GOLF COURSE 2030
GREAT BRITAIN & IRELAND

ACTION PLAN

RESOURCES TO INCLUDE SYNTHETIC PLANT PROTECTION PRODUCTS, AGGREGATES, AND THE GREENKEEPING WORKFORCE

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1. INTRODUCTION

Golf Course 2030 is an initiative by The R&A addressing challenges from, and taking opportunities presented by, the changing climate, resource constraints and regulation to secure optimal golf course condition and playability for current and future generations. Recognising that change is already happening in relation to climate, resources, and regulation (the ‘drivers of change’) The R&A is working with industry stakeholders to identify the challenges and opportunities presented by these anticipated changes, and considering a range of significant issues, to review the current and emerging knowledge and practice, and having done so to propose a series of actions designed to address the issue and to provide a framework around which future strategy and implementation can be constructed. This Action Plan is focusing on ‘Resources’, defined as synthetic chemical plant protection products (chemicals), aggregates (sand and gravel), and the golf course workforce.

The Action Plan has been informed by conversations with industry colleagues from each of the three areas represented, by surveys, by review of relevant literature, and by personal perceptions formed from over 30 years’ experience in the industry supported by relevant personal academic history. It reviews each of the three areas in turn and presents a collective summary and conclusions.

2. SYNTHETIC PLANT PROTECTION PRODUCTS (CHEMICALS, PESTICIDES)

As a land-based industry, and one which uses pesticides routinely, golf course management is not immune from concerns about the use of chemicals and their potential environmental impact, about the withdrawal from use of several active ingredients which have been available for many years to treat a variety of infestations, and about the impact that restrictions on their continued use might have on turf quality, attractiveness of the game of golf, and therefore the financial viability of golf providers, particularly when coupled with global climate change and the potential impacts of that on disease, insect, and plant interactions in fine turf situations.

A simple on-line search reveals the perception of chemical use on golf courses to be a complex issue with several perspectives offered, rarely positive in nature, ranging from concern over loss of quality of playing surfaces as a consequence of the golf course manager not having chemical controls at his or her disposal, through to the potential for these compounds to be damaging to human health. Concerns about chemical use on golf courses reflect wider societal concerns about their use in agriculture, pesticide use being associated, for example, with the loss in numbers of pollinating insects over the last 35 – 40 years, and the impact that loss may have on agricultural production. At the time of writing there are two major stories circulating in the general media, one relating to litigation against the manufacturers of the herbicide glyphosate, the second relating to the banning of the fungicide chlorothalonil for use in the EU, these serving to illustrate the level to which chemical use as an issue has reached the public consciousness, and about the concerns around it. As stated, these stories appear in the general media for consumption by a general audience, however they do not explore the issue from a specialist point of view, that remaining the preserve of the specialist, or trade, media. Representation in the trade literature of concerns around chemical use, and specifically of the reduction in the number of active ingredients approved for use in fine turf, centres more around the issues for the turf
management professional and seeks to understand the implications for the manager and for the business, and whilst it might be expected that a consistent set of views would emerge this is not the case. An example of the ‘doom and gloom’ scenario is presented in a 2007 publication by the Greenerkeepers Training Committee, ‘On Course’ (when the removal of synthetic pesticides from approved lists had been mooted but had not yet begun in earnest) whereas a feature article on the website of BIGGA in December 2018 (with many chemical products by now having been withdrawn) is more factual and discusses the issues in pragmatic terms relating them directly and practically to the work of the greenkeeper.

It is apparent that, in relation to chemical use on golf courses, the industry is in a position whereby it can no longer rely on chemicals due in part to political and public pressure, and due in part to the reduction in number of approved products, and so the purpose of this section of the Action Plan is to identify and discuss the current situation relating to chemical use in golf course management in the UK and Ireland. The aims of this report are:

- to present information relating to the use of Agro-chemicals in the UK and Ireland
- to explore attitudes around chemical use on golf courses
- to present results of a survey undertaken to establish a picture of chemical use on golf courses in the UK and Ireland
- to identify alternative approaches and products and discuss their efficacy
- to suggest areas of research into alternative approaches and products
- to propose actions at different levels within the industry.

2.1 Chemical use in the UK and Ireland

It would be useful to establish a clear picture of pesticide use on golf courses in the UK and Ireland through reference to sales data from the companies who supply to the industry, however that information isn’t openly available due in part to commercial sensitivity. Information and data are however available that identifies the total use of pesticides in European countries and on the numbers of active ingredients and formulations approved for use in turf in the UK.

2.2 Total use of pesticides

Data on overall pesticide sales in Europe is captured by the European Commission and can be accessed on the Eurostat website. Data for each country can be extracted - that for the UK and Ireland is presented in Figure 1.

These data show a decline in total sales within the UK over the period, with a particularly low year in 2013 yet peaking again in 2014; for Ireland the total sales remain broadly similar in 2017 as in 2011 with minor variations in the intervening years. The use of pesticides in turf management is a sub-set of this usage and it is meaningless to try to extrapolate or infer anything from this data, however it is nevertheless interesting to note a downward trend in the UK. (The data is further sub-categorised into insecticides, fungicides, herbicides, molluscicides, plant growth regulators and ‘others’, and is available at Eurostat).

(As stated, this data represents total sales of pesticides in the EU and does not separate for agriculture, amenity turf management, or golf course management, so is of limited value. Further searches for pesticide use in the UK provided only 1 snapshot of total pesticide use on golf courses in the UK in the year 2012, for which the total weight or active ingredient applied was 78,202kg. The data for other years couldn’t be found).
Information of greater value for the purposes of this Action Plan is that on the availability of pesticides approved for use in turf management that is available in the UK Pesticide Guide (published annually). The UK Pesticide Guide provides lists of active ingredients and of combinations of active ingredient that are approved for use together in specific products, and so can present a confusing picture. For the purposes of this Action Plan the number of specific active ingredients that are approved for use in ‘Managed Amenity Turf’ (ignoring their approvals for use alone or in combination) have been gathered from this publication for the years 2010–2019 and summarised in Figure 2 as a snapshot comparing the years 2010 and 2019.
What is clear from this data is that the number of approved active ingredients is reducing and the trend would suggest a very real possibility that there will be no remaining active ingredients a decade from now, and in other European countries including Denmark and The Netherlands this is already the situation. The reduction in the number of approved products is an outcome of European law and it might be tempting to speculate about the outcome of the current Brexit process, however even if the UK leaves the European Union completely informed opinion is that legislation would not be reversed, and that, “what is lost is lost”.[10]

From the foregoing it can be concluded that there is a trend of reduction of use of pesticides in the UK in recent years, and that in the turf management situation there is a loss of active ingredients, which might suggest a forced reduction in use in golf course management. In order to gather some data directly from golf course managers a survey was conducted in March 2019 seeking information about the nature of use and of trends in use. The main findings are discussed below.

2.3 Survey of Chemical Use

The survey elicited 255 responses from the UK and Ireland, the majority from parkland golf courses operated by members’ clubs, and with a midweek green fee of less than £50 (60). A summary is presented below.

Of the respondents 94% use or have used fungicides, these predominantly on greens for Fusarium Patch and Anthracnose, the trend being for preventative use but also curative depending upon the circumstances; applications tend to be made to the whole area rather than as spot treatments. 17% of respondents report using more fungicide than five years ago, with 56% reporting using less and 27% ‘about the same’. Over 90% of respondents report using a range of active ingredients as part of a conscious disease management strategy.

Over 90% of respondents reported using herbicides, predominantly on fairways (92%) and tees (77%) against broadleaved weeds; applications tend to be full coverage and are based on a range of active ingredients. Respondents report using less total herbicide (40%) or about the same (55%) compared to 5 years ago.

Insecticide use is more difficult to ascertain because there have been no approved insecticides for use on turf since 2016. Despite this over 50% reported having used insecticides in the past and if they were available would use them against leatherjackets (94%) and chafer grubs (58%).

