ASTM D 2922 and D 3017 (nuclear methods). To establish correlations of moisture and density with the nuclear methods, the sand cone test method (ASTM D 1556, Density and Unit Weight of Soil in Place by the Sand-Cone) or the Drive Cylinder Method (ASTM D 2937, Density of Soil in Place by the Drive-Cylinder Method) shall be used once per 25 nuclear density tests when Category 1 materials are placed. This correlation will also be used to evaluate the effect impacted materials may have on the nuclear gauge~~densiometer~~.

Compaction testing for Category 1 materials will be documented in accordance with procedures established in the *CQA Plan*.

Rework

At locations where the field testing indicates densities below the requirements of the *IMP Plan*, the failing area shall be reworked.

Lines and Grades

Surveying of lines and grades shall be conducted by the ~~Subcontractor~~Contractor on a periodic basis during the ~~depositing~~ placement and compaction of the impacted materials as specified in the Technical Specifications. The CQC Consultant ~~shall~~ will monitor the surveying to ~~ensure~~ confirm that slopes are properly constructed to promote proper drainage and ~~assure~~ confirm that required separation distances are maintained. Any deviation from the *IMP Plan* procedures ~~shall~~ will be reported to the ~~CM~~Construction Manager for corrective action.

A.4.2 Category 2 Materials (*En Masse* Placement)

Placement Quality Control

The CQC Consultant ~~shall~~ will monitor and document that the placement of Category 2 materials is in accordance with the *IMP Plan*.

Monitoring of placement by the CQC Consultant ~~shall~~ will include verification that:

- loose lift thickness is no more than 21 in. ~~(533 mm)~~ ±3 in. ~~(76 mm)~~;
- Category 1 materials are worked into the lift as much as practical;
- horizontal extent of a lift is no more than 100 ft~~.~~ ~~(30 m)~~ and each lift is surrounded with 10 ft~~.~~ ~~(3 m)~~ of Category 1 material; and~~;~~
- horizons are limited to two lifts and separated vertically by at least the minimum ~~a~~ 4 ft~~.~~ ~~(1.2 m)~~ required thickness of the intervening horizon of Category 1 materials.

Compaction Quality Control

The CQC Consultant ~~shall~~ will monitor and document that the Category 2 materials have received the compaction effort specified by the *IMP Plan*. Category 1 materials used to surround the ~~cover each lift of~~ Category 2 material ~~shall~~ will be tested in accordance with Section A.4.1 of this IMP QA Plan, but at a frequency as follows:~~.~~

- for side berms, once per 250 ft length but not less than twice per lift; and
- for cover soil over Category 2 material, no testing is required aside from monitoring proofrolling of the final surface.

Compaction testing of Category 1 materials surrounding ~~covering~~ the Category 2 material ~~shall~~ will be documented in accordance with procedures established in the *CQA Plan*.

Rework

At locations where the field testing indicates~~d~~ densities below the requirements of the *IMP Plan*, the failing area shall be reworked as specified in Section 8.3.2 of the IMP Plan.

A.4.3 Category 3 Items (Individual Items)

Placement Quality Control

The CQC Consultant ~~shall~~ will monitor and document that the placement procedures presented in Section 8.4 of ~~this~~ the *IMP Plan* are followed by the ~~Subcontractor~~Contractor in the placement of Category 3 items. Monitors will observe and document that the maximum lift thicknesses of Category 1 materials placed around the individually placed items are in accordance with the *IMP Plan*.

Compaction Quality Control

The CQC Consultant ~~shall~~ will monitor and document that the Category 1 materials used in the placement of Category 3 items have received the compaction effort specified by the *IMP Plan*. Category 1 materials used in the placement of Category 3 materials shall be tested in accordance with Section A.4.1 of this IMP QA Plan, but at a frequency as follows:

- for soil cover lifts, once per each soil cover lift;~~,~~ and
- for side berms, once per 250 ft ~~(76 m)~~ length but not less than twice per grid element.

Compaction testing of Category 1 materials used in the placement of Category 3 items ~~shall~~ will be documented in accordance with procedures established in the *CQA Plan*.

Rework

At locations where the field testing indicates densities below the requirements of the *IMP Plan*, the failing area shall be reworked.

A.4.4 Category 4 Materials (Highly Compressible)

Placement Quality Control

The CQC Consultant ~~shall~~ will monitor and document that the placement procedures presented in Section 8.5~~0~~ of the *IMP Plan* are followed by the ~~Subcontractor~~Contractor in the placement of Category 4 materials. Monitors ~~shall~~ will observe and document that maximum loose lift thicknesses are in accordance with the *IMP Plan*.

Compaction Quality Control

The CQC Consultant ~~shall~~ will monitor and document that the Category 4 materials, and the Category 1 materials used in the placement of Category 4 materials, have received the ~~compacting~~ compaction effort specified by the *IMP Plan*. Category 1 materials used in the placement of Category 4 materials ~~shall~~ will be tested in accordance with Section A.4.1 of this IMP QA Plan, but at a frequency as follows:

- for side berms, once per 250 ft~~.~~ ~~(26 m)~~ length but not less than twice per grid element; and
- for cover 12- to 15-in. thick loose lifts, once per each soil cover lift.

Compaction testing for Category 1 materials will be documented in accordance with procedures established in the *CQA Plan*.

Rework

At locations where the field testing indicates densities below the requirements of the *IMP Plan*, the failing area shall be reworked.

A.4.5 Category 5 Materials (Special Handling, Placement and Compaction)

Placement Quality Control

The CQC Consultant ~~shall~~ will monitor and document that the placement procedures, trench/excavation dimensions or berm heights, maximum loose lieft thicknesses, and compacted height of final soil lifts are in accordance with the *IMP Plan* (or its appropriate addenda presented in Appendix C).

Compaction Quality Control

Highly Compressible Materials and Piping Containing Asbestos Insulation

The CQC Consultant ~~shall~~ will monitor and document that the Category 1 materials used in the placement of these Category 5 materials (*IMP Plan* Sections 8.6.3 and 8.6.4, respectively) have received the compaction effort specified by the *IMP Plan*. Category 1 materials used in the placement of these Category 5 materials shall be tested in accordance with Section A.4.1, but at a frequency as follows:

- for initial soil cover lifts in trenches or excavations, no testing is necessary or desired aside from observing compaction passes; and
- for subsequent soil cover lifts in trenches or excavation, once per each soil cover lift in each trench or excavation.

Compaction testing of Category 1 materials used in the placement of these Category 5 materials ~~shall~~ will be documented in accordance with procedures established in the *CQA Plan*.

Sludges

The CQC Consultant ~~shall~~ will monitor and document that the Category 1 materials used in the placement of these Category 5 materials, and these Category 5 materials themselves, have received the compaction effort specified by the *IMP Plan*.

Category 1 materials used in the placement of sludges shall be tested in accordance with Section A.4.1 of this IMP QA Plan, but at a frequency as follows:

- for side berms, once per 250 ft. ~~(76 m)~~ but not less than a minimum of two per grid element; and

- for soil cover, once per each soil cover lift in each placement grid~~unit~~.

Compaction testing of these Category 5 materials, and Category 1 materials used in the placement of these Category 5 materials, ~~shall~~ will be documented in accordance with procedures established in the *CQA Plan*.

A.5 AS-PLACED ~~PLANS~~RECORDS

~~The CQC Consultant shall prepare as-placed plans for the completed impacted materials placement activities. These plans shall report how much of each category of impacted material is in each grid element by lift with each cell. The Subcontractor~~~~Construction Contractor~~ ~~shall allow for this activity in the scheduling of impacted materials placement and shall promptly furnish appropriate sketches, notes, files, and records to the CQC Consultant.~~

~~for preparation of as-placed records shall be as follows:~~

~~CQC Consultant~~

The CQC Consultant will prepare daily placement sketches showing impacted material category, lift numbers, and grid designation. Daily sketches will be provided to Fluor Fernald, Inc. The CQC Consultant will keep track of placement locations by grid, lift, and category of material. The CQC Consultant shall coordinate with Fluor Fernald, Inc. on placement location issues.

~~Fluor Fernald, Inc.~~

Daily placement sketches prepared by the CQC Consultant and survey data provided by the Contractor will be used by Fluor Fernald, Inc. to develop an as-placed plan view for each lift, which shows each grid by cell. The as-placed plan will include total in-place cubic yards (icy) per lift, impacted material category, and date placed. Fluor Fernald, Inc. will develop cell cross sections from the as-placed plans showing impacted material category by lift.

