Speed Letter

Illinois Department of Transportation

Bureau of Bridges & Structures • 2300 S. Dirksen Parkway • Springfield, Illinois 62764

To: Kaskaskia Engineering Group, LLC
23 Public Square
Suite 404
Belleville, IL 62220

Attention: Marsia Geldert-Murphy
Cory Stanczyk

Date: November 5, 2008	**Job No.:** P-98-017-08
SN: 060-0344	**Contract No.:** 76B50
Route: F.A.P. 314	
Section: 110BR-1	
County: Madison	
Other: IL Rte. 4 over Silver Creek	

Subject: **Structure Geotechnical Report (SGR) Review**

We are Sending:

☐ Structure Geotechnical Report ☐ Foundation/Wall Design Details ☐ Settlement/Stability Analysis
☐ Approval ☒ Comments ☐ Special Provisions ☐

These Are:

☐ Approved As Submitted ☒ Approved Subject to Changes & Comments Below
☐ Returned for Revisions and Re-submittal ☐ For Your Use ☐ For Review and Comments
☐

Remarks:

This is a follow up to our original review of your SGR dated July 2008 and subsequent discussion with Cory Stanczyk on November 3, 2008, it is our understanding that Kaskaskia Engineering Group, LLC will revise the SGR to address the issue(s) below.

- The scour depth for the piers can be reduced per Bridge Manual 2.3.6.3.2. The SGR should be revised to:

Design Scour Elevation (feet)	N. Abut.	Pier 1	Pier 2	S. Abut.
	456.8	426.0	417.0	457.0

Please provide our office with a copy of the revised SGR to verify completion of the above and for our future reference when reviewing the final plans. If you have any questions or need further assistance, please contact Jacek Ejmont at (217)-785-1463 or Riyad Wahab at (217)-782-2704 of our Foundations and Geotechnical Unit.

Copies To: Allen Henderson & Assoc., Inc.

By _____
For The Engineer of Bridges & Structures

REVISED
STRUCTURE GEOTECHNICAL REPORT

BRIDGE REPLACEMENT
IL ROUTE 4 OVER EAST FORK OF SILVER CREEK

FAP ROUTE 314
SECTION 110BR-1
MADISON COUNTY, ILLINOIS
PTB 146/31
EXISTING STRUCTURE NO. 060-0109
PROPOSED STRUCTURE NO. 060-0344
JOB NO. P-98-017-08, D-98-017-08
Contract No. 76B50

Prepared by:

Kaskaskia Engineering Group, LLC
23 Public Square, Suite 404
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Phone: 618.233.5877 Fax: 618.233.5977
KEG No. 08-0006 (W.O. #2)

Authored By:
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Prepared for:

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September 2008

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TABLES

EXHIBITS

1.0 PROJECT DESCRIPTION AND PROPOSED STRUCTURE INFORMATION

1.1 Introduction

The geotechnical study summarized in this report was performed for the proposed bridge on Illinois Route 4 over the East Fork of Silver Creek in Madison County, Illinois. The purpose of our services is to develop design and construction recommendations for the proposed bridge plans.

1.2 Project Description

The project features replacement of the existing bridge (S.N. 060-0109) located at Illinois Route 4 over the East Fork of Silver Creek in Madison County, Illinois. The project is located approximately 0.7 miles north of US Highway 40, approximately 1.0 mile northwest of St. Jacob, Illinois. The general location of the bridge is shown on a USGS topographic Location Map, Exhibit A. The proposed bridge location is shown on Site Map, Exhibit B. The site lies within the limits of the Third Principal Meridian, (T. 3N, R. 6W, Section 7-8,) in the Till Plains Section, specifically the Springfield Plain, and is comprised mostly of Lawson silt loam material as shown on Physiographic Division Map, Exhibit C.

1.3 Proposed Bridge Information

We understand that the proposed new structure (S.N. 060-0344) will consist of a three span steel beam structure with an eight inch reinforced concrete deck. The structure will be built on a zero degree skew. The proposed bridge centerline station will be shifted 13 feet (ft.) south to Station 756+18. The proposed substructure will consist of open abutments with an approximate overall length of 237 ft. as measured from the inside face of the abutments. Further substructure details will be based on the SGR. H-pile foundations are anticipated to be used for supporting the new bridge. The design high water elevation for the structure is El. 462.68.

2.0 EXISTING BRIDGE INFORMATION

The original structure was constructed in 1933, reconstructed in 1975 as FA Route 68, Section 110BR at Station 756+05, and deck repairs were done in 2004 as FAP 314, Section 110BR-1. The existing structure (S.N. 060-0109) carries IL 4 over the East Fork of Silver Creek, 0.7 miles North of US 40. The existing structure does not have a skew. The existing superstructure consists of four spans of precast, prestressed concrete deck beams. The out-to-out deck width is approximately 33 feet, the clear

bridge roadway width is 32 ft. 6 inches (in.) and the total structure length is 201 ft. 4 ¾ in. back-to-back abutments. The 21-inch concrete deck provides one 12-foot lane in each direction. The existing substructure consists of open concrete abutments and piers supported by concrete piles.

The Bridge Condition Report, dated July 6, 2007, recommends complete replacement of the existing structure due to age and condition of the structure and major PCC deck beam deficiencies. A recent field inspection noted that the PCC deck beams are in poor condition with spalls, delaminations, and stirrups exposed with active corrosion. The bearing pads at the end of the beams are misplaced at the center of the beams rather than centered on the joints between beams which may be allowing a rotation of the beams under traffic resulting in reflective cracking in the overlay and possible shear key grout failure.

3.0 SUBSURFACE EXPLORATION AND GENERALIZED SUBSURFACE CONDITIONS

Two standard penetration test (SPT) borings, designated B-1 and B-2, were drilled near the proposed South Abutment and North Abutment locations from March 12-14, 2008. The boring locations were staked in the field and drilled by Kaskaskia Engineering Group, LLC (KEG). The proposed pier locations were not accessible for drilling because of the high water level of Silver Creek due to above average rainfall this season. Borings B-1 at the southwest quadrant of the abutment and B-2 at the northwest quadrant of the abutment were both extended to auger refusal to obtain a more accurate profile of the bedrock depth along the structure. Detailed information regarding the nature and thickness of the soils and rock encountered and the results of the fields sampling and laboratory testing are shown on the Boring Logs, Exhibit D. The boring locations are shown on the Plan and Profile included in Exhibit E.

Generally, at the ground surface, the soil profile consisted of a silty clay fill material. The profile at Boring B-1 continued with silty clays and clays until transitioning to a 5 ft. layer of fine to medium sand at El. 430. After a thick layer of high plastic clay with some sand, the profile transitioned to a sandy clay layer with shale and very high blow counts. At El. 375, the profile returned to alternating between sandy clays and silty clays with moderate blow counts until auger refusal on sandstone at approximate El. 359.

The profile at Boring B-2 generally alternated between silty clays and sandy clays with some shale until auger refusal on sandstone at approximate El. 379.

Table 3.1 shows the top of rock elevations for Borings B-1 and B-2.

Table 3.1 - Bedrock Elevation

Boring	Bedrock Elevation
B-1	359
B-2	379

Groundwater elevations, encountered during drilling, ranged from approximate El. 446 to El. 439. It should be noted that the groundwater level is subject to seasonal and climatic variations and other factors and may be present at different depths in the future. In addition, without extended periods of observation, measurement of the true groundwater levels may not be possible.

4.0 GEOTECHNICAL EVALUATIONS

4.1 Settlement

Because the new bridge replaces an existing structure and substantial grading is not anticipated, detrimental settlement of the bridge embankments is not anticipated. Rock-bearing piles should experience settlements of less than 0.5 inch.

4.2 Slope Stability

A slope stability analysis using STABL for Windows 3.0 was performed for 2:1 slopes for both the sideslopes and backslopes at the abutments. The three conditions analyzed were end-of-construction, long-term and seismic; a critical factor of safety (FOS) was determined for each condition. According to current IDOT practice, the minimum FOS is 1.5 for end of construction or long term slope stability and 1.0 for seismic. Table 4.1 below summarizes the results of our analysis all FOS calculated exceed the minimum requirements. The STABL program output from this analysis can be found in Exhibit F.

Table 4.1 – Slope Stability Critical FOS

	Calculated Critical FOS		
	End of Construction	Long Term	Seismic
North Abutment (Boring B-2 Soil Profile)	5.8	8.2	5.1
South Abutment (Boring B-1 Soil Profile)	4.9	5.9	3.7

4.3 Seismic Considerations

According to the United States Geological Survey (USGS) Seismic Hazard Map of Illinois, which was obtained from the USGS website, the project site is in a low to moderate seismic hazard zone.

The 2008 AASHTO LRFD Code for a 1000 Year Return Period shows that for a Site Class D Soil the Design Spectral Acceleration at 1.0 sec (S_{D1}) for the project site is 0.24g and the Design Spectral Acceleration at 0.2 sec (S_{DS}) is 0.556g. The bridge should be designed for Seismic Performance Zone (SPZ) "2" based on the acceleration coefficient.

4.4 Lateral Pile/Pier Response

An accurate representation of the pile response under loading is required for design of the bridge superstructure. The pile response can be developed by modeling the soil/pile interaction with the computer program LPILE Plus Version 5.0 (LPILE). LPILE uses discrete elements to represent the pile and non-linear springs to represent soil resistance. The P-Y (lateral resistance) curves developed by LPILE represent the lateral deflection for a specific load at predetermined points along the pile.

