

STRUCTURE GEOTECHNICAL REPORT

Proposed S.N. 081-P001

44th Avenue
Over Unnamed Tributary to Rock River
FAP Route 595
Section (142-1, 142)R
Rock Island County

PTB 155 - Item 026
IDOT Job No. D-92-003-06
Contract No. 64B83

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Exhibits:
1) Location Map
2) Boring Locations
3) Subsurface Data Profile
4) Boring Logs
5) Slope Stability Output

Project Description and Proposed Structure Information

The project consists of extending an existing 8'x5' double barrel reinforced concrete box culvert under 44th Avenue at station 200+88.31 to accommodate proposed widening of the roadway. The culvert will be extended 21'-0" on the north end and 23'-0" on the south end. The proposed length of the culvert including extensions will be 103'-0" out to out headwalls with a 1° right ahead skew. Proposed box dimensions of the extensions are 8'x5' at both ends. The work will need to be completed using stage construction. The proposed structure design will follow the LFD Design Specifications.

Soil retention during stage construction is not expected to be required. Proposed roadway over culvert will carry one lane of traffic in each direction including additional widths for turn lanes on both sides. 5 foot sidewalks will be located on each side of the roadway just outside the curbs. The maximum fill height is approximately 2'-2" above the culvert. The extensions will have 8'-6" long wingwalls to retain 1:2 (V:H) embankment slopes. On the USGS Coal Valley quadrangle map, the project area falls within Section 15 of Township 17 N and Range 1 W of the 4th PM. A location map is presented in Exhibit 1.

The project also requires separate SGR's to be prepared for SN 081-1118, SN 081-1120 and Retaining Wall Location-1.

Existing Information

The existing culvert is located at station 200+88.31 under 44th Avenue just south of IL Rte. 5. The 8'x5' double barrel culvert has a current length of 59'-0" measured along the centerline of the culvert with a 1° right ahead skew. The existing structure has a maximum fill height of ±2'-2". The roadway currently provides one lane of traffic in each direction. Stationing along the roadway increases from west to east.

Existing plans were not available for the structure.

Site Investigation, Subsurface Exploration and Generalized Subsurface Conditions

The project site is located in an urban area approximately one mile north of the Rock River. The tributary flows from north to south and merges with the Rock River. Existing buried telephone lines are present at the north end of the culvert within the limits of the extension.

The boring data was provided by IDOT District 2 personnel. Two borings drilled in August of 2011 are associated with the culvert location. Boring B-1b was drilled at station 200+58 approximately 40 feet right of the centerline and was terminated 16 feet below the ground surface. Boring B-2b was drilled at station 201+15 approximately 32 feet left of the centerline and was terminated 21 feet below the ground surface. Boring locations relative to the culvert location are shown in Exhibit 2.

At each location, a standard penetration test (SPT) was conducted every 2.5 feet according to AASHTO T 206 using a hollow stem auger drill. The borings show a rock layer with depths ranging from 15 to 20 feet below the surface with water being

encountered at a depths ranging from 14.5 to 17 feet. The borings show a majority of the soil below the culvert consisting of moist silty clay with blow count values ranging from 2 to 6 blows per feet and unconfined compressive strength values ranging from 0.3 to 1.1 tsf. Boring B-2b encountered a 3.5 ft thick sand layer right above the rock layer with blow count value of 13 blows per foot. The rock layer encountered at B-1b was sandstone, while the rock layer at B-2b was shale. Additional boring data can be found in boring logs attached in Exhibit 4 and Subsurface Data Profile in Exhibit 3.

Geotechnical Evaluations

Settlement: A preliminary settlement analysis was performed using an estimated service loading of 700 psf and the resulting maximum settlement is estimated to be 3.42" at the north extension and 1.17" at the south extension. If these settlements are considered intolerable by the structural designer, ground modifications will be necessary. We recommend two treatment options. One option is to provide standard concrete collars as per the IDOT Bridge Manual 2.3.11.4.1 at the joints between the existing box and the extensions. Another option is to remove the streambed soils beneath the proposed culvert extensions down to Elev. 559.7 at the north extension, and Elev. 562.1 at the south extension, and replace with Rockfill. Excavation depths are estimated to be up to 6'-1" which would require temporary shoring and dewatering. It is our understanding that Ciorba is considering another structural treatment option. It should be the structural designer's discretion to select the most appropriate option for counter measure of differential settlement, depending on the cost of each option.

Slope Stability: Slope Stability analyses were performed using a temporary excavation 1:1 slope model which produced a factor of safety over 3. The resulting maximum excavation required for construction is 9 feet.

Seismic Considerations: No problems affecting serviceability are anticipated following a seismic event.

