Sustainable Golf Development

Guidelines

Second Edition

More than a game

Photo Credit: Federación Peruana de Golf

Contents

Cover Photo Credit: ECP Environmental Solutions by Luiza Reis

Foreword

Golf has great potential to positively contribute towards sustainable development across emerging and established markets. We are seeing more and more new and existing golf facilities developing innovative solutions to new problems right across the globe. These facilities are generating benefits for their social and natural environments whilst providing multiuse recreational facilities for all generations.

Facilities like this typify the sentiment that golf can be *more than a game*... they can be new recreational facilities for golf, walking, cycling and socialising. Golf facilities everywhere, of all shapes and sizes, are used as meeting spaces for local community groups and councils, school groups, evening socials, coffee clubs, local markets and more. They also play a role in conserving local habitats, cleaning rivers and streams, housing bats, birds and amphibians, connecting green corridors and linking up wider pedestrian networks.

This work is being done now and often goes unnoticed. The guidelines presented here highlight some of the growing number of credible examples where great golf developments are taking place and golf continues to be *more than a game*.

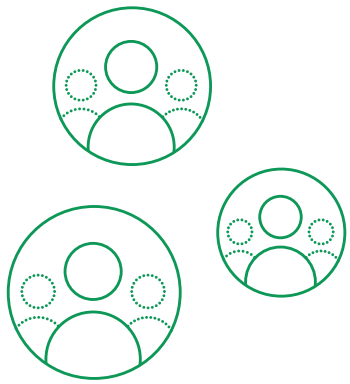
GEO Foundation 2017

Photo Credit: The Open, Greenlinks™

Opportunity

Like all sectors of business, golf has an opportunity, as part of the modern sustainability movement, to strengthen its image, influence and profitability. Golf can demonstrate great leadership by delivering maximum social and environmental value through sport. Unlike other sectors, golf has an opportunity to simultaneously improve quality of life and enrich the health of the natural landscape. In the process, the sport can address a range of concerns, such as over regulation, unfair restrictions on the use of resources and negative public opinion.

As a multifaceted land, leisure and economic development, golf's challenges and opportunities are complex and often closely interconnected. These guidelines seek to unpack the complexity of these challenges and introduce practical solutions to promote and support sustainability in and through golf.



Golf is a Global Community

- 34,011 golf facilities
- 80 million players.
- 207 countries.
- 143,000 events per year.
- $70 billion turnover per year.

OnCourse® Developments

A voluntary standard, guidance programme and certification system developed for golf in collaboration with the golf and sustainability industries, representing a strong and credible platform to deliver the vision of valuing golf for maximising its economic, social and environmental contribution.

Embracing Sustainability

In recent years, the sport has shown how it is adapting to future challenges. New projects are coming forward that push the boundaries of conventional golf course design. The ideas below are being generated by challenges faced, such as resource availability, personal time constraints, tighter land restrictions and increasing social challenges:

Urban golf courses - Jamor Golf Course, Lisbon, Portugal
Managed by: Portuguese Golf Federation

Opened in 2013 and situated only fifteen minutes' drive from Lisbon Centre, Jamor golf course is owned by the Portuguese state and forms part of the Sports Complex Centre of Jamor. The Jamor golf course is a result of a successful partnership between the Portuguese Institute of Sport and Youth and the Portuguese Golf Federation. With the inauguration of the nine-hole golf course, Jamor turned golf into a more accessible discipline for the general public and particularly to young people. Jamor's facilities are available to players of all levels.

6-hole golf courses - Ksirovka Golf Academy
Designed by: Gaunt Golf Design

Opened in July 2014, Ksirovka features a six-hole golf course and a driving range It is an urban golf academy designed to attract new golfers to the game in the Czech Republic's second largest city, Brno. The Czech Republic has five six-hole golf courses open for play and one under construction in the province of Plzensky.

'Alternative forms of the game introduce a fun and very accessible version of the game to a new audience. We have seen a distinct growth in interest for these alternative forms of the game, from 6-hole short courses to FootGolf layouts, people are being introduced to golf in many new ways.'

Howard Swan, Swan Golf Designs

Jamor Golf Academy, Lisbon

Social - Topgolf
Located in 21 U.S. States and the UK

A golf entertainment venue featuring fun and competitive golf games for all ages, with playing 'bays' similar to bowling lanes, Topgolf is a relaxed and social venue for people to explore the game, perhaps for the first time. You can challenge your friends and family to point-scoring golf games and anyone of any ability can play all year round. The area is made up of a 240-yard field with dartboard-like targets in the ground. The closer to the centre, or 'bull's-eye, you get and the farther out you hit your microchipped balls, the more points you receive.

TopGolf, Centennial, C.O.

Wild Rivers Coastal Alliance, South Oregon

Alternative layouts - The Loop at Forest Dunes, MI.
Designed by: Renaissance Golf Design

The Loop at Forest Dunes features two distinct layouts using the same eighteen greens but playing clockwise one day (black routing) and counterclockwise the next (red). On land normally used for one course, Tom Doak and his team at Renaissance Golf Design provided the owner with two distinctive new tracks at Forest Dunes. The facility maximises the use of its land and generates an increase in the number of rounds played and the number of days people stay.

Community Alliances
Wild Rivers Coast Alliance, OR.
Supported by: Bandon Preserve Golf Course

This is a grant-making organisation committed to supporting communities along the south coast of Oregon. As a philanthropic arm of Bandon Dunes Golf Resort, Wild Rivers Coast Alliance utilises the proceeds from the resort's fifth golf course, Bandon Preserve, a 'course with a mission', to award grants that promote a region where healthy ecosystems drive a vibrant economy. They look for opportunities on the south coast of Oregon to foster community collaborations driving economic opportunities in a way that preserves and respects the health and integrity of the region's natural resources and local community values.

The Loop at Forest Dunes, M.I.

Embracing Sustainability

'Urban golf facilities can play a key role in the future of golf. Located close to large populations, it makes golf more accessible and possible for many new players, young and old. Unlike other sports, such as rugby or tennis, golf has a "pitch" that can be shaped and moulded to fit peculiar and vacant urban sites of many shapes and sizes. These urban golf facilities, permanent or temporary, can also serve as multifunctional hubs for many other uses such as community meeting rooms or outdoor education areas.'

Jeff Howes
Jeff Howes Golf design

Evolution not revolution...

Sustainability was part of golf from the start and must be part of golf in the future. Sustainable courses respect their surroundings and honour the natural environment. They seek to embrace the uniqueness of each site – by enhancing its history, culture, landforms, and wild plant and animal species.

Children's Course, The North Berwick GC, Scotland

Children focused - The North Berwick Golf Club, Scotland

The 'children's course' is a nine-hole par three course adjacent to the west links of North Berwick Golf Club. It is an ideal place with the perfect layout to encourage youngsters to take up the game. The course is open all year round and is managed and maintained by North Berwick Golf Club. Adults are welcome, but only if accompanied by a child. During the summer months, competitions are open to all children under the age of 14.

