1925 PAGCS

The BONNIE GREENSWARD

OUR 95TH YEAR

2019-20 VOL. IV

WAR REVIVAL 2020: GOING BACK DOWN THE SHORE

After a five year hiatus, the long standing War at the Shore, a joint meeting of the PAGCS and GCSANJ, is back. The planning committee could not be more excited to bring this event to the members of both chapters.

This tournament officially dates back to 2006 [but has its roots in an organic meet-up down the shore for golf, gambling and general camaraderie]. Traditionally the season kickoff event for both chapters, it is a spirited competition [think Ryder cup] that brings together two associations with a lot in common – from members to a shared river.

The event was last held at Atlantic City Country Club in 2015, and for the revival, the event will return to ACCC — home to one heck of a Bloody Mary, and an even better set up. With numerous holes that offer glimpses of Atlantic City itself, the course provides water views on five holes and is a perfect balance of soul feeding and challenging.

(photo credit Mark Beaumont, superintendent)

Each chapter is limited to 30 teams [60 players], and the deadline [4/10/20] will come up quick, so be sure to find your partner and register early — while team registration is preferred, single registrations will be accepted. Watch your inbox for more information and registration details to come next week.

NINETY-FIVE, GOING ON 100!

The PAGCS will turn 95 in September. And there's lots to celebrate this year

First up, we have brought back two of your favorite events: Team Matches [see pg. 37] and the War at the Shore [pg. 1/12].

The Association, second oldest of its kind, also rolled out a new logo along with the new website. We plan to highlight some of PAGCS history all year long. Please share yours with us!

>>EVENTS

WAR AT THE SHORE: JOINT WITH GCSANJ
April 20 @ 12:00 pm - 7:00 pm
Atlantic City Country Club

The War at the Shore Revival 2020! Each Chapter is limited to 60 players, so be sure to register early.

PAGCS SCHOLARSHIP BENEFIT
May 11
Rock Manor Golf Club

This annual event helps the PAGCS continue its long standing tradition of supporting students employed by members as they pursue their turf education and careers.

MEMBER-GUEST TOURNAMENT
June 16
Huntingdon Valley Country Club

PHILLIES VERSUS METS
July 24 @ 7:00 pm

MEMBER-MEMBER TOURNAMENT
September 14
Squires Golf Club

GOLF CHAMPIONSHIP
October 12
Rolling Green Golf Club

PAGCS ANNUAL MEETING
November 2
Whitemarsh Valley Country Club

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>>THE PM

It's now March, and what can I say about the 2019-2020 winter season... The weather seems to be doing its own thing again, with a roller coaster ride of temperature swings.

I believe November was the coldest month so far this winter season. Most of the snow has stayed in the Midwest and lake-effect snow areas. It reminds me of the winter of '97/'98, which also was quite warm and uneventful. I believe PENNDOT is close to having a record of zero salt spreading year. Who knows, it's only the beginning of March and she came in like a Lamb–maybe Mother Nature will throw in a heavy snowfall...time will tell.

On a more stable topic, I would like to welcome everyone to the 2020 golf season coming up. We are starting off the new decade, and our 95th year, with the introduction of the new PAGCS website. We look forward to the new and improved functionality of this site for our members and the ease of use and maintenance by the office management.

The goal of the Board is to keep everyone abreast of what is going on in the Association and the golf industry: I believe the new site will certainly assist. The site has been completely revamped to be more user friendly. The new functionality will make it easier to register for events and pay dues, as well as keep up with news and issues that impact our industry.

One highlight of the new website includes the PAGCS Sponsorship page. While recognizing our top sponsors and all the sponsors that contribute to the Association, additional functionality enables users to click on a sponsor logo or name and have direct access to the sponsor's website. Additionally, users will find a new and improved events calendar. New PAGCS Vice President Darren Farrar has been busy over the winter setting up with some great events, and the new calendar functionality on the website will make it easier for everyone to view, register and enjoy the events.

Kicking off the 2020 season, we will be heading back to Atlantic City Country Club in April for the War at the Shore against the New Jersey Association. We have not had this meeting since 2015, but after careful planning, it will be a fun event.

MORE ON THE 2020 CALENDAR

In May, we plan to have our annual four-person-scramble PAGCS Scholarship event at Rock Manor Golf Club.

The Member-Guest meeting in June will be held at Huntingdon Valley Country Club, and we are planning an exceptional event for you and your guest.

Instead of golf in July, Darren has brought back the Night at the Phillies, and the hometown heroes will face the Mets: this should be a nice time of year to get together and take in a baseball game.

In September, we pulled off the "once in lifetime event"–the Member-Member at Squires Golf Club. How? Let's just say Darren happened to have the sun and moon aligned properly and made the call at the right time. It should be a great time at this Men's Only Club.

Rolling Green Golf Club will host the PAGCS Golf Championship in October, so be prepared for a challenge at this gem we have not visited since 2004.

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The Annual Meeting heads back to Whitemarsh Valley Country Club, another shining star we have all been itching to play again.

We will conclude the year with the annual toy drive and Christmas celebration and more to come on that soon. Hats off to Darren Farrar for working hard on scheduling these events. I hope that everyone makes an effort to get out and enjoy some comradery with some fellow members of the Association.

In addition to our events this season, Aronimink Golf Club will be hosting the KPMG Women's PGA Championship June 25th to 28th. I would like to congratulate John Gosselin and his team and wish them the best of luck as they prep for this event. Aronimink Golf Club is looking for volunteers for that event, so if you can spare yourself and/or your assistant, please do so.

On behalf of the PAGCS Board of Directors, I wish everyone a great start to a new decade of golf in 2020. I wish the weather would not get any stranger, but buckle up and enjoy the ride and be prepared for what Mother Nature will throw our way this year. As Stephen King said in Different Seasons, "there's no harm in hoping for the best as long you're prepared for the worst." I wish you all the best this year! If you have any questions or comments about your experience with the Association, please feel free to contact myself or any other PAGCS board member. Again, thanks for your support and I look forward to seeing everyone at our events this year.

Thank you,

—Doug Rae

Springhaven unearths a boneyard (photo credit Charlie Miller, CGCS)

Mother Nature is no match for winter projects with the team at Old York Road Country Club (photo credit Darren Farrar)

>>ISSUE GUIDE

BENCHMARKING PUTTING GREEN ORGANIC MATTER IN THE PHILADELPHIA REGION

Researchers: *Doug Linde, PhD*
Professor of Turf Management
Delaware Valley University

Brendan Hannan
Agronomist
New Zealand Sports Turf Institute

Despite significant changes in sand topdressing/injection practices the past 10 years, golf courses in the Philadelphia region are still vulnerable to excessive levels of organic matter which can, in severe cases, lead to catastrophic turf loss. In addition, there is evidence that too much sand introduction can be leading to other problems. The objective of this study was to benchmark current trends in OM, topdressing, and nitrogen on putting greens in the Philadelphia region. From this study, superintendents will have more insight on the ideal range for organic matter and can see how their greens and practices compare to the benchmarked greens. In addition, superintendents can use the data to justify funds for additional materials and equipment, to justify more or less surface-disrupting practices, and to have more confidence to make a change in their management practices.

MATERIALS AND METHODS:

The study ran from 2016 to 2019. Putting greens were sampled by the same person between July and mid-August of each year. This time period was chosen because during that period greens in the Philadelphia region are most susceptible to catastrophic turf loss due to high organic matter and sand introduction is minimal. One goal of sampling was to sample greens from a wide variety of operating budgets, construction methods, and grass species composition. Another goal was to sample greens from courses of members of the Philadelphia Association of Golf Course Superintendents (PAGCS). The PAGCS helped fund the study by paying for the lab testing in 2018 and 2019. Visits and testing were done free of charge to courses participating in 2018 and 2019. Labor and travel costs were donated by Dr. Linde.

Three greens from each course were sampled for organic matter (OM). Eight core samples, each 0.75 inches in diameter, were taken from each green with a core sampler. Sample locations were across the entire green as to include each section of the green. While in the core sampler, each core was sliced into 4 sections based on the depth from the surface (0-1 inch from the surface, 1-2 inch, 2-3 inch, and 3-4 inch) with a knife. The verdure was removed from the top section using a knife and cutting board. Each section was composited by depth into the appropriate sample bag so that 8 subsamples of each depth were in each bag. Each green had 4 composited samples by depth that were air-dried and then sent to Penn State University's Agricultural Analytical Lab to be tested for percent soil organic matter by the loss on ignition (LOI) test.

Immediately after collecting core samples from a green, surface firmness and moisture content were measured about 1 inch from each sample location. One drop of a 2.25 kg Clegg hammer was used to measure firmness. A Fieldscout TDR 150 soil moisture meter with 3-inch probes was used to measure soil moisture. Surface trueness was assessed using the bobble test as described by Linde et al. (2017). For the bobble test, at least 3 balls at a minimum of 3 locations on the green were rolled about 8 feet from the evaluator's hand. The amount of ball bobbles and snaking in the last 3 feet of roll were visually observed and given a rating between 1 and 10 where 1 = many bobbles and much snaking, 5 = some bobbles and snaking, 9 = 1 bobble or snake, and 10 = no bobbles or snaking. A bobble was defined as vertical deviation of the ball while it rolled. Snaking was defined as lateral deviation of the ball from its intended path. Percent creeping bentgrass was visually estimated. Other data such as core cultivation frequency (corings), green acreage, sand applied per year, nitrogen per year, sand dustings per year, construction method and operating budget course category were collected through communication with the superintendent. Superintendents chose which category their annual 18-hole maintenance operating budget fell into (< $500,000; $500,000 to $1,000,000; or > $1,000,000).

