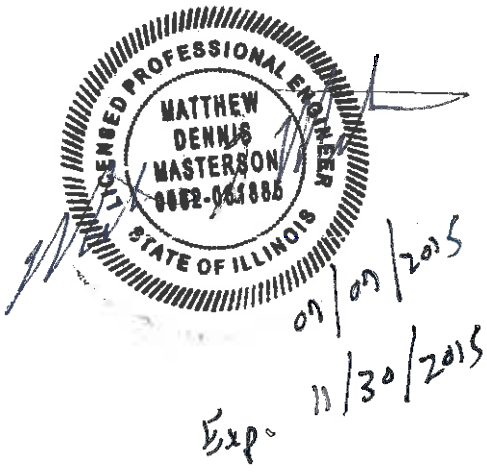
STRUCTURE GEOTECHNICAL REPORT

F.A.P. Route 685 (IL 9) over
North Fork LaMoine River

Existing S.N. 055-0015
Proposed S.N. 055-0097

F.A.P. ROUTE 685
SECTION (120-BR)1
MCDONOUGH COUNTY, ILLINOIS
JOB NO. D-94-012-09
PTB 150/024
CONTRACT NO. 68215
KEG NO. 09-0006.03



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Kaskaskia
Engineering Group, LLC

EXECUTIVE SUMMARY

F.A.P. Route 685 (IL 9) over North Fork LaMoine River
Section (120-BR)1
McDonough County, Illinois
Job No. D-94-012-09
PTB 150/024
Contract No. 68215
Proposed Structure No. 055-0097

The new structure is a three-span bridge located west of the intersection of Illinois Route 9 and East 1800th Street in McDonough County, Illinois. The purpose of this report is to present design and construction recommendations for the proposed structure.

Slope stability is not anticipated to be an issue at the east or west abutment locations.

The proposed structure will widen the existing roadway approximately 1.5 ft. New approach embankments with fills less than 2 ft. are proposed. Since no significant grading or changes to the existing embankments are expected at the proposed structure, it is estimated that the existing embankments will experience settlements of less than 0.5 in. Therefore, settlement is not a concern for the proposed structure.

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EXHIBITS

1.0 Project Description and Proposed Structure Information

1.1 Introduction

The geotechnical study summarized in this report was performed for the proposed structure at IL Route 9 over North Fork LaMoine River in McDonough County, Illinois. The purpose of this report is to present design and construction recommendations for the proposed structure.

1.2 Project Description

The project consists of installation of a new three-span bridge (SN 055-0097) located at IL Route 9 over North Fork LaMoine River. The project is located approximately 450 ft. west of the intersection of IL Route 9 and East 1800th Street. The general location of the structure is shown on a USGS Topographic Location Map, Exhibit A. The site lies within the limits of the Fourth Principal Meridian (T. 7N R. 2W Section 36) within the Galesburg Plain of the Till Plains section of the Central Lowland Province.

1.3 Proposed Bridge Information

The proposed structure (SN 055-0097) located at Illinois Route 9 over North Fork LaMoine River will consist of one, three-span structure built on a 15 degree skew from the centerline. The structure will have a width of 35 ft. – 2 in. out to out. The centerline of the structure will lie at Sta. 312+59.00 (IL Route 9). Integral abutments are proposed for the substructure.

The structure will measure 235 ft., measured along the centerline of IL Route 9, from back to back of abutments, and will support two, 12-ft. lanes with 4-ft. outside shoulders. Further substructure details will be based on the findings of this SGR.

1.4 Existing Bridge Information

The existing structure (SN 055-0015) was built in 1960 as a three-span continuous steel multi-beam/girder structure with a length of 154 ft. back-to-back abutments and with a 33 ft. – 8 in. out-to-out width.

2.0 Site Investigation, Subsurface Exploration, and Generalized Subsurface Conditions

The site investigation plan was developed by the Illinois Department of Transportation (IDOT). A KEG representative did not observe any part of the field exploration, or make site observations, including review of the soil samples retained during drilling. Due to a lack of field testing for compressive strength values of the retained samples, KEG estimated the unconfined compressive strengths of the cohesive samples based off of empirical data and engineering judgement.

Four standard penetration test (SPT) borings, designated B-1 through B-4, were drilled on June 10 through June 14, 2013. One rock core was performed at B-3 on June 12, 2013. The stations and offsets of the borings are listed in Table 2.1. The boring locations are shown on the Type, Size, and Location Plan (TS&L), Exhibit B, as provided by Allen Henderson and Associates, Inc.

Detailed information regarding the nature and thickness of the soils encountered and the results of the field sampling and laboratory testing are shown on the Boring Logs, Exhibit C. A soil profile can be found under Subsurface Profile, Exhibit D.

Table 2.1 – Boring Stations and Offsets

Designation	Stationing	Offset from Proposed Centerline	Surface Elevation (ft.)
B-1	313+11.5	37.0 ft. Right	622.5
B-2	313+76.5	45.0 ft. Right	623.0
B-3	312+6.5	42.5 ft. Right	623.4
B-4	311+41.5	41.0 ft. Right	623.0

2.1 Subsurface Conditions

The stratigraphy of the borings exhibited layers of clayey/sandy loam, silty clays, clays, silts, coarse sands, gravel, cobbles, and boulders. In general, the lithologic succession beneath the ground surface is as follows:

a) Fill (Clay/Sandy Clay/Sandy Loam) - All of the borings encountered fill material ranging from approximately 8 to 13 ft. The driving resistance (N-values) ranged from 2 to 10 blows per foot (bpf). The moisture content of the fill varied from 14 to 42 percent.

b) Clay/Loam/Sand - Below the fill material, layers of clay, loam, and sand were encountered ranging from 10 to 34 ft. thick. The N-values ranged from 1 to 16 bpf, with unconfined compressive strengths (Q_u) values from less than 0.50 to 3.5 tons per square foot (tsf). The moisture content varied from 13 to 37 percent.

c) Sand - From approximate El. 600 to 575 of each boring, sand was encountered. The sand layer in B-2 extended to approximately El. 565. The N-values ranged from 12 to 61 bpf, with moisture contents of 10 to 23 percent.

d) Clay/Sandy Clay/ Silty Clay - From approximate El. 570 to 550 of each boring, a layer of clay, sandy clay, and silty clay were encountered. A sandy clay layer extended to El. 545 in B-4. The N-values ranged from 9 to 38 bpf, with Q_u values from 1.1 to 4.5 tsf. The moisture content ranged from 14 to 46 percent.

e) Sand - A layer of sand was encountered from approximate El. 550 to 544 in B-1, B-2, and B-3. The N-values ranged from 22 to 46 bpf, with moisture contents of 7 to 18 percent.

f) Weathered Interbedded Dolomite Shale - From approximate El. 544 to termination/auger refusal of the borings, gray weathered shale, or shale with interbedded dolomite was encountered. B-3 was extended to approximate El. 536 with rock coring methods. The N-values ranged from 50 blows per 5 in. to 50 blows per 0 in., with moisture contents of 13 to 16 percent. The rock core was identified as weathered interbedded dolomite and shale and had a recovery of 33 percent and Rock Quality Designation (RQD) equal to zero.

2.2 Bedrock

Table 2.2 shows the elevation of auger refusal on apparent bedrock for Boring B-2 and the top elevation of the shale/shale with interbedded dolomite in the borings. Auger refusal is a designation applied to any material that cannot be further penetrated by the power auger without extraordinary effort and is indicative of a very hard or very dense material, usually bedrock.

Table 2.2 – Top of Rock Elevations

Boring	Auger Refusal Elevation (ft.)	Top of Rock Elevation (ft.)
B-1	N/A	544.02
B-2	543.50	544.50
B-3	N/A	543.90
B-4	N/A	545.00

2.3 Groundwater

Groundwater was encountered during drilling in Boring B-1 at El. 611.5, B-2 at El. 611.5, B-3 at El. 612.4, and B-4 at El. 607.0. It should be noted that the groundwater level is subject to seasonal and climatic variations. In addition, without extended periods of observation, measurement of true groundwater levels may not be possible.

3.0 Geotechnical Evaluations

3.1 Settlement

Since no significant grading or changes to the existing embankments are expected at the proposed structure, it is estimated that the existing embankments will experience settlements of less than 0.5 in. Therefore, no settlement calculations were performed for the proposed structure.

3.2 Slope Stability

The proposed construction of the IL Route 9 Bridge results in new endslopes at the abutment locations.

The proposed abutments are integral abutments with endslopes at 1 Vertical to 2 Horizontal (1V:2H), to the toe in the streambed. Slope stability of the endslopes was analyzed using SLOPE/W; the soil properties at the site, including Borings B-2 and B-4; and endslope geometrics.

KEG modeled the slopes at both abutment locations and the slopes at both river bank locations. Three conditions were modeled for each: end-of-construction, long-term, and a design seismic event. A critical factor of safety (FOS) was calculated for each condition. According to current standard of practice, the target FOS is 1.5 for end-of-construction and long-term slope stability and 1.0 for the design seismic event.

In order to model the end-of-construction condition, full cohesion was used with a friction angle of 0 degrees assumed for cohesive soils. Nominal values for cohesion were used with full friction angle to model the long-term and seismic conditions to analyze the theoretical condition where pore water pressure has dissipated. For new fill and clay and silty clay materials, a nominal cohesion of 50 psf was utilized. Friction angles ranged from 26 to 38 degrees.

The Bishop Circular Method, which generates circular-shaped failure surfaces, was used to calculate the critical failure surfaces and FOS for the proposed conditions. The FOS obtained in the analysis are shown in Table 3.1. SLOPE/W program output from this analysis can be found in SLOPE/W Slope Stability Analysis, Exhibit E.

Table 3.1 – Slope Stability Critical FOS

Location	Slope	Calculated Critical FOS		
		End-of-Construction	Long-Term	Seismic
East Abut – Upper Slope	1V:2H	3.1	2.0	1.7
East Abut – Lower Slope	1V:2H	3.0	1.9	1.7
West Abut – Upper Slope	1V:2H	3.0	2.0	2.0
West Abut – Lower Slope	1V:2H	4.5	1.7	1.6

All factors of safety obtained in the analysis meet the required values.

3.3 Seismic Considerations

The determination of Seismic Site Class was based on the method described by IDOT AGMU Memo 09.1 - Seismic Site Class Definition and the IDOT-provided spreadsheet titled: Seismic Site Class Determination. Using these resources, the controlling global site class for this project is Soil Site Class D.

Additional seismic parameters were calculated for use in design of the structure and evaluation of liquefaction potential. The USGS published information and mapping (http://earthquake.usgs.gov/), including software directly applicable to the AASHTO Guide Specifications for LRFD Seismic Bridge Design, was used to develop the parameters for the project site location. The values, based on a 1000-Year Return Period with a Probability of Exceedance (PE) of 7 percent in 75 years and the Soil Site Class D, are summarized below.

Table 3.2 – Summary of Seismic Parameters

Parameter	Value
Soil Site Class	D
Spectral Response Acceleration, 0.2 Sec, S_{DS}	0.166g(Site Class D)
Spectral Response Acceleration, 1.0 Sec, S_{D1}	0.110g (Site Class D)
Seismic Performance Zone	1

As indicated in the table above, the Seismic Performance Zone is 1, based on S_{D1} and Table 3.15.2 in the IDOT Bridge Manual, the Soil Site Class D, and Figure 2.3.10-3 in the IDOT Bridge Manual.

3.4 Scour

The design scour elevations for the proposed bridge are shown in Table 3.3. They have been reviewed in accordance with All Bridge Designers (ABD) Memorandum 14.2. Class A5 stone rip-rap will be placed on the surface of the proposed east and west end-slopes from top to toe, as well as the intermediate piers, to reduce the potential for future scour.

Table 3.3 – Design Scour Elevations

Design Scour Elevations (ft.)					
	West Abutment	Pier #1	Pier #2	East Abutment	Item 113
Q100	625.82	604.45	599.50	626.16	5
Q500	625.82	601.95	594.50	626.16	
Design	625.82	604.45	599.50	626.16	
Check	625.82	601.95	594.50	626.16	

3.5 Mining Activity

According to the Illinois State Geological Survey (ISGS) website, coal mining has occurred in McDonough County. According to the McDonough County, Illinois Coal Mines and Underground Industrial Mines Map, dated August 6, 2012, obtained from the ISGS website (http://www.isgs.illinois.edu/maps-data-pub/coal-maps.shtml), the project site was not undermined. Refer to the ISGS Mine Map, Exhibit F, for additional information.

3.6 Liquefaction

A liquefaction analysis is not required to be performed since the project is in a Seismic Performance Zone 1 as per IDOT Bridge Manual and AGMU Memo 10.1 - Liquefaction Analysis.

Liquefaction was not considered as a reduction for the pile design capacity or other foundation considerations included herein.

3.7 Approach Slab

In accordance with the IDOT Bridge Manual, KEG evaluated the foundation soils at the approach slabs for bearing capacity and excessive settlement. With proper compaction of the new approach embankment fill, the bearing capacity and settlement requirements of the IDOT Bridge Manual should be satisfied. Backfill placed directly behind the abutments should be in accordance with Guide Bridge Special Provision #76.

4.0 Foundation Evaluations and Design Recommendations

4.1 General Feasibility

According to IDOT ABD Memo 12.3, dated July 25, 2012; HP 10X42 or larger H-piles are feasible pile types for foundation support of the proposed integral abutment. Due to the calculated effective expansion length (EEL) for the controlling east abutment of 141.11 ft. and the proposed 15 degree skew from the centerline, the IDOT Integral Abutment Feasibility Analysis Spreadsheet, July 7, 2014, indicates that metal shell piles are not a feasible option for the proposed structure. As an alternative, the use of Semi-integral abutments would allow for the use of metal shell piles for the foundation support of the proposed structure abutments.

4.2 Pile Supported Foundations

The foundations supporting the proposed bridge must provide sufficient support to resist dead and live loads, including seismic loadings. The Modified IDOT Static Method uses the LRFD Pile Design Guide Procedure to estimate the pile lengths.

The Strength 1 factored loads were 900 kips at the abutments and 1900 kips at the piers. The loads were provided by Allen Henderson and Associates, Inc. The estimated pile lengths for the pile types considered are shown in Exhibit G - Pile Length/Pile Type. The Nominal Required Bearing (R_N) represents the resistance the pile will encounter during driving. These values will assist the contractor in selecting a proper hammer size. The Factored Resistance Available (R_F) documents the net long-term axial factored pile capacity available at the top of the pile to support the factored substructure loadings.

Based on the pile cutoff elevations for the abutments shown in the TS&L provided by Allen Henderson and Associates, Inc. The estimated pile lengths for several pile types considered are summarized below in Table 4.1 – Pile Types and Estimated Lengths for Abutments and Piers. The input and output pile design spreadsheets are also included in Exhibit G – Pile Length/Pile Type, for additional information.

As shown in Exhibit G – Pile Length/Pile Type, downdrag, liquefaction, and scour have not been considered at the abutment locations. Scour was considered for the intermediate pier substructures. The following values are for H-piles driven into the underlying rock.

Table 4.1 – H-Pile Types and Estimated Lengths for Abutments and Piers

Structure Unit	Pile Size	Maximum Nominal Required Bearing R_N (kips)	Maximum Factored Resistance Available R_F (kips)	Estimated Pile Length (feet)	Estimate Pile Cut-off Elevation (feet)	Estimated Pile Tip Elevation (feet)
West Abutment	HP 10X42	335	184	85	627.82	542.82
	HP 12X53	418	230	85	627.82	542.82
	HP 12x74	589	324	88	627.82	539.82
	HP 14x73	578	318	86	627.82	541.82
	HP 14x89	705	388	88	627.82	539.82
	HP 14x117	929	511	92	627.82	535.82
Pier 1	HP 10X42	335	174	86	627.8	541.82
	HP 12X53	418	217	86	627.8	541.82
	HP 12x74	589	311	90	627.8	537.82
	HP 14x73	578	303	87	627.8	540.82
	HP 14x89	705	373	89	627.8	538.82
	HP 14x117	929	495	93	627.8	534.82
Pier 2	HP 10X42	335	174	86	627.8	541.82
	HP 12X53	418	218	86	627.8	541.82
	HP 12x74	589	312	89	627.8	538.82
	HP 14x73	578	304	87	627.8	540.82
	HP 14x89	705	374	89	627.8	538.82
	HP 14x117	929	496	92	627.8	535.82

East Abutment	**HP 10X42**	335	184	86	628.16	542.16
	HP 12X53	418	230	86	628.16	542.16
	HP 12x74	589	324	89	628.16	539.16
	HP 14x73	578	318	87	628.16	541.16
	HP 14x89	705	388	89	628.16	539.16
	HP 14x117	929	511	92	628.16	536.16

Since the H-piles are assumed to be end-bearing in rock, KEG recommends a test pile be installed at one of the abutment locations. A test pile is installed prior to production driving so that actual on-site field data can be gathered to further evaluate pile driving requirements for the project. This also is the manner in which the contractor's proposed equipment and methodologies identified in their Pile Installation Plan can be assessed.

4.3 Lateral Pile Response

Generally, the geotechnical engineer provides soil parameters to the structural engineer so that an L-Pile program or other approved software can be used for the lateral or displacement analysis of the foundations. Table 4.2 is included for the structural engineer's use in evaluating lateral pile response. The values were estimated based on the descriptions as listed on the boring logs. No specific hydrometer analyses were performed on the site soils.