Why18 - Edwin Roald

Re-introducing flexible hole counts allows golf courses to be more responsive to their environments, communities and the economy. Instead of focusing on predetermined hole numbers, such as six, nine and twelve, an existing eighteen-hole facility can avoid expensive changes by simply eliminating a handful of holes, thus reducing resource use while appealing to customers' rapidly changing lifestyles.

Brautarholt Golf Course, Iceland

Club de Golf Terramar EDGA Open, Spain

Accessible forms of golf - European Disabled Golf Association

Helping individuals with impairment to start, stay with, succeed in and enjoy golf, EDGA is dedicated to providing golfers with disabilities with the opportunity to integrate into the mainstream sport of golf. With the development of programmes to introduce more individuals with disabilities to golf, and the promotion of a competition series and ranking, EDGA provides all those with disabilities who wish to take part and those who enjoy the competitive elements of the sport with the opportunity to do so. EDGA is a non-governmental, non-profit organisation made up of twenty national golf federations from around the world, with the aim of providing help and advice relating to golf for the disabled.

Algarve Tennis & Fitness Club, Almancil, Portugal

FootGolf, Algarve Tennis & Fitness Club, Almancil, Portugal
Designed by: Swan Golf Designs

Arguably, it is a concern for the long-term sustainability of the game that participation numbers are reducing and confidence and interest in the traditional game of golf are dwindling. All the more reason to look at it laterally to find ways to make the game more attractive. Rounds on shorter courses, less long and demanding, are called for. FootGolf is a fine example of what can be achieved in providing facilities upon which youngsters, families and social groups can have real fun. Who knows, they might just get more into the game.

'We believe in creating greater biodiversity that promotes a park-like habitat. That vision is not one of an isolated habitat, but of a system of recreational corridors that connect throughout the golf course and the entire development.'

Kyle Philips ASGCA.
Kyle Philips Golf Course Design.

Verdura Golf Resort, Sicily, Italy

Designed by: Kyle Philips ASGCA. Kyle Philips Golf Course Design

37°28'28"N 13°11'36"E

Located along the seafront on the south coast of Sicily, Verdura integrates the native Sicilian habitat throughout the golf course. Originally a monoculture of fruit trees on exposed soil, the property now includes over forty different species of native shrubs, trees and grasses. Water is sourced on site to provide irrigation and the culturally significant tower and train stations have been restored along with the retained olive and orange orchards to reflect the agricultural heritage of the region.

Lebovic Golf Club, Aurora, Canada

Designed by: Doug Carrick ASGCA, Carrick Design

43°58'43"N 79°25'05"W

Integrated into woodlands north of Toronto, the golf course has been in design and development for over twenty years. The course preserves the natural features of the site, including forty-five acres of forest, wetlands and streams. Minimal earthworks retain the natural terrain and character of the property. Irrigation water comes from 100% storm-water run off or treated sewage effluent. A series of interconnected ponds are used to filter and mix water before use.

The Business

Today, corporate responsibility and sustainable practices are expected of businesses and significant investments. Any evidence of environmental damage or unethical business practices seriously impacts on the profitability and public reputation of a project.

In the 21st century, more and more businesses, organisations and individuals are building sustainability into their day-to-day decision making. Understanding how we do business is as important to today's customer as what we do. Modern golf developments are finding that 'being more sustainable' means doing things more simply, better and faster.

Adopting new standards

A new forestry policy, released in March 2014 by HSBC, requires all forestry customers to obtain 100% certification from the Forest Stewardship Council (FSC) or Programme for the Endorsement of Forest Certification (PEFC) in high-risk countries. An excerpt (below) from their policy states:

> *'HSBC does not wish to finance unacceptable impacts in this potentially high-risk sector (forestry). We wish to ensure that our customers operate in accordance with good international practice, helping those that make acceptable progress, but closing relationships with those who do not meet our standards. We also need to ensure that commitments made by HSBC can be successfully checked. As the forestry sector has credible certification schemes with a material market share, we use certification to check that customers meet our standards.'*
>
> Hong Kong and Shanghai Banking Corporation Ltd. (HSBC)
> Forestry Policy - March 2014

Compare the lost opportunities of typical golf courses to the full potential reached by venues such as Irie Fields at Belle Mont Farm, where a monoculture of sugar cane was converted into a rich and diverse golf landscape, creating a range of direct and indirect skilled and unskilled employment and providing recreation for the wider community.

Irie Fields Golf Course, Kittitian Hill, St. Kitts and Nevis

Designed by: Ian Woosnam signature, Gary Johnston EIGCA, European Golf Design

17°23'07"N 62°49'39"W

Community benefits are at the heart of this project. Driven by the client team, the golf course was constructed with zero-chemical use. It was implemented without an externally appointed main contractor and directly employed the labour force necessary for the relevant tasks. 95% of the workforce came from the island. The project transformed a monoculture of sugar cane into a diverse mosaic of native and edible landscapes, and the area is now being maintained organically.

- Zero-chemical construction
- Converted monoculture of sugar cane fields
- 97% of bulk materials sourced from island
- 25Ha. of edible landscapes
- 95% of labour workforce from island

Photo Credit: European Golf Design

The Golf Development Industry

Golf development is an interdependent industry including developers, architects, builders, superintendents and suppliers, working closely together to deliver the next generation of golf courses. Their contributions to this publication are much appreciated and bring to life the subject of sustainable golf development through case studies and insights into their work and achievements.

American Society of Golf Course Architects (ASGCA)

Established in 1947 by fourteen founding fathers, the mission of the ASGCA is much the same today as when those original members outlined the articles of incorporation:

- Foster the game of golf, its growth and advancement.
- Foster professionalism of ASGCA members through education, promotion and fellowship of the world's leading golf course architects.
- Support design excellence by creating golf courses that are technically, strategically and aesthetically excellent while meeting the economic, environmental and other needs of golf course owners, developers and communities.
- Expand the opportunities of ASGCA members to better serve their clients and the game of golf.

The ASGCA are proud to have participated in the creation of the guidelines. We believe this tool can help promote sustainable golf course development, and help the golf industry continue to raise its profile as an entity dedicated to good stewardship of the environment.

Society of Australian Golf Course Architects (SAGCA)

The SAGCA was formed in 1989 with the purpose of creating a society of fellow professionals with the intent of meeting regularly to exchange ideas and experiences, encourage the highest standard of golf course design and construction, and further advance the status of their golf course architecture.

SAGCA aims to encourage the advancement of the game by highlighting its health benefits, the opportunities for social interaction and the importance of golf courses as green open spaces – especially in cities.

European Institute of Golf Course Architects (EIGCA)

The EIGCA represents Europe's most qualified golf course architects. Members of the EIGCA have shown through their skill, experience and training that they are able to design and oversee the construction of golf courses to the highest standards. The EIGCA believes golf course sustainability and stewardship of the environment to be the cornerstones of golf course architecture. Golf courses can have a positive impact on the environment and the ways in which golf course architects design courses reflect the importance of environmental sustainability in golf course development.

These guidelines and associated tools, including the EIGCA's sustainable education programme 'Raising the Standard of Sustainable Golf Course Development' are important in demonstrating that golf courses can be developed in ways good for all concerned. The EIGCA is proud of our input assisting GEO, which dates back more than a decade, and look forward to further close collaboration with all of the team there in the coming years.