Having reviewed the use and availability of pesticides in the UK and Ireland the following are the significant points:

- overall use of pesticides in the UK is dropping whilst in Ireland it appears static
- there is a trend towards fewer pesticides being approved for use in turf in the UK with some categories having been lost altogether
- the use of fungicides and herbicides in UK and Ireland greenkeeping is very widespread (over 90% for each category) although there is a trend towards using less and they are used in a planned rather than a reactive manner.

From this there appears to be a situation where ‘push’ will meet ‘shove’ inasmuch as greenkeepers will want to continue to use chemicals but there will be fewer approved products and there is likely to be increasing political and social pressure on the golf industry to further reduce their use. This situation has to be framed against the ‘three scenarios’
around which the Golf Course 2030 initiative has been constructed (see Appendix). The three scenarios describe a continuum from a ‘limited change’ picture in which, ‘alternative technologies, management solutions and behavioural change’ will address the challenges and, ‘optimal golf course condition and playability is secured’ (scenario 1) to one in which, ‘alternative technologies, management solutions and behavioural change fail to address the challenges’, a consequence being that ‘golf will be played on inferior surfaces compared to what we enjoy today’.

Inherent within each of these scenarios is change, perhaps limited, perhaps less so, and the requirement to investigate and adopt, ‘alternative technologies, management solutions and behavioural change’. In the next part of this report these will be identified and discussed.

2.4 Chemicals – Potential Solutions

2.4.1 Alternative Technologies

For the purposes of this Action Plan ‘alternative technologies’ is taken to mean any product or material that can be physically applied to turf with the objective of reducing the incidence or severity of impact caused by fungal pathogens, insect pests, or non-desirable plant species, and can be broadly grouped under the heading ‘biopesticides’. A Biocidal Products Directive 2009/128 was developed and reported by DEFRA in 2013; it identified three main classes of biopesticide products which are semiochemicals (such as pheromones), micro-organisms and natural chemicals (such as plant extracts) and reported that these products, ‘have many established uses for pest control and are increasingly being used by growers in the USA and mainland Europe’, although there is no specific mention of turf management. The use and potential use of biopesticides exists for a range of crop plants including members of the Gramineae and could provide the experience and skills to investigate their use in turf grasses. A list of publications for at least one centre of study is available.

Interestingly and perhaps following a lead from agriculture and horticulture examples of these products and materials can easily be obtained commercially in the turf management industry, examples from two of the groups including the following:

- pheromone traps
- mycorrhizae or other microorganisms intended to support the health of the turfgrass plant either in direct interaction or soil-mediation
- compost teas – a ‘home-made’ version of microbiological inoculation of the plant/soil system
- plant extracts or plant-active compounds including seaweed products, phosphite or salicylic acid that might act as elicitors of a plant defence response.

Claims made in commercial literature about these products makes claim of efficacy and list benefits, for example increased root growth and suppressed disease activity, but are rarely supported by data derived from robust science. An informed view is that these claims are made by extrapolating findings from other horticulture or crop systems and making parallel claims for their use in turf.

Despite this there is some robust scientific data that supports the potential for the use of these products in turf management, for example work on mycorrhizae by Alan Gange and colleagues of Holloway College, and work on phosphite by John Dempsey and colleagues, however in conversations with industry colleagues in preparation of this Action Plan the consensus emerged that there is no known body or bodies of work on these compounds in turf management that significantly demonstrate efficacy. Although not representing the
climatic conditions of the UK and Ireland but nevertheless interesting and of some relevance, 
a four-year field and laboratory study carried out in the Nordic countries by STERF, 
investigating the use of alternative products including seaweed and microbial products, 
concluded that, ‘none of the test products represent any real alternative to fungicides for 
control of Microdochium nivale or other diseases on Scandinavian golf courses’17. It is 
concluded that there is some way to go before it can be stated for certain that ‘alternative 
technologies’ as represented by these products can be considered effective in turf 
management situations.

In addition to scientific evidence relating the uses of these compounds or products is the 
perception of practitioners who are innovators or early adopters of these technologies. In 
the survey greenkeepers were asked which products or approaches they had used from a list 
containing mycorrhizal inoculants, compost teas, garlic, and phosphites. The following is a 
summary of the findings:

33% of respondents have used mycorrhizae; 26% have used compost teas; 34% have used 
garlic; 71% have used phosphites. Responses about the perceived efficacy of these products 
were effectively neutral, with the vast majority of respondents indicating that the products 
had ‘some effect but were not wholly effective’. As such there are no worthwhile conclusions 
to be drawn from this exercise and further investigation through scientific trials is probably 
merited.

2.4.2 Management Solutions

The term ‘Management Solutions’ could embrace many things, but is interpreted here as a 
change of approach to turf management away from one that relies on the availability of 
chemicals for an ‘easy fix’ to one which recognises, plans and implements a range of practices 
within a turf management programme, one objective of which is to minimise the impact of 
undesirable organisms on turf quality, i.e. on an approach of Integrated Plant Management, 
or IPM.

IPM is an approach to plant management that works with the ecosystem, which is a 
combination of preventative and curative actions, which recognises threshold levels of 
damage, which is effective, and which functions within political, economic, social and 
environmental constraints. It is a well-established concept and practice in agricultural, 
horticultural and turf management settings. It is strongly felt by industry colleagues that the 
importance of grass species selection, soil/plant interface, organism biology, and disease 
pressure are well understood at present and, in that respect, we have a well-developed set of 
principles. In practical terms there are some very good tools emerging, largely from the 
commercial sector, that support an IPM strategy and provide ‘real-time’ information and 
some specific practices that can be implemented when disease pressure is high or when early 
symptoms are apparent. These include modelling and prediction in the ‘Greencast’ website8 
produced by Syngenta that presents, among other things, a ‘live’ map showing areas of the 
UK and Ireland where disease pressure is currently high, and which provides information on 
pest infestations and emerging best practice. A second example is research undertaken by 
ICL which demonstrates the control of Fusarium Patch using an integrated approach of dew 
dispersants, fertiliser application and application of an iron-containing product9. Both of 
these examples come from the commercial sector, and so in some quarters will be viewed 
with suspicion or cynicism, however the science is good and the results impressive, so a 
greater volume of work of this type would be welcomed.
Following conversations and discussions with industry colleagues it is felt, despite an understanding of IPM and a desire to manage turf in an integrated manner, as well as the examples from the commercial sector mentioned above, that many of the technical knowledge and potential solutions are known or could be established with relatively straightforward scientific investigation. This could include technologies being developed in agriculture, horticulture, other forms of land management or sectors not directly linked with land management, e.g. the drone and remote sensing technology that is starting to be deployed on golf courses. It is felt therefore that the implementation of IPM is hampered by a variety of non-technical obstacles in many golf situations. These obstacles can include governance structures, appreciation of the need for and setting of course policy and course management objectives, communication between management and golfers, accommodation of required practices within the golfing calendar, and the competence of individual office-bearers and employees. In other words, integrated golf management or integrated club management! In instances where all of these management functions are operating well, then an IPM programme and practices has every opportunity of being implemented successfully, however in instances where they are not then it is more difficult. As such it is felt that an element of the response to reducing availability of chemicals and the potential to have to live with a little more imperfection requires changes of attitude and behaviour as much as anything else.

2.4.3 Behavioural Change

Turf quality can be described through a combination of functional (speed and smoothness of ball roll, firmness) and a set of visual parameters (colour, visual uniformity, definition, striping) and an assessment of quality, despite there being some quantifiable properties, is often subjective depending on a range of experiences, attitudes, and exposure to different forms of golf either in person or through the media. Personal conversations with many greenkeepers from a wide variety of situations reveal that greenkeepers and course managers have a wide range of attitudes and opinions around this topic. In some instances functional quality is emphasised and there is less emphasis on the ‘conventional’ visual parameters of colour and definition (Open Championship venues and other traditional courses come into this category) whereas in others the emphasis is on visual ‘perfection’ with some functional quality being sacrificed (European Ryder Cup venues and many ‘resort’ courses would be typical of this category). Neither of these extremes is right nor wrong, inasmuch as every golf course is different and has to meet the needs of its golfing community, however the pursuit of either style has implications in terms of resource use, including pesticides, and how readily they will be able to adapt to changes including fewer pesticides.

