

**YOUR  
ISTRC SYSTEM<sup>TM</sup>  
REPORT**

**ALL STAR  
GOLF CLUB**

September 12, 2002  
North Course: Green #13  
South Course: Greens 8 & 16  
Lab ID: Sample Report (Full Report)

Presented To:

**Mr. John Doe, GCS**

1530 East Kansas City Road  
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Olathe, Kansas 66061



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September 12, 2002

Mr. John Doe, GCS  
ALL STAR GOLF CLUB  
1530 E. Kansas City Road  
Olathe, KS 66061

re: Lab ID: Sample Report; ISTRC SYSTEM™ BenchMarking of undisturbed core samples from **The North Course:** Green #13 [center] – 1<sup>st</sup> & 2<sup>nd</sup> tiers; and **The South Course:** Green #8 [back center]; and Green #16 [center].

Dear John;

We have completed the ISTRC SYSTEM™ BenchMarking of the undisturbed core samples taken from **The North Course:** Green #13 [center] – 1<sup>st</sup> & 2<sup>nd</sup> tiers; and **The South Course:** Green #8 [back center]; and Green #16 [center]. The section references in this report are to our **ISTRC's Guidebook**.

### **I. CURRENT CONDITIONS** (per Information Supplied to ISTRC)

The All Star Golf Club features two 18-hole golf courses – The South & North Courses. We understand the South Course is the older of the two courses, which was built in 1991 while the North Course was built in 1993. The greens were constructed according to USGA recommended specifications using what appears to be a coarse sand/peat blend. The primary objectives for testing are to monitor any changes in the physical properties and/or particle distribution since 2000 & 2001 and monitor the effectiveness of the current maintenance program.

The current aerification program consists of hollow coring twice per year using ½ inch hollow tines to a depth of 3 to 4 inches and supplemented with 3 to 4 hollow quad aerifications. The greens are also lightly topdressed on a weekly basis and needle tined periodically during the season. The Graden verticutter is also used in conjunction with aerification to help manage the accumulation of thatch.

Overall, the greens continue to exhibit classic symptoms associated with excess organic matter & thatch. The distinct variation in the infiltration rates highlights the impact of the layers to impede water movement through the profile. The layering in Green #13 (North) and Green #8 (South) is considerably more dense & compacted than Green #16 (South) and is evident in the current time lapse photos and tested bulk densities.

Table 1 is an updated evaluation of the greens' turf quality and micro-environments [growing conditions]. Through our work we have found that the numerical ratings within Table 1 are an essential part of the testing because they provide a correlation between the tested physical properties and your visual interpretation of each green.

**Table 1.** **Scale: 1 [bad] – 5 [moderate] – 10 [excellent]**

	<b>Turf Quality (Current)</b>	<b>Turf Quality (Sept. 2000)</b>	<b>Air Movement</b>	<b>Direct Sunlight</b>	<b>Comments</b>
<b><u>North Course</u> Green #13</b>	8-9	8-9	5	7	Situated in a bowl
<b><u>South Course</u> Green #8</b>	7	7	7	10	Collection area in back right location
<b>Green #16</b>	8	8	10	10	Wide open

## II. DISCUSSION OF LAB RESULTS

The laboratory data can be found in its entirety at the end of this report. There are two sets of data. The first set of data consists of the physical evaluation, the evaluation of the root systems, and the measurement of the organic matter by layer.

The second set of data contains the textural & particle size analysis. The textural analysis measures the percentage of gravel, sand, silt and clay comprising the soil. The particle size distribution analyzes the size distribution of the sand.