Table 4.2 – Soil Parameters for Lateral Pile Load Analysis

Boring	Elev. at Bottom of Layer	γ (pcf)	Short Term		Long Term		N	Assumed % fines < #200	K (pci)	ε50
			Φ (deg.)	c (psf)	Φ (deg.)	c (psf)				
B-1	616.5	120	0	600	27	50	5	35	100	0.010
	616.5	115	0	250	32	50	2	60	30	0.020
	606.0	110	32	N/A	32	N/A	2	10	20	N/A
	604.0	115	0	500	30	50	1	60	30	0.020
	602.5	125	0	500	26	50	2	75	30	0.020
	596.5	115	0	1350	32	50	9	35	500	0.007
	584.0	110	34	N/A	34	N/A	22	10	60	N/A
	581.5	115	0	3300	30	100	26	75	1000	0.005
	573.5	110	36	N/A	36	N/A	61	10	125	N/A
	569.0	120	0	4500	27	100	41	40	2000	0.005
	549.0	125	0	2000	26	100	21	75	500	0.007
	544.0	110	34	N/A	34	N/A	46	10	125	N/A
	541.5	125	0	3500	12	100	100	N/A	500	0.007
B-2	616.0	125	0	900	26	50	7	75	100	0.010
	613.0	115	0	250	32	50	2	60	30	0.020
	609.5	120	0	750	30	50	6	35	100	0.010
	604.0	110	32	N/A	32	N/A	2	10	20	N/A
	598.5	120	0	500	27	50	5	40	100	0.010
	594.0	125	0	1250	26	50	14	75	500	0.007
	589.5	110	34	N/A	34	N/A	12	10	60	N/A
	584.5	115	0	3250	32	100	26	35	1000	0.005

Boring	Elev. at Bottom of Layer	γ (pcf)	Short Term		Long Term		N	Assumed % fines < #200	K (pci)	ε50
			Φ (deg.)	c (psf)	Φ (deg.)	c (psf)				
	579.5	115	0	3900	28	100	31	95	1000	0.005
	564.5	110	36	N/A	36	N/A	34	10	125	N/A
	549.5	125	0	1430	26	100	19	75	500	0.007
	544.5	110	34	N/A	34	N/A	32	10	60	N/A
	543.5	125	0	2000	12	250	100	N/A	1000	0.005
B-3	617.4	125	0	875	26	50	7	85	100	0.010
	615.4	120	0	250	27	50	2	80	30	0.020
	612.4	120	0	250	27	50	2	40	30	0.020
	608.9	110	32	N/A	32	N/A	2	10	20	N/A
	599.9	125	0	1762	26	100	13	75	500	0.007
	597.4	120	0	3000	27	100	31	40	1000	0.005
	574.9	110	34	N/A	34	N/A	28	10	60	N/A
	559.9	125	0	3530	26	100	33	75	1000	0.005
	554.4	120	0	1500	26	100	22	95	500	0.007
	550.4	125	0	2100	26	100	27	75	1000	0.005
	543.9	110	34	N/A	34	N/A	37	10	125	N/A
	530.9	125	0	3500	12	100	100	N/A	1000	0.005
B-4	619.5	125	0	1000	26	50	8	85	100	0.007
	616.0	120	0	800	27	50	6	80	100	0.010
	610.0	125	0	500	26	50	4	70	30	0.020
	606.5	115	0	500	30	50	2	55	30	0.020
	602.0	125	0	3150	26	100	13	75	1000	0.005
	600.0	115	0	5500	28	100	44	95	2000	0.004
	579.0	110	34	N/A	34	N/A	28	10	60	N/A
	575.0	125	0	3500	26	100	43	60	1000	0.005
	570.0	120	0	4000	27	100	42	80	2000	0.005
	560.0	125	0	1100	26	50	17	85	500	0.007
	554.0	120	0	1500	26	100	15	80	500	0.007
	550.0	125	0	1400	26	50	22	85	500	0.007
	545.0	120	0	1500	27	100	21	60	500	0.007
	539.5	135	0	3500	12	100	100	N/A	1000	0.005

5.0 Construction Considerations

5.1 Construction Activities

Construction activities should be performed in accordance with the current IDOT Standard Specifications for Road and Bridge Construction and any pertinent Special Provisions or Policies.

5.2 Temporary Sheeting and Soil Retention

Temporary sheeting is required at the existing east and west abutments during construction, as staged construction is anticipated for this project.

At the east abutment, for a retained soil height of 15 ft., with an average N-value of 5 bpf, the required embedment depth is 28.0 ft. For a retained soil height of 17 ft., with an average N-value of 6 bpf, the required embedment depth is 30.0 ft. If the retained height exceeds 17 ft. at the east abutment location, the IDOT Temporary Sheet Piling Design Guide and Charts indicate that a Cantilevered Sheet Piling System would no longer be feasible.

At the west abutment, for a retained soil height of 15 ft., with the N-values and Q_u values of the boring logs, the required embedment depth is 23.5 ft. For a retained soil height of 18 ft., with an average N-value of 11 bpf, the required embedment depth is 26.0 ft. If the retained height exceeds 18 ft. at the west abutment location, the IDOT Temporary Sheet Piling Design Guide and Charts indicate that a Cantilevered Sheet Piling System would no longer be feasible.

While the IDOT method shows that a maximum retained height of 17 ft. and 18 ft. for the east and west abutments, respectively, is feasible, KEG typically recommends a minimum of 2 ft. embedment per 1 ft. retained height. In KEG's opinion, sheeting can be installed with standard vibratory methods to approximate El. 595 ft. at the East Abutment and El. 602 ft. at the West Abutment; below these elevations, the sheeting may require a driven installation method. If the required embedment depths extend below these elevations and the contractor determines that a driven method is not feasible, a soil retention system will be required. An Illinois-licensed structural engineer is required to seal the design of the temporary soil retention system, if deemed necessary.

5.3 Site and Soil Conditions

Should any bridge or embankment design considerations assumed by either IDOT or KEG change, KEG should be contacted to determine if the recommendations stated in this report still apply.

See Section 205 – Embankment, of the Standard Specifications of Road and Bridge Construction for specific information on embankment construction.

5.4 Foundation Construction

Conventional pile driving equipment and methodologies should be assumed. Protective tips should be provided for the piles.

A JULIE locate shall be conducted to determine if any underground utilities are present in the area of the proposed structure prior to construction. If utilities become a problem during construction, the appropriate owner shall be contacted immediately.

5.5 Cofferdam Construction

Cofferdams will be required at the proposed pier locations. The estimated water surface elevation is greater than 6 ft. above the bottom elevation of the substructure. Therefore, a Type 2 cofferdam will be required. All cofferdams are required to be dewatered. Sand and loam materials are present at the site of the cofferdams requiring the use of a seal coat. A seal coat will reduce the potential for water from seeping beneath the sheet piling in the dewatered cofferdam. As per the 2012 IDOT Bridge Manual, if a seal coat is specified, General Note 26 shall be added to the plans.

6.0 Computations

Computations and analyses for special circumstances, if any, are included as exhibits. Please refer to each section of the report for reference to the exhibit containing any such calculations or analysis used.

7.0 Geotechnical Data

Soil borings can be found in Exhibit C. The Subsurface Profile can be found in Exhibit D.

8.0 Limitations

The recommendations provided herein are for the exclusive use of Allen Henderson and Associates, Inc. and IDOT. They are specific only to the project described and are based on the subsurface information obtained at four boring locations within the bridge area in 2013, KEG's understanding of the project as described herein, and geotechnical engineering practice consistent with the standard of care. No other warranty is expressed or implied. KEG should be contacted if conditions encountered during construction are not consistent with those described.

EXHIBIT A

USGS TOPOGRAPHIC LOCATION MAP

Project Location

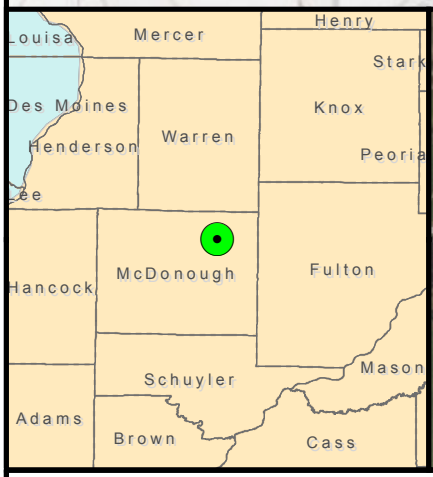


Exhibit A
Location Map
IL 9 over N. Fork LaMoine River
McDonough County, Illinois

N

0 500 1,000
Feet

Designed By: ASC
Drawn By: ASC
Checked By: MDM
Date: 7/25/13
Project #: 09-0006.03

Kaskaskia Engineering Group, LLC

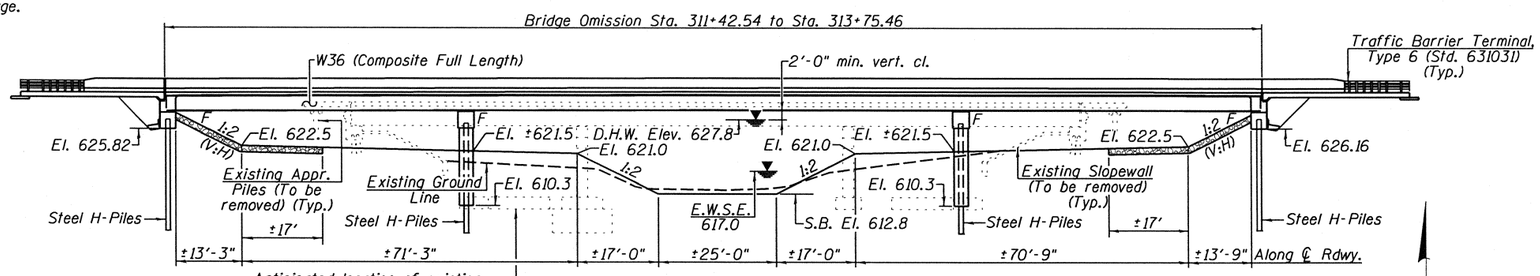
EXHIBIT B

TYPE, SIZE, AND LOCATION PLAN (TS&L)

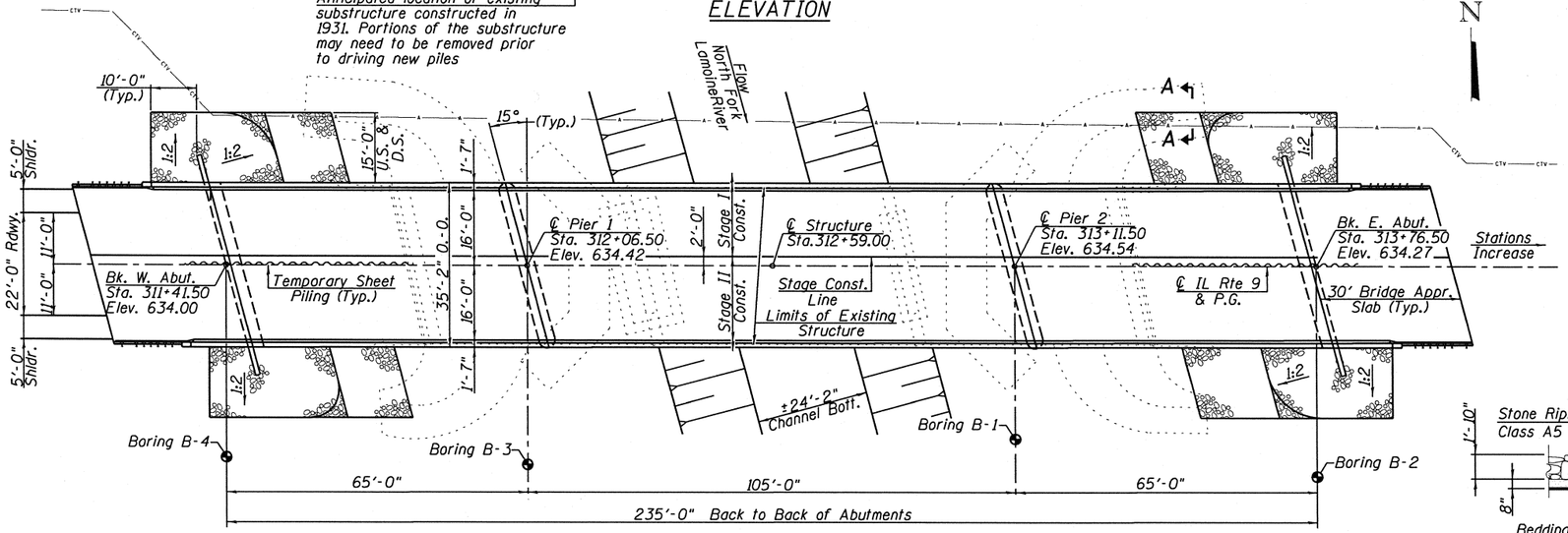
Bench Mark: Chiseled " □ " on S.W. wingwall of S.N. 055-0015. El. 632.07

Existing Structure: Structure Number 055-0015, built in 1960 as S.B.I. Route 95, Section 120 BR at Station 312+59.00. Structure consists of three span continuous wide flange beams supported spill-thru abutments and hammer head piers. 153'-6" back-to-back abutments. 33'-8" out-to-out deck. Structure to be removed and replaced using stage construction.

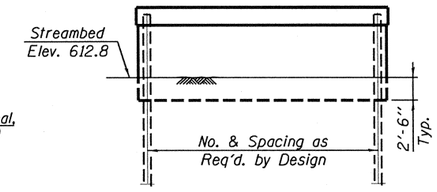
No Salvage.



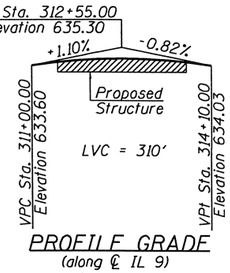
ELEVATION



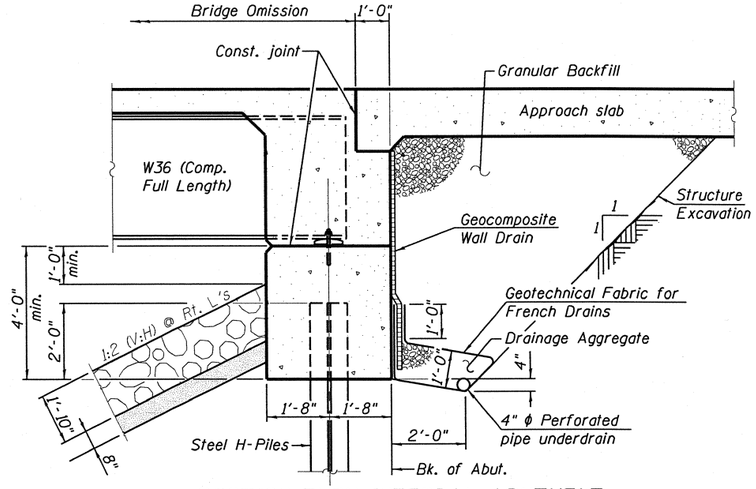
PLAN



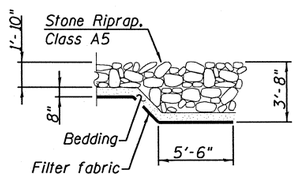
PIER SKETCH



PROFILE GRADE
(along ℄ IL 9)



SECTION THRU INTEGRAL ABUTMENT
(Horiz. dim. @ Rt. L's)



SECTION A-A

HIGHWAY CLASSIFICATION

F.A.P. Route 685 - IL Rte. 9
Functional Class: Minor Arterial
ADT: 2,650 (2011); 2714 (2032)
ADTT: 275 (2011); 282 (2032)
DHV: 326 (2032)
Design Speed: 55 m.p.h. (posted); 55 m.p.h. (design)
Two way traffic Directional Dist. 50:50

LOADING HL 93

Allow 50#/sq. ft. for future wearing surface.

DESIGN SPECIFICATIONS

AASHTO LRFD Bridge Design Specifications, 7th Edition.

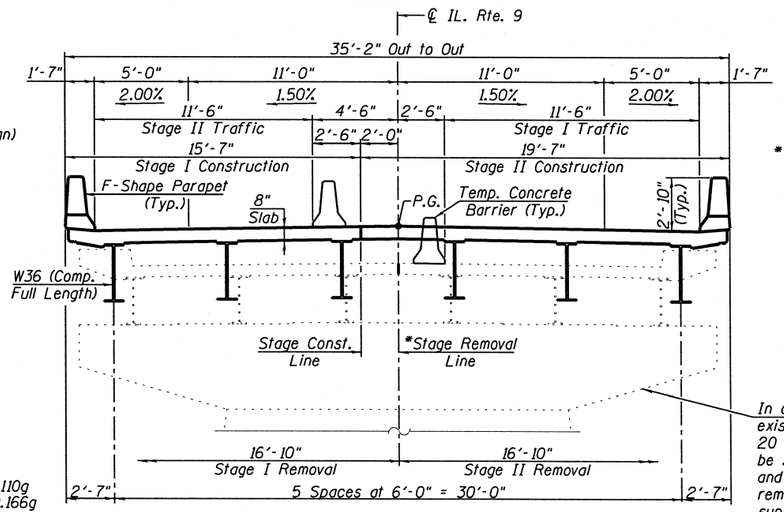
DESIGN STRESSES

FIELD UNITS

f'_c = 3,500 psi
f_y = 60,000 psi (reinforcement)
f_y = 50,000 psi (M270 Grade 50)

SEISMIC DATA

Seismic Performance Zone (SPZ) = 1
Design Spectral Acceleration at 1.0 sec. (S_{D1}) = 0.110g
Design Spectral Acceleration at 0.2 sec. (S_{DS}) = 0.166g
Soil Site Class = D



PROPOSED CROSS SECTION
(Looking East)

* Stage Removal Line applies to the existing superstructure and abutments only. Exising piers to be removed during Stage II Removal.

In order to ensure the overall stability of the existing piers and avoid overstressing the 20 ton timber piles, the existing piers shall be shored prior to Stage I Removal. The piers and shoring shall be removed following the removal of the remaining portion of the superstructure during Stage II Removal.