A generalized soil profile was developed to represent the variable soil conditions at the North and South Abutments and Pier No. 1 and Pier No. 2. An HP 12x 53 pile driven to end bearing on bedrock was assumed in the pile response analysis. The strong (longitudinal dominant) axis and the weak (transverse dominant) axis were analyzed for each substructure with applied lateral loads of 20 kips, 15 kips, 10 kips and 5 kips, respectively.

The analyses were performed with the pile head fixed against rotation for the abutments. The pile top and tip elevations for the North Abutment were assumed to be at El. 459 and El. 379 respectively; the generalized soil profile data for the North Abutment was assumed from soil Boring B-2. The pile top and tip elevation for the South Abutment were assumed to be El. 459 and El. 359 respectively; the generalized soil profile data for the South Abutment was assumed from soil Boring B-1.

The analyses were performed for the piers with the pile head free to rotate. The pile top and tip elevations for Pier No. 1 were assumed to be at El. 459 and El. 379 respectively. Generalized soil profile data for Pier No. 1 was assumed from Boring B-2. The pile top and tip elevations for Pier No. 2 were assumed to be El. 460 and El. 359, respectively.

Generalized soil profile data for Pier No. 2 was assumed from Boring B-1. The soil/pile response curves and the output files of LPILE analyses are presented in Exhibit G. These curves represent the soil/pile response under normal conditions. The curves can be used to represent the pile response, or stiffness, to loading in the dynamic analyses of the structure.

Table 4.2 summarizes the depths of fixity and lateral deflections computed using LPILE for each substructure unit after applying the lateral loads in both the longitudinal and transverse directions.

Table 4.2 – LPILE Analysis Summary

Structural Unit and Loading Condition		Applied Lateral Load							
		20 Kips		15 Kips		10 Kips		5 Kips	
		Fixity Depth (ft)	Lateral Deflection (in)	Fixity Depth (ft)	Lateral Deflection (in)	Fixity Depth (ft)	Lateral Deflection (in)	Fixity Depth (ft)	Lateral Deflection (in)
North Abutment	Longitudinal	16	0.155	16	0.09	15	0.043	14	0.012
	Transverse	16	0.30	14	0.177	13	0.083	10	0.023
South Abutment	Longitudinal	18	0.155	16	0.092	14	0.043	13	0.012
	Transverse	15	0.30	14	0.178	12	0.083	11	0.023
Pier No. 1	Longitudinal	33	15	33	8.6	28	4.4	21	1.44
	Transverse	15	2.6	13	1.7	13	.94	9	0.35
Pier No. 2	Longitudinal	20	10.6	18	6.4	15	3.5	13	1.3
	Transverse	15	5.3	15	3.4	13	1.92	10	0.75

4.5 Scour

Although significant scour is not anticipated for the structure, the placement of riprap along the slopes will prevent any significant scour from occurring. Table 4.3 shows the Design Scour Elevations. No reduction in the scour elevations was applied. The near surface soil profile anticipated, either a silty or sandy clay, would not be considered less scour prone than the default properties assumed in the hydraulic analysis.

Table 4.3 Design Scour Elevations

Design Scour Elevation (feet)	N. Abutment	Pier No. 1	Pier No. 2	S. Abutment
	456.8	446.0	439.0	457.0

4.6 Mining Activity

No visual indication of subsurface mining activities was evident at the site. According to the Coal Mines Madison County dated August 2007, which was obtained from the Illinois State Geological Survey (ISGS) website, the project site was not undermined.

The listed disclaimer indicates locations of some features on the mine map may be offset by 500 or more feet due to errors in the original source maps, the compilation process, digitizing, or a combination of these factors. The location of this bridge is more than 500 feet away from the closest mining area shown on the map.

4.7 Liquefaction

A liquefaction analysis was performed. The results for the soil profile encountered in Boring B-2 indicated one 2.5-foot thick liquefiable layer at approximate El. 420 for the generalized soil profile for the North Abutment and Pier No. 1. However, this layer is confined above and below by soils which do not appear to be susceptible to liquefaction. The liquefaction analysis using the soil profile for the soils encountered in Boring B-1 near the proposed South Abutment indicated no liquefiable layers.

5.0 FOUNDATION EVALUATIONS AND DESIGN RECOMMENDATIONS

The foundations supporting the proposed bridge must provide sufficient support to resist dead and live loads, including seismic loadings. Based on the encountered subsurface conditions and the information available to date, we recommend using H-pile driven to bedrock at the pier and abutment locations.

In order to clarify the definition of pile lengths as stated in our discussion below, the estimated pile lengths are measured from the "top of friction" elevation, therefore only that portion of the pile length contributing skin friction in the capacity analysis. Therefore, actual top of pile elevations will be higher and estimated lengths will be longer.

Based on the depth to sandstone bedrock in Borings B-1 and B-2, abutment pile lengths will range from approximately 80-100 feet for H-pile. We estimated that the abutment top of pile elevations would be approximately El. 459 at both the North and South Abutments. The pier pile lengths will range from approximately 80-100 feet, and we estimated the pier top of pile elevation would be approximately El. 460 at both Pier No. 1 and Pier No. 2. The analysis for Pier No. 1 was based on Boring B-2, and Pier No. 2 was based on Boring B-1. Significant additional settlement of the embankment and the abutments is not anticipated because the subsurface materials mainly consist of cohesive materials which we have determined are not susceptible to liquefaction and only minor grading is anticipated. Therefore, downdrag forces on the new piles should be negligible.

The Nominal Required Bearing values as well as the corresponding Factored Resistance Available for design, the Estimated Pile Lengths, Pile Top and Tip Elevations and Minimum Required Pile Groups for the pile types being considered are

shown in the Pile Design Table 5.1. The Nominal Required Bearing represents the resistance the pile will experience during driving as well as assist the Contractor in selecting a proper hammer size. The Factored Resistance Available documents the net long term axial factored pile capacity available at the top of pile to support factored structure loadings. The pile group shows the minimum number of pile needed at each substructure unit to support the factored design loads.

The factored design loads provided by Henderson and Associates are 1,150 kips at the abutments and 1,975 kips and 2,050 kips at Pier No. 1 and Pier No. 2, respectively. The program Driven 1.2, developed by the Federal Highway Administration, was used to determine ultimate pile capacity and estimated pile lengths for the pile types being considered. The results of this analysis indicates Nominal Ultimate Bearing (not Factored Resistance available), and is included in Exhibit H. It should also be noted the pile lengths modeled in the Driven analysis include data from the top of boring, (approximate ground surface El. 462).

The Driven analysis results show that the Maximum Nominal Required Bearing for the Steel H-pile will not be exceeded prior to reaching bedrock, therefore, end bearing on bedrock is recommended.

Pile groups were determined by taking the total factored loads for each substructure unit and dividing by the factored resistance available for each type of H-pile considered. The Minimum Pile Groups represent the minimum number of pile needed to support the factored structural loads provided by the structural engineer. Larger pile groups may be necessary to meet maximum spacing requirements at each substructure unit. The results are shown in Table 5.1 below.

Table 5.1 Pile Design Table

Substructure Unit	Pile Top Elevation	Pile Tip Elevation	Estimated Pile Length*	Pile Designation	Nominal Required Bearing	Factored Resistance Available	Minimum Pile Group
North Abutment	458.8	379.0	80'	HP 12X53	419	209	**6**
				HP 12X63	497	248	**5**
				HP 14X73	578	289	**4**
South Abutment	459.0	359.0	100'	HP 12X53	419	209	**6**
				HP 12X63	497	248	**5**
				HP 14X73	578	289	**4**
Pier No. 1	459.6	379.0	80'	HP 12X53	419	209	**10**
				HP 12X63	497	248	**8**
				HP 14X73	578	289	**7**
Pier No. 2	459.7	359.0	100'	HP 12X53	419	209	**10**
				HP 12X63	497	248	**9**
				HP 14X73	578	289	**7**

*Estimated Pile Lengths are based on the assumed pile top and pile tip elevations.

Based on the estimated pile lengths for both the abutment and pier locations, steel H-pile driven to bedrock (end bearing) is recommended for the piers and abutments. The estimated pile lengths are based on the assumed pile top and tip elevations.

Because the borings were located at each abutment we recommend one test pile driven at each of the pier locations due to the varying bedrock elevations encountered. A test pile is performed prior to production driving so that actual, on-site, field data can be gathered to determine 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.

6.0 CONSTRUCTION CONSIDERATIONS

6.1 Construction Activities

The 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.*

6.2 Temporary Shoring

We understand temporary shoring will be required at the abutments during construction. The subsurface conditions below the estimated dredge line indicate weak soils with low unconfined compressive strengths. Therefore, use of the IDOT temporary sheet piling design charts is not feasible for this location. The soil retention system should extend from the start of the existing north abutment to the end of the proposed south abutment and will required more analysis. An Illinois Licensed Structural Engineer is required to seal the design of the temporary soil retention system.

7.0 GEOTECHNICAL DATA

Soil borings and laboratory test results can be found in Exhibit D. The Subsurface Data Profile can be found in Exhibit E. The Structural Geotechnical Report Responsibility (SGR) Checklist can be found in Exhibit I.