The golfing community is mentioned above; in preparation of this Action Plan the attitudes of the golfing community in relation to course condition were discussed in conversation with several industry colleagues.20 Golf as a sport and as a social phenomenon is one in which someone can demonstrate his or her social standing through their membership of a particular club or playing in particular prestige venues, so when done well the functional and visual presentation of the golf course can be a source of real pride to a member or ‘nomadic’ golfer, however when this is compromised or breaks down it can be a source of embarrassment or worse. The consensus was reached that many golfers would find it difficult to articulate ideas about turf quality, but nevertheless, and in relation to the point above, perceive ‘imperfections’ in ‘their’ turf as a failure by the greenkeeper, which by implication reflects badly on them as a member or golfer. As such there would appear to be a real disconnect between the golfing community and the greenkeeping community in terms of realistic expectations and objectives in a world where there is increasing pressure to reduce chemical use and therefore higher degrees of ‘imperfection’ become more likely. The perceived attitude in
many instances is that imperfections should be minimised or eliminated, almost at any cost, particularly on greens – the end justifies almost any means.

Returning to the three scenarios of Golf Course 2030 it is clear that the golf course industry won’t jump in a single step from the current situation to scenario 3, but it would also appear that even moving to scenario 1 will be a painful experience for some golfers and some turf managers. Changes are coming to the ways in which turf and golf courses are managed whether we like it or not, and it is concluded that bringing about a real shift in perceptions and attitudes within the golfing community is a pivotal element to the success of the Golf Course 2030 initiative in keeping golf attractive as a mass participation sport and golf courses attractive as a place where people enjoy spending time with family, friends and guests.

Recommended actions in relation to synthetic plant protection products are provided in the ‘Action Points’ section starting on page 22.

3. AGGREGATES (SAND AND GRAVEL)

The game of golf originated on the sandy links land of the east of Scotland, so has always been associated with the game. Most early courses are on ‘windblown sand’ or ‘shelly sand’ in places where the sand is naturally blown and therefore where some areas receive a natural topdressing of sand. Topdressing has become an element of many greenkeeping programmes on inland as well as coastal locations and it is almost unthinkable that golf courses would not topdress. Changes in topdressing practices over the last 30 years – light and frequent compared to heavy and occasional; using sand specifically to dilute organic matter in fast-growing situations; topdressing of fairways – have occurred due to emerging agronomic practice and the mechanisation of the task, leading to an increased demand for good quality sand. Sand is also used in other areas of the golf courses, in bunkers and in construction: since the 1960s the USGA construction method for greens has become the industry standard worldwide, again increasing demand for sand particularly during periods of growth in the number of golf courses. During construction (but also in routine use) there is demand for other aggregates, namely gravel, usually for ‘gravel carpets’ within constructed greens and tees, and for backfilling of drainage trenches.

The quantities of sands and gravels used in golf course management is one concern, another is the quality. The sands and gravels specified for golf course use have very narrow ranges of tolerance around mineralogy (silica sands are favoured) particle size distribution, content of ‘fines’, particle shape, pH, and colour, usually related to functionality in the specific uses defined, sometimes related to aesthetics e.g. for bunker sands.

Aggregates are a natural resource and a finite one. As such there is concern at all levels about current rates of extraction and usage; sand extraction and use has been framed as a global crisis and its over-extraction is of significant environmental concern on a global and local scale. It is against this background that aggregates as a resource for golf course management have been identified as an area of concern within the Golf Course 2030 initiative: this section of the Action Plan aims to identify the current known reserves of suitable aggregates in the UK and Ireland to establish patterns of use, and to identify alternatives should it be established that issues exist around supply of aggregates of suitable quality in the future.
3.1 Aggregates in the UK and Ireland

Aggregates are primarily used in the construction industries, sourced either from sand and gravel quarries or from crushed rock, and are extracted in the UK from some 1300 quarries, from the work of 28 marine dredgers, and through recycling\(^{26}\). Production of sand and gravel in the UK (2014) is given as 61.1 million tonnes, with a further 100 million tonnes of crushed rock; for Ireland the figures are 7 million tonnes and 22 million tonnes respectively\(^{26}\). Information on planning permissions for continued extraction of sand and gravel and crushed rock (England and Wales) indicate that the majority of these permissions will expire over the next 15 – 20 years, although there are a few long-term permissions that have up to 50 years remaining\(^{24}\). Information of this type for Scotland is more difficult to obtain - a 2004 publication\(^{27}\) stated that, ‘No systematic survey of permitted reserves of silica sand in Scotland has been undertaken’. No update to this could be found. Similarly, no comparable information could be found for Ireland.

In addition to quantifiable reserves there is the consideration of proximity to market of appropriate materials because haulage adds to the costs and to the carbon footprint. In Scotland the primary reserves of good quality silica sand for turf use are fairly well distributed in the central belt, in Fife, in Aberdeenshire and in Ayrshire. In England and Wales the primary reserves are in Cheshire, in Nottinghamshire, and in Surrey. In Ireland the main deposits are in Wexford and in County Tyrone. As such there is a reasonable distribution throughout the UK and Ireland although proximity to market and haulage costs will remain an issue.

3.2 Golf Course Usage

3.2.1 Supply

Aggregate use in the UK and Ireland is dominated by construction; figures for ‘major end use’ are available\(^{28}\) however amenity use, which would include golf course, is not identified as a ‘major end use’, meaning that specific information about the levels of use in golf course management are difficult to establish. Several conversations were held with industry colleagues around aggregate use in golf courses\(^{29, 30, 31}\); through these conversations it was established that golf course use represents a very small proportion of overall aggregate use in the UK and Ireland, meaning that some companies are not interested in supplying this market due to increased technical demands and costs of producing to the required quality. Materials of the required quality are becoming harder to find, and on a longer-term perspective the aggregates industry would find it difficult to commercially justify the development of a known resource for golf course use even if it was known to be of good quality. In summary, it is established that it will be more difficult for the aggregates industry to continue to supply the quality and quantity of aggregates required for golf course use in the UK and Ireland (particularly sands), and that if the right quality materials are found and made available then the costs will be higher than they are currently.

3.2.2 Demand

On the premise that it is difficult to clearly establish the quantities of aggregates supplied to golf courses in the UK and Ireland, and that supply presumably reflects demand, then it is similarly difficult to clearly establish such demand. Despite this a survey was undertaken to try and establish a picture of trends in usage, if not absolute quantities. The survey elicited 258 responses; the main findings relating to aggregate use are as follows:
• 96% of golf courses use sand for topdressing at least once per year. The majority of courses use between 50 and 150 tonnes per year (67%) with 18% using over 150 tonnes. The majority report that this is within 10% of usage 2 years ago however 35% are using more than two years ago, and 44% are using more than 5 years ago
• 90% of golf courses use bunker sand at least once per year. The majority of use is less than 40 tonnes (76%). Over 80% report using about the same or a little less than 2 and 5 years ago
• 58% of golf courses use gravel at least once per year. Usage is typically (over 85%) less than 40 tonnes per year, which is within 10% of the quantities used 2 and 5 years ago
• other uses of aggregate include granite dust and low-quality sand for paths and under areas of matting.

In summary, there appears to be an increase in demand for topdressing sand over the last 5 years, whereas demand for bunker sand and gravel is static.

A clear conclusion from gaining an understanding of both aggregate supply in the foreseeable future and aggregate demand in the present, is that a situation is developing where availability of material is in decline at the same time as demand is increasing. Clearly this is not sustainable and solutions need to be found, one of which is the consideration of alternative products.

