Golf Course 2030

Innovation in Coastal Management for Golf Courses

Practical Pilot Study

Contents.

Thanks to Moray Golf Club (www.moraygolf.co.uk) for images and support as trial site for this pilot project.

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SISKIN Asset Management Limited BOOSTING NATURAL RESILIENCE

Golf Course 2030 seeks innovative, practical solutions to mitigate the impact of a changing climate wherever the game is played. In the arena of coastal change management the most pressing of these concerns is erosion.

Siskin has developed an innovative concept which can potentially support golf clubs facing the threat of coastal erosion. This concept was developed through the work of golfers determined to find a way to resist the effects of erosion on their own coastal golf club.

Golf Course 2030 supported Siskin in carrying out a demonstration trial which has shown the concept can be a practical and affordable method of mitigating coastal erosion.

Design concept and design specification.

Existing known methods for management of coastal erosion comprise a wide range of techniques each with their own pros and cons.

Design concept

Existing methods for management of coastal erosion comprise a wide range of techniques each with their own pros and cons. Recognised low impact, affordable soft engineering solutions are effective in low energy locations but may not be adequate in more aggressive erosion locations. Hard engineered solutions providing effective mitigation at high energy erosion sites would likely be unaffordable for many golf clubs and may also struggle to meet planning requirements.

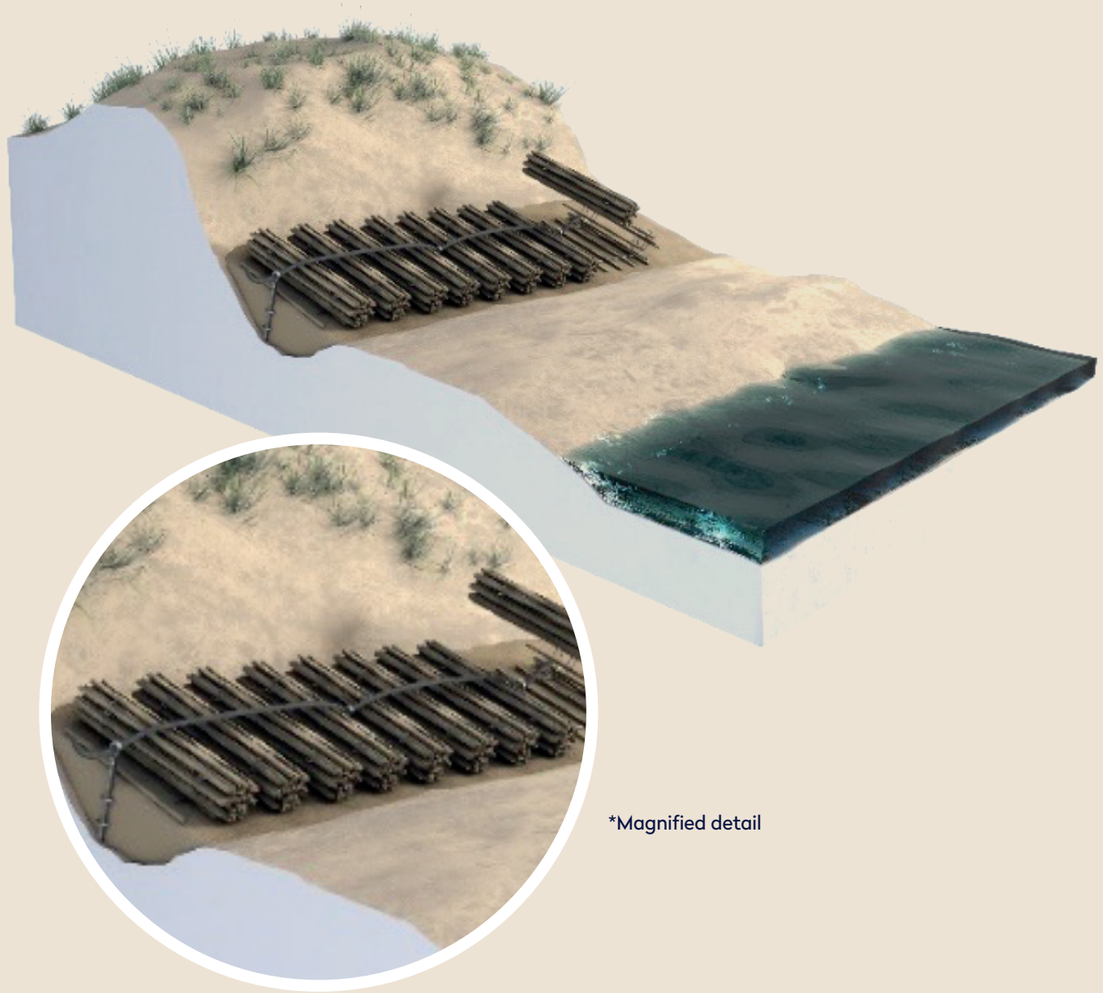
The concept seeks to innovate a middle-ground solution to resolve planning and environmental concerns and provide effective erosion mitigation at affordable cost.

