

# Sustainable Golf Development

Creating a Positive Legacy

# Partners & supporters

*GEO is an international non profit organization dedicated to supporting sustainability in and through the sport of golf, working with stakeholders across the golfing, government, environmental and academic communities.*

*Specifically, we'd like to acknowledge the financial and in-kind support of the following organizations, that made the creation of this guidance possible.*

*We are also very grateful to the members of the European Institute of Golf Course Architects, the American Society of Golf Course Architects and the Society of Australian Golf Course Architects for providing the real-world case studies that help to illustrate key elements of sustainable golf development.*



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# Driving the Green

Like all sectors of business, golf affects society and the environment, and has a responsibility to minimise negative impacts and maximise positive benefits. Unlike all sectors, golf's opportunity to jointly enhance quality of life and enrich the ecology of landscapes extends far and deep.

**A**s a multi-faceted land, leisure and economic development, golf's challenges and opportunities are complex and often closely interconnected.

There are no shortage of strategic challenges to the game's sustainable growth. On the one hand, external environmental designations and regulations are restricting land and water availability. Within the industry, investor profit motive often continues to over-ride 'common good' outcomes – without recognising the real compatibility of the two. And this is where the upside of sustainable golf development is obvious.

All over the world, consumer choices are being directly influenced by ethical and environmental issues. Governments are gaining votes for their policies on environmental protection, resource efficiency and pollution prevention. Energy, water and other essential costs are rising all the time. And the media is more than willing to spotlight

suggestions of 'injustice' or 'damage' at the push of a button – locally to globally.

Denying this inevitable trend is a losing battle which works against profitability. By contrast, the businesses best placed for success are those which adapt and embrace.

It's to this cause that GEO is dedicated. To do nothing other than promote and support sustainability in golf, driven by the vision that golf will be universally valued for maximizing its social and environmental contribution.

## ***Embracing sustainability***

GEO is unequivocally positive about both the concept and the reality of sustainable golf. For good reason. Which land-based, public-facing business would not want to be highly regarded and well known because it is resource efficient, ecologically rich and community integrated?

Like all sectors, golf has been going through the process of learning how to adapt. What to





Developing — or redeveloping — golf courses around a vision of social, environmental and economic sustainability is an extension of golf's roots. It's not a revolution but an evolution of age-old values

do, where to start, what are the big priorities and what is of lesser importance?— Golf has been learning the language of sustainability and reflecting on the wide range of modern day issues and concerns. That's not an easy process. Genuine sustainability solutions are often hard to identify and harder to build, and sometimes the harsh realities presented by a planet under pressure are not easy to accept.

That's why our approach is pragmatic and practical, making sustainability easier for everyone to understand and deliver. We have worked hard to refine golf's sustainability agenda into six themes that can be applied

to the entire industry — water, energy and resources, environmental quality, landscape and ecosystems, people and communities and products and supply chains. We want to take the mystery out of a broad and complex subject and empower people in golf to make the real world decisions and take the practical actions that make a difference.

### ***Evolution not revolution***

Sustainability is a great fit for the game of golf. It was part of golf from the start and it must be part of golf in the future. Sustainable courses respect their surroundings and honour the natural environment. They create green space

**Message from Jonathan Smith**  
*Chief Executive, Golf Environment Organization*

Sustainable golf development is successful golf development, where everyone wins. By bringing the conservation of landscape and ecosystems, resource efficiency and community integration to the heart of your project, you will create a more profitable outcome — in the full sense of the word.

This guidance explains why that is, and how you can make it a reality in your golf development — leaving a lasting positive legacy for people and the environment.

We also feature GEO Legacy™ — a programme which helps teams plan, deliver and articulate the sustainability of their project, from concept to conclusion, leading to the prestigious award of GEO Certified™ Development or Renovation.

Our thanks go out to all the people and organizations who have supported the production of this guidance. Our world is so complex and the issues we face so large in number and scale that there is no single solution from a single source. Individual leadership, within a framework of collaboration is key to success. We've tried to take that approach into this work, and we invite you to do the same at your club and in your golf development. There really is a role and reward for everyone.



where the land may have previously been abused. They 'pay the rent' for their existence by enhancing natural habitats and ecosystems, improving overall environmental quality and treading lightly on natural resources. And they seek to embrace the uniqueness of each site — not rewrite its history, culture, landforms, and wild plant and animal species.

This harks back to golf's very origins: the original Scottish courses where natural landforms, including knolls, hummocks, swales, coastal bunkers and ponds were existing features of the local terrain. No development required. Sheep sheared the

meadows and maintenance was decidedly low input and organic. The game was affordable, and accessible to many.

This reminds us that we can learn a huge amount from the older courses, particularly the way they work with the land, tread lightly, and respect the landscape that provides their form and context.

Sustainable golf course conception, design, and construction extends and encapsulates five centuries of golf tradition: enjoying fresh air and physical movement in an uplifting natural setting in a way that harms none and benefits all.





‘In sustainability, every decision is double edged – one way positive benefit, another – negative impact. The problem and the solution often found lying side by side.’

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# Create your Legacy

*GEO seeks to help golf development teams plan, deliver and articulate the social and environmental value of their project – from concept to construction and opening – leading to the prestigious award of GEO Certified™ Development or Renovation.*

Building on the GEO guidance for Sustainable Golf Development, GEO Legacy™ drives comprehensive and fully customized sustainability reporting for new projects and renovations.

## ***Multiplying the value of great golf design***

- Bringing development teams together around common vision and goals
- Supporting the presentation of a strong sustainability case to regulators and local communities
- Constructive evaluation and feedback from an Accredited GEO Sustainability Associate (GEOSA)
- Credible and long-lasting recognition for becoming a GEO Certified™ Development or Renovation.

The GEO Certified™ ecolabel for Development and Renovation showcases leadership, spotlighting the creativity and responsibility behind the planning, design and construction of a profitable, resource-efficient and ecologically-rich golf facility.

## ***Support and recognition***

GEO Legacy™ has been carefully crafted to integrate seamlessly into real world golf development. The efficient, collaborative process is based around focused dialogue, concise feedback and professional evaluation reports at each of five key milestones.

- 1. Enrolment** initial project appraisal and formal entry into GEO Legacy™
- 2. Planning** optimizing the use of land, matching site and locality with appropriate development model, and considering infrastructure needs
- 3. Design** integrating project component details in a cohesive package; painting a clear and powerful picture of your project's sustainability
- 4. Construction** sensitive realization of planning and design, retaining opportunity for creative refinements to enhance the product, preparing for the transition to management
- 5. Certification** and opening day announcement of the GEO Certified™ Development/Renovation ecolabel. Communications support and optional launch attendance.

## ***GEO Sustainability Associates***

The GEOSA Network is an international community of technical experts specializing in the business of sustainable golf. A small but highly qualified group of the GEOSA membership is accredited to verify Legacy projects. GEOSA have extensive field experience and are specially trained to support golf development teams.





## Golf's Ecolabel



Development  
& Renovation



Course & Club  
Management

### ***Evidence of your commitment and achievements***

At the heart of GEO Legacy™, templated statements from your project team are constructively evaluated by an Accredited GEOSA.

Combined, these four documents — and the creative thought behind them — carry proof of the project team's environmental and social considerations both internally and publicly.

For example, the Sustainability Blueprint in phase two is a highly valuable inclusion for planning applications and stakeholder consultation; a positive, engaging and relevant preface to detailed EIA reports.

In the context of overall development budgets, programme costs represent a solid investment. Depending on the size and complexity of the project, administration and verification fees scale accordingly. With a renovation starting at €15,000 and a large, high complexity development resort at €48,000, GEO Legacy™ is customized to suit each and every project.

GEO Legacy™ is an investment. An investment in access to world leading sustainable golf expertise and valuable programme content, that credibly and visibly connects your project with the global drive towards sustainability.



### **GEO Legacy™ Milestones**

The boxed GEO Legacy™ features throughout this document detail the milestone reports produced as you work towards the GEO Certified™ ecolabel for Development or Renovation.

The Legacy Field Manual can be found in full at [golfenvironment.org/legacy](http://golfenvironment.org/legacy).

Abbreviated checklists for planning, design and construction can be found at the end of the key chapters in this document.



# The Business of Sustainable Golf

*Sustainable development is all about the product you create, how you create it and how you communicate its unique qualities to consumers. It cuts to the heart of short and long-term profitability.*

Corporate responsibility and environmental stewardship are now expected from all developers. Evidence of environmental damage and unethical business practices can seriously impact profitability and public reputation. During the 2008 downturn, for instance, 'green' housing was one of the few areas in real estate that saw any demand.

Delivering social and environmental performance cuts to the heart of successful business planning, and a proactive approach to sustainability will deliver significant bottom line benefits through public goodwill, efficiencies, increased marketability and higher returns on investment.

Protecting and enhancing the environment is always cheaper, in terms of both construction and ongoing maintenance, than heavily engineering and modification. And while some of the latest sustainable building technologies might cost more initially to purchase and install, the lifecycle savings and payback periods make real financial sense. Whether the facility is a quick build-and-sell-on or a proprietary development with long-term operational interests, sustainability affects the bottom line.

The most significant 'sustainability versus profit' choices tend to arise during project conceptualization and masterplanning

in integrated golf, leisure and residential developments. In such projects the predominant model has often been to develop as much land into real estate as possible, squeezing that which is available for golf and other landscape and ecosystem features. While such projects might bring higher short-term returns on investment, a weaker golfing product, expensive maintenance of engineered fixes, and degraded residential views will all inhibit these projects' enduring success.

In addition, such projects usually lack meaningful and distinctive unique selling points and fail to engage the local population. Such a project may miss the opportunity to create a great golf course as the heart of a thriving golf business that continues to multiply value for itself and the community for decades to come.

Compare the lost opportunities of standard-design golf courses to the full potential reached by Old Works Golf Club (shown below), which restored a polluted industrial site, turned its historical equipment and natural features into unique attributes, created a range of direct and indirect skilled and unskilled employment, and provided recreation for the community. This really is golf as a catalyst for ecological and community regeneration. Here are some of the tangible benefits of embracing sustainability:

#### ON THE GROUND:

*Heythrop Park, Oxfordshire, United Kingdom*

*Designed by: Mackenzie & Ebert Golf Design*

This project exemplifies good practice in the integration of new golf development in historic landscapes. The project permitting was agreed subject to restoration of a minimum of 95 per cent of the original landscape design dating from the seventeenth century, which had become substantially degraded as trees became overmature and the park suffered general neglect. A combination of fieldwork and documentary research was required to identify the historic design: the golf course routing was then prepared around this using the landscape design as a primary constraint. The restored park is managed under a prescribed Historic Landscape Management Plan and is open to the public, with footpaths and bridleways crossing the course.



#### ***Faster planning approvals***

Environmental and social reasons are the most common cause for a project to be refused planning consent, resulting in by far the greatest potential for government- or community-induced delay. Faster approval times can be gained by investing in site and community research and a proactive approach to sustainability, which can result in less conflict. Contrast this to a spendthrift approach that 'saves' consulting fees and avoids environmental and social issues until they are forced upon a project because of local opposition. The resulting additional carrying costs and lost revenue due to delayed opening can far exceed any initial savings.

Doing research and pinning your colours to long-term sustainability early on allows the project team to:

- Become the site experts and know more about the local environment than potential critics
- Have knowledge to counter unfounded attacks
- Address most public and regulatory concerns before they are voiced
- Generate credibility and public and official confidence in the project from the start.

Given the costs and potential risk in golf course development, it is vital that investors in a project are confident of its success. A steady pace toward regulatory approval and demonstrated community acceptance reduces the likelihood of investor withdrawal.

The Legacy programme helps ensure the best possible product that will be more efficient to build and operate, while the GEO Certified™ ecolabel is an asset that you can market onwards to maximize revenue generation.