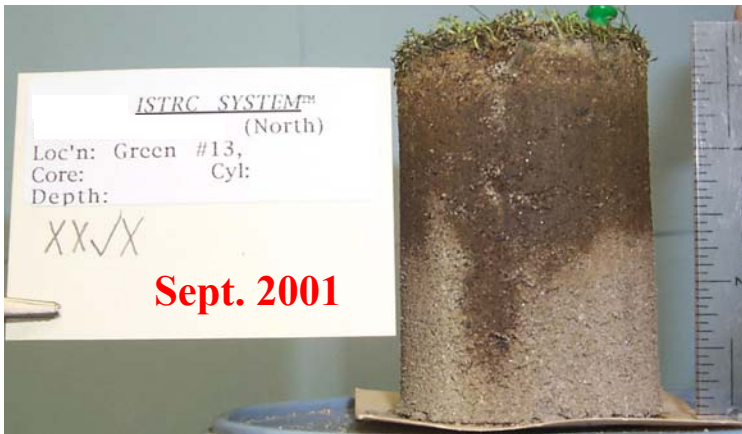
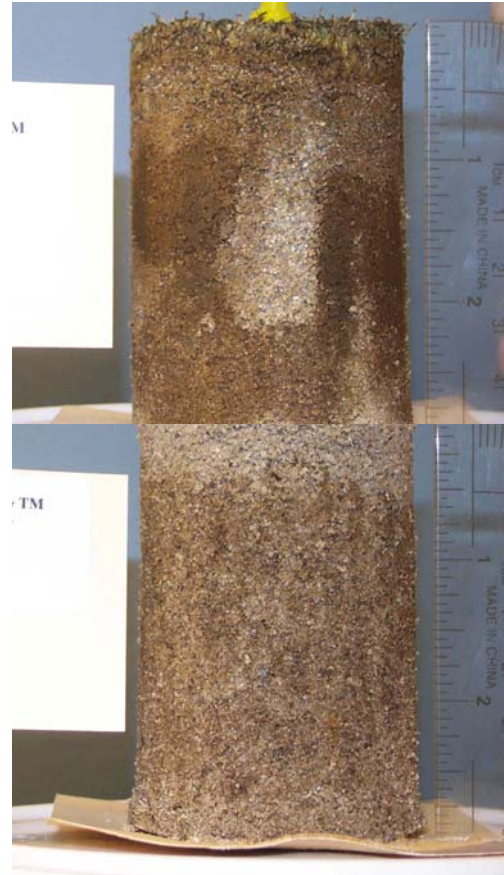
We have also attached an aerification displacement chart at the end of the report. We designed the displacement chart to calculate the percentage of surface area that is removed from the green with various size tines and spacings. We have found that the chart is an excellent reference to evaluate the effectiveness of your program. If you have any questions interpreting the chart please feel free to give us a call.

On the following pages we will discuss each of the tested greens. Included with the discussion is a photo of the green, a selected time lapse photo of the root zone, and our Target Table with the green's physical properties. Tables 2-5 compare the current test results to our recommended target range for well-drained, sand-based greens.

The time lapse photos included on the following pages were taken to monitor the drying process of your greens and to provide visual confirmation of the tested physical properties. The X's & check marks represent 5-minute increments in the drying process. As a general rule the more X's & check marks the higher the water holding properties. We have found the photos are also an excellent indicator of organic matter/thatch accumulation and variations in water holding throughout the profile.