Golf Course Builders Association of America (GCBAA)

The GCBAA is a non-profit trade association of the world's foremost golf course builders and leading suppliers to the golf course construction industry. Founded in the early 1970s, its members represent all segments of the golf course construction industry.

The GCBAA enjoyed providing guidance through the creation of the guidelines, and thank GEO for providing these tools to promote sustainable golf course development and maintenance across the globe.

Photo Credit: Aidan Bradley, Askernish Golf Club

Benefits & Expectations

Value

A transparent and holistic approach to a project closely integrated with its environment leads to greater knowledge of the site and a far easier construction process. Time savings can be found in the permission process through good site investigations and improved stakeholder communications of the opportunities and investment being made.

Integration

Walking and studying the site are fundamental. A great golf development will work creatively with the site conditions to arrive at a responsive and genuine solution. The example *(opposite)* of Pinehurst N^{o.} 2 demonstrates what can be realised if a course responds directly to the site conditions and evolves accordingly. The discovery process of understanding a site maximises its attributes and context, leading to greatly reduced construction and year-on-year maintenance budgets.

Product

People enjoy playing a golf course that speaks of its place. Whether people are visitors or residents, a genuine golf course experience, true to its location, is a strong product. The Olympic golf course in Rio de Janeiro *(below)* is an example of a course embracing local vegetation qualities to create the character of a golf course subtly contoured, allowing the site terrain to inform the design.

Retention of local qualities – natural, historic and cultural – generates an understandable attraction to a golf course and a leading position in the marketplace.

An efficient product which runs well, is well connected to its community, has reliable local supply chains and thrives in its surroundings is also more than likely to generate better profit margins with reduced maintenance bills and risk further down the line.

'I am delighted to have been part of the standard development process and helping the sport to address a vital component of its sustainability performance which is crucial for golf's growth and future success. The next step is to make sure it is used in practice – by developers, by investors and governments, and their agencies, as a framework to ensure the best possible outcomes from projects in their jurisdiction.'

Richard Holland
Director of Markets
World Wildlife Fund (WWF)

Olympic Golf Course, Brazil

Designed by: Gil Hanse ASGCA, Hanse Golf Design

31°17'10"N 120°42'02"E

Developed to tight deadlines and in difficult conditions, this was a site primarily either devoid of vegetation or becoming overrun with exotic species, potentially vulnerable to other forms of 'harder' development. Now, the land will be actively managed for diverse nature conservation, local community recreation, education and sports development by a non-profit sports body in collaboration with other local stakeholders, and guided by a robust environmental management plan.

- Transplanted 15,000 species to restore 33Ha. of native habitat
- Increase in fauna species from 118 to 263
- On-site nursery with over 475,000 plants from native seed
- 100% recycled slate used in pathways
- First publicly accessible facility in Brazil

Photo Credit: ECP Environmental Solutions by Luiza Reis

Pinehurst No.2, Pinehurst, North Carolina, United States

Designed by: Donald Ross. | Renovated by: Coore & Crenshaw

35°11'44"N 79°28'26"W

This golf course evolved over time and was reduced back to a style closer to the original design intent. Bermudagrass rough planted in the 1970s was removed, and the sandscapes found in the original course of the early 1900s were re-established. All the sprinkler heads used to irrigate the rough were removed. The total number of irrigation equipment items was reduced from 1,100 irrigation heads to just 450 heads, half around tees and greens, the remainder in fairways.

- 40 acres of rough reduction
- Lower water use
- Less fuel use
- Lower maintenance costs
- 35 acres of longleaf pine and wiregrass habitat

Photo Credit: worldgolf.com

Communications

We live in a well-connected society, where individuals feel empowered through technology and social media to take part in debate and discussion on an unprecedented scale. Transparency is king in this newly emerging media landscape. Being able to stand up proudly and strongly when communicating the wider contributions of your operations and investments will increase your reach and build confidence in your audience.

Individuals and governments are better equipped than ever to identify reality from perception, generating a growing expectation for projects and investments to better articulate their social and environmental values to stakeholders and the wider community.

Golf du Rhin, Chalampé, France

Designed by: Harradine Golf

47°51'05"N 7°33'41"E

The club's sustainability work has been very positive for its image and reputation:

'People tell potential members that we are working on sustainability. Visitors came to see what we have done in respect of the environment. And some new members joined because of our work … something the staff and the committee are proud of.'

Michel Zimmerlin, Club Manager, Golf du Rhin (eighteen holes, 6,278 metres, year of opening: 1969)

- All-year-round golf course of choice for members and international guests from near and far.

Photo Credit: Golf du Rhin

Support and Recognition

OnCourse® Developments provides customised project services and streamlined sustainability reporting to development teams – support for efficient project planning and comprehensive mapping of key issues combined with confident, credible and independent representation of a project's environmental and social value to governments, investors and stakeholders.

OnCourse® Developments uses three themes – nature, resources and community – to practically apply the three pillars of sustainability to the golf development process. The objective is to tackle the broad and complex subject of sustainability by guiding real-world decisions and taking practical actions that make a difference.

The programme is open to every proposed golf course, from large resort developments to smaller scale golf facilities.

> *"Adaptable, open and affordable is at the core of the what OnCourse® Developments stands for…great golf."*

Supporting great golf

- Presenting a strong sustainability case to regulators, investors, stakeholders and local communities.
- Bringing teams together around a consistent sustainability agenda.
- Comprehensive and relevant sustainability reporting. International promotion to media.

Optional:

- Verification from an accredited independent source.
- Credible and lifelong recognition *GEO Certified® Development.*

Nature Resources Community

NATURE · RESOURCES · COMMUNITY 2017 GEO Certified® DEVELOPMENT

Sustainable Golf Development

Voluntary Sustainabilty Standard (VSS)

The VSS was developed through eighteen months of open consultation with the public and an international expert working group made up of golf and non-golf representatives, which was preceded by two years of real-world testing with ten live golf developments from across the globe. The result is an open access document, designed to inform the process of delivering an internationally recognised sustainable golf development, accessible, adaptable and affordable for all forms of golf development.

- Free and available online: Sustainable Golf Development Standard

Photo Credit: Royal Ostend Golf Club

International Social And Environmental Labelling Alliance

ISEAL Alliance

ISEAL is the global leader in defining and communicating what good practice looks like for sustainability standards. ISEAL helps drive standards towards delivering more positive impact. At the heart of this is ISEAL's set of core principles, which define credibility in standards. The ISEAL credibility principles are the result of global multistakeholder consultations and define what we think is essential for a standards system to deliver positive social or environmental impact.

- GEO is a full member of the ISEAL Alliance

Efficient and collaborative

Integrated into the process of golf development, this efficient and collaborative process is based around focused dialogue and concise feedback, and is underpinned by a robust certification system. The GEO Certified® ecolabel showcases leadership and spotlights the creativity behind the preparation, design and construction of a profitable, resilient and ecologically rich golf facility.

Commitments and achievements

Strong and credible verified data is generated by comprehensive reporting which records project targets and is independently verified by an accredited independent verifier. Delivery of successful and more sustainable golf development is backed by the international VSS for golf development and assured under the ISEAL Alliance's highest standard codes of good practice.