8.0 LIMITATIONS

The recommendations provided herein are for the exclusive use of Henderson and Associates and IDOT. They are specific only to the project described and are based on subsurface information obtained at two boring locations within the bridge area, our 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.

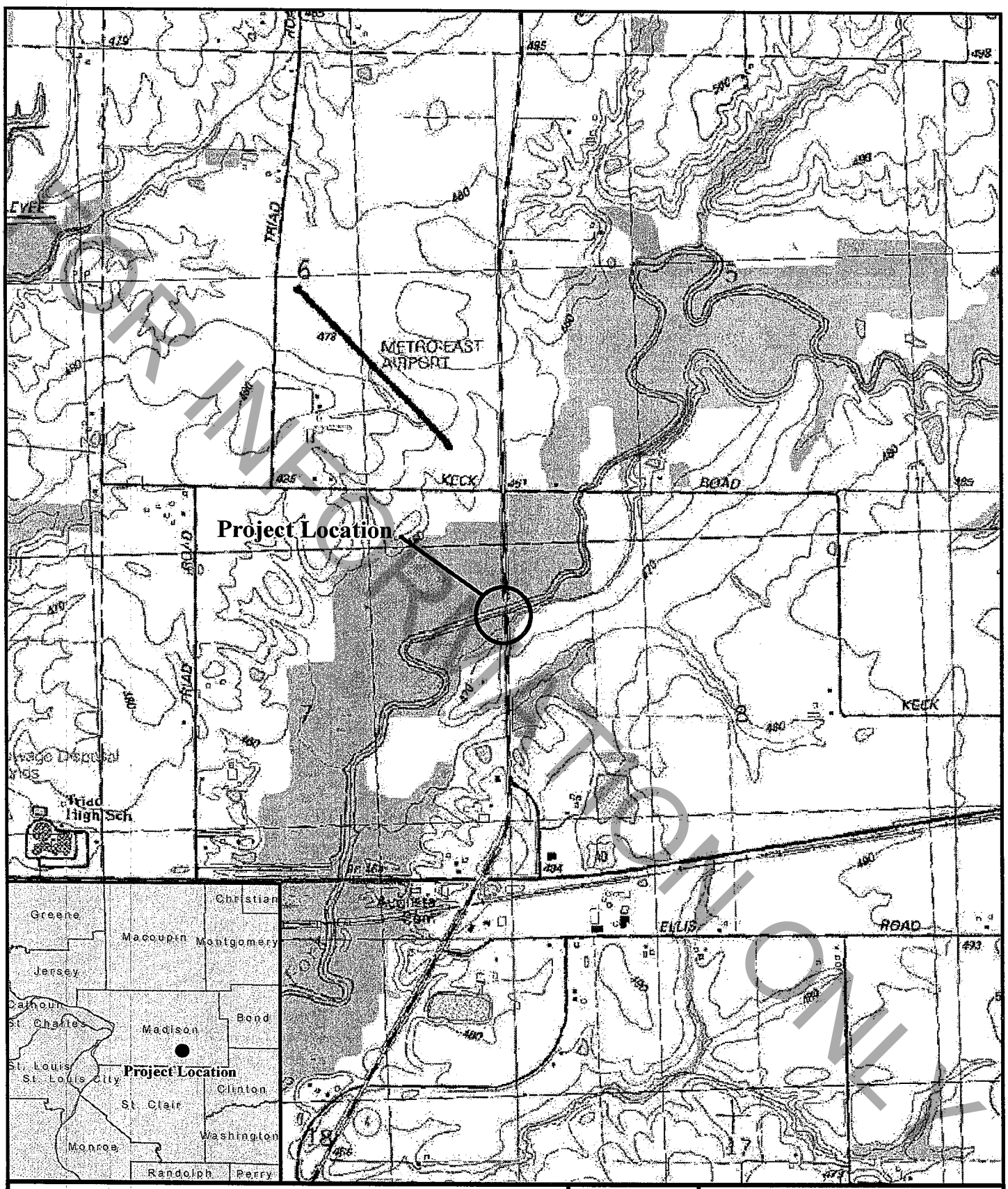

Exhibit A
Location Map
IL Rt. 4 over E. Fork of Silver Creek
Madison County, Illinois

N

0 500 1,000
Feet

Designed By: TDW
Drawn By: TDW
Checked By: MGM
Date: 6/1/08
Project #: 08_0006

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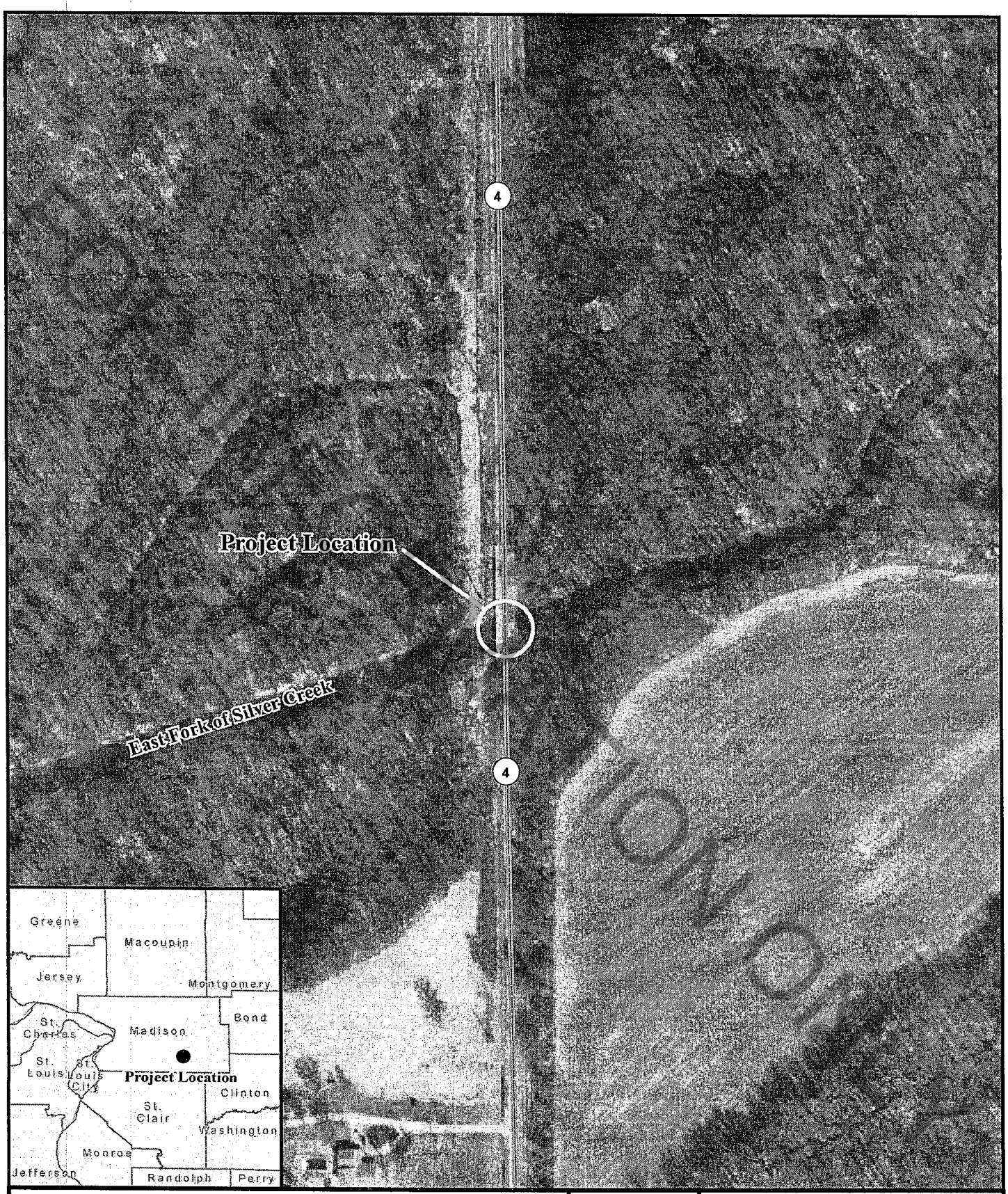

Exhibit B
Site Map
IL Rt. 4 over E. Fork of Silver Creek
Madison County, Illinois

