

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
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 GEOTECHNICAL UNIT

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PREPARED BY:

CATLIN

ENGINEERS and SCIENTISTS
 WILMINGTON, NORTH CAROLINA

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION				GRADATION				TERMS AND DEFINITIONS				ABBREVIATIONS																																																			
<p>SOIL IS CONSIDERED TO BE THE UNCONSOLIDATED, SEMI-CONSOLIDATED OR WEATHERED EARTH MATERIALS WHICH CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER, AND WHICH YIELDS LESS THAN 100 BLOWS ACCORDING TO STANDARD PENETRATION TEST (ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM AND BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION AND OTHER PERTINENT FACTORS, SUCH AS, MINERALOGICAL COMPOSITION, ANGULARITY STRUCTURE, PLASTICITY, ETC. EXAMPLE: VERY STIFF, GRAY SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6.</p>				<p>WELL GRADED - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE UNIFORM - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. (ALSO POORLY GRADED) GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLES OF TWO OR MORE SIZES. ANGULARITY OF GRAINS THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS ARE DESIGNATED BY THE TERMS: ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.</p>				<p>ALLUVIUM (ALLUV.) - SOILS WHICH HAVE BEEN TRANSPORTED BY WATER. APPARENT DIP - THE DIP OF ROCK STRATA NOT PERPENDICULAR TO STRIKE. AQUIFER - A WATER BEARING FORMATION OR STRATA. AUGER REFUSAL (A.R.) - POINT AT WHICH POWER AUGERS WILL NOT PENETRATE. BEDDED - SOIL OR ROCK LYING IN A POSITION ESSENTIALLY PARALLEL. BEDROCK - ROCK OF RELATIVELY GREAT THICKNESS AND EXTENT IN ITS ORIGINAL LOCATION. CALCAREOUS (CALC.) - SOILS WHICH CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE. COHESIVE SOIL - A SOIL THAT WHEN UNCONFINED HAS CONSIDERABLE DRY STRENGTH AND SIGNIFICANT COHESION WHEN SUBMERGED. COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE. CORE RECOVERY (% REC.) - TOTAL LENGTH OF ALL ROCK DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE. COQUINA - A ROCK TYPE COMPOSED ESSENTIALLY OF MARINE SHELLS CEMENTED BY CALCIUM CARBONATE. DIKE - IGNEOUS ROCK INTRUSION WHICH IS NARROW COMPARED WITH ITS OTHER DIMENSIONS. DIP - THE ANGLE BETWEEN A BEDDING PLANE, JOINT PLANE OR FAULT PLANE AND THE HORIZONTAL, MEASURED PERPENDICULAR TO THE STRIKE. DUMPS - UNCOVERED DEPOSITS OF WASTE MATERIAL SUCH AS WOOD, MASONRY DEBRIS OR GARBAGE. FAULT - A BREAK IN THE CONTINUITY OF A BODY OF ROCK, ATTENDED BY A MOVEMENT ON EITHER OR BOTH SIDES OF THE BREAK. FINES - PORTIONS OF A SOIL FINER THAN NO. 200 U.S. STANDARD SIEVE. FISSILITY OR FISSILE - A PROPERTY OF SPLITTING EASILY ALONG CLOSELY SPACED PARALLEL