HALEY & ALDRICH, INC.
6500 Rockside Road
Suite 200
Cleveland, OH 44131
216.739.0555

MEMORANDUM

17 April 2018
File No. 128064-006

SUBJECT: History of Construction – Cell 002 West
Associated Electric Cooperative, Inc.
Thomas Hill Energy Center
Clifton Hill, MO

Haley & Aldrich, Inc. (Haley & Aldrich) has assisted Associated Electric Cooperative, Inc. (AECI) with compiling the history of construction in accordance with §257.73(c)(1) for the existing coal combustion residuals (CCR) surface impoundment known as inactive Cell 002 West at the Thomas Hill Energy Center (THEC). This document addresses the requirements of the US Environmental Protection Agency's (EPA's) Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities, 40 CFR Part 257 (CCR Rule), specifically §257.73(c)(1). Based on the USEPA's issued CCR Rule Partial Vacatur in 2016, the inactive Cell 002 West impoundment at the THEC is subject to applicable requirements of the CCR Rule. To the extent feasible, AECI has provided documentation supporting the history of construction. Information on the history of construction of inactive Cell 002 West is presented in the following sections.

§257.73(c)(1)(i): The name and address of the person(s) owning or operating the CCR unit; the name associated with the CCR unit; and the identification number of the CCR unit if one has been assigned by the state.

Owner:	Associated Electric Cooperative, Inc. 2814 South Golden Avenue P.O. Box 754 Springfield, Missouri 65807
Name of CCR Unit:	Cell 002 West (current naming convention, historically referred to Ash Pond - Cell 1, Pond 001 Cell 2 and Pond No. 1 in past reports)

§257.73(c)(1)(ii): The location of the CCR unit identified on the most recent U.S. Geological Survey (USGS) 7 ½ minute or 15 minute topographic quadrangle map, or a topographic map of equivalent scale if a USGS map is not available.

Latitude: 39°32'38"
Longitude: 92°38'16"
The general location of the facility is provided in Appendix A.

<u>§257.73(c)(1)(iii):</u> A statement of the purpose for which the CCR unit is being used.

The inactive Cell 002 West was previously used for settling and wet storage of fly ash and boiler slag from the THEC.

<u>§257.73(c)(1)(iv):</u> The name and size in acres of the watershed within which the CCR unit is located.

USGS Watershed Name: Little Chariton Watershed 10280203
Watershed Acreage: 679 square miles
Unit-specific Watershed Area: 17 acres

The watershed area, which includes only the impoundment area itself, is based on the most recent site topography, provided by AECI. It should be noted that the drainage area was determined as part of the Inflow Flood Control System Plan required by §257.83 of the CCR Rule which is provided under separate cover.

<u>§257.73(c)(1)(v)</u>: A description of the physical and engineering properties of the foundation and abutment materials on which the CCR unit is constructed.

The description of the physical and engineering properties of the foundation and abutment materials on which Cell 002 West was constructed was discussed in the "Geologic Summary – Pond 001 Cell 2" by Gredell Engineering Resources, Inc. dated 5 October 2015 is provided as Appendix B. The description of the physical and engineering properties of the foundation and abutment materials on which Cell 002 West was constructed was discussed on pages 3-4, of "Global Stability Evaluation Mine Waste and Ash Pond Embankments" by Geotechnology, Inc. dated 22 April 2010, and the excerpt is provided as Appendix C. AECI was not able to locate other original construction design documents related to this criterion.

<u>§257.73(c)(1)(vi)</u>: A statement of the type, size, range, and physical and engineering properties of the materials used in constructing each zone or stage of the CCR unit; the method of site preparation and construction of each zone of the CCR unit; and the approximate dates of construction of each successive stage of construction of the CCR unit.

Cell 002 was originally constructed as an embankment encompassing of the entire southern boundary of both Cell 002 West and Cell 002 East. No construction information was available regarding the original design or installation of this embankment.

In 2015, a separator berm was constructed in a north-south orientation from the Cell 002 embankment north into native soils. Information describing the design of this separator berm entitled "Pond 001 Cell 2 Separation Berm" by Gredell Engineering Resources, Inc. dated 12 October 2015 is provided in Appendix D.

§257.73(c)(1)(vii): At a scale that details engineering structures and appurtenances relevant to the design, construction, operation and maintenance of the CCR unit, detailed dimensional drawings of the CCR unit, including a plan view and cross sections of the length and width of the CCR unit, showing all zones, foundation improvements, drainage provisions, spillways, diversion ditches, outlets, instrument locations, and slope protection, in addition to the normal operating pool surface elevation and the maximum pool surface elevation following peak discharge from the inflow design flood, the expected maximum depth of CCR within the CCR surface impoundment, and any identifiable natural or manmade features that could adversely affect operation of the CCR unit due to malfunction or mis-operation.

Drawings providing information listed above, as available have been provided in Appendix E.

§257.73(c)(1)(viii): a description of the type, purpose, and location of existing instrumentation.

No instrumentation exists for Cell 002 West.

§257.73(c)(1)(ix): area-capacity curves for the CCR unit.

Design area-capacity curves for the modified Cell 002 West after separator berm construction are provided in Appendix F. It should be noted that updated area-capacity curves for the impoundment are being developed as part of the Inflow Flood Control System Plan required by §257.83 of the CCR Rule which will be provided under separate cover.

§257.73(c)(1)(x): a description of each spillway and diversion design features and capacities and calculations used in their determination.

Following the Cell 002 West modification with separator berm, decant water discharges through a 15-inch CMP culvert at an upstream invert elevation of 718.0 ft (note that actual installation of material type was changed during construction and no emergency spillway was installed). This culvert discharges into Cell 003 to the south. Further information of the location and details of these spillways are provided in Appendix F.

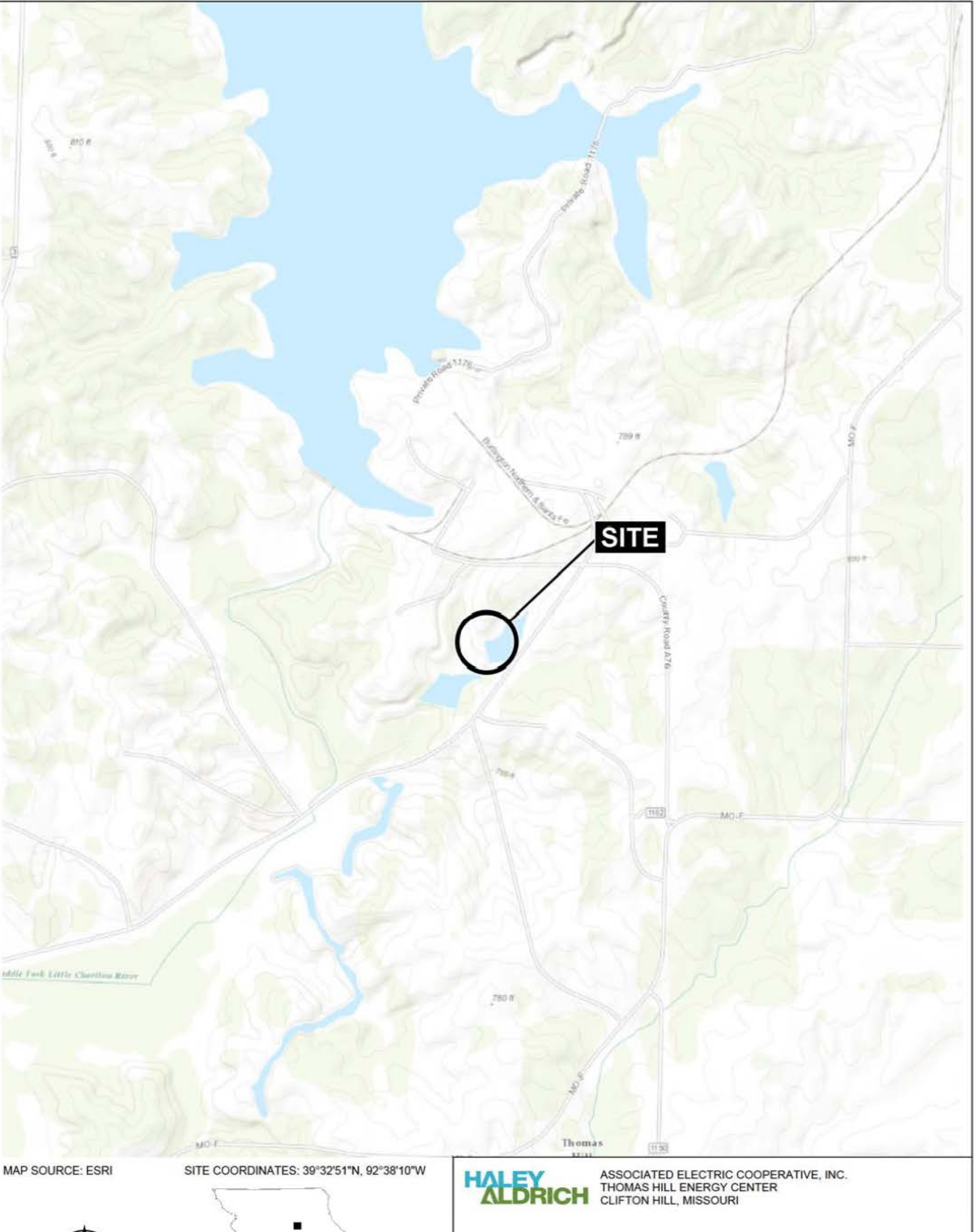
§257.73(c)(1)(xi): The construction specifications and provisions for surveillance, maintenance, and repair of the CCR unit.

AECI implements 7-day inspections of the embankment for Cell 002 West in accordance with the CCR Rule. No other applicable operations plan applies to Cell 002 West.

§257.73(c)(1)(xii): any record or knowledge of structural instability of the CCR unit.

There are no records or knowledge of structural instability associated with Cell 002 West.

APPENDIX A
Site Locus



MAP SOURCE: ESRI

SITE COORDINATES: 39°32'51"N, 92°38'10"W

HALEY ALDRICH

ASSOCIATED ELECTRIC COOPERATIVE, INC.
THOMAS HILL ENERGY CENTER
CLIFTON HILL, MISSOURI

POND 001 - CELL 002 West
PROJECT LOCUS

APPROXIMATE SCALE: 1 IN = 2000 FT
APRIL 2018

FIGURE 1

APPENDIX B

Geologic Summary – Pond 001 Cell 2

By Gredell Engineering Resources, Inc. dated October 2015

1505 E. High Street
Jefferson City, Missouri 65101
Telephone No. (573) 659-9078
Fax No. (573) 659-9079

GREDELL Engineering Resources, Inc.

Memo

To: Associated Electric Cooperative, Inc. – Thomas Hill Energy Center File

From: Mikel C. Carlson, R.G., Senior Geologist

CC:

Date: 10/5/2015

Re: Geologic Summary - Pond 001 Cell 2

On September 4-5, 2014, a limited subsurface site investigation was conducted by Gredell Engineering for the purpose of identifying geologic formations constituting uppermost bedrock within the Pond 001 (Cell 2) work area. Four temporary boreholes (B-1, B-2, B-3, and B-4) were advanced to depths of between 15.9 and 20.8 feet using a combination of hollow-stem auger and wireline coring techniques. The locations of the four boreholes are presented on Attachment 1. In general, hollow-stem augers were advanced through unconsolidated material to the top of bedrock, followed by the recovery of whole rock core using an NQ wireline core barrel. Split-spoon samples were recovered during auger drilling at approximate 2.5-ft increments until conventional refusal was attained. In addition, one Shelby Tube sample was acquired from boring B-2. All drilling was performed by Palmerton & Parrish, Inc. of Springfield, Missouri under the direct supervision of a Gredell Engineering staff member who is also a Registered Geologist in the State of Missouri. Upon completion of drilling, each borehole was immediately plugged in accordance with 10 CSR 23-6.050 and a Registration Record filed with the MDNR-Wellhead Protection Program within applicable timeframes. A select number of split-spoon samples were also submitted to Reitz & Jens, Inc. of St. Louis, Missouri for geotechnical analysis, including moisture content, USCS Classification, Atterberg Limits, and particle size distribution. An estimate of hydraulic conductivity was also obtained from the Shelby Tube sample recovered from boring B-2 using a flexible wall permeameter (ASTM D-5084).

Field drilling notes are provided for reference as Attachment 2. Drilling logs are provided in Attachment 3. A copy of the registration record and acceptance from the MDNR-Wellhead Protection Program is provided in Attachment 4. Geotechnical laboratory results are provided in Attachment 5. Whole-rock core recovered during field activities is currently stored at the offices of Gredell Engineering in Jefferson City and is available for review.

A summary of the drilling activity is as follows. An assessment of bedrock stratigraphy was aided by review of detailed drilling records of exploratory borings drilled in close proximity to the Pond 001 (Cell 2) area (AECI Coal Permit Records on file with the Missouri Land Reclamation Program) All bedrock formations encountered are assigned to the Desmoinesian Series of the Pennsylvanian System.

Boring B-1 was advanced to a total depth of 20.8 feet. Unconsolidated material consisting of clayey, glacial drift/outwash was encountered to a depth of 17.5 feet. Underlying bedrock consisted of approximately 3.3 feet of thick-bedded limestone identified as the Blackjack Creek (Limestone) Formation (lower Marmaton Group).

Boring B-2 was advanced to a total depth of 20.5 feet. Unconsolidated material consisting of clayey, glacial drift/outwash was encountered to a depth of 12.3 feet. Underlying bedrock consisted of approximately 3.1 feet of thick-bedded limestone identified as the Blackjack Creek (Limestone) Formation, followed by 3.2 feet of black, fissile shale identified as the Excello Formation (basal Marmaton Group), a 0.2-ft thick coal smut identified as the Mulky Coal (uppermost Cherokee Group), and 1.6 feet of gray clayshale tentatively identified as the upper part of the Lagonda Shale (upper Cherokee Group).

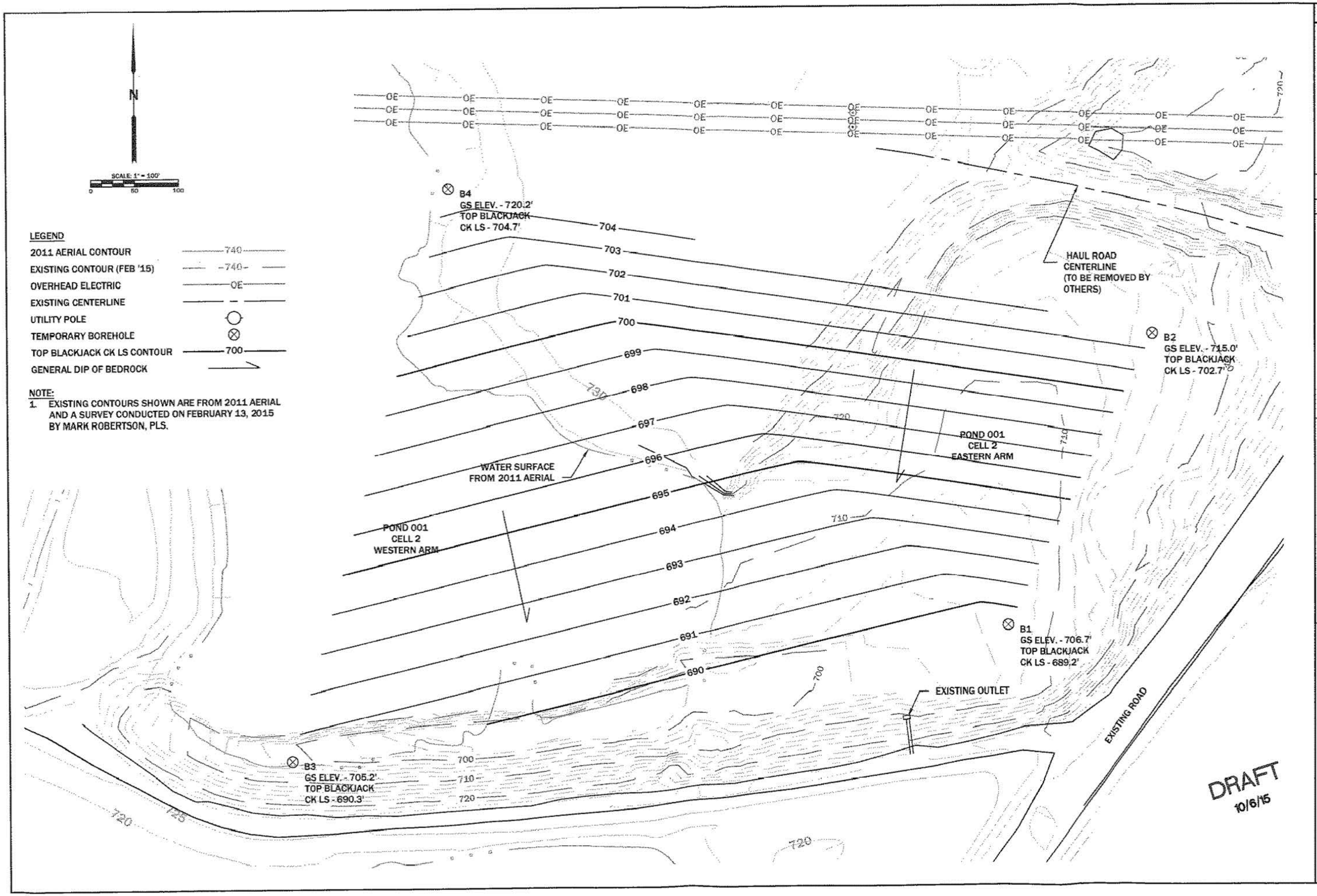
Boring B-3 was advanced to a total depth of 20.3 feet. The uppermost 4.0 feet consisted of ash, followed by 10.9 feet of unconsolidated, clayey, glacial drift/outwash to a depth of 14.9 feet. Underlying bedrock consisted of 2.9 feet of thick-bedded limestone identified as the Blackjack Creek (Limestone) Formation, followed by 2.5 feet of black, fissile shale identified as the Excello Formation (basal Marmaton Group).

Boring B-4 was advanced to a total depth of 15.9 feet. Approximately 11.6 feet of ash was penetrated before encountering approximately 3.9 feet of variegated clayshale and siltstone identified as representative of the Little Osage Formation (lower Marmaton Group). The boring was terminated at conventional auger refusal approximately 0.4 feet into a well-indurated limestone believed representative of the underlying Blackjack Creek Formation.

Subsequent to completion of the four boreholes, each location was surveyed by a professional land surveyor to obtain x, y, z coordinate data. The survey data was used to develop a bedrock structure map using the top of the Blackjack Creek (Limestone) Formation as a reference datum. The bedrock contours are depicted on Attachment 1 for reference. The contours indicate that Blackjack Creek strata dip generally southward toward the previously strip-mined areas termed Mine Block Areas 11 and 17.

Attachment 1

Boring Location Map



LEGEND

2011 AERIAL CONTOUR	740
EXISTING CONTOUR (FEB '15)	-740-
OVERHEAD ELECTRIC	OE
EXISTING CENTERLINE	— —
UTILITY POLE	○
TEMPORARY BOREHOLE	⊗
TOP BLACKJACK CK LS CONTOUR	700
GENERAL DIP OF BEDROCK	→

NOTE:
1. EXISTING CONTOURS SHOWN ARE FROM 2011 AERIAL AND A SURVEY CONDUCTED ON FEBRUARY 13, 2015 BY MARK ROBERTSON, PLS.

#	DATE	REVISION DESCRIPTION	BY

GREDELL Engineering Resources, Inc.
ENVIRONMENTAL ENGINEERING LAND - AIR - WATER
1505 East High Street Telephone: (573) 659-9078
Jefferson City, Missouri Facsimile: (573) 659-9079
MO CORP. ENGINEERING LICENSE NO. E-2001001669-D

THOMAS HILL
ENERGY CENTER
aeci
associated electric cooperative, inc.

GEOLOGIC STRUCTURE MAP
BLACKJACK CREEK LIMESTONE
POND 001 - CELL 1
GEOLOGIC EVALUATION

SURVEYED	DESIGNED	DRAWN	CHECKED	APPROVED	DATE	SCALE	PROJECT NAME	FILE NAME	SHEET #
NA	MCC	AJK	MCC	MCC	10/2015	AS NOTED	AECI/THEC	GEO STRUCT MAP	1 OF 1

Attachment 2

Field Drilling Notes

AE[illegible] - T[illegible] 9/4/14

Time: 8:10 Weather: Sunny/dry, 90's

Accompanied by: PPI, Mike Ayers/Josh Starkey

Headwaters + Ronnie Stamey 660-464-1126

Kim D

On site to assess bedrock at base of Pond 001/Cell 2 by drlg/coring 4 borings + 2 coring along NW + NE doglegs.

Also to examine bedrock exposure along NW of Cell 2B.

Spoke w/Kim @ guardshack entrance. Received permission to access Cell 2B while waiting on drillers. Thin ledges 2"-4" [illegible] LS, took photos.

Misc Phone Calls (...65, office, PPI)

Met drillers @ 9:22

Safety Training - 9:30 - 10:00

Visit w/ Ronnie (Headwaters) @ 10:10

Mob to B-1 (East, S site) @ 10:20

B-1 Rig Up 10:29 Begin 10:35 End 1:35

HSA to: 17.5'

SS-1 1.5' - 3.0' (2/2/4), Recover 12" Ash?

SS-2 4.0 - 5.5' (2/3/4) Recover 18" Ash/Clay

SS-3 6.5' - 8.0' (1/2/2), Recover 18" Clay!

SS-4 9.0 - 10.5 (1/1/2) Recover 18" Clay!

Plastic, Moist

B-1 (Con't)

SS-5 11.5'-13.0' (2/3/4), Recover 18" Clay.

SS-6 14.0'-15.5' (1/1/2) Recover 18" Clay/Slt Sd

SS-7 16.5'-17.5' (1/50*) Recover 12"

Refusal @ 17.5' @ 11:30

Retool to core + resume @ 1:08

(Lunch Break 12 - 1^00)

Core Run #1; 17.5'-20.8' (39"/39") 1:22-1:34

LS, call it good, pass To Blk Sh

at base

Break down + move To next hole

@ 1:36

B-2 NE L of East Arm

Rig Up: 2:01 Begin: 2:10 End: 3:56

HSA to 12.3'

SS-1 1.5'-3.0' (1/3/4) Recover 13" Ash

SS-2 4.0'-5.5' (1/[illegible]/3) Recover 18' Ash/Clay 5.0'

ST-3 6.5'-8.0 Wrapped

SS-4 9.0'-10.5' (1/2/3) Recover 18" Clay

SS-5 11.5'-12.3' (1/50+) Recover 9" Clay/Sd+Cor

Refusal 12.3' @ 2:56

42 Retool to core ~ resume @ 3:08

Run #1 12.3'-15.8' (38"/42") 3:08-3:19

NR base of run - coal? Ryan/Kim D visit 3:10-3:20

Run #2 15.8'-20.5' (56"/56") 3:27-3:49

P/u base previous run

Bk Sh/Coal/Underclay

B-2 (Con't)

Break down + move to next hole @ 3:56

To B-3 @ 4:13

B-3 SW L W dike, W/in active exc area

Rig up: 4:25 Begin: 4:34 End: 6:16

HSA to 14.9'

SS-1 1.5'-3.0' (11/19/14) Recover 15" B. Ash

SS-2 4.0'-5.5' (1/4/6) Recover 18" Ash/Bk Clay

SS-3 6.5'-8.0' (3/5/7) Recover 13" Bk Clay

SS-4 9.0'-10.5' (3/5/7) Recover 17" Bk Clay

SS-5 11.5'-13.0' (2/4/6) Recover 17" Dk Brn Clay

SS-6 14.0-14.9' (3/50*) Recover 10" Ash/Brn/SS?

Refusal 14.9' @ 5:27

14" Retool to core + resume @ 5:33

Run #1 14.9'-16.2' (12"/14") 5:36-5:42

(14.5?) ~~Lagoon Bt?~~

Run #2 16.2'-20.3' (45"/49") 5:46-6:12

(19.3?) Ls/Bk Sh

Call it good @ 6:16

Leave Site @ 6:40

Time: 7:30 Weather: Sunny, dry, 80's
Accompanied by: PPI; Mike A; John S. @ 8:10
Visitors: K. Murphy 10:50 - 11:00

Back on site to complete final borehole (B-4).
Prelim analysis of rocks recovered from B-1, 2, + 3
strongly suggest lower Little Osage Fm. clays;
Blackjack Creek Ls, Excello Shale, Mulky Coal

Boring	Black Ash/Clay	Clay	Ls	Bk Shale	TD
1	4.7	12.8	3.3	NDE	20.8
2	5.0	9.3			20.5
3	4.7	10.2			20.3
4	11.6	4.3	Top		15.9

Visit w/ Ronnie (NW) + Kim about hole location
B-4 NW ∠, West dogleg
Have drlrs B/F holes while locating B-4
@ 8:15 - 8:45. Kim D. okay w/ set up
Rig gets stuck; NW dozer pull out w/ dozer
creating ramp for better access; done @ 9:58
Rig up 9:59 Begin: 10:08 End: 11:12
NSA to 15.9
drill w/o SS samples to 6.5' due to
creation of ramp in ash for access

B-4 (con't)
SS-1 6.5-8.0' (2/2/1) Recovery 12" B. Ash
SS-2 9.0-10.5' (1/1/1) Recovery 4" B. Ash
SS-3 11.5'-13.0' (6/13/19) Recovery (11.6') 18" Clay (Fill)
SS-4 14.0-15.5' (7/11/11) Recovery 15" Bk Clay/Sh
SS-5 15.5'+ Cutting hits rock, confirm
w/ SS 50+ No advance
Refusal 15.9' @ 11:12
Call it good (Top Ls)
Breakdown Rig 11:15 - 11:45

Leave Site @ 12:15

In J/L @ 2:00

Attachment 3

Drilling Logs

KEY TO SYMBOLS

Pond 001, Cell 2

Symbol	Description
▩	Fill: Bottom Ash/Fly Ash
▨	Medium to High Plasticity Clay
▨	High Plasticity Clay
▨	Sandy Clay
▨	Gravelly Sandy Clay/Sandy Gravelly Clay
▦	Limestone
▤	Shale
■	Coal
▨	Gravelly Clay
▤	Weathered Shale
▤	Siltstone
▦	Weathered Limestone

Misc. Symbols

▲	Standard Penetration Test N-Value(Blows Per Last Foot)

Soil Samplers

◩	Standard penetration test (SPT)
◫	NX Rock core

Symbol	Description
⧅	Undisturbed thin wall Shelby tube

Notes:

NE	Not Encountered
CFA	Continuous Flight Augers

GREDELL Engineering Resources, Inc.

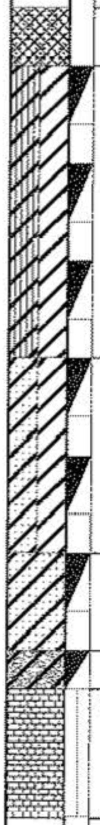
BORING LOG B1

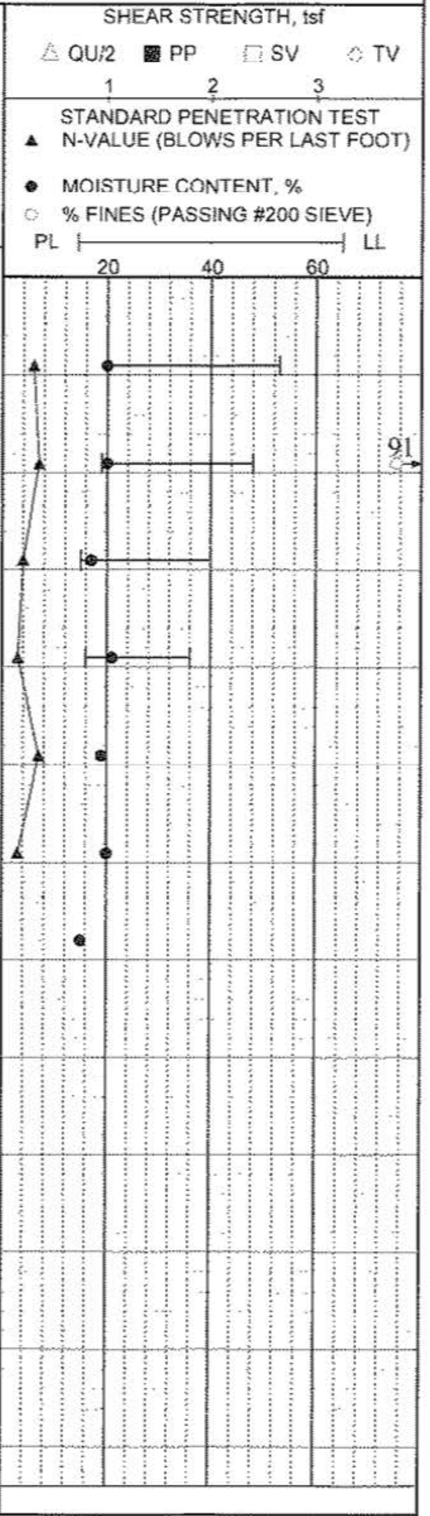
Pond 001, Cell 2
Thomas Hill Energy Center
CLIENT: **AECI**

LOCATION: See Plan of Boring Locations
ELEVATION: 706.7 ft DATUM: Site Topo
DATE DRILLED: 9/4/14

DEPTH (FEET)	ELEVATION	WATER TABLE	MATERIAL DESCRIPTION	SAMPLE ID DRY DENSITY (pcf) BLOWS PER 6 INCHES RQD= ROCK QUALITY DES. REC= RECOVERY	MOISTURE CONTENT PERCENT BY WEIGHT
0			FILL: Bottom ash and fly ash.		
	705		SILTY CLAY and CLAY: Black (10YR 2/1) with dark yellowish brown mottles, dry to moist, firm, medium to high plasticity, trace sand.	SS1 2-2-4	20
5			- dark yellowish brown (10YR 4/4) with gray mottles, moist, hard.	SS2 2-3-4	20
	700		- few strong brown mottles, few fine roots.	SS3 1-2-2	17
10			SANDY SILTY CLAY/CLAY: Dark yellowish brown with gray mottles, moist, firm to hard, medium to high plasticity, fine to coarse sand, few large Iron-Manganese concretions.	SS4 1-1-2	21
	695		- trace fine subangular gravel.	SS5 2-3-4	19
15			SANDY SILTY CLAY: Dark yellowish brown, moist, firm, medium plasticity, trace fine to coarse subangular gravel.	SS6 1-1-2	20
	690		GRAVELLY SANDY CLAY: Dark yellowish brown with strong brown mottles, dry to moist, firm to hard, medium to high plasticity, fine coarse angular gravel.	SS7 1-50	15
20			LIMESTONE: Blackjack Creek	CR1	
	685		Boring terminated at 20.8 feet below ground surface in Limestone.		
25	680				
30					

GRAPHIC LOG / SAMPLE TYPE





DRILLING COMPANY: PPI, Inc.
DRILLING METHOD: HSA/NQ Core
DRILL RIG: CME-75
SPT HAMMER: Automatic
LOGGED BY: M. Carlson

STRATIFICATION LINES ARE APPROXIMATE SOIL BOUNDARIES ONLY; ACTUAL CHANGES MAY BE GRADUAL OR MAY OCCUR BETWEEN SAMPLES.

WATER LEVELS: DURING DRILLING: ____ FEET
AFTER DRILLING: ____ FEET
COMPLETION DEPTH: 20.8 FEET
BACKFILLED WITH: Cement/Bentonite Grout

Date Printed: 10/[illegible]

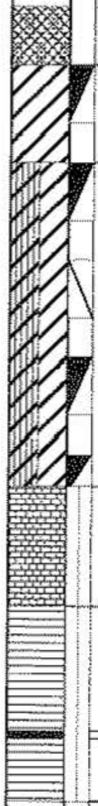
GREDELL Engineering Resources, Inc.

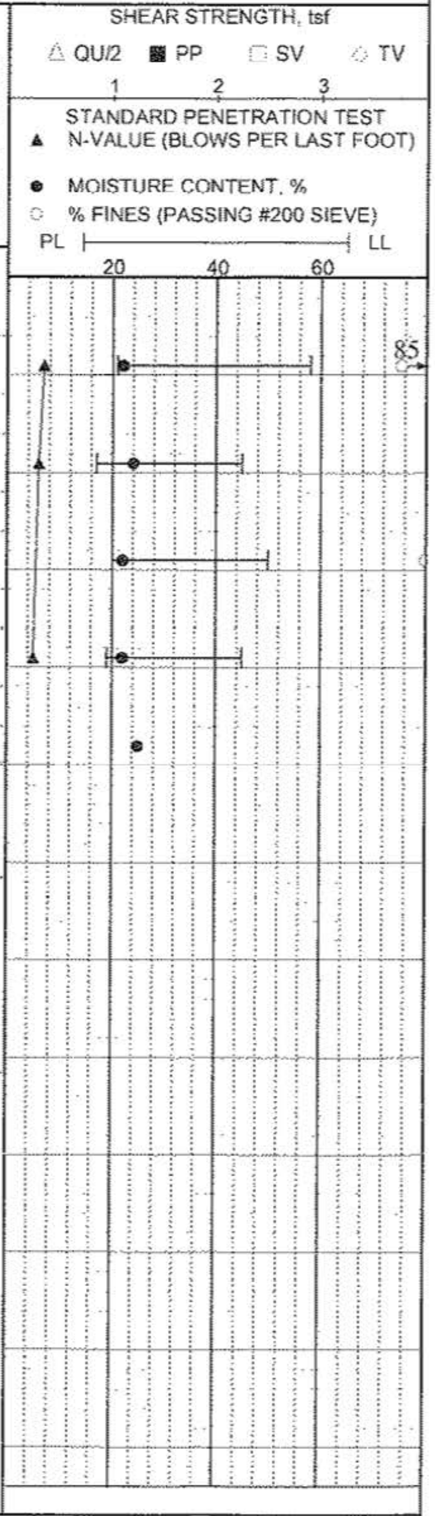
BORING LOG B2

Pond 001, Cell 2
Thomas Hill Energy Center
CLIENT: **AECI**

LOCATION: See Plan of Boring Locations
ELEVATION: 714.98 ft DATUM: Site Topo
DATE DRILLED: 9/4/14

DEPTH (FEET)	ELEVATION	WATER TABLE	GRAPHIC LOG	SAMPLE TYPE	MATERIAL DESCRIPTION	SAMPLE ID DRY DENSITY (pcf) BLOWS PER 6 INCHES RQD= ROCK QUALITY DES. REC= RECOVERY	MOISTURE CONTENT PERCENT BY WEIGHT
0					FILL		
					CLAY: Black (10YR 2/1) with dark yellowish brown mottles, moist, hard, high plasticity, trace fine sand.	SS1 1-3-4	22
5	710				SILTY CLAY and CLAY: Dark yellowish brown, moist, firm to hard, medium to high plasticity, trace fine to medium sand.	SS2 1-3-3	24
					- trace gray and black mottles.	ST3 104 pcf	22
10	705					SS4 1-2-3	22
					CLAY: Dark yellowish brown and gray, moist, firm, high plasticity, trace fine to medium sand, trace fine angular gravel.	SS5 1-50	25
					LIMESTONE: Blackjack Creek	CR1	
15	700				SHALE: Excello Shale	CR2	
					COAL: Mulky Coal		
20	695				SHALE: Lagonda Shale		
					Boring terminated at 20.5 feet below ground surface in Shale.		
25	690						
30	685						





DRILLING COMPANY: PPI, Inc.
DRILLING METHOD: HSA/NQ Core
DRILL RIG: CME-75
SPT HAMMER: Automatic
LOGGED BY: M. Carlson

STRATIFICATION LINES ARE APPROXIMATE SOIL BOUNDARIES ONLY; ACTUAL CHANGES MAY BE GRADUAL OR MAY OCCUR BETWEEN SAMPLES.

WATER LEVELS: DURING DRILLING: ____ FEET
AFTER DRILLING: ____ FEET
COMPLETION DEPTH: 20.4 FEET
BACKFILLED WITH: Cement/Bentonite Grout

Date Printed: 10/5/2015

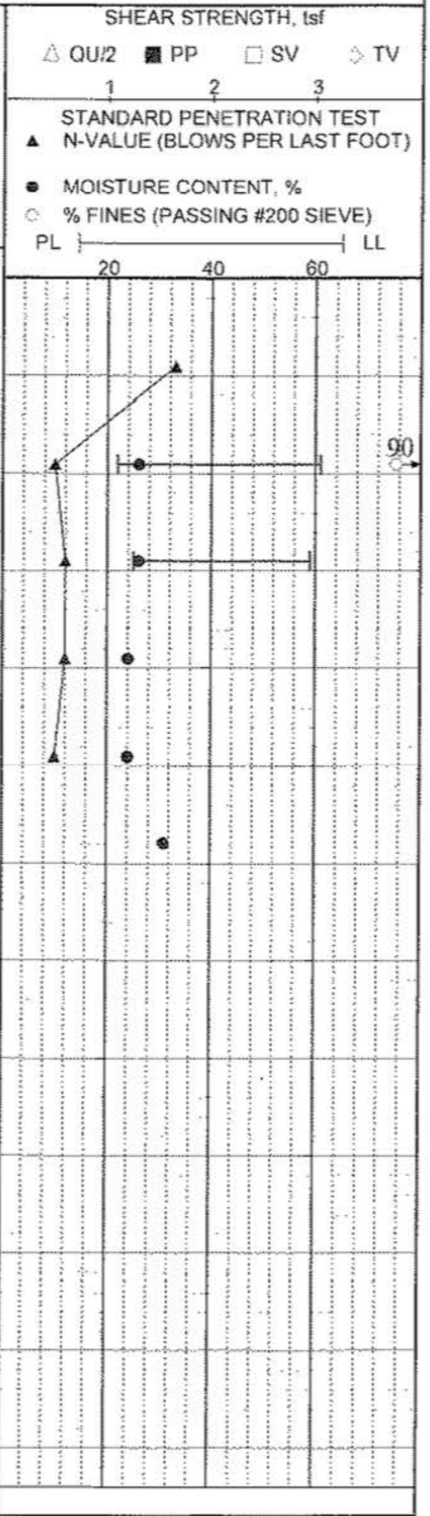
GREDELL Engineering Resources, Inc.

