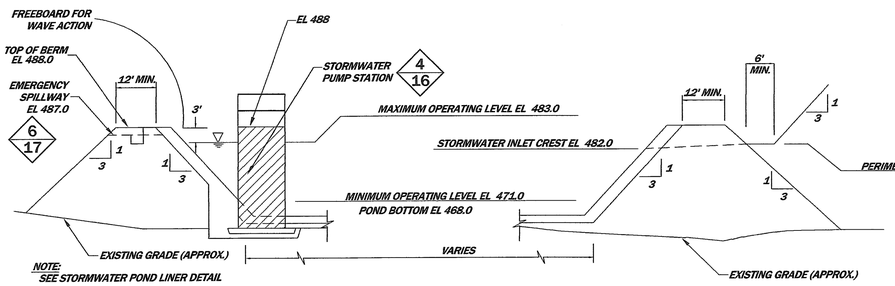
PRINT DIST.

REVISIONS

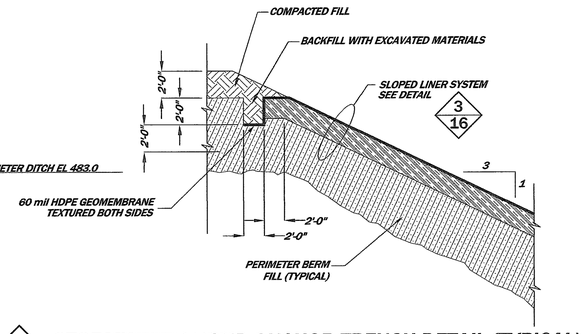
REV.	W.O.	SYM
1		1

08/02/13: REVISED NOTE 1.



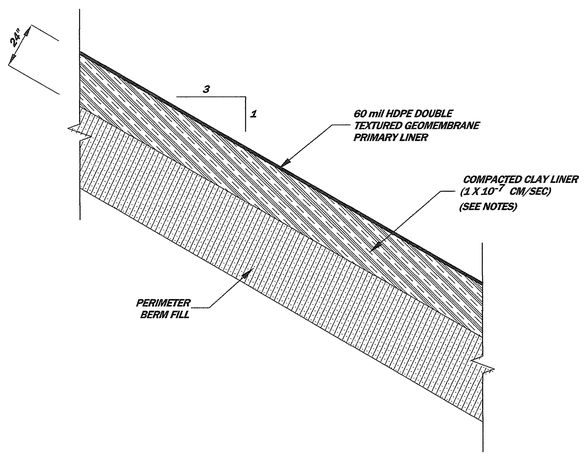
1/16 STORMWATER POND PROFILE (TYPICAL)

N.T.S.



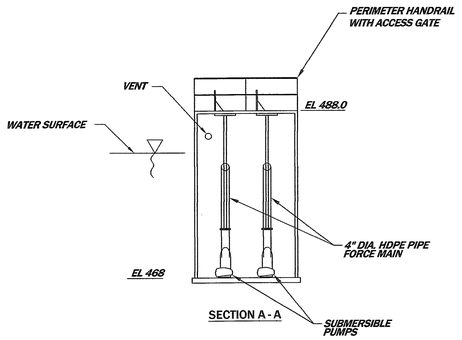
2/16 STORMWATER POND ANCHOR TRENCH DETAIL (TYPICAL)

N.T.S.

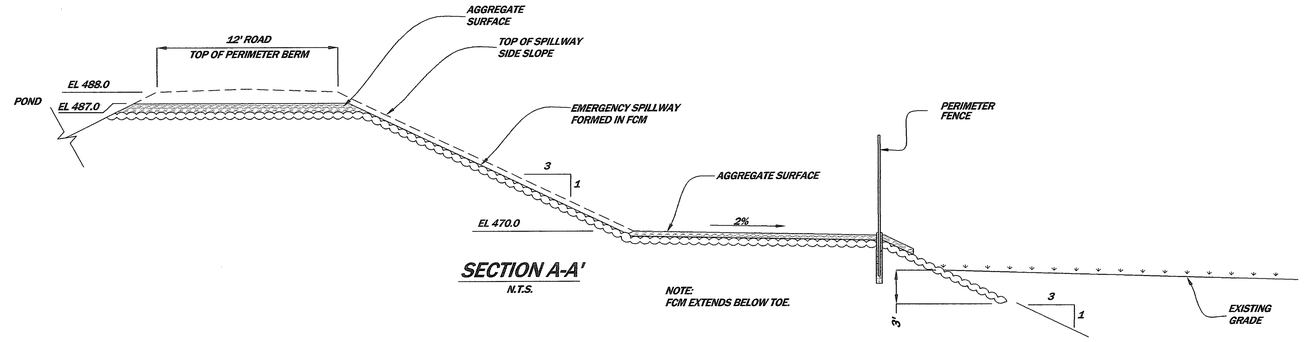


3/16 STORMWATER POND LINER DETAIL (TYPICAL)

N.T.S.



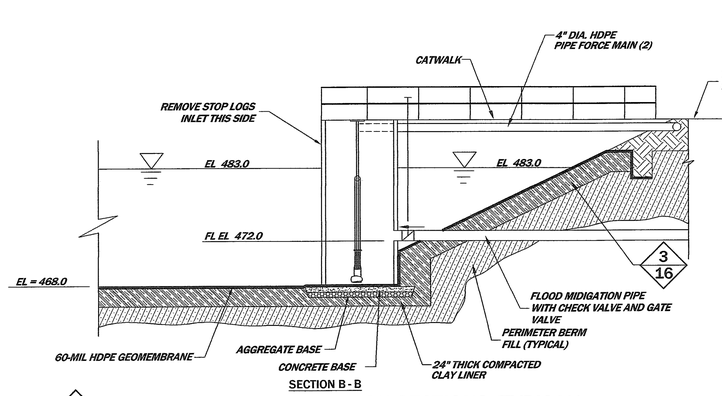
SECTION A - A



SECTION A-A'

N.T.S.

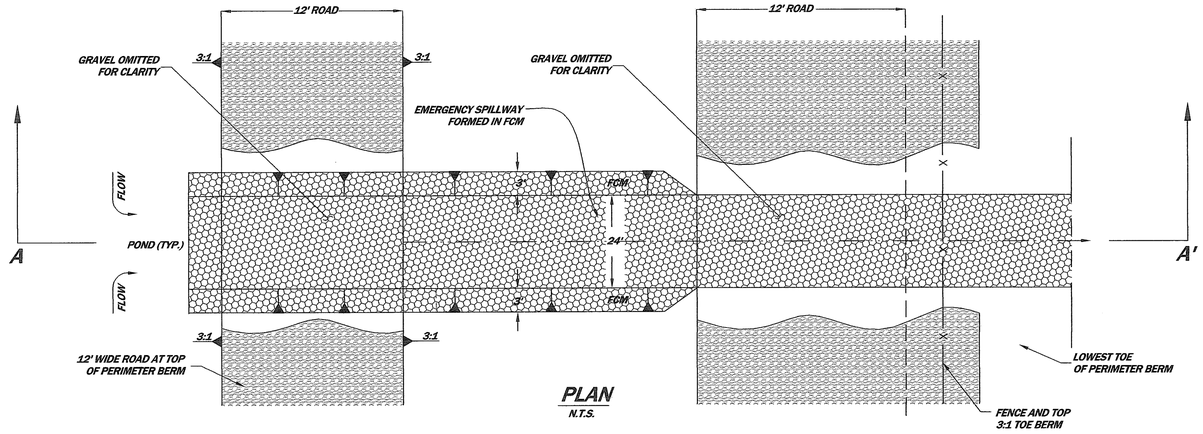
NOTE: FCM EXTENDS BELOW TOE.



SECTION B - B

4/16 STORMWATER PUMP STATION SECTIONS (TYPICAL)

N.T.S.

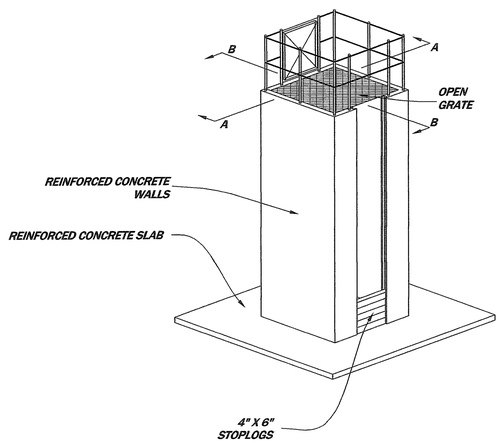


PLAN

N.T.S.

6/16 POND EMERGENCY SPILLWAY DETAILS

N.T.S.



5/16 STORMWATER PUMP STATION WET WELL ISOMETRIC (TYPICAL)

N.T.S.

NOTE:

1. THE DETAILS AND DESIGN OF THE STORMWATER POND ARE SHOWN FOR INFORMATION ONLY. A SEPARATE NPDES CONSTRUCTION PERMIT WILL BE OBTAINED.

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314.993.4132 (voice) 314.993.4177 (fax)

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ENVIRONMENTAL ENGINEERING
LAND AIR WATER
1005 East High Street Jefferson City, Missouri 65101
Telephone: (573) 635-5070 Facsimile: (573) 635-5079

PREPARED FOR Ameren MISSOURI

DRAWN	W.J.A. (G.E.R.)
CHKD.	R.L.R. (G.E.R.)
SUPV.	T.R.G. (G.E.R.)
APPD.	T.R.G. (G.E.R.)

