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To

KØBENHAVENS GOLF KLUB

AGRONOMY REPORT ON THE GOLF COURSE
Date of Inspection – 28 May 2009

1.0 PRESENT

1.1 The course was inspected with Martin Nilsson and Mogens Nielsen.

1.2 Matters arising were discussed with Steen Christian Pedersen.

2.0 BRIEF

2.1 To carry out a review of course condition and resources for maintenance.

2.2 To collect samples for laboratory analysis.

2.3 To comment upon findings and to make recommendations for future action.

3.0 REVIEW

3.1 During the past twelve months there has been excellent progress as a result of both surface management operations on greens and action within phase 1 of the course renovation programme. Both processes are making headway at a much faster rate than expected. However, extra speed on the course renovation project has held back the operations required to make a fundamental improvement to the fairways.

3.2 The surface management programme applied to greens over the past two years has the aim of producing high quality putting surfaces, reliably throughout the year, in the special circumstances of KGK. The current status the greens in achieving these aims has been especially good during the past year and the results now being achieved on, e.g. the 4th, 14th and 15th are very close to the finished product. The putting surfaces at the 2nd, 7th, 9th, 10th, 11th, 12th, 13th and 16th are close behind the very best and are expected to reach the highest standard over the next year or so.

3.3 With respect of the other putting surfaces, my comments were:

- At the 1st, the turf has benefitted from being fenced off over winter and has not suffered quite so much severe disease damage as has been the case in past years. Nevertheless, there have been fundamental technical improvements too, with a decline in the amount of Poa and an increase in Agrostis and Festuca. There was still some disease scarring after the winter

(likely to be a consequence of extra shade) and the grasses had a comparatively low vigour, which could be due to root invasion from surrounding trees. It was noted too that a sand layer some 5 cm from the surface is still an impediment to root growth. Such a root break can have similar effects to tree root problems and is an item for special attention.

- The 3rd green was particularly weak to the left hand side where there are invasive tree roots from the nearby Oak trees that will be competing with the turf. I was pleased to the park authorities have given permission for tree root pruning and this has been pencilled in for later in the year.

- Invasive tree roots creating an environment in which shallow rooted Poa can still compete with Agrostis and Festuca remains a problem to the rear of the 5th green, where tree root pruning is also planned. Good.

- At the 6th, the comparative weakness of the turf around the rear margin seems to be as much due to soil compaction as it does to tree root invasion (the trees here are Horse Chestnuts, rather than Oaks). This soil compaction is something for attention whether you extend the green or not. I was not keen on the idea of extending the green closer to the trees because I think you will find it will be difficult to keep the turf well.

- The turf at the 8th has improved considerably. It was much more uniform and complete, with a better quality. There is a high percentage of Fescue and the Poa is blending in rather better. Nevertheless, in the subsurface, the profile is still too fat within the top 5-8 cm and this feature requires special action within the management programme.

- At the 17th, there is a large patch of Poa in the hollow in the centre/left of the putting surface, where surface water run off will gather. Beneath this patch, the soil profile was particularly hard due to silt build up at 20-25 cm from surface level and this layer is not responding well to routine vertidraining. Here the soil will repack quickly after vertidraining, due to a high level of water movement through the ground. In such circumstances it is necessary to take away a percentage of this silty soil and replace it with something better.

- The weakest green on the main course was the 18th, where there is still a high percentage of Poa in the turf and this was rather thin and scarred. This is a shady spot and the green will be affected by invasive tree roots (that are planned for pruning). In addition though, there is a fundamental flaw in the underlying make up in that the soil profile is heavily compacted and silted through a depth of 15-25 cm, which is not responding to vertidraining. So, there needs to be a plan to take away a percentage of this soil to reduce bulk density and replace it with something better, to improve water balance within the growing environment.