RESULTS

Comparisons were made using descriptive statistics and correlation coefficients. A total of 52 courses (155 greens) were tested. Of the 52 courses, 42 (81%) had superintendent's that were members of the PAGCS. All courses were within 60 miles of downtown Philadelphia.

Table 1 lists the descriptive statistics by three categories—all greens, operating budget, and construction method. Select data were put into figures. In general, greens were sampled from a wide variety of operating budgets, construction methods, and percent creeping bentgrass (see "n" values in Table 1 which represents number greens in each category). A good use of Table 1 is for superintendents to see how their greens compare to others in similar categories. For example,

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Table 1. Descriptive statistics by putting green category

Category† (n)	Trueness‡	Firmness Gmax	Moisture Content VWC %	Bentgrass %	% Organic matter by depth (inches) 0 to 1	1 to 2	2 to 3	3 to 4	Annual Sand rate§ ft^3 sand/1000 ft^2/yr	Annual N rate lb N/1000 ft^2/yr
All greens (155)										
AVG	7.3	64	24	68	2.66	1.86	1.52	1.60	15	2.3
Min	4.0	43	8	5	0.60	0.46	0.13	0.00	2	0.5
Max	9.0	88	45	100	10.40	5.90	6.37	7.44	67	4.5
Budget 1 (46)										
AVG	6.5	59	30	60	3.59	2.23	1.76	1.59	8	2.6
Min	4.0	43	14	10	1.09	0.49	0.13	0.00	2	1.5
Max	8.0	80	40	99	10.40	4.90	6.37	7.19	15	4.0
Budget 2 (55)										
AVG	7.0	64	24	63	2.28	1.76	1.43	1.56	16	2.3
Min	5.0	47	12	5	0.60	0.46	0.30	0.30	6	0.8
Max	9.0	83	45	100	6.87	4.74	4.46	4.66	34	3.2
Budget 3 (54)										
AVG	8.3	68	20	80	2.25	1.65	1.40	1.65	21	2.2
Min	6.0	54	8	10	0.90	0.50	0.15	0.06	7	0.5
Max	9.0	88	32	100	6.27	5.90	4.81	7.44	67	4.5
California (18)										
AVG	7.4	62	21	88	1.84	1.32	0.51	0.32	11	2.6
Min	6.0	50	12	50	1.09	0.70	0.30	0.03	7	0.5
Max	9.0	78	30	99	2.50	1.80	0.90	0.50	15	4.0
Sand-capped (53)										
AVG	7.2	63	28	48	2.87	2.36	2.70	3.47	16	2.1
Min	4.0	47	13	5	1.20	1.00	0.80	0.60	3	0.7
Max	9.0	82	45	100	6.87	5.90	6.37	7.44	67	3.3
USGA (84)										
AVG	7.4	65	23	76	2.70	1.66	0.99	0.70	15	2.4
Min	5.0	43	8	10	0.60	0.46	0.13	0.00	2	0.8
Max	9.0	88	40	100	10.40	4.90	4.18	2.80	67	4.5

† Budget 1 = Operating budget < $500,000/yr, Budget 2 = $500,000 to $1 million/yr, Budget 3 = > $1 million/yr.

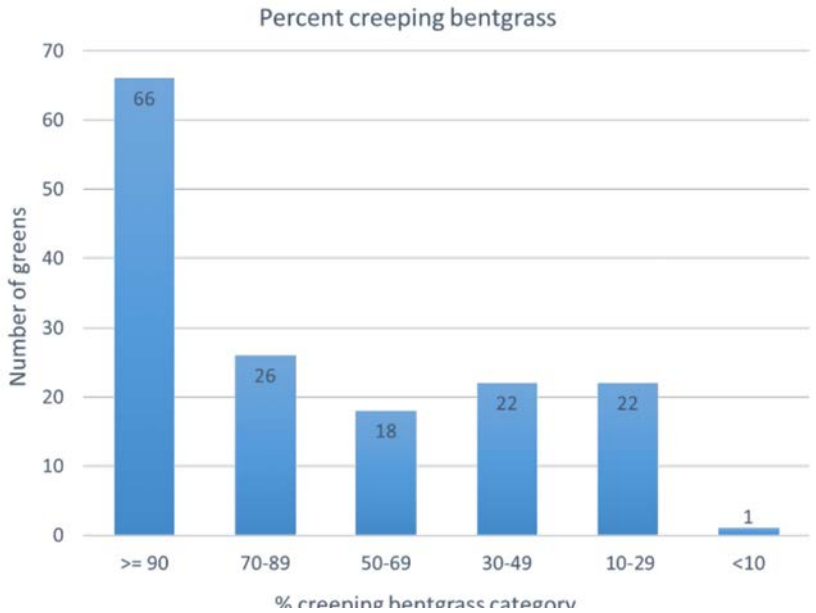
‡ Visual rating (1-10) of amount of bobbling as balls rolled across green (1 = many bobbles, 10 = no bobbles).

§ Includes all sand and sand-based materials broadcasted and injected to greens.

one superintendent that participated in the study had been aggressively introducing sand into his greens the past few years and asked if he may be doing too much. He was also getting pressure from members to cut back on the amount of surface disruption. The superintendent compared the data from three of his greens to the summary data and decided to cut back on the amount of cultivation and sanding for next season. Caution should be taken when making comparisons because values are not absolutes and benchmarking studies like this one have much inherent variability.

Figure 1 shows the percent creeping bentgrass composition of the greens

Figure 1.



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sampled in various categories. Putting greens in the Philadelphia region contain two grass species, creeping bentgrass and *Poa annua*. In Figure 1, a green with 70% creeping bentgrass had 30% *Poa annua*.

For all categories except sand-capped, the 0 to 1-inch depth had the highest %OM (Table 1 and Figure 2). The average %OM in the top 0 to 1-inch for the 155 greens was 2.7% with a range from 0.6 to 10.4%. In their 2006-08 benchmarking study, Schmid et al. (2014) reported the average %OM from 308 greens across the USA was 3.1% with a range from 1.2 to 8.4%. Their results were similar to the current study despite some differences in the sampling method. Schmid et al. (2014) took three 0.75-inch core samples from 3 greens per course. Each sample contained the soil from 0-3 inches below the verdure. In an unpublished putting green benchmarking study the New Zealand Sports Turf Institute (NZSTI) conducted in 2013 on 150 greens across New Zealand, the average %OM in the top 0 to 0.8 inch depth was 9.7% with a range from 2.3 to 42.0% (D. Linde and B. Hannan, personal communication, 12/24/19).

Sand-capped greens had much higher OM levels in the 2 to 3-inch and 3 to 4-inch depths compared to California and USGA greens (Table 1 and Figure 2). The greens in the sand-capped category typically were constructed with native soil before 1970, had 3-5 inches of topdressing gradually applied over many years on top of the original soil which had a much finer soil texture such as a silt loam or clay loam. The results of the agronomic practices from previous years were buried deeper each year. One common agronomic practice between 1970 and 1990 was topdressing with a "dirty sand" such as a 6:2:2 (sand:soil:peat) mixture (Zontek, 1980). Since the 1990s, topdressing with pure sand has become the most common material used for topdressing. In contrast, most of the USGA and California greens were built after 1980 and, starting at the 2 to 3-inch depth, the %OM became low and similar to levels in a new sand-based green.

Although useful, making comparisons solely on the averages without statistical procedures can lead to false conclusions. Averages can be greatly affected by data outliers (extreme values). Another way to make comparisons between data is with correlation. Correlation is a statistical technique that can show whether pairs of variables are related, and if so, what is the strength of the relationship. The correlation coefficient is a way to put a value to the relationship. Correlation coefficients (r and p) range between -1 and 1. A "0" means there was no relationship between the variables, while a -1 or 1 means that there was

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a very strong negative or positive relationship. In addition, a negative correlation means as one variable increases the other decreases. A positive correlation means both variables increase simultaneously. Keep in mind that a strong correlation does not always mean a true cause and effect between the variables.

Table 2 lists correlations for various data comparisons with an emphasis on the %OM in the 0 to 1-inch depth. That depth is most critical to playability, receives the highest management intensity, and is where the majority of new OM is deposited. The correlations in Table 2 were very strong for %OM of adjacent depths. For example, the correlation between the %OM in the 2 to 3-inch depth and the %OM in the 3 to 4-inch depth was 0.85. Trueness and moisture had moderate correlations with %OM in the 0 to 1-inch depth while sand rate, N rate, and corings had weak correlations with %OM at that depth. These weak correlations were surprising because they were counterintuitive to the common belief that more core aeration and sand introduction will decrease OM and more N will increase OM. In the 2013 NZSTI benchmarking study, correlations between %OM, trueness, firmness, moisture, sand rate and N rate for 150 greens were also weak to moderate in strength with topdressing rate and %OM in the 0 to 0.8 inch depth having the strongest correlation coefficient of -0.63 (D. Linde and B. Hannan, personal communication, December 24, 2019). All other correlation coefficients were less than 0.52.

The nature of a benchmarking study lends itself to much variability and makes it more difficult to show strong correlations, especially for variables that can widely vary during the season such as firmness, moisture content, and trueness. A one-time measure of these variables may not be representative of their typical levels throughout the growing

Table 2. Select correlations for data comparisons from 155 putting greens in the Philadelphia region from 2016-19.

