

# ROYAL COPENHAGEN GOLF CLUB IRRIGATION

## NOTES ON IRRIGATION VISIT w/c 29<sup>TH</sup> OCTOBER 2018



### PRESENT:

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RHA

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#### 1. INTRODUCTION & EXECUTIVE SUMMARY

- 1.1 The purpose of the visit was to look at the existing irrigation system and comment on its current status, the potential for the addition of green surrounds [back to back], approaches and fairway watering and generally provide recommendations as to remedial works required to bring it up to modern standards to provide efficient and effective watering of the golf course.
- 1.2 The current irrigation system at Royal Copenhagen Golf Club (RCGC) was installed in 1994 by S48. The system included borehole water supply and pumping plant, mains pipe work, control cabling and pop up irrigation to greens putting surfaces and tees playing surfaces.
- 1.3 Overall the irrigation system at RCGC is a good condition for its age, however, the average lifespan of an irrigation system is generally 25 years with certain elements having potentially a longer lifespan and some a shorter lifespan depending upon usage and servicing. The system has received a good level of ongoing maintenance and has been cared for very well by the Greenstaff for which credit must certainly be given.
- 1.4 The management and maintenance of golf courses has, however, changed significantly since the original system was installed with a focus now on finite moisture management within the playing surfaces requiring target specific irrigation and therefore it is important that the irrigation system at RCGC is upgraded to take into account these changes.
- 1.5 RCGC are at the stage now where a decision needs to be made regarding;
- 1.6 Do they live with what they have got and adapt it accordingly [where/if possible] until the inadequacies and inefficiencies with the current system are having unacceptable quality issues with the management and maintenance of the golf course, or

- 1.7** Do they begin the planning for upgrading their irrigation system to ensure its is in line with up to date technologies moving forward and negate the failing infrastructure and operational problems which will only come with time.
- 1.8** The existing irrigation design and specification uses methodology from the era when the system was installed [early 1990's]. Adding to the existing system infrastructure will therefore always be a compromise in terms of efficiency, operation and quality and even with all the investigations possible into the existing system infrastructure [pipe work, control cable etc] there is always going to be an element of risk and unknown which would need to be appreciated and understood by RCGC.
- 1.9** As the average lifespan of an irrigation system is 25 years and to ensure a more efficient use of water improving overall moisture management and to bring the system up to modern standards we would therefore recommend the planning begins now for replacement of the existing system. This will allow for the green surround [back-back], approach and fairway irrigation which the golf club would like to implement to be designed in harmony with the greens and tees irrigation which would not be possible when adding to the existing irrigation system.
- 1.10** We would also recommend that any golf club takes a pro-active approach which is why we believe the planning for upgrading the system should begin now before it becomes an immediate necessity.
- 1.11** It should be stated here that the Greenstaff have managed very well indeed with the irregular sprinkler spacings and positions on the greens to ensure moisture management is as controlled as possible. However, we believe with the inadequacies in the current green irrigation and age of its infrastructure that whilst adding green surround and approach irrigation is likely to be possible this would be a retrograde step. RCGC would be spending their money much more wisely if the greens irrigation is replaced so that the green surrounds and approach sprinklers can be positioned more optimally. On the tees the existing irrigation will not allow for any real form of moisture management and the current design is extremely wasteful of water with many areas of the tees not receiving any water at all. Hence our recommendation that the tees irrigation is also replaced.
- 1.12** The planning would commence with the drawing up of an irrigation design 'master plan' working closely with the Course Manager, Committee/Board and STRI/R&A Agronomist to ensure the irrigation system is upgraded and modernised in line with the current and future management and maintenance of the golf course. This would include re-visiting the areas to be irrigated (green putting surfaces, green surrounds, green approaches, fairways, tees etc), how these areas are irrigated i.e. moisture control, required application rates, irrigation time window, water resources (for example is sufficient water available for fairways) etc, with the aim of preparing a design on the irrigation system with a view to upgrading the system.
- 1.13** An irrigation system is a maintenance tool like the grass cutting machinery, however, with the majority of the infrastructure being out of sight unfortunately it is often out of mind. It is also the most expensive single item of maintenance equipment on any golf course. Like any item of maintenance equipment there is a need to replace/upgrade wearing parts prior to them wearing out completely and at RCGC this would include pipe work, valves, sprinklers, control cable and control system etc.