N

0 100
Feet

Designed By: TDW
Drawn By: TDW
Checked By: MGM
Date: 6/1/08
Project #: 08_0006

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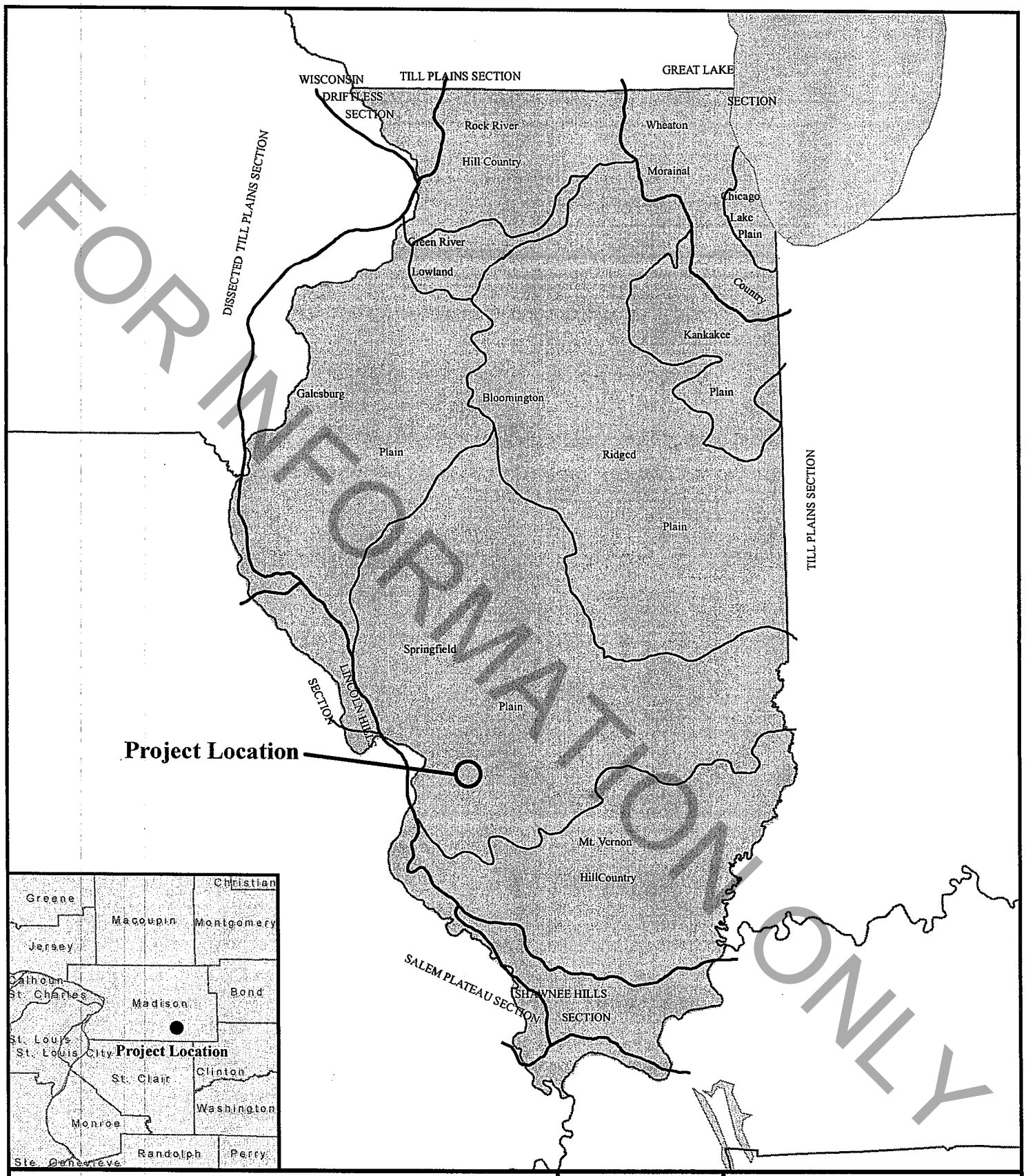

Exhibit C
Physiographic Divisions Map
IL Rt. 4 over E. Fork of Silver Creek
Madison County, Illinois

N

0 12.5 25
Miles

Designed By: TDW
Drawn By: TDW
Checked By: MGM
Date: 6/1/08
Project #: 08_0006

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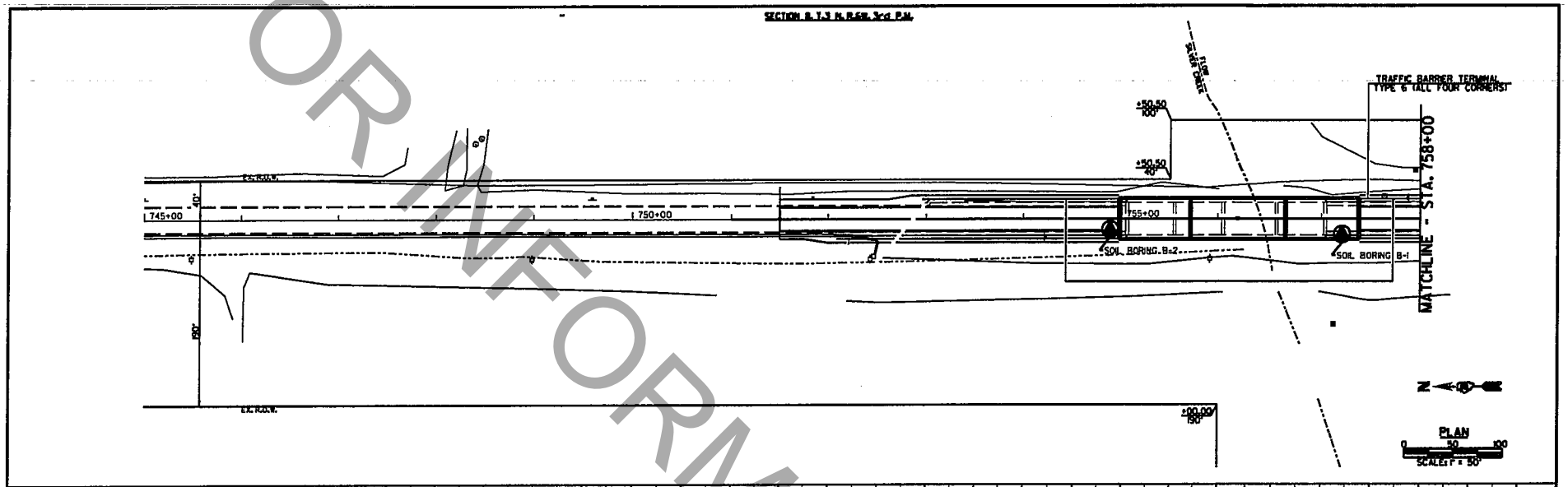

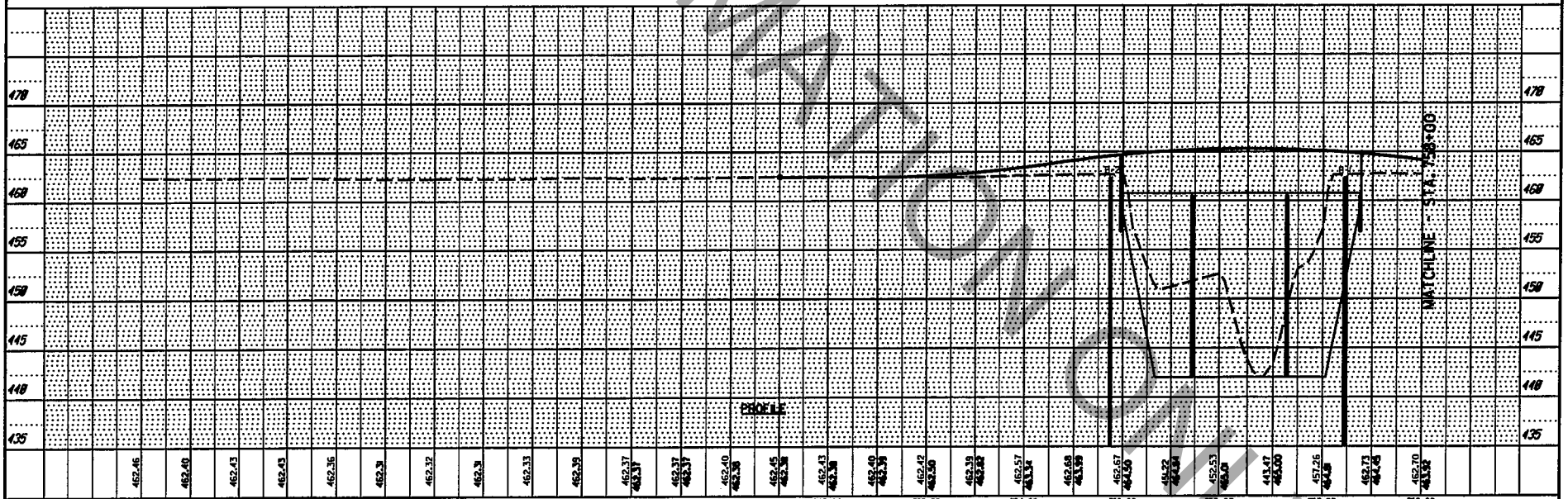

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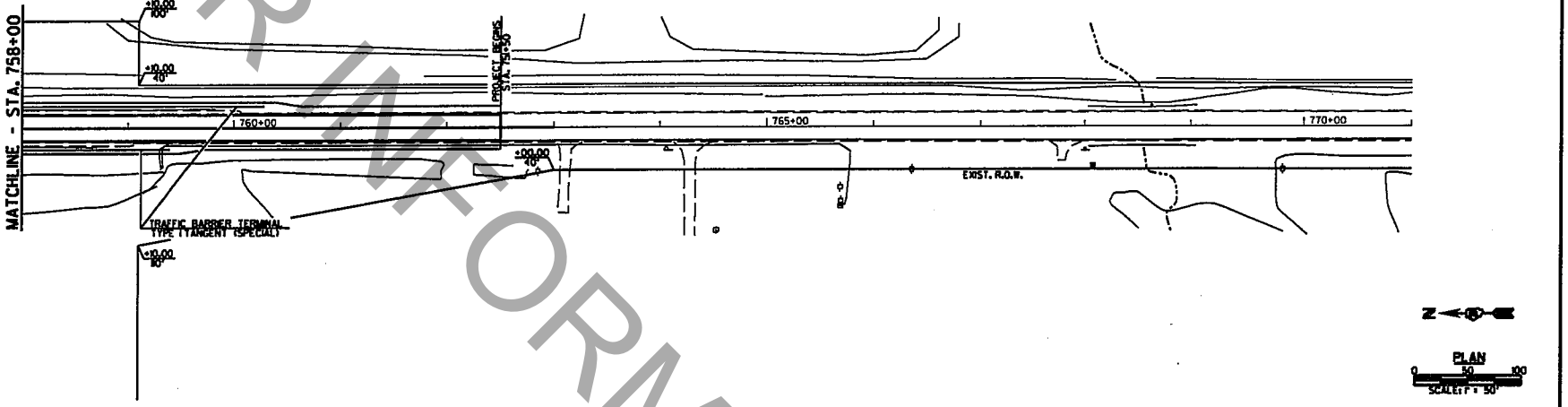