Scour: The design scour elevations should correspond to the bottom of the toe wall elevations on upstream and downstream ends as shown in the table below. The 10-year velocity for the culvert with proposed extensions is 9.11 fps. The Hydraulic Report recommends Class A4 Riprap at each end.

Design Scour Elevation (ft.)	U.S. Invert	D.S. Invert
		563.76

Mining Activity: According to the Illinois State Geological Survey (ISGS) "Coal Mines in Illinois Viewer," there is an abandoned underground coal mine 0.33 miles north of the culvert location. However, no mining activity has been present at the proposed project location.

Box Culvert Evaluations and Design Recommendations

Culvert Barrel. According to IDOT Culvert Manual, proposed culvert extensions should match existing culvert design. The existing culvert is a cast-in-place culvert with cast-in-

place wingwalls and headwalls. It is recommended that the proposed culvert barrels be cast-in-place to match the existing culvert.

The bearing capacity at the base of the foundation was found to be more than adequate for resistance of the estimated bearing pressure. No ground modifications are expected to be required to the culvert base material.

Wingwalls. There are several feasible options for selection of wingwalls. The wall type selection should be performed considering but not limited to soil conditions, length and economy.

Per IDOT Culvert Manual Figure 3.1.5-2, based on the 1° skew, 1:2 (V:H) slope behind the wingwall and an estimated H_L of 6'-4", the wingwall length chart shows a length of 8'-6". The Standard wall lengths may need to be modified on the west sides due to the curved roadway at the intersection.

The horizontal cantilever wingwall is the most appropriate design choice according to the Culvert Manual. The IDOT Bridge Manual also states that horizontal cantilever shall be considered the most economical. The recommended active earth pressure as an equivalent fluid pressure on the wingwalls according to the proposed design is 48 pcf.

Cantilever sheet pile wall with a concrete cap is a feasible option. Given cohesive soils at the base, driving piles appears to be possible. However, this wall type is not economical for short walls.

Soldier pile walls are not an ideal option considering fill situation for the project. Additionally, this wall will require drainage behind it and is not economical for shorter walls.

Gabion baskets appear to be feasible and can be constructed easily and quickly with traditional labor equipment. This wall can be labor intensive and expensive if a nearby stone source is not available.

Construction Considerations

Cofferdams: In order to maintain a dry construction area, dewatering techniques may be necessary. However, based on hydraulic conditions, a temporary cofferdam is not expected to be necessary. Stream diversion could be utilized in order to facilitate construction of the box culvert.

Stage Construction: The culvert extensions will be constructed utilizing stage construction.

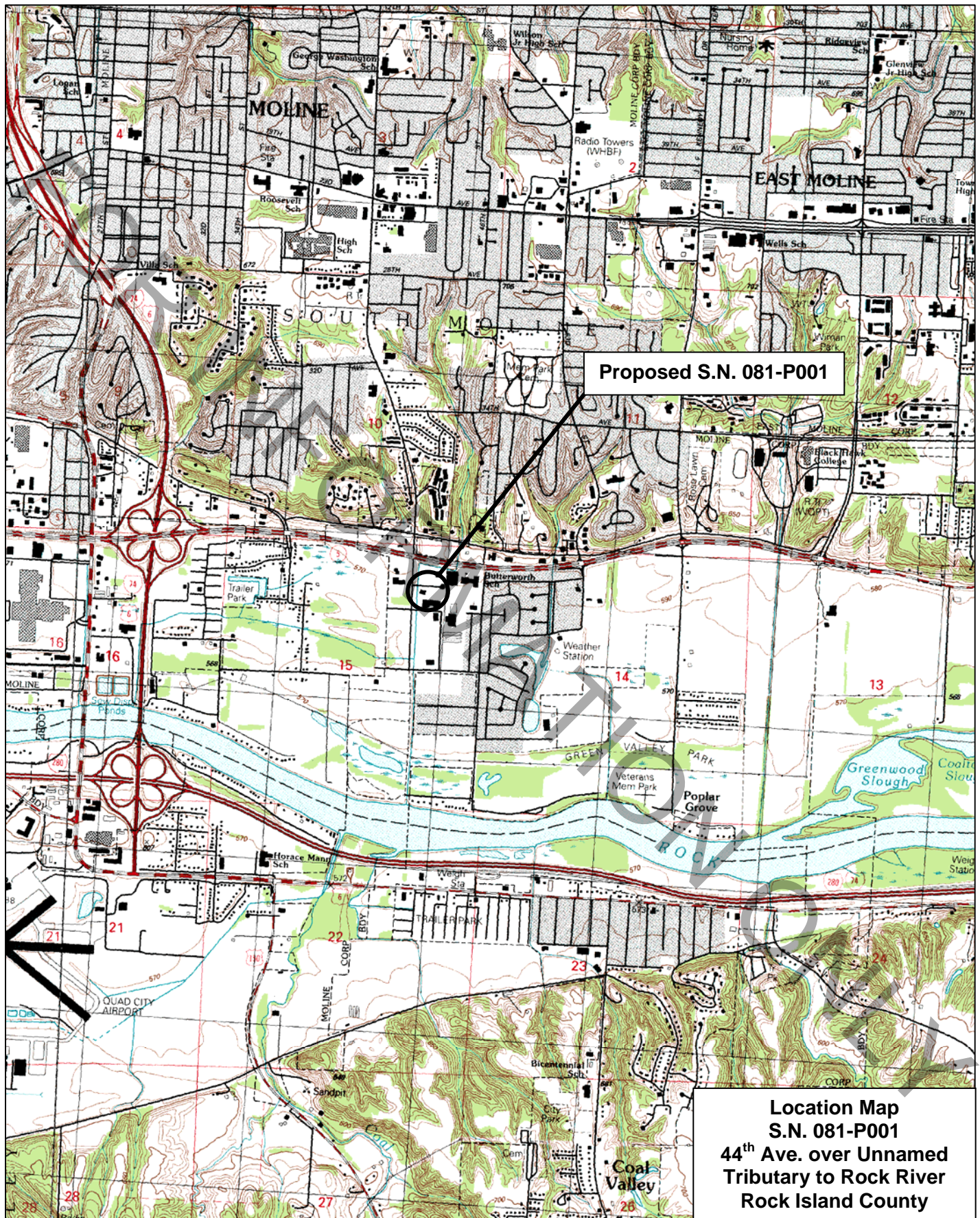
Temporary Soil Retention: It is expected that soil retention will not be required considering that existing wingwalls will not be removed. However, if existing wingwalls are required to be removed, then temporary sheet piling with a minimum section modulus of 9.9 in³ is a feasible option.