**\*Continue on the next page\***

## Green #13 (North Course)



**Table 2.**

‘+’ improvement, ‘=’ no change, ‘-’ regressed

Green #13	Well-Drained Greens	Comparison Index* +, =, -	September, 2002	Sept. 2001	Sept. 2000
<b>Infiltration Rate [In/hr]</b>	6 to 10	=	0.31 [very low – consistent with a low air porosity and a high percentage of organic matter in the upper 2 inches of the green]	0.35	0.12
<b>Subsurface Air Capacity [Non-Capillary Porosity]</b>	~20%	=	11.79% [very low]	11.71%	11.39%
<b>Water Porosity [Capillary]</b>	15% to 20%	+	30.21% [high]	36.74%	27.20%
<b>Bulk Density [g/cc]</b>	1.35 to 1.45	-	1.42 [high – would benefit from compaction relief]	1.31	1.45
<b>Water Holding</b>	10% to 15%	+	21.22% [positive improvement]	28.07%	18.70%
<b>Organic Content – 0 to 1”</b>	1.5% to 2.5%	+	4.12% [marginal change since 2000]	4.44%	4.26%
<b>Organic Content – 1 to 2”</b>	1.0% to 2.0%	-	2.19% [high]	1.59%	1.05%
<b>Organic Content – 2 to 3”</b>	0.5% to 2.0%	=	0.98% [ok]	0.91%	0.71%
<b>Organic Content – 3 to 4”</b>	0.5% to 1.5%	=	0.69% [ok]	0.68%	0.54%
<b>Root Mass</b>	at least ½ in.	-	3/8 in.	½ in.	3/8 in.
<b>Feeder Roots</b>	at least 3.5 in. –med. density	-	Less than 3 in.	3 in. sparse	<3 in.

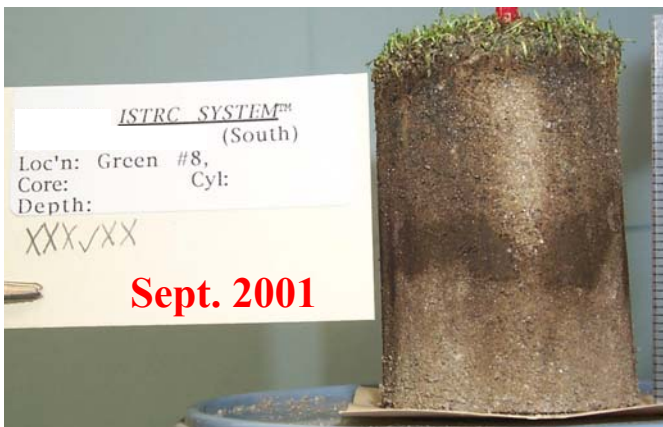
The good news is Green #13's 2<sup>nd</sup> tier physical properties are very good and should support excellent drainage as long as the water is able to bypass the upper root zone. The apparent transition in organic matter & physical properties at 2 to 3 inches suggest conventional aeration to a depth of 3 to 4 inches should effectively penetrate below the organic layering.

**Table 3. ISTRC Target Ranges**

<b>Green #13</b>	<b>2<sup>nd</sup> Tier [4–8 in.]</b>	<b>Well-Drained 2<sup>nd</sup> &amp; 3<sup>rd</sup> tiers</b>
<b>Infiltration Rate [In/hr]</b>	28.26 [excellent]	10+
<b>Subsurface Air Capacity [Non-Capillary Porosity]</b>	26.83% [excellent]	At least 20%
<b>Water Porosity [Capillary]</b>	11.54% [ok]	Less than 20%
<b>Bulk Density [g/cc]</b>	1.55 [acceptable with an above average infiltration rate & air porosity]	1.40 to 1.50
<b>Water Holding</b>	7.43% [ok]	Less than 15%
<b>Organic Content – 4 to 5"</b>	0.51% [ok]	0.5% to 1.5%
<b>Organic Content – 5 to 6"</b>	0.42% [ok]	0.5% to 1.5%
<b>Organic Content – 6 to 7"</b>	0.41% [ok]	0.5% to 1.5%
<b>Organic Content – 7 to 8"</b>	0.41% [ok]	0.5% to 1.5%
<b>Root Mass</b>	N/A	at least ½ in.
<b>Feeder Roots</b>	None	at least 3.5 in. –med. density

**\*Continue on the next page\***

## Green #8 (South Course)



Green #13 (North) and Green #8 (South) continue to be limited by a high percentage of organic matter within the upper 1 to 2 inches of the green. The positive improvements in Green #8's tested physical properties since last year clearly highlights the impact of organic matter on the root zone permeability, water holding, and water porosity. The good news is further reductions in organic matter should yield positive improvements in the overall balance of physical properties.

