Design Criteria for the Lateral Expansion of the Leland Olds Station Coal Combustion Residual (CCR) Landfill

Leland Olds Station Landfill
Stanton, North Dakota

AECOM Project number: 60545172
November 20, 2017

Prepared for:

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1. Introduction

1.1 §257.70 Citation of Relevant Design Criteria

(a)(1) New CCR landfills and any lateral expansion of a CCR landfill must be designed, constructed, operated, and maintained with either a composite liner that meets the requirements of paragraph (b) of this section or an alternative composite liner that meets the requirements in paragraph (c) of this section, and a leachate collection and removal system that meets the requirements of paragraph (d) of this section. (2) Prior to construction of an overfill the underlying surface impoundment must meet the requirements of § 257.102(d).

(b) A composite liner must consist of two components; the upper component consisting of, at a minimum, a 30-mil geomembrane liner (GM), and the lower component consisting of at least a two-foot layer of compacted soil with a hydraulic conductivity of no more than 1 × 10-7 centimeters per second (cm/ sec). GM components consisting of high density polyethylene (HDPE) must be at least 60-mil thick. The GM or upper liner component must be installed in direct and uniform contact with the compacted soil or lower liner component. The composite liner must be: (1) Constructed of materials that have appropriate chemical properties and sufficient strength and thickness to prevent failure due to pressure gradients (including static head and external hydrogeologic forces), physical contact with the CCR or leachate to which they are exposed, climatic conditions, the stress of installation, and the stress of daily operation; (2) Constructed of materials that provide appropriate shear resistance of the upper and lower component interface to prevent sliding of the upper component including on slopes; (3) Placed upon a foundation or base capable of providing support to the liner and resistance to pressure gradients above and below the liner to prevent failure of the liner due to settlement, compression, or uplift; and (4) Installed to cover all surrounding earth likely to be in contact with the CCR or leachate.

(d) The leachate collection and removal system must be designed, constructed, operated, and maintained to collect and remove leachate from the landfill during the active life and postclosure care period. The leachate collection and removal system must be: (1) Designed and operated to maintain less than a 30-centimeter depth of leachate over the composite liner or alternative composite liner; (2) Constructed of materials that are chemically resistant to the CCR and any non-CCR waste managed in the CCR unit and the leachate expected to be generated, and of sufficient strength and thickness to prevent collapse under the pressures exerted by overlying waste, waste cover materials, and equipment used at the CCR unit; and (3) Designed and operated to minimize clogging during the active life and post-closure care period.

(e) Prior to construction of the CCR landfill or any lateral expansion of a CCR landfill, the owner or operator must obtain a certification from a qualified professional engineer that the design of the composite liner (or, if applicable, alternative composite liner) and the leachate collection and removal system meets the requirements of this section.

1.2 Summary of Design Criteria Certification

This Design Criteria Certification for the lateral expansion at the Basin Electric Power Cooperative Leland Olds Station Landfill has been prepared in accordance with the requirements specified in 40 Code of Federal Regulations (CFR) § 257.70 (USEPA, 2015), which states the CCR Rule requirements for design criteria for new CCR landfills and any lateral expansion of a CCR landfill. These regulations require the CCR unit owner or operator must obtain a certification from a qualified professional engineer that the design of the composite liner (or, if applicable, alternative composite liner) and the leachate collection and removal system meets the requirements of this section. This certification must be obtained prior to construction of the CCR landfill or any lateral expansion of a CCR landfill.

The following pages provide design as it relates to 40 CFR § 257.70 that pertain to the design of the lateral expansion at the Leland Olds Station Landfill near Stanton, North Dakota. An application for renewal of the existing North Dakota solid waste permit (SP-0143) was submitted in March 2017,

including the “Engineering Report” (AECOM, 2017a), with the new permit, incorporating the design information cited herein, issued on June 28, 2017. Permit drawings specific to the liner and leachate collection systems are included in Appendix A

