STRUCTURE GEOTECHNICAL REPORT

US 45 OVER SOUTH FORK SALINE RIVER
FAP 881 SECTION 32B-1
SALINE COUNTY, ILLINOIS
SN 083-0011(exist.) SN 083-0067 (prop.)
JOB No. D-99-052-08
CONTRACT NUMBER 98083

Prepared for

Planning Unit
Illinois Department of Transportation
Springfield, IL 62764

Prepared by

Mohammed A. Kothawala, P.E., D.GE
Wang Engineering, Inc.
On behalf of

Foundations and Geotechnical Unit

July 18, 2011

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STRUCTURE GEOTECHNICAL REPORT

FAP 881, US 45
OVER SOUTH FORK SALINE RIVER
SALINE COUNTY

EX SN: 083-0011, PR SN: 083-0067

1.0 INTRODUCTION

This report presents the results of subsurface investigation, laboratory testing, and geotechnical evaluation for the proposed US 45 over South Fork of the Saline River. The project site is located in Saline County, Illinois. The purpose of geotechnical work was to evaluate the subsurface soil and groundwater conditions within this project area that would form a basis for foundation and earthwork design recommendations and provide a report summarizing the results of our studies, conclusions, and recommendations for the replacement of existing US 45 Bridge. The bridge is approximately 1.5 miles north of Stonefort, Illinois.

2.0 EXISTING AND PROPOSED STRCUTURES

Existing Structure (No. 083-0011) is a three span structure with a total length of 214'-5" back to back of abutments. The substructure consists of pile bent abutments and reinforced concrete solid wall piers. One pier is supported on spread footing on bedrock and another on piles. The existing structure modified in 1954 will be removed and replaced with a new structure at the same location.

The proposed bridge structure will be a three-span steel girder structure with cast-in-place concrete deck. The bridge will carry two 12-foot lanes in each direction with a 4'-0" shoulder on each side of structure. The structure will be 35'-2" wide out-to-out and will be 200'-0" long back-to-back abutments. The abutments are proposed to be integral type abutments. The existing grade will be raised a resurfacing thickness. The proposed structure will have the same centerline station as the existing bridge with zero degree skew. The flow line elevation will be the same as the existing and riprap will be placed on the end-slopes and around the piers.

The preliminary estimated substructure LRFD factored loads for the Strength I load combination provided by the IDOT Planning Unit are as follow:

Abutments: Vertical: 606.2 Kips, Lateral: 84.3 kips as of 07/18/11 (103.8 kips was initial estimate)
Piers: Vertical: 1351.2 kips, Lateral: 219.0 kips

3.0 GEOLOGIC SETTING

The project area is located in southwest Saline County, northeast of the Town of Stonefort. On the USGS *Carrier Mills Quadrangle* map, the IL 45 Bridge over South Fork Saline River is located at NE ¼ of Section 20, Tier 10 South, Range 5 East of the Third Principal Meridian.

The following review of the published geologic data, with emphasis on factors that might influence the design and construction of the proposed engineering works, is meant to place the project area within a geological framework and, thus, to confirm the dependability and consistency of the present subsurface investigation results. For the study of the regional geologic framework, we considered southern Illinois area in general and Saline County in particular.

3.1 Physiography

At the bridge site, the river runs west to east. Across the floodplain, surface elevations measure 388 to 400 feet, but IL 45 roadway at the bridge site measure elevations of approximately 398 feet.

3.2 Surficial Cover

Glacial and postglacial deposits overlie the bedrock surface. Near the project area, the glacial deposits include Peoria and Roxana wind-blown silts (loess) and lacustrine deposits of Equality Formation, both part of the Mason Group (Willman et al. 1975, Hansel and Johnson 1996, Nelson 2007). Postglacial deposits are made up of sand and silt alluvium deposited by South Fork Saline River along its valley (Cahokia Formation).

In the project area the yellowish brown to gray loess deposits measure 5 to 10 feet in thickness. The Equality Formation, with thicknesses of up to 30 feet, and characterized as brown to gray, fine textured, with occasional distinct bedding structure, predominantly clay and silt, and silty clay with occasional seams of fine sand (Hansel and Johnson 1996); consists of high moisture content, low to medium blow counts, and high compressibility deposits (Bauer et al. 1991).

3.3 Bedrock

In southern Saline County is situated along the southern margin of the Illinois Basin. Thus, the bedrock strata, dip northward into the basin at an average rate of about 70 feet per mile, which equates less than 1° of dip (Nelson 2007). In the project area the surficial cover rests unconformably on top of the sandstone bedrock of the Tradewater Formation, which is part of the Pennsylvanian System. Top of the bedrock lies less than 20 feet below the ground surface (bgs). The sandstone is cross-bedded to massive and can get up to 60 feet in thickness (Nelson 2007).

The subsurface investigation results fit into the local geologic context. The borings drilled in the project area revealed the native sediments consists of medium dense silt loam; follow by soft to medium stiff silty clay loams and resting on top of sandstone bedrock. Borings core into the sandstone bedrock.

3.4 Mining Activity

The Saline County is identified as coal producing area by Illinois State Geological Survey (ISGS, 2008). The nearest active coal mine perimeter is located approximately 500 yards northeast, downstream from the bridge, on the north side of the South Fork Saline River (Myers 2005). According to the ISGS, coal mining was performed north of the creek and west of US 45 for which the nearest access shaft was about 100 feet and the perimeter is about 250 feet north of the proposed bridge structure. No mining is recorded directly under the proposed structure.

