

To: Michael J. Fowler, Pavement Management, Project Manager

From: Eric Denardo, Geotechnical Engineer via Callie Ewald, P.E., Senior Geotechnical Engineer

Date: September 26th, 2014

Subject: Essex-Richmond STP 2931(1)

1.0 INTRODUCTION

We have completed our geological and geotechnical investigation of a section of VT Route 117 that runs through the towns of Essex, Jericho, and Richmond, Vermont. As requested, an investigation was performed on a 6.845 mile section starting 1.227 miles east of the intersection of VT 2A, VT 15, and VT 117 and extending to the intersection of VT 117 and US RT 2 in Richmond. The proposed project includes the full-depth reclamation of existing pavement, placement of new pavement, and related shoulder and ditch work. Contained herein are the results of field sampling, testing, and laboratory analyses of soil.

2.0 FIELD INVESTIGATION

The field investigation was conducted between August 26th, and September 5th, 2014. Thirty-nine solid stem auger borings were performed in general accordance with AASHTO test method T 306, *Processing Auger Borings for Geotechnical Explorations*, to determine the subsurface profile to aid in the design and reconstruction of Route 117. A summary of the location of each boring is provided below in Table 2.1. The borings began at approximately MM 0.7 in Richmond, with a boring conducted approximately every 0.2 miles, alternating between the eastbound and westbound lanes.

Table 2.1: Boring Locations

Boring #	Town	Travel Lane	Mile Marker	Offset (ft)
B-101	Richmond	Westbound	0.7	-4.3
B-102	Richmond	Eastbound	0.55	5.5
B-103	Richmond	Westbound	0.35	-3.4
B-104	Richmond	Eastbound	0.15	4.0
B-105	Jericho	Westbound	2.85	-1.8
B-106	Jericho	Eastbound	2.65	0.2
B-107	Jericho	Westbound	2.45	-10.0
B-108	Jericho	Eastbound	2.25	12.2
B-109	Jericho	Westbound	2.05	-7.3
B-110	Jericho	Eastbound	1.85	10.9
B-111	Jericho	Westbound	1.65	-14.4

B-112	Jericho	Eastbound	1.45	2.0
B-113	Jericho	Westbound	1.25	-5.9
B-114	Jericho	Eastbound	1.05	0.2
B-115	Jericho	Westbound	0.85	-6.1
B-116	Jericho	Eastbound	0.65	12.3
B-117	Jericho	Westbound	0.45	-7.1
B-118	Jericho	Eastbound	0.25	11.3
B-119	Jericho	Westbound	0.05	-12.0
B-120	Essex	Eastbound	4.3	11.7
B-121	Essex	Westbound	4.1	-5.6
B-122	Essex	Eastbound	3.9	2.7
B-123	Essex	Westbound	3.7	-11.6
B-124	Essex	Eastbound	3.5	6.6
B-125	Essex	Westbound	3.3	-16.0
B-126	Essex	Eastbound	3.1	11.8
B-127	Essex	Westbound	2.9	-6.0
B-128	Essex	Eastbound	2.7	5.9
B-129	Essex	Westbound	2.5	-0.8
B-130A	Essex	Westbound	2.3	-9.3
B-130B	Essex	Eastbound	2.3	9.3
B-131A	Essex	Westbound	2.1	24.6
B-131B	Essex	Eastbound	2.1	-24.0
B-132	Essex	Eastbound	1.9	14.5
B-133	Essex	Westbound	1.7	-11.0
B-134	Essex	Eastbound	1.5	-7.4
B-135	Essex	Westbound	1.3	15.0
B-136	Essex	Eastbound	1.23	-1.7
P1	Richmond	Westbound	0	-11.4

All borings were performed using the CME 45C trailer mounted skid rig. A 4-inch auger flight was rotary drilled to 5 feet below the top of roadway at each location. The auger was then removed so a visual observation of the soil profile could be made. This method has proven to be an efficient and reasonably accurate way to view changes in strata and obtain samples off the auger flights.