BORING LOG B3

Pond 001, Cell 2
Thomas Hill Energy Center
CLIENT: **AECI**

LOCATION: See Plan of Boring Locations
ELEVATION: 705.23 ft DATUM: Site Topo
DATE DRILLED: 9/4/14

DEPTH (FEET)	ELEVATION	WATER TABLE	GRAPHIC LOG	SAMPLE TYPE	MATERIAL DESCRIPTION	SAMPLE ID DRY DENSITY (pcf) BLOWS PER 6 INCHES RQD= ROCK QUALITY DES. REC= RECOVERY	MOISTURE CONTENT PERCENT BY WEIGHT
0	705				FILL: Bottom ash and fly ash.	SS1 11-19-14	
5	700				SILTY CLAY and CLAY: Clay, black, moist, firm, high plasticity. Silty Clay, dark yellowish brown and gray, moist, firm, medium plasticity, trace fine sand.	SS2 1-4-6	26
					CLAY: Black, moist, firm to hard, high plasticity, trace fine to coarse gravel, trace fine to coarse sand.	SS3 3-5-7	26
10	695				- with dark yellowish brown, trace coarse angular gravel.	SS4 3-5-7	24
					GRAVELLY CLAY: Dark yellowish brown and gray, moist, firm to hard, high plasticity, fine to coarse gravel, trace fine to coarse sand.	SS5 2-4-6	24
15	690				SANDY GRAVELLY CLAY: Dark yellowish brown and gray, moist to wet, soft to firm, high plasticity, fine to coarse angular gravel.	SS6 3-50	31
					LIMESTONE: Blackjack Creek	CR1	
					SHALE: Excello Shale	CR2	
20	685				Boring terminated at 20.3 feet below ground surface in Shale.		
25	680						
30	675						



DRILLING COMPANY: PPI, Inc.
DRILLING METHOD: HSA/NQ Core
DRILL RIG: CME-75
SPT HAMMER: Automatic
LOGGED BY: M. Carlson

STRATIFICATION LINES ARE APPROXIMATE SOIL BOUNDARIES ONLY; ACTUAL CHANGES MAY BE GRADUAL OR MAY OCCUR BETWEEN SAMPLES.

WATER LEVELS: DURING DRILLING: ____ FEET
AFTER DRILLING: ____ FEET
COMPLETION DEPTH: 20.3 FEET
BACKFILLED WITH: Cement/Bentonite Grout

Figure Sheet 1 of 1

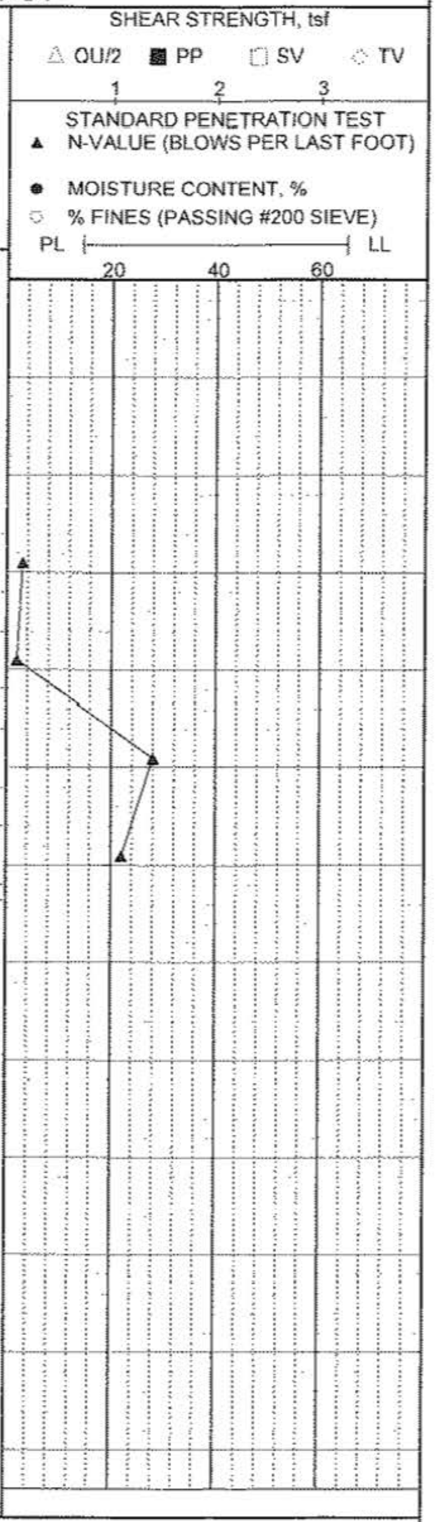
GREDELL Engineering Resources, Inc.

BORING LOG B4

Pond 001, Cell 2
Thomas Hill Energy Center
CLIENT: **AECI**

LOCATION: See Plan of Boring Locations
ELEVATION: 720.19 ft DATUM: Site Topo
DATE DRILLED: 9/5/14

DEPTH (FEET)	ELEVATION	WATER TABLE	GRAPHIC LOG	SAMPLE TYPE	MATERIAL DESCRIPTION	SAMPLE ID DRY DENSITY (pcf) BLOWS PER 6 INCHES RQD= ROCK QUALITY DES. REC= RECOVERY	MOISTURE CONTENT PERCENT BY WEIGHT
0	720				FILL: Bottom ash and fly ash.		
5	715						
					- bottom ash, dry.	SS1 2-2-1	
10	710				- bottom ash with fly ash, moist.	SS2 1-1-1	
					WEATHERED SHALE/SILTSTONE: Gray and very pale brown, dry, very thinly bedded, soapy texture.	SS3 6-13-15	
15	705					SS4 7-11-11	
					WEATHERED LIMESTONE: Gray, moderately hard.	SS5 50	
					Boring terminated at 15.9 feet below ground surface due to SPT refusal in Weathered Limestone.		
20	700						
25	695						
30	690						



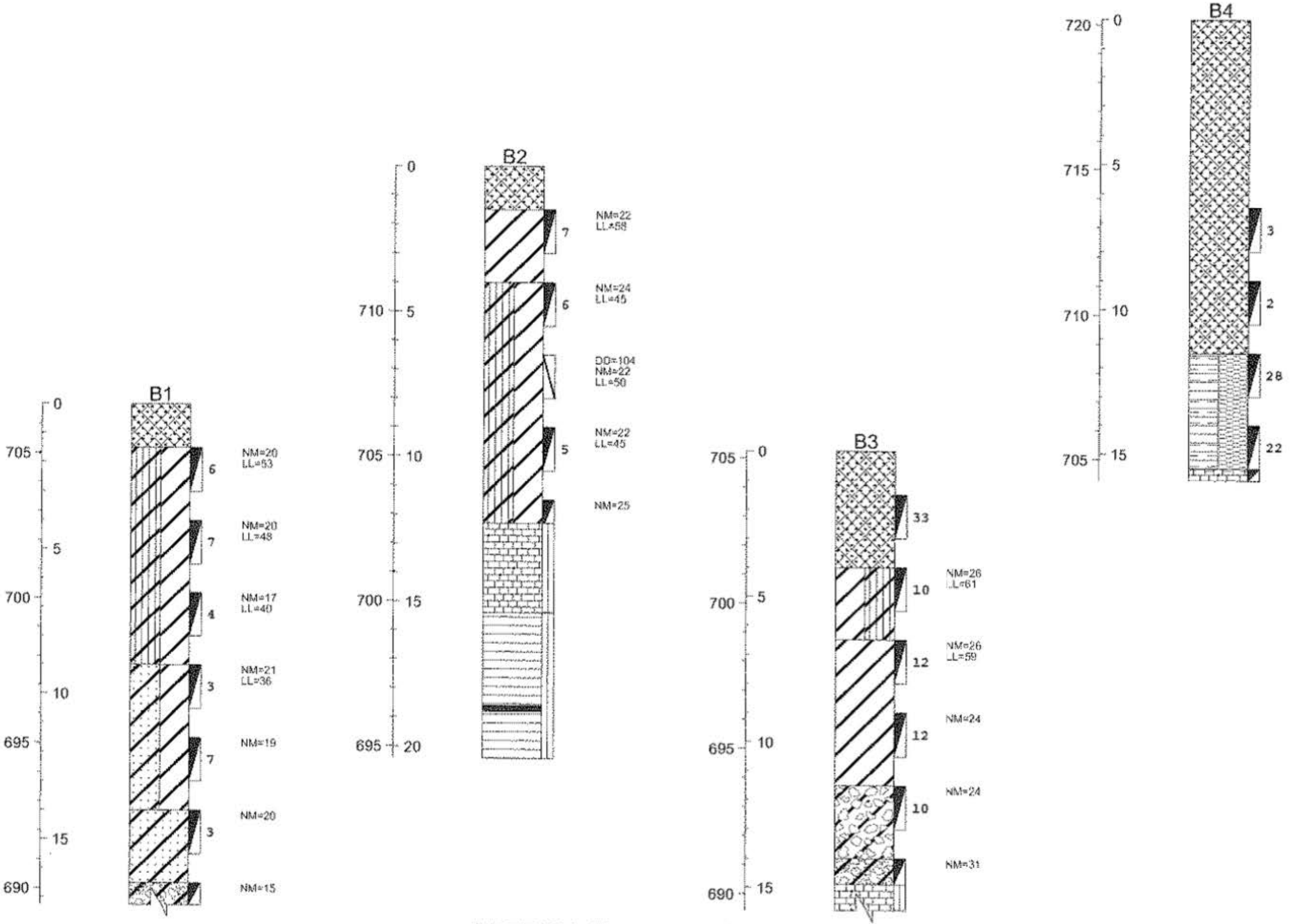
DRILLING COMPANY: PP1, Inc.
DRILLING METHOD: HSA/NQ Core
DRILL RIG: CME-75
SPT HAMMER: Automatic
LOGGED BY: M. Carlson

STRATIFICATION LINES ARE APPROXIMATE SOIL BOUNDARIES ONLY; ACTUAL CHANGES MAY BE GRADUAL OR MAY OCCUR BETWEEN SAMPLES.

WATER LEVELS: DURING DRILLING: ____ FEET
AFTER DRILLING: ____ FEET
COMPLETION DEPTH: 15.9 FEET
BACKFILLED WITH: Cement/Bentonite Grout

Date Printed: [illegible]

LOG OF BORINGS
Pond 001, Cell 2



GREDELL Engineering Resouces. Inc.

Attachment 4

Registration Record

STATE OF MISSOURI Jeremiah W. (Jay) Nixon, Governor • Sara Parker Pauley, Director

DEPARTMENT OF NATURAL RESOURCES

www.dnr.mo.gov
P.O. Box 250, Rolla, MO 65402-0250
(573) 368-2165
FAX(573) 368-2317

file(PCD3A)
October 09, 2014

AECI-THOMAS HILL ENERGY CENTER
5693 HWY F
CLIFTON HILL, MO 65244

Re: 00496720

OFFICIAL DOCUMENT

DEAR AECI-THOMAS HILL ENERGY CENTER :

Congratulations! This confirms that your soil boring information has been reviewed and registered by the Missouri Department of Natural Resources, Missouri Geological Survey.

This letter should be filed with the Abandonment Registration Record received from your permitted well driller or pump installer.

This letter may be needed in the future as proof of Registration, verifying that your well was plugged in accordance with the Missouri Well Construction rules.

If you have questions regarding this letter please contact the Wellhead Protection Section at 573-368-2165.

Your Well Registration Number: B039598

Well Number:

Reference Number: 00496720

Site Name:

Site Address:

Site City:

GREDELL Engineering Resources, Inc.

ENVIRONMENTAL ENGINEERING LAND - AIR - WATER

Offices in Jefferson City, Rolla and Springfield, Missouri

September 18, 2014

Mr. Matt Parker
Wellhead Protection Unit
Missouri Geological Survey
Missouri Department of Natural Resources
111 Fairgrounds Road, P.O. Box 250
Rolla, Missouri 65402

Re: Registration Record for Exploratory Borings
S-30, T-55N, R-15W, Randolph County

Dear Mr. Parker:

Enclosed please a Registration Record documenting the proper abandonment of four (4) exploratory borings needed to delineate formation stratigraphy at the AECI-THEC power plant facility. Each boring was immediately plugged upon completion of drilling on September 4-5, 2014. Maximum depth was 20 feet. No groundwater was observed during drilling operations.

A check in the amount of $50.00 accompanies this submittal (check #9054). I would appreciate someone in your office sending me a receipt for payment at the earliest practicable date.

If you have any questions, please contact me at your convenience.

Sincerely,

Mikel C. Carlson, R.G.
Senior Geologist
Permit #002876M

Enclosure

MISSOURI DEPARTMENT OF
NATURAL RESOURCES
MISSOURI GEOLOGICAL SURVEY

MONITORING WELL PLUGGING REGISTRATION RECORD

OFFICE USE ONLY
REF NO.
DATE RECEIVED
CR NO.
CHECK NO.
TRANSMITTAL NO.
STATE WELL NUMBER
APPROVED BY
DATE APPROVED
ENTERED
ROUTE

INFORMATION SUPPLIED BY WELL OR PUMP INSTALLATION CONTRACTOR

OWNER NAME: AECI-Thomas Hill Energy Center
TELEPHONE NUMBER: 660-261-3263
VARIANCE NUMBER (IF APPLICABLE): N/A
OWNER ADDRESS: 5693 Hwy F
CITY: Clifton Hill
STATE: MO
ZIP CODE: 65244
ADDRESS OF WELL SITE: As Above
CITY: As Above
STATE:
ZIP CODE:
REFERENCE NUMBER OF ORIGINAL WELL (IF KNOWN): N/A
SITE NAME: Thomas Hill Energy Center
WELL NUMBER: N/A
DATE: 09/09/2014

LOCATION OF WELL
LAT. 39 ° 32 ' 38.2 "
LONG. 92 ° 38 ' 13.5 "
DRILL AREA: 3
COUNTY: Randolph
SMALLEST NW ¼ NW ¼ NE ¼ LARGEST
Sec. 30 Township 55 North 15 Range ☐ East ☑ West

PLUGGING INFORMATION

ORIGINAL DRILLER (IF KNOWN):
DATE ORIGINALLY DRILLED:
STATIC WATER LEVEL: N/A
DRILLER NOTES: No groundwater observed

☐ MONITORING WELL
DEPTH OF WELL: ______ FT.
LENGTH OF RISER: ______ FT.
SCREEN/RISER DIAMETER: ______ IN.
WELL SCREEN AND RISER REMOVED? ☐ Yes ☐ No
PUMP AND SAMPLING EQUIPMENT REMOVED? ☐ Yes ☐ N/A ☐ No
CASING REMOVED? ☐ Yes ☐ N/A ☐ No

☑ SOIL BORING(S)
Boring Diameter: 8.25/3 IN.

QUANTITY	DEPTH
4	17'-20'
TOTAL 4 BORING(S)	TOTAL 76 FT.

TYPE OF FILL MATERIAL: ☐ Gravel ☐ Sand ☑ Other
AMOUNT OF FILL USED: ______ ☐ TONS ☐ CUBIC YARDS
DEPTH TO TOP OF FILL: ______ FT.

GROUT INSTALLATION METHOD: ☑ Gravity ☐ Tremie ☐ Excavation
GROUT MATERIAL USED:
Neat Cement: ☐ Hi-Early ☑ Type 1
Bentonite: ☐ Slurry ☑ Granular ☐ Pellets ☐ Chips ☐ Other ______
HOW MANY GALLONS OF WATER MIXED PER BAG OF CEMENT OR BENTONITE? ■ Hydrated to Saturation
TOTAL NUMBER OF BAGS OF GROUT USED: 8
POUNDS OF GROUT PER BAG: 50

DATE 1ST WELL PLUGGED: 09/04/2014
DATE LAST WELL PLUGGED: 09/05/2014
FINISHED SURFACE MATERIAL: ☑ Soil ☐ Asphalt ☐ Concrete ☐ Other
SURFACE MATERIAL LENGTH: ______ FT. ______ IN.

REMARKS: Base of exploratory borings cored using NQ (3" nom). Plugged immediately after drilling completed.
REASON FOR ABANDONMENT: Exploratory borings

I hereby certify that the monitoring well herein described was plugged in accordance with the Department of Natural Resources requirements for the plugging of wells.

SIGNATURE (PRIMARY CONTRACTOR):
PERMIT NUMBER: 2876M
DATE: 09/09/2014
SIGNATURE (CONTRACTOR): Richard A. Dunn
PERMIT NUMBER: 001220-MH
DATE: 9/10/14
SIGNATURE (APPRENTICE):
PERMIT NUMBER: 004591-M
DATE: 9/10/14

MO 780-2161 (11-13)
REMIT TO: MISSOURI DEPARTMENT OF NATURAL RESOURCES, MISSOURI GEOLOGICAL SURVEY
WELLHEAD PROTECTION SECTION, PO BOX 250, ROLLA, MO 65402 573-368-2165
ENCLOSE $50 FEE WITH REGISTRATION RECORD WITHIN 60 DAYS AFTER WELL PLUGGING OR WITHIN 180 DAYS AFTER THE PLUGGING OF TEMPORARY WELLS

Attachment 5

Geotechnical Laboratory Results

REITZ & JENS, INC.
CONSULTING ENGINEERS

1055 corporate square drive
st. louis, missouri 63132
phone: 314.993.4132
fax: 314.993.4177
www.reitzjens.com

September 26, 2014

Mr. Travis Doll, R.G., R.E.H.S.
Gredell Engineering Resources, Inc
1505 East High Street
Jefferson City, Missouri 65101

RE: Laboratory Soil Testing for
AECI-THEC Pond 001, Cell 2
Thomas Hill, Missouri

Dear Mr. Doll:

The requested lab results are included within this submittal. The lab tests were performed by Reitz & Jens' NICET certified technicians and registered professional engineers. All lab tests were completed according to ASTM standards. These standards included: dry preparation of soil D421, particle size analysis D422, #200 wash D1140, moisture content D2216, Unified Soil Classification D2487, Atterberg limits D4318, and hydraulic conductivity D5084.

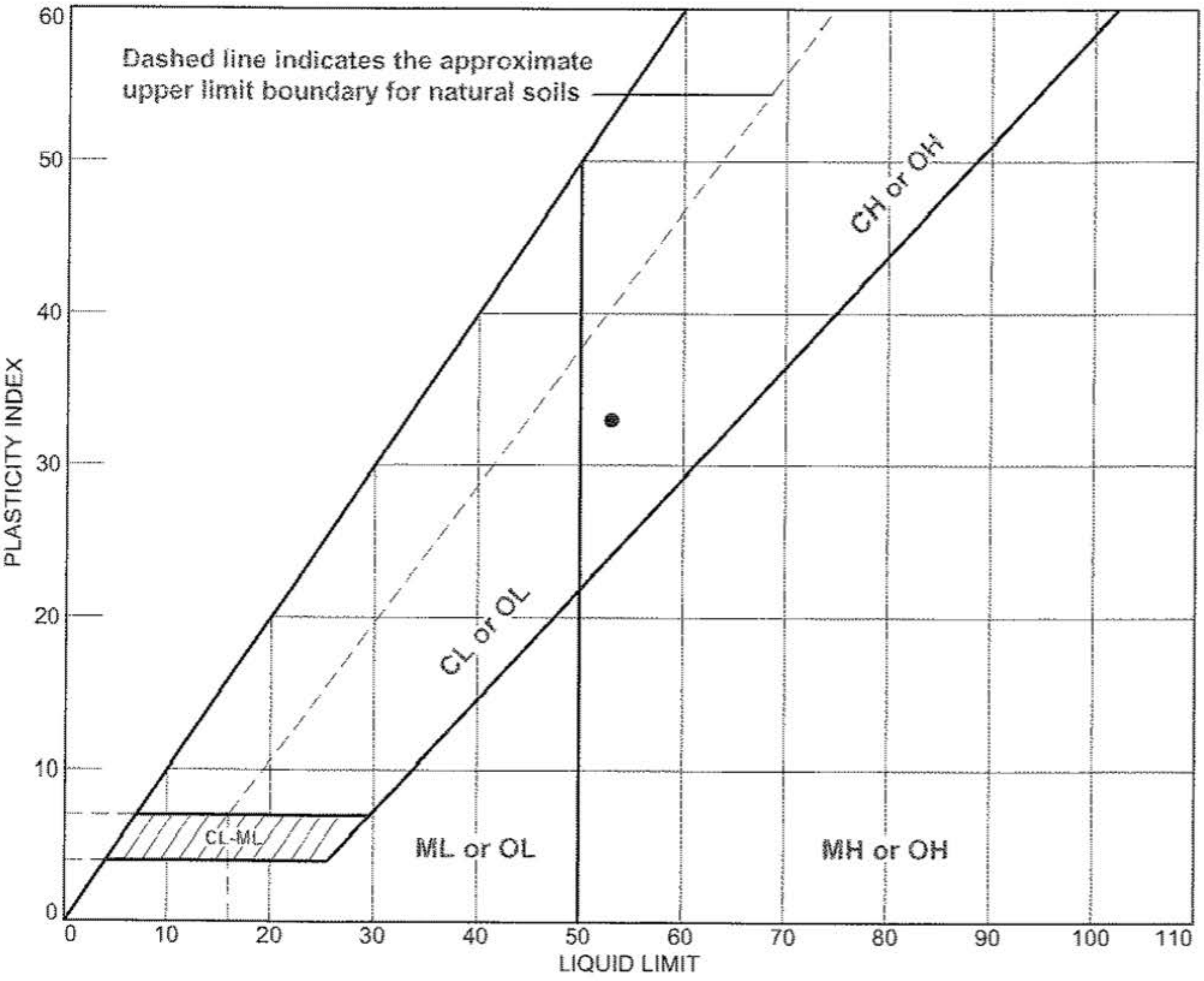
If you have questions about the results or any other soil related issues please let me know. Thank you for the opportunity to complete lab testing on your project.

Sincerely,
REITZ & JENS, Inc.

Kyle E Kocher

Kyle E Kocher, P.E.
Project Manager

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	B-1	SS-1	1.5	20.3	20	53	33	CH

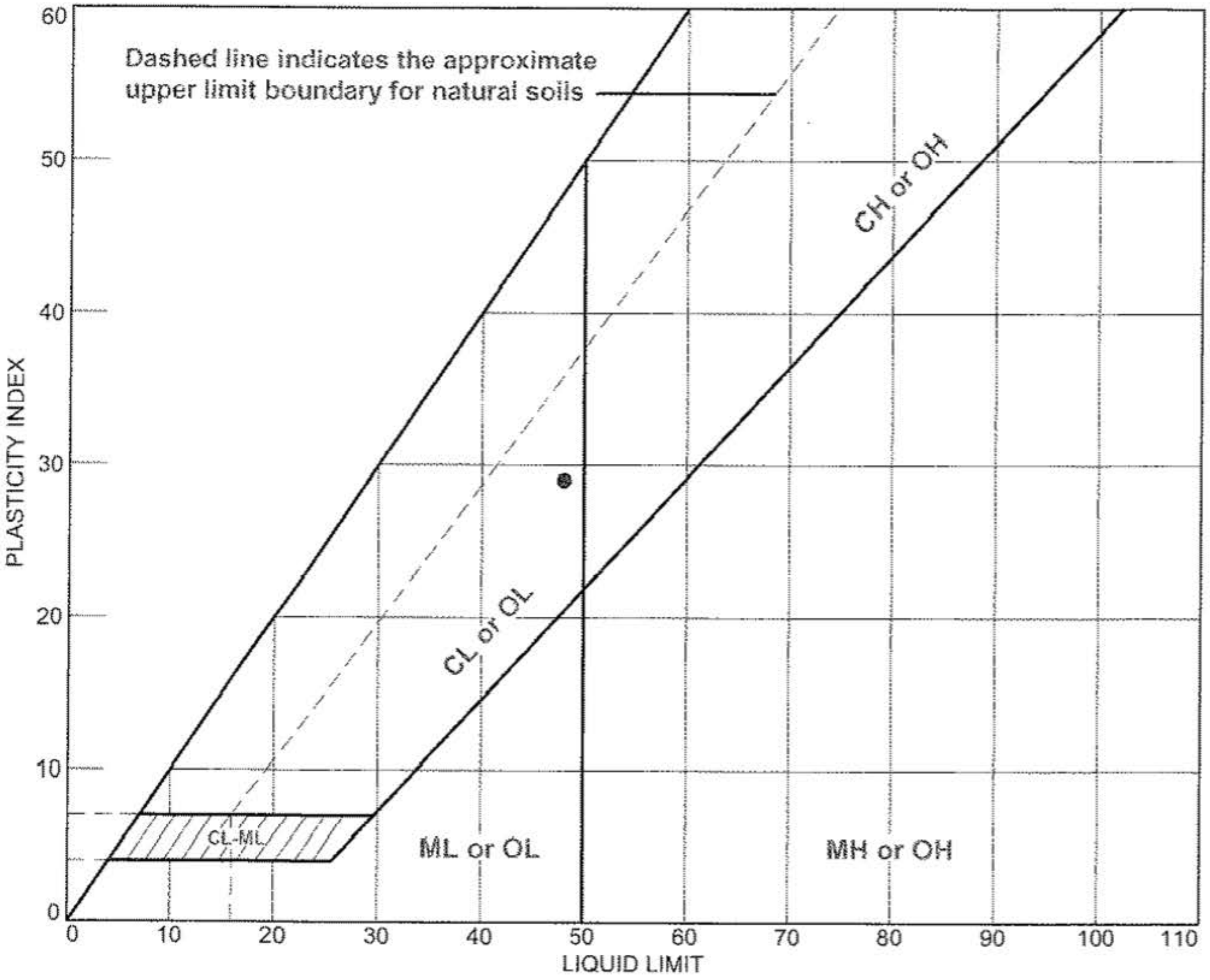
REITZ & JENS, INC.
CONSULTING ENGINEERS

Client: Gredell Engineering Resources, Inc
Project: AECI-THEC Pond 001, Cell 2

Project No.: 2014120901 **Figure**

Tested By: J. Crose **Checked By:** K. Kocher, P.E.

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	B-1	SS-2	4.0	19.6	19	48	29	CL

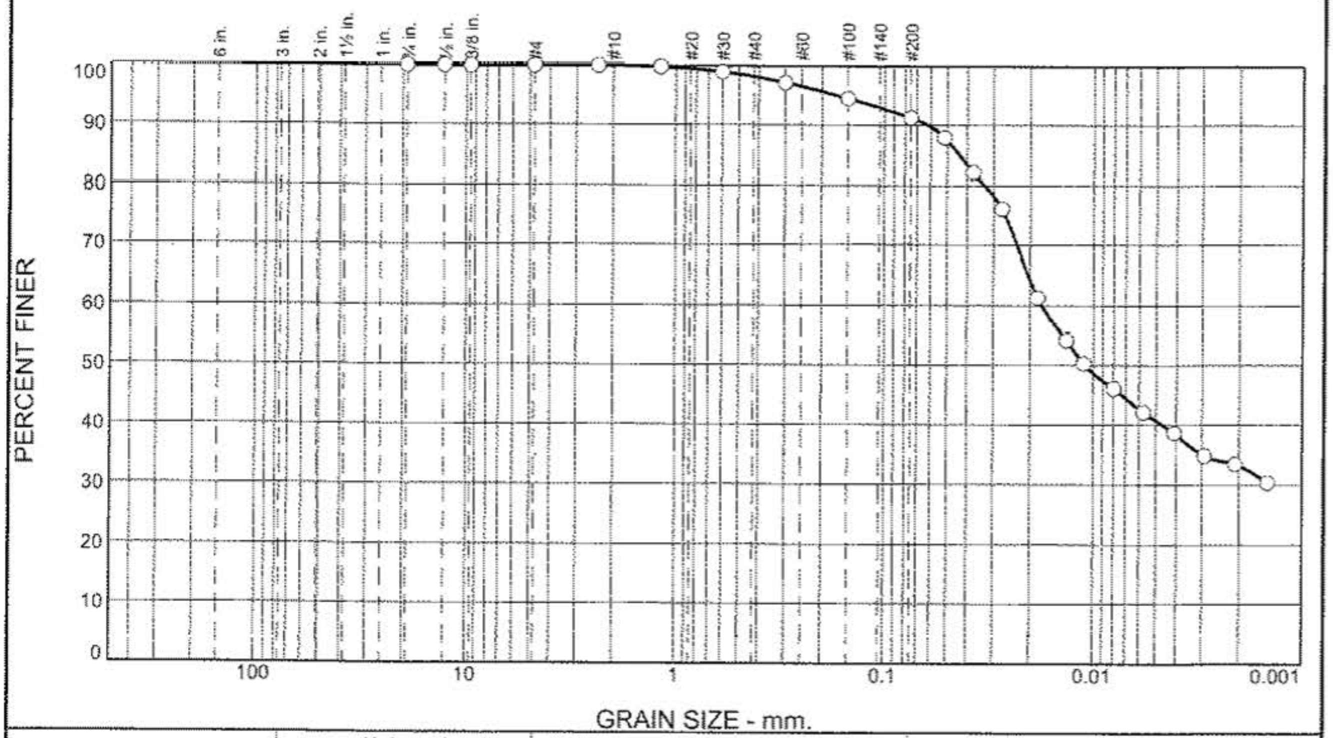
REITZ & JENS, INC.
CONSULTING ENGINEERS

Client: Gredell Engineering Resources, Inc
Project: AECI-THEC Pond 001, Cell 2

Project No.: 2014120901 **Figure**

Tested By: J. Crose **Checked By:** K. Kocher, P.E.

Particle Size Distribution Report - ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	1.8	6.9	50.6	40.7

Test Results (ASTM D 422 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4	100.0		
1/2	100.0		
3/8	100.0		
#4	100.0		
#8	100.0		
#16	99.8		
#30	98.9		
#50	97.2		
#100	94.5		
#200	91.3		
0.0516 mm.	88.1		
0.0376 mm.	82.2		
0.0274 mm.	76.0		
0.0185 mm.	61.3		
0.0135 mm.	54.2		
0.0112 mm.	50.3		
0.0080 mm.	46.2		
0.0057 mm.	42.2		
0.0041 mm.	38.6		
0.0029 mm.	34.8		
0.0021 mm.	33.4		
0.0015 mm.	30.4		

* (no specification provided)

Material Description

Atterberg Limits (ASTM D 4318)

PL= 19 **LL=** 48 **PI=** 29

Classification

USCS (D 2487)= CL **AASHTO (M 145)=** A-7-6(28)

Coefficients

D_{90}= 0.0613 D_{85}= 0.0436 D_{60}= 0.0177

D_{50}= 0.0109 D_{30}= D_{15}=

D_{10}= C_u= C_c=

Remarks

Date Received: 9-18-14 **Date Tested:** 09-23-14

Tested By: J. Crose

Checked By: K. Kocher, P.E.

Title: Project Engineer

Source of Sample: B-1 **Depth:** 4.0 **Date Sampled:**

Sample Number: SS-2

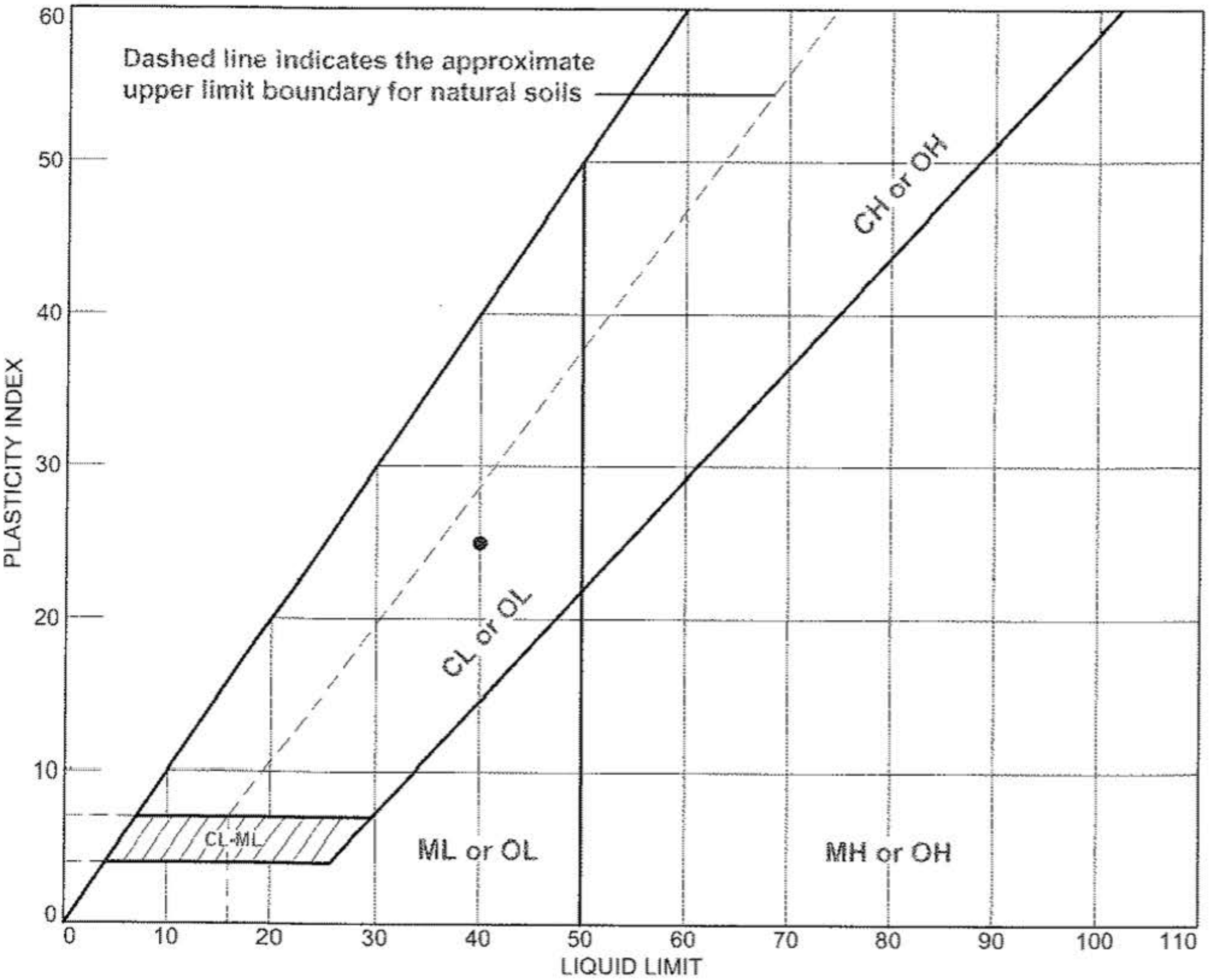
REITZ & JENS, INC.
CONSULTING ENGINEERS

Client: Gredell Engineering Resources, Inc

Project: AECI-THEC Pond 001, Cell 2

Project No: 2014120901 **Figure**

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	B-1	SS-3	6.5	16.8	15	40	25	CL

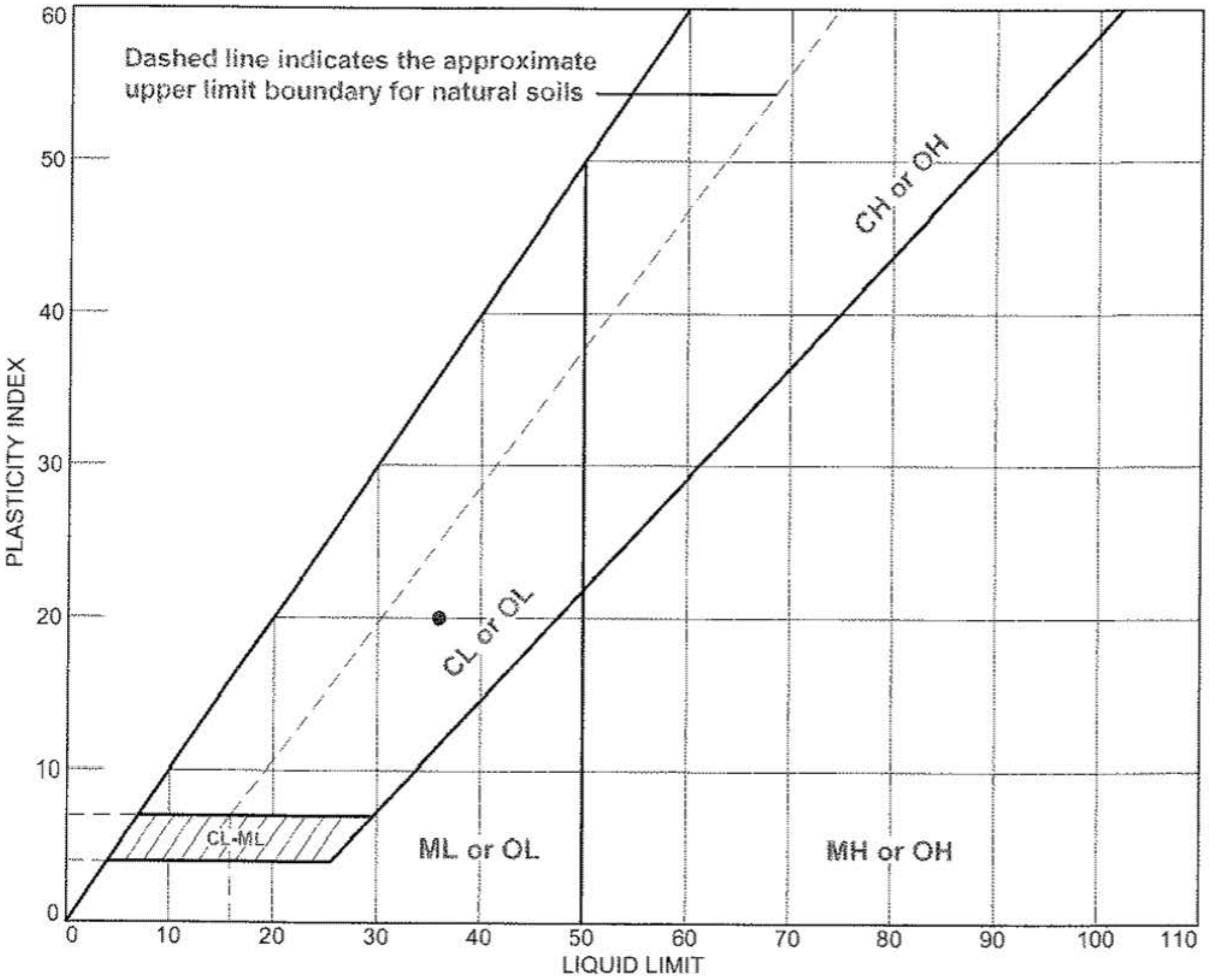
REITZ & JENS, INC.
CONSULTING ENGINEERS

Client: Gredell Engineering Resources, Inc
Project: AECI-THEC Pond 001, Cell 2

Project No.: 2014120901 **Figure**

Tested By: J. Pruett **Checked By:** K. Kocher, P.E.