SHEET 16
PROPOSED UTILITY WASTE LANDFILL STORMWATER POND STORAGE AND TRANSFER DETAILS

LOCATION		CLASS
001009	LABADIE ENERGY CENTER	02010

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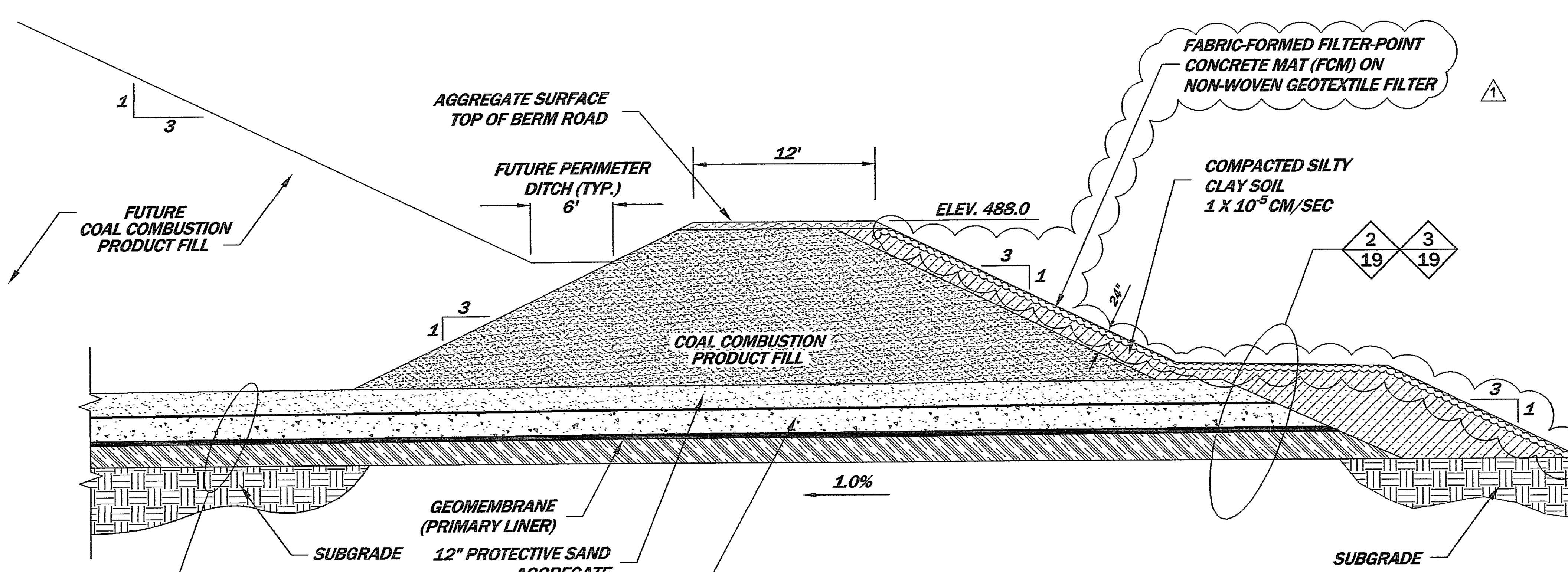
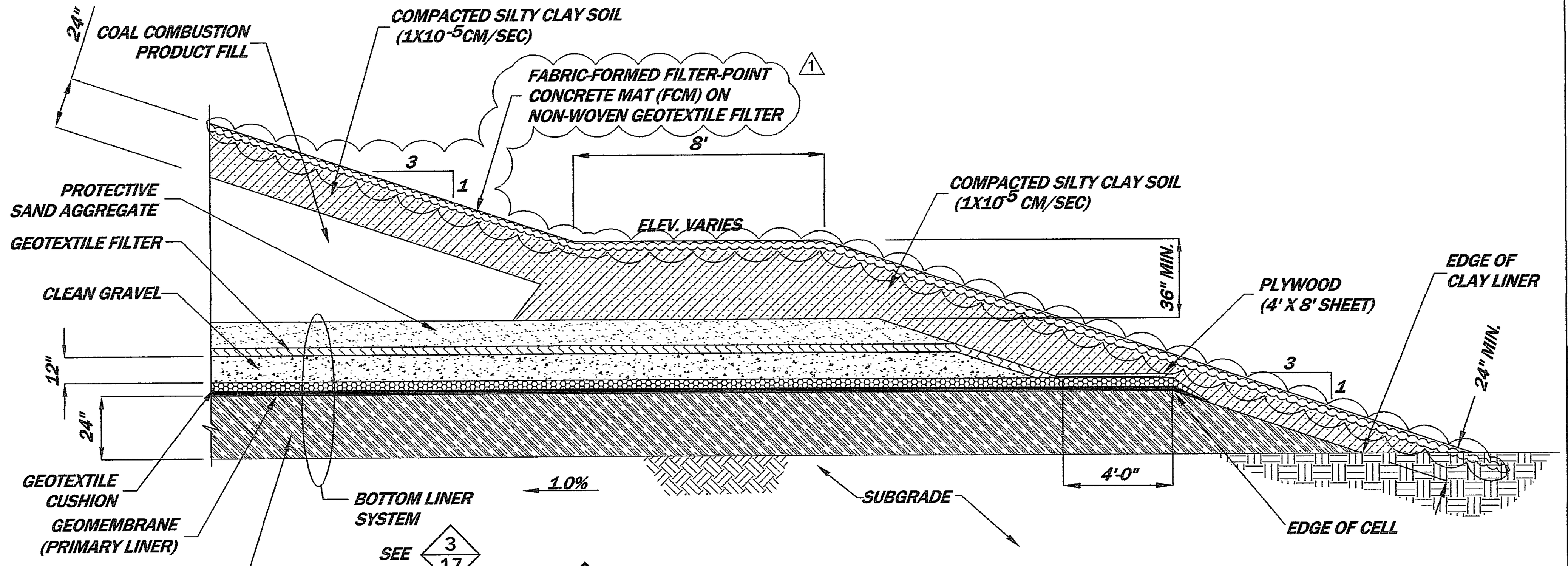
1		1

08/02/13: ADD WETLAND SETBACK AND BMP TO DETAILS 4 & 5; ADD FCM TO DETAILS 1, 2 & 3; ADD NOTE 1.



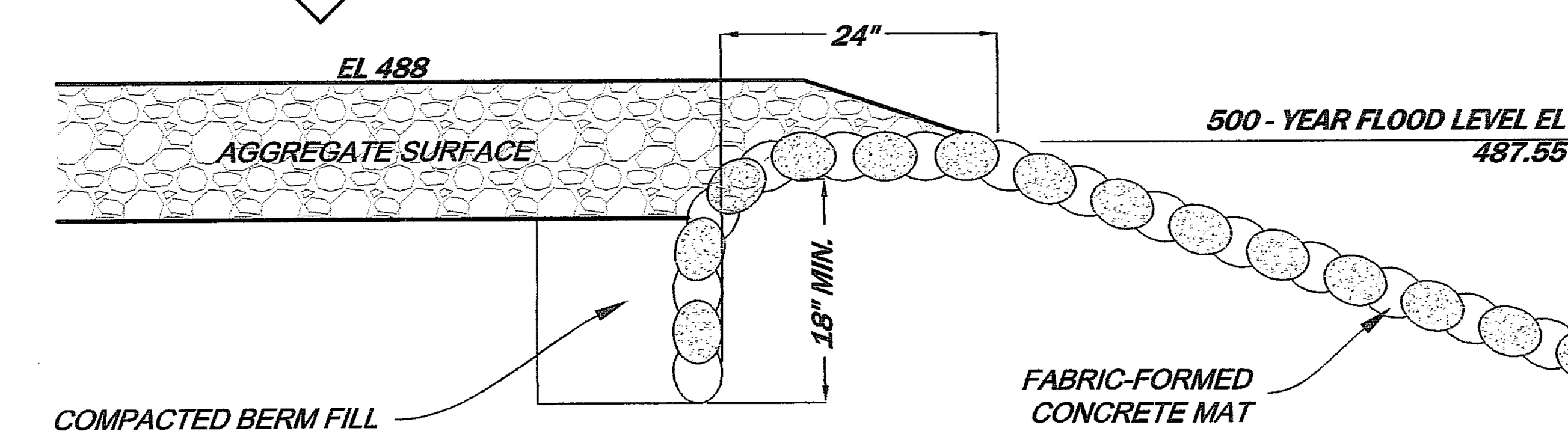
1/19 INTERIOR BERM

N.T.S.

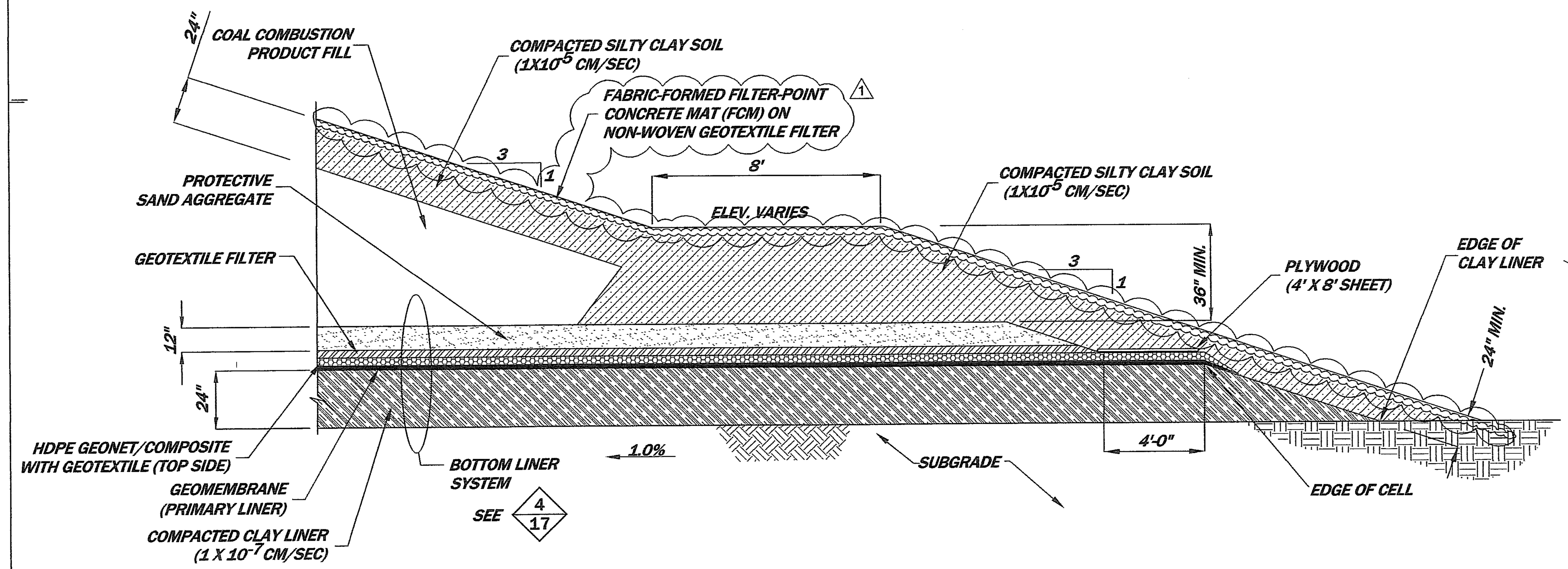


2/19 INTERIOR BERM TOE DETAIL

N.T.S.