**Table 4.**

'+ improvement, '=' no change, '- regressed

Green #8	Well-Drained Greens	Comparison Index* +,-,=	September, 2002	Sept. 2001
<b>Infiltration Rate [In/hr]</b>	6 to 10	+	0.88 [very low – Green #8's time lapse photo clearly depicts a high percentage of organic matter with excess compaction]	0.33
<b>Subsurface Air Capacity [Non-Capillary Porosity]</b>	~20%	=,+	9.91% [very low]	9.30%
<b>Water Porosity [Capillary]</b>	15% to 20%	+	30.63% [high]	39.12%
<b>Bulk Density [g/cc]</b>	1.35 to 1.45	-	1.45 [the tested bulk densities 1.42 & 1.45 g/cc would be characterized as high for the amount of organic matter and in need of compaction relief]	1.32
<b>Water Holding</b>	10% to 15%	+	21.12% [high]	29.65%
<b>Organic Content – 0 to 1"</b>	1.5% to 2.5%	+	2.98% [high]	3.67%
<b>Organic Content – 1 to 2"</b>	1.0% to 2.0%	+	1.95% [at the upper limit]	2.46%
<b>Organic Content – 2 to 3"</b>	0.5% to 2.0%	=	1.07% [ok]	1.10%
<b>Organic Content – 3 to 4"</b>	0.5% to 1.5%	=	0.69% [ok]	0.70%
<b>Root Mass</b>	at least ½ in.	+	3/8 in.	¼ in.
<b>Feeder Roots</b>	at least 3.5 in. –med. density	=	Less than 3 in.	<3 in.

## Green #16 (South Course)



Overall, Green #16 has improved since the 2001 testing with a significant reduction in organic matter, water holding & water porosity. The distinct increase in bulk density also confirms a substantial reduction in thatch since last year. Interestingly, Green #16 has reported the highest infiltration rate & air porosity of the tested greens. As we discussed on the phone, the tested infiltration rate & air porosity tend to be somewhat inconsistent with the relatively high percentage of organic matter & high water holding properties. Over the years our testing & research has shown it is not uncommon for greens with excess thatch to support adequate infiltration rates & air porosity despite high water holding & water porosity properties.

**Table 5.**

‘+’ improvement, ‘=’ no change, ‘-’ regressed

Green #16	Well-Drained Greens	Comparison Index* +,=,-	September, 2002	Sept. 2001	Sept. 2000
<b>Infiltration Rate [In/hr]</b>	6 to 10	+	7.31 [very good despite a high percentage of organic matter & thatch – unfortunately the positive improvements in root zone permeability coupled with a high water holding & total porosity exceeding 50% is a strong indicator of excess thatch]	1.04	8.31
<b>Subsurface Air Capacity [Non-Capillary Porosity]</b>	~20%	+	19.51% [good]	12.94%	14.62%
<b>Water Porosity [Capillary]</b>	15% to 20%	++	30.51% [high]	45.44%	32.37%
<b>Bulk Density [g/cc]</b>	1.35 to 1.45	+	1.28 [considerably lower than Greens 8 & 13 – would be consistent with a higher percentage of organic matter & thatch]	1.07	1.25
<b>Water Holding</b>	10% to 15%	++	23.91% [very high]	42.58%	25.97%
<b>Organic Content – 0 to 1”</b>	1.5% to 2.5%	+	3.99% [high]	5.07%	4.49%
<b>Organic Content – 1 to 2”</b>	1.0% to 2.0%	+	3.02% [high]	3.92%	2.65%
<b>Organic Content – 2 to 3”</b>	0.5% to 2.0%	=	1.44% [ok]	1.36%	1.11%
<b>Organic Content – 3 to 4”</b>	0.5% to 1.5%	+	0.85% [ok]	2.45%	0.80%
<b>Root Mass</b>	at least ½ in.	+	3/8 in.	¼ in.	½ in.
<b>Feeder Roots</b>	at least 3.5 in. –med. density	+	3 in. sparse	<3 in.	<3 in.