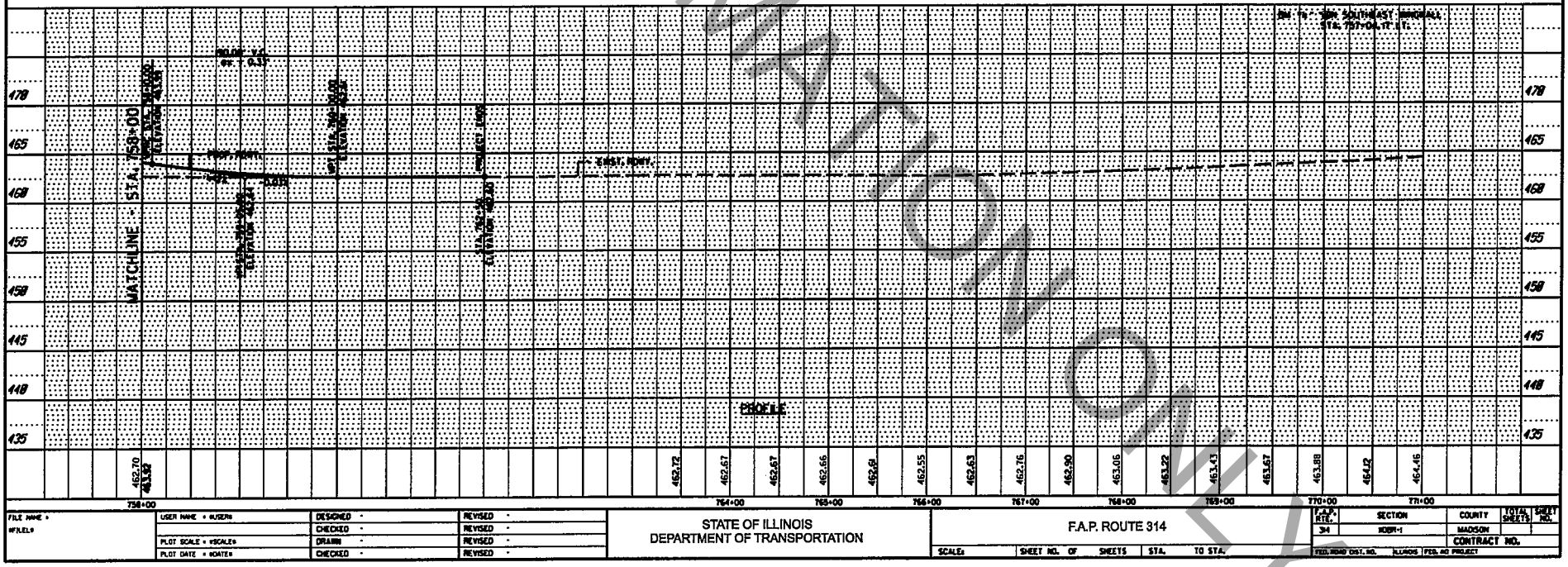

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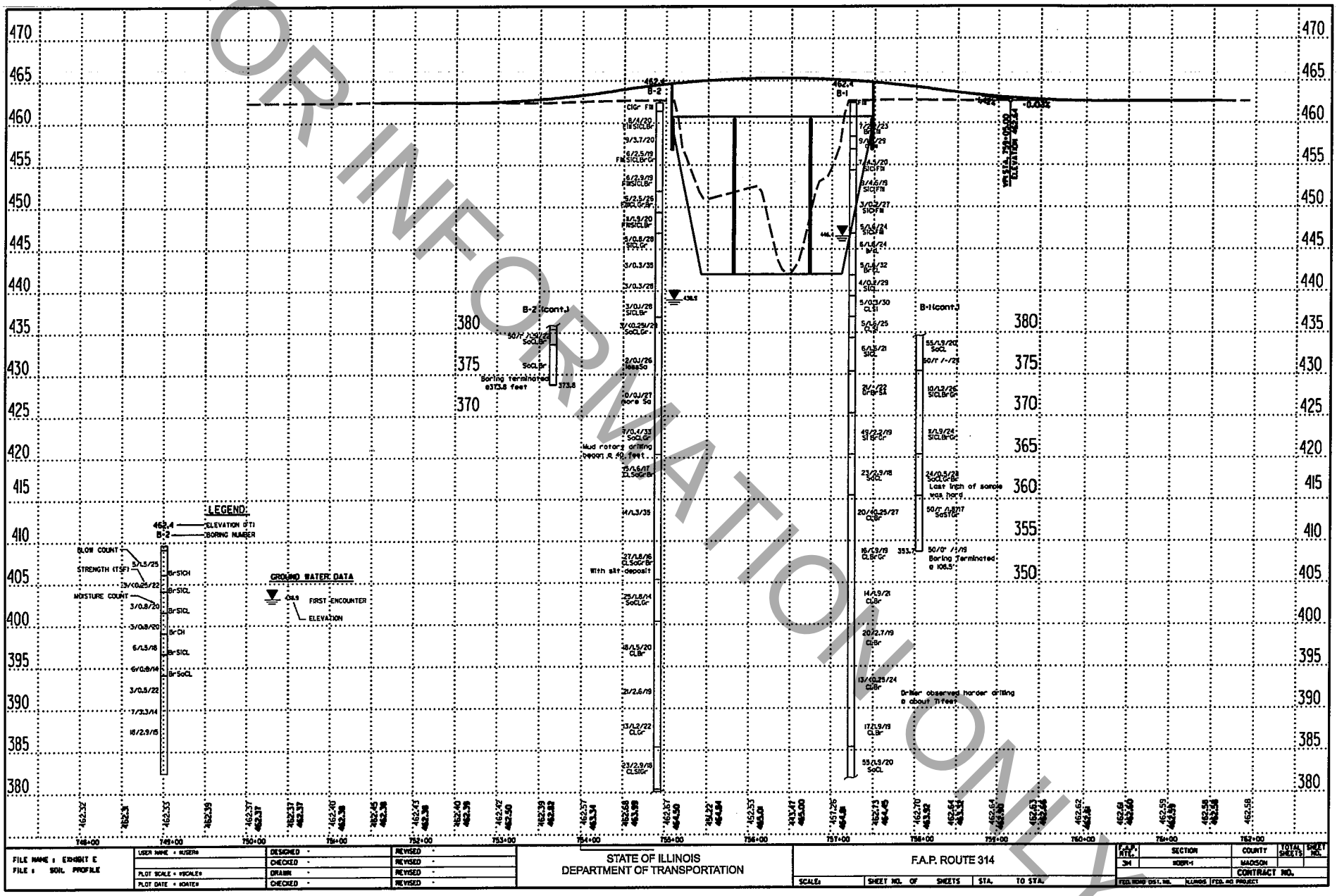

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Illinois Department of Transportation

Division of Highways
SCI Engineering, Inc.

SOIL BORING LOG

Date 05/14/08

ROUTE FAP 314 DESCRIPTION Illinois Route 4 over East Fork of Silver Creek - Bridge Replacement LOGGED BY SCI

SECTION 110BR-1 LOCATION Approx. 1/2 mile N of U.S. Rt 40/Sections 7NE & 8NW, TWP 3N, RNG 6W

COUNTY Madison DRILLING METHOD CME 55 w/HSA HAMMER TYPE Automatic

STRUCT. NO. Existing 060-0109
Station

BORING NO. B-1
Station 757+21
Offset 16 ft Rt.
Ground Surface Elev. 462.4 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 446.4 ft ▼
Upon Completion - ft
After - Hrs. - ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material Description
				FILL: Brown and grayish brown, low plastic (A-7)
	2 3 4	2.2	23	
458.4				
	2 4 5	1.5	29	FILL: Brown, high plastic clay (A-7)
-5		P		
456.9				FILL: Brown, low plastic silty clay (A-7)
	3 4 3	4.5	20	
		P		
454.4				FILL: Brown, low plastic silty clay (A-6)
	3 4 5	4.5	19	
-10		P		
	1 1 2	0.2	27	
		B		
	2 2 3	1.6	24	
-15		B		
446.9				CLAY: Grayish brown, high plastic, trace sand (A-7) ▼
	2 3 3	1.6	24	
		B		
	2 2 3	1.6	32	Becomes brown and reddish brown
-20		B		

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material Description
441.9				SILTY CLAY: Gray, low plastic (A-7)
	1 2 2	0.2	29	
		B		
439.4				SILTY CLAY: Gray and brown, low plastic, trace sand (A-6)
	1 2 3	0.3	30	
-25		B		
436.9				CLAYEY SILT: Gray, low plastic (A-4)
	1 2 3	1.5	25	
		P		
434.4				SILTY CLAY: Gray, low plastic, some sand (A-6)
	2 3 3	1.6	21	
-30		B		
430.4				SAND: Grayish brown, fine to medium (A-3)
	4 13 8	-	22	
-35				
				Mud rotary drilling began at 35 feet.
425.4				SILT: Brown and gray, low plastic (A-4)
	19 25 24	2.2	19	
-40		S/10		

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
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Illinois Department of Transportation

Division of Highways
SCI Engineering, Inc.

