Run-On and Run-Off Control System Plan

CFR 257.81

Fly Ash Reservoir 1 Landfill

Cardinal Plant

Brilliant, Ohio

October, 2016

Prepared for: Cardinal Operating Company - Cardinal Plant

Brilliant, Ohio

Prepared by: Geotechnical Engineering Services

American Electric Power Service Corporation

1 Riverside Plaza

Columbus, OH 43215

GERS-16-123

Run-On and Run-Off Control System Plan
CFR 257.81
Fly Ash Reservoir FAR 1 Landfill
Cardinal Plant

GERS-16-123

PREPARED BY Mohammad A. Ajlouni, Ph.D.,P.E. **DATE** 10/04/2016

REVIEWED BY Daniel W. Pizzino, P.E. **DATE** 10/10/2016

APPROVED BY Gary F. Zych, P.E.
Manager – AEP Geotechnical Engineering **DATE** 10/11/2016

STATE OF OHIO
MOHAMMAD
A
AJLOUNI
67074
REGISTERED
PROFESSIONAL ENGINEER

I certify to the best of my knowledge, information, and belief that the information contained in this Run-On and Run-Off Control System plan meets the requirements of 40 CFR § 257.81

TABLE OF CONTENTS

1.0 OBJECTIVE

This report was prepared by AEP- Geotechnical Engineering Services (GES) section to fulfill requirements of CFR 257.81 for Run-On and Run-Off Control System plan of CCR units.

2.0 DESCRIPTION OF THE CCR UNIT

The Cardinal Fly Ash Reservoir 1 (FAR 1) Residual Solid Waste Landfill is located in Jefferson County, Brilliant, Ohio. The landfill is owned by Buckeye Power and AEP Generation Resources (GENCO) a unit of American Electric Power. The landfill is operated by Cardinal Operating Company-Cardinal Plant. Cardinal Landfill is being constructed under Permit To Install (PTI) No. 06-07993, issued on May 11, 2007. The Cardinal Power Plant in Wells Township, Jefferson County, near the town of Brilliant in eastern Ohio.

The 127 acre landfill consists of two phases and six cells. Phase 1 overlies the bench area between the FAR 1 impoundment and the highwall and consists of Cells 1 and 2 in addition to Cell 3. Phase 2 will be developed over the FAR 1 impoundment (except for Cell 3) and consists of Cells 4 – 6.
The FAR 1 landfill receives gypsum from the plant via trucks.

3.0 DESCRIPTION OF RUN-ON AND RUN-OFF CONTROL SYSTEM 257.81(c)(1)

[The owner or operator must prepare initial and periodic run-on and run-off control system plans for the CCR unit according to the timeframes specified in paragraphs (c)(3) and (4) of this section.]

Since the Cardinal FAR 1 Landfill is an operating facility, this Plan describes the existing run-on and run-off control features as well as those planned as part of future phase construction. Generally, run-on control features address collection and conveyance features associated with non-contact stormwater (i.e., liquid not coming in contact with the waste). Run-off control features address collection, conveyance, and treatment features for contact stormwater (i.e., liquid coming in contact with the waste).

This Plan summarizes the run-on and run-off control features and provides supporting calculations and figures. The supporting calculations and figures are similar to those submitted as part of the permit application process for the currently approved Solid Waste/National Pollutant Discharge Elimination System (NPDES) Permit from the OEPA associated with the Cardinal FAR 1 Landfill.

4.0 RUN-ON CONTROL SYSTEM 257.81 (a)(1)

[A run-on control system to prevent flow onto the active portion of the CCR unit during the peak discharge from a 24-hour, 25-year storm.]

4.1 RUN-ON CONTROL OUTSIDE THE LANDFILL FOOTPRINT

Run-on control outside of the landfill footprint generally consist of stormwater surface controls, which prevent stormwater falling outside of the landfill footprint from running onto the active portions of the landfill. These stormwater surface controls have been developed in accordance with the Design and Construction Requirements contained in the OEPA Solid Waste Regulations and meet the requirement for the Cardinal FAR 1 Landfill NPDES Permit.

These stormwater surface controls are constructed in phases associated with landfill development. The Cardinal FAR 1 Landfill has been subdivided into two phases reflecting the order in which each partial area of the landfill will be constructed and filled. Cardinal FAR 1 Landfill is currently placing waste in Phase 1. Phase 1 consists of 3 separate cells, Cell 1, Cell 3, and Cell 2 which is/ will be constructed in this sequence. As the landfill operations progress, a subsequent phase/cells of the landfill is prepared and constructed. Surface water/erosion control structures (cover, diversion berms, channels, ditches, etc.) are then constructed as part of the phase development.

Along the FAR 1 landfill Highwall, no diversions were constructed and the run-on flow is collected using the highwall drainage layer (2-feet thick#57 stone layer) that is connected to the under drain layer (subsurface drainage layer of the landfill) which is ultimately transmitted to the FAR II Reservoir.
A General Phasing Plan (Drawing No. 13-30100-4B in Attachment B) depicts an overview of the landfill sequencing. Drawing Nos. 13-30100-6A through 13-30100-6G in Attachment B provide detail regarding the individual phase development. During operation of the landfill, regular maintenance and inspection of these structures is performed to ensure proper control of surface water and eroded sediments.

Other standard operating procedures associated with control of surface water and eroded sediments are implemented on a regular as-needed basis and include:

- Construction of containment berms;
- Inspection of control structures;
- Maintenance and repair of channels and structures;
- Removal of accumulated sediment in sediment ponds;
- Placement of temporary and permanent protective cover and establishment of cover vegetation;
- Minimizing active fill areas within the phase;
- Installation and maintenance of silt fence and inlet protection; and,
- General best management practices as define in the Soil Erosion and Sediment Control Plan for the project.

A description of specific criteria used in the design of the stormwater surface controls, specifically stormwater channels, culverts, and sediment ponds, is included below.

4.1.1 STORMWATER CHANNEL AND CULVERT DESIGN

Existing and/or future permanent drainage channels collect and convey non-contact water to the FAR II sediment pond. The surface water channels are designed such that the run on volumes and peak flows were calculated using the "Soil-Cover Complex" methodology presented in Soil Conservation Service Technical Release No. 55 and 20 (USDA, SCS 1986 USDA –SCS, 1982). Site soils were classified as Hydrologic Soil Group “C”, and all land covers were assumed to be in "good" condition. Times-of-concentration were computed using the "segmental" method in TR-55. Peak discharge factors were obtained from tables in TR-55.

The hydrologic design basis for surface water collection and conveyance structures is the 25-year, 24-hour storm. This design storm event is applicable to the site runoff collection channels and culverts. The Federal Highway Administration Hydraulic Engineering Circular No. 15 (HEC-15) was used as a guideline for channel linings and maximum velocities for drainage ditches. The 2-year, 24-hour; 25-year, 24-hour storms were used to calculate the runoff detention volume, the flood storage volume, freeboard, and the emergency spillway discharge, respectively, for the Sediment Pond.

The rainfall intensities at the location of the Cardinal FAR 1 Landfill applicable to the design of surface water structures were obtained from the United States Department of Commerce, Weather Bureau, Technical Paper No. 40, Rainfall Frequency Atlas of the United States, for Jefferson County, Ohio. The historical rainfall distribution for each 2-hour storm is based on the Soil Conservation Service (SCS) Type II rainfall distribution. Antecedent Moisture Condition II - Normal was assumed for design.

Seventeen (17) existing or future culverts are associated with Cardinal FAR 1 Landfill development. Riprap outlet protection is used to prevent erosion at each culvert. Refer to Drawing Nos. 13-30100-6G, 13-30100-7D, 13-30100-7E for the locations, sizes, and outlet protection specifics for the culverts.

Supporting calculations showing size and capacity for the channels and culverts using the above-described methodology (i.e., 24-hour, 25-years storm event) are presented in the PTI.

4.2 RUN-ON CONTROL INSIDE THE LANDFILL

Active waste operations will continue at the Cardinal FAR 1 Landfill until final design grades are reached. As waste placement reaches the planned exterior grades of the landfill throughout the planned operation of the facility, the waste will be covered with a protective cover system or cap constructed with the on-site soils.

Similar to the run-on control features, stormwater control features atop of the permanent cover (i.e., benches, down-chutes, etc.) have a hydrologic design basis of the 25-year, 24-hour storm event. Refer to the supporting calculations in the PTI.

5.0 RUN-OFF CONTROL SYSTEM 257.81 (a)(2)and(b)

[A run-off control system from the active portion of the CCR unit to collect and control at least the water volume resulting from a 24-hour, 25-year]

[Run-off from the active portion of the CCR unit must be handled in accordance with the surface water requirements under § 257.3–3.]

5.1 OUTER PERIMETER CONTAINMENT BERM

The Landfill is designed with an outer containment berm with a maximum exterior slope of 3 horizontal to 1 vertical (3H:1V) (Drawing 13-301007C). An internal perimeter ditch is constructed in which run-off over the waste outer slopes is collected and routed toward an internal sediment basins which convey the flow to the leachate collection pipes via risers (Drawing 13-301007C). The working surface of the active landfill remains relatively level with the active fill area being sloped towards the interior of the landfill where designed chimney drains collect and transmit the surface flow to the leachate collection pipes. The outer containment berm serves the purpose to separate run-off (contact water) from flowing outside of the waste placement area.

The initial containment berm for waste placement, positioned at the exterior of the two, has a minimum height of 10 feet, a crest width of 6 feet and side slopes of 3H:1V or flatter on the exterior side.

<u>5.2</u> LEACHATE COLLECTION SYSTEM

Runoff from the active area ("contact water") is collected as part of the leachate collection system and is conveyed , via the vertical chimney drains, to the leachate collection system, and associated transmission pipes. The surface of the active fill area is sloped towards the interior of the landfill, graded to minimize ponding of water, and directs excess surface water to chimney drain locations.

The Hydrologic Evaluation of Landfill Performance (HELP) model was used to calculate the average daily leachate flow and the average annual leachate volume for the Cardinal FAR 1 Landfill.

Note that the HELP Model calculations included in PTI include evaluations where the peak precipitation event is 4.01 inches, which corresponds to the 24-hour, 25-year storm event. Therefore, design aspects of Cardinal FAR 1 Landfill which rely on the above described leachate generation estimates are designed for the 24-hour, 25-year storm event per §257.81. Drawing Nos. 13-30100-4B and 13-30100-7B in Attachment C identify the location of the leachate collection system.

Leachate and contaminated stormwater (stormwater that has come in contact with waste) is collected by the leachate conveyance features and conveyed to leachate treatment Pond via transmission pipes.

Drawing Nos. 13-30100-4B and 13-30100-7B in Attachment C identify the location and the details of the leachate collection system and the Leachate Treatment Pond.

<u>5.3</u> SEDIMENTATION AND LEACHATE TREATMENT POND

The FAR 1 RWL design incorporates the existing FAR II as the Facility sedimentation and Leachate Treatment Pond.
FAR II is an approximate 161 acre reservoir that accepts fly ash from the Cardinal Plant, is contained by a Fly Ash Reservoir Dam (FAD II) with current Top of Dam Elevation of 983 ft and maximum Pool Elevation of 974.0. FAR II is located adjacent to FAR 1 RWL, as shown on the permit drawings. The area accepting runoff into FAR II already includes the drainage area from the proposed FAR 1 RWL. FAR II stormwater storage has been designed for a 50 year 24-hour storm event exceeding the OAC 3745- 30-07 storage requirements for the Facility Sedimentation Pond. The FAR II emergency spillway was designed for the FAR II probable maximum flood (PMF). The principal spillway discharge structure controls the maximum pool, was designed for the 50 year 24-hour storm event, and is shown on permit Drawing 13-30100-7A.

The maximum holding capacity of the Leachate Storage Pond is 1,771 acre-feet (ac-ft). The holding capacity is sufficient to contain the anticipated leachate volume for a 30 day period, as required by the OEPA Solid Waste Regulations. In addition, the FAR II pond is capable of managing the PMF storm for FAR II Drainage area without overtopping of the dam crest.

The Leachate Treatment Pond pool elevation is monitored and managed on a regular basis by the landfill operator. Leachate is mixed with the fly ash sluicing water and released from the reservoir via the Principle spillway as a part of the normal operation of the FAR II Dam.

6.0 PLAN REVIEW AND CHANGES IN FACILITY CONFIGURATION

In accordance with §257.81, this Run-On and Run-Off Control Plan shall be reviewed periodically, at a minimum of every 5 years. During such reviews, this Plan will be updated as needed to reflect the current design and operation of the Cardinal FAR 1 Landfill. A Plan Review Log to record periodic Plan reviews and revisions is included in Attachment A.

ATTACHMENT A

PLAN REVIEW LOG

Cardinal FAR 1 LANDFILL

RUN-ON, RUN-OFF CONTROL PLAN
PLAN REVIEW LOG

Action	Performed by:	Date
Prepare Initial Run-On, Run-Off Control Plan	AEP	10/17/2016

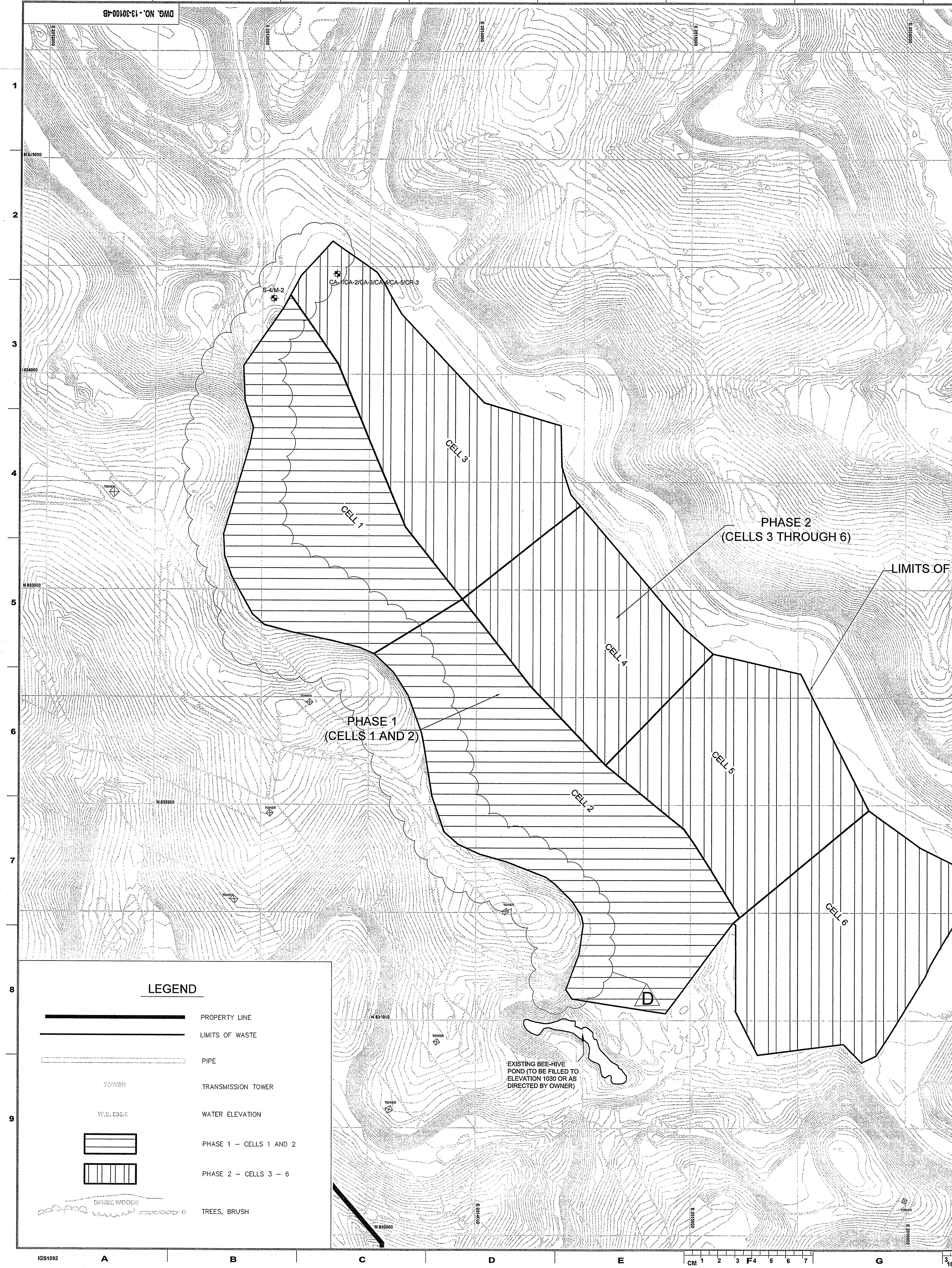
Note:

1. In accordance with §257.81, this Run-On and Run-Off Control Plan shall be reviewed periodically, at a minimum of every 5 years.

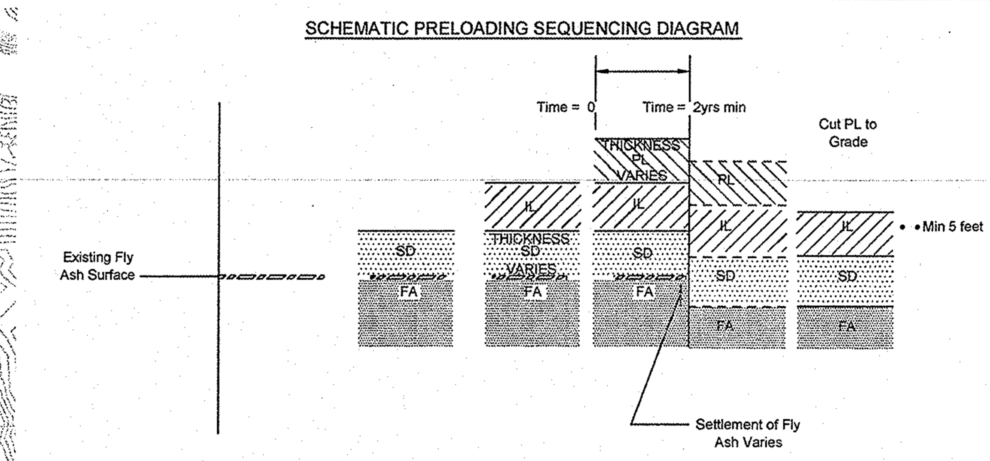
ATTACHMENT B

RUN-ON CONTROL SYSTEM SUPPORTING DRAWINGS

DWG. NO. - 13-30100-4B



SCHEMATIC PRELOADING SEQUENCING DIAGRAM



SCHEMATIC LEGEND

- FA (FLY ASH)
- SD (SUBSURFACE DRAINAGE / CONTOURING FILL LAYER)
- PL (PRELOAD LAYER)
- IL (ISOLATION LAYER)

CELL #	AREA (ACRE)	WASTE VOLUME (CY)
1	23.03	2,042,000
2	31.65	3,049,000
3	21.25	2,894,000
4	15.68	4,083,000
5	18.66	4,602,000
6	19.18	2,273,000
TOTAL	129.45	18,943,000

VOLUMES GIVEN ABOVE REPRESENT VOLUMES DETERMINED FROM THE SERIES 6 CONSTRUCTION STAGING AND OPERATION DRAWINGS.