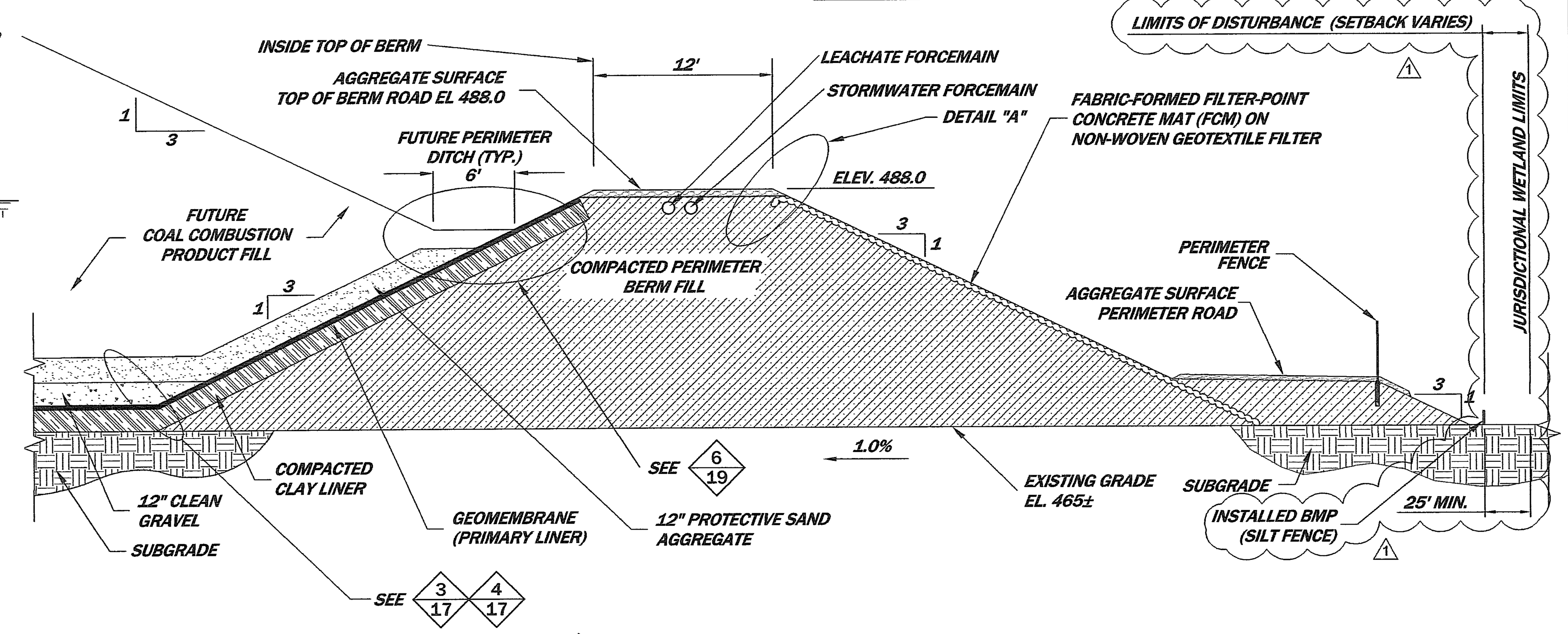


DETAIL "A"

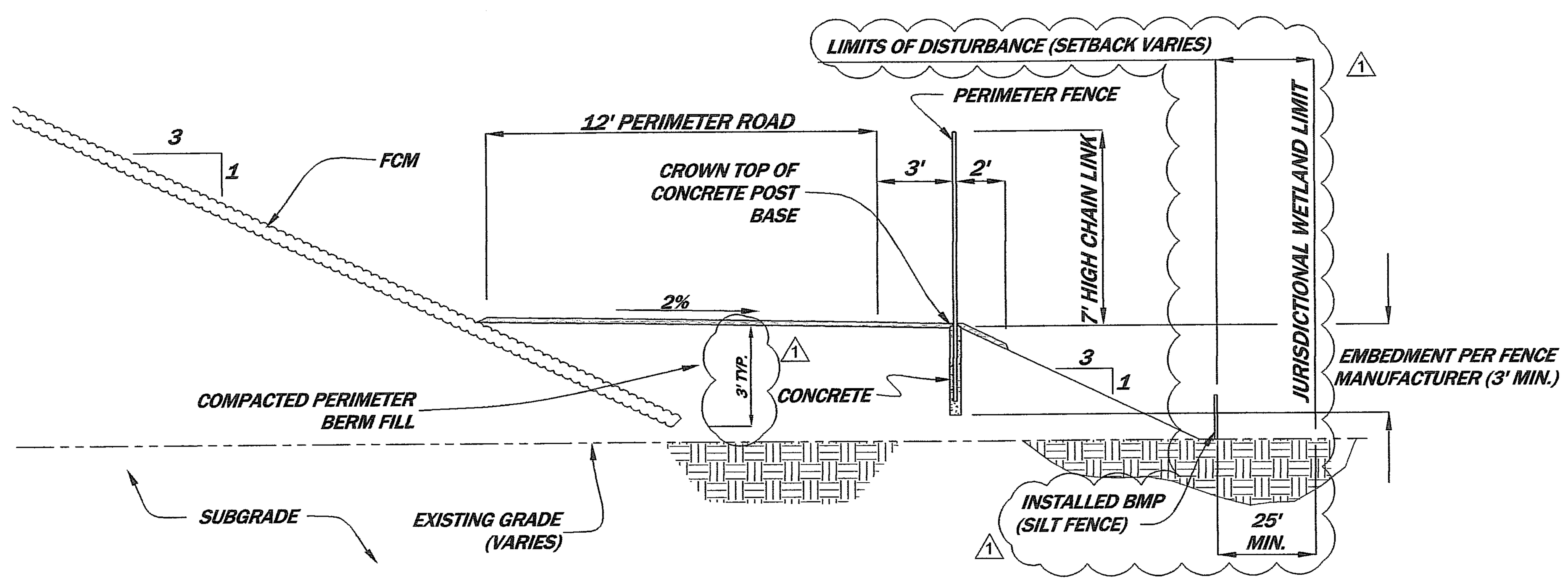


3/19 INTERIOR BERM TOE DETAIL (ALTERNATE)

N.T.S.

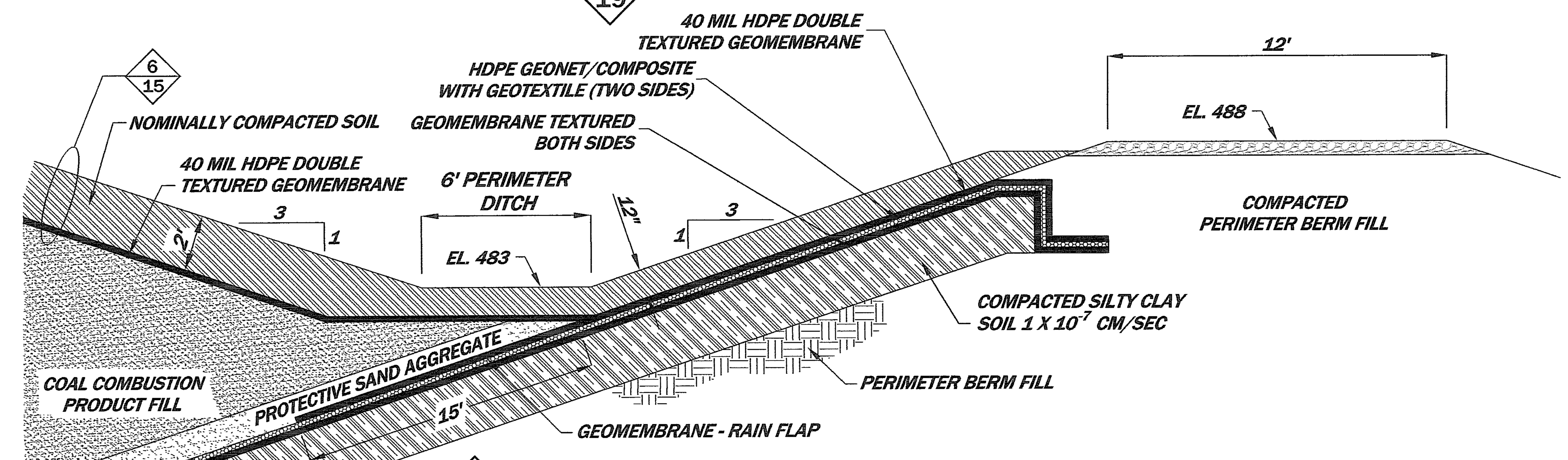


4/19 EXTERIOR BERM (TYPICAL)



5/19 PERIMETER ROAD AND FENCE DETAIL (TYPICAL)

N.T.S.



6/19 PERIMETER DITCH AT CLOSURE

NOTES:

1. FABRIC-FORMED FILTER-POINT CONCRETE MAT (FCM) ON NON-WOVEN GEOTEXTILE FILTER SHALL HAVE A MINIMUM THICKNESS OF 2.2".

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GREDELL Engineering Resources, Inc. ENVIRONMENTAL ENGINEERING LAND AIR WATER

PREPARED FOR Ameren MISSOURI

THOMAS R. GREDELL NUMBER PE-21137 PROFESSIONAL ENGINEER

DRAWN	W.J.A. (G.E.R.)
CHKD.	R.L.R. (G.E.R.)
SUPV.	T.R.G. (G.E.R.)
APPD.	T.R.G. (G.E.R.)