### III. SUMMARY

Our general recommendations are contained in Section V – *Maintenance Practices* – on page 20 of **The ISTRC Guidebook**. We encourage you to read this section.

Overall the greens have improved since last year highlighted by a consistent reduction in organic matter, lower water holding & water porosity properties, and higher infiltration rates & air porosities. Unfortunately, a high percentage of organic matter & thatch continues to limit the physical properties. As a result, we would recommend that you continue to aggressively manage the greens with an emphasis on lowering the high percentage of organic matter & thatch. If Green #13's 2<sup>nd</sup> tier physical properties are an accurate representation of both courses, conventional aerification to a depth of 3 to 4 inches should provide an appropriate depth for aerification. As the greens continue to mature we would recommend regular testing to not only identify any changes in the physical properties and/or particle distribution but also continue to monitor the effectiveness of the maintenance program. The good news is regular testing will provide the necessary data to identify any modifications that need to be implemented into the current program. If you have any question or want to further discuss the current test results and their impact on your greens we encourage you to give us a call.

Finally, we would recommend that you continue to monitor your greens with regular testing. The information derived from regular testing allows you to: (a) evaluate the effectiveness of the maintenance program, (b) modify the program based on hard data, (c) make adjustments to the program to meet the individual needs of specific greens, and (d) detect problems before they affect the health of the greens.

We are always available to answer questions and discuss ideas with you. Our service is not confined to analyzing undisturbed cores. We do not charge for telephone calls and we encourage our client superintendents to use us as a resource.

Sincerely,

**I.S.T.R.C.**

by:

Matt Pulis, M.S.  
Agronomist

**encl.: ISTRC's Guidebook**



**I.S.T.R.C.**  
**International Sports Turf Research Center, Inc.**

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**INVOICE**  
**ISTRC EIN: 48-1078972**

**Invoice Number:**

**000000**

<b>Company:</b> ALL STAR GOLF CLUB	<b>Facility:</b> North: Green #13 South: Greens 8 & 16
<b>Address:</b> 1530 East Kansas City Road #110	<b>Material tested:</b> N/A
<b>City:</b> Olathe, KS 66061	<b>Invoice Date:</b>
<b>Attention:</b> Mr. John Doe, GCS	<b>Due Date:</b>
<b>Phone:</b> 913-829-8873	<b>Secondary Phone or E-mail:</b>
<b>Lab ID #:</b> Sample Report	<b>Account No.:</b> 9138873

***Thank You For Your Business***

<i>Quantity</i>	<i>Description</i>	<i>Unit Price</i>	<i>Invoiced Amount</i>
4	ISTRC SYSTEM Undisturbed Core Analysis	\$450.00	\$ 1,800.00
	<b>TOTAL DUE THIS INVOICE:</b>		<b>\$ 1,800.00</b>

# I.S.T.R.C.

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### The I.S.T.R.C. System™

Company: ALL STAR GOLF CLUB (North & South Courses)  
 Name: Mr. John Doe "GCS"  
 Address: 1530 E. Kansas City Rd. #110  
 City, ST, Zip: Olathe, Kansas 66061-3651

Account No. 9138873
Date 28-Aug-06
Facility All Star G.C.

### Physical Evaluation

ISTRC Rep.