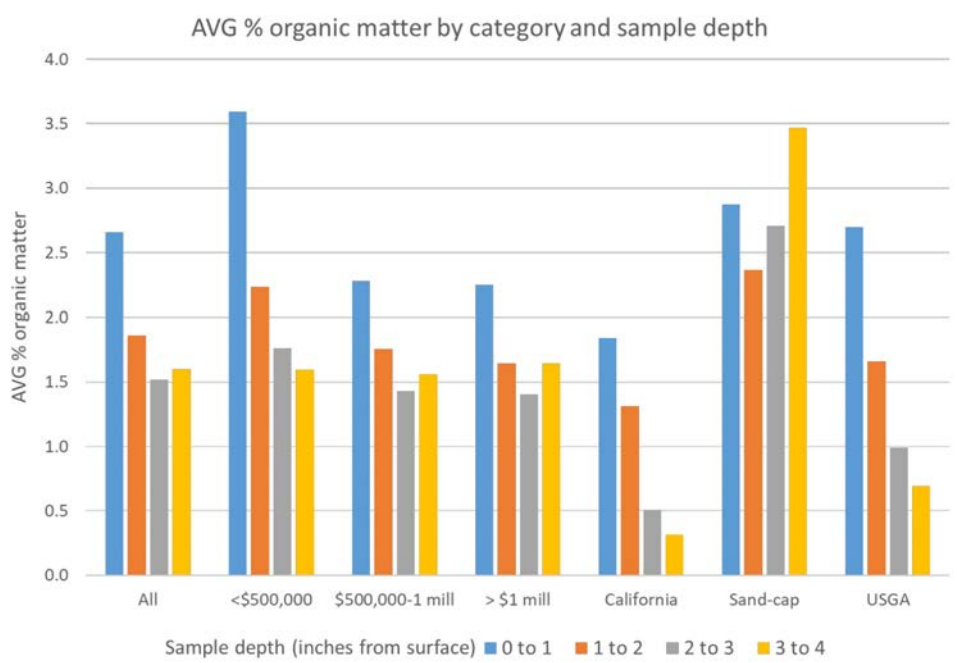
Comparison	Correlation statistics		
	n	r†	p-value‡
Trueness vs Firmness	155	0.37	0.001
Trueness vs Moisture	155	-0.48	0.001
%OM§ 0-1 inch vs Trueness	155	-0.37	0.001
%OM 0-1 inch vs Firmness	155	-0.15	0.058
%OM 0-1 inch vs Moisture	155	0.40	0.001
%OM 0-1 inch vs %Bentgrass	155	-0.26	0.001
%OM 0-1 inch vs %OM 1-2 inch	155	0.63	0.001
%OM 1-2 inch vs %OM 2-3 inch	155	0.74	0.001
%OM 2-3-inch vs %OM 3-4 inch	155	0.85	0.001
%OM 0-1 inch vs Sand rate	149	0.28	0.001
%OM 0-1 inch vs Nitrogen rate	149	-0.15	0.060
%OM 0-1 inch vs Corings	152	-0.23	0.005

† Pearson's correlation coefficient r.

‡ 2-tailed significance test statistic.

§ % organic matter by depth from surface in inches.

Figure 2.



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season. Some sources of variability for this project included time and day of testing, rainfall or irrigation before testing, time since last cultivation or topdressing, sample preparation, time since mowing or rolling, age of the green, management practices, and soil composition. As a result, some findings can be counterintuitive. For example, a putting green that is high in organic matter near the surface, gets minimal coring and topdressing, and retains moisture like a sponge typically is soft and bumpy. However, there are times during the season that such a green will be firm and smooth, especially during dry-down periods and shortly after rolling.

The number of core aerations (corings) per year are listed in Figure 3. The majority (75%) of greens were core aerated twice per year. Of the 33 greens that received 0 or 1 corings per year, 21 (64%) were from budget category #1 (<$500,000 per year). Of the 54 greens in budget category #3, 51 (94%) were core aerated twice per year and 3 (6%) were done 4 times per year.

Table 3. Correlations between golf course operating budget category and various variables for 155 putting greens in the Philadelphia region from 2016-19.

Comparison	Correlation statistics		
	n	ρ†	p-value‡
Budget§ vs Trueness	155	0.61	0.001
Budget vs Firmness	155	0.42	0.001
Budget vs Moisture	155	-0.51	0.001
Budget vs % Bentgrass	155	0.32	0.001
Budget vs %OM¶ 0 to 1-inch	155	-0.30	0.001
Budget vs %OM 1 to 2-inch	155	-0.24	0.003
Budget vs %OM 2 to 3-inch	155	-0.04	0.630
Budget vs %OM 3 to 4-inch	155	0.06	0.440
Budget vs Sand rate	149	0.52	0.001
Budget vs Nitrogen rate	149	-0.15	0.060
Budget vs Corings	152	0.46	0.001

† Spearman's correlation coefficient ρ.
‡ 2-tailed significance test statistic.
§ Operating budget was split into 3 categories;
< $500,000/yr, $500,000 to $1 million/yr, > $1 million/yr.
¶ % organic matter by depth from surface in inches.

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Sand dustings were defined as light topdressings of sand as opposed to a heavy topdressing after core aeration. Of the 155 greens, 94 (61%) greens received regular sand dustings while 61 (39%) did not. Of those 61 greens that did not get dustings, 34 (56%) were from budget category #1. Also, 51 of 54 (94%) greens in budget category # 3 received regular sand dustings. The results from the number of corings and dustings are not surprising in that courses with the higher budgets are doing the most coring and dusting. In addition, the averages in Table 1 and correlations in Table 3 show some relationship trends such as higher budget courses have greens that are truer, drier, firmer, use less N, and introduce more sand than lower budget courses. This data can be useful by superintendents to help get more resources or justify their maintenance practices.

This study did provide some insight on the ideal range of OM in a Philadelphia region putting green. Only 38 (24%) of the 155 greens had %OM levels ≥ 3% in the 0 to 1-inch depth and only 27 (17%) had levels ≥ 4%. Therefore, most greens (83%) had OM levels less than the USGA's standard recommendation of 3-4% in the upper rootzone (Moeller and Lowe, 2016). However, as stated by Moeller and Lowe, there are instances in which some putting greens might perform well at one level of OM while others experience problems. OM lab data should not be the sole factor guiding management programs (Moeller and Lowe, 2016). For example, in the current study, the course with the highest %OM levels in the 0 to 1-inch depth (6-10 %OM) did not have catastrophic turf loss during the excessively wet summer in 2018 while two courses that had catastrophic putting green turf loss in 2019 had %OM levels that ranged from 1.7 to 2.3 %OM.

The average sand introduction rate was 15 ft^3 sand/1000 ft^2/yr with a range from 2 to 67 (Table 1 and Figure 4). Only 6 of 155 greens (2 courses) had rates greater than the 40-50 ft^3 sand/1000 ft^2/yr recommendation by the USGA. Vermeulen and Hartwiger (2005) reported the results of a USGA topdressing study that surveyed 10 or more superintendents of well-maintained golf courses within each USGA regional office. They reported an average of 16 ft^3 topdressing/1000 ft^2/yr (range = 7 to 26) for the Mid-Atlantic regional office based in Glen Mills, PA and an average of 27 ft^3 topdressing/1000 ft^2/yr (range = 14 to 51) for the Mid-Atlantic regional office based in Pittsburgh, PA. The average sand introduction rate for budget category #3 in the current study was 21 ft^3 sand/1000 ft^2/yr with a range from 7 to 67. Therefore, the sand introduction rates from this study were similar to the USGA study. This

Figure 3.

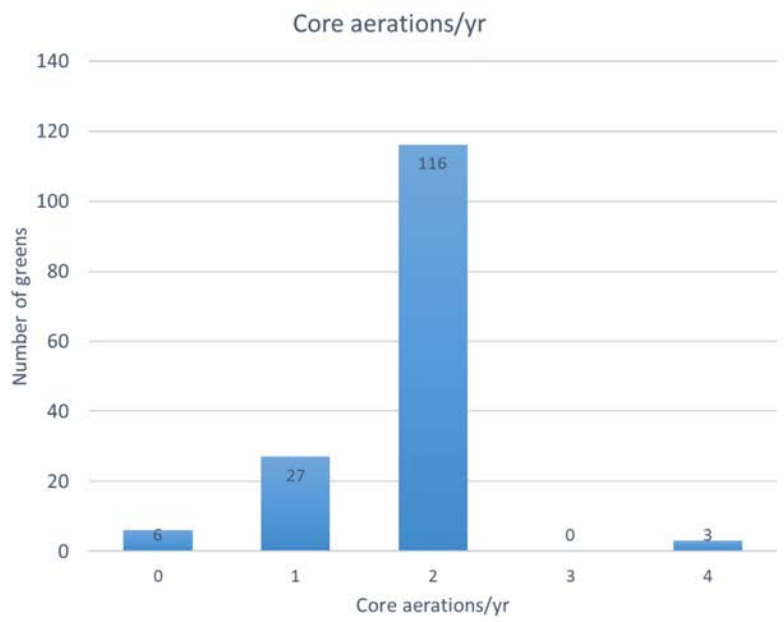
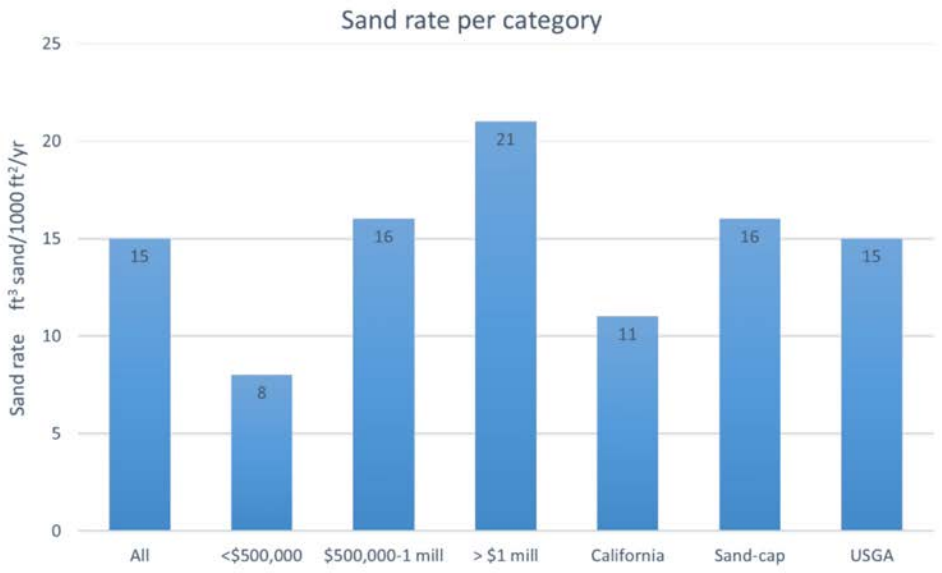


Figure 4.