SHEET 19
PROPOSED UTILITY WASTE LANDFILL
MISCELLANEOUS DETAILS 2

LOCATION		CLASS
001009	LABADIE ENERGY CENTER	02010
Ameren MISSOURI ST. LOUIS, MISSOURI	JANUARY 2013	REV. 0

SCHEDULE CJG-S23

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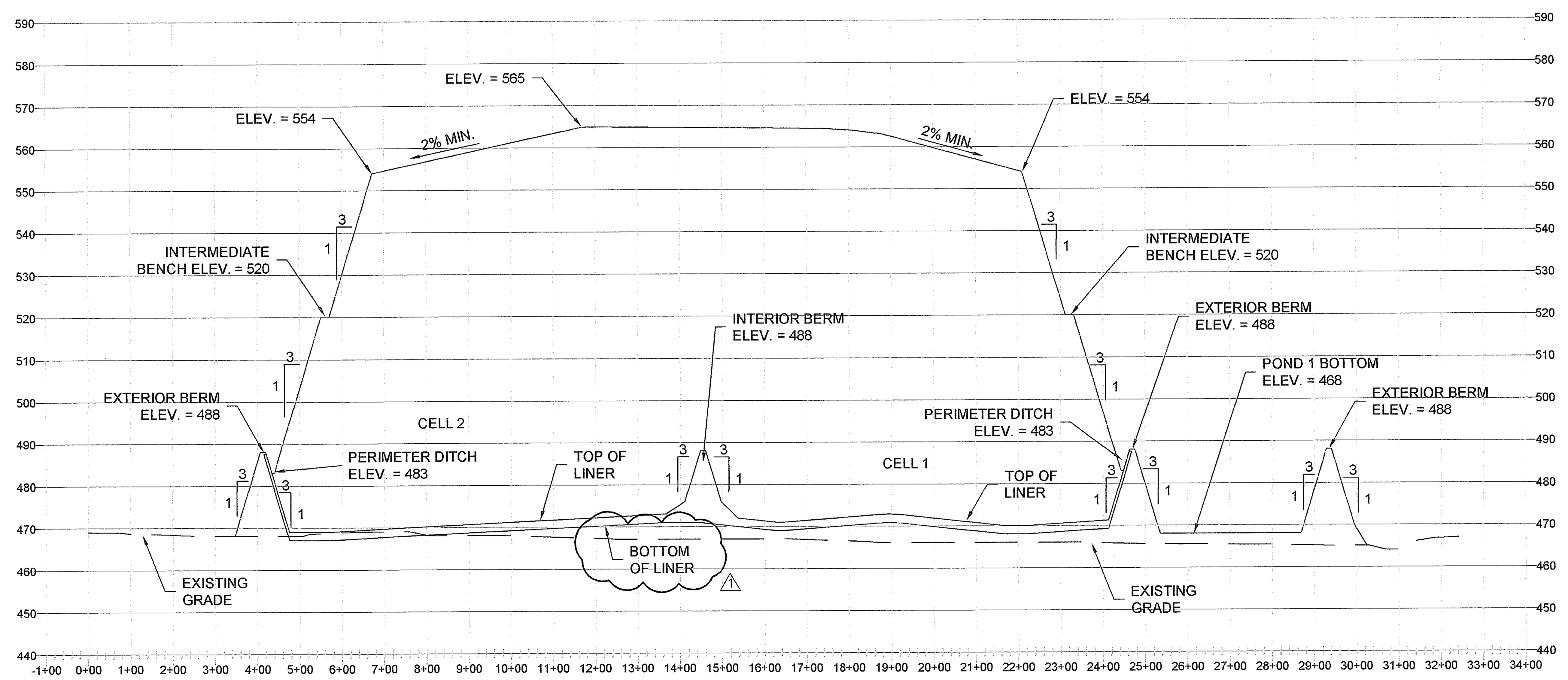
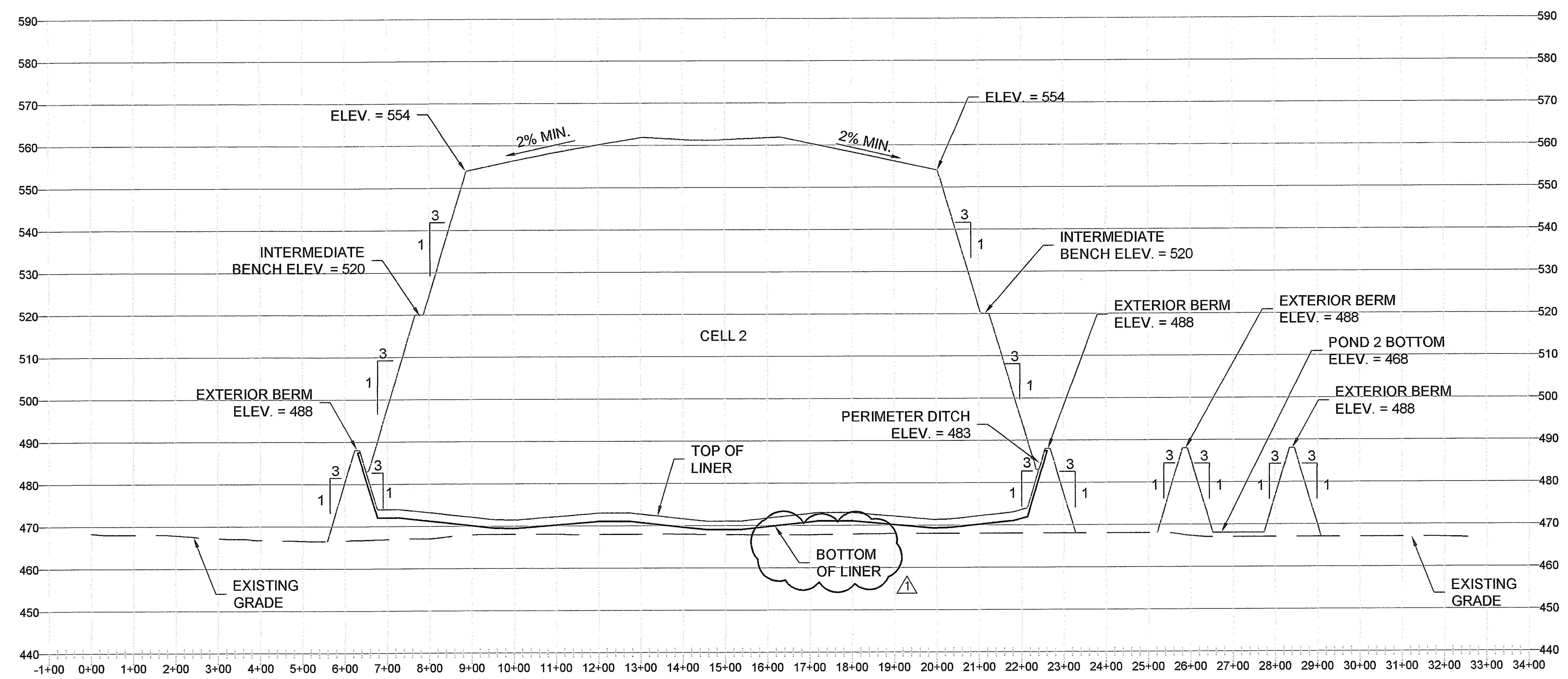
08/02/13: SHOW BOTTOM OF LINER.



CROSS SECTION A-A'

PROFILE SCALES:
1" = 200' HORIZONTAL
1" = 20' VERTICAL



CROSS SECTION B-B'

PROFILE SCALES:
1" = 200' HORIZONTAL
1" = 20' VERTICAL

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Facsimile: (573) 659-9079

PREPARED FOR Ameren MISSOURI

STATE OF MISSOURI
THOMAS R. GREDELL
NUMBER EN-27137
PROFESSIONAL ENGINEER

DRAWN W.J.A. (G.E.R.)	SHEET 22 PROPOSED UTILITY WASTE LANDFILL CROSS SECTIONS A-A' AND B-B'
CHKD. R.L.R. (G.E.R.)	
SUPV. T.R.G. (G.E.R.)	
APPD. T.R.G. (G.E.R.)	LOCATION 001009 · LABADIE ENERGY CENTER · CLASS 02010
Ameren MISSOURI · ST. LOUIS, MISSOURI	JANUARY 2013 · REV. 0

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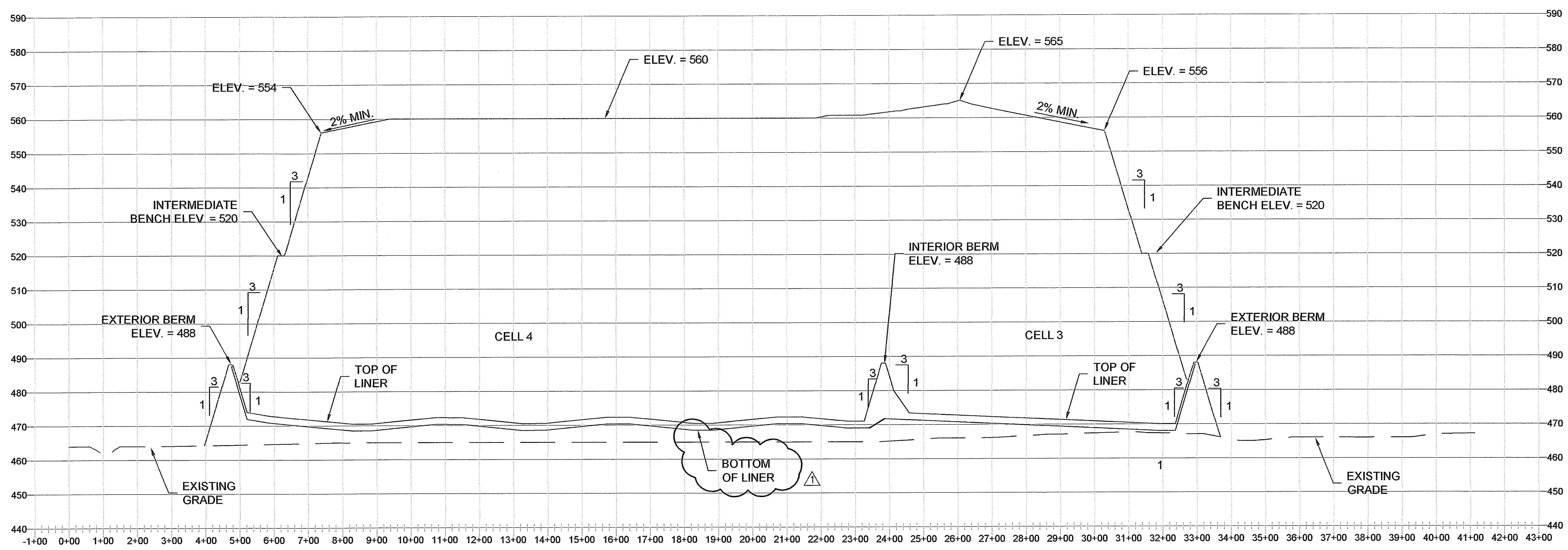
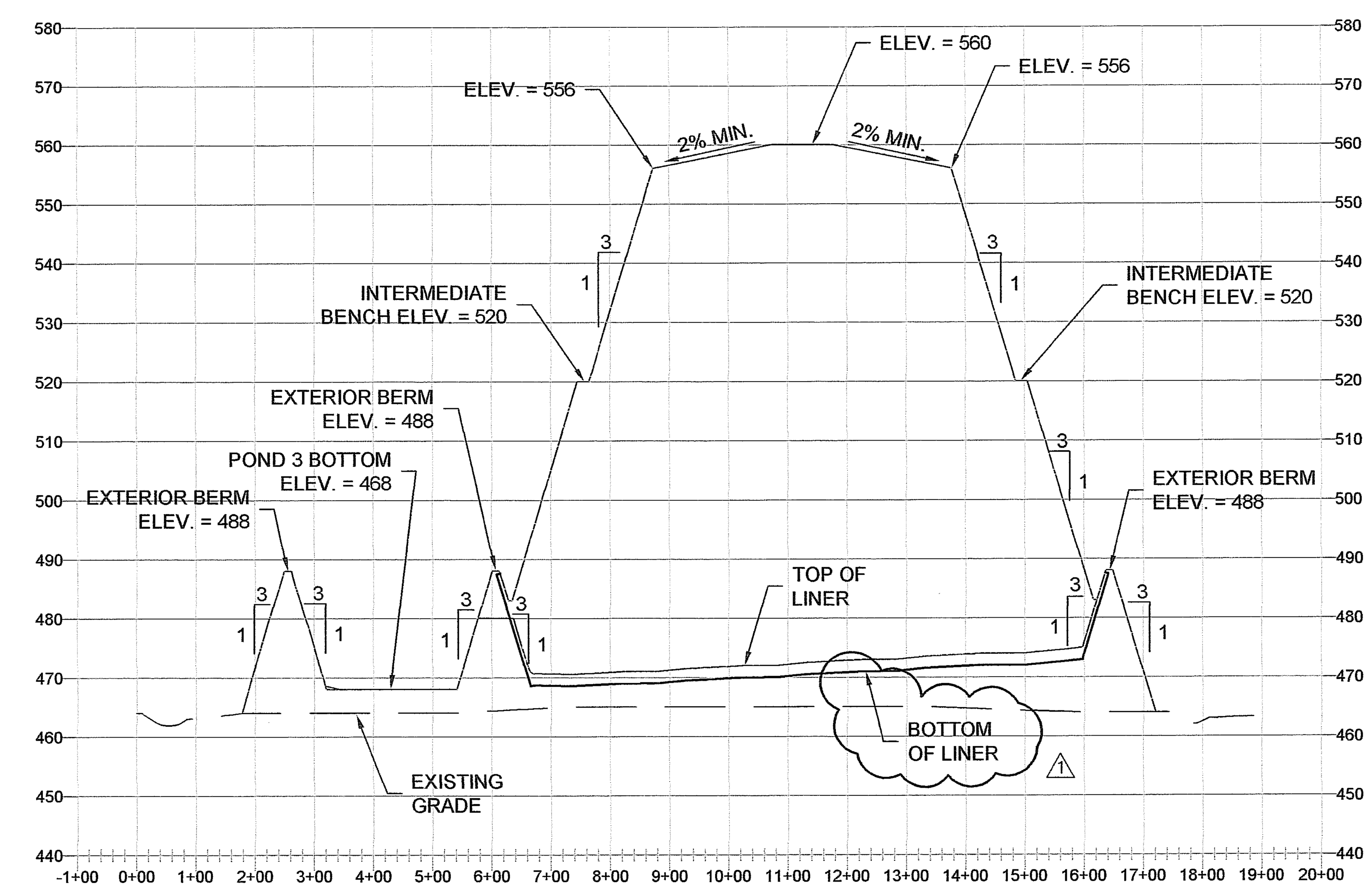
1		1
08/02/13: SHOW BOTTOM OF LINER.		