For each boring, soil samples were visually identified and taken back to the Soils Laboratory for classification and testing.

3.0 FIELD AND LABORATORY TESTING

Laboratory tests were conducted on samples to evaluate grain size, moisture content, percent finer than No. 200 sieve, and liquid and plastic limits when applicable. This testing, along with field descriptions, was conducted on all of the soil samples and can be found on the attached drilling notes.

4.0 SOIL PROFILE

Review of the lab data, borings, and field testing revealed the following information about soil strata for the borings:

The thickness of bituminous pavement varied from 0.17 to 0.92 feet thick with an average thickness of 0.49 feet. The pavement overlies a granular material of sand, silt, and gravel. This layer of granular material extends to the bottom of the exploration or refusal. Materials exhibiting plastic properties were encountered in borings B-115, B-120, B-123, and B-128. This material was classified as silt or silty sand in the laboratory.

Refusal was encountered in one boring in the project. Boring B-136 located at approximately MM 1.23 in Essex had refusal at 2.1 feet on what appeared to be concrete, based on visual inspection. Further borings were completed 5 feet in each direction at the same offset to identify the extents of the concrete. No refusal was encountered in these additional borings. All other borings were completed to 5 feet with no refusal. An additional probe, P-1, was drilled at MM 0.0 in Richmond in an area where exposed bedrock was observed. No refusal was encountered to a depth of 5 feet. Groundwater was not encountered during drilling in any of the borings.

The attached drilling notes contain specific information regarding particle percentages, depths, and additional tests, if applicable. Also attached is a visual representation of the subsurface profile, interpreted by the borings, showing the various strata.

5.0 CONCLUSION

If you have any questions, or you would like to discuss this report, please contact us at (802) 828-2561. Typed Drilling Notes are attached and are available in the CADD design files: M:\Projects\10C268\Materials&Research.

Enclosures: Drilling Notes (4 Pages)
 Boring Profile Sheet
 Geotechnical Analysis Data File (2 Pages)

c: Electronic Read File
 Project File/CEE
 END



**STATE OF VERMONT
AGENCY OF TRANSPORTATION
CONSTRUCTION & MATERIALS BUREAU
GEOTECHNICAL ENGINEERING SECTION
DRILLING NOTES**

PROJECT NAME: ESSEX-RICHMOND PROJECT NUMBER: STP 2931(1) SITE: VT RT 117 DATE: 8/29/2014
 BORING CREW: Daigneault, Judkins TESTED BY: J. Touchette REVIEWED BY: E. Denardo