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is assuming that the well-maintained golf courses surveyed in the USGA study were similar in quality to the courses in budget category #3 (> $1 million/yr). Lastly, Schmid et al. (2014) reported that greens receiving an annual sand topdressing rate of atleast 20 ft^3 topdressing/1000 ft^2/yr were consistently < 3.3% OM. When comparing sand rate between all these studies, surprisingly, it appears that golf courses in the Philadelphia region are not introducing more sand/topdressing today than they were 10-15 years ago.

To provide more insight on whether Philadelphia region superintendents could be introducing too much sand into greens, data from 20% (31) of the greens with the lowest OM in the 0 to 1-inch depth were analyzed more closely. The green with the lowest %OM (0.6 %) in the 0 to 1-inch depth was a 9-month-old USGA green. There were 31 greens with less than 1.6 %OM in the 0 to 1-inch depth. The average sand introduced/yr for the 31 greens was 19 ft^3 sand/1000 ft^2/yr while the average for all greens was 15 ft^3 sand/1000 ft^2/yr. The average firmness was slightly higher (66 gmax) than for all greens (64 gmax) and the average moisture content was drier (19%) than for all greens (24%). By maintaining OM levels closer to the levels in a new sand-based green, superintendents may encounter the same challenges as growing-in a new green—poor moisture and nutrient retention. For example, 3 greens tested at one course in this study had low OM levels ranging from 1-1.2%. The superintendent had been aggressively introducing sand into his greens the past few years and reported the highest sand rate in the study of 67 ft^3 sand/1000 ft^2/yr. During the next year, the new superintendent at the course reported that various greens had symptoms of doughtiness shortly after rainfall and was considering ways to improve moisture retention. Another potential challenge that may occur on greens that get a high amount of cultivation and sand is a reduction in surface stability. There is anecdotal evidence that too much regular cultivation and sand application could leave the top inch of the surface loose and unstable.

SUMMARY OF RESULTS AND CONCLUSIONS

1. 52 courses (155 greens) were tested.
2. 42 (81%) of the 52 courses had superintendent's that were members of the PAGCS.
3. Greens were sampled from a wide variety of operating budgets, construction methods, and percent creeping bentgrass within 60 miles of Philadelphia.
4. 75% of greens were cored aerated 2X/yr.
5. Higher budget courses do more sand introduction and core aeration and have greens that are truer, drier, firmer, and use less N than lower budget courses.
6. The top inch of soil had the highest %OM.
7. Sand-capped greens had much higher OM levels in the 2 to 3-inch and 3 to 4-inch depths compared to California and USGA greens.
8. Only 24% of the 155 greens had %OM levels ≥ 3% in the 0 to 1-inch depth and only 17% had levels ≥ 4%.
9. Most greens (83%) had OM levels less than the USGA's standard recommendation of 3-4% in the upper rootzone.
10. The average sand introduction rate was 15 ft^3 sand/1000 ft^2/yr with a range from 2 to 67. Only 6 of 155 greens (2 courses) had rates greater than the 40-50 ft^3 sand/1000 ft^2/yr recommendation by the USGA.
11. When comparing sand rate between various studies, surprisingly, it appears that golf courses in the Philadelphia region are not introducing more sand/topdressing today than they were 10-15 years ago.
12. High amounts of regular cultivation and sand increase the green's potential for poor moisture and nutrient retention and an unstable surface often observed in a new sand-based green.
13. OM data has much variability
14. Be consistent with sampling method and use the same lab for OM testing
15. Collect performance data, such as firmness, trueness, and moisture, various times during the season.
16. Test the best and worst performing greens
17. Find a % OM that works best for your greens

ACKNOWLEDGEMENTS:

Thank you to the PAGCS for helping fund this study and to all the superintendents that allowed access to their golf course.

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LLANERCH RENOVATION, AN INTERVIEW WITH THOMAS J. MCFEELEY, SENIOR ASSISTANT GOLF COURSE SUPERINTENDENT

by Nick Sujkowski, PAGCS Assistant Representative to the Board

For this edition of the Assistant's Corner, I visited with Thomas McFeeley, Senior Assistant Superintendent at Llanerch Country Club in Havertown, PA. Tom, along with Superintendent Brendan Byrne, and the rest of the team at Llanerch recently went through a large-scale renovation project; here is what Tom had to say about it as well as his chosen career path. –NS

How did you originally get into turf?

It started out as a summer job for me. I began working at Rolling Green when I was 18 years old. I consider myself curious by nature, so I found myself asking a lot of questions about the industry. I was fortunate enough to have a collection of great people around me at Rolling Green who pointed me in the right direction. Once I realized I could make a career out of it I never looked back.

Where did you attend turf school? When?

I attended Rutgers University for their two year program. I completed the program in the spring of 2016.

How long have you been working at Llanerch?

I started at Llanerch between my first and second year at Rutgers. I have now been here for five years.

Who was the architect in charge of the project?

Brian Schneider of Renaissance Golf Design

> IT'S BEEN A REAL TREAT TO SEE THINGS UNFOLD, AND I CONSIDER THESE OPPORTUNITIES PRICELESS.

How closely were you able to work with Brian?

I have been lucky enough to be heavily involved with almost everything pertaining to the project. I've had the opportunity of not only being involved with all of the meetings that come along with a project of this nature, but also the chance to have one-on-one time with Brian to pick his brain and see how he works. It's been a real treat to see things unfold, and I consider these opportunities priceless. I'm incredibly grateful that Brendan has involved me so much. Also, I would be remiss not to mention Blake Conant. Blake has been on site with Brian throughout the process and has done a great job. It's been a treat to work alongside Blake as well.

How much of the course was involved in the renovation project?

This year, we started with the nine holes on the north side of Steel Rd., closest to the clubhouse, which we in the grounds maintenance department refer to as "clubhouse side." Steel Rd. splits the property in two with a set of nine holes on either side. We decided to do half of the course this year and then finish the rest next year. This affords the club the ability to leave the other side open for play so our membership can still enjoy their golf course while we work. It also just works better this way logistically, and for timing purposes.

Front bunkers were added in the 1930s to defend the short 18th

What course improvements did this project include?

Greens were expanded for a variety of reasons. In some instances, they were expanded to recapture original size, in others for additional pin locations, and also just to add some different quirks and twists. Hole #8 saw the most drastic of changes. In my opinion, it was the most significant part of the project because we removed the sod, completely re-contoured the green, and then replaced the original sod. The tees on #8 were also moved about 25 yards to the right to change the angle into the green. The new teeing ground also presents a more visually daunting shot with the pond now directly in front. It's an outstanding golf hole.

Continued on next page

Continued from previous page

New sand pits right of the 9th green

The bunkers were rebuilt with the Better Billy Bunker liner system and the style was changed from flashed sand to more of a grass down look. A number of fairway bunkers were removed and replaced with mounding or "cops," as I've heard Brian call them, which go along with other hummocks and berms found on the property.

I think other parts of this project that are important to mention include additional shortgrass areas around greens, fairway re-contouring and expansion, extensive tree removal, cartpath removal and re-installation, bunker removals/ rebuilds, tee re-construction, and brand new greens irrigation loops using HDPE piping.

When you visit Llanerch or see photos on Twitter of the work, it is obvious that there is something unique going on with the bunker faces. What type of turf was used to sod the bunkers and why did you choose it?

We chose to go with Zenith Zoysia on the faces of bunkers. While the shaping was in process we quickly realized just how drastic these slopes were going to be. This in turn would present us with some maintenance nightmares. Although it may be a little outside the box, we are confident that the Zoysia will require less inputs and less maintenance which will alleviate some of these issues for us.

What was your favorite part of doing this work?

The satisfaction of seeing things come together after grinding it out for a while. Whether that be on a specific hole, or a specific area, or phase #1 as a whole. It's really nice to see all the hard work paying off. The golf course is coming together beautifully and it's fun to be a part of it.

How do you feel this project has helped you with your future career?