3.3 Alternative Products

There are several products with potential for use in turf management as alternatives to sand and gravel, including recycled aggregates and recycled glass as alternatives to sand, and recycled gravels and e.g. recycled materials from building demolition or refurbishment.

3.3.1 Recycled Aggregates

It is reported that 120 million tonnes of construction, demolition and excavation waste is produced in the UK each year, of which 90 million tonnes is recycled as construction materials and aggregates. Details on quality of this material for any potential use could not be found but, in any case, it represents a potential resource for golf course use and the supply and quality issues merit further investigation.

3.3.2 Recycled Glass

Recycled glass is a valuable resource for making new glass as it is less costly to process than the original sand from which it was made. It also represents a resource that could be used as a sand substitute in golf course management. A project from 2004 conducted at the STRI demonstrated that recycled glass showed all necessary properties for use as a bunker sand, a topdressing sand and as a rootzone sand. Despite the potential of this material its adoption appears to be limited to a few isolated situations; further research and promotional work for this material as a viable alternative to sand is recommended.

3.3.3 Other Recycled Materials

Other recycled materials with potential for use in golf course situations include crushed sanitary ware derived from, for example, hotel refurbishments or demolition sites. Anecdotal evidence suggests that this material has the potential for use as an alternative to gravel in drainage trenches and within the relatively new practice of lining bunkers with porous materials as a method to prevent sand washing down the bunker face.
Use of these alternatives has not yet become established practice but each has potential subject to being able to source the right quality of material at a price that the market can support.

Recommended actions in relation to aggregate products are provided in the ‘Action Points’ section starting on page 22.

4. THE GREENKEEPING AND GOLF COURSE MANAGEMENT WORKFORCE

The drivers for change in golf course management and greenkeeping are clearly identified and explained in the Golf Course 2030 document and ensuring change will require some level of response by all those involved in golf, not least the greenkeeping and golf course management workforce. This section of the Action Plan is therefore concerned with the levels of preparedness of the current and future greenkeeping and golf course management workforce in being able to manage effectively in a changing world. For some the limited adaptations described within Golf Course 2030 scenario 1 will be a challenge; the severe challenges described in scenario 3, and the adaptations required to deal with such magnitude of change, will be a challenge for all concerned in the management and maintenance of golf courses. The Golf Course 2030 initiative provides the opportunity to describe, consider, and discuss a number of areas of interest relating to the golf industry and greenkeeping workforce when contemplating the future of golf course management. These areas include:

- greenkeeping and golf course management as a profession for potential entrants of different backgrounds and education attainment at school
- current curriculum in formal and informal greenkeeper education and its fitness for purpose for the challenges ahead
- current staffing and qualification levels within UK and Ireland greenkeeping/golf course management
- future staffing and qualification requirements.

4.1 Greenkeeping and Golf Course Management as a Profession

In conversation with industry colleagues it was stated that there is ‘clearly a problem’ in recruiting people into the land-based industries in general, despite there being a skills shortage within the workforces for these industries, and it is particularly difficult to attract young people. Additional to this is an issue of the types of young people who are attracted to a career in golf course management, inasmuch as the industry has traditionally recruited the ‘16+ school leaver rather than the ‘18+’, in other words it is regarded as a career comparable to the building trades rather than one that involves a university education and a career in the ‘professions’. Golf Course Management is clearly one of the land based industries and these difficulties and characteristics were echoed in conversation with Jim Croxton, CEO of BIGGA, who expressed the view that it is indeed difficult to attract people specifically into greenkeeping, and that as an industry we are in a position of facing a labour shortage in the UK. It is difficult to establish why this lack of attractiveness might be the case, however there are some clear criteria as to what makes a particular career attractive. These include:

- profile and image; the perception of there being a ‘real skill’
- salary and remuneration
- opportunities for development
- long-term career prospects.
Following several conversations with industry colleagues and indeed following over 30 years personal experience within the industry, it is suggested that there is a problem with profile and image of greenkeeping, both within the golf community and more widely. During the interviews for The R&A Greenkeeping Scholarship the candidates are asked how they think greenkeepers are perceived: the answers vary, however a great many suggest that greenkeepers are seen as no more than ‘grass cutters’, whilst a few provide a more positive response depending upon their own experiences and backgrounds. Additional perceptions have been gained in conversation with further industry colleagues; the perception of Jonathan Wright of the PGA is that greens staff are frequently ‘hidden’ to golfers and other golf club employees, often due to different working hours and to being based in a different physical location away from the clubhouse, and so have a low profile and little opportunity to interact positively with other professionals and golfers. Richard Flint of England Golf presented a similar perspective, suggesting that, in his experience, there is a poor culture of communication between the Clubs as employers and their greenkeepers, and that Head Greenkeepers and Golf Course Managers are not regarded as part of the senior management team within many golf clubs, and are rarely included, for example, in management meetings. These are of course general impressions and there is a wide range within golf management with many examples of good practice and team working within golf clubs and golf providers at all levels of the market, however the fact that two major organisations hold these perspectives must be of concern.

In wider society there is a perceived lack of knowledge and understanding of what greenkeepers do. From personal experience it is known that, for example, careers advisers in schools, even in Fife, the Home of Golf, have no knowledge of greenkeeping as a career choice and rarely recommend greenkeeping to their pupils as a consequence of this.

Given this scenario, both from within golf and from a general illustrative point, it is concluded that there is a real challenge in raising the profile of greenkeeping and golf course management and having it recognised as a real skill, such that it can attract employees in sufficient number and of sufficient educational attainment. This must be regarded as a significant challenge in preparation for any of the three Golf Course 2030 scenarios.

4.2 Salary and Remuneration

The Committee for Golf Club Salaries states that, “Concerns about the levels of pay in golf clubs have been growing in recent years. It is becoming more apparent that low pay has an impact on the golf club’s workforce, contributing to problems of morale, recruitment, retention, leadership and diversity”. The ‘2019 recommendations’ of this committee are as follows:

<table>
<thead>
<tr>
<th>Area</th>
<th>Salary after 48 months greenkeeping, qualified</th>
</tr>
</thead>
<tbody>
<tr>
<td>London Area</td>
<td>£27222</td>
</tr>
<tr>
<td>South East</td>
<td>£26039</td>
</tr>
<tr>
<td>All remaining UK</td>
<td>£24288</td>
</tr>
</tbody>
</table>

There are further recommendations for salaries for ‘Supervisors’ and ‘Managers’ ranging from £26318 to £54110 depending on experience, range of duties and size of golf course.

This compares with a UK national average salary of £29009, and the salary that can be expected by a ‘Labourer’ of £28237.
The CGCS also makes recommendations for ‘Managers’ i.e. Club Managers and Secretaries, ranging from £22413 outside London with limited responsibility, to £91549 for a club within London with ‘Championship Status and/or Substantial Additional Facilities’.

It is clear therefore that, at entry level and on becoming qualified, the maximum salary that can be expected is considerably below the UK national average and that of ‘labourer’, and from that point of view can only be of limited appeal to many young people. Whilst salaries are higher for those carrying more responsibility the value of a Course Manager at a prestige venue is little more than 60% of that of the comparable Club Manager/Secretary.

4.3 Opportunities for Career Development

The CGCS have set out a clear Career Pattern for greenkeepers and golf course managers, the entry point of which is illustrated as being GCSE (England and Wales, and presumably embracing National 4s and 5s in Scotland) and which presents progression through apprenticeships, qualifications, experience and on/off the job training to a position ultimately of Course Manager or Estates/General Manager. This is supported with a flow diagram of qualifications from WBD/SVQ level 2 to MSc Sports Surface Technology.

It is clear from this that the potential exists for good careers in golf course management, and again from personal experience and in conversation with industry representatives, there are recognised and demonstrable examples of those with the right combination of skills and experience progressing to develop first class careers. Interest through the careers section of the BIGGA website for the senior posts is very high, and career prospects are considered excellent for the ‘right people’.