- 1.14** The underlying areas of concern with the system are;
- the need to ascertain how much water is available for irrigation
  - the uPVC main line pipe work [ring main]
  - the areas of irrigation on the golf course and how/where water is being applied
  - the tee irrigation; coverage, sprinkler location, valves, control of where water is applied etc
  - the green irrigation; coverage [uniformity], sprinkler location / spacings, valves etc
  - the need to ensure watering of the green putting surfaces independently of the green surrounds
  - the lack of fairway irrigation to allow management of these surfaces like the greens [if this is required]
  - the control system; age of control cable and controller etc
- 1.15** The way forward is to obtain a irrigation master plan design to meet Royal Copenhagen's future requirements so that all areas requiring irrigation are accurately and successfully irrigated. From this design a scaled plan, detailed specification and bill of quantities can be produced. This can then be sent out to tenderers to obtain 'like for like' quotations for the proposed works which are totally comparable and competitive. This would then form the basis of any accurate budgets moving forward.
- 1.16** We would comment as follows;

## **2. *EXISTING IRRIGATION SYSTEM***

### **2.1 *Areas to be Irrigated;***

The current irrigation system was designed to irrigate the following areas;

- Greens putting surfaces and immediate surrounds [not independently]
- Tees playing surfaces

**2.2** Since the original system was installed there have been modifications to some areas of the course (greens) and therefore there is a requirement to assess on a hole by hole basis what areas require irrigation. Sprinkler technology has changed in 20 years and there are options available which would reduce water usage and provide better coverage and uniformity in wind which should certainly be considered.

### **2.3 *Water Supply;***

The water supply for the golf course is from a borehole beside the 10<sup>th</sup> Green.

**2.4** The borehole yield has recently been reconfirmed at 30m<sup>3</sup>/hr.

**2.5** It is imperative that RCGC maintain detailed records of water usage. On this basis there is a need to have the Siemens Magflo meter [MAG500] repaired/replaced in the borehole well head chamber.

- 2.6 To ensure adequate water is available, the following table shows approximate water usage for different sizes of irrigation system to replace E/T during dry periods of weather;

| 2.7 | <i>Areas Irrigated for the Irrigation System – 18 holes</i>               | <i>Water Required / Day<br/>[estimated]</i> |
|-----|---|---|
|     | Greens putting surfaces   | 65 m <sup>3</sup> /day                      |
|     | Greens putting surfaces and tees playing areas                            | 170 m <sup>3</sup> /day                     |
|     | Greens putting surfaces, green surrounds and tees playing areas           | 250 m <sup>3</sup> /day                     |
|     | Greens putting surfaces, green surrounds, fairways and tees playing areas | 650 m <sup>3</sup> /day                     |

- 2.8 If we work on an eight hour watering window, and allow for some system inefficiencies then the following minimum flow rates from the borehole are required;

| 2.9 | <i>Areas Irrigated for the Irrigation System – 18 holes</i>               | <i>Water Required / Day<br/>[estimated]</i> |
|-----|---|---|
|     | Greens putting surfaces, green surrounds and tees playing areas           | 35 m <sup>3</sup> /hr                       |
|     | Greens putting surfaces, green surrounds, fairways and tees playing areas | 90 m <sup>3</sup> /hr                       |

- 2.10 The water quality from the borehole supply is reported to be very good [it is of drinkable quality]. We would still recommend that the water quality is analysed at least annually concentrating on pH, alkalinity and salinity. This would provide a record of water quality for future use.

- 2.11 The golf club are currently investigating the availability of water for irrigation. This will be particularly important if the irrigation system is expanded to fairways. Essentially the water availability from the existing aquifer would likely influence any future irrigation design and how/if the irrigation can be expanded to fairways.

- 2.12 We would recommend that the existing borehole is retained in full working order to provide a backup water supply in case the new borehole diminishes in yield or there is a problem with the pump etc.