This has been my first large scale renovation work since coming into the industry. It's obviously a great résumé builder. With that being said, there are other aspects that will benefit me beyond just looking good on paper. The intangible things that can't be measured are what I value most. Leading the crew through new concepts, adjusting on the fly, quick-thinking/decision making, and a general understanding of how to control the chaos and keep things moving. I consider all of that invaluable. These things are what will help my career the most moving forward. I can't stress how appreciative I am towards Brendan and the membership here at Llanerch for providing me with these opportunities. –TM

[Tom McFeeley began his career under the wings of PAGCS member and former Board Member Charlie Carr, while he was GCS at Rolling Green. Tom has been a PAGCS member since shortly after he joined the Llanerch team. Tom can be reached at tmcfeeley11@gmail.com]

I would like to congratulate Tom, Brendan, and the rest of the team involved with this project on a job well done. I was fortunate enough to have played Llanerch earlier this summer and it is fascinating to see all the positive changes that they have made. –NS ◆

18th Hole in Progress

FOR ADDITIONAL INFORMATION/ COVERAGE OF THE WORK:

- "Feed the Ball" podcast 43:40 – 50:50
- Twitter
  - Golf Course Superintendent – Brendan Byrne @BrendanJByrne01
  - Senior Assistant Superintendent – Thomas McFeeley @McFeeleyTurf
  - Assistant Superintendent – Jared Hafer @jared_hafer
  - Assistant Superintendent – Mike Davis @MykusMaximus
  - Golf Course Architect – Brian Schneider @bschneider126
  - Blake Conant @Dundee_Golf
  - Total Turf Golf @TotalTurfGS
- Instagram
  - Llanerch Country Club Archives @Llanercharchives

CUSHMAN'S GROWING GREENS CONTINUES TO GENERATE FUNDS FOR ASSOCIATION

The Growing Greens program supports the PAGCS by donating $50 for each Cushman Hauler utility vehicle purchased by a member back to the Association.

The new Cushman hauler has many exciting features, including a versatile glove box that makes room for larger items, optional outlets for smartphone and tablet charging, premium tires designed to maximize traction without damaging greens, and much more.

To schedule a demo, contact Jeff Haas or TJ Hart.

GROWING GREENS

THANK YOU TO THE COURSES WHO RECENTLY PURCHASED A HAULER AND DESIGNATED THE FUNDS TO THE PAGCS

Fieldstone GC
Landis Creek GC
Radley Run CC
Rolling Green GC
Saucon Valley CC
Squires GC
Union League GC @ Torresdale
Wilmington CC

GOLF COURSE ITEMS
EXPECTED LIFE CYCLE

HOW LONG SHOULD PARTS OF THE GOLF COURSE LAST?

No two golf courses are alike except for one thing: deferring replacement of key items can lead to greater expense in the future, as well as a drop in conditioning and player enjoyment. The following information represents a realistic timeline for each item's longevity.

Component life spans can vary depending upon location of the golf course, quality of materials, original installation and past maintenance practices. The American Society of Golf Course Architects (ASGCA) encourages golf course leaders to work with an ASGCA member, superintendents and others to assess their course's components.

ITEM	YEARS
Greens (1)	15 – 30 years
Bunker Sand	5 – 7 years
Irrigation System	10 – 30 years
Irrigation Control System	*10 – 15 years*
Pump Station	*15 – 20 years*
Cart Paths – asphalt (2)	5 – 10 years (or longer)
Cart Paths – concrete	15 – 30 years (or longer)
Practice Range Tees	5 – 10 years
Tees	15 – 20 years
Corrugated Metal Pipes	15 – 30 years
Bunker Drainage Pipes (3)	5 – 10 years
Mulch	1 – 3 years
Grass (4)	Varies

NOTES: ***(1)*** *Several factors can weigh into the decision to replace greens: accumulation of layers on the surface of the original construction, the desire to convert to new grasses and response to changes in the game from an architectural standpoint (like the interaction between green speed and hole locations).* ***(2)*** *Assumes on-going maintenance beginning 1 - 2 years after installation.* ***(3)*** *Typically replaced because the sand is being changed – while the machinery is there to change sand, it's often a good time to replace the drainage pipes as well.* ***(4)*** *As new grasses enter the marketplace – for example, those that are more drought and disease tolerant — replanting may be appropriate, depending upon the site.*

ASGCA thanks those at the USGA Green Section, Golf Course Builders Association of America, Golf Course Superintendents Association of America and various suppliers for their assistance in compiling this information.

The materials presented on this chart have been reviewed by the following Allied Associations of Golf:

For more information, contact ASGCA at (262) 786-5960 or visit www.ASGCA.org

DATA COMPILED BY ASGCA, 125 NORTH EXECUTIVE DRIVE, SUITE 302, BROOKFIELD, WI 53005

GCSAA

GCSAA DEADLINE DATES

MARCH 13
National Golf Day registration deadline

MARCH 15
Par Aide Garske Grants due

MARCH 27
Teach at 2021 GIS deadline

APRIL 15
Legacy Awards due

GIS ORLANDO 2020

During the Golf Industry Show, held in Orlando this winter, attendees from the state of Pennsylvania gathered for an evening of networking, camaraderie and discussion about the industry. Known as the Allied Hospitality Suite, the event was held at a sports bar venue called the Groovy Goat on Weds., Jan. 29, 2020.

Hosted by the PGCSA [Pennsylvania Golf Course Superintendents Association], the event brings together all seven [six GCSAA affiliated] chapters from across the state. Funding for the event is provided by the generosity of sponsors—see box [cue location]. Please thank these sponsors for making this event the tremendous success that it was this year.

PAGCS President Doug Rae, left, with [LtoR] Mike Stranzl, Steve McDonald, and Ray Waltz.

PLEASE THANK OUR 2020 HOSPITALITY SPONSORS

Black Diamond, $2000+

Eastern Irrigation Pump and Supply, George Ley

George E Ley Co, George Ley

Diamond, $1500-$1999

Bayer Environmental Sciences, Darin Batisky

Bayer Environmental Sciences, Jeff Weld

Platinum, $1000-$1499

Dryject of Western PA, Ben Little

Dryject of Eastern PA - Jeff Broadbelt

Fisher and Son's Co Inc, Mike Fisher

Frontier Golf Inc, Jason Sloan

Pocono Turf Supply Co, Tom Hunter

Gold, $500-$999

Aer-Core Inc, Bill Mast

Advanced Turgrass, Travis Livingston

BASF, Dave Schell

EH Griffith Inc, Paul La Marca

Finch Services, Paul Schultheis

Grass Roots Turf Products, Steve Chirip

Lawn and Golf Supply Co Inc, Ken Jeinnings

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Silver, $250-$499

Arms Turf Products, Brian Bates

Club Car, Mike Bosch

Krigger Company Inc, Gail Fitzgerald

Mazella Partnership, Nick Mazella, NEW IN 2020

Mitchell Products, Kevin Mitchell, NEW IN 2020

Plant Food Co, Mike Janzer

Sunburst Turf Solutions, Mike Nati

Synatek, Warren Savini

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Keystone Turf Products, Mark Kenyhercz

Ewing Irrigation, Brad Helcoski

REMI Golf and Turf, Sean Remington, NEW IN 2020

MESA® Technology:
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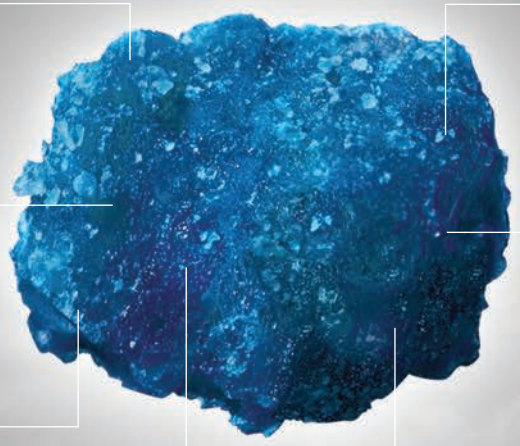

In a world full of coated nitrogen sources, MESA sets itself apart with its truly unique performance and composition. MESA's methylene urea granule, infused with ammonium sulfate provides green up without flush growth. As the methylene urea begins to break down and provide dependable slow release nitrogen the trapped ammonium sulfate slowly becomes available and provides additional nitrogen to the plant. MESA is the only nitrogen source that provides nitrogen and sulfur in three different ways … quick, slow and controlled. The results are picture perfect fairways! Learn more at LebanonTurf.com or call 1-800-233-0628.

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GCSAA CERTIFICATION FOR EQUIPMENT MANAGERS IN THE DEVELOPMENT STAGES

The certification program for equipment managers is in development. In the meantime, begin working to complete the Equipment Management Certificate Program Level 1 and Level 2. Successful completion of these programs will be prerequisites to enter the certification program.

EMCP LEVEL 1

Training and skills recognition for equipment managers and technicians

"The EMCP is a vital part of equipment managers' professional development. All the questions on the exams are direct from our industry and create a true test of your knowledge." – Trent Manning, Ansley Golf Club

Equipment Management Certificate Program Level 1 is a series of exams designed to demonstrate proficiency in key competency areas related to turf equipment. This certificate program is available to any and all turf equipment technicians regardless of whether you work for a golf course.

The program is made up of eight exams covering the key competency areas of:

- cutting units
- drivetrain systems
- electrical systems
- engine technology
- hydraulic systems
- metalworking and fabrication
- spray systems
- fundamentals of turfgrass operations

You can choose to take one exam or work to complete the entire program by successfully completing all eight exams in any order.