4.0 METHODS OF INVESTIGATION

In order to collect the information needed for our analyses and recommendations, IDOT District Nine conducted subsurface investigation and laboratory testing described in the following sections. The bridge plans dated 1954 show log of three borings performed, one near each abutment and one near existing pier number 2.

4.1 Subsurface Investigation

The subsurface investigation was performed between the period of November 6 and November 8, 2007, and consisted of three structure borings identified as 1-S through 3-S. Borings 1-S and 3-S were conducted at the south and north bridge approach, respectively; whereas, Boring 2-S was drilled north of south abutment. The soil was sampled at 2.5-foot intervals to the auger refusals. Rock coring was conducted at each borings after auger refusal was reached. Boing locations are shown on the boring logs and TSL plan (Exhibit 1).

Boring logs included lithological descriptions, visual-manual soil classifications, SPT results recorded as blows per 6 inches of penetration, Rimac unconfined compressive strength (Qu) test results, as well as rock recovery and Rock Quality Designation (RQD).

Groundwater observations were made during drilling operations.

4.2 Laboratory Testing

Samples were tested in the laboratory for moisture content only.

5.0 RESULTS OF FIELD AND LABORATORY INVESTIGATIONS

Detailed descriptions of the soil conditions encountered during the subsurface investigation are presented on the attached boring logs and in the *Subsurface Soil Data Profile* (Exhibit 2). Please note that strata contact lines represent approximate boundaries between soil types. The actual transition between soil types in the field may be gradual in horizontal and vertical directions.

5.1 Soil Conditions

2- to 2.5- foot thick asphalt and concrete pavements structure were encountered in Borings 1-S and 3-S, respectively. In descending order, the general lithologic succession encountered along the proposed project includes: 1) very soft to very stiff silty clay to clay loam; 2) very dense sandstone.

(1) Very Soft to Very Stiff Silty Clay to Clay Loam

Immediately beneath the ground surface or pavement structures, the borings revealed 18.5 to 35.0 feet (elevation 395.5 to elevation 360.5 feet) of very soft to very stiff, brown and gray silty clay to clay loam. The soil has Q_u values of 0.1 to 2.3 tsf, averaging 0.77 tsf, and moisture content (MC) values of 16 to 32%, averaging 24%.

(2) Very Dense Sandstone

The top of bedrock elevation was indicated by split-spoon refusal and confirmed with rock coring. Based on the split-spoon refusals, the top of sandstone elevation varies from 360.5 to 379.0 feet. From the rock coring samples, the bedrock was identified as brown and gray sandstone, with recovery of 40 to 100% and RQD of 7 to 77%. The 1954 borings show top of bedrock elevation varying from 364.0 to 378.0 feet. The Table 1 shows summary of top of bedrock elevations.

Table 1
Summary of Bedrock Elevations

Existing Sub Structure	Boring Number	Approximate top of bedrock elevation, feet
South Abutment (1954-Sta. 616+80.73)	No. 1 (1954) 1-S (2007)	366.0 360.5
Pier 1 (1954-Sta. 615+34.65)	---	368.0 (1954 plans)
Pier 2 (1954-Sta. 616+12.40)	No. 2 (1954) 2-S (2007)	364.0 363.8
North Abutment (1954-Sta. 614+66.32)	No. 3 (1954) 3-S (2007)	378.0 377.5

5.2 Groundwater Conditions

While drilling, groundwater was encountered at Elevation 370.0 feet in Boring 1-S. Surface water was measured at Elevations 378.8 feet.

6.0 ANALYSIS AND RECOMMENDATIONS

6.1 Settlement

It is understood that the roadway profile grade will remain the same. No additional fill will be required at the abutment locations and therefore we do not expect any settlement of the new approach pavement or embankments.

6.2 Slope Stability

It is understood that the roadway will not be widened and no changes in existing embankment side slopes are proposed. There will be new end slopes against the abutments with a layer of stone rip rap at the surface. The slope stability of the end slopes was analyzed based on the subsurface soil and groundwater conditions encountered in the borings. Analyses were performed with SLIDE v5.0 computer software. We considered end slope of 1:2 (V:H). The minimum required factor of safety (FOS) is 1.5 (IDOT, 2009). The minimum FOS calculated considering short-term soil parameters was 1.42. Details of the slope stability analysis with the critical failure surfaces and results are presented in Exhibit 3. It is understood that the existing end slopes at 1:2 (V:H) are stable. The height and location of the new end slopes will be essentially same as the existing ones. Therefore, it is our opinion that the new end slopes at 1:2 (V:H) will be stable.

6.3 Seismic Design Considerations

Since the soils are described on the boring logs as cohesive in nature, liquefaction of these soils is not expected. Therefore, there is no need for a remedial treatment of the soils or foundations.

The Seismic Site Class was determined using a procedure developed by IDOT (AGMU memo 09.1). The soils within the top 100 feet have average normalized undrained shear strength of 2.18 ksf, classifying the site in Seismic Site Class C (AASHTO, 2008 Method C).

The seismic design spectral acceleration parameters recommended for design in accordance with the 2008 *Interim Revisions* of the AASHTO *LRFD Design Specifications* are summarized in Table 2 (AASHTO, 2008).