WATERWAY INFORMATION

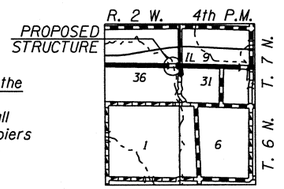
Drainage Area = 49.20 mi²
Exist. Low Grade Elev. 630.70 @ Sta. 306+00
Prop. Low Grade Elev. 630.70 @ Sta. 306+00

Flood	Freq. Yr.	Q C.F.S.	Opening Sq. Ft. Exist.	Opening Sq. Ft. Prop.	Nat. H.W.E.	Head - Ft. Exist.	Head - Ft. Prop.	Headwater El. Exist.	Headwater El. Prop.
	10	4470	972	1356	626.4	1.2	0.6	627.6	627.0
Design	50	6960	1177	1650	627.8	1.7	0.9	629.5	628.7
Base	100	8100	1207	1764	628.3	2.1	1.0	630.4	629.3
Overtop E	150	8500	1207		628.7	2.0		630.7	
Max. Calc.	500	10800	1207	2006	629.4	2.4	1.2	631.8	630.6

10 year velocity through existing bridge = 4.6 fps
10 year velocify through prop. bridge = 3.3 fps

DESIGN SCOUR ELEVATION TABLE

	Design Scour Elevations (ft.) W. Abut.	Pier 1	Pier 2	E. Abut.
0100	626.37	603.45	598.00	626.66
0500	626.37	598.75	593.00	626.66



LOCATION SKETCH

GENERAL PLAN & ELEVATION
IL ROUTE 9 OVER NORTH FORK LAMOINE RIVER
F.A.P. ROUTE 685 - SEC. (120-BR)1
MCDONOUGH COUNTY
STA. 312+59.00
STRUCTURE NO. 055-0086

FILE NAME = 055-0015 STRUCTURE.dgn	USER NAME =	DESIGNED - GBR	REVISED -
		CHECKED - RKA	REVISED -
	PLOT SCALE =	DRAWN - MJS	REVISED -
	PLOT DATE = 1/9/2015	CHECKED - GBR	REVISED -

Allen Henderson & Associates, Inc.
Civil and Structural Engineers
IL Design Firm No. 184-01907

GENERAL PLAN & ELEVATION

SHEET NO. 1 OF 1 SHEETS

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
685	(120-BR)1	McDONOUGH	____	____
		CONTRACT NO. 68215		
FED. ROAD DIST. NO. _	ILLINOIS	FED. AID PROJECT		

EXHIBIT C

BORING LOGS

Illinois Department of Transportation
Division of Highways
Terracon

SOIL BORING LOG

Date 6/10/13

ROUTE IL Route 9 **DESCRIPTION** East Pier Boring **LOGGED BY** AF

SECTION 120-BR-1 **LOCATION** , **SEC.** , **TWP.** , **RNG.** , **Latitude** , **Longitude**

COUNTY McDonough **DRILLING METHOD** HSA **HAMMER TYPE** AUTO

STRUCT. NO. 055+0086
Station 312+59

BORING NO. 1
Station 313+11.5
Offset 37.0 ft RT
Ground Surface Elev. 622.52 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 611.5 ft ▼
Upon Completion ft
After Hrs. ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
622.02				**TOPSOIL**, approximately 6"
	1			**FILL: SANDY CLAY**, trace organics, brown
	2		19	
	3			
	2			
	3		29	
-5	2			
616.52				
	1			**FILL: SANDY LOAM**, trace organics, brown
	1		19	
	1			
614.02				
	1			**SAND**, gray, very loose, (possible fill)
	1		19	
-10	2			
▼				
	0			
	1		14	
	1			
	1/12"		21	
-15	1			
606.02	0			
	0	<0.5	31	**SILTY LOAM**, gray, very soft
	1	P		
604.02				
				CLAY, gray, soft
	1/12"	<0.5	32	
602.52 -20	2	P		

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
	2			**SANDY LOAM**, gray, medium stiff to stiff
	3	0.8	19	
	7	P		
	5			
	7		18	
-25	8			
596.52				
	3			**SAND**, gray, medium dense to dense
	5		6	
	9			
	12			
	14		17	
-30	18			
	5			
	9		20	
-35	10			
584.02				
	6			**SILTY LOAM**, gray, very stiff
	11		18	
-40	15			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Illinois Department of Transportation
Division of Highways
Terracon

SOIL BORING LOG

Date 6/10/13

ROUTE IL Route 9 **DESCRIPTION** East Pier Boring **LOGGED BY** AF

SECTION 120-BR-1 **LOCATION** , **SEC.** , **TWP.** , **RNG.** , **Latitude** , **Longitude**

COUNTY McDonough **DRILLING METHOD** HSA **HAMMER TYPE** AUTO

STRUCT. NO. 055+0086
Station 312+59

BORING NO. 1
Station 313+11.5
Offset 37.0 ft RT
Ground Surface Elev. 622.52 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 611.5 ft ▼
Upon Completion ft
After Hrs. ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material Description
				SILTY LOAM, gray, very stiff *(continued)*
581.52				
				SAND, gray, very dense
	40			
	46		11	
-45	15			
573.52	9			
	18	4.5	14	**SANDY CLAY**, greenish-brown, very stiff to hard
-50	23	P		
569.02				
	9			**CLAY**, gray, stiff to very stiff
	12	1.8	30	
-55	13	S		
	4	3.0	27	
	7	P		
-60	8			

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material Description
				CLAY, gray, stiff to very stiff *(continued)*
	5			
	7	1.9	20	
-65	8	S		
	7			
	10	1.3	17	
-70	17	S		
549.02				
	7		18	**SAND**, gray, dense
	19			
-75	27			
544.02				
	50/1"		14	**WEATHERED INTERBEDDED DOLOMITE & SHALE**, gray
-80				

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Illinois Department of Transportation
Division of Highways
Terracon

SOIL BORING LOG

Date 6/10/13

ROUTE IL Route 9 **DESCRIPTION** East Pier Boring **LOGGED BY** AF

SECTION 120-BR-1 **LOCATION** , **SEC.** , **TWP.** , **RNG.** ,
Latitude , **Longitude**

COUNTY McDonough **DRILLING METHOD** HSA **HAMMER TYPE** AUTO

STRUCT. NO. 055+0086
Station 312+59

BORING NO. 1
Station 313+11.5
Offset 37.0 ft RT
Ground Surface Elev. 622.52 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 611.5 ft ▼
Upon Completion ft
After Hrs. ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
WEATHERED INTERBEDDED DOLOMITE & SHALE, gray 541.52			
(continued)	50/0"		16
End of Boring			
-85			
-90			
-95			
-100			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Illinois Department of Transportation
Division of Highways
Terracon

SOIL BORING LOG

Date 6/11/13

ROUTE IL Route 9 **DESCRIPTION** East Abutment Boring **LOGGED BY** AF

SECTION 120-BR-1 **LOCATION** , **SEC.** , **TWP.** , **RNG.** ,
Latitude , **Longitude**

COUNTY McDonough **DRILLING METHOD** HSA **HAMMER TYPE** AUTO

STRUCT. NO. 055+0086
Station 312+59

BORING NO. 2
Station 313+76.5
Offset 45.0 ft RT
Ground Surface Elev. 623.00 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 611.5 ft ▼
Upon Completion ft
After Hrs. ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material Description
				TOPSOIL, approximately 10"
				622.10
				FILL: CLAY, brown, trace organics
	3			
	4		23	
	6			
	2			
	2		34	
-5	2			
	1			
	1		22	
	1			
				FILL: SANDY LOAM, gray
	1			
	1		24	
613.00 -10	1			
				SANDY CLAY LOAM, gray, medium stiff
	2			▼
	3		19	
	3			
				609.50
	2			**SAND**, gray, very loose
	1		18	
	1			Clay seam at 14.5 feet
-15				
	2			
	1		14	
	1			
				604.00
	2			
	1	<.5	24	**SANDY CLAY**, gray, soft to medium stiff
-20	1	P		

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material Description
				SANDY CLAY, gray, soft to medium stiff *(continued)*
	1			
	2	<.5	27	
	5	P		
	3			
				598.50
	5	1.2	24	
-25	9	S		**CLAY**, gray, stiff
	5			
	6	1.3	14	
	8	S		
	3			
				594.00
	5		17	**SAND**, gray, medium dense
-30	7			
				589.50
	7			**SANDY LOAM**, gray, medium dense
	12		19	
-35	14			
				584.50
	11			**SILT**, gray, dense
	15		20	
-40	16			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Illinois Department of Transportation
Division of Highways
Terracon

SOIL BORING LOG

Date 6/11/13

ROUTE IL Route 9 **DESCRIPTION** East Abutment Boring **LOGGED BY** AF

SECTION 120-BR-1 **LOCATION** , **SEC.** , **TWP.** , **RNG.** ,
Latitude , **Longitude**

COUNTY McDonough **DRILLING METHOD** HSA **HAMMER TYPE** AUTO

STRUCT. NO. 055+0086
Station 312+59

BORING NO. 2
Station 313+76.5
Offset 45.0 ft RT
Ground Surface Elev. 623.00 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 611.5 ft ▼
Upon Completion ft
After Hrs. ft

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
SILT, gray, dense *(continued)*				
579.50				
SAND, gray, medium dense to very dense		4		
		5		17
	-45	9		
		7		
		13		19
	-50	15		
		27		
		29		10
	-55	31		
564.50				
CLAY, gray, stiff to very stiff		8		
		11	1.3	32
	-60	17	S	
CLAY, gray, stiff to very stiff *(continued)*		3		
		4	1.1	31
	-65	5	S	
		9		
		9	1.9	19
	-70	11	S	
549.50				
SAND, gray, medium dense		8		
		12		14
	-75	20		
544.50				
FRACTURED BEDROCK				
543.50				
Auger Refusal at 79.5 feet	-80			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Illinois Department of Transportation
Division of Highways
Terracon

SOIL BORING LOG

Date 6/11/13

ROUTE IL Route 9 **DESCRIPTION** East Abutment Boring **LOGGED BY** AF

SECTION 120-BR-1 **LOCATION** , **SEC.** , **TWP.** , **RNG.** ,
Latitude , **Longitude**

COUNTY McDonough **DRILLING METHOD** HSA **HAMMER TYPE** AUTO

STRUCT. NO. 055+0086
Station 312+59

BORING NO. 2
Station 313+76.5
Offset 45.0 ft RT
Ground Surface Elev. 623.00 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 611.5 ft ▼
Upon Completion ft
After Hrs. ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
End of Boring			
-85			
-90			
-95			
-100			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Illinois Department of Transportation
Division of Highways
Terracon

SOIL BORING LOG

Date 6/12/13

ROUTE IL Route 9 **DESCRIPTION** West Pier Boring **LOGGED BY** AF

SECTION 120-BR-1 **LOCATION** , **SEC.** , **TWP.** , **RNG.** ,
Latitude , **Longitude**

COUNTY McDonough **DRILLING METHOD** HSA **HAMMER TYPE** AUTO

STRUCT. NO. 055+0086
Station 312+59

BORING NO. 3
Station 312+6.5
Offset 42.5 ft RT
Ground Surface Elev. 623.40 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 612.4 ft ▼
Upon Completion ft
After Hrs. ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material Description
				TOPSOIL, approximately 6" 622.90
				FILL: CLAY, trace organics, brown
	3			
	3		25	
	3			
	3			
	4		16	
-5	4			
				617.40
	1			**FILL: SANDY CLAY**, trace
	1		20	organics, brown and gray
	1			
				615.40
				SANDY CLAY, gray, soft
	0			
	1		22	
-10	1			
				612.40 ▼
	1			**SAND**, gray, very loose to loose
	1		26	
	1			
	2			
				608.90
	3		25	
-15	3			**CLAY**, gray, stiff to very stiff
	5			
	6	2.2	14	
	8	B		
	6			
	7		16	
-20	8			

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material Description
				CLAY, gray, stiff to very stiff *(continued)*
	6			
	6	2.2	14	
	10	B		
				599.90
	10			**SANDY CLAY**, gray, very stiff
	11	3.0	17	
-25	20	P		
				597.40
	9			**SAND**, gray, medium dense to
	11		20	dense
	15			
	7			
	10		23	
-30	17			
	7			
	10		19	
-35	12			
	5			
	3		18	
-40	14			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Illinois Department of Transportation
Division of Highways
Terracon

SOIL BORING LOG

Date 6/12/13

ROUTE IL Route 9 **DESCRIPTION** West Pier Boring **LOGGED BY** AF

SECTION 120-BR-1 **LOCATION** , **SEC.** , **TWP.** , **RNG.** ,
Latitude , **Longitude**

COUNTY McDonough **DRILLING METHOD** HSA **HAMMER TYPE** AUTO

STRUCT. NO. 055+0086
Station 312+59

BORING NO. 3
Station 312+6.5
Offset 42.5 ft RT
Ground Surface Elev. 623.40 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 612.4 ft ▼
Upon Completion ft
After Hrs. ft

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
SAND, gray, medium dense to dense *(continued)*				
		13		
		23		13
	-45	25		
574.90				
CLAY, gray, very stiff to hard		11		
		11	1.8	20
	-50	15	S	
		12		
		13	4.3	14
	-55	25	B	
		10		
		13	4.5	14
	-60	23	B	
CLAY, gray, very stiff to hard *(continued)*				
559.90				
SILTY CLAY, gray, stiff to very stiff		8		
		9	1.5	27
	-65	13	P	
554.40		8		
CLAY, gray, very stiff		12	2.1	16
	-70	15	B	
550.40				
SAND, gray, dense to very dense		8		
		12		7
	-75	25		
		8		
543.90		32		14
WEATHERED SHALE, dark gray	-80	50/3"		

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Illinois Department of Transportation
Division of Highways
Terracon

SOIL BORING LOG

Date 6/12/13

ROUTE IL Route 9 **DESCRIPTION** West Pier Boring **LOGGED BY** AF

SECTION 120-BR-1 **LOCATION** , **SEC.** , **TWP.** , **RNG.** ,
Latitude , **Longitude**

COUNTY McDonough **DRILLING METHOD** HSA **HAMMER TYPE** AUTO

STRUCT. NO. 055+0086
Station 312+59

BORING NO. 3
Station 312+6.5
Offset 42.5 ft RT
Ground Surface Elev. 623.40 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 612.4 ft ▼
Upon Completion ft
After Hrs. ft

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
WEATHERED SHALE, dark gray *(continued)*				
		50/1"		15
	-85			
535.90				
Borehole continued with rock coring.				
	-90			
	-95			
	-100			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Illinois Department of Transportation
Division of Highways
Terracon

ROCK CORE LOG

Date 6/12/13

ROUTE IL Route 9 **DESCRIPTION** West Pier Boring **LOGGED BY** AF

SECTION 120-BR-1 **LOCATION** , **SEC.** , **TWP.** , **RNG.** ,
Latitude , **Longitude**

COUNTY McDonough **CORING METHOD** Rotary Wash

STRUCT. NO. 055+0086
Station 312+59

BORING NO. 3
Station 312+6.5
Offset 42.5 ft RT
Ground Surface Elev. 623.40 **ft**

CORING BARREL TYPE & SIZE NQ Wireline
Core Diameter 2 **in**
Top of Rock Elev. **ft**
Begin Core Elev. 535.90 **ft**

		DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
WEATHERED INTERBEDDED DOLOMITE & SHALE, gray	535.90		1	33	0		
		-90					
	530.90						
End of Boring		-95					
		-100					
		-105					

Color pictures of the cores _____
Cores will be stored for examination until _____
The "Strength" column represents the uniaxial compressive strength of the core sample (ASTM D-2938)

Illinois Department of Transportation

Division of Highways
Terracon

SOIL BORING LOG

Date 6/14/13

ROUTE IL Route 9 **DESCRIPTION** West Abutment Boring **LOGGED BY** AF

SECTION 120-BR-1 **LOCATION** , **SEC.** , **TWP.** , **RNG.** ,
Latitude , **Longitude**

COUNTY McDonough **DRILLING METHOD** HSA **HAMMER TYPE** AUTO

STRUCT. NO. 055+0086
Station 312+59

BORING NO. 4
Station 311+41.5
Offset 41.0 ft RT
Ground Surface Elev. 623.00 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 607.0 ft ▼
Upon Completion ft
After Hrs. ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				TOPSOIL, approximately 12"
622.00				
	1			**FILL: CLAY**, trace organics, brown
	3		25	
	5			
619.50				
	3			**FILL: SANDY CLAY**, brown
	3		14	
-5	3			
	3			
616.00	3		27	
	4			**FILL: CLAY**, brown and gray to gray
	1			
	1		27	
-10	1			
	0			
	1		42	
	1			
610.00				
	1			**LOAM**, gray, soft
	1	<.5	37	
-15	1	P		
▼				
606.50	3			
	5	3.5	13	**CLAY**, gray, stiff to very stiff
	8	P		
	3			sand seam at 18.5 to 19 feet
	5	2.8	13	
-20	7	B		

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				CLAY, gray, stiff to very stiff *(continued)*
602.00				
	15			**SILT**, gray, dense
	19		18	
	25			
600.00				
	16			**SAND**, gray, medium dense to dense
	19		20	
-25	26			
	8			
	11		21	
	17			
	5			
	6		18	
-30	7			
	8			
	10		21	
-35	16			silt seam at 34.5 to 35 feet
	10			
	12		20	
-40	15			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Illinois Department of Transportation
Division of Highways
Terracon

SOIL BORING LOG

Date 6/14/13

ROUTE IL Route 9 **DESCRIPTION** West Abutment Boring **LOGGED BY** AF

SECTION 120-BR-1 **LOCATION** , **SEC.** , **TWP.** , **RNG.** ,
Latitude , **Longitude**

COUNTY McDonough **DRILLING METHOD** HSA **HAMMER TYPE** AUTO

STRUCT. NO. 055+0086
Station 312+59

BORING NO. 4
Station 311+41.5
Offset 41.0 ft RT
Ground Surface Elev. 623.00 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 607.0 ft ▼
Upon Completion ft
After Hrs. ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				SAND, gray, medium dense to dense *(continued)*
579.00	10			
	17	3.5	15	**CLAY**, gray, very stiff to hard
-45	26	P		
575.00				
				SANDY CLAY, gray, hard
	13			
	15	4.0	18	
-50	27	P		
570.00				
				CLAY, gray, stiff to very stiff
	5			
	7	1.1	24	
-55	12	S		
				sand seam at 58.5 to 59 feet
	3			
	5		26	
-60	9			
				CLAY, gray, stiff to very stiff *(continued)*
560.00				
				SILTY CLAY, gray, stiff
	6			
	7	1.5	28	
-65	8	P		
554.00	8			
	10	1.4	46	**CLAY**, gray, stiff to very stiff
-70	12	B		
550.00				
				SANDY CLAY, gray, stiff to very stiff
	8			
	8	1.5	20	
-75	13	P		
545.00				
	50/5"			**HIGHLY WEATHERED SHALE**, gray
			13	
-80				

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Illinois Department of Transportation
Division of Highways
Terracon

SOIL BORING LOG

Date 6/14/13

ROUTE IL Route 9 **DESCRIPTION** West Abutment Boring **LOGGED BY** AF

SECTION 120-BR-1 **LOCATION** , **SEC.** , **TWP.** , **RNG.** ,
Latitude , **Longitude**