- Lastly, the practice putting green is almost exclusively Poa and suffers from the same problems as the 18th, but to an even more acute level. Some tree root pruning may be practical, but certainly you cannot improve the situation with respect of heavy shade. In such circumstances I think it is impractical to expect to produce even a moderately stable turf that is equivalent to the greens out in the course, even if you build a free draining structure, and strip and resurface every few years. As such, my recommendation is not to rebuild the putting green, and to accept that Poa is the turf type that is best

adapted to this growing environment. So the way forward is to work on silt accumulation and water retention, by similar methods to that proposed for the 18th. Then the putting green can still provide a fun area, and if players need to perfect their putting stroke before a round they can use the alternative putting green at the other side of the clubhouse.

3.4 Having identified critical issues with respect of individual greens, I would note too that I think the greens other than the 18th and the practice putting green have all improved considerably during the past year, and with special action from hole to hole I anticipate ongoing progress to full consistency.

3.5 Moving on, as part of the course renovation project additional areas of putting surface have been built at a selection of greens. The original proposal for these areas was to use turf from the Par 3 course, and where this has been done (at, e.g. the 4th, 14th, 15th and 16th) the turf has bedded in well to date. Some of the extension areas looked a little bit patchy because of variations in the make up of grasses, but I expect these to blend in progressively over the next 1-2 years. However, there was insufficient turf for every green extension and at the 1st and 3rd turf has had to be imported from the UK to complete the job. This turf was also well anchored. With careful action to establish these new areas before they are brought into the full intensity of putting surface management, I do not anticipate any major problems. Note though, the imported soil layer at the turf base is an issue, and this will need to be hollow tined regularly for the foreseeable future.

3.6 Reshaping of the surrounds to greens has produced excellent results. The turf imported from the UK has taken well and looked very healthy. This is quite a mature material with a significant layer of fibre at the turf base, which has advantages as well as disadvantages. On the plus side this will certainly help with wear resistance. The one feature that detracted from a uniform appearance was the presence of significant patches of coarse Poa. I expect some of this to disappear as mowing becomes tighter, but if some ugly spots remain there is a case for cutting out and filling in the gaps by soiling and seeding.

3.7 The same turf has been used on new tees, where the Poa can be further encouraged to disappear by verticutting and scarifying. Certainly, scarifying and sand top dressing will be necessary to help control the fibre layer here, because this makes the platforms feel just a little bit too soft. This might be combined with hollow tining to help further key the turf into the underlying rootzone material.

3.8 The new bunkers looked very good. New sand has been installed that has not yet had the opportunity to bed in properly and was quite soft and loose. An analysis of the particle size distribution of the sand has been carried out (see ETL Report 008710), attached as an appendix. There is a good distribution of particles, but a more detailed view suggests the particle shape is rounded, whereas the ideal is an angular sand that will lock together to give firmness underfoot and avoid plugging. As such, the sand may be slow to bed down until some dirt is mixed in, or you may have to find a more angular sand to spread over the surface of what has been installed.

3.9 There was quite a satisfactory grass cover throughout the fairways, but the turf was rather long and woolly, and in many cases the quality of the grass mix is not to the high standards of links-quality fairways. A reasonable grass

type is present on the higher parts of the course (e.g. at the 11th, 13th and 14th), but elsewhere it is quite coarse and I would expect the fairways to be wet at times. The primary requirement for the improvement of the fairways is to deal with heavy soil compaction. With this in mind my strong recommendation is that intensive vertidraining must be a high priority action. There will be a low value to scarifying, overseeding or top dressing until such a time that effective vertidraining has been carried out.

3.10 The Par 3 course is being rebuilt as part of the course renovation project. No additional operations were advised at that stage.

4.0 RESOURCES AND EQUIPMENT

4.1 I was very pleased to learn the Club has maintained a minimum staffing level of six greenkeepers and is taking positive action to retain good staff.

4.2 No problems were reported with respect of irrigation and I understand irregular water supply is no longer an issue.

4.3 No new comments were made concerning machinery. However a tractor mounted brush will be an asset for the long term maintenance of the fairways.

