Testing Laboratory
Certificate #1552-01

NML

ISTRC NEW MIX LAB, L.L.C.
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Report of Test Results

Report To: Mr. Paul Hagy
NEESE MATERIALS
Address: 1919 S. Shiloh, Suite 312-LB2
Garland, TX 75042

Re: None Specified

Lab ID & Job Sequence: 09020001 A

Report Date: **February 11, 2009**
Date Received: February 2, 2009
Test Dates: February 2 to 6
Condition of Sample(s): intact

Particle Size Analysis*

Sample # & Type	Sample Description	Soil Textural Components [Reported Values are % of the whole]				Sand Distribution by Size Size reported as Mesh # & mm [Value Reported is % Retained]						
		Sand .05 -2.0	**Silt** .002 -05	**Clay** < .002	#10 **Gravel** 2.0 mm	**#18** v. Coarse 1.0 mm	**#35** Coarse 0.5 mm	**#60** Medium 0.25 mm	**#80** Fine 0.18 mm	**#100** Fine 0.15 mm	**#140** v. Fine 0.10 mm	**#270** v. Fine 0.05 mm
	USGA Recommended Specifications for Root Zone Mixes	≥ 89% of Total	≤ 5% ≤ 10% w/ #140 + #270	≤ 3%	≤ 3% ≤ 10% #10 + #18	≤ 10%	≥ 60% #35 + #60		≤ 20% #80 + #100		≤ 5% #140 + #270 & ≤ 10% w/ Silt + Clay	
1 S	**Arkansas Best #1 Bunker sand**	98.76	0.53	0.40	0.31	6.73	34.56	31.10	12.76	4.26	6.11	3.31

*ASTM F1632 & C136 - Reported values are the average of two test samples

Bunker Sand Analysis*

Sample # & Type	Sample Description	Moisture Content - predicted % in field -	Penetrometer Values [kg/cm²]			
			'Fluffed' Dry	'Settled' Dry	'Fluffed' Moist	'Settled' Moist
1 S	**Arkansas Best #1 Bunker sand**	5.96	2.75 to > 4.75	4.0 to > 4.75	3.85 to 4.75	> 4.75

*NML SOP, Moisture content prediction based on -50 cm tension table

Sample # & Type	Sample Description	Crusting	Color+			
			Munsell Color Name	Hue	Value	Chroma
1 S	**Arkansas Best #1 Bunker sand**	None	White	2.5Y	8	0