COUNTY McDonough **DRILLING METHOD** HSA **HAMMER TYPE** AUTO

STRUCT. NO. 055+0086
Station 312+59

BORING NO. 4
Station 311+41.5
Offset 41.0 ft RT
Ground Surface Elev. 623.00 ft

Surface Water Elev. ft
Stream Bed Elev. ft

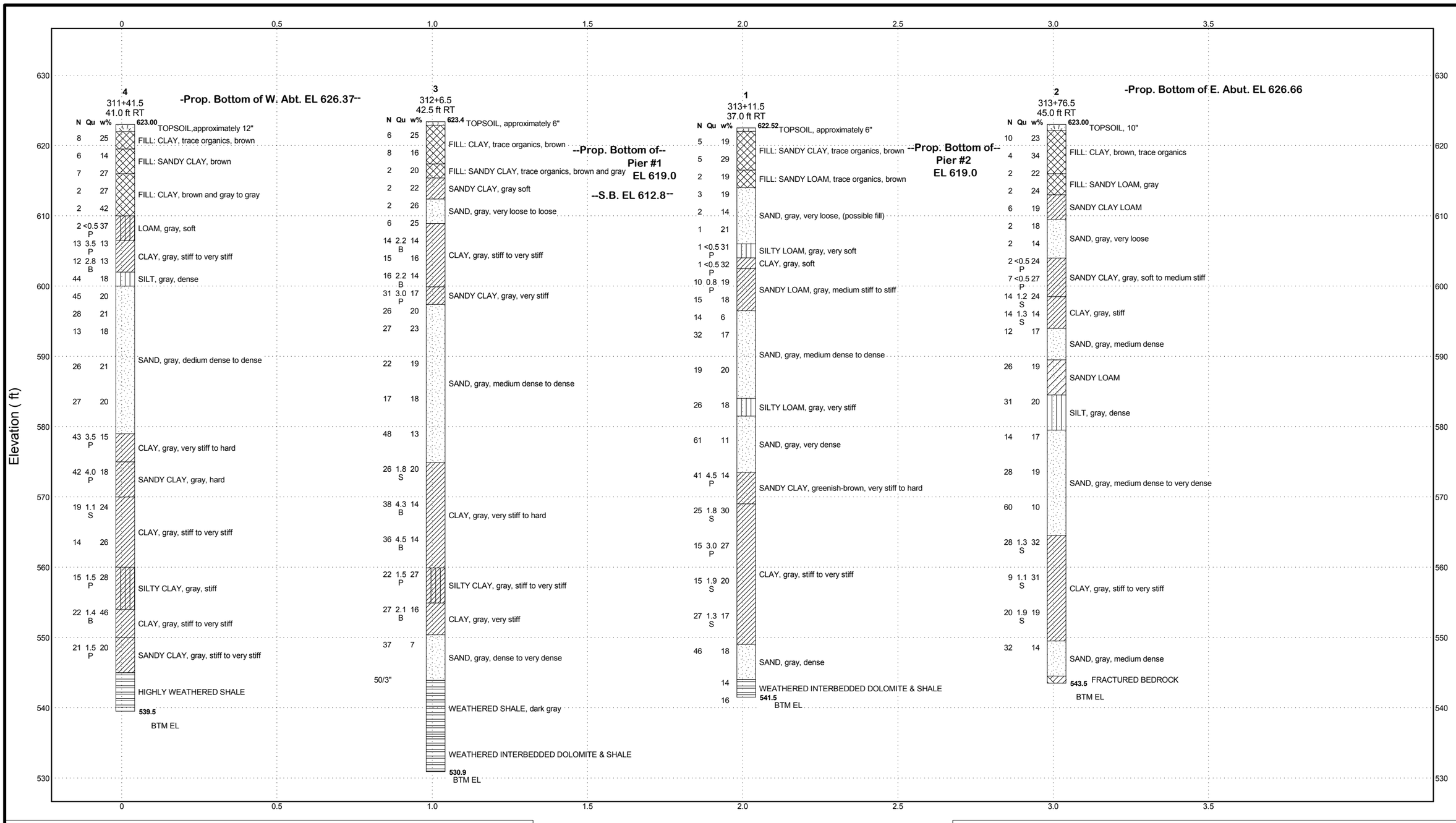
Groundwater Elev.:
First Encounter 607.0 ft ▼
Upon Completion ft
After Hrs. ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	
HIGHLY WEATHERED SHALE, gray *(continued)*				
539.50				
End of Boring	50/0"			
-85				
-90				
-95				
-100				

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

EXHIBIT D

SUBSURFACE PROFILE



Kaskaskia Engineering Group, LLC

SUBSURFACE PROFILE IL 9 o. N. Fork LaMoine River

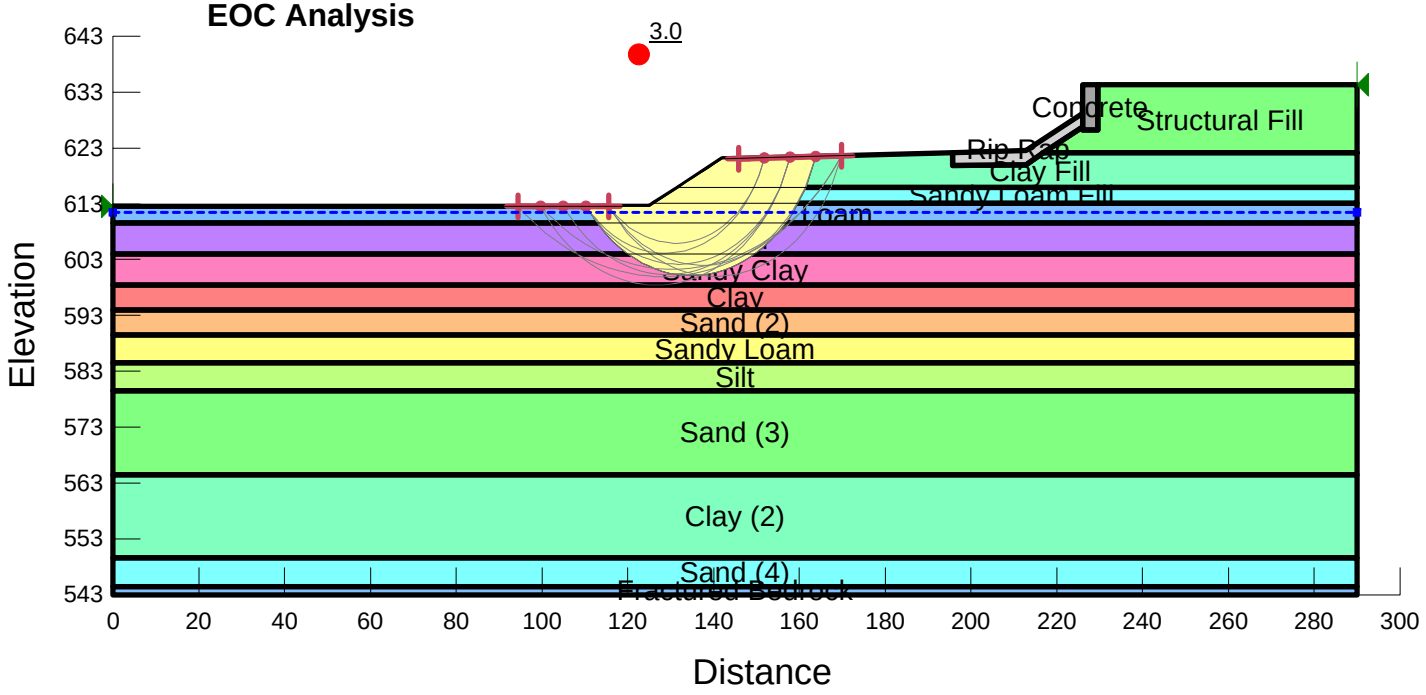
Route: Il Route 9
Section: 120-BR-1
County: McDonough

PRINTERMOD2 11X17 IL 9 OVER NORTH FORK LAMOINE RIVER.GPJ IL_DOT.GDT 8/6/13

EXHIBIT E

SLOPE/W SLOPE STABILITY ANALYSIS

IL Route 9 over North Fork LaMoine River
East Abutment (Boring 2)
EOC Analysis



Name: Concrete
Unit Weight: 145 pcf
Cohesion': 5,000 psf
Phi': 45 °

Name: Rip Rap
Unit Weight: 145 pcf
Cohesion': 0 psf
Phi': 45 °

Name: Structural Fill
Unit Weight: 125 pcf
Cohesion': 1,500 psf
Phi': 0 °

Name: Clay Fill
Unit Weight: 125 pcf
Cohesion': 900 psf
Phi': 0 °

Name: Sandy Loam Fill
Unit Weight: 115 pcf
Cohesion': 250 psf
Phi': 0 °

Name: Sandy Clay Loam
Unit Weight: 120 pcf
Cohesion': 750 psf
Phi': 0 °

Name: Sand
Unit Weight: 110 pcf
Cohesion': 0 psf
Phi': 32 °

Name: Sandy Clay
Unit Weight: 120 pcf
Cohesion': 500 psf
Phi': 0 °

Name: Clay
Unit Weight: 125 pcf
Cohesion': 1,250 psf
Phi': 0 °

Name: Sand (2)
Unit Weight: 110 pcf
Cohesion': 0 psf
Phi': 34 °

Name: Sandy Loam
Unit Weight: 115 pcf
Cohesion': 3,250 psf
Phi': 0 °

Name: Silt
Unit Weight: 115 pcf
Cohesion': 3,900 psf
Phi': 0 °

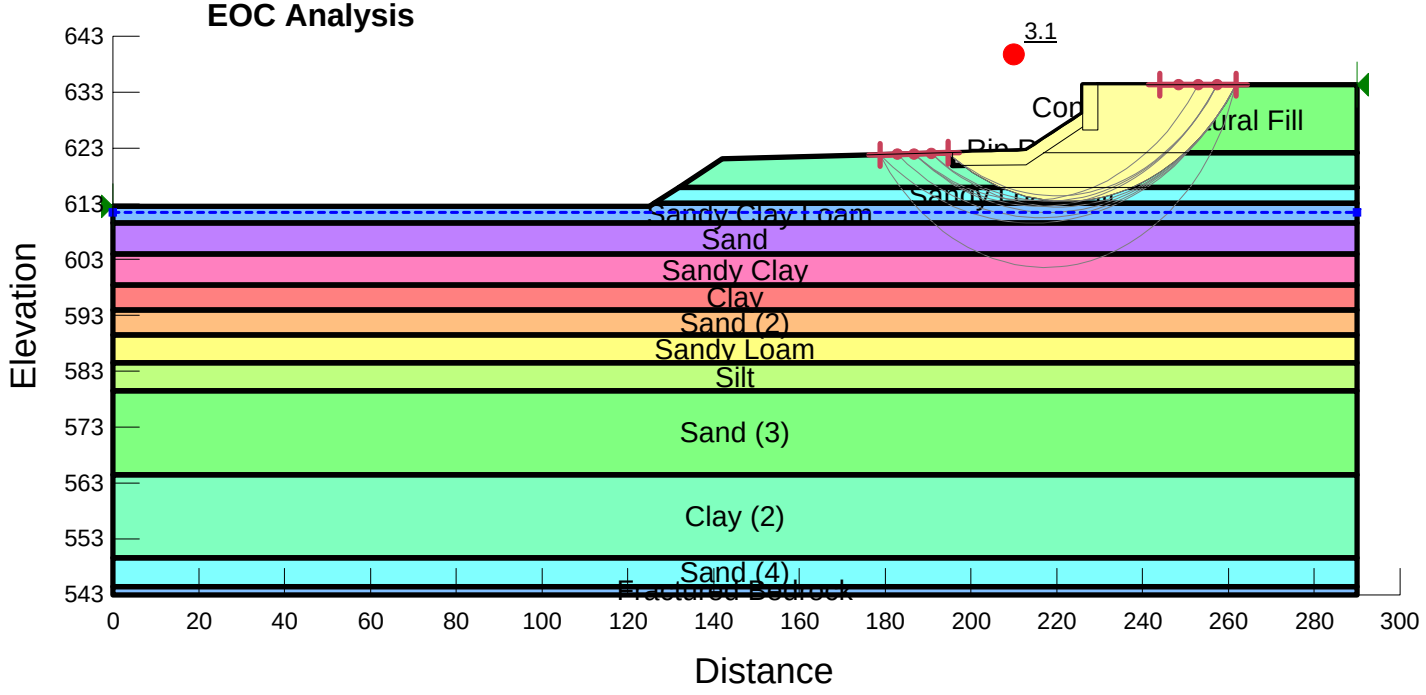
Name: Sand (3)
Unit Weight: 110 pcf
Cohesion': 0 psf
Phi': 36 °

Name: Clay (2)
Unit Weight: 125 pcf
Cohesion': 1,433 psf
Phi': 0 °

Name: Sand (4)
Unit Weight: 110 pcf
Cohesion': 0 psf
Phi': 34 °

Name: Fractured Bedrock

IL Route 9 over North Fork LaMoine River
East Abutment (Boring 2)
EOC Analysis



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Unit Weight: 125 pcf
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Cohesion': 0 psf
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Unit Weight: 115 pcf
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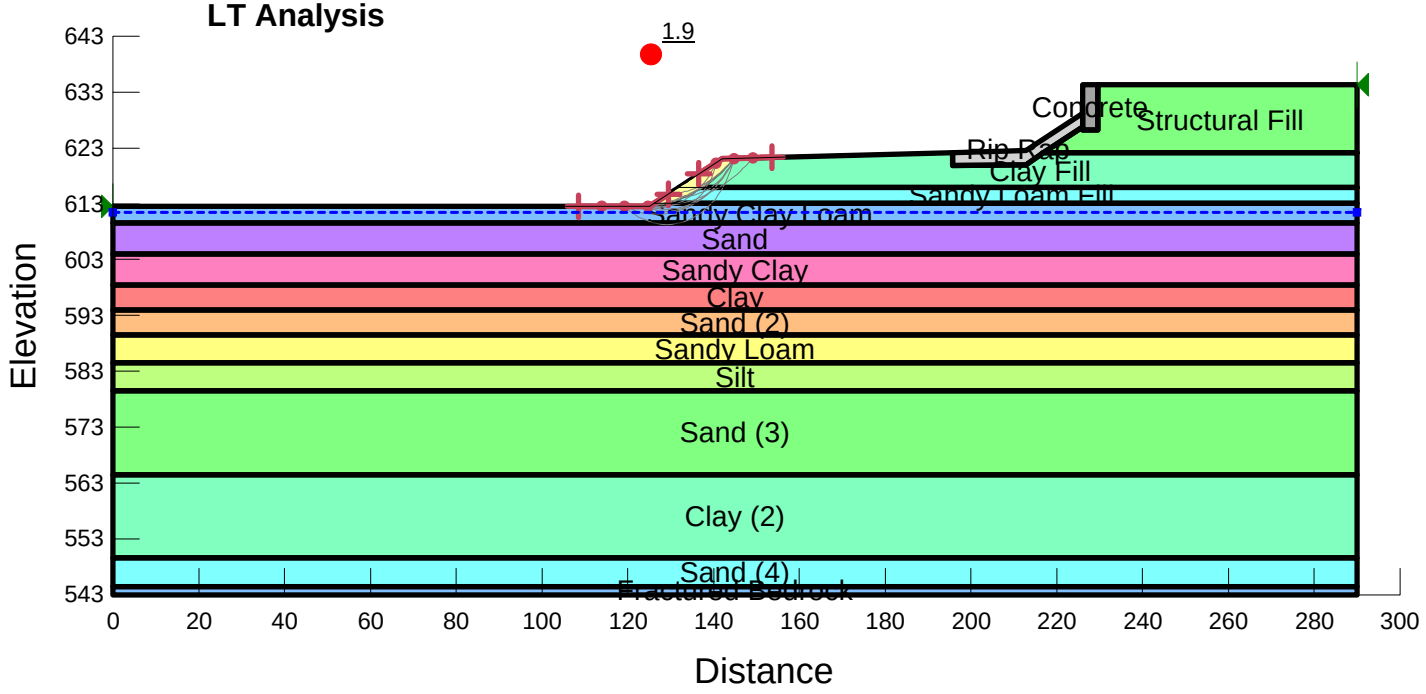
Unit Weight: 125 pcf
Cohesion': 1,433 psf
Phi': 0 °

Name: Sand (4)
Unit Weight: 110 pcf
Cohesion': 0 psf
Phi': 34 °

Name: Fractured Bedrock

IL Route 9 over North Fork LaMoine River
East Abutment (Boring 2)
LT Analysis



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Unit Weight: 145 pcf
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Unit Weight: 145 pcf
Cohesion': 0 psf
Phi': 45 °

Name: Structural Fill
Unit Weight: 125 pcf
Cohesion': 100 psf
Phi': 26 °

Name: Clay Fill
Unit Weight: 125 pcf
Cohesion': 50 psf
Phi': 26 °

Name: Sandy Loam Fill
Unit Weight: 115 pcf
Cohesion': 50 psf
Phi': 32 °

Name: Sandy Clay Loam
Unit Weight: 120 pcf
Cohesion': 50 psf
Phi': 30 °

Name: Sand
Unit Weight: 110 pcf
Cohesion': 0 psf
Phi': 32 °

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Unit Weight: 120 pcf
Cohesion': 50 psf
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Cohesion': 0 psf
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Unit Weight: 115 pcf
Cohesion': 100 psf
Phi': 32 °