PLANES. FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIAL. FLOODPLAIN - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM. FORMATION - A MAPPABLE UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD. FRACTURE - A CRACK LARGE ENOUGH TO BE VISIBLE TO THE UNAIDED EYE. FRIABLE - EASY TO BREAK OR CRUMBLE. GRANULAR MATERIAL - SOIL THAT WHEN UNCONFINED HAS LITTLE OR NO DRY STRENGTH AND HAS LITTLE OR NO COHESION WHEN SUBMERGED. GROUNDWATER (G.W.) - WATER THAT IS FREE TO MOVE THROUGH SOIL MASS UNDER THE INFLUENCE OF GRAVITY. GROUNDWATER LEVEL - LEVEL OF WATER WITH RESPECT TO EXISTING GROUND SURFACE. HARDPAN - A GENERAL TERM USED TO DESCRIBE A HARD CEMENTED SOIL LAYER WHICH DOES NOT SOFTEN WHEN WET. INDURATED - EARTH MATERIAL HARDENED BY HEAT, PRESSURE OR CEMENTATION. INTERBEDDED - ALTERNATING LENSES OR LAYERS OF SOIL AND/OR ROCK MATERIALS. JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED. LAMINATED - VERY THIN ALTERNATING LAYERS LESS THAN 2.5 CM. LAYER - SUBJECT MATERIAL GREATER THAN INCH IN THICKNESS. LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT. LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS. MARL - A NON-INDURATED, CALCAREOUS DEPOSIT OF CLAYS, SILTS AND SANDS, OFTEN CONTAINING SHELLS. MICACEOUS SOIL (MIC.) - A SOIL OR ROCK TYPE CONTAINING AN APPRECIABLE AMOUNT OF MICA. MUCK (MK.) - A HIGHLY ORGANIC SOIL OF VERY SOFT CONSISTENCY, GENERALLY FOUND ON TIDAL FLATS, LAKE OR STREAM FLOODPLAINS. PEAT (PT) - A FIBROUS MASS OF ORGANIC MATTER IN VARIOUS STAGES OF DECOMPOSITION. PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM. RESIDUAL SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK. ROCK - SEE LEGEND ROCK QUALITY DESIGNATION (R.Q.D.) - A MEASURE OF ROCK QUALITY DESCRIBED BY: TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 10 CM DIVIDED BY THE TOTAL LENGTH OF CORE RUN EXPRESSED AS A PERCENTAGE. SANITARY LANDFILLS - COMPACTED AND/OR COVERED LAYERS OF SOIL AND WASTE PRODUCTS. SAPROLITE (SAP.) - RESIDUAL SOIL WHICH RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK. SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLAIN. SILL - AN IGNEOUS SHEET OF INTRUSIVE ROCK WHOSE THICKNESS IS SLIGHT COMPARED TO ITS LATERAL EXTENT. SOME - PRESENCE OF 5% TO 30% OF SUBJECT MATERIAL. STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N OR B.P.F.) OF A 63.5 KG HAMMER FALLING 0.75 M REQUIRED TO PRODUCE A PENETRATION OF 0.3 M INTO SOIL WITH A 5 CM OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL PENETRATION RESISTANCE OF LESS THAN 2.5 CM WITH 50 BLOWS. STRIKE - THE DIRECTION OR BEARING OF A HORIZONTAL LINE IN THE PLANE OF AN INCLINED STRATUM, JOINT, FAULT OR OTHER STRUCTURAL PLANE. SUBGRADE - THE SOIL PREPARED TO SUPPORT A STRUCTURE OR A PAVEMENT SYSTEM. TOPSOIL (T.S.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER. TRACE - PRESENCE OF LESS THAN 5% OF SUBJECT MATERIAL.