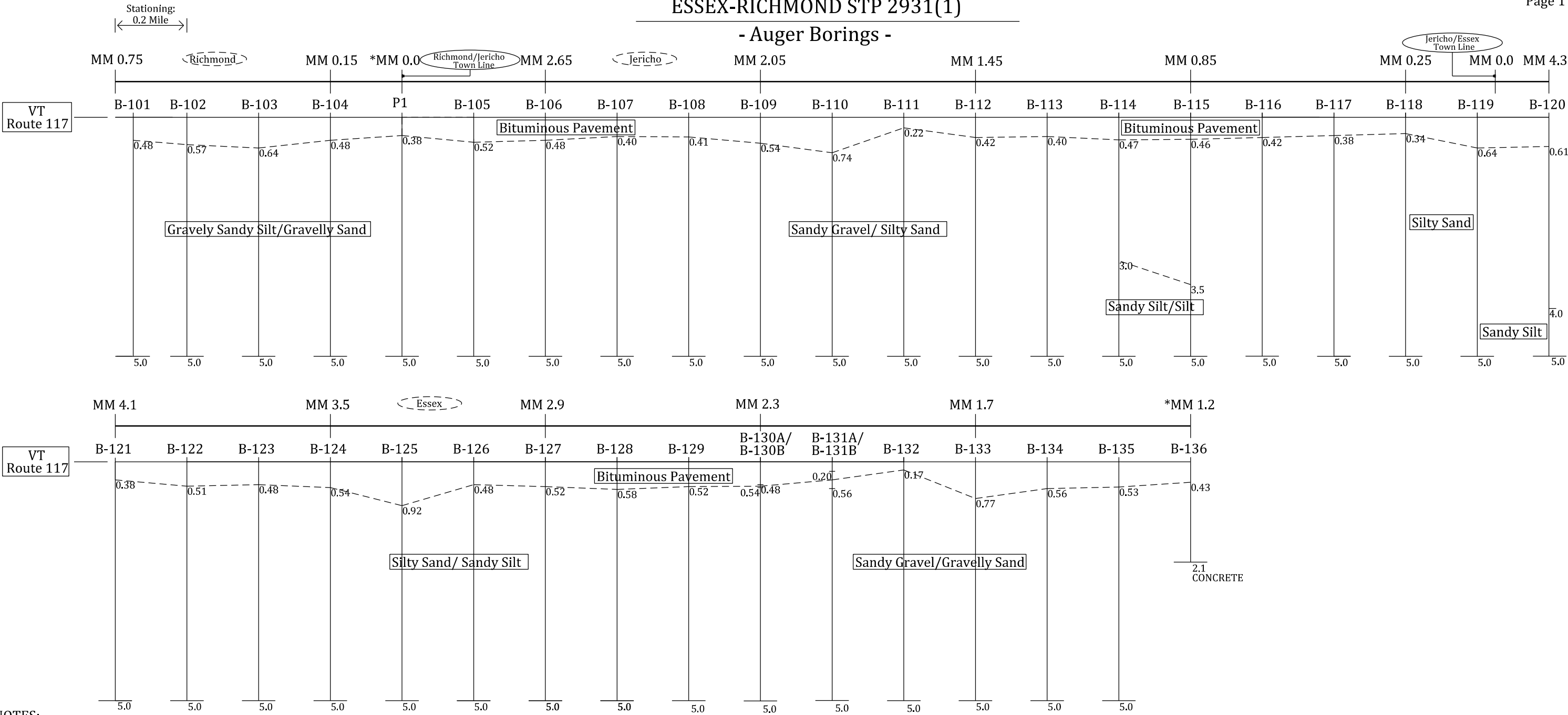
BORING No.	DATE DRILLED	Mile Marker (Town)	OFFSET (FT)	DEPTH (FT)	SAMPLE TYPE	FIELD DESCRIPTION	LABORATORY RESULTS							
						SOIL TYPE, COLOR, MOISTURE	% MOISTURE	AASHTO CLASS.	SOIL DES.	% GRAVEL	% SAND	% FINES	LIQUID LIMIT	PLASTIC LIMIT
B-101	8/27/14	0.7 (R)	-4.3	0.0-0.48	SSA	Asphalt								
				0.48-5.0		Si Gr Sa brn M	10.2	A-4	GrSaSi	21.7	30.1	48.2	NP	NP
B-102	8/27/14	0.55 (R)	5.5	0.0-0.57	SSA	Asphalt								
				0.57-5.0		Si Sa Gr brn M	3.4	A-1-b	SaGr	47.4	37.6	15.0	NP	NP
B-103	8/27/14	0.35 (R)	-3.4	0.0-0.64	SSA	Asphalt								
				0.64-5.0		Si Gr Sa brn M	7.9	A-2-4	SiGrSa	32.8	38.5	28.8	NP	NP
B-104	8/27/14	0.15 (R)	4.0	0.0-0.48	SSA	Asphalt								
				0.48-5.0		Si Gr Sa brn M	7.8	A-2-4	GrSaSi	23.0	51.7	25.3	NP	NP
B-105	8/27/14	2.85 (J)	-1.8	0.0-0.52	SSA	Asphalt								
				0.52-5.0		Si Gr Sa brn M	7.4	A-2-4	SiGrSa	26.5	51.7	21.8	NP	NP
B-106	8/27/14	2.65 (J)	0.2	0.0-0.48	SSA	Asphalt								
				0.48-5.0		Si Gr Sa brn M	4.3	A-1-b	SiGrSa	39.0	39.7	21.4	NP	NP
B-107	8/27/14	2.45 (J)	-10.0	0.0-0.4	SSA	Asphalt								
				0.4-5.0		Si Sa Gr brn M	4.8	A-1-b	SaGr	53.5	31.9	18.6	NP	NP
B-108	8/27/14	2.25 (J)	12.2	0.0-0.41	SSA	Asphalt								
				0.41-5.0		Si Sa Gr brn M	6.9	A-1-b	SaGr	44.7	37.1	18.3	NP	NP