2. Design Criteria for Composite Liner

2.1 §257.70(b) Citation

A composite liner must consist of two components; the upper component consisting of, at a minimum, a 30-mil geomembrane liner (GM), and the lower component consisting of at least a two-foot layer of compacted soil with a hydraulic conductivity of no more than 1 × 10^{-7} centimeters per second (cm/ sec). GM components consisting of high density polyethylene (HDPE) must be at least 60-mil thick. The GM or upper liner component must be installed in direct and uniform contact with the compacted soil or lower liner component. The composite liner must be: (1) Constructed of materials that have appropriate chemical properties and sufficient strength and thickness to prevent failure due to pressure gradients (including static head and external hydrogeologic forces), physical contact with the CCR or leachate to which they are exposed, climatic conditions, the stress of installation, and the stress of daily operation; (2) Constructed of materials that provide appropriate shear resistance of the upper and lower component interface to prevent sliding of the upper component including on slopes; (3) Placed upon a foundation or base capable of providing support to the liner and resistance to pressure gradients above and below the liner to prevent failure of the liner due to settlement, compression, or uplift; and (4) Installed to cover all surrounding earth likely to be in contact with the CCR or leachate.

2.2 §257.70(b): Two Components of Composite Liner

The composite liner specified in the design documents consists of an upper component consisting of a 60-mil high density polyethylene geomembrane liner and a lower component consisting of a two-foot layer of compacted soil with a hydraulic conductivity of no more than 1 × 10^{-7} centimeters per second (cm/ sec) (AECOM, 2017a) (Sheet C-7.1, Appendix A).

2.3 §257.70(b)(1): Chemical Properties, Strength, and Thickness of Materials

The composite liner materials specified in the design documents have appropriate chemical properties and sufficient strength and thickness to prevent failure due to pressure gradients (including static head and external hydrogeologic forces), physical contact with the CCR or leachate to which they are exposed, climatic conditions, the stress of installation, and the stress of daily operation. No geosynthetic clay liner (GCL) is being proposed at this time, so chemical compatibility testing for the proposed liner system is not being conducted.

2.4 §257.70(b)(2): Shear Resistance

The composite liner materials specified in the design documents provide appropriate shear resistance of the upper and lower component interface to prevent sliding of the upper component including on slopes[(3)]. Shear strength testing of the soil-geosynthetic interface will be conducted on field samples of the geosynthetic liner and the clay soils in order to confirm that the soil-geosynthetic interface relationship observed in these materials meets or exceeds the as-designed shear resistance.

2.5 §257.70(b)(3): Foundation or Base for Composite Liner

The base for the composite liner system specified in the design documents is capable of providing support to the liner and resistance to pressure gradients above and below the liner to prevent failure of the liner due to settlement, compression, or uplift (AECOM, 2017b).

2.6 §257.70(b)(4): Limits of Composite Liner

The design limits of the composite liner specified in the design documents cover all surrounding earth likely to be in contact with the CCR or leachate (Sheet 3.0, Appendix A).

3. Design Criteria for Leachate Collection System

3.1 §257.70(d) Citation

(d) The leachate collection and removal system must be designed, constructed, operated, and maintained to collect and remove leachate from the landfill during the active life and post-closure care period. The leachate collection and removal system must be: (1) Designed and operated to maintain less than a 30-centimeter depth of leachate over the composite liner or alternative composite liner; (2) Constructed of materials that are chemically resistant to the CCR and any non-CCR waste managed in the CCR unit and the leachate expected to be generated, and of sufficient strength and thickness to prevent collapse under the pressures exerted by overlying waste, waste cover materials, and equipment used at the CCR unit; and (3) Designed and operated to minimize clogging during the active life and post-closure care period.

3.2 §257.70(d): Active Life and Post-Closure Care Period

The leachate collection and removal system must be designed, constructed, operated, and maintained to collect and remove leachate from the landfill during the active life and post-closure care period[(2)] (Sheets C-3.0, C-7.1, C-7.2, and C-7.3, Appendix A).

3.3 §257.70(d)(1): Maximum Depth of Leachate

The leachate collection system specified in the design documents was designed to maintain less than a 30-centimeter depth of leachate over the composite liner (AECOM, 2017a).

3.4 §257.70(d)(2): Chemical Properties, Strength, and Thickness of Materials

The design documents specify materials for the leachate collection system that are chemically resistant to the CCR and any non-CCR waste managed in the CCR unit and the leachate expected to be generated and of sufficient strength and thickness to prevent collapse under the pressures exerted by overlying waste, waste cover materials, and equipment used at the CCR unit (Sheet C-7.1, Appendix A).