SOIL BORING LOG

Date 05/14/08

ROUTE FAP 314 DESCRIPTION Illinois Route 4 over East Fork of Silver Creek - Bridge Replacement LOGGED BY SCI

SECTION 110BR-1 LOCATION Approx. 1/2 mile N of U.S. Rt 40/Sections 7NE & 8NW, TWP 3N, RNG 6W

COUNTY Madison DRILLING METHOD CME 55 w/HSA HAMMER TYPE Automatic

STRUCT. NO. Existing 060-0109
Station

BORING NO. B-1
Station 757+21
Offset 16 ft Rt.
Ground Surface Elev. 462.4 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 446.4 ft ▼
Upon Completion - ft
After - Hrs. - ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
SILT: Brown and gray, low plastic (A-4) *(continued)*			
420.4			
SANDY CLAY: Grayish brown, low plastic (A-7)			
-45	8 11 12	2.9 B	18
415.4			
CLAY: Brown, high plastic, some sand (A-7)			
-50	5 8 12	<0.25 P	27
Becomes grayish brown, brown, and gray, and grades to trace fine gravel			
-55	4 7 9	1.9 B	19
Becomes brown			
-60	3 6 8	1.9 B	21
CLAY: Brown, high plastic, some sand (A-7) *(continued)*			
-65	5 8 12	2.7 B	19
-70	3 6 7	<0.25 P	24
Driller observed harder drilling at about 71 feet.			
-75	5 7 10	1.9 B	19
385.4			
SANDY CLAY: Greenish gray and dark brown, low plastic (A-6)			
-80	13 22 33	1.9 S/15	20

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
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SOIL BORING LOG

Date 05/14/08

ROUTE FAP 314 **DESCRIPTION** Illinois Route 4 over East Fork of Silver Creek - Bridge Replacement **LOGGED BY** SCI

SECTION 110BR-1 **LOCATION** Approx. 1/2 mile N of U.S. Rt 40/Sections 7NE & 8NW, TWP 3N, RNG 6W

COUNTY Madison **DRILLING METHOD** CME 55 w/HSA **HAMMER TYPE** Automatic

STRUCT. NO. Existing 060-0109
Station

BORING NO. B-1
Station 757+21
Offset 16 ft Rt.
Ground Surface Elev. 462.4 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 446.4 ft ▼
Upon Completion - ft
After - **Hrs.** - ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
SANDY CLAY: Greenish gray and dark brown, low plastic (A-6) *(continued)*			
Becomes dark brown and greenish gray (parent material is clayey shale/shale)	50/1" 50/1"	-	24
-85			
375.4 SILTY CLAY: Brownish gray, low plastic, some sand (A-6)			
	4 5 5	1.2 B	26
-90			
	3 5 6	1.9 B	24
-95			
365.4 SANDY CLAY: Gray and brown, low plastic (parent material is clayey shale/shale) (A-6)			
	4 8 16	0.5 B	24
-100			

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
SANDY CLAY: Gray and brown, low plastic (parent material is clayey shale/shale) (A-6) *(continued)*			
Driller observed last inch of sample was hard. 360.4 SANDSTONE: Gray	50/2" 50/1"	1.8 P	17
-105			
353.7 Boring terminated at 108.5 feet.	50/2" 50/0"	-	19
-110			
-115			
-120			

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SOIL BORING LOG

Date 05/12/08

ROUTE FAP 314 DESCRIPTION Illinois Route 4 over East Fork of Silver Creek - Bridge Replacement LOGGED BY SCI

SECTION 110BR-1 LOCATION Approx. 1/2 mile N of U.S. Rt 40/Sections 7NE & 8NW, TWP 3N, RNG 6W

COUNTY Madison DRILLING METHOD CME 55 w/HSA HAMMER TYPE Automatic

STRUCT. NO. Existing 060-0109
Station

BORING NO. B-2
Station 754+88
Offset 16 ft Rt.
Ground Surface Elev. 462.4 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 438.9 ft ▼
Upon Completion - ft
After - Hrs. - ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Material Description
				FILL: Cinders and gravel
				461.4
	4 3 5	4.0 P	20	FILL: Brown, low plastic silty clay, trace sand (A-6)
-5	4 4 5	3.7 B	20	
	3 2 4	2.5 S/15	19	Becomes dark brown, olive gray, and brown
-10	2 2 4	2.9 B	19	Becomes brown
				451.9
	2 3 2	2.5 B	26	FILL: Gray and brown, high plastic clay (A-7)
				449.4
-15	4 5 6	1.9 B	20	FILL: Dark brown, low plastic silty clay, trace sand (A-6)
				446.9
	0 2 2	0.8 B	28	SILTY CLAY: Gray, low plastic (A-6)
-20	1 1 2	0.3 B	35	Becomes dark brown
-25	1 1 2	0.3 B	28	SILTY CLAY: Gray, low plastic (A-6) *(continued)* Becomes gray
	1 1 2	0.1 B	28	Becomes brown ▼
				436.9
	2 2 1	<0.25 P	29	SANDY CLAY: Gray, low plastic (A-6)
-30	0 0 2	0.1 B	26	Becomes less sandy (A-7)
-35	0 0 0	0.1 B	27	Becomes more sandy (A-6)
-40	1 2 5	0.4 B	33	Becomes brown and grades to trace organics

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
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STRUCT. NO. Existing 060-0109
Station

BORING NO. B-2
Station 754+88
Offset 16 ft Rt.
Ground Surface Elev. 462.4 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 438.9 ft ▼
Upon Completion - ft
After - Hrs. - ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
SANDY CLAY: Gray, low plastic (A-6) *(continued)* Mud rotary drilling began at 40 feet.			
420.4 CLAY: Grayish brown, high plastic, some sand, trace fine gravel (A-7)			
-45	4 7 8	1.6 B	17
-50	5 5 9	1.3 B	35
With silt deposit			
-55	6 10 17	1.8 B	16
405.4 SANDY CLAY: Gray, low plastic (parent material is clayey shale/shale) (A-6)			
-60	6 10 15	1.8 B	14
SANDY CLAY: Gray, low plastic (parent material is clayey shale/shale) (A-6) *(continued)*			
400.4 CLAY: Brown, high plastic, some sand, trace fine gravel (A-7)			
-65	5 8 10	1.5 B	20
-70	5 8 13	2.6 B	19
-75	3 5 8	1.2 B	22
385.4 CLAYEY SILT: Olive gray and gray, low plastic (A-4)			
-80	8 13 20	2.9 B	18

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
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Station

BORING NO. B-2
Station 754+88
Offset 16 ft Rt.
Ground Surface Elev. 462.4 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 438.9 ft ▼
Upon Completion - ft
After - Hrs. - ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	
CLAYEY SILT: Olive gray and gray, low plastic (A-4) *(continued)*				
380.4				
SANDY CLAY: Brown, low plastic (parent material is clayey shale/shale) (A-6)				
378.6 Driller observed rough drilling at about 83 feet.	50/5" 50/1"	1.5 P	22	
SANDSTONE: Gray, some silt				
-85				
No recovery 373.8	50/1"			
Boring terminated at 88.5 feet.				
-90				
-95				
-100				

