



Turf & Soil Diagnostics

December 7, 2017

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

TSD File #17120010

Enclosed are the laboratory results of the Bells Savoy Tee Sand sample and the subsequently prepared lab mix. These samples were tested according to the USGA protocols. These results are being compared to the 2004 USGA recommendations for putting green construction, which are often used in the evaluation of tee mix.

The particle size distribution of the Bells Savoy Tee Sand is finer graded than USGA recommendations for greens, which should not necessarily disqualify the material from use in tees. There is a minimal amount of silt and clay present. The sand fraction is uniform in particle size, with most of the sand in the medium and fine sand size fractions.

As requested, we prepared a 90/10 mix by volume using the Bells Savoy Tee Sand and the previously submitted $\frac{1}{4}$ Command compost sample.

The USGA performance testing indicates that the Bells Savoy Tee Sand and the Lab-made 90/10 Mix with $\frac{1}{4}$ Command both have a saturated hydraulic conductivity (infiltration rate) that meets USGA recommendations. The total porosity of the mix is acceptable.

Total porosity is comprised of air-filled (aeration) and water-filled (capillary) pore space. Aeration porosity is made up of relatively large pores that conduct water under saturated conditions. When drained, they are filled with air which provides the oxygen that is necessary for root growth. Capillary porosity is made up of small pores that hold water against the force of gravity, retaining much of it for plant use. Ideally, a root zone mix would contain a nearly equal distribution of air and water filled pore space after free drainage.

The aeration porosity is low and the capillary porosity is high compared to USGA recommendations for greens. The results suggest that this mix should have good drainage and the potential for low aeration and high water retention after free drainage.

The performance of a tee mix can also be influenced by construction method, including the absence or presence of drainage, drain spacing, and depth of root zone mix.

If you have any questions or need further assistance, please do not hesitate to contact us. Samples are generally kept on the premises for 45 days after report date. Thank you for using Turf & Soil Diagnostics, Inc.

Sincerely,

Duane K. Otto

Duane K. Otto
Vice President



Turf & Soil Diagnostics



Texas Sports Sands
 Paul Hagy
 702 Easy Street
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Date Received Dec-04-2017
 Date Reported Dec-07-2017
 Facility Product Development

Particle Size Evaluation*

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)	% Retained mm (US sieve)				
							V. Coarse 1.0 (18)	Coarse 0.5 (35)	Medium 0.25 (60)	Fine 0.15 (100)	V. Fine 0.05 (270)
17120010-1	Bells Savoy Tee Sand	98.7	1.0	< 1.0	0.0	0.1	0.6	8.0	48.4	33.6	8.5
USGA Recommendations for Greens		≥ 92%	≤ 5%	≤ 3%	≤ 3% Gravel ≤ 10% Combined		≥ 60% Combined		≤ 20%	≤ 5%***	

Lab ID#	Sample Name	Uniformity Coefficient Cu	D15 mm	D50 mm	D85 mm	Shape Angularity	Shape Sphericity	USDA Textural Classification	Acid Reaction	pH [‡] 1:1	% Organic Matter Dry Wt.**
17120010-1	Bells Savoy Tee Sand	2.1	0.16	0.28	0.46	Sub-Angular to Well Rounded	Medium to High	Sand	Moderate		

*ASTM F1632 Method A & Determination of Size Factors SOP ‡ASTM D4972 w/ CaCl₂ **ASTM F1647 Method A

***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 Duane K. Otto



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Date Received Dec-4-2017
 Date Reported Dec-7-2017
 Facility Product Development

30 cm USGA Physical Evaluation*

Lab ID#	Sample Name	Infiltration Rate* in/hr	Infiltration Rate* cm/hr	Particle Density** g/cc	Bulk Density g/cc	Total %	Porosity Water-filled %	Air-filled %	Degree of Saturation %
17120010-1	Bells Savoy Tee Sand	21.3	54.0		1.58				
17120010-2	Lab-made 90/10 Mix with 1/4 Command	10.3	26.1	2.63	1.56	40.4	32.8	7.7	81
USGA Recommendations		≥ 6	≥ 15	-	-	35 - 55	15 - 25	15 - 30	-

* Saturated Hydraulic Conductivity (K-SAT)

Air-filled - noncapillary. Water-filled - capillary

Lab ID#	Sample Name	Sand Parameters		Peat Parameters		pH [‡] 1:1	Elec. Cond. mS / cm 1:1	Organic Matter % Dry Wt. ^{‡‡}	Equivalent Pounds of Command per ton of Sand
		Bulk Weight LBS / FT ³	Moisture % Dry Wt.	Bulk Weight LBS / FT ³	Moisture % Wet Wt.				
17120010-1	Bells Savoy Tee Sand								
17120010-2	Lab-made 90/10 Mix with 1/4 Command		2.8		41.6	7.4		1.12	115
USGA Recommendations for Greens								-	

*ASTM F1815

**SSSA, Methods of Soil Analysis

‡ ASTM D4972 w/ CaCl₂

‡‡ ASTM F1647 Method A

The lab-made mixes were prepared using the Bells Savoy Tee Sand sample (Lab ID #17120010-1) and 1/4 Command sample (Lab ID #17110064-2).

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Sample condition upon receipt was normal.

Samples were received without a transmittal letter.

Duane K. Otto

Reviewed by _____