~~The as-placed plans and cell cross sections retained by Fluor Fernald, Inc. as the as-placed records for each cell.~~

~~Contractor~~

The Contractor shall coordinate impacted material placement survey activities in accordance with the Technical Specifications. The Contractor shall provide survey information to the Construction Manager in a timely manner. The Contractor shall also keep track of placement locations by grid, lift, Category of material and submit surveyed volumes by category to the Construction Manager.~~allow for activities to support preparation of as-placed records in the scheduling of impacted material placement and shall promptly furnish appropriate sketches, notes, files, and records to the for inclusion.~~

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APPENDIX B

BEST AVAILABLE TECHNOLOGY DETERMINATION FOR REMEDIATION CONSTRUCTION ACTIVITIES ON THE FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

BEST AVAILABLE TECHNOLOGY DETERMINATION FOR REMEDIATION CONSTRUCTION ACTIVITIES ON THE FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

Category	Remediation Activities/Areas Included	Standard or Site-Specific Limit	Dust Controls/Work Practices*
Paved roadways and paved parking areas	Activities: • Hauling materials and equipment • Vehicle and equipment traffic Areas: All predetermined areas designed and improved specifically for vehicle traffic. Improvements include the application of materials such as asphalt or concrete that forms a firm level surface for travel.	Limit: There shall be no visible particulate emissions from any paved roadway or paved parking area except for a period of time not to exceed one minute during any sixty-minute observation period.	• Apply dust suppression agents. • Minimize the amount of unnecessary traffic on paved roadways used for hauling materials and vehicle/equipment traffic. • Limit speed to 20~~15~~ mph or less during operation of equipment or vehicles. • Apply appropriate dust suppression agents such as water or surfactants to materials being transported by truck load beds to ensure the transported materials will not become airborne; cover truck load beds when transported materials are still likely to become airborne. • Wheel wash prior to entering paved roadways or paved parking areas. • Wet sweep or otherwise remove any clods, clumps, tracks, or visible deposits of soil or mud from paved roadways or paved parking areas, applying appropriate dust control measures to suppress the generation of visible dust that may result from the sweeping or removal process. • Repair or resurface paved roadways/parking areas as needed.
Unpaved roadways, unpaved parking areas, and wind erosion from storage piles	Activities: • Hauling materials and equipment • Vehicle and equipment traffic Areas: All predetermined areas designed and improved specifically for vehicle traffic. Improvements include the application of gravel, shredded shingles, cinders, compaction, etc. to the delineated areas.	Limit: There shall be no visible particulate emissions from any unpaved roadway, unpaved parking area, or wind erosion from a storage pile except for a period of time not to exceed three minutes during any sixty-minute observation period.	• Apply dust suppression agents. • Minimize the amount of unnecessary traffic on unpaved roadways or unpaved parking areas. • Limit speed to 10~~15~~ mph during operation of equipment or vehicles. • Apply dust suppression agents such as surfactants or crusting agents to storage piles or cover with tarpaulin, plastic, etc., if practical; for extended periods of planned inactivity, vegetate as a last resort if protective cover or periodic application of crusting agent proves ineffective. • Apply appropriate dust suppression agents such as water or surfactants to materials being transported by truck load beds to ensure the transported materials will not become airborne; cover truck load beds when transported materials are still likely to become airborne. • Wheel wash prior to entering unpaved roadways or unpaved parking areas. • Remove, as practical, any clods, clumps, tracks, or visible deposits of soil or mud from unpaved roadways or unpaved parking areas. • Repair or resurface roadways/parking areas as needed or use an alternative road surface as a last resort.

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BEST AVAILABLE TECHNOLOGY DETERMINATION FOR REMEDIATION CONSTRUCTION ACTIVITIES ON THE FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

Category	Remediation Activities/Areas Included	Standard or Site-Specific Limit	Dust Controls/Work Practices*
Project field activities and material handling/vehicle traffic on storage piles	Activities: • Excavation • Trenching • Loading/Unloading • Transportation to defined roadway (paved or unpaved) • Load-in/Load-out on storage piles • Material placement in Onsite Disposal Cell • Vehicle traffic on storage piles Areas: • Working faces • Transition areas between working faces and defined roadways (paved or unpaved) • Onsite Disposal Cell • Storage Piles	Standard: Visible particulate emissions from project field activities/areas shall not exceed twenty percent (20%) opacity as a three-minute average. (OAC 3745-17-07 (B)(1))	• Apply dust suppression agents. • Minimize the amount of unnecessary traffic in and around field activities. • Limit speed to 10~~15~~ mph or less during operation of equipment or vehicles. • Reduce rate of excavation. • Minimize height of drop during loading and unloading. • Change method of excavation & transport (E.G., from front end loader dumping into a truck to self-propelled pan). • Apply dust suppression agents such as surfactants or crusting agents to storage piles. • Apply appropriate dust suppression agents such as water or surfactants to materials being transported by truck load beds to ensure the transported materials will not become airborne; cover truck load beds when transported materials are still likely to become airborne.

* to be applied progressively as environmental conditions dictate.

APPENDIX C

ADDENDA TO THE IMPACTED MATERIALS PLACEMENT PLAN

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PLACEMENT RESTRICTIONS FOR SPECIALIZED PLACEMENT PLANS

PLACEMENT RESTRICTIONS	ADDENDUM 1 (Bagged Impacted Material)	ADDENDUM 2 (Thorium and Non-Bagged Impacted Material)	ADDENDUM 3 (Alternate CAT 2 Placement)
TRENCHES SHALL NOT BE EXCAVATED IN PREVIOUSLY PLACED CATEGORY 2 THROUGH 5 IMPACTED MATERIAL, PROTECTIVE, CONTOURING, OR SELECT IMPACTED MATERIAL LAYERS.	X	X	X
IMPACTED MATERIAL SHALL NOT BE PLACED DIRECTLY ON PREVIOUSLY PLACED CATEGORY 2 THROUGH 5 IMPACTED MATERIAL, PROTECTIVE LAYER, OR SELECT IMPACTED MATERIAL LAYERS.	X	X	X
PLACEMENT GRID SHALL NOT BE LOCATED WITHIN 100 FT LATERALLY ADJACENT TO A CATEGORY 3 GRID IN THE SAME HORIZON	X	X	
GRIDS WITH TRANSITE DEBRIS OR THORIUM DEBRIS PLACED BY THE GRID METHOD SHALL NOT BE LATERALLY ADJACENT TO EACH OTHER WITHIN THE SAME HORIZON.		X	
GRIDS WITH TRANSITE DEBRIS OR THORIUM DEBRIS PLACED BY THE TRENCHING METHOD SHALL NOT BE LATERALLY ADJACENT TO EACH OTHER WITHIN THE SAME HORIZON.		X	
GRIDS WITH TRANSITE DEBRIS OR THORIUM DEBRIS PLACED BY THE GRID METHOD AND GRIDS WITH TRANSITE DEBRIS OR THORIUM DEBRIS PLACED BY THE TRENCHING METHOD SHALL NOT BE ADJACENT TO EACH OTHER IN THE SAME HORIZON.		X	
IMPACTED MATERIAL SHALL BE PLACED ABOVE AN INTERVENING HORIZON OF CATEGORY 1 IMPACTED MATERIAL		X	X
IMPACTED MATERIAL SHALL NOT BE PLACED WITHIN 6 FEET UNDER THE SELECT IMPACTED MATERIAL FOR THE FINAL COVER SYSTEM		X	X
PLACEMENT OF IMPACTED MATERIAL PER THIS ADDENDUM IS LIMITED TO ONE LIFT PER GRID FOR THE LIFE OF THE CELL		X	

"X" INDICATES THAT PLACEMENT RESTRICTION IS APPLICABLE TO ADDENDUM NOTED.

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Addendum No. 1
To
IMPACTED MATERIALS PLACEMENT PLAN
ON-SITE DISPOSAL FACILITY

Specialized Placement Plan
for Bagged Impacted Material

20100-PL-007
Revision 1
March 2000

United States Department of Energy

Fernald Environmental Management Project
Fernald, Ohio

Prepared by

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Under

Fluor Fernald
Subcontract 95PS005028

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On-Site Disposal Facility (OSDF)

Addendum 1 - OSDF Impacted Material Placement Plan
Rev.1, Date: January 20, 1999

Specialized Placement Plan for Bagged Impacted Material

According to Section 8, Article 8.6.1 of the Impacted Material Placement (IMP) Plan, Revision 0, dated January 1998, a specialized placement plan is to be developed for "materials either nominally larger than the physical criteria for the OSDF..." or "not reasonably anticipated by currently identified categories...". The following specialized placement plan provides the placement and compaction requirements for the bagged impacted materials which will not fit in the trenching system described for Category 5 impacted material placement as discussed in Section 8, Article 8.6.3 of the IMP plan.

Placement

Bagged impacted materials, including thorium contaminated soils and debris, requiring placement in the OSDF is limited. The primary criterion for the placement of bagged impacted materials is that the materials are placed in a manner protective of the health and safety of OSDF personnel and the public. A secondary criterion is to minimize differential settlement of the OSDF cover system.

