



## Construction Specification 204 Earthfill for Waste Storage Facilities

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### SCOPE

The work shall consist of all operations necessary to place the earthfill or soil liner required by the drawings or directed by the Technician.

### MATERIALS

All fill materials shall be obtained from required excavations and designated borrow areas. The selection, blending, routing, and disposition of materials shall be subject to approval by the Technician.

Fill materials shall contain no sod, brush, roots, frozen soil, or other perishable materials. Stones larger than two-thirds of the uncompacted layer thickness shall be removed from the materials prior to compaction. Additional soil properties are shown on the drawings.

Sand and gravel fill required below concrete footings and floor slabs as indicated on any Wisconsin Standard Drawings shall consist of either in place or imported granular soils. These granular soils shall contain no rocks greater than 4" in maximum dimension and be reasonably well graded such that the surface is firm once wetted and compacted. The material shall have no more than 15%, by weight, passing the Number 200 sieve size.

Foundry sand shall be ferrous foundry sand with minimal concentrations of hazardous constituents, cores and other over-sized materials crushed or removed, and contain at least 5% bentonite.

### GENERAL

Construction operations shall be carried out in such a manner and sequence that erosion and air and water pollution will be minimized. The completed job shall present a professional appearance and shall conform to the lines, grades, and elevations as shown on the drawings or as staked in the field. All operations shall be carried out in a safe and skillful manner. Safety and health regulations shall be observed and appropriate safety measures used by the contractor.

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### FOUNDATION PREPARATION

The foundation area shall be cleared of trees, stumps, roots, brush, rubbish, frozen soil, and stones having a maximum dimension greater than 6 inches. Foundations shall be stripped to remove vegetation and other unsuitable materials to a minimum depth of 6 inches or to a greater depth if so shown on the drawings. Topsoil shall be stripped from the foundation area and stockpiled for use as a top dressing for vegetation establishment unless otherwise shown on the drawings.

The moisture content of the scarified foundation materials shall be maintained as specified for the earthfill in Section 7. The surface materials of the foundation shall be compacted and bonded with the first layer of earthfill as specified for subsequent layers of earthfill.

### EXCAVATION

The required excavations shall conform to the lines, grades, and elevations as shown on the drawings. Excavation beyond specified limits shall be corrected by filling with approved compacted materials.

The required dimensions and side slopes of all structure and trench excavations shall be as shown on the drawings. Trenches deeper than 4 feet shall have side slopes above the 4-foot depth excavated at 0.5:1 or flatter depending on the materials being excavated or the trench shall be braced to safeguard the work and workers. When backfilling pipe trenches in the waste storage facility embankment, the trench slopes shall be cut back to 1:1 from 12 inches above the top of the pipe. The backfill material and compaction shall be equivalent to the surrounding embankment.

To the extent that they are needed, all suitable materials removed from the specified excavations shall be used in the construction of the required earthfill or soil liner. The suitability of materials for specific purposes will be determined by the Technician.

All surplus or unsuitable excavated materials shall be disposed of at the locations shown on the drawings or as approved by the Technician. Surplus materials shall not be placed in wetlands.

## **BORROW AREAS**

When the quantities of suitable materials obtained from specified excavations are insufficient to construct the specified fill portions of the permanent works, additional materials shall be obtained from the designated borrow areas. The borrow area shall be stripped to remove vegetation or other unsuitable materials to a minimum depth of 6 inches or to the depth shown on the drawings. This stripping shall be performed immediately prior to use of the borrow material to reduce the time the area is exposed to erosion. For large borrow areas, only a portion of the area should be stripped at a time.

## **FILL MOISTURE CONTENT**

Fill materials shall have a moisture content sufficient to insure the required compaction. When kneaded in the hand, the soil will form a ball which does not readily separate and will not extrude out of the hand when squeezed tightly. The adequacy of the moisture content will be determined by the Technician.

If the top surface of compacted fill is too dry to permit suitable bond, it shall either be removed or scarified and wetted by sprinkling to an acceptable moisture content prior to placement of the next layer of fill. The applied water must be allowed time to be absorbed by the fill or disked into the dry layer.

Fill material that is too wet shall be allowed to dry to an acceptable moisture content before placement. If the top surface of compacted fill is too wet, it shall be either removed or allowed to dry to an acceptable moisture content before compaction or placing additional layers of fill.

## **FILL PLACEMENT**

Fill shall not be placed until the required excavation and preparation of the underlying foundation is completed and approved by the Technician. Fill shall be placed beginning at the lowest elevation of the foundation. No fill shall be placed on a frozen surface.

If the surface of any layer becomes too hard and smooth for proper bond with the succeeding layer, it shall be scarified parallel to the axis of the fill to a depth of not less than 2 inches before the next layer is placed.