4.4 Qualifications and Curriculum

Any discussion of what makes the ‘right’ person must look at the education and development opportunities available to anyone coming into greenkeeping as a career choice. Greenkeeper education and training can be identified as formal training leading to a qualification through a College or training provider, and informal training and development outside of that setting, commonly through Continuing Professional Development (CPD) activities.

4.4.1 Formal Curriculum

Formal curriculum in greenkeeping has existed for some 45 years, and has developed to provide a range of provision in the UK and Ireland that today includes the following:

Work-Based Qualifications

- Level 2 Certificate in Golf Greenkeeping
- Framework Level 2 Work-Based Diploma
- SVQ Level 2 Sports Turf
- FETAC Major Level 4 Horticulture specialising in Greenkeeping

These qualifications are an introduction to greenkeeping and concentrate on the practical tasks of the greenkeeper, supported by underpinning knowledge.

- Level 3 Diploma in Golf Course Supervision
- SVQ Level 3 Sports Turf Management
These qualifications introduce a qualified Level 2 greenkeeper to more complex tasks for which he or she will be required to take some organisational/managerial responsibility and include further development of knowledge and understanding.

**Work Related Qualifications**

- National Certificate in Greenkeeping
- NFQ Level 6 Sportsturf Science and Maintenance (Ireland)
- Higher National Certificate in Golf Course Management
- Higher National Diploma in Golf Management
- Foundation Degree in Sportsturf
- BSc (Hons) Turfgrass Science
- MSc Sports Surface Technology
- MA Sustainable Golf Course Management

These are available in a range of delivery options including full time in college and fully online distance learning reflecting changing educational patterns, the concept of lifelong learning, and the demand for education and qualifications from those in employment.

With the exception of NC Greenkeeping (which is in effect a full-time version of SVQ Level 2) these programmes develop the skills and competences expected of greenkeepers moving to supervisory or management positions. All of these include a deeper level of study into the science and practice of golf course management including topics such as Soil Science, Ecology, Plant Pathology, Plant Physiology, Golf Course Construction, Drainage, Irrigation and Mechanisation. The HNC and HND also introduce topics including Budgeting, Supervision and Management, Golf History, Human Resource Management, and Business Strategy and Culture. As such they are very much focused on the mechanics of the greenkeeping and golf course management tasks i.e. they are Vocational Qualifications. The MA Sustainable Golf Course Management is alone in specifically providing a contextual setting within the sustainability challenges faced by golf course management and represented by Golf Course 2030. It is suggested that future curriculum should include a greater contextualisation within the framework of the ‘sustainability agenda’.

**4.5 Current Staffing and Qualification Levels**

Staffing levels on UK and Ireland golf courses varies widely with known examples ranging from 1 full time greenkeeper and 1 seasonal for 18 holes to 13 full time plus a further 9 ‘seasonals’ for 18 holes, this reflecting the wide range of financial and social circumstances within which golf operates in the UK and Ireland. In preparation of this Action Plan a short survey was undertaken to try to establish a ‘typical’ picture of staffing and qualifications levels in UK and Ireland Greenkeeping. The survey elicited 75 responses, 45 of these from Scotland, 18 from England, 10 from Ireland and 2 from Wales. The majority (65%) were from private members clubs, the balance almost equally between municipal and commercial facilities, and 75% were from facilities with a week day visitor green fee of less than £100 (35% less than £50). The findings are briefly discussed below.

Twenty-eight per cent of respondents reported a summer greenkeeping team of more than 10, 44% between 6 and 10, and 28% of 5 or fewer. Of the 75 respondents their personal level of qualification was 51% holding or studying for HNC or HND, 21% for S/NVQ Level 3, 12% for S/NVQ2, and 13% at BSc or MA. High levels of engagement in education and CPD were indicated.
Respondents were also asked one question about the degree to which sustainability was a central theme of their education. Eleven per cent suggested that their programme contained almost nothing about sustainability, with the remainder reporting that it was either mentioned although was not embedded in the programme (39%), that it was a central theme to most modules (28%) or that the whole programme was committed to sustainable greenkeeping (23%). Whilst this is pleasing it also indicates that there is quite a way to go to fully embed the principles of sustainability within the industry’s educational offering.

A summary of this short survey is that most facilities have a team of 10 greenkeepers or fewer, and that there is a high level of engagement in development through formal education towards a qualification, and that the awareness of sustainability is high, even if it is not yet fully embedded within every programme and finding its way into the consciousness of every candidate.

4.6 Continuing Professional Development

Continuing professional development (CPD) has become a major part of greenkeeper education over the past 20 years or so, much of it driven by BIGGA, for whom it is a very specific element of their corporate vision and of their stated values. This is represented each year as a component of ‘Harrogate Week’ by a comprehensive programme at ‘Continue to Learn’, providing for all experience and educational levels within the greenkeeping workforce; there is the ‘Future Turf Managers Initiative’, a 3 day residential programme supported by Jacobsen, which focuses on management and leadership skills for aspiring industry leaders; there is the Master Greenkeeper Certificate; there is a range of Scholarship opportunities supported by several partners including The R&A; there is Toro Student Greenkeeper of the Year; there are regional conferences, seminars and networking events. In short, there is a very active CPD programme all with the aim of increasing the educational level, competence, and professionalism of the greenkeeper and golf course manager.

One view of CPD in greenkeeping and golf course management is that it picks up where the formal curriculum leaves off, in that, as stated above, the formal curriculum is very much around the competences of physically doing the job, and other than the HNC and HND in Golf Course Management, has a limited offering aimed towards development of the ‘soft skills’ that are identified as lacking in many greenkeepers by both the PGA and England Golf.

From that perspective it makes an invaluable contribution to the professionalisation of greenkeeping and golf course management.

The MA in Sustainable Golf Course Management has been mentioned previously. This programme sits alone as specifically and formally offering a Course Module in ‘Theoretical Perspectives of Sustainability’. As golf collectively moves towards a challenging future as set out by Golf Course 2030 it is felt that the conceptual framework of sustainability should be built into all formal programmes, and that there should also be an offering in the CPD provision that introduces and builds on this as the political, economic, social and environmental space that golf now occupies, and within which it comes under such scrutiny.

4.7 Future Staffing and Qualification Levels

Discussing the future by necessity requires a certain amount of speculation, however it is possible to present an ‘informed speculation’; the following is such an exercise for greenkeeping and golf course management.
At present almost all of the education and career pathways within greenkeeping are framed around the 16+ school leaver and therefore represents careers in greenkeeping and golf course management as an equivalent pathway to ‘the trades’. It is proposed that greenkeeping is rarely thought of as a career choice for someone with Highers or A-Levels, meaning that the industry doesn’t routinely attract people with the level of academic ability represented by these qualifications. A consequence of this is that the industry, with all its technical and ‘soft skill’ demands, is missing out on the brightest young people, some of whom would have a wonderful contribution to make. It is further proposed that the perception of the greenkeeper as an artisan worker contributes to the detachment between those running golf clubs and those managing golf courses, and that this relationship between greenkeepers and golfers, and greenkeepers and golf professionals and secretaries, is deeply embedded in the social history and culture of the game. A personal involvement in The R&A Scholarship programme shows that this is not universally the case and there are some extremely well educated Scholars who have found their way into golf course management from an academically impressive school career, but they are the exception rather than the rule. The industry needs to find a way to attract more of them.