Prior to commencement of placement activities, the contractor shall identify an appropriate grid(s) for the placement of the bagged impacted material. The placement grid(s) shall be approved by the Construction Manager. The approved grid(s) shall have a 3 ft (0.9m)to 4 ft (1.2m) depth of previously placed Category 1 material and shall comply with the following placement procedures.

A trench for bagged material placement in the approved grid(s) location shall be excavated, as shown in attached Figure 1. The bottom of the trench shall have minimum of 6 in (150mm) of Category 1 material above a previously placed Category 1 through 5 material. The trench shall not be excavated in previously placed protective, contouring, or select

impacted material layers. The width of the trench shall be approximately the width of the transporting container for the bagged impacted material plus 2 ft (0.6m). The width of the trench is anticipated to be approximately 8 ft (2.4m) to 12 ft (3.6m). Category 1 impacted material excavated from the trench shall be stored at least 6 ft (1.8m) away from the trench opening. The length of the trench shall vary depending on the quantity of bagged impacted material to be placed in the OSDF. The depth of bagged impacted material in the trench shall be approximately 24 in (600mm). The maximum distance between the bag(s) placed in the trench and trench walls and between the bags shall be 2 ft (0.6m). The placement of bagged impacted material shall be performed in accordance with Fernald Environmental Management Project (FEMP) radiological safety procedures, as well as the contractor's Safe Work Plan, to minimize worker exposure.

Compaction

Compaction shall not be performed directly on the bagged impacted material. Contact with the bagged material shall be minimized by personnel and equipment. After placement of the bagged impacted material in the trench, void spaces between the bags and between the bags and trench walls shall be filled with Category 1 material. The Category 1 material filled in void spaces shall not be compacted. An initial lift of 15 in (376mm) ±3 in (76mm) thick Category 1 material shall be placed over the bagged impacted material. The top of the initial lift shall be compacted with a minimum of four passes of a portable flat-plate, self-propelled double drum roller compactor, or a smooth drum vibratory roller and shall not require compaction testing. Additional 12 in (300mm) ±3 in (76mm) thick Category 1 lifts shall be placed above the initial lift. Total thickness of Category 1 material placed above the bagged impacted material, including the initial lift, shall be a minimum 3 ft (0.9m) as shown on attached Figure 1. The Category 1 lifts above the initial lift shall be compacted by a CAT 826 compactor, CAT 815 compactor, or equivalent, to meet at least 90 percent of the standard Proctor dry density. The compaction shall be tested in accordance with the IMP Plan.

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Addendum No. 2
To
IMPACTED MATERIALS PLACEMENT PLAN
ON-SITE DISPOSAL FACILITY

Specialized Placement Plan
for Thorium and Non-Bagged Impacted Material

20100-PL-007
Revision 1
March 2000

United States Department of Energy

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Addendum No. 2

To

Impacted Material Placement Plan

On-Site Disposal Facility

Specialized Placement Plan for Thorium and Non-bagged Impacted Material

In accordance with Section 8, Article 8.6.1 of the Impacted Material Placement (IMP) Plan, Revision 0, dated January 1998 for the On-Site Disposal Facility (OSDF), a specialized placement plan is required to be prepared for "materials either nominally larger than the physical criteria for the OSDF..." or "not reasonably anticipated by currently identified categories...". This specialized placement plan provides requirements and two options for placement of Category 2, Category 3, Category 4, and Category 5 thorium and non-bagged impacted material. This impacted material cannot be placed as described in Section 8, Article 8.6.3 of the IMP Plan or as described for bagged material in Addendum No 1, "Specialized Placement Plan for Bagged Impacted Material" because of more restrictive radiological requirements for thorium and more restrictive placement requirements for non-bagged asbestos.

PLACEMENT REQUIREMENTS

Placement of Category 2, Category 3, Category 4 and Category 5 thorium and non-bagged impacted material shall be performed in accordance with Fernald Environmental Management Project (FEMP) radiological safety procedures, the IMP Plan, including fugitive dust control and storm water runoff control, and the Contractor's approved Safe Work Plan. The Contractor's Safe Work Plan shall be revised to include requirements for placement of thorium and non-bagged impacted material as described in this Addendum No. 2. In addition to the requirements described in the above said documents, thorium and non-bagged impacted material shall be placed in a manner protective of the health and safety of OSDF personnel and the public, utilizing the As Low As Reasonably Achievable (ALARA) approach and shall meet the OSDF performance criteria stated in the Design Criteria Package for the OSDF.

PLACEMENT OPTIONS

Thorium and non-bagged impacted material (e.g. thorium contaminated debris, broken

transite panels, and soil containing friable asbestos) is expected to be generated as buildings are demolished. Additionally, some non-bagged impacted material may be generated in small quantities as other remediation activities are performed. To provide flexibility, two options are specified herein for placement of Category 2, Category 3, Category 4 and Category 5 thorium and non-bagged impacted material. These options are specified to minimize potential radiological exposure to personnel and equipment, limit dust generation, control storm water runoff, and place thorium and non-bagged impacted material in a safe manner. The two placement options are:

- Option 1 - Placement by Grid Method
- Option 2 - Placement by Trenching Method

Selection of the placement option will be made by the Construction Manager based on the quantity of thorium and non-bagged impacted material that is available for placement and availability of a required grid.

Option 1 - Placement by Grid Method

Non-bagged impacted material shall be placed by grid method when an estimated quantity of debris for placement is equal to or more than that required to fill half a grid (approximately 220 bcy or more) or when a previously placed minimum 3 ft (0.9 m) thick Category 1 grid is not available for placement by Option 2 trenching method. Bagged thorium impacted debris shall be placed by Option 2 only.

A minimum of two (2) working days prior to commencement of non-bagged impacted material placement by grid method, the Construction Manager will select and approve a grid(s). The approved selected grid(s) shall meet the following requirements:

- Grid shall not be located within 100 ft (30m) laterally adjacent to a Category 3 grid in the same horizon
- Grids with non-bagged impacted material placed by the Grid Method shall not be laterally adjacent to each other within the same horizon.
- Grid with non-bagged impacted material placed by the Grid Method and grid with thorium and non-bagged impacted material or bagged thorium impacted material placed by the Trenching Method shall not be adjacent to each other in the same horizon.
- Non-bagged impacted material shall be placed above an intervening horizon of Category

1 impacted material.

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- Non-bagged impacted material shall not be placed directly on previously placed Category 2 through 5 impacted material, protective layer, or select impacted material layer.

- Non-bagged impacted material shall not be placed within 6 ft (1.8 m) under the select impacted material for the final cover system.

- Only one (1) lift of non-bagged impacted material shall be placed in each grid.

Non-bagged impacted material placement in grid(s) shall be in accordance with the following requirements and general procedures and as shown on Figures 1, 2 and 3.

General procedures include:

- Preparation of the grid

- Debris placement

- Initial and additional lifts of Category 1 material

Requirements for each procedure are as follows:

Preparation of the Grid: After a grid is selected and approved, perimeter berms shall be constructed on three sides of the grid, as shown on Figure 1. These berms shall be constructed from Category 1 material; they shall be 24 in (600 mm) high and have a minimum top width of 10 ft (3 m). The berms shall be placed and compacted in 12 inch (300 mm) to 15 inch (375 mm) loose lifts in accordance with the IMP Plan. An additional berm shall be constructed (with the same requirements of the perimeter berms) in the middle of the grid to provide access for a trackhoe (or other equipment) to spread and compact the material. Until non-bagged impacted material placement in the grid is complete, the fourth side shall be left open for truck entrance and exit to and from the grid. The fourth side of the perimeter berm shall be constructed after completion of non-bagged impacted material as shown in Figures 2, and 3. The berms shall be compacted to meet at least 90 percent of the standard Proctor maximum dry density as described in the IMP Plan (Section 7.4.2). Compaction shall be tested in accordance with the IMP Plan. The surface of the Category 1 material on which the non-bagged impacted material will be placed shall be graded at an approximately 1% slope downward away from the truck entrance and exit side of the grid. A temporary diversion berm (approx. 18 inches [450

mm] high), as needed, shall be constructed approximately 30 ft (9 m) in front of the grid entrance to limit runoff from entering the grid. The grid shall be oriented so that the open side of the grid (fourth perimeter berm) is at the up gradient side of the grid. The required radiological controls for the placement area will be established prior to commencement of non-bagged impacted material placement.