EMCP LEVEL 2

Recognition for advanced skills

The Equipment Management Certificate Program Level 2 is the next step on the career path for equipment managers. This certificate is earned by successfully passing one proctored exam which addresses the competency areas of:

- Administrative Management
- Best Management Practices
- Cutting Units
- Drivetrains
- Electrical Systems
- Engine Technology
- Hydraulic Systems
- Metalworking
- Spray Systems
- Turfgrass Operations

You must have successfully completed all eight certificates in EMCP Level 1 to be eligible to begin EMCP Level 2. ◆

PA BEST MANAGEMENT PRACTICES MANUAL: UPDATE

The statewide committee for the BMP project has been working hard to bring the updated BMP to its completion. The manual is now in its final draft review stage and in the hands of the committee for edits and commentary. That process is projected to close on March 16. The next stage will bring the manual to its final form and begin development of the website. The committee will continue to update everyone on the project as it moves forward.

ORGANIC MATTER MANAGEMENT:

Extract and Replace versus Injection on Sand-based Greens

by Jeff Broadbelt, VP of Operations, DryJect, Inc. and Ed McCoy, PhD, Ohio State University

If you are in a situation where you need to reduce your organic matter percentage on sand based greens, what is a good program to implement? Conventional wisdom tells you to core aerate, remove the plugs, top-dress heavily with sand and brush it in to fill the holes. Intuitively, extraction and replacement is more effective then sand injection alone using either high pressure water injection or solid tine and backfilling with sand. But how significant is the difference? In fact, there are people out there that imply you cannot effectively manage organic matter without extracting a portion of the root zone (Moeller, A., Lowe, T. 2016). The purpose of the article is to examine the math behind both extraction and replacement or sand injection alone. Understanding the effect each method has from a direct mathematical standpoint will help you create a suitable plan of action that has the least cost and disruption to play.

Suppose you have greens that are testing out to be 4.57% organic matter (OM) within the top 3 inches of your greens. Your goal may be to reduce it close to 3.25% as quickly as possible and maintain it somewhere at or below that threshold in the future. You set the time period that you would like to achieve this at 1.5 growing seasons. During that time period you estimate that you may gain another .43% OM so you set the start point for reduction at 5.00%. How many times do you need to core aerate with what size tines? Of course the larger the tines diameter and the tighter the spacing, the fewer the number of applications will be needed. In the case of injection, the same logic applies where the tighter the spacing, the fewer applications you will need to perform the task. This logic is related to the "area of disruption" often spoke about and where the USGA and others have recommended (Hartwiger, C., O'Brien, P. 2001, et al.) that the total of any given growing season fall under the guidelines of 10-20% surface disruption for organic matter control.

For this exercise we will assume that all core holes can be successfully filled with topdressing. Excess sand topdressing left in the turf canopy is assumed zero and subsequently not factored in. Although this does not occur in practice we adopted this simplification to directly compare core extraction and filling with sand to injection.

An additional component of these calculations is determining the bulk density of the soil mix. The equation used for this calculation comes from the Estimated Bulk Density Calculation from USDA-NRCS (undated) which employs data of the component sand (1.56 g cm^3) and organic matter (0.22 g cm^3) bulk density values. This equation, BD = 100/(% OM/OM BD)+((100-%OM)/SAND BD)) computes to an existing BD of 1.196 g cm^3 after the assumed growth is factored in.

Following core extraction and refilling with sand, the average organic matter content across the green is calculated by using a soil mixing equation adapted from Taylor and Blake (1984). In this equation for core extraction and refilling the mass of organic matter remaining after extraction is divided by the mass of added sand plus the mass of the remaining root zone. Thus extraction of organic matter and presuming that the added sand contains essentially zero organic matter serves to reduce the average organic matter within the green itself.

For sand injection, the mixing equation is a bit different because no organic matter is removed by coring, so here the mass of the existing organic matter prior to application is divided by the mass of the added sand plus the mass of the existing root zone. Presuming the added sand also contains essentially zero organic matter, injection by itself serves to reduce the average organic matter within the green, in this case by dilution. To re-set the total soil weight back to the 0-3 inch zone we then use the new bulk density multiplied by the total volume of the 0-3" zone.

The present situation tracks the organic matter changes within the surface 3 inches of a green and 2 by 2 inch spacing on both the coring tines or the sand injector. The calculations are also for 0.5 in diameter tines or equivalently 0.5 inch diameter injection holes. The calculation procedure is, however, adaptable for different depths, spacing and hole diameters.

The results for these calculations following 8 consecutive applications of either core extraction and refilling with sand or sand injection demonstrate an essentially equivalent degree of organic matter reduction within the green where core reduced the OM to 3.04% and injection to 3.11% (Fig. 1).

Using conditional probability when coring and refilling allows for a "shortcut" to arrive at the net change in soil weight and percent OM when a total number of applications are entered. Conditional probability factors in the amount of new amendment extracted from the previously filled core holes. In other words the percent of hitting virgin green space diminishes each time. The equation is 1-((1-area of disruption)X(1- area of disruption) to the power of (# of applications -1) or 1-((1-4.91)X(1-4.91)^(8-1)=33.15%. The product of 33.15% is then multiplied by the original OM weight of the soil profile to arrive at the weight extracted. It will be replaced with sand that is 7.091 times heavier then OM (SAND BD 1.56/OM BD.22). This new sand weight is added to the original sand weight and the new OM weight to arrive at total soil weight. The new OM weight is then divided by total soil weight to arrive at the new percent OM (Table 1)

CORE vs. INJECT ORGANIC MATTER REDUCTION

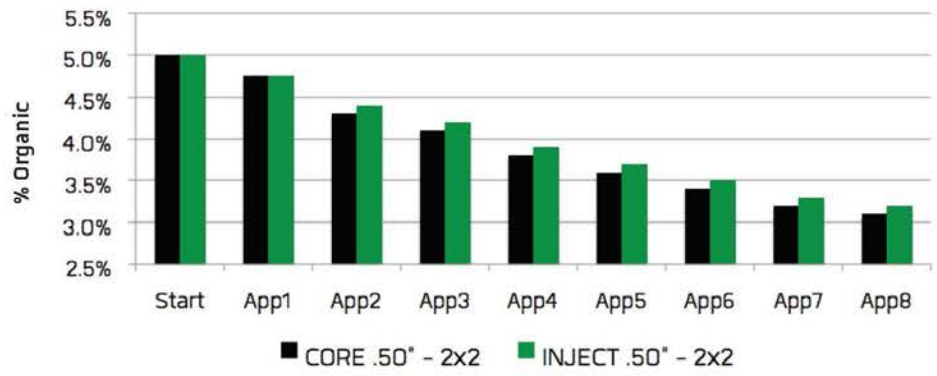

Figure 1. Bar chart showing 8 consecutive applications

TABLE 1

			CONDITIONAL PROBABILITY:			
			% OF GREEN HIT		33.15%	
APPLICATION #	8					
	SAND	OM	TOTAL	BD	SAND	OM
START	17730	933.2	18663	1.1958	95%	5%
WEIGHT CHANGE	2193	(309.31)				
NEW WEIGHTS	19923	624	20547	1.3165	96.96%	3.04%

Sand injection will of course result in elevating the green over time. Coring and then filling the holes will add to elevation also but not near as much. It does this because it would be impossible to get 100% of the sand brushed into the aeration holes. Somewhere in the neighborhood of 20 to 30% more sand topdressing needs to be applied in addition to what the math works out for the aeration holes alone. In general, the greater the area of disruption, the higher the percentage will make it to the holes. Careful consideration has to be given to not over saturate the surface area between the core holes when attempting to fill them as this may contribute to sand layering.

Of course, using coring and injection together is a viable option. A scenario that may be sensible when on a short timeline to reduce organic matter percentage dramatically is to start off with a very aggressive core aeration and backfilling. This way you get the benefits of extraction without the harvesting of newly amended sections of the green. Coring after multiple injections is just like coring after coring and backfilling. Its effectiveness diminishes because of the extraction of new material already in place. Using .50 inch tines at 1.5 x 1.5 inch spacing is a lot of work but gets you down to 4.45% organic quickly, which is close enough to pick away at it with less disruptive to play injection methods. It will take quite a bit of sand to backfill these holes but if you can endure the pain it is a great jump start. The total tons needed to fill JUST the holes for 100,000 square feet will be 106. You will need to order approximately 20-30% more to account for sand left in the turf canopy and waste in general. Following up with multiple injections at 1.5 x 1.5 inch spacing with an average hole size of .328 will slowly get you to your target zone. After eight injections the OM has dropped to 3.10%. Each injection will use 45.72 tons of sand based on 100,000 square feet (Fig. 2).

CORE vs. INJECT ORGANIC MATTER REDUCTION

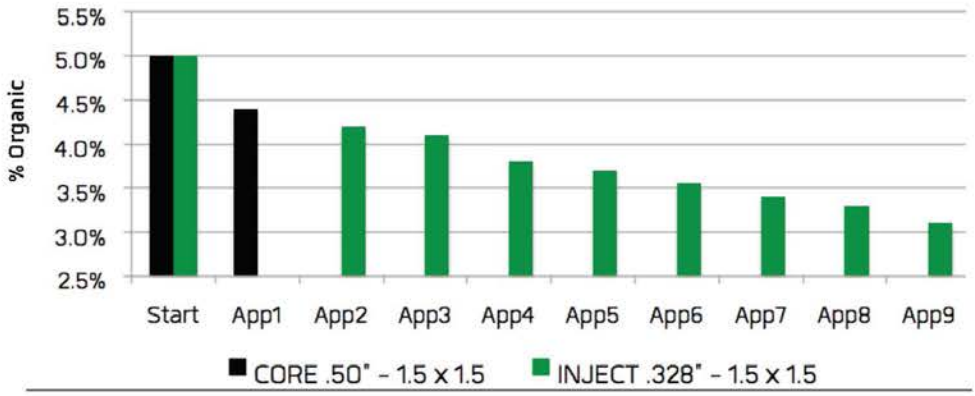

Figure 2. Depicts a very aggressive core aeration followed by 8 injection applications

Once you have gotten the percent organic matter down to where you want it, the next goal is to maintain that percentage uniformly in the upcoming years. You have already done the hard part. It should not be too difficult to manage going forward. Percent organic matter build up over a given amount of time could span a broad range. It is dependent on the type of turf you are maintaining, fertility inputs, climate, etc. Regular testing will help to determine if you are on target with your maintenance regime.