Name: Silt
Unit Weight: 115 pcf
Cohesion': 100 psf
Phi': 28 °

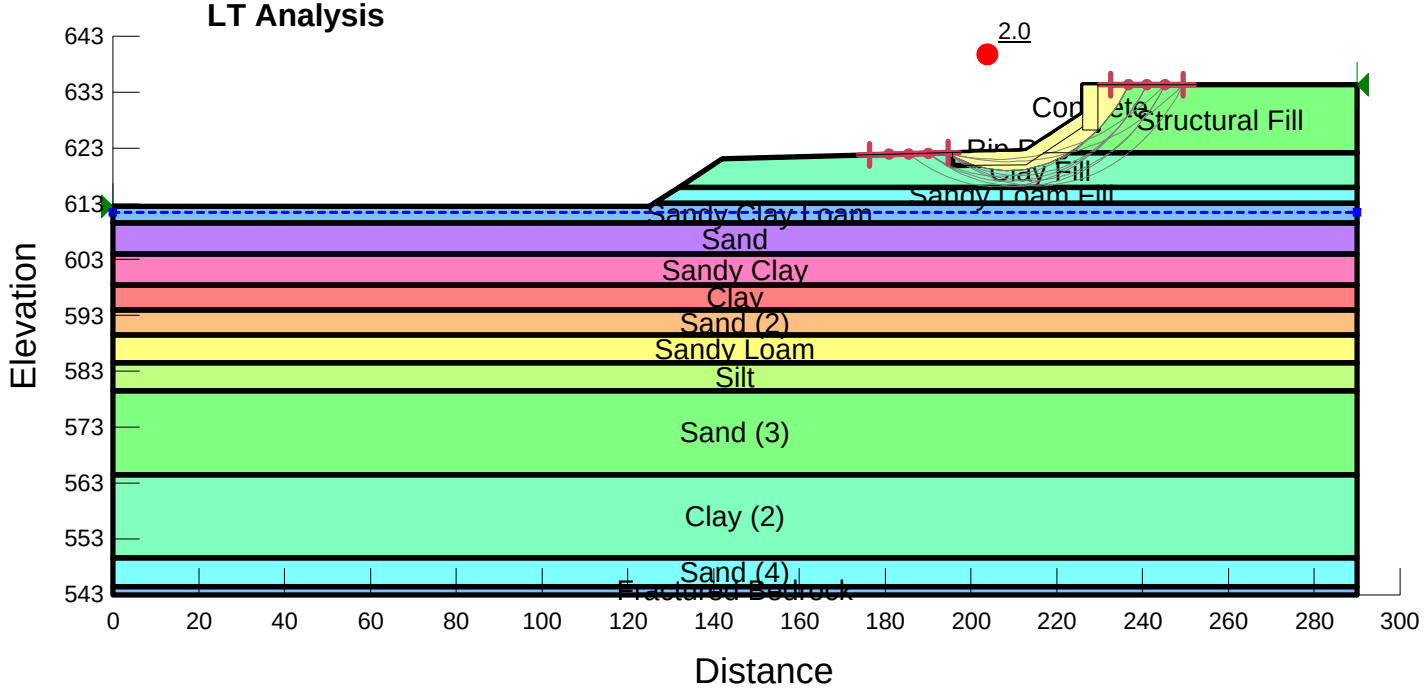
Name: Sand (3)
Unit Weight: 110 pcf
Cohesion': 0 psf
Phi': 36 °

Name: Clay (2)
Unit Weight: 125 pcf
Cohesion': 100 psf
Phi': 26 °

Name: Sand (4)
Unit Weight: 110 pcf
Cohesion': 0 psf
Phi': 34 °

Name: Fractured Bedrock

IL Route 9 over North Fork LaMoine River
East Abutment (Boring 2)
LT Analysis



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Unit Weight: 125 pcf
Cohesion': 50 psf
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Unit Weight: 115 pcf
Cohesion': 50 psf
Phi': 32 °

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Cohesion': 50 psf
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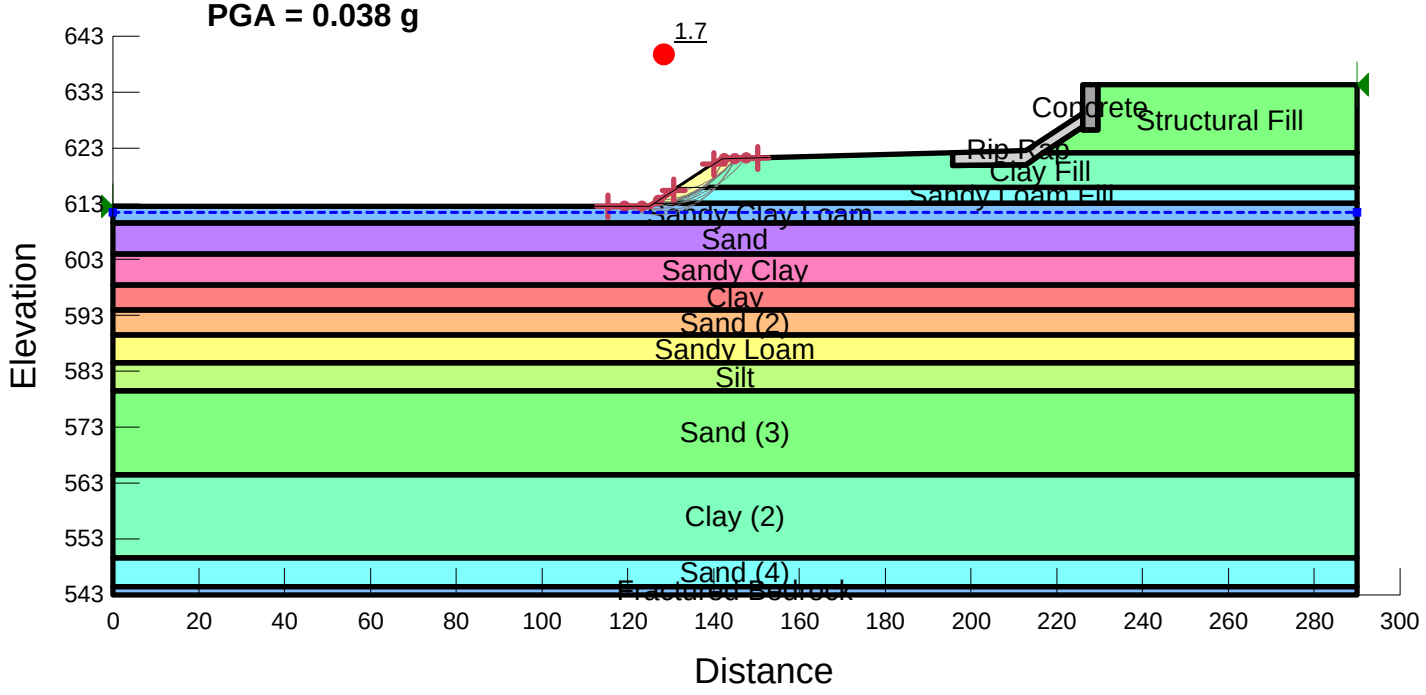
Cohesion': 100 psf
Phi': 26 °

Name: Sand (4)
Unit Weight: 110 pcf
Cohesion': 0 psf
Phi': 34 °

Name: Fractured Bedrock

IL Route 9 over North Fork LaMoine River
East Abutment (Boring 2)
Seismic Analysis
PGA = 0.038 g



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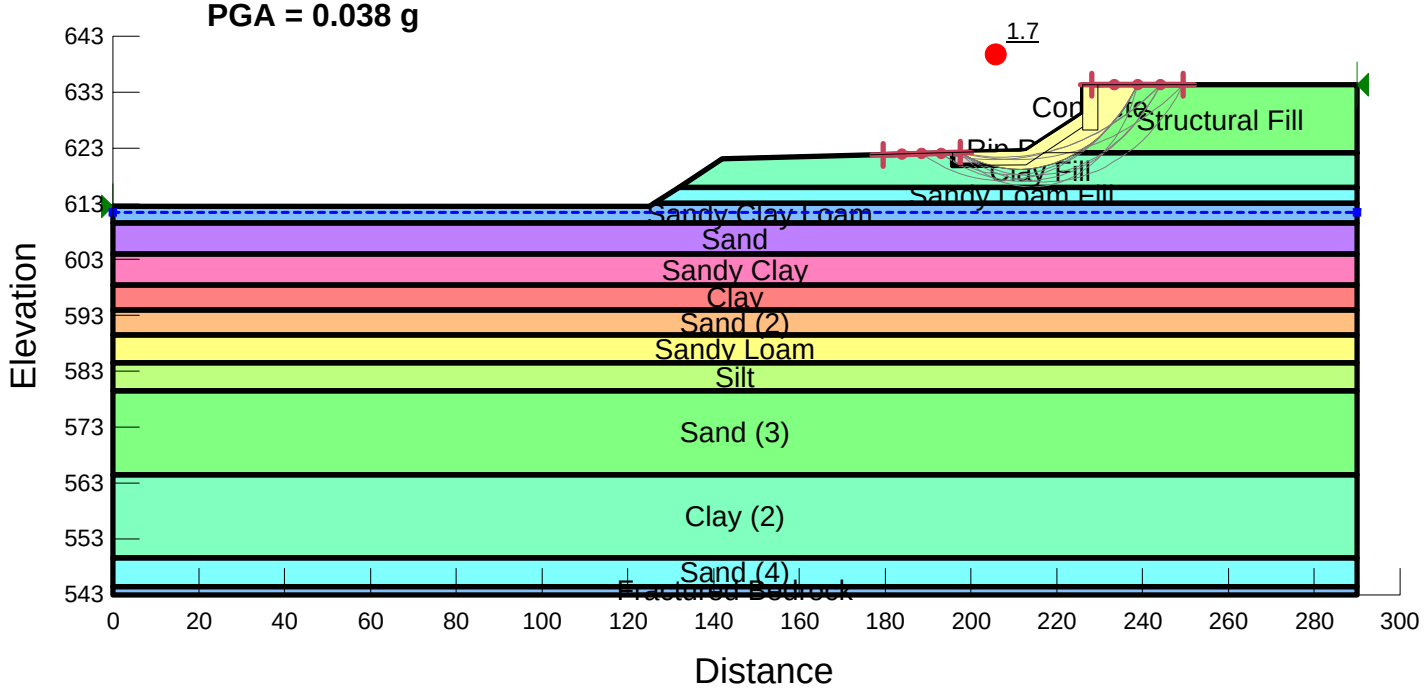
Unit Weight: 125 pcf
Cohesion': 100 psf
Phi': 26 °

Name: Sand (4)
Unit Weight: 110 pcf
Cohesion': 0 psf
Phi': 34 °

Name: Fractured Bedrock

IL Route 9 over North Fork LaMoine River
East Abutment (Boring 2)
Seismic Analysis
PGA = 0.038 g



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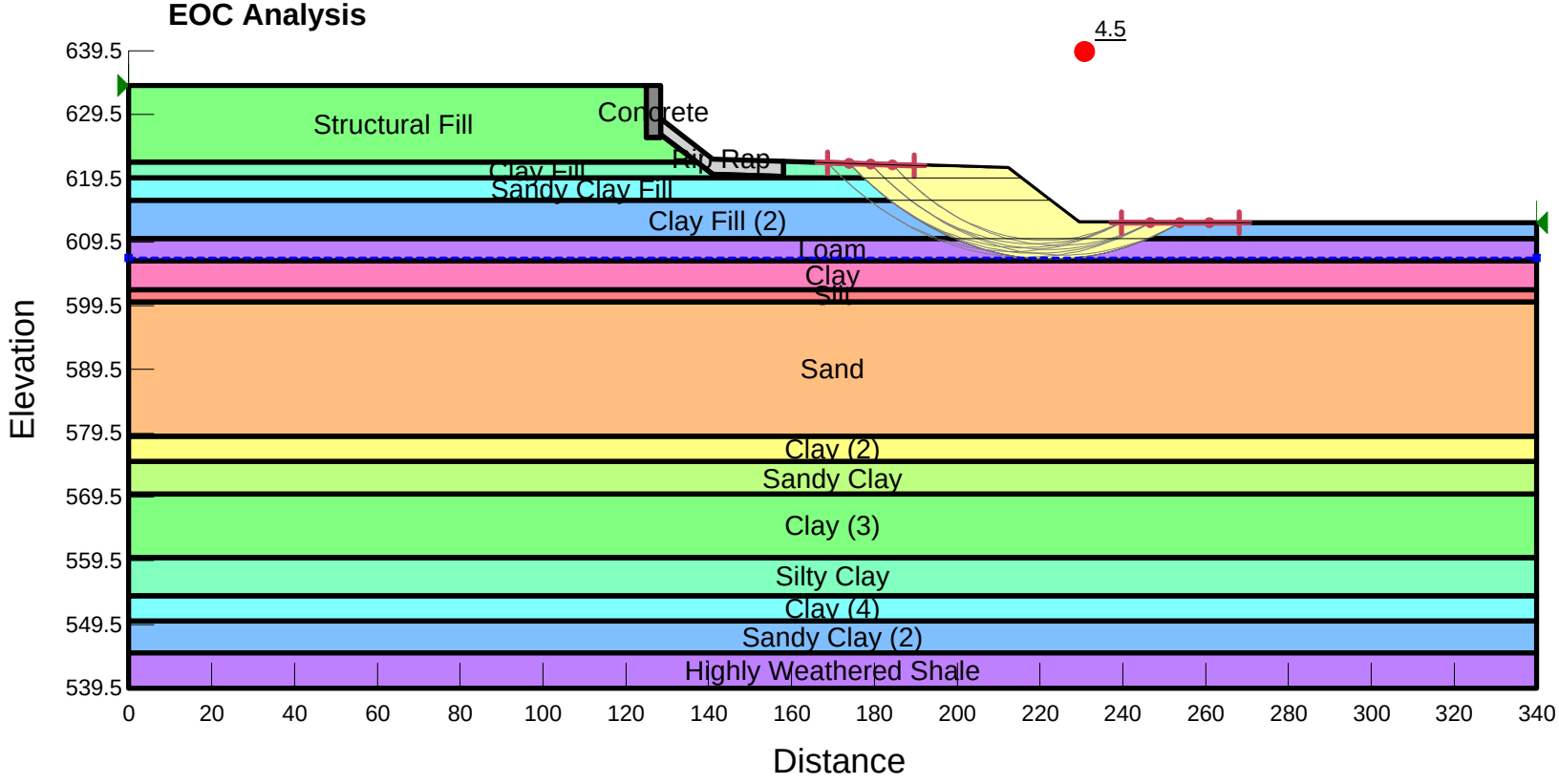
Cohesion': 100 psf
Phi': 26 °

Name: Sand (4)
Unit Weight: 110 pcf
Cohesion': 0 psf
Phi': 34 °

Name: Fractured Bedrock

IL Route 9 over North Fork LaMoine River
West Abutment (Boring 4)
EOC Analysis



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Unit Weight: 145 pcf
Cohesion': 0 psf
Phi': 45 °

Name: Structural Fill
Unit Weight: 125 pcf
Cohesion': 1,500 psf
Phi': 0 °

Name: Clay Fill
Unit Weight: 125 pcf
Cohesion': 1,000 psf
Phi': 0 °

Name: Sandy Clay Fill
Unit Weight: 120 pcf
Cohesion': 800 psf
Phi': 0 °

Name: Clay Fill (2)
Unit Weight: 125 pcf
Cohesion': 500 psf
Phi': 0 °

Name: Loam
Unit Weight: 115 pcf
Cohesion': 500 psf
Phi': 0 °

Name: Clay
Unit Weight: 125 pcf
Cohesion': 3,150 psf
Phi': 0 °

Name: Silt
Unit Weight: 115 pcf
Cohesion': 5,500 psf
Phi': 0 °

Name: Sand
Unit Weight: 110 pcf
Cohesion': 0 psf
Phi': 34 °

Name: Clay (2)
Unit Weight: 125 pcf
Cohesion': 3,500 psf
Phi': 0 °

Name: Sandy Clay
Unit Weight: 120 pcf
Cohesion': 4,000 psf
Phi': 0 °

Name: Clay (3)
Unit Weight: 125 pcf
Cohesion': 1,100 psf
Phi': 0 °

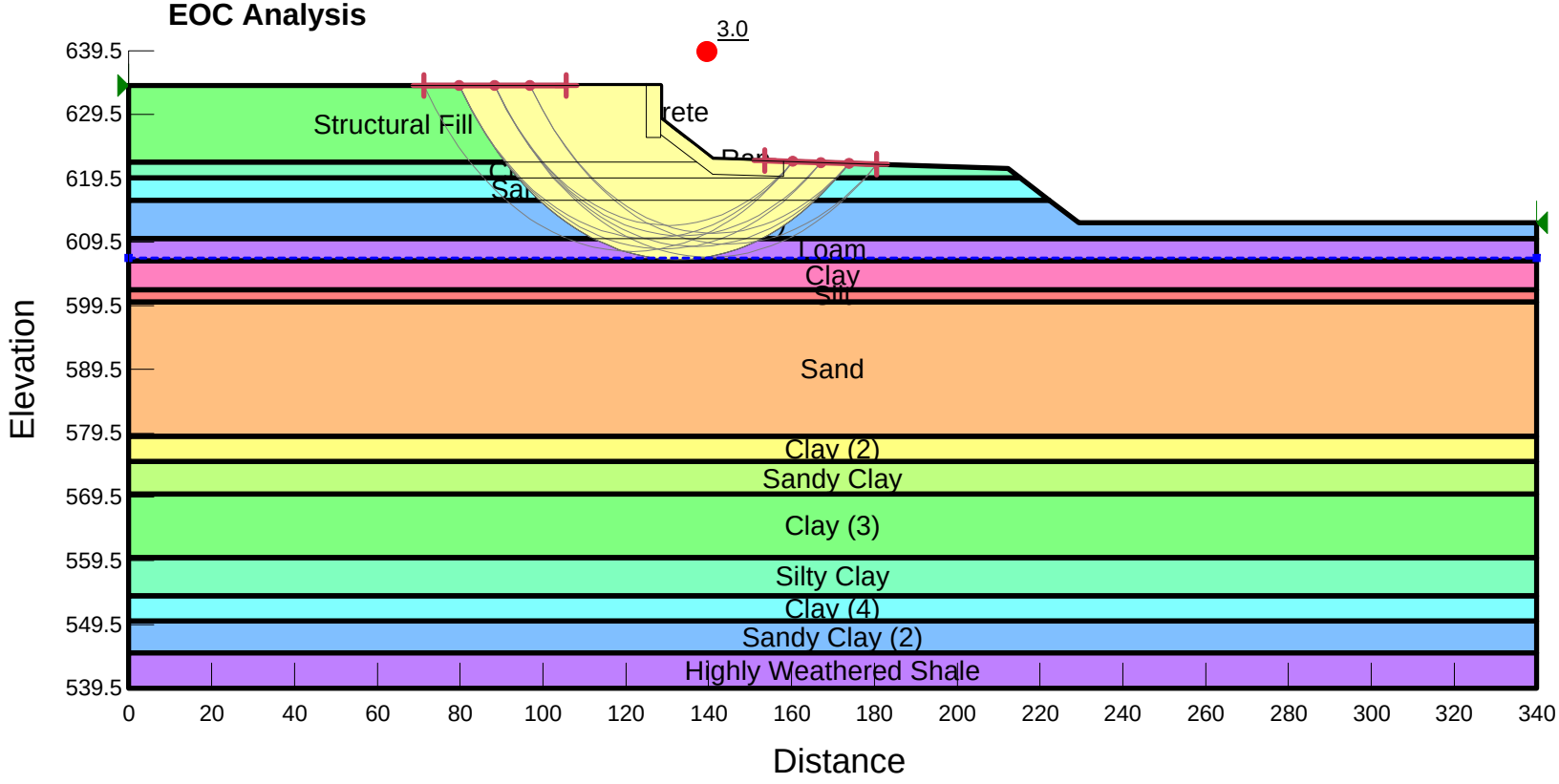
Name: Silty Clay
Unit Weight: 120 pcf
Cohesion': 1,500 psf
Phi': 0 °