3.5 §257.70(d)(3): Minimize Clogging

The leachate collection system specified in the design documents was designed to minimize clogging during the active life and post-closure care period. Hydraulic conductivity ratio (HCR) testing will be conducted on samples of CCR from the station over samples of the aggregate and bottom ash being used in the leachate collection system in order to confirm that no clogging issues related to chemistry issues or relative particle size are anticipated.

4. Certification

4.1 §257.70(e) Citation

(e) Prior to construction of the CCR landfill or any lateral expansion of a CCR landfill, the owner or operator must obtain a certification from a qualified professional engineer that the design of the composite liner (or, if applicable, alternative composite liner) and the leachate collection and removal system meets the requirements of this section.

4.2 Certification

Certification Statement 40 CFR §257.70(e) – Design of the Composite Liner and the Leachate Collection and Removal System for the Lateral Expansion of a CCR Landfill

CCR Unit: Basin Electric Power Cooperative; Leland Olds Station; Ash Landfill Expansion

I, John Cannon, being a Registered Professional Engineer in good standing in the State of North Dakota, do hereby certify, to the best of my knowledge, information, and belief, that the information contained in this document have been prepared in accordance with the accepted practice of engineering. I certify, for the above referenced CCR Unit, that the design for the composite liner and leachate collection and removal system described in this document meets the requirements of 40 CFR § 257.70.

John Cannon
Printed Name

November 20, 2017
Date

5. Limitations

Existing permits, recent topographic information, land survey information, and as-built drawings from previously constructed landfill cells have been furnished to AECOM by Basin Electric Power Cooperative, which AECOM has used in preparing the design documents. AECOM has relied on this information as furnished. The design basis and documents are based on AECOM's understanding of current plant operations, maintenance, storm water handling, and ash handling procedures at the landfill, as provided by Basin Electric Power Cooperative. Changes in any of these operations or procedures may result in deviation from the intended design and operation of the landfill expansion.

The design is based on established engineering principles. Our services were provided in a manner consistent with the level of care and skill ordinarily exercised by other professional consultants under similar circumstances. No other representation is intended.