Debris Placement: After the grid has been prepared, trucks transporting non-bagged impacted material shall dump material at the down gradient end of the grid. Non-bagged impacted material shall be spread and tamped by the bucket of a trackhoe to achieve a maximum loose lift thickness of 18 inches (450 mm). The trackhoe shall be of sufficient size and reach and be situated in such a way that only the bucket shall contact the non-bagged impacted material. Compaction, other than tamping from a trackhoe bucket shall not be performed directly on the non-bagged impacted material. In accordance with the ALARA concept, equipment operators and other personnel shall avoid contact with thorium or asbestos impacted material. Also, trucks delivering thorium impacted debris shall not drive on material deposited by the trucks or previously placed thorium impacted debris to minimize the potential for thorium contamination on the outside of the vehicle. A radiological technician or trained asbestos personnel, as appropriate, will monitor the trucks at the exit to the grid as shown on Figure 1. Fugitive dust and storm water runoff controls shall be in accordance with the IMP Plan. Water trucks and/or water hoses shall be available at the location of placement activities. The top of non-bagged impacted material shall be surveyed for location and elevation and information shall be submitted to the Construction Manager.

Initial and Additional Lifts of Category 1 Material: As the material placement progresses, an initial 15 inches (375 mm), minimum, 18 in (450 mm) maximum loose lift of Category 1 material (soil and soil-like material) shall then be placed on top of the non-bagged impacted material by the end of each working day. No non-bagged impacted material shall remain uncovered with Category 1 material by the end of the workday. The entire grid shall be covered with an initial lift by the end of five (5) working days. The initial lift shall be compacted with a minimum of four one-way passes of a self-propelled double drum roller compactor, a smooth drum vibratory roller or other compaction equipment approved by the Construction Manager. No compaction testing will be performed on the initial lift above the non-bagged impacted material. As shown in Figures 2 and 3, the fourth side of the perimeter berm will be constructed after non-bagged impacted material placement is completed. After the fourth side of the perimeter berm has been placed and initial lift is

placed over the non-bagged impacted material, the temporary diversion berm to control storm water runoff, as needed, shall be removed. An additional 12 inches (300 mm) ±3 inches (75 mm) loose lift(s) of Category 1 material shall be placed above the initial lift. Total compacted thickness of Category 1 material placed above the non-bagged impacted material, including the initial lift, shall be at least as thick as the intervening horizon described in the IMP Plan. See attached Figure 3. The Category 1 lift(s) above the initial lift shall be compacted to meet at least 90 percent of the standard Proctor maximum dry density. Appropriate compaction equipment, including the Cat-826 landfill compactor or approved equivalent, shall be used on lifts above the initial lift to meet the specified compaction requirements. Compaction of the additional lift(s) shall be tested in accordance with the IMP Plan.

After compacting the final lift of Category 1 material over the non-bagged impacted material the Category1 material shall be proof-rolled. Soft spots indicated by tire ruts more than 3 inches (76 mm) in depth or visible deflection under the moving proof rolling equipment shall be stabilized through additional passes of the compactor. The proof rolling equipment shall have a minimum gross vehicle weight of 20 tons (180kN) and exert a ground pressure of at least 65 psi (450 kPa). Any soft spot that cannot be stabilized with further compactive effort shall be cause for additional treatment to the satisfaction of the Construction Manager.

<u>Option 2 – Placement by Trenching Method</u>

Bagged thorium or non-bagged impacted material shall be placed by trenching method when the material estimated quantity of debris will be less than the quantity required to fill a half grid (less than approximately 220 bcy) and a previously placed minimum 3 ft (0.9 m) thick Category 1 grid is available for placement of the bagged thorium or non-bagged impacted material as shown in Figure 4.

A minimum of two (2) working days prior to commencement of impacted material placement by the trenching method, the Construction Manager will select and approve a grid previously placed with a minimum 3 ft (0.9 m) thick Category 1 layer overlying an intervening horizon of Category 1 material. The trench for placement of bagged thorium or non-bagged impacted material by this method shall meet the following requirements:

- Grid shall not be located within 100 ft (30 m) laterally adjacent to a Category 3 grid in

the same horizon.

- Grids with bagged thorium or non-bagged impacted material trenches shall not be laterally adjacent to each other within the same horizon.

- Grid with non-bagged impacted material placed by the Grid Method and grid with bagged thorium or non-bagged impacted material placed by the Trenching Method shall not be adjacent to each other in the same horizon.

- A trench for bagged thorium or non-bagged impacted material shall not be excavated in previously placed Category 2 through 5 impacted material, protective layer, or select impacted material layer.

- A trench for bagged thorium or non-bagged impacted material shall not be excavated within 6 ft (1.8 m) under the select impacted material for the final cover system

- Only one (1) lift of bagged thorium or non-bagged impacted material shall be placed in each grid.

- Minimum thickness of Category 1 material under bagged thorium or non-bagged impacted material trench excavation shall be the thickness of the intervening horizon of Category 1 impacted material as described in the IMP Plan.

Bagged thorium or non-bagged impacted material placement in a trench shall be in accordance with the following requirements and general procedures and as shown on Figure 4.

General procedures include:

- Trench Excavation

- Debris Placement

- Initial and Additional Lifts of Category 1 Material

Requirements for each procedure are as follows:

Trench Excavation: After a grid(s) is selected and approved, a trench (or trenches) shall be excavated as shown on Figure 4. Each trench shall be a minimum of 3 ft (0.9 m) deep and a maximum of 4 ft (1.2 m) deep and between 8 ft (2.4 m) and 12 ft (3.6 m) wide. A minimum 6 ft (1.8 m) distance shall be maintained between top of the side slopes of the adjacent trench. One end of the trench shall be graded to a minimum 5H:1V ramp (subject to approval by FDF Safety Engineer) for truck access into the trench. The trench bottom

shall be graded at an approximately 1% slope downward away from the truck access ramp. The maximum trench length shall be approximately 70 ft (21 m) and shall be limited by the maximum length that can be excavated in one grid and still provide adequate access to enter and exit the trench. The Category 1 material excavated from the trench shall be stockpiled a minimum of 6 ft (1.8 m) from the top of the side slopes of the trench and shall be used later for initial and additional lifts over the bagged thorium or non-bagged impacted material. The necessary radiological controls or trained asbestos personnel, as appropriate, will be established prior to commencement of bagged thorium or non-bagged impacted material placement.

Debris Placement: After the trench is excavated, trucks transporting bagged thorium or non-bagged impacted material shall back down the ramp and begin dumping material at the furthest end of the trench. Bagged thorium or non-bagged impacted material shall be spread and tamped by the bucket of a trackhoe to achieve a maximum loose lift thickness of 18 inches (450 mm). The trackhoe shall be situated in such a way that only the bucket shall contact the bagged thorium or non-bagged impacted material. Compaction, other than tamping from a trackhoe bucket shall not be performed directly on the bagged thorium or non-bagged impacted material. Equipment operators and other personnel shall avoid contact with thorium or asbestos impacted material in accordance with the ALARA concept. Trucks delivering thorium impacted debris shall not drive on material deposited by the trucks or previously placed thorium impacted material to minimize the potential for thorium contamination on the outside of the vehicle. A radiological technician or trained asbestos personnel, as appropriate, will monitor the trucks at the exit to the trench as shown on Figure 4. Fugitive dust and storm water runoff controls shall be in accordance with the IMP Plan. Water trucks and/or water hoses will be available at the location of placement activities. The bottom of the trench and the top of the bagged thorium or non-bagged impacted material shall be surveyed for location and elevation and information shall be submitted to the Construction Manager.

Initial and Additional Lifts of Category 1 Material: After bagged thorium or non-bagged impacted material is placed in the trench and compacted, it shall be covered with an initial 15 inches (375 mm) minimum, 18 in (450 mm) maximum loose lift of Category 1 material by the end of each working day. The initial lift shall be compacted with a minimum of four one-way passes of a self-propelled double drum roller compactor, a smooth drum vibratory roller or other compaction equipment approved by the Construction Manager. No compaction testing will be performed on the initial lift above bagged thorium or non-bagged

impacted material. An additional 12 inches (300 mm) ±3 inches (75 mm) loose lift(s) of Category 1 material shall be placed above the initial lift. Total compacted thickness of Category 1 material placed above the bagged thorium or non-bagged impacted material, including the initial lift, shall be a minimum 15 inches (375 mm) as shown on attached Figure 4. The Category 1 lift(s) above the initial lift shall be compacted to meet at least 90 percent of the standard Proctor maximum dry density. Appropriate compaction equipment, shall be used on lifts above the initial lift to meet the specified compaction requirements. Compaction of the additional lift(s) shall be tested in accordance with the IMP Plan.