PHASE 1 CONSTRUCTION

1. IMPROVE EXISTING ACCESS ROADS AND CONSTRUCT LAY DOWN AREAS, STAGING AREAS, AND EROSION CONTROL STRUCTURES.
2. EXCAVATE EXISTING MINE SPOIL FROM PHASE 1 AREA. (SEE SHEET 4C FOR GRADING PLAN)
3. PROCESS MINE SPOIL FOR PLACEMENT AS ISOLATION LAYER MATERIAL FOR PHASE 1, PHASE 2, AND AS REPLACED SUBGRADE MATERIAL.
4. STOCKPILE PROCESSED MATERIAL IN PHASE 1 AREA OR ANOTHER DESIGNATED AREA.
5. PLACE PRELOAD IN PHASE 2 CELLS.
6. PLACE SUBGRADE MATERIAL ABOVE EXCAVATED AREA (SEE SHEET 4D FOR GRADING PLAN).
7. CONSTRUCT PHASE 1 SUBSURFACE DRAINAGE LAYER ABOVE SUBGRADE (MINIMUM 2 FEET THICK) (SEE SHEET 4E).
8. PLACE GEOTEXTILE ABOVE SUBSURFACE DRAINAGE LAYER AS SEPARATOR.
9. CONSTRUCT CONTOURING FILL LAYER (SEE SHEET 4F).
10. CONSTRUCT PHASE 1 ISOLATION LAYER (MINIMUM 5 FEET THICK) (SEE SHEET 4G).
11. CONSTRUCT PHASE 1 RECOMPACTED SOIL LINER ABOVE ISOLATION LAYER (MINIMUM 1.5 FEET THICK) (SEE SHEET 4I).
12. PLACE GEOMEMBRANE ABOVE RECOMPACTED SOIL LINER (PVC LINER).
13. PLACE GEOTEXTILE AS CUSHION ABOVE GEOMEMBRANE.
14. CONSTRUCT TEMPORARY LEACHATE PIPING ACROSS FAR 1 BENEATH BOTTOM OF PHASE 2 ISOLATION LAYER (SEE SHEETS 6A AND 7B).
15. CONSTRUCT LEACHATE MANAGEMENT SYSTEM COLLECTION MANHOLES, TRANSMISSION PIPING AND SAMPLING STRUCTURE.
16. CONSTRUCT PHASE 1 LEACHATE MANAGEMENT LAYER (MINIMUM 1 FOOT THICK)) AND PLACE GEOTEXTILE AS SEPARATOR AND FILTER ABOVE AND BELOW LAYER (SEE SHEET 4J).
17. PLACE PROTECTIVE COVER (MINIMUM 3 FEET THICK) ABOVE LEACHATE COLLECTION LAYER.
18. CONSTRUCT INTERPHASE BERM AND TEMPORAY LINER SYSTEM TERMINATION BETWEEN PHASE 1 AND PHASE 2.
19. BEGIN PHASE 1 WASTE PLACEMENT OPERATIONS (SEE SHEET 4K).
20. AS WASTE REACHES FINAL GRADES, BEGIN FINAL COVER PLACEMENT IN ACCORDANCE WITH FINAL COVER CONSTRUCTION STAGING AND OPERATION STAGES. (SEE SHEET 6B AND 6C).

PHASE 2 CONSTRUCTION

1. CONSTRUCT PHASE 2 SUBSURFACE DRAINAGE LAYER ABOVE EXISTING FAR 1 COVER (MINIMUM 2 FEET THICK) (SEE SHEET 4E).
2. PLACE GEOTEXTILE ABOVE SUBSURFACE DRAINAGE LAYER AS SEPARATOR.
3. CONSTRUCT CONTOURING FILL LAYER (SEE SHEET 4F).
4. CONSTRUCT PHASE 2 ISOLATION LAYER (MINIMUM 5 FEET THICK) (SEE SHEET 4G).
5. PLACE TEMPORY GEOTEXTILE LOCATOR AND CONSTRUCT MINESPOIL PRELOAD IN PHASE 2 CELLS (SEE SHEET 4H).
6. REMOVE PRELOAD AND GEOTEXTILE LOCATOR. REESTABLISH BASE GRADE AND FILL AND RECOMPACT SURFACE TO ISOLATION LAYER MINIMUM REQUIREMENTS (SEE SCHEMATIC PRELOADING PLACING DIAGRAM ON THE LEFT).
7. CONSTRUCT PHASE 2 RECOMPACTED SOIL LINER (MINIMUM 1.5 FEET THICK) ABOVE RECOMPACTED ISOLATION LAYER (SEE SHEET 4I).
8. PLACE GEOMEMBRANE ABOVE RECOMPACTED SOIL LINER (PVC LINER).
9. PLACE GEOTEXTILE AS CUSHION ABOVE GEOMEMBRANE.
10. CONSTRUCT PHASE 2 LEACHATE MANAGEMENT LAYER (MINIMUM 1 FOOT THICK) AND PLACE GEOTEXTILE AS SEPARATOR AND FILTER ABOVE. ABANDON OR REMOVE PREVIOUS TEMPORARY LEACHATE PIPING AFTER CONNECTION OF PHASE 2 PERMANENT PIPING.
11. PLACE PROTECTIVE COVER (MINIMUM 3 FEET THICK) ABOVE LEACHATE COLLECTION LAYER. REMOVE PORTION OF INTER PHASE BERM ABOVE PROTECTIVE COVER.
12. BEGIN PHASE 2 WASTE PLACEMENT OPERATIONS (SEE SHEET 4K).
13. AS WASTE REACHES FINAL GRADES, BEGIN FINAL COVER PLACEMENT IN ACCORDANCE WITH FINAL COVER CONSTRUCTION STAGING AND OPERATION STAGES. (SEE SHEET 6D THRIUGH 6G AND 4M FOR FINAL GRADES).

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0 200 400
SCALE IN FEET

LEGEND

- PROPERTY LINE
- LIMITS OF WASTE
- PIPE
- TOWER — TRANSMISSION TOWER
- W.E. 836.5 — WATER ELEVATION
- PHASE 1 – CELLS 1 AND 2
- PHASE 2 – CELLS 3 – 6
- TREES, BRUSH

SOLID WASTE
APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
AUG 10 2011
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

DATE	NO.	DESCRIPTION	APPD.
DEC 1 2010	D	PTI MODIFICATION NO. 1 MAA	GFZ
NOV 17 2006	C	REVISED - NOD 2 RESPONSE	DGB
MAY 25 2006	B	REVISED - NOD 1 RESPONSE	DGB
OCT 24 2005	A	ISSUED FOR PERMIT	DGB

REVISIONS

CARDINAL OPERATING COMPANY

CARDINAL PLANT

BRILLIANT OHIO

TITLE: CARDINAL FAR 1 RESIDUAL WASTE LANDFILL GENERAL DEVELOPMENT

STATE OF OHIO ★ MOHAMMAD A AJLOUNI 67074 REGISTERED PROFESSIONAL ENGINEER

SIGNATURE
12-01-2010
DATE

DWG. NO. 13-30100-4B-D

SCALE:
DR:
CH:
ENGR.
PROJ. ENGR.
DATE:
APPROVED BY
CIVIL ENGINEERING DIVISION

O.E.P.A. DRAWING NO. 4B

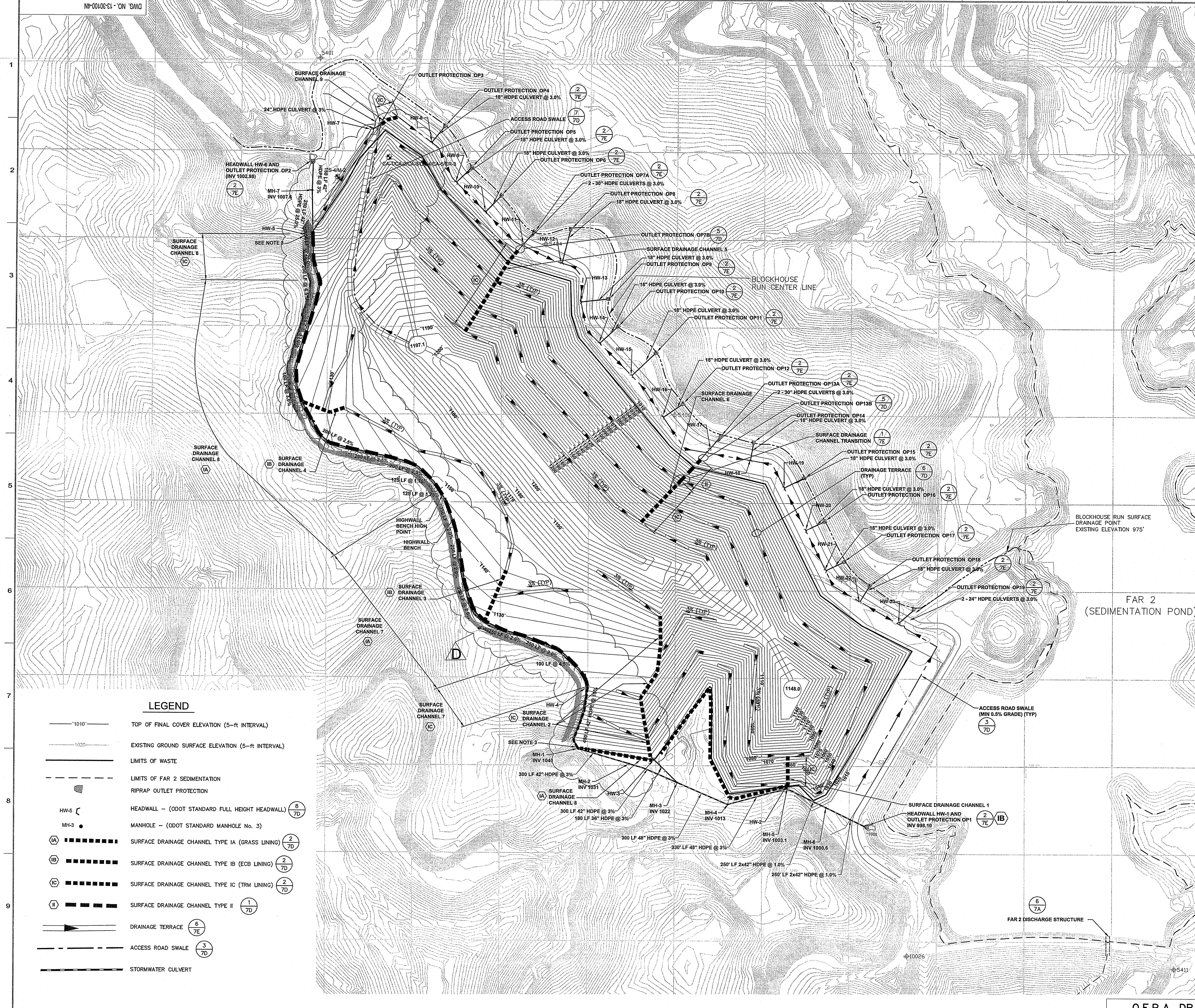
DRAWING 4B OF 39

AEP AMERICAN ELECTRIC POWER
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

SYSTEM DATE-
SYSTEM TIME-
15th FLR.CED

IGS1092

DWG. NO. - 13-30100-4N



STORMWATER MANAGEMENT PLAN NOTES:

1. HDPE PIPES SHOWN ON THIS DRAWING ARE CORRUGATED.
2. PERMANENT GROUNDWATER CONTROL STRUCTURES ARE PRESENTED IN PLAN SHEET 4E.
3. RUNOFF FROM HIGHWALL BENCH AT SOUTHEAST AND NORTHWEST ENDS WILL BE ROUTED TO MH-1 AND HW-5, RESPECTIVELY. HW-5 CONNECTS WITH 42-INCH HDPE PIPE DRAINING TO MH-7 AND ONTO HW-6.

GRADING SHOWN ON THIS SHEET

VEGETATIVE LAYER
~~FINAL COVER~~
RECOMPACTED SOIL BARRIER
WASTE
PROTECTIVE COVER — GEOTEXTILE
LEACHATE MANAGEMENT LAYER — GEOTEXTILE
RECOMPACTED SOIL LINER — GEOMEMBRANE
PRELOAD PLACEMENT
ISOLATION LAYER
CONTOURING FILL — GEOTEXTILE
SUBSURFACE DRAINAGE LAYER
PLACED SUBGRADE
EXISTING FLY ASH
BEDROCK

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LEGEND

- TOP OF FINAL COVER ELEVATION (5-ft INTERVAL)
- EXISTING GROUND SURFACE ELEVATION (5-ft INTERVAL)
- LIMITS OF WASTE
- LIMITS OF FAR 2 SEDIMENTATION
- RIPRAP OUTLET PROTECTION
- HW-5 HEADWALL – (ODOT STANDARD FULL HEIGHT HEADWALL) 8/7D
- MH-3 MANHOLE – (ODOT STANDARD MANHOLE No. 3)
- IA SURFACE DRAINAGE CHANNEL TYPE IA (GRASS LINING) 2/7D
- IB SURFACE DRAINAGE CHANNEL TYPE IB (ECB LINING) 2/7D
- IC SURFACE DRAINAGE CHANNEL TYPE IC (TRM LINING) 2/7D
- II SURFACE DRAINAGE CHANNEL TYPE II 1/7D
- DRAINAGE TERRACE 6/7E
- ACCESS ROAD SWALE 3/7D
- STORMWATER CULVERT

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OHIO ENVIRONMENTAL PROTECTION AGENCY
AUG 10 2011
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DEC 1 2010	D	PTI MODIFICATION NO. 1 MAA	GFZ
NOV 17 2006	C	REVISED - NOD 2 RESPONSE	DGB
MAY 25 2006	B	REVISED - NOD 1 RESPONSE	DGB
OCT 24 2005	A	ISSUED FOR PERMIT	DGB

REVISIONS

CARDINAL OPERATING COMPANY

CARDINAL PLANT

BRILLIANT OHIO

TITLE: CARDINAL FAR 1 RESIDUAL WASTE LANDFILL STORMWATER MANAGEMENT PLAN

DWG. NO. 13-30100-4N-D

STATE OF OHIO — MOHAMMAD A AJLOUNI 67074 — REGISTERED PROFESSIONAL ENGINEER

SIGNATURE
12-01-2010
DATE

SCALE: | CIVIL ENGINEERING DIVISION
DR:
CH:
ENGR.
PROJ. ENGR.
DATE:
APPROVED BY

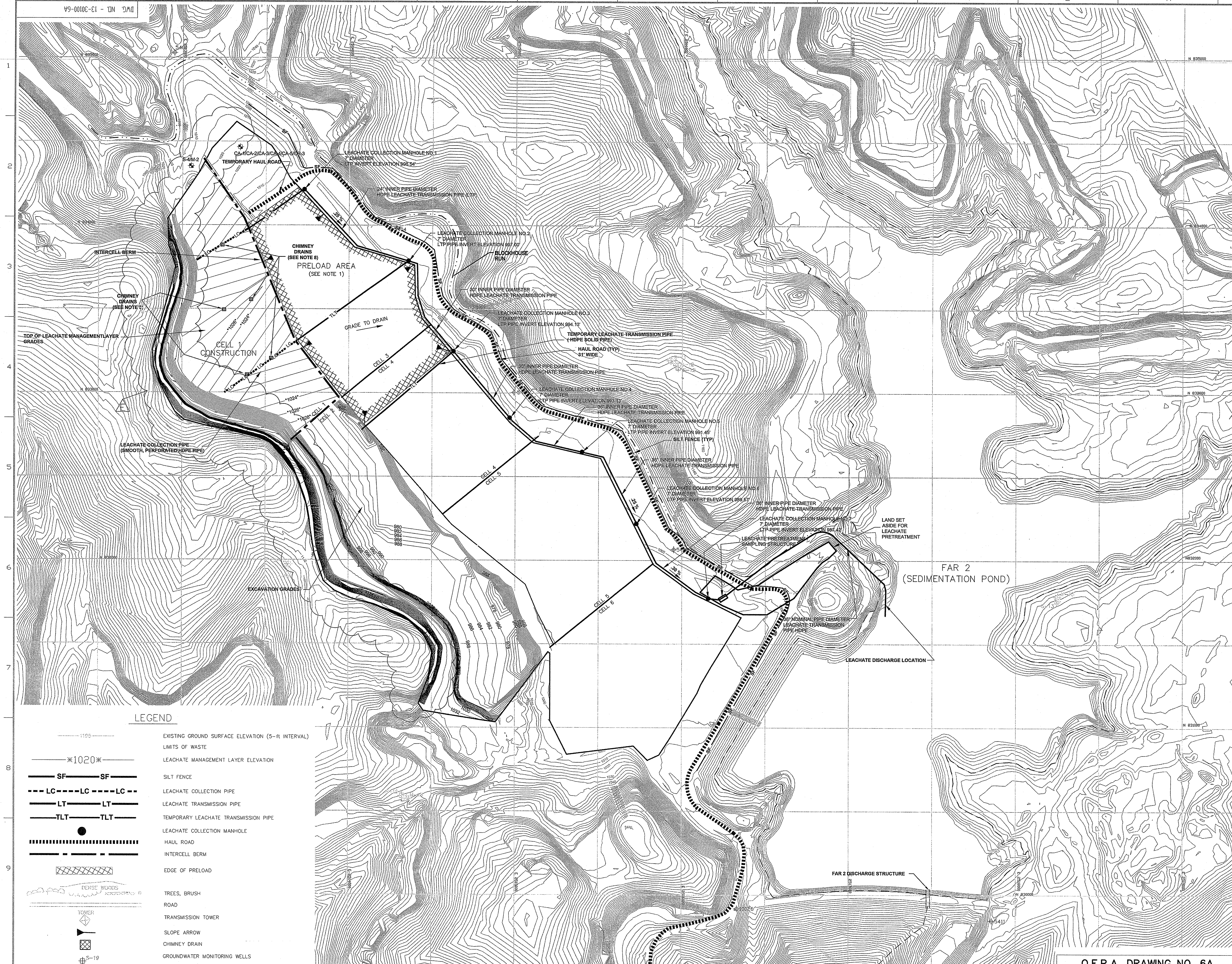
AEP AMERICAN ELECTRIC POWER — 1 RIVERSIDE PLAZA COLUMBUS, OH 43215

O.E.P.A. DRAWING NO. 4N

DRAWING 4N OF 39

IGS1092

SYSTEM DATE- SYSTEM TIME- 15th FLR.CED



CELL 1:
1. EXCAVATE MINESPOIL, SHAPE AND GRADE REMAINING MINESPOIL BERM ALONG FAR 1.
2. CONSTRUCT SUBGRADE LAYER, SUBSURFACE DRAINAGE LAYER AND CONTOURING FILL LAYER.
3. CONSTRUCT 5 FOOT MINIMUM ISOLATION LAYER
4. CONSTRUCT RECOMPACTED SOIL LINER, GEOMEMBRANE AND LEACHATE MANAGEMENT SYSTEM.
5. CONSTRUCT TEMPORARY LINER TERMINATION BERMS. INSTALL FUTURE TIE-IN LOCATIONS FOR RECOMPACTED SOIL LINER, AND LEACHATE MANAGEMENT SYSTEM.