4.4 Lastly, an item for serious discussion for the future should be where to locate and develop a turf nursery for the greens. In a situation where the course is being maintained in a pesticide free environment there is always the risk of a few scars from time to time. Also there are the problems of deer damage and weed removal to consider.

5.0 GREENS

5.1 Assessment

Away from greens where there were a few residual scars ball roll was smooth at a good pace.

The turf on most putting surfaces was dense and complete, and it was just in places where there is a shallow root depth that the turf seemed stressed. In general, this feature was in association with residual zones of Poa, which must be kept under stress, but the sand root break close to surface level at the 1st was impacting on Agrostis as well.

Keeping the Poa under stress will continue to help to reduce the percentage present and is a very necessary part of the overall management package. At the same time though, it is important that you manage growing conditions so that Festuca and Agrostis can overtake the Poa. With this in mind, there is a need for selective operations from green to green to address special problem features, as listed in item 3.3 above. Tree root pruning is still needed at the 3rd and 5th, as discussed last year, and If you can carry out similar work at the 6th and 18th as well, this will be all to the good. Some tree root pruning may be practical at one side of the practice putting green, but this is not likely to be possible where the trees are particularly close.

At the 1st and 8th there are contrasting features for attention within the top 10 cm of the profiles beneath greens. At the 1st there is an especially heavy sand root break some 5 cm from the surface, while at the 8th the upper profile is still quite fat within the top 5-8 cm. In both cases hollow tining will be an important treatment on at least two occasions per year. Ideally you should follow on by packing the holes with Zeolite or Axis to make this treatment doubly beneficial in comparison with just basic top dressing using normal sandy materials.

On the other side of the coin, there is now no requirement for hollow tining on those greens where there is a high population of Festuca species, e.g. at the 4th and 14th. On remaining greens it has been a sensible move to cut back the intensity of coring to one operation per year (in summer) for the present.

On putting surface extension areas I certainly would advise hollow tining this summer if you can carry out the work without lifting the turf (proceed with caution in the first instance). This must be repeated in spring 2010.

As to other features that are being monitored:

- Thatch levels in the immediate turf base have now been brought to the target depth of 1.0 cm overall. This is an amount that will be kept in check by routine verticutting and frequent top dressings. Deep scarification is not required.

- Dry Patch problems were reported to be much less. I assume this is because you have got rid of a lot of Poa and are replacing it with deeper rooted species. Dry Patch will be even less with tree root pruning.

- Some disease damage is to be expected from time to time, particularly in locations that can be heavily shaded, where there is a high degree of susceptibility to Fusarium. Nevertheless, you can expect the amount of damage due to Fusarium to be less as turf quality improves. Close mown turf will always be affected by some disease damage from time to time, but if you have good quality grasses the problem will be small and recovery will be rapid. The one disease seen on the day was Red Leaf Spot, especially on the 16th green, with scattered patches on the 11th and 13th as well. This is a low impact disease that specifically affects Agrostis. I expect the effects will grow out when you apply the summer fertiliser dressing. It is unusual for this disease to cause any real damage and leave scars.

- Deep vertidrain treatments have brought about a much improved level of compaction control beneath the majority of greens. As such, I suggest the intensity of this work can be reduced in 2009/10, to using narrower diameter pins (12 mm) on two occasions, rather than using thick pins with a lot of lift.

- Where there is residual soil compaction, in the hollow at the 17th and over the 18th and practice putting green in general, it seems here the amount of silt in the soil at 15-25 cm is such that the next stage of operations will be to carry out a rudimentary Drill and Fill operation to take away a percentage of the poor soil and replace it with something better. This will make subsequent vertidraining more effective, by creating more space into which the soil can be moved and by reducing the rate of subsequent recompaction.