After compacting the final lift of Category 1 material over the bagged thorium or non-bagged impacted material, the Category1 material shall be proof-rolled. Soft spots indicated by tire ruts more than 3 inches (76 mm) in depth or visible deflection under the moving proof rolling equipment shall be stabilized through additional passes of the compactor. The proof rolling equipment shall have a minimum gross vehicle weight of 20 tons (180 kN) and exert a ground pressure of at least 65 psi (450 kPa). Any soft spot that cannot be stabilized with further compactive effort shall be cause for additional treatment to the satisfaction of the Construction Manager. As shown on Figure 4, the trench will subsequently be covered with an intervening horizon of Category 1 material.

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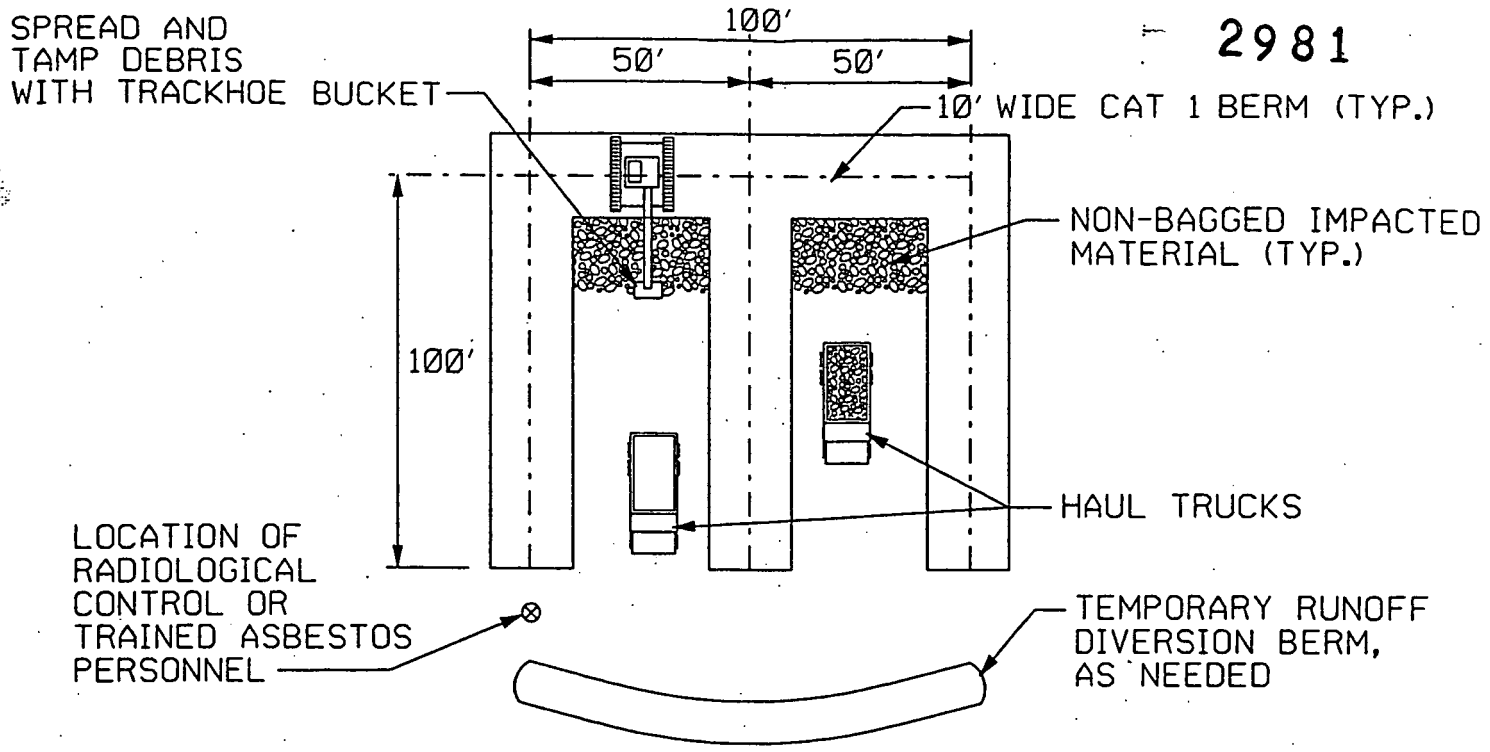

PLACING NON-BAGGED IMPACTED MATERIAL IN GRID

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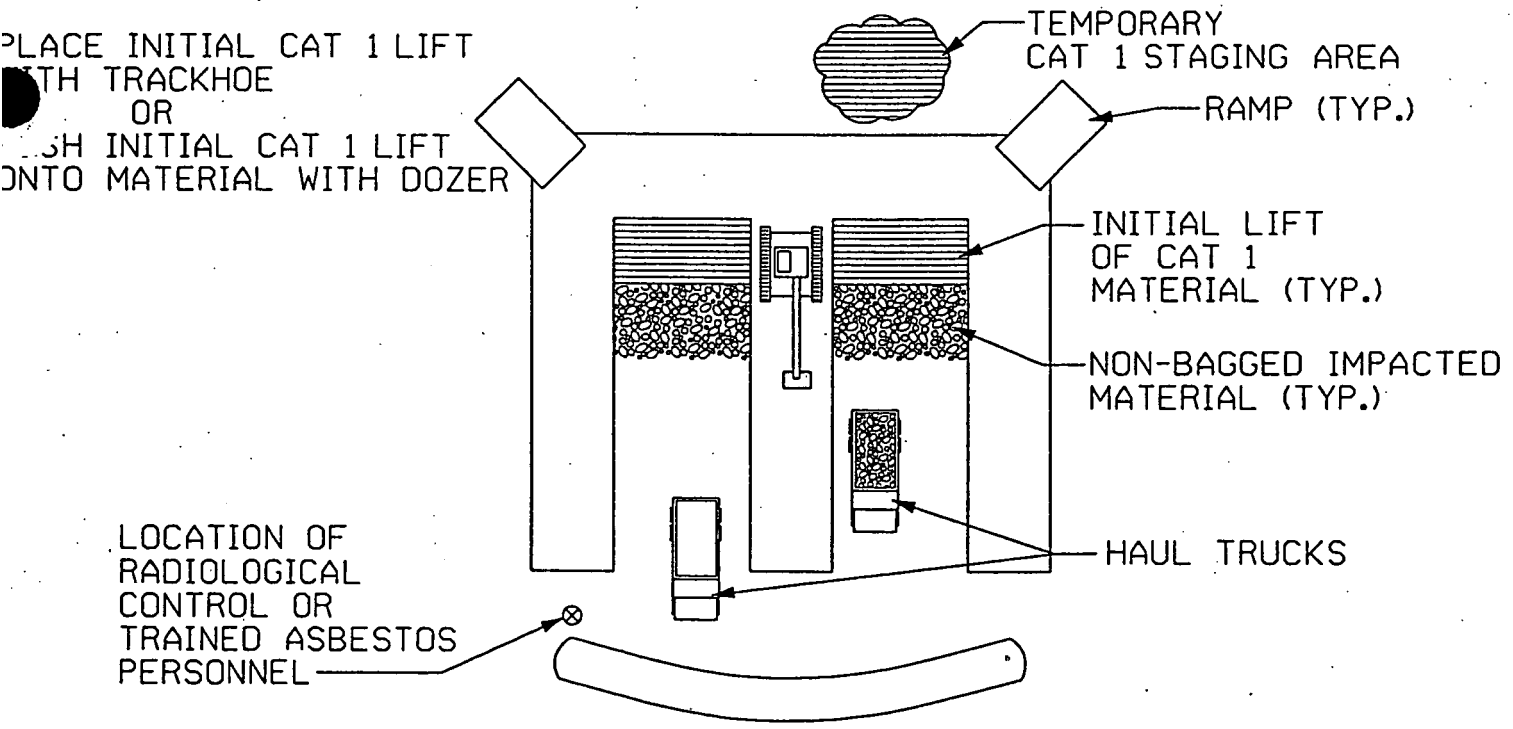