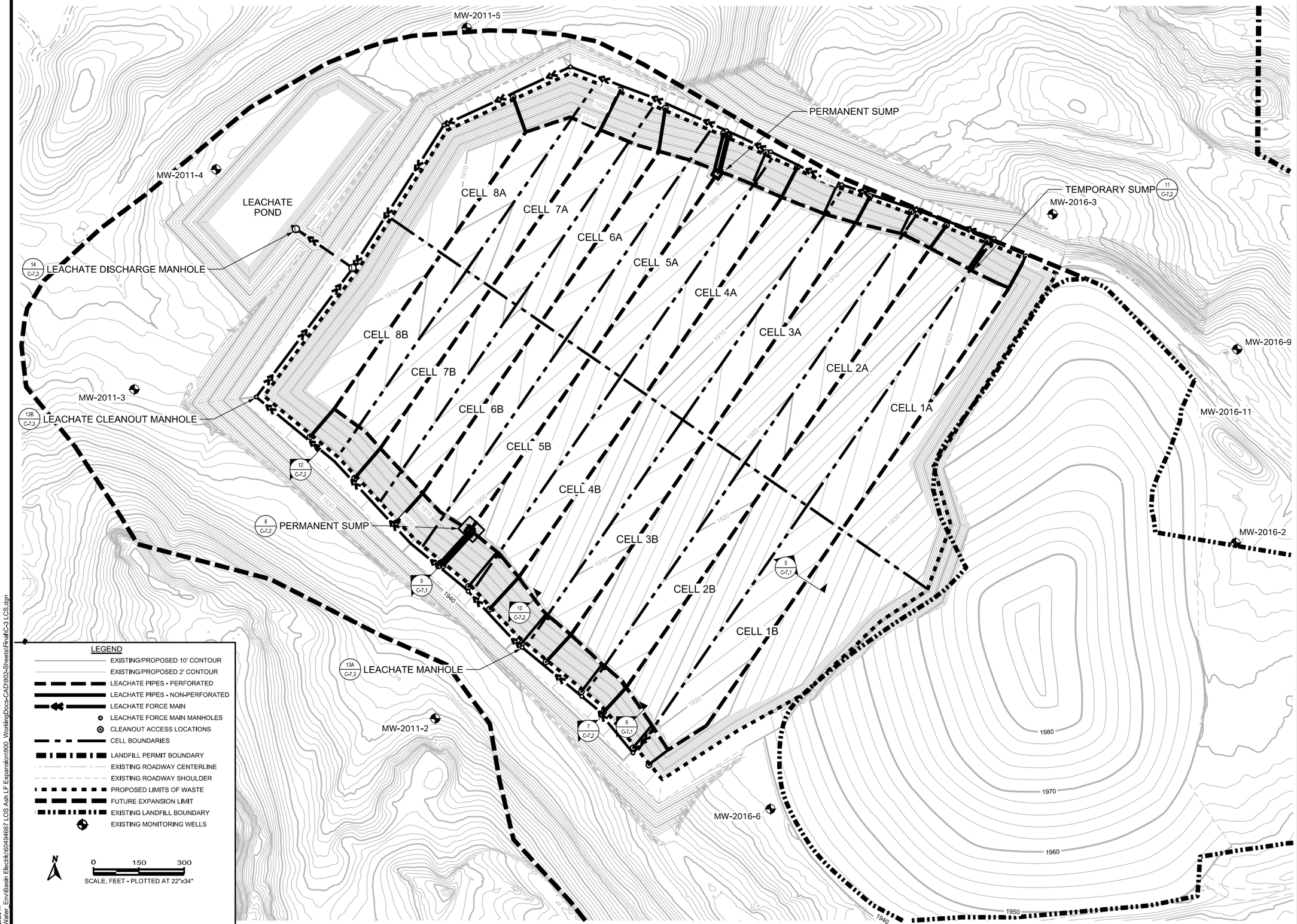
6. References

U.S. Environmental Protection Agency. (USEPA, 2015). *Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments*, 40 CFR §257. Federal Register, Volume 80, Subpart D, April 17, 2015.

AECOM (2017a). *Engineering Report – Ash Landfill Expansion, Leland Olds Station*. March 23, 2017.

AECOM (2017b). *Supplemental Site Characterization Report – Ash Landfill Expansion, Leland Olds Station*. March 23, 2017.

Appendix A – Liner and Leachate Collection System Drawings



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LELAND OLDS STATION
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ISSUE/REVISION

I/R	DATE	DESCRIPTION
1	2017-03-23	ISSUED-PERMIT SUBMITTAL

NOTES

TOPOGRAPHIC SURVEY BY KBM, NOVEMBER 2015. TOPOGRAPHY UPDATED BY BEPC, OCTOBER 5, 2016.

COORDINATES ARE ND STATE PLANE SOUTH, NAD 1929.

PROJECT NUMBER

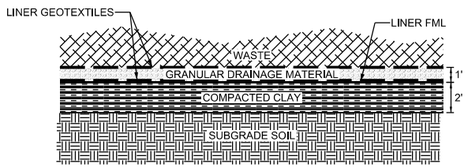
60494667

SHEET TITLE

LEACHATE COLLECTION SYSTEM

SHEET NUMBER

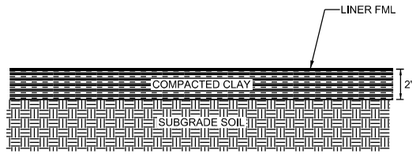
C-3.0



1A C-2.0 BASE LINER SECTION
NOT TO SCALE

NOTES:

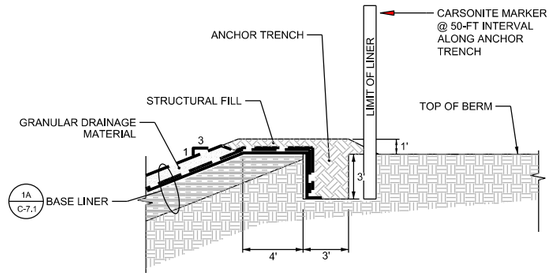
1. LINER FML TO BE TEXTURED 60-MIL HIGH DENSITY POLYETHYLENE (HDPE).
2. CLAY TO BE COMPACTED TO 95% STANDARD PROCTOR DENSITY, MAX. PERMEABILITY = 1.0 x 10-7 CM/SEC.
3. GRANULAR DRAINAGE MATERIAL TO BE UNIT 2 BOTTOM ASH. MIN. PERMEABILITY = 1.0 x 10-3 CM/SEC.
4. LINER GEOTEXTILES TO BE 8 OZ. NON-WOVEN POLYETHYLENE.