'Golf is the only sport to have representation, via the GEO, in the ISEAL Alliance. Following our standard setting code shows a commitment to transparency, multistakeholder balanced input and, along with our impacts and assurance codes, helps to ensure that standards will produce positive and measurable environmental and social impacts. Having worked with GEO for several years now, we continue to be impressed with their commitment to sustainability in golf and, as an ISEAL Alliance member, their work with other leading sustainability standards.'

Martyn Cole,
ISEAL's Credibility Manager.

Typical timeline

Stage One: Preparation
1. Expression of Interest
2. Project Appraisal
3. **Registration**

Stage Two: Design
1. Initial team meeting
2. Develop goals/targets with team
3. Site visit with independent verifier
4. On-going liaison with project team
5. Finalise Blueprint V1
6. **Verifier approves Blueprint V1**

Stage Three: Construction
1. Construction team meeting
2. Record construction progress against goals/targets
3. Site visit with independent verifier
4. Finalise Blueprint V2
5. **Verifier approves Blueprint V2**

Stage Four: Completion
1. Gather final information
2. Site visit with independent verifier
3. **Verifier issues Certification Report**
4. *GEO Certified® development*

Preparation

Successful projects have a clear and comprehensive approach to preparation, design and construction. Depending on the location, the environmental and planning laws which apply to a golf development project can vary from the extremely rigorous to virtually non-existent.

Cultural influences also play a key role in the speed of progress and levels of support a project receives on a local or regional level. Again, allowing adequate preparation time to engage with the contextual issues of social, political and environmental factors will better equip a project with the correct knowledge and lay the foundations for a long-term support network.

This preparatory work is not an academic exercise. The information and relationships uncovered in the preparation stage will inform the design process. The first design decision will likely have the most significant influence on the environmental and social outcomes of a project.

"When beginning the process of design, one must use the natural beauty of the landscape to suggest to us how we may create the golf course. Then we can deliver a course with strategy and technical challenge, which also provides emotional enjoyment and connection with the natural environment."

Michel Niedbala
Golf Optimum

Getting to know the site

Sustainable golf developments are not created by doing the legal minimum. Beyond being familiar with the relevant laws and regulations, a development must examine the site itself and study its natural, social and cultural qualities. The example of Northern Golf Courses *(below)* shows how approaches to design are affected by regional climate, leading to reshaping of surfaces and rethinking out-of-play areas as sacrificial in the freezing winter months.

Northern Golf Courses

by Edwin Roald EIGCA, Golf Course Architect

Winter turf damage, often caused by suffocation under ice, threatens many northern golf courses. Planning should therefore facilitate melting by maximising the use of areas open to the low rays of the winter sun. When ground is frozen, water can only run along the surface. Melting water must be given an easy exit, ideally from raised areas with enough slope, possibly feeding into bunkers, with overflow pipes and banks that do not erode easily.

Photo Credit: Northern Akureyri GC 4-hole by Edwin Roald EIGCA

Rockwind Community Links, New Mexico, United States

Redesigned: Andy Staples ASGCA, Staples Golf Design

32°46'18"N 103°12'05"W

Before its renovation, the course struggled with low participation rates, increasing maintenance costs and lack of revenue. Today, it is an asset to the community and has almost doubled its revenues. Rockwind focused on creating opportunities for all its residents, not only golfers, implementing a trail system around the course for the community's enjoyment, introducing an auxiliary space for local events and weddings, and opening its restaurant and other facilities to the entire community.

- Annual rounds played increased from 17,000 to 30,000.
- 5-tees play from 7,100 to 4,200yds.
- Embraces exisiting landscape terrain

Photo Credit: geekedongolf.com

Soil, water, climate and topography are leading factors in the overall sustainability of a golf development. The better the site 'provides' in these categories the easier, simpler and faster the project will be realised. The information we take from site surveys should not just be read, but analysed for a full appreciation of the interplay between the environmental and social factors it reveals.

Successful permit applications are built on a sound understanding of this dynamic scene. Incorporating sensitive and valuable habitat whilst understanding and celebrating the cultural qualities of a site leads to better informed discussions with governments and stakeholders – building confidence that projects are delivering the best possible proposals economically, socially and environmentally.

'The initial stages of a golf development are crucial to the long-term success of a golf development. Emphasis must be placed on good site selection criteria and the fundamental qualities that make up a great golf course: character, views, topography, soil, water and accessibility. Once we have a site that has a strong mix of these qualities we can look to maximise the potential that site holds.'

Jeremy Slessor, Managing Director.
European Golf Design

Photo Credit: European Golf Design


0 chemicals used
97% of local materials
25 Ha. edible landscapes
IRIE FIELDS 2016
NATURE · RESOURCES · COMMUNITY
2016
GEO Certified®
DEVELOPMENT

Photo Credit: ECP Environmental Solutions by Luiza Reis

Design

Vision

Defining a clear vision for a golf development helps to retain a focus and assists in decision making throughout a project. It provides perspective during detailed site discussions and clarity around basic decisions of site organisation and design parameters.

Preparatory studies of areas such as hydrology, topography and ecology combine with initial regulatory meetings to form the basis for a project vision. A vision borne out of some constraints or some discipline is often more creative and focused. Without some constraints, projects are left seeking something, with total freedom.

Action

Turning a vision into a spatial representation of a proposal involves a complex process of consideration and testing of ideas. The breadth and depth of issues influencing this moment can be wide ranging, depending on site conditions. The onus is on the project team to ensure a comprehensive and forensic examination of the factors at play before beginning the process.

If we assume the selection of an appropriate site, broad organisational decisions relating to, for example, access, scale and structure, will strongly shape the long-term success of a project. Bringing together the components of a golf development into a design plan involves the input of technical data and careful assessment in order to arrive at a preferred solution. During the design stage, having an individual team member with an overview of the project will help in holding onto the balance of land-use and maintaining the project's vision.

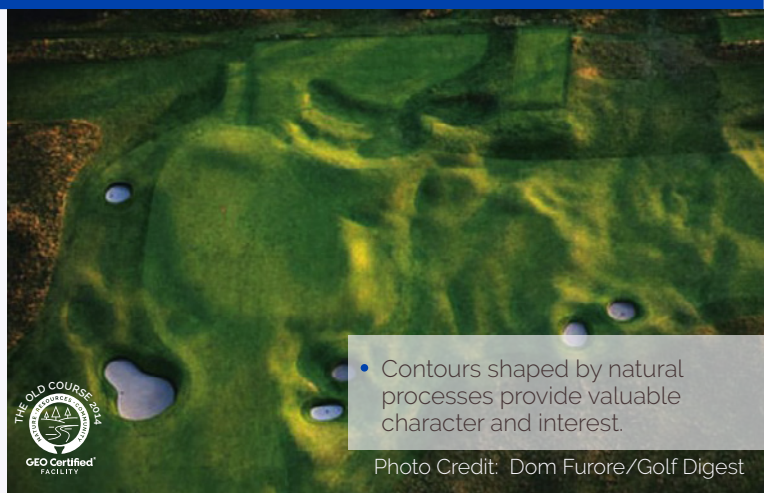
'We sense that golf development is shifting back to the traditional core values of the game, with courses that evoke a distinct and natural sense of place, unique and responsive to their site and conditions. With attention to design detail, these courses can be more fun, affordable and accessible to play, with lower construction and operating costs.'