The general media and golfing press are replete with stories of golf’s decline. It is beyond the scope of this Action Plan to explore that, however it is widely accepted that this is the case, and so it is speculated that golf clubs and providers are under financial pressure. One consequence of this is that they will seek to reduce costs; a common way to achieve this in golf as everywhere else, is to reduce staff levels. When set alongside challenges described by Golf Course 2030 it is speculated that greenkeeping teams will not be growing, so it will be incumbent on golf course managers to achieve the same results, or better, with fewer staff. One potential way of doing this is with automation, and there is great speculation at present within the industry about automated mowers and other machines. The Agricultural Engineers Association discussed that this is a growing trend in land-based industries and is growing in other parts of Europe²⁰, particularly the Nordic countries, for use in some areas where it is considered suitable. At present automation is used primarily in general amenity areas and there are real concerns about health and safety in its use, particularly in areas where there are concentrations of people; clearly golf courses come to mind in this regard. In any event the technology for automated mowing and other tasks already exists, and the fact that it is automated suggests that tasks such as mowing could be done during periods when people are not around e.g. at night. If there is sufficient commercial gain for all concerned, the practical problems will be solved and automated mowers and perhaps other equipment will become a frequent sight on golf courses.

A further speculation around staffing and salaries is that employers might choose to have a smaller workforce but with each greenkeeper paid more²¹, suggesting that further emphasis will be required to bringing the people into the industry who possess the appropriate technical, management and interpersonal skills.

In terms of future qualifications it is likely that the culture within greenkeeping will continue to drive employees at all levels to achieve the appropriate qualifications and undertake appropriate CPD. There may however need to be some development of curriculum to ensure that principles of sustainability is embedded at all levels.
5. SUMMARY AND CONCLUSIONS

Findings for each of the three resources can be summarised as follows:

Chemicals

- Political and public pressure is driving a reduction in approvals for chemicals to be used in turf management including golf courses.
- Greenkeepers are reducing their chemical use and using them as wisely, however they remain an important tool in controlling undesirable organisms.
- Alternative chemicals, whilst supplied commercially, have not been proven to provide adequate control of undesirable organisms in a turf situation.

Aggregates

- Aggregate supplies of adequate quantity and suitable quality are likely to become scarcer and more expensive over the next 20 years and beyond.
- Evolving greenkeeping practice has led to increased demand for aggregates, particularly sand.
- Alternative products exist but despite proving suitable from a technical perspective have not been widely adopted.

The Greenkeeping Workforce

- Greenkeeping is still widely perceived as an ‘artisan’ career and struggles to attract entrants of high educational attainment from school.
- Greenkeeping salaries do not compare favourably with the national average salary, although salaries of more senior greenkeepers are more equitable.
- Greenkeeper education and training is strong through formal qualifications and CPD and is popular within the profession. Sustainability is a recognised element of greenkeeper training but not specifically embedded within all programmes.
- Greenkeeper education and career paths are targeted predominantly at the 16+ school leaver and do not attract ‘degree level’ candidates.

A significant element of this Action Plan is to discuss how the challenges presented can be met through consideration of alternative technologies, management solutions, and behavioural change, considering each of the three scenarios set out in the Golf Course 2030 document. These three elements of the response are discussed in the following section.

5.1 Potential Responses

5.1.1 Alternative Technologies

Alternative technologies can be identified as a range of things including biopesticides, recycled glass, and automated machinery, and each has a role to play. It would, however, be careless not to consider existing technologies and methods as a partial solution, at least with respect to scenario 1. There is currently widespread good practice in relation to reducing pesticide use through managing turf to be drier and firmer, not just in the links environment but in all golf course environments. This is often based on adjusting the grass species composition to produce blends which are less susceptible to severe scarring. This is achieved through careful management of fertiliser, ‘soil conditioner’ and water inputs, management of plant health and stress, appropriate aeration programmes, and the use of appropriate levels
of topdressing sands. In scenario 1, that of limited change, it is likely that current best practice will allow optimal turf conditions to be provided.

For scenario 2, that of severe restrictions in chemical use and 50% less water, it is unlikely that current best practice or the modest gains derived from any as-yet unproven bio-pesticides will allow optimal turf conditions to be met other than during favourable seasons of the year. Turfgrass species selection will play a more important role under these conditions, and those with courses dominated by grasses less prone to disease and that are more drought tolerant will, obviously, be in an advantageous position. Alternatives to sand, and automated equipment, might allow some cost saving and more directed use of the greenkeeping workforce, and it is possible that, for example, drier summers will mean less mowing requirement of turf areas and less requirement for topdressings as firmness will come more naturally. Golf Course 2030 recognises the potential for golf to be more enjoyable due to firmer surfaces and seasonal variability. Management solutions and behavioural change will become more important.

Scenario 3 is a doomsday scenario in which technological change will not be able to produce optimal turf quality. Management solutions will struggle to deal with the issues presented, and behaviours of all associated with golf will be challenged should the game become unrecognisable from its current form.

5.1.2 Management Solutions

Management is concerned with the organisation and coordination of things, activities or people towards defined business objectives, and encompasses skills including planning, delegation, decision-making, communication, delegation, motivation, and problem solving. In the three scenarios presented in Golf Course 2030 effective management will be vital to ensure the ongoing viability of individual golf courses and golf as a sport. It is essential therefore that education and CPD programmes continue to emphasise the importance of these ‘soft skills’ for the golf course manager and include them within the educational offering. Both the PGA and England Golf identified these skills as lacking in many of today’s head greenkeepers and course managers, but also emphasised the importance of them in the golf community setting, both for demonstrating competence and managing effectively, and also for credibility within the organisation and the change in perceptions that might be brought about by that. Should golf move along the continuum towards scenario 3, and it becomes more difficult from a technical perspective to produce optimal golf course condition, and if this is perceived by golfers and others as a failure by the greenkeeper, then the importance of objective setting, communication, and other professional management practices and behaviours will assume greater importance. Good practice in golf course management at present includes preparation of a course policy document and appropriate communication of that to golfers and colleagues, however it is not universal practice and in the absence of such a document the idea can easily take hold that the greenkeeper doesn’t know what he/she is doing and makes it up as he/she goes along. It is therefore imperative that the development of robust management competences in greenkeeping is continued at all levels and in all forms of greenkeeper education and professional development.

In addition, and in parallel to Management Solutions is the issue of Leadership. It is strongly felt that the issues of sustainability in golf course management (represented by the Golf Course 2030 initiative) should be ‘front and centre’ for all organisations within the industry that are considered as having a leadership role, including governing bodies, governance organisations, trade associations and membership organisations, who all need to show commitment to high-level principles, long term strategic direction and focus for the industry,
and provide mentoring and support to those practitioners implementing change and working with it on a daily basis.

5.1.3 Behavioural Change

Behavioural change is a challenging topic to discuss as it affects all stakeholders and will necessitate a challenge to the status quo, of ‘the way we do things in golf’. Golf has a long history as a sport and since the first constituted societies has had an association with social status in Scotland, the UK and internationally. A common reaction when discussing golf with international colleagues is that it is held to be for the social elite of their country, and indeed whenever golf has grown rapidly it has always been among people, ‘whose social status was agreeable’. The development of golf course management and greenkeeping has developed in parallel with this over the past century and a half; guided in the UK since 1929 by the Board of Greenkeeping Research (now the STRI) and in the United States by the USGA Green Section since 1920. Throughout this period increasingly technological solutions have been found to improve golf course turf to the point at which it has become possible to control almost every element of the environment in which it is grown, ranging from soil moisture and nutritional content to control of undesirable organisms to a range of performance parameters to effectively a turf grass monoculture. The late 20th century accelerated this development through the use of inorganic fertilisers, automated irrigation systems, standardised construction methods and the use of synthetic plant protection products. The challenges now faced by golf, and described in Golf Course 2030, present the first time for over a century that turf quality, at least defined by aesthetic parameters, will no longer be seen to ‘improve’, and change will in all likelihood be interpreted as decline as restrictions on the use of water, chemicals and fertilisers have more of an impact. This has considerable implications for the future of the game, particularly if the potential loss of visual quality is interpreted as reflecting negatively on the golf club concerned (and by implication its members) and/or on golf in general. Interestingly, whilst visual quality might decline, functional quality (firmness, ball roll) is likely to improve, as described in scenario 2 of the Golf Course 2030 document. (Indeed, this has been observed personally in the Netherlands and in Denmark – the maintenance of golf courses to be drier and firmer has led to increased enjoyment of the game). Change is always challenging, however it would appear that golf has no choice but to accept it and that its many and varied stakeholders will need to adapt their behaviour accordingly.