COVERING NON-BAGGED IMPACTED MATERIAL

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FIGURE 1

IORIUM AND NON-BAGGED IMPACTED MATERIAL PLACEMENT

OPTION 1 - GRID METHOD

PLAN VIEW

SHEET 1 OF 3

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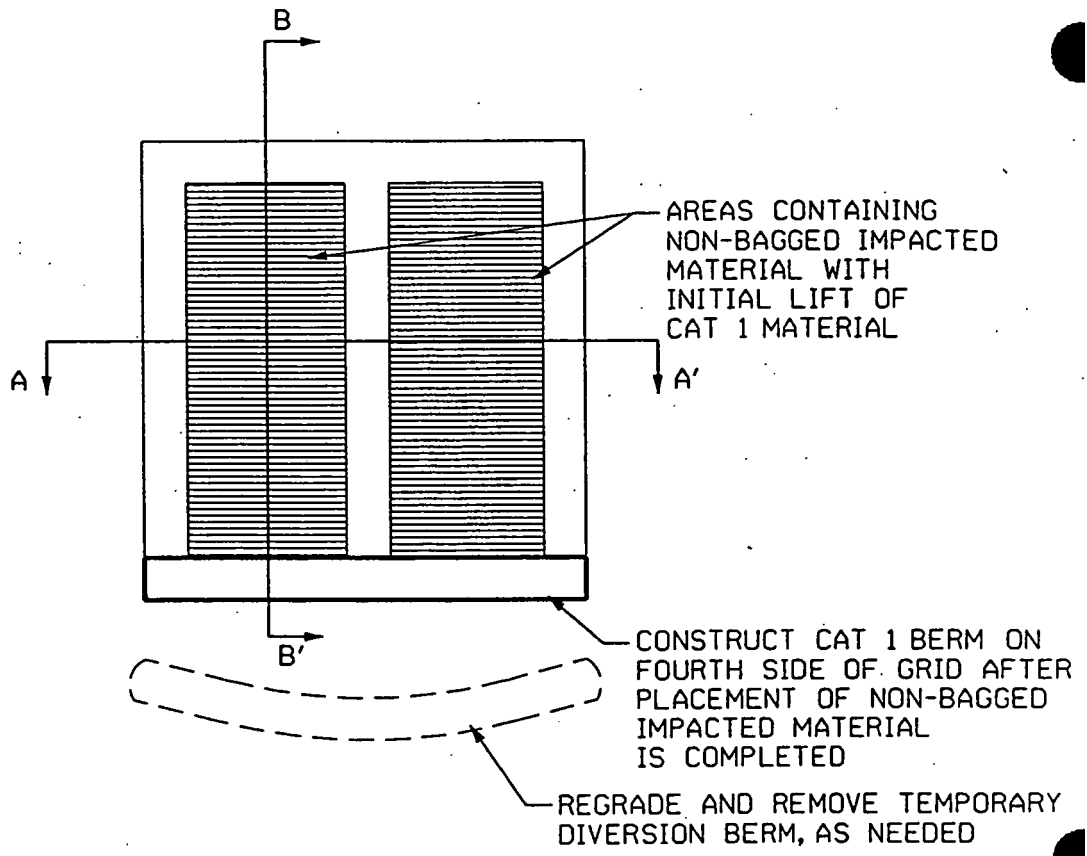

COMPLETION OF NON-BAGGED IMPACTED MATERIAL GRID

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NOTES: SEE FIGURE 3 (SHEET 3 OF 3) FOR AA' AND BB' CROSS SECTIONS.

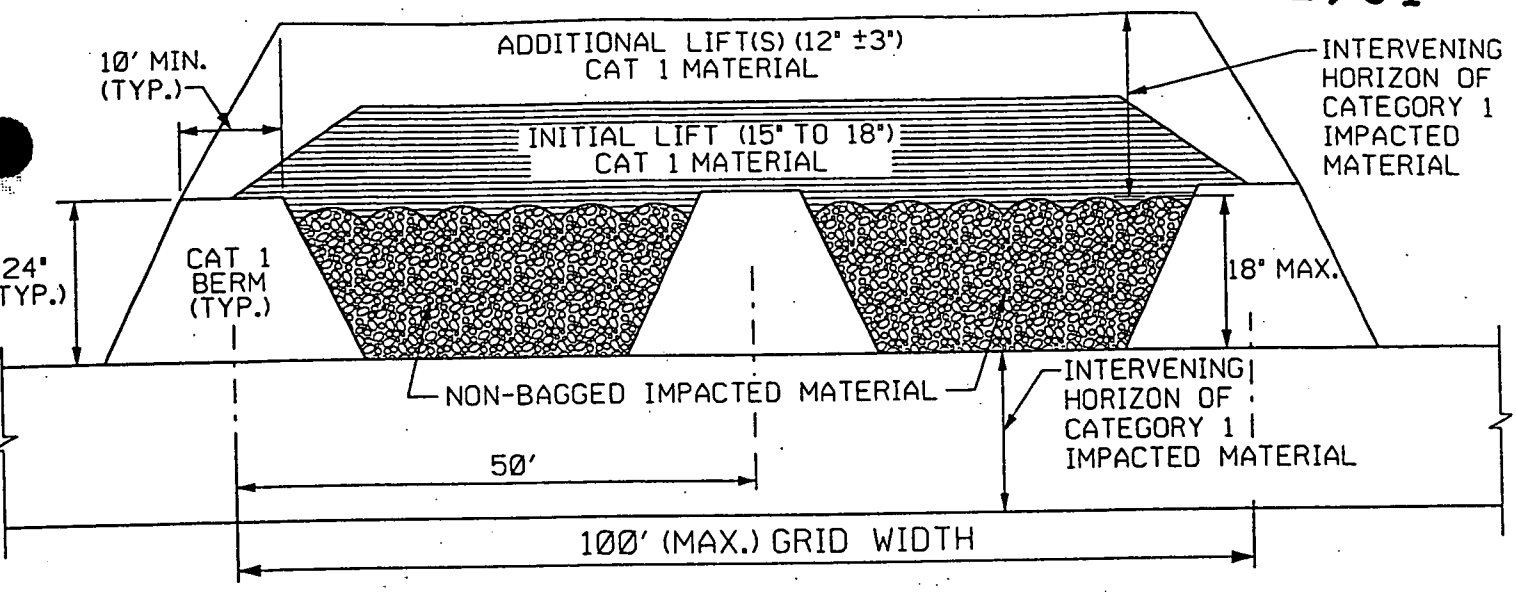
FIGURE 2

IORIUM AND NON-BAGGED IMPACTED MATERIAL PLACEMEN

OPTION 1 - GRID METHOD

PLAN VIEW

SHEET 2 OF 3



SECTION A-A'

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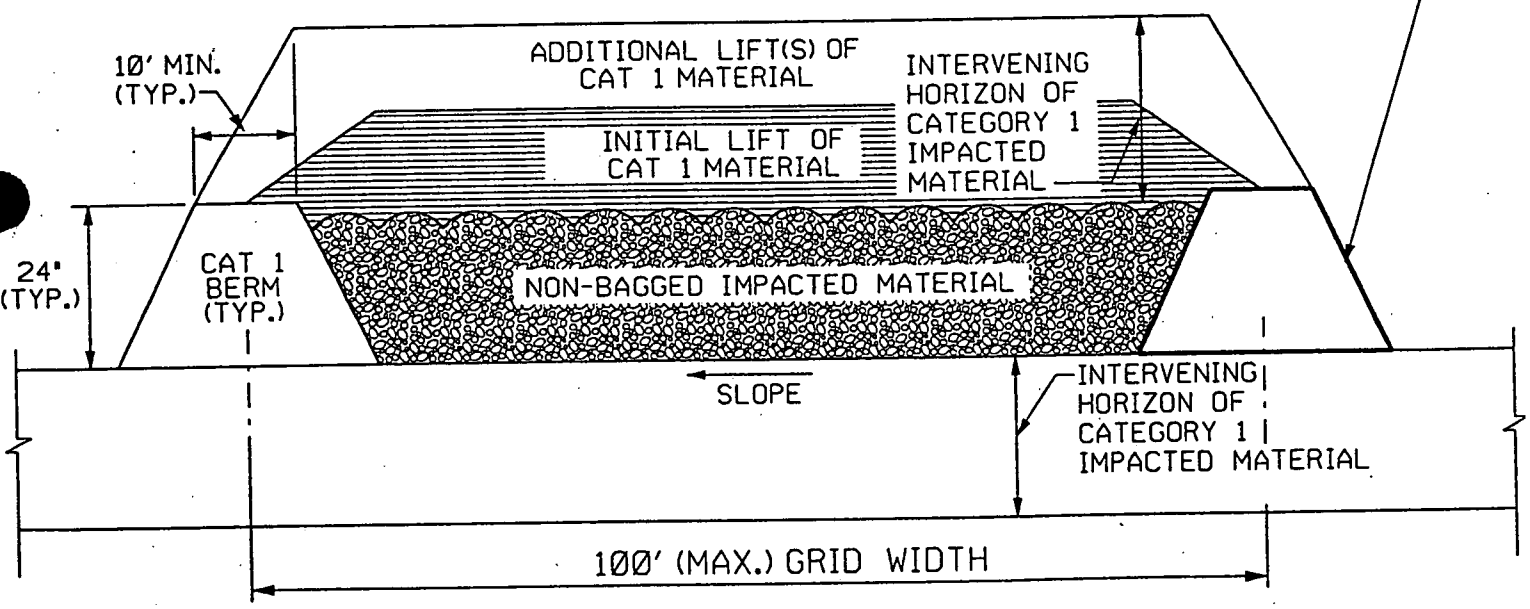
CONSTRUCT CAT 1 BERM ON FOURTH SIDE OF GRID AFTER PLACEMENT OF NON-BAGGED IMPACTED MATERIAL IS COMPLETED