There has been quite a lot of discussion on the amount of sand required to be applied during any growing season to prevent organic matter build up. Again there are many variables that could influence this. Research and surveys have put the range as low as 18 or as high as 50 cubic feet per 1,000 square feet (O'Brien, P., Hartwiger, C. 2003., Gaussoin, R.). For the most part it does not matter how you get it there but common sense would have you using the several known methods in combination while making sure it stays in the target zone. At this point the target zone could be 0 to 2.5" in depth. In reality once organic matter is under control the best thing you can do is make sure you have a reasonable topdressing program that uses light infrequent applications to thoroughly cover 100% of the surface area. This method covers the surface area organic build up.

To make sure organic build up stays diluted underneath the canopy and in the most active root zone area, some form of aeration and incorporation method should be used. It could be a combination of several methods such as coring and replacing, injection, deep verticutting and replacing or solid tine and backfilling. Each has its own attributes. The positive thing is that since you are starting at a good point, the total area of disruption does not have to be as dramatic as when your goal was to drop organic percentage. Consider leaning toward methods that have tighter spacing but with smaller holes or verticut lines to ensure a more homogeneous coverage. Keep in mind that core holes smaller then 3/8" are very difficult to backfill with sand.

Table 2. Demonstrates a maintenance regime after the Organic Matter percentage has been dropped to a healthy level. It is based on the assumption that there is an average of a .30% increase in organic matter percent per year for the entire 2.5 inch zone. It is acknowledged that the OM growth is greatest near the surface and progressively less with depth. This assumption can and will fluctuate in different climatic regions and will change with differing maintenance inputs and turf varieties.

TABLE 2

MAINTAIN ORGANIC %

CORE & REPLACE		
	WIDTH	LENGTH
SPACING	3	2
TARGET DEPTH	2.5	
INJECTION:		
	WIDTH	LENGTH
SPACING	1.5	2
TARGET DEPTH	2.5	
AREA OF DISRUPTION		
CORE		3.27%
INJECTION		2.82%
		6.09%
ORGANIC % REDUCTION		
CORE		-0.13%
INJECTION		-0.12%
TOPDRESSING		-0.15%
		-.40%
NEW OM%		3.00%

OM% START	3.10%
1 YR GROWTH	0.30%
TOTAL TARGET	3.40%
TINE SIZE:	0.500
HOLE SIZE:	0.328

SAND CUBIC FT/1,000

CORE	6.82 *
INJECTION	5.87
TOPDRESS	12.00
	24.69

TOPDRESS

^APPS	CUBIC'/M	TOTAL
16	0.75	12

^3 APP EQUIVALENT WHEN FILLING CORE HOLES WHEN LEFT IN CANOPY. 13 STAND ALONE APPS.

TOTAL TONS SAND BASED ON:		
100,000	SQ.FEET	120.20

*AMOUNT NEEDED TO FILL ONLY HOLES

Assuming that you are able to replace all extracted material properly, coring and replacement will slightly exceed straight injection from a mathematical standpoint in reducing organic matter percentage by weight. Relying on straight coring alone would be very labor intensive and definitely disrupt play quite a bit during your short corrective time period. Because of the injection method's low impact on playability, you may want to seriously consider incorporating this method into your program. Could you even try to use injection all by itself? The math should help you decide.

Table 3. Shows the impact of tine size and spacing or comparable sizing for injection on sand material needed and impact at certain levels on OM reduction. (See page 5)

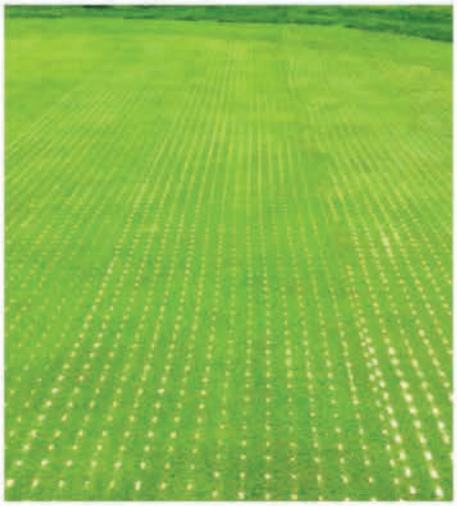

TABLE 3

AERATION SURFACE AREA, VOLUME AND ORGANIC MATTER IMPACT

TOTAL SQ FEET: 100,000

SPACING	HOLES PER SQ. FT.	SINGLE TINE SQ. INCHES	% SURFACE AREA IMPACT	DEPTH	VOLUME EXTRACTED OR DISRUPTED CU. INCHES/F T	POUNDS DRY SAND PER 1,000 TO FILL HOLES ONLY OR INJECTED	% OM REDUCTION IN HOLE DEPTH PROFILE*	TONS OF DRY SAND TO PERFECTLY FILL EACH HOLE FOR ABOVE SQ T	OM REDUCTION AFTER 4 XS IN SHORT TIME PERIOD*
CORE AERATION					**1/4" TINES**				
1 X 1	1.44	0.0491	4.91%	3	21.21	1195	6.31%	59.8	22.54%
1 X 2	72	0.0491	2.45%	3	10.60	598	3.18%	29.9	12.00%
2 X 2	36	0.0491	1.23%	3	5.30	299	1.59%	14.9	6.20%
3 X 2	24	0.0491	0.82%	3	3.53	199	1.06%	10.0	
3 X 3	16	0.0491	0.55%	3	2.36	133	0.71%	6.6	
					3/8" TINES				
1 X 1	144	0.1104	11.04%	3	47.71	2689	13.94%	134.5	
1 X 2	72	0.1104	5.52%	3	23.86	1345	7.08%	67.2	
2 X 2	36	0.1104	2.76%	3	11.93	672	3.57%	33.6	13.39%
3 X 2	24	0.1104	1.84%	3	7.95	448	2.39%	22.4	9.14%
3 X 3	16	0.1104	1.23%	3	5.30	299	1.59%	14.9	6.20%
					1/2" TINES				
2 X 2	36	0.1963	4.91%	3	21.21	1195	6.31%	59.8	22.54%
3 X 2	24	0.1963	3.27%	3	14.14	797	4.23%	39.8	15.66%
3 X 3	16	0.1963	2.18%	3	9.42	531	2.83%	26.6	10.74%
3 X 4	12	0.1963	1.64%	3	7.07	398	2.12%	19.9	
					5/8" TINES				
2 X 2	36	0.3068	7.67%	3	33.13	1867	9.78%	93.4	
3 X 2	24	0.3068	5.11%	3	22.09	1245	6.57%	62.2	
3 X 3	16	0.3068	3.41%	3	14.73	830	4.40%	41.5	
3 X 4	12	0.3068	2.56%	3	11.04	622	3.31%	31.1	
DRYJECT INJECTION					**TOPCHANGER HD MANIFOLD 0.328" AVERAGE HOLE DIAMERTER**				
1.5 X 1	96	0.0845	5.63%	3	24.33	1371	7.22%	68.6	24.23%
1.5 X 1.5	64	0.0845	3.76%	3	16.22	914	4.84%	45.7	17.17%
1.5 X 1.7	56	0.0845	3.31%	3	14.31	807	4.28%	40.3	15.38%
1.5 X 2	48	0.0845	2.82%	3	12.17	686	3.64%	34.3	13.29%
					ORIGINAL MANIFOLD 0.40" AVERAGE HOLE DIAMETER				
3 X 2	24	0.1257	2.09%	3	9.05	510	2.71%	25.5	10.13%
3 X 3	16	0.1257	1.40%	3	6.03	340	1.81%	17.0	6.92%
3 X 4	12	0.1257	1.05%	3	4.52	255	1.36%	12.7	
					MAXIMUS MANIFOLD 0.70" AVERAGE HOLE DIAMETER				
6 X 5	4.8	0.3848	1.28%	9.5	17.55	989	N/A	49.5	
6 X 6	4	0.3848	1.07%	9.5	14.62	824	N/A	41.2	
DRILL & FILL					**3/4" TINES**				
7.5 X 7.5	2.56	0.4418	0.79%	10	11.31	637	N/A	31.9	
					1.0" TINES				
7.5 X 7.5	2.56	0.7854	1.4%	10	20.11	1133	N/A	56.7	
GRADEN					**5/64" BLADES**				
1 INCH	N/A	N/A	7.81%	1	11.25	634	3.37%	31.7	
					9/64" BLADES				
1 INCH	N/A	N/A	14.06%	1	20.25	1141	6.03%	57.1	

*GRADEN % ORGANIC MATTER REDUCTION BASED ON DEPTH PROFILE OF: 3 INCHES

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WET, BUT NOT SO WILD

ROUNDS PLAYED INCREASE SLIGHTLY IN 2019 DESPITE SECOND-WETTEST YEAR ON RECORD

by Tom Mackin - thengfq.com, February 2020

The golf gods can be a fickle bunch but they have nothing on Mother Nature, producer of the one element general managers or course superintendents can't control.