Table 2

Seismic Design Parameters for US 45 over South Fork Saline River

Spectral Acceleration Period (sec)	Spectral Acceleration Coefficient[1)] (% g)	Site Factors	Design Spectrum for Site Class C[2)] (% g)
0.0	PGA= 35.5	F_{pga}= 1.05	**A_s= 40.1**
0.2	S_1= 67.2	F_a= 1.13	**S_{DS}= 75.9**
1.0	S_2= 16.9	F_v= 1.63	**S_{D1}= 27.5**

Considering seismic design spectrum values shown in Table 1 and Site Class of C; and based on Table 3.15.2-1 and Figure 2.3.10-3 in the IDOT Bridge Manual, the Seismic Performance Zone is 2.

6.4 Scour Considerations

If the bottoms of the substructures are established at design scour elevations, no reduction in the design scour amount for the foundation design will be required. As per Planning Unit, the Estimated Water Surface Elevation (EWSE) is 381.25 feet, and the streambed elevation at the pier is 387 feet. The Design High Water Elevation is 392.4 feet. The recommended design scour elevations are shown in the Table 3. The recommended scour elevations for the foundation design are as per IDOT 2009 Bridge Manual.

Table 3
Design Scour Elevations

Substructure	North abutment	*Pier 1	*Pier 2	South Abutment
Design Scour Elevation (ft)	390.33	382.0	382.0	390.13

*Assuming a ground surface Elev. of 687 at both Piers and a 50-year scour depth of 5 feet.

The scour elevation coincides with the bottom of the individual pile encasement at the Pier and therefore no reductions for scour are to be taken into account.

6.5 Foundation Evaluations

6.5.1 Foundation Feasibility

It is understood that the bridge structure is proposed to be supported on integral abutments. Soil borings revealed layers of soft to stiff cohesive soils below the pavement to top of the bedrock. A shallow foundation consisting of spread footings would not be suitable considering the low bearing capacity and settlement concern. A drilled shaft foundation system is not preferred for integral abutments. The drilled shafts socketed into bedrock could be used to support other types of abutments. The use of drilled shafts however is expected to be cost prohibitive. Therefore, it is our opinion that a driven pile foundation system will be appropriate to support the integral abutments. Normally metal shell cast in-place concrete piles are more economical than H-piles however considering bridge length, we recommend H-piles.

6.5.2 Pile Foundation

Since top of the weathered bedrock was encountered between elevations 379.0 and 360.5 feet approximately 11 to 29.5 feet below bottom of the abutment footings and 22.5 feet below river bed for the piers, we recommend H-piles driven to Maximum Nominal Required Bearing to top of the bedrock.

We recommend the pile data shown in the Table 4 for all H-piles considering two-foot of penetration into the pile caps. The estimated tip elevations and lengths shown in Table 4 do not include any set in rock required due to lateral loadings. The Maximum Nominal Required Bearing values shown in Table 5 are the maximum allowed by the IDOT. The most economical pile size should be selected.

Table 4
Estimated Pile Lengths

Substructure	Boring Reference	Estimated Top of Bedrock Elevation	Estimated Tip Elevation	Estimated Length, feet
North Abutment	3-S	377.5	372.5	20.0
Pier1		*367.3	362.3	30.4
Pier 2	2-S	363.8	358.8	33.8
South Abutment	1-S	360.5	355.5	36.6

* Assumed based on 1954 plans.

One test pile should be identified on the plans at Pier 1, since no boring was performed at this location, which should be installed prior to ordering of the production piles.

6.5.3 Downdrag Loads

Since the grade will not be raised and no settlement is expected, there will not be any downdrag load on the piles.

6.5.4 Foundation Settlement

The driven H-pile foundations designed and constructed as recommended will undergo negligible settlement (less than 0.4 inch).

6.5.5 Pile Resistance to Lateral Loads

Lateral loads on piles should be analyzed for maximum moments and lateral deflections. The geotechnical resistance factor of 1.0 should be used. No allowance should be made for the frictional resistance of the cap concrete on soil. The required lateral capacity can be obtained by increasing the pile size and/or number of piles. The lateral load capacity analysis can be performed using computer program such as COMP 624P, L-pile, LATPILE or any other such program. The estimated soil parameters that may be used for the analysis of stresses and deflection under lateral loads are presented in Table 5. Group action should be considered in calculating total lateral load resistance of the substructures.

The pile lengths at the north abutment will be shorter than at south abutment due to shallow bedrock depth. We performed analysis of piles under lateral load using computer program LPILE Plus version 5.0 (by Lymon C. Reese et al, ENSOFT, Inc.). Based on the preliminary lateral loads of 103.8 kips at the abutments, it was initially estimated that the piles at the north abutment would not have adequate embedment to develop fixity and, therefore, it was initially calculated that at least two feet of set in rock was to be required at the north abutment

However, new lateral loads provided by the Planning Unit on 07/18/11 (84.3 kips) show an almost 20% decrease in the lateral loads at the abutments. The piles at the north and south abutments will have an estimated 12.83 and 29.5 ft of embedment before reaching bedrock. Per the 2009 Bridge Manual, penetration of steel H-piles into sandstone may vary from a minimum of 1.5 ft to a maximum of 6.0 ft into sandstone. Our estimate is that the piles will achieve an average of 3.0 ft of penetration into the bedrock thus increasing the total pile embedment at the north and south abutment to 15.8 and 32.6 ft, respectively. A different pile size with greater section modulus than necessary for the vertical load would be required to control lateral deflection. A detail lateral deflection analysis can be performed, at the request of the Designer, during the Final Design Phase once the loads are known with greater certainty.