Name: Clay (4)
Unit Weight: 125 pcf
Cohesion': 1,400 psf
Phi': 0 °

Name: Sandy Clay (2)
Unit Weight: 120 pcf
Cohesion': 1,500 psf
Phi': 0 °

Name: Highly Weathered Shale

IL Route 9 over North Fork LaMoine River
West Abutment (Boring 4)
EOC Analysis



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Unit Weight: 145 pcf
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Phi': 45 °

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Cohesion': 1,500 psf
Phi': 0 °

Name: Clay Fill
Unit Weight: 125 pcf
Cohesion': 1,000 psf
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Unit Weight: 120 pcf
Cohesion': 800 psf
Phi': 0 °

Name: Clay Fill (2)
Unit Weight: 125 pcf
Cohesion': 500 psf
Phi': 0 °

Name: Loam
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Cohesion': 500 psf
Phi': 0 °

Name: Clay
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Cohesion': 3,150 psf
Phi': 0 °

Name: Silt
Unit Weight: 115 pcf
Cohesion': 5,500 psf
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Unit Weight: 110 pcf
Cohesion': 0 psf
Phi': 34 °

Name: Clay (2)
Unit Weight: 125 pcf
Cohesion': 3,500 psf
Phi': 0 °

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Cohesion': 4,000 psf
Phi': 0 °

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Unit Weight: 125 pcf
Cohesion': 1,100 psf
Phi': 0 °

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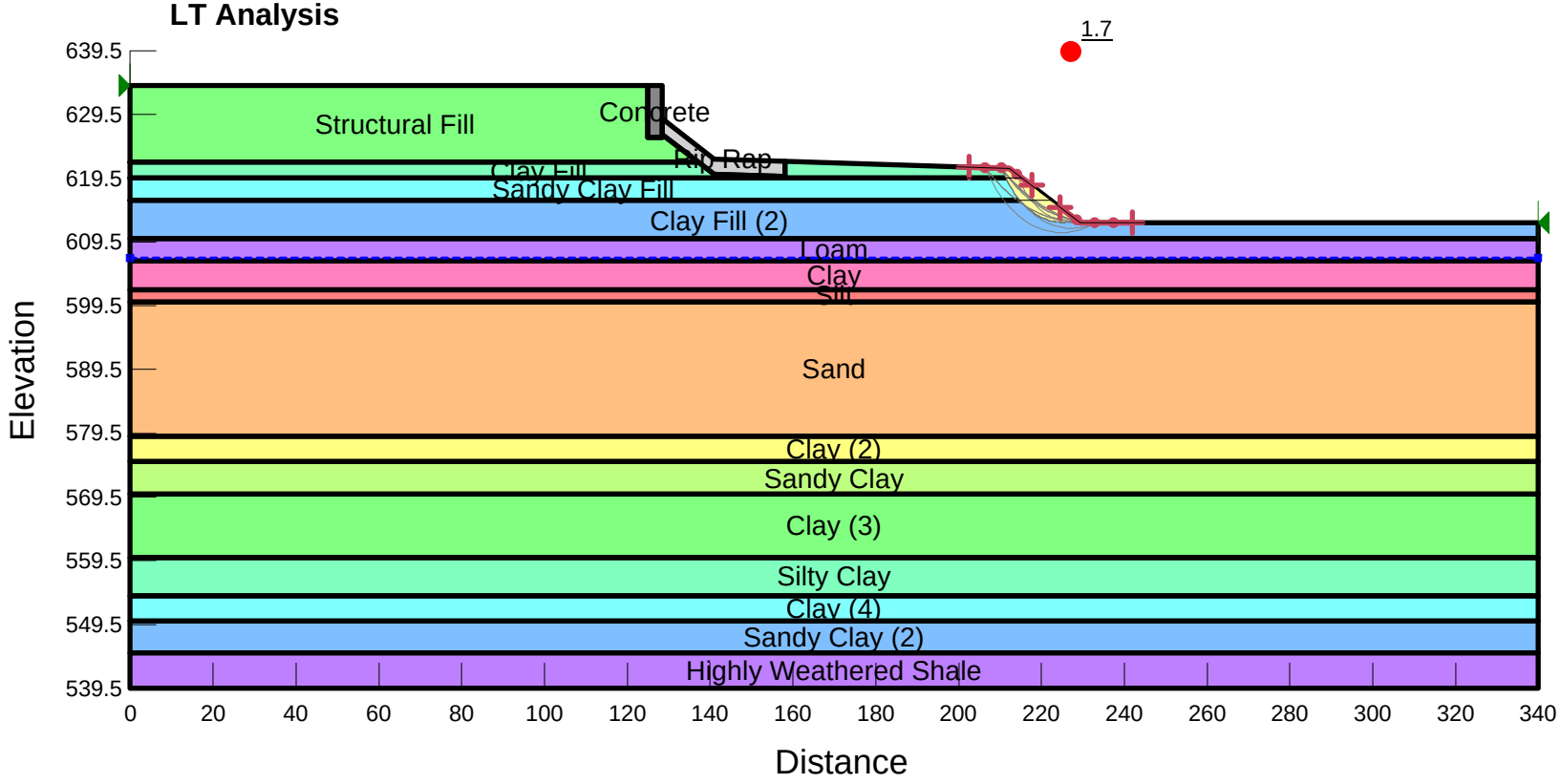
Unit Weight: 120 pcf
Cohesion': 1,500 psf
Phi': 0 °

Name: Clay (4)
Unit Weight: 125 pcf
Cohesion': 1,400 psf
Phi': 0 °

Name: Sandy Clay (2)
Unit Weight: 120 pcf
Cohesion': 1,500 psf
Phi': 0 °

Name: Highly Weathered Shale

IL Route 9 over North Fork LaMoine River
West Abutment (Boring 4)
LT Analysis



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Unit Weight: 125 pcf
Cohesion': 50 psf
Phi': 26 °

Name: Loam
Unit Weight: 115 pcf
Cohesion': 50 psf
Phi': 30 °

Name: Clay
Unit Weight: 125 pcf
Cohesion': 100 psf
Phi': 26 °

Name: Silt
Unit Weight: 115 pcf
Cohesion': 100 psf
Phi': 28 °

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Cohesion': 0 psf
Phi': 34 °

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Unit Weight: 125 pcf
Cohesion': 100 psf
Phi': 26 °

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Unit Weight: 120 pcf
Cohesion': 100 psf
Phi': 27 °

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Unit Weight: 125 pcf
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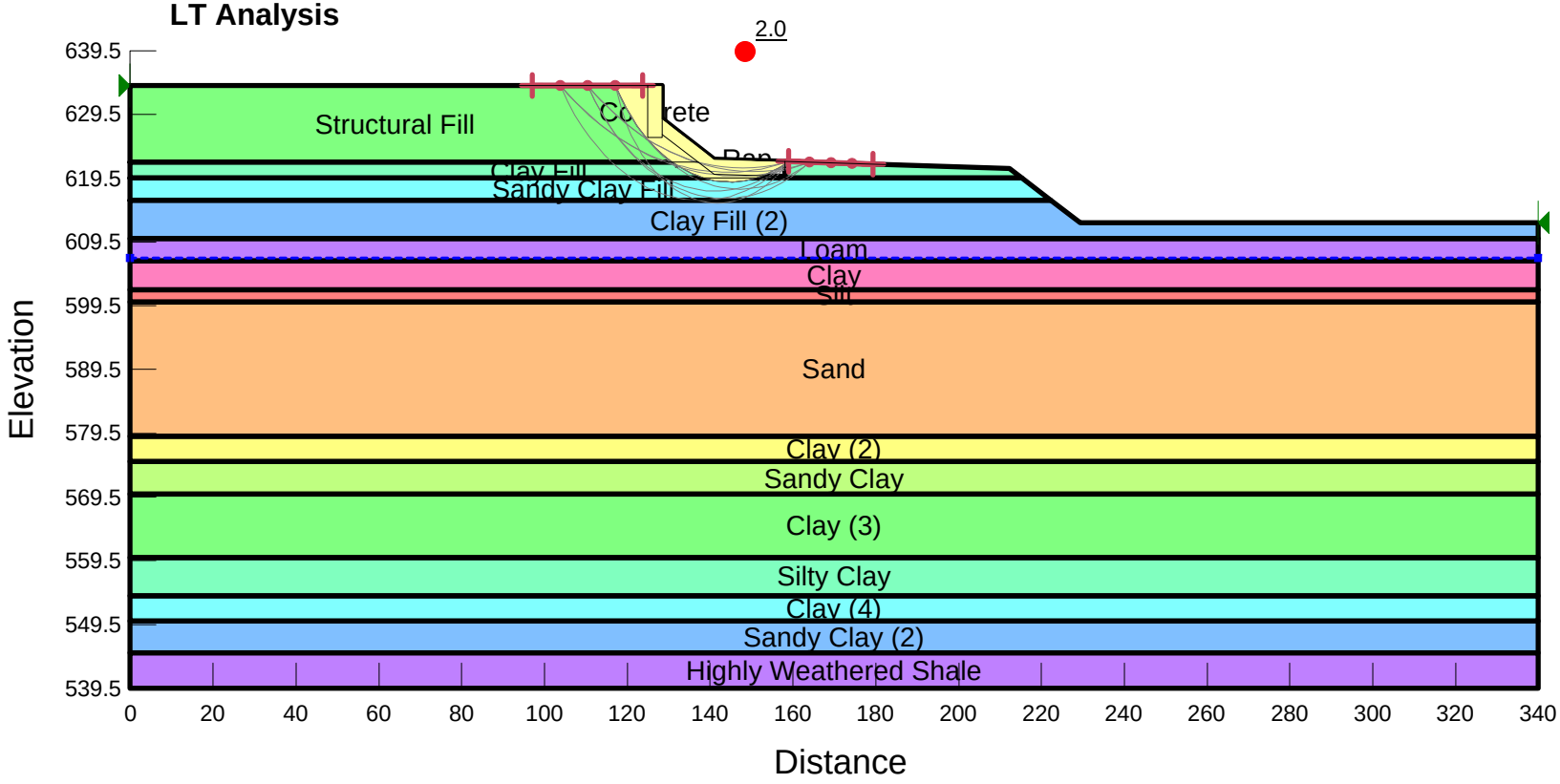
Name: Silty Clay
Unit Weight: 120 pcf
Cohesion': 100 psf
Phi': 26 °

Name: Clay (4)
Unit Weight: 125 pcf
Cohesion': 50 psf
Phi': 26 °

Name: Sandy Clay (2)
Unit Weight: 120 pcf
Cohesion': 100 psf
Phi': 27 °

Name: Highly Weathered Shale

IL Route 9 over North Fork LaMoine River
West Abutment (Boring 4)
LT Analysis



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Cohesion': 5,000 psf
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Name: Rip Rap
Unit Weight: 145 pcf
Cohesion': 0 psf
Phi': 45 °

Name: Structural Fill
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Cohesion': 50 psf
Phi': 26 °

Name: Loam
Unit Weight: 115 pcf
Cohesion': 50 psf
Phi': 30 °

Name: Clay
Unit Weight: 125 pcf
Cohesion': 100 psf
Phi': 26 °

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Unit Weight: 115 pcf
Cohesion': 100 psf
Phi': 28 °

Name: Sand
Unit Weight: 110 pcf
Cohesion': 0 psf
Phi': 34 °

Name: Clay (2)
Unit Weight: 125 pcf
Cohesion': 100 psf
Phi': 26 °

Name: Sandy Clay
Unit Weight: 120 pcf
Cohesion': 100 psf
Phi': 27 °

Name: Clay (3)
Unit Weight: 125 pcf
Cohesion': 50 psf
Phi': 26 °

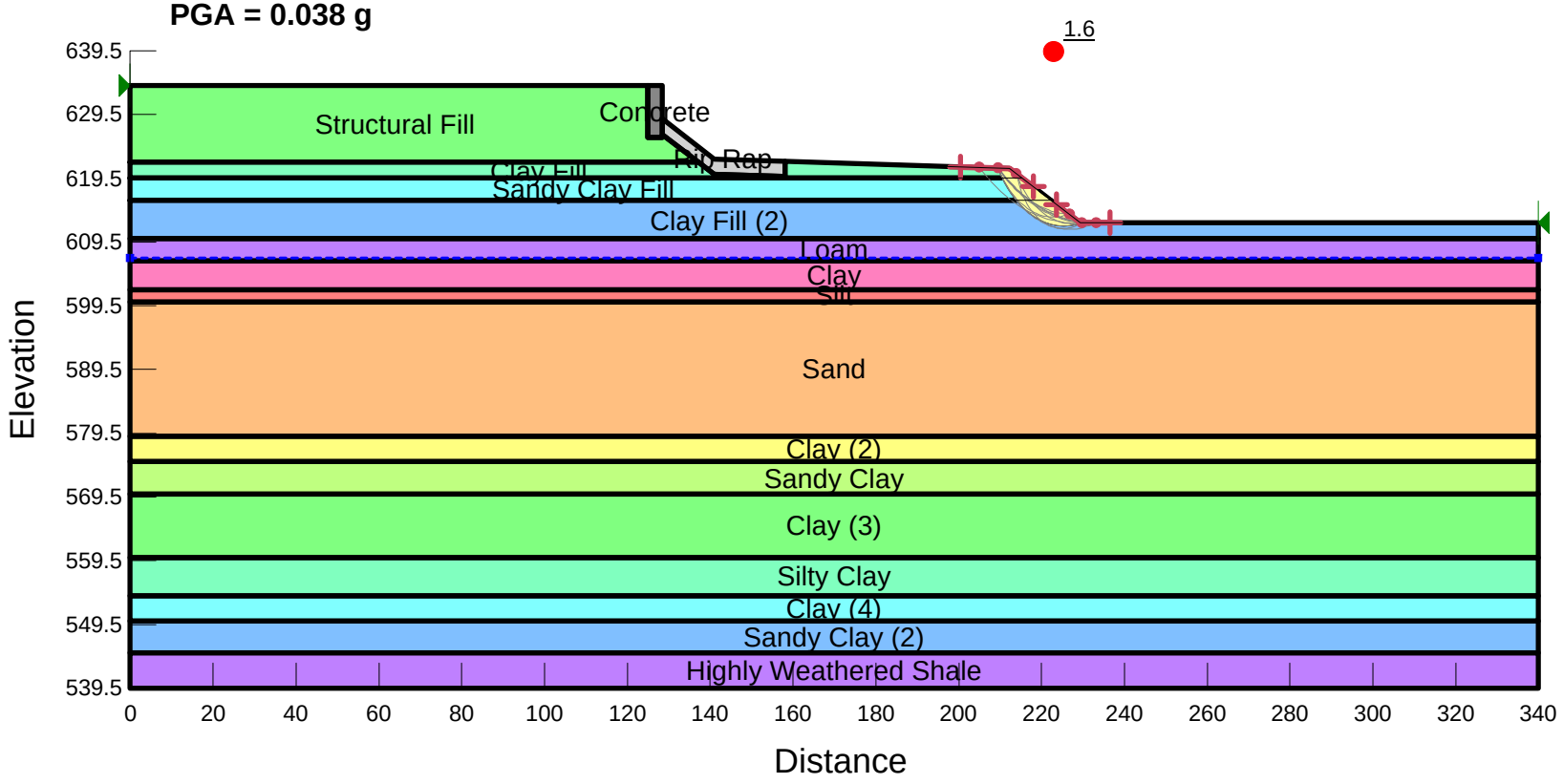
Name: Silty Clay
Unit Weight: 120 pcf
Cohesion': 100 psf
Phi': 26 °

Name: Clay (4)
Unit Weight: 125 pcf
Cohesion': 50 psf
Phi': 26 °

Name: Sandy Clay (2)
Unit Weight: 120 pcf
Cohesion': 100 psf
Phi': 27 °

Name: Highly Weathered Shale

IL Route 9 over North Fork LaMoine River
West Abutment (Boring 4)
Seismic Analysis
PGA = 0.038 g