#### ISTRC SYSTEM™ Core Analysis

Porosity		
Total Porosity	Capillary [Water Pores]	Non-Capillary [Air Pores]
%	%	%

LAB ID NO.	SAMPLE NAME	Infiltration Rate in/hr	40 cm Water Holding %	Bulk Density g/cc	Solids %	Total Porosity %	Capillary [Water Pores] %	Non-Capillary [Air Pores] %
02080017-G13	Green #13, Center, 1st Tier, North Course	0.31	21.22	1.42	58.00	42.00	30.21	11.79
	Organic [ISTRC Walkley/Black] .25 to 1 in.	4.12%				Root Mass: 3/8"		
	Organic [ISTRC Walkley/Black] 1 to 2 in.	2.19%				Feeders: less than 3"		
	Organic [ISTRC Walkley/Black] 2 to 3 in.	0.98%						
	Organic [ISTRC Walkley/Black] 3 to 4 in.	0.69%						
02080017-G13	Green #13, Center, 2nd Tier, North Course	28.26	7.43	1.55	61.63	38.37	11.54	26.83
	Organic [ISTRC Walkley/Black] 4 to 5 in.	0.51%				Root Mass: N/A		
	Organic [ISTRC Walkley/Black] 5 to 6 in.	0.42%				Feeders: none		
	Organic [ISTRC Walkley/Black] 6 to 7 in.	0.41%						
	Organic [ISTRC Walkley/Black] 7 to 8 in.	0.41%						
02080017-G08	Green #8, Back Center, South Course	0.88	21.12	1.45	59.46	40.54	30.63	9.91
	Organic [ISTRC Walkley/Black] .25 to 1 in.	2.98%				Root Mass: 3/8"		
	Organic [ISTRC Walkley/Black] 1 to 2 in.	1.95%				Feeders: less than 3"		
	Organic [ISTRC Walkley/Black] 2 to 3 in.	1.07%						
	Organic [ISTRC Walkley/Black] 3 to 4 in.	0.69%						
02080017-G16	Green #16, Center, South Course	7.31	23.91	1.28	49.98	50.02	30.51	19.51
	Organic [ISTRC Walkley/Black] .25 to 1 in.	3.99%				Root Mass: 3/8"		
	Organic [ISTRC Walkley/Black] 1 to 2 in.	3.02%				Feeders: 3" sparse		
	Organic [ISTRC Walkley/Black] 2 to 3 in.	1.44%						
	Organic [ISTRC Walkley/Black] 3 to 4 in.	0.85%						
	USGA Sample Range [Root Zone Mix]	6 to 12	10 to 20	1.4 to 1.7	45 to 65	35 to 55	15 to 25	15 to 30

Reviewed by: \_\_\_\_\_

# I.S.T.R.C.

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Company: ALL STAR GOLF CLUB (North & South Courses)  
 Name: Mr. John Doe "GCS"  
 Address: 1530 E. Kansas City Rd. #110  
 City, ST, Zip Olathe, Kansas 66061-3651

Account No. 9138873

Date 29-Aug-06

Facility All Star G.C.

ISTR Rep.