Table 5
Recommended Soil Parameters for Lateral Load Pile Analysis

Soil Type (Layer)	Total Unit Weight, γ (pcf)	Undrained Shear Strength, c_u (psf)	Estimated Friction Angle, Φ (°)	Estimated Lateral Soil Modulus Parameter, k (pci)	Estimated Soil Strain Parameter, ε_{50}
V. Soft Cohesive Soils (Qu less than 0.25 tsf)	110	200	0	16	.02
Med. Stiff Cohesive Soils (Qu 0.5 to 0.99 tsf)	120	750	--	100	.01
Stiff Cohesive Soils (Qu 1.0 to 1.99)	120	1000	0	233	.009
Hard Cohesive soils (Qu .> 4.5 tsf)	125	4000	0	1332	.0047
V. Loose to Loose Granular Soils (N 4 to 10)	115	0	32	30	--
Med. Dense Granular Soils (N 11 to 30)	120	0	34	60	--

6.6 Stage Construction Design

To accommodate the stage construction, steel sheet-pile walls driven along the roadway centerline will be required. Our preliminary analysis based on IDOT Bridge Manual Section 3.13.1 indicates that a temporary cantilever sheet piling will be feasible. Estimated geotechnical parameters for the design of temporary sheet pile walls considering short term condition are included in Table 6.

Table 6
Geotechnical Parameters for Design of Steel Sheet Pile Walls

Soil Description	Moist Unit Weight (pcf)	Shear Strength Properties Short Term	
		Cohesion Cu (psf)	Friction Angle, φ (Degree)
Very Soft Cohesive	110	200	0
Soft Cohesive	115	400	
Medium Stiff Cohesive	120	800	0
Stiff Cohesive	120	1200	0
Weathered Bedrock	135	0	38

6.7 Lateral Design Pressures

For the design of abutments and wingwalls, we recommend linearly increasing lateral pressure at 40 pounds per square foot (psf) per foot of depth below finished grade for embankment slope of horizontal considering drainable backfill. Additional lateral load from traffic should include a surcharge of 2 feet of soil considering unit weight of 125 pounds per cubic foot. The backfill and the drainage behind the abutments should be in accordance with IDOT 2009 Bridge Manual.

7.0 CONSTRUCTION CONSIDERATIONS

7.1 Excavation

Foundation excavations should be performed in accordance with local, state, and federal regulations.

7.2 Dewatering

Seepage water that does accumulate in open excavations at the abutment substructure locations can be removed using the sump pump method.

7.3 Filling and Backfilling

Embankment fill required to attain the final design subgrade elevations should be in accordance with Section 205 of the IDOT Standard Specifications. All fill and backfill materials should be pre-approved by the site engineer. The fill should be free of organic materials and debris. The backfill behind the abutments should be in accordance with IDOT 2008 Bridge Manual.

7.4 Cofferdam

Piers will be solid wall encased bent piers supported on a single row of piles located on the berms higher than EWSE, no water at the pier site is expected. Therefore cofferdam or underwater excavation protection will not be necessary for construction of the piers.

7.5 Construction Monitoring

There is no need for a special construction monitoring for the foundations except normally required by the IDOT Standard Specifications, Special Provisions and Contract Plans.

7.7 Pile Installation

Piles should be installed in accordance with Section 512 of the IDOT Standard Specifications. The length of the test pile should be at least 10 feet longer than the estimated length of the piles.

REFERENCES

AASHTO 2007. LRFD Bridge Design Specifications. American Association of State Highway and Transportation Officials, Inc., Washington, D.C.

Bauer, R.A., Curry, B.B., Graese, A.M., Vaiden, R.C., Su, W.J., and Hasek, M.J., 1991, Geotechnical Properties of Selected Pleistocene, Silurian, and Ordovician Deposits of Northeastern Illinois: Environmental Geology 139, Illinois State Geological Survey, 69 p.

Hansel, A.K., and Johnson, W.H., 1996, Wedron and Mason Groups: Lithostratigraphic Reclassification of the Wisconsin Episode, Lake Michigan Lobe Area: ISGS Bulletin 104: Champaign, Illinois State Geological Survey, 116 p.
ISGS, 2008, Directory of Coal Mines in Illinois: McDonough County, Illinois State Geological Survey.

IDOT 1999. Geotechnical Manual. Illinois Department of Transportation.

IDOT 2009. Bridge Manual. Illinois Department of Transportation.

IDOT 2007. Standard Specifications for Road and Bridge Construction. Illinois Department of Transportation.

IDOT 2004. *Drainage Manual*. Illinois Department of Transportation.

ISGS, 2008, Directory of Coal Mines in Illinois: McDonough County, Illinois State Geological Survey.

