REPORT

Formby Golf Course Coastal Change Management Plan

GC2030 Coastal Change Project 2 Piloting

Client: The R&A

Reference: GC2030-RHD-P2-L2-RP-C-0021

Status: Final/C01

Date: 19 July 2021

Royal HaskoningDHV

Enhancing Society Together

HASKONINGDHV UK LTD.

Rightwell House
Rightwell East
Bretton
Peterborough
PE3 8DW
Industry & Buildings
VAT registration number: 792428892

+44 1733 334455 **T**
+44 1733 262243 **F**
info@uk.rhdhv.com **E**
royalhaskoningdhv.com **W**

Document title: Formby Golf Course Coastal Change Management Plan

Document short title: Formby CCMP
Reference: GC2030-RHD-P2-L2-RP-C-0021
Status: C01/Final
Date: 19 July 2021
Project name: GC2030 Coastal Studies
Project number: PB9651

Classification
Project related

Revision history

Revision	Date	Description	Prepared	Checked	Approved
P01-S3	11/05/21	Pilot Plan to inform the 80% deliverables stage	Victoria Clipsham (Royal HaskoningDHV), Rachael Holsgrove (Royal HaskoningDHV), David Hopkins (Formby GC), Stuart Leech (Formby GC)	Jaap Flikweert	Jaap Flikweert
C01-S4	16/07/21	Final Pilot Plan	Victoria Clipsham (Royal HaskoningDHV)	Jaap Flikweert	Jaap Flikweert

Royal HaskoningDHV

Table of Tables

Table of Figures

1 Introduction

This document is the Coastal Golf Course Management Plan for Formby Golf Course. It has been developed as part of The R&A's Golf Course 2030 initiative to establish a sound framework for taking forward future management of golf courses.

Golf Course Coastal Change Management Plans

Development of these plans is seen as a way of getting ahead of the game in terms of planning for change and addressing concerns in relation to coastal change.

This document is part of a toolbox for golf courses, supported by the following:

- The R&A's Golf Course 2030 Coastal Change Action Plan provides an overview of current approaches and governance, and its sources (https://www.randa.org/Sustainability/GC2030/Action-Plans).
- A practical Golf Course Coastal Solutions Catalogue which presents innovative and nature-based solutions for coastal management. This aims to help coastal golf courses select intervention options. It links closely to the CGCMP: the information collated in the CGCMP forms input for a Tool to identify potential options. The Catalogue sets out each option's main characteristics, such as conditions where they are applicable, pros and cons, ecosystem benefit considerations and ballpark costs, illustrated with case studies. See sections 3.4 and 5 of this Plan.
- An Ecosystems Benefits Management Tool which enables course managers to establish what habitat types are present on their site, determine the conservation interests on the site, identify potential issues and solutions for the relevant habitat types. This will provide practical advice on what options are available and how they could affect the ecosystem. It forms another input into the selection tool of the Golf Course Coastal Solutions Catalogue (sections 3.4 and 5 of this Plan).

Formby Golf Course is in Formby on the west coast of England. The course is bordered by a railway along the eastern edge (holes 1 to 3 run along this edge) and Formby Beach, a National Trust protected area, along the western edge. Formby was used as a case study by the National Trust as part of the 2015 Shifting Shores report, as the motion of the sand dunes creates some of the best mobile sand dune habitat in the United Kingdom.

The development of the Plan has been led by the team at Royal HaskoningDHV (Jaap Flikweert, Victoria Clipsham, Rachael Holsgrove) with support from David Hopkins Chairman of the Course Development Steering Group, Formby Golf Club) and Stuart Leech (Secretary/Manager, Formby Golf Club).

The following organisations and stakeholders have been consulted as part of the Plan's development:

- Annual consultation with Sefton Council in relation to the results of their annual coastal monitoring report (analysis of data collected in March/April each year).
- Annual site visits with Sefton Council, the National Trust and Natural England to review the erosion and state of the dunes.

This is Version 1 of the Plan and is for approval by Formby Golf Club Council.

Version 1 of Formby Golf Club's Coastal Change Management Plan was primarily developed to provide an example that other golf courses can follow when developing their CCMP. For that reason, Version 1 Plan reflects Formby Golf Club's situation in 2018, when they had identified the urgent need to plan for ongoing coastal change. The more recent developments and current status are described in a text box in section 6.