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	B-1	SS-4	9.0	21.3	16	36	20	CL

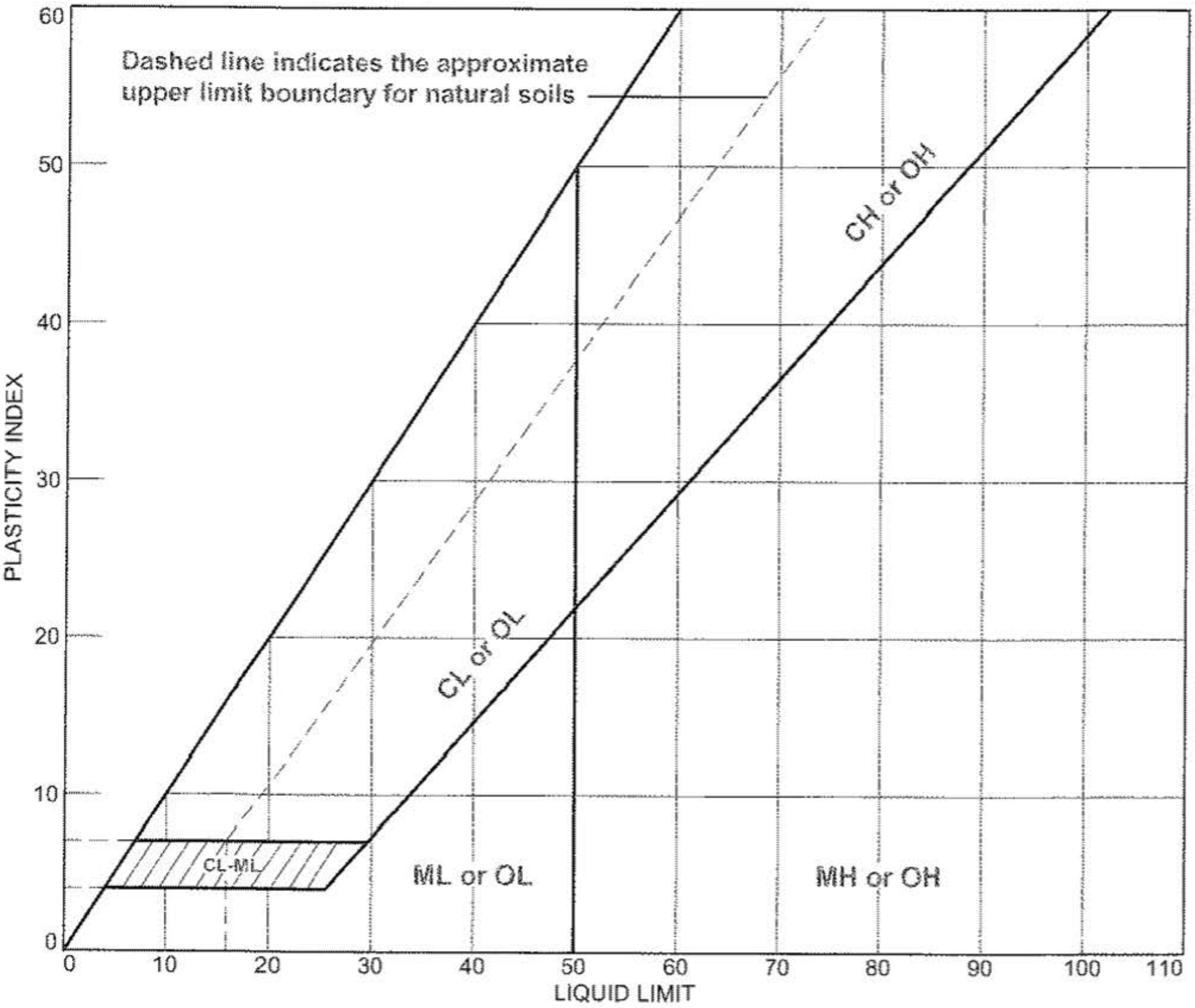
REITZ & JENS, INC.
CONSULTING ENGINEERS

Client: Gredell Engineering Resources, Inc
Project: AECI-THEC Pond 001, Cell 2

Project No.: 2014120901 **Figure**

Tested By: J. Pruett **Checked By:** K. Kocher, P.E.

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

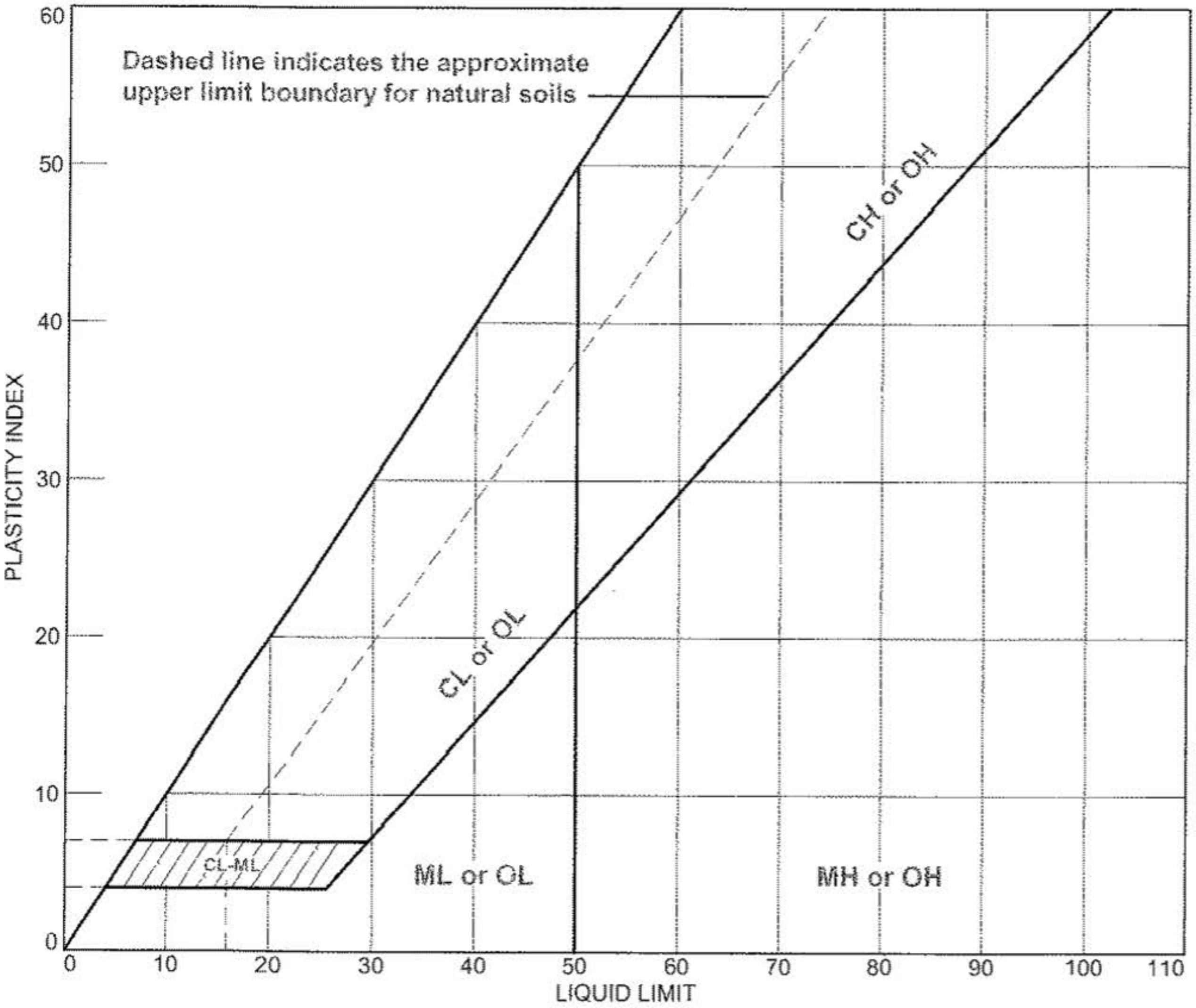
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	B-1	SS-5	11.5	19.4				

REITZ & JENS, INC.
CONSULTING ENGINEERS

Client: Gredell Engineering Resources, Inc
Project: AECI-THEC Pond 001, Cell 2

Project No.: 2014120901 **Figure**

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

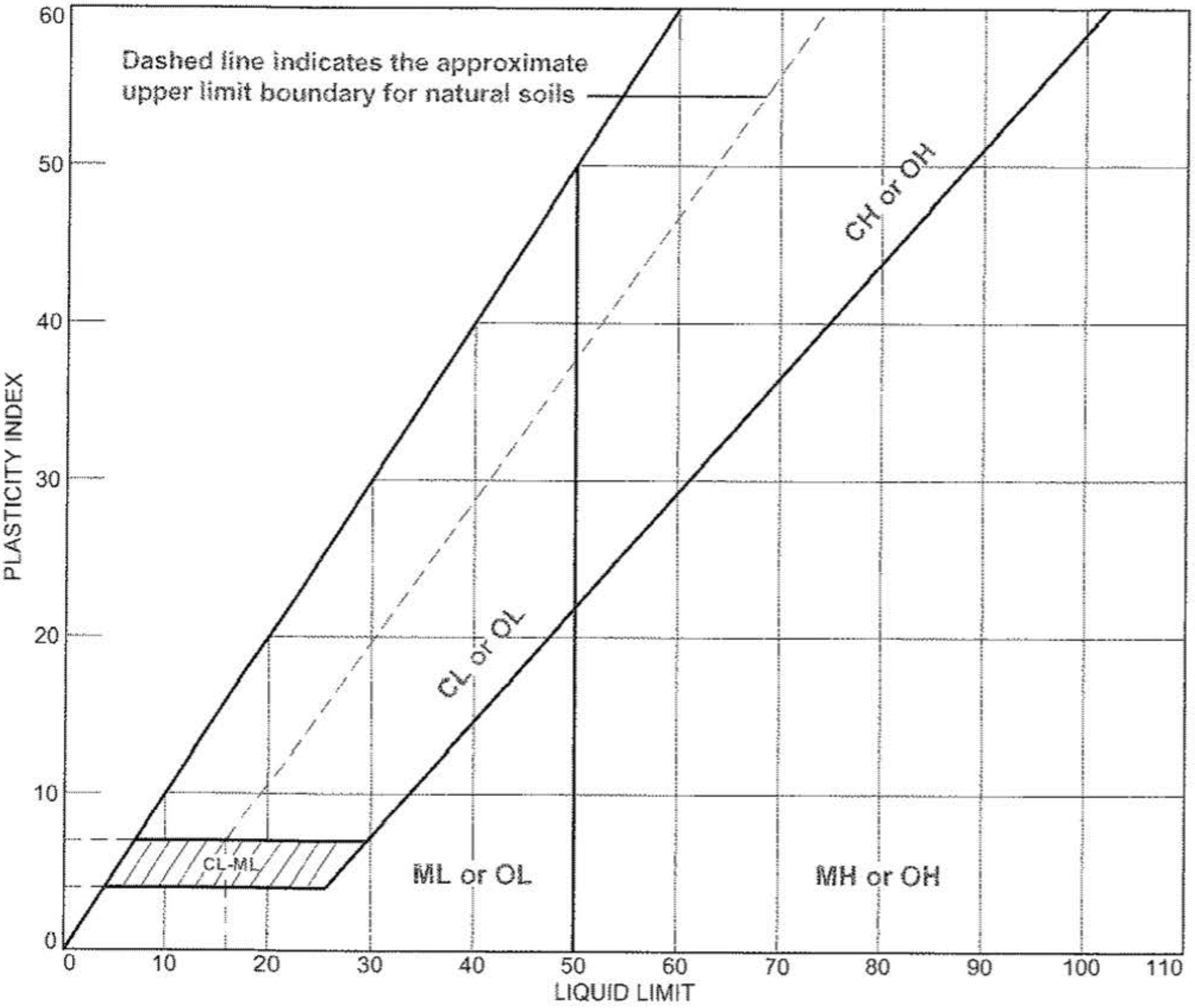
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	B-1	SS-6	14.0	19.5				

REITZ & JENS, INC.
CONSULTING ENGINEERS

Client: Gredell Engineering Resources, Inc
Project: AECI-THEC Pond 001, Cell 2

Project No.: 2014120901 **Figure**

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

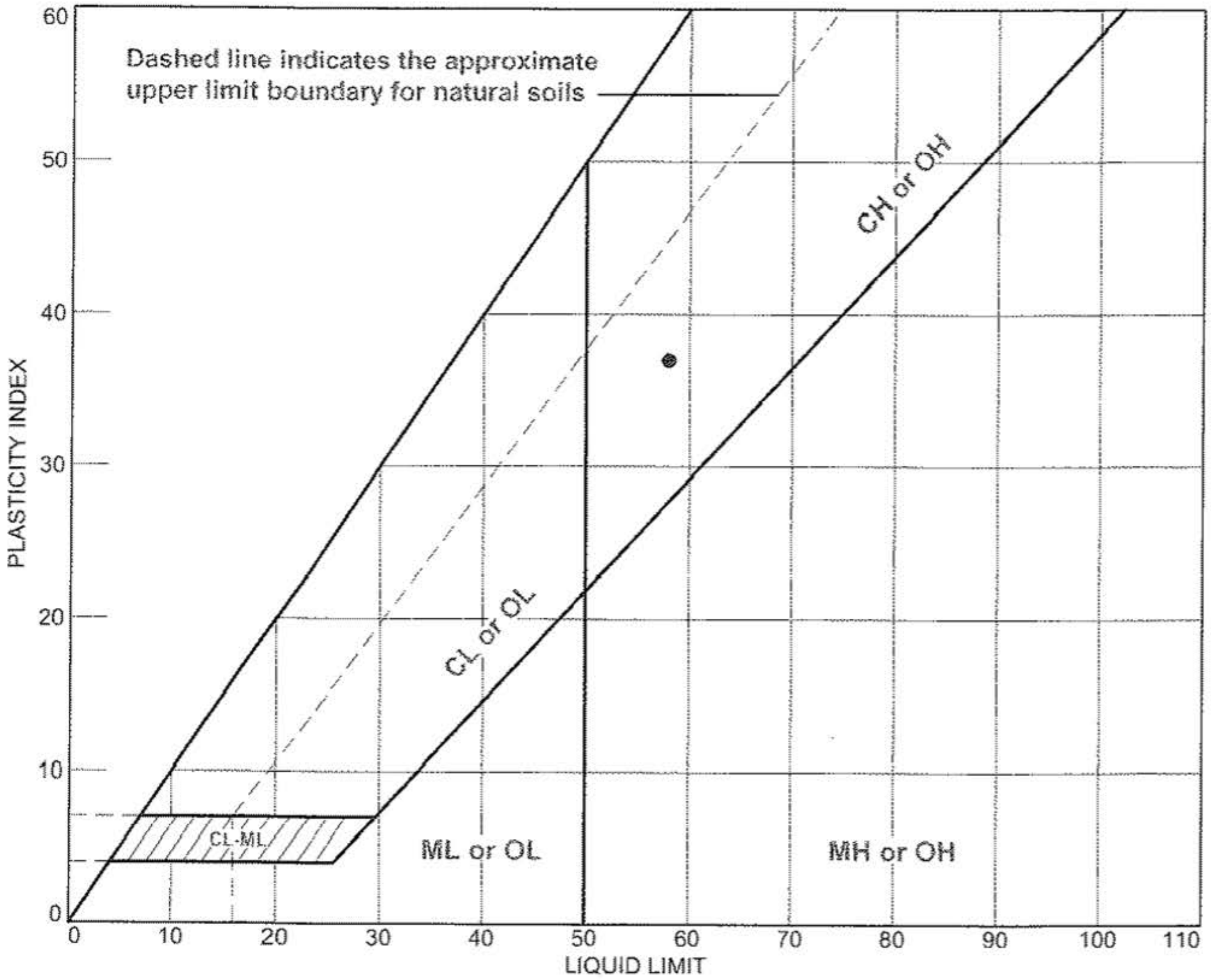
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	B-1	SS-7	16.5	14.7				

REITZ & JENS, INC.
CONSULTING ENGINEERS

Client: Gredell Engineering Resources, Inc
Project: AECI-THEC Pond 001, Cell 2

Project No.: 2014120901 **Figure**

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA								
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	B-2	SS-1	1.5	22.1	21	58	37	CH

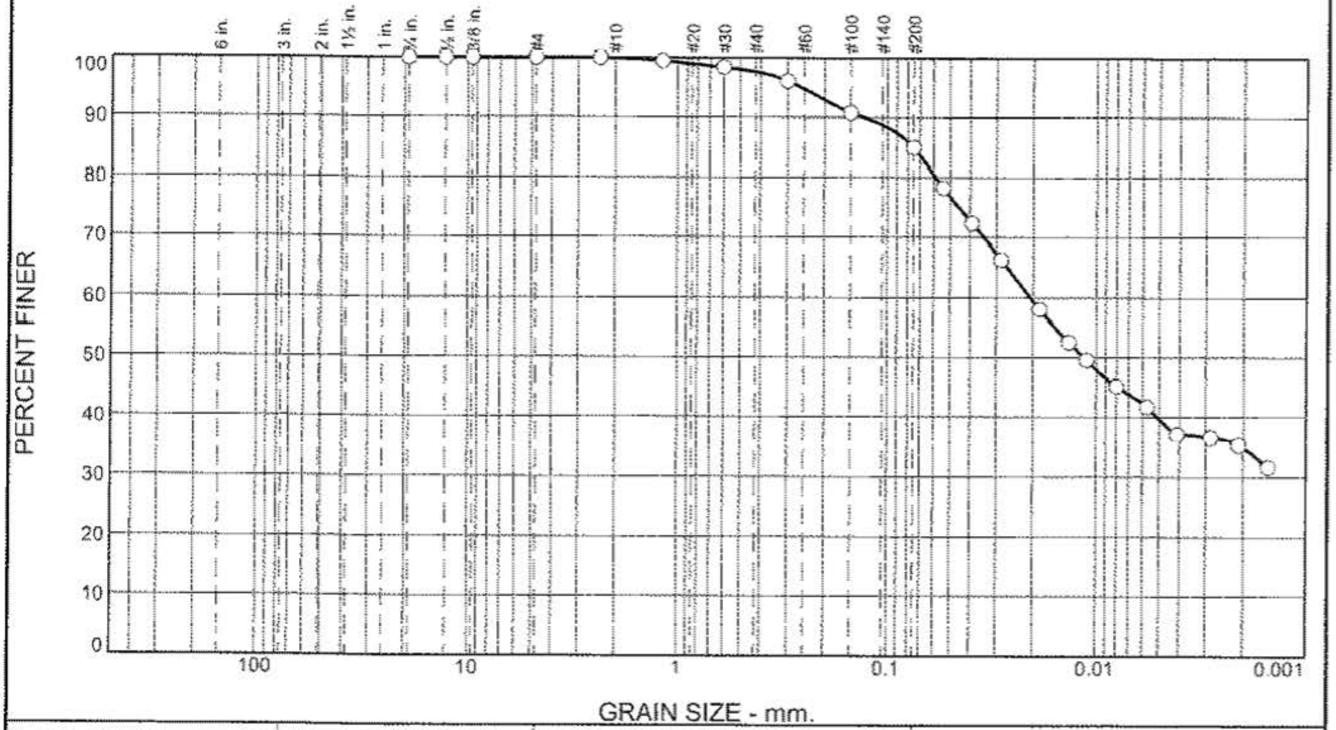
REITZ & JENS, INC.
CONSULTING ENGINEERS

Client: Gredell Engineering Resources, Inc
Project: AECI-THEC Pond 001, Cell 2

Project No.: 2014120901 **Figure**

Tested By: J. Crose **Checked By:** K. Kocher, P.E.

Particle Size Distribution Report - ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.1	2.3	12.6	45.3	39.7

Test Results (ASTM D 422 & ASTM D 1140)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4	100.0		
1/2	100.0		
3/8	100.0		
#4	100.0		
#8	100.0		
#16	99.4		
#30	98.4		
#50	96.1		
#100	90.8		
#200	85.0		
0.0541 mm.	78.2		
0.0393 mm.	72.3		
0.0285 mm.	66.4		
0.0187 mm.	58.1		
0.0135 mm.	52.5		
0.0111 mm.	49.5		
0.0080 mm.	45.2		
0.0057 mm.	41.7		
0.0041 mm.	37.1		
0.0029 mm.	36.5		
0.0021 mm.	35.4		
0.0015 mm.	31.6		

* (no specification provided)

Material Description

Atterberg Limits (ASTM D 4318)

PL= 21 **LL=** 58 **PI=** 37

Classification

USCS (D 2487)= CH **AASHTO (M 145)=** A-7-6(33)

Coefficients

D_{90}= 0.1298 D_{85}= 0.0750 D_{60}= 0.0207
D_{50}= 0.0115 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 9-18-14 **Date Tested:** 09-19-14

Tested By: J. Crose

Checked By: K. Kocher, P.E.

Title: Engineer

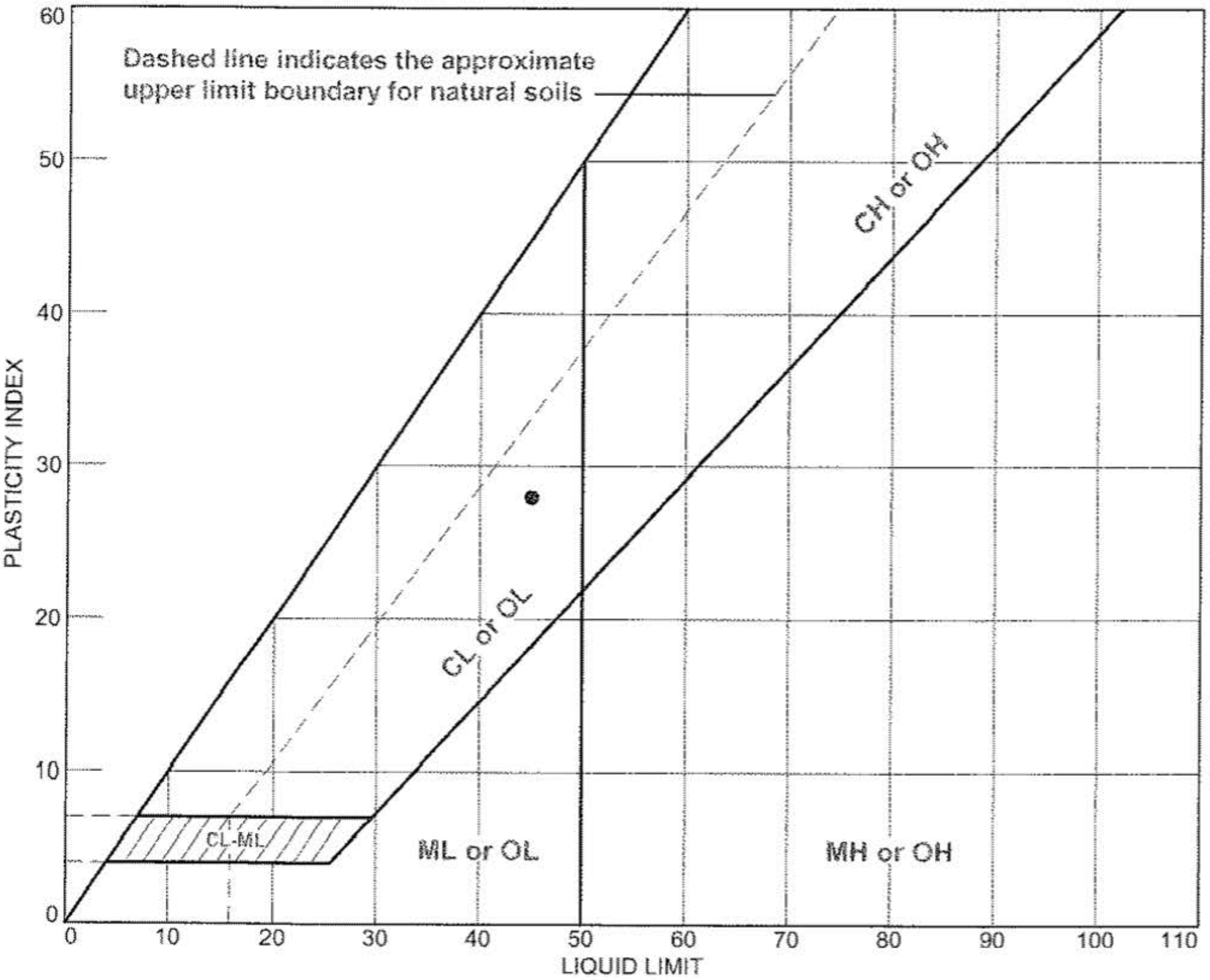
Source of Sample: B-2 **Depth:** 1.5 **Date Sampled:**
Sample Number: SS-1

REITZ & JENS, INC.
CONSULTING ENGINEERS

Client: Gredell Engineering Resources, Inc
Project: AECI-THEC Pond 001, Cell 2

Project No: 2014120901 **Figure**

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

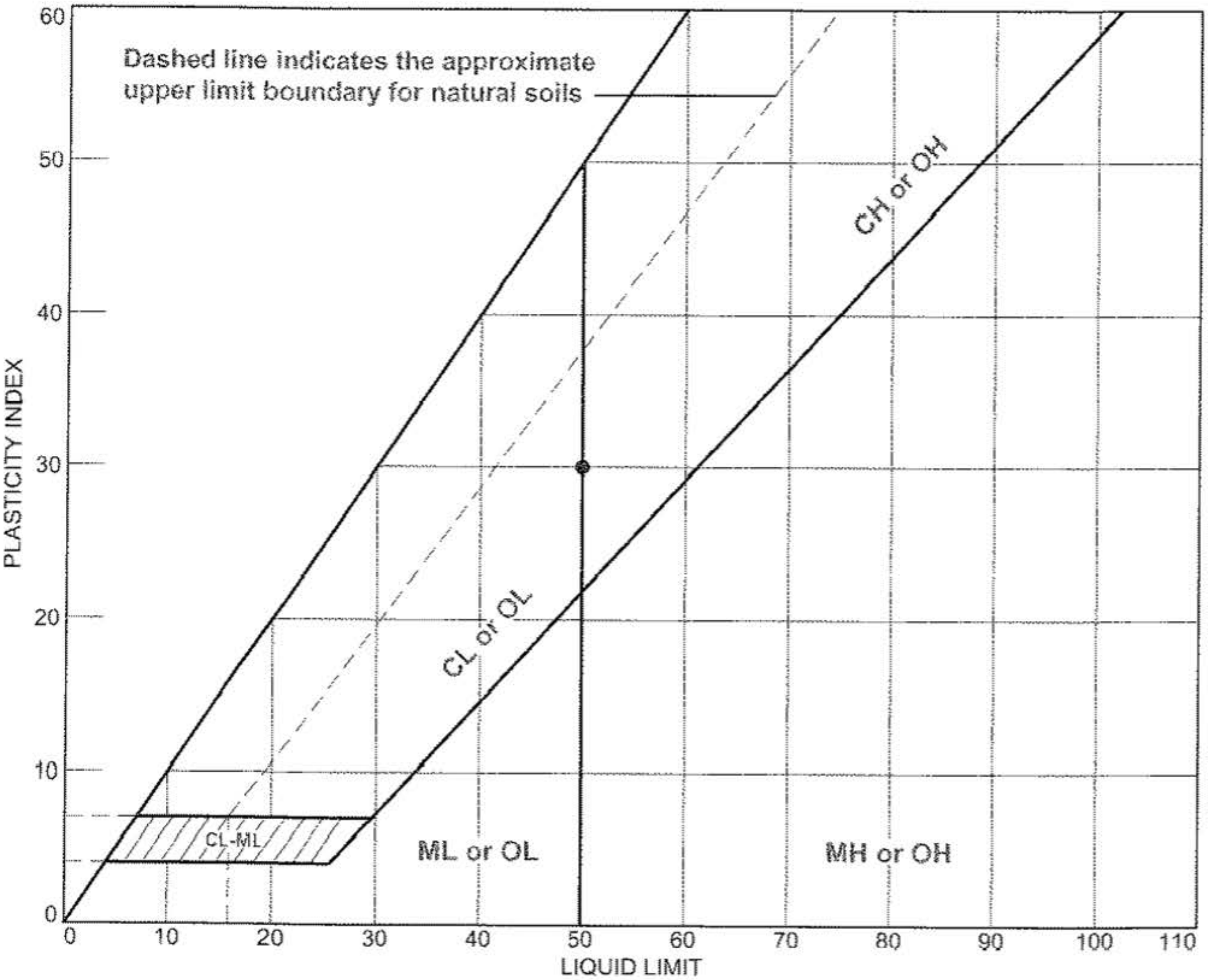
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	B-2	SS-2	4.0	23.7	17	45	28	CL

REITZ & JENS, INC.
CONSULTING ENGINEERS

Client: Gredell Engineering Resources, Inc
Project: AECI-THEC Pond 001, Cell 2
Project No.: 2014120901 **Figure**

Tested By: J. Crose **Checked By:** K. Kocher, P.E.

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	B-2	ST-3	6.5	21.8	20	50	30	CH

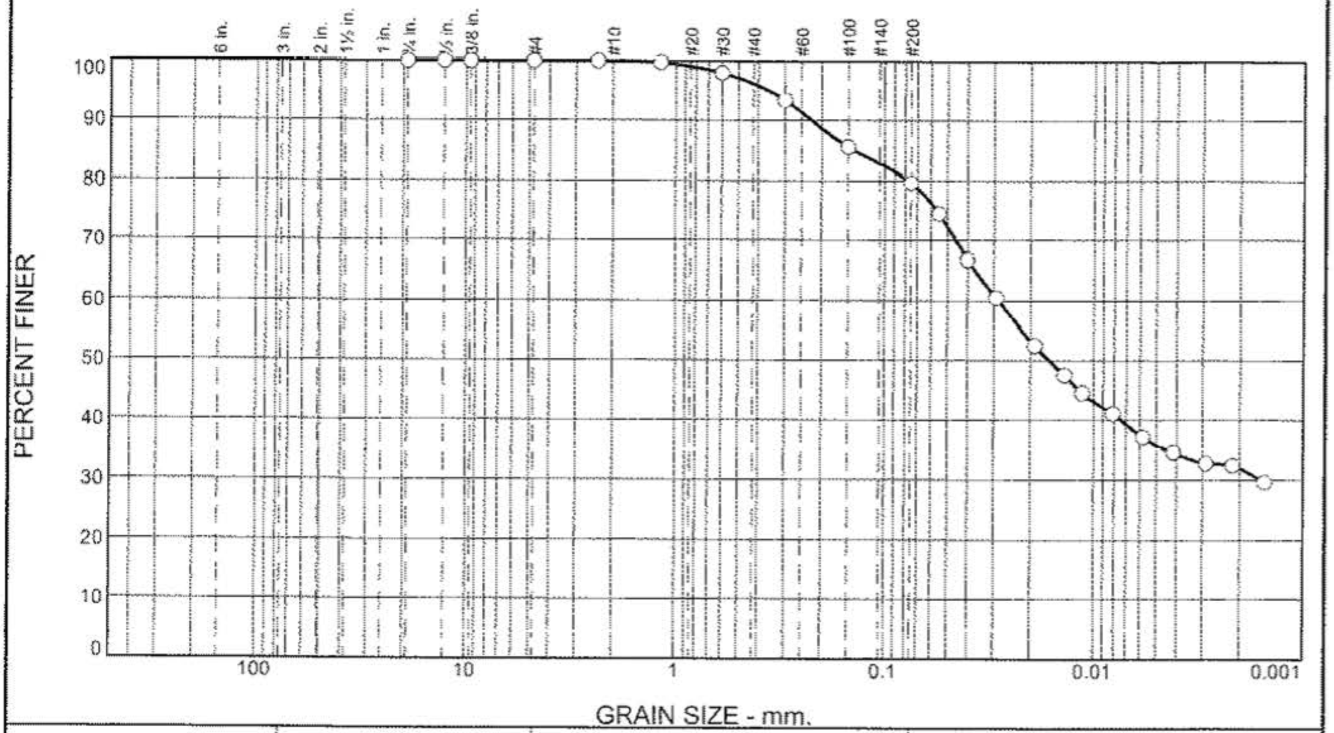
REITZ & JENS, INC.
CONSULTING ENGINEERS

Client: Gredell Engineering Resources, Inc
Project: AECI-THEC Pond 001, Cell 2

Project No.: 2014120901 **Figure**

Tested By: J. Crose **Checked By:** K. Kocher, P.E.

Particle Size Distribution Report - ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	3.8	16.5	43.9	35.8

Test Results (ASTM D 422 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4	100.0		
1/2	100.0		
3/8	100.0		
#4	100.0		
#8	100.0		
#16	99.7		
#30	97.9		
#50	93.4		
#100	85.6		
#200	79.7		
0.0550 mm.	74.4		
0.0403 mm.	66.9		
0.0292 mm.	60.5		
0.0191 mm.	52.5		
0.0138 mm.	47.6		
0.0114 mm.	44.6		
0.0081 mm.	41.2		
0.0058 mm.	37.1		
0.0042 mm.	34.6		
0.0029 mm.	32.8		
0.0022 mm.	32.4		
0.0015 mm.	29.6		

* (no specification provided)

Material Description

Atterberg Limits (ASTM D 4318)

PL= 20 **LL=** 50 **PI=** 30

Classification

USCS (D 2487)= CH **AASHTO (M 145)=** A-7-6(24)

Coefficients

D_{90}= 0.2217 D_{85}= 0.1395 D_{60}= 0.0284
D_{50}= 0.0162 D_{30}= 0.0016 D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 9-18-14 **Date Tested:** 09-19-14

Tested By: J. Crose

Checked By: K. Kocher, P.E.

Title: Project Engineer

Source of Sample: B-2 **Depth:** 6.5 **Date Sampled:**
Sample Number: ST-3

REITZ & JENS, INC.
CONSULTING ENGINEERS

Client: Gredell Engineering Resources, Inc
Project: AECI-THEC Pond 001, Cell 2

Project No: 2014120901 **Figure**

Gredell; AECI-THEC
Pond 001, Cell #2
B-2, ST-3, 6.5'-8.0'
Hydraulic Conductivity

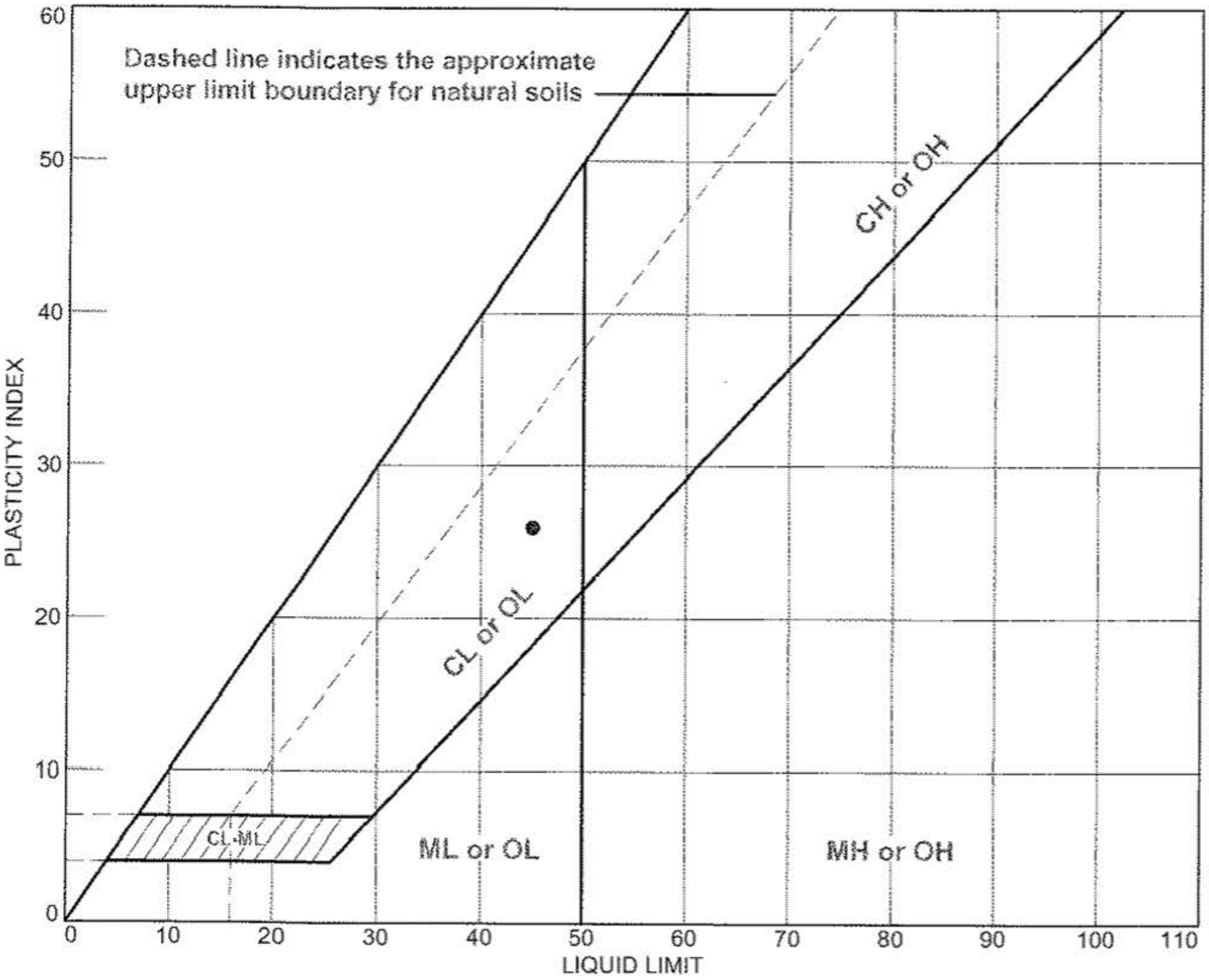
Soil Conditions	
Pre-test conditions	**Post-test Conditions**
Wet Density = 126.8 (lbs/ft^3)	Wet Density = 128.0 (lbs/ft^3)
% Moisture = 21.8%	% Moisture = 23.8%
Dry Density = 104.1 (lbs/ft^3)	Dry Density = 103.0 (lbs/ft^3)

Test Information	
a (cm^2)=	0.1969
L (cm)=	3.5408
A (cm^2)=	20.0997989

Trial 1														
			Base Burette		Top Burette									
Date and Time	Elapsed Time (seconds)	Cell Burette Reading (ml)	Reading (ml)	Distance from Datum (cm)	Reading (ml)	Distance from Datum (cm)	Total Head Across Sample (cm of water)	Temperature (°C)	Weighed Average Temp. (°C)	Uncorrected Hydraulic Conductivity (cm/sec)	Correction Factor	Cumulative Time (sec)	Corrected Hydraulic Conductivity (cm/sec)
9/24/14 8:25	0	17.1	10.00	27.200	0.00	78.000	121.158	21.9					
9/24/14 8:46	1260	17.1	8.96	32.483	1.04	72.717	110.592	22	21.95	1.25E-06	0.9544733	1260	1.20E-06
9/24/14 9:06	2460	17.1	8.08	36.954	1.94	68.145	101.549	22.1	22.00	1.24E-06	0.9533218	2460	1.19E-06
9/24/14 9:25	3600	17.1	7.32	40.814	2.70	64.284	93.828	22.3	22.06	1.23E-06	0.9518862	3600	1.17E-06
9/24/14 9:45	4800	17.0	6.54	44.777	3.46	60.423	86.004	22.2	22.11	1.24E-06	0.9508323	4800	1.18E-06
9/24/14 10:05	6000	17.0	5.88	48.130	4.12	57.070	79.299	22.3	22.14	1.22E-06	0.9502009	6000	1.16E-06
9/24/14 10:25	7200	17.1	5.28	51.178	4.72	54.022	73.203	22.4	22.17	1.21E-06	0.9494067	7200	1.15E-06
9/24/14 10:45	8400	17.0	4.72	54.022	5.28	51.178	67.513	22.3	22.20	1.21E-06	0.9488401	8400	1.15E-06
9/24/14 11:06	9660	17.1	4.20	56.664	5.80	48.536	62.230	22.4	22.22	1.20E-06	0.9483971	9660	1.13E-06

Hydraulic Conductivity= 1.1E-06

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	B-2	SS-4	9.0	21.5	19	45	26	CL

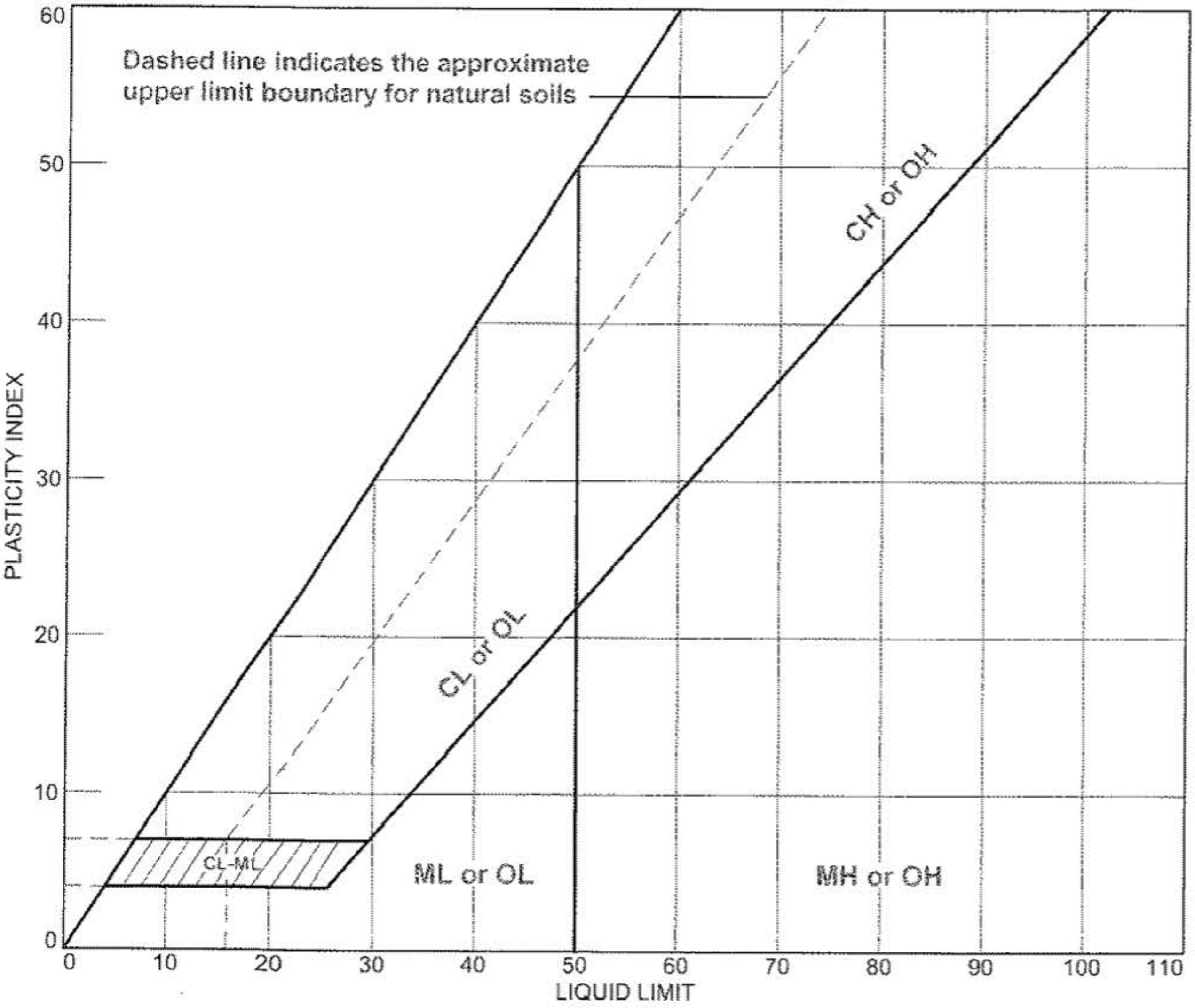
REITZ & JENS, INC.
CONSULTING ENGINEERS

Client: Gredell Engineering Resources, Inc
Project: AECI-THEC Pond 001, Cell 2

Project No.: 2014120901 **Figure**

Tested By: J. Crose **Checked By:** K. Kocher, P.E.