CELL 2:
1. BEGIN EXCAVATION OF MINESPOIL, SHAPE AND GRADE LEFT IN PLACE MINESPOIL BERM ALONG FAR 1.

CELL 3:
1. EXCAVATE TO AND CONSTRUCT/VERIFY SUBSURFACE DRAINAGE LAYER.
2. CONSTRUCT CONTOURING FILL LAYER AND ISOLATION LAYER.
3. INSTALL TEMPORARY LEACHATE TRANSMISSION PIPES.
4. INSTALL SUBSURFACE DRAINAGE AND LEACHATE TRANSMISSION PIPES, MANHOLES, AND STRUCTURAL FILL.
5. PLACE PRELOAD FILL

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CELL 4:
1. CONSTRUCT/VERIFY SUBSURFACE DRAINAGE LAYER.
2. CONSTRUCT CONTOURING FILL LAYER AND ISOLATION LAYER.
3. INSTALL TEMPORARY LEACHATE TRANSMISSION PIPES FOR FUTURE CONNECTION TO CELL 2 PIPING.
4. INSTALL SUBSURFACE DRAINAGE AND LEACHATE TRANSMISSION PIPES, MANHOLES, AND STRUCTURAL FILL.
5. CONTINUE PLACEMENT OF PRELOAD FILL.

CELL 5:
1. INSTALL SUBSURFACE DRAINAGE AND LEACHATE TRANSMISSION PIPES, MANHOLES, AND STRUCTURAL FILL.

CELL 6:
1. INSTALL SUBSURFACE DRAINAGE AND LEACHATE TRANSMISSION PIPES, MANHOLES, AND STRUCTURAL FILL.
2. INSTALL LEACHATE TRATMENT STRUCTURE AND DISCHARGE PIPING TO FAR 2.

NOTES:
1. PRELOAD PLACEMENT IS ADVANCED BASED ON THE RATE OF EXCAVATION OF THE MINESPOIL BENCH AND PRODUCTION OF ISOLATION MATERIAL.
2. LEACHATE COLLECTION MANHOLES, TRANSMISSION PIPES AND TREATMENT STRUCTURE (OUTSIDE THE LIMITS OF WASTE) FOR THE ENTIRE RESIDUAL WASTE LANDFILL ARE TO BE CONSTRUCTED DURING CELL 1 CONSTRUCTION.
3. TEMPORARY LEACHATE TRANSMISSION PIPES WILL BE INSTALLED BENEATH ISOLATION LAYER AND ABANDONED AFTER CONSTRUCTION OF OVERLYING CELL LINER AND LEACHATE COLLECTION SYSTEMS.
4. LOCATION OF TEMPORARY HAUL ROADS FOR CELL CONSTRUCTION OR WASTE HAULING WILL VARY DURING OPERATIONS.
5. REFER TO SHEET 4E, 7A, AND 7F FOR SUBSURFACE DRAINAGE LAYER AND HIGHWALL DRAINAGE LAYER GRADING PLAN AND DETAILS.
6. SEE SHEET 4E FOR SUBSURFACE DRAINAGE LAYER PIPES.
7. RUN ON DIVERSION DITCHES TO BE INSTALLED ALONG HIGHWALL BENCHES.
8. CHIMNEY DRAINS ARE USED TO CONVEY CONTACT STORMWATER TO THE LEACHATE COLLECTION SYSTEM. WHERE POSSIBLE CHIMNEY DRAINS HAVE BEEN LOCATED ABOVE LEACHATE COLLECTION CORRIDOR PIPES.WHERE THIS CAN NOT BE DONE DUE TO SURFACE DRAINAGE NEEDS THEY HAVE BEEN LOCATED ABOVE LEACHATE LATERAL COLLECTION PIPES. DRAIN LOCATIONS ARE SHOWN ON 6 SERIES DRAWINGS AND DRAWING 4J AT TOP LEFT CORNER. DETAILS ARE SHOWN ON DRAWING 7B.

SOLID WASTE
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OHIO ENVIRONMENTAL PROTECTION AGENCY
AUG 10 2011
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JAN 25 2007	D	REVISED - NOD 2 SUPPLEMENTAL RESPONSE	DGB
NOV 17 2006	C	REVISED - NOD 2 RESPONSE	DGB
MAY 25 2006	B	REVISED - NOD 1 RESPONSE	DGB
OCT 24 2005	A	ISSUED FOR PERMIT	DGB

REVISIONS

CARDINAL OPERATING COMPANY

CARDINAL PLANT

BRILLIANT OHIO

TITLE: CARDINAL FAR 1 RESIDUAL WASTE LANDFILL CONSTRUCTION STAGING AND OPERATION STAGE A

DWG. NO. 13-30100-6A-E

SCALE: DR: CH: ENGR. PROJ. ENGR. DATE: APPROVED BY

CIVIL ENGINEERING DIVISION

STATE OF OHIO
MOHAMMAD A AJLOUNI 67074
REGISTERED PROFESSIONAL ENGINEER

SIGNATURE
12-01-2010
DATE

O.E.P.A. DRAWING NO. 6A

DRAWING 6A OF 39

AEP AMERICAN ELECTRIC POWER
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

LEGEND

- EXISTING GROUND SURFACE ELEVATION (5-ft INTERVAL)
- WASTE GRADE CONTOURS
- LIMIT OF WASTE
- SILT FENCE
- LEACHATE COLLECTION PIPE
- LEACHATE TRANSMISSION PIPE
- TEMPORARY LEACHATE TRANSMISSION PIPE
- LEACHATE COLLECTION MANHOLE
- HAUL ROAD
- INTERCELL BERM
- FINAL WASTE GRADES FOR THIS STAGE
- SURFACE DRAINAGE CHANNEL SEE DRAWING 4N FOR TYPE
- EDGE OF PRELOAD
- TREES, BRUSH
- ROAD
- TRANSMISSION TOWER
- SLOPE ARROW
- CHIMNEY DRAINS
- GROUNDWATER MONITORING WELLS

STAGE G DESCRIPTION

CELL 1:
1. FINALIZE PHASE 2 FINAL COVER.

CELL 2:
2. FINALIZE PHASE 2 WASTE GRADE.

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CELL 3:
1. FINALIZE PHASE 2 WASTE GRADE.

CELL 4:
1. FINALIZE PHASE 2 WASTE GRADE.

CELL 5:
1. FINALIZE PHASE 2 WASTE GRADE. DEGIN FINAL COVER.
2. CONTINUE CONSTRUCTING LANDFILL ACCESS ROAD.

CELL 6:
1. BEGIN WASTE PLACEMENT.

NOTES:

1. TEMPORARY COVER WILL BE PLACED IF FINAL OR INTERIM WASTE GRADES ARE TO BE EXPOSED FOR MORE THAN 180 DAYS BEFORE FINAL COVER IS PLACED.
2. LOCATION OF TEMPORARY HAUL ROADS FOR CELL CONSTRUCTION OR WASTE HAULING WILL VARY DURING OPERATIONS.
3. UNTIL FINAL COVER GRADES ARE ACHIEVED WASTE SURFACES SHALL BE GRADED TO DRAIN TOWARD CHIMNEY DRAINS AND/OR TEMPORARY INTERIM SLOPES. INTERIM SURFACE WORKING BENCHES WILL BE GRADED AT 2% OR HIGHER GRADES AND INTERIM DRAINAGE TERRACES GRADED AT 0.5% GRADE. TEMPORARY DIVERSION BERMS ALONG FINAL WASTE PERIMETER WILL BE NECESSARY.
4. REFER TO SHEET 4E, 7A, AND 7F FOR SUBSURFACE DRAINAGE LAYER AND HIGHWALL DRAINAGE LAYER GRADING PLAN AND DETAILS.
5. CHIMNEY DRAINS ARE USED TO CONVEY CONTACT STORMWATER TO THE LEACHATE COLLECTION SYSTEM. WHERE POSSIBLE CHIMNEY DRAINS HAVE BEEN LOCATED ABOVE LEACHATE COLLECTION CORRIDOR PIPES. WHERE THIS CAN NOT BE DONE DUE TO SURFACE DRAINAGE NEEDS THEY HAVE BEEN LOCATED ABOVE LEACHATE LATERAL COLLECTION PIPES. DRAIN LOCATIONS ARE SHOWN ON 6 SERIES DRAWINGS AND DRAWING 4J AT TOP LEFT CORNER. DETAILS ARE SHOWN ON DRAWING 7B.
6. THE TEMPORARY INTERIM WORKING BENCHES WILL BE GRADED TO HAVE AT LEAST 2% SLOPE TOWARDS A CHIMNEY DRAIN.

SOLID WASTE APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
AUG 10 2011
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

DATE	NO.	DESCRIPTION	APPD.
DEC 1 2010	E	PTI MODIFICATION NO. 1 MAA	GFZ
JAN 25 2007	D	REVISED - NOD 2 SUPPLEMENTAL RESPONSE	DGB
NOV 17 2006	C	REVISED - NOD 2 RESPONSE	DGB
MAY 25 2006	B	REVISED - NOD 1 RESPONSE	DGB
OCT 24 2005	A	ISSUED FOR PERMIT	DGB

REVISIONS

CARDINAL OPERATING COMPANY

CARDINAL PLANT

BRILLIANT OHIO

TITLE: CARDINAL FAR 1 RESIDUAL WASTE LANDFILL CONSTRUCTION STAGING AND OPERATION STAGE G

DWG. NO. 13-30100-6G-E

SCALE: | CIVIL ENGINEERING DIVISION
DR:
CH:
ENGR.
PROJ. ENGR.
DATE:
APPROVED BY

STATE OF OHIO MOHAMMAD A AJLOUNI 67074 REGISTERED PROFESSIONAL ENGINEER

SIGNATURE
12-01-2010
DATE

O.E.P.A. DRAWING NO. 6G

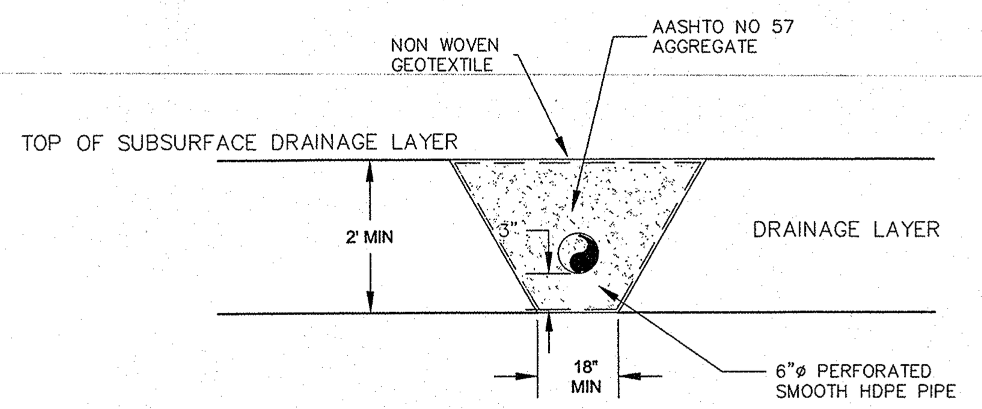
DRAWING 6G OF 39

AMERICAN ELECTRIC POWER
1 RIVERSIDE PLAZA COLUMBUS, OH 43215

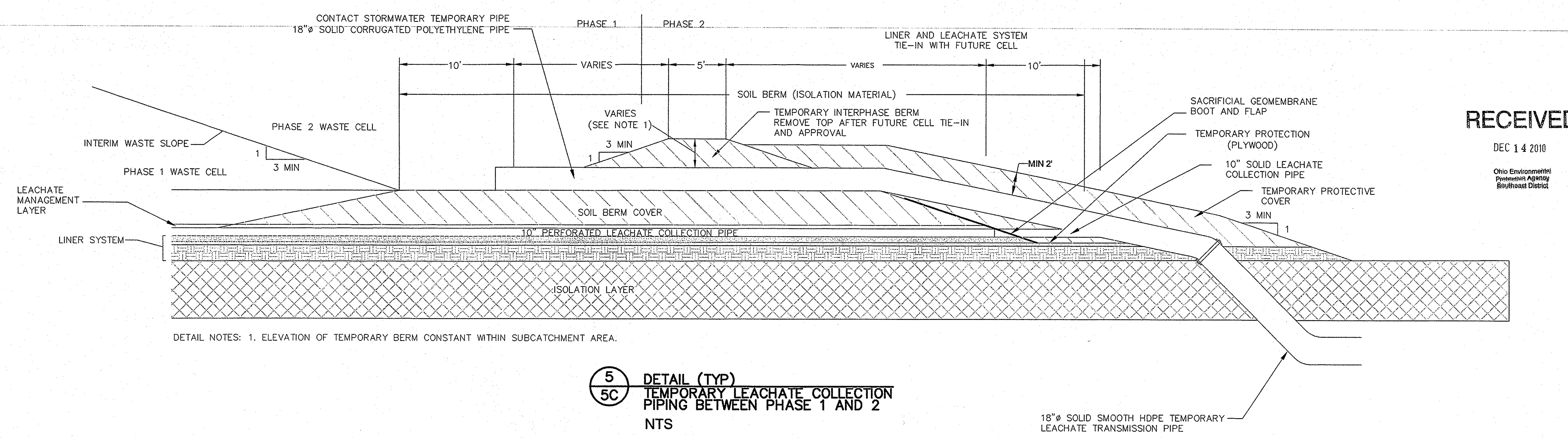
IGS1092

SYSTEM DATE-
SYSTEM TIME-
15th FLR.CED

DWG. NO. - 13-30100-7A



1 / 4E DETAIL (TYP)
SUBSURFACE DRAINAGE PIPE
NTS



DETAIL NOTES: 1. ELEVATION OF TEMPORARY BERM CONSTANT WITHIN SUBCATCHMENT AREA.

5 / 5C DETAIL (TYP)
TEMPORARY LEACHATE COLLECTION PIPING BETWEEN PHASE 1 AND 2
NTS

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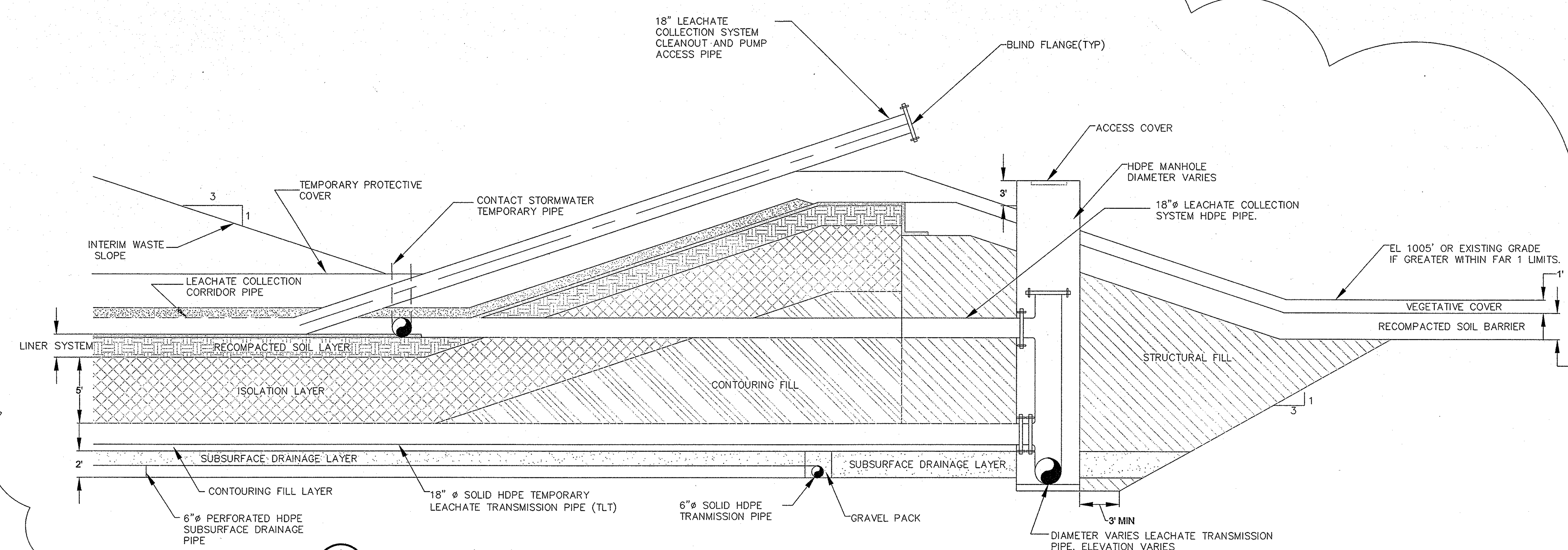
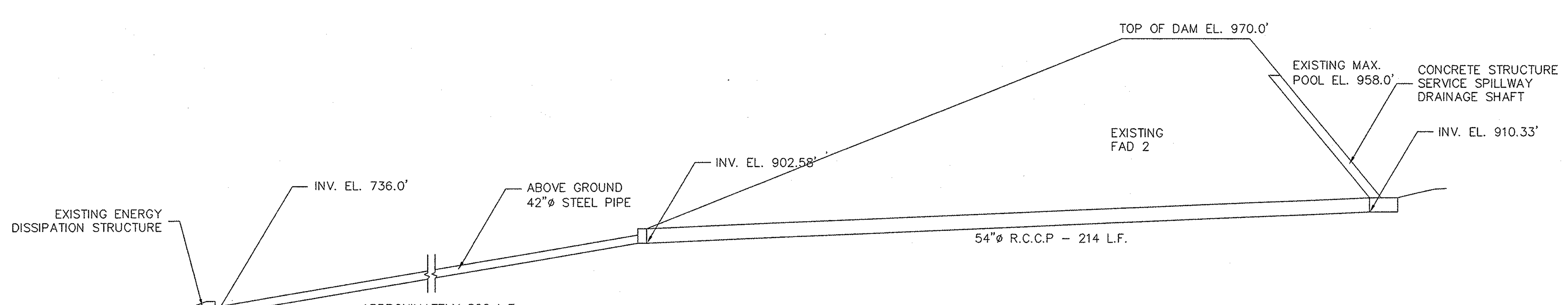


A / – SECTION (TYP)
INTERIM LEACHATE COLLECTION SYSTEM AND INTERFACE WITH LEACHATE TRANSMISSION TRENCH AT MANHOLE
NTS

D



6 / 4N DETAIL (TYP)
EXISTING FAR2 DISCHARGE STRUCTURE
NTS

SOLID WASTE APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
AUG 10 2011
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REVISIONS