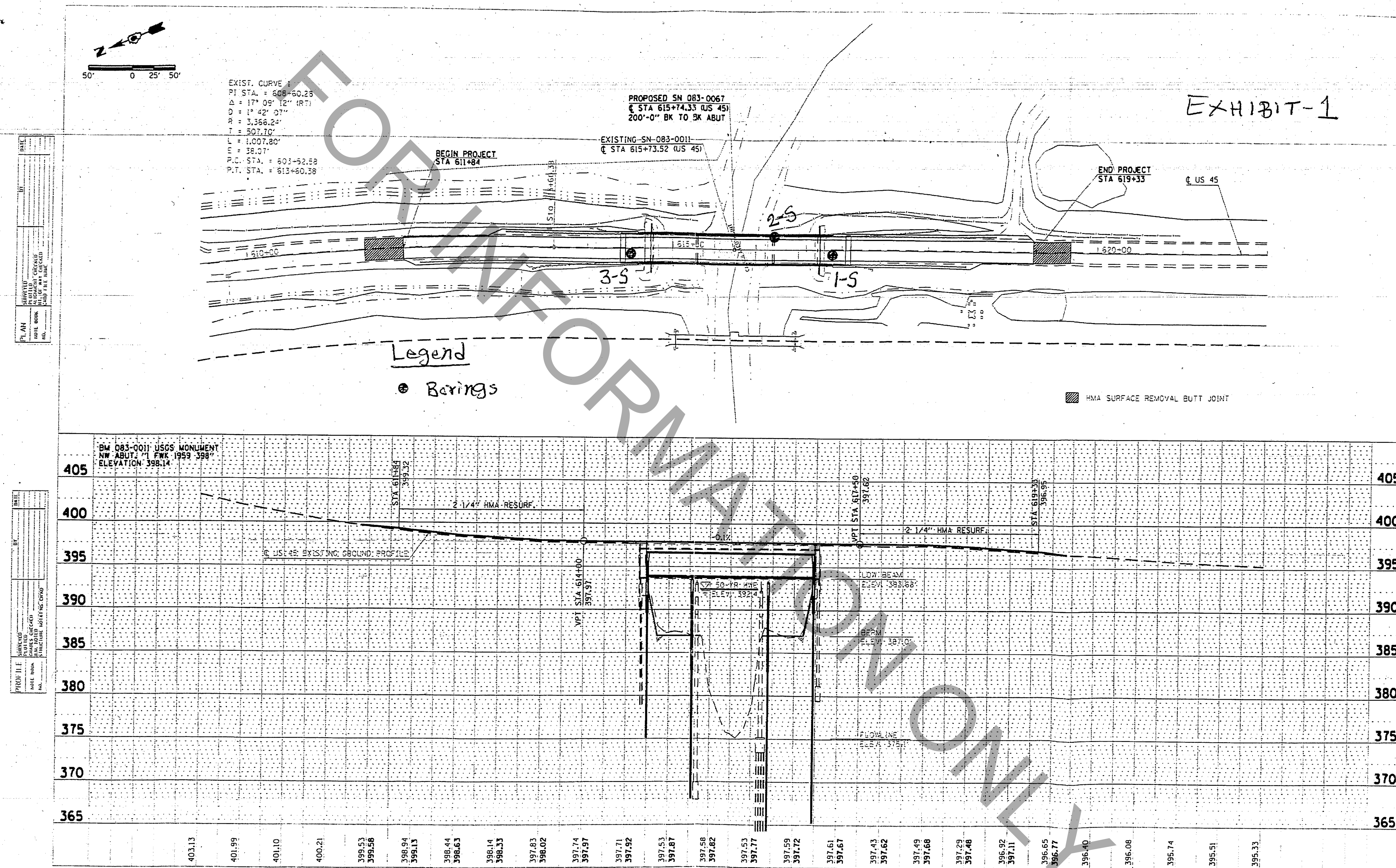
Myers, A.R. 2005, Coal Mines in Illinois, Carrier Mills Quadrangle Map, Mine Outlines, Illinois State Geological Survey, 3 map sheets accompanies the Coal Mines Directory for Carrier Mills Quadrangle, 1:24,000.

Nelson, W.J., 2007, Bedrock Geology of Carrier Mills Quadrangle, Williamson and Saline Counties, Illinois: Illinois State Geological Survey, Illinois Geologic Quadrangle Map, IGQ Carrier Mills-BG, 2 sheets, 1:24,000.

Willman, H.B., Atherton, E., Buschbach, T.C., Collinson, C., Frye, J.C., Hopkins, M.E., Lineback, J.A., and Simon, J.A., 1975, Handbook of Illinois Stratigraphy: ISGS Bulletin 95: Urbana, Illinois State Geological Survey, 261 p.

EXHIBITS

EXHIBIT-1



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	PLOT SCALE =	DRAWN -	REVISED -
	PLOT DATE = 3/1/2010	CHECKED -	REVISED -
		DATE -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