***Lower capital investment and construction costs***

Deliberately working with existing contours and mature vegetation minimizes engineered solutions, earthmoving, planting, and irrigation and thus reduces investment and construction costs. Further, potential problems due to hydrological changes, impeded drainage, erosion, die-back or wind throw of trees, over-shading of playing areas, and inappropriate planting and seeding can all be avoided.

***More unique selling points***

Retaining local, natural features and tapping consumer interest in sustainability and healthy lifestyles offers a golf facility a superior competitive advantage in the marketplace. A higher quality product, more positive public profile and a basis from which to articulate social and environmental responsibility can set one facility apart from its neighbours and enable more compelling marketing messages.

**ON THE GROUND:**

*Old Works Golf Club, Montana, United States*

*Designed by: Nicklaus Design*

Old Works is a pioneering example of a publicly-owned, community-driven development becoming the catalyst for the restoration of a major brownfield site. Commenced in 1994, the Old Works project in Anaconda, Montana, was the first golf development to be built on a Federal Environmental Protection Agency 'Superfund' site. The former copper smelting works was transformed by Nicklaus Design to create a layout which features trademark black bunkers, using crushed ore waste from the smelting process. Many historic relics of the smelter are also incorporated, including the flue and oven remains. The water quality of Warm Springs Creek, once utilized by the smelting operation, has been dramatically improved: it now hosts a healthy population of trout.



*Reduce long-term  
maintenance expense*

Investing in a large and resource-intensive land-based business that fails to insulate the business from rising resource costs increasingly represents a business risk. A more considered approach to planning and design can insulate the business from price increases and conservation restrictions to positively impact asset values.

It might sound  
counter-intuitive, but  
putting the planet  
first can actually pay.



# The Language of Sustainability

*What people understand as 'sustainable' is evolving all the time. Our collective knowledge is ever broader and deeper. Individuals and governments are better equipped to identify the real from the perceived. The overall bar of expectation is rising and the ability to articulate the true social and environmental impact of your development has never been more important.*

Governments, environmental and community-based organizations around the world are using new tools and concepts to try to determine how much and what forms of economic and leisure development can be deemed 'sustainable' in locations. It's recognized as important for society to try to understand at what point development moves from being beneficial to deleterious.

Of course, none of this is an exact science, nor is it rigorously and consistently applied around the world, and much depends on the type of development being considered. However, the following methodologies are being applied to help stakeholders gain a better understanding of when development will start to exceed the aesthetic, biological, energy, water, social and cultural capacity of our surroundings.

## ***Cumulative impacts***

Cumulative impacts result when the effects of one action are added to or interact with other effects. For example, several golf developments in close proximity may give rise to significant landscape, ecological or resource effects in combination, when none would have by itself. Analysis of cumulative impacts is important in identifying the carrying capacity of a biodiverse area under threat by humans, known as a hotspot, to accommodate multiple golf developments. Such analysis can also help reveal appropriate thresholds for sustainable development.

Conversely, clusters of golf facilities that have been well planned, designed and constructed can help to preserve the landscape and ecosystem fabric of larger units of land, and bring them under conservation-based management for decades and centuries to follow. Golf can be associated positively with increasing the ecosystem and resource-carrying capacity of a region.

## ***Carrying capacity***

Broadly, carrying capacity refers to the amount of an activity or resource use that a system can support sustainably, without showing economic, social and environmental deterioration and decline in the longer term. This fundamental concept underpins modern-day approaches to sustainable development. Strategic planning now seeks to define the capacity of areas to accommodate various levels of development of different types, and in accumulation.

Carrying capacity studies can be beneficial to developers in anticipating and addressing competition for limited resources and customers. Such studies can also help in phasing development. Energy and water capacities might increase through the use of new technologies, increasing the amount of permitted development.

## ***Thresholds***

By better understanding the carrying capacity for golf development for a defined area or region, taking into account its other land



#### ON THE GROUND:

*Yas Links, Abu Dhabi, United Arab Emirates*

*Designed by: Kyle Phillips Golf Course Design*

Yas Links saw a sustainable approach to the creation of a golfing landscape in the growing Middle East market. Located on Yas Island, an existing barren desert site with no vegetation or wildlife, the project was conceived from the outset to utilize reclaimed water for irrigation, resulting in the decision to limit the maintained turf area to 39 hectares within a total site area of 93 hectares, and to employ *paspalum* as the principal turfgrass species. There will be minimal use of pesticides, and a long term aim to enable a wholly-organic management regime. An existing mangrove and natural tidal area was preserved adjacent to site, and a bird sanctuary was introduced and expanded.



and resource use needs, it is possible to begin to identify thresholds for sustainable development. Although not usually precise, given the complexity and subjectivity involved, this concept is increasingly tied to strategic land-use planning decisions. For example, when governments release parcels of land for macro-scale tourism development, they often set a pre-determined ratio for the number of golf courses and density of residential units for that area. Doing so creates a planning framework that protects sensitive and vulnerable ecological and cultural zones. This approach also ensures that soft landscapes will be present amongst harder elements of development.

Threshold-guided plans for development are often of great interest to the local community, which may wish to see economic development and the creation of employment and wealth, but which also wants to protect

other valued assets, such as access to green space, protection of historical sites and biodiversity hotspots.

#### *A common language for discourse*

In many places where concern about the sustainability of golf development exists, the concepts of cumulative impact, carrying capacity, and threshold level can be used to help understand whether the concerns are legitimate or unfounded. Often people simply want to know that thoughtful consideration of environmental issues has guided the types and overall levels of economic and tourism development.

Within reason, the application of the above concepts can help everyone generate an understanding of issues that need to be considered when seeking to evaluate sustainable levels of golf development.

#### *Realities of a planet under pressure*

Growth in population and consumption present global society with tough choices on the use of land and resources, and there is no special dispensation for golf.

Not all proposed golf projects should proceed, even with a sophisticated design approach, and integration of the latest technology. Under sound, objective and scientific evaluation, certain sites and locations are 'inappropriate' or 'too sensitive' for golf development.

Some landscapes and ecosystems deserve protection from development. Some climates challenge the

basic concept of sustainable golf, with unavoidable impacts during development and throughout long-term management. Sometimes social and environmental sensitivities outweigh the benefits generated. And some places have enough golf and development – adding more may tip the balance beyond the natural or cultural carrying capacity of the area, leading to unacceptable environmental and/or socio-economic impacts.

Sometimes the cost and opportunity cost can simply be too high.

# Integrated Approach

*The best sustainability outcomes arise when skilled professionals come together around a clear sustainability based vision, ready to apply the principles and practices of sustainability throughout decision making, remaining prepared to evolve ideas and think outside the box.*

In part because of their multi-dimensional nature, good golf development thrives on iteration — continual refinement, exploring alternative options and testing possible solutions — to ultimately find the best fit of the project to the client's needs and the site. Design and construction are connected in a similar way: the best end products and outcomes occur when design details continue to be refined and polished as the development physically takes shape.

Strategic land-use planning establishes the political and spatial framework within which a project will be conceptualized, masterplanned, designed and constructed.

A comprehensive evaluation increases the project team's understanding of environmental legislation and land and resource use policies that apply to the site. It also brings forward specific details about the locality and region that inform the team about



ON THE GROUND:

*Chambers Bay, Tacoma, United States*

*Designed by: Robert Trent Jones II*

Chambers Bay is a celebrated example of golf development on a brownfield site, well integrated into a wider, mixed-use masterplan. The project restored a degraded landscape, created new municipal green space, repaired the natural fabric of the urban fringe, and also made significant use of construction materials sourced on site while demonstrating respect for its industrial heritage. Chambers Bay hosted the US Amateur in 2010 and will host the US Open in 2015.



the site and its surroundings, and identifies golf development permitting criteria against which proposals will be evaluated.

Next, integrated planning and design explores site options and possible solutions, all while seeking to design out negative impacts and design in positive outcomes. Concepts are visualized in detail, on paper and screen, ready to be transformed into reality. Outcomes emerging from this stage include site-specific design and spatial plans, detailed drawings and construction specifications.

The process of refinement continues even after construction begins, with skilled and sensitive work on site remaining adaptable to late-stage alterations that polish the quality of the product.

After construction, the transitional grow-in phase begins to fix the landscape's structure, and ancillary elements such as roadways and maintenance facilities are completed.

Finally, a comprehensive management plan will continue to protect and further enhance the designed-in sustainability features and to retain the integrity of the site's assets.

The biggest risk to sustainability lies in fixing concept and design ideas in stone before fully understanding the social, economic and environmental context of the project.



# Planning

*The biggest wins and losses are framed during the earliest stages of project planning.*

Integrated planning and design are crucial to a good outcome. Decisions made during early stage planning — particularly during conceptualization and master-planning — will have the most significant bearing on the environmental and social footprint of the development — both in the short and long term. For this reason, it is critical to get the product concept correct from the outset.

## ***Appreciating the context and getting to know the site***

Understanding the development context requires development team professionals to become fully aware of all the local laws and restrictions. Depending on the geographic location, the environmental and planning laws which apply to a golf development project can vary from the extremely rigorous to the virtually non-existent.

Even if regulations are lax, a good project will take steps to do what is best for the land and for the long-term benefit of the golf course business. Great and sustainable golf developments are not framed merely by doing the legal minimum, so after becoming familiar with all the laws that may restrict development, the next step is to thoroughly understand the site itself, particularly its unique natural and cultural qualities.

Thorough site surveys allow the team to discover what needs to be protected and enhanced — for example, how the native ecosystem functions and where the most sensitive and highest-quality natural areas are located. At the same time the team will identify less environmentally sensitive areas to locate components that are perhaps more heavily engineered and higher impact. The team should also seek to understand the cultural heritage of the area and any historical or archaeological features, as well as what access is currently available to the local population and what are their expectations and rights.



## **Legacy planning**

Produce a Sustainability Blueprint for your project. Paint a powerful picture of your sustainability vision and objectives; get on the front foot in local government and community conversations; demonstrate clearly and concisely how sustainability cuts to the heart of what you are seeking to create. Describe the ways that your project will benefit people and the environment, and how you are credibly addressing inevitable trade-offs and unavoidable impacts.

#### ON THE GROUND:

*Devil's Thumb, Delta, Colorado, United States*

*Designed by: Phelps-Atkinson Golf Design*

Devil's Thumb is an affordable public facility constructed in a rural Colorado community at over 5,000 feet above sea level. The site was dominated by heavily-eroded landforms (locally known as 'Dobies') sculpted from a sterile, high-sodium adobe clay. These provide a stunning visual contrast with the very tightly-defined playing area footprint, which minimizes overall resource input, resulting in a win-win scenario.



The land itself also needs to be thoroughly examined — for example, the depth of the soil, rock obtrusions, and steepness of the slopes. Also the hydrology: which areas are too wet to sustainably drain and would be better retained as functioning wetlands within the development? Can the natural hydrology of the site be improved — for example, by opening up agricultural drainage and connecting surface drainage and water bodies?

Information derived from site surveys should be carefully analyzed and properly evaluated to build a genuine appreciation of the interaction between the desired development and the host site.

Sustainable courses typically protect ecological hot spots on the property by steering clear of the most valuable habitats and biodiverse spaces. Working around ecological hotspots often leads to them becoming positive features that define the golf course and the landscape character.

Securing planning permits in a timely manner depends on fully understanding the regulatory and site contexts. Exploring and being able to demonstrate and communicate the team's in-depth consideration of the site's natural and cultural qualities, options and alternatives, can help assure governments and stakeholders that the developers have created the best proposal possible, economically, socially and environmentally.

#### *Purposeful regulatory relations*

In meetings with regulatory bodies:

- Enter discussions in a positive, open-minded way with a clear vision and objectives for your development
- Be prepared on all key issues of government policy and local concern and interest
- Understand the legitimate and priority concerns over the development, and be ready to counter concerns that are based on assumption or misinformation
- Avoid presenting the project as a fait accompli without room for adaptation.

Without a sound understanding of the site's core attributes, it is impossible to know what kind of golf development would be best.