CROSS SECTION C-C'

PROFILE SCALES:
1" = 200' HORIZONTAL
1" = 20' VERTICAL



CROSS SECTION D-D'

PROFILE SCALES:
1" = 200' HORIZONTAL
1" = 20' VERTICAL

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LAND AIR WATER
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PREPARED FOR Ameren MISSOURI

STATE OF MISSOURI
THOMAS R. GREDELL
NUMBER E-21187
REGISTERED PROFESSIONAL ENGINEER

DRAWN W.J.A. (G.E.R.)	SHEET 23 PROPOSED UTILITY WASTE LANDFILL CROSS SECTIONS C-C' AND D-D'		
CHKD. R.L.R. (G.E.R.)			
SUPV. T.R.G. (G.E.R.)			
APPD. T.R.G. (G.E.R.)	LOCATION 001009	LABADIE ENERGY CENTER	CLASS 02010
Ameren MISSOURI	ST. LOUIS, MISSOURI	JANUARY 2013	REV. 0

SCHEDULE CJG-S23

REITZ & JENS, INC.
CONSULTING ENGINEERS

GREDELL Engineering Resources, Inc.
ENVIRONMENTAL ENGINEERING LAND - AIR – WATER

Project Engineering Team

Ameren Missouri
Labadie Energy Center
Construction Permit Application for a Proposed Utility Waste Landfill Franklin County, Missouri

Prepared for:

Ameren MISSOURI

Power Operation Services
3700 South Lindbergh Blvd.
St. Louis, Missouri 63127

January 2013, REVISED August 2013

SCHEDULE CJG-S23

Ameren Missouri
Labadie Energy Center
Construction Permit Application for a Proposed Utility Waste Landfill
Franklin County, Missouri

Ameren Missouri
Power Operation Services
3700 South Lindbergh Blvd.
St. Louis, Missouri 63127

January 2013, Revised August 2013

Prepared By:

Reitz & Jens, Inc.
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(314) 993-4132

and

GREDELL Engineering Resources, Inc.
1505 East High Street
Jefferson City, Missouri 65101
(573) 659-9078

Donald Gredell
8-5-2013

SCHEDULE CJG-S23

Ameren Missouri Labadie Energy Center
Construction Permit Application (CPA)
for
Proposed Utility Waste Landfill (UWL)
Solid Waste Disposal Area
Franklin County, Missouri

January 2013, Revised August 2013

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Ameren Missouri Labadie Energy Center
Construction Permit Application (CPA)
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January 2013, Revised August 2013

List of Drawings

1.0 INTRODUCTION

Union Electric doing business as (dba) Ameren Missouri (hereafter referred to as Ameren Missouri) is requesting a State of Missouri Solid Waste Disposal Area Construction Permit for a Utility Waste Landfill (UWL) to be located in northeastern Franklin County. The proposed UWL name will be "Ameren Missouri Labadie Utility Waste Landfill".

With this report, Ameren Missouri proposes to construct a UWL for disposal of coal combustion products (CCPs) from the Labadie Energy Center that pass the paint filter test (having no free liquids). This engineering report describes the facility and procedures that Ameren Missouri will use to dispose of all current and future CCPs produced by the Labadie Energy Center. This report describes the design, construction and operating techniques required to dispose of CCPs at the Labadie UWL.

The landfill design and operating procedures have been prepared in accordance with the UWL requirements of the Missouri Solid Waste Management Law and Rules and Franklin County ordinances. In addition, the design and operation of the proposed UWL have been developed in accordance with accepted engineering practice. This construction permit application, engineering design, operating manual and supporting appendices and reports are organized in a format consistent with the Missouri Solid Waste Management Rules 10 CSR 80-2 and 10 CSR 80-11 for UWL permitting, design and operation. As a reference guide, a correlation of the applicable Missouri Solid Waste regulatory references to the table of contents of this report is provided in Table 1A and Table 1B at the end of this report. Table 1A is sorted in the order of this report's table of contents. Table 1B is sorted in order of the Missouri regulatory references.

Reitz & Jens, Inc. (Reitz & Jens) and GREDELL Engineering Resources, Inc. (Gredell Engineering) are the team of design professionals retained by Ameren Missouri to develop the UWL design and Construction Permit Application (CPA). Reitz & Jens' scope of services as lead engineer included overall project management, UWL layout and design, characterizing the geotechnical engineering properties of the site, analyzing the site for global stability, settlement, flood protection, and identifying applicable criteria. Gredell Engineering's scope of services, as a subconsultant to Reitz & Jens, included completing the Detailed Site Investigation, UWL layout and design, as well as preparing the engineering reports and plans necessary to complete the solid waste permitting documents for the Missouri Department of Natural Resources (MDNR).

Ameren Missouri acknowledges that one concept proposed for the UWL construction described in this report utilizes an alternative design concept that does not adhere strictly to MDNR's historic interpretation of 10 CSR 80-11.010 for the design of the UWL. Specifically, the site conditions will result in intermittent contact of a small percentage of the constructed bottom liner (primarily at the sumps) with the alluvial groundwater. As allowed by 10 CSR 80-11.010(1), Sections 3.0 and 4.0 of this report, in conjunction with the details provided in the drawings and the appendices to this report, demonstrate that the design concepts proposed for the UWL

design meet or exceed the minimum requirements of 10 CSR 80-11.010.

The CCP disposal plan for the UWL will be implemented in four (4) phases (reference Sheet 3). The total acreage of the four (4) disposal phases is approximately 166.5 acres. The proposed phases are designed for disposal of all CCPs generated by the Labadie Energy Center. Currently, these CCPs consist primarily of fly ash (70%) and bottom ash (30%), but Flue Gas Desulfurization (FGD) byproducts will be generated when plant FGD scrubbers become operable. As proposed, each phase will consist of one disposal cell.

The UWL design has been developed in accordance with the requirements of 10 CSR 80-11.010. The UWL design will include a composite liner system, which exceeds these requirements. The composite liner system will consist of a 24-inch thick compacted clay component with a permeability not to exceed 1×10^{-7} cm/sec and a 60-mil thick HDPE geomembrane component, plus a leachate collection and drainage system to maintain less than 12 inches of hydraulic head on the liner system at any time during the life of the facility.

The approximate 166.5-acre CCP disposal area is designated for development and closure in phases with appropriate closure cost estimates and financial assurance instruments (FAIs) proposed for each phase. The phased development, operation and closure of the UWL are discussed in more detail in subsequent sections of this report.

1.1 Site Background

Ameren Missouri operates a coal-fired power plant known as the Ameren Missouri Labadie Energy Center. The Labadie Energy Center is located north of Interstate Highway 44 and northeast of the town of Labadie, Missouri on the south side of the Missouri River. The Labadie Energy Center was constructed from 1967 to 1970 and power generation began in 1970. The plant has a total generating capacity of 2,405 megawatts (MW). The current estimated annual production of CCPs (fly ash and bottom ash) is approximately 550,000 dry tons.

The proposed UWL site is immediately east of the power plant's existing CCP ash ponds. Currently, CCPs from the plant are wetted and placed in the ash ponds (NPDES permitted wastewater treatment devices) located on the south side of the power plant. A new flue gas desulfurization (FGD) system is scheduled to be built at the plant in the future. The FGD will generate an estimated maximum of 280,000 additional dry tons of CCPs per year. The UWL design includes the capacity to manage the FGD byproduct, as well as the other CCPs (e.g., fly ash and bottom ash) currently being produced by the plant.

This CPA details the design, construction and operational techniques for the proposed UWL at the Labadie Energy Center. Additional descriptions of the physical characteristics of the utility wastes to be managed at the UWL are described in Section 4.3.

The site lies in part of sections 8 and 17 and part of U.S. Survey 98 in Township 44 North, Range 2 East if the Fifth Principal Meridian in Franklin County, Missouri.

Reference to the Center for Applied Research and Environmental Systems (CARES) or similar mapping programs shows that the approximate midpoint of the proposed UWL is Latitude 38.5621 and Longitude –90.8168. The proposed UWL site is located approximately two and three-quarters (2.75) miles northeast of the town of Labadie, and two and three-quarters (2.75) miles northwest of the town of St. Albans (Figure 1).

The proposed UWL disposal area is located within a tract of land entirely owned by Ameren Missouri totaling over 1,000 acres, of which approximately 166.5 acres is planned for active disposal. The area method of waste disposal is proposed for use throughout the 166.5-acre waste boundary. Three (3) stormwater management ponds (a 5.7-acre pond for Phases 1 and 2, a 4.4-acre pond for Phase 3, and a 3.4-acre pond for Phase 4) are also located within the approximate 813-acre UWL permit boundary. Other areas within the UWL permit boundary will be used for soil stockpiles, access roads, perimeter fencing, flood protection berms, and buffer areas.

This CPA, drawings and associated reports and supporting documentation address the substantive requirements of the State of Missouri construction permit application, as well as applicable Franklin County ordinances, for the construction and operation of a UWL.

1.2 Proposed Facility

The proposed UWL covers a waste boundary area of approximately 166.5 acres of the 813-acre landfill permit boundary within the Ameren Missouri Labadie Energy Center Property. Sheet 2 shows the existing site conditions. An access road from the existing power plant to the UWL will be constructed near the northwest corner of Phase 1 across Labadie Bottom Road. Labadie Bottom Road divides Phases 1 and 2 of the proposed UWL site in the east-west direction and will be relocated as a part of the development of Phase 2. An underground pipeline owned by Explorer Pipeline runs generally north-south through the site in between Phases 1 and 2 (west of the pipeline) and Phases 3 and 4 (east of the pipeline). Two elevated access roads will be constructed across the pipeline as part of the Phase 3 development.