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CARDINAL OPERATING COMPANY
CARDINAL PLANT
BRILLIANT OHIO

TITLE: CARDINAL FAR 1 RESIDUAL WASTE LANDFILL SUBSURFACE DRAINAGE AND OTHER DETAILS

DWG. NO. 13-30100-7A-D

SCALE: DR: CH: ENGR. PROJ. ENGR. DATE: APPROVED BY
CIVIL ENGINEERING DIVISION

STATE OF OHIO MOHAMMAD A AJLOUNI 67074 REGISTERED PROFESSIONAL ENGINEER

SIGNATURE
12-01-2010
DATE

O.E.P.A. DRAWING NO. 7A

DRAWING 7A OF 39

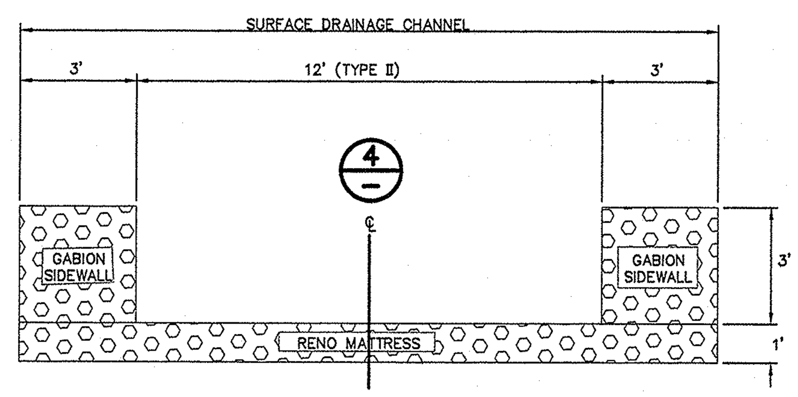
AEP AMERICAN ELECTRIC POWER
1 RIVERSIDE PLAZA COLUMBUS, OH 43215

IGS1092

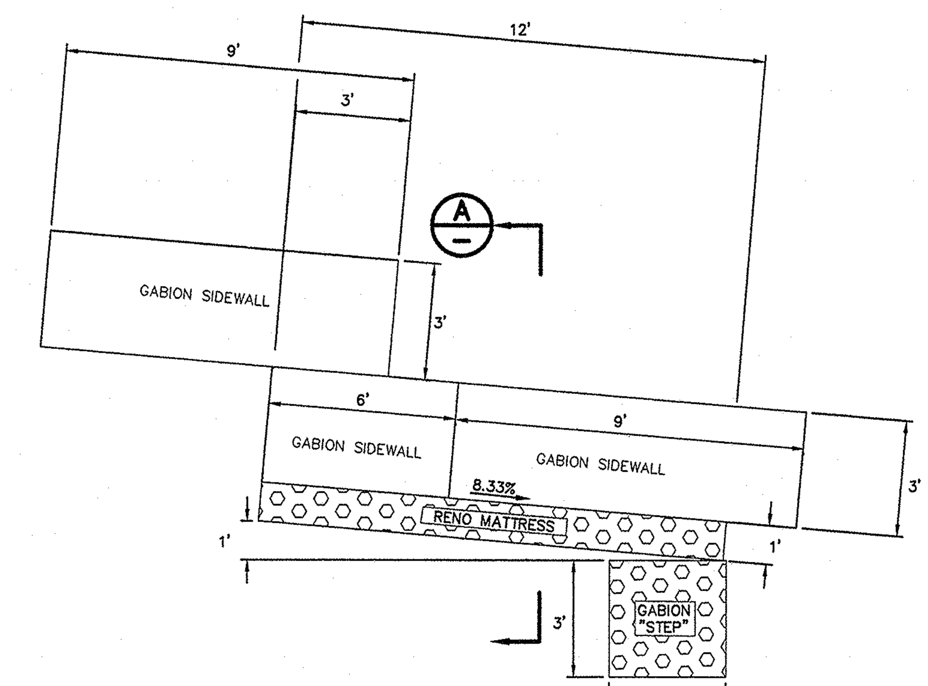
DWG. NO. - 13-30100-7D

NOTES:

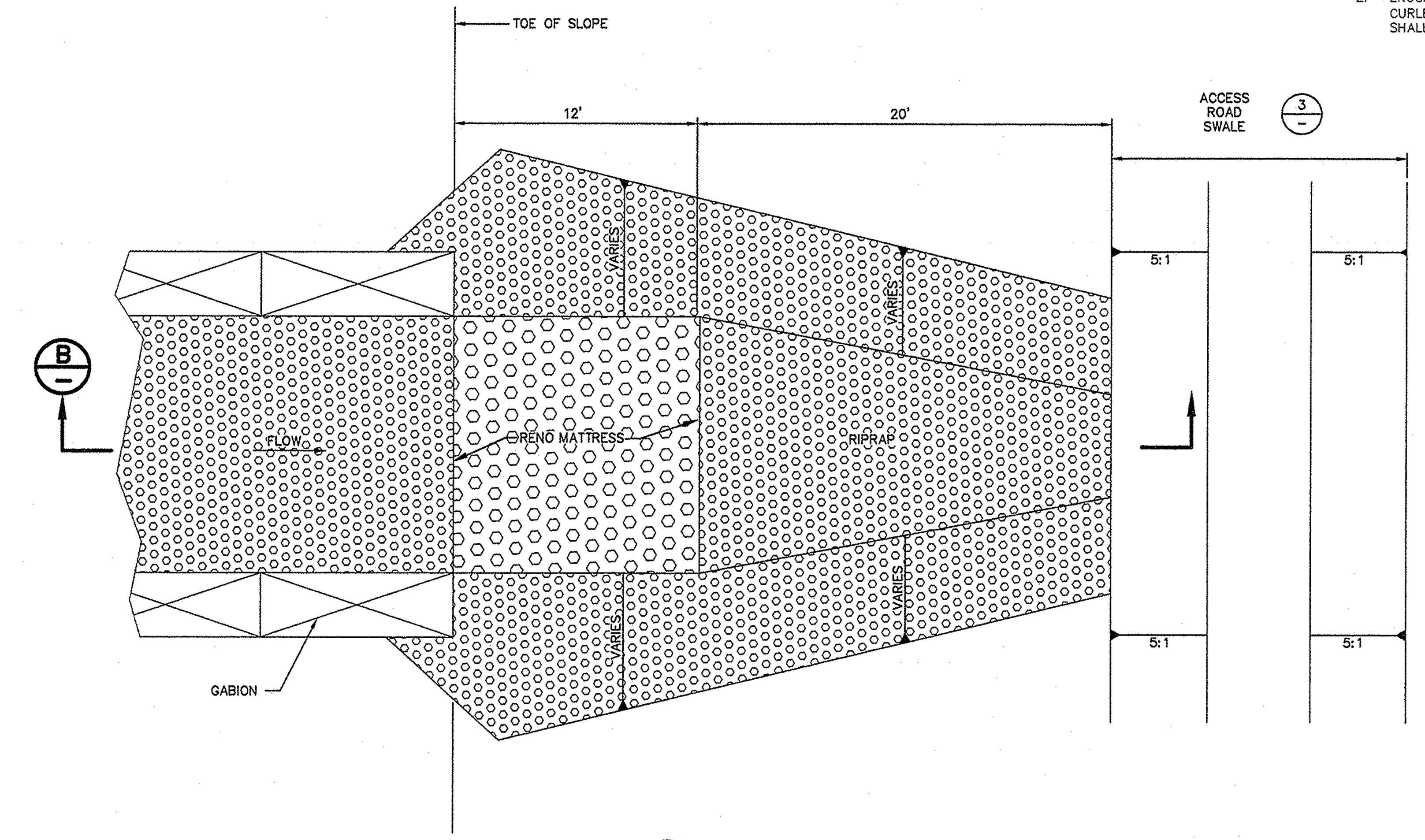
1. GABION BASKETS AND RENO MATTRESSES SHALL CONFORM TO ASTM A-975, STYLE
2. EROSION CONTROL BLANKET (ECB) SHALL BE NORTH AMERICAN GREEN S150, CURLEX II STITCHED, OR APPROVED EQUIVALENT. TURF REINFORCEMENT MAT (TRM) SHALL BE NORTH AMERICAN GREEN P350, LANDLOK TRM 450, OR APPROVED EQUAL.



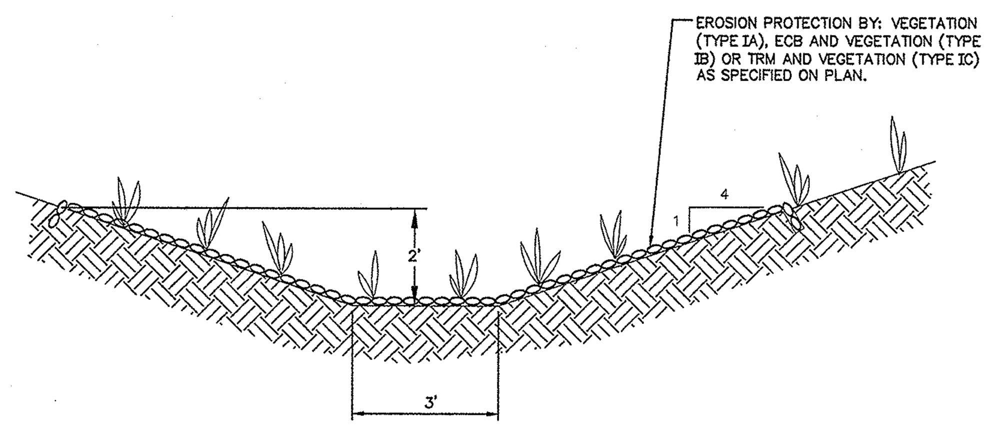
1 / 4N DETAIL
SURFACE DRAINAGE CHANNEL TYPE II
SCALE: NTS
(SEE NOTE 1 AND DETAIL 4 ON THIS SHEET)



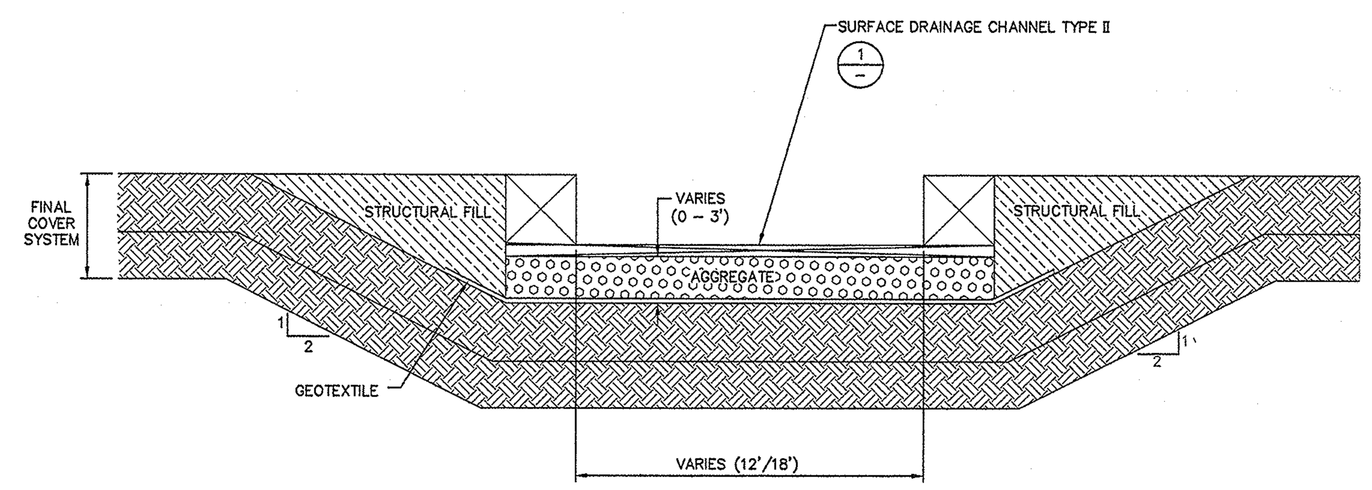
4 PROFILE
SURFACE DRAINAGE CHANNEL
SCALE: NTS
(SEE NOTE 1)



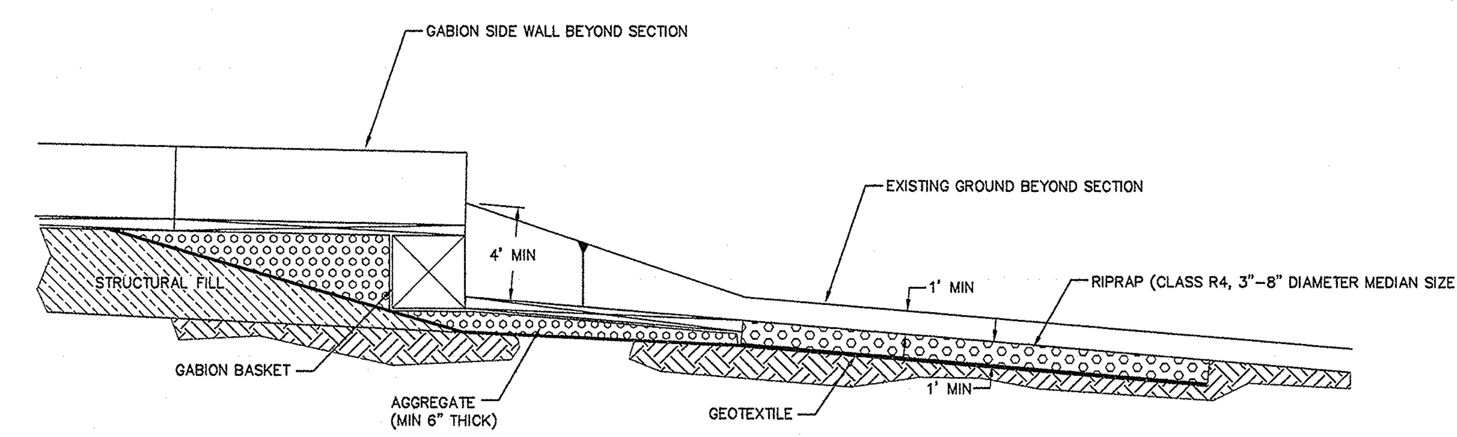
5 / 4N PLAN
OUTLET PROTECTION
SCALE: NTS
(SEE NOTE 1)



2 / 4N DETAIL (TYP)
SURFACE DRAINAGE CHANNEL TYPE IA/IB/IC
SCALE: NTS
(SEE NOTE 2)



A SECTION
SURFACE DRAINAGE CHANNEL TYPE II
SCALE: NTS
(SEE NOTE 1)



B SECTION
TRANSITION
SCALE: NTS
(SEE NOTE 1)

SOLID WASTE APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
MAY 11 2007
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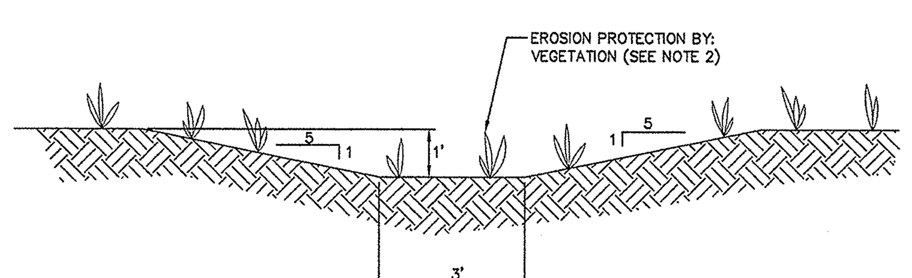
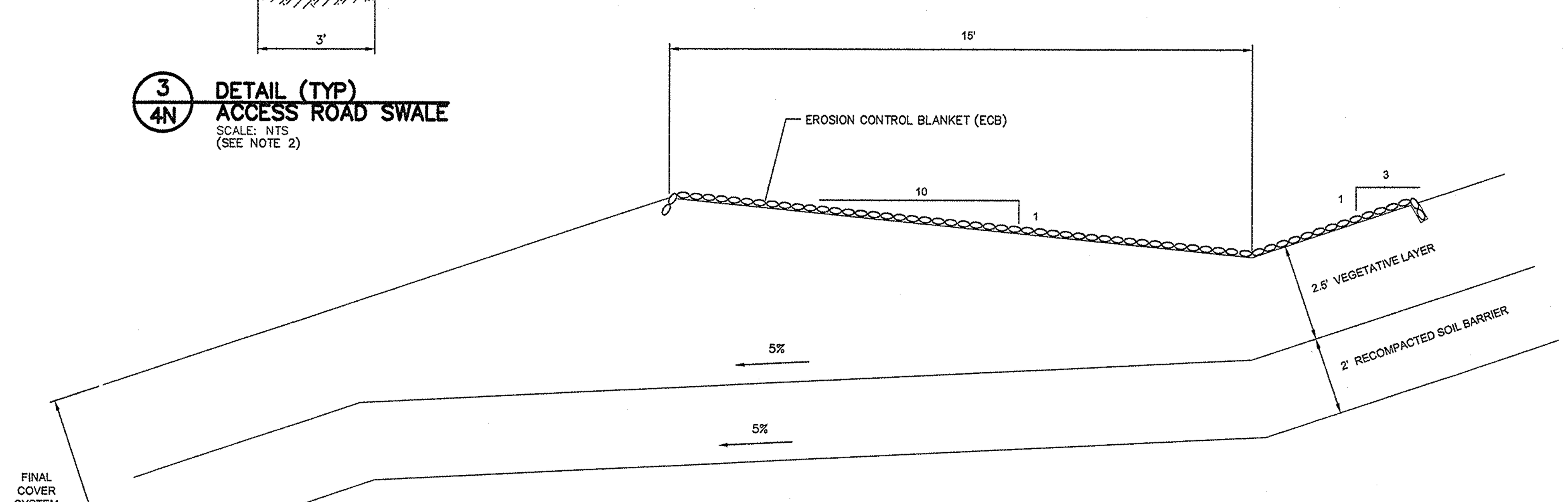
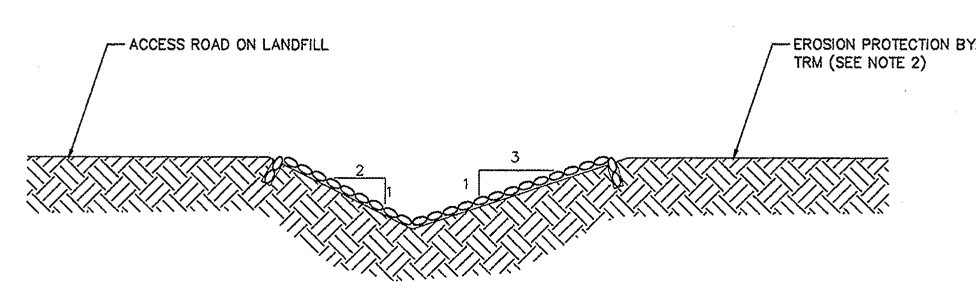


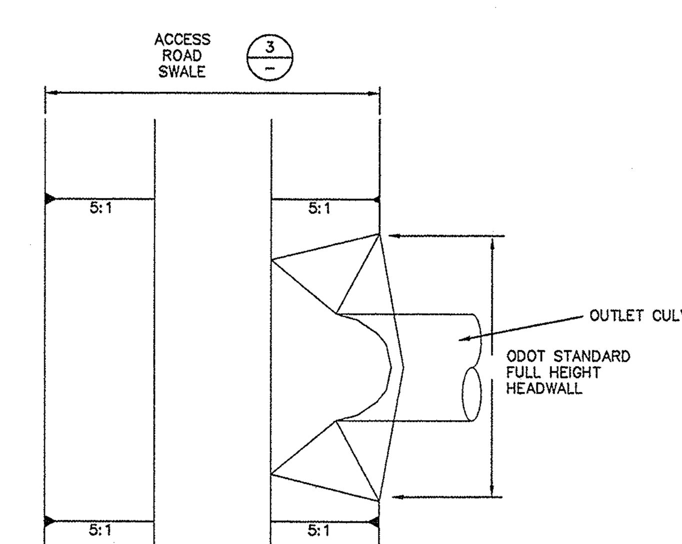
3 / 4N DETAIL (TYP)
ACCESS ROAD SWALE
SCALE: NTS
(SEE NOTE 2)