# Conceptualization

*A big word but with a straightforward sustainability meaning. It's all about matching the right development type with site and locality.*

Another aspect of integrated planning and design comes in the form of knowledgeable conceptualization, which begins when the regulatory and site research is in hand. Although it starts as a simple idea, the project's core concept is central throughout the development process and frames the vision for an opening-day product that will carry forward for decades. The physical outcome of this stage is a development vision, based on some core principles and made tangible through some anticipated real-world outcomes. Broad-scale diagrams of key development features, framed within a plan that shows how the development will comfortably fit the site, are also useful to create early visualizations of the look, feel and plan of a sustainable integrated development.

Conceptualization should not be rushed. Quickly made decisions at this stage can be a source of regret — particularly during permitting, construction and the life of the development.

A good concept unlocks the opportunity to get the very best out of a site. A good concept matches the development with the land. Site conditions and the locality should be key drivers of conceptualization decisions and a major priority should be using landform and climate to best advantage.

Fitting the development to the site for one golf course meant maintaining lava flows, old walls, wetlands and coastal landforms. For another it involved retaining all the existing boundary features that interfaced the course with its surroundings — walls, woodland strips and hedgerows — to minimize the visual impact of the golf course on the landscape. In another it meant retaining world war two relics as visible reminders of the landscape's past.

## ***Conceptualization conflicts***

There are a few common and recurring issues that challenge the compatibility of a concept with its location. For example, preconceptions for the scale of the course or over-allocation of the land to real estate can both squeeze too many golf features into too small an area. Developers need to scale the development to fit the landscape, leaving space for natural vegetation and habitats.

When sizing the golf course, the development team should consider who will be playing. A heavy focus on resort and championship-level facilities can exclude opportunities for affordable grassroots development of the game. This consideration is at the heart of the course's business model: will the course have restricted membership and access or seek a broader business base from the local community and tourists? One golf course development team asked themselves this question and used their answer to conceptualize a model

Focusing on being eco-superior from the outset paves the way for a truly ecologically rich, resource-efficient and community-engaged development.



of accessibility throughout the development: the golf course, clubhouse and even the land around the clubhouse. In this regard more and more developments are trying to combine prestige with inclusiveness in order to maximize the diversity of customer.

Pre-conceived golf course design philosophy — for example links, water, forest, heathland, parkland — may drive a perception that these features have to be artificially created, even when they don't fit the site concept or make ecological sense. A radically land-altering concept leads to waste, unnecessary impacts, expensive mitigation, and other problems. It's more sustainable to adapt course features to each individual site. To embrace the values of the site and surroundings, rather than ignore them. It's stating the obvious but a free draining heathland site is perfect for a heathland course, without expansive artificial water features. A links course does not need artificial tree plantations, and a wetland site

should retain wetland characteristics. A desert course should, in fact, look like a desert, unless there is a genuine opportunity to build on existing 'oasis' qualities.

The concept of sustainable resource use may be another area that serves as a focus for a development concept. Some development teams set sustainability goals that drive their planning process, such as to use 100 per cent recycled water and waste recycling plus a defined percentage of renewable energy use.

Some teams adopt policies to utilize as many local and recycled materials as possible, sourcing rootzone from local compost manufacturers, wood from recycled and certified forest product sources, irrigation and drainage pipework manufactured from recycled plastic.

Even if your resource-use goals are not fully realized, they will set a tone of commitment to sustainability throughout the planning stage.

#### ON THE GROUND:

*Golfbaan Heelsumse Veld, Arnhem, Netherlands*  
*Remodelled by: Steve Marnoch, golfMarnoch*

A project with two complementary objectives – enhancing the golfing interest and quality of the original layout, and restoring degraded heathland habitat. Since the last ice age this landscape has evolved on a substrate of pure glacial sand. More recently, 20th century agricultural use produced a superficial layer of rich topsoil. The remodelling concept was inspired on the existing 'dry dales' (glacial meltwater channels) which are utilized as key strategic topographic features. Substantial areas of topsoil were removed creating new areas of bare sand and heathland habitats, with additional 'landscape ecology' benefits: the large-scale heathland patches contribute to the creation of a new network of wildlife corridors at a national level, allowing species to move between the north of Holland and the Rhine Valley.



# Masterplanning

*Masterplanning develops the concept diagram to the next level, and establishes the project's physical scale and footprint.*

Expanding on the visionary conceptualization with specific detail, masterplanning presents the project's land use balance and spatially represents what is to be created in a precise manner, though still at a relatively large scale. The masterplan should balance an appropriate density and form of development with natural and viable landscapes and ecosystems, in a layout that is optimal for the site. This stage is crucial in defining the overall environmental load of the project, and in retaining and enhancing functioning ecosystems that mitigate the load, so as to deliver a net environmental gain.

The masterplan will allocate distinct land-use parcels and reveal the spatial relationships between them, as well as define course routing configurations and human access patterns.

The masterplan's apportionment of the land directly impacts the sustainability of the development. Decisions made at this stage determine whether or not the project will successfully balance financial, community and environmental needs. Too much wild space and the project might not pay. Too much concrete and manicured amenity grass and there may not be enough space for ecosystems that function, biodiversity that can survive or unique landscape characteristics.

A more naturalized development is beneficial financially — particularly in integrated resort and residential developments. Thinking carefully about maximizing the quality of the development's water and land (known as the blue and green) will also have a positive impact on housing and course asset value — a good example of how sustainability can be equated to quality.



Although in theory masterplans allow for further iteration and refinement, in practice it is important to get the first published version of the plan right. This is the vision that investors and developers tend to fix in their minds' eyes.

Instead of allocating 70 per cent of the land to housing and 30 per cent to the golf course, a more sustainable ratio would be 40 per cent housing to 60 per cent golf course. 'Losing' 30 per cent of land does not mean losing 30 per cent of potential homes, as good overall design can intensify density (versus the sprawling nature of many golf communities) while creating exceptional features in the course and overall landscape that will better absorb and help sell those houses at higher individual premiums.

The scale of natural areas, whether around or integrated into the golf course — ideally both — must be sufficient to support viable, biodiverse populations, especially species targeted for conservation. In addition, natural areas should be able to deliver valuable ecosystem services, such as continual treatment and enhancement of water quality. For example, an integrated network of connected habitats, extending to join up with off-site natural areas, allows wild populations to access more resources.

Competing goals that interfere with efforts to balance land use should be resisted. For example, sensitive natural areas might be located precisely where intensive development is most desired. Constant pressure for higher-density development can compromise the retention and creation of viable ecosystem networks or preclude sufficient space for natural, lightly engineered systems. Oversized clubhouses or housing on visually sensitive high points can also compromise sustainability. In contrast, a course that maximizes natural areas as part of enhancing the golfing and overall lifestyle experience can increase value while reducing construction and long-term maintenance costs. Some of the courses highlighted throughout this document are among the most prestigious in the world precisely because of how they balanced development need with environmental consideration.

#### ON THE GROUND:

*Verdura Golf & Spa Resort, Sicily, Italy*

*Designed by: Kyle Phillips Golf Course Design*

The masterplan at Verdura is notable for its use of prime seafront land for two 18-hole courses, complemented by a more compact resort development. This innovative land use balance is supported by a commitment to enhance biodiversity by establishing true native Sicilian plant species throughout the site, which was formerly dominated by a monoculture of irrigated fruit trees on maintained bare soil. 25 per cent of the site is devoted to environmentally sensitive areas, and over forty different species of native shrubs, trees, and grasses have been established.





# Field Manual – Planning

*This is an overview of the comprehensive GEO Legacy™ Planning Checklists that can be found at: [golfenvironment.org/legacy/guidance/field-manual/planning](http://golfenvironment.org/legacy/guidance/field-manual/planning).*



## Landscape and ecosystems

- ☐ Visualise an ecologically-rich landscape at the heart of your golf product
- ☐ Study the ecology, landscape character, hydrology and geomorphology to understand the potential of your site
- ☐ Avoid predetermined design styles and marketing tags such as links, forest, wetlands, heathland etc.
- ☐ Avoid premature decisions on golf course length, and number of holes to be built
- ☐ Masterplan the development around, rather than through or over, the most valuable and interesting existing landscape and ecological features
- ☐ Consider carefully the visual sensitivity of clubhouse location



## Water

- ☐ Use broad-scale hydrological assessment to provide the basis for informed decision making
- ☐ Understand the quantity of water resources available to the project, and any future requirement or opportunity to transition or diversify water sources
- ☐ Incorporate zones of hydrological and watershed importance into masterplans and site layouts
- ☐ Think carefully and objectively about the suitability of open water features, and their environmental, construction and lifecycle cost
- ☐ On sites that are suitable for the creation of water features take the opportunity to maximize the value of new wetland and water ecosystems
- ☐ Adopt a 'natural systems engineering' approach for drainage and storm water management
- ☐ Masterplan development impacts away from existing natural zones of hydrological interest
- ☐ Conceptualize a grassing plan that is the most drought and disease tolerant, and leaves the smallest possible turfgrass footprint
- ☐ Adopt a landscape planting strategy that is based entirely on drought tolerant trees and shrubs



## Energy and resources

- ☐ Strive to conceptualize a project that could become a net energy exporter
- ☐ Understand the current energy infrastructure for your project and have an energy specialist explore the potential for on-site or local renewables
- ☐ Evaluate the potential energy flows to and from the project site such as waste heat from local industry, excess heat generated on site, aquifer/ground water heat transfer etc
- ☐ Optimize the location of buildings to benefit from natural heating, cooling and lighting
- ☐ Masterplan the irrigation system to maximize gravity-feed



## Products and supply chains

- ☐ Drive sustainability through the project's supply chain via a central ethical and environmental procurement policy
- ☐ Integrate all possible use of recycled materials
- ☐ Seek opportunities to pioneer new sources of local, fair trade and recycled materials
- ☐ Masterplan the site to leave space and suitable locations for the ongoing storage and handling of recycled materials



## Environmental quality

- ☐ Plan to enhance the overall environmental quality of the existing site, enhancing the quality of soil, air and water
- ☐ Avoid developing on or close to hydrologically sensitive parts of the site, where groundwater may be compromised
- ☐ Allocate the best quality areas of soil to 'softer' aspects of development such as fairways, semi rough and patches between holes
- ☐ Retain enough green space, vegetation patches and functioning ecosystems to allow natural processes to improve water, soil and air quality
- ☐ Understand the sensitivity and connectivity with any adjacent wetlands, water courses and aquifers



## People and communities

- ☐ Develop a project concept which will drive as many benefits to local people as possible. Engage, listen to and strive to meet their needs and aspirations
- ☐ Make it a determined part of your legacy to multiply meaningful benefits to local people for decades to come
- ☐ Undertake a socio-economic evaluation of the project – to explore practical ways in which local people and communities can derive benefit
- ☐ Consult local authorities to dovetail with local infrastructure plans, and to explore opportunities for joint public/private investment
- ☐ Masterplan for other users – local people and communities – not just investors and golfers, and other target consumers
- ☐ Engage with government at national and local levels to identify how the project might be a catalyst for other wider economic benefits
- ☐ Create real growth by adding to and diversifying golf facility provision, rather than competing with existing golf courses

Think comprehensively, understand your natural and cultural assets, respect them and use them to your advantage.

# Design

*Sustainable design is all about the details for individual project components coming together in a cohesive and integrated package.*



In the design phase, the details come together — and many important technical choices are made. Topographic and grassing plans, landscaping and ecological designs, drainage, irrigation and community access plans are among the critical components of sustainable golf design. When overlaid, these details should combine to paint a clear and powerful picture of the project's sustainability.

## ***Topographic plans and earthworks***

Topographic plans show the amount of physical landscape change that will take place. Efforts should be made to minimize earth movement while creating a golfing product with sufficient interest.

Earthmoving brings inevitable environmental impacts. It disturbs the soil structure and its ecology and can result in siltation and erosion. Clearly some topography is more prone to erosion than others. Moving earth can also put terrestrial ecology at risk and damage existing hydrological and watershed functions.