The DSI determined that insufficient clay is available on-site for constructing the clay soil liner component of the composite liner system. Therefore, an off-site borrow source of liner quality clay at Ameren Missouri's Callaway Energy Center in Callaway County, Missouri has been located, explored and identified through geotechnical exploration and testing and is proposed as the liner quality clay source for the Labadie Energy Center UWL. Approximately 1.75 feet of vegetative soil will be stripped from the 225-acre footprint of the proposed UWL for use as the vegetative soil cover on the final cap. For general discussion in this report, the size of the UWL will be referred to as the 813-acre UWL permit boundary and a 166.5-acre waste boundary.

The entire 813-acre UWL permit boundary is zoned by Franklin County as Agricultural Non-Urban (ANU) (refer to Sheet 4). Improvements within the UWL permit boundary include the 166.5-acre waste disposal area, stormwater management ponds, soil stockpile areas, flood

protection berms, perimeter stormwater control structures, site access roads, perimeter security fencing, buffer zones, and groundwater monitoring. These items are discussed in more detail in Section 3.0, Landfill Design. Sheet 3 provides an overview of the proposed UWL project and Sheet 4 shows the waste boundary and the UWL permit boundary.

1.3 Landfill Owner and Operator

Union Electric Company d.b.a. Ameren Missouri is the owner and operator, as defined by 10 CSR 80-2.010(67) and 10 CSR 80-2.010(68), of the land within the UWL permit boundary. A copy of the property deeds for this tract is found in Appendix A.

Union Electric Company is a registered Missouri corporation in good standing with the Secretary of State's office. Appendix B provides a copy of Union Electric Company's Certificate of Amendment to Articles of Organization from the Missouri Secretary of State's Office. A Registration of Fictitious Name for Ameren Missouri is also provided in Appendix B. A copy of a current Certificate of Corporate Good Standing is found in Appendix C.

1.4 Applicant Violation History

Ameren Missouri, a subsidiary of Ameren, is the sole interest in the application for construction permit. Ameren Missouri has maintained and submitted an annual update of the Violation History Disclosure Statement since the issuance of the Missouri Solid Waste Disposal Area Construction Permit No. 0918301 for the Sioux Power Energy Center UWL on March 28, 2008, as required. MDNR has accepted Ameren Missouri's violation history information submitted for the Sioux Power Energy Center UWL. The March 25, 2013 letter transmitting Ameren Missouri's most recent, completed MDNR Violation History Disclosure Statement is found in Appendix D.

1.5 Request for Recommendation from East Central Solid Waste Management District, Region I

As required by 260.205.7 Missouri Revised Statues (RSMo), Ameren Missouri requested a recommendation in support of this application for a UWL from the executive board of East Central Solid Waste Management District, Region I, on June 13, 2012. A copy of this letter is included in Appendix E. Region I does not currently have an approved solid waste management plan. Ameren Missouri will work with Region I to ensure that future revisions to their solid waste management plan include the Ameren Missouri Labadie UWL.

2.0 SITE SELECTION

Based on the findings of the Preliminary Site Investigation (PSI) and Detailed Site Investigation (DSI), the proposed Labadie UWL site is suitable for development of a modern, state-of-the-art and environmentally sound solid waste disposal area. The surrounding drainage patterns, topography and natural geologic and hydrologic conditions allow for the design and operation of a UWL that can provide necessary capacity, while maintaining the aesthetic and environmental quality of the surrounding area. The geologic suitability of the site as a UWL is supported by the Missouri Department of Natural Resources, Division of Geology and Land Survey's (MDNR-DGLS) February 2, 2009 letter approving the PSI for the UWL site, and MDNR-DGLS' April 8, 2011 letter approving the DSI for the Labadie UWL site

Both the State of Missouri Solid Waste Management Law and Rules and applicable Franklin County ordinances will regulate the Labadie UWL as a solid waste disposal area (e.g., landfill). Applicable portions of the Franklin County ordinances are provided in Appendix F. The requirements of the Franklin County ordinances are substantially compatible with the Missouri Solid Waste Management Rules.

2.1 Site Location

The site is located in northeastern Franklin County, in the northwestern part of Township 44 North, Range 2 East, approximately two and three-quarters (2.75) miles northeast of the town of Labadie, and two and three-quarters (2.75) miles southwest of the town of St. Albans (Figure 1). The site is located on the Labadie, MO U.S.G.S quadrangle topographic map. The cover sheet of the plans shows the UWL location in relation to the Ameren Missouri Labadie Energy Center, County Route T, Labadie Bottom Road, and the Missouri River.

2.2 Legal Description of the Property

Kuhlmann Design Group developed legal descriptions of the 813-acre proposed UWL permit boundary and the 166.5-acre waste boundary in 2012. A survey plat and legal descriptions of the proposed UWL permit boundary and waste boundary areas are provided in Appendix V. A copy of the property deeds and the detailed legal descriptions are provided in Appendix A.

2.3 Site Access

The site is located east of the Ameren Missouri Labadie Energy Center and south of the Missouri River. Site access will be from an all-weather access road extended from the existing plant to the perimeter flood protection berm near the northwest corner of Phase 1 as shown on Sheet 5. The access road will be built to a minimum elevation of 486, which is 2 feet above the 100-year flood elevation. The location of the site and public roads within one (1) mile of the site and beyond is shown on Sheet 1.

Franklin County is the sole regulatory agency for the affected roadways. Franklin County has

issued a letter of agreement (copy enclosed in Appendix F) for the conceptual roadway alterations presented. Prior to any roadway construction, detailed plans will be completed and the required Franklin County permits will be obtained.

All CCPs will initially be delivered to the UWL by truck from Ameren Missouri's Labadie Energy Center using the all-weather access roads. Trucks will not travel on public roads when transporting CCPs from the Labadie Energy Center to the UWL. The top of the perimeter flood protection berms are designed to carry truck traffic within the UWL permit boundary. Traffic from the plant to the UWL will typically include trucks hauling utility waste (CCPs), maintenance vehicles or equipment and passenger vehicles for landfill employees. All CCPs trucked to the UWL will be moisture conditioned for dry placement in the UWL.

A seven-foot high security fence will be installed around the entire active UWL perimeter (reference Sheet 19, detail 5/19). Locked gates will be located at all ingress and egress points to the UWL waste boundary to control access to the disposal area. Ameren Missouri Labadie Energy Center security staff is on duty 24-hours per day and will provide additional security to the UWL through routine site monitoring. Only personnel authorized by Ameren Missouri will be allowed within the UWL perimeter security fence.

2.4 Zoning and Land Use

The property is currently zoned Agricultural Non-Urban (ANU). On October 25, 2011, Franklin County, by Commission Order, amended Section 15, Article 2 of their Land Use Regulations to add a definition for Utility Waste Landfill, as well as Section 238 to Article 10 "Supplementary Use Regulations". Section 238 added regulations regarding Utility Waste Landfills including allowing Utility Waste Landfills as a permitted use in the ANU zoning district. A copy of the Commission Order regarding Utility Waste Landfill regulations, the definition of Utility Waste Landfill, and Section 238 are found in Appendix F. In addition, Appendix F contains a copy of a letter from the County dated August 21, 2012, stating that the proposed site is in compliance with all existing Franklin County ordinances, and a letter dated January 7, 2013 from the County Independent Registered Professional Engineer stating that they agree with the conceptual designs presented in pre-submittal meetings.

2.5 Surrounding Land Use

The proposed UWL, as well as all contiguous properties surrounding the 813-acre UWL permit boundary, are located within unincorporated Franklin County.

As required by 10 CSR 11.010(4)(5)B, the location of all known residences, buildings, wells, watercourses, springs, lakes, rock outcroppings, caves, and sinkholes within one-quarter mile of the UWL waste boundary are shown on Sheet 4. The entire site and land adjacent to the site is currently zoned Agricultural Non-Urban (ANU). The nearby property on the bluffs to the south is currently zoned Community Development (CD). Adjacent land uses within these zoning designations include Ameren Missouri's Labadie Energy Center to the west, and residential use

on the bluffs to the south. Current land use within one-quarter mile of the UWL waste boundary and adjacent to the UWL permit boundary is primarily agricultural and the majority of the property is owned by Ameren Missouri. One exception is the extreme southern arc of the line denoting one-quarter mile from the waste boundary that intersects a small portion of four parcels on the edge of the bluffs to the south. A list of names and addresses of all recorded owners of real property either adjoining or within 1,000 feet of the proposed UWL permit boundary is provided in Appendix G.

As required by 10 CSR 80-11.010(5) and Section 238.C.3.h of the Franklin County ordinances, a minimum 100-foot buffer zone has been maintained between the UWL waste boundary and dedicated public road right-of-ways, and a minimum 300 foot setback has been maintained between the UWL waste boundary and all property lines not under common ownership with the UWL site. All existing easements, jurisdictional wetlands and minimum buffers are shown on Sheets 2, 3 and 4. Ameren Missouri will relocate and/or vacate any public road, utility and easement within the UWL waste boundary, as necessary, prior to the construction of Phase 2 of the UWL. The UWL solid waste disposal boundary is significantly more than 300 feet from the property lines north, east, south and west of the site.

The proposed UWL will cover approximately 166.5 acres of the 813-acre site. The maximum height of the proposed UWL is approximately 100 feet above the existing grades as shown on Sheet 10. The proposed maximum elevation of the UWL is 565. The final side slopes of the UWL will be a maximum of 3:1 (H:V). The top of the 3:1 side slopes begins at elevation 554 for Phases 1 and 2, and at elevation 556 for Phases 3 and 4. The 3:1 side slope ends at the perimeter ditch at the toe of the slope at approximate elevation 483. The top of the UWL will have a relatively flat, constant slope of no less than 2% that continues to rise to a peak elevation of 565. The side slopes of the disposal area are not expected to significantly flatten within the life of the facility as a result of internal consolidation of the dry CCP wastes.

2.6 Site Topography

The existing topography within the 813-acre permit boundary is relatively flat. Ground surface elevations range from 460 to 471 feet. The tract is mapped in the 100-year floodplain of the Missouri River and protected from regular flooding by the Labadie Bottom Levee District's agricultural levee located both north and south of Ameren Missouri's property. There is one topographic ridge, approximately five (5) feet high in the north part of site (Phase 2) and several shallow drainage features within the levee protected area south and southwest of the proposed waste boundary that drain to the southern boundary of Ameren Missouri's property. This drainage system is regularly pumped over the levee into Becker Creek where the discharge ultimately flows from west to east back to the Missouri River along the bluffs. The 813-acre site generally drains from northwest to southeast.

The Labadie Energy Center and ash pond embankments to the west, as well as levees on the north and south block river water from flowing onto the UWL site, except in the most severe

floods. The topography surrounding the 813-acre tract is composed of the broad, flat floodplains of the Missouri River that is similar to the flat topography of the site. The Missouri River lies generally to the north of the UWL. The bluffs bordering the Missouri River valley are adjacent the proposed UWL permit boundary to the south, but are separated from the UWL boundary by the southern portion of the Labadie Bottom Levee District levee, an existing railroad embankment, and Becker Creek.

2.7 Utilities

Sheet 2 shows the existing site conditions, including all existing utilities. The existing utilities within the proposed UWL permit boundary include underground pipelines, underground telephone, overhead power (electric), fiber optic cable, and small drainage culverts.