LAB ID NO.	SAMPLE NAME	Textural Analysis				Sand Particle Size Distribution						
		Sand	Silt	Clay	Gravel	Very Coarse	Coarse	Medium	Medium	Med/Fine	Fine	Very Fine
		USDA (mm)	.05 to 2.00	.002 to .05	<.002	2.00	1.00	0.50	0.25	0.18	0.15	0.10
	U.S. Sieve (mesh)	270 to 18	(Pan)	(Pan)	10	18	35	60	80	100	140	270
		<b>% Retained on Sieve</b>										
02080017-G13	.25 - 1.0 in.	95.56	0.02	4.30	0.12	5.95	33.20	45.25	6.22	2.17	1.80	0.97
<b>Green #13</b>	1.0 - 2.0 in.	95.06	0.02	4.47	0.45	9.92	32.50	34.25	8.42	3.95	3.95	2.07
<b>Center</b>	2.0 - 3.0 in.	94.51	0.02	4.50	0.97	12.50	33.42	30.72	7.25	4.32	4.00	2.30
<b>1st Tier, North</b>	3.0 - 4.0 in.	95.44	1.77	1.77	1.02	13.85	33.37	30.60	7.70	3.80	4.00	2.12
02080017-G13	4.0 - 5.0 in.	96.86	0.01	2.58	0.55	14.85	33.80	31.02	7.22	4.40	3.87	1.70
<b>Green #13</b>	5.0 - 6.0 in.	96.76	1.18	1.19	0.87	16.10	34.57	30.95	7.02	3.37	3.42	1.33
<b>Center</b>	6.0 - 7.0 in.	96.80	1.10	1.10	1.00	14.92	33.02	31.82	7.65	4.37	3.62	1.40
<b>2nd Tier, N.</b>	7.0 - 8.0 in.	96.53	1.40	1.40	0.67	15.65	35.32	29.42	7.17	3.75	3.82	1.40
02080017-G08	.25 - 1.0 in.	95.62	0.02	4.06	0.30	5.52	32.07	44.62	6.85	2.87	2.27	1.42
<b>Green #8</b>	1.0 - 2.0 in.	93.31	3.95	1.97	0.77	11.35	26.07	32.05	11.90	5.12	4.55	2.27
<b>Back Center</b>	2.0 - 3.0 in.	92.16	5.10	1.62	1.12	12.90	24.92	27.27	12.35	6.75	5.15	2.82
<b>South Course</b>	3.0 - 4.0 in.	92.83	3.89	1.58	1.70	11.70	26.62	28.07	12.75	6.02	5.10	2.57
02080017-G16	.25 - 1.0 in.	95.96	0.02	4.00	0.02	5.35	30.57	48.12	6.20	2.55	2.00	1.17
<b>Green #16</b>	1.0 - 2.0 in.	94.63	1.54	3.33	0.50	7.87	26.37	38.67	11.45	4.45	4.02	1.80
<b>Center</b>	2.0 - 3.0 in.	93.93	3.44	1.58	1.05	11.25	26.27	32.27	12.45	5.75	3.72	2.22
<b>South Course</b>	3.0 - 4.0 in.	94.21	2.16	2.16	1.47	13.22	26.87	30.20	13.00	5.32	3.60	2.00
<b>USGA</b>		89 to 100	5 Max.	3 Max.	3 Max.	10 Max.	At least 60		20 Max.		5 Max.	
<b>Recommended Specifications</b>			10 Max. w/ Fine & V.F.		10 Max.						10 Max. w/Silt & Clay	
<b>ISTR Guidelines</b>		89 to 100	5 Max.	3 Max.	3 Max.	10 Max.	15 to 25	40+	10 to 15	20 - #80	5 Max.	
			10 Max. w/ Fine & V.F.		10 Max.		65 to 85 Optimum				10 Max. w/Silt & Clay	

Reviewed by: \_\_\_\_\_

# ISTRC

## International Sports Turf Research Center Aerification Displacement Chart

Tine Size	1.25" x 1.25" Centers	1.5" x 1.5" Centers	2.0" x 2.0" Centers	2.5" x 2.5" Centers	5" x 5" Centers
1/4" Hollow Tines	3.14%	2.18%	1.23%	0.79%	
3/8" Hollow Tines	7.07%	4.91%	2.76%	1.77%	
1/2" Hollow Tines	12.57%	8.73%	4.91%	3.14%	
5/8" Hollow Tines		13.64%	7.67%	4.91%	
5/8" Hollow Vertidrain					1.23%
3/4" Hollow Tines				7.07%	1.77%
3/4" Hollow Vertidrain					1.77%
1" Hollow Tines					3.14%
1" Hollow Vertidrain					3.14%
7/8" Drill & Fill (7" Ctrs)					1.23%
Graden Verticutter (15 Blades @ 1" Spacings)	<u>1mm Blade</u> 3.93%	<u>2mm Blade</u> 7.87%	<u>3mm Blade</u> 11.81%		

Note: 1/4" Quadtines remove as much material as Regular 1/2" Hollow Tines  
 3/8" minimum for ease of topdressing fill if replacement of material is required  
 For double aerification make two passes at approx. 37° (slightly less than 45°) to minimize overlap