6 / 4N DETAIL (TYP)
DRAINAGE TERRACE
SCALE: NTS
(SEE NOTE 2)



7 / 4N DETAIL (TYP)
ACCESS ROAD SWALE
SCALE: NTS
(SEE NOTE 2)



8 / 4N PLAN (TYP)
ACCESS ROAD SWALE CULVERT
SCALE: NTS

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MAY 02 2007
Ohio Environmental Protection Agency Southeast District

DATE	NO.	DESCRIPTION	APPD.
MAY 25 2006	B	REVISED – NOD 1 RESPONSE	DGB
OCT 24 2005	A	ISSUED FOR PERMIT	DGB

REVISIONS

CARDINAL OPERATING COMPANY

CARDINAL PLANT

BRILLIANT OHIO

TITLE: CARDINAL FAR 1 RESIDUAL WASTE LANDFILL EROSION AND SEDIMENT CONTROL /STORMWATER CONTROL ELEMENTS I

DWG. NO. 13-30100-7D-B

GEOSYNTEC CONSULTANTS
55 WEST WACKER DRIVE, SUITE 1100
CHICAGO, IL 60601 USA
(312) 658-0500

STATE OF OHIO
DANIEL G. BODINE
E-61363
REGISTERED PROFESSIONAL ENGINEER
SIGNATURE
13 October 2006
DATE

~~PROJECT NO. CHE8126~~
FILE NO.
DRAWING 7D OF 39

SCALE:
DR:
CH:
ENGR.
PROJ. ENGR.
DATE:
APPROVED BY

CIVIL ENGINEERING DIVISION

AMERICAN ELECTRIC POWER
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

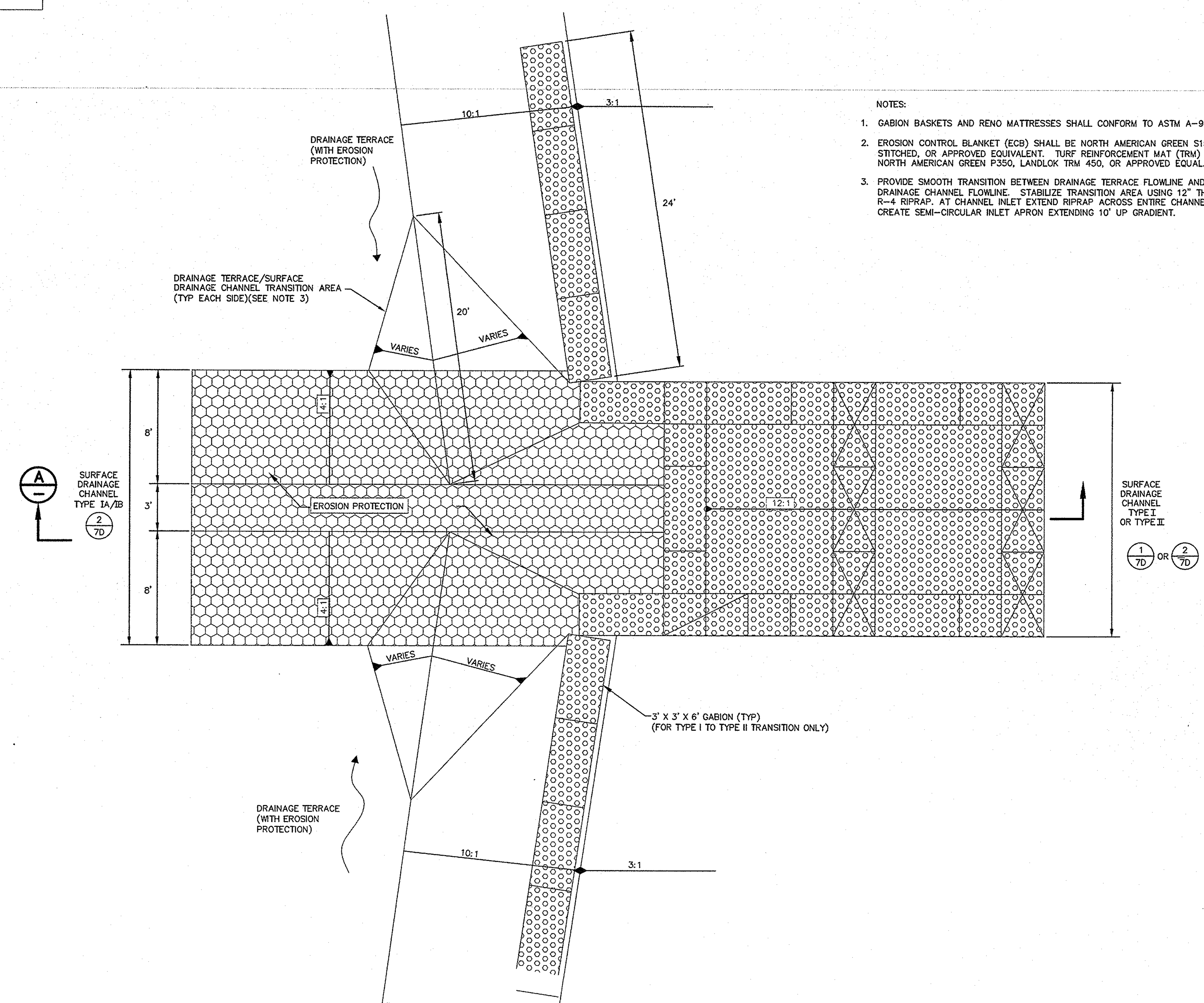
O.E.P.A. DRAWING NO. 7D

IGS1092

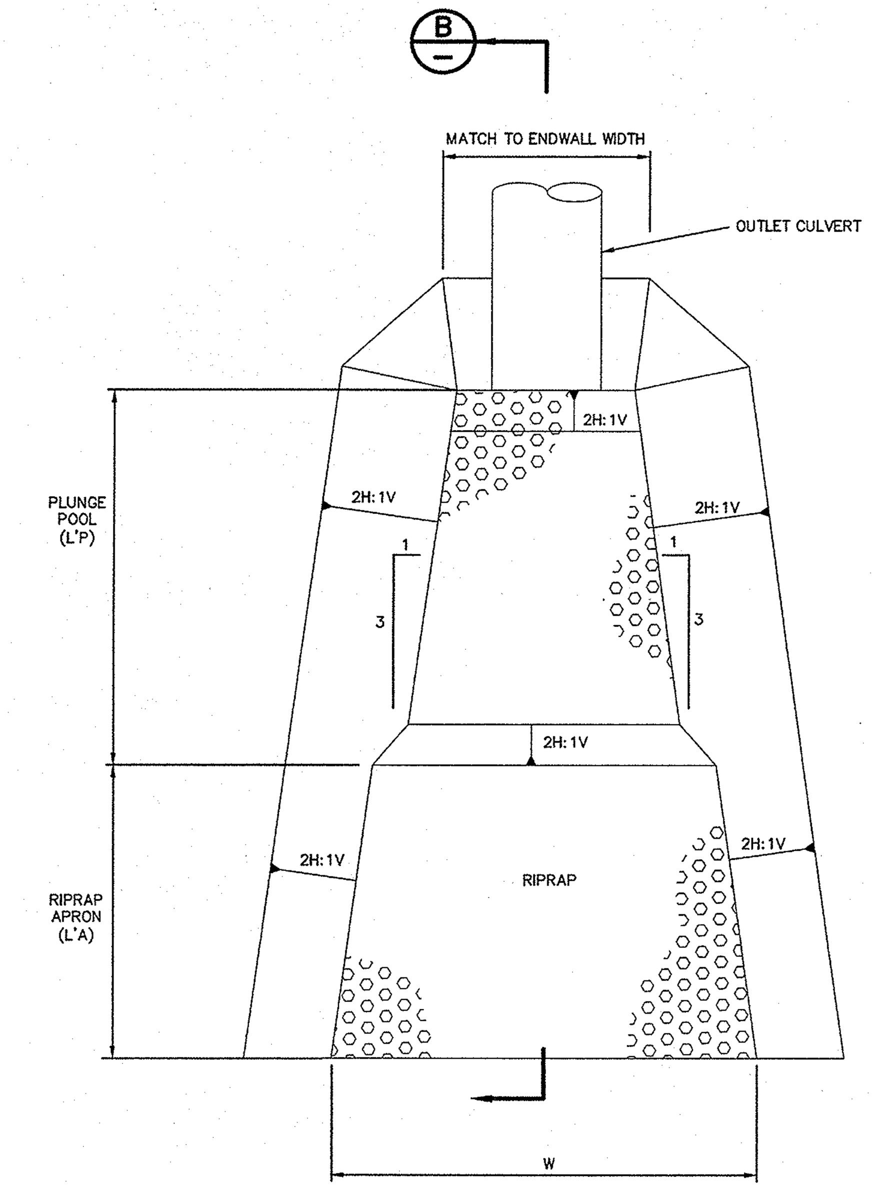
SYSTEM DATE–
SYSTEM TIME–
15th FLR CED

NOTES:

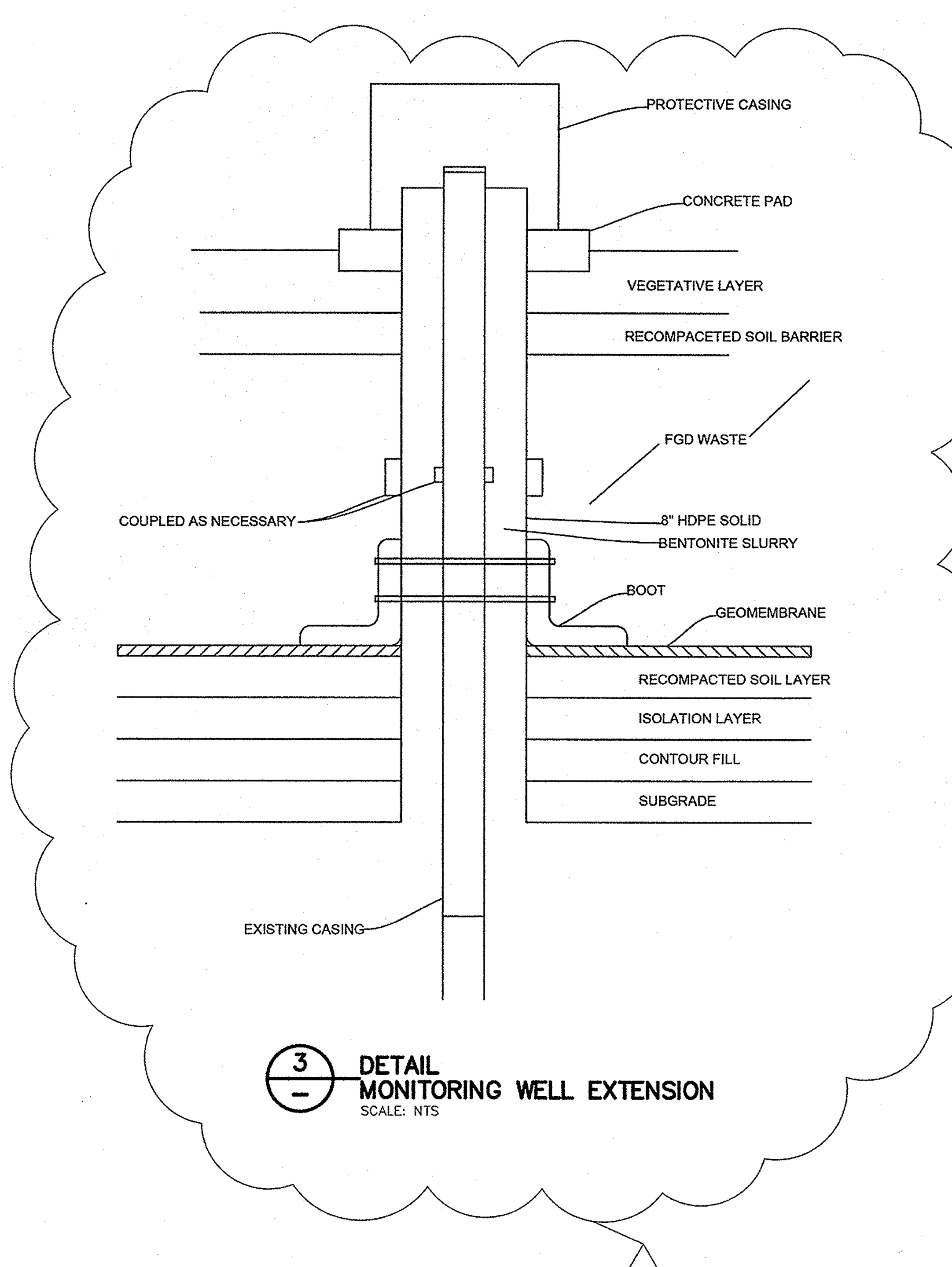
1. GABION BASKETS AND RENO MATTRESSES SHALL CONFORM TO ASTM A–975, STYLE 1.
2. EROSION CONTROL BLANKET (ECB) SHALL BE NORTH AMERICAN GREEN S150, CURLEX II STITCHED, OR APPROVED EQUIVALENT. TURF REINFORCEMENT MAT (TRM) SHALL BE NORTH AMERICAN GREEN P350, LANDLOK TRM 450, OR APPROVED EQUAL.
3. PROVIDE SMOOTH TRANSITION BETWEEN DRAINAGE TERRACE FLOWLINE AND SURFACE DRAINAGE CHANNEL FLOWLINE. STABILIZE TRANSITION AREA USING 12" THICK LAYER OF R–4 RIPRAP. AT CHANNEL INLET EXTEND RIPRAP ACROSS ENTIRE CHANNEL WIDTH AND CREATE SEMI-CIRCULAR INLET APRON EXTENDING 10' UP GRADIENT.



1 PLAN
SURFACE DRAINAGE CHANNEL TRANSITION
SCALE: NTS
(SEE NOTE 1)



2 / 4N DETAIL
OUTLET PROTECTION
SCALE: NTS



3 DETAIL
MONITORING WELL EXTENSION
SCALE: NTS

RECEIVED
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Ohio Environmental Protection Agency
Southeast District

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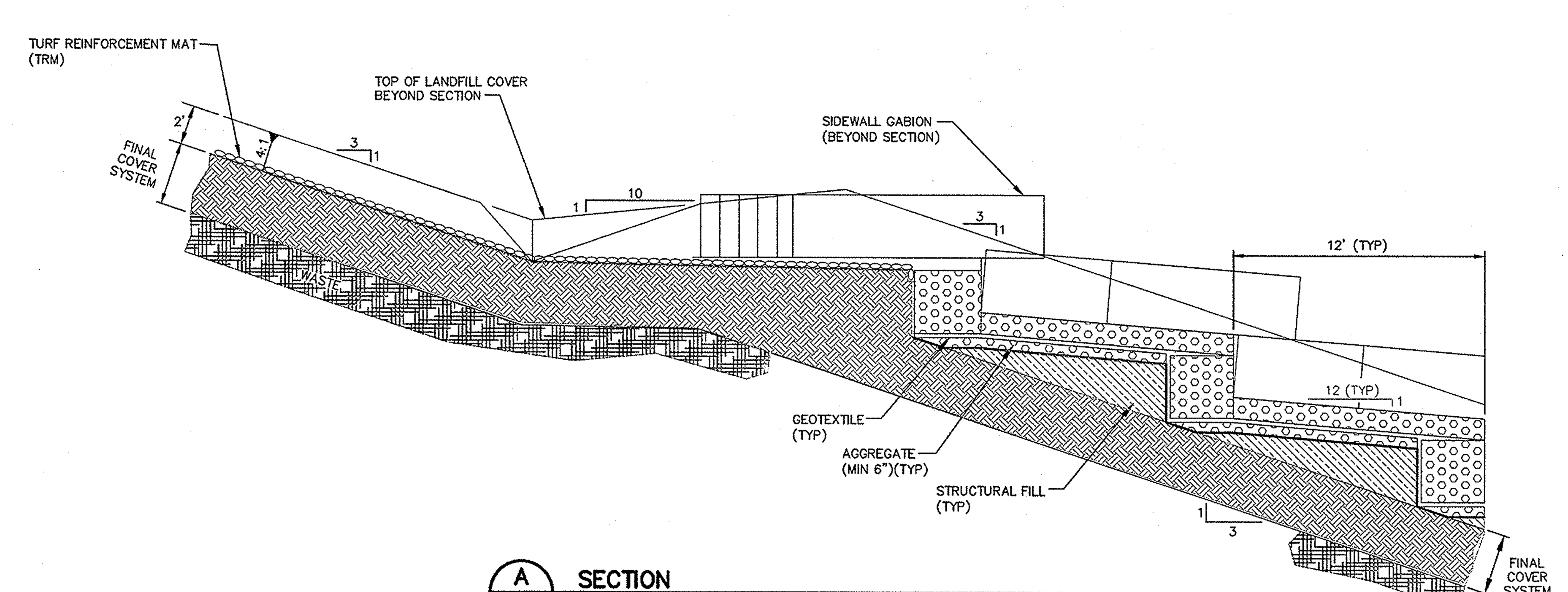
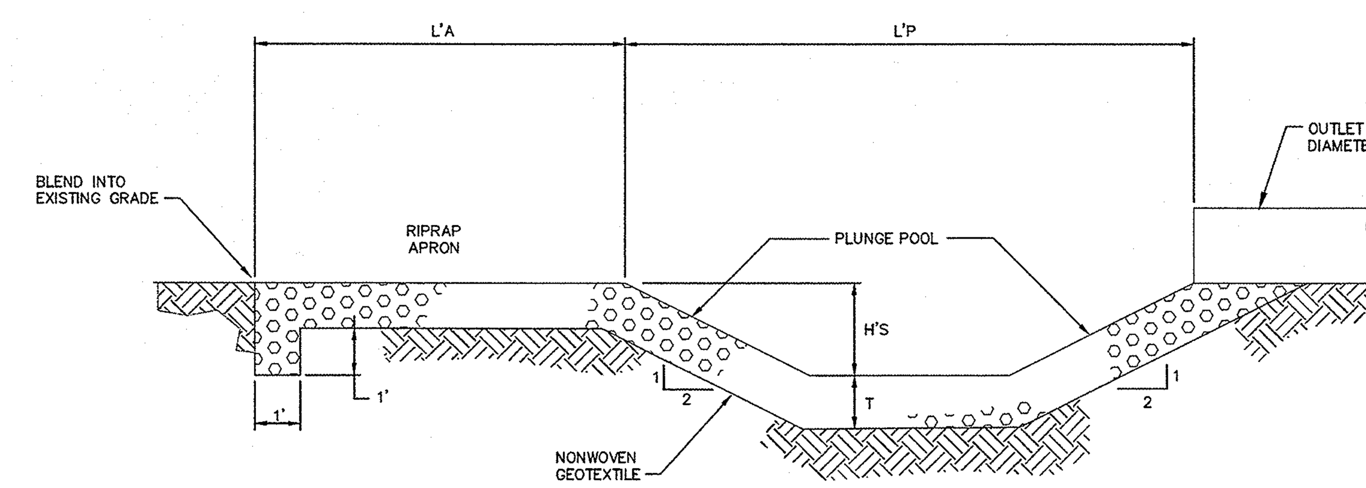
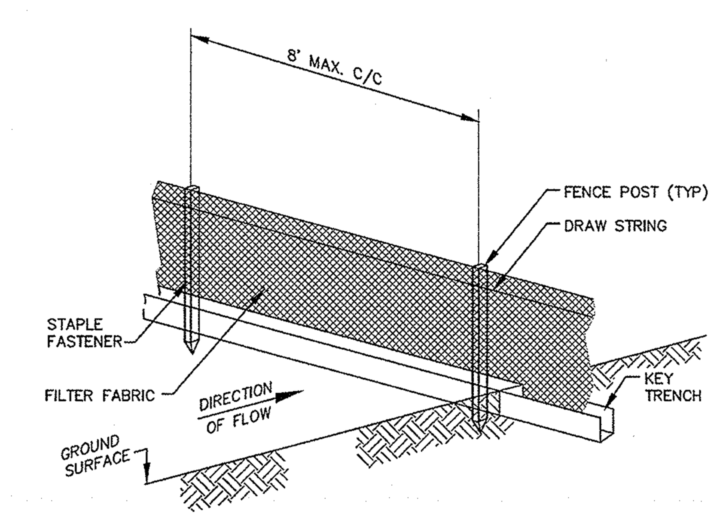