Excavation: A 1:1 temporary excavation slope for construction clearance has adequate factor of safety. The factor of safety is limited to 1:1 slopes and any steeper slopes should not be used.

Backfill: Backfill for the culvert shall be per the IDOT Standard Specifications.

Ground Improvement: No ground improvement is anticipated at this location.

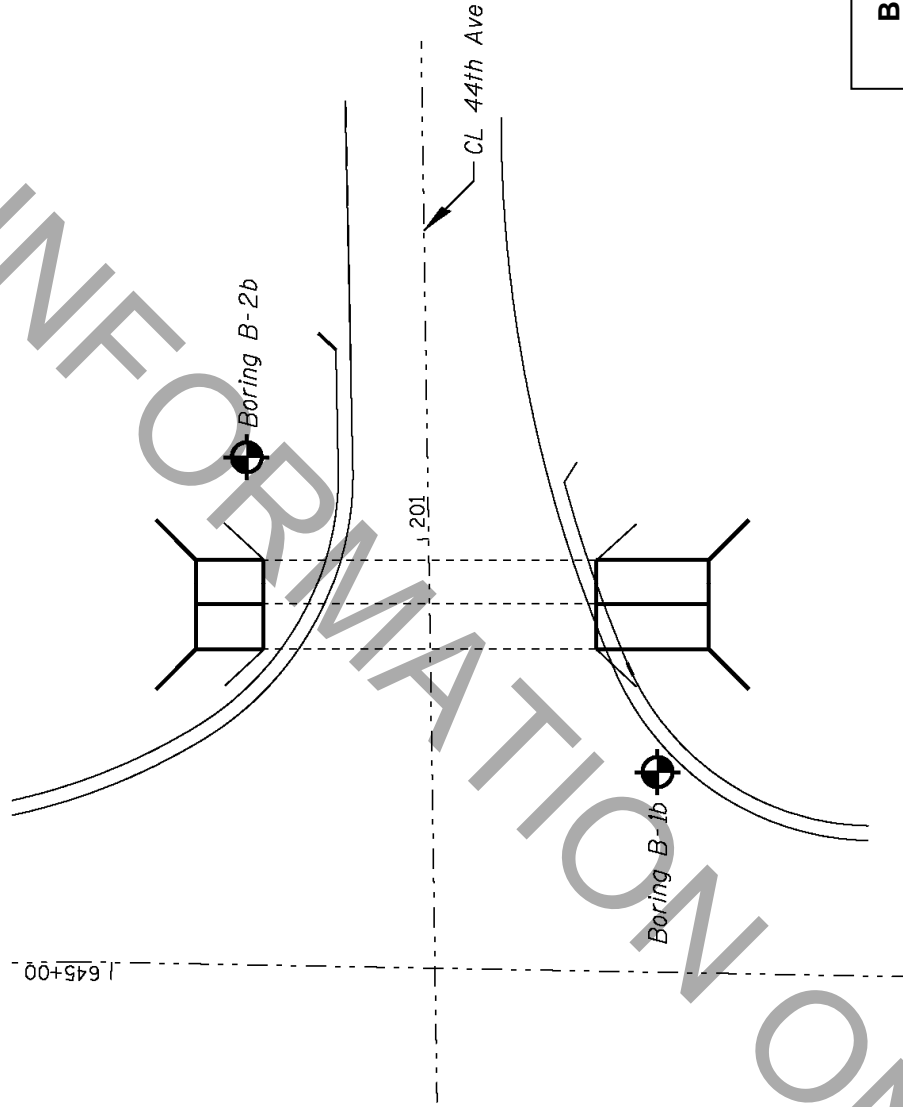
FOR INFORMATION ONLY



**Location Map
S.N. 081-P001
44th Ave. over Unnamed
Tributary to Rock River
Rock Island County**

Boring Locations
S.N. 081-P001
44th Ave. over Unnamed
Tributary to Rock River
Rock Island County

FOR INFORMATION ONLY



Boring B-1b



Station 200+58
Offset 40.00ft Rt CL

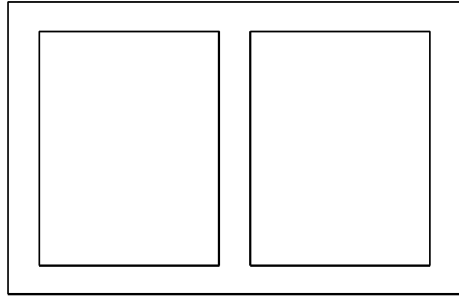
	<u>N</u>	<u>Qu</u>	<u>W</u>
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SILTY CLAY LOAM

0.5 P 17.0 %
5 0.5 P 27.0 %
4 0.5 B 33.0 %
6 0.9 B 27.0 %
5 0.9 B 35.0 %
2 0.7 B 56.0 %

SANDSTONE

100/6"  Groundwater elevation encounter while drilling.
 Groundwater elevation upon completion.



Boring B-2b

Station 201+15
Offset 32.00ft Lt CL

	<u>N</u>	<u>Qu</u>	<u>W</u>
569.40			
568.90			
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548.50			

SILTY CLAY LOAM



SAND

SHALE

9.0 %
4 1.1 P 23.0 %
2 0.4 B 32.0 %
4 0.5 B 28.0 %
2 0.3 P 22.0 %
3 0.6 B 44.0 %
3 0.6 B 58.0 %



Illinois Department of Transportation

Division of Highways
Illinois Department of Transportation/D-2

SOIL BORING LOG

Page 1 of 1