With respect of the practice putting green, the Club reported a plan to improve it by reconstruction to provide a free draining growing environment, then to follow on by occasional re-sodding using imported material to maintain a turf type that will be something similar to the greens on the course as a whole. However, my view is that the growing environment here is so dark and sheltered that following reconstruction you will find it difficult to maintain Festuca dominated putting surface for more than two or three years and so the need for returfing is likely to be far too frequent to make this a satisfactory solution. My suggestion is to regard this putting green as a fun area and to make the best out of what you have, rather than carry out fundamental reconstruction. The turf type best adapted to these circumstances is Poa, and the best thing to do will be to make the Poa as healthy as possible in a situation where you can do little or nothing about the inherent defects arising from the surrounding trees. You can improve the underlying growing medium, which is very hard 15-25 cm from surface level. So, the best way forward will be to remove some of this poor soil (rather than all of it) on a progressive basis to help the ground drain more freely, and, when drainage due to gravity is complete, have a lower level of water retention.

5.2 Treatment recommendations

The core programme being applied to greens is giving very good results. Nevertheless, there is scope for adjustments to take account of changing circumstances and to focus special action on those places where there remain some features that are supporting Poa and inhibiting the spread of Festuca and Agrostis. These points are confirmed as follows:

Hollow tining. It was reported that hollow tining was missed out this spring in order to provide better putting surfaces for longer, which is a sensible course of action. For the future, I suggest a flexible approach to hollow tining in the light of conditions from green to green. For the greens where there is now a high content of Festuca, e.g. at the 4th and 14th, my suggestion is to drop out hollow tining altogether, and to introduce new seed on just one occasion per year with the overseeding machine. For most other greens there is a case for hollow tining on one occasion per year in summer, as planned.

However, at the 1st, 8th, 18th and practice putting green I recommend hollow tining a minimum twice per year, and if you can coordinate hollow tining with inputs of Zeolite or Axis to backfill the holes, this will make the work even more positive. There is a lot of information on both Zeolite and Axis and their use in turf management on the internet.

Vertidraining. The heavy duty vertidraining advised in the past has been effective, and so the intensity of this work can now be brought back to a preventative level. With this in mind, I suggest vertidraining on two occasions in autumn/winter 2009/10, using 12 mm pins to a depth of 25 cm, applying gentle lift without ridging. Follow on with a light rolling, but no top dressing.

Drill and Fill – 18th and practice putting green. Heavy soil compaction caused by silt accumulation is a problem in both these cases. To take away a percentage of the damaged soil away I suggest you use a soil borer to

create holes of 4-5 cm diameter to a depth of 35 cm in a grid pattern, say a 20 cm spacing in the first instance. Having taken out the soil, use a funnel to pour a mixture of sand and Zeolite or sand and Axis (in the proportions 50:50 by volume) into the holes, before closing off the top by replacing a plug of turf 3-5 cm deep. If you cannot get hold of Axis or Zeolite use dry bunker sand.

Drill and Fill – 17 green. At the 17th, I think operations are required along similar principles to those described above for the 18th but in the low hollow only. Here the volumes of water moving through the soil are likely to be large, so the channels should be larger to limit the rate of subsequent silting up. So, here I suggest taking out plugs of turf with a Turf Doctor or similar, then boring down to a depth of 35-40 cm using a 10 cm diameter auger and remove the arising soil. Replace it with bunker sand to plug depth, packing in well. Subsequently put back a 10 cm depth of turf.

Tree root pruning. Carry out tree root pruning at the 3rd and 5th as described last year. If then you can progress on to the 6th and 18th and part of the practice putting green, this will be all to the good.

Weed control. Weed control in a pesticide-free environment is a difficult issue. Certainly, I think you will have to live with the local populations of Sagina. Fortunately, these do not really impact on the quality of the greens. Plantago species can be removed with a knife. As to the Cerastium, I suspect you will have to remove this by plugging as a winter programme, when you have satisfactory turf to use as a replacement.

Verticutting and top dressing. Monthly verticutting and top dressing will be a key treatment throughout the growing season. The verticutting need not be deep and can be restricted to no more than, say 1 mm below roller level. The top dressing material being used is a good product and is compatible with the top layer beneath the turf on putting surfaces. See the ETL analysis results in the appendix for the top dressing mix and the top layer from green 4. The top dressing will improve the particle size distribution of the top layer without being fundamentally different, and will help to dilute organic matter build up.