2 Understanding the context

2.1 Description and function

2.1.1 Course specific

2.1.1.1 Course layout

Formby Golf Club is an 18-hole course on the west coast of England. A plan of the golf course showing the location of each green (numbered) and associated area is provided below as Figure 2.1. The club house is located as far landward as possible (indicated by location A in Figure 2.1 below).

The satellite image in Figure 2.2 below shows the approximate boundary of the golf course, indicating the position of the golf course in relation to the wider area and the coast.

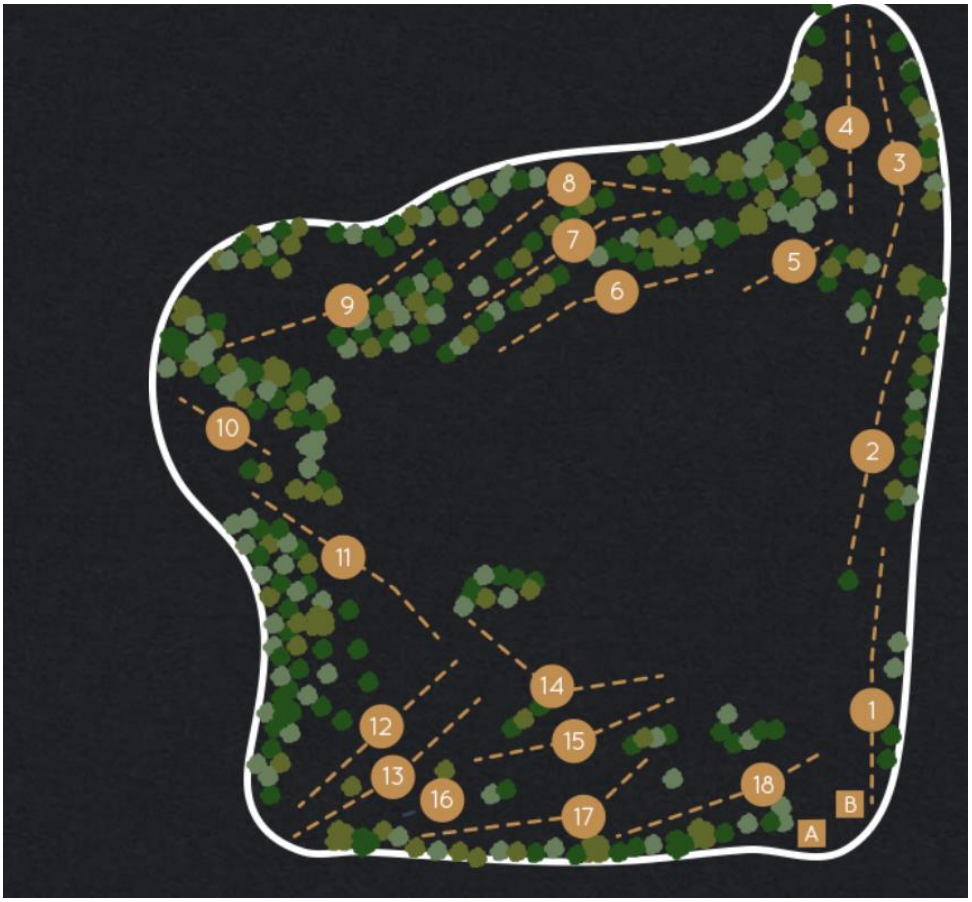


Figure 2.1 Formby Golf Club plan (taken from https://www.formbygolfclub.co.uk/course/hole-by-hole-guide/)