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

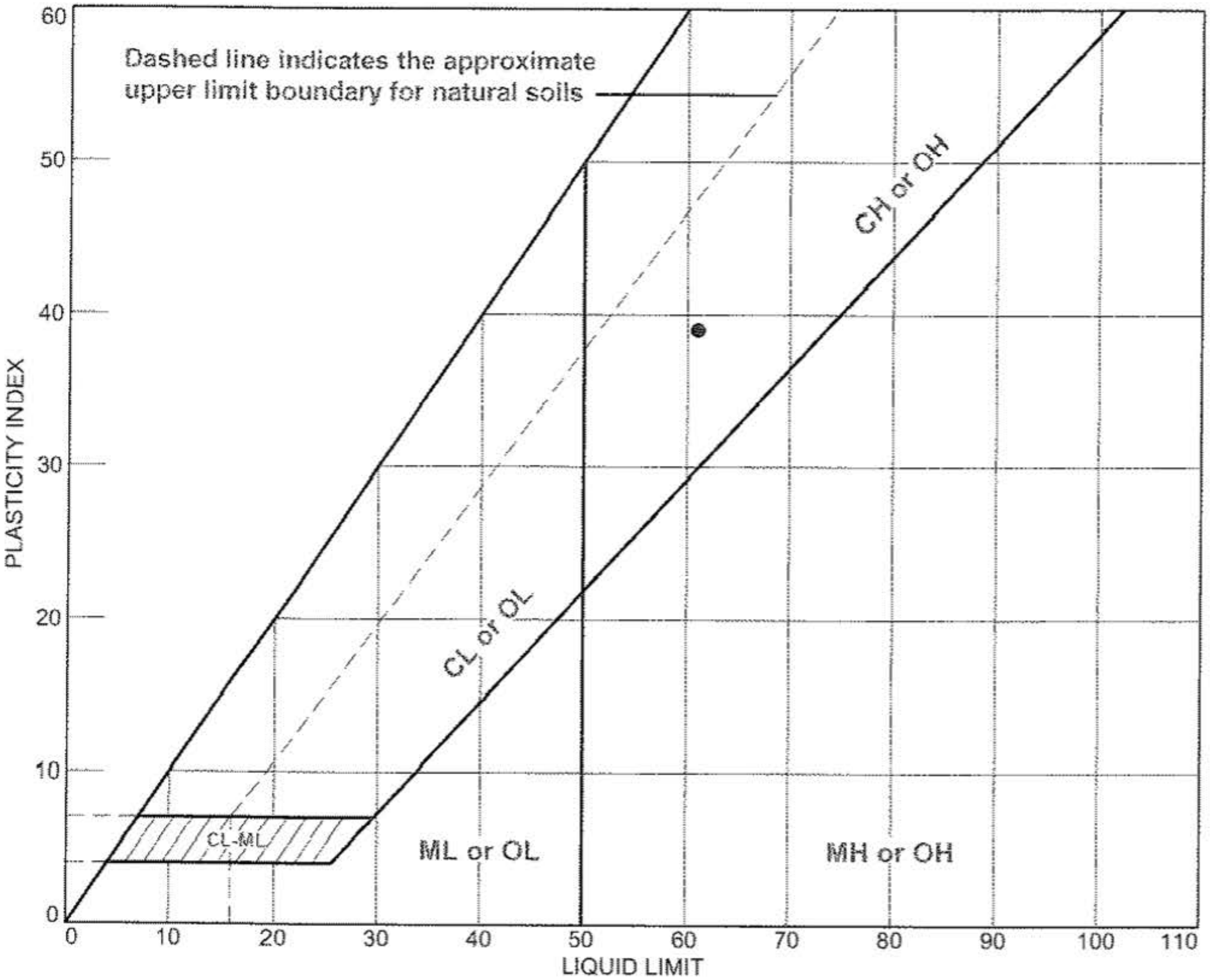
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	B-2	SS-5	11.5	24.7				

REITZ & JENS, INC.
CONSULTING ENGINEERS

Client: Gredell Engineering Resources, Inc
Project: AECI-THEC Pond 001, Cell 2

Project No.: 2014120901 **Figure**

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA								
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	B-3	SS-2	4.0	25.9	22	61	39	CH

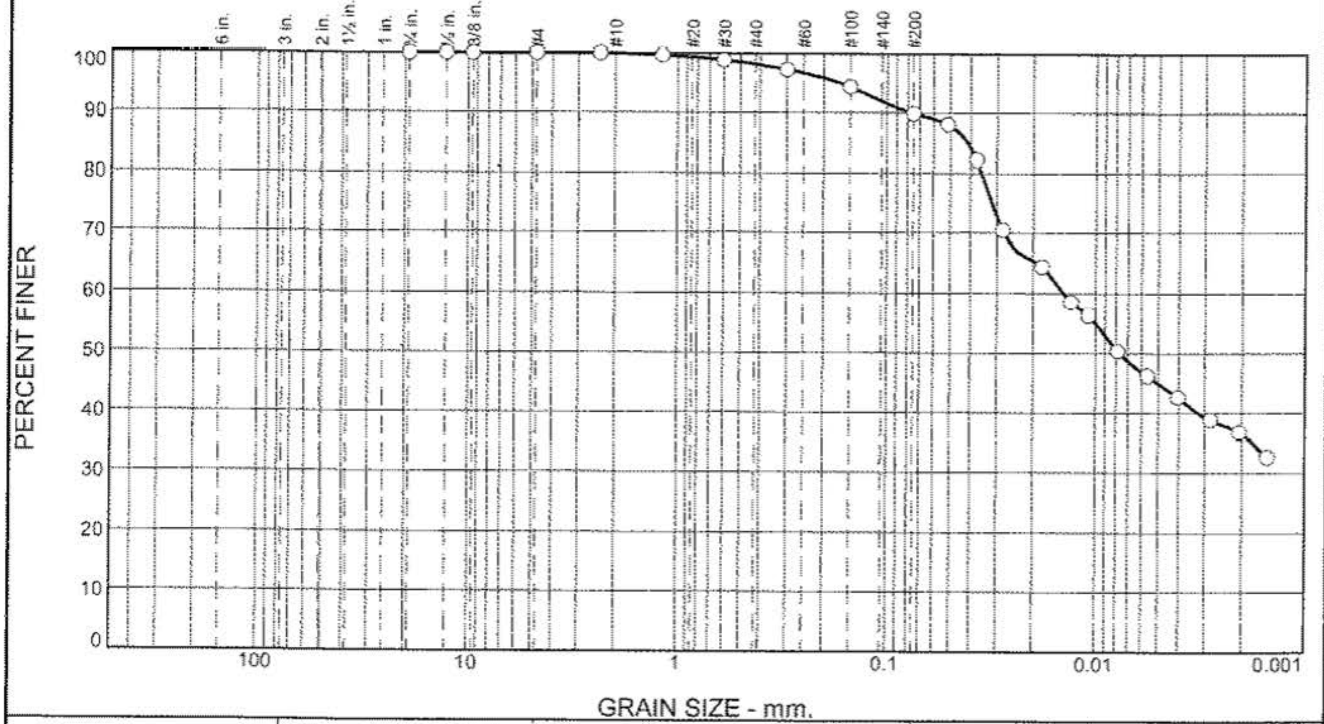
REITZ & JENS, INC.
CONSULTING ENGINEERS

Client: Gredell Engineering Resources, Inc
Project: AECI-THEC Pond 001, Cell 2

Project No.: 2014120901 **Figure**

Tested By: J. Crose **Checked By:** K. Kocher, P.E.

Particle Size Distribution Report - ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	1.8	8.3	44.9	45.0

Test Results (ASTM D 422 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4	100.0		
1/2	100.0		
3/8	100.0		
#4	100.0		
#8	100.0		
#16	99.6		
#30	98.8		
#50	97.3		
#100	94.4		
#200	89.9		
0.0515 mm.	88.2		
0.0375 mm.	82.3		
0.0281 mm.	70.4		
0.0182 mm.	64.5		
0.0132 mm.	58.5		
0.0109 mm.	56.4		
0.0079 mm.	50.4		
0.0056 mm.	46.2		
0.0040 mm.	42.7		
0.0028 mm.	38.9		
0.0021 mm.	36.8		
0.0015 mm.	32.6		

* (no specification provided)

Material Description

Atterberg Limits (ASTM D 4318)

PL= 22 **LL=** 61 **PI=** 39

Classification

USCS (D 2487)= CH **AASHTO (M 145)=** A-7-6(39)

Coefficients

D_{90}= 0.0762 D_{85}= 0.0412 D_{60}= 0.0143
D_{50}= 0.0077 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 9-18-14 **Date Tested:** 09-19-14

Tested By: J. Crose

Checked By: K. Kocher, P.E.

Title: Project Engineer

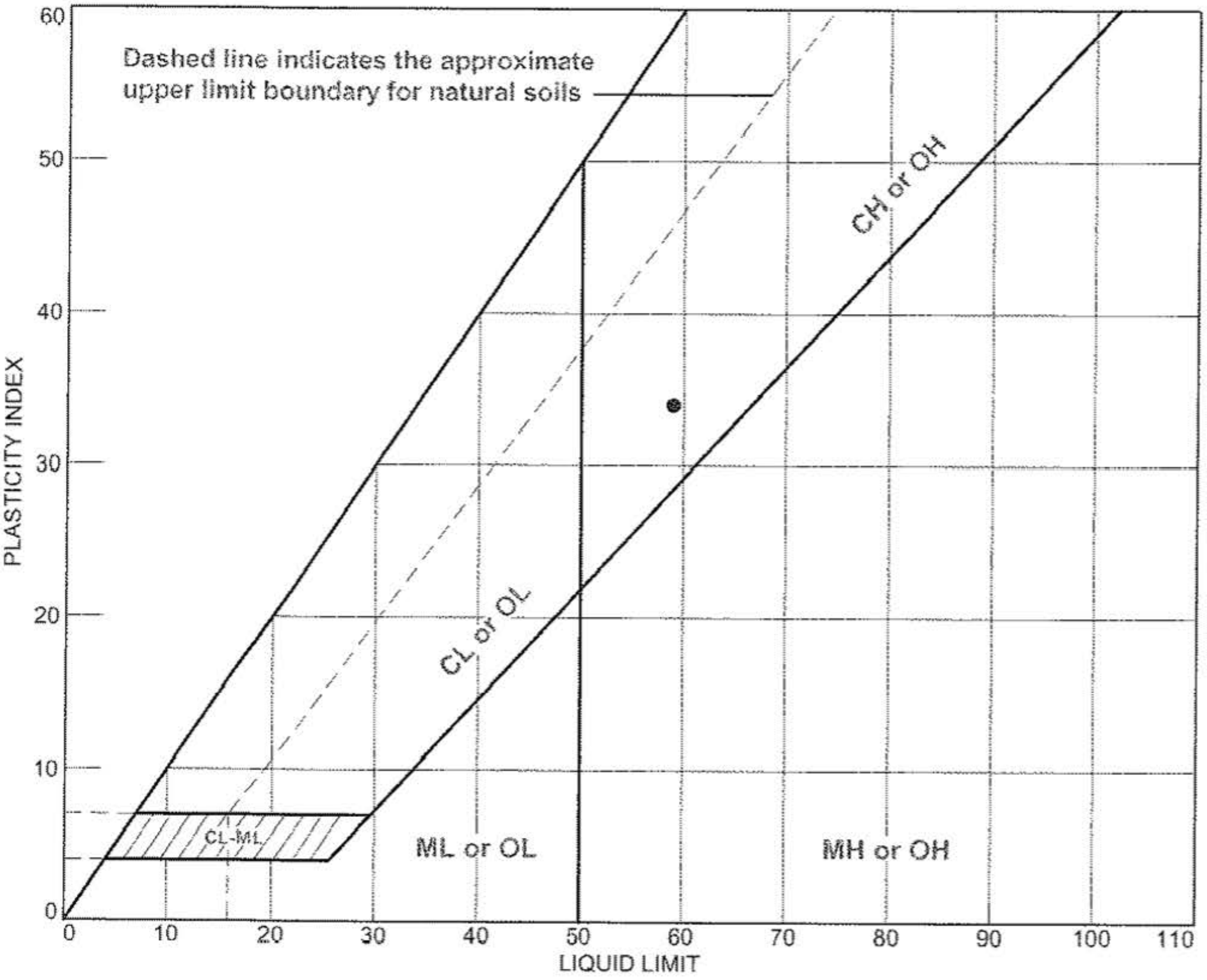
Source of Sample: B-3 **Depth:** 4.0 **Date Sampled:**
Sample Number: SS-2

REITZ & JENS, INC.
CONSULTING ENGINEERS

Client: Gredell Engineering Resources, Inc
Project: AECI-THEC Pond 001, Cell 2

Project No: 2014120901 **Figure**

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	B-3	SS-3	6.5	25.5	25	59	34	CH

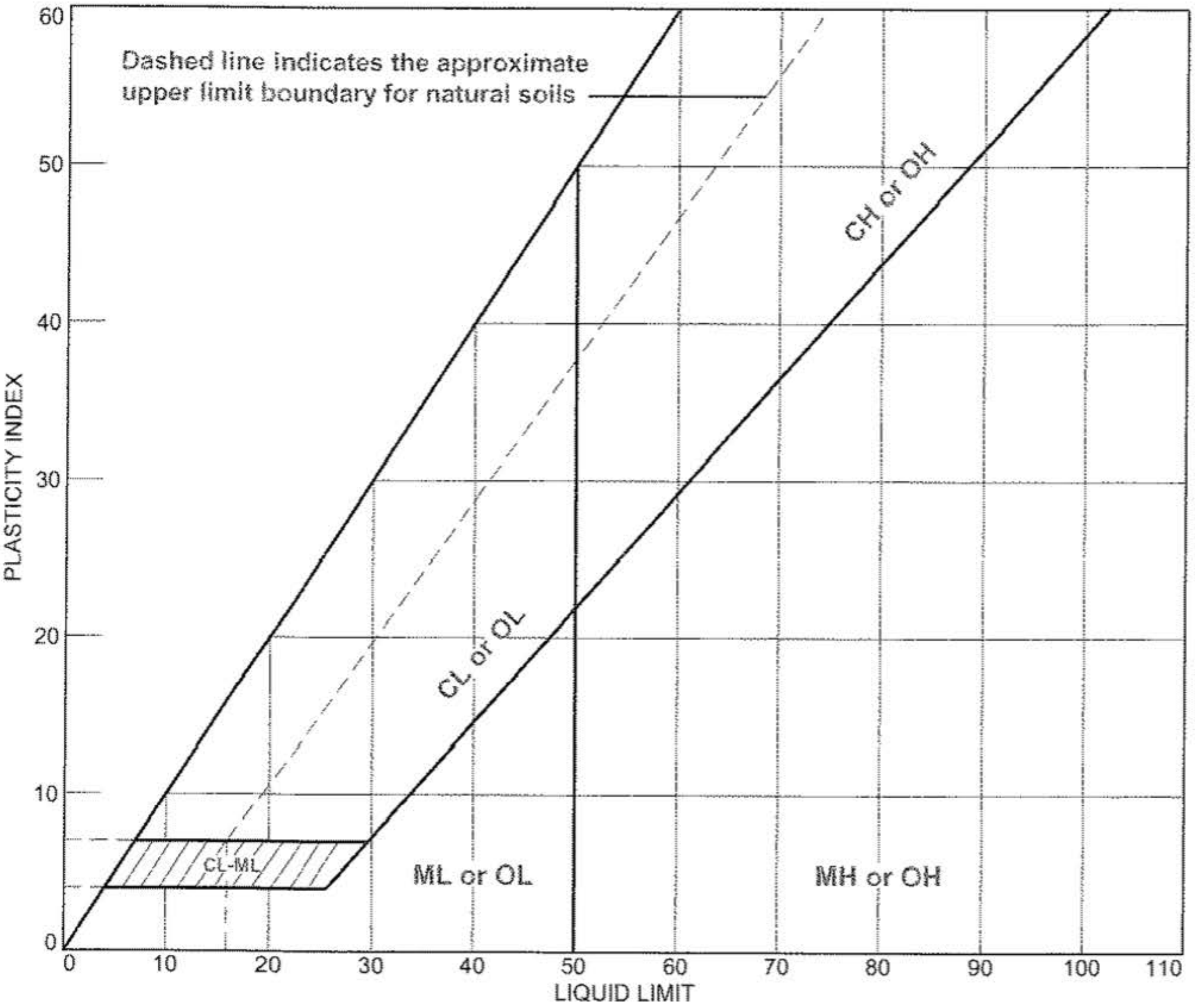
REITZ & JENS, INC.
CONSULTING ENGINEERS

Client: Gredell Engineering Resources, Inc
Project: AECI-THEC Pond 001, Cell 2

Project No.: 2014120901 **Figure**

Tested By: J. Crose **Checked By:** K. Kocher, P.E.

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

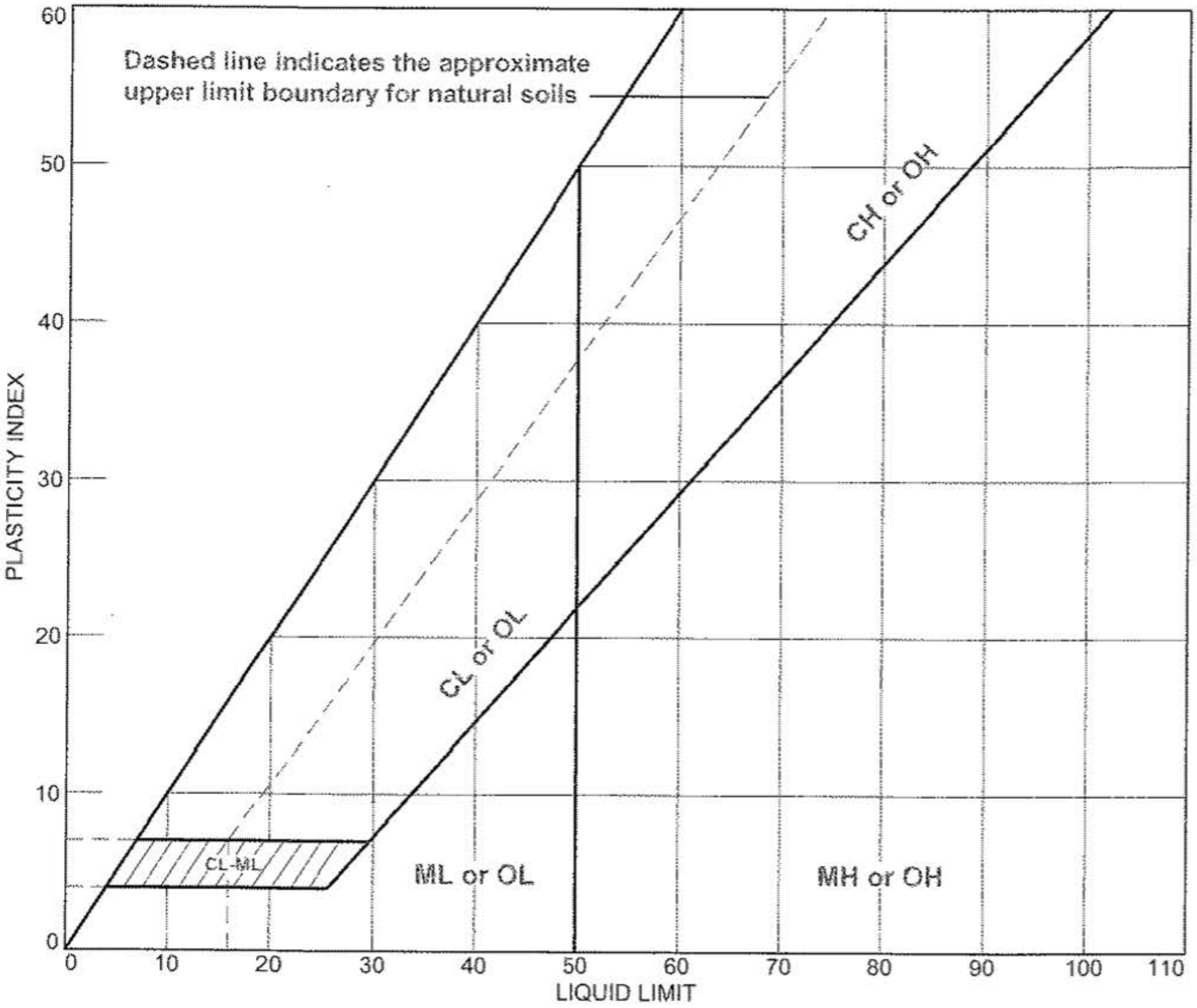
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	B-3	SS-4	9.0	24.2				

REITZ & JENS, INC.
CONSULTING ENGINEERS

Client: Gredell Engineering Resources, Inc
Project: AECI-THEC Pond 001, Cell 2

Project No.: 2014120901 **Figure**

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

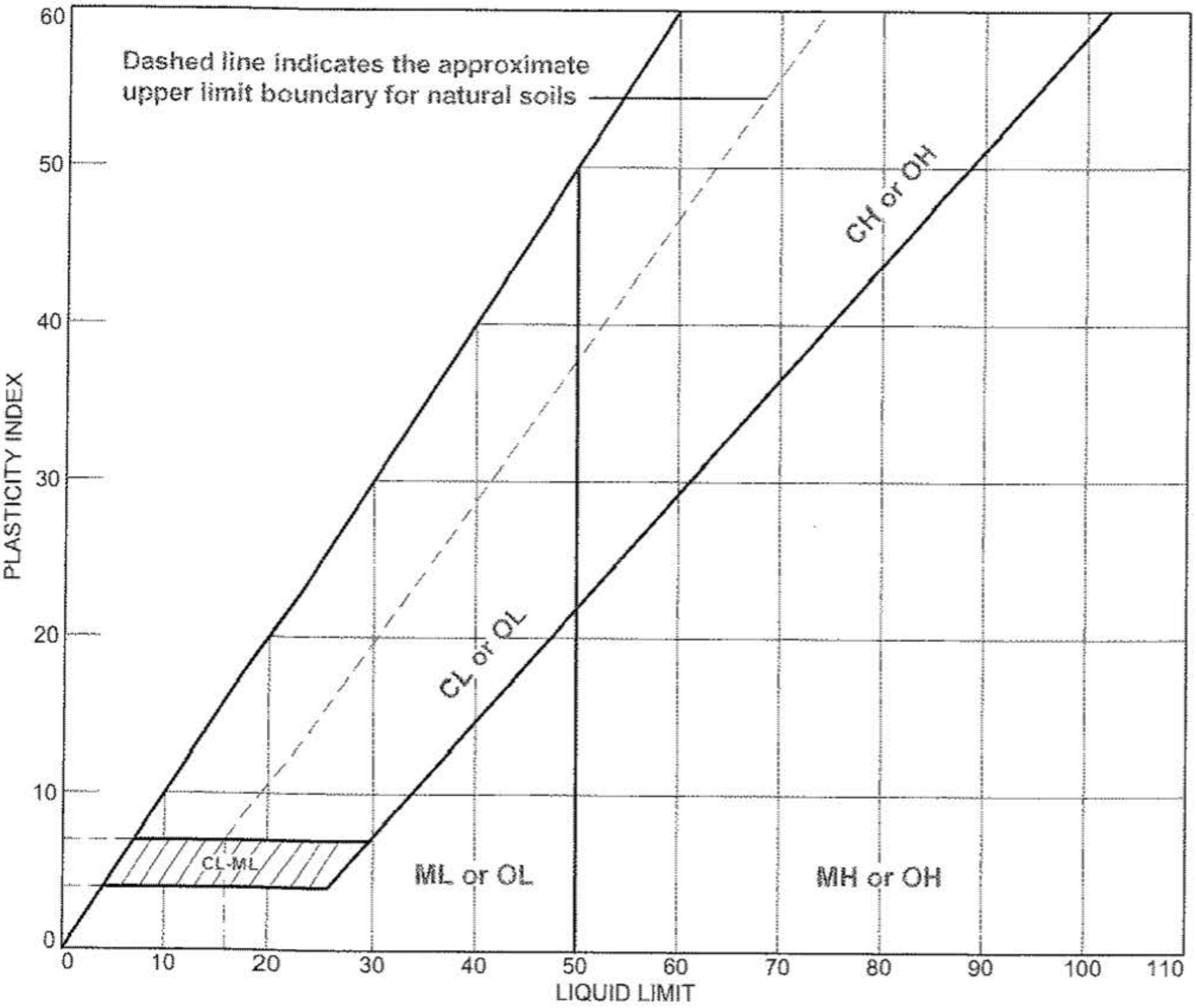
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	B-3	SS-5	11.5	23.5				

REITZ & JENS, INC.
CONSULTING ENGINEERS

Client: Gredell Engineering Resources, Inc
Project: AECI-THEC Pond 001, Cell 2

Project No.: 2014120901 **Figure**

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	B-3	SS-6	14	31.0				

REITZ & JENS, INC.
CONSULTING ENGINEERS

Client: Gredell Engineering Resources, Inc
Project: AECI-THEC Pond 001, Cell 2

Project No.: 2014120901 **Figure**

APPENDIX C

Excerpt from:

Global Stability Evaluation – Mine Waste and Ash Pond Embankments, AECI Facilities

By Geotechnology, Inc., dated April 22, 2010

GLOBAL STABILITY EVALUATION
MINE WASTE AND ASH POND EMBANKMENTS
AECI FACILITIES
BEE VEER AND THOMAS HILL, MISSOURI

Prepared for:

ASSOCIATED ELECTRIC COOPERATIVE, INC.
Springfield, Missouri

Prepared by:

GEOTECHNOLOGY, INC.
St. Louis, Missouri

Geotechnology Project No. J011309.01

April 22, 2010

Unless noted on the logs, the lines designating the changes between various strata represent approximate boundaries. The transition between materials may be gradual or may occur between recovered samples. The stratification given on the logs, or described herein, is for use by Geotechnology in its analyses and should not be used as the basis of design or construction cost estimates without realizing that there can be variation from that shown or described.

The logs and related information depict subsurface conditions only at the specific locations and times where sampling was conducted. The passage of time may result in changes in conditions, interpreted to exist, at or between the locations where sampling was conducted.

LABORATORY TESTING

Laboratory testing was performed to estimate pertinent engineering and index properties of the soil. Moisture contents were determined for cohesive soil samples, and Atterberg limits tests were accomplished on selected samples. Unconfined compression tests were performed on selected Shelby tube samples. Consolidated-undrained triaxial compression tests were performed on representative samples. Laboratory test results are presented in Appendices B and D.

SECTION III - SUBSURFACE CONDITIONS

STRATIGRAPHY

Bee Veer Facility. Borings D-1 and -2 were drilled at the Bee Veer site. The borings were located at the top and toe of the embankment, respectively. The overburden in Boring-D-1, drilled on the embankment, consists of fill underlain by silty clay. The fill is comprised of 39 feet of silty clay mixed with sand, gravel and coal debris. The percentage of coal debris in the fill varies widely. Representative samples in the fill had unit dry densities from 88 to 107 pounds per cubic foot (pcf). Moisture content percentages ranged from the upper-teens to the low thirties. SPT N-values in the embankment fill varied from 8 to 15 blows per foot (bpf). The natural soil encountered beneath the fill consists of medium stiff, brown and gray, silty clay with sand. The silty clay extends to a depth of approximately 67 feet. In Boring D-2 the surface stratum consists of gray and brown clay, which extends to a depth of 8 feet. Below the clay, approximately 3.5 feet of weathered limestone is present. The limestone is underlain by hard, brown and gray, silty clay to a depth of approximately 16 feet. In both borings the silty clay is underlain by moderately hard, gray shale. Auger refusal occurred in Boring D-1 at a depth of 72 feet, and at a depth of 20.5 feet in Boring D-2.

CPT soundings DC-1 through -3, which were performed along the top of the embankment, indicate the presence of 40 to 43 feet of interlayered silty clay, clay, sandy silt and sandy clay with gravel, which probably is the embankment fill. Below the fill stiff to very stiff, occasionally soft, silty clay to clay is present. CPT soundings DC-4 and -5, which were performed behind the embankment in the mine waste storage area, indicate the presence of 45 to 60 feet of very soft to soft, occasionally stiff, fine-grained soil. Below the mine waste, natural soil comprised of silty clay, clay and silt are present. The natural soil strata in all CPT soundings extended to the cone refusal depths of 66 to 101 feet.

Thomas Hill Facility. Borings C-1 and -2 were drilled at the north and south embankments, respectively. At the north embankment, clay fill with silt and sand is present to a depth of 11 feet. Moisture content of the fill varied between low to mid twenties. SPT N-values ranged from 8 to 11 bpf. Below the fill, interlayered, medium stiff to very stiff, brown and gray clay and silty clay are present. The fine-grained soil extends to the depth of exploration (50feet). The south embankment includes 20 feet of fill. The fill consists of interlayered silty clay and clay. A representative sample in the fill had a unit dry density of 100 pcf. Moisture content ranged from upper teens to mid twenties. The fill is underlain by stiff, brown and gray clay. The clay extends to the top of limestone at a depth of 37 feet. Auger refusal was encountered at 37.2 feet.

The CPT soundings indicate the presence of 37 to 42 feet of stiff to very stiff, silty clay to clay, which is underlain by stiff, clayey to sandy silt. The silt stratum extends to the depth of termination or refusal. The sounding on the south embankment encountered refusal at a depth of 52.6 feet.

GROUNDWATER

Groundwater was not observed in the borings during the subsurface exploration program. Also, the possible groundwater level in two of the borings (i.e. Borings C-1 and D-1) could not be recorded due to the rotary wash technique used in drilling the borings. Rotary wash drilling technique includes the introduction of water into the borehole which masks the presence of groundwater. However, based on the CPT soundings, groundwater at Bee Veer and Thomas Hill appear to be at depths of 46 to 53 feet and 33 to 40 feet, respectively. Groundwater levels shown on the logs may not have stabilized before backfilling, which is typical in less permeable cohesive soil. Consequently, the indicated/lack of observed groundwater levels may not represent present or future levels. Groundwater levels may vary significantly over time due to the effects of seasonal variation in precipitation, recharge, presence of creeks or lakes nearby, or other factors not evident at the time of exploration.

SECTION IV – EMBANKMENT INSPECTIONS AND GLOBAL STABILITY EVALUATION

As part of the embankment evaluation, slope stability analyses were performed. Current topographic plans were not provided. Our analyses are based on topographic plans dated 1998 (Bee Veer) and 2005 (Thomas Hill). Results of the analysis are discussed in subsequent sections.

EMBANKMENT INSPECTIONS

An engineer from Geotechnology visually inspected the existing embankments. Inspection check lists and the photographs of the embankments are included in Appendix E. The photograph locations and viewing directions are shown on Plates 2 and 3. Based on our inspection it appears that the embankments are in stable condition

SLOPE STABILITY ANALYSIS

Slope stability analysis consists of comparing the driving forces within a slope to the resisting forces and determining the factor of safety. Gravity forces tend to move the slope downwards (driving force), while resisting forces derived from the soil shear strength tend to keep the slope in place. When the driving force acting on the slope is greater than the resisting force, sliding can occur. The factor of safety of the slope is the ratio of the restraining force divided by the driving force. Generally, when the factor of safety is 1 or less, the slope is considered to be unstable. The accepted standard in local practice is to have a factor of safety of 1.5 for long-term static stability of a slope, and 1.0 for pseudo-static (seismic loading) and rapid drawdown conditions.

Slope stability analyses were performed for the embankment at Bee Veer and the north and south embankments at Thomas Hill. The locations of typical cross-sections of the embankments are represented by Sections A-A through C-C, and are shown on Plates 2 and 3. Soil properties used in the stability analysis were selected based on laboratory test results, CPT data interpretation and Geotechnology's experience with similar materials. The soil properties used in the models are summarized in the following table:

BEE VEER SOIL PROPERTIES

Soil Type	Density (pcf)	Cohesion (psf)	Friction Angle (°)
Embankment Fill	120	100	28
Silty Clay (CL)	118	50	31
Clay (CH)	120	50	25

THOMAS HILL SOIL PROPERTIES			
Soil Type	**Density (pcf)**	**Cohesion (psf)**	**Friction Angle (°)**
Embankment Fill	120	100	28
Silty Clay (CL)	120	50	27
North Embankment Clay (CH)	120	50	26
South Embankment Clay (CH)	120	50	27

Geotechnology performed stability analysis for deep seated, global failure of the embankments. Representative cross-sections of the embankments are shown on the attached Plates 4 through 15. Since the embankments have been in place for several years, long-term stability of the embankments was analyzed (i.e. effective stress conditions). Based on field observations and CPT data interpretation, groundwater at the Bee Veer embankment was assumed to vary from El 746 at the embankment toe to El 763 behind the embankment. The normal pool levels at the south and north ponds at Thomas Hill were considered to be at El 710 and 724, respectively. A pseudo-static seismic analysis was performed on the typical embankment sections using horizontal and vertical accelerations of 0.04g and 0.02g, respectively, which corresponds to a seismic event with a 90 percent probability of not being exceeded in 50 years (i.e. 1 in every 500 years). The Morgenstern-Price procedure was used to compute factors of safety. The computer program SLOPE/W was used to perform the computations. The calculated factors of safety are given in the following table.

Location	Cross Section	Condition	Calculated F.O.S.	Plate
Bee Veer	A-A'	Static	1.6 and 1.5	4 and 5
		Seismic	1.4 and 1.3	6 and 7
Thomas Hill	B-B'	Static	1.5	8
	(South Embankment)	Rapid Drawdown	1.3	9
	Downstream slope	Seismic	1.3	10
	B-B'	Static	2.6	11
	(South Embankment	Rapid Drawdown	2.0	12
	Upstream slope)	Seismic	2.1	13
	C-C'	Static	2.1	14
	(North Embankment)	Seismic	1.9	15

We recommend a minimum factor of safety of 1.5 for long-term stability. Based on the analyses, the embankments have factors of safety greater than 1.5. During an extreme event, such as an earthquake or the rapid drawdown of the downstream pond due to a dam breach, a factor of safety of 1.0 or more is recommended and it appears that the embankments satisfy the minimum requirements. Geotechnology's zone of investigation only considered analytical surfaces that intersected the crest of the embankment as failure in this zone would result in a breach of the embankment. Analytical surfaces with a lower factor of safety do occur. These surfaces though, are shallow, are contained within the slope of each embankment, and would not result in an embankment breach.

SEISMICITY

The site is located in a region of the country that has a significant seismic risk due to the presence of the New Madrid Seismic Zone (NMSZ) in southeastern Missouri. The NMSZ is the site of three of the largest magnitude earthquake events (estimated surface-wave magnitudes greater than or equal to 8.0) to strike North America in recorded history (December 1811 through February 1812).