6.0 GREEN EXTENSIONS

6.1 Assessment

The new areas of turf laid out as putting surface extensions are establishing well to date. These were being mown without damage at a height of cut of 6.0 mm.

For the short term, apply very light top dressings every couple of weeks to develop the smoothest possible surfaces. Step down the height of cut slowly to match these in with greens as a whole by the second half of the summer.

Include these areas on all other routine treatments for greens, but it will be particularly important to hollow tine this year, and again next spring. Take care at the beginning to avoid the risk of lifting the turf. If you do get some lift, try increasing the space between the tines. If you can add Axis or Zeolite to the holes after coring, this will help the integration of the turf with the

underlying soil, but if not use normal sandy compost as before. Carry out overseeding with each hollow tining, but also include these areas with the general overseeding using the machine to help them become part of each green at the earliest date.

7.0 GREEN SURROUNDS

7.1 Assessment

All green surrounds looked rather better this year, but there has been a special improvement where there has been reshaping and returfing. The mature turf from the UK has been a good choice, even though the number of Poa patches that have come through have been more than expected. As noted earlier, I think some of these will disappear as you start to lower the height of cut, and you can hasten this process by occasional light verticutting where access is possible. Cut out the residual ugly patches and carry out repairs by soiling and seeding.

The smoothness of contours of the re-laid turf was very satisfactory. I did not see a need for top dressing on surrounds in general. Focus this action on foregreens, where the height of cut will be tighter. Combine this with rolling to have a rapid effect. Localised rolling might be carried out on surrounds in general if there are places which seem a little bit bumpy, but I would not see this as crucial.

The prevailing height of cut was at 25 mm. Now the surrounds are growing well, reduce the height of cut in two stages over 4-6 weeks to a final setting of 18 mm for the current year.

If the turf retains good vigour there is no requirement for fertiliser treatment. If it becomes yellow, a small granular feed will restore good health.

With respect of aeration, I do not envisage a need for intensive treatments, other than where player traffic is focused on lines on walk-on and walk-off. Here, vertidraining will be necessary from time to time in winter.

8.0 TEES

8.1 Assessment

The main criticism of the new turf on tees was that it was a little bit soft underfoot. As such it will benefit from hollow tining in summer, followed on by top dressing. Then, in late summer scarify to a depth of 1 cm using pedestrian operated equipment, remove the arisings, and apply a further application of sand top dressing. In the short term, top dress to help develop maximum surface smoothness. Once this has been achieved carry out verticutting to thin out the Poa patches.

Apply fertiliser as required to sustain steady growth.

9.0 BUNKERS

9.1 Assessment

New bunker shaping looked good and underlying drainage was reported to be rapid. The quality of drainage has been addressed on a bunker by bunker basis, by adding outflow drains where the effectiveness of soakaways is not at an optimum. This is a sensible approach and should be continued in phase 2.

Comments on the bunker sand have been made earlier. This is likely to take some time to bed in because the shape of the particles is quite rounded, whereas an angular sand is preferred in these circumstances.

10.0 FAIRWAYS

10.1 Assessment

At that stage the grass on fairways was rather long and woolly, but it was felt this would soon be improved by planned mower adjustments.

As to more fundamental issues, the primary requirement for long term improvement of the fairways is to carry out heavy duty vertidraining with 20-25 mm pins and plenty of lift to break up heavy soil compaction. With action in this respect I expect not only the fairways will drain more freely, but also the nature of the grasses making up the turf will improve dramatically. If you combine winter vertidraining with spring rolling, I think you can make a lot of improvements quickly, without having to go to the expense of overseeding and top dressing. These can follow at a later date, if found to be necessary from hole to hole.

Verticutting of fairways using the Veemo units will be more practical when you have smoother surfaces after rolling. A better method of routine grooming will be to use a tractor mounted brush (e.g. from Greentek or similar) at monthly intervals prior to mowing.

D M STANSFIELD
5 June 2009