D92-004-06 Box Culvert, double 8' x 5', 44th Avenue, 100' E. of 41st Street, 500' S. of John Deere Road

Date 8/4/11

ROUTE FAP 595 DESCRIPTION _____ LOGGED BY W. Garza

SECTION 142-R LOCATION S. Moline Twp. - 15NE, SEC., TWP. 17N, RNG. 1W

COUNTY Rock Island DRILLING METHOD Hollow Stem Auger HAMMER TYPE CME-45 Automatic

STRUCT. NO. _____
Station 200+89

BORING NO. B-2b
Station 201+15
Offset 32.00ft Lt CL
Ground Surface Elev. 569.40 ft

D E P T H
B L O W S
U C S
M O I S T

Surface Water Elev. _____ ft
Stream Bed Elev. 92.00 ft
Groundwater Elev.:
First Encounter 552.4 ft ▽
Upon Completion 558.4 ft ▽
After _____ Hrs. _____ ft

D E P T H
B L O W S
U C S
M O I S T

Soil Description	Depth (ft)	Blows (/6")	UCS (tsf)	Moist (%)	Soil Description	Depth (ft)	Blows (/6")	UCS (tsf)	Moist (%)
DRY brown SILTY CLAY LOAM				9.0	VERY DENSE black SHALE with COAL (continued)	00/10'			
	567.40				End of Boring	548.40			
STIFF light brown SILTY CLAY LOAM		2							
	565.90	1	1.1	23.0					
		3	P						
SOFT dark gray SILTY LOAM		1							
	563.40	1	0.4	32.0					
		1	B						
SOFT gray LOAM		1							
	560.90	1	0.5	28.0					
		3	B						
SOFT light gray SANDY LOAM		0							
	558.40	0	0.3	22.0					
		2	P						
MEDIUM gray CLAY LOAM with 11% ORGANICS		0							
	555.90	1	0.6	44.0					
		2	B						
MEDIUM gray SILTY LOAM with 10% ORGANICS		0							
	552.90	1	0.6	58.0					
		2	B						
MEDIUM tan/gray SAND		4							
	550.90	4							
		9							
		26							

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)

BBS, from 137 (Rev. 8-99)