Bill Coore, ASGCA
Coore & Crenshaw

St Andrews Links, Scotland

56°21'35"N 2°49'30"W

The contours that run across St Andrews Links provide the character and challenge that golfers associate with traditional links golf. They also play a key role in supporting good turfgrass health and the natural water movement patterns of the golf course. Contours can be used to shed and channel excess surface water whilst also adding great fun and creativity to a golf course. St Andrews Links demonstrates the value of preserving existing contours and subtle undulations.



- Contours shaped by natural processes provide valuable character and interest.

Photo Credit: Dom Furore/Golf Digest

Design

The section below briefly describes some of the typical areas of consideration for a golf development. These areas should not be seen as stand-alone elements but rather as interdependent parts. For more details on any of the topics below, refer to the VSS or online guidance from the GEO.

Golf course layout

The general arrangement of a golf course and its built components should be clear and the routing logical and efficient. Careful placement of the pieces of the puzzle offers savings in construction time and materials, reducing roads, pathways and hard landscape areas, and providing efficient access.

Earthworks

Demonstrating the amount of physical landscape change that will take place, these works are typically a product of course routing and placement of built elements. An overall layout that maximises the potential in the general lie of the land inevitably makes savings in the volume of earthworks required. In the example of Chambers Bay *(below)*, the golf course used existing dramatic landforms as a framework for the course layout. Creative navigation of these forms has resulted in the golf course remaining walkable and cart path free.

Less earthworks movement means less disruption to the soil and subsoil structure, reducing risks of soil erosion and pollution of nearby waterways or drain lines. We cannot expect to fully define the areas and quantities of earthworks in the design stage. Major efficiencies in this area can be found in the approach taken to site clearance and the working methodology when the construction process gets underway.

Ecology

The context of the golf course is important to understand, as well as the golf holes themselves. Often, what happens outside the golf holes has a greater influence on contributions to and perceptions of the overall development. The treatment of out-of-play areas, planting palettes and the general look and feel of the golf scene is important.

Chambers Bay, Washington, United States

Designed by: Bruce Charlton, ASGCA. Robert Trent Jones II

47°12'02"N 122°34'16"W

This is a celebrated example of a golf development on a former brownfield site, well integrated into a wider mixed-use masterplan. Situated on the urban fringe of Tacoma with a bay flanking the golf course, the situation provides the backdrop to a dramatic golf course that made significant use of materials found on site and provided a productive use for land with limited suitability for other uses.

- Hosted 2015 U.S. Open and 2010 U.S. Amateur.
- Converted brownfield land back into productive use.

Photo Credit: Chambers Bay

West Cliffs Golf Course, Portugal

Designer: Cynthia Dye, ASGCA. Dye Design Group

39°24'58"N 9°14'30"W

Situated on sandy clifftops adjacent to the Atlantic Ocean, West Cliffs is fortunate to have a site rich in flora. The rich and vibrant landscape was a defining feature of the golf course design. During the site works, the seed bank stored in the topsoil was respread at the fringes of the playing surfaces. This seed bank germinated and colonised these areas, knitting the golf course back into the native habitat. These collected seeds will also be used to create a plant nursery for future maintenance needs.

- Allowing native habitats to characterise the golf course.

Photo Credit: West Cliffs

Generating this scene from the native plants and landscape typologies will result in a landscape that sits better in its surrounds. This golf course will also be less demanding in the long term, as it is not fighting against the rising tide of native species encroaching on something forced and false. West Cliffs golf course (above) is one where the native colourful coastal habitat contributes greatly to the overall character of the course and helps the course to sit comfortably in the wider landscape.

Water features and wetland offer good opportunities to exploit and integrate good ecological principles into the golf development. A locally led approach to planting choice is very resourceful – locally found species will naturally propagate better and require less water and fertiliser as they are better adapted to local climatic conditions.

Photo Credit: GEO Foundation

'Our designs are first and foremost driven by the desire to create a course that embraces its native surrounds. Within this framework, we work to create a course that would be sound strategically, interesting and fun to play for all classes of golfers. This can manifest itself in numerous ways such as the turfgrass selection for the course, greens design or in allowing the native vegetation and existing conditions to be the main constituent for the out-of-play areas.'

Gil Hanse, ASGCA.
Principle, Hanse Golf Design

Examples

Below are select examples of great golf developments located in a diverse range of climates. These are all golf facilities that conserve and enhance nature, and the developers of which think creatively to improve resource efficiency and connect the developments to their local communities.

JW Marriott Scottsdale Camelback Inn Resort & Spa.

Camelback Golf Club - Ambiente course. Redesigned by: Jason Straka ASGCA, Fry/Straka Global Course Design, LLC on behalf of Hurdzan/Fry Environmental Golf Course Design

33°33'14"N 111°56'03"W

This comprehensive renovation secured the long-term future of the golf course. Significant water and cost savings have been realised through the removal of over 100 acres of turfgrass, replaced by native Sonoran Desert plantings throughout the rough areas, and more drought-tolerant turfgrass varieties on tees, greens and fairways. Other measures included improvements to natural drainage efficiency, reduction in flood risk and integration of organic soil fertilisers to promote healthy soils and a denser turf coverage.

JJW Resorts, San Lorenzo Golf Course, Portugal

Designed by: Joseph Lee and Rocky Roquemore

37°01'53"N 8°00'42"W

Set in the Quinta do Lago Estate through undulating pine woodland and alongside the spectacular Rio Formosa estuary, one of the seven natural wonders of Portugal, the golf course benefits from the natural views and atmosphere of the estuarine landscape. The area is popular not just for golf but also for hiking, tennis, cycling and bird watching – all activities which can be undertaken on and around the golf course.

Jinji Lake Golf Club, Suzhou, China

Designed by: Jeff Lawrence ASGCA, Gary Player Design

31°17'10"N 120°42'02"E

Built on reclaimed land in a highly urbanised area adjacent to Dushu Lake and Jinji Lake, the site now provides a habitat to several species of ground nesting birds and small wild animals. As an environmental shelter for the city, the course takes several approaches to making a suitable shelter for all kinds of flora and fauna, including the Mandarin duck and the ring-necked pheasant. A low input approach is taken to the management with no irrigation, fertiliser or controls used in out-of-play areas.

- Over 100Ha. of native habitats created on previous industrial park
- Zero irrigation of out-of-play areas
- Over 40Ha. of aquatic and wetland habitats

Photo Credit: Gary Player Design

Old South Golf Links, Hilton Head Island, S.C. United States

Designed by: Clyde Johnston ASGCA, Clyde Johnston Designs

32°13'59"N 80°48'50"W

Old South has decreased its water use by over 1 million gallons per year since 2010, investing in energy-efficient equipment and daily monitoring of weather and resource consumption. The course was designed to optimise and harmonise with its many natural landscape variations, and hosts more than 100 acres of native woodland, wetland and open water features. These elements are linked together across the site and form important habitats for local wildlife.