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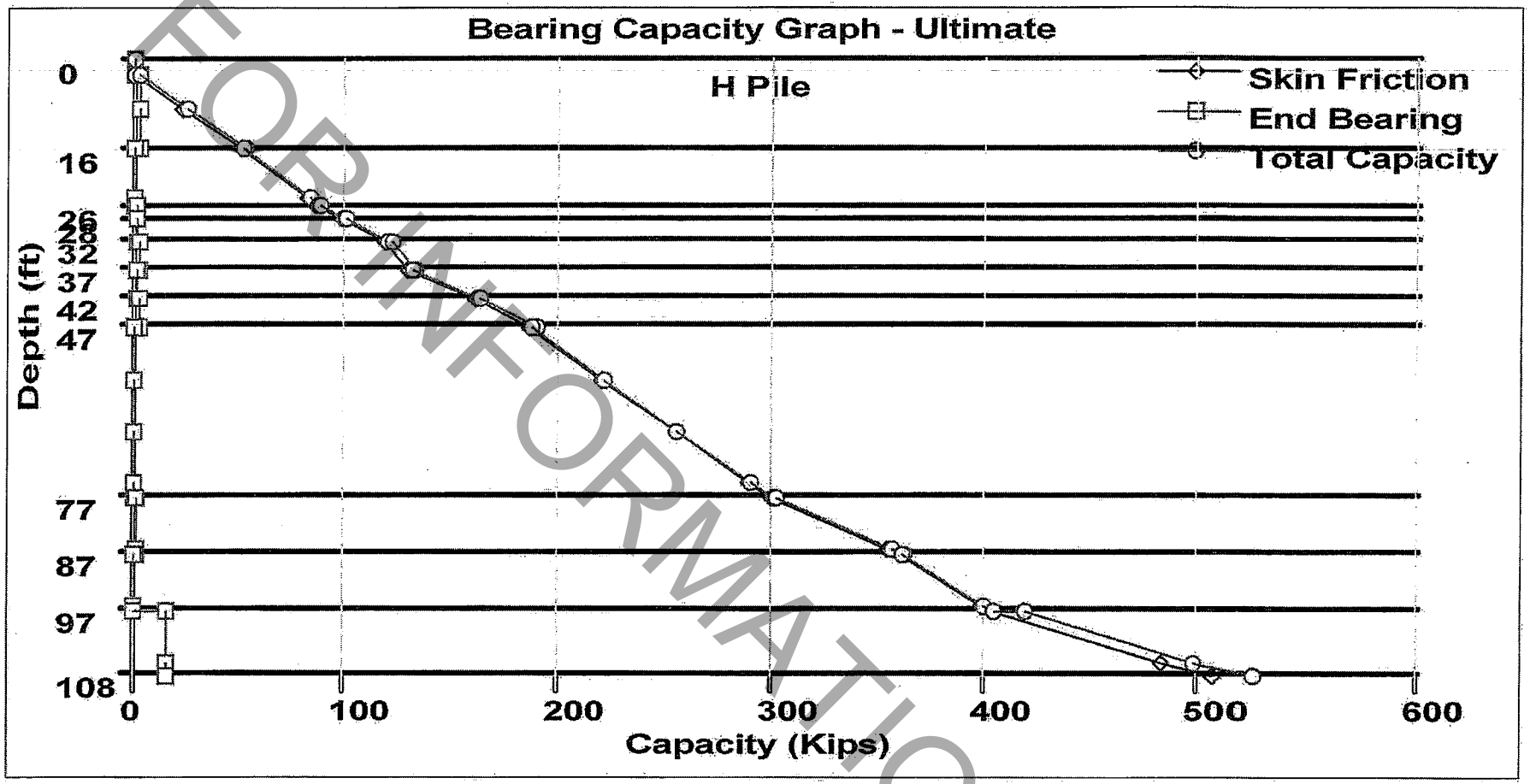

SOUTH ABUTMENT BORING B-1

HP 12X53

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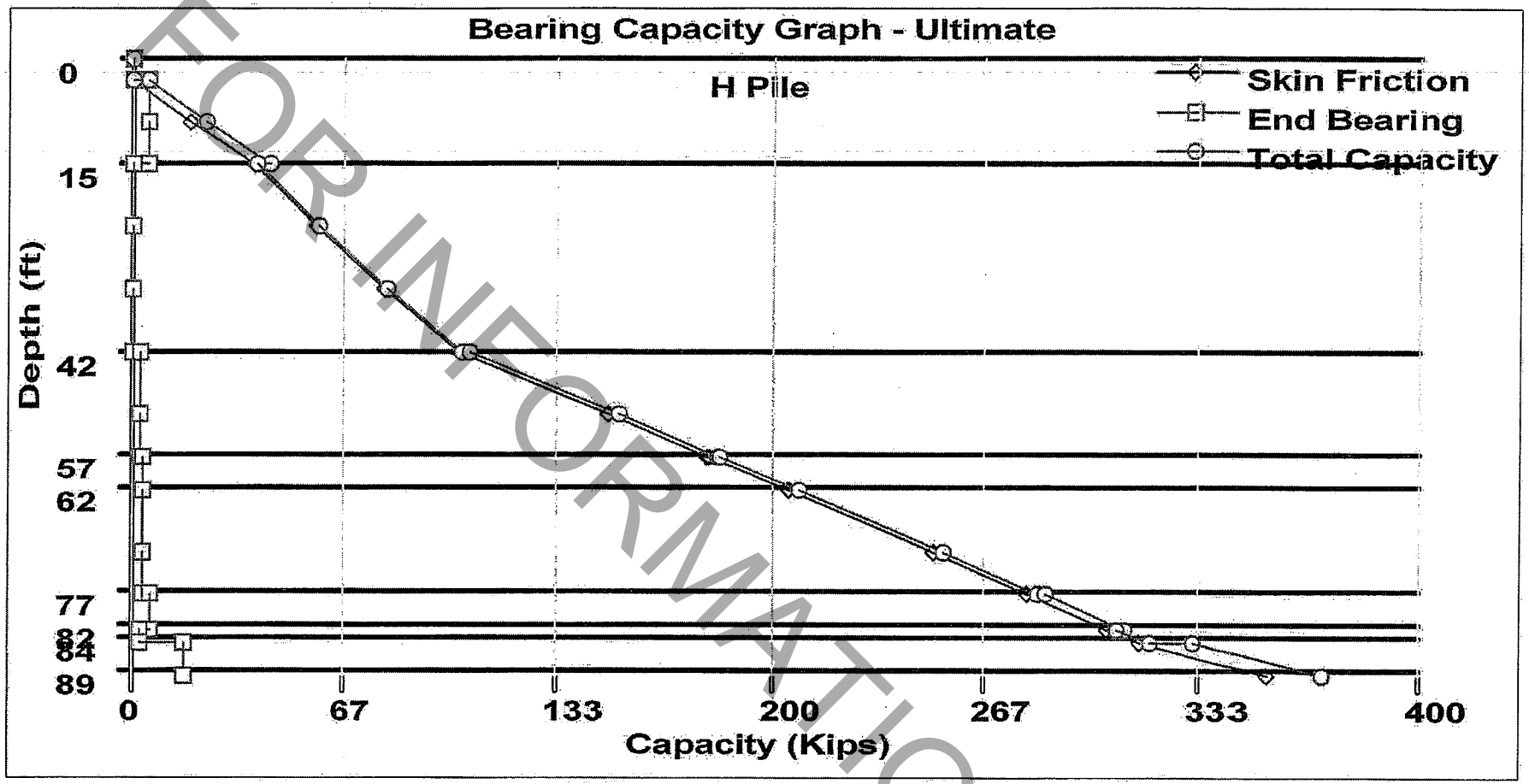

North Abutment Boring B-2

HP 12x53

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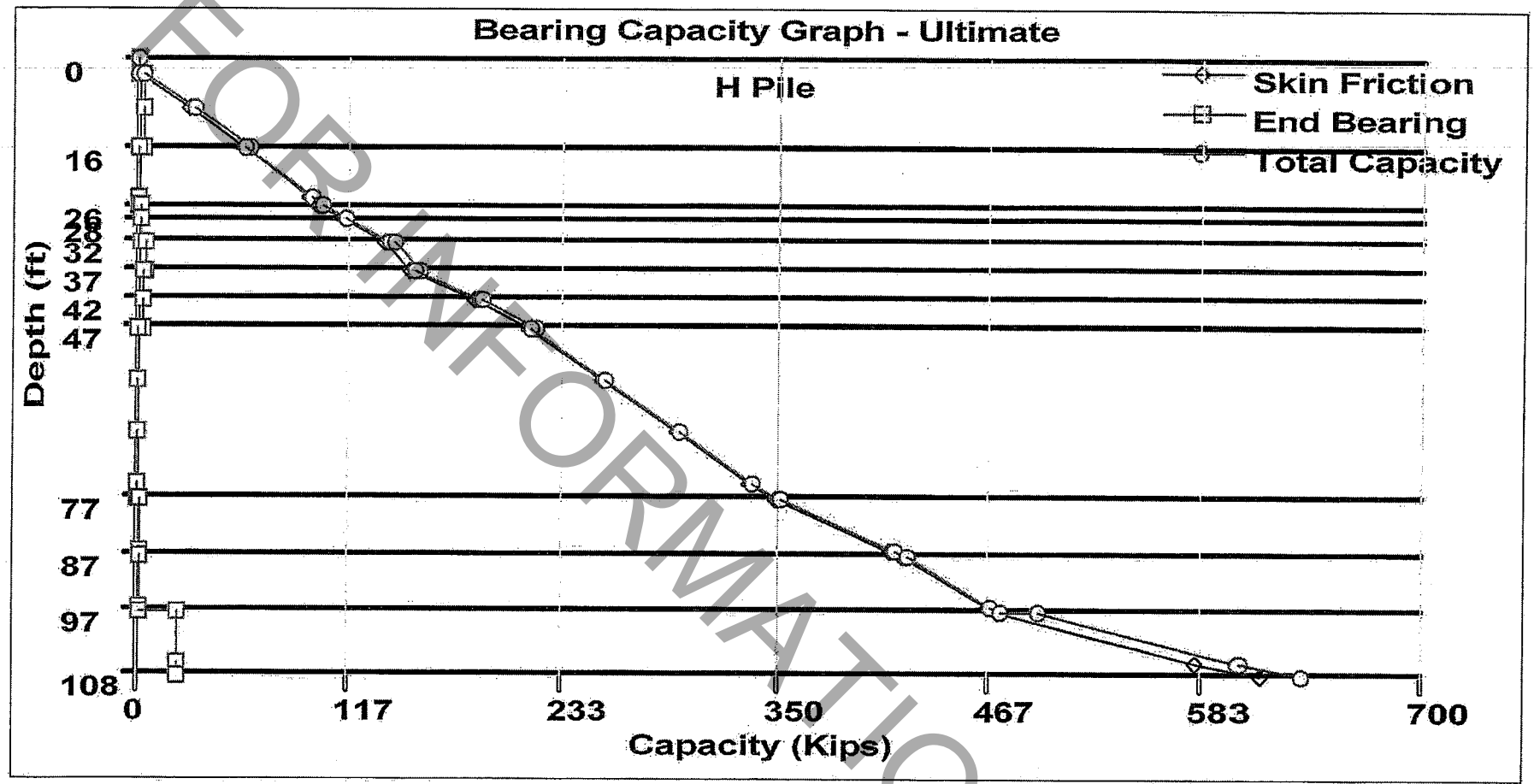