NOTE: FOR PLAN VIEW SEE FIGURE 2 (SHEET 2 OF 3)

SECTION B-B'

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FIGURE 3

HORIUM AND NON-BAGGED IMPACTED MATERIAL PLACEMENT

OPTION 1 - GRID METHOD

CROSS SECTIONS

SHEET 3 OF 3

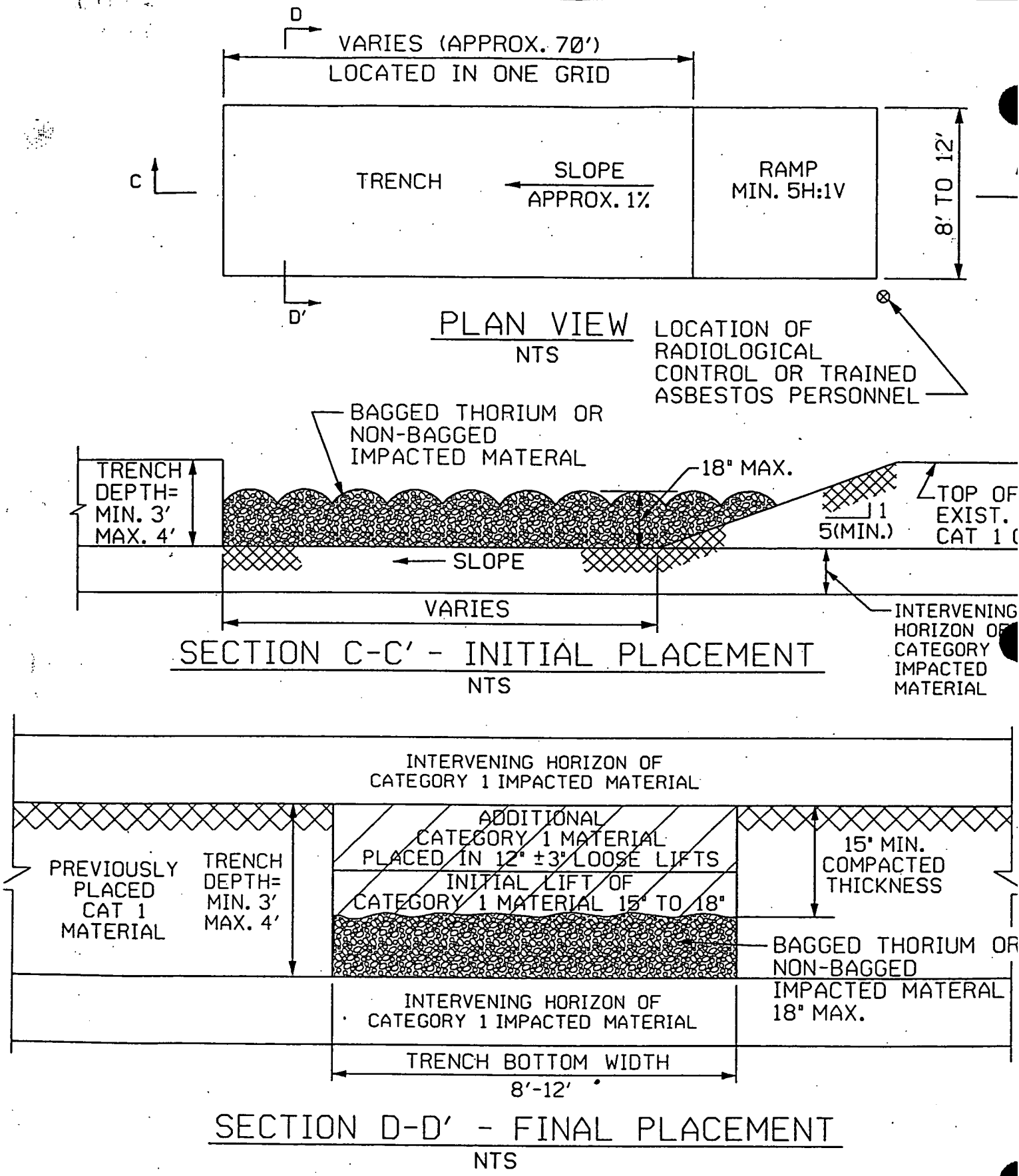

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FIGURE 4
THORIUM AND NON-BAGGED IMPACTED MATERIAL PLACEMEN
OPTION 2 - TRENCHING METHOD
SHEET 1 OF 1

Addendum No. 3
To
IMPACTED MATERIALS PLACEMENT PLAN
ON-SITE DISPOSAL FACILITY

Alternative Trenching Method for Placement of Category 2 Impacted Material

20100-PL-007

Revision 1
MARCH 2000

United States Department of Energy

Fernald Environmental Management Project
Fernald, Ohio

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Addendum No. 3

To

Impacted Material Placement Plan

On-Site Disposal Facility

Alternative Trenching Method for Placement of Category 2 Impacted Material

In accordance with Section 8, Article 8.3 of the Impacted Materials Placement (IMP) Plan, Revision 0, dated January 1998 for the On-Site Disposal Facility (OSDF) describes the placement and compaction procedures for Category 2 impacted material. As described in Section 5, Article 5.2 of the IMP Plan, Category 2 impacted materials are materials that can be transported, placed, spread and compacted *en masse*. Examples of Category 2 impacted material include: broken-up concrete foundations, impacted soil mixed with broken-up concrete, general building rubble and debris of irregularly shaped metals or other components of the superstructure or substructure with a maximum length of 10 ft (3 m) and a maximum thickness of 18 in (450 mm).

This specialized placement plan provides an alternative trenching method and related requirements for placement of Category 2 impacted material. This alternative trenching method shall be used for non-routine placement of Category 2 impacted material when:

- Types of Category 2 impacted material require lateral confinement for spreading and placement activities (e.g., structural steel, pipes), or
- Types of Category 2 material require special handling (such as large structural members that meet the Category 2 materials size criteria).

PLACEMENT REQUIREMENTS

Placement of Category 2 impacted material using the alternative trenching method shall be performed in accordance with Fernald Environmental Management Project (FEMP) radiological safety procedures, the IMP Plan, including fugitive dust control and storm water runoff control, and the Contractor's approved Safe Work Plan. The Contractor's Safe Work Plan shall be revised to include requirements for the Alternative Trenching

Method. In addition to the requirements described in the above said documents, Category 2 impacted material shall be placed in a manner protective of the health and safety of OSDF personnel and the public, utilizing the As Low As Reasonably Achievable (ALARA) approach and shall meet the OSDF performance criteria stated in the Design Criteria Package for the OSDF.

A minimum of two (2) working days prior to commencement of Category 2 impacted material placement by the alternative trenching method, the Construction Manager will select and approve a previously placed minimum 3 ft (0.9 m) thick Category 1 grid overlying an intervening horizon of Category 1 material. The trench for placement of Category 2 material by this method shall meet the following requirements:

- A trench shall not be excavated in previously placed Category 2 through 5 impacted material, protective layer, or select impacted material layer.
- A trench shall not be excavated within 6 ft (1.8 m) under the select material for the final cover system.
- Minimum thickness of Category 1 material under trench excavation shall be as thick as the intervening horizon of Category 1 impacted material as described in the IMP Plan.

Category 2 material placement in a trench shall be in accordance with the requirements and general procedures presented herein and as shown on Figure 1.