STRUCTURE NO. 083-0011
PLAN AND PROFILE

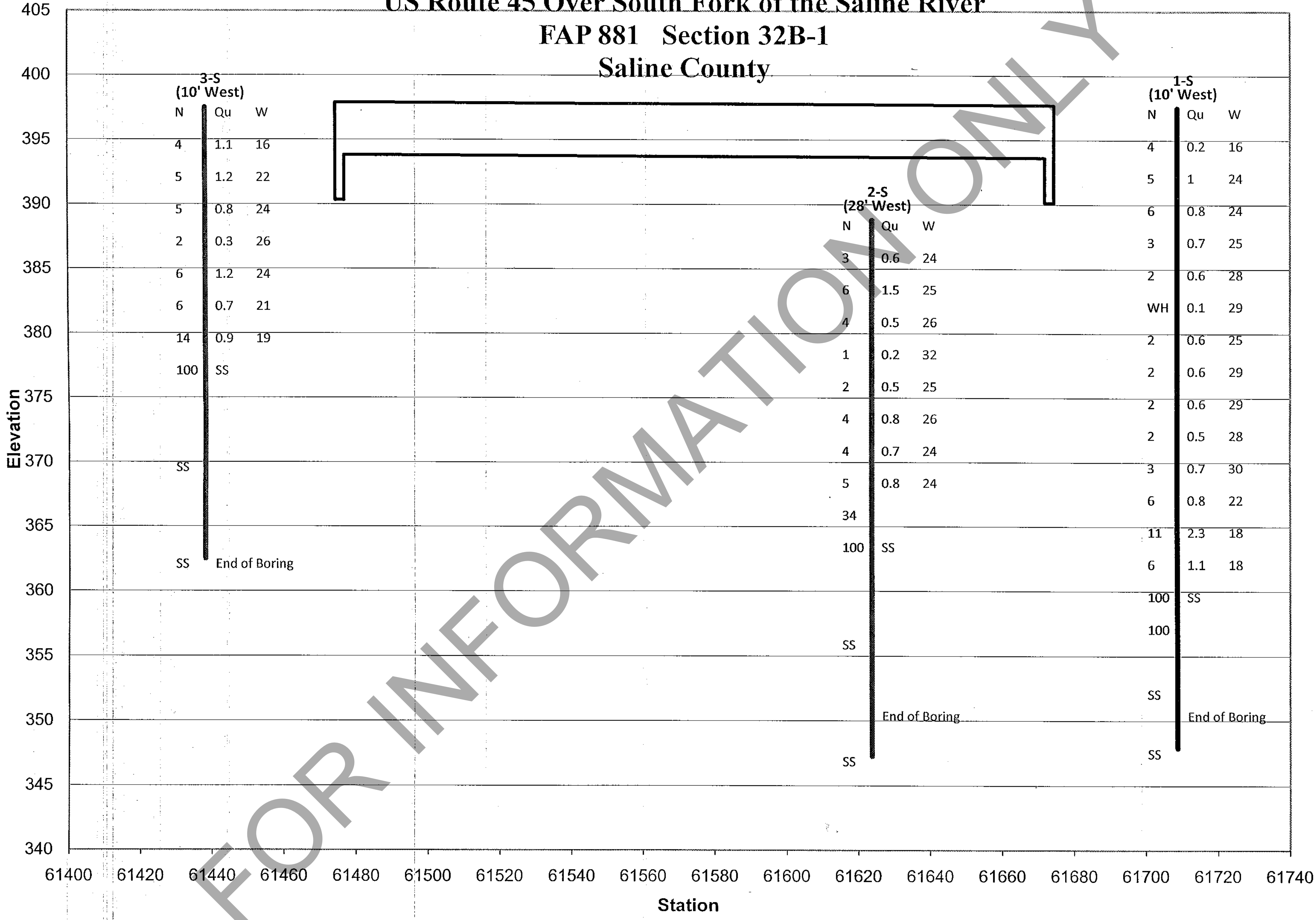
SCALE: | SHEET NO. | OF | SHEETS | STA. 609+50.00 TO STA. 622+00.00

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
881	123-1	SALINE		

CONTRACT NO. 98093

ILLINOIS FED. AID PROJECT

SN 083-0067 (prop.)
US Route 45 Over South Fork of the Saline River
FAP 881 Section 32B-1
Saline County



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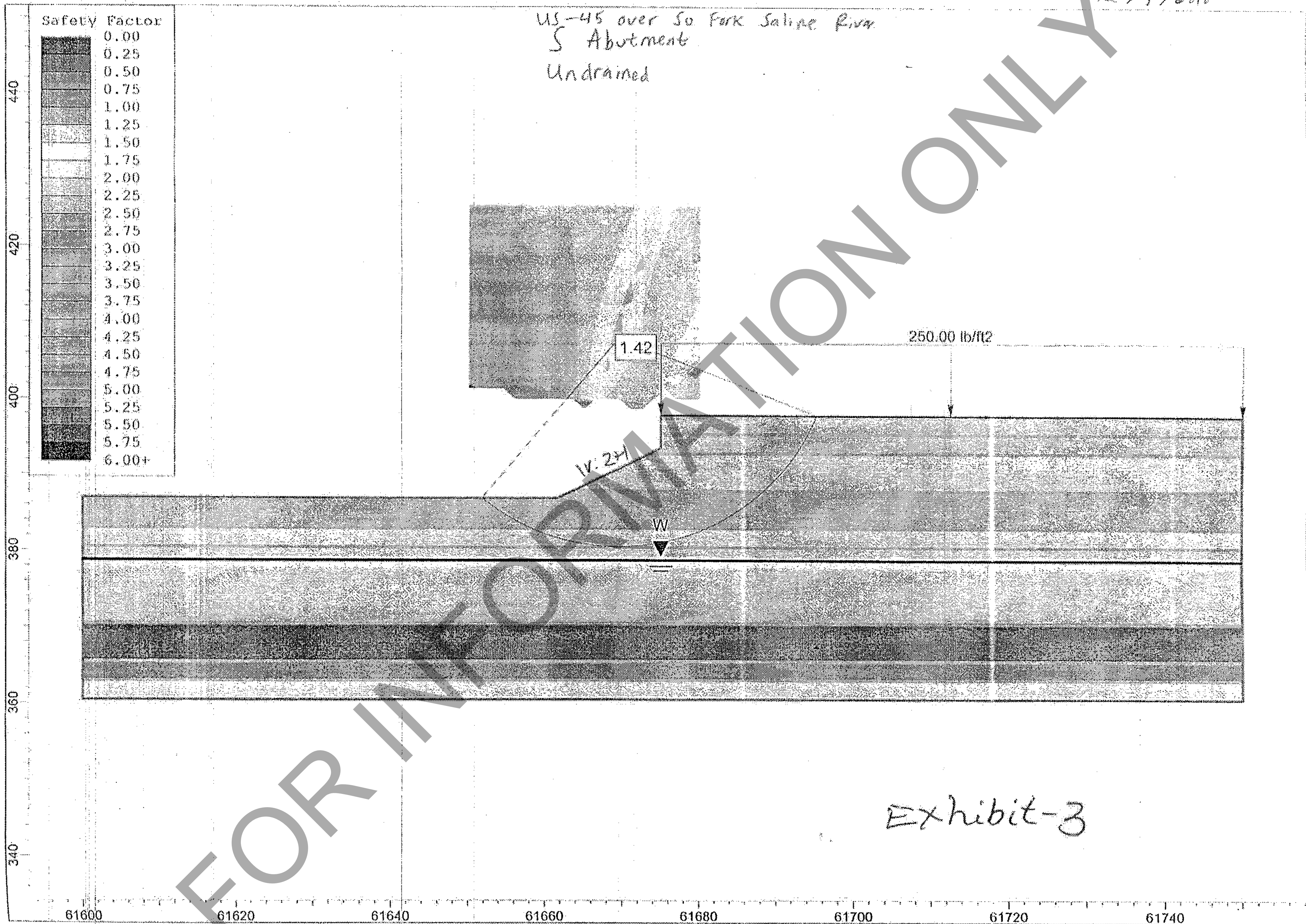

