



P.O. Box 3411, Hagatna, Guam 96932
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 apdi@guam.net

BORING LOG

PROJECT: Rte 1 & 3 Intersection Improvements		BORING ID: EX-7A
SITE LOCATION: Rte 1 & 3 Intersection		START DATE / TIME: 12/3/2019 1353
DRILLER: George Ongebei	METHOD: Air-Rotary- 18" Tricone bit for surface casing & 12" Tricone bit for remainder of borehole	FINISH DATE / TIME: 12/12/2019 1330
LOGGED BY: Kaylyn Bautista		EST SURFACE ELEV: 288 above msl

COMMENTS: Borehole EX-7a was drilled in the detrital facies of the Mariana limestone, a friable to well-cemented coarse- to fine-grained generally porous and cavernous white detrital limestone, mostly of lagoonal origin. Lithologic samples were obtained by catching the drilling fluids carrying the cuttings being ejected from the annulus of the bore in a sieve. The sieve contents are rinsed to remove drilling fluid and then bagged and labeled. The lithologic samples are drill cuttings derived from the interaction of the drill bit and the solid, lithified strata. Cutting sizes are not a true indicator of the rock in-situ, but of the interaction of the drill bit and the strata. **Note:** 12 3/4" diameter stainless steel surface casing was installed on 12/4/2019 and grouted on 12/5/2019. FT/MN drilling rate is the actual average rate during drilling and doesn't account for drill rod changeouts, borehole swabbing or stoppages.

DATE	TIME	DEPTH (ft)	FT/MIN	NOTES	LITHOLOGY (DESCRIPTION OF CUTTINGS)
12/3/2019	1353	0	0.0	Began drilling operations. 18" diameter to 40' bgs for 12-3/4" surface casing installation.	
12/3/2019	1403	10	0.5	1403 Sample #1 0-10'	Moderately sorted 1" to 1/16" cemented limestone fragments, white to off-white; 5% recrystallization; 1% staining, red-orange; 1% fossil imprints (bivalve).
12/3/2019	1426	20	0.8	1428 Sample #2 10-20'	Well sorted 7/16" to 1/16" cemented limestone fragments, off-white; 1% recrystallization; 1% staining, yellow orange; 1% fossil imprints.
12/3/2019	1524	30	0.6	1524 Sample #3 20-30'	Moderately sorted 3/16" to 1/16" cemented limestone fragments, off-white; 5% recrystallization; 1% staining, orange; 5% fossil imprints.
12/3/2019	1546	40	0.6	1546 Sample #4 30-40' End of drilling for the day = 40'.	Well sorted 1/2" to 1/16" cemented limestone fragments, white to off-white; 10% recrystallization; 1% staining, orange to brown; 5% fossil imprints..
12/10/2019	1301	50	0.7	Began drilling operations at 38' with 12" diameter bit inside of surface casing. Grey foam. 1249 Sample #5 40-50'	Man-made conglomerate between 38 to 41 feet depth; 3/8" to 3/16" cemented limestone fragments, white to off-white.
12/10/2019	1318	60	0.9	1319 Sample #6 50-60'	Moderately sorted 9/16" to 1/16" cemented limestone fragments, white to off-white; 10% recrystallization; 20% capillary voids; 5% fossil imprints; 10% man-made (residual) conglomerate.
12/10/2019	1329	70	1.7	No sample 60-70'	No sample recovery.
12/10/2019	1336	80	0.6	1337 Sample #7 70-80' No sample 80-90'	Moderately sorted 9/16" to 1/16" cemented limestone fragments, off-white; 1% recrystallization; 5% fossil imprints; <1% fossilized gastropod pieces from voids; 5% man-made residual conglomerate fragments.
12/10/2019	1352	90	1.7	1358 Sample #8 90-100'	Moderately sorted 5/8" to 1/16" cemented limestone fragments, off-white; 1% recrystallization; 15% capillary voids; 5% fossil imprints; 1% man-made (residual)conglomerate.
12/10/2019	1358	100	1.7	1402 Sample #9 100-110'	Moderately sorted 5/8" to 1/16" cemented limestone fragments, off-white; "5% recrystallization; 5% capillary voids; 5% fossil imprints; 1% man-made (residual)conglomerate.