</p>				<p>BLDR. - BOULDER CL. - CLAY COB. - COBBLE CSE. - COARSE EST. - ESTIMATED F. - FINE FOSS. - FOSSILIFEROUS FRAC. - FRACTURED FRAG./S - FRAGMENTED/FRAGMENTS GR. - GRAVEL LL - LIQUID LIMIT LS. - LIMESTONE MOD. - MODERATELY MED. - MEDIUM NA - NOT ANALYZED W - MOISTURE CONTENT MOT. - MOTTLED OM - OPTIMUM MOISTURE ORG. - ORGANIC</p> <p>PL - PLASTIC LIMIT PI - PLASTICITY INDEX P - POROSITY R.C.P. - RECENT COASTAL PLAIN SD. - SAND SAT. - SATURATED SL. - SILT SLI. - SLIGHTLY G_s - SPECIFIC GRAVITY U₉₀ - UNCONFINED COMPRESSIVE STRENGTH γ - UNIT WEIGHT (WET UNIT WEIGHT) γ_d - DRY UNIT WEIGHT γ_{SAT} - SATURATED UNIT WEIGHT v - VOID RATIO W_{OH} - WEIGHT OF HAMMER</p>																																																			
<p>SOIL LEGEND AND AASHTO CLASSIFICATION</p> <table border="1"> <thead> <tr> <th>GENERAL CLASS.</th> <th>GRANULAR MATERIALS (≤ 35% PASSING #200)</th> <th>SILT-CLAY MATERIALS (> 35% PASSING #200)</th> <th>ORGANIC MATERIALS</th> </tr> </thead> <tbody> <tr> <td>GROUP CLASS.</td> <td>A-1, A-1-b, A-2, A-2-4, A-2-5, A-2-6, A-2-7</td> <td>A-4, A-5, A-6, A-7, A-7-5, A-7-6</td> <td>A-1, A-2, A-3, A-4, A-5, A-6, A-7</td> </tr> <tr> <td>SYMBOL</td> <td>(Diagrams showing various soil textures)</td> <td>(Diagrams showing various soil textures)</td> <td>(Diagrams showing various soil textures)</td> </tr> <tr> <td>% PASSING</td> <td>50 MX, 30 MX, 15 MX, 75 MX, 40 MX, 25 MX, 10 MX</td> <td>40 MX, 30 MX, 15 MX, 10 MX, 5 MX, 2 MX, 1 MX</td> <td>GRANULAR SOILS, SILT-CLAY SOILS, MUCK, PEAT</td> </tr> <tr> <td>LIQUID LIMIT PLASTIC INDEX</td> <td>6 MX, N.P.</td> <td>40 MX, 30 MX, 15 MX, 10 MX, 5 MX, 2 MX, 1 MX</td> <td>SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER, HIGHLY ORGANIC SOILS</td> </tr> <tr> <td>GROUP INDEX</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>USUAL TYPES OF MAJOR MATERIALS</td> <td>STONE FRAGS. GRAVEL AND SAND, FINE SAND, SILTY OR CLAYEY GRAVEL AND SAND</td> <td>SILTY SOILS, CLAYEY SOILS</td> <td></td> </tr> <tr> <td>GEN. RATING AS A SUBGRADE</td> <td>EXCELLENT TO GOOD</td> <td>FAIR TO POOR</td> <td>FAIR TO POOR, POOR, UNSUITABLE</td> </tr> </tbody> </table> <p>P.I. OF A-7-5 ≤ L.L. - 30 : P.I. OF A-7-6 > L.L. - 30</p>				GENERAL CLASS.	GRANULAR MATERIALS (≤ 35% PASSING #200)	SILT-CLAY MATERIALS (> 35% PASSING #200)	ORGANIC MATERIALS	GROUP CLASS.	A-1, A-1-b, A-2, A-2-4, A-2-5, A-2-6, A-2-7	A-4, A-5, A-6, A-7, A-7-5, A-7-6	A-1, A-2, A-3, A-4, A-5, A-6, A-7	SYMBOL	(Diagrams showing various soil textures)	(Diagrams showing various soil textures)	(Diagrams showing various soil textures)	% PASSING	50 MX, 30 MX, 15 MX, 75 MX, 40 MX, 25 MX, 10 MX	40 MX, 30 MX, 15 MX, 10 MX, 5 MX, 2 MX, 1 MX	GRANULAR SOILS, SILT-CLAY SOILS, MUCK, PEAT	LIQUID LIMIT PLASTIC INDEX	6 MX, N.P.	40 MX, 30 MX, 15 MX, 10 MX, 5 MX, 2 MX, 1 MX	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER, HIGHLY ORGANIC SOILS	GROUP INDEX	0	0	0	USUAL TYPES OF MAJOR MATERIALS	STONE FRAGS. GRAVEL AND SAND, FINE SAND, SILTY OR CLAYEY GRAVEL AND SAND	SILTY SOILS, CLAYEY SOILS		GEN. RATING AS A SUBGRADE	EXCELLENT TO GOOD	FAIR TO POOR	FAIR TO POOR, POOR, UNSUITABLE	<p>MINERALOGICAL COMPOSITION</p> <p>MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE.</p> <p>COMPRESSIBILITY</p> <p>SLIGHTLY COMPRESSIBLE LIQUID LIMIT LESS THAN 30 MODERATELY COMPRESSIBLE LIQUID LIMIT 31-50 HIGHLY COMPRESSIBLE LIQUID LIMIT GREATER THAN 50</p> <p>ROCK DESCRIPTION</p> <p>IN THE BROADEST MEANING, HARD ROCK IS CONSIDERED THAT MATERIAL WHICH CANNOT BE SAMPLED BY CONVENTIONAL SOIL SAMPLING TOOLS OR TECHNIQUES. THE BOUNDARY BETWEEN SOIL AND ROCK IS ARBITRARY. TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF "WEATHERED ROCK". FOR THE PURPOSE OF THIS INVESTIGATION, THESE MATERIALS ARE DIVIDED AS FOLLOWS:</p> <table border="1"> <thead> <tr> <th>WEATHERED ROCK (SWR) (HWR)</th> <th>SOFT WEATHERED ROCK</th> <th>HARD WEATHERED ROCK</th> <th>MATERIAL THAT CAN BE PENETRATED WITH SOME DIFFICULTY USING POWER AUGERS AND YIELDS SPT VALUES > 100 BLOWS BUT < SPT REFUSAL.</th> </tr> </thead> <tbody> <tr> <td>(Diagram)</td> <td>(Diagram)</td> <td>(Diagram)</td> <td>(Diagram)</td> </tr> <tr> <td></td> <td></td> <td></td> <td>MATERIAL THAT CAN BE PENETRATED WITH GREAT DIFFICULTY USING POWER AUGERS AND YIELDS SPT REFUSAL. *</td> </tr> <tr> <td>HARD ROCK (HR)</td> <td>CORED ROCK</td> <td>INFERRED ROCK LINE **</td> <td>MATERIAL THAT CANNOT BE PENETRATED BY POWER AUGERS, EXCEPT IN THIN LEDGES, AND REQUIRES ROCK CORING TOOLS FOR OBTAINING A SAMPLE.</td> </tr> </tbody> </table> <p>* SPT REFUSAL ≤ 2.5 CM OF PENETRATION PER 50 BLOWS. ** AN INFERRED ROCK LINE INDICATES THE LEVEL AT WHICH AUGERS COULD NO LONGER PENETRATE. THE HARD ROCK SYMBOL IS SHOWN WHEN ROCK IS CORED AND ONLY TO THAT DEPTH CORED. A DESCRIPTION OF ROCK IS GIVEN INCLUDING: CORE RECOVERY (REC.) - TOTAL LENGTH OF ROCK RECOVERED IN THE CORE BARREL DIVIDED BY THE TOTAL LENGTH OF THE CORE RUN TIMES 100%. ROCK QUALITY DESIGNATION (R.Q.D.) - TOTAL LENGTH OF SOUND ROCK SEGMENTS RECOVERED THAT ARE LONGER THAN OR EQUAL TO 0.1 DIVIDED BY THE TOTAL LENGTH OF THE CORE RUN TIMES 100%.</p>				WEATHERED ROCK (SWR) (HWR)	SOFT WEATHERED ROCK	HARD WEATHERED ROCK	MATERIAL THAT CAN BE PENETRATED WITH SOME DIFFICULTY USING POWER AUGERS AND YIELDS SPT VALUES > 100 BLOWS BUT < SPT REFUSAL.	(Diagram)	(Diagram)	(Diagram)	(Diagram)				MATERIAL THAT CAN BE PENETRATED WITH GREAT DIFFICULTY USING POWER AUGERS AND YIELDS SPT REFUSAL. *	HARD ROCK (HR)	CORED ROCK	INFERRED ROCK LINE **	MATERIAL THAT CANNOT BE PENETRATED BY POWER AUGERS, EXCEPT IN THIN LEDGES, AND REQUIRES ROCK CORING TOOLS FOR OBTAINING A SAMPLE.								
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