- 2.13 *In summary the recommendations from what was seen during the visit would be;*
- *ensure accurate water usage records are maintained [ongoing]*
  - *ensure water quality is checked regularly*
  - *investigate alternative supplies of water [a second borehole] to ascertain total available pumping rate for the future*
  - *maintain the existing borehole supply as a backup*

**2.14 Water Storage;**

There is no form of water storage as the water from the borehole enters the irrigation system directly.

- 2.15 It is very unlikely it would possible to install any form of water storage within the deer park estate.

**2.16     *Pumping System;***

The irrigation pumping system is in effect the borehole.

**2.17**     There is a borehole well head chamber below ground within which there is the well head pipe work and electrical isolation etc. We are not in any way experts in health and safety (H&S), however, we do know that in the UK it would be imperative that the necessary H&S documentation is in place and infrastructure / access to the chamber is considered safe and meets with UK law.

**2.18**     The borehole well head arrangement varies in age. There has been a new pump installed and new stainless steel pipe work from the top of the well head [in 2018]. This is connected into the existing 3 inch delivery pipe work which connects to the golf course pipe work.

**2.19**     Where the older well head infrastructure exists there is a need to have the pressure vessel examined and checked for safety (and then annually thereafter) [and replaced as necessary]. There is also a need to service/replace the Siemens Magflo [MAG500] meter so that water usage can be recorded.

**2.20**     The capacity of the new pump is understood to be 30m<sup>3</sup>/hr at 90mH and uses a single submersible Grundfos SP30-12 11kW pump down in the borehole. The borehole is 46m in depth with the slotted casing beginning at 40m.

**2.21**     The pump system design is setup to operate when there is a drop in pressure within the irrigation system mains pipework i.e. it provides a fully pressurised system whereby the main line pipework is pressurised 24 hour per day.

**2.22**     A fully pressurised system enables watering on demand which will only aid to help with maintenance operations on the golf course i.e. washing in fertiliser, hand watering for application of wetting agents etc. Another advantage of the main line pipe work having water within it 24 hours a day i.e. pressurised, is that it will also stop the ingress of air which will cause water hammer and degrade/damage the main line pipework at joints much quicker.

**2.23**     With VFD (variable frequency drive) control the pump starting mechanism is much gentler on the main line pipework and this will extend its life i.e. the flow and pressure build up is lower and slower thus reducing the 'shock' on the main line pipe work. Along with the fully pressurised system this will certainly be one of the facts which has ensured the existing uPVC main line pipe work is still holding pressure well.

**2.24**     *In summary the pumping station is in good working order. The recommendations from what was seen during the visit would be;*

- *ensure the well head chamber can be accessed easily and all the relevant H&S documentation is in place when working in the chamber and that the design meets with Danish H&S.*
- *ensure the pressure vessel and checked [replaced as necessary] and serviced annually for H&S reasons*
- *ensure the Siemens Magflo [MAG500] meter is serviced / replaced*
- *ensure a fully pressurised pipe work system is retained for the future*

**2.25     *Irrigation Pipework;***

The existing mains pipework is predominantly uPVC [90mm] with some spurs of PEM (medium density polyethylene) [63mm] all installed in 1994. The lateral pipe work to the greens and tees was all reported to be PEM in sizes 63/50/40mm.

**2.26**     During the visit there were no reported problems with the existing irrigation pipework, either main line or lateral pipe work feeding the individual greens and tees.

**2.27**     We tried to perform a pressure drop test from the pump station, however, this was difficult due to the existing pressure gauge only reading to 6 bar. However, the testimony to the integrity of the pipe work system would be represented by a limited pressure drop from the pump station and how frequently the system is re-pressurised measuring the water loss during each re-pressurisation. From the time spent in the well head chamber the pressure drop seemed very small and over a fifteen minute period the system did not re-pressurise.

**2.28**     The average lifespan of a uPVC pipework system is 25 years although this depends upon the quality of the original installation.

**2.29**     The existing 90mm uPVC pipe work ring (which forms most [over 80%] of the main line pipe work) whilst of suitable capacity for greens putting surfaces, green surrounds and tees may not be suitable for approach irrigation and would certainly not be suitable for fairway irrigation. uPVC pipe work is also not used in the water industry anymore and the availability of fittings for repairs are likely to become increasingly more difficult to obtain. We would also be cautious of connecting into the uPVC pipe work for upgrading the tees irrigation and greens irrigation.