1B C-2.0 LEACHATE POND LINER SECTION
NOT TO SCALE

NOTES:

1. LINER FML TO BE TEXTURED 60-MIL HIGH DENSITY POLYETHYLENE (HDPE).
2. CLAY TO BE COMPACTED TO 95% STANDARD PROCTOR DENSITY, MAX. PERMEABILITY = 1.0 x 10-7 CM/SEC.



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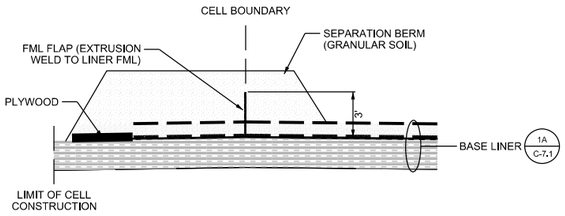

3 C-2.0 CELL SEPARATION BERM
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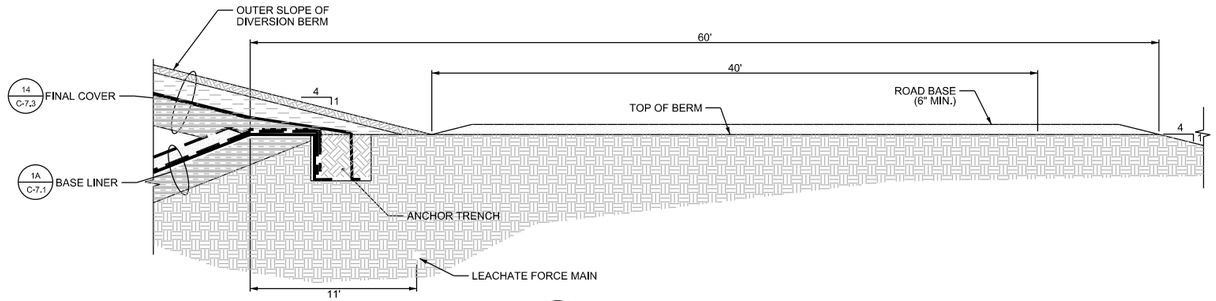

4 C-2.0 LINER/COVER TIE-IN
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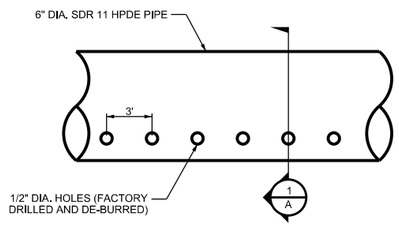

A C-7.1 LEACHATE COLLECTION PIPE
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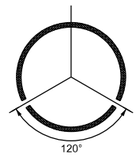

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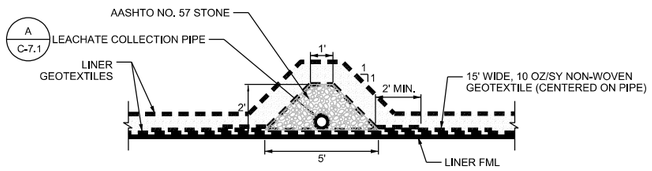

5 C-3.0 LEACHATE COLLECTION PIPE SECTION
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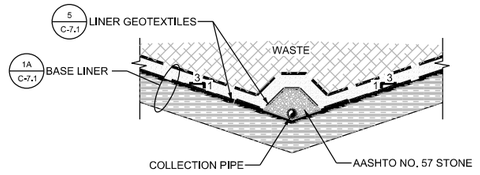

6 C-3.0 COLLECTION PIPE IN TOE TRENCH
NOT TO SCALE

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1	2017-03-23	ISSUED-PERMIT SUBMITTAL