Naturally it costs more to move a lot of earth than to move little. Balancing a cut and fill within localized parts of a site will reduce labour, fuel and disposal cost during construction and restrict overall disturbance to well-defined zones of the site. If needed, a shortfall of fill material could be overcome by creating additional lakes and water features.



#### ON THE GROUND:

*Castle Stuart, Inverness, United Kingdom  
Designed by: Gil Hanse and Mark Parsinen*

A visually sensitive site on the shores of the Moray Firth, Castle Stuart saw an innovative and sensitive earthworks design lead to the creation of a golf course with a very strong and authentic sense of place. Views to prominent receptor points off site played a key role in defining both the routing plan and the detailed design of the finished topographic levels.



If done properly and in certain locations, earthmoving can also bring significant long-term environmental benefits, especially on brownfield sites. Reshaping the land can rejuvenate the landscape following industrial use or intensive agricultural use. It can regenerate ecosystems — the creation of new pond and wetland areas being perhaps the most obvious. It can also be used to create niche grasslands, such as wet hollows and dry knolls.

Shaping the landscape can be used in other ways too. It can be shaped to direct water — and golf balls. Slopes that feed balls back into playing areas can reduce the overall acreage of maintained turfgrass. In addition, positive drainage can deliver water into attenuation ponds and reduce the need for pipework.

The goal for all projects should be to design a cost-effective earthworks solution that delivers visual interest to stimulate and challenge the golfer, while reflecting the character of the local landscape.

Design is where the golf architect truly takes the stage, conducting the orchestra of individual specialists to produce the final symphony.

## Legacy design

Taking your expression of sustainability to the next level. Putting flesh on the bones of your Sustainability Blueprint.

Explain how your integrated approach has folded ecological richness, resource efficiency and community integration into the physical layout and design of diverse strands of development.

Visualize the sustainability of your golf course, clubhouse, maintenance facility and other components. Overlaying all your design details – for grassing, irrigation, drainage, landscaping, earthworks. Show how they come together for a complete real world outcome.



# Grassing, Landscape and Ecological Design

When one thinks of golf course landscaping, turfgrass first comes to mind. Naturally, sustainable grassing plans are based on the use of the most drought-tolerant and disease-resistant turfgrasses for the locality. The wrong grasses for the locale — especially on cold, dry or high-altitude courses — can shorten the available playing season. For example, in the Alps and Iceland, the playing season is very short, and those courses need grasses that will recover quickly with minimal water and fertilizer.

Just as importantly as species selection, however, is avoiding blanket turfgrass coverage in the first place. It can be costly to maintain and doesn't contribute much to habitat or biodiversity.

Rather than being a focus, grassy areas should be presented in the context of other vegetation coverage, such as semi-natural and natural grasslands, sandscapes, scrub and woodland plant communities. Good grassing plans include all these vegetative components, communicating not only that the footprint of the playing area has been minimized, but also describing the relationship and interface between turf and other vegetation types.

Good looking landscapes are not enough. They need to have a biological function if they are to regulate, provide and replenish. All living things need space to feed, breed and shelter, and populations need to be able to move. Giving biodiversity a long term chance means providing habitats that are large enough and well connected.

A golf course conceived without concern for sustainability often has a much greater hectareage planted in turfgrass than is really needed for a good game. The designer should look creatively for ways to integrate more natural, less resource-intensive non-turf vegetation into the strategy of the course. Making the fairway wider in typical landing

areas and narrower elsewhere can often reduce fairways considerably. A hilly course in the American Northwest is returning low-lying areas, normally carried by even high-handicap golfers, to a natural state with the expectation of reducing turf by 10 per cent or so. As the plan is developed, it should be carefully evaluated for economy. Given the short and long-term implications for water, fertilizer, pesticide, fuel and energy use in construction and maintenance, it pays to make the right decisions on grass coverage and species at the outset.

Closely related to grassing plans, landscaping plans provide additional detail on the specific nature and composition of grassland, shrub, woodland and other vegetation types. These plans should cover the entire development — even the area immediately around the clubhouse, gardens and communal green spaces in and around housing.

Emphasis should be on the use of native, drought tolerant species throughout the development, with care taken to select species and interfaces between species that will bring the greatest ecological value — for example, selecting one tree or shrub species over another because it has a greater association of fungi, birds and invertebrates.

Landscape designers should seek to retain as many habitats as possible, incorporating them into the golfing challenge and the aesthetic character of the course by utilizing them as natural hazards or carries. In addition, valuable vegetation species can be uplifted and replanted at alternative locations on site. Examples of successful translocation of vegetation include wetland species such as reeds, protected species such as orchids, and grassland and heathland turf.

Whether leaving trees and shrubs where they've grown naturally, transplanting or

planting anew, it's best to aim for continuous cover, which means making sure there are always generations of younger trees emerging. Continuous cover in woodlands ensures a consistent character and continuity of landscape over time by reducing the risk of sudden loss of tree cover.

In addition, finding ways to connect vegetation and reduce habitat fragmentation can improve population dynamics amongst wildlife. Hedges and walls can link habitat patches and provide cover for small animals. Designing with landscape ecology in mind will result in a variety of habitats in a wide range of shapes and sizes.

Habitat can be formed where you might not at first consider it. The topography at the bottom of a pond, for example, can create niches for diversity; varying depths stratifies water temperatures. Scaloping the edges of a pond with a gradation of submerged to marshy vegetation provides habitat at its margins. Golf courses have also been designed with floating nesting islands in the middle of ponds.

Vegetation can be established in more places than you might expect, as well, for example, by forming small ledges or pockets on rock faces. Cuttings may also be a potential wildlife habitat; sand martins, for example, have been known to use newly cut faces in softer material as nesting sites. Even the eaves of buildings can be used for habitat when fitted with built-in nest boxes.

Transitional zones of all types provide opportunity for diverse habitats. Woodland edges, where woodlands and shrubby areas intersect, are often the most species-diverse areas and can provide excellent habitat for a variety of animals, especially when the edges create nooks and crannies. Even the interfaces between turfgrass and rough grass, or turf and sandscape, has ecological value. Considering how transition zones will interface with playing areas can often be a key recurring design feature, and not always the easiest to get right.

#### ON THE GROUND:

*Golf Gleidingen, Laatzen, Germany*

*Designed by: Krause Golf Design*

This project showcases habitat enhancement on the grand scale. The 110 hectare site near Hannover was formerly intensive sugar-beet production. Now a modest 32 hectares of maintained turf is balanced by over 65 hectares of natural roughs and 10 hectares of lakes and wetlands.





# Drainage

*A fundamental aspect of water resource management that should work with rather than against the watershed.*

Drainage design determines how much drainage engineering is required on the site and how much is required to treat the waste water that emerges from the development. The golf course itself should be viewed not only as land that needs to be drained, but as a catchment that can receive and treat surface and sub-surface runoff through natural systems.

Open ditches are often underrated as components in the drainage system. Not only are they a means of achieving efficient, flexible flow rates and are relatively easy to maintain, but from the environmental perspective they provide habitat.

A well-designed and constructed open ditch, with a variable cross-section and gradient, rough bank profile, and naturally curved alignment, will rapidly colonise to provide a range of ecological niches and will become a useful wildlife corridor. Ditches may also be attractive landscape features and strategic golfing hazards in their own right.

Water-shedding characteristics should be integral to landform design. The intention should always be to achieve complete, positive surface drainage away from all playing areas, avoiding any potential ponding. Courses have successfully used landforms, slopes and swales to shed water to out-of-play areas, ponds and wetlands. In financial terms, there are huge construction and maintenance cost savings to be accrued through a focus on softer and more localised engineering solutions for site drainage.



Piped, culverted and canalized drainage systems can degrade natural catchment processes and ecosystems and create trains of engineering and mechanized treatment. Golf developments should use natural drainage flows as much as possible.

Dry regions need a different drainage approach than wetter regions. In the desert, open water features can lead to significant loss of this precious resource through evaporation. Instead, pipework along with engineered water treatment and underground water storage are better approaches to capture and reuse course runoff for irrigation.

Where piped drainage is required, the system should incorporate inspection chambers and silt traps in key locations – for example, where a change of direction, gradient or pipe diameter occurs. These are all potential locations for the deposition of sediment which may therefore be easily removed during routine maintenance to prevent transfer to adjacent watercourses. In addition, where piped drainage outfalls to a watercourse or water feature, headwalls are advisable to prevent the erosion of banks and resulting sediment contamination.

ON THE GROUND:  
*Wychwood Park, Cheshire, England*  
*Designed by: Hawtree Ltd (Ken Moodie)*

An early 1990s example of the adoption of a full 'natural systems management' approach to water management. The 180 hectare site was originally under agriculture and was zoned in the municipal land use plan for combined residential/leisure uses. The masterplan included two golf courses, a hotel, and a number of housing clusters.



# Irrigation

*There is no excuse for inefficient water use and attention to detail here is a basic requirement for every golf development and renovation.*

Sustainable irrigation can reap huge financial rewards — saving tens or hundreds of thousands of dollars a year. With water prices rising and vulnerable to disruption, and other large-scale users seeking reasons to take a bigger share of the resource, golf courses need to demonstrate the responsible use of water. One course installed a tertiary water treatment plant that allows it to get 60 per cent of its irrigation water from recycled industrial and domestic sources, with expected savings of US\$70,000 per year — year after year.

Like many elements of golf development design, sustainable irrigation planning and design is a specialized subject that deserves the input of qualified, experienced and ideally, independent advisers. Mistakes and missed opportunities can prove to be very costly.

The first mistake commonly made is irrigating more area than necessary. This is closely linked with grassing plan design, which should minimize the footprint of the course that requires irrigation. Minimizing irrigation is particularly important in dry regions.

The cost of irrigation can be reduced by using gravity, for example siting holding tanks and reservoirs in locations that minimize the energy required for pumping. These decisions are closely linked with site hydrology. One golf course cut the energy required to power its irrigation by 45 per cent by introducing a new water supply designed around gravity feeding.

On a more technical level, the irrigation expert needs to match water pressure with the valves to ensure the most efficient and effective application of water. Similarly, sprinkler head coverage should be located and targeted to provide an even application of water and avoid watering areas that don't require it. Placing a lysimeter on a green helped one course test the water quality running through the putting green's root zone. This approach could also help gather evidence of fertilizers and pesticides travelling through the putting green and into the soil and water table.

## ON THE GROUND:

*Celtic Manor Resort, Wales, United Kingdom  
Designed by: European Golf Design (Ross McMurray)*

The Twenty Ten course lies in close proximity to environmentally-designated areas within the Usk Valley including a Special Area of Conservation and a Site of Special Scientific Interest. Key elements of the golf course design included a programme to conserve and enhance wildlife corridors along the River Usk and throughout the site. Retained trees and hedgerows were incorporated into meadow 'reens' and pools crossing the site, which also enhanced 'support' habitats in the form of interconnecting corridors of tree lines, hedgerows and strips of uncut grass. These were of particular importance to maintain dormouse habitat. A 12m-wide protective buffer zone was created from the top of the bank of the Usk to prevent disturbance of otters, both during construction and afterwards.





# Community Access

*There are dozens of ways in which local people's needs can be met and even exceeded – very often to the direct financial benefit to the facility.*

Access plans are an important aspect of the overall sustainability of a golf development. As large spaces, often close to population centres, golf developments interface directly with local people. Given that social equity, justice and integration are important pillars of sustainability, golf developments that unnecessarily or deliberately disenfranchise people cannot be deemed sustainable.

Golf developments can overcome this risk by ensuring that existing and potential rights of way and traditional access routes are protected and, wherever possible, enhanced. Safety dictates that access should probably not lead to non-golfers wandering over the course, but most golf developments have non-golfing areas and boundary areas that can accommodate walking, cycling and horse-riding paths.