South Abutment Boring B-1 HP 14x73

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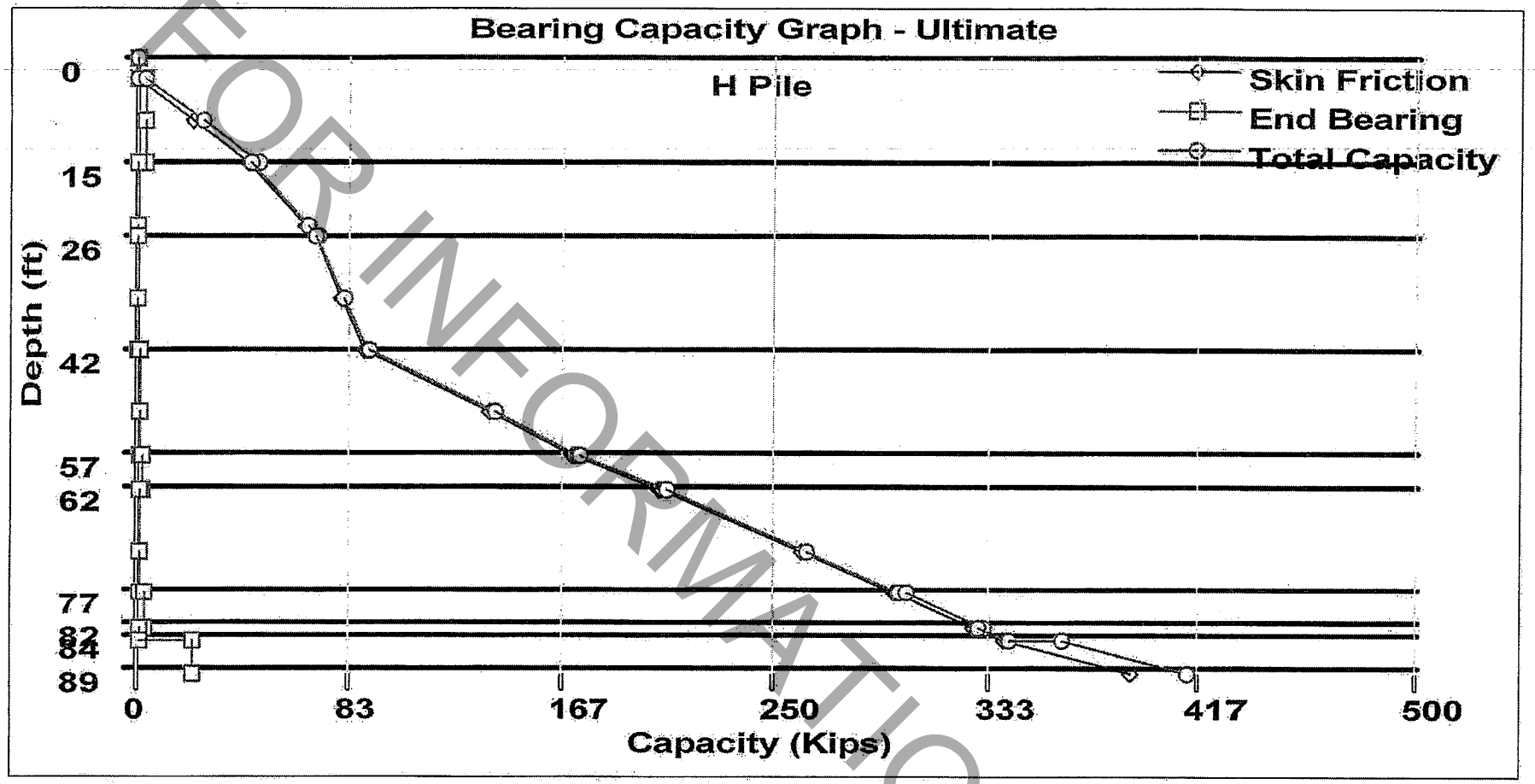

North Abutment Boring B-2 HP 14x73

Illinois Department of Transportation

Structure Geotechnical Report Responsibility Checklist

Structure Number: 060-0344 (prop.) 060-0109 (exist.) Contract Number: _____ Date: 6/30/2008
Route: FAP 314 Section: 110BR-1 County: Madison
TSL plans by: Allen Henderson & Associates, Inc.
Structure Geotechnical Report and Checklist by: Kaskaskia Engineering Group, LLC

IDOT Structure Geotechnical Report Approval Responsibility : ☐ Qualified District Geotechnical Personnel ☒ BBS Central Geotechnical Unit

Geotechnical Data, Subsurface Exploration and Testing	Yes	No	N/A
All pertinent existing boring data, pile driving data, site inspection information included in the report?	☒	☐	☐
Are the preliminary substructure locations, foundation needs, and project scope discussions between Geotechnical Engineer and Structure Planner included in the report?	☒	☐	☐
All ground and surface water elevations shown on all soil borings and discussed in the report?	☒	☐	☐
Has all existing and new exploration and test data been presented on a subsurface data profile?	☒	☐	☐
Is the exploration and testing in accordance with the IDOT Geotechnical Manual policy?	☒	☐	☐
Are the number, locations, depths, sampling, testing, and subsurface data adequate for design?	☒	☐	☐
Geotechnical Evaluations			
Have structure or embankment settlement amounts and times been discussed in report?	☒	☐	☐
Does the report provide recommendations/treatments to address settlement concerns?	☐	☐	☒
Has the critical factor of safety against slope instability been identified and discussed in the report?	☒	☐	☐
Does the report provide recommendations/treatments to address stability concerns?	☐	☐	☒
Is the seismic design data (PGA, amplification, category, etc.) noted in the report?	☒	☐	☐
Have the vertical and horizontal limits of any liquefiable layers been identified and discussed?	☒	☐	☐
Has seismic stability been discussed and have any slope deformation estimates been provided?	☒	☐	☐
Has the report discussed the proximity of ISGS mapped mines or known subsidence events?	☒	☐	☐
Has scour been discussed, any Hydraulics Report depths reported & soil type reductions made?	☒	☐	☐
Do the Factors of Safety meet AASHTO and IDOT policy requirements?	☒	☐	☐
Geotechnical Analyses and Design Recommendations			
When spread footings are recommended, has a bearing capacity and footing elevation been provided for each substructure or footing region?	☐	☐	☒
Has footing sliding capacity been discussed?	☐	☐	☒
When piles are recommended, does the report include a table indicating estimated pile lengths vs. a range of feasible required bearings and design capacities for each pile type recommended?	☒	☐	☐
Have any downdrag, scour, and liquefaction reductions in pile capacity been addressed?	☐	☐	☒
Will piles have sufficient embedment to achieve fixity and lateral capacity?	☒	☐	☐
Have the diameters & elevations of any pile pre-coring been specified (when recommended)?	☐	☐	☒
Has the need for test piles been discussed and the locations specified (when recommended)?	☒	☐	☐
Has the need for metal shoes been discussed and specified (when recommended)?	☐	☐	☒
When drilled shafts are recommended, have side friction and/or end-bearing values been provided?	☐	☐	☒
Has the feasibility of using belled shafts been discussed when terminating above rock, or have estimated top of rock elevations been provided when extending into rock?	☒	☐	☐
Have shaft fixity, lateral capacity, and min. embedment been discussed?	☒	☐	☐
When retaining walls are required, has feasibility and relative costs for various wall types been discussed?	☐	☐	☒
Have lateral earth pressures and backfill drainage recommendations been discussed?	☐	☐	☒
Has ground modification been discussed as a way to use a less expensive foundation or address feasibility concerns?	☐	☐	☒
Have any deviations from IDOT Geotechnical Manual or Bridge Manual policy been recommended?	☐	☒	☐
Construction Considerations			
Has the need for cofferdams, seal coat, or underwater structure excavation protection been discussed?	☐	☐	☒
Has stability of temporary construction slopes vs. the need for temporary walls been discussed?	☐	☐	☒
Has the feasibility of cantilevered sheeting vs. a temporary soil retention system been discussed?	☒	☐	☐
Has the feasibility of using a geotextile wall vs. a temp. MSE for any temp fill retention been noted?	☐	☐	☒

"In order to aid in determining the level of departmental review, please attach additional documentation or reference specific portions of the SGR to clarify any checklist responses that reflect deviation from IDOT policy/practice."

BBS-2602 (4/05)