Name: Concrete
Unit Weight: 145 pcf
Cohesion': 5,000 psf
Phi': 45 °

Name: Rip Rap
Unit Weight: 145 pcf
Cohesion': 0 psf
Phi': 45 °

Name: Structural Fill
Unit Weight: 125 pcf
Cohesion': 100 psf
Phi': 26 °

Name: Clay Fill
Unit Weight: 125 pcf
Cohesion': 50 psf
Phi': 26 °

Name: Sandy Clay Fill
Unit Weight: 120 pcf
Cohesion': 50 psf
Phi': 27 °

Name: Clay Fill (2)
Unit Weight: 125 pcf
Cohesion': 50 psf
Phi': 26 °

Name: Loam
Unit Weight: 115 pcf
Cohesion': 50 psf
Phi': 30 °

Name: Clay
Unit Weight: 125 pcf
Cohesion': 100 psf
Phi': 26 °

Name: Silt
Unit Weight: 115 pcf
Cohesion': 100 psf
Phi': 28 °

Name: Sand
Unit Weight: 110 pcf
Cohesion': 0 psf
Phi': 34 °

Name: Clay (2)
Unit Weight: 125 pcf
Cohesion': 100 psf
Phi': 26 °

Name: Sandy Clay
Unit Weight: 120 pcf
Cohesion': 100 psf
Phi': 27 °

Name: Clay (3)
Unit Weight: 125 pcf
Cohesion': 50 psf
Phi': 26 °

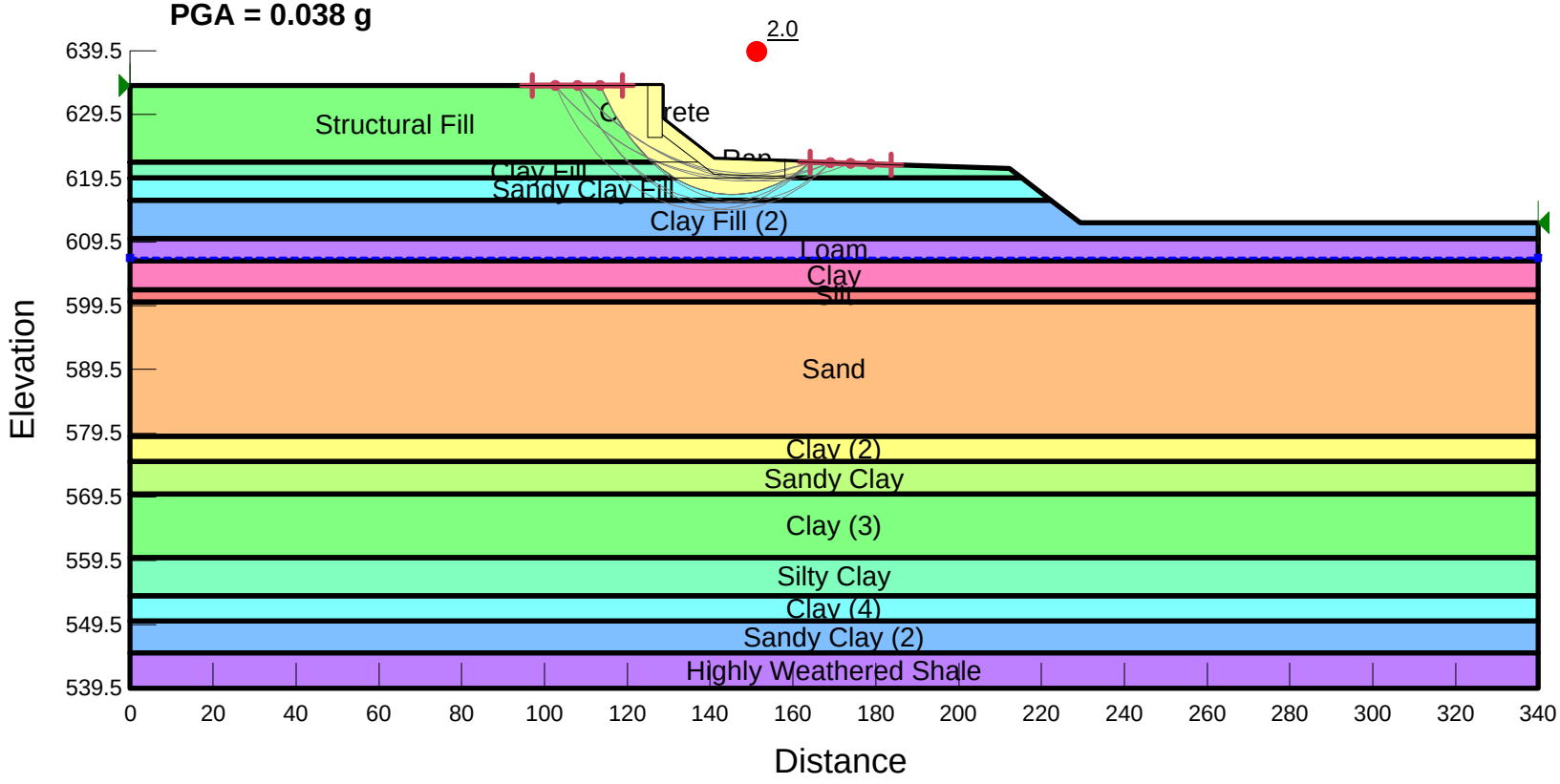
Name: Silty Clay
Unit Weight: 120 pcf
Cohesion': 100 psf
Phi': 26 °

Name: Clay (4)
Unit Weight: 125 pcf
Cohesion': 50 psf
Phi': 26 °

Name: Sandy Clay (2)
Unit Weight: 120 pcf
Cohesion': 100 psf
Phi': 27 °

Name: Highly Weathered Shale

IL Route 9 over North Fork LaMoine River
West Abutment (Boring 4)
Seismic Analysis
PGA = 0.038 g



Name: Concrete
Unit Weight: 145 pcf
Cohesion': 5,000 psf
Phi': 45 °

Name: Rip Rap
Unit Weight: 145 pcf
Cohesion': 0 psf
Phi': 45 °

Name: Structural Fill
Unit Weight: 125 pcf
Cohesion': 100 psf
Phi': 26 °

Name: Clay Fill
Unit Weight: 125 pcf
Cohesion': 50 psf
Phi': 26 °

Name: Sandy Clay Fill
Unit Weight: 120 pcf
Cohesion': 50 psf
Phi': 27 °

Name: Clay Fill (2)
Unit Weight: 125 pcf
Cohesion': 50 psf
Phi': 26 °

Name: Loam
Unit Weight: 115 pcf
Cohesion': 50 psf
Phi': 30 °

Name: Clay
Unit Weight: 125 pcf
Cohesion': 100 psf
Phi': 26 °

Name: Silt
Unit Weight: 115 pcf
Cohesion': 100 psf
Phi': 28 °

Name: Sand
Unit Weight: 110 pcf
Cohesion': 0 psf
Phi': 34 °

Name: Clay (2)
Unit Weight: 125 pcf
Cohesion': 100 psf
Phi': 26 °

Name: Sandy Clay
Unit Weight: 120 pcf
Cohesion': 100 psf
Phi': 27 °

Name: Clay (3)
Unit Weight: 125 pcf
Cohesion': 50 psf
Phi': 26 °

Name: Silty Clay
Unit Weight: 120 pcf
Cohesion': 100 psf
Phi': 26 °

Name: Clay (4)
Unit Weight: 125 pcf
Cohesion': 50 psf
Phi': 26 °

Name: Sandy Clay (2)
Unit Weight: 120 pcf
Cohesion': 100 psf
Phi': 27 °

Name: Highly Weathered Shale

EXHIBIT F

ILLINOIS STATE GEOLOGICAL SURVEY

MINE MAP

ILLINOIS STATE GEOLOGICAL SURVEY

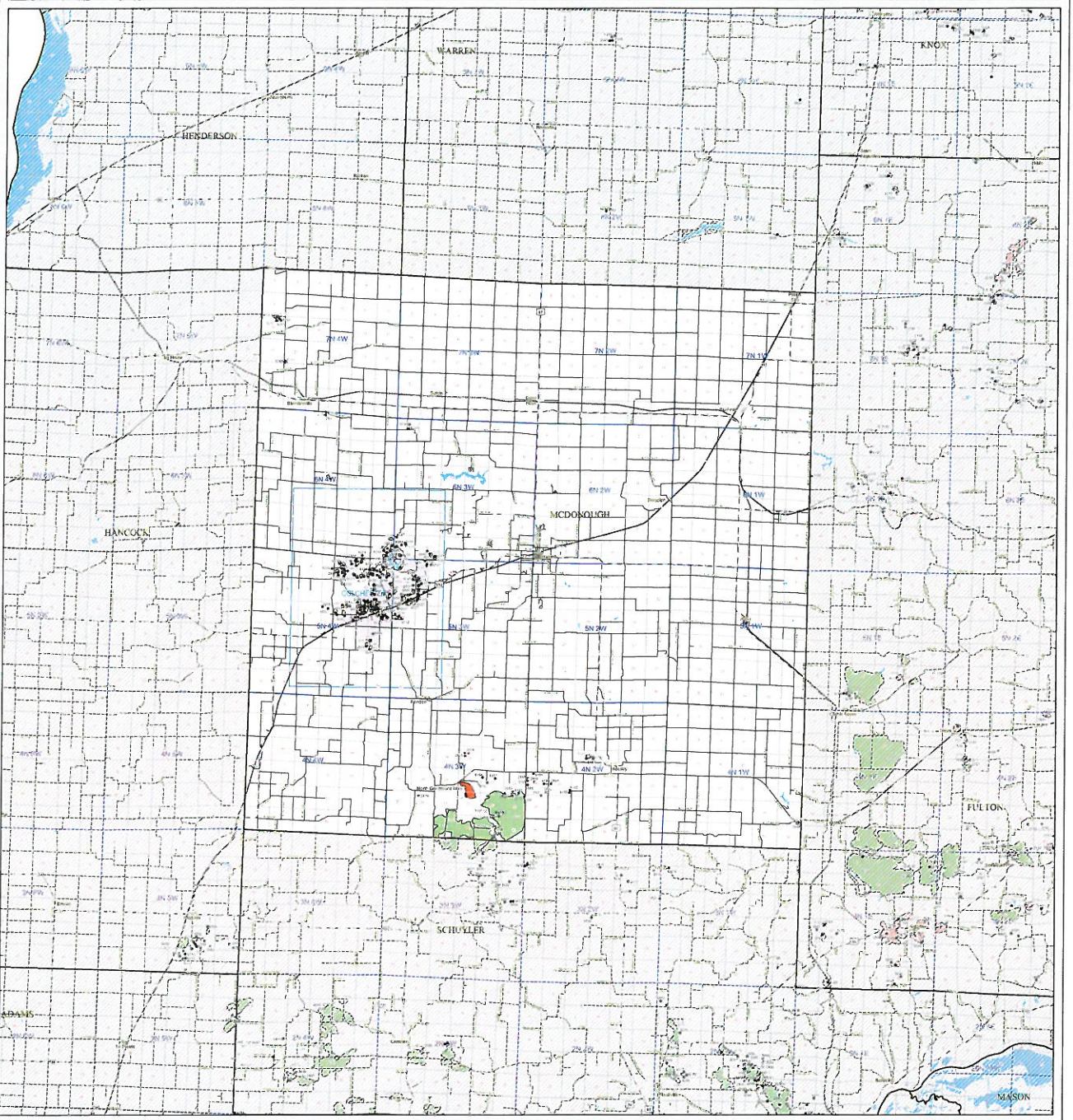
ILLINOIS

Coal Mines and Underground Industrial Mines
MCDONOUGH
County

County Coal Map Series
Illinois Coal Section
Map construction: Aug 6, 2012

For further information contact:
Phyllis Research Incharn
Illinois State Geological Survey
University of Illinois at Urbana-Champaign
615 East Peabody Drive
Champaign, Illinois 61820-6964
(217) 333-4747
http://www.isgs.illinois.edu

County coal maps and select quadrangle maps available as downloadable PDF files at http://library.isgs.illinois.edu/maps-data-pub/coal-maps/county_index.shtml



1:100,000

Herrin Coal Depth

Summary Coal Depth

Colchester Coal Depth

Herrin Coal Thickness

Summary Coal Thickness

Colchester Coal Thickness

- County
- Township
- Section
- Quadrangle study (Available on request)
- Lake or river
- Coal mine - active
- Underground coal mine - abandoned
- Surface coal mine - abandoned
- Indefinite underground coal mine boundary - abandoned
- Underground industrial mine and surrounding buffer region
- Coal mine and/or mine#or (Unregistered, power label)
- Opening type unknown
- Uncertain location
- Active surface tipple
- Abandoned surface tipple
- Active shaft
- Abandoned shaft
- Active slope
- Abandoned slope
- Active drift
- Abandoned drift
- Underground industrial mine entrance or general location

Map Explanation

This map summarizes the most recent inventory for this county. Please consult the directory for an explanation of the qualities information shown on this map. Buffer regions for industrial mineral mines were compressed from this map due to limited information regarding these mines. The size of the buffer region is dependent on the uncertainty or inaccuracy of the mine's location. For more information regarding industrial mineral mines, please contact the ISGS Industrial Minerals Section.

The maps and digital files used for this work were compiled from data digitized from a variety of public and private sources and have varying degrees of completeness and accuracy. The present reasonable interpretations of the geology of the area are based on available data. These data were compiled and digitized at a scale of 1:62,500. Locations of mine features may be offset by 100 feet or more due to errors in the original source maps, the compilation process, digitizing, or a combination of these factors.

These data are not intended for use in site specific screening or decision-making. Data included in this map are suitable for use at a scale of 1:100,000.

Disclaimer

EXHIBIT G

PILE LENGTH/PILE TYPE

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

I.D.O.T. BBS FOUNDATIONS AND GEOTECHNICAL UNIT

Modified 10/18/2011

SUBSTRUCTURE========== East Abut.
REFERENCE BORING ========== 2
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 628.16 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRI 623.16 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) Scour
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========= 626.16 ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========= 900 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)==== 36.40 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE = 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 197.80 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 74.18 KIPS

MAX. REQUIRED BEARING & RESISTANCE for Selected Pile, Soil Profile, & Losses

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req.d Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
929 KIPS	**929** KIPS	**511** KIPS	**92** FT.

PILE TYPE AND SIZE ========== Steel HP 14 X 117
Plugged Pile Perimeter========== 4.850 FT. Unplugged Pile Perimeter========== 7.117 FT.
Plugged Pile End Bearing Area========== 1.469 SQFT. Unplugged Pile End Bearing Area===== 0.239 SQFT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED SIDE RESIST. (KIPS)	NOMINAL PLUGGED END BRG. RESIST. (KIPS)	NOMINAL PLUGGED TOTAL RESIST. (KIPS)	NOMINAL UNPLUG'D SIDE RESIST. (KIPS)	NOMINAL UNPLUG'D END BRG. RESIST. (KIPS)	NOMINAL UNPLUG'D TOTAL RESIST. (KIPS)	NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
622.10	1.06	1.50	8		4.9		31.7	7.3		***11.6***	12	0	0	6	6
619.60	2.50	1.30	10		10.5	26.8	25.8	15.5	4.4	***24.4***	24	0	0	13	9
617.10	2.50	0.50	4		4.7	10.3	***30.5***	6.9	1.7	31.3	31	0	0	17	11
616.00	1.10	0.50	4		2.1	10.3	***27.4***	3.1	1.7	33.6	27	0	0	15	12
614.50	1.50	0.25	2		1.5	5.1	***28.9***	2.2	0.8	35.7	29	0	0	16	14
613.00	1.50	0.25	2		1.5	5.1	40.7	2.2	0.8	***39.6***	40	0	0	22	15
611.00	2.00	0.75	6		5.4	15.4	***46.1***	8.0	2.5	47.5	46	0	0	25	17
609.50	1.50	0.75	6		4.1	15.4	***42.1***	6.0	2.5	52.2	42	0	0	23	19
607.00	2.50		2	Medium Sand	0.4	7.3	***42.5***	0.6	1.2	52.8	43	0	0	23	21
604.00	3.00		2	Medium Sand	0.5	7.3	***46.0***	0.8	1.2	54.1	46	0	0	25	24
602.00	2.00	0.50	2		3.8	10.3	***49.8***	5.5	1.7	59.6	50	0	0	27	26
599.50	2.50	0.50	7		4.7	10.3	68.9	6.9	1.7	***68.9***	69	0	0	38	29
597.00	2.50	1.20	14		9.9	24.7	***80.9***	14.6	4.0	83.8	81	0	0	45	31
594.00	3.00	1.30	14		12.7	26.8	110.7	18.6	4.4	***105.2***	105	0	0	58	34
592.00	2.00		12	Medium Sand	2.1	43.9	112.9	3.1	7.1	***108.3***	108	0	0	60	36
589.50	2.50		12	Medium Sand	2.7	43.9	138.5	3.9	7.1	***115.9***	116	0	0	64	39
587.00	2.50	3.25	26		19.7	66.9	158.2	28.8	10.9	***144.8***	145	0	0	80	41
584.50	2.50	3.25	26		19.7	66.9	196.0	28.8	10.9	***176.6***	177	0	0	97	44
582.00	2.50		31	Hard Till	4.1	85.1	200.1	6.0	13.8	***182.6***	183	0	0	100	46
579.50	2.50		31	Hard Till	4.1	85.1	***170.3***	6.0	13.8	183.0	170	0	0	94	49
574.50	5.00		14	Medium Sand	6.2	51.2	227.7	9.1	8.3	***200.5***	200	0	0	110	54
569.50	5.00		28	Medium Sand	12.6	102.5	357.5	18.5	16.7	***238.0***	238	0	0	131	59
564.50	5.00		60	Medium Sand	46.3	219.6	***210.9***	67.9	35.7	274.6	211	0	0	116	64
559.50	5.00	1.30	28		21.1	26.8	***227.9***	30.9	4.4	304.9	228	0	0	125	69
554.50	5.00	1.10	9		18.6	22.7	***263.0***	27.3	3.7	334.8	263	0	0	145	74
549.50	5.00	1.90	20		27.3	39.1	***368.3***	40.1	6.4	387.6	368	0	0	203	79
547.00	2.50		32	Medium Sand	7.6	117.1	***375.9***	11.2	19.0	398.8	376	0	0	207	81
544.50	2.50		32	Medium Sand	7.6	117.1	449.4	11.2	19.0	***420.7***	421	0	0	231	84
543.50	1.00			Shale	60.4	183.0	509.9	88.7	29.8	***509.3***	509	0	0	280	84.7
542.50	1.00			Shale	60.4	183.0	***570.3***	88.7	29.8	598.0	570	0	0	314	85.7
541.50	1.00			Shale	60.4	183.0	***630.7***	88.7	29.8	686.6	631	0	0	347	86.7
540.50	1.00			Shale	60.4	183.0	***691.1***	88.7	29.8	775.3	691	0	0	380	87.7
539.50	1.00			Shale	60.4	183.0	***751.5***	88.7	29.8	864.0	752	0	0	413	88.7
538.50	1.00			Shale	60.4	183.0	***812.0***	88.7	29.8	952.6	812	0	0	447	89.7
537.50	1.00			Shale	60.4	183.0	***872.4***	88.7	29.8	1041.3	872	0	0	480	90.7
536.50	1.00			Shale	60.4	183.0	***932.8***	88.7	29.8	1129.9	~~933~~	~~0~~	~~0~~	~~513~~	~~91.7~~
535.50	1.00			Shale	60.4	183.0	***993.2***	88.7	29.8	1218.6	~~993~~	~~0~~	~~0~~	~~546~~	~~92.7~~
534.50	1.00			Shale		183.0			29.8						

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

I.D.O.T. BBS FOUNDATIONS AND GEOTECHNICAL UNIT

Modified 10/18/2011

SUBSTRUCTURE========== Pier #2 East
REFERENCE BORING ========== 1
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 627.80 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRI 607.30 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) Scour
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========= 594.50 ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========= 1900 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)==== 36.40 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE = 2
Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 208.79 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 78.30 KIPS

MAX. REQUIRED BEARING & RESISTANCE for Selected Pile, Soil Profile, & Losses

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req.d Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
929 KIPS	**929** KIPS	**496** KIPS	**92** FT.