**2.30**     All irrigation systems since the mid-late 1990's used polyethylene [HDPE & MDPE]. This specification of pipe work is also used in the utility industry for water, gas, heating etc. Whilst the manufacturers are not committing to a life expectancy there are talks about 40+ years. Indeed as a design practice we have just upgraded the irrigation system at Royal Birkdale and Royal Cinque Ports etc where the HDPE/MDPE pipe work installed in 1997/1998 has been reused and their control system, control cables, valves and sprinklers upgraded.

**2.31**     There is an existing as laid plan of the irrigation system, however, this is not to scale and predominantly a sketch. To upgrade the irrigation system there would be a requirement of an accurate base plan to form the basis of any re-design / upgrading works. We would recommend that RCGC also obtain an aerial image (drone survey) of the golf course which can be used as a background for any upgrading works.

**2.32**     *The recommendations from what was seen during the visit would be;*

- *whilst the uPVC pipe work appears to be in good working order its capacity is limiting for future system expansion and from our experience in the UK it is nearing its average life expectancy*
- *the pipe work for the greens and tees, whilst it is polyethylene, is in the wrong location to allow for upgrading to the greens and tees with ease and cost effectively. The routing of the tee pipe work would also be difficult to find*
- *any future works to the irrigation system should include for new pipe work in all areas*

**2.33     *Control System & Control Cable;***

The electrical control system of the sprinkler stations at RCGC utilises a central computer, decoder operated system manufactured by Rain Bird.

**2.34**     The central computer controller is located in the office of the Course Manager at the Golf Maintenance Facility. The computer software which controls the system is Rain Bird Master 3. The software is now obsolete and uses a DOS based operating system. Whilst it is successfully operating the current irrigation system (we believe) it would not be suitable for any upgraded irrigation works.

**2.35**     The Rain Bird software is not linked to a radio remote controlled interface, or facilitates mobile apps, which allow for operation of the irrigation system from out on the golf course without the need for an operator at the central pc in the office.

**2.36**     There were no reported problems with the control cable from the central computer to the individual decoders operating sprinkler stations out on the golf course. However, with the control cabling and decoders nearing 25 years old the potential for increasing problems, such as cables leaking to earth, is something RCGC must consider.

**2.37**     It was not possible to check the condition of the control cable network during the visit and whilst this is feasible it would not be cost effective. It would require a qualified engineer to identify and break every cable joint and check each and every individual core within each section of cable.

**2.38**     With the need to upgrade the main line pipe work we would recommend the control cable, which would be installed with the main line pipe work in one operation, is upgraded at the same time i.e. to provide the golf course with a completely new main line and control cable network and control system.

**2.39**     Future faults with the current control cable system are likely to occur at cable terminations/jointing as these degrade over time. There may also been problems with the decoders over time.

**2.40**     *In summary to allow for more flexible operation of the irrigation electronic control in the future there is certainly a need to plan for replacing the central control system and control cable on the golf course.*

**2.41     *Irrigation to Greens, Approaches, Fairways and Tees;***

The requirement for irrigation to individual areas of the course; greens, green surrounds, approaches, fairways and tees needs assessing throughout the Course on a Hole x Hole basis.

**2.42**     We would recommend a complete system walk though between the Course Manager and Irrigation Design Consultant to carefully look at all of the above aspects on a Hole x Hole basis. This should be done with an accurate and scaled base plan of any proposed new irrigation system overlaid onto an aerial image.

**2.43**     From a sprinkler coverage perspective it needs to be understood that it will not be possible to avoid all the overthrow of water into areas not requiring irrigation particularly with wind disturbance/drift.