Every stakeholder in golf will need to embrace change and modify his/her behaviour whether that be as a global or national governing body, a course designer, an agronomic advisor, a golf course manager, a supplier, or a golfer. This is likely to include, but not be restricted to, the following:

5.2 The R&A and National Governing Bodies

The website of The R&A states that it, ‘engages in and supports activities undertaken for the benefit of the sport of golf’, and further that it organises championships, ‘governs the sport of golf worldwide’ (with the exception of the USA and Mexico) and ‘provides best practice guidelines on all aspects of golf course management’. The websites of the National Golf Associations (England, Ireland, Scotland, Wales) describe their roles very much around growing the games in their areas of jurisdiction, supporting clubs in their management and development, and supporting national teams. In reviewing these websites it is apparent that golf courses are not mentioned on the home pages of any of them; for the National Governing Bodies it is difficult to find any reference to golf courses on their websites at all; for The R&A golf courses are found under the ‘Sustainability’ tab. None of these organisations
appear to define themselves as having a leadership role in the industry, and although that is apparent in this current initiative it is implicit rather than being stated. It is felt, because its participants and adherents already have an emotional investment, that sport has a massive opportunity to encourage, educate and influence its participants and wider society in all aspects, including sustainability. By clearly adopting a leadership role and setting the principles, long-term strategic direction and focus, the governing organisations of golf can contribute to creating an environment that elicits the desired operational response at ‘core’ level. The R&A and the National Governing Bodies could do more to bring the issues represented by Golf Course 2030 to the front and centre of current thinking, as a minimum through their websites – their interface with the public – about the game and by doing so demonstrate a higher level of advocacy for the issues faced by golf.

5.3 Professional Tours and Associated Media

In speaking with industry colleagues in preparation for this Action Plan the conversation often came on to a discussion of professional golf, the golf courses they perform on, and the way in which these are portrayed by the golf media. This coincided with discussions about from where golfers and the golf community get their information and form their impressions about golf courses and golf course management. A general consensus is that the ‘big media’ e.g. Sky Sports play a significant role in informing the golfing public on issues relating to golf courses, yet their commentators are not necessarily adequately informed of the realities themselves. It is felt that more could be done to work cooperatively with and support the ‘big media’ in getting appropriate messages about the future of golf course management out to the golfing public; it would take intervention at the senior management level within the appropriate organisations to facilitate this.

5.4 Key Decision Makers and Influencers at Golf Facilities

Key decision makers and influencers at golf facilities can include the owner(s), golf course manager, the club manager/secretary, the professional, and club officials drawn from the membership. It is felt that the club professional is likely to be the most significant person within this group: the club professional is likely to come into contact with almost every golfer either before or after a round, and through the position of providing a service at that point of a golfer’s day can be seen as ‘everyone’s friend’. This is a different relationship to those that exist elsewhere within a traditional golf club. It has been established that greenkeepers are often invisible to the golfer, and so any messages about the condition of the golf course on a daily basis are likely to go through the professional. It is therefore important that this person is sufficiently knowledgeable to provide good quality information. The critical point in relation to this is providing the right level of entry level information to the club professional, enabling them to be a signpost to the right person or the right resources.

It has also been established that the ‘soft skills’ are often not strong in a golf course manager/greenkeeper, and that attitudes within clubs often mean that this person is not considered a member of the management team.

A summary to be drawn from this is that golf clubs and facilities need to ensure that their attitudes, management structures, and internal management processes are fit for purpose in the world as it now is and as it changes. Key decision makers must keep themselves abreast of changes and developments and provide leadership within the club environment as the industry adapts; CPD is essential to facilitate this. Willingness to critically review and reform, and to undertake appropriate education and professional development, is important to ensure efficient management and communication for all influencers within golf facilities.
5.5 Golf Developers and Architects, Advisory Agronomists, Researchers, Educators, Commercial Suppliers

This group of stakeholders contributes greatly to the technical context and physical environment for greenkeeping and golf course management and carry a great responsibility for the future of golf course management within the context of change.

The golf course architect sets the objectives for the golf course in terms of ‘look and feel’, including, for example, the grass selection, and its maintenance requirements, with implications for resource demands, including those discussed in this report and also water, fertilisers, and energy. It is sometimes felt that there is a disconnect between what is possible within the specific environment and the vision that is set; in other words objectives are not always ‘SMART’, which makes it difficult for them to be met and can threaten sustainability of the golf course and the business. The European Institute of Golf Course Architects (EIGCA) run a Continued Professional Development programme, Raising the Standard in Sustainable Golf Course Development (RSSGCD)\(^2\), which is the only significant professional initiative within the industry aimed at raising awareness of sustainability issues across the board amongst practitioners. RSSGCD is both broad and deep, and addresses all aspects of sustainability.

Advisory agronomists also carry a responsibility to provide support that is appropriate to the specific circumstances of the golf course, and in the changing world will need to support greenkeepers in relation to setting appropriate and realistic turf quality parameters, understanding e.g. disease pressure and the integrated management techniques by which it can be managed and mitigated, as well as alternative technologies as discussed.

In many ways it is the function of these stakeholders to communicate good and emerging practice to the turf manager. It is incumbent upon them therefore to maintain their own technical knowledge and understanding, to present information in ways that can be clearly understood, and to maintain an awareness of the issues being faced by the turf manager and golf industry.

5.6 Golf Course Managers/Greenkeepers

Behaviour change for the golf course manager or greenkeeper is likely to involve a willingness to adopt new practices and technologies, adaptability and realism in setting turf quality objectives, and a positive attitude towards continuing professional development in order to maintain professionalism and positive relationships within the golfing community.

5.7 Golfers

The anticipated changes as described by Golf Course 2030 will be challenging for many golfers. Over the last 40 years it has been possible to produce uniformly green, lush turf and produce high green speeds, but it is anticipated that this will no longer be feasible in the majority of cases. Golfers won’t be able to change attitudes without the right information and incentives, and it will be incumbent upon national governing bodies, club managers and officials to facilitate information events and to communicate with golfers appropriately. For their part, golfers need to be prepared to change their point of view and embrace a different perspective.
6. RECOMMENDATIONS FOR ACTION

The preparation of this Action Plan has included a lot of searching for information, reading, conversations with many industry colleagues, and consideration of a great many variables and scenarios. This report is a summary of those findings and considerations; the pages that follow are a condensation of all of that into a few recommended action points for consideration. These are set out for each of the three resource areas of the Action Plan and are intended to be realistic in their scope and ambition, and to make a feasible and realistic contribution to the development of golf course management as we face the potential scenarios presented by Golf Course 2030.

6.1 Synthetic Plant Protection Products

<table>
<thead>
<tr>
<th>Issue</th>
<th>Proposed Action Point</th>
<th>By Whom</th>
<th>Scenario 1, 2, 3</th>
</tr>
</thead>
</table>
| Existing Best Practice | 1. Continue to identify, disseminate, encourage, and implement good turf management practice. This needs to reflect the challenges and opportunities presented by the changing climate, resource constraints and regulation, for example, increased turf stress due to water availability/quality issues, increased disease pressure due to weather patterns and fewer options for chemical management of diseases, pests and weeds. This includes thinking seriously about transitioning towards grasses which are less disease and pest susceptible and more drought tolerant. | The R&A, Agronomists, Educators, Key Influencers in Clubs, Golf Course Managers, CPD providers | Scenario 1: Existing best practice has the potential to mitigate against the changes identified in scenario 1 for the majority of golf courses in the UK and Ireland, if widely adopted.  
Scenario 2: Current good practice will go some way towards mitigating scenario 2, but change will be required from all stakeholders around expectations of golf course condition and playability.  
Scenario 3: Current good practice will not be sufficient to mitigate for scenario 3, although will remain a cornerstone of sustainable turf management. |
2. Encourage uptake of the OnCourse platform and the recording and reporting of plant protection products.