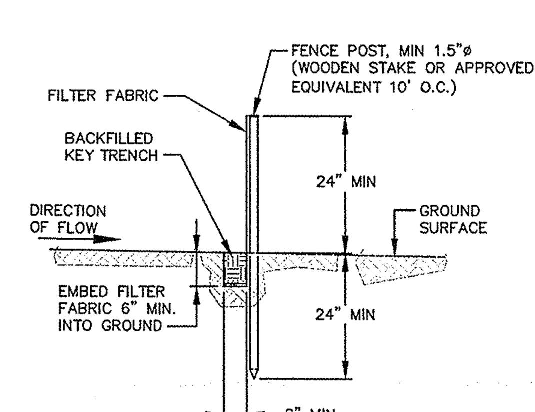
A SECTION
SURFACE DRAINAGE CHANNEL TRANSITION (TYPE I TO TYPE II)
SCALE: NTS
(SEE NOTE 1)



OUTLET PROTECTION SCHEDULE						
STRUCTURE	RIPRAP		DIMENSION (FEET)			
	NATIONAL STONE ASSN. CLASSIFICATION	INSTALLATION THICKNESS (T)	L'P	L'A	W	H'S
OP 1,2	R6 (7"–20" DIAMETER, MEDIAN SIZE 12")	24"	18	9	40	2
OP 3	R6 (7"–20" DIAMETER, MEDIAN SIZE 12")	24"	10	5	20	1
OP 4 TO 19	R5 (5" – 16", MEDIAN SIZE 9")	18"	14	8	22	1.5

B SECTION
OUTLET PROTECTION
SCALE: NTS





4 / 6A DETAIL (TYP)
SILT FENCE
NTS

DATE	NO.	DESCRIPTION	APPD.
DEC 1 2010	C	PTI MODIFICATION NO. 1 MAA	GFZ
MAY 25 2006	B	REVISED - NOD 1 RESPONSE	DGB
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REVISIONS

CARDINAL OPERATING COMPANY

CARDINAL PLANT

BRILLIANT OHIO

TITLE: CARDINAL FAR 1 RESIDUAL WASTE LANDFILL EROSION AND SEDIMENT CONTROL / STORMWATER CONTROL ELEMENTS II

DWG. NO. 13-30100-7E-C

SCALE: CIVIL ENGINEERING DIVISION

DR:
CH:
ENGR:
PROJ. ENGR:
DATE:
APPROVED BY

STATE OF OHIO
MOHAMMAD A AJLOUNI
67074
REGISTERED PROFESSIONAL ENGINEER

SIGNATURE
12-01-2010
DATE

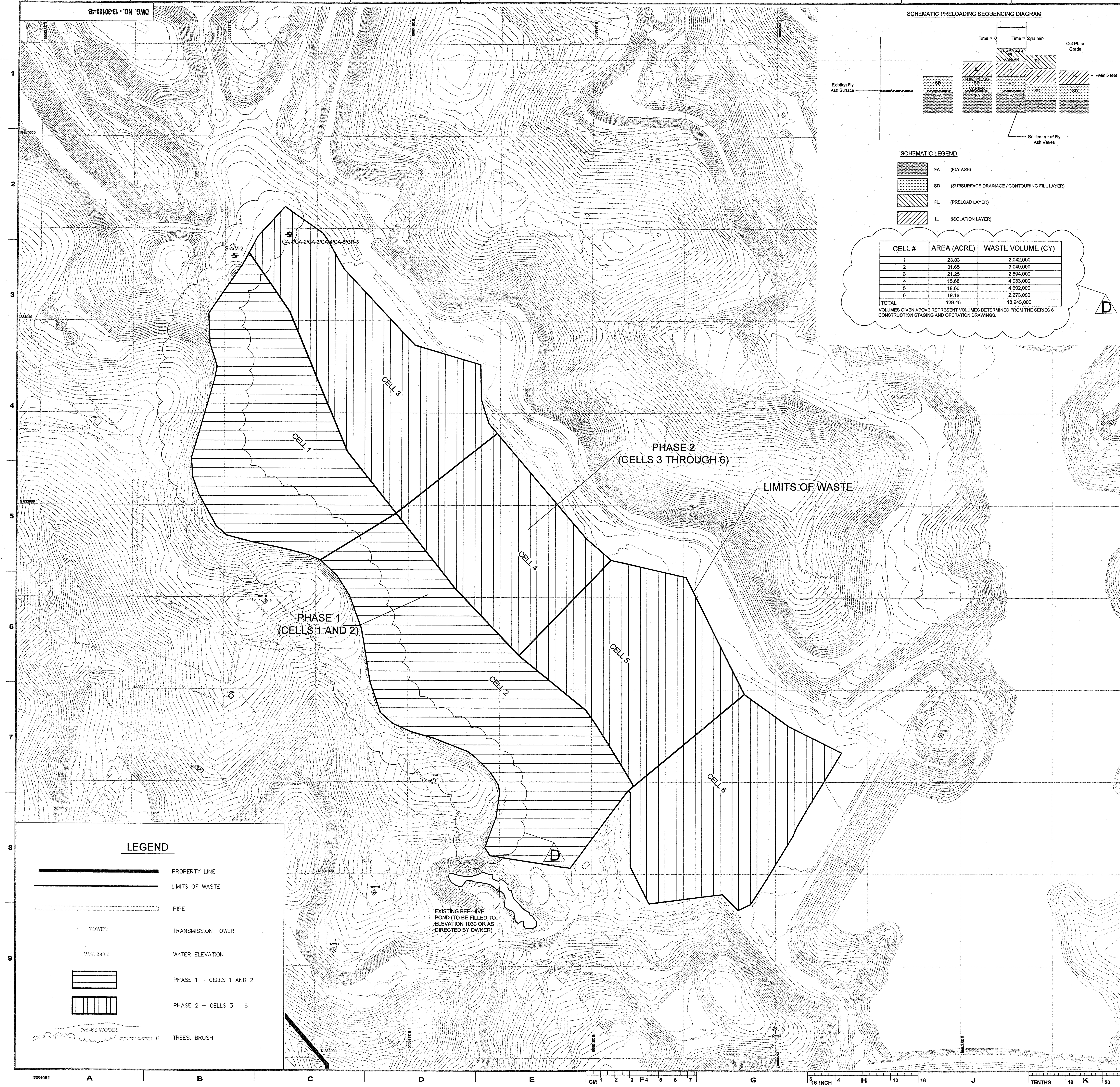
AMERICAN ELECTRIC POWER
1 RIVERSIDE PLAZA COLUMBUS, OH 43215

O.E.P.A. DRAWING NO. 7E

IGS1092

ATTACHMENT C

RUN-OFF CONTROL SYSTEM SUPPORTING DRAWINGS



CELL #	AREA (ACRE)	WASTE VOLUME (CY)
1	23.03	2,042,000
2	31.65	3,049,000
3	21.25	2,894,000
4	15.68	4,083,000
5	18.66	4,602,000
6	19.18	2,273,000
TOTAL	129.45	18,943,000

VOLUMES GIVEN ABOVE REPRESENT VOLUMES DETERMINED FROM THE SERIES 6 CONSTRUCTION STAGING AND OPERATION DRAWINGS.

D

PHASE 1 CONSTRUCTION

1. IMPROVE EXISTING ACCESS ROADS AND CONSTRUCT LAY DOWN AREAS, STAGING AREAS, AND EROSION CONTROL STRUCTURES.
2. EXCAVATE EXISTING MINE SPOIL FROM PHASE 1 AREA. (SEE SHEET 4C FOR GRADING PLAN)
3. PROCESS MINE SPOIL FOR PLACEMENT AS ISOLATION LAYER MATERIAL FOR PHASE 1, PHASE 2, AND AS REPLACED SUBGRADE MATERIAL.
4. STOCKPILE PROCESSED MATERIAL IN PHASE 1 AREA OR ANOTHER DESIGNATED AREA.
5. PLACE PRELOAD IN PHASE 2 CELLS.
6. PLACE SUBGRADE MATERIAL ABOVE EXCAVATED AREA (SEE SHEET 4D FOR GRADING PLAN).
7. CONSTRUCT PHASE 1 SUBSURFACE DRAINAGE LAYER ABOVE SUBGRADE (MINIMUM 2 FEET THICK) (SEE SHEET 4E).
8. PLACE GEOTEXTILE ABOVE SUBSURFACE DRAINAGE LAYER AS SEPARATOR.
9. CONSTRUCT CONTOURING FILL LAYER (SEE SHEET 4F).
10. CONSTRUCT PHASE 1 ISOLATION LAYER (MINIMUM 5 FEET THICK) (SEE SHEET 4G).
11. CONSTRUCT PHASE 1 RECOMPACTED SOIL LINER ABOVE ISOLATION LAYER (MINIMUM 1.5 FEET THICK) (SEE SHEET 4I).
12. PLACE GEOMEMBRANE ABOVE RECOMPACTED SOIL LINER (PVC LINER).
13. PLACE GEOTEXTILE AS CUSHION ABOVE GEOMEMBRANE.
14. CONSTRUCT TEMPORARY LEACHATE PIPING ACROSS FAR 1 BENEATH BOTTOM OF PHASE 2 ISOLATION LAYER (SEE SHEETS 6A AND 7B).
15. CONSTRUCT LEACHATE MANAGEMENT SYSTEM COLLECTION MANHOLES, TRANSMISSION PIPING AND SAMPLING STRUCTURE.
16. CONSTRUCT PHASE 1 LEACHATE MANAGEMENT LAYER (MINIMUM 1 FOOT THICK)) AND PLACE GEOTEXTILE AS SEPARATOR AND FILTER ABOVE AND BELOW LAYER (SEE SHEET 4J).
17. PLACE PROTECTIVE COVER (MINIMUM 3 FEET THICK) ABOVE LEACHATE COLLECTION LAYER.
18. CONSTRUCT INTERPHASE BERM AND TEMPORAY LINER SYSTEM TERMINATION BETWEEN PHASE 1 AND PHASE 2.
19. BEGIN PHASE 1 WASTE PLACEMENT OPERATIONS (SEE SHEET 4K).
20. AS WASTE REACHES FINAL GRADES, BEGIN FINAL COVER PLACEMENT IN ACCORDANCE WITH FINAL COVER CONSTRUCTION STAGING AND OPERATION STAGES. (SEE SHEET 6B AND 6C).

PHASE 2 CONSTRUCTION

1. CONSTRUCT PHASE 2 SUBSURFACE DRAINAGE LAYER ABOVE EXISTING FAR 1 COVER (MINIMUM 2 FEET THICK) (SEE SHEET 4E).
2. PLACE GEOTEXTILE ABOVE SUBSURFACE DRAINAGE LAYER AS SEPARATOR.
3. CONSTRUCT CONTOURING FILL LAYER (SEE SHEET 4F).
4. CONSTRUCT PHASE 2 ISOLATION LAYER (MINIMUM 5 FEET THICK) (SEE SHEET 4G).
5. PLACE TEMPORY GEOTEXTILE LOCATOR AND CONSTRUCT MINESPOIL PRELOAD IN PHASE 2 CELLS (SEE SHEET 4H).
6. REMOVE PRELOAD AND GEOTEXTILE LOCATOR. REESTABLISH BASE GRADE AND FILL AND RECOMPACT SURFACE TO ISOLATION LAYER MINIMUM REQUIREMENTS (SEE SCHEMATIC PRELOADING PLACING DIAGRAM ON THE LEFT).
7. CONSTRUCT PHASE 2 RECOMPACTED SOIL LINER (MINIMUM 1.5 FEET THICK) ABOVE RECOMPACTED ISOLATION LAYER (SEE SHEET 4I).
8. PLACE GEOMEMBRANE ABOVE RECOMPACTED SOIL LINER (PVC LINER).
9. PLACE GEOTEXTILE AS CUSHION ABOVE GEOMEMBRANE.
10. CONSTRUCT PHASE 2 LEACHATE MANAGEMENT LAYER (MINIMUM 1 FOOT THICK) AND PLACE GEOTEXTILE AS SEPARATOR AND FILTER ABOVE. ABANDON OR REMOVE PREVIOUS TEMPORARY LEACHATE PIPING AFTER CONNECTION OF PHASE 2 PERMANENT PIPING.
11. PLACE PROTECTIVE COVER (MINIMUM 3 FEET THICK) ABOVE LEACHATE COLLECTION LAYER. REMOVE PORTION OF INTER PHASE BERM ABOVE PROTECTIVE COVER.
12. BEGIN PHASE 2 WASTE PLACEMENT OPERATIONS (SEE SHEET 4K).
13. AS WASTE REACHES FINAL GRADES, BEGIN FINAL COVER PLACEMENT IN ACCORDANCE WITH FINAL COVER CONSTRUCTION STAGING AND OPERATION STAGES. (SEE SHEET 6D THRIUGH 6G AND 4M FOR FINAL GRADES).

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DEC 14 2010
Ohio Environmental Protection Agency Southeast District

0 200 400
SCALE IN FEET

SOLID WASTE
APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
AUG 10 2011
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REVISIONS

CARDINAL OPERATING COMPANY

CARDINAL PLANT

BRILLIANT OHIO

TITLE: CARDINAL FAR 1 RESIDUAL WASTE LANDFILL GENERAL DEVELOPMENT

STATE OF OHIO
MOHAMMAD A AJLOUNI 67074
REGISTERED PROFESSIONAL ENGINEER

SIGNATURE
12-01-2010
DATE

DWG. NO. 13-30100-4B-D

SCALE:
DR:
CH:
ENGR.
PROJ. ENGR.
DATE:
APPROVED BY

CIVIL ENGINEERING DIVISION

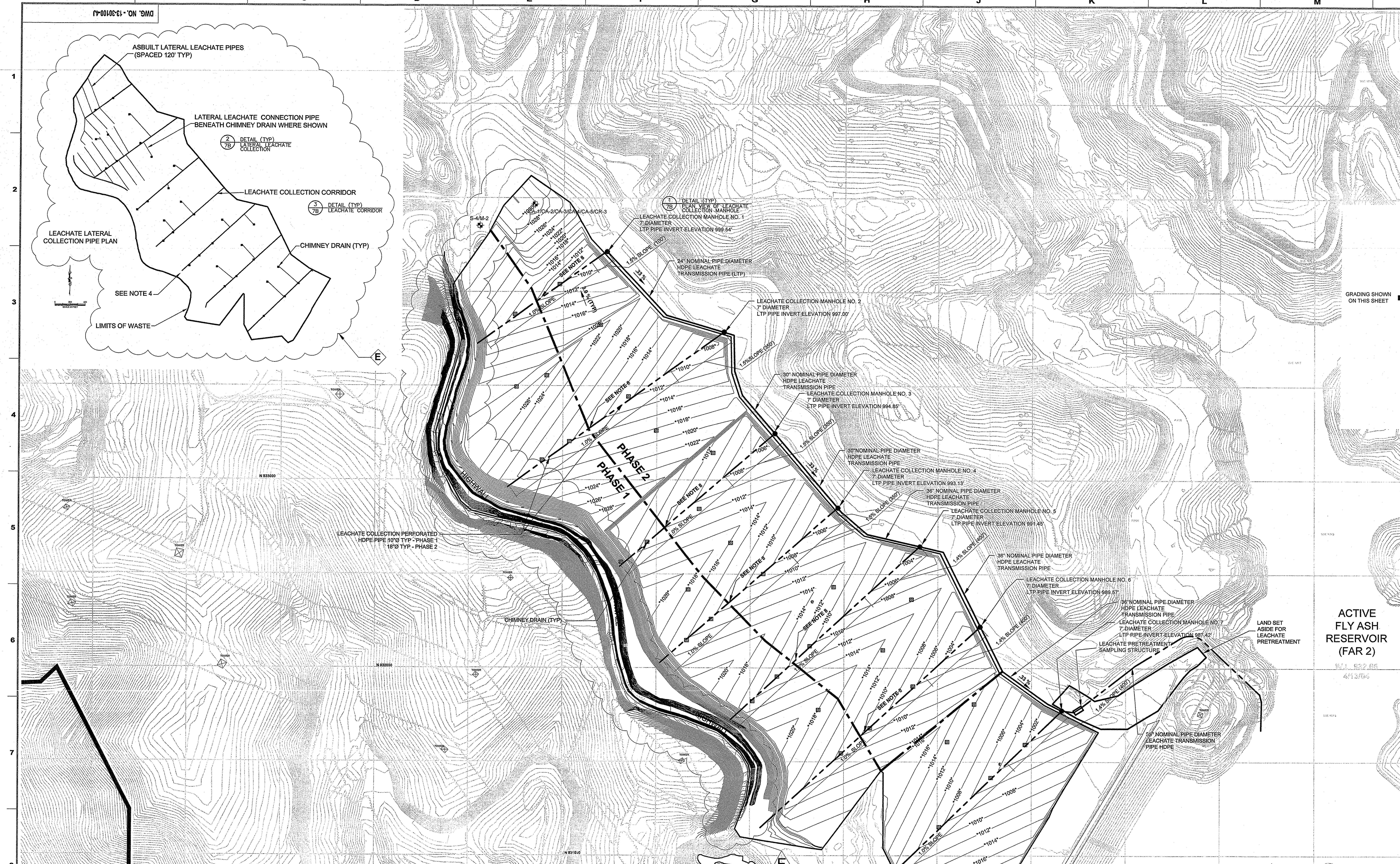
AEP AMERICAN ELECTRIC POWER

1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

O.E.P.A. DRAWING NO. 4B

DRAWING 4B OF 39

SYSTEM DATE-
SYSTEM TIME-
15th FLR.CED



LEACHATE MANAGEMENT / PROTECTIVE COVER PLAN NOTES:

1. THIS SHEET SHOWS THE GRADES FOR TOP OF LEACHATE MANAGEMENT LAYER. THE HIGHWALL GRADES SHOWN ARE EXCAVATION GRADES ONLY.
2. LEACHATE MANAGEMENT SYSTEM CONSISTS OF LEACHATE COLLECTION PIPES AND 1 FOOT GRANULAR DRAINAGE LAYER. A DOUBLE-SIDED GEOCOMPOSITE WILL BE USED FOR LEACHATE COLLECTION ALONG THE HIGHWALL RECOMPACTED SOIL LINER AS SHOWN IN HIGHWALL DETAILS ON SHEET 7F.
3. PLACE LEACHATE COLLECTION PIPES IN CORRIDORS AS SHOWN WITHIN THE 1 FOOT GRANULAR DRAINAGE LAYER.
4. LATERAL LEACHATE PIPES ARE NOT PLACED ALONG THE HIGHWALL.
5. LATERAL LEACHATE PIPES IN THE NORTHEAST CORNER ARE ALIGNED TO REFLECT LOCAL GRADING.
6. PLACE GEOTEXTILE ABOVE LEACHATE MANAGEMENT LAYER.
7. THREE (3) FEET PROTECTIVE COVER WILL BE PLACED OVER THE GRADES SHOWN ON THIS SHEET.
8. AT THE COMPLETION OF EACH PHASE 2 CELL LINER SYSTEM CONSTRUCTION, THE PHASE 1 10-INCH DIAMETER PERFORATED LEACHATE COLLECTION PIPE WILL TRANSITION INTO A PERMANENT PHASE 2 18-INCH DIAMETER PERFORATED LEACHATE COLLECTION PIPE. THE 18-INCH PIPE WILL ALSO BE USED TO ACCOMODATE ACCESS OF A CONTINGENCY LEACHATE COLLECTION PUMP WHEN AND IF NEEDED.