- 2.44** During the visit the following areas were looked at to confirm some of the points identified above;
- 2.45** ***Greens & Approach Irrigation;***  
The following greens were inspected during the visit;  
- 2<sup>nd</sup> / 6<sup>th</sup> / 10<sup>th</sup> / 12<sup>th</sup> / 16<sup>th</sup> / 18<sup>th</sup> Green
- 2.46** The sprinklers on the greens are Rain Bird 750 & 751, adjustable part circle models. Where checked they were operating [pressure regulated] at 4.8bar. When more than two sprinklers were operated on any green the pressure reduced so that when four sprinklers were operating on the 2<sup>nd</sup> green for example the pressure was only 2.2 bar. This is insufficient for efficient sprinkler operation.
- 2.47** Where necessary the sprinklers on some greens are configured for nearly full circle to cover the surrounds. In many instances the surround needs watering independently of the putting surface and with the current sprinkler configuration this is not possible. To ensure full flexibility of irrigation coverage from the sprinklers around the green as RCGC have identified the use of back to back sprinklers should be considered and installed where necessary. Where the surround is narrow and does not necessitate the need for a full circle sprinkler or a separate back to back sprinkler the use of rear nozzles should be considered.
- 2.48** In general the sprinkler spacing's on the greens were not uniform which makes accurate application of water (distribution uniformity) and calculation of sprinkler precipitation rate and run time calculations (scheduling) impossible. The Greenstaff are managing very well with the poor spacing, however, the poor spacing should be addressed particularly if green surround and approach irrigation is to be added.
- 2.49** The addition of green surround and approach irrigation onto the existing green irrigation setup would not be advised as if the basis [starting point] from which it is added is poor then the outcome would need to be a compromise which we feel would be a backward step for RCGC
- 2.50** In the future the sprinklers should either use a square or triangular configuration. Uniform spacing's are very important to ensure good water distribution to the surface and guarantee the minimum amount of water is required to successfully irrigate the surface.
- 2.51** Wind disturbance/drift is a problem on areas of the course. Whilst the sprinkler selection and nozzles installed on many of these greens is suitable for head to head coverage there is a need in windy conditions to either install sprinklers with large nozzles or with a lower angle of trajectory. Using larger nozzles than the sprinkler spacing will provide a greater chance of achieving head to head coverage, however, in some instances this may not be enough and a lower angle of trajectory may be needed too.
- 2.52** Some of the greens sprinklers are too low in the ground and some need levelling to aid their operation. We understand the sprinklers can be raised on the triple swing joints onto which they are installed. This work would normally be done over a winter period.



- 2.53** *In summary the greens irrigation functions and is managed well by the Greenstaff, however, to ensure the best possible chance of achieving good distribution uniformity and allowing for green surround and approach irrigation to be added in harmony and without comprise the irrigation to the greens should be replaced.*
- 2.54** *Before any replacement there is a need to undertake a thorough assessment of each green to decide where back to back sprinklers are required and where tail nozzles are required (and discuss the merits of each)*
- 2.55** ***Fairway Irrigation;***  
There is currently no fairway watering on the golf course.
- 2.56** Fairway watering would certainly provide the golf club with the ability to manipulate the natural environment i.e. apply supplemental water when required to ensure turfgrass survival, allow for seed germination and washing in of wetting agents etc.
- 2.57** Fairway watering will require additional water quantities and a larger pipe work network i.e. the hydraulic capacity in the system would need increasing as would the control system network.
- 2.58** *In summary should the golf club consider there may be a need for fairway watering then it would certainly be prudent to explore the additional infrastructure cost so that it can be installed as/when required. This would ensure the irrigation system is future proofed from a hydraulic perspective particularly if polyethylene pipe work is used with its anticipated 40+ year life expectancy.*
- 2.59** ***Irrigation to Fairway Bunkers;***  
There is currently no dedicated irrigation to the fairway bunkers on the golf course.
- 2.60** A common problem with bunkers is sand blow and drying turf around the faces and irrigation can provide an effective method of wetting the sand sufficient to reduce the sand blow and supplying additional water to the turf on top of the faces.
- 2.61** A unique scenario at RCPC is the damage caused by the deer on the course. Whilst we are not sure if bunker irrigation would assist this may reduce potential damage from these animals if the damage they cause is considered a problem by the golf club.
- 2.62** ***Walkway Irrigation;***  
The irrigation of walkways, and the importance that walkways play in the presentation of a course, has changed significantly in the last five years. We are not sure if RCGC consider irrigation of their walkways a requirement, however, we thought it should be mentioned for a discussion point at least.
- 2.63** ***Tees Irrigation;***  
The following tees were inspected during the visit;  
- 2<sup>nd</sup> / 6<sup>th</sup> / 10<sup>th</sup> / 12<sup>th</sup> / 16<sup>th</sup> / 18<sup>th</sup> Tees
- 2.64** The sprinklers on the tees are predominantly the Rain Bird Falcon, adjustable part circle models. There are also some Hunter and Toro models when single sprinklers have been replaced. They are configured to operate in groups [blocks].