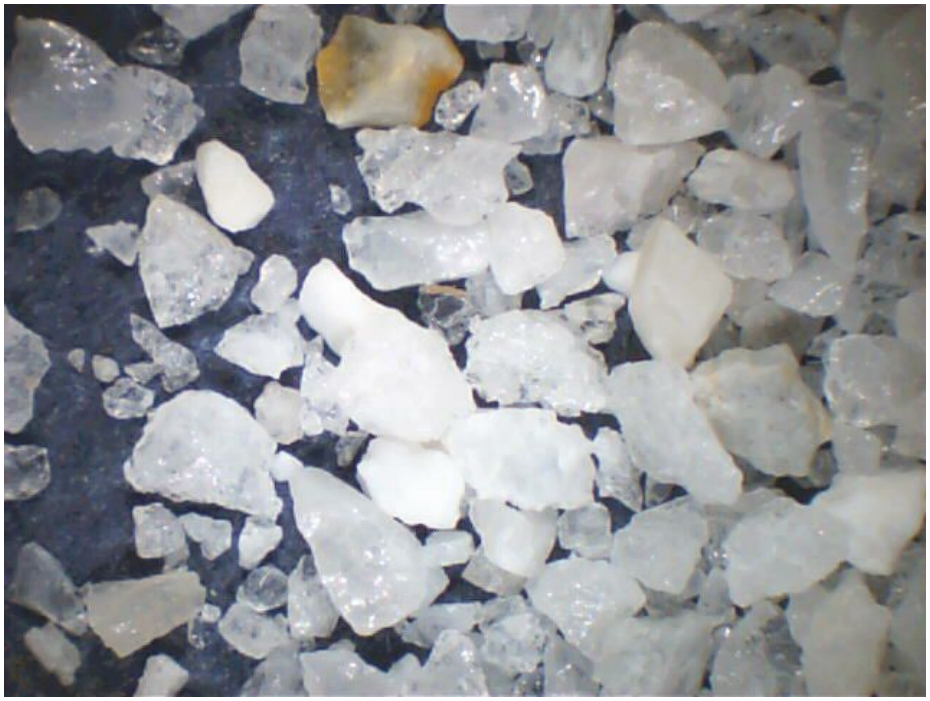
*NML SOP, +Munsell Soil Color Chart

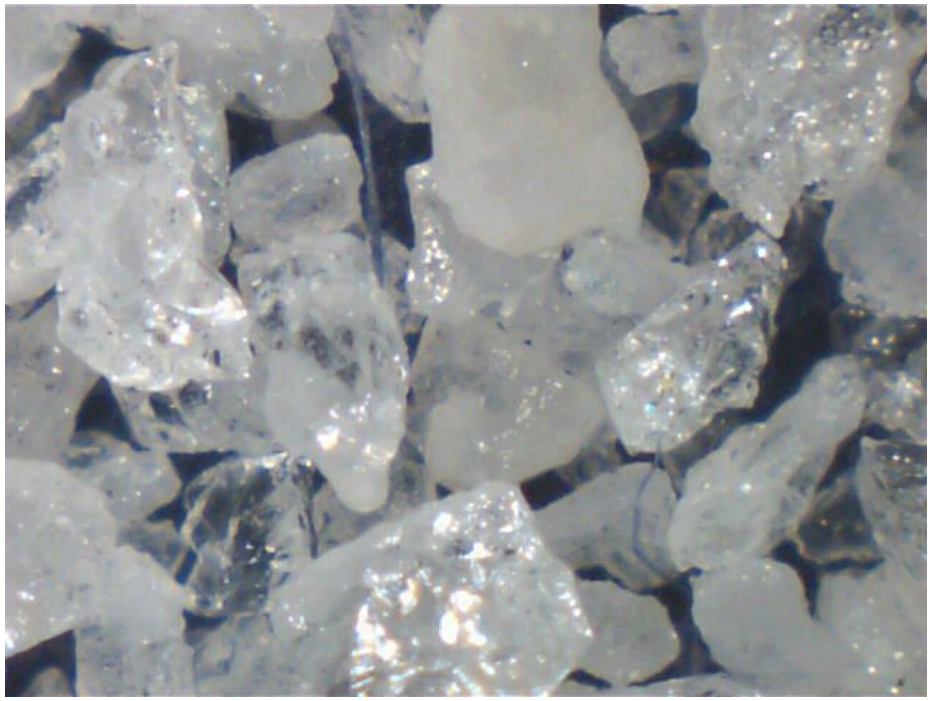
Particle Shape / Size Parameters / Ksat

Sample # & Type	Sample Description	Sphericity / Angularity*	D85* [mm]	Infiltration Rate** [in./hr. Ksat]
1 S	**Arkansas Best #1 Bunker sand**	Low to Medium Sphericity, Angular to Sub-Angular to Sub-Rounded	0.88	26.49

*ASTM F1632, **ASTM F1815

Sphericity & Angularity





Comments:

1. The Arkansas Best #1 Bunker sand sample was tested for its resistance to fried egg lies in both an oven dried and moist condition. The moist condition was approximately 5.96% water holding. The water holding predicts the moisture content of the sand in the field when affected by irrigation overspray, rain events, or syringing. Historically, penetrometer tests have been based on bunker sands solely in their dried condition. Our field research has found that a larger percentage of bunkers are played in a moist condition. Irrigation overspray is the primary source of water in bunker sands, but it is also a common practice to syringe bunkers – particularly during tournament play. Moisture firms up a sand increasing its resistance to golf ball burying. As the top inch dries out, the sand's properties will emulate the penetrometer values in the dry condition while the moist sand below the surface will emulate the penetrometer values in the moist condition providing resistance to burying.