RECEIVED
DEC 14 2010
Ohio Environmental Protection Agency Southeast District

RECOMPACTED SOIL BARRIER PLAN NOTES:

VEGETATIVE LAYER
~~FINAL COVER~~
RECOMPACTED SOIL BARRIER
WASTE
GRADING SHOWN ON THIS SHEET
PROTECTIVE COVER
LEACHATE MANAGEMENT LAYER
GEOTEXTILE
RECOMPACTED SOIL LINER
GEOTEXTILE GEOMEMBRANE
PRELOAD
ISOLATION LAYER
CONTOURING FILL LAYER
GEOTEXTILE
SUBSURFACE DRAINAGE LAYER
SUBGRADE
EXISTING FLY ASH
BEDROCK

LEGEND

1010	TOP OF LEACHATE MANAGEMENT LAYER (2-ft INTERVAL)
1050	EXISTING GROUND SURFACE ELEVATION (5-ft INTERVAL)
	LIMITS OF WASTE
	PIPE
	LEACHATE COLLECTION PIPE
	LEACHATE COLLECTION MANHOLE
	INTERCELL BERM BETWEEN PHASES
DENSE WOODS	TREES, BRUSH
TOWER	TRANSMISSION TOWER
W.E. 836.6	EXISTING WATER ELEVATION
	PROPERTY LINE
	CHIMNEY DRAINS

SOLID WASTE APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
AUG 10 2011
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

DATE	NO.	DESCRIPTION	APPD.
DEC 1 2010	F	PTI MODIFICATION NO. 1 MAA	GFZ
	E	REVISED TO REFLECT LEACHATE LATERAL PIPES REMOVAL	
JAN 31 2007	D	REVISED - NOD 2 SUPPLEMENTAL RESPONSE	DGB
NOV 17 2006	C	REVISED - NOD 2 RESPONSE	DGB
MAY 25 2006	B	REVISED - NOD 1 RESPONSE	DGB
OCT 24 2005	A	ISSUED FOR PERMIT	DGB

REVISIONS

CARDINAL OPERATING COMPANY

CARDINAL PLANT

BRILLIANT OHIO

TITLE: CARDINAL FAR 1 RESIDUAL WASTE LANDFILL LEACHATE MANAGEMENT PLAN

DWG. NO. 13-30100-4J-F

STATE OF OHIO MOHAMMAD A AJLOUNI 67074 REGISTERED PROFESSIONAL ENGINEER

SIGNATURE
12-01-2010
DATE

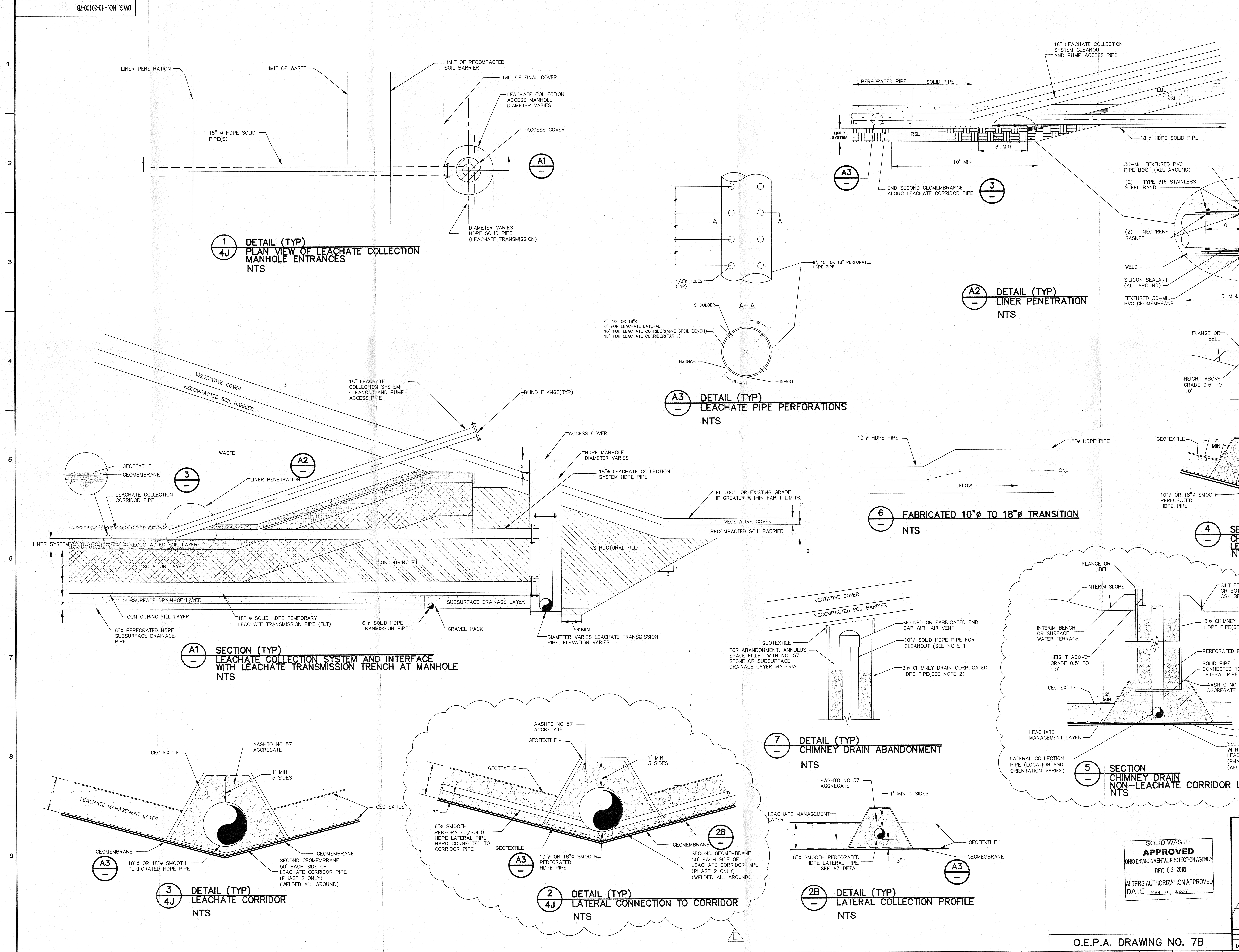
SCALE: DR: CH: ENGR. PROJ. ENGR. DATE: APPROVED BY

CIVIL ENGINEERING DIVISION

AEP AMERICAN ELECTRIC POWER
1 RIVERSIDE PLAZA COLUMBUS, OH 43215

O.E.P.A. DRAWING NO. 4J

DRAWING 4J OF 39



NOTES

1. INSTALL ONE CLEANOUT PIPE PER PHASE PER LC PIPE LOCATION IF CHIMNEY DRAIN IS LOCATED OVER TOP OF AN LC PIPE. SEE SHEET 4J FOR CHIMNEY DRAIN LOCATIONS.
2. CHIMNEY DRAIN PIPE SHALL BE PERFORATED AND GEOTEXTILE FILTER WRAPPED (AOS ≤ U.S. SIEVE NO. 100) OR SOLID PIPE WITH MINIMUM 2 FT OF BOTTOM ASH ALL AROUND PERIMETER.

DATE	NO.	DESCRIPTION	APPD.
OCT 25 2010	E	REVISED TO REFLECT LEACHATE LATERAL PIPES REMOVAL	MAA
JAN 25 2007	D	REVISED NOD 2 SUPPLEMENTAL RESPONSE	DGB
NOV 17 2006	C	REVISED - NOD 2 RESPONSE	DGB
MAY 25 2006	B	REVISED - NOD 1 RESPONSE	DGB
OCT 24 2005	A	ISSUED FOR PERMIT	DGB

REVISIONS

CARDINAL OPERATING COMPANY

CARDINAL PLANT

BRILLIANT OHIO

TITLE: CARDINAL FAR 1 RESIDUAL WASTE LANDFILL LEACHATE COLLECTION AND MANAGEMENT SYSTEM ELEMENTS

DWG. NO. 13-30100-7B-E

SCALE: DR: CH: ENGR. PROJ. ENGR. DATE:

CIVIL ENGINEERING DIVISION

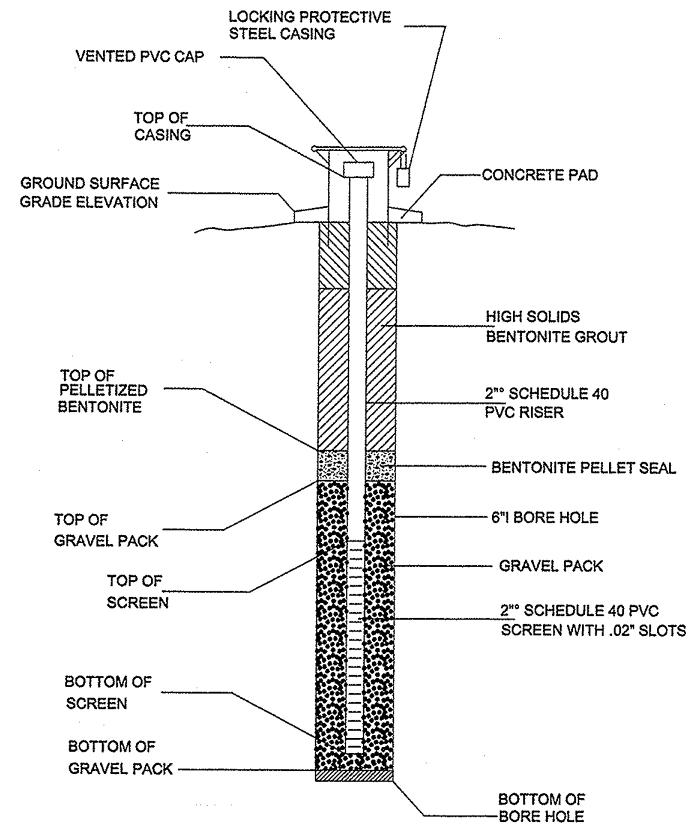
APPROVED BY

DRAWING 7B OF 39

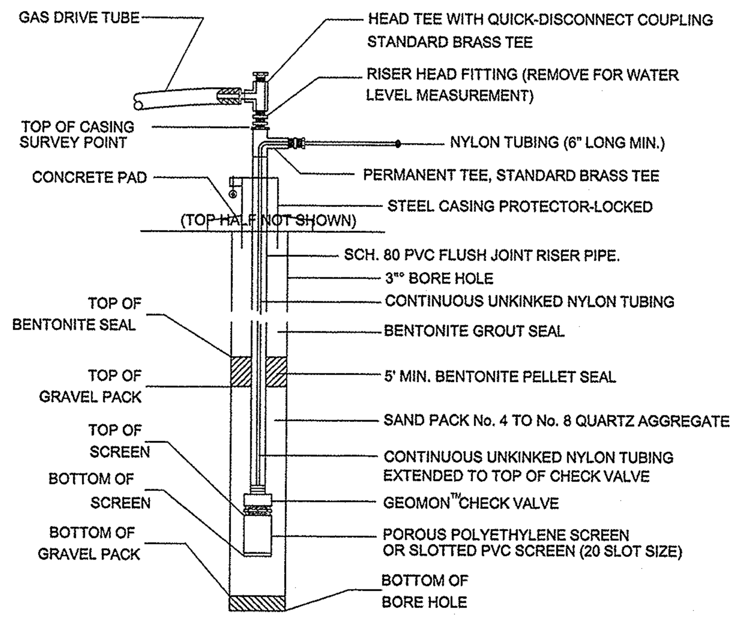
AMERICAN ELECTRIC POWER
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

SYSTEM DATE-
SYSTEM TIME-
15th FLR.CED

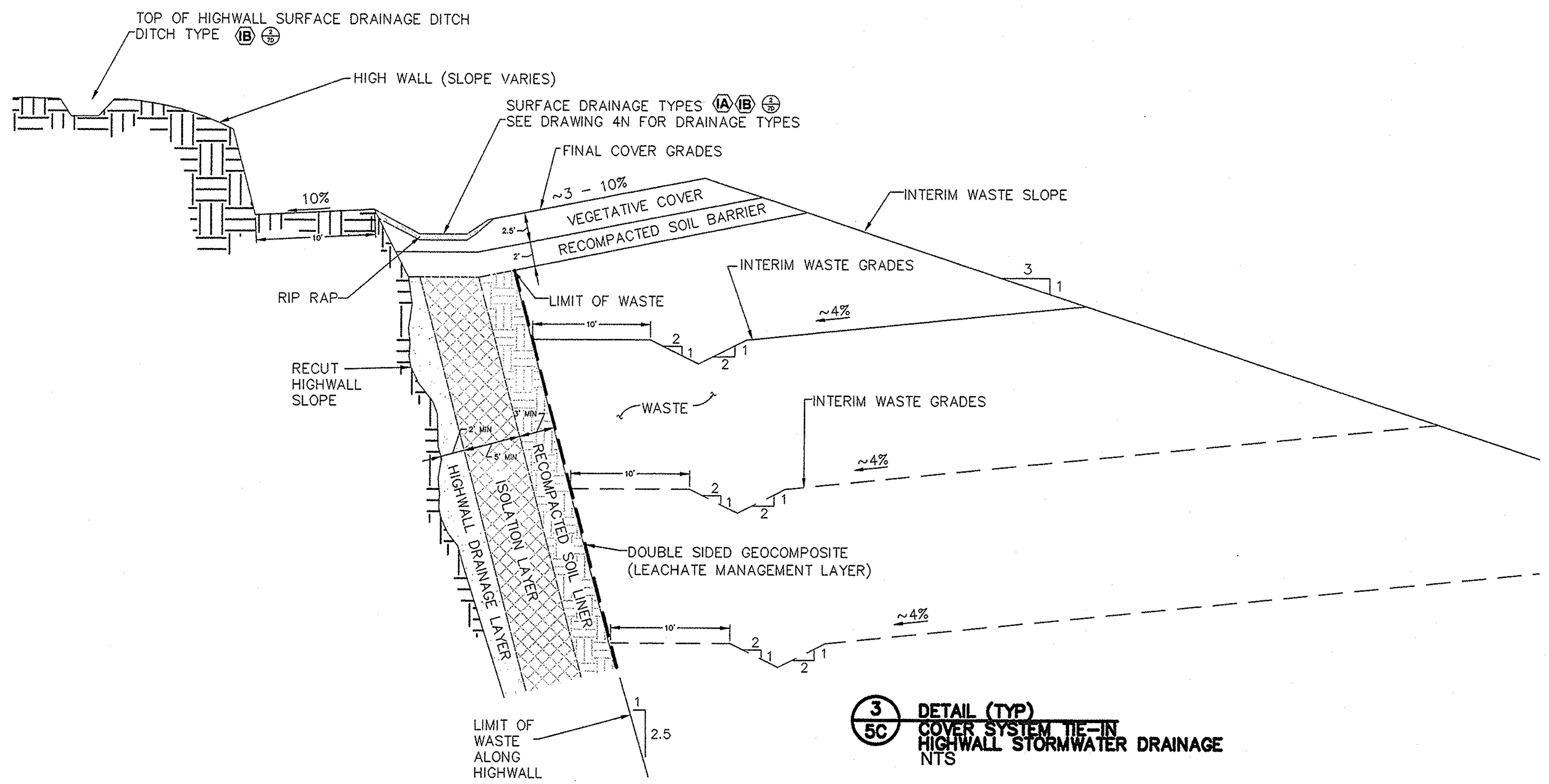
DWG. NO. - 13-30100-7F



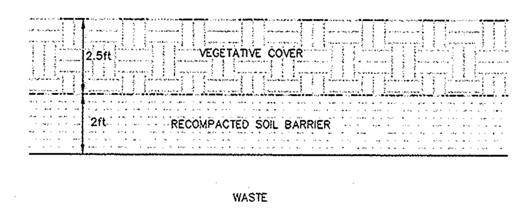
1/3A DETAIL (TYP) SHALLOW AQUIFIER MONITORING WELL
NTS



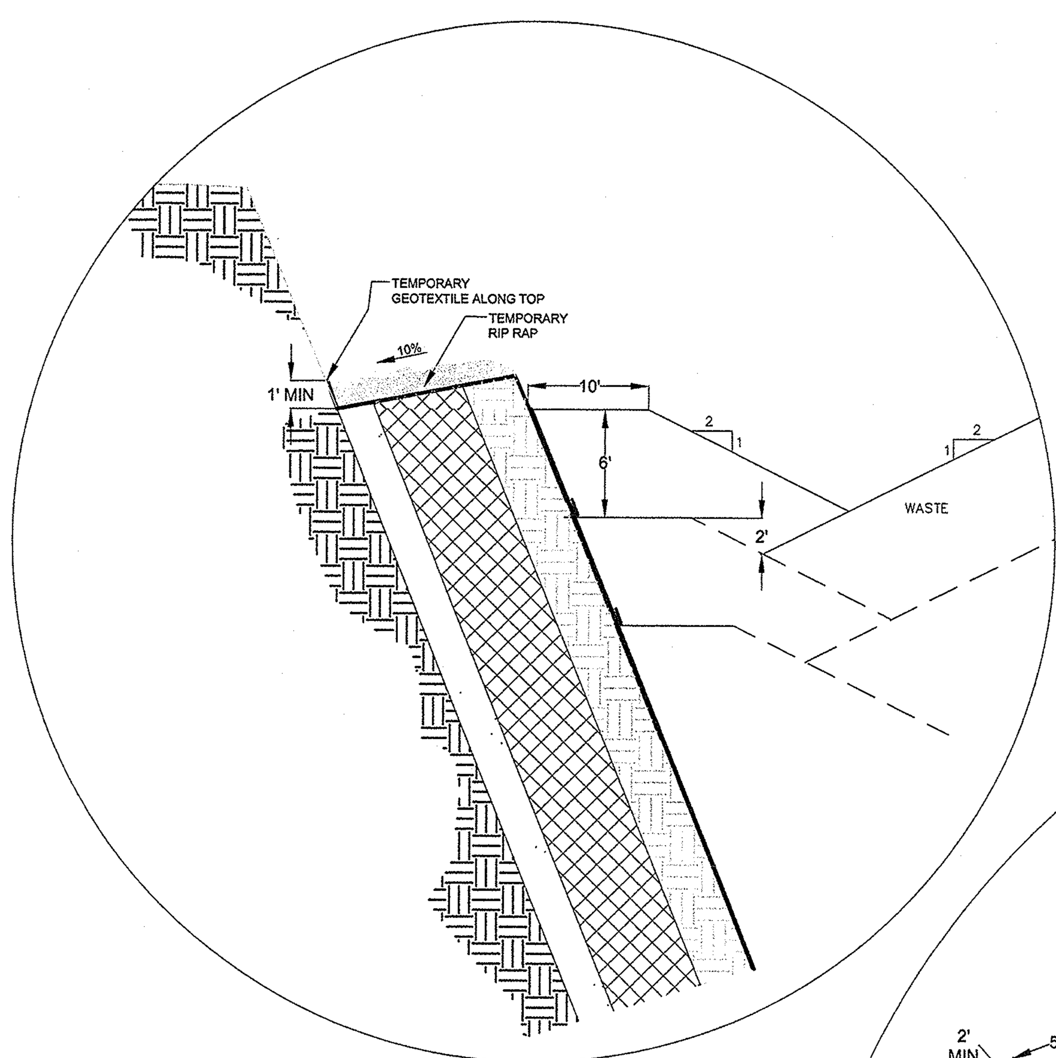
2/3B DETAIL (TYP) BEDROCK MONITORING WELL (DEDICATED NITROGEN GAS SAMPLING PUMP)
NTS

