Turf & Soil Diagnostics

January 30, 2018

Dennis Klene
Texas Sports Sands
702 Easy Street
Garland, TX 75042

RE: Sugar Creek Country Club - TSD File #18010059

Enclosed are the results of the sand and gravel samples received by our laboratory on 1/26/2018.

The Arkansas White TSS sample was tested as received and evaluated for use in sand bunkers. To evaluate bunker sands, we use the criteria published in a 1986 issue of Golf Course Management, and 1998 issue of the USGA Green Section Record.

The sample has a particle size distribution that meets the bunker sand guidelines, although it is finer graded than the USGA particle size recommendations for greens. This suggests it may present a layering risk from sand splashed from green-side bunkers onto coarser graded greens. The D85 of the sand is 0.79 mm. The sand particle shape is mostly angular. Generally angular sands are preferred for bunkers.

The sand is clean with little silt and clay present. As a result, there is no crusting of the sand after wetting and drying. This suggests that bunkers with this sand in place may not require significant raking after rainfall or irrigation events.

A minimum infiltration rate of 20 inches per hour is recommended for bunker sand. The infiltration rate is above this, so drainage should not be a problem initially.

To measure the potential of a sand to produce fried egg lies or buried balls, we measure the resistance of the sand to ball penetration using a penetrometer. Values of between 1.8 and 2.4 are considered acceptable, with values above 2.4 considered desirable. The sample has a penetrometer reading in the desirable range.

The 3/8 West Houston TSS has gradation and uniformity coefficient that meet the USGA recommendations for drainage gravel. The D15 of this sample is 4.6 mm, thus it will meet bridging requirements with sand or root zone mix that has D85 greater than or equal to 0.59 mm.

Based on the results of the submitted samples, the Arkansas White TSS and 3/8 West Houston TSS sample meet the sand/gravel compatibility requirements, and a choker layer should not be required.

If you have any questions or are in need of further assistance, please contact us. Samples are generally kept on the premises for 45 days after report date. Thank you for using Turf & Soil Diagnostics, Inc.

Sincerely,

Sam Ferro

Digitally signed by Sam Ferro
Date: 2018.01.30 16:27:23 -05'00'

Sam Ferro
President

Turf & Soil Diagnostics
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Turf & Soil Diagnostics

ACCREDITED TESTING Cert #0797.01

Texas Sports Sands
Paul Hagy
702 Easy St
Garland, TX 75042

Date Received Jan-26-2018
Date Reported Jan-30-2018
Facility Sugar Creek Country Club

Particle Size Evaluation*

							% Retained mm (US sieve)					
Lab ID#	**Sample Name**	**% Sand 2.0 - 0.05 mm**	**% Silt 0.05-0.002mm**	**% Clay < 0.002mm**	**Gravel 4.0 (5)**	**Gravel 2.0 (10)**	**V. Coarse 1.0 (18)**	**Coarse 0.5 (35)**	**Medium 0.25 (60)**	**Fine 0.15 (100)**	**Fine 0.10 (140)**	**V. Fine 0.05 (270)**
18010059-1	Arkansas White TSS	98.4	< 1.0	< 1.0	0.0	0.6	2.8	34.3	34.9	17.4	6.6	2.8
USGA Recommendations for Greens		≥ 92%	≤ 5% Silt	≤ 3% Clay	≤ 3% Gravel ≤ 10% Combined			≥ 60% Combined		≤ 20%	≤ 5%***	
Bunker Sand Guidelines[1]			≤ 3%		≤ 2%		≤ 15%	78 - 100%				≤ 5%

[1] From Golf Course Management 54:64-70, 1986 [2] From USGA Green Section Record 36:9-12, 1998

Lab ID#	**Sample Name**	**Uniformity Coefficient Cu**	**D15 mm**	**D50 mm**	**D85 mm**	**Shape Angularity**	**Shape Sphericity**	**USDA Textural Classification**	**Acid Reaction**	**Infiltration Rate** in/hr**	**Infiltration Rate** cm/hr**	**Bulk Density g/cc**
18010059-1	Arkansas White TSS	3.2	0.17	0.39	0.79	Angular to Sub-Angular	Medium to Low	Sand	None	37.3	94.7	1.48
Bunker Sand Guidelines[2]		-	-	-	-	-	-	-	-	> 20	> 50	-

*ASTM F1632 Method A & Determination of Size Factors SOP **ASTM F1815 30cm Tension

***Maximum of 10% combined on Very Fine Sand, Silt, and Clay fractions.

Samples were tested as received and comments pertain only to the samples shown.

This report may not be reproduced in part, but only in full.

Sample condition upon receipt was normal.

Samples were received without a transmittal letter.

Reviewed by Sam Ferro

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Bunker Sand Evaluation

Lab ID#	Sample Name	Dry Color	Wet Color	Penetrometer Value kg/cm^2
18010059-1	Arkansas White TSS	White w/ Black Specks	5Y 8/1 White w/ Black Specks	4.5

Lab ID#	Sample Name	Shape Angularity	Shape Sphericity	Crusting	Set-Up
18010059-1	Arkansas White TSS	Angular to Sub-Angular	Medium to Low	None	None

Bunker SOP

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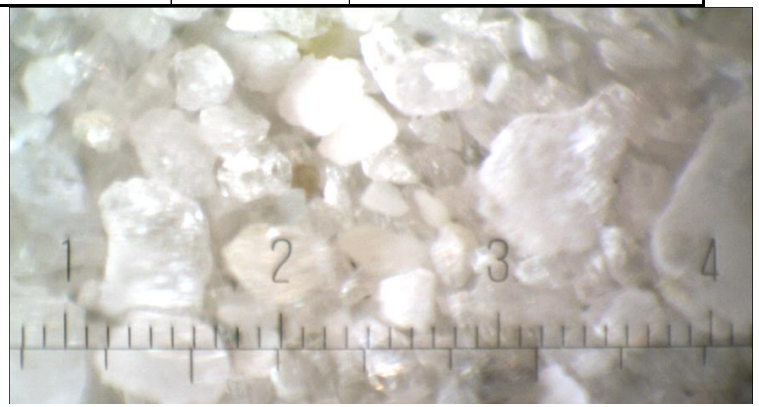

Photomicrograph of Lab ID 18010059-1 Arkansas White TSS.

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Gravel Distribution Analysis*

		% Passing (US sieve) mm								
Lab ID#	**Sample Name**	**1/2 inch 12.5 mm**	**3/8 inch 9.5 mm**	**1/4 inch 6.3 mm**	**No. 5 4.0 mm**	**No. 7 2.8 mm**	**No. 10 2.0 mm**	**No. 18 1.0 mm**	**Uniformity Coefficient**	**D15 mm**
18010059-3	3/8 West Houston TSS	100.0	99.6	41.0	2.6	0.2	0.1	0.1	1.9	4.6
USGA Recommendations		100	-	-	-	-	≤ 10	≤ 5	< 3.0	See Below

USGA Gravel/Sand compatibility: D15 Gravel < 8 x D85 Sand (Bridging) & D15 Gravel > 5 x D15 Sand (Permeability)

*ASTM Method C136 & Determination of Size Factors SOP
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