BORING No.	DATE DRILLED	Mile Marker (Town)	OFFSET (FT)	DEPTH (FT)	SAMPLE TYPE	FIELD DESCRIPTION	LABORATORY RESULTS								
						SOIL TYPE, COLOR, MOISTURE	% MOISTURE	AASHTO CLASS.	SOIL DES.	% GRAVEL	% SAND	% FINES	LIQUID LIMIT	PLASTIC LIMIT	
B-109	8/27/14	2.05 (J)	-7.3	0.0-0.54	SSA	Asphalt									
				0.54-5.0		Gr Si Sa brn M	10.3	A-2-4	GrSiSa	24.2	45.8	30.0	NP	NP	
B-110	8/27/14	1.85 (J)	10.9	0.0-0.74	SSA	Asphalt									
				0.74-5.0		Gr Si Sa brn M	10.2	A-2-4	SiSa	15.0	63.7	21.2	NP	NP	
B-111	8/27/14	1.65 (J)	-14.4	0.0-0.22	SSA	Asphalt									
				0.22-5.0		Gr Si Sa brn M	5.5	A-2-4	SiSa	11.3	66.4	22.2	NP	NP	
B-112	8/27/14	1.45 (J)	2.0	0.0-0.42	SSA	Asphalt									
				0.42-5.0		Si Gr Sa brn M	4.2	A-1-b	SiGrSa	35.1	43.9	21.0	NP	NP	
B-113	8/27/14	1.25 (J)	-5.9	0.0-0.4	SSA	Asphalt									
				0.4-5.0		Si Sa Gr brn M	2.3	A-1-b	SiSaGr	43.4	36.2	20.4	NP	NP	
B-114	8/27/14	1.05 (J)	0.2	0.0-0.47	SSA	Asphalt									
				0.47-3.0		Si Gr Sa brn M	2.5	A-1-b	SaGr	48.0	36.0	15.9	NP	NP	
				3.0-5.0		Sa Si gry M	16.0	A-4	SaSi	1.1	26.0	72.9	NP	NP	
B-115	8/27/14	0.85 (J)	-6.1	0.0-0.46	SSA	Asphalt									
				0.46-3.5		Si Sa Gr brn M	2.8	A-1-b	SaGr	46.2	38.7	15.1	NP	NP	
				3.5-5.0		Sa Cl Si gry M	19.8	A-4	Si	3.8	13.0	83.1	27.0	21.0	
B-116	8/27/14	0.65 (J)	12.3	0.0-0.42	SSA	Asphalt									
				0.42-5.0		Si Gr Sa brn M	9.8	A-2-4	SiSa	17.9	54.3	27.8	NP	NP	
B-117	8/26/14	0.45 (J)	-7.1	0.0-0.38	SSA	Asphalt									
				0.38-5.0		Si Gr Sa brn M	8.9	A-2-4	SiGrSa	32.5	37.4	30.1	NP	NP	
B-118	8/26/14	0.25 (J)	11.3	0.0-0.34	SSA	Asphalt									
				0.34-5.0		Gr Si Sa brn M	8.7	A-2-4	SiSa	8.5	64.4	27.1	NP	NP	
B-119	8/26/14	0.05 (J)	-12.0	0.0-0.64	SSA	Asphalt									
				0.64-5.0		Si Gr Sa brn M	5.7	A-2-4	SiGrSa	27.5	49.0	23.5	NP	NP	