Based on data given in "Standard Specifications for Highway Bridges" adapted by the American Association of State Highway and Transportation Officials (2002), the bedrock acceleration at the site is anticipated to be about 4 percent of gravity. The acceleration given herein was obtained from the gravity contours given in Figure 1-5 of the referenced publication. The acceleration corresponds to a seismic event with a 90 percent probability of not being exceeded in 50 years. The soil profile at the site can be classified as Type I. Hence, the site coefficient, S, is 1.0.

SECTION V - LIMITATIONS OF REPORT

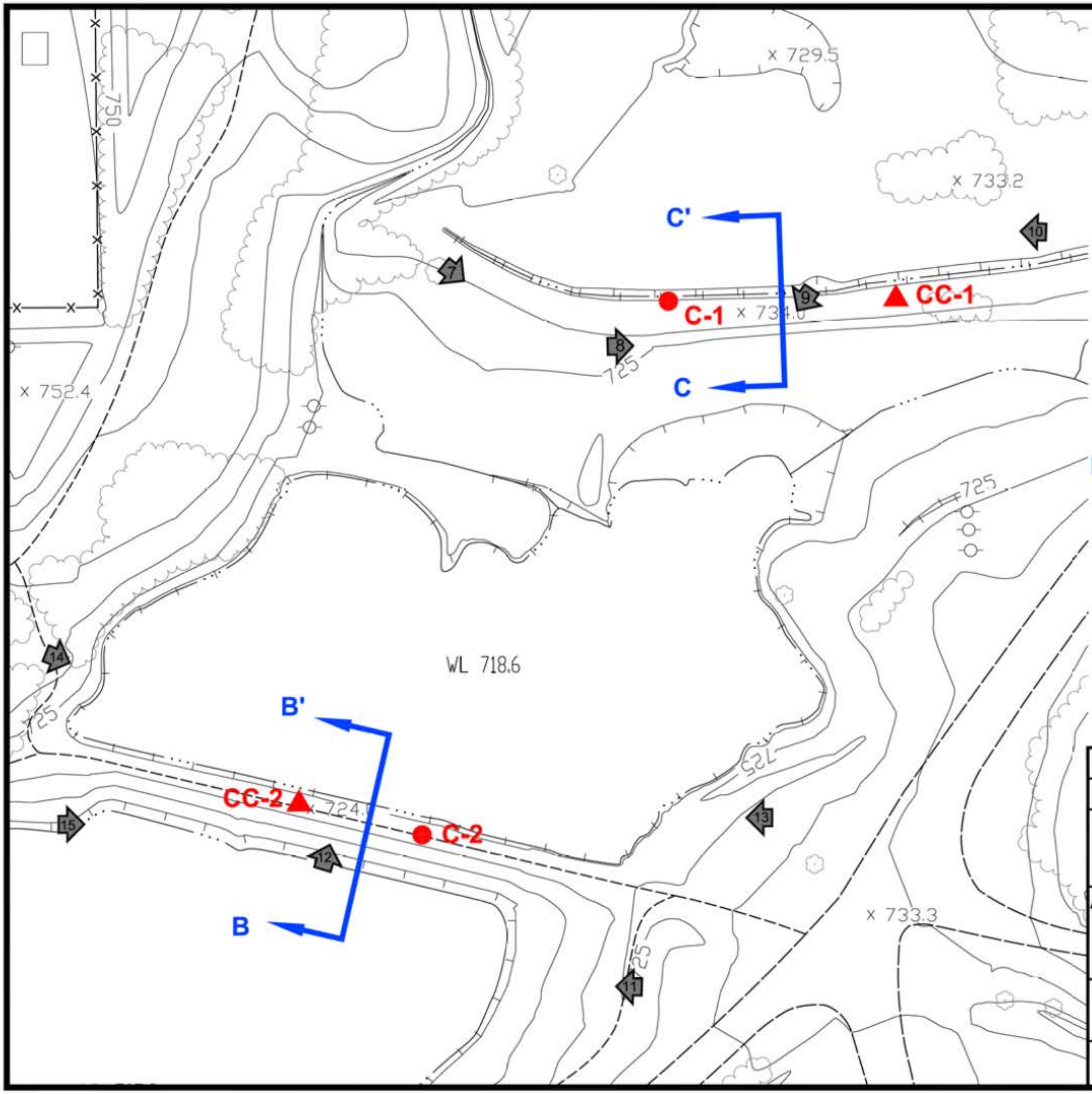
This report has been prepared on behalf of and for the exclusive use of the client for specific application to the named project as described herein. The information is provided for factual data only and not as a warranty of subsurface conditions included in this report.

Geotechnology has attempted to conduct the services reported herein in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality and under similar conditions. The recommendations and conclusions contained in this report are professional opinions. No other representation, expressed or implied, is included or intended.

Unless specifically stated in our proposal or this report, the scope of our services for this phase of the project did not include any environmental assessment or investigation for the presence or absence of wetlands or hazardous or toxic material in the soil, surface water, groundwater or air, on or below or around this site. Any statements in this report or on the boring logs regarding odors noted or unusual or suspicious items or conditions observed are strictly for the information of our client. Our scope did not include any services to investigate or detect the presence of mold or any other biological contaminants (such as spores, fungus, bacteria, viruses, and the by-products of such organisms) on and around the site, or any services designed or intended to prevent or lower the risk of the occurrence of an infestation of mold or other biological contaminants.

The analyses, conclusions, and recommendations contained in this report are based on the data obtained from the subsurface exploration. The field exploration methods used indicate subsurface conditions only at the specific locations where samples were obtained, only at the time they were obtained, and only to the depths penetrated. Discrete sampling cannot be relied on to accurately reflect natural variations in stratigraphy that may exist between sample locations and/or intervals. Unless specifically noted, the scope of our services did not include an assessment of the effects of flooding and natural erosion of adjacent creeks or rivers on the project site.

Geotechnology will not be responsible for any claims, damages, or liability associated with any other party's interpretations of the subsurface data or reuse of the subsurface data or engineering analyses in this report without our express written authorization.



NOTES

1. Plan adapted from an electronic drawing provided by Surdex, dated 10/14/2005.

2. Borings were located in the field with reference to site features and are shown approximate only.

LEGEND

● Boring Location

▲ CPT Sounding Location

⬇ Photo Location and Orientation

B B' Cross Section

0 200 400
SCALE IN FEET

N

Drawn By: SLC	Ck'd By:	App'vd By:
Date: 01-21-10	Date:	Date:

GEOTECHNOLOGY INC.
ENGINEERING AND ENVIRONMENTAL SERVICES
ST. LOUIS • COLLINSVILLE • KANSAS CITY

Ashpond Embankment Stability Evaluations
AECI Power Plant
Thomas Hill, Missouri

PLAN OF SITE AND BORING LOCATIONS

Project Number
J011309.01

PLATE 3

APPENDIX A

IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL ENGINEERING REPORT

Important Information about Your
Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you —* should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely, on Your ASFE-Member Geotechncial Engineer for Additional Assistance

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you ASFE-member geotechnical engineer for more information.

ASFE
THE BEST PEOPLE ON EARTH

8811 Colesville Road/Suite G106, Silver Spring, MD 20910
Telephone: 301/565-2733 Facsimile: 301/589-2017
e-mail: info@asfe.org www.asfe.org

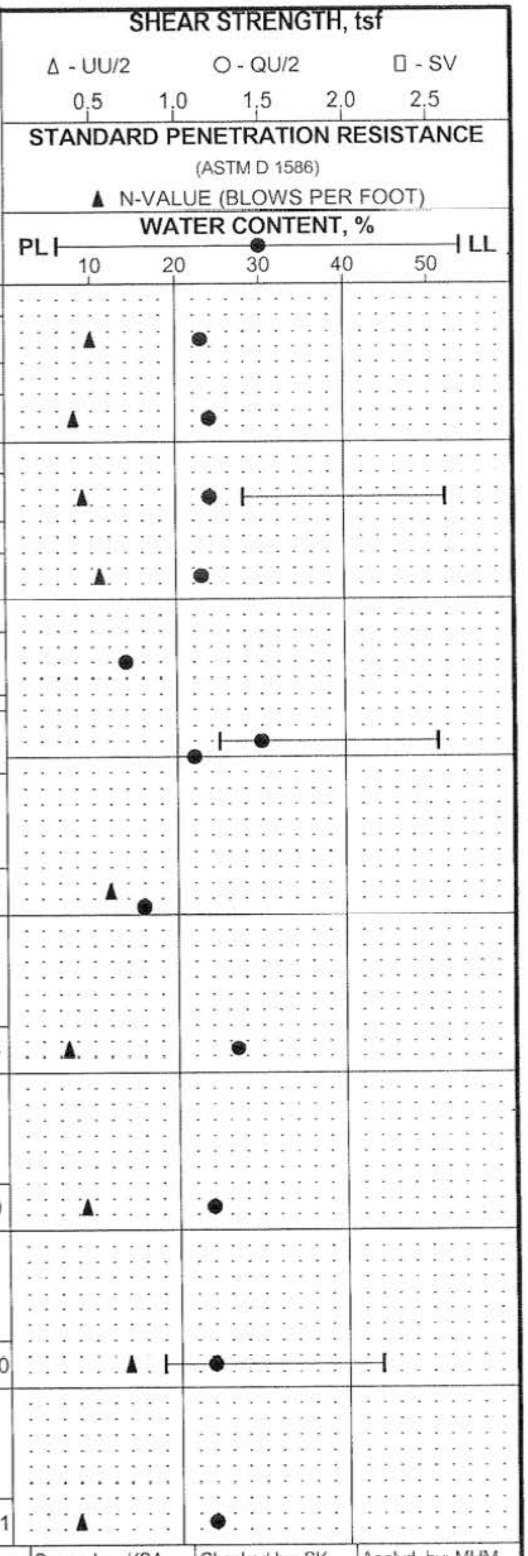
APPENDIX B

DETAILED LOGS OF BORINGS
BORING LOG: TERMS AND SYMBOLS

Surface Elevation: 735 | Completion Date: 1/13/10

Datum msl

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Crushed rock, slag and fly ash		4-4-6	SS1
	FILL: brown and gray clay, trace silt and sand		3-4-4	SS2
5			3-4-5	SS3
			4-5-6	SS4
10				
	Very stiff, yellow, brown and gray CLAY - (CH)			ST5
			97 99	ST6
15				
	Medium stiff to stiff, brown and gray CLAY with sand and gravel - CH		3-5-7	SS7
20				
			3-3-4	SS8
25				
			3-4-5	SS9
30				
	Stiff to medium stiff, gray, silty CLAY - (CL)			
			5-7-7	SS10
35				
			2-4-4	SS11



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

__ AUGER 3 3/4" HOLLOW STEM

WASHBORING FROM 40 FEET

BS DRILLER RFW LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: KSA	Checked by: SK	App'vd. by: MHM
Date: 1/20/10	Date: 4/6/10	Date: 4/19/10

GEOTECHNOLOGY INC
FROM THE GROUND UP

Thomas Hill
Ash Pond Evaluation

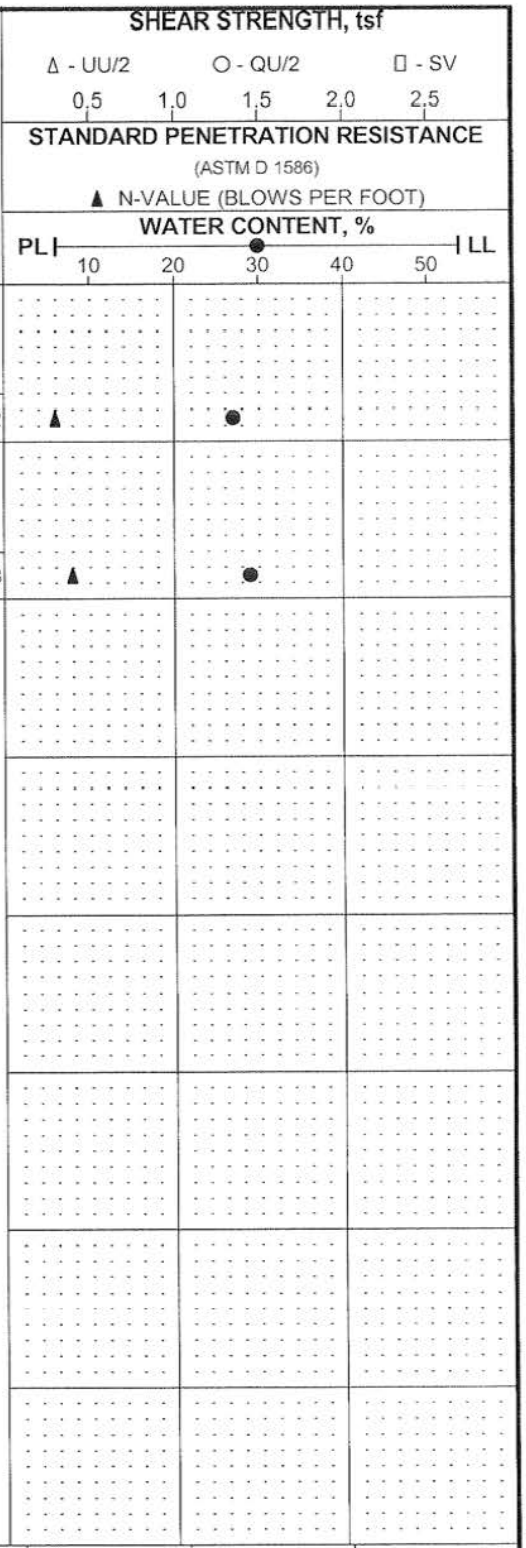
LOG OF BORING: C-1

Project No. J011309.01

Surface Elevation: 735 Completion Date: 1/13/10

Datum msl

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Stiff to medium stiff, gray, silty CLAY - (CL) *(continued)*	▨		
	Medium stiff to stiff, brown and gray CLAY, trace sand - CH	▨		
			2-3-3	SS12
45				
			3-4-4	SS13
50	Boring terminated at 50 feet.			
55				
60				
65				
70				
75				



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WASHBORING FROM 40 FEET

BS DRILLER RFW LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: KSA	Checked by: SK	App'vd. by: MHM
Date: 1/20/10	Date: 4/6/10	Date: 4/19/10

GEOTECHNOLOGY INC
FROM THE GROUND UP

Thomas Hill
Ash Pond Evaluation

CONTINUATION OF
LOG OF BORING: C-1

Project No. J011309.01

BORING LOG: TERMS AND SYMBOLS

GENERAL NOTES

1. *Information on each boring log is a compilation of subsurface conditions based on soil or rock classifications obtained from the field as well as from laboratory testing of samples. The strata lines on the logs may be approximate or the transition between the strata may be gradual rather than distinct. Water level measurements refer only to those ob - served at the times and places indicated, and may vary with time, geologic condition or construction activity.*
2. *Relative composition and Unified Soil Classification designations are based on visual estimates and are approximate only. If laboratory tests were performed to classify the soil, the unified designation is show in parenthesis.*
3. *Value given in Unit Dry Weight/SPT Column is either a unit dry weight in pounds per cubic foot, if adjacent to a ST sample designation, or blows per 6-inch increment if adjacent to a SS sample designation.*

ABBREVIATIONS

UU/2	*Shear Strength from Unconsolidated – Undrained Triaxial Test (ASTM D2850)*
QU/2	*Shear Strength from Unconfined Compression Test (ASTM D2166)*
SV	*Shear Strength from Field Vane (ASTM D2573)*
PL	*Plastic Limit (ASTM D4318)*
LL	*Liquid Limit (ASTM D4318)*

LEGEND

CS	Continuous Sampler
GB	Grab Sample Taken From Auger Cuttings Or Wash Water Return
NX 100 42	NX Rock Core with Percent Recovery/R.Q.D. Given In Adjacent Column
PST	Three Inch Diameter Piston Tube Sample
SS	Split Spoon Sample (Standard Penetration Test)
ST	Three Inch Diameter Shelby Tube Sample
*	Sample Not Recovered
SV	Field Vane Test

SPLIT – BARREL SAMPLER DRIVING RECORD

Blow Per Foot (N-Value)	*Description*
25	*25 blows drove sampler 12 inches after initial 6 inches of seating.*
75/10"	*75 blows drove sampler 10 inches after initial 6 inches of seating.*
50/S3"	*50 blows drove sampler 3 inches during initial 6 inch seating interval.*

NOTES:
1. *To avoid damage to sampling tools, driving is limited to 50 blows during any six inch interval.*
2. *N-Value (Blow Count) is the standard penetration resistance based on the total number of blows, using a 140-lb hammer with 30-inch free fall, required to drive a split spoon the last two of three, 6-inch drive increments. (Example: 4/7/9, N = 7 + 9 = 16). Values are shown as a summation on grid plot and may be shown as 4/7/9 in Unit Dry Weight – SPT column.*

RELATIVE COMPOSITION

Trace……………………...0-10 %
With/Some…………....11-35 %
Soil modifier such…..... > 35 %
As silty, clayey, sandy, etc.

DENSITY OF GRANULAR SOILS

Descriptive Term:	***N—Value***
Very Loose	*0 - 4*
Loose	*5 - 10*
Medium Dense	*11 - 30*
Dense	*31 - 50*
Very Dense	*> 50*

STRENGTH OF COHESIVE SOILS

Consistency	**Undrained Shear Strength Tons Per Sq. Ft.**	**Field Test**	**Approximate N-Value Range**
Very Soft	*less than 0.12*	*Thumb will penetrate soil more than 1"*	*0 - 1*
Soft	*13 to 0.25*	*Thumb will penetrate soil about 1"*	*2 - 4*
Medium Stiff	*0.26 to 0.50*	*Thumb will penetrate soil about ¼"*	*5 – 8*
Stiff	*0.51 to 1.00*	*Thumb hardly indents soil*	*9 – 15*
Very Stiff	*1.01 to 2.00*	*Thumb will not indent soil, but readily indented with thumbnail*	*16 – 30*
Hard	*greater than 2.00*	*Thumbnail will not indent soil*	*> 30*

SOIL GRAIN SIZE

SOIL STRUCTURE

Calcareous *– Having appreciable quantities of carbonate.*

Fissured *– Containing shrinkage or relief cracks, often filled with sand or silt; usually more or less vertical.*

Slickensided *– Having planes of weakness that appear slick and glossy. The degree of slickensidedness depends upon the spacing of slickensides and the ease of breaking along those planes.*

Layer *-- Inclusion greater than 3 inches thick.*

Seam *– Inclusion 1/8 inch to 3 inches thick extending through the sample*

Parting *– Inclusion less than 1/8 inch thick.*

Pocket *– Inclusion of material of different texture that is smaller than the diameter of the sample.*

Interlayered *– Soil samples composed of alternating layers of different soil types.*

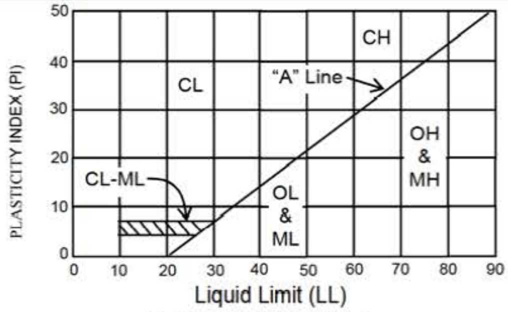
Intermixed *– Soil samples composed of pockets of different soil types and a layered or laminated structure is not evident.*

Laminated *– Soil sample composed of alternating partings or seams of different soil type.*

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			SYMBOL	DESCRIPTION
Coarse-Grained Soils (More than 50% Larger than No 200 Sieve Size)	Gravel and Gravelly Soils	Clean Gravels Little or no Fines	GW	Well-Graded Gravel, Gravel-Sand Mixture
			GP	Poorly –Graded Gravel, Gravel-Sand Mixture
		Gravels with Appreciable Fines	GM	Silty Gravel, Gravel-Sand-Silt Mixture
			GC	Clayey-Gravel, Gravel-Sand-Clay Mixture
	Sand and Sandy Soils	Clean Sands Little or no Fines	SW	Well-Graded Sand, Gravelly Sand
			SP	Poorly Graded Sand, Gravelly Sand
		Sands with Appreciable Fines	SM	Silty Sand, Sand-Silt Mixture
			SC	Clayey Sand, Sand-Clay Mixture
Fine-Grained Soils (More than 50% Smaller than No 200 Sieve Size)	Silts and Clays	Liquid Limit Less Than 50	ML	Silt, Clayey Silt, Silty or Clayey Very Fine Sand, Slight Plasticity
			CL	Clay, Sandy Clay, Silty Clay, Low to Medium Plasticity
			OL	Organic Silts, or Silty Clays of Low Plasticity
	Silts and Clays	Liquid Limit More Than 50	MH	Silt, Fine Sandy or Silt Soil with High Plasticity
			CH	Clay, High Plasticity
			OH	Organic Clay of Medium to High Plasticity
	Highly Organic Soils		PT	Peat, Humus, Swamp Soil

PLASTICITY CHART



RELATIVE PLASTICITY

Nonplastic	Cannot Roll Into Ball
Trace Plasticity	Barely Roll Into Ball
Medium Plastic	Can be Rolled Into Ball
Highly Plastic	No Rupture by Kneading

VISUAL DESCRIPTION CRITERIA*

TABLE 1: CRITERIA FOR DESCRIBING ANGULARITY OF COARSE-GRAINED PARTICLES

Description	***Criteria***
Angular	*Particles have sharp edges and relatively plane sides with unpolished surfaces*
Subangular	*Particles are similar to angular description but have rounded edges*
Subrounded	*Particles have nearly plane sides but have well-rounded corners and edges*
Rounded	*Particles have smoothly curved sides and no edges*

TABLE 2: CRITERIA FOR DESCRIBING PARTICLE SHAPE

Description	***Criteria***
Flat	*Particles with width/thickness X3*
Elongated	*Particles with length/width X3*
Flat and Elongated	*Particles meet criteria for both flat and elongated*

TABLE 3: CRITERIA FOR DESCRIBING MOISTURE CONDITION

Description	***Criteria***
Dry	*Absence of moisture, dusty, dry to the touch*
Moist	*Damp, but no visible water*
Wet	*Visible free water, usually soil is below the water table*

TABLE 4: CRITERIA FOR DESCRIBING REACTION WITH HCL

Description	***Criteria***
None	*No visible reaction*
Weak	*Some reaction, with bubbles forming slowly*
Strong	*Violent reaction, with bubbles forming rapidly*

TABLE 6: CRITERIA FOR DESCRIBING CEMENTATION

Description	***Criteria***
Weak	*Crumbles or breaks with handling or little finger pressure*
Moderate	*Crumbles or breaks with considerable finger pressure*
Strong	*Will not crumble or break with finger pressure*

TABLE 8: CRITERIA FOR DESCRIBING DRY STRENGTH

Description	***Criteria***
None	*The dry specimen crumbles into powder with mere pressure of handling*
Low	*The dry specimen crumbles into powder with some finger pressure*
Medium	*The dry specimen breaks into pieces or crumbles with considerable finger pressure*
High	*The dry specimen cannot be broken with finger pressure. Specimen will break into pieces between thumb and a hard surface.*
Very High	*The dry specimen cannot be broken between the thumb and a hard surface*

TABLE 9: CRITERIA FOR DESCRIBING DILATANCY

Description	***Criteria***
None	*No visible change in the specimen*
Slow	*Water appears slowly on the surface of the specimen during shaking and does not disappear or disappears slowly upon squeezing.*
Rapid	*Water appears quickly on the surface of the specimen during shaking and disappears quickly upon squeezing.*

TABLE 10: CRITERIA FOR DESCRIBING TOUGHNESS

Description	***Criteria***
Low	*Only slight pressure is required to roll the thread near the plastic limit. The thread and the lump are weak and soft.*
Medium	*Medium pressure is required to roll the thread to near the plastic limit. The thread and the lump have medium stiffness*
High	*Considerable pressure is required to roll the thread to near the plastic limit. The thread and the lump have very high stiffness*

TABLE 12: IDENTIFICATION OF INORGANIC FINE-GRAINED SOILS FROM MANUAL TESTS

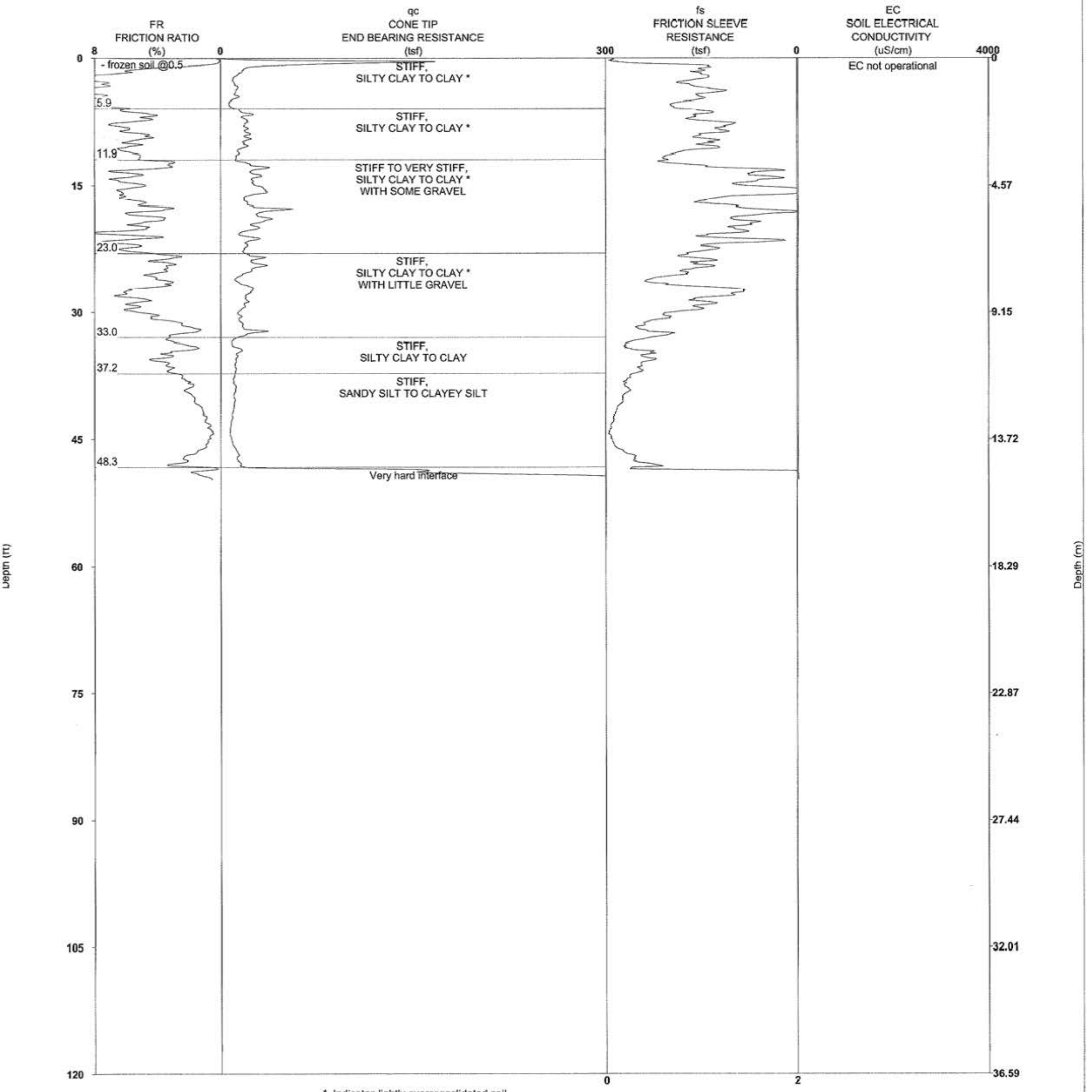
Soil Symbol	***Dry Strength***	***Dilatancy***	***Toughness***
ML	*None to low*	*Slow to rapid*	*Low or thread cannot be formed*
CL	*Medium to high*	*None to slow*	*Medium*
MH	*Low to medium*	*None to slow*	*Low to medium*
CH	*High to very high*	*none*	*High*

**NOTES: 1. Tables adapted from ASTM D2488 "Description and identification of Soils" (Visual-Manual Procedure)*
2. Tables 5, 7 and 11 incorporated into other information on this plate.

APPENDIX C

CPT REPORT FROM STRATIGRAPHICS INC.

CPTU-EC LOG WITH LITHOLOGIC EVALUATION CPCC01



* Indicates lightly overconsolidated soil

** Indicates heavily overconsolidated or cemented soil

Latitude: 39.54378 Longitude: -92.63682

PROJECT NAME:Thomas Hill Site
PROJECT NUMBER:10-110-020

STRATIGRAPHICS

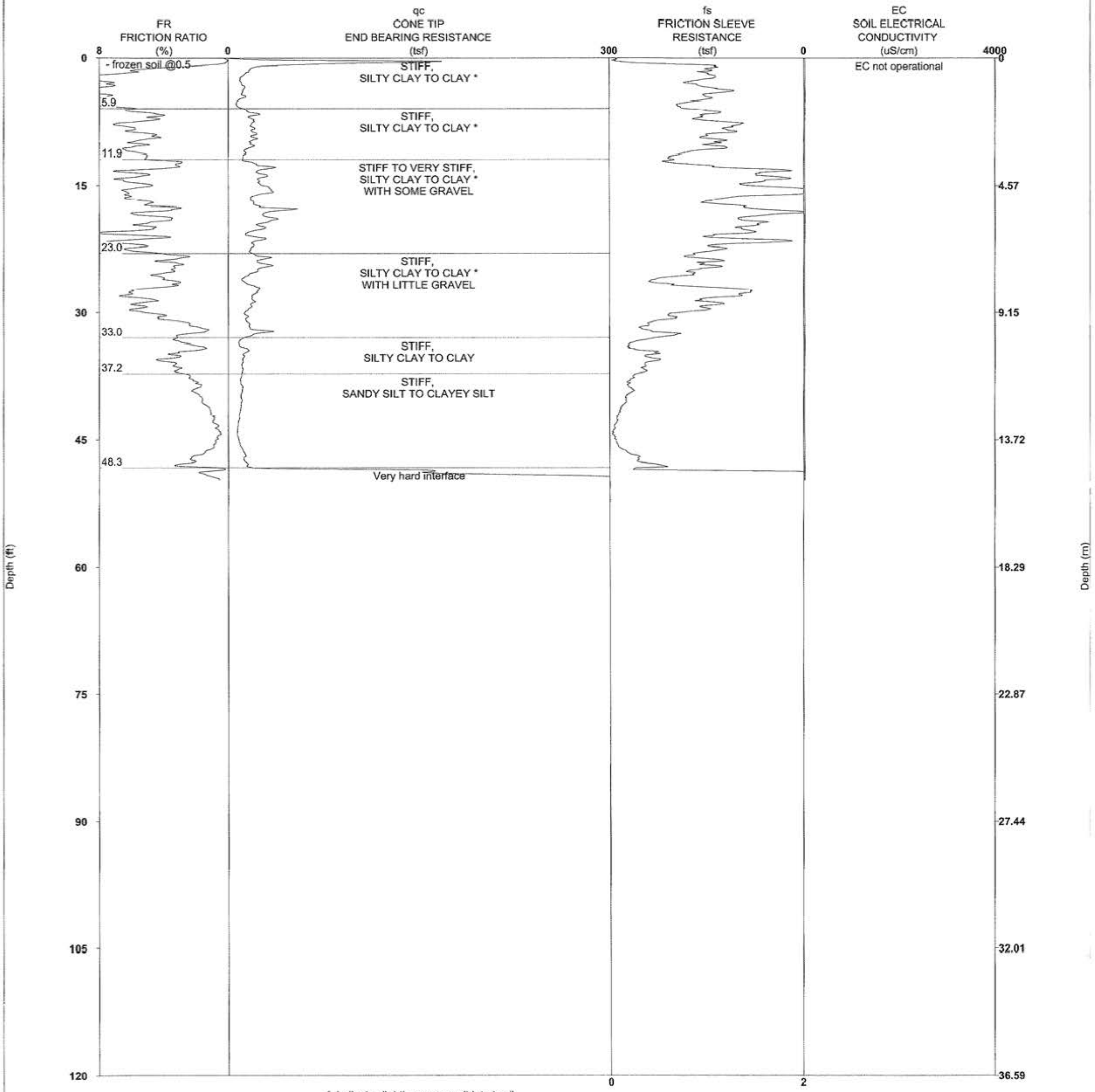
R1 DATE:2/3/2010 TIME:8:59 AM
SOUNDING NUMBER:CC-01

CPCC01

TABLE 1
SUMMARY OF CPTU-EC SOUNDINGS
Vee-Beer Site
10-110-020

SOUNDING NUMBER	DATE PERFORMED	SOUNDING TYPE	SOUNDING DEPTH (feet)	COMMENTS	COORDINATES LONGITUDE (dec. deg)	LATITUDE (dec. deg)
CP-CC-01	02/03/10	CPTU-EC	49.8		-92.63682	39.54378
CP-CC-02	02/03/10	CPTU-EC	52.6		-92.63939	39.54198
CP-DC-01	02/02/10	CPTU-EC	93.3		-92.56260	39.64643
CP-DC-02	02/02/10	CPTU-EC	66.0		-92.56195	39.64728
CP-DC-03	02/02/10	CPTU-EC	74.5		-92.56293	39.64555
CP-DC-04	02/02/10	CPTU-EC	91.3		NO GPS	
CP-DC-05	02/02/10	CPTU-EC	101.4		-92.56213	39.64581
TOTAL FOOTAGE:			529.0			

CPTU-EC LOG WITH LITHOLOGIC EVALUATION CPCC01



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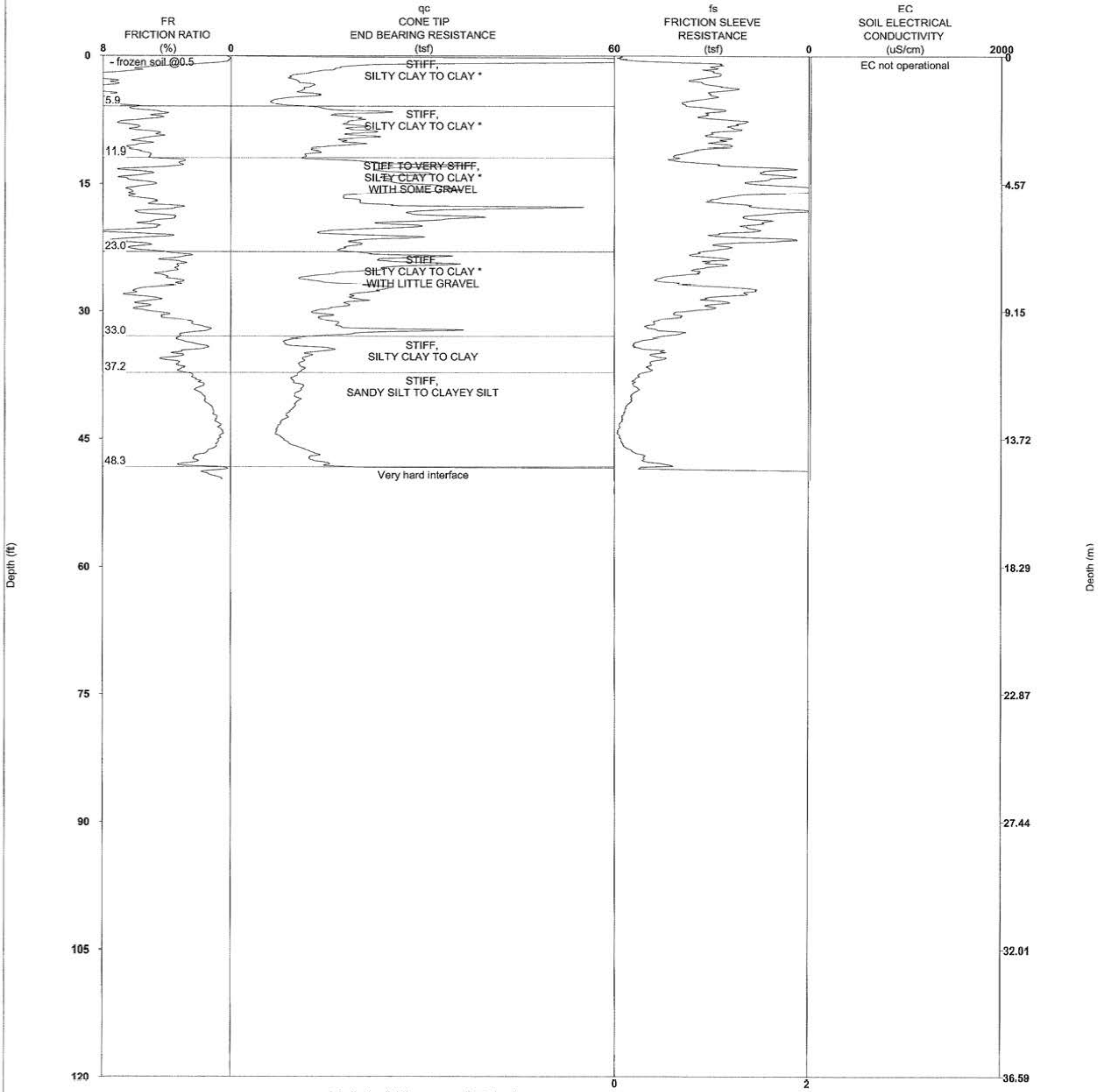