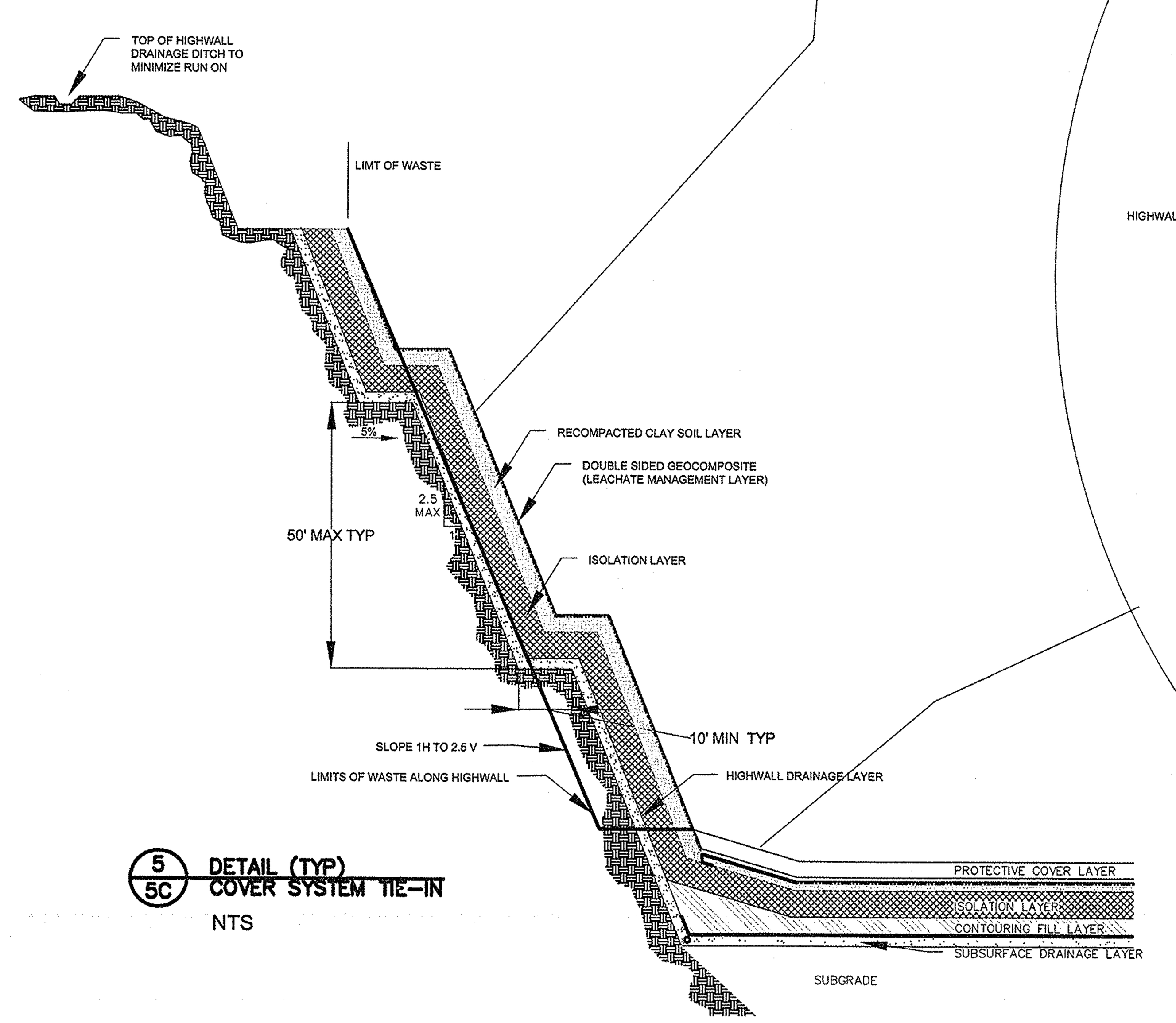


3/5C DETAIL (TYP) COVER SYSTEM TIE-IN HIGHWALL STORMWATER DRAINAGE
NTS

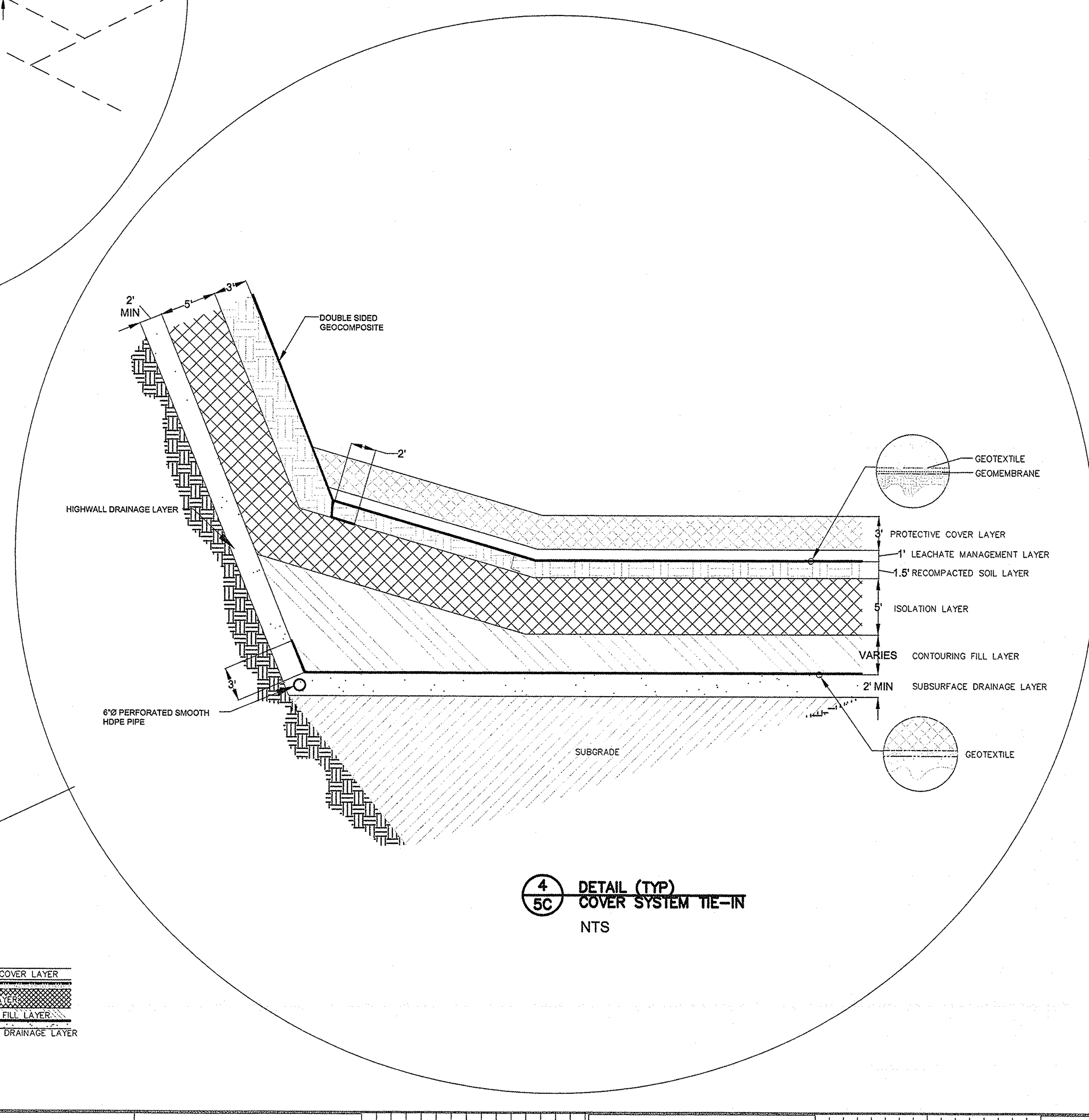


6/5B DETAIL (TYP) COVER SYSTEM: RECOMPACTED SOIL BARRIER AND VEGETATIVE COVER 6/5C-5D
NTS

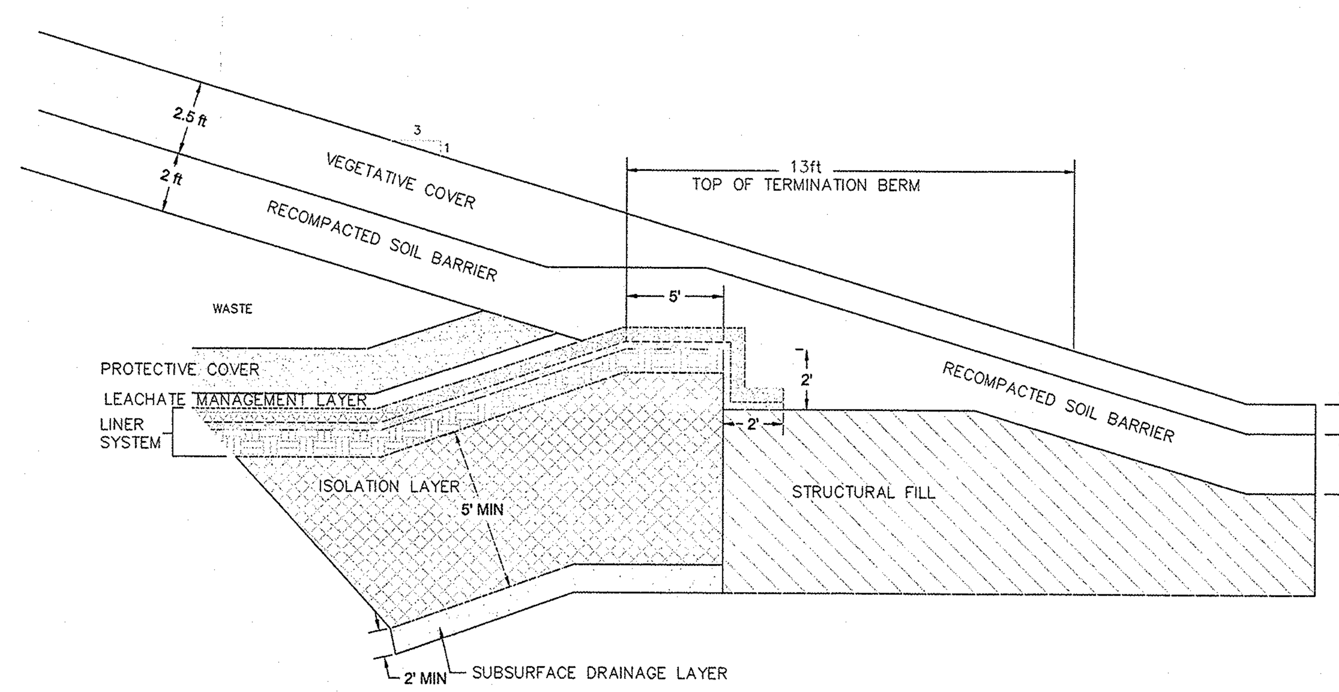




5/5C DETAIL (TYP) COVER SYSTEM TIE-IN
NTS

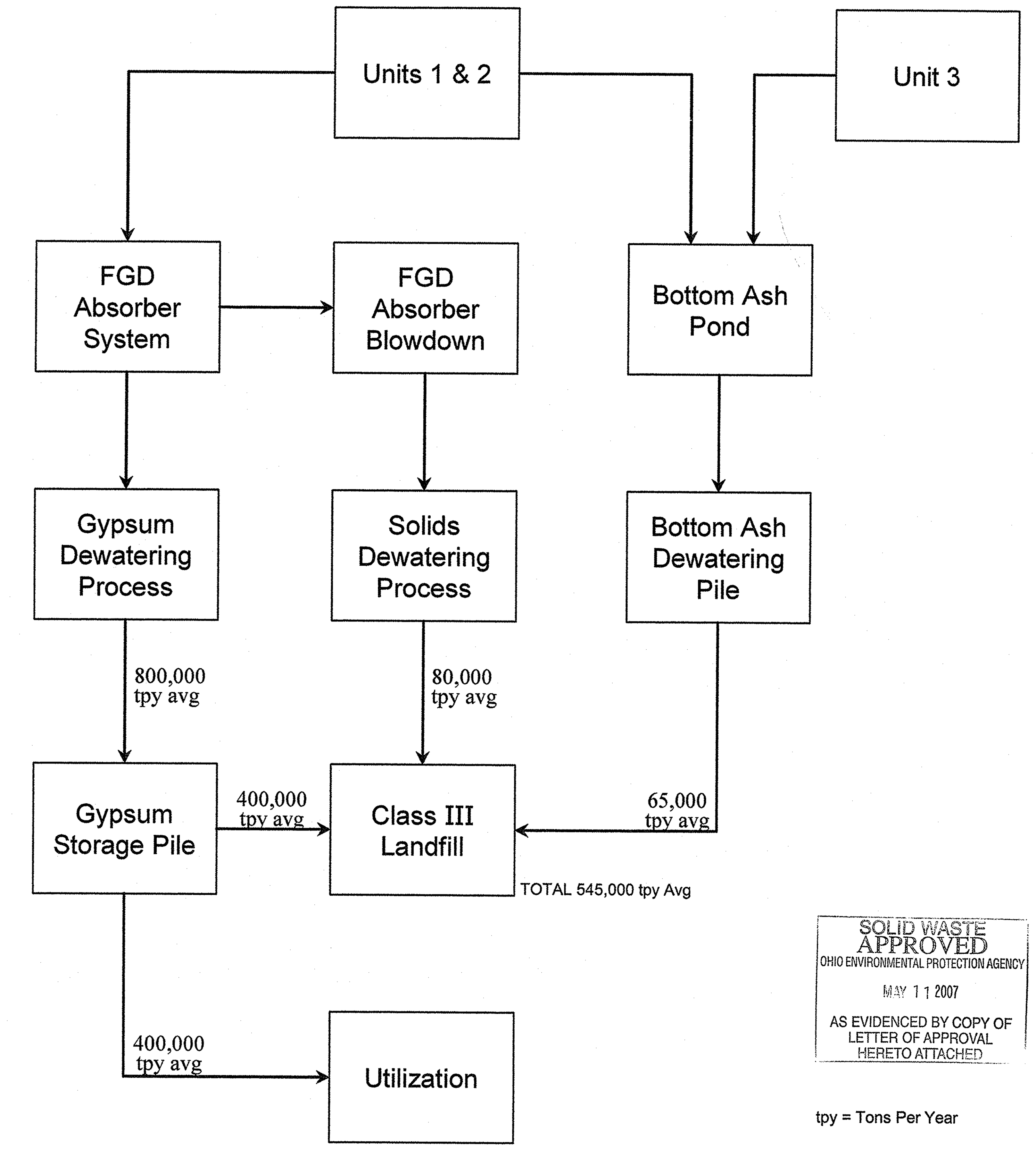


4/5C DETAIL (TYP) COVER SYSTEM TIE-IN
NTS



7/5B DETAIL (TYP) COVER SYSTEM TIE-IN WITH TERMINATION BERM 7/5C-5D
NTS

GENERAL PROCESS FLOW DIAGRAM



tpy = Tons Per Year

SOLID WASTE APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
MAY 11 2007
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

RECEIVED
MAY 02 2007
Ohio Environmental Protection Agency Southeast District

DATE	NO.	DESCRIPTION	APPD.
JAN 25 2007	D	REVISED NOD 2 SUPPLEMENTAL RESPONSE	DGB
NOV 17 2006	C	REVISED - NOD 2 RESPONSE	DGB
MAY 25 2006	B	REVISED - NOD 1 RESPONSE	DGB
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REVISIONS

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CARDINAL OPERATING COMPANY
CARDINAL PLANT
BRILLIANT OHIO

TITLE: CARDINAL FAR 1 RESIDUAL WASTE LANDFILL COVER SYSTEM AND OTHER DETAILS

DWG. NO. 13-30100-7F-D

SCALE: CIVIL ENGINEERING DIVISION

GEOSYNTEC CONSULTANTS
55 WEST WACKER DRIVE, SUITE 1100
CHICAGO, IL 60601 USA
(312) 658-0500

STATE OF OHIO
DANIEL G. BODINE
E-61363
REGISTERED PROFESSIONAL ENGINEER

Daniel G. Bodine
SIGNATURE
25 Jan 2007
DATE

PROJECT NO. CHE8126

O.E.P.A. DRAWING NO. 7F

DRAWING 7F OF 39

AEP AMERICAN ELECTRIC POWER
1 RIVERSIDE PLAZA COLUMBUS, OH 43215

IGS1092