BORING No.	DATE DRILLED	Mile Marker (Town)	OFFSET (FT)	DEPTH (FT)	SAMPLE TYPE	FIELD DESCRIPTION	LABORATORY RESULTS								
						SOIL TYPE, COLOR, MOISTURE	% MOISTURE	AASHTO CLASS.	SOIL DES.	% GRAVEL	% SAND	% FINES	LIQUID LIMIT	PLASTIC LIMIT	
B-120	8/26/14	4.3 (E)	11.7	0.0-0.61	SSA	Asphalt									
				0.61-4.0		Si Sa brn M	4.1	A-1-b	SiSa	12.3	66.5	21.1	NP	NP	
				4.0-5.0		Sa Si Cl gry-brn M	16.1	A-4	SaSi	5.3	35.3	59.4	27.0	22.0	
B-121	8/26/14	4.1 (E)	-5.6	0.0-0.38	SSA	Asphalt									
				0.38-5.0		Gr Si Sa brn M	13.8	A-4	SaSi	4.9	33.1	62.1	NP	NP	
B-122	8/26/14	3.9 (E)	2.7	0.0-0.51	SSA	Asphalt									
				0.51-2.5		Gr Si Sa brn M	6.6	A-1-b	SiGrSa	29.9	46.3	23.8	NP	NP	
				2.5-5.0		Sa Si gry M	11.3	A-4	SiSa	14.3	47.2	38.4	NP	NP	
B-123	8/26/14	3.7 (E)	-11.6	0.0-0.48	SSA	Asphalt									
				0.48-5.0		Cl Si Sa brn M	12.3	A-4	SaSi	2.6	48.5	48.9	19.0	17.0	
B-124	8/26/14	3.5 (E)	6.6	0.0-0.54	SSA	Asphalt									
				0.54-5.0		Gr Si Sa Dm/Brn M	11.9	A-4	SiSa	10.5	47.7	41.8	NP	NP	
B-125	8/26/14	3.3 (E)	-16.0	0.0-0.92	SSA	Asphalt									
				0.92-5.0		Si Sa Gr red-brn M	1.9	A-1-b	SaGr	54.1	35	10.9	NP	NP	
B-126	8/26/14	3.1 (E)	11.8	0.0-0.48	SSA	Asphalt									
				0.48-5.0		Gr Si Sa brn M	4.8	A-2-4	Sa	14.7	65.8	19.5	NP	NP	
B-127	8/26/14	2.9 (E)	-6.0	0.0-0.52	SSA	Asphalt									
				0.52-5.0		Gr Si Sa brn M	4.2	A-1-b	SiSa	18	58.9	23.1	NP	NP	
B-128	8/26/14	2.7 (E)	5.9	0.0-0.58	SSA	Asphalt									
				0.58-5.0		Sa Si Dk/brn M	14	A-4	SaSi	3.4	39	57.6	16	14	
B-129	8/26/14	2.5 (E)	-0.8	0.0-0.52	SSA	Asphalt									
				0.52-5.0		Si Gr Sa gry M	1.3	A-1-a	SaGr	62.8	24.4	12.8	NP	NP	
B-130A	8/26/14	2.3 (E)	-9.3	0.0-0.54	SSA	Asphalt									
				0.54-5.0		Si Sa Gr gry M	1.5	A-1-a	SaGr	58.5	27.7	13.9	NP	NP	

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- Auger Borings -



- NOTES:
1. Lithologic descriptions are broad descriptions of soils encountered in the borings conducted for this report (B-101 through B-136). Lithologic conditions between borings may vary.
 2. See Auger Notes for individual bore hole information.
 3. Vertical depths in feet.
 4. Groundwater was not encountered during drilling.

*Not to horizontal scale