PILE TYPE AND SIZE ========== Steel HP 14 X 117
Plugged Pile Perimeter========== 4.850 FT. Unplugged Pile Perimeter========== 7.117 FT.
Plugged Pile End Bearing Area========== 1.469 SQFT. Unplugged Pile End Bearing Area===== 0.239 SQFT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED SIDE RESIST. (KIPS)	NOMINAL PLUGGED END BRG. RESIST. (KIPS)	NOMINAL PLUGGED TOTAL RESIST. (KIPS)	NOMINAL UNPLUG'D SIDE RESIST. (KIPS)	NOMINAL UNPLUG'D END BRG. RESIST. (KIPS)	NOMINAL UNPLUG'D TOTAL RESIST. (KIPS)	NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
604.02	3.28	0.50			6.2		16.5	9.1		***10.8***	11	3	0	3	24
602.52	1.50	0.50			2.8	10.3	25.5	4.2	1.7	***15.9***	16	5	0	4	25
600.02	2.50	0.80			7.2	16.5	32.7	10.5	2.7	***26.4***	26	9	0	6	28
596.52	3.50	0.80			10.0	16.5	77.5	14.7	2.7	***46.8***	47	14	0	11	31
594.02	2.50		14	Medium Sand	3.1	51.2	146.5	4.5	8.3	***62.1***	62	14	0	20	34
591.52	2.50		32	Medium Sand	7.6	117.1	106.5	11.2	19.0	***65.5***	66	14	0	22	36
584.02	7.50		19	Medium Sand	12.6	69.6	111.3	18.5	11.3	***82.7***	83	14	0	31	44
581.52	2.50	3.00			18.5	61.8	291.4	27.2	10.0	***136.2***	136	14	0	60	46
573.52	8.00		61	Medium Sand	76.2	223.3	256.9	111.8	36.3	***230.0***	230	14	0	112	54
569.02	4.50		41	Hard Till	10.4	112.6	***191.7***	15.2	18.3	233.0	192	14	0	91	59
566.52	2.50	1.80			13.2	37.1	***229.6***	19.3	6.0	256.4	230	14	0	112	61
561.52	5.00	3.00			37.1	61.8	***244.1***	54.4	10.0	307.1	244	14	0	120	66
556.52	5.00	1.90			27.3	39.1	***259.0***	40.1	6.4	345.2	259	14	0	128	71
549.02	7.50	1.30			31.6	26.8	432.3	46.4	4.4	***414.6***	415	14	0	214	79
544.02	5.00		46	Medium Sand	28.2	168.4	475.2	41.4	27.4	***458.4***	458	14	0	238	84
543.02	1.00			Shale	60.4	183.0	***535.6***	88.7	29.8	547.1	536	14	0	280	84.8
542.02	1.00			Shale	60.4	183.0	***596.0***	88.7	29.8	635.7	596	14	0	313	85.8
541.02	1.00			Shale	60.4	183.0	***656.4***	88.7	29.8	724.4	656	14	0	347	86.8
540.02	1.00			Shale	60.4	183.0	***716.8***	88.7	29.8	813.0	717	14	0	380	87.8
539.02	1.00			Shale	60.4	183.0	***777.2***	88.7	29.8	901.7	777	14	0	413	88.8
538.02	1.00			Shale	60.4	183.0	***837.7***	88.7	29.8	990.3	838	14	0	446	89.8
537.02	1.00			Shale	60.4	183.0	***898.1***	88.7	29.8	1079.0	898	14	0	480	90.8
536.02	1.00			Shale	60.4	183.0	***958.5***	88.7	29.8	1167.6	~~959~~	~~14~~	~~0~~	~~513~~	~~91.8~~
535.02	1.00			Shale	60.4	183.0	***1018.9***	88.7	29.8	1256.3	~~1019~~	~~14~~	~~0~~	~~546~~	~~92.8~~
534.02	1.00			Shale	60.4	183.0	***1079.3***	88.7	29.8	1345.0	~~1079~~	~~14~~	~~0~~	~~579~~	~~93.8~~
533.02	1.00			Shale	60.4	183.0	***1139.8***	88.7	29.8	1433.6	~~1140~~	~~14~~	~~0~~	~~612~~	~~94.8~~
532.02	1.00			Shale	60.4	183.0	***1200.2***	88.7	29.8	1522.3	~~1200~~	~~14~~	~~0~~	~~646~~	~~95.8~~
531.02	1.00			Shale	60.4	183.0	***1260.6***	88.7	29.8	1610.9	~~1261~~	~~14~~	~~0~~	~~679~~	~~96.8~~
530.02	1.00			Shale	60.4	183.0	***1321.0***	88.7	29.8	1699.6	~~1321~~	~~14~~	~~0~~	~~712~~	~~97.8~~
529.02	1.00			Shale	60.4	183.0	***1381.4***	88.7	29.8	1788.2	~~1381~~	~~14~~	~~0~~	~~745~~	~~98.8~~
528.02	1.00			Shale	60.4	183.0	***1441.8***	88.7	29.8	1876.9	~~1442~~	~~14~~	~~0~~	~~779~~	~~99.8~~
527.02	1.00			Shale	60.4	183.0	***1502.3***	88.7	29.8	1965.5	~~1502~~	~~14~~	~~0~~	~~812~~	~~100.8~~
526.02	1.00			Shale	60.4	183.0	***1562.7***	88.7	29.8	2054.2	~~1563~~	~~14~~	~~0~~	~~845~~	~~101.8~~
525.02	1.00			Shale	60.4	183.0	***1623.1***	88.7	29.8	2142.8	~~1623~~	~~14~~	~~0~~	~~878~~	~~102.8~~
524.02	1.00			Shale	60.4	183.0	***1683.5***	88.7	29.8	2231.5	~~1684~~	~~14~~	~~0~~	~~912~~	~~103.8~~
523.02	1.00			Shale	60.4	183.0	***1743.9***	88.7	29.8	2320.1	~~1744~~	~~14~~	~~0~~	~~945~~	~~104.8~~
522.02	1.00			Shale	60.4	183.0	***1804.3***	88.7	29.8	2408.8	~~1804~~	~~14~~	~~0~~	~~978~~	~~105.8~~
521.02	1.00			Shale		183.0			29.8						

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

I.D.O.T. BBS FOUNDATIONS AND GEOTECHNICAL UNIT — Modified 10/18/2011

SUBSTRUCTURE========== West Abut
REFERENCE BORING ========== 4
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 627.82 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRI 622.82 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) Scour
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========= 625.82 ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========= 900 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)==== 36.40 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE = 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 197.80 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 74.18 KIPS

PILE TYPE AND SIZE ========== Steel HP 14 X 117
Plugged Pile Perimeter========== 4.850 FT. Unplugged Pile Perimeter========== 7.117 FT.
Plugged Pile End Bearing Area========== 1.469 SQFT. Unplugged Pile End Bearing Area===== 0.239 SQFT.

MAX. REQUIRED BEARING & RESISTANCE for Selected Pile, Soil Profile, & Losses

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req.d Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
929 KIPS	**929** KIPS	**511** KIPS	**92** FT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED SIDE RESIST. (KIPS)	NOMINAL PLUGGED END BRG. RESIST. (KIPS)	NOMINAL PLUGGED TOTAL RESIST. (KIPS)	NOMINAL UNPLUG'D SIDE RESIST. (KIPS)	NOMINAL UNPLUG'D END BRG. RESIST. (KIPS)	NOMINAL UNPLUG'D TOTAL RESIST. (KIPS)	NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
622.00	0.82	1.50	8		3.8		24.4	5.6		***9.0***	9	0	0	5	6
619.50	2.50	1.00	8		8.6	20.6	27.9	12.6	3.3	***20.8***	21	0	0	11	8
617.50	2.00	0.75	6		5.4	15.4	36.4	8.0	2.5	***29.2***	29	0	0	16	10
616.00	1.50	0.90	7		4.7	18.5	***27.8***	7.0	3.0	34.0	28	0	0	15	12
613.00	3.00	0.25	2		3.0	5.1	***30.7***	4.3	0.8	38.4	31	0	0	17	15
610.00	3.00	0.25	2		3.0	5.1	***38.8***	4.3	0.8	43.5	39	0	0	21	18
606.50	3.50	0.50	2		6.6	10.3	107.2	9.7	1.7	***63.3***	63	0	0	35	21
604.50	2.00	3.50	13		16.6	72.1	109.4	24.4	11.7	***85.3***	85	0	0	47	23
602.00	2.50	2.80	12		17.7	57.7	190.2	25.9	9.4	***121.5***	122	0	0	67	26
600.00	2.00		44	Hard Till	5.1	120.8	239.2	7.5	19.6	***136.1***	136	0	0	75	28
597.00	3.00		45	Medium Sand	16.3	164.7	193.3	23.9	26.8	***149.9***	150	0	0	82	31
594.50	2.50		28	Medium Sand	6.3	102.5	***144.7***	9.3	16.7	150.2	145	0	0	80	33
589.50	5.00		13	Medium Sand	5.7	47.6	198.0	8.4	7.7	***166.4***	166	0	0	92	38
584.50	5.00		26	Medium Sand	11.5	95.2	213.2	16.9	15.5	***183.9***	184	0	0	101	43
579.00	5.50		27	Medium Sand	13.3	98.8	245.7	19.5	16.1	***206.4***	206	0	0	114	49
575.00	4.00		43	Hard Till	9.9	118.1	252.8	14.5	19.2	***220.5***	220	0	0	121	53
570.00	5.00		42	Hard Till	11.9	115.3	***172.0***	17.5	18.7	222.9	172	0	0	95	58
564.50	5.50	1.10	19		20.4	22.7	***192.5***	30.0	3.7	252.9	192	0	0	106	63
560.00	4.50	1.10	14		16.7	22.7	***217.4***	24.5	3.7	278.8	217	0	0	120	68
554.00	6.00	1.50	15		28.0	30.9	***243.4***	41.1	5.0	319.5	243	0	0	134	74
550.00	4.00	1.40	22		17.8	28.8	***263.2***	26.1	4.7	345.9	263	0	0	145	78
545.00	5.00	1.50	21		23.3	30.9	438.7	34.2	5.0	***404.9***	405	0	0	223	83
544.00	1.00			Shale	60.4	183.0	499.1	88.7	29.8	***493.6***	494	0	0	271	83.8
543.00	1.00			Shale	60.4	183.0	***559.5***	88.7	29.8	582.2	560	0	0	308	84.8
542.00	1.00			Shale	60.4	183.0	***619.9***	88.7	29.8	670.9	620	0	0	341	85.8
541.00	1.00			Shale	60.4	183.0	***680.4***	88.7	29.8	759.5	680	0	0	374	86.8
540.00	1.00			Shale	60.4	183.0	***740.8***	88.7	29.8	848.2	741	0	0	407	87.8
539.00	1.00			Shale	60.4	183.0	***801.2***	88.7	29.8	936.8	801	0	0	441	88.8
538.00	1.00			Shale	60.4	183.0	***861.6***	88.7	29.8	1025.5	862	0	0	474	89.8
537.00	1.00			Shale	60.4	183.0	***922.0***	88.7	29.8	1114.1	922	0	0	507	90.8
536.00	1.00			Shale	60.4	183.0	***982.4***	88.7	29.8	1202.8	~~982~~	~~0~~	~~0~~	~~540~~	~~91.8~~
535.00	1.00			Shale	60.4	183.0	***1042.9***	88.7	29.8	1291.4	~~1043~~	~~0~~	~~0~~	~~574~~	~~92.8~~
534.00	1.00			Shale	60.4	183.0	***1103.3***	88.7	29.8	1380.1	~~1103~~	~~0~~	~~0~~	~~607~~	~~93.8~~
533.00	1.00			Shale	60.4	183.0	***1163.7***	88.7	29.8	1468.7	~~1164~~	~~0~~	~~0~~	~~640~~	~~94.8~~
532.00	1.00			Shale	60.4	183.0	***1224.1***	88.7	29.8	1557.4	~~1224~~	~~0~~	~~0~~	~~673~~	~~95.8~~
531.00	1.00			Shale	60.4	183.0	***1284.5***	88.7	29.8	1646.0	~~1285~~	~~0~~	~~0~~	~~706~~	~~96.8~~
530.00	1.00			Shale	60.4	183.0	***1344.9***	88.7	29.8	1734.7	~~1345~~	~~0~~	~~0~~	~~740~~	~~97.8~~
529.00	1.00			Shale		183.0			29.8						

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

I.D.O.T. BBS FOUNDATIONS AND GEOTECHNICAL UNIT

Modified 10/18/2011

SUBSTRUCTURE========== Pier #1 West
REFERENCE BORING ========== 3
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 627.80 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRI 607.30 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) Scour
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========= 601.95 ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========= 1900 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)==== 36.40 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE = 2
Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 208.79 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 78.30 KIPS

PILE TYPE AND SIZE ========== Steel HP 14 X 117
Plugged Pile Perimeter========== 4.850 FT. Unplugged Pile Perimeter========== 7.117 FT.
Plugged Pile End Bearing Area========== 1.469 SQFT. Unplugged Pile End Bearing Area===== 0.239 SQFT.

MAX. REQUIRED BEARING & RESISTANCE for Selected Pile, Soil Profile, & Losses

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req.d Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
929 KIPS	**929** KIPS	**495** KIPS	**93** FT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED SIDE RESIST. (KIPS)	NOMINAL PLUGGED END BRG. RESIST. (KIPS)	NOMINAL PLUGGED TOTAL RESIST. (KIPS)	NOMINAL UNPLUG'D SIDE RESIST. (KIPS)	NOMINAL UNPLUG'D END BRG. RESIST. (KIPS)	NOMINAL UNPLUG'D TOTAL RESIST. (KIPS)	NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
604.90	2.40	2.20	14		14.4		53.5	21.1		***27.5***	27	8	0	7	23
602.40	2.50	1.90	15		13.7	39.1	73.4	20.0	6.4	***48.5***	49	15	0	11	25
599.90	2.50	2.20	16		15.0	45.3	104.8	22.0	7.4	***73.2***	73	15	0	25	28
597.40	2.50	3.00	31		18.5	61.8	156.8	27.2	10.0	***105.9***	106	15	0	43	30
594.90	2.50		26	Medium Sand	5.8	95.2	166.2	8.4	15.5	***114.9***	115	15	0	48	33
589.90	5.00		27	Medium Sand	12.1	98.8	160.0	17.7	16.1	***129.6***	130	15	0	56	38
584.90	5.00		22	Medium Sand	9.7	80.5	151.4	14.3	13.1	***140.9***	141	15	0	62	43
579.90	5.00		17	Medium Sand	7.5	62.2	272.4	11.0	10.1	***170.4***	170	15	0	78	48
574.90	5.00		48	Medium Sand	30.6	175.7	***164.3***	44.8	28.6	192.7	164	15	0	75	53
569.90	5.00	1.80	26		26.4	37.1	257.9	38.7	6.0	***242.3***	242	15	0	118	58
564.90	5.00		38	Hard Till	10.4	104.3	262.8	15.3	17.0	***256.7***	257	15	0	126	63
559.90	5.00		36	Hard Till	9.7	98.8	***204.6***	14.3	16.1	259.9	205	15	0	97	68
554.40	5.50	1.50	22		25.7	30.9	***242.6***	37.6	5.0	299.6	243	15	0	118	73
550.40	4.00	2.10	27		23.3	43.2	358.1	34.2	7.0	***348.7***	349	15	0	176	77
543.90	6.50		37	Medium Sand	24.9	135.4	430.6	36.6	22.0	***393.1***	393	15	0	201	84
542.90	1.00			Shale	60.4	183.0	491.1	88.7	29.8	***481.7***	482	15	0	250	84.9
541.90	1.00			Shale	60.4	183.0	***551.5***	88.7	29.8	570.4	551	15	0	288	85.9
540.90	1.00			Shale	60.4	183.0	***611.9***	88.7	29.8	659.0	612	15	0	321	86.9
539.90	1.00			Shale	60.4	183.0	***672.3***	88.7	29.8	747.7	672	15	0	354	87.9
538.90	1.00			Shale	60.4	183.0	***732.7***	88.7	29.8	836.3	733	15	0	388	88.9
537.90	1.00			Shale	60.4	183.0	***793.1***	88.7	29.8	925.0	793	15	0	421	89.9
536.90	1.00			Shale	60.4	183.0	***853.6***	88.7	29.8	1013.7	854	15	0	454	90.9
535.90	1.00			Shale	60.4	183.0	***914.0***	88.7	29.8	1102.3	914	15	0	487	91.9
534.90	1.00			Shale	60.4	183.0	***974.4***	88.7	29.8	1191.0	~~974~~	~~15~~	~~0~~	~~520~~	~~92.9~~
533.90	1.00			Shale	60.4	183.0	***1034.8***	88.7	29.8	1279.6	~~1035~~	~~15~~	~~0~~	~~554~~	~~93.9~~
532.90	1.00			Shale	60.4	183.0	***1095.2***	88.7	29.8	1368.3	~~1095~~	~~15~~	~~0~~	~~587~~	~~94.9~~
531.90	1.00			Shale	60.4	183.0	***1155.6***	88.7	29.8	1456.9	~~1156~~	~~15~~	~~0~~	~~620~~	~~95.9~~
530.90	1.00			Shale	60.4	183.0	***1216.1***	88.7	29.8	1545.6	~~1216~~	~~15~~	~~0~~	~~653~~	~~96.9~~
529.90	1.00			Shale	60.4	183.0	***1276.5***	88.7	29.8	1634.2	~~1276~~	~~15~~	~~0~~	~~687~~	~~97.9~~
528.90	1.00			Shale	60.4	183.0	***1336.9***	88.7	29.8	1722.9	~~1337~~	~~15~~	~~0~~	~~720~~	~~98.9~~
527.90	1.00			Shale	60.4	183.0	***1397.3***	88.7	29.8	1811.5	~~1397~~	~~15~~	~~0~~	~~753~~	~~99.9~~
526.90	1.00			Shale	60.4	183.0	***1457.7***	88.7	29.8	1900.2	~~1458~~	~~15~~	~~0~~	~~786~~	~~100.9~~
525.90	1.00			Shale	60.4	183.0	***1518.1***	88.7	29.8	1988.8	~~1518~~	~~15~~	~~0~~	~~820~~	~~101.9~~
524.90	1.00			Shale	60.4	183.0	***1578.6***	88.7	29.8	2077.5	~~1579~~	~~15~~	~~0~~	~~853~~	~~102.9~~
523.90	1.00			Shale	60.4	183.0	***1639.0***	88.7	29.8	2166.1	~~1639~~	~~15~~	~~0~~	~~886~~	~~103.9~~
522.90	1.00			Shale	60.4	183.0	***1699.4***	88.7	29.8	2254.8	~~1699~~	~~15~~	~~0~~	~~919~~	~~104.9~~
521.90	1.00			Shale	60.4	183.0	***1759.8***	88.7	29.8	2343.5	~~1760~~	~~15~~	~~0~~	~~952~~	~~105.9~~
520.90	1.00			Shale		183.0			29.8						