Exhibit-3

APPENDIX A

ILLINOIS DEPARTMENT OF TRANSPORTATION
District Nine Materials

Bridge Foundation Boring Log
Sheet 1 of 2

FAP 881 (US 45) Over So Fork Saline River

Route: FAP 881 (US 45) Structure Number: 083-0011 Date: 11/6/2007

Section 33 BFY Bored By: R Moberly

County: Saline Location: 1.5 mi N of Stonefort Checked By: R Moberly

Boring No 1-S
Station 617+08.73
Offset 10' W CL
Ground Surface 397.5 Ft

Surf Wat Elev: 378.8
Ground Water Elevation
when Drilling 370
At Completion
At: Hrs:

Description	DEPTH	BLOWS	Qu tsf	W%
Asphalt and Concrete				
395.5				
Very soft, very moist, grey and brown, Silty Clay Loam to Clay Loam A-4 with gravel		2		
		2	0.2E	16
		2		
393.0				
Medium to stiff, very moist, brown, Silty Clay Loam A-4	5.0	3		
		3	1.0S	24
		2		
		1		
		3	0.8S	24
		3		
388.0				
Medium, very moist, grey, Silty Clay to Silty Clay Loam A-6	10.0	1		
		2	0.7B	25
		1		
		WH		
		1	0.6B	28
		1		
383.0				
Very soft, wet, grey, Silty Clay to Silty Clay Loam A-6	15.0	WH		
		WH	0.1E	29
		WH		
380.5				
Medium, wet, grey, Silt Loam to Silty Clay Loam A-4 w/ sand seam		WH		
		1	0.6S	25
		1		
378.0				
Medium, very moist, grey, Silty Clay to Silty Clay Loam A-6	20.0	WH		
		1	0.6B	29
		1		
		1		
		1	0.6B	29
		1		
373.0				
	25.0	1		

Description	DEPTH	BLOWS	Qu tsf	W%
Medium to soft, very moist, grey, Silty Clay A-6		1	0.5B	28
		1		
370.5				
Medium, very moist, brown mottled grey, Clay to Silty Clay A7-6		1		
		1	0.7B	30
		2		
	30.0	1		
		3	0.8B	22
		3		
365.5				
Very stiff, moist, brown, Clay to Clay Loam A-6		1		
		5	2.3B	18
		6		
363.0				
Stiff, moist to very moist, brown, Clay Loam to Silty Clay Loam A-4	35.0	1		
		3	1.1B	18
		3		
360.5				
Very dense, dry, brown, Sandstone		100/4"		
358.0				
Very dense, dry, grey, Sandstone with clay layers	40.0	100/1"		
Cored 39.6 to 44.6 feet 75% Recovery, 48% RQD				
353.0				
Very dense, dry, grey, Sandstone	45.0			
Cored 44.6 to 49.6 feet 97% Recovery, 53 % RQD				
348.0				
	50.0			

N-Std Pentr Test: 2" OD Sampler, 140# Hammer, 30" Fall (Type Fail. B-Bulge S-Shear E-Estimated P-Penetrometer)

Route: FAP 881 (US 45)

Date: 11/6/2007

Section: 33 BFY

County: Saline

Boring No: 1-S

Station: 617+08.73

Offset: 10' W CL

Ground Surface: 397.5 Ft

	DEPTH	BLOWS	Qu tsf	W%		DEPTH	BLOWS	Qu tsf	W%
Bottom of hole = 49.6 feet Free water observed at 27.5 ft Elevation referenced to USGS 1 FWK; Elevation = 398.1 feet To convert "N" values to "N60" values multiply by 1.25	55.0					80.0			
	60.0					85.0			
	65.0					90.0			
	70.0					95.0			
	75.0					100.0			

N-Std Pentr Test: 2" OD Sampler, 140# Hammer, 30" Fall (Type Fail. B-Bulge S-Shear E-Estimated P-Penetrometer)