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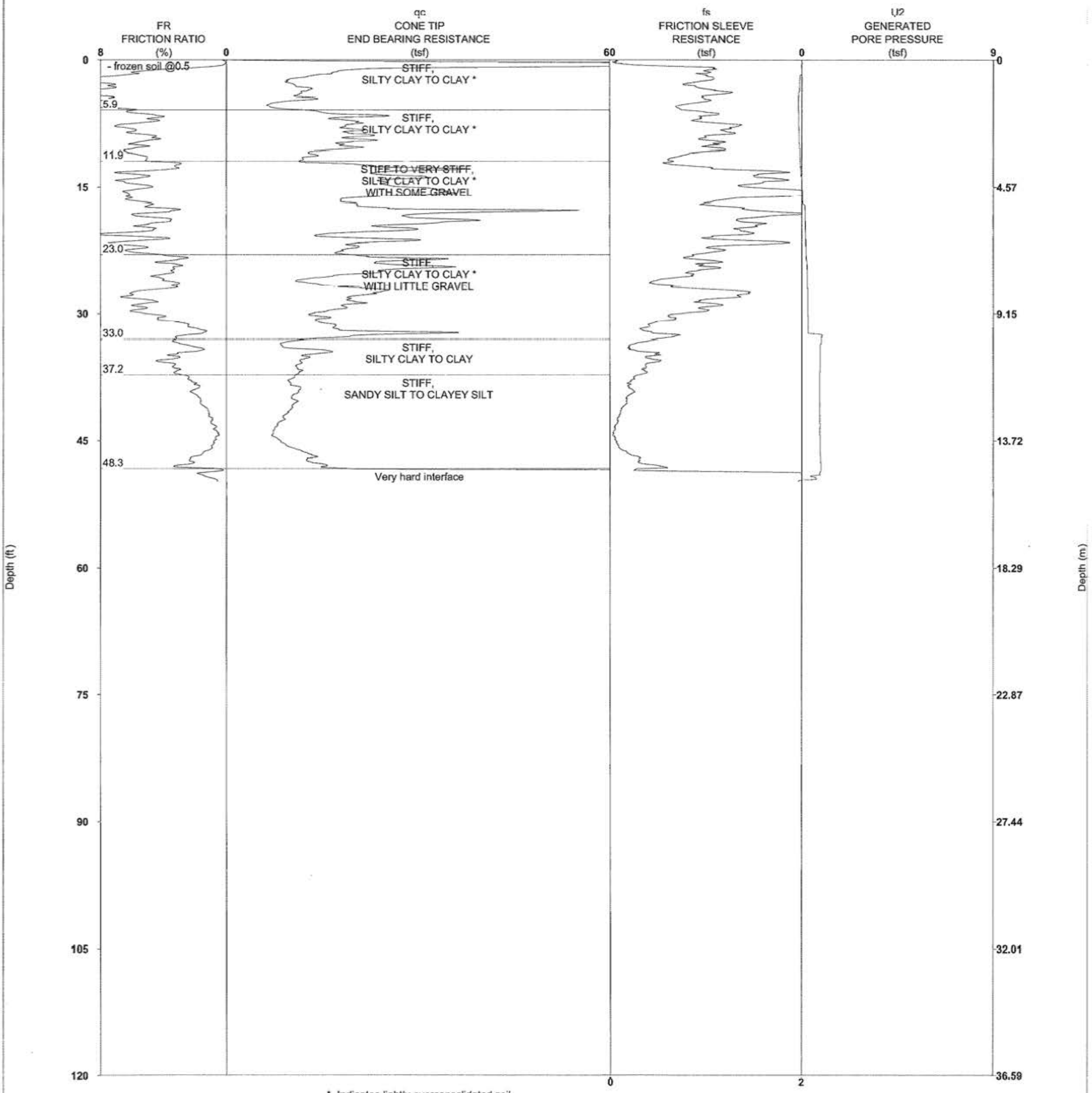

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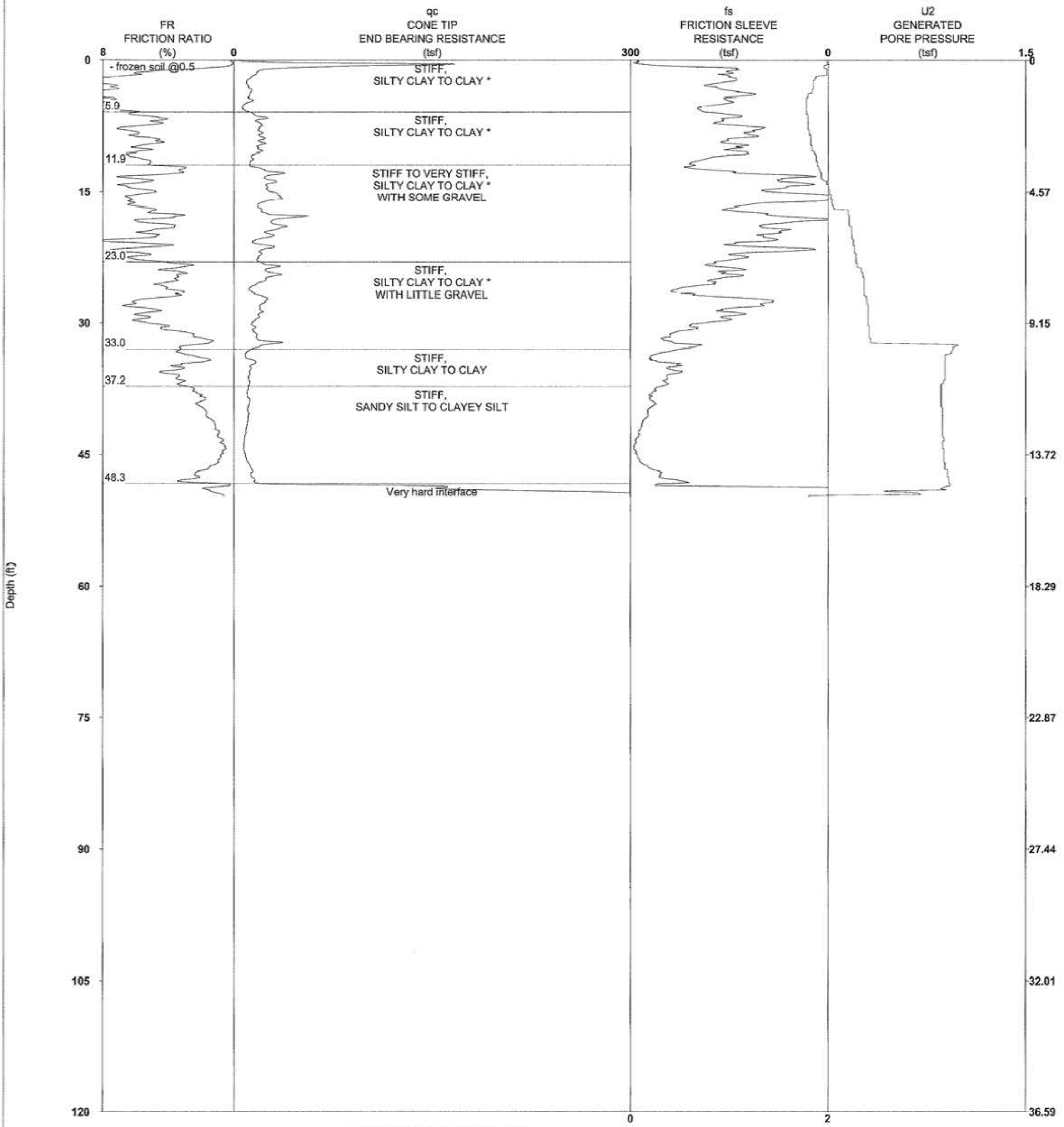

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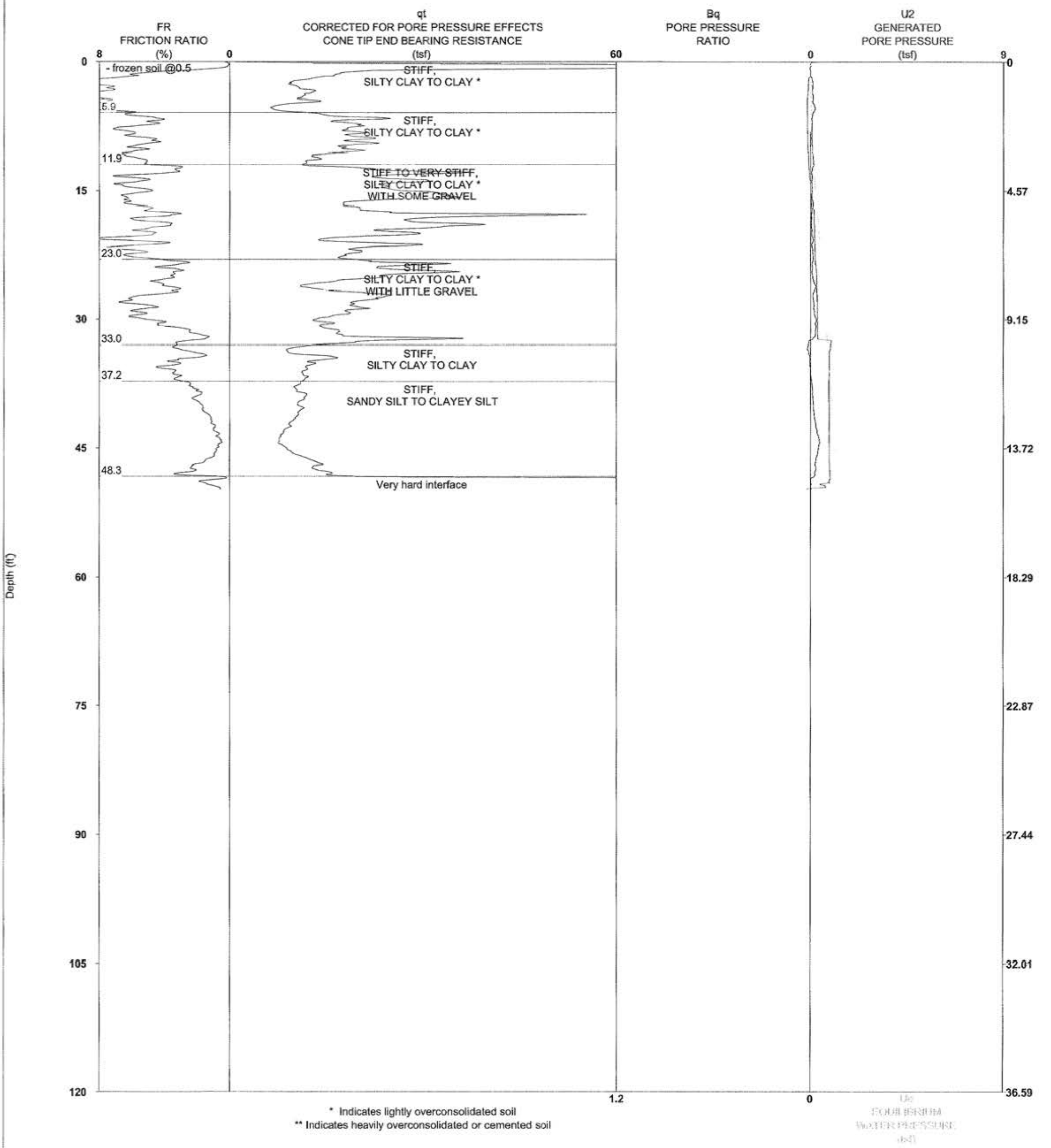

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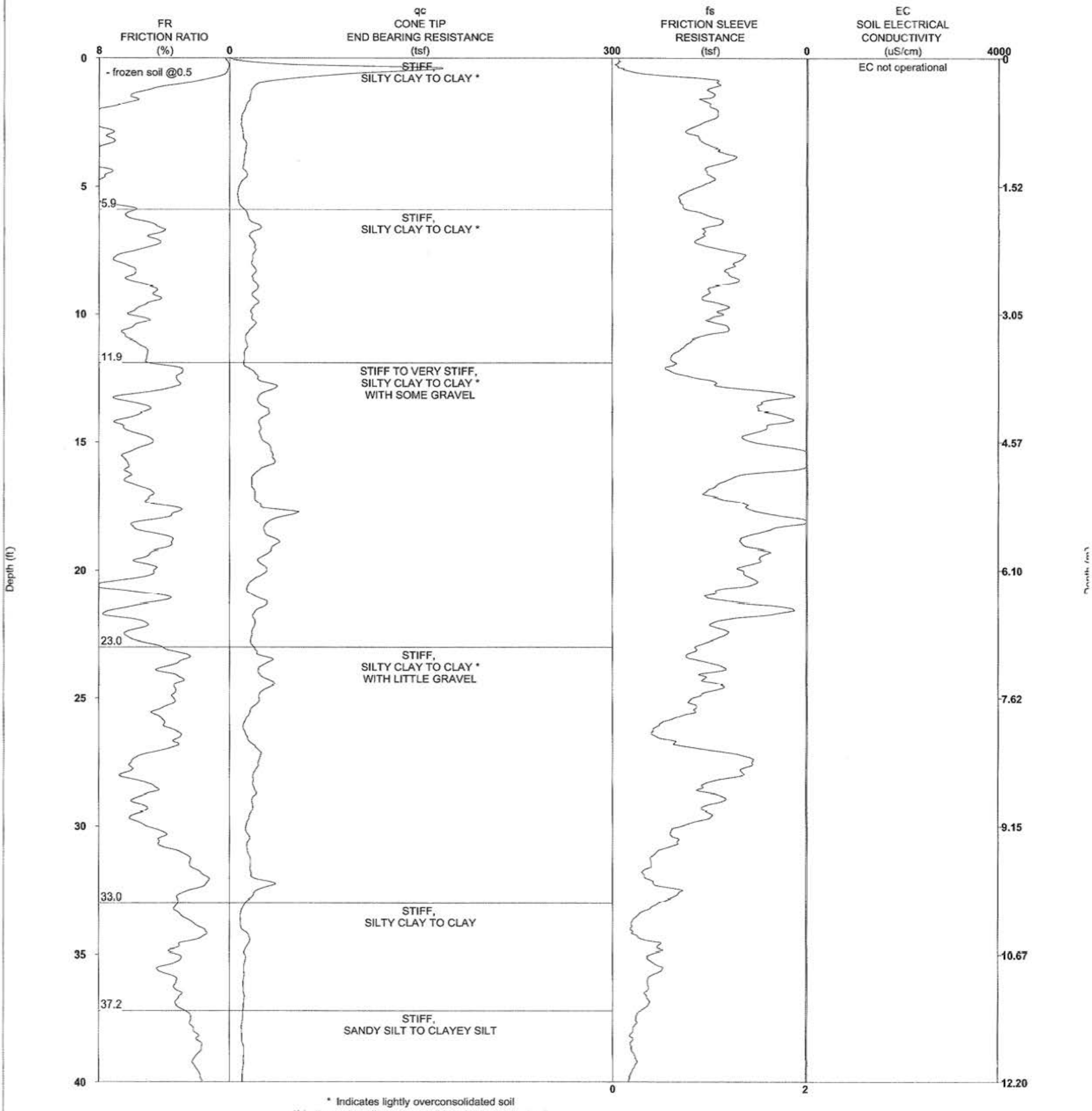

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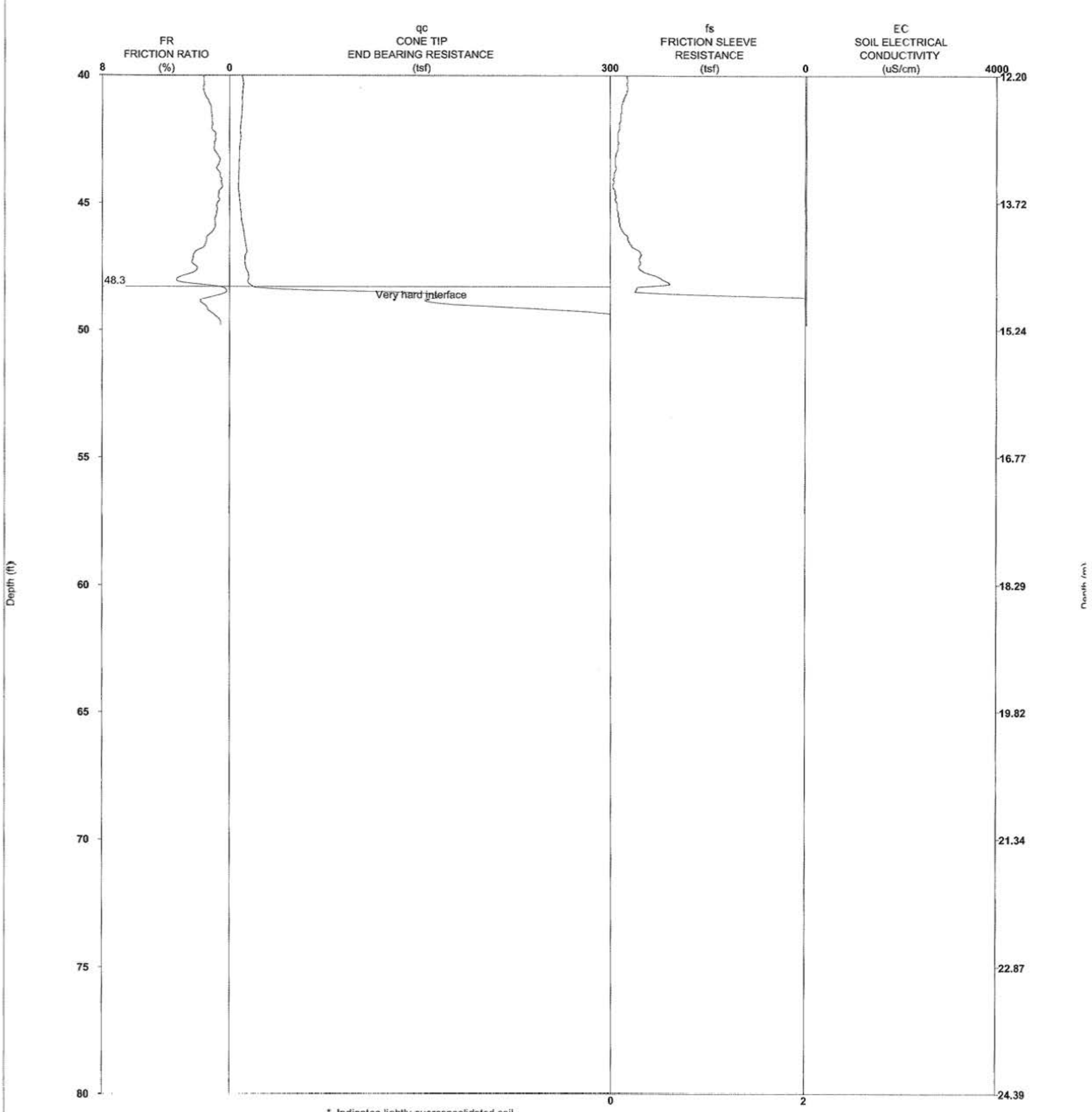

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CPCC01

STRATIGRAPHICS
SOUNDING NUMBER:CC-01
PROJECT NAME:Thomas Hill Site
PROJECT NUMBER:10-110-020
R1 DATE:2/3/2010 TIME:8:59 AM

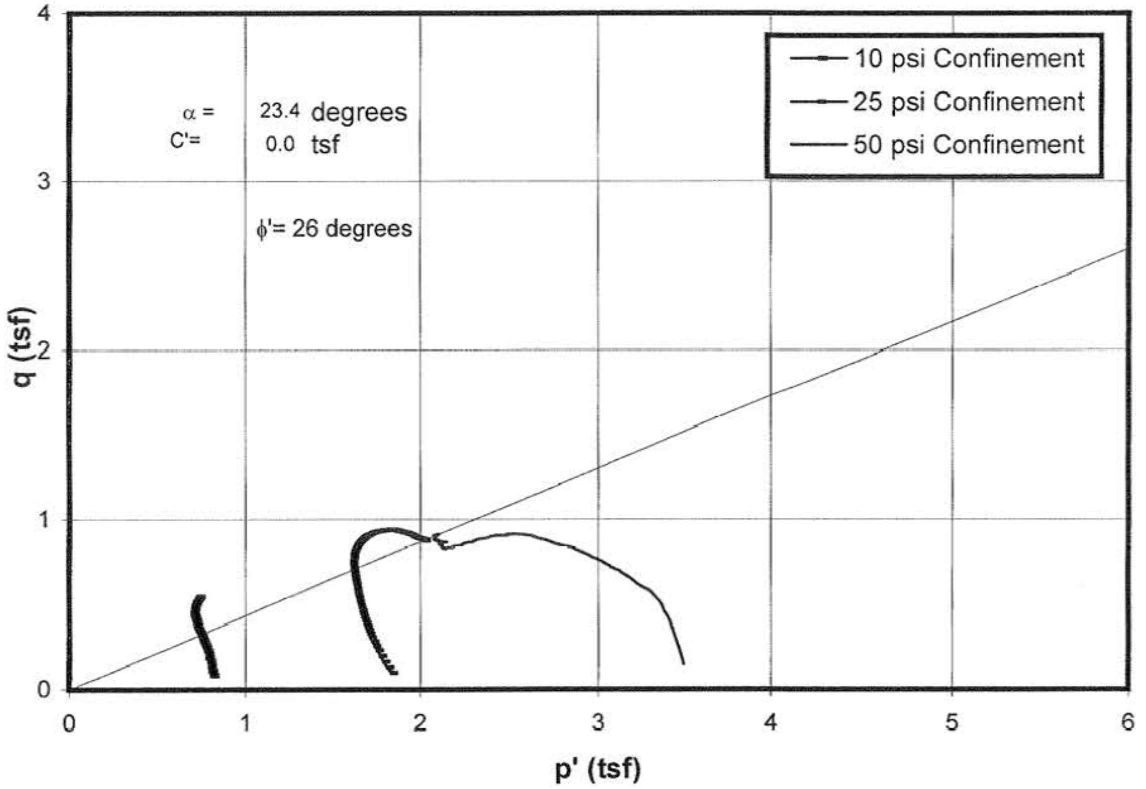
Stratum Description From Evaluated Log
Very hard interface

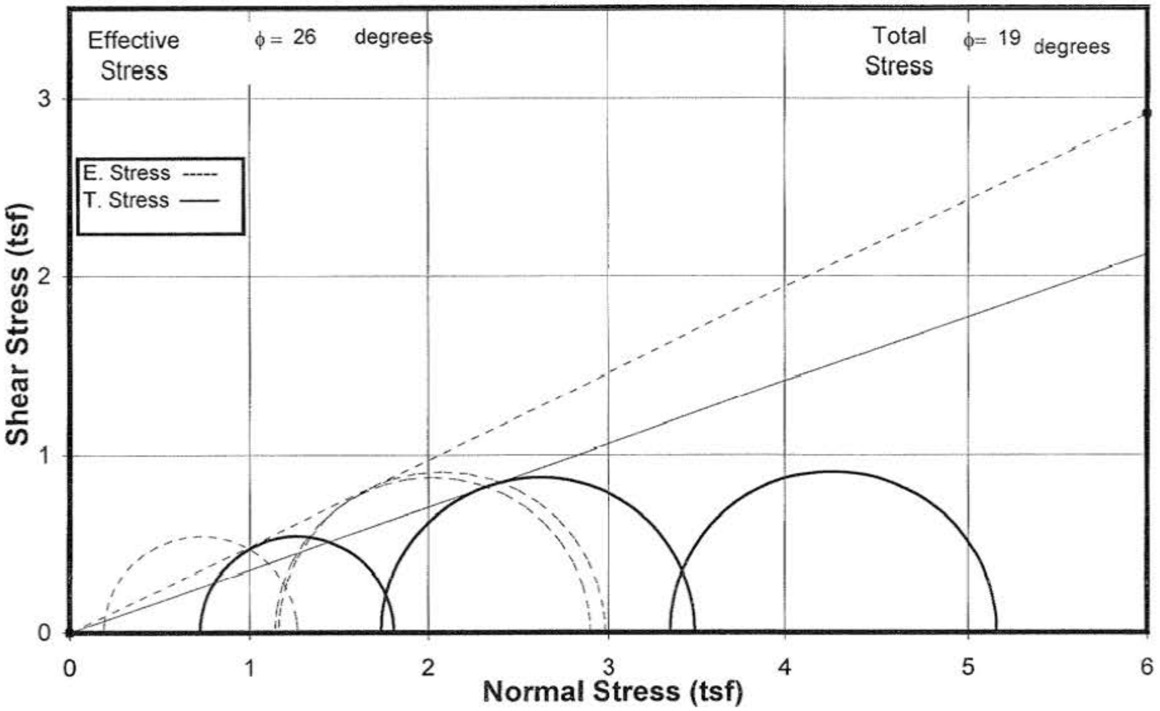
AVG	211.78	193.18	2.56	1.06	0.77	212.10	0.00	23.00		41.20	44.40	56.00	76.00				47.20	74.40	43.00	67.60	2.77	1.49
MIN	119.5	109.3	0.25	0.2	0.5	119.9	0	23		40	42	40	60				16	22	15	20	2.74	1.48
MAX	330.8	301.2	3.89	1.6	0.92	331.1	0	23		42	46	60	80				66	109	60	99	2.8	1.51

Depth (ft)	Cone (tsf)	Norm Cone (tsf)	Friction (tsf)	Averaged Friction Ratio (%)	Generated Pore Water Pressure (tsf)	Corrected For Pore Water Pressure Total Cone Resistance (tsf)	Pore Pressure Ratio (%)	Soil Conductivity (uS/cm)	Evaluated Soil Type	Drained Friction Angle (deg)		Relative Density (%)		Nc	Undrained Shear Strength (ksf)	Undrained Large Strain Shear Strength (ksf)	SPT (N)		NORM SPT (N1')		Total Stress	Effective Stress
										From	To	From	To				From	To	From	To		
48.50	119.5	109.3	0.25	0.2	0.92	119.9	0.00	23	Medium dense, Sand to silty sand	42	46	40	60				16	22	15	20	2.74	1.48
48.75	160.5	146.7	2.30	1.4	0.87	160.9	0.00	23	Dense, Sand to silty sand	40	42	60	80				44	66	40	60	2.76	1.49
49.00	175.5	160.2	3.56	1.6	0.88	175.8	0.00	23	Dense, Sand to silty sand	40	42	60	80				44	66	40	60	2.77	1.49
49.25	272.6	248.5	3.89	1.3	0.50	272.8	0.00	23	Dense, Sand to silty sand	42	46	60	80				66	109	60	99	2.79	1.50
49.50	330.8	301.2	2.78	0.8	0.69	331.1	0.00	23	Dense, Sand to silty sand	42	46	60	80				66	109	60	99	2.80	1.51

APPENDIX D

LABORATORY TEST DATA





CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST
ASTM D 4767
Project No.: J011309.01
Boring: C-1
Sample: ST-6 - Depth: 13.5

APPENDIX D
Pond 001 Cell 2 Separation Berm
By Gredell Engineering Resources, Inc. dated October 2015

1505 E. High Street
Jefferson City, Missouri 65101
Telephone No. (573) 659-9078
Fax No. (573) 659-9079

GREDELL Engineering Resources, Inc.

Memo

To: Associated Electric Cooperative, Inc. – Thomas Hill Energy Center File

From: Andrew D. Rackers, P.E., Environmental Engineer II

CC:

Date: 10/12/2015

Re: Pond 001 Cell 2 Separation Berm

Pond 001 Cell 2 (Cell 2) construction modifications to divide Cell 2 into two (2) separate basins (an eastern basin and a western basin) and changes in designated use at Associated Electric Cooperative Inc. (AECI) – Thomas Hill Energy Center (THEC) necessitated the design of a separation berm within Cell 2.

Historically, Cell 2 was used as a coal combustion residuals (CCRs) surface impoundment. In 2012, AECI-THEC had Gredell Engineering estimate the volume of CCRs stored in Cell 2 with the intent to arrange for the removal and recycling or disposal of the accumulated CCR in Cell 2. Since 2012, AECI-THEC has ceased depositing CCRs in Cell 2 and has been consistently working to clean out the accumulated CCRs in it. A new federal regulation (40 CFR Part 257 Subpart D) establishing minimum standards for CCR surface impoundments having an effect date of October 19, 2015 led AECI-THEC to decide to modify Cell 2 to divide it into a closed (clean) side (the eastern basin) and an inactive side (the western basin). A separation berm was designed for Cell 2 to divide it into eastern and western basins. Accumulated CCRs in Cell 2 have been completely removed from the eastern basin and either transported to the active CCR landfill or stored in the new western basin of Cell 2. The eastern basin of Cell 2 is designated for use as a stormwater runoff control basin. The western basin of Cell 2 is designated for use as an inactive CCR surface impoundment

The separation berm was designed in a north-south alignment between the existing Cell 2 – Pond 001 Cell 3 (Cell 3) dam and the peninsula of the natural existing ridge within Cell 2. The berm is designed to be constructed by excavating a key trench and placing, compacting, and grading earthen material to a final design elevation. Fill materials will consist of compacted clay soil. The final design parameters are further described as follows:

- Final elevation of the Cell 2 separation berm will be 721.0 feet with a top gravel driving surface at a minimum width of eight (8) feet.

- Key trench will be keyed into the existing bottom surface at a minimum bottom width of eight (8) feet, a minimum depth of three (3) feet, and two horizontal to one vertical (2H:1V) side slopes.

- The berm side slopes will be three horizontal to one vertical (3H:1V).

- The earthen material will consist of compacted clay soil, compacted in uniform horizontal lifts with a maximum loose thickness of eight (8) inches to a density of 95% Standard Proctor Maximum Dry Density (MDD).

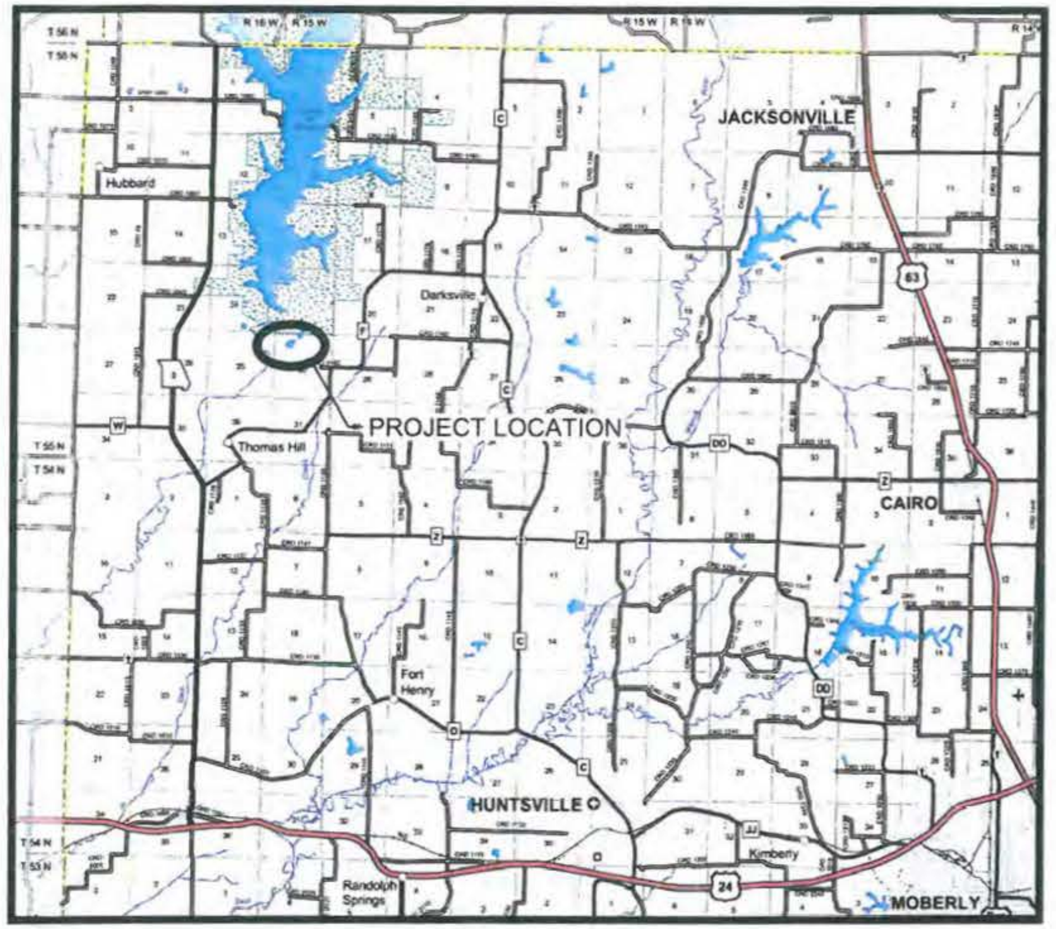
The Cell 2 separation berm design was completed in accordance with the new federal regulation and the applicable design standards using recognized and accepted good engineering practices. See the attached plans and specifications detailing the design of the Cell 2 separation berm.

Design Plans

ASH POND 001 - CELL 2
SEPARATION BERM

THOMAS HILL ENERGY CENTER
ASSOCIATED ELECTRIC COOPERATIVE, INC.
CLIFTON HILL, MISSOURI
OCTOBER 2015

INDEX OF SHEETS



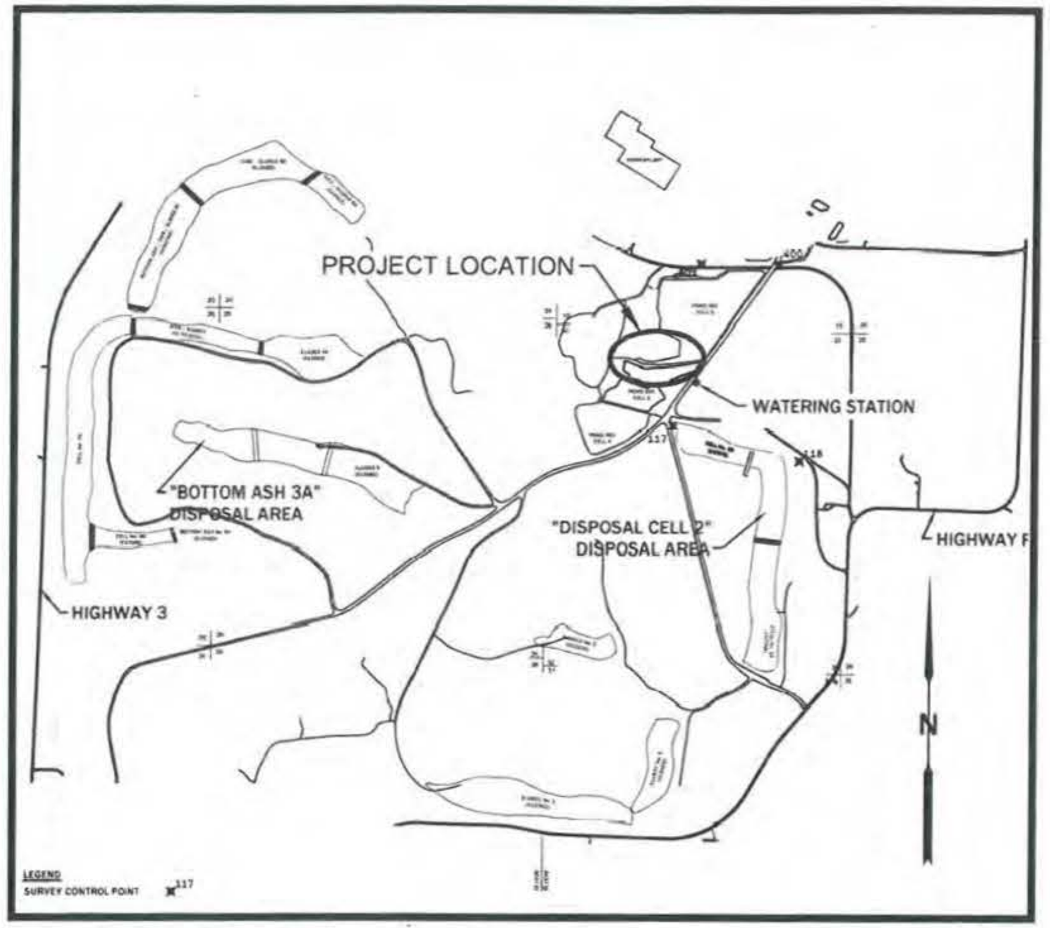
SITE VICINITY MAP

N.T.S.

STATE OF MISSOURI

SITE LOCATION MAP

N.T.S.



SITE ACCESS MAP

1"=3000'

NOTES:

1. ALL WORK UNDER THIS CONTRACT SHALL BE FUNCTIONALLY & SUBSTANTIALLY COMPLETE BY OCTOBER 16, 2015.
2. ASSOCIATED ELECTRIC COOPERATIVE, INC. (AECI) PROPOSES TO CONSTRUCT A SEPARATION BERM FOR ASH POND 001 CELL 2 AND RE-GRADE THE EXISTING DAM BETWEEN CELL 2 AND CELL 3 AS INDICATED ON THE PROJECT DOCUMENTS TITLED "ASH POND 001 - CELL 2 SEPARATION BERM". AECI MAY TERMINATE CONTRACT ACTIVITIES AT ANY TIME, WITHOUT REGARD TO CONSTRUCTION COMPLETION, AT THEIR SOLE DISCRETION.
3. THE CONTRACTOR MAY VISIT THE SITE AND INVESTIGATE PROJECT CONDITIONS TO EVALUATE MATTERS PERTINENT TO BIDDING AND PLANNING AND TO DETERMINE FEASIBLE AND APPROPRIATE MEANS AND METHODS TO COMPLETE PROJECT.
4. CONTRACTOR IS TO LOCATE UTILITIES THROUGH THE MISSOURI ONE-CALL SYSTEM (1-800-DIG-RITE) AND COORDINATION WITH AECI.
5. OVERHEAD ELECTRIC SHOWN IS BASED ON SURVEYED LOCATIONS OF POWER POLES AND AERIAL IMAGERY PROVIDED BY GOOGLE EARTH.
6. CONTRACTOR SHALL SCHEDULE A PRE-CONSTRUCTION MEETING WITH AECI TO REVIEW AND VERIFY MINIMUM EQUIPMENT CLEARANCE AND GENERAL SAFETY REQUIREMENTS FOR ANY WORK IN THE VICINITY OF THE 345 kV OVERHEAD ELECTRIC DISTRIBUTION LINES. CONTRACTOR IS TO SUBMIT A WORK PLAN ADDRESSING SAFETY RELATED TO THE OVERHEAD ELECTRIC DISTRIBUTION LINES, INCLUDING MEASURES TO ASSURE THAT MINIMUM EQUIPMENT CLEARANCE REQUIREMENTS ARE MAINTAINED BY THE CONTRACTOR.
7. MUCH OF THE PLANT PROPERTY IN THE NEAR VICINITY OF THE PROJECT IS RECLAIMED MINED LAND THAT CANNOT BE DISTURBED. AECI HAS MARKED THESE BOUNDARIES IN THE FIELD. NO CONSTRUCTION ACTIVITIES, EQUIPMENT TRAFFIC, OR MATERIALS STORAGE ARE PERMITTED ON RECLAIMED LAND.
8. CONTRACTOR IS RESPONSIBLE FOR CLEANUP AND REMEDIATION OF ANY SPILLS OF HAZARDOUS SUBSTANCES, FUELS AND LUBRICANTS, AND ANY SPILLS OF EXCAVATED MATERIAL.
9. THE CONTRACTOR'S OPERATIONS ARE TO BE PERFORMED IN A WORKMAN LIKE MANNER AND IN A MANNER THAT WILL NOT ADVERSELY IMPACT THE OWNER'S SEDIMENT CONTROL SYSTEM'S EFFLUENT QUALITY. THE CONTRACTOR SHALL COORDINATE ITS OPERATIONS WITH THE OWNER'S ENVIRONMENTAL COMPLIANCE MANAGER TO MAINTAIN COMPLIANCE WITH NPDES PERMIT NO. MO-0003948 AND THE EFFLUENT REQUIREMENTS OF ASH POND 001 CELL 3 AS LISTED IN THE SPECIFICATIONS.
10. DO NOT OBSTRUCT OR RESTRICT ROADWAYS WITHOUT AECI PERMISSION.
11. WHEN CONSTRUCTION ACTIVITIES REQUIRE TEMPORARILY OBSTRUCTING ROADWAYS TO ANY DEGREE, NOTIFY AECI A MINIMUM OF 72 HOURS IN ADVANCE OF THE NEED TO OBSTRUCT A ROADWAY. DO NOT PROCEED WITH SUCH WORK UNTIL APPROVED IN WRITING BY AECI.
12. CONTRACTOR WILL MAINTAIN ROADS TO COMPLY WITH DUST CONTROL AND GRADE. VEHICLES MUST OBEY POSTED SPEED LIMIT. A WATERING STATION IS LOCATED JUST SOUTH OF POND 1 CELL 2 ON THE EAST SIDE OF THE ROAD AND IS AVAILABLE FOR CONTRACTOR USE.
13. PROVIDE TRAFFIC WARNING SIGNS, BARRIERS AND OTHER APPROPRIATE DEVICES TO PROTECT CONSTRUCTION PERSONNEL AND TO WARN VEHICLE OPERATORS WHEN CONDUCTING WORK ADJACENT TO ROADWAYS.
14. CONTRACTOR IS RESPONSIBLE FOR JOB-SITE HOUSEKEEPING, TO INCLUDE DAILY COLLECTION AND DISPOSAL OF TRASH, CONSTRUCTION DEBRIS, CONTAINERS, PACKING MATERIALS, PALLETS, ETC., AND FOR WORKMANLIKE MANAGEMENT OF EQUIPMENT, TOOLS, AND RELATED MATERIALS.
15. CONTRACTOR SHALL INSTALL AND MAINTAIN SEDIMENT & EROSION CONTROL STRUCTURES IN ACCORDANCE WITH INDUSTRY ACCEPTED BEST MANAGEMENT PRACTICES AND AECI APPROVAL AT THE ASH POND 001 CELL 2 ACCESS AREA AND AT OTHER LOCATIONS AS DIRECTED BY AECI.
16. EXISTING CONDITIONS SURVEY DATA (EXISTING TOPOGRAPHY) WAS OBTAINED BY MARK W. ROBERTSON, PLS NO. 2008016665, CENTRALIA, MISSOURI DURING OCTOBER 2013 & FEBRUARY 2015.
17. SURVEY CONTROL IS IN MISSOURI STATE PLANE COORDINATE SYSTEM, CENTRAL ZONE. NAD 27.