General procedures include:

- Trench Excavation
- Category 2 Material Placement
- Lift(s) of Category 1 Material

Requirements for each procedure are as follows:

<u>Trench Excavation:</u> After a grid(s) is selected and approved, a trench (or trenches) shall be excavated as shown on Figure 1. Each trench shall be a minimum of 3 ft (0.9 m) deep and a maximum of 4 ft (1.2 m) deep, and between 15 ft (4.6 m) and 18 ft (5.5 m) wide. A minimum 6 ft (1.8 m) distance shall be maintained between top of the side slopes of the adjacent trenches. One end of the trench shall be graded to a minimum 5H:1V (subject to approval by FDF Safety Engineer) ramp for truck access into the trench. The maximum trench length shall be approximately 70 ft (21 m) and shall be limited by the maximum

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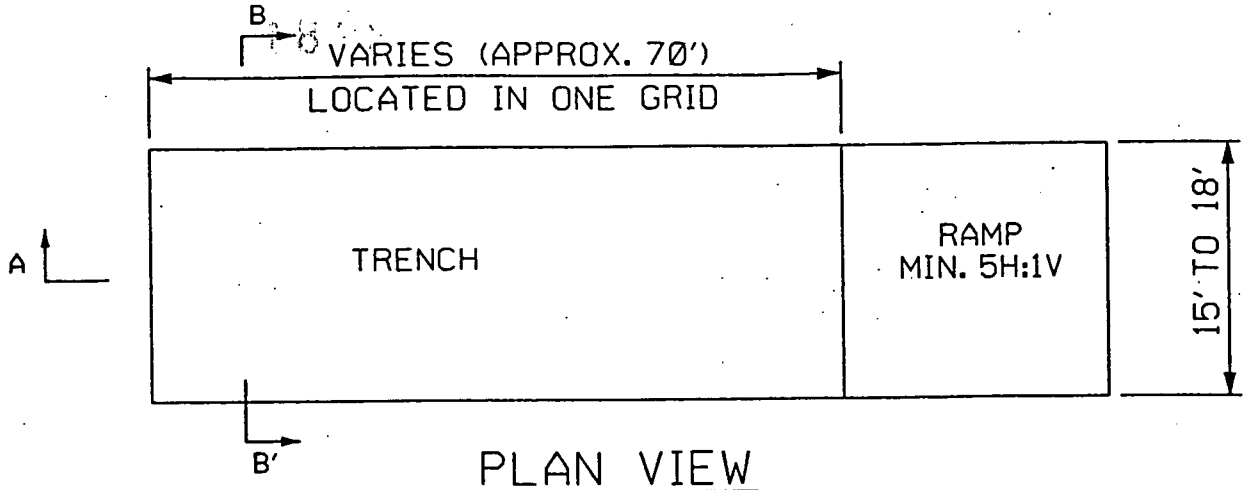
length that can be excavated in one grid and still provide adequate access to enter and exit the trench. The Category 1 material excavated from the trench shall be stockpiled a minimum of 6 ft (1.8 m) from the top of the side slopes of the trench and shall be used later for lift(s) of Category 1 material over the Category 2 impacted material.

Category 2 Material Placement: After the trench is excavated, trucks transporting Category 2 impacted material shall back down the ramp and begin dumping material at the furthest end of the trench. Category 2 material shall be spread by construction equipment, such as a trackhoe or dozer, to achieve a maximum loose lift thickness of 18 in. (450 mm) ± 3 in. (75 mm). Contractor shall spread and mix Category 1 material as much as practicable with Category 2 material during placement in the trench. The objective of this mixing is to fill voids within the Category 2 material, increase the density, and aid in homogenizing the debris. Initial compaction shall be accomplished using a Cat 826 landfill compactor or equivalent within the trench. Fugitive dust and storm water runoff controls shall be in accordance with the IMP Plan. Water trucks and/or water hoses will be available at the location of placement activities.

Lift(s) of Category 1 Material: The compacted Category 2 impacted material shall be covered with a 12 in. (300 mm) to 15 in. (375 mm) loose lift of Category 1 material. The lift shall be compacted with a minimum of four one-way passes of a self-propelled double drum roller compactor, a smooth drum vibratory roller or other compaction equipment approved by the Construction Manager. Additional 12 in. (300 mm) to 15 in. (375 mm) loose lift(s) of Category 1 material shall be placed, if necessary, to the top of trench elevation. Total compacted thickness of Category 1 material placed above the Category 2 impacted material, shall be a minimum of 15 in. (375 mm) as shown on attached Figure 1. The lift(s) of Category 1 material shall be compacted to at least 90 percent of the standard Proctor maximum dry density. Compaction shall be tested in accordance with the IMP Plan. As shown on Figure 1, the trench will subsequently be covered with an intervening horizon of Category 1 material.



PLAN VIEW
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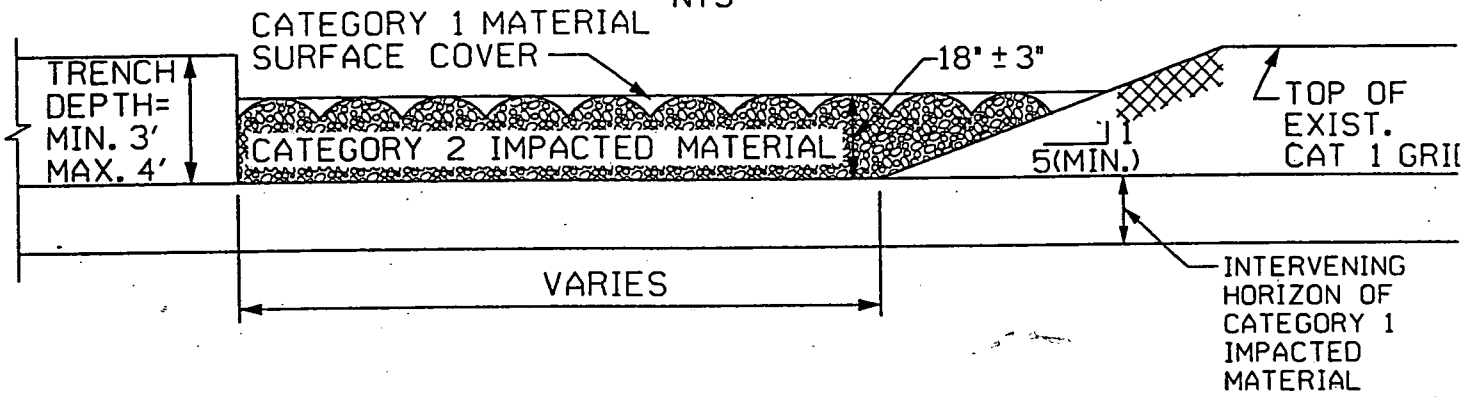

SECTION A-A' - CATEGORY 2 MATERIAL PLACEMENT
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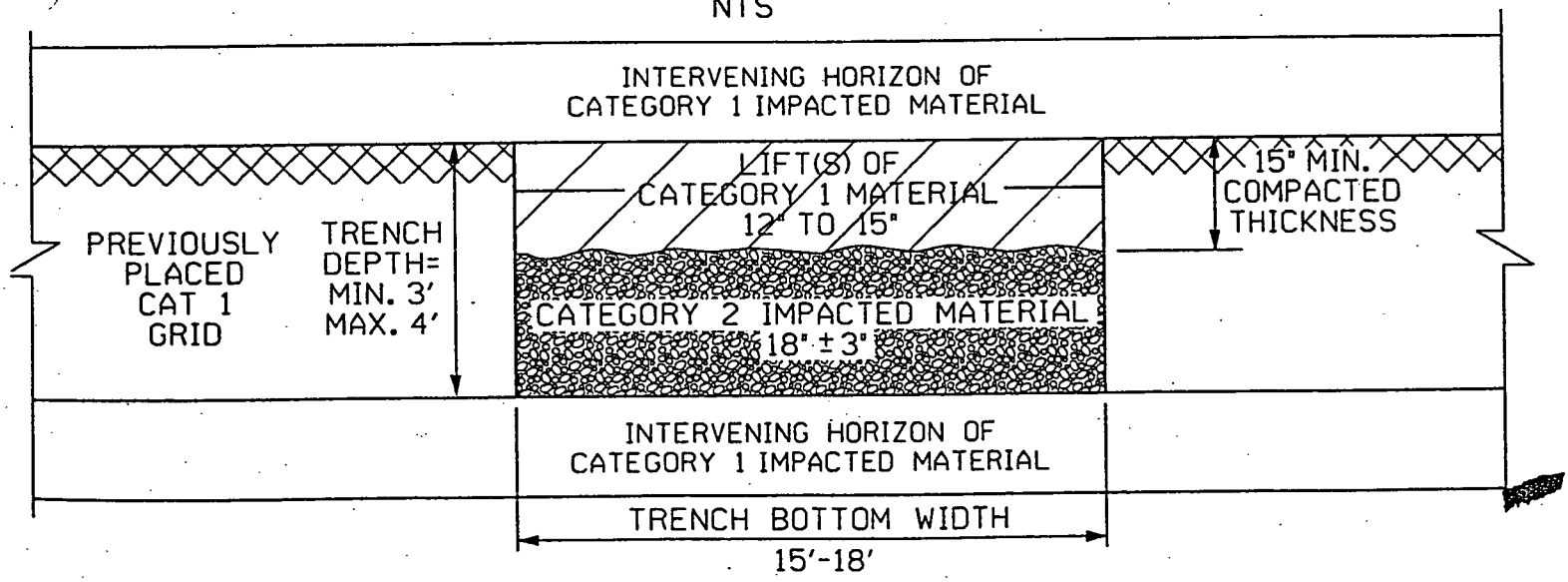

SECTION B-B' - PLACEMENT OF CATEGORY 1 LIFT(S)
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FIGURE 1
CATEGORY 2 IMPACTED MATERIAL PLACEMENT
ALTERNATIVE TRENCHING METHOD
SHEET 1 OF 1