Underground telephone lines are located along the Labadie Bottom Levee District levee to the south and generally parallel to the southern landfill permit boundary. The underground telephone lines are located outside the proposed construction boundaries of the UWL.

Existing overhead power lines are located west and generally parallel to the western waste boundary along Phases 1 and 2. Ameren Missouri owns and maintains these power lines. The power lines do not need to be relocated to accommodate the construction and/or operation of the UWL.

An underground pipeline, owned by Explorer Pipeline, is located southeast and east of the power plant and running north between UWL waste disposal area Phases 1/2 and Phases 3/4. The footprint of Phases 1 through 4 avoids conflicts with this existing pipeline. The development of the UWL next to the pipeline has been discussed with the Explorer Pipeline and was determined to be technically feasible. A copy of Ameren's November 15, 2012 email to Explorer Pipeline and Explorer Pipeline's January 28, 2013 letter concurring with the UWL development is provided in Appendix V.

An existing fiber optic line runs east-west along the Union Pacific Railroad right-of-way south of the UWL southern waste boundary and, therefore, is located outside the proposed construction boundaries of the UWL.

The access road from the plant to the UWL will cross over Labadie Bottom Road during the operation of all landfill Phases. An access road overpass is planned which will allow continuous operation of the UWL and segregate the UWL traffic from public traffic on Labadie Bottom Road. Future access roads will cross over the existing Explorer pipeline to provide access from Phases 1 and 2 to Phases 3 and 4. Requirements for building these access roads have been discussed with Explorer Pipeline and will be incorporated into the future access road design.

2.8 Site Selection Location Restrictions

Missouri's solid waste disposal area rules require applicants to follow a two-step site evaluation

process prior to filing an official construction permit application. Step one is to apply for a Preliminary Site Investigation (PSI) to the Division of Geology & Land Survey (DGLS). Step two follows approval of the site under the PSI process and consists of conducting a Detailed Site Investigation (DSI) of the site geology and hydrology. These steps are discussed in more detail below.

On October 9, 1991, the United States Environmental Protection Agency (EPA) published 40 CFR Part 258, which contained the final rules for the federal Solid Waste Disposal Facility Criteria applicable to municipal solid waste disposal areas. The federal location restrictions do not apply to UWLs; however, the State of Missouri modeled site restrictions for UWLs after the federal requirements for municipal solid waste landfills.

Four (4) specific location restriction criteria must be evaluated when siting a utility waste landfill in Missouri. The site selection requirements and each specific location restriction criteria are discussed below as they relate to the proposed landfill.

2.8.1 Preliminary Site Investigation (PSI)

On December 3, 2008, a PSI request was submitted on behalf of Ameren Missouri in compliance with 260.205.2 and 10 CSR 80-2.015 to request consideration for development of a solid waste disposal area limited to the disposal of utility waste. This type of solid waste disposal area is defined by regulation as a UWL. By regulation, UWLs can only accept waste materials listed in 10 CSR 80-11.010 and specifically identified in this report.

This PSI request was reviewed and evaluated by the MDNR and the Division of Geology and Land Survey (DGLS). DGLS conducted a field inspection of the site and approved the PSI request on February 2, 2009.

2.8.2 Detailed Site Investigation (DSI)

A DSI work plan for the required geologic and hydrologic field site investigation work was submitted on behalf of Ameren Missouri to DGLS on May 18, 2009. DGLS reviewed the Detailed Site Investigation Work Plan and issued a written letter of approval on June 15, 2009. Fieldwork began on September 2009 and with the exception of survey work and monthly piezometric monitoring, was completed in January 2010. Groundwater level measurements, evaluation of field data, and preparation of a detailed geologic and hydrologic report continued through November 2010. A report containing the findings, conclusions and recommendations of the DSI process was submitted February 4, 2011. A revision to the DSI report was submitted to DGLS on March 30, 2011. DGLS issued final approval of the DSI report on April 8, 2011. Per 10 CSR 80-2.015(1)(D), approval indicates "…that the site has been found to have suitable geologic and hydrologic characteristics for development of an environmentally sound solid waste disposal area."

2.8.3 Floodplains

The project site is shown on FEMA's Flood Insurance Rate Maps (FIRM) 29071C0180D, 29071C0185D, 29071C0190D, and 29071C0195D for Franklin County, Missouri, that became effective on October 18, 2011. According to the FIRM, the site is located at approximate Missouri River Mile (RM) 57 with the regulatory 100-Year Flood Elevation (Base Flood Elevation, or BFE) at the UWL site of approximately 484. The current FIRM shows that project improvements will be made within Zone AE (100-year floodplain) within the regulatory floodway. Panel 2904930105B of the superseded Flood Boundary and Floodway Map (FBFM) and Flood Insurance Rate Map (FIRM) for the site had an effective date of October 16, 1984. These FEMA maps showed the BFE at the UWL site to be approximately 480 and that the project improvements would be made in Zone A10, entirely outside the regulatory floodway.

The proposed UWL site and surrounding areas are protected from regular Missouri River flooding by the Labadie Levee District agricultural levee. The flows of the river are blocked from impacting the UWL site by the agricultural levee and the fill for the Labadie Energy Center to the west (upstream) of the UWL. The power plant is built on fill that blocks flows during all floods up to the 500-year event, creating an ineffective or low flow area downstream of the plant. The entire UWL is located within this ineffective flow area. In addition, a perimeter berm will be constructed around the entire active disposal area that will function as a flood protection dike. The top of the perimeter berm will be at elevation 488.0, approximately 4 feet higher than the current 100-year BFE at the UWL site. As part of ongoing UWL operation and maintenance, both during operation and post-closure, the top of berm elevation will be periodically determined by level survey. If the elevation of the exterior berms settles below the 500-year elevation of 487.6, suitable fill will be added to the perimeter roads on the top of the berm to raise the minimum berm elevation to 488.0.

Ameren Missouri retained CDG Engineers to analyze the UWL development's impact on the regulatory Base Flood Elevations (BFE) of the Missouri River. This analysis determined that the project will create "No Rise" in the regulatory BFE of the Missouri River. This analysis was submitted to Franklin County for approval. In a letter dated January 22, 2013, Franklin County's Independent Professional Registered Engineer stated that they concur with the analysis and methodology provided by CDG Engineers, and recommended approval of the "No Rise" certificate. A copy of the referenced letter is included in Appendix H.

2.8.4 Wetlands

As required by 10 CSR 80-11.010(4)(B)2, the proposed UWL site has been evaluated for the presence of wetlands. On September 10, 2012 the United States Department of the Army, Kansas City District Corps of Engineers (USACE) issued a preliminary Jurisdictional Determination (JD) for the site that includes all property within the UWL permit boundary. This JD identified several Waters of the United States (wetlands) that are jurisdictional under Section 404 of the Clean Water Act. The UWL site and appurtenances have been designed to avoid

impacts to all jurisdictional areas and as a result, no Department of the Army (404) permit is required. A copy of the USACE's preliminary Jurisdictional Determination letter is included in Appendix I.

2.8.5 Seismic Impact Zone

Missouri Solid Waste regulations promulgated under 10 CSR 80-11.010(4)(B)3 require an evaluation to determine if a proposed landfill site is located in a seismic impact zone. According to 10 CSR 80-2.010(96), seismic impact zone is defined as, "*an area with a ten percent (10%) or greater probability that the maximum horizontal acceleration in lithified earth material, expressed as a percentage of the earth's gravitational pull (g), will exceed 0.10 g in two hundred fifty (250) years".*

The current reference for the expected probability of acceleration for design stability purposes is the 2008 "Documentation for the 2008 Update of the United States National *Seismic Hazards Maps*" generated by the USGS (Petersen et al.) and available from the USGS as Open-File Report 2008-1128. Reference to the hazard map most closely aligned with 10 CSR 80-2.010(57) is a large-scale map entitled, "*Peak Acceleration (PGA) with 2 Percent Probability of Exceedance in 50 Years*". Review of this map suggests that the proposed landfill site is located in an area where the peak acceleration exceeds 10 percent. Therefore, the site has been determined to be located within a seismic impact zone as defined under 10 CSR 80-2.010(96). A copy of the referenced hazard map can be found as Figure 7 of the DSI report and Figure C-1 in Appendix J.

Available information was reviewed during the DSI process to verify and document that the proposed UWL waste boundary is not located within 200 feet of a fault that has had displacement in Holocene time, in accordance with 10 CSR 80-11.010(4)(B). Review of site-specific geological information, including maps, cross sections, and boring logs, has provided no evidence of Holocene age fault displacement within any of the field exploration locations. In addition, review of available literature describing the regional geology of the site has not identified the presence of faults subject to Holocene age displacement near the Labadie Energy Center property.

2.8.6 Unstable Areas

The proposed UWL property has been evaluated for unstable conditions in previous and recent geotechnical field investigations (Appendix J). The data generated by those investigations was supplemented with other relevant information to determine compliance with the unstable area siting criteria as defined in 10 CSR 80-11.010(4)(B)4. This rule states:

> *Owners/operators of proposed utility waste landfills located in an unstable area shall demonstrate to the department that the utility waste landfill's design ensures that the integrity of the structural components of the utility waste landfill will not be disrupted. The owner/operator shall consider the following factors, at a minimum, when determining*

whether an area is unstable:

- *On-site or local rock or soil conditions that may result in failure or significant differential settling*
- *On-site or local geologic or geomorphologic features*
- *On-site or local human-made features or events (both surface and subsurface)*

Unstable areas are further defined in 10 CSR 80-2.010(114) as:

> *A location that is susceptible to natural or human-induced events or forces capable of impairing the integrity of some or all of the landfill structural components responsible for preventing releases from a landfill. Unstable areas can include poor foundation conditions, areas susceptible to mass movements and karst terrains.*

Poor foundation conditions are defined in 10 CSR 80-2.010(77) as:

> *Those areas where features exist which indicate that a natural or man-induced event may result in inadequate foundation support for the structural components of a landfill.*

Areas susceptible to mass movement are defined in 10 CSR 80-2.010(6) as:

> *Those areas of influence (for example, areas characterized as having an active or substantial possibility of mass movement) where the movement of the earth material at, beneath or adjacent to the sanitary landfill, because of natural or man-induced events, results in the downslope transport of soil and rock material by means of gravitational influence. Areas of mass movement include, but are not limited to, landslides, avalanches, debris slides and flows, solifluction, block sliding and rock fall.*

Karst terrains are defined in 10 CSR 80-2.010(49) as:

> *Areas where karst, with its characteristic surface and subsurface features, is developed as the result of dissolution of limestone, dolomite or other soluble rock. Characteristic physiographic features present in karst terrains include, but are not limited to, sinkholes, losing streams, caves, solution channels or conduits, springs and solution valleys.*

On-site or local soil conditions that may result in significant differential settling, including poor foundation conditions and areas susceptible to mass movement, have been addressed by the proposed UWL design. Detailed analysis of the UWL stability is presented in the Geotechnical Engineering Report included in Appendix J. The stability of the UWL slopes was analyzed using both short-term (undrained) and long-term (drained) shear strength properties, and the potential impact of liquefaction of foundation soils.