SURVEY CONTROL POINTS BY MARK ROBERTSON 5-7-13

POINT NUMBER	NORTHING	EASTING	ELEVATION	DESCRIPTION
117	1350078.09	461590.63	726.68	IR58
118	1349525.95	463587.97	779.61	IR58
400	1352594.34	463227.89	760.98	TH2
401	1352603.11	462016.41	755.77	BM

SEE NOTE 17.

THOMAS R. GREDELL
NUMBER
PE-021137

Thomas R. Gredell
10-7-15

Thomas R. Gredell, P.E.
E-021137

#	DATE	REVISION DESCRIPTION	BY

GREDELL Engineering Resources, Inc.
ENVIRONMENTAL ENGINEERING LAND - AIR - WATER
1505 East High Street
Jefferson City, Missouri
Telephone: (573) 659-9078
Facsimile: (573) 659-9079
MO CORP. ENGINEERING LICENSE NO. E-2001001669-D

THOMAS HILL
ENERGY CENTER
aeci

COVER SHEET
POND 001 - CELL 2
SEPARATION BERM

SURVEYED	DESIGNED	DRAWN	CHECKED	APPROVED	DATE	SCALE	PROJECT NAME	FILE NAME	SHEET #
NA	MW	AJK	MW	TRG	10/2015	AS NOTED	AECI/THEC	COVER	1 OF 5

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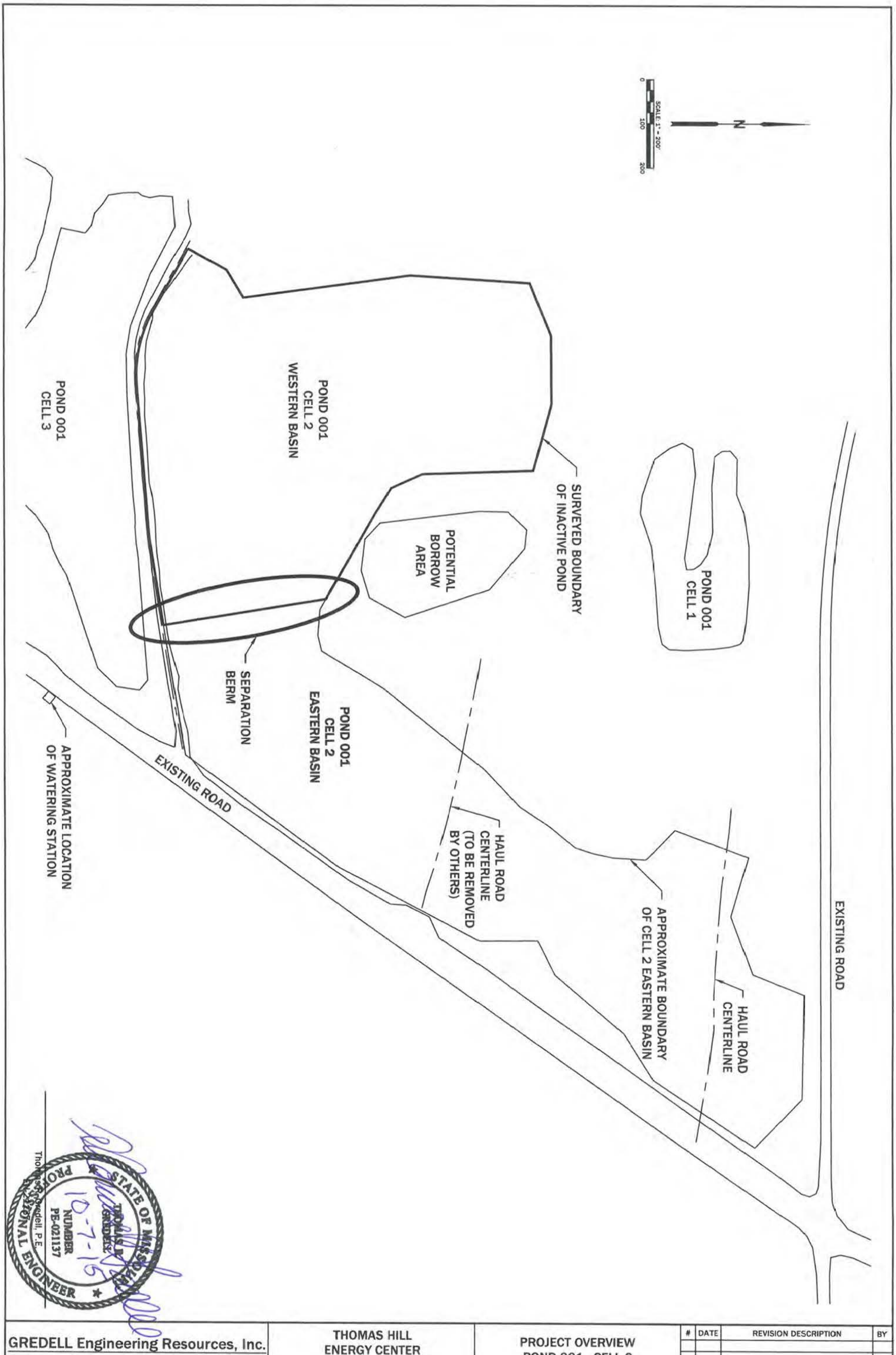

Thomas R. Gredell
NUMBER PE-021137
10-7-15

Thomas R. Gredell, P.E.
PE-021137

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THOMAS HILL
ENERGY CENTER
aeci
associated electric cooperative, inc.

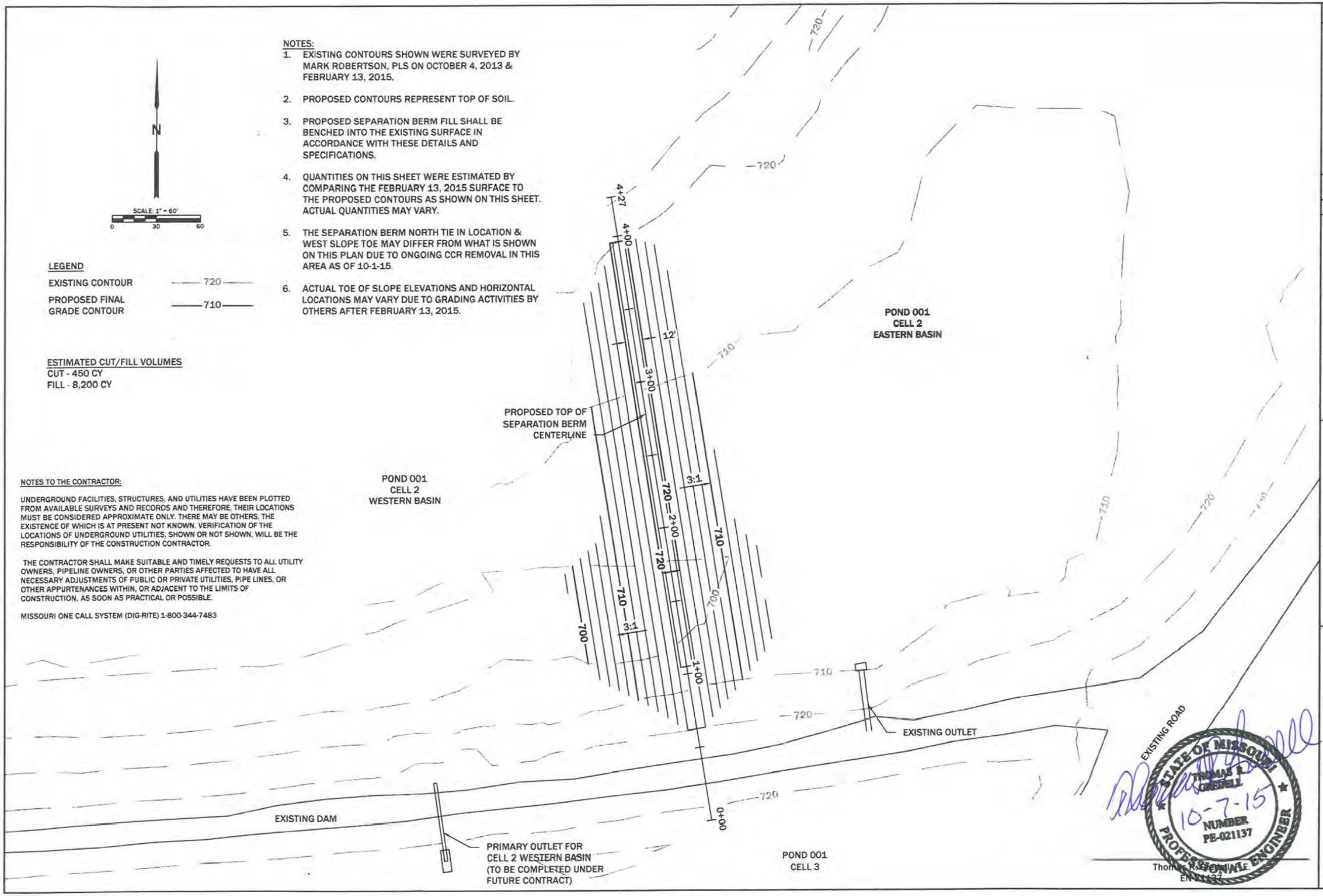
SURVEYED	DESIGNED	DRAWN	CHECKED	APPROVED	DATE	SCALE
NA	MW	AJK	AR	TRG	10/2015	AS NOTED

PROJECT OVERVIEW
POND 001 - CELL 2
SEPARATION BERM

PROJECT NAME	FILE NAME	SHEET #
AECI/THEC	PROJECT OVERVIEW	2 OF 5

#	DATE	REVISION DESCRIPTION	BY

M:\Share\CADDFiles\AECI\THEC\AECI-THEC ASH VOLUME\POND 001 CELL 2 - SEPARATION BERM\SEPARATION BERM.DWG, CELL 2 SEPARATION BERM GRADING PLAN, 10/7/2015 10:45:05 AM



NOTES:

1. EXISTING CONTOURS SHOWN WERE SURVEYED BY MARK ROBERTSON, PLS ON OCTOBER 4, 2013 & FEBRUARY 13, 2015.
2. PROPOSED CONTOURS REPRESENT TOP OF SOIL.
3. PROPOSED SEPARATION BERM FILL SHALL BE BENCHED INTO THE EXISTING SURFACE IN ACCORDANCE WITH THESE DETAILS AND SPECIFICATIONS.
4. QUANTITIES ON THIS SHEET WERE ESTIMATED BY COMPARING THE FEBRUARY 13, 2015 SURFACE TO THE PROPOSED CONTOURS AS SHOWN ON THIS SHEET. ACTUAL QUANTITIES MAY VARY.
5. THE SEPARATION BERM NORTH TIE IN LOCATION & WEST SLOPE TOE MAY DIFFER FROM WHAT IS SHOWN ON THIS PLAN DUE TO ONGOING CCR REMOVAL IN THIS AREA AS OF 10-1-15.
6. ACTUAL TOE OF SLOPE ELEVATIONS AND HORIZONTAL LOCATIONS MAY VARY DUE TO GRADING ACTIVITIES BY OTHERS AFTER FEBRUARY 13, 2015.

LEGEND

EXISTING CONTOUR	— — 720 — —
PROPOSED FINAL GRADE CONTOUR	——710——

ESTIMATED CUT/FILL VOLUMES

CUT - 450 CY
FILL - 8,200 CY

NOTES TO THE CONTRACTOR:

UNDERGROUND FACILITIES, STRUCTURES, AND UTILITIES HAVE BEEN PLOTTED FROM AVAILABLE SURVEYS AND RECORDS AND THEREFORE, THEIR LOCATIONS MUST BE CONSIDERED APPROXIMATE ONLY. THERE MAY BE OTHERS, THE EXISTENCE OF WHICH IS AT PRESENT NOT KNOWN. VERIFICATION OF THE LOCATIONS OF UNDERGROUND UTILITIES, SHOWN OR NOT SHOWN, WILL BE THE RESPONSIBILITY OF THE CONSTRUCTION CONTRACTOR.

THE CONTRACTOR SHALL MAKE SUITABLE AND TIMELY REQUESTS TO ALL UTILITY OWNERS, PIPELINE OWNERS, OR OTHER PARTIES AFFECTED TO HAVE ALL NECESSARY ADJUSTMENTS OF PUBLIC OR PRIVATE UTILITIES, PIPE LINES, OR OTHER APPURTENANCES WITHIN, OR ADJACENT TO THE LIMITS OF CONSTRUCTION, AS SOON AS PRACTICAL OR POSSIBLE.

MISSOURI ONE CALL SYSTEM (DIG-RITE) 1-800-344-7483

THOMAS R. GREDELL
NUMBER
PE-021137
10-7-15

Thomas R. Gredell P.E.
EN 21137

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MO CORP. ENGINEERING LICENSE NO. E-2001001669-D

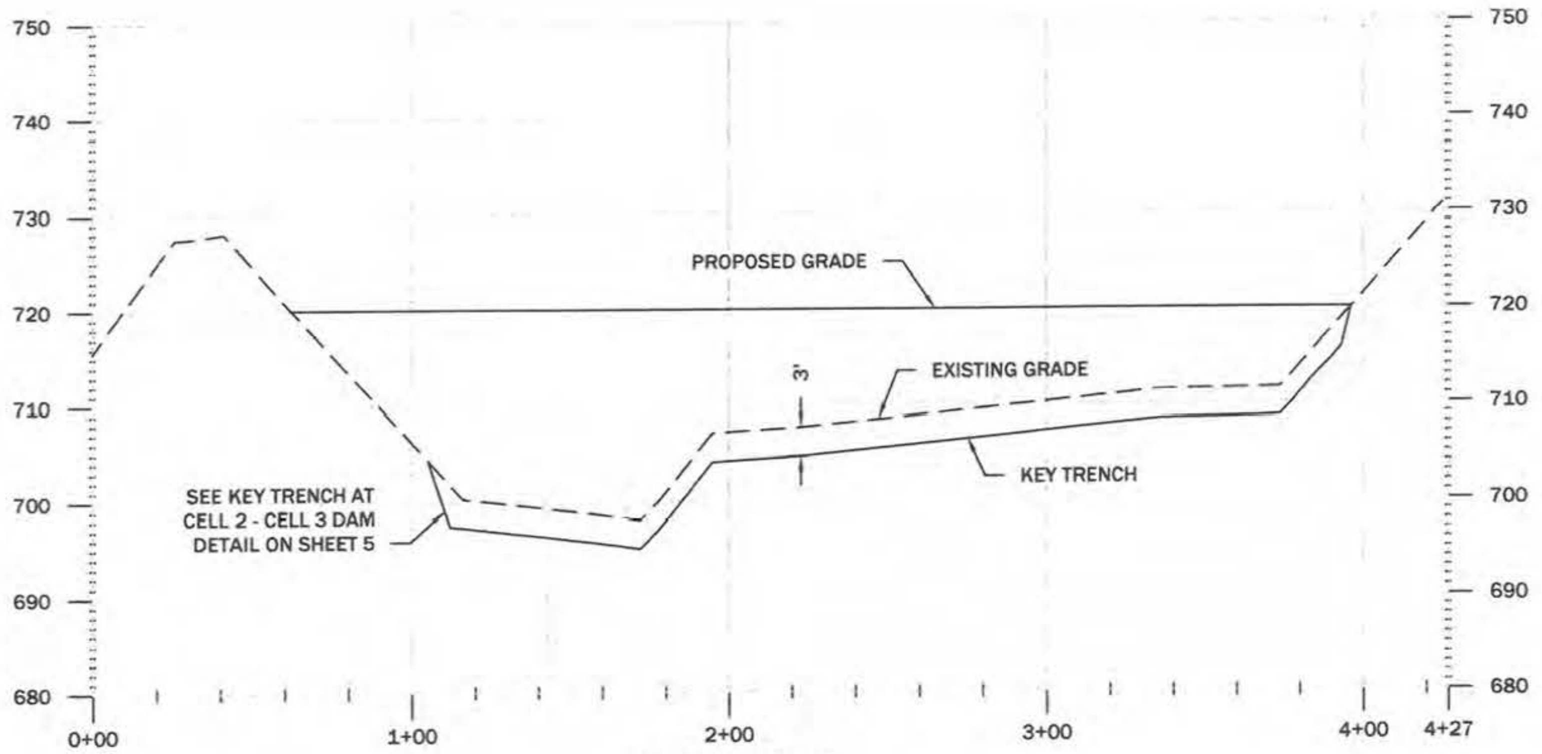
THOMAS HILL
ENERGY CENTER
associated electric cooperative, inc.

SURVEYED	DESIGNED	DRAWN	CHECKED	APPROVED	DATE	SCALE
NA	MW	AJK	AR	TRG	10/2015	AS NOTED

CELL 2 SEPARATION BERM
GRADING PLAN
POND 001 - CELL 2
SEPARATION BERM

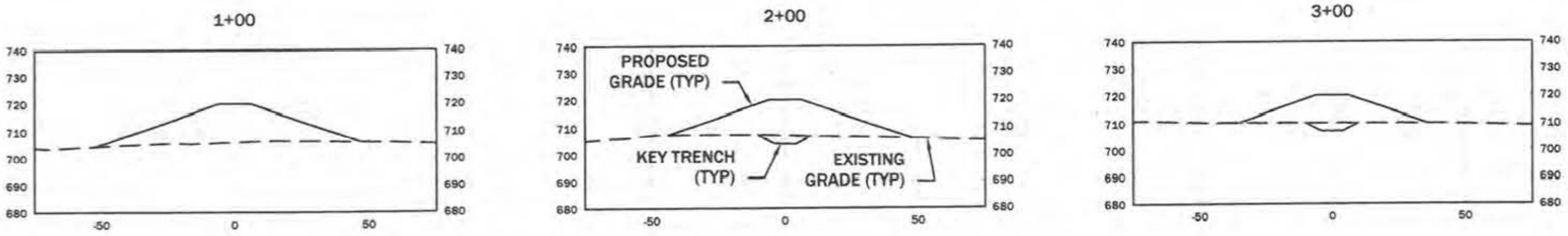
PROJECT NAME	FILE NAME	SHEET #
AECI/THEC	SEPARATION BERM	3 OF 5

#	DATE	REVISION DESCRIPTION	BY



SEPARATION BERM
SCALE:
HORIZONTAL - 1"=60'
VERTICAL - 1"=20'

NOTE:
1. SEE SHEET 5 FOR SEPARATION BERM AND KEY TRENCH DETAILS.



CROSS SECTIONS
SCALE:
HORIZONTAL - 1"=60'
VERTICAL - 1"=60'

10-7-15
THOMAS R. GREDELL
NUMBER
PE-021137

Thomas R. Gredell, P.E.
EN-2113[illegible]

#	DATE	REVISION DESCRIPTION	BY

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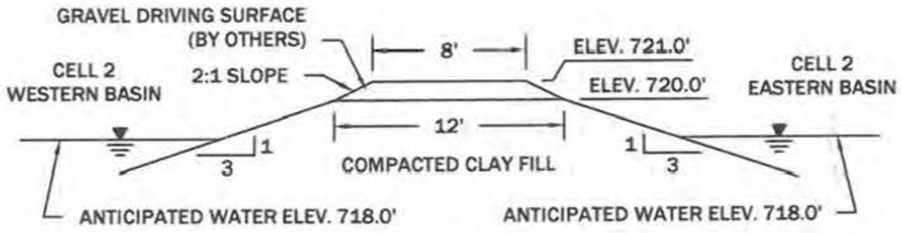
THOMAS HILL
ENERGY CENTER

CELL 2 SEPARATION BERM
PROFILE AND CROSS SECTIONS
POND 001 - CELL 2
SEPARATION BERM

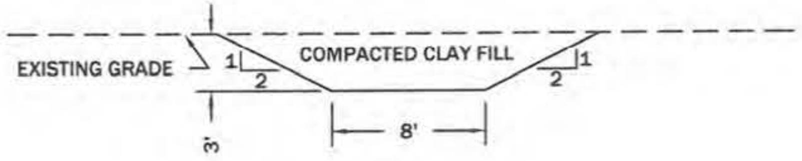
SURVEYED	DESIGNED	DRAWN	CHECKED	APPROVED	DATE	SCALE	PROJECT NAME	FILE NAME	SHEET #
NA	MW	AJK	AR	TRG	10/2015	AS NOTED	AECI-THEC	SEPARATION BERM	4 OF 5

:\Share\CADDFiles\AECI\THEC\AECI-THEC ASH VOLUME\POND 001 CELL 2 - SEPARATION BERM\SEPARATION BERM.DWG, CELL 2 SEPARATION BERM PROFILE AND CROSS SECTIONS, 10/7/2015 10:45:13 AM



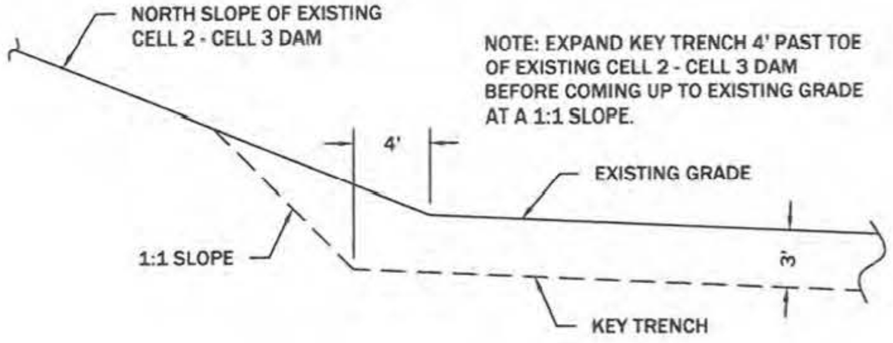
SEPARATION BERM

1"=10'



KEY TRENCH

1"=10'



NOTE: EXPAND KEY TRENCH 4' PAST TOE OF EXISTING CELL 2 - CELL 3 DAM BEFORE COMING UP TO EXISTING GRADE AT A 1:1 SLOPE.

KEY TRENCH AT CELL 2 - CELL 3 DAM

1"=10'

THOMAS R. GREDELL
NUMBER PE-021137
10-7-15

Thomas R. Gredell, P.E.

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THOMAS HILL ENERGY CENTER

aeci

DETAILS
POND 001 - CELL 2
SEPARATION BERM

SURVEYED	DESIGNED	DRAWN	CHECKED	APPROVED	DATE	SCALE	PROJECT NAME	FILE NAME	SHEET #
NA	MW	AJK	AR	TRG	10/2015	AS NOTED	AECI-THEC	SEPARATION BERM	5 OF 5

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Technical Specifications

CCR SEPARATION BERM
Pond 001 Cell 2 - 2015

THOMAS HILL ENERGY CENTER
ASSOCIATED ELECTRIC COOPERATIVE, INC.
CLIFTON HILL, MISSOURI
October 1, 2015

PROJECT DESCRIPTION AND SPECIFICATIONS

This project involves constructing a berm to separate Pond 001 Cell 2 (Cell 2) at the Thomas Hill Energy Center. The Cell 2 separation berm will be constructed in a north-south alignment, dividing Cell 2 into eastern and western surface impoundments. The separation berm will incorporate a compacted clay cutoff trench below existing grade, and a compacted clay embankment. A compacted aggregate driving surface will be constructed by others, outside this scope of work, to allow vehicular traffic for inspection and maintenance purposes. The overall purpose of the berm is to create a clean, inactive surface impoundment in the eastern basin of Cell 2 to be used as a stormwater detention basin, and an inactive CCR surface impoundment in the western basin of Cell 2 containing legacy CCR solids and liquids. The two surface impoundments are further described as follows:

- The eastern surface impoundment is a clean, unlined, surface impoundment, utilized as a non-CCR stormwater detention basin. Discharge will be via the existing Cell 2 drop inlet discharge structure into Pond 001 Cell 3 (Cell 3).
- The western surface impoundment is an unlined, inactive CCR surface impoundment containing legacy CCR solids and liquids. Discharge will be via new primary and emergency pipe discharge structures into Cell 3.

In addition, the project involves reducing the height of the existing dam between Cell 2 and Cell 3 (Cell 2 – Cell 3 dam), and re-grading its upstream and downstream slopes. A compacted aggregate driving surface will be constructed by others, outside this scope of work, to allow vehicular traffic for inspection and maintenance purposes. The overall purpose of reducing the existing dam's height is to facilitate slope maintenance and inspection.

PROJECT OVERVIEW

CCRs are sluiced via a pipeline from the plant into Pond 001 Cell 1. CCRs and liquids are conveyed around Cell 2 to Cell 3 through a discharge channel locally referred to as the "Babbling Brook." Cell 2 receives only stormwater runoff. Excavation activities are currently underway to remove CCRs from Cell 2 for disposal. A contractor will be selected to construct a berm in a north-south alignment along the shortest centerline distance between the existing Cell 2 – Cell 3 dam and the natural existing ridge within Cell 2. The berm will be constructed by excavating a key trench and placing, compacting, and grading earthen material to a final design elevation. Fill materials will consist of compacted clay soil. The fill materials are further described as follows:

- Final elevation of the Cell 2 separation berm shall be 720.0 feet with a minimum top width of twelve (12) feet prior to gravel placement as shown on the plan sheets.
- Key trench shall be keyed into the existing bottom surface at a minimum bottom width of eight (8) feet, a minimum depth of three (3) feet, and two horizontal to one vertical (2H:1V) side slopes.
- The berm side slopes shall be three horizontal to one vertical (3H:1V).
- The earthen material shall consist of compacted clay soil, compacted in uniform horizontal lifts with a maximum loose thickness of eight (8) inches to a density of 95% Standard Proctor Maximum Dry Density (MDD).

The selected contractor will be required to excavate earthen material from the existing Cell 2 – Cell 3 dam and re-grade the existing side slopes utilizing the excavated earthen material. Excess earthen material shall be stockpiled on site as directed by Associated Electric Cooperative, Inc. (AECI). Primary and emergency outlets shall be installed as depicted on the plan sheets. The final design parameters are further described as follows:

- Final elevation of the existing dam shall be 722.0 feet with a minimum top width of fourteen (14) feet prior to gravel placement as shown on the plan sheets.
- Final downstream face of dam side slopes shall be re-graded to three horizontal to one vertical (3H:1V) or flatter.
- Final upstream face of dam side slopes shall be re-graded from the existing upstream toe of the Cell 2 – Cell 3 dam to the proposed final elevation of the existing dam prior to gravel placement (722.0 feet).
- The primary and emergency outlets shall be placed as shown on the plan sheets.

AECI reserves the right to inspect and oversee all construction activities, as well as reject any proposed activity that it deems will not meet the overall project goals, schedule, and objectives.

PROJECT SCHEDULE

The project will begin in September 2015 and the construction of the Cell 2 separation berm must be functionally and substantially complete by October 16, 2015. Functionally and substantially complete includes the placement, compaction, and grading of earthen materials for the Cell 2 separation berm to the design elevations specified on the plan sheets and in the written specifications, or as directed by AECI for the Cell 2 separation berm.

PROJECT GOALS

AECI's criteria to determine project completion is based on the following project goals:

1. Place, compact, and grade suitable earthen materials to the design elevations specified on the plan sheet and in the written specifications, or as directed and approved by AECI for the Cell 2 separation berm.
2. Excavate, place, compact, and grade existing earthen dam materials to the design elevations specified on the plan sheet and in the written specifications, or as directed and approved by AECI for the existing Cell 2 – Cell 3 dam.

PROJECT SPECIFICATIONS

General

Contractor activities must be coordinated with AECI throughout the project. Cell 2 is an inactive surface impoundment that receives stormwater. Plant operations will not be suspended to complete the construction project. The contractor may be required to remove CCRs from the site area in order to prepare the subgrade prior to excavating the key trench and placing and compacting earthen material. CCRs removed from the site shall be disposed in on-site Disposal Cell 3, or as directed by AECI. Contractor is to coordinate with AECI regarding all CCR removal and disposal.

Contractor is responsible for dewatering Cell 2 and maintaining proper water management throughout the duration of excavation and construction. Contractor is also responsible for maintaining AECI roadways, used for hauling operations, to comply with AECI standards for dust emission levels and proper roadway grades.

The Contractor must maintain the integrity of all structures within the vicinity of the project including, but not limited to: dewatering pad for Cell 1; Cell 2 outlet structure; and the adjoining AECI roads.

The Contractor must coordinate operations with AECI's Environmental Compliance Manager to maintain the following water quality discharge effluent limits at the point of discharge from Pond 001.

1. pH no less than 6.5 and no greater than 9.0;
2. Total Suspended Solids (TSS) no greater than 20 mg/L,
3. Oil and Grease (O&G) no greater than 1 mg/L.

The Contractor is responsible for means and methods within the vicinity of Cell 2, including BMPs, to meet the required water quality parameters stated above. Contractor shall submit a sediment control plan, as part of the work plan submittal, to be approved by AECI prior to excavation.

Compacted Clay Soil

Suitable earthen materials for use as compacted clay soil shall have a group symbol of CL, CH, or SC according to the Unified Soil Classification System. Earthen material shall be free of rock larger than two inches in any dimension, debris, waste, vegetation, or other deleterious matter. Onsite borrow areas are available to the contractor, at AECI's discretion, within 2,000 feet of the project area.

Soil Compaction

Soils shall be placed in uniform horizontal lifts with a maximum loose thickness of eight (8) inches, and uniformly and thoroughly compacted to the specified moisture and density requirements. Compacted soils shall be subject to periodic testing to the approved moisture and density specifications. Material conditioning procedures, compaction equipment, and compaction rolling patterns will be approved by AECI and shall be consistent throughout the project. The compacted clay soils will be compacted with equipment that kneads, compacts, and interbonds the soil from the bottom of the lift up. Tracked equipment cannot be used for clay soil compaction.

Uniformly moisten or aerate subgrade and each subsequent fill layer to achieve the specified minimum percent of maximum dry density and soil moisture content.

Remove and replace, or scarify and air dry, satisfactory soil material that is too wet to compact within the specified moisture range and to the specified density.

All fill for the compacted clay berm shall be compacted to a minimum of 95 percent of ASTM D698 (Standard Proctor) maximum dry density at a moisture content between minus 2% and plus 4% of the optimum moisture content. Refer to attached laboratory results. A minimum of three (3) complete coverage passes of the compaction equipment is also required. The Contractor is responsible for obtaining and submitting representative proctor test results for any fill material not taken from the identified onsite borrow area.

Where fill is to be placed on existing slopes that are steeper than ten horizontal to one vertical (10H:1V), the existing slopes shall be continuously benched to receive fill. Bench surfaces shall be no steeper than 10H:1V, and bench vertical rises shall be no more than 12-inches in height. Benching shall be of sufficient width to permit placing and compacting operations. Each horizontal cut shall begin at the intersection of the ground line and the vertical side of the previous bench. The intersection of the Cell 2 separation berm and the Cell 2 – Cell 3 dam shall be benched in the manner described in this paragraph.

All compacted clay fill for pipe embedments shall be carefully placed and thoroughly compacted to a minimum 95 percent ASTM D698 (Standard Proctor) maximum dry density at moisture content between minus 2% and plus 4% of the optimum moisture content to produce a uniform pipe embedment for the primary and emergency outlet discharge pipes for the western basin of Cell 2. Compacted clay fill shall fill all voids in the pipe embedment. Primary and emergency outlet discharge pipes shall be fully supported in haunches formed in the compacted clay fill as shown on the plan sheets. Rock shall not be used for pipe embedment material.

Contractor shall carefully place and compact all pipe backfill so as not to displace, damage, or deform the primary and emergency outlet discharge pipes. Contractor is responsible for the means and methods to ensure the primary and emergency outlet discharge pipes are not damaged during installation.

Nonwoven Geotextile

A nonwoven geotextile shall be installed on top of the southerly slope of the existing Cell 2 – Cell 3 dam at the effluent of the primary and emergency outlet discharge pipes for the western, inactive Cell 2 surface impoundment and extend to the toe of the southerly slope to separate the dam surface from the rip-rap. The geotextile shall be Mirafi 180N by TenCate or an approved equivalent. The geotextile shall be laid on top of the subgrade and stretched tight to remove any folds or wrinkles. In areas where material seams overlap, the geotextile overlap shall be a minimum of twelve (12) inches or in accordance with the manufacturer's guidelines, standards and specifications. The lapped edges shall be oriented in the direction of the fill placement, to minimize peeling potential. Equipment shall not operate in direct contact with the geotextile. The edges of the geotextile shall be secured on the south and the north edges in an anchor trench (as shown on the plan sheets) and on all other sides with sandbags or by other means prior to the placement of fill material.

The geotextile shall be protected from long term exposure to direct sunlight during transport and storage. Storage of the geotextile shall be in such a manner to avoid contact with excessive mud, epoxies, wet concrete, or any other deleterious materials.

Geotextile fabric required for the project shall be installed in accordance with the manufacturer's guidelines, standards, and specifications. Care will be used during construction to ensure that geotextile materials are not damaged.

The effluent of the primary and emergency discharge pipes of the western, inactive Cell 2 surface impoundment shall be elevation 716.5 feet. Geotextile shall extend from the effluent discharge pipe elevation to the toe of the slope of Cell 2 – Cell 3 dam as depicted on the plan sheets. Geotextile shall be placed three (3) feet to either side of the center line of the primary and emergency spillway effluent discharge pipes.

Rip-Rap

The contractor shall furnish and place a six (6) inch thick layer of two (2) inch dense graded aggregate base on top of the geotextile to be installed on the southerly slope of the Cell 2 – Cell 3 dam at the effluent of the primary and emergency discharge outlet pipes for the western, inactive Cell 2 surface impoundment. The contractor shall furnish and place a two (2) foot layer of twelve (12) inch rip-rap on the southerly slope of the Cell 2 – Cell 3 dam from the effluent of the primary spillway for the western, inactive Cell 2 surface impoundment on top off the six (6) inch layer of dense graded aggregate base.

The effluent discharge pipe elevation of the primary and emergency spillways for the western, inactive Cell 2 surface impoundment shall be elevation 716.5 feet. Rip-rap and dense graded base aggregate shall extend from the effluent discharge pipe elevation to the toe of the slope of the Cell 2 – Cell 3 dam as depicted on the plan sheets. The rip-rap and dense graded aggregate base shall be placed three (3) feet to either side of the center line of the primary and emergency spillway effluent discharge pipes.

Grading

Uniformly grade all areas surrounding the constructed Cell 2 separation berm and the modified Cell 2 – Cell 3 dam to a smooth surface, free from irregular surface changes. Finish grade to cross-sections, lines, and elevations indicated. Uniformly grade all borrow areas to establish positive drainage and provide a smooth surface traversable by light duty pickup trucks.

Seeding and Mulching

Finish graded areas shall be disked to a depth approved by the Owner or their representative in preparation for fertilizer, seed and mulch.

Contractor is responsible for providing and placing fertilizer, seed, and mulch on the uniformly graded borrow areas. Fertilizer shall be applied at a 60 lb. - 90 lb. - 90 lb. nitrogen, phosphorous, and potassium (NPK) ratio per acre. Seeding mixture for erosion control shall be a fescue/clover/lespedeza mixture applied at a rate of 35 pounds per acre of pure live seed (pls) fescue seed, 10 pounds per acre of pls clover seed, and 6 pounds per acre of pls lespedeza seed. Seeding mixture for cover crop shall be oats applied at a rate of 35 pounds per acre. Mulch shall be wheat straw and applied at a rate of 1.5 to 2 tons per acre and crimped.

Outlet Structures

The primary and emergency outlet structures shall be fifteen (15) inch ADS HP Storm (polypropylene) pipe or approved equivalent. Pipe shall have a smooth interior and annular exterior corrugation. Pipe joints shall be watertight and of gasketed integral bell and spigot design.

The minimum length for the primary and emergency outlet pipes shall be as shown on the plan sheets. Primary and emergency outlet pipe influent and effluent elevations shall be as shown on the plan sheets.

The primary and emergency outlet pipes shall be fitted with a minimum of three (3) anti-seep collars as shown on the plan sheets. Anti-seep collars shall be Scheib Drainage NO-SEEP anti-seep collars or approved equivalent. Anti-seep collars shall form a watertight seal with the outlet pipe. Anti-seep collars shall be fully buried in clay fill as shown on the plan sheets.

Field Quality Control

Contractor shall allow the Owner, or their representative, to observe, inspect, and test density and moisture content of each fill layer. Testing shall occur at the Owner or their representative's discretion. The contractor shall not proceed until test results for previously completed work verify compliance with the specifications.

If test results indicate that fills are below specified density and/or outside of specified moisture ranges, scarify, moisten, aerate, and dry, or remove and replace soil as necessary to the depth required, re-compact, and re-test until obtaining required density and moisture content.

Protection

Protect newly graded areas from wind and rain erosion.

Settled, tracked, or eroded areas shall be filled and repaired and grades re-established to the required elevations and slopes.

CONTRACT PERFORMANCE STANDARDS

Contractor will be responsible for the means and methods of the construction of the berm and borrow area in the vicinity of Cell 2, with compensation based on verified quantities and unit bid prices.

If the Contractor fails to meet the water quality effluent limits that cause AECI to incur a Notice of Violation (NOV) for water quality, the Contractor will be subject to removal from the project and liquidated damages of 10% of contract total. AECI may sample the discharge from the contractor's work area at their discretion to determine if the water discharge meets the required water quality limits.

A record survey will be conducted BY THE OWNER following the completion of the construction of the Cell 2 separation berm and the Cell 2 – Cell 3 dam.