Creative access planning can be a major success story for golf developments – demonstrating understanding and accommodation of local people's needs and aspirations. By contrast, golf developments that seek to excessively restrict access to and over land are likely to be seen as excluding and exclusive in a negative sense.

It's a strange irony, but golf developments have often been criticised for working against, rather than for local communities. Demonstrating that this is not the case, and that golf always brings net gains, rests with every developer and every project team.

## ON THE GROUND:

*Mainzer Golf Club, Rhineland, Germany  
Designed by: Städler Golf Courses  
(Christoph Städler and Achim Reinmuth)*

This development saw the restoration of a quarry and subsequent landfill site, conserving and providing enhanced habitats for species including eagle owl, grey woodpecker, lizards and kingfishers. New public pathways and cycle routes around the site connect two local towns. It was described by the local environment authority as an “exemplary mix of leisure activity and nature conservation”.



# Other Design Elements

*Without a consistent approach across the details, the macro-decisions won't be bound together.*

## ***Roads, cart paths and car parks***

The more that paved surfaces are designed in to a golf development, the more resources consumed and the heavier the environmental footprint. Minimizing the amount of additional surface features such as roads, cart paths and car parks will minimize the environmental load caused by their construction and use. In the case of cart paths, designing a walkable course may negate or reduce the need for them, which in turn reduces short-term construction impacts and long-term fuel usage.

Where car parks, paths and roads are integral to the development, the designer should try to minimize their impact. Pervious materials, such as recycled gravels, aggregates, road planings, and geotextiles made from recycled plastics and other fabrics allow rainwater filtration and minimize waste water. When water runoff is inevitable, catch drains can harvest, treat and detain the flow for use in irrigation and equipment washing.

Cart paths also tend to create a visual intrusion on the game. Creating invisible cart path systems of geotextile or growing-cell materials allows them to carry wear without dominating the aesthetic. Further, locating cart paths discretely helps avoid visual intrusion and a disconnection between playing surface and adjoining vegetation. Alternatively, cart paths can contribute to the visual aesthetic when made of local materials, such as cobbles or slate.

## ***Bunkers***

Determining the location, form and overall number of bunkers is one of the most sensitive aspects of golf course design — and one that can have huge resource implications for construction and ongoing maintenance. Sand bunkers are one option for golfing hazards, but they are not an essential component.

Certainly, bunkering should not come at the expense of other more natural and lower impact forms of hazard that might be more appropriate to the site, or even already exist

### ON THE GROUND:

*The Castle Course, St Andrews, United Kingdom  
Designed by: David McLay Kidd*

The Castle Course clubhouse incorporates the use of geothermal energy where ten boreholes draw water and ground source heat pumps accurately control the heating and cooling needs of the building. The heat pump system supplies under-floor heating throughout the clubhouse and strategically positioned fan coils control a stable and comfortable environment.



on the site, such natural sandscapes, open water, wetlands, ditches, rough grasslands, rock outcrops and knolls. Bunkers needn't be over-styled or overworked.

### ***Tee and green complexes***

As well as being of huge importance in defining the identity of the course, and being perhaps the most scrutinized areas in terms of playability and enjoyment, the detailed design of tees and greens are also critical components in integrating the course into the landscape, in the levels of resource consumption the course will require, and also in the degree of risk the course poses to water quality (siting in proximity to water courses). Tee areas in particular often have considerably more turfgrass than is needed (for instance, behind or to the sides).

### ***Clubhouses and other buildings***

The clubhouse communicates the uniqueness of a course when a sustainability-focused architect designs in features that reflect local character together with environment-friendly building principles.

The key principle of passive building design can do much to design out short and long-term consumption of materials and resources. The architect should pay attention to siting and orientation of the clubhouse, for example, and how it fits into the overall landscape.

One developer, who has built courses in a variety of locations, uses shady and naturally ventilated locations for clubhouses and restaurants in hot regions; in cold climates he places buildings in sunny and sheltered areas that benefit from solar radiation and avoid the wind. Other green building principles include site stewardship and protection, rainwater harvesting and water conservation, use of sustainable materials, energy supply and conservation, and sustainable construction practices. Some real-world examples include the use of a ground-source heating system for a clubhouse. Although the system cost US\$20,000 more up front, it will pay for itself in five years. Another example is a photovoltaic panel system for a clubhouse roof. One golf course reduced electricity use from the public grid by 25 per cent, saving €4,000 per year, with a nine-year payback period and 30-year life expectancy.

The maintenance centre offers another excellent opportunity to integrate best practice methods to provide ecological benefit. Care should be focused on designing areas for chemical storage, washing, fuelling, and mixing and loading. The filling of sprayer tanks and refuelling in particular should take place on impermeable surfaces.

#### **ON THE GROUND:**

*The Carrick on Loch Lomond, Dunbartonshire, United Kingdom  
Designed by: Carrick Design*

The Carrick is a great example of landscape-led design within a National Park and National Scenic Area. Subtle contouring, carefully positioned tee and green complexes of appropriate scale, use of native vegetation on prominent areas – all combining to retain landscape character units and harmonize visual appearance from roadways, paths and loch.



# Field Manual – Design

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## Landscape and ecosystems

- ☐ Ensure topographic changes protect landscape character, taking the opportunity to enhance the most degraded and intensively man-modified areas of landscape
- ☐ Utilize materials that are typical of the neighbouring landscape, reduce the need for signage and furniture
- ☐ Pay attention to transitional zones between vegetation types and habitats. Maximise patch sizes and connectivity
- ☐ Reduce the intrusion of bunkers, tee and green complexes on visually sensitive sites
- ☐ Consider whether open water is appropriate for the site
- ☐ Avoid using liners wherever possible, but be aware that lined ponds can provide a valuable addition of open water 'oases' in otherwise wetland-impooverished regions
- ☐ Naturalize water features as far as possible. Sterile, synthetic, wet holes contribute much less than diverse, living water bodies
- ☐ Use native species in all landscaping designs, and drought-tolerant varieties where climate dictates
- ☐ Pay attention to detail in defining the extent of grassed areas. Every acre of managed turf is an acre less ecological habitat



## Water

- ☐ Design the smallest possible turfgrassed areas – each unnecessary acre of fairway and maintained rough increases the water footprint for decades to come
- ☐ Select the best-adapted turf species and cultivars for the local environmental conditions and most sustainable use of water – especially the largest areas, fairways and semi-rough
- ☐ Strive to use open drainage features as an alternative to pipework – including open ditches, swales, and filtration trenches
- ☐ Incorporate buffer zones, no-spray spaces and other 'structural' best management practices to ensure protection of water quality
- ☐ Design an irrigation system which will deliver the most efficient application of water to the smallest possible area of turf
- ☐ Integrate existing types of sand waste or dwarf shrub communities into the design to reduce irrigated area and integrate course into landscape
- ☐ Focus on important aquatic system design details such as littoral shelves and shallow margins, varied depths and convoluted pond and wetland edges



## Energy and resources

- ☐ In general, seek a design for the site that minimises the amount of earthwork, thereby reducing energy and fuel demands during construction
- ☐ Apply key principles of passive design to reduce energy demands, including solar gain, shelter, natural ventilation and insulation
- ☐ On some sites, higher levels of earthmoving will pay back over the lifecycle of the development in terms of enhanced landscape, enhanced biodiversity and economic multiplier
- ☐ Minimize the maintained area – every unnecessary acre of fairway, semi-rough and maintained rough increases the carbon footprint of the development for decades to come
- ☐ Minimize irrigation requirements. The treatment and pumping of irrigation water is a major source of energy consumption in golf developments
- ☐ Minimize excessively sloped and intricate shaping around bunkers and green complexes, which require labour and fuel intensive hand mowing
- ☐ Design a golf course that can be walked, thereby reducing the amount of fuel and resources used to maintain and fuel golf carts





## Products and supply chains

- ☐ Design buildings in a style that enables them to be constructed using local materials and local tradespeople, rather than shipping in prefabricated products and components from distance
- ☐ Design all landscape and engineering features to be constructed using local materials. The most significant might be walls, fencing, paths and paving
- ☐ Design out as many features as possible that will require long distance transportation of materials and products
- ☐ Integrate into design the ability to utilize on site materials that arise through construction — such as soils, stone, wood and existing cleared plant material



## Environmental quality

- ☐ Design a top-of-the-range maintenance facility to protect your development from the harmful effects, both in cost and reputation, of a pollution incident
- ☐ Protect water quality by designing rough grass soakaways and attenuation areas, swales and turfgrass biofilters. Use topography to shed water into natural attenuation areas and ditches
- ☐ Design healthy, balanced and functioning ecosystems in ponds and wetland areas to minimize the likelihood of nutrient over-loading and eutrophication
- ☐ Select stress, disease and drought tolerant grasses to minimize long terms inputs of water, fertilizer and pesticides and reducing risks to soil, water and air quality



## People and communities

- ☐ Design vegetation screens and vegetative buffers to separate golf from other potential recreational users such as walkers, cyclists and horse-riders
- ☐ Create secluded wildlife havens and habitat meeting points to create biodiversity hotspots that are accessible to non golfers
- ☐ Where appropriate, integrate features of historical and cultural heritage interest, establishing a sense of place and celebrating the connection with the past

Delivering sustainability best practice is not a formula or a straight jacket. Quite the opposite. It's a world of creativity, where subtlety, perception and acumen are fully rewarded.

# Construction

*During construction the practical and physical interaction takes place between the project and the host environment. It is when the landscape is actually altered, species and habitats disturbed, traffic introduced, and resources and products consumed.*

The on-the-ground aspect of construction makes it the time when environmental impacts and enhancements can be most easily observed. The local environment is subject to rapid change and environmental quality is most at risk.

The construction phase clearly has the most potential to generate pollution, through the emission of particulate emissions and dust, contamination of water and the generation of noise. In addition construction activities can also pollute and damage soil. Short-term construction impacts may lead to permanent, long-term detrimental effects. Many natural and semi-natural ecosystems are vulnerable when disturbed, and their innate capacity to recover may be destroyed.



#### ON THE GROUND:

*Bigwin Island Golf Club, Ontario, Canada*

*Designed by: Stanley Thompson, renovated by Carrick Design*

Set on a 500 acre island in the pristine Lake of Bays, the extensive redevelopment of Stanley Thompson's Bigwin Island raised water quality protection concerns among residents and locals during construction and post construction, with a particular focus on fish spawning grounds. A series of temporary sediment basins and ponds were constructed at strategic locations to trap and settle out sediments during periods of heavy rain on the exposed soil, protecting the shoreline of the island from potential erosion runoff. It was also necessary to develop a method of filtering storm water runoff before it was released to the lake from fairways, greens and tees. The smaller sediment basins in the treed areas remain in place today, still filtering runoff. Bigwin Island is proud that its environmentally-responsible golf course management techniques continue doing their bit for the unique and pristine natural setting.



*Adapted from An Environmental Approach to Golf Course Development. © American Society of Golf Course Architects. Download the full publication at [www.asgca.org](http://www.asgca.org)*

Construction is the time to find ways to deliver as light a project as possible. For example, one course phased in development of some parts of a site to reduce disturbance on breeding birds, feeding invertebrates, and flowering plants. Another used recycled vegetable oils to meet half the construction fuel needs. Another reported that they had an extremely positive experience engaging local conservation groups to monitor and minimize the adverse impacts. The advice added little overhead but significantly reduced negative results.

Use a professional, experienced constructor, and ensure the project manager buys into the true nature and significance of sustainability issues.

## Legacy construction

Reinforce your due diligence in protecting the quality of the environment and consideration of local people. Represent the comprehensive breadth and depth of best practices to be applied.

Create a resource which benefits project managers and constructors, and which satisfies regulatory needs. Leave a simple but effective grow-in and management hand over plan to ensure your sustainability legacy continues.