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12/10/2019	1406	110	1.3	1410 Sample #10 110-120'	Moderately sorted 9/16" to 1/16" cemented limestone fragments, white to off-white; 5% recrystallization; 1% capillary voids; 5% fossil imprints.
12/10/2019	1429	120	1.5	1431 Sample #11 120-130'	Well sorted 1/2" to 1/16" cemented limestone fragments, white to off-white; 1% recrystallization; 5% capillary voids; 1% fossil imprints.
12/10/2019	1439	130	2.2	1439 Sample #12 130-140'	Moderately sorted 1/2" to 1/16" cemented limestone fragments, white to off-white; 1% recrystallization; 5% staining, red orange; 10% recalcified fossil fragments from voids; 1% fossil imprints; <1% man-made (residual) conglomerate.
12/10/2019	1457	140	2.2	1503 Sample #13 140-150'	Moderately sorted 9/16" to 1/16" cemented limestone fragments, white to off-white; 5% recrystallization; 5% staining, orange brown; 5% fossil imprints.
12/10/2019	1509	150	1.3	1510 Sample #14 150-160'	Moderately sorted 5/8" to 1/16" cemented limestone fragments, white to off-white; 1% recrystallization; 5% staining, orange brown; <1% capillary voids.
12/10/2019	1521	160	1.4	1522 Sample #15 160-170' a	Moderately sorted 9/16" to 1/16" cemented limestone fragments, white to off-white; 1% recrystallization; 5% staining orange brown; 2% recalcified fossil fragments from voids (gastropod).
12/10/2019	1530	170	1.1	1529 Sample #16 160-170' b	Moderately sorted 9/16" to 1/16" cemented limestone fragments; white to off-white; 1% recrystallization; 5% staining, brown; <1% fossil imprints; recalcified fossil fragment from void (bivalve).
12/10/2019	1535	180	2.0	1539 Sample #17 170-180'	Moderately sorted 3/8" to 1/16" cemented limestone fragments, white to off-white; 10% recrystallization; 5% staining, orange; 5% fossil imprints.
12/10/2019	1547	190	0.8	1558 Sample #18 180-190' End of drilling for the day = 195'.	Moderately sorted 9/16" to 1/16" cemented limestone fragments, white to off-white; 30% recrystallization; 1% staining, orange brown; 1% capillary voids.
12/11/2019	0830	200	0.7	Began drilling operations at 195'. 0835 Sample #19 190-200'	Moderately sorted 9/16" to 1/16" cemented limestone fragments, white to off-white; 10% recrystallization; 5% staining, light orange.
12/11/2019	0841	210	0.9	0848 Sample #20 200-210'	Moderately sorted 1/2" to 1/16" cemented limestone fragments, white to off-white; 5% recrystallization; 5% staining, light orange; 1% fossil imprints.



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12/11/2019	0856	220	0.9	0900 Sample #21 210-220'	Moderately sorted 3/4" to 1/16" cemented limestone fragments, mostly white, to off-white; <1% recrystallization; 1% capillary voids.
12/11/2019	0908	230	0.8	0916 Sample #22 220-230'	Moderately sorted 1/2" to 1/16" cemented limestone fragments, mostly white, to off-white; 1% recrystallization; 5% staining yellow to light orange; 5% fossil imprints.
12/11/2019	0919	240	0.8	0923 Sample #23 230-240'	Well sorted 5/8" to 1/16" moderately cemented, slightly chalky (friable) limestone fragments, mostly white, to off-white; 10% recrystallization; 1% staining, orange-brown.
12/11/2019	0928	250	1.1	0937 Sample #24 240-250'	Moderately sorted 1/2" to 1/16" moderately cemented, slightly chalky (friable) limestone fragments, white to off-white; 5% recrystallization; 5% staining, yellow-orange-brown; 10% fossil imprints.
12/11/2019	0956	260	1.0	0959 Sample #25 250-260'	Moderately sorted 5/8" to 1/16" moderately cemented, slightly chalky (friable) limestone fragments, mostly white, to off-white; <1% staining, light orange
12/11/2019	1006	270	1.0	Heavy chatter; foam color = brown 1007 Sample #26 260-270'	Moderately sorted 1/2" to 1/16" moderately cemented, slightly chalky (friable) limestone fragments, mostly white, to off-white; <1% staining, light orange.
12/11/2019	1017	280	1.1	1017 Sample #27 270-280'	Moderately sorted 13/16" to 1/16" cemented limestone fragments, white to off-white; 10% staining, brown to dark brown; 35% staining, red orange.
12/11/2019	1023	290	1.7	1024 Sample #28 280-290'	Moderately sorted 5/8" to 1/16" moderately cemented limestone fragments, light brown; 10% staining dark brown; 15% staining red brown; 10% staining buff/light orange.
12/11/2019	1035	300	1.5	1038 Sample #29 290-300'	Poorly sorted 3/4" to 1/16" moderately cemented, slightly chalky (friable) limestone fragments, off-white; 5% staining, dark brown; 5% staining red brown-orange.
12/11/2019	1042	310	1.4	1047 Sample #30 300-310'	Poorly sorted 3/4" to 1/16" moderately cemented, slightly chalky (friable) limestone fragments, white to off-white; 1% staining, dark brown; 1% staining buff/light orange.
12/11/2019	1054	320	2.0	1056 Sample #31 310-320'	Poorly sorted 1/2" to <1/16" moderately cemented, slightly chalky (friable) limestone fragments; <1% staining, dark brown; <1% staining, buff to red-orange.