- 2.65** The tee irrigation at RCGC is very inadequate and uses a design philosophy which is 20+ years old and which never achieved the desired aim. Tee irrigation 20+ years ago was never a priority hence the infrastructure was cheaply installed with the aim of getting 'some' water to the tee surfaces.
- 2.66** Each hole at RCGC has a single tee solenoid valve [Rain Bird EFB-CP 1½" model] with all the tees in a tee complex operated from this single valve. This makes accurate application of water to an individual tee within a tee complex impossible.
- 2.67** The solenoid valves are not fitted with pressure regulation to ensure that the sprinklers receive an even pressure within the limits of the irrigation design. This is therefore likely to influence the operational pressures of the sprinklers across the course which would cause some tees to receive more water and other less for the same spacing, nozzle and run time. The pressures at tee sprinklers taken during the visit would confirm this as they varied from 4.2 bar to 6.8 bar. There is a need to have pressure regulation fitted to all solenoid valves in the future and it is not known why it was not fitted during the original installation [it may not have been available].
- 2.68** There is often only a single sprinkler for a tee at RCGC and many tee sprinklers are located a large distance from the teeing surface. When only a single sprinkler is used to irrigate a particular surface this requires 40% of water to be wasted to ensure successful irrigation of the tee surface. This is not acceptable in 2018.
- 2.69** As with the greens the poor sprinkler spacing makes it impossible to calculate accurate sprinkler precipitation rates and run times for the tees.
- 2.70** In many cases at RCGC some areas of the tee surfaces do not receive sufficient water and with the inefficiency of operation [coverage and waste of water] the tee irrigation is not used regularly by the Greenstaff.
- 2.71** *In summary the tee irrigation needs to be replaced so that each tee within a tee complex can be separately irrigated ensuring that water can be targeted to where it is needed and water usage is efficient.*

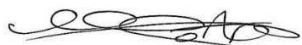
### **3. OUTLINE BUDGET COSTS**

- 3.1** Before any accurate budgets can be put together there is a need to undertake a thorough assessment of the irrigation requirements on each hole from a coverage and setup perspective and produce a design and master plan on the way forward.
- 3.2** We were asked to provide some budget costs for the following;
- The addition of green surround irrigation [for back-back sprinklers]
  - The addition of approach irrigation
  - The addition of fairway irrigation
- 3.3** We believe the existing irrigation system has the capacity, both electrically and hydraulically to add green surround irrigation. It is likely the capacity is there for approach irrigation too, however, we would prefer to undertake some design works initially before confirming this.