# Site Preparation

*A number of environmentally sensitive steps will help to prepare the site, including fencing off sensitive areas, routing site access, siting materials storage, designating haul routes, planning for waste disposal and scheduling utilities.*

## ***Cordons sanitaires***

Before commencement of construction, it is vital to isolate and fence particularly sensitive areas known as 'cordons sanitaires'. These include watercourses, ecological hot-spots, archaeological sites and high-quality landscape elements. Commonly, no construction machinery or activities will be permitted within the cordon sanitaire. The type of fencing used must be robust enough to deter entry by heavy equipment or it may be ignored. Although cordons sanitaires should always be shown on plans, on-site refinement by the appropriate specialists — ecologist, archaeologist, landscape architect — is recommended.

Specimen trees are a very common example of a landscape feature to be protected. The entire area of the root system of the tree should be included. Contrary to the popular misconception, the diameter of root spread is roughly two to three times the height of the tree, so protection should be placed well beyond the edge of the canopy. Within this zone, any change in ground levels or chemical spillage may cause permanent damage to the root system and ultimately the death of the tree. Physical damage to tree trunks should also be avoided.

Watercourses and wetland areas can be further protected by allowing a dense growth of vegetation to grow up on the edge prior to the start of work, acting as a buffer to sediment erosion and chemical ingress.

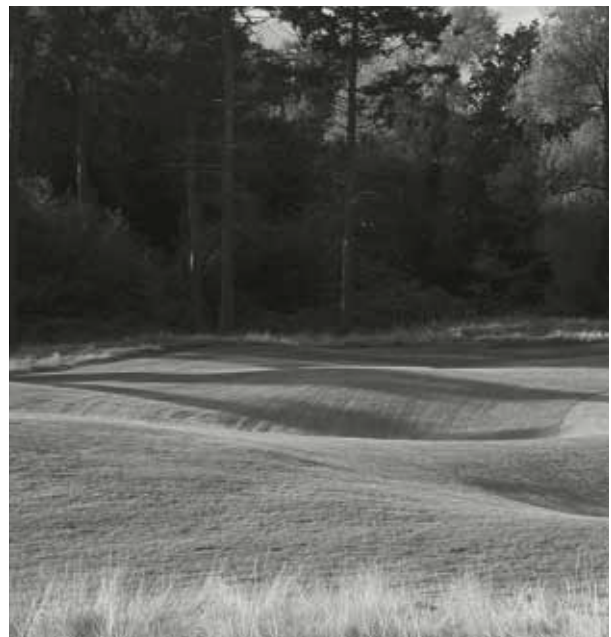
## ***Site access and compound***

The establishment of a suitable access point and compound to house temporary offices, storage and toilet facilities will be one of the construction contractor's earliest priorities. The location of the access point and compound should be carefully selected to take account of environmental as well as operational factors.

Because the main access point and compound will be a focus of traffic, materials handling and storage, and waste disposal, it should be sited well away from any watercourses and other sensitive habitats on an area of dry, well-drained ground to minimize the risk of water contamination during refuelling and mixing of materials. A temporary impervious area for handling potentially hazardous materials may be constructed. Use of a single access point is also desirable. In addition to improving safety, it will also restrict the area required to be rehabilitated.

Construction of the hard-standing surface required for access and parking of vehicles and earthmoving plant can often be coordinated with the permanent road layout, so the base courses may be laid as soon as possible and used as a temporary surface.

A designated maintenance area for machinery should also be provided, including an area for wheel-washing to ensure that oils, sediments, and seeds of invasive plants are intercepted. Sediment from the wash-down area should be further intercepted by a silt trap and, if uncontaminated, may be re-used as fill on site.





### ***Materials storage***

Closely linked to the establishment and management of the site compound is materials storage. While the aim should be to bring all materials to the site only when required, in practice this may not be possible or economical. Most critical will be fuel and chemical storage. Spillage response strategies should be identified. Diesel, other fuel oil, lubricant and hydraulic fluid may be contained by sandbags and other absorbent materials available on site as part of an emergency spill kit.

Temporary storage at localized working areas, e.g. storage of gravel or sand within the root zone or at green sites, should be discouraged, as it is generally more difficult to prevent contamination. If local storage is unavoidable, topsoil should be stripped from the area to be used before placing the materials.

### ***Haul routes***

Done well, the layout of a circulation system of temporary roads allows materials and machinery to move efficiently, minimizing both the construction cost and the potential environmental impacts. Topsoil should be stripped from these areas and stockpiled, and ideally the routes should coincide with the layout of permanent roadways. Routes should avoid fairways, wetter areas, and all environmentally sensitive areas, and avoid the potential for run-off to watercourses.

In general, haul routes should be minimized. If possible only allow one-way traffic to reduce slewing of vehicle tyres and tracks and consequent damage to soil structure in wet conditions. Haul routes to green complexes should always lead from the rear of the green, if possible, to avoid compaction of the approach. Temporary haul routes should be decompacted by ripping prior to reinstatement.





### ***Vegetation clearance***

Individual trees or woodland areas should be marked by the contractor and checked by the architect before felling. Specialist forestry contractors, tree surgeons, or others experienced in tree clearance work should always be used. Special care is required to avoid damage to adjacent trees, which may mean taking down individual trees in sections. Staged felling — working outwards from a centreline — allows the greatest control. The landscape architect should be given the opportunity to identify specific individual trees or areas of vegetation that can be successfully incorporated into the design.

### ***Waste disposal***

Waste disposal during construction needs to be managed effectively. For example, all waste material should be taken off-site to a licensed facility; empty chemical containers should be disposed of by a licensed agent.

Woodland debris and stumps can be chipped and the material re-used as mulch to suppress weeds in newly planted woodland areas. Felled timber may be sold or repositioned as habitat. Other organic waste can be composted where feasible. Burning should be minimized and only as permitted by local regulations.

### ***Utilities***

Scheduling a service provider to identify the location of underground utilities should be addressed from the outset and built into the site preparation timeline. The early and accurate location of services can avoid environmental damage and costly repairs. In expanding utilities, an effort should be made to have all the work done in sequence, to avoid areas being torn up repeatedly.

Once excavated, glacial landforms and mature vegetation cannot be replaced. Construction mistakes can be very costly.

# Conserving Topsoil

*Conservation of topsoil is a basic principle in landscape and golf course construction. For golf projects, a shortfall of healthy topsoil at the post-shaping replacement stage is extremely common, often with significant implications to the budget*

Respreading suspect or damaged topsoil is a risk not worth taking, as it will inevitably lead to later problems with the quality of the playing surface.

Topsoil is distinct from subsoil. Topsoil contains organic material and acts as a growing medium. Its physical and chemical properties differ from subsoil in colour, texture, acidity and nutrient status. Where doubt exists, sampling and testing can be conducted. Differentiating soil types allows topsoil of higher quality to be identified for use on critical playing areas, such as green approaches, green collars and bunker mounds. Soil types of different textures and fertilities should be kept segregated in storage and re-spread in areas similar to their original environment.

Soil can be damaged in storage. Good practice in handling will avoid many problems. Most importantly, the soil should be handled as little as possible — ideally avoiding the need to stockpile by stripping, transporting and replacing in the same operation. It should be moved only when dry and not frozen to avoid damage to the particles and voids that form its structure. Threshold soil moisture levels, above which work must be suspended, may be set

and tested with a soil tensiometer. Conversely, when the weather is too dry, especially when combined with windy conditions, soil particles may be lost as dust.

If soil stockpiling is required, stockpiles should be sited on level, well-drained ground of similar soil type cleared of its own topsoil. Such stockpiles should be sited away from watercourses and other areas vulnerable to deposition of eroded soil. Stockpiles should have a high surface area to volume ratio, should be free of weeds, are not trafficked by machinery once formed, and remain in place for no more than eight weeks.

If the vegetation won't be replanted, it's normal to pre-treat soil with an herbicide before soil removal. When the vegetation has died back, the soil should be rotavated prior to stripping. During stripping, other materials may be revealed underneath, including organic material, sand and gravel. Provided quality can be tested as suitable, these materials may be re-used — for example, in the construction of greens and tees — to reduce costs and improve the overall environmental sustainability of the project.

## ON THE GROUND:

*Geysir Golf Club, Haukadalur, Iceland  
Designed by: Edwin Roald Golf Design*

This project showcases the innovative use of simple, low-resource construction techniques. An enjoyable nine-hole layout has been created on a tiny 18 hectare site at an affordable cost, without compromising the authentic quality of either the golfing experience or the stunning natural setting. On-site sand and gravel deposits allowed zero import of materials for both green construction and drainage, and with fescues being the appropriate species choice in this northern climate, low input maintenance is rewarded by exceptional playing surfaces. Deliberate choice of a basic mobile pump, with minimal pipe infrastructure, means it becomes 'too much bother to over-water', and all playing areas can be mown by a single person in one day on ride-on machinery.





# Earthworks and Shaping

*The objective here is to minimise the amount of material shifted, in line with creating an enjoyable golf course in an authentic landscape setting.*

The bulk earthworks phase of the project covers the operations required to alter the basic topography of the site, as distinct from the subsequent fine-tuning of surface contours, termed shaping. The main activities at the earthworks stage are cutting to reduce surface levels and filling to increase levels. It is at this stage that the largest equipment is required; accordingly, the potential for environmental damage is high.

From an aesthetic perspective, care should be taken to ensure that the exposed cutting faces are finished to leave no scars from machinery and that an irregular natural appearance is achieved. The distinctive geological properties of rock should be revealed.

Where rock excavation is required, drilling or blasting is needed. This is clearly a specialist issue, and it has the potential to create significant vibrations, noise and dust. In most countries, health and safety legislation will prescribe acceptable limits.

Final shaping of the surface contours of the golf course will significantly affect the final course appearance. The skill of the machine operators will determine the successful interpretation of the architect's drawings. Accomplished shapers are genuine craftsmen and are much in demand, because of their ability to interpret an architect's vision, rather than produce a standard pre-defined shape.





The shaping operations will grade landforms below the finished surface level to allow for the resspreading of topsoil and for green and tee construction layers. Respread soil may be prone to storm water erosion. Turfing can stabilize the area better than seeding, though sand-bagging, erosion-control fences, temporary ditches and other methods may be needed to stem soil erosion. In extreme cases, entire green complexes have been known to be washed out by storm damage.

From a sustainability perspective, stepping back to consider the macro scale landscape change is just as important as green or bunker design detail.

#### ON THE GROUND:

*Hamilton Island Golf Club, The Whitsundays, Australia*  
*Designed by: Thomson Perrett Golf Course Architects*

Located within the Great Barrier Reef National Park, a World Heritage Zone, Hamilton Island Golf Club showcases the use of local materials and environmentally sensitive construction. In places the coral reef surrounding Dent Island is 100 metres wide and access to the island was restricted to a few hours per day at high tide. The limited topsoil stripped from the site was used to cap the golf course. A temporary plant was also established on site to crush local stone into differing classes of material for use on the cart paths, road bases, back filling of trenches etc.



# Drainage and Irrigation

*During construction this is an area for logistical planning – scheduling works to minimise disturbance and increase efficiency.*

Drainage construction should be carefully sequenced to minimize repeated disturbance of shaped and finished areas. Trenching, pipe-laying and backfilling activities should be programmed to take place in each area as it becomes available, normally after the placement of topsoil but before final cultivations, rather than as a continuous operation over the entire site. In addition, the use of tracked vehicles or vehicles with low ground pressure tyres helps to minimize soil disturbance and compaction.

The relatively flat nature of the extensive playing areas of a golf course means that drainage gradients are often very shallow. Gradients of no greater than 1:200 are common. This places a premium on the accuracy of levelling to avoid costly and damaging re-excavation and re-laying. Laser-guided excavation and trenching equipment is therefore strongly recommended.

Irrigation efficiency, and therefore water conservation, may be similarly affected by poor construction standards – for example, if leakages occur. The pipes, valves and sprinklers will normally be installed after topsoil re-spread and before seeding, so the main irrigation construction concerns relate to potential compaction of topsoil. As the golf course irrigation system will be used to ensure that seeds stay moist prior to germination, the programme for irrigation installation must be planned to be ready for the best time to seed the course.