Criteria to determine project completion will be based on the project goals:

1. Place, compact, and grade earthen materials to the design elevations specified on the plan sheet and in the written specifications, or as directed and approved by AECI for the Cell 2 separation berm.
2. Excavate, place, compact, and grade earthen materials to the design elevations specified on the plan sheet and in the written specifications, or as directed and approved by AECI for the existing Cell 2 – Cell 3 dam.

3. SUBSTANTIAL COMPLETION BY OCTOBER 16, 2015 IS MANDATORY FOR THE CELL 2 SEPARATION BERM!

CONTRACT PAYMENT

The Contractor will be paid based on contractual unit bid prices and verified quantities. The Contractor shall include a proposed interim pay schedule as a part of the bid.

AECI will make the final determination of when the construction of Cell 2 separation berm and the Cell 2 – Cell 3 dam are substantially and functionally complete. AECI will require written notice 5 working days in advance of the Contractor's completion date to schedule a final survey of the constructed berm and dam. Once the final survey is completed, the surveyed area shall not to be disturbed. AECI will pay for the first final survey of the completed construction. Any subsequent additional surveys will be at the Contractor's expense.

CONTRACTOR SUBMITTALS

Construction Progress Work Plan and Schedule:

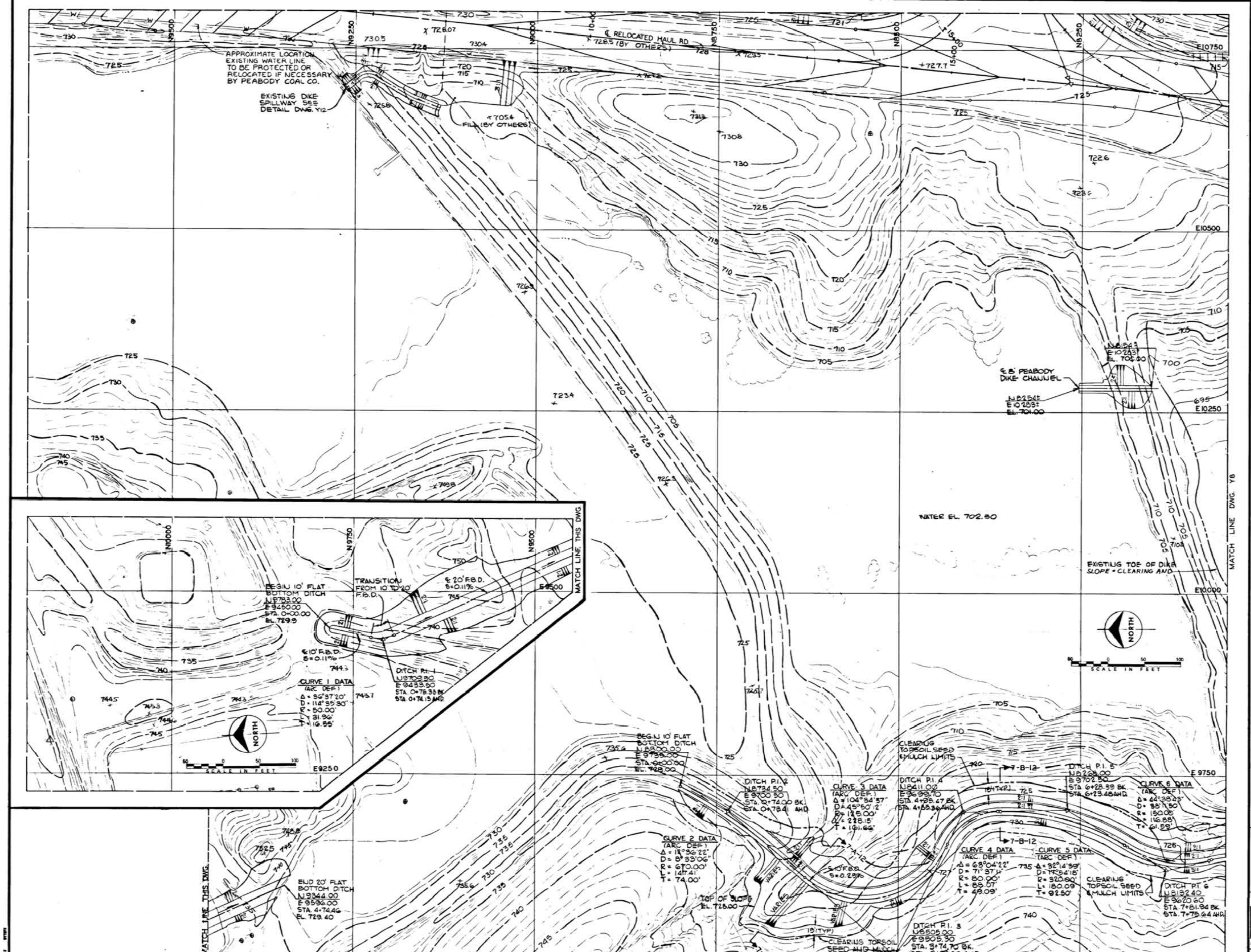
The Contractor is to submit a Construction Progress Work Plan and Schedule detailing equipment (expected types and numbers of equipment required, including hauling equipment); spill prevention procedures; dewatering and water control plans; erosion control plan; access points, routes and methods; and a detailed schedule including number of weather allowance days prior to mobilizing equipment to the site.

As a part of the Construction Progress Work Plan and Schedule, the Contractor will provide a SCHEDULE for substantial and functional completion of the required work by October 16, 2015. At a minimum, the schedule should identify a proposed start date, any periods of planned inactivity, and a proposed end date. Completion of the construction of the Cell 2 separation berm by October 16, 2015 is mandatory. Failure to meet this project deadline will result in liquidated damages of $5,000 per day.

The Construction Progress Work Plan and Schedule is subject to the Owner's review and consent. Neither the Owner's review of or consent to the Construction Progress Schedule will cause the Owner to be responsible or liable for any deficiencies of the Construction Progress Schedule, or for the Contractor's failure to perform the work in accordance with this contract.

END OF PROJECT DESCRIPTION AND SPECIFICATIONS

APPENDIX E
Available Misc. Drawings



NO.	DATE	BY	REVISION
	6-8-79	RAW	ISSUED AS B-D
⚠1	3-10-80	DLM	**CONFORMING TO CONSTRUCTION RECORDS**

RICHARD A. WHEATON
NUMBER E-12309

THOMAS HILL POWER PLANT
ASH POND FACILITIES #2

ASSOCIATED ELECTRIC COOPERATIVE
MISSOURI 73
CONTRACT NO. 142

GRADING PLAN 1

Burns & McDonnell
Engineers – Architects – Consultants
KANSAS CITY, MISSOURI

DATE	DEC. 1, 1978	DRAWING NO.	REV.
		Y7	1

APPENDIX F
Pond 001 Cell 2 Western Basin Hydrologic Analysis
By Gredell Engineering Resources, Inc. dated October 2015

1505 E. High Street
Jefferson City, Missouri 65101
Telephone No. (573) 659-9078
Fax No. (573) 659-9079

GREDELL Engineering Resources, Inc.

Memo

To: Associated Electric Cooperative, Inc. – Thomas Hill Energy Center File

From: Andrew D. Rackers, P.E., Environmental Engineer II

CC:

Date: 10/12/2015

Re: Pond 001 Cell 2 Western Basin Hydrologic Analysis

Pond 001 Cell 2 (Cell 2) construction modifications to divide Cell 2 into two (2) separate basins (an eastern basin and a western basin) and changes in designated use at Associated Electric Cooperative Inc. (AECI) – Thomas Hill Energy Center (THEC) necessitated the design of primary and emergency outlet structures for the western basin of Cell 2. A hydrologic and hydraulic analysis of the watershed for the western basin of divided Cell 2 was performed to facilitate the design of primary and emergency outlet structures.

Historically, Cell 2 was used as a coal combustion residuals (CCRs) surface impoundment. In 2012 AECI-THEC had Gredell Engineering estimate the volume of CCRs stored in Cell 2 with the intent to arrange for the removal and recycling or disposal of the accumulated CCR in Cell 2. AECI-THEC has ceased depositing CCRs in Cell 2 and has been consistently working to clean out the accumulated CCRs in it since 2012. A new federal regulation (40 CFR Part 257 Subpart D) establishing minimum standards for CCR surface impoundments having an effect date of October 19, 2015 led AECI-THEC to decide to complete construction modifications to Cell 2 to divide it into a closed (clean) side (the eastern basin) and an inactive side (the western basin). A separation berm was constructed in Cell 2 to divide Cell 2 into eastern and western basins. Historical accumulated CCRs in Cell 2 have been completely removed from the eastern basin and either transported to the active CCR landfill or stored in the new western basin of Cell 2. No new CCRs or CCR process water is being placed in the western basin of Cell 2. By definition, the western basin of Cell 2 is an inactive CCR surface impoundment per Part 257, Subpart D – Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments (Federal CCR Regulation).

The design of primary and emergency outlet structures was conducted based upon a hydrologic and hydraulic analysis, performed by generating a SCS curve number model using Hydraflow Hydrographs for the drainage area of the western basin. Watershed drainage areas were estimated using 2015 topographic surveys generated by Mark Robertson, PLS, 2011 aerial contours generated by Surdex, and 2015 Google Earth satellite imagery. Precipitation event parameters were obtained from the National Oceanic and Atmospheric Administration (NOAA) Atlas 14 precipitation frequency estimates. The resulting stormwater runoff calculations were made per the methods in *Soil and Water Conservation Engineering, Fourth Edition* (Schwab, Fangmeier, and Frevert 1993). The parameters below were used to generate the SCS curve number model:

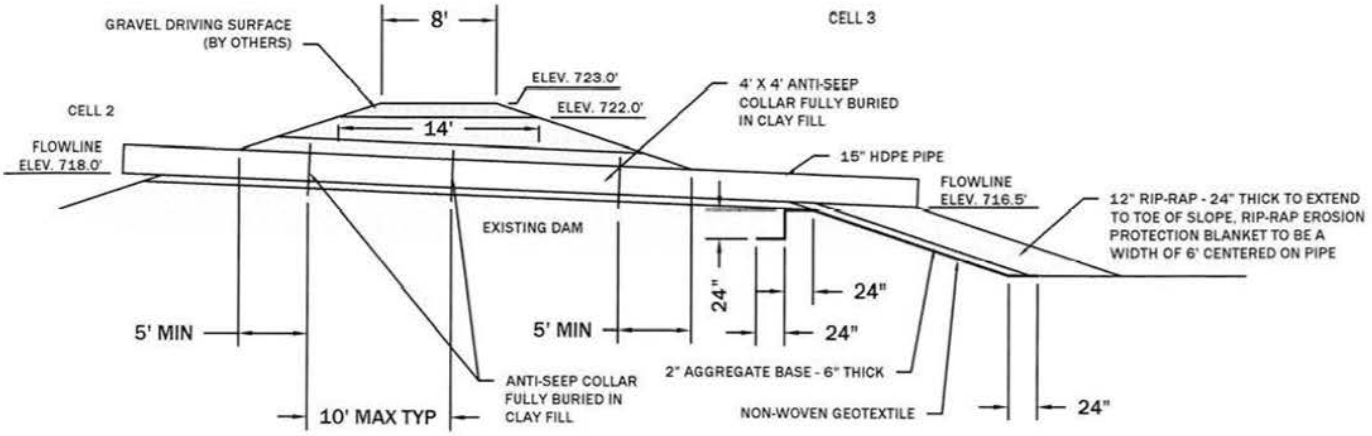
- Watershed Parameters:
    - Land Surface: 9.5 Acres, Hydrologic Soil Group C, Meadow – Land Use, 71 – Runoff Curve Number
    - Water Surface: 8.7 Acres, 100 – Runoff Curve Number
- Precipitation Event:
    - 100-year, 24-hour – approximately 7.93 inches
    - SCS Rainfall Distribution – Type II

The SCS curve number model generated a peak flow rate of 155.48 cubic feet per second (cfs) for the watershed and the time to reach the peak discharge is 11.93 hours. The peak discharge from the primary outlet structure is 2.39 cfs and the time to reach the peak flow rate is 17.98 hours. The total volume of water generated by the design storm event is 9.03 acre-feet. The maximum water surface elevation of the western basin of Cell 2 based upon the design storm event is 718.77 feet (0.77 feet above the inlet elevation of the primary outlet pipe). The maximum water surface elevation generated by the design storm (100-year, 24-hour) is less than the inlet elevation of the emergency outlet structure. See the attached Hydrograph Report for a detailed description of the results of the SCS curve number model analysis.

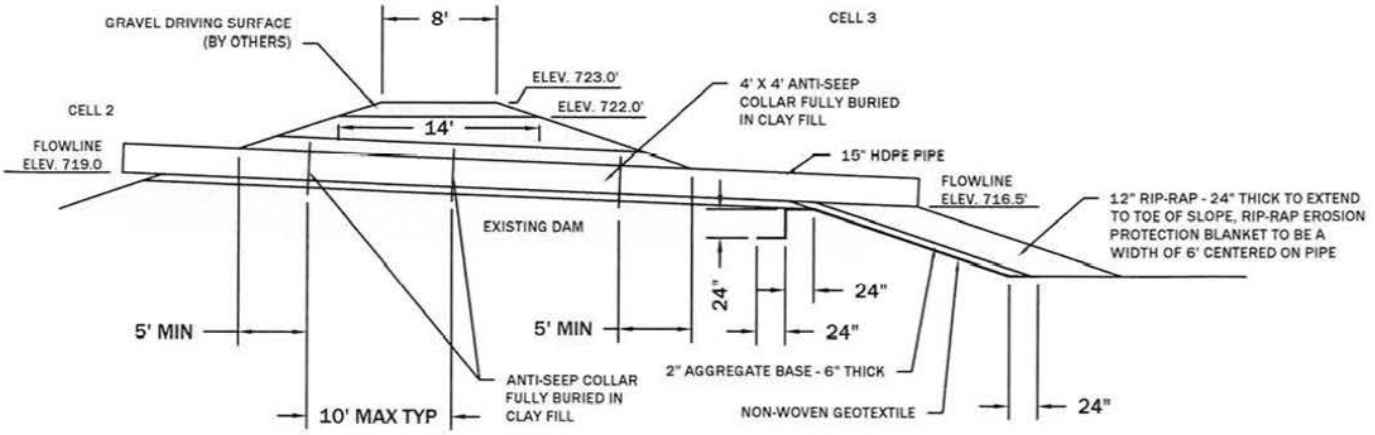
Based upon the resulting peak runoff values to be discharged from the western basin, the primary outlet structure needed was determined to be a 15-inch dual wall polypropylene pipe. The inlet elevation of the primary discharge structure was set at 718.0 feet to maintain two (2) feet of freeboard in the western basin below the top of berm elevation of 720.0. The elevation of the primary discharge pipe outlet was set at 716.5 feet on the Pond 001 Cell 3 side of the dam. A secondary emergency outlet structure (a second 15-inch dual wall polypropylene pipe) was required in the western Cell 2 – Cell 3 dam to prevent overtopping the Cell 2 – Cell 3 dam. The inlet elevation is 719.0 feet and the outlet elevation is 716.5 feet. See Figure 1 – Western Basin Outlet Pipe Details for design details of the proposed dual wall polypropylene outlet structures.

Figure

DRAFT
09/30/15



CELL 2 - CELL 3 DAM
PRIMARY OUTLET PIPE SECTION
N.T.S.



CELL 2 - CELL 3 DAM
EMERGENCY OUTLET PIPE SECTION
N.T.S.

AECI-THEC CELL 2
SEPARATION BERM
CELL 2 WESTERN BASIN OUTLET

GREDELL Engineering Resources, Inc.

ENVIRONMENTAL ENGINEERING LAND - AIR - WATER

1505 East High Street
Jefferson City, Missouri

Telephone: (573) 659-9078
Facsimile: (573) 659-9079

MO CORP. ENGINEERING LICENSE NO. E-2001001669-D

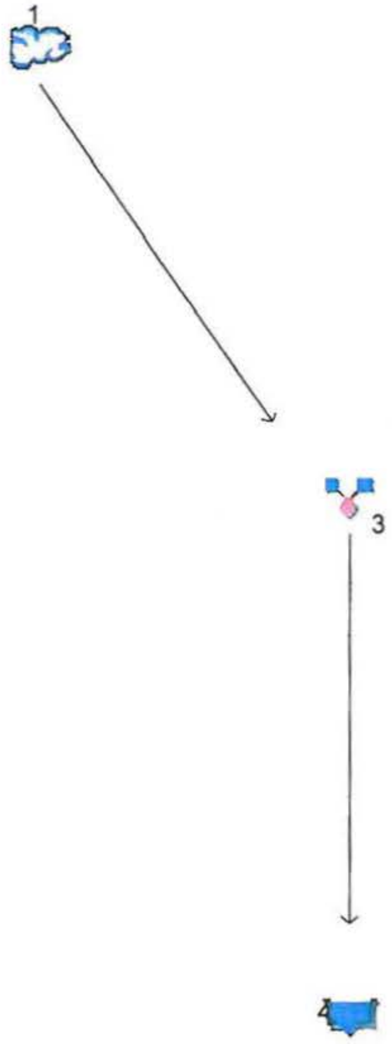
FIGURE 1 - WESTERN BASIN OUTLET PIPE DETAILS

DATE	SCALE	PROJECT NAME	REVISION
09/2015	AS NOTED	AECI-THEC CELL 2 SEPARATION BERM	
DRAWN	APPROVED	FILE NAME	SHEET #
MW	TG	CELL 2 OUTLET DETAILS	1 OF 1

M:\Share\CADDFiles\AECI\ ECI THEC ASH VOLUME\POND 001 CELL 2 - SEPARATION BERM\CELL 2 OUTFALL MODIFICATION.dwg, West Basin Outlet Pip 2/2015 4:02:08 PM

Hydrograph Report

Watershed Model Schematic



Legend

Hyd.	Origin	Description
1	SCS Runoff	Area 1
2	SCS Runoff	Water Surface
3	Combine	Combined Areas
4	Reservoir	<no description>

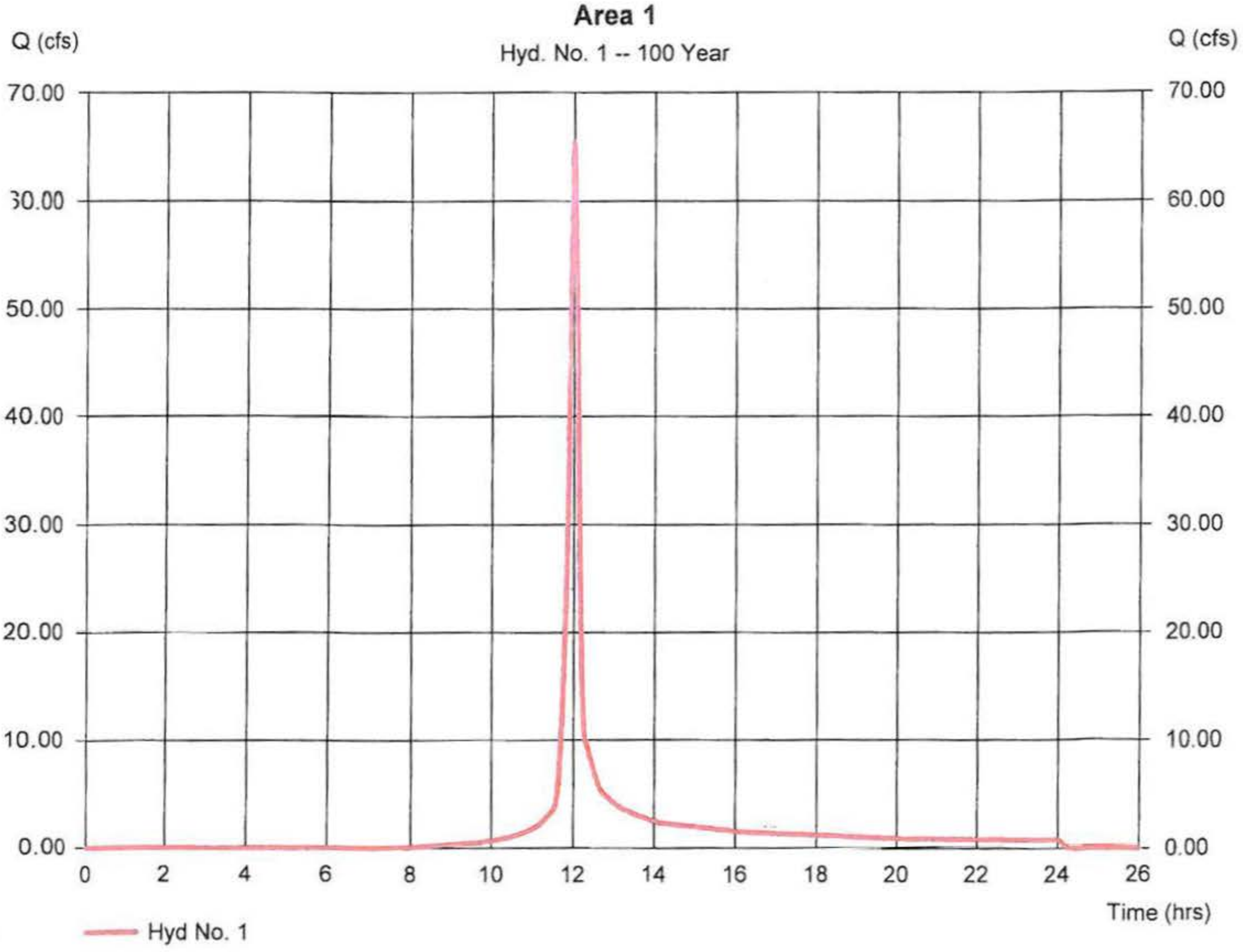
Hydrograph Report

Hyd. No. 1

Area 1

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 1 min
Drainage area = 9.500 ac
Basin Slope = 5.0 %
Tc method = LAG
Total precip. = 7.93 in
Storm duration = 24 hrs

Peak discharge = 65.37 cfs
Time to peak = 12.00 hrs
Hyd. volume = 158,602 cuft
Curve number = 71
Hydraulic length = 515 ft
Time of conc. (Tc) = 10.88 min
Distribution = Type II
Shape factor = 484

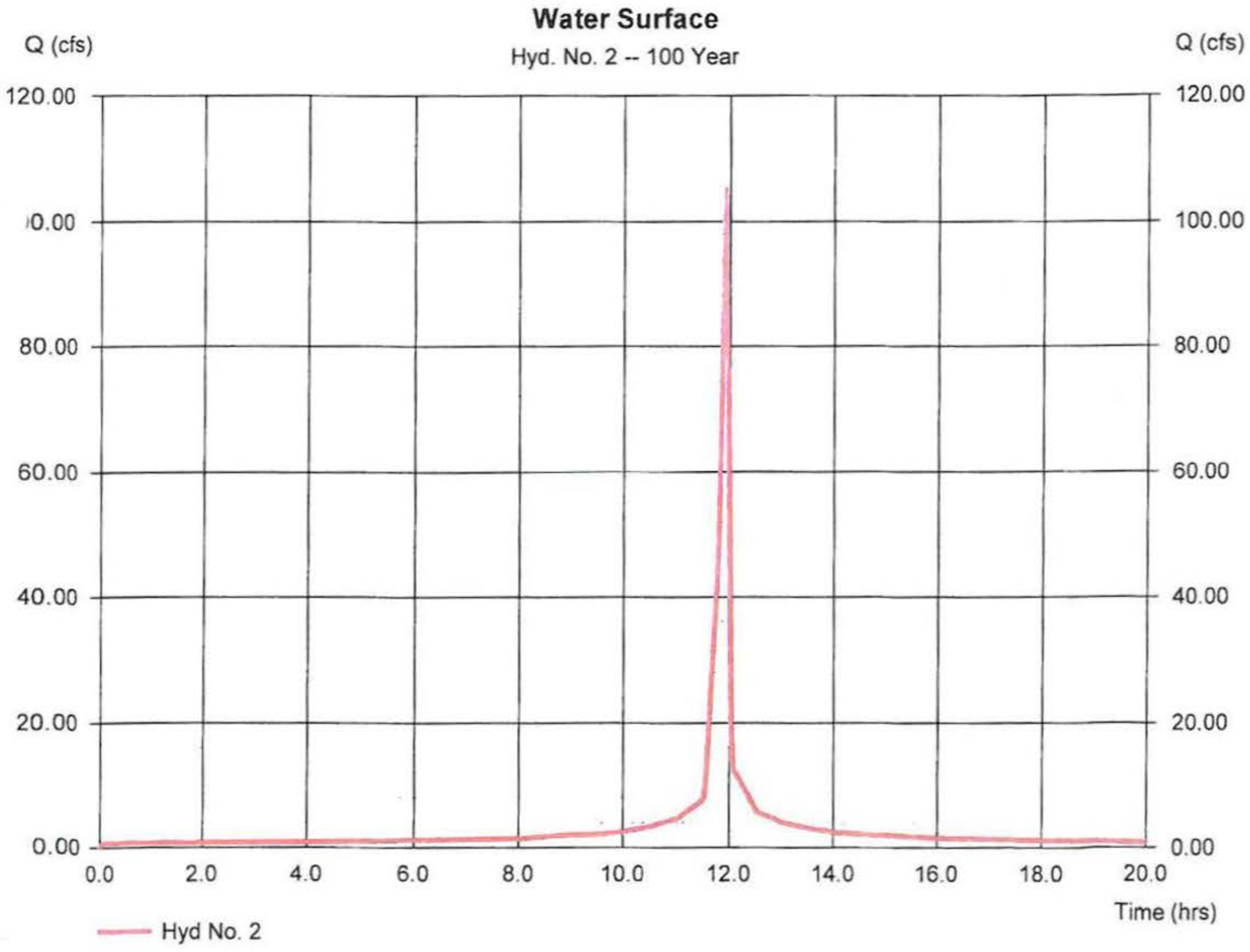


Hydrograph Report

Hyd. No. 2

Water Surface

Hydrograph type	= SCS Runoff	Peak discharge	= 104.96 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.92 hrs
Time interval	= 1 min	Hyd. volume	= 234,785 cuft
Drainage area	= 8.700 ac	Curve number	= 100
Basin Slope	= 0.0 %	Hydraulic length	= 1 ft
Tc method	= LAG	Time of conc. (Tc)	= 1.67 min
Total precip.	= 7.93 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

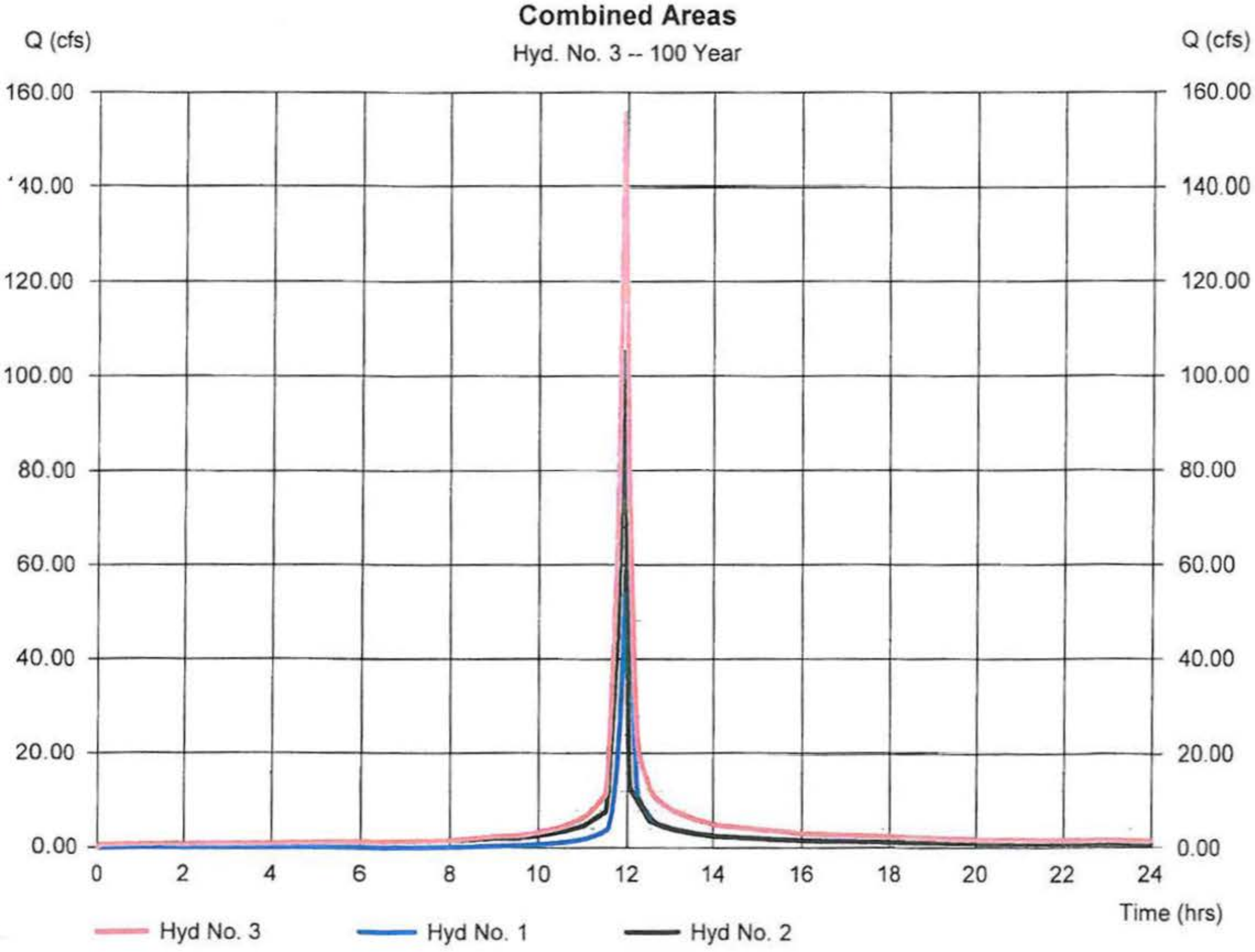


Hydrograph Report

Hyd. No. 3

Combined Areas

Hydrograph type	= Combine	Peak discharge	= 155.48 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 1 min	Hyd. volume	= 393,387 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 18.200 ac



Hydrograph Report

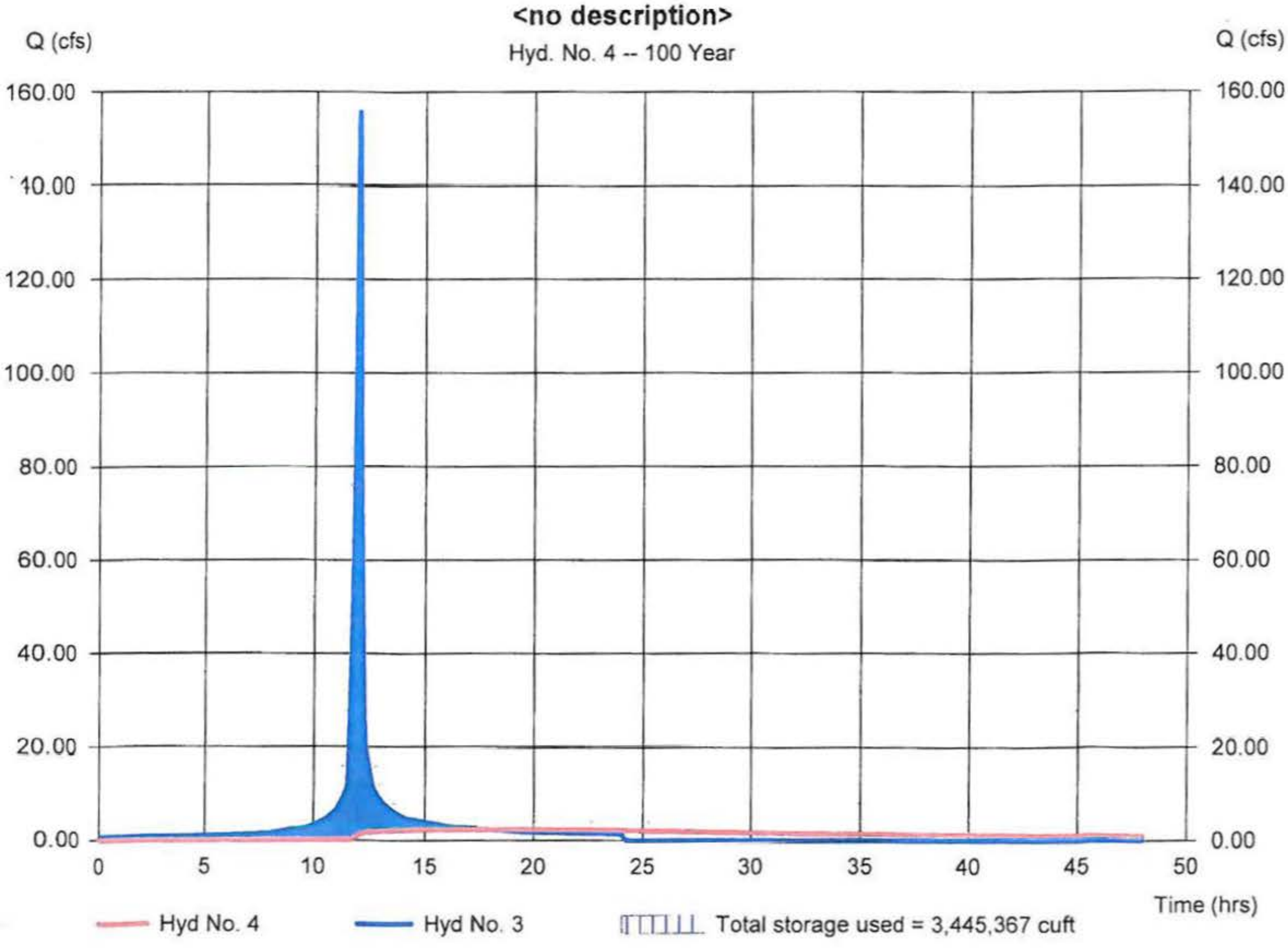
Hyd. No. 4

<no description>

Hydrograph type = Reservoir
Storm frequency = 100 yrs
Time interval = 1 min
Inflow hyd. No. = 3 - Combined Areas
Reservoir name = Western Cell 2

Peak discharge = 2.389 cfs
Time to peak = 17.98 hrs
Hyd. volume = 222,696 cuft
Max. Elevation = 718.77 ft
Max. Storage = 3,445,367 cuft

Storage Indication method used. Wet pond routing start elevation = 718.00 ft.



Pond Report

Pond No. 1 - Western Cell 2

Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 698.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	698.00	13,650	0	0
2.00	700.00	24,899	38,549	38,549
12.00	710.00	131,611	782,550	821,099
14.00	712.00	235,795	367,406	1,188,505
16.00	714.00	316,509	552,304	1,740,809
18.00	716.00	352,572	669,081	2,409,890
20.00	718.00	378,359	730,931	3,140,821
22.00	720.00	410,513	788,872	3,929,693

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 15.00	0.00	0.00	0.00
Span (in)	= 15.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 718.00	0.00	0.00	0.00
Length (ft)	= 54.00	0.00	0.00	0.00
Slope (%)	= 2.80	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

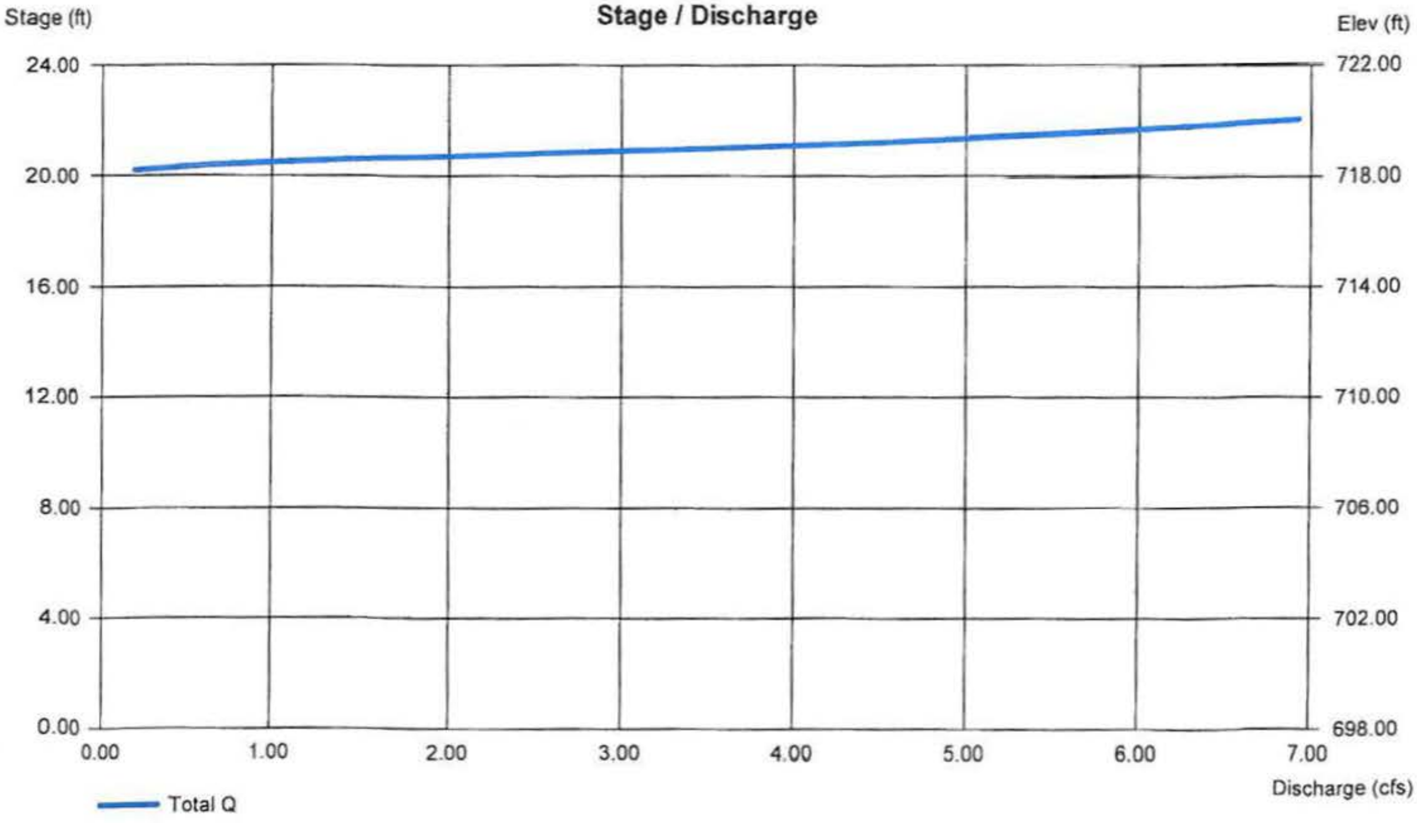
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.00	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= ---	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 0.000 (by Contour)

TW Elev. (ft) = 0.00

Note Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control Weir risers checked for orifice conditions (ic) and submergence (s)



Hydraflow Table of Contents