- 3.4** An approximate budget cost would be;
- Green Surrounds - £45,000
  - Approaches - £40,000
- 3.5** There would be a need for the existing control cable network [as well as the pipe work] to be investigated thoroughly before the addition of green surround irrigation and approach irrigation. Please refer to our previous comments in relation to whether we feel expansion of the existing system in this way is the way forward to RCGC.
- 3.6** The existing irrigation does not have the capacity to add fairway watering both electrically and hydraulically.
- 3.7** As we have discussed our recommendation would be for RCGC to decide where they want to go with their irrigation system. If a complete upgrade/replacement is considered the way forward the following would be approximate budgets [for a system to the green putting surfaces, green surrounds, approaches and tee playing surfaces];
- |            |  |                 |
|------------|--|-----------------|
| <b>3.8</b> | Main line and control cable                      | £175,000        |
|            | Green irrigation                                 |                 |
|            | (including immediate surrounds and approaches)   | £120,000        |
|            | Tee irrigation                                   | £105,000        |
|            | Control System                                   | £50,000         |
|            | Preliminaries                                    |                 |
|            | (mobilisation / accommodation / deliveries etc)  | £100,000        |
|            | <u>Total [excluding irrigation pump station]</u> | <u>£550,000</u> |
- 3.9** The key areas for investment moving forward are;
- Obtaining an accurate scaled plan and aerial image to allow planning for the works
  - Produce an irrigation design for the system including master plan for the future system
  - Water supply and pumping
  - Irrigation system including main line pipe work, central control system and cable network, greens irrigation (including surrounds and approaches) and tee irrigation [consideration to be given for fairway, bunker and walkway irrigation]
- 3.10** RHA would be pleased to help you with any of the above assessments as RCGC consider necessary.
- 3.11** In the future we would also recommend that RCGC consider a dedicated irrigation technician in-house. Any irrigation system represents a large capital investment and as mentioned previously is the most expensive item of maintenance equipment on the golf course and therefore there is a requirement to have a member of staff who is fully conversant in its design, setup and operation. This will ensure the system is maintained proactively rather than reactively to protect the investment made by the golf club. Other more established golf courses like RCGC now have an in-house dedicated irrigation technician.

**4. SUMMARY**

- 4.1** In order to maintain a high quality golf course there is a requirement to have an efficient and reliable irrigation system covering the green putting surfaces (and surrounds where necessary), approaches, fairways, walkways and tees playing surfaces to supplement deficiencies in summer rainfall and to assist in various essential maintenance operations.
- 4.2** The existing system was installed to a very good standard and has provided a reliable insurance policy against periods of dry weather over the past 24+ years since its installation. There is, however, a need to bring the system up to modern standard to ensure it can provide the necessary efficient coverage, reliability and control features throughout that are required in modern golf course management.
- 4.3** Martin Nilsson reported that the existing automatic irrigation system on the golf course, although an essential maintenance tool, is used on a limited basis to encourage native bent and fescue grasses indicative of traditional golf, as over watering will promote weedier species. We would totally agree with this philosophy, however, when an irrigation system is used in this manner any inefficiencies in its infrastructure and operational capabilities become more apparent and there is a greater need for a reliable, target area specific automatic system to act as an insurance policy to ensure water can be applied as and when required.
- 4.4** The aim of any irrigation system is to apply water evenly to the areas required, and to be able to apply sufficient water to maintain soil moisture during drought conditions to all of the areas within the specified irrigation time cycle.
- 4.5** With the objective of RCGC being to improve the irrigation system on the golf course there is a need to consider and plan and invest in;
- **Preparation of a master plan for the irrigation system moving forward**
  - **Water storage & pumping system**
  - **Central control system and control cable network**
  - **Irrigation to greens, green surrounds, approaches and tees**
  - **Irrigation to fairways, bunkers and walkways [as considered necessary and water quantities permit]**
- 4.6** Finally it is important that any irrigation modifications out must meet RCGC current and future requirements. This will enable a structured Master Plan to be implemented, and followed, in an approach to upgrading the system to meet current industry standards and RCGC time and financial resources.



*Prepared by Adrian Mortram  
12<sup>th</sup> November 2018*

**5 APPENDICES – PHOTOS**



Irrigation borehole well head manifold [new]



Pressure vessel in well head chamber [old]



Green sprinklers in operation – note poor spacing and reduced pressure



Green sprinkler in operation



Green isolation valves  
Note; condition of handles and access to components  
(assemblies are certainly showing their 24+ years)





Tee sprinkler operation

Note; sprinklers too far off teeing surface, wasted water off teeing surfaces, poor coverage with sprinklers down one side etc







Tee sprinkler operation

Note; sprinklers too far off teeing surface, only one sprinkler per tee, wasted water off teeing surfaces, insufficient sprinklers on tees etc





Tee solenoid valves

Note; condition of handles, poor access to components, no isolation valves for servicing,  
no pressure regulation  
(assemblies are certainly showing their 24+ years)





Typical Green isolation valve assembly – 2018 [example photo]



Typical Tee solenoid valve assembly – 2018 [example photo]



An example of a sprinkler operating at a lower angle