The minimum static factor of safety (FS) of the completed landfill using long-term strength properties ranged from 1.46 to 2.27, which satisfies the minimum required FS of 1.5 considering

the conservative assumptions used in these analyses. The "initial" configuration (with 18 feet of CCP in place) was also analyzed using long-term shear strength properties. The minimum FS ranged from 1.47 to 2.70. The minimum FS for failure surfaces along the interfaces of the composite liner was 1.99.

At the locations where the liquefaction analyses indicated a high potential for liquefaction in strata, a residual cohesive shear strength value was input for the liquefied soil stratum. The minimum FS for failure surfaces that intercept the liquefied soil stratum ranged from 1.76 to 2.09 for the initial configuration of the UWL, and from 1.46 to 1.78 for the completed UWL. All are greater than the minimum recommended FS of 1.2 to 1.3. Therefore, the stability of the UWL is adequate for both intermediate and final configuration, and for both static conditions and when anticipated liquefaction is present.

Seismic analyses were performed in accordance with the 1998 Draft *Technical Guidance Document on Static and Seismic Slope Stability for Solid Waste Containment Facilities* produced by the MDNR Solid Waste Management Program and Timothy Stark, Ph.D., P.E. of the University of Illinois at Urbana-Champaign. The criterion for the seismic stability analyses of a landfill is based upon the estimated lateral deformation or spreading that may occur, rather than a factor of safety against failure with a pseudo-static seismic load (MDNR-SWMP and Stark, 1998). Numerous stability analyses were completed to determine the yield acceleration (K_y) for both the initial configuration and the final or full configuration of the landfill, as well as failure along the interface of the composite liner. The calculated K_y ranged from 0.13g to 0.28g. The proposed geometry of the berm and CCP fill was analyzed in SHAKE2000 for both a short-duration time-history and a long-duration time-history, to determine the estimated cumulative lateral deformation where the K_y of a section is exceeded by the estimated peak ground accelerations in the pseudo time-histories. The maximum estimated cumulative deformation is less than 0.05 inch.

Interior berms are proposed to be constructed using compacted CCP from the existing ash pond. The composite clay liner and drainage layer would extend under the interior berm, to permit extension of the liner and drainage layer for the next cell. The FS for the slope stability of the interior berm was analyzed using the drained shear strength properties of compacted fly ash. The minimum FS for a global circular slope failure and the full height of CCP is 1.91. The minimum FS for a sliding block failure along the extension of the composite clay liner and drainage layer beneath the interior berm is 1.59. The K_y is 0.06g for a sliding block failure along the bottom liner. The calculated cumulative lateral deformation is about 1 inch.

The Missouri regulations for a utility waste landfill (10 CSR 80-11.010) do not specify the maximum allowed deformation. The regulations for a sanitary landfill (10 CSR 80-3.010) stipulate that the cumulative lateral deformation must be less than 6 inches. Therefore, the design of the proposed landfill, both the permanent perimeter slopes and berms and the temporary interior slope and berm, satisfy this requirement.

There are no known springs, caves or sinkholes within one-quarter mile of the landfill site. Rock outcrops are present in the Missouri River bluffs more than one-quarter mile to the south of the UWL. No other potentially significant geologic or geomorphologic features have been identified at this UWL site. No significant on-site or local human-made features or events, either surface or subsurface, are in evidence at the site within the proposed footprint of the UWL.

2.9 Geotechnical Investigations

Reitz & Jens has performed two separate geotechnical investigations at the site. The first investigation was in 2007 prior to the PSI (Appendix 4 of the DSI Work Plan). Eight (8) geotechnical borings were drilled around the anticipated perimeter of the proposed disposal area during this investigation. These exploratory borings ranged in depth from 20 to 104.5 feet. Three (3) piezometers, P-1, P-2, and P-3 were installed and remained in place, and were utilized in, the DSI process.

The second geotechnical investigation was completed as a part of the DSI field investigation between September 2009 and January 2010. This investigation obtained shallow soil samples and groundwater level information from 97 additional borings that were converted to piezometers, 22 “temporary” geotechnical borings, and 93 Cone Penetrometer Tests within the UWL footprint. A copy of the Geotechnical Engineering Report for the UWL characterizing the on-site soils and surficial materials above bedrock, and evaluating their impact on the UWL design is provided in Appendix J.

Following the DSI field investigation at the UWL site, Reitz & Jens conducted a geotechnical investigation at off-site Ameren Missouri property near the Callaway Energy Center in Callaway County, Missouri. This investigation located and evaluated an off-site source of clay soils in sufficient quantity and quality to construct the soil liner component of the UWL composite bottom liner. Twelve (12) soil borings were completed in the off-site borrow area in Callaway County. A report documenting the findings of sufficient quantities and quality of clay soil materials is included in the geotechnical report provided in Appendix J.

A summary description of the bedrock, soils and groundwater conditions that were identified during the geotechnical investigations are provided below.

2.9.1 Soils

The UWL site is located in the floodplain of the Missouri River. Deposition of soils in a floodplain is dependent on the velocity of the water. As the flood waters slow the larger size particles are deposited first, and then the finer particles. The velocities of the water vary over the floodplain and with each flood as the topography changes. Therefore, soil deposits in a floodplain ("alluvial" deposits) vary both with depth and in horizontal extent. The borings and CPT soundings at the site revealed a typical alluvial stratigraphy.

The surface soils are generally clays and silty clays with scattered seams and layers of low

plastic silt, underlain by silts. The thicknesses of these fine-grain deposits ranged from 2 to 13 feet. There is not an overall pattern to the stratification of the upper fine-grain soils, except for the presence of clayey sandy silt at the surface near the southern end. Sandy silts, silty fine sands, and fine sands, generally to depths of 22 to 36 feet, underlie the upper fine-grain soils. These upper sandy soils are generally loose to medium-dense. The upper sandy soils are underlain by fine to coarse, poorly-graded sands (SP), with some silty sands (SM) and gravelly sands at greater depths. These lower sands generally ranged from medium dense to very dense, increasing in density with increasing depth.

The results of the geotechnical investigations and laboratory testing revealed an inconsistent deposition of clay soils and a limited quantity of on-site soils that meet the requirements for clay liner (permeability of $1x10^{-7}$ cm/sec or less). The relatively high groundwater levels and the poor quality of on-site soil materials relative to clay content will require off-site clay borrow sources to construct the UWL composite liner system. Approximately 1.75 feet of vegetative cover soils will be stripped from the UWL waste boundary footprint and stockpiled for use in the final cap cover. All other soil materials for construction of the UWL, including the perimeter flood protection berms, will come from off-site borrow sources. Off-site borrow sources will be identified and qualified prior to construction of each UWL phase.

The investigation of the 182-acre off-site clay soil borrow site at the Ameren Missouri's Callaway Energy Center included twelve (12) borings ranging in depth from 14 to 31 feet, with some borings terminating at bedrock refusal. Samples of subsurface soils were obtained at about 2.5-foot intervals in the top 10 feet, and at 5-foot intervals below 10 feet. Generally, the recovered soil samples were classified as CH and CL clay materials with some traces of sand, silt and gravel. The range of liquid limits in the recovered soil samples was 28% to101%, with an average of 60%. Plastic Indices ranged from 16 to 33. All of the samples had 40% or more passing the #200 sieve. The quantity of available clay soil borrow was estimated for clay soils with a liquid limit greater than 40 that did not have a significant amount of sand and gravel. For purposes of estimating clay soil quantities, the 182-acre off-site borrow site was broken down into five (5) individual borrow areas with a total estimated quantity of suitable liner quality clay soils in all five borrow areas of roughly 4.4 million CY. A 149-acre portion of this off-site borrow site, which can produce an estimated 2.6 million CY of liner quality clay, has been permanently deed restricted to provide the liner quality clay soils for the Labadie UWL.

2.9.2 Bedrock

Because of the thickness of alluvial deposits and depth to solid bedrock, consolidated sediments or bedrock materials beneath the site were not sampled. Three (3) deep borings drilled during the geotechnical investigations indicate that there are strata of sands containing chert, limestone fragments and gravel, with the amount of the gravel-size fragments increasing with depth. The three (3) deep borings hit refusal on limestone boulders or bedrock at depths of 91.5 feet to 107.6 feet. Recent geologic mapping of the Labadie area by DGLS (Starbuck, 2010) indicate that this bedrock unit is most likely the Jefferson City-Cotter limestone formation

(reference Figure 3 of the DSI Report).

2.9.3 Groundwater Occurrence

Hydrogeologic investigation of the proposed landfill site has shown that groundwater is present in the sandy soils underlying the site. The sandy soils of the Missouri River floodplains are capable of yielding sufficient quantities of groundwater for the purposes of monitoring and sampling, consistent with the current definition of an aquifer as promulgated under 10 CSR 80-2.010(5).

Piezometric monitoring at the proposed landfill site indicates that the static water level is influenced by stages of the Missouri River. As documented in the DSI, monthly measurements made over the 12-consecutive month time period reveal that the water table elevations ranged from a maximum of 464.66 feet in P-20 (June 2010) to a minimum of 456.43 feet in P-9 (December 2009) during routine monthly measurements, but supplemental measurements made in select piezometers during the months of April, May, and June 2010 showed a maximum recorded elevation of 468.87 feet in P-9 on May 18, 2010. When topographic differences across the site are considered, actual water depth below ground surface (bgs) typically ranged from two to 13 feet during a given month, but in some instances groundwater rose up to, and in some cases, slightly exceeded ground surface elevation (June 8, 2010 data for P-102, P-155, P-165, P-167, and P-177).

Groundwater levels were relatively uniform across the site during a given monitoring event. The maximum variability recorded was during the month of December 2009 (3.94 feet) and the minimum variability recorded was during the month of May 2010 (0.95 feet). From month-to-month, variability within a given piezometer was greatest in those located in the northwestern part of the site, closest to the Missouri River. It was least variable in those piezometers clustered in the southeastern part of the site, farthest from the Missouri River. Fluctuations in the elevation of the water table are controlled by localized or seasonal variations in the Missouri River stage. Franklin County Land Use ordinances include a definition of the “Natural Water Table” as “The level at which water stands in a fully saturated unconfined aquifer as measured by shallow piezometers or wells. The natural water table is under static hydrologic conditions and uninfluenced by groundwater pumping or other engineered activities”. Because the Missouri River is an “open river,” the level of the Missouri River and the natural water table at the site is never under truly “static hydrologic conditions.” Based on the groundwater elevation monitoring at the site and almost 11 years of daily Missouri River level readings at the Labadie Energy Center, a periodic high “Natural Water Table” at the site was determined to be el. 464 NAVD88 (reference Appendix Z). Overall, when river elevations are relatively high, groundwater movement is generally toward the east and southeast. Conversely, when river elevations are relatively low, groundwater movement is generally to the north and northwest. (refer to the Figures 18 through 29 in the DSI Report for the range of observed groundwater flow gradients). On-site infiltration of precipitation does not appear to have a significant effect on the water table elevation.