3. Establish a mechanism for knowledge and technology transfer from other sectors to expedite the availability of proven means of managing diseases, pests and weeds.

Timescale: Ongoing, however specific objectives, if developed, could be met within 3 years.

| Integrated Turf Management | 4. Produce a ‘best management’ handbook/database relating specifically to *Poa annua/Agrostis* greens in parkland situations. (Modelled on the ‘Red Fescue Management’ handbook produced by STERPI’s). This should include thinking seriously about transitioning towards grasses which are less disease and pest susceptible and more drought tolerant. | Collaboration between researchers, commercial companies, educators | Scenario 1
Good IPM practices will mitigate against the changes identified in scenario 1.

Scenarios 2 and 3
Good IPM will be a cornerstone of turf management in scenarios 2 and 3 but will not mitigate against all the potential effects described therein. |

Timescale: Achievable within 3 years.
### Alternative Technologies

5. Build a robust research base on the efficacy of novel compounds and products in protecting against diseases and pests of turf grasses, particularly when grasses are under stress.

Timescale: Definition of a specific research programme can be made within 1 year. Experimental work established and preliminary results available within 3 years. Timescale is open-ended depending on many factors.

<table>
<thead>
<tr>
<th>Researchers, educators</th>
<th>Scenario 1</th>
<th>Scenario 2, Scenario 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternative technologies (biopesticides) have the potential to support turf management in scenario 1, but will be a management tool rather than a curative solution to disease outbreaks or pest infestations.</td>
<td>New technologies will not provide sufficient plant protection to overcome outbreaks or infestations in scenarios 2 and 3, but they have the potential to be a contributor to plant health and resilience in stressful situations.</td>
<td></td>
</tr>
</tbody>
</table>

### 6.2 Aggregates

<table>
<thead>
<tr>
<th>Issue</th>
<th>Proposed Action Point</th>
<th>By Whom</th>
<th>Scenario 1, 2, 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Availability of Aggregates</td>
<td>1. Build awareness of the finite nature of sand and gravel as a resource; encourage refection by golf course managers on current levels of usage; encourage alternative practices that contribute to smooth and firm turf (this reflects ‘Current Good Practice’ above).</td>
<td>The R&amp;A, Educators, CPD Providers, Industry Bodies, Commercial Suppliers</td>
<td>Scenarios 1</td>
</tr>
<tr>
<td></td>
<td>Timescale: On-going, but communication and awareness initiatives started within 1 year.</td>
<td></td>
<td>Judicious use of sand for topdressing as part of a ‘good practice’ management programme will be one element contributing to mitigation of the effects of scenario 1, however as an increasingly scarce and costly resource it will need to be used sparingly.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Scenarios 2 and 3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>It will not be possible in scenarios 2 and 3 to mitigate the potential difficulties encountered through topdressing. It is likely to continue to be a component</td>
</tr>
</tbody>
</table>
| Alternative Products | 3. Promote the use of alternative products based on current evidence.  
4. Conduct further field trials on the effectiveness of alternative products as construction and topdressing materials. This should include an investigation into the possibility of using the softer Permian, Triassic, Jurassic, Cretaceous and Tertiary sandstones.  
Timescale: On-going, but communication and awareness initiatives started within 1 year. Field | The R&A, Researchers, Educators, CPD Providers, Commercial Suppliers  
As above – these products are alternatives and even if found to perform as equivalents to natural sands and gravels would not on their own mitigate the effects within any of the three scenarios. They do however have the potential to be used as part of a ‘best practice’ turf management programme. |
<table>
<thead>
<tr>
<th>Issue</th>
<th>Proposed Action Point</th>
<th>By Whom</th>
<th>Scenario 1, 2, 3</th>
</tr>
</thead>
</table>
| Work to bring people into greenkeeping from different educational backgrounds | 1. Develop the profile of greenkeeping as a profession, to include:  
  • Golf Course Management as a complex profession requiring high levels of competence in many disciplines  
  • Improved salaries and remuneration  
  • Career prospects  
  • Development of higher-level programmes e.g. further degree provision  
  • Investigate development of Degree Apprenticeships. | The R&A, BIGGA, National Governing Bodies, Education Providers, Golf Media, All Industry Stakeholders, Awarding Bodies | The actions within this table cannot be specifically attributed against the three scenarios, for these actions are needed now. The challenges faced by the scenarios outlined in Golf Course 2030 require a complex set of attributes, skills and competences of the greenkeeping workforce. Greenkeeper education and training has developed over the last 30 years to give a most impressive offering, and is, arguably, the most comprehensive and well developed within the golf industry. Despite this there is a perceived need for further development to support golf course management away from being perceived solely as an artisan occupation to be perceived as a true profession. The success of otherwise of this will challenge long-held social arrangements and attitudes within golf, particularly |
<table>
<thead>
<tr>
<th>Sustainability in the Curriculum</th>
<th>2. Review curriculum and embed principles and practices of sustainability throughout, appropriate to the academic level.</th>
<th>Educators, GTC, Education Advisory Groups</th>
<th>As above.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timescale: On-going and dependent upon timescales of existing review cycles.</td>
<td>3. Work to have principles and practices of sustainability embedded within CPD.</td>
<td>Organisers and presenters of CPD</td>
<td></td>
</tr>
<tr>
<td>Timescale: Communication and support for CPD providers within 1 year.</td>
<td>4. Provide CPD for educators and CPD providers in principles and practices of sustainability.</td>
<td>The R&amp;A, GEO, BASIS, The Climate Coalition</td>
<td></td>
</tr>
</tbody>
</table>

Timescale: Ongoing. Proposals for further degree within 1 year. Investigation of Degree Apprenticeships within 1 year. Introduction of degree and/or apprenticeship degree within 3 – 5 years.

To not respond positively to change and continue on the journey of greenkeeper development will be to let down the industry and the game of golf; the custodians of the collective asset of golf courses have a vital and pivotal role to play as we face the future. These recommended actions will continue that journey.
| Soft Skills | 5. Review formal curriculum and embed soft skills throughout.  
6. Continue to develop soft skills training in CPD programmes.  
Timescale: On-going and dependent upon timescales of existing review cycles. | Educators, GTC  
Organisers and presenters of CPD | As above. |
|---|---|---|---|
| Greenkeeper Profile | 7. Develop programmes and events that develop the knowledge and awareness within the golf community of the responsibilities, skills, and competences of the golf course workforce.  
Timescale: Development programmes formulated and events held within 1 year. | National Governing Bodies, BIGGA, Educators, CPD Providers | As above. |
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David Roy, Crail Golfing Society/CMAE
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Mike Clark, SRUC
Ian Butcher, SRUC
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Dr Christian Spring, STRI
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Dr Andy Owen, ICL Ltd
Richard Flint, England Golf
Theodora Levanti-Rowe, Agricultural Engineers Association
Jim Croxton, BIGGA
Jonathan Wright, The PGA
Damian McLaverty, GCSAI
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48 ELGCA Raising the Standard in Sustainable Golf Course Development (RSSGCD)
APPENDIX. Golf Course 2030 Scenarios

Scenario 1. Limited change from the environment that now exists as alternative technologies, management solutions and behavioural change address the challenges posed by climate, resources and regulations and optimal golf course condition and playability is secured.

Scenario 2. Severe restrictions in the availability and use of synthetic chemical plant protection products, together with 50% less water being available for irrigation compared with current levels. Alternative technologies, management solutions and behavioural change partially address the challenges posed by climate, resources and regulations.

Scenario 3. The banning of all chemical plant protection products and fertilisers, together with 75% less water being available for irrigation compared with current levels. Alternative technologies, management solutions and behavioural change fail to address the challenges posed by climate, resources and regulations.