## ON THE GROUND:

*Granite Links, Massachusetts, United States  
Designed by: Sanford Golf Design*

The aesthetic and infrastructure enhancement of the Boston cityscape, made possible by the highway relocation and tunnel project, also allowed the beneficial reuse of a large landfill as an open space and for the Quarry Hills Recreation Complex. After thirteen years and 900,000 truck loads of fill material, the 27-hole Granite Links Golf Course, athletic fields, rock climbing sites, hiking trails and other amenities provide a recreational facility to be enjoyed by residents and visitors for years to come.

*Adapted from An Environmental Approach to Golf Course Development. © American Society of Golf Course Architects. Download the full publication at [www.asgca.org](http://www.asgca.org)*



# Grow-in

*Sites can be vulnerable to degradation until they are vegetated. Effective grow in depends on sufficient resources being timed to coincide with construction sign off.*

The primary purpose of cultivation is to create optimum seed-bed conditions. That is, to enable seed to be evenly distributed, allow all seeds to come into contact with soil and its moisture, and to make the soil friable enough to allow tender embryo roots to penetrate the soil. Environmental issues at the cultivation stage are typically not significant; although there may be some danger of wind erosion and dust nuisance where cultivation operations are carried out in very dry conditions.

Certification or seed testing is extremely important to sustainability, and strongly recommended. The use of pre-seeding fertilizer, pre-emergent herbicide and selective herbicides is normal in establishing turfgrass swards. At the time of the seeding operation, calm, dry, but not too hot conditions are required.

Whilst seeding is always the preferred method of grass establishment, there are times when turf has to be used. Under these circumstances, the turf should be custom grown on a matching root zone or, alternatively, washed turf should be used. Pins or pegs can be used to hold turf in position on steep banks, such as for bunker construction.

Think ahead to anticipate potential problems arising from the erosion of exposed growing medium, and put in place contingency measures.

## ON THE GROUND:

*The Links at Fancourt, George, South Africa  
Designed by: Gary Player Golf Course Design*

The Links at Fancourt saw the transformation of a completely flat former airport and waste site into a tour venue using only on-site, local, or recycled materials. A low turf-grass footprint is complemented by large-scale functional wetland and wet grassland ecosystems, protected by the site's all-organic pesticide programme.



# Planning for Management

*The long term sustainability of a golf development is determined by consistent and continual improvement in management.*

The sustainability agenda represents a huge opportunity for successful long-term golf facility management and should be embraced for the way it can drive business performance, golf course profile and profit. Developing a sustainability-based management plan allows golf course management staff to layout their plans for water, energy, landscape and ecosystem, environmental quality, products and supply chains, and people and communities.

Inherent in environmental management are a great many no- and low-cost ways of generating meaningful efficiencies. For example, a golf course in Florida in the United States irrigates between midnight and 6am. This timing coincides with both the lowest wind speeds in the area, the least evaporation, and off-period utility pricing, thus saving the facility an estimated US\$6,000 per year in electrical costs.

Every acre of turf that can be less intensively managed represents tens of thousands of

dollars saved. Observing the game may indicate where maintained turf is currently located but may not be required — such areas can be returned to their natural state. At one golf course in the United States, for example, 11 acres of landscaped areas have been modified to low-input designs with native and drought-tolerant plant material. In addition, many new areas of rough grassland have been introduced, further reducing the overall irrigation coverage.

During drier times of year, zones might be programmed to reduce irrigation. A course in Virginia in the United States prolongs its water supply during dry periods by reducing irrigation by 50 per cent or more. They've found that keeping fairways and roughs somewhat dry under normal conditions allows the vegetation to adapt better to drought.

Even simple policy decisions, linked to light-touch staff and customer communications, can lead to significant reductions in maintenance budgets. Communicating a





## The GEO OnCourse™ programme helps course and club decision makers work together practically to integrate sustainability across the entire facility – leading to the GEO Certified™ industry ecolabel.

golf course's sustainability efforts helps customers appreciate the environmentally friendly design and construction of a site and sets its current maintenance programme in context, allowing them to be part of the solution. A course in Nebraska in the United States developed a golf course pocket guide in cooperation with the Natural Resource Conservation Service to educate golfers on the sustainability efforts at the course.

Tournaments can be greener too. The 2010 Ryder Cup left a significantly lighter environmental footprint thanks to a pioneering green drive. Coordinated activity among sponsors, contractors and suppliers contributed to a carbon footprint reduction of 31 per cent and an 87 per cent re-use and recycling of waste.

The GEO OnCourse™ programme provides a comprehensive and yet streamlined step-by-step guidance and best practice checklists for sustainable golf facility management. Through this programme any golf course can

demonstrate its sustainability and give staff the confidence and credibility to promote its sustainability efforts by achieving GEO Certified™ status. The certification further differentiates the course and provides another unique selling point for the club, locally to globally.

Environmental and social performance is a continuum, not a destination, and common issues can bring facility decision makers together around positive shared goals. It is important to realize that every achievement drives a positive profile for the facility and the professionals that manage it.

Existing golf courses should sign up for the GEO OnCourse™ programme, which provides details on how the principles described in this document can be carried over into daily operations once clubs are up and running. The programme provides numerous ways in which existing golf clubs can improve procedures and processes in ways that are both cost effective and environmentally sensitive.

### ON THE GROUND:

*Prince's Golf Club, Kent, England*

*Remodelled by: European Golf Design (Gary Johnston)*

This remodelling of a classic links layout, originally by Sir Guy Campbell and John Morrison, provided an opportunity to encourage further conservation and enhancement of important dune grassland habitat. In conjunction with the national conservation body, Natural England, Prince's Golf Club has worked hard to increase species diversity in the out of play areas, using sheep to graze and thin out the sward.

During the remodelling, additional measures adopted included translocating dune grasses to reinstate disturbed areas. Bunker sand was saved to be reused as top-dressing material.



# Field Manual – Construction

*This is an overview of the comprehensive GEO Legacy™ Construction Checklists that can be found at: [golfenvironment.org/legacy/guidance/field-manual/planning](http://golfenvironment.org/legacy/guidance/field-manual/planning).*



## Landscape and ecosystems

- ☐ Draw upon ecological, landscape and hydrological surveys of the site to ensure the construction team is aware of sensitive areas
- ☐ Adopt a sensitive, gradual and flexible approach to clearance, seeking to minimize the extent of disturbed area and limit the clearance of natural vegetation, incorporating these areas as golfing hazards where possible. Work outwards in phases from golf hole centrelines
- ☐ Establish voluntary cordons sanitaires and 'no impact zones' across the site to protect the highest value landscape and ecological features
- ☐ Translocate suitable species/ individual specimens and/or areas of valuable vegetation to other parts of site
- ☐ Refine vegetation cover in order to maximize the landscape ecology of the site. Retain and create corridors between habitats
- ☐ Seek new small scale opportunities for previously unidentified or unplanned habitat niches including localized soakaways, swales, reedbeds and vegetation headlands
- ☐ Scrape areas to create vegetated but seasonally flooding depressions and wet, marshy grasslands



## Water

- ☐ Seek further opportunities to minimize the amount of irrigated amenity grassland. These often become most apparent during late construction and grow in
- ☐ Refine irrigation and drainage plans – seeking opportunities to harvest runoff, and ensuring irrigation is targeted to the final grassing plan
- ☐ Ensure ecological design is faithfully and accurately delivered during pond, wetland and water course construction
- ☐ Seek opportunities to replace or integrate piped drainage with swales, ditches and seasonal and permanent attenuation ponds and soakaways
- ☐ Protect existing water bodies and water courses using physical barriers and fences, bio-filters and no-spray zones



## Energy and resources

- ☐ Explore opportunities to introduce cleaner, renewable fuels for haulage and on site machinery – for example, second generation biofuels
- ☐ Select the latest generation of temporary power generators, and look to second generation biofuels and LPG powered options
- ☐ Use low sulphur diesel oil in all vehicle and equipment engines, and incorporate the latest specifications of particulate filters and catalytic converters
- ☐ Look for transportation alternatives for all materials being brought to site – for example, rail and boat/barge
- ☐ Carefully plan construction logistics to reduce fuel consumption – particularly in the phasing of on-site operations and through a focus on getting things right first time round
- ☐ Minimize overall fuel and energy use by minimizing the amount of physical landscape change and seeking late stage opportunities to integrate existing landform



## Products and supply chains

- ☐ Select an appropriate greens construction method and specification, bearing in mind the need to ensure that long-term maintenance requirements can be met
- ☐ Using agronomic advice, seek to use a peat substitute (e.g. coir) for organic component of rootzone. Ideally, source or produce a local compost based product
- ☐ Minimize the importation of bulky construction materials by using on site resources, including recycled aggregates, crushed rock and quarried sands, gravels and soils and timber
- ☐ Make it a policy to use as many products with recycled content as possible, such as irrigation and drainage pipework made from recycled plastics; geotextile membranes derived from recycled plastics; coir matting and rolls; wood-chip derived from pallets and other waste wood; recycled and reprocessed glass sands; recycled brick, slate, tiles, paving, cobbles and other finishing materials for buildings and landscapes
- ☐ Use non-toxic variants of paint, solvent and other potentially hazardous materials wherever possible
- ☐ Source plants, shrubs and flowers locally to ensure best adaptability to climate



## Environmental quality

- ☐ Handle soil when conditions are suitable and soil is dry and friable, use plant expressly designed for the purpose
- ☐ Vary the depth of strip to reflect local soil conditions, stripping only true topsoil and maintaining integrity of subsoil
- ☐ Minimize the length of topsoil storage periods, and stockpile in the right way – that is not in overly large mounds
- ☐ Use erosion control fences, temporary ditches and other measures to reduce soil loss, avoiding cultivation operations in very dry/windy conditions
- ☐ Plan haul routes to make use of permanent roadways where feasible. Avoid fairways, wet areas and environmentally sensitive areas
- ☐ Minimize the quantity of steep slopes that are vulnerable to erosion, ensuring all critical pollution prevention measures are designed into maintenance facilities
- ☐ Protect air by carefully planning construction logistics to reduce noise levels, and utilizing the most modern machinery, with the best fuel efficiency and lowest noise operating levels

# Field Manual – Construction



## Environmental quality

- ☐ Introducing cleaner, renewable and less greenhouse gas emitting fuels into the supply for haulage and on site machinery – for example, second generation biofuels
- ☐ Screen the site to stop dust spreading or place fine mesh screening close to the dust source. Adopt a policy of no, or minimal, on-site burning. Chip and mulch cleared vegetation into material for re-use as mulches, landscape coverings, path materials and growing media
- ☐ Protect water through the use of silt fences and sediment traps, minimizing the amount of exposed ground and stockpiles, and seed over or cover
- ☐ Phase construction to minimize the amount of surface area at any one point in time that is un-vegetated, helping to prevent erosion and siltation particularly in monsoon and other intense rainfall areas, and on sloping and fine soiled sites
- ☐ Ensure spillage response strategies and materials are in place and seeking alternatives to herbicide based vegetation clearance, such as weed burners
- ☐ Ensure all critical pollution prevention measures are designed into the temporary (or permanent) maintenance facility
- ☐ Strict application of buffer zones and no spray/treatment areas around watercourses, wetlands, reed-beds, ditches, marshy grasslands etc
- ☐ Avoid pumping any water containing silt into other water bodies, and prevent water from entering excavation areas by using cut-off ditches
- ☐ Wheel and plant washing facilities should be secure and wash water should be contained for treatment, disposal and/or re-use
- ☐ Site storage tanks for fuels, oils, and chemicals on impervious bases within a containment or embankment
- ☐ Cover car parks, paths and other surfaces in permeable materials to allow slow, diffuse percolation of rainwater and surface runoff, reducing the concentrations of particulates and heavy metals, rubbers and plastics into water courses



## People and communities

- ☐ Communicate that you have utilized all the locally sourced resources you can – from people to products – an important aspect of the local social and economic multipliers of the project
- ☐ Create vacancies for education and training during construction, partnering with local schools, colleges and universities to provide vocational insight into diverse technical skills
- ☐ Hold an official open day, when members of the local community can come onto site and view the construction operations
- ☐ Work up your traffic plan with input from local people. Strive to find a programme of machinery and materials delivery that minimizes the impact on local people
- ☐ Phase deliveries and avoid specified times. Creating customized delivery routes into the site will all assist in reducing noise, dust and other anti-social aspects of construction
- ☐ Prefer local contractors – bear in mind that every dollar spent in the local community has a better chance of recycling back to your business!
- ☐ Undertake construction-focused economic impact analysis so that you can communicate the short term and immediate financial value of the development to local people



# Building a Winning Team

*The best golf projects are based on teamwork. Building strong professional working relationships between all individuals and organizations involved, with everyone working toward a common vision and goal, will maximize the project's potential.*

Implementing sustainability works best with a fully integrated project team from conception and planning, through design, construction, and management. The developer should involve a wider range of professional expertise than is often currently practised, including the employment of sustainable development specialists.