Available topsoil shall be placed on the top and the exposed outside slopes of the waste storage facility embankment, the borrow areas, and any other area where the topsoil was removed during construction and where vegetation will be established.

The pre-compacted thickness of each layer of fill and compaction requirements shall be as stated below unless otherwise specified in the construction plans. Materials placed by dumping in piles or windrows shall be spread uniformly to not more than the specified layer thickness prior to compaction. The Technician shall determine if adequate compaction is being achieved and may require more than the minimum specified passes of the compaction equipment.

1. Embankments. The fill shall be placed in horizontal layers extending the entire length and width of the embankment. Unless otherwise specified in the construction plans, compaction requirements shall be as shown in Table 1. Each layer shall be compacted by a minimum of one pass over the entire surface of the fill by the compaction equipment.
2. Adjacent to Structures and Pipes. Adjacent to structures or pipes, earthfill shall be placed in 4-inch lifts (prior to compaction) in a manner adequate to prevent damage to the structure and to allow the structure or pipe to gradually and uniformly assume the backfill loads. Compaction shall be accomplished by means of manually directed power tampers or plate vibrators or hand tamping unless otherwise specified. Heavy equipment shall not be operated within 2 feet of any structure or pipe. Compaction by means of drop weights operating from a crane or hoist of any type will not be permitted.

All intrusions into or penetrations of a clay or other soil liner will be backfilled with equivalent material and compacted to maintain its integrity. Pipe trenches into a storage facility will be backfilled with the same soils and compaction required for the storage facility for the distance shown on the drawings.

3. **Soil Liners.** A soil liner shall be installed as designated on the drawings. This work shall consist of constructing a low permeability earthliner for the inside slopes and the bottom of the earthen basin to the thickness shown on the drawings. It also includes the soil liner material placed in conjunction with other liner materials to form a composite liner as shown on the drawings. Only soils approved by the Technician will be used.

The soil liner fill shall be placed in layers with a maximum thickness of 6 inches prior to compaction. The liner material shall be disked or worked in such a manner as to obtain a maximum clod size of 4 inches prior to compaction. Each layer of liners that do not require a specified density shall be compacted by a minimum of one pass over the entire surface of the fill by a:

- Rubber-tired front end loader (fully-loaded); or
- Scraper (fully-loaded); or
- Articulated haul truck (fully-loaded); or
- Sheepsfoot; or Tamping roller

Smooth drum rollers are not suitable for compaction of fine-grained liners.

Operation of the compaction equipment will be continuous over the entire area during fill operations. Any liner area disturbed by subsequent construction operations will be scarified and recompactd as specified.

4. **Small Areas of Unsuitable Materials.** Lenses or pockets of soil not meeting the criteria requirements in the applicable NRCS Standard or shown on the drawings, shall be removed and replaced with specified materials. The extent of removal and the quality of replacement materials will be as shown on the drawings or approved by the Technician. Excavated slopes shall be 1:1 or flatter. Replacement soil material placement, layer thickness, and compaction will be as stated for soil liners. Manually directed power tampers may be used for compaction and the soil shall be placed in 4-inch lifts prior to compaction.

**Table 1 - Embankment Compaction Requirements**

Equipment Type	Applicable Soils <sup>1</sup>	Maximum Fill Height <sup>2</sup> (feet)	Layer Thickness <sup>3</sup> (Inches)
Sheepsfoot or tamping roller 10,000 lb. min. operating weight	ML, MH, CL, CH, SM, SC, GM, GC	None	9
Vibratory tamping roller 9,000 lb. min. operating weight	SM, SC, GM, GC	None	6
Smooth steel drum vibratory roller 10,000 lb. min.	SP, SW, GP GW	20	6
Rubber-tired scraper or articulated haul truck (fully loaded)	ML, MH, CL, CH SM, SC, GM, GC	None	9
Rubber-tired front end loader (fully loaded)	ML, MH, CL, CH SM, SC, GM, GC	20	6

<b>Equipment Type</b>	<b>Applicable Soils<sup>1</sup></b>	<b>Maximum Fill Height<sup>2</sup> (feet)</b>	<b>Layer Thickness<sup>3</sup> (Inches)</b>
Track-type crawler standard tracks 30,000 lb. min.	SM, SC, GM, GC, ML, CL, SP, SW, GP, GW	10	6
Farm tractor 2,400 lb. min.	ML, MH, CL, CH, SM, SC, GM, GC	15	6
<sup>1</sup> Unified Soil Classification System. <sup>2</sup> Measured from the top of the fill to the lowest point along the centerline of the fill. <sup>3</sup> Prior to compaction.			

## **Specific Site Requirements**