NOTES

PROJECT NUMBER

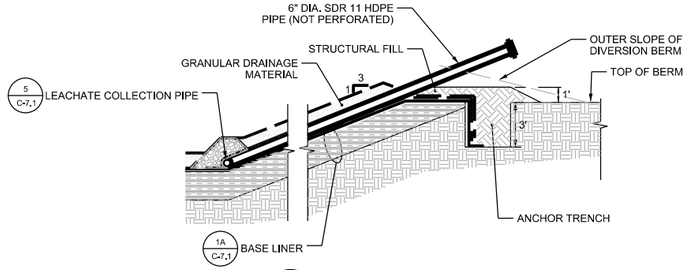
60494667

SHEET TITLE

LINER DETAILS

SHEET NUMBER

C-7.1



7 C-3.0 COLLECTION PIPE CLEANOUT (TYP.)
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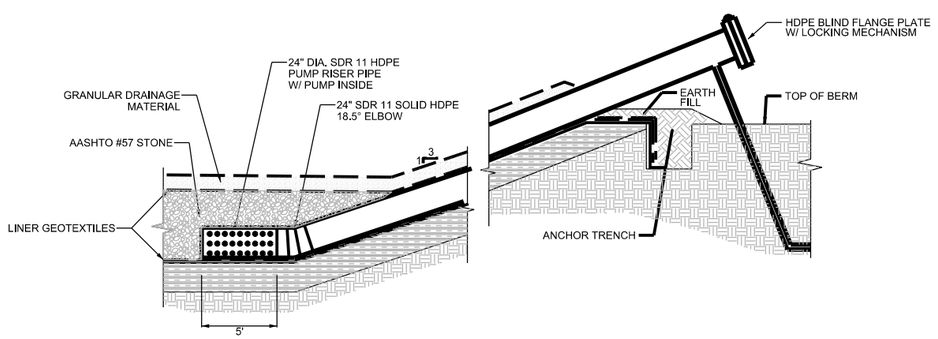

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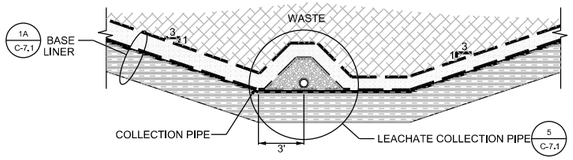

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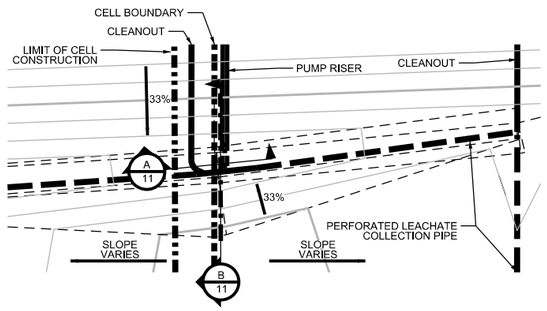

11 C-3.0 TEMPORARY SUMP (PLAN VIEW - TYP.)
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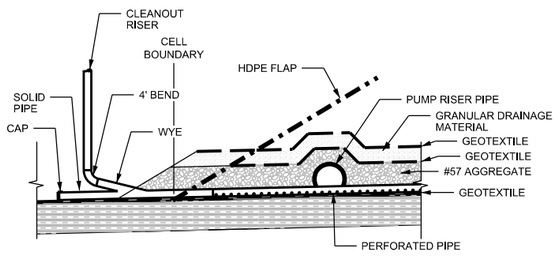
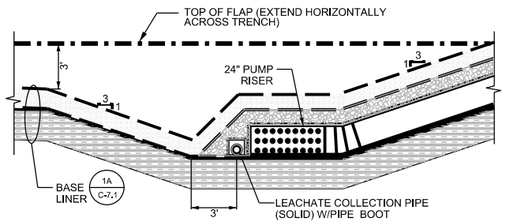
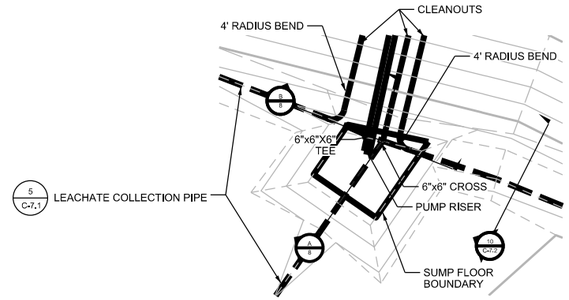