The good news? Rounds played in the U.S. were up 1.5% last year over 2018, with an estimated 440 million overall rounds played on the books. The New England, Middle Atlantic and East North Central regions, which extend from Massachusetts to Michigan and accounts for almost half of national golf facilities and rounds, fared slightly better weather-wise in 2019. It's a good indicator that the location of precipitation often matters more than the amount.

A rain-soaked course in New Jersey. (Photo courtesy: Erik Matuszewski)

The not-so-good news? The second-wettest year on record in the U.S. dampened budgets at number of courses in other parts of the country.

Last year's record rainfall totals were more concentrated in the Central and Plains states than 2018, which now ranks as the fourth-wettest year on record, yet it was the West and Mountain regions most affected by poor weather in terms of play, with rounds down 3.4% and 2.4%, respectively, from 2018. For Mike

August 2019

January 2020

Woods, PGA director of golf at Haggin Oaks Golf Complex in Sacramento, California, it was all about the rain.

"When you're used to 18 inches, getting 33 inches like we did throws a big monkey wrench into your golf operation," he said. "The weather impact on rounds played in February, when we had 9.5 inches of rain (rather than the usual four inches), was a negative 36% from 2018. We also had 10 days where both of our courses were shut down completely due to hard rain. Usually, we only have three of those days a year."

There's also what Woods call the "lag effect."

"Say it rained hard yesterday and today it's sunny and beautiful, but no carts can come off the path," he said. "People just decide to not play because they know it might be a swampy mess out there. So that's not a playable day. People will just go skiing instead at Lake Tahoe, which is 90 minutes away from us. They had a phenomenal last winter up there with a record snowfall. You could ski and play golf on the 4th of July weekend, which is unheard of."

Typically, the MacKenzie Course at Haggin Oaks averages 60,000 rounds annually, while 45,000 rounds are played on the adjacent Arcade Creek course. Last year's wet weather was especially detrimental in January (overall rounds -8%), March (-9%) and December (-10%), with other months fluctuating 2% either way. "We were down about 8%, or 9,000 rounds, overall in 2019," said Woods.

Play in Arizona held steady for the most part. Daryl Crawford, general manager at Papago Golf Course in Phoenix, attributed a good year to both positive weather and the opening of a new clubhouse (not to mention the closing of nearby ASU Karsten Golf Course in May).

Rounds last year were up over 2018 at Papago, which averages between 52,000 and 55,000 annually. Even during the intensely hot summer months, play was consistent. "We have such a large local following who have been playing here for decades," said Crawford. "They know what's it like to play in the summer. They play early in the morning or late in the afternoon to take advantage of the rates and to play quickly. Weekends then are still very busy and we often use double tee starts in the morning. We're also trying to increase 9-hole rounds. We're getting a lot more calls about that now and I think that's a good thing."

Click here to read more

HAVE NEWS TO SHARE?

Please send it to the PAGCS office.
kliebsch@pagcs.org

>>MEMBERS FALL AND WINTER

Tyler Bloom
Superintendent
Sparrows Point GC
Paul Stead & Geoff Stricker
**Requesting reinstatement*

Kevin Coombs
Affiliate
Coombs Sod Farm
GCSNJ Member
Greg D'Antonio & Darren Farrar

Travis Gross
Kennett Square Golf & CC
Assistant
Member of Mid-Atlantic Association
Paul Stead & Josh Saunders

Thomas Richey
Whitemarsh Valley CC
Technician
Member of the Georgia Association
Darren Farrar & Derrick Wozniak

William Leedoom
Assistant
Fieldstone GC
Greg Eisner & Darren Farrar

Keith Ciferni
Assistant
Fieldstone GC
Greg Eisner & Darren Farrar

Matt Stout
Affiliate
Noble Turf
Larry Corr & Scott Anderson

Chris Braun
Affiliate
STI of PA
Dave Visocan & Mike Mulhare

Lewis Brenton
Superintendent
Shearon Environmental
Darren Farrar & Derrick Wozniak

Anthony Johnson
Superintendent
Philmont CC
Mike Mulhare & Matt Rogers

Travis Gross
Assistant
Kennett Square Golf & CC
Paul Stead & Darren Farrar

PATRIOT GOLF DAY MOVES TO MEMORIAL DAY WEEKEND

Patriot Golf Day is the largest grassroots golf fundraiser in America, and this year, Folds of Honor has partnered with PGA HOPE (Helping Our Patriots Everywhere). As a result, Patriot Golf Day will move to its rightful home over Memorial Day Weekend, a holiday devoted to the memory of the men and women who have paid the ultimate sacrifice for our nation.

Last year, with our efforts, Patriot Golf Day raised over $7 million—which funded over 1,400 scholarships. This year, donations received as a result of your efforts will enable both Folds of Honor and PGA HOPE to better serve the needs of Veterans and their families through the game of golf.

https://www.foldsofhonor.org/patriotgolfday/

Patriot Teaching & Coaching Day is an opportunity for instructors, coaches and fitness professionals throughout the game of golf to fundraise within your already existing lesson program for Folds of Honor and their mission to leave no family behind.

THANK YOU TO GEORGE E. LEY FOR THE GENEROSITY YEAR AFTER YEAR

TEAM MATCHES: THEY'RE BACK FOR 2020

The 95th year of the PAGCS is full of exciting news and events, as you have seen with the roll out of the new website. In addition to the revival of the War at the Shore, we are also bringing back Team Matches.

This better-ball of partners competition kicks off in April, and registration is available to all PAGCS members through March 31. So grab a partner and have some fun. Read on for more information.

Teams: Must be a member of the PAGCS. Brackets will be formed in both Net and Gross divisions. To compete in the Net competition each player must have an official USGA handicap and current GHIN number by the time the brackets are announced.

Monies: $40 to be paid at the time of registration. The money will be pooled for the gross and net brackets, and the winners from each match played, each round, will win a cash prize! All pay outs will be presented at the completion of the season.

Matches: It is up to the two teams to determine a neutral golf course to play the match. Contacting the host superintendent, at the neutral site, to ask for golf course availability to play the match is the required etiquette.

THE NET MATCH PLAY BRACKET

- 2-player teams playing match-play golf using USGA Handicaps.
- Handicaps will be played at 90% in 2020. **USGA recommended percentage for team match play*
- In general, after handicap allowances have been applied in match play formats, the player with the lowest Playing Handicap plays off zero strokes relative to the other player(s). The other player(s) receive(s) the difference between their own Playing Handicap and that of the player with the lowest Playing Handicap.
- Each round of matches must be completed by the deadlines posted. There will be no extensions of time past these deadlines.
- If a match can't be played by its deadline, and neither team has elected to forfeit the match due to their unavailability, a coin toss will determine the winner.

THE GROSS MATCH PLAY BRACKET

- 2-man teams playing match-play golf with no handicaps. (All players are scratch.)
- Each round of matches must be completed by the deadlines posted. There will be no extensions of time past these deadlines.
- If a match can't be played by its deadline, and neither team has elected to forfeit the match due to their unavailability, a coin toss will determine the winner.

Thank you in advance for your cooperation. Have fun and enjoy the camaraderie more than the competition! Registrations are due March 31 and the brackets will be released April 15th. For questions, please contact golf committee members Rich Sweeney or Jeff Haas

FACILITY FOCUS: Eight is Enough

FACILITY: Bidermann Golf Club

CONTRIBUTOR: Patrick Michener, new PAGCS Board Member and co-chair of Public Relations and Outreach Committee.

WANT TO SEE YOUR FACILITY FEATURED?

Please email photos and information to kliebsch@pagcs.org

FIRST GREEN IS GROWING IN 2020

The First Green program continues to grow in our region. New courses are jumping on board for 2020, and we can't wait to share more in the upcoming months. If you would like to host or want more information, please contact the PAGCS office [kliebsch@pagcs.org].

2019 Hosts:

Ledgerock Golf Club, Alan Fitzgerald

Coatesville Country Club, Chris Walton

Philadelphia Cricket Club, Dan Meersman and Robb Moulds

Walnut Lane Golf Course and the First Tee of Greater Philadelphia, Ben Davies. ◆

FROM THE EXECUTIVE DIRECTOR

The First Tee of Greater Philadelphia cannot thank the PAGCS and all the dedicated Superintendents and vendors enough for the continued support of the Walnut Lane Golf Club. Without your help over the past few years, the golf course would never have made it and would have been added to the long list of closed clubs. Because of the volunteer labor on our "Annual Work Day," as well as the many who provide expertise to our staff, the course has turned the corner from being a bottom tier course to being one with a growing reputation and financial stability.

As a result of the success at Walnut Lane GC, First Tee took the bold step to save the John F. Byrne GC (located in northeast Philadelphia) from closing on October 31, 2019. This would not have happened unless the members of PAGCS helped us at Walnut Lane to gain the confidence that it could be done. We have a lot of work to accomplish at John Byrne, but we now have a successful blueprint to follow and we are indebted to all of you. As a result of your efforts, the community and our First Tee kids benefit greatly.

Bill Hyndman [kneeling right] is flanked by his team at First Tee of Greater Philadelphia

There are so many people to thank, and we appreciate that everyone helps for the sake of giving back and not for the recognition. Thank you, all.

Sincerely,

Bill Hyndman, executive director, First Tee of Greater Philadlephia


WITH YOU WHEN THE GOING GETS ROUGH.
No matter how good you are, sooner or later, you'll find yourself in a tough spot. We'll help get you back on the fairway. With decades of experience, we will use our unmatched product selection to develop a custom solution for your course. From innovative problem-solving to exclusive training, discover expertise that can only come from the green industry's No. 1 supplier. Partner with us, and let's grow Stronger Together.
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