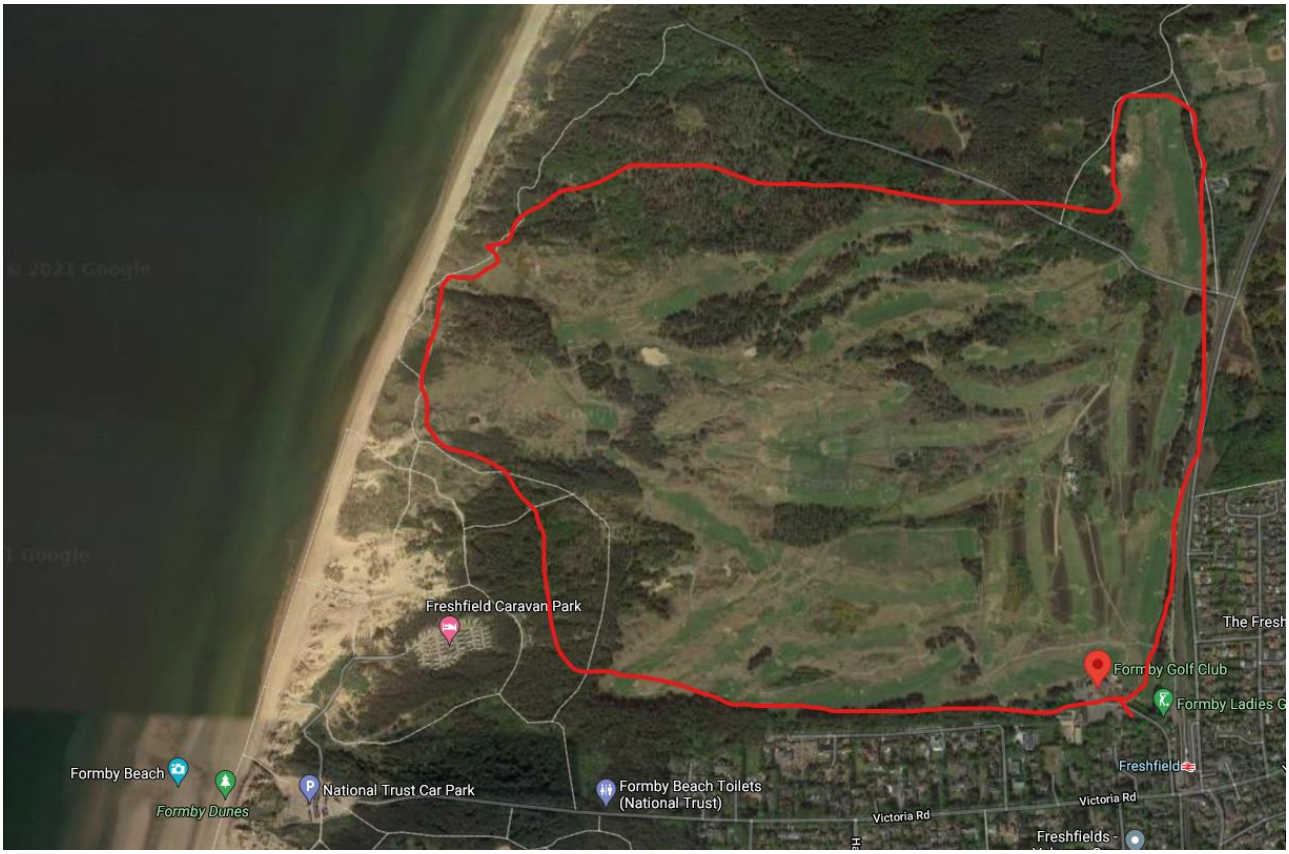


Figure 2.2 Google Satellite image showing approximate boundary of the golf course. Red marker indicates the location of the clubhouse. Image ©2021 Infoterra Ltd & Bluesky, Maxar Technologies, The GeoInformation Group, Map data ©2021

2.1.1.2 Geology and topography

The British Geological Survey Geology of Britain Viewer (www.bgs.ac.uk/map-viewers/geology-of-britain-viewer/) indicates that the golf course is located on blown sand superficial deposits. Furthermore, Cranfield University Soilscapes map (www.landis.org.uk/soilscapes/) indicates that most of the golf course is located on sand dunes, while the south eastern corner is located in naturally wet very acid sandy and loamy soils.

The topographic variation at the golf course can be seen from the contour lines on Figure 2.3. The golf course itself is relatively flat, with the majority of the golf course at approximately 10 metre above Ordnance Datum (mAOD). The area around the golf course does not have significant variability in the topographic levels.

Figure 2.3 Topography of the golf course and surrounding area (https://osmaps.ordnancesurvey.co.uk/)

2.1.1.3 Coastal flood and erosion risk

The Environment Agency's Flood Map for Planning (https://flood-map-for-planning.service.gov.uk/) indicates that the whole golf course is in Flood Zone 1. This means that there is less than 0.1% chance of flooding in any year from the sea. The sand dunes to the west of the golf course are in Flood Zones 2 and 3. This means that there is between a 0.1% and greater than 0.5% chance of flooding in any one year from the sea.

Formby Point, located approximately 1.5 kilometres to the south of the golf course frontage, is believed to be the fastest eroding coastline in the United Kingdom. The National Coastal Erosion Risk Management (NCERM) (https://www.arcgis.com/apps/webappviewer/index.html?id=9cef4a084bbb4954b970cd35b099d94c) indicates that in the short term (up to 2025), the coast could erode between 28 and 52 metres. This increases to between 70 and 130 metres for the medium term (up to 2055) and 140 and 260 metres for the long term (up to 2105).