Crucially, all professionals must be engaged early enough in the process to ensure that their inputs, insights and solutions are maximized. An experienced project manager working on a sustainability-focused project should harness the innovative inputs of the following team roles:

## ***Sustainability adviser***

Unique to sustainable development, the appointment of an experienced sustainability adviser can provide early-stage, strategic and practical insight into the opportunities and constraints of the development site and give constructive input to team discussions on the sustainability of master plans, conceptualized layouts and detailed design proposals. This role also helps ensure that a balance of hard and soft technological solutions is integrated efficiently

The value of putting a project on a firm sustainability foundation from the start — aligning the development concept with government policy and local community aspirations — can't be overemphasized. The work of the sustainability adviser can also be

leveraged through communications, helping to effectively manage contentious issues and mapping a comprehensive, cohesive and proactive sustainability blueprint. This small initial investment can pay big dividends down the road.

## ***Market and financial adviser***

Development partners are acutely aware that it is not a good time to invest in resource-hungry golf developments with poor public relations. For these reasons, it is important to let social and environmental issues inform the project's business model. A good market and financial adviser will be able to work alongside a sustainability adviser to factor in and quantify the monetary value of resource efficiencies and a high-quality product.



### *Masterplanner*

A sound understanding of the area's cultural and natural capital is the best starting point for all aspects of site planning from spatial planning to physical mapping and zoning of development areas. This role is about getting the very best out of the site, physically matching the development to the land, and conceptualizing a product that has a strong and unique aesthetic and cultural connection to its surroundings.

The masterplanner creates a framework for the development and sets the tone in which engineering solutions can be kept to a minimum to maximize sustainability. A focus on function and form can help to lighten the overall footprint of the development and create a harmonious, environmentally integrated product.

### *Architect*

New architectural design philosophies can reduce the immediate and long-term environmental footprint of buildings. An architect focused on sustainability will employ green building principles to create healthy indoor spaces that are also highly energy and water efficient.

A high-quality clubhouse that functions effectively to meet customer needs, that integrates the principles of passive design and is backed by the latest technological advances will be a long-term asset to any development. This harmony of function, form and technology will future-proof your buildings and reduce your bottom line.

The profitability gains from eco-friendly buildings can be significant. Research cited by the US Green Building Council highlights the value of green buildings. They consume far fewer resources throughout their lifetime, specifically, 25-50 per cent less energy; 30-40 per cent less carbon dioxide emissions, 40 per cent less water use, and 70 per cent less solid waste. Further, green buildings, on average, have a 7.5 per cent higher market value than regular buildings.

The best outcomes occur by design,  
not by accident, and no one person  
has all the answers.



### *Golf architect*

Some of the most valuable environmental enhancements in golf occur where golfing drama is combined with ecosystem regeneration and positive landscape change. The key to achieving the best possible environmental outcomes — maximizing the environmental quality of the course — is in allowing the design to be guided and influenced by the specific site, integrating golf into the landscape rather than imposing the game upon it. The most memorable and inspiring golf is authentically presented within an ecologically viable and stunning landscape.

A golf architect focused on sustainability principles will connect great golf design to a thoughtful vision for a functioning environment. Win-win golf courses emerge when the designer's creativity is in tune with the site's natural and cultural attributes.

### *Irrigation engineer*

An irrigation engineer focused on sustainability will seek to minimize hard engineering solutions, such as pumping and purification systems, and instead favour natural solutions such as gravity-fed irrigation and wetlands for water purification. Indeed soil percolation, detention and natural treatment provide valuable ecological services at little cost and can be used as landscape features for the development. In arid regions, especially, golf development should minimize demand and maximize recycled self-sufficiency.

### *Agronomist*

The input of a qualified and experienced agronomist is extremely important. Not just in ensuring a high-quality playing surface throughout the longest possible playing season, but also in ensuring long-term maintenance budgets are financially sustainable.

The agronomist focused on sustainability will place particular emphasis on determining the best grasses for the largest expanses of maintained turf — namely fairways and semi-roughs. Attention to detail on tees, greens and surrounds are also important, but in most cases overall resource inputs are lower, due to a smaller total hectareage.

The agronomist should liaise closely with the golf architect on issues of grassing plans, and also with irrigation engineers on predictions for total irrigated area, water consumption and water type (for example greywater or fresh). The architect, irrigation engineer, and agronomist should work together to minimize the grassing plan, use the most suitable species and water most efficiently to minimize water resource use.

### *Construction manager*

Potential environmental risks, such as erosion, siltation, chemical runoff, dust, soil damage and wildlife disturbance are particularly pertinent during the construction period. The construction manager needs to be fully bought into the sustainability vision and detail a complete Constructions Method Statement that describes how impacts throughout the construction period will be minimized.

### *Public relations and marketing specialist*

With increasing interest from mainstream media, travel and lifestyle publications, and print and broadcast golf media, sustainability achievements can fuel low-cost, high-return publicity. A PR and marketing expert can ensure the sustainable development team's work gets recognized. A sustainability emphasis can generate good press at all levels, including internationally. This role can also head off negative publicity by proactively communicating the development team's environmental track record and engaging the local community and planning authorities.

### *Course and club managers*

It is increasingly common to bring the course superintendent or greenkeeper into the development during the design and construction phases. This can help considerably with continuity of handover into grow in, and ensure that maintenance teams have an understanding about how soils and drainage were altered during development. More and more course managers have environmental knowledge and experience and this can be harnessed to ensure outcomes from development can be realistically sustained and even enhanced through ongoing course and club operations.

# About the Guidance

*The GEO Legacy™ Guidance targets two main categories of user: developers, whose chief concern is the realization of the project, and regulatory bodies and their consultees, whose primary interests are strategic land-use policy and the functioning of the development control system.*



This guidance was produced in an effort to support all those people who directly and indirectly work in and influence the development and renovation of golf facilities.

This is a broad international, national and local audience, comprising core golf development team professionals, but also including government officials, environmental NGO staff, local community representatives and academics.

For this reason, and given the uniqueness of every golf project, the guidance does not seek to provide a formula or template, but rather tries to provide a framework for effective sustainability based decision making. Principles and best practices that, if embraced comprehensively, can result in better outcomes in more projects.

The guidance has been produced with the input of a diverse body of writers and consultees. A wide range of perspective and expertise has been folded together through the editorial process, to present what we hope will be a roadmap that all stakeholders can endorse and follow.

Three core principles have been central to the work:

**Credibility** – in step with cutting edge sustainability thinking

**Comprehensiveness** – embodying all key social and environmental issues related to golf development

**Practicality** – providing a logical, structured lead-in to delivering valuable real-world outcomes.

The guidance does not cover the operational phase, that is, golf course management and maintenance, which is well-researched and documented in other guidance, criteria, tools, resources and programs, including the GEO OnCourse™ programme for sustainable golf facility management.





### *Authors and contributors*

#### **Lead guidance authors**

Jonathan Smith, GEO

Mike Wood, EIGCA, Landscape Architect  
and Golf Course Architect

#### **Contributing authors**

Dr Keith Duff, Golf Course Consultant

Dr Bud Smart, Sustainable Golf LLC

Vincent Hoen, Ecofys

Conor Kretsch, COHAB Initiative

Dr Paolo Croce, Università di Pisa

Dr Ole Sandberg, Landscape Architect

Dougie Adams, Oxford Economics

#### **Additional contributors**

Jeremy Pern, EIGCA, Golf Course Architect

Benjamin Warren, GEO

Lodewijk Klootwijk, EGCOA

Steve Isaac, The R&A

The Council, EIGCA

David McLaren, European Tour

Gordon Shepherd, WWF International

John Finisdore, World Resources Institute

Mark Sandilands, KPMG

Dr Charles Peacock, NC State University

Aylwin Tai, Club Managers Association of China

#### **Editor**

Collins Hemingway with Carrine Greason

#### **Consultees**

Ross Perrett, SAGCA

Neil Crafter, SAGCA

Paul Mogford, SAGCA

Adam Lawrence, *Golf Course Architecture*

Achim Reinmuth, EIGCA

Edwin Roald, EIGCA

Guy Hockley, EIGCA

Brian Phillips, EIGCA

Chad Ritterbusch, ASGCA

Rick Phelps, ASGCA

Bill Love, ASGCA

Steve Smyers, USGA

Lu Jun

Kawata Taizo, JSGCA

Sato Takeshi, JSGCA

Sato Kentaro, JSGCA

Tom Doak, Renaissance Golf Design

Scott Ferrell/Brian Lussier, Gary Player Design

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photograph of Askernish Golf Club and report  
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# Partners and supporters

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## ***The R&A***

The R&A engages in and supports activities that benefit the game of golf. Each year, it distributes roughly £5 million to deserving causes from grassroots initiatives, through coaching and regional championships, to professional tours all over the world. The R&A is dedicated to providing front-line support and guidance to assist golf courses in developing a positive relationship with the environment.

## ***European Tour***

The European Tour is committed to celebrating the game of golf, from the origins of the professional game building a proud history of achievement, sportsmanship and integrity to showcase our diverse global talent and rich landscapes. The Tour's innovative approach embraces the world, combining championships of tradition with new tournaments in the cities and countries of the future.

## ***European Institute of Golf Course Architects***

Representing Europe's most qualified golf course designers, the EIGCA believes environmental stewardship is a cornerstone of the profession, and a well designed golf course is one that achieves the best fit between quality of the golf course and the natural, economic and social characteristics of its environment.

## ***European Golf Course Owners Association***

Embracing the latest environmental thinking and technical solutions, and transparently communicating performance, enables EGCOA members to promote golf's stewardship of the environment. The association aims to actively encourage and support practical environmental stewardship on golf courses across Europe.

## ***Jacobsen***

Jacobsen's mission is to be the premier supplier of high-quality turf equipment, utility vehicles, golf cars and tractors while also working to be environmentally conscious. From prestigious championship golf courses to the World Cup, for more than a century, the most important turf in the world has been manicured by Jacobsen – the only turf equipment manufacturer to be accredited with ISO 14001 certification.

## ***Japanese Society of Golf Course Architects***

For nearly twenty years the Japanese Society of Golf Course Architects has represented and supported a group of highly qualified professionals. Providing education and sharing best practices and knowledge, contributing to a strong commitment to good design that takes into account the ideas put forth in this guidance.

## ***American Society of Golf Course Architects***

The ASGCA supports members with education and shared knowledge, including promotion of environmentally responsible golf course design. ASGCA members work to construct courses that are in concert with nature; accommodating players and native wildlife and vegetation and playing a positive role in preserving the environment.

## ***Society of Australian Golf Course Architects***

SAGCA encourages and supports the highest standard of design and construction among members, including a commitment and understanding of sustainability which is important in the world today. SAGCA members believe golf courses can and should have a very positive impact, protecting and enhancing the environment.



Jacobsen is proud to be helping golf  
drive environmental performance



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## Colt and Alison's legacy...



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