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12/11/2019	1059	330	2.0	1100 Sample #32 320-330'	Poorly sorted 5/8" to <1/16" moderately cemented, slightly chalky (friable) limestone fragments; <1% staining, dark brown; <1% staining, buff.
12/11/2019	1109	340	2.0	1111 Sample #33 330-340'	Poorly sorted 1/2" to <1/16" moderately cemented, slightly chalky (friable) limestone fragments; 1% staining, dark brown; 5% staining, buff.
12/11/2019	1117	350	1.3	1120 Sample #34 340-350'	Poorly sorted 3/4" to <1/16" moderately cemented, slightly chalky (friable) limestone fragments; 1% staining, dark brown; 1% staining, buff.
12/11/2019	1419	360	1.7	1421 Sample #35 350-360'	Moderately sorted 3/4" to 1/16" cemented limestone fragments, white to off-white; 1% recrystallization; 1% capillary voids; 5% staining, orange; <1% staining, dark brown.
12/11/2019	1424	370	2.0	1426 Sample #36 360-370'	Moderately sorted 1" to 1/16" cemented limestone fragments, white to off-white; 1% recrystallization; 5% staining, dark brown; 10% staining, buff to dark orange; <1% fossil imprints.
12/11/2019	1455	380	1.7	1456 Sample #37 370-380'	Moderately sorted 3/4" to 1/16" cemented limestone fragments; white to off-white; 1% recrystallization; 15% staining, buff to orange.
12/11/2019	1502	390	1.4	1504 Sample #38 380-390'	Moderately sorted 5/8" to 1/16" cemented limestone fragments, white to off-white; 1% recrystallization; 5% staining, buff to orange.
12/11/2019	1511	400	2.5	1514 Sample #39 390-400'	Moderately sorted 3/4" to 1/16" cemented limestone fragments, mostly white, to off-white; 5% recrystallization; 1% fossil imprints; 1% staining, orange.
12/11/2019	1517	410	1.7	1521 Sample #40 400-410'	Moderately sorted 5/8" to 1/16" cemented limestone fragments, mostly white; 10% recrystallization; 1% fossil imprints.
12/11/2019	1529	420	1.7	1531 Sample #41 410-420'	Moderately sorted 5/8" to 1/16" cemented limestone fragments, mostly white; 1% recrystallization; 1% capillary voids; 1% staining, dark brown.
12/11/2019	1536	430	1.4	1537 Sample #42 420-430' End of drilling for the day = 435'.	Moderately sorted 3/4" to 1/16" cemented limestone fragments, white to off-white; 1% recrystallization.



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12/12/2019	0902	440	1.3	Began drilling operations at 435' Sample #43 430-440'	Poorly sorted 1/2" to 1/16" cemented limestone fragments, white to off-white; 10% recrystallization; 10% staining, orange; 5% staining, dark brown; 1% fossil imprint (bivalve).
12/12/2019	0906	450	2.5	0910 Sample #44 440-450'	Moderately sorted 1/2" to 1/16" cemented limestone fragments, white to off-white; 15% recrystallization; 10% staining, dark orange; 5% fossil imprints.
12/12/2019	0916	460	1.4	0917 Sample #45 450-460'	Poorly sorted 3/4" to 1/16" cemented limestone fragments, white to off-white; 5% recrystallization; 1% staining, dark orange; 1% fossil imprints.
12/12/2019	0923	470	1.4	0925 Sample #46 460-470'	Moderately sorted 3/4" to 1/16" cemented limestone fragments, white to off-white; 1% recrystallization; 1% staining, orange; 1% staining, dark brown; 5% capillary voids.
12/12/2019	1043	480	1.7	1046 Sample #47 470-480'	Poorly sorted 1" to 1/16" cemented limestone fragments, white to off-white; 10% recrystallization; 15% staining, buff-orange; 15% capillary voids; 5% fossil imprints.
12/12/2019	1052	490	1.1	1054 Sample #48 480-490'	Moderately sorted 3/4" to 1/16" cemented limestone fragments, white to off-white; 5% recrystallization, 1% staining, brown; 5% fossil imprints.
12/12/2019	1111	500	1.7	1115 Sample #49 490-500'	Poorly sorted 1 1/4" to 1/16" cemented limestone fragments, white to off-white; 15% recrystallization; 1% staining, buff-orange; 20% capillary voids.
12/12/2019	1119	510	1.3	Foam height rose >2 feet, cuttings displaced; break to allow foam to settle	
12/12/2019	1301	520	2.5	1302 Sample #50 500-510' No 520-520' sample, cuttings displaced by upthrust of watery foam	Moderately sorted 3/4" to 1/16" cemented limestone fragments, white to off-white; 1% recrystallization; 1% staining, orange brown; 1% fossil imprints.
12/12/2019	1309	530	1.3	1308 Sample #51 520-530'	Moderately sorted 5/8" to 1/16" cemented limestone fragments, white to off-white; <1% recrystallization; 5% staining, orange brown; 10% fossil imprints.
12/12/2019	1326	540	1.4	1327 Sample #52 530-540'	Moderately sorted 5/8" to 1/16" cemented limestone fragments, white to off-white; <1% recrystallization; 5% staining, buff to orange; 1% fossil imprints.
12/12/2019	1330	545	1.3	1333 Sample #53 540-545' Terminal depth = 545'.	Moderately sorted 1 1/4" to 1/16" cemented limestone fragments, white to off-white; 1% staining, buff; 5% capillary voids; 10% fossil imprints.

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