Concept design philosophy

- Work with natural processes to the greatest extent possible.
- Maximise use of sustainable, environmentally low-impact materials.
- Make use of low-complexity techniques for ease of construction & maintenance.
- Affordable, low life cycle cost.

In any erosion setting geographical and geomorphological characteristics of the coastline to be protected are an essential consideration. The concept method described focuses on locations where erosion effects are dominated by wave run up and wind blow effects i.e. soft coastline.

In these settings the coastal edge is destabilised by undercut from wave energy uncovering loose material which becomes prone to pick up on the wind. The dominant factor in this overall process was seen to be loss of material at the toe of the dune/land mass in the back beach area. Installing a system which absorbs wave energy and inhibits undercut at the dune/land toe intersection mitigates the loss of such material.



*Magnified detail

Design specification

Consideration of which materials may absorb energy at the dune toe whilst being sustainable and environmentally low impact led initially to use of brash bales (a by-product of commercial forestry). These were to be placed dune toe/ beach intersection laid in a geometry at right angles to the coastline. Following testing in the field, this approach was refined to use of chestnut paling fencing lined with brash materials to fabricate bespoke cylindrical bales.

Here a raft of cylindrical bales is arranged over a network of previously installed anchors. Tethers attached to each anchor are then threaded through the bale raft and the finished structure is held in place by a retention mechanism tensioned against the anchors.

The specific choice of anchor system at a given location is dependent on underlying ground conditions. Typically in soft coastline settings screw piles are suitable. Fig A below shows standard screw pile materials.

These require only a standard construction excavator equipped with a hydraulic torque driver for installation as shown in Fig B below.

Where ground conditions dictate other anchor options such as micro pile or deadweight anchoring may be suitable alternatives.

Fig A. Screw pile materials

Fig B. Screw pile installation at Moray GC

Trials work programme.

Construction trials

Early construction trials of a sample structure using standard brash bales were carried out at SRUC Elmwood with the assistance of the Greenkeeping team. This demonstrated the construction and maintenance of a coastal defence installation using the concept could be delivered using existing skill sets within a typical greenkeeping workforce.

The trial, however, also demonstrated that bespoke, fabricated bales, constructed from a combination of chestnut paling and brash are a preferable option to standard brash bales. Fabricated bales can be sized to suit the specific site, are more easily handled, and are more structurally consistent.

Consent process

The selected site for the demonstration project was agreed to be Moray Golf Club on the North-East coast of Scotland. The specific location was chosen to provide protection at a site suffering from active erosion and posing a threat to course infrastructure. Following agreement on siting the total time to construction completion on the ground was less than 6 months, inclusive of the statutory planning process.

Any engineered coastal defence project will typically require statutory planning approval. Dependent on location the relevant planning regime may use either land based or marine based processes. In the case of the Siskin technique the typical regime applicable is the land based process which has a performance standard for a non major development (sites of <2Ha) of 8 weeks. At Moray Golf Club, and a second, small scale test facility elsewhere, planning approval was achieved within the 8 week standard. It is advised that Golf facilities should always consult with their local planning authorities prior to undertaking any coastal defence work.

Demonstration project.

The demonstration trial installed at Moray Golf Club comprises a 40m long section of the base case design. This provides protection to the 17th tee of the Championship course where progressive erosion was evident through the development of a sand cliff. The specific characteristics of the site are a low lying, frontal dune system fronted by a shingle back beach. The installation was completed over a 1-week period in November 2021.