The North West England and North Wales Shoreline Management Plan provides erosion estimates, as shown in Figure 2.4.

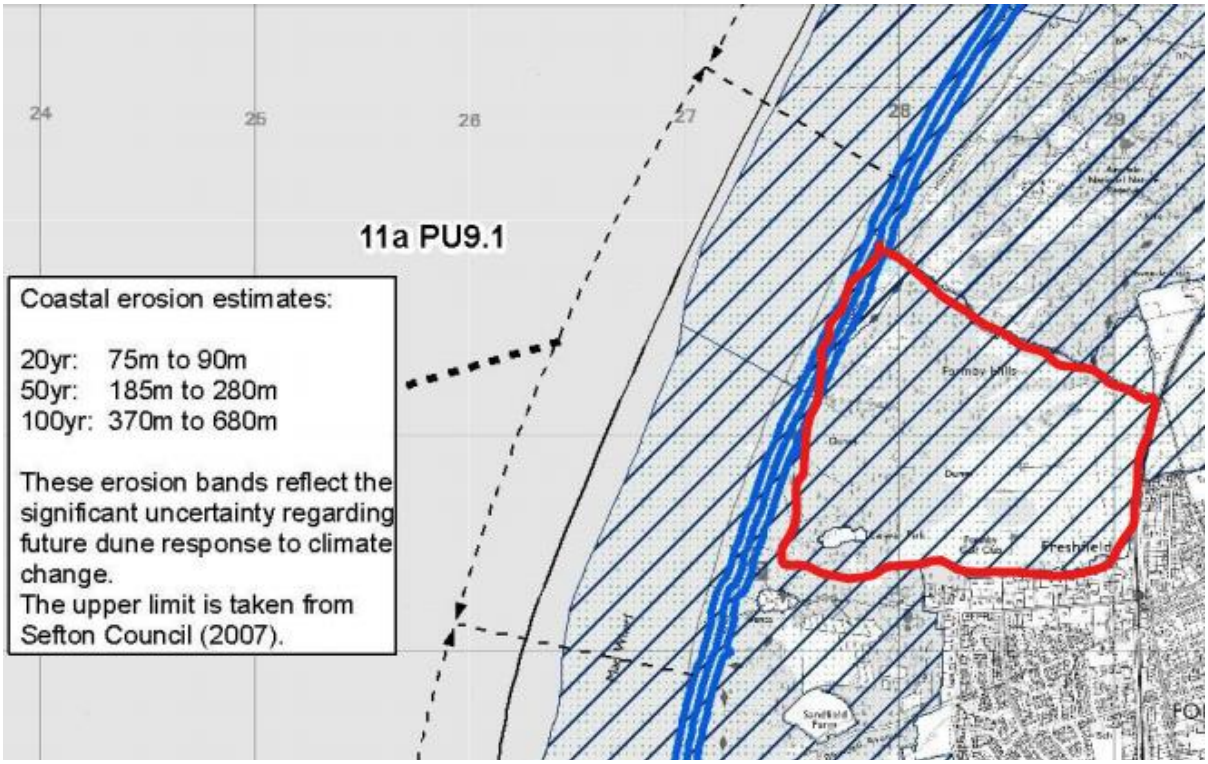


Figure 2.4 Coastal Erosion Estimates (From North West and North Wales Shoreline Management Plan Sub-Cell 11a, Area 9 Map 1. Red line indicates approximate golf course site boundary.

Anecdotal evidence indicates an average of 2.5 metres of the dunes are lost each year due to erosion, although this varies considerably, with a storm in 2013 causing a loss of 15 metres in a single night. It is noted that windblown sand, which affects playability, becomes an issue when erosion is within 150 metres of the course. This affects all of the holes along the western side of the course (holes 9-12, and specifically the 9th green and fairway and the 10th tees and fairway).

Sefton Council have produced a plan (Figure 2.5) which shows where the coast is expected to be in future in relation to the 10th tee (see Figure 2.1 for location). This plan shows the expected level of erosion in 10-year increments between 2025 and 2105 and indicates that the coast will be within 200 metres of the 10th hole by 2035 and within 100 metres by 2065.

The golf club already engage with Sefton Council and Natural England regarding coastal erosion. Before the Covid-19 pandemic, this was in the form of an annual site visit and it is expected that this will resume once restrictions allow.