ILLINOIS DEPARTMENT OF TRANSPORTATION
District Nine Materials

Bridge Foundation
Boring Log

FAP 881 (US 45) Over So Fork Saline River

Route: FAP 881 (US 45) Structure Number: 083-0011 Date: 11/8/2007

Section 33 BFY Bored By: R Moberly

County: Saline Location: 1.5 mi N of Stonefort Checked By: R Moberly

Boring No 2-S
Station 616+23.73
Offset 28' E CL
Ground Surface 388.8 Ft

Surf Wat Elev: 378.8
Ground Water Elevation
when Drilling
At Completion
At: Hrs:

Description	DEPTH	BLOWS	Qu tsf	W%
Medium, moist to very moist, brown, Silt Loam A-4				
		1		
		1	0.6S	24
		2		
384.3				
Stiff, moist, brown, Silt Loam to Silty Clay Loam A-4	5.0	2		
		3	1.5S	25
		3		
381.8				
Medium, very moist, grey, Silty Clay to Silty Clay Loam A-6		1		
		2	0.5B	26
		2		
379.3				
Very soft, wet, grey, Silty Clay to Silty Clay Loam A-6	10.0	WH		
		WH	0.2B	32
		1		
376.8				
Soft, very moist, brown mottled grey, Silty Clay A-6		WH		
		1	0.5B	25
		1		
374.3				
Medium, very moist, brown mottled grey, Silty Clay to Silty Clay Loam A-6	15.0	1		
		2	0.8B	26
		2		
		1		
		2	0.7B	24
		2		
369.3				
Medium, very moist, brown mottled grey, Clay to Silty Clay A-6	20.0	1		
		2	0.8B	24
		3		
366.3		2		
Dense, moist, brown and grey, Weathered Sandstone w/ clay layers		10		
		24		
363.8	25.0	10		

Description	DEPTH	BLOWS	Qu tsf	W%
Very dense, dry, brown, Sandstone		100/9"		
362.3				
Very dense, dry, grey, Sandstone				
Cored 26.5 to 31.5 feet				
100% Recovery, 70% RQD				
	30.0			
357.3				
Very dense, dry, grey, Sandstone				
Cored 31.5 to 36.5 feet				
100% Recovery, 76% RQD				
	35.0			
352.3				
Very dense, dry, grey, Sandstone				
Cored 36.5 to 41.5 feet				
100% Recovery, 77% RQD				
	40.0			
347.3				
Bottom of hole = 41.5 feet				
No free water observed				
Elevation referenced to USGS 1 FWK; Elevation = 398.1 feet	45.0			
To convert "N" values to "N60" values multiply by 1.25				
	50.0			

N-Std Pentr Test: 2" OD Sampler,140# Hammer, 30" Fall (Type Fail. B-Bulge S-Shear E-Estimated P-Penetrometer)

ILLINOIS DEPARTMENT OF TRANSPORTATION
District Nine Materials

Bridge Foundation Boring Log

FAP 881 (US 45) Over So Fork Saline River

Route: FAP 881 (US 45) Structure Number: 083-0011 Date: 11/7/2007

Section 33 BFY Bored By: R Moberly

County: Saline Location: 1.5 mi N of Stonefort Checked By: R Moberly

Boring No 3-S
Station 614+38.32
Offset 10' W CL
Ground Surface 397.5 Ft

Surf Wat Elev: 378.8
Ground Water Elevation
when Drilling
At Completion
At: Hrs:

Description	Elev.	DEPTH	BLOWS	Qu tsf	W%
Asphalt and Concrete	395.0				
Stiff, moist, brown, Silty Clay Loam A-4	393.0		2 2	1.1B	16
Stiff, moist to very moist, brown, Silty Clay Loam A-6	390.5	5.0	1 3 2	1.2B	22
Medium, very moist, grey mottled brown, Silty Clay to Silty Clay Loam A-6	388.0		1 2 3	0.8B	24
Soft, very moist, grey mottled brown, Silty Clay to Silty Clay Loam A-6	385.5	10.0	1 1 1	0.3B	26
Stiff, very moist, brown mottled grey, Silty Clay Loam A-6	383.0		1 3 3	1.2S	24
Medium, moist to very moist, brown, Silty Clay A-6	380.5	15.0	1 3 3	0.7B	21
Medium, moist, brown, Clay Loam to Silty Clay Loam A-6	379.0		1 4 10	0.9B	19
Medium, moist, brown, Weathered Sandstone	377.5				
Very dense, damp, brown, Sandstone with clay layers Cored 20.4 to 25.4 feet 40% Recovery, 22% RQD		20.0	9 100/5"		
		25.0			

Description	Elev.	DEPTH	BLOWS	Qu tsf	W%
Very dense, dry, brown, Sandstone and Clay Shale with clay layers Cored 25.4 to 30.4 feet 40% Recovery, 7% RQD	372.0				
		30.0			
Very dense, dry, grey, Sandstone Cored 30.4 to 35.4 feet 100% Recovery, 63% RQD	367.0				
		35.0			
	362.0				
Bottom of hole = 35.4 feet No free water observed Elevation referenced tio USGS 1 FWK; Elevation = 398.1 feet					
		40.0			
To convert "N" values to "N60" values multiply by 1.25					
		45.0			
		50.0			

N-Std Pentr Test: 2" OD Sampler,140# Hammer, 30" Fall (Type Fail. B-Bulge S-Shear E-Estimated P-Penetrometer)