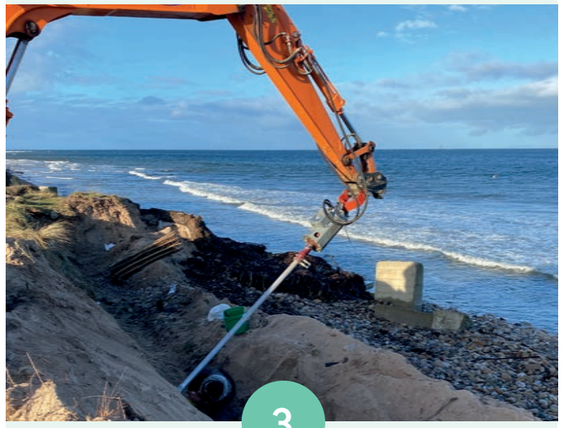
Design of the trial structure was completed in parallel with the planning approval process. On grant of planning approval orders for materials and 3rd party services were placed with fabrication of the required paling/brash bales being completed in parallel. Installation work on site commenced approx. 7 weeks later.

Month	JUNE-21				JULY-21				AUG-21				SEPT-21				OCT-21				NOV-21			
Week No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Hosting agreement																								
Design																								
Develop planning application									‹› Application submitted															
Planning application process																	‹› Application approved							
Procure materials & services																								
Fabricate brash/paling bales																								
Construction phase																								

Fig C. Trial project execution schedule

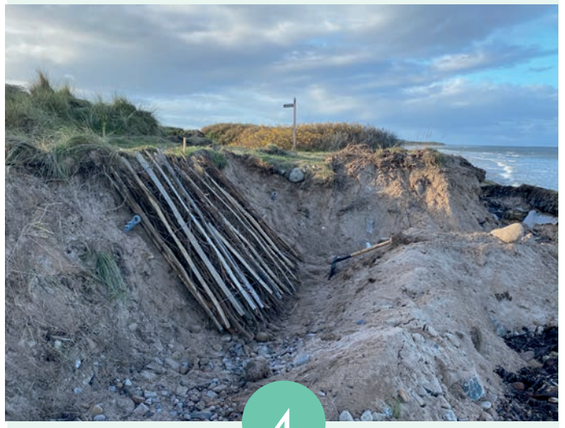
The construction of the defence structure was a straightforward process with the sequence of activities being:

1. As found survey
2. Regrade dune face to required angle
3. Install screw pile anchors @ 45 deg into the root of the dune
4. Lay out bale raft
5. Tether retention beams and torque up system to fix in situ
6. Reinstate site



3

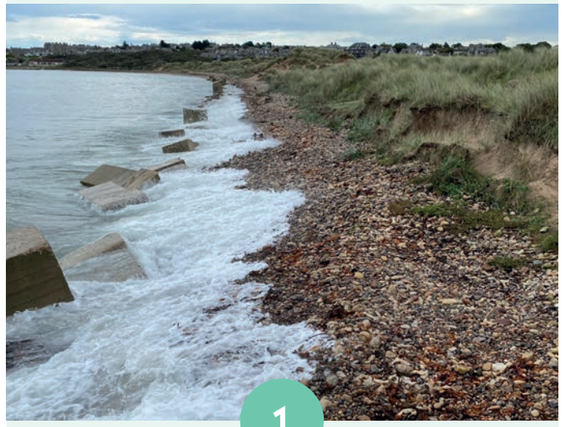
Running anchor array



4

Laying out bale raft

The photo sequence here illustrates the construction process:

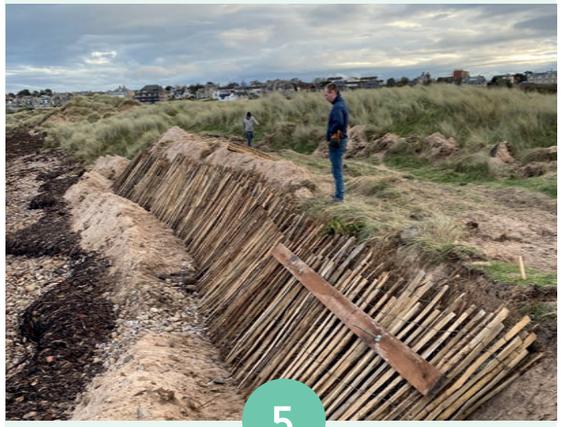


1

As found status

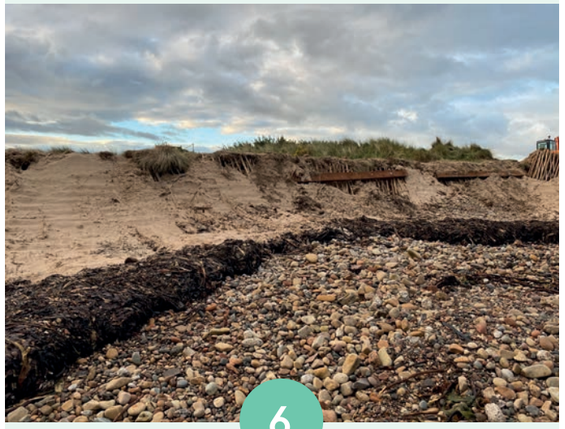
2

Re-grading of sand cliff



5

Retention beam installation



6

Reinstated site

Following installation regular monitoring of the trial structure and the adjacent coast shows whilst erosion has been halted at the location protected it has continued to either side.

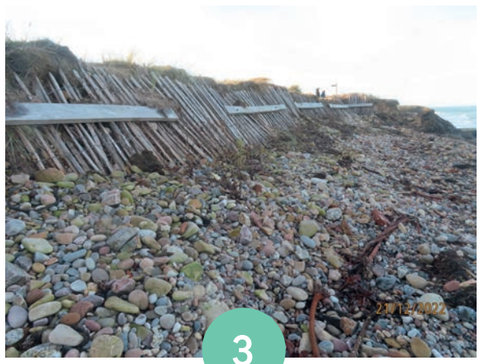
This mitigation of the erosion effects has been achieved over two full winter periods. The time when erosion is most likely. To date there has been no requirement for intervention or remedial upgrade of the structure. The photo sequence below shows a time lapse view of the structure in operation over the period since first installation:

1

January 2022

2

August 2022



3

December 2022

4

March 2023

5

July 2023

Findings and conclusions.

Findings

1. The planning approval process at 2 separate locations has been completed without issue.

2. The permeable bale method uses standard materials and simple fabrication and construction methods. This can be readily installed by typical greenkeeping and/or volunteer workforce as an alternative to using 3rd parties.

3. The base case design as installed at Moray Golf Club is effective in a shingle beach environment.

4. The base case design is currently unproven in pure sand environments although research continues.

5. The low complexity of design and construction facilitates the use of the system as a rapid deployment 'hot spot' protection.
   Note: Design and additional trial work is ongoing to fully prove use in short sections to overcome concerns regarding end termination design.

6. The flexibility of the permeable bale system allows tuning of the design to a wide range of settings.

Conclusions

The permeable bale method provides effective mitigation in beach settings equivalent to those at Moray Golf Club.

Subject to further trial works in a range of beach environments the concept and derivative designs offer potential for cost effective mitigation of erosion threats faced by golf courses.

The nature of the innovative solution is such that implementation could be delivered through a combination of external support or in house resources as appropriate to the golf facility.

Any golf facility seeking to undertake coastal defence works should consult with appropriate experts in the field and their local planning authority prior to commencing work.

The R&A group of companies was formed in 2004 to take on The Royal and Ancient Golf Club of St Andrews' responsibilities for governing the Rules of Golf, staging The Open, golf's original championship, and developing the sport. The World Golf Museum in St Andrews is part of The R&A group.

Together The R&A and the USGA govern the sport of golf worldwide, operating in separate jurisdictions with a commitment to a single code for the Rules of Golf, Rules of Amateur Status and Equipment Standards. The R&A, through R&A Rules Ltd, governs the sport worldwide, outside of the United States and Mexico, on behalf of over 41 million golfers in 145 countries and with the consent of 161 organisations from amateur and professional golf.

The R&A has responsibility for running a series of world class amateur events and international matches in women's and girls' as well as men's and boys' golf. The R&A stages the AIG Women's Open and works with the DP World Tour to stage the Senior Open presented by Rolex.

The R&A is committed to investing £200 million over ten years in developing golf and supports the growth of the sport internationally, including the development and management of sustainable golf facilities. For more information, visit www.randa.org

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