A 11 SECTION A



B 11 SECTION B



8 C-3.0 SUMP PLAN VIEW (TYP.)
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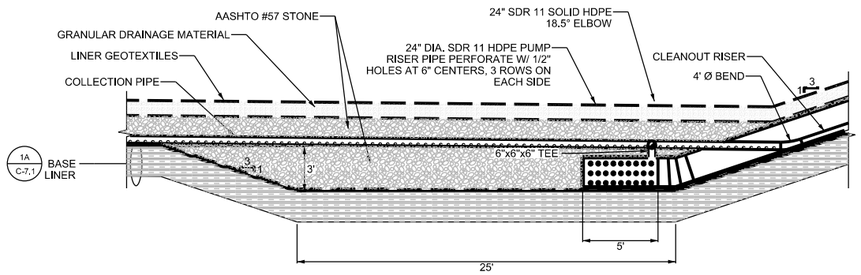

A 8 SUMP SECTION A-A'
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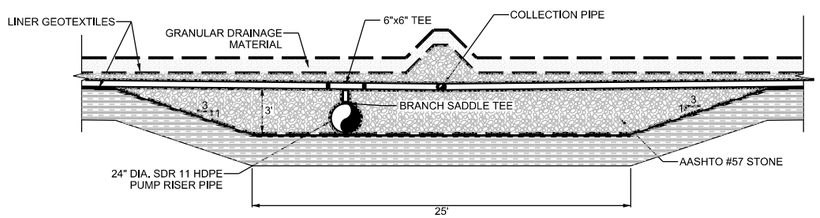

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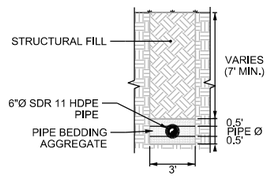

12 C-3.0 FORCE MAIN SECTION
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NOTES

PROJECT NUMBER

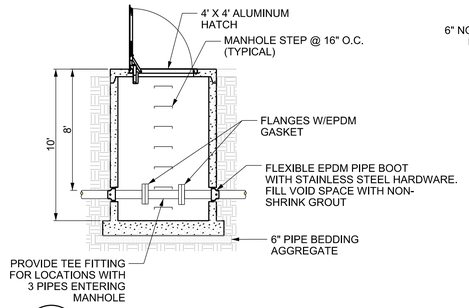
60494667

SHEET TITLE

LEACHATE COLLECTION
SYSTEM DETAILS

SHEET NUMBER

C-7.2



13A C-3.0 LEACHATE MANHOLE (TYP.)
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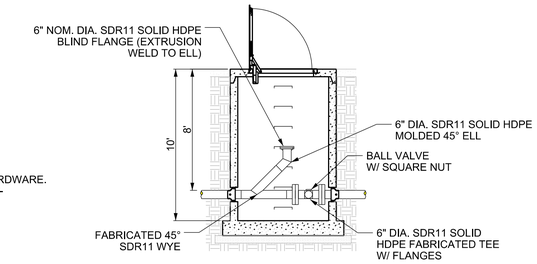

13B C-3.0 CLEAN-OUT MANHOLE (TYP.)
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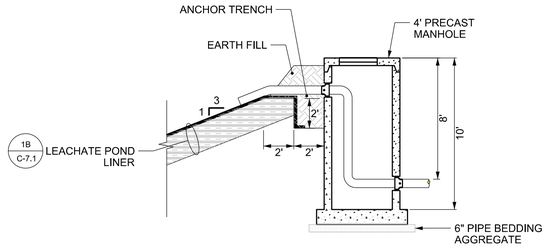

14 C-3.0 LEACHATE DISCHARGE MANHOLE (TYP.)
NOT TO SCALE

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CLIENT

BASIN ELECTRIC
POWER COOPERATIVE
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REGISTRATION

REGISTERED PROFESSIONAL ENGINEER
JOHN CANNON
PE-10000
DATE 3/23/17
NORTH DAKOTA

ISSUE/REVISION

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NOTES

PROJECT NUMBER

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SHEET TITLE

LEACHATE COLLECTION/
FINAL COVER DETAILS

SHEET NUMBER

C-7.3