2. A 1 kg gram sub-sample was split from the submitted material, its moisture content was increased to approximately 8.0%, and lab cores were prepared for the infiltration rate testing. The infiltration rate samples were collected after the compacted lab cores were subjected to a constant head of water for a period of 4 hours. The 26.49 inches of water per hour is very good. The sand has very good drainage and evaporation potential.

3. The USGA's particle size recommendations for golf green construction do not apply to bunker sands. The recommendations are relevant, however, in evaluating the layering impact a migrating bunker sand may have on a golf green. The D_{85} value is included for bridging calculations with drainage gravel.

4. The tested sand complied exceeded the USGA's recommended 5% maximum for the very fine sand particles retained on the 140 & 270 sieves. Layering could be an issue on areas of the collars and greens affected by migrating sand. It is possible that the fine sand could become an impediment to water and air permeability in the affected areas. It is possible to minimize any negative impact. It is our recommendation that the crew remove the migrating sand at least once a day. Regular grooming and light verticutting plus topdressing on a regular basis will dilute the sand that is not removed by the crew.

5. The Bunker Sand Analysis reports penetrometer ranges in a "Fluffed" and "Settled" condition in both dry and moist conditions. The dry fluffed condition simulates both: (a) the conditions of a well-worked (fluffed) base when allowed to dry out, and (b) the conditions on a “typical” bunker's face [about 1:1 pitch]. The moist fluffed condition simulates the conditions of a moist sand on a steep bunker face [approximately 3:1 pitch]. Shallower faces will emulate the settled moist property. The dry settled condition simulates the conditions in a bunker's flat areas when allowed to dry out. The moist settled condition simulates the moist base and typical bunker faces when moist. The first value in each range is the amount of pressure required to bury a golf ball to its midpoint. The second value in each range is the amount of pressure required to bury a golf ball past its midpoint. The range's midpoint should be used to evaluate the resistance of a sand in each predicted condition.

6. In its dry and moist settled conditions, the submitted sand, exceeded the penetrometer's maximum range of 4.75 kg/cm^2 of force to bury the ball past its midpoint. In both conditions, the sand is highly resistant to burying. In the dry fluffed condition, the range was 2.0 3.5 kg/cm^2 to bury to the midpoint, but it was highly resistant to burying past the midpoint. In the moist fluffed condition, the range was a very firm 3.85 to the penetrometer's maximum 4.75 kg/cm^2. The sand was highly resistant to burying in all tested conditions.

7. The following table places the test results into context with other sands. Manufactured sands A & C are commonly found in tournament venues.

Bunker Sand Analysis*

Sample # & Type	Sample Description	Shape Sphericity / Angularity*	Penetrometer Values [kg/cm^2]			
			'Fluffed' Dry	'Settled' Dry	'Fluffed' Moist	'Settled' Moist
11 S	**Manufactured Sand "A"**	Low to Medium to High Sphericity, Angular to Sub-Angular	2.2 to 3.0	3.0 to 4.0	2.75 to 4.0	> 4.75
12 S	**Manufactured Sand "B"**	Low to Medium to High Sphericity, Very Angular to Angular	3.0 to > 4.75	4.5 to > 4.75	4.25 to 4.75	> 4.75
13 S	**Blended Manu. Sands "A" & "C"**	Low to Medium to High Sphericity, Angular to Sub-Angular	2.8 to > 4.75	3.75 to > 4.75	2.75 to 3.75	> 4.75
1 S	**River Sand "D"**	Medium to High Sphericity, Sub-Angular to Sub-Rounded	1.75 to 2.5	2.75 to 4.5	2.0 to 2.5	> 4.75
2 S	**River Sand "E"**	Medium to High Sphericity, Sub-Angular to Sub-Rounded to Rounded	1.6 to 2.5	2.6 to 3.5	1.5 to 2.75	4.75 to > 4.75
8 S	**Contaminated River Sand "F"**	Medium to High Sphericity, Sub-Angular to Sub-Rounded to Rounded	3.0 to 3.75	3.6 to > 4.75	3.75 to 4.75	> 4.75

*ASTM F1632

[Note: The opinions expressed in this report are outside the scope of the A2LA certification in accordance with ISO/IEC 17025, as amended from time to time.]

Sincerely;

New Mix Lab

by:
Robert S. Oppold, COO
Quality Manager