- Increase pollinator population by planting wildflowers.
- 1 million gallon per year water reduction since 2010

Photo Credit: Old South Golf Links

Qatar International Golf Club, Education City, Doha, Qatar

Designed by: José María Olazábal, Olazabal Design

25°18'23"N 51°25'13"E

Opening in 2018, this has an 18-hole, a 9-hole and a world's first floodlit 6-hole course. Education is the leading theme of this development, a feature evident in its generous practice and teaching infrastructure and the Pearl Programme, a kids' outreach campaign reaching 10,000 children so far. The three courses include a restored wadi system, recycled water for irrigation, 4,000 new trees and 90,000 shrubs, groundcover and bushes. The majority of these are native.

- Pearl Coaching Programme: 4,000 school children enrolled
- 100% recycled water for irrigation
- Rehabilitated and restored wadi system

Photo Credit: Olazabal Design

Design

Drainage

A full understanding of how the watershed of a site works forms the basis for how to go about finding a drainage solution. Finding nature-led solutions to drainage is a highly creative part of the design process, as seen at Wychwood Park GC *(opposite)*, where open channels and swales are used to create habitats and clean water, saving time, resources and effort in construction and maintenance. Understanding the natural drainage patterns of the site should not only influence the drainage layout but also the routing of the golf course, placement of water features and the strategy involved in individual holes. Prioritising where and how much drainage is needed is an art which takes confidence and knowledge.

'When designed properly, ground contours can be very effective in guiding water off play surfaces, negating the need for large amounts of subsurface drainage (a hefty cost). We know mounds are typically always well drained and surface swales can help move water off the play zones so it makes a lot of sense to utilise or even build undulations for drainage purposes and improved playing surfaces.'

Paul Jansen
Jansen Golf Design
and Construction

Irrigation

The scarcity of water and its rising price is a significant consideration for sustainable development. The responsible use of water is paramount when planning growth and development for a country or region. It represents big business with potentially hundreds of thousands of annually available monetary savings to be made.

When setting out a golf development from the start, there is no better time to plan significant savings and future-proof the development. Consider first if an irrigation system is needed. If it is, think about where is it needed, priority areas, and where savings can be made. Could the

Grass Selection

Selecting the right grass for a locality is critical to the quality and long-term costs of a golf course such as at the Bear Trace at Harrison Bay *(below)*. A number of relevant factors require consideration when selecting the grass species for a particular location or surface: temperature, sunlight hours, water availability, microclimate and soil properties. It is important to take an informed and objective decision when selection is made – the choice will have potentially the biggest influence on resource efficiency long term.

The Bear Trace at Harrison Bay, Tennessee, United States

Designed by: Jack Nicklaus ASGCA, Nicklaus Design

35°12'01"N 85°06'33"W

This is a state park course alongside Harrison Bay with a focus on resource efficiency and nature conservation. In 2003, the course replaced the bentgrass on the greens with Champion Ultradwarf bermudagrass. The conversion reduced the amount of fungicides applied to the greens and the number of man hours required to maintain the greens. The conversion also reduced the input of water by over 1 million gallons of water annually.

- Reduced costs from $39,000 to $8,000 on greens
- 50 acres of turfgrass converted to non-irrigated natural areas
- Frequent irrigation head audits for placement and patterns

Photo Credit: The Bear Trace at Harrison Bay

Los Robles Greens Golf Course, California, United States

Redesigned by: Jason Straka ASGCA, Fry/Straka Global Course Design, LLC
Managed by: Arcis Golf, LLC

34°10'28"N 118°52'42"W

Los Robles Greens golf course was redesigned with the purpose of creating a mutually profitable and environmentally beneficial, socially accepted golf course. In the process, water consumption was reduced by 25% and 31 acres of turf were replaced with native landscape. Other design strategies used included recycled mulch and leaf litter from city collections as a base in non-turf areas, native and drought-tolerant grasses along the fairways and bunkers, and planting low growing native shrubs along the tees and in other out-of-play areas.

'I'm convinced that it is best to use a grass that won't die. On the putting greens, I can plant a grass that will die without intensive maintenance, because I am always going to provide intensive maintenance to the greens. But fairways cover well over 10 ha on most courses, and it just is not possible to provide intensive maintenance over such a large area. If I plant a grass that won't die, the surface can be maintained aggressively to create the desired playing surface. I can mow the fairways shorter, but the grass won't die. I can keep the fairways dry, even going without supplemental irrigation during the dry season, but the grass won't die. I can maintain the fairways with a slow growth rate, avoiding frequent applications of water and fertiliser, and still the grass won't die.'

Micah Woods, Chief Scientist Asian Turfgrass Center

Wychwood Park, Cheshire, England

Designed by: Hawtree Ltd (Ken Moodie EIGCA)

53°03'15"N 2°23'32"W

A creative and fully integrated nature-based approach to drainage of a golf site. The 180Ha site contains a Site of Special Scientific Interest and a Special Area of Conservation that was in poor condition prior to the development and associated management plans. Proposals incorporated extensive water management provisions including flood attenuation design, wetlands, lakes, ditches and raised walkways to preserve the sensitive habitat.

Österlens Golfklubb, Sweden

Designed by: Pierre Fulke Design

55°37'18"N 14°16'24"E

On the coastline of the Baltic Sea, the golf club has sandy soils and good views across the sea. A forward-thinking maintenance practice with organic fertilisers and zero pesticides used in two years. The recently built maintenance facility has created a safe and clean working environment with integrated and alarmed oil and grease separators. The facility has a dedicated wash-down area and secure areas for storage and/or preparation of any hazardous materials.

- Integrates organic fertilizer
- Zero pesticides in 2-years
- Hybrid machinerary
- Out-of-play areas grazed by organic certified sheep

Photo Credit: Österlens Golfklubb

San Bartolo Project, Peru

Designed by: Augustin Piza EIGCA, Piza Golf Design

12°22'53"S 76°46'58"W

A project led by the Peruvian Golf Federation, its primary focus is on the safety and wellbeing of the poorer children in its community and using golf to build their confidence and discipline. Run by community workers, the facility rewards children who have attended local schools with access to the golf course, teaching and safe social spaces to interact. The golf course makes use of a derelict piece of land that is unfavourable for many other uses.

- Use of poor and degraded land of low value.
- Incentive for children to go to school, be safe and improve discipline through golf
- A secure facility run by community workers to provide new opportunities for work and fun.

Photo Credit: Federacion Peruana de Golf

Askernish Golf Course, South Uist, Scotland

Designed by: Martin Ebert, Mackenzie & Ebert Ltd.

57°11'22"N 7°24'51"W

A course rediscovered on the island of South Uist. An Old Tom Morris course previously occupied the land before falling out of use. The new course, created in the same spirit as the original, was built using local labour and materials. The course is maintained using innovative and low impact methods of seaweed fertilisation, light grazing of cattle and local sands for bunkering and top dressing. Local grasses and habitats were retained and conserved throughout.

- Minimal earthmoving in a 'mow-it-out' style of construction
- Native drought tolerant grass
- Locally sourced seaweed for fertilizer
- Community supported construction

Photo Credit: Aidan Bradley, Askernish Golf Club

Design

Accessibility

Golf developments should strive to connect both physically through pathway networks and green infrastructure and also to the society and businesses around them. For a development to be considered successful, it needs to contribute to the community and remain a steward of the site in the long term.

Open lines of communication and transparency add to a sense of confidence and connection with the community. This sense of trust can mean a lot in the design process. When the project team assess and adapt the designs, good neighbour relations can save months if not years of time prior to construction.

Creating a close and safe physical integration between golf and non-golf activities can help to break down perceived barriers between activities and add assets to a development such as cycleways, fitness circuits and bridleways. The example of the project in San Bartolo in Peru *(opposite)* is a fine example of a social and sport initiative offering profound community benefits through golf.

Clubhouses and other buildings

The siting and orientation of the clubhouse should be a key discussion point as the general arrangement of a site comes together. These initial decisions give a better opportunity to maximise good low-energy design principles such as reducing resource demand and maximising thermal efficiency and healthy air circulation patterns.

The re-use of existing structures for future golf buildings can inherently lead to reduced resource use and visual impact of a development, whilst offering an element of local heritage and instant character to a new development.

The maintenance facility, as in the example at Österlens Golfklubb *(opposite)*, offers excellent opportunities to integrate ecological benefits to the building design and recapture greywater for machinery wash-down or flushes.

'The planning, orientation and materiality of the clubhouse are key areas that should be addressed at an early stage, in conjunction with a clubhouse architect. It is important for the masterplan to draw these factors together within the overall layout - and re-visit them as the design proceeds. Construction programme and costs will be positively affected by such early consideration. Importantly, the proper enjoyment of the facility by users and staff will be enhanced.'

Mungo Park, ACArch
Clubhouse Architect

The Castle Course, Scotland, United Kingdom

Designed by: Fraser Smart RIAS, Links Design Studio

56°19'49"N 2°45'01"W

The design of the clubhouse incorporates geothermal energy to meet the heating and cooling needs of the building whilst minimising running costs. The heat pump system supplies underfloor heating throughout the clubhouse and strategically positioned fan coils around the public and staff areas control a stable and comfortable environment for staff, visitors and golfers alike. Figures suggest that this system can heat this clubhouse at approximately a quarter of the typical cost.

- 10 boreholes draw water and ground source heat energy
- Only 1/4 of the cost to heat clubhouse

Photo Credit: St Andrews Links Trust

Photo Credit: ECP Environmental Solutions by Luiza Reis


2x the fauna diversity
1st public golf facility
33 Ha. restored native habitat
OLYMPIC GC RIO 2016
NATURE · RESOURCES · COMMUNITY
2016
GEO Certified®
DEVELOPMENT

Photo Credit: Alexandra Betâmio de Almeida

Construction

During the construction stage, careful planning and good site preparation help to ensure the design is executed well and the process of construction runs smoothly. At this stage, there is generally a greater awareness amongst the local community of the potential impact of the development. The landscape usually goes through a rapid and very visible transformation during development. Communication of progress can help ease concerns and promote good practices being carried out on site.

The construction stage is a time where efficiencies can be found. Flexibility in the construction plan is important to allow for these efficiencies: 'found' elements can be incorporated into course layout and can enrich the overall project, or valuable on-site materials such as sand or natural stones can be uncovered and used to save time and money. This is a good time to develop relations, build a strong local supply chain for construction work and later to supply the operations of the course.

Consideration should be given to involving the future superintendents in the building work. As the future stewards of the golf course, their in-depth knowledge of how the course was built, where potential problem areas might be and all the locations of underground infrastructure can be invaluable in the efficient long-term operations of the golf course.

I only realized after building a couple of courses that even more important than minimalist design, is minimalist construction. When we resist the temptation to re-shape fairways, and incorporate the natural contours, we preserve the integrity of the topsoil and its valuable ecosystem. When someone says our course looks like it's been there for 100 years, that's because most of it HAS been there all along.

Tom Doak
Renaissance Golf Design

Construction

Site Preparation

Before construction begins, protection and awareness are two of the immediate priorities. Make sure everyone on site is aware of any protected areas through staff briefings and clear signage around the compound. Ignorance of these sensitive site areas can be problematic on sites, potentially leading to complications and damages, both financial and reputational, for the project.

Access and Compound

The design and positioning of the construction compound should be well thought through: does the site call for two compounds? Can we site it on the future maintenance area? Can it be away from adjacent residents? Does it minimise the need for roads to be laid down? Is it away from waterways or sensitive receptors? Is it secure? The compound will likely bring ancillary uses such as parking, storage yards, wash-down areas, meeting rooms, shelters, sanitation water and power connections. These structures can be in place for several years so should be given proper consideration.

Site clearance

This phase of construction work provides an opportunity to integrate the golf course closely with existing landscape character. Working outwards from the centreline in stages offers the greatest control in this respect, at each stage seeking to retain and integrate valuable existing qualities into the final solution.

Waste

The management of waste on site should be approached from the point of view of reducing the amount of waste created. Beyond that, re-using or recycling what is created on site is preferable before looking at ways to treat and dispose of waste. Creative thinking is needed to come up with site-specific solutions for each facility, as in the example of Ljunghusens Golf Club in Sweden *(opposite)*.

> *'I will work very methodically in the clearance stage. Usually three or four phases of clearance, at each stage carefully assessing what is revealed and amending the golf hole to "fit" within the existing scenery. Often we will find valuable landscape assets that bring quality and character to the golf course.'*
>
> Jorge Santana, EIGCA GolfDesign

Maleny Golf Club, Queensland, Australia

Designed by: Graham Papworth SAGCA, GNP Golf Designs Pty. Ltd.

26°45'31"S 152°51'55"E

The course aims to transform a neglected agricultural site into an asset that will serve the community and cater to local tourism. It has been designed based on sound ecological guidelines, and built with the help of the community. The course's first nine holes have been constructed in the most part by volunteers of the club's membership, keeping in line with the budget. The club recently received significant funds from the Queensland and local governments to construct the second nine holes.

- $450,000 from the Sunshine Coast Council
- $100,000 from the Queensland Government
- Community volunteer workforce

Photo Credit: Maleny GC

Construction

Ljunghusens Golf Club, Sweden

Designed by: Douglas Brasier

55°23'25"N 12°54'25"E

When Ljunghusens Golf Club renovated their clubhouse, sustainability was an important consideration. This led to passive design solutions and a focus on renewable energy. Although the clubhouse doubled in size, they reduced their electricity and fuel bills thanks to the instalment of a large-scale ground source heat pump with pipes beneath the semi-rough. The club is on track to pay back the investment within 4-years.

- €40,000 per-year savings on energy
- 3,100m of pipe for ground source heat pump

Photo Credit: Ljunghusens GC

Good land management techniques such as re-using green waste as compost or mulching material can be implemented. Even in the hard landscape elements, any local rock found on site should be considered for use in external features or furniture, or crushed into a construction base material.

'Planning and preparation are key moments for us when starting a new build. We must know and understand the site and the design very well before we start. An open and honest relationship with the client and design team is vital, as is having a good team of staff at our side who are well informed, strong communicators and take responsibility for their work area seriously.'

Benjamim Silva, CEO
ProGolf Construction

Ombria Golf Course, Portugal

Designed by: Jorge Santana EIGCA, GolfDesign

37°11'30"N 8°00'29"W

Located in the hills north of Loulé and at the confluence of two rivers in the Algarve region. In close collaboration with the local authority, the construction work involves restoring and enhancing the river corridors to improve the flood water capacity of the river's flood plain, benefiting towns and villages previously at risk downstream. There are also significant associated benefits for local wildlife with increased biodiversity and new native habitats.

- Over 1,800m of riparian habitat created
- Removal of 100% of the exotic plant species in the river corridor

Photo Credit: Ombria Resorts

Construction

Topsoil

An often misunderstood but vital component of a healthy and sustainable golf course is a good supply of high quality topsoil. Existing soil quality has dramatic implications on the cost and complexity of a golf development.

Correct and careful handling of the soils ensures efficient use of this existing asset. To reduce damage to a site's soil, work needs to be carried out under the correct conditions: dry, no heavy frost and not windy. Where available, use low pressure equipment to reduce compaction of soils. Reduce the number of level changes and overcompaction of the subsoils, which can increase the risk of problems in the quality of playing surfaces later on.

Earthworks

This process takes the design proposal and projects it onto the fine surface contours of the finished course. Establishing vegetation cover quickly after respreading of the growing medium is desirable to bind the soil in place. Erosion controls such as straw bales and sand bags to reduce risk of soil pollution should be in place.

As in the case of waste, water and energy, the starting position is to reduce as far as possible the quantity of earth movement. Moving less earth will save time, money and resources and still generates great results that sit better in the natural landscape.

Drainage and Irrigation

Timing of installation is important to reduce handling of the soil and preserve the quality and integrity of the final shaping levels and growing medium. Phasing construction programmes is an art, which can result in great efficiencies as different areas synchronise. Real life rarely works out as planned on paper. Flexibility and communication is key to ensuring the installation works go smoothly.

'The art of golf course architecture is best executed in the field in collaboration with talented construction teams. Spending a great deal of time in the field allows us to discover and use features that otherwise could be missed, shaping golf courses that are true to their natural and cultural surroundings.'

David McLay Kidd
DMK Golf Design

The R&A, Allan Robertson House, Scotland

Designed by: Paul Kimber EIGCA, Kimber Golf Design

56°17'52"N 2°38'51"W

A new facility forms a key part of a new equipment testing facility for the R&A. Situated at the far end of the existing driving range at Kingsbarns golf course, the project is an example of resourceful land planning and partnership involving all parties. Previously unused land was brought into use with a unique facility that transformed the land into a healthy wetland habitat, extensive wildflower meadow and fully permeable development that recycles its run off to irrigate the golf areas as needed.

- 100% recycled irrigation water
- 800m² of wildflower meadow
- 161 new native trees
- 227m² of wetland habitat

Photo Credit: GEO

Construction

Sand Valley Mammoth Dunes Course, Nekoosa, W.I., United States

Designed by: David McLay Kidd, DMK Golf Design

44°10'28"N 89°51'29"W

The golf course, developed in collaboration with local authorities, has recovered and restored a rich sand dune ecosystem previously overrun with red pine plantations. The course aims to bring back the diversity of flora and fauna to the area through the restoration. Resource efficiency is considered with subtle contouring and drought-tolerant grasses used on the course. A significant contribution has also been made to a local economy that was previously showing incomes well below the national average.

Photo Credit: DMK Golf Design

Grow-In

The final stage in the construction process is the establishment of the final playing surface. Once the seedbed is prepared it is important to get the establishment process underway to bind the soils and knit the course together. Correct levels of water, sunlight, temperature and nutrients need to be available to the grass at this time to avoid failure of plants and wasted resources.

Lining up the correct conditions through good planning and management of resources is key to the success of this stage – be patient and wait for a window of opportunity. Starting by investing in good quality seed, appropriately selected for the conditions, will help to significantly reduce the risk of failure or poor take up of the grass, which could result in delays to opening times and associated loss of revenue.

Sand Hills, Mullen, Nebraska, United States

Designed by: Bill Coore ASGCA and Ben Crenshaw, Coore & Crenshaw Design

37°11'30"N 8°00'29"W

In the remote town of Mullen Nebraska, Sand Hills golf course was created primarily because the land was so well suited for golf. With good soil, terrain, natural vegetation, water availability and good growing conditions, it was possible to create the golf course quickly and relatively inexpensively. There are also long term benefits to these conditions – maintaining healthy turfgrass is easier and cheaper and fewer controls or inputs are used in the process.

Photo Credit: Dom Furore/Golf Digest

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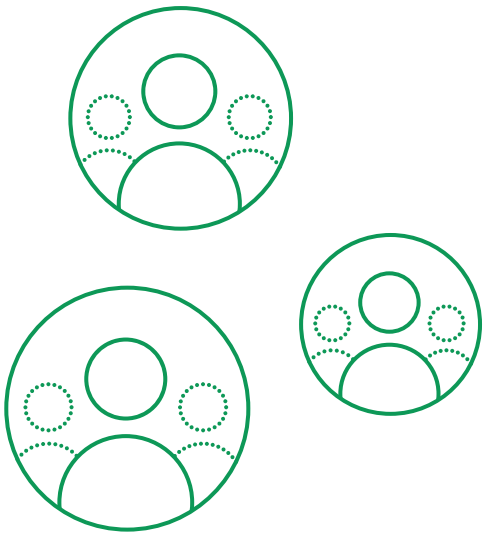

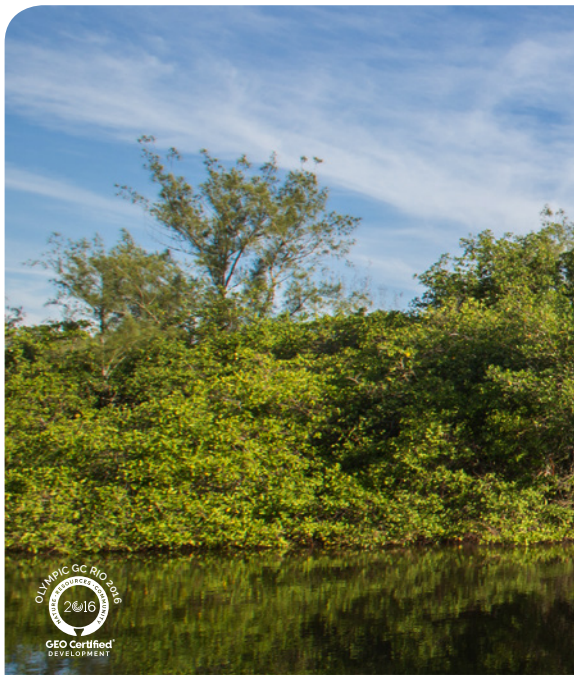

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Photo Credit: ECP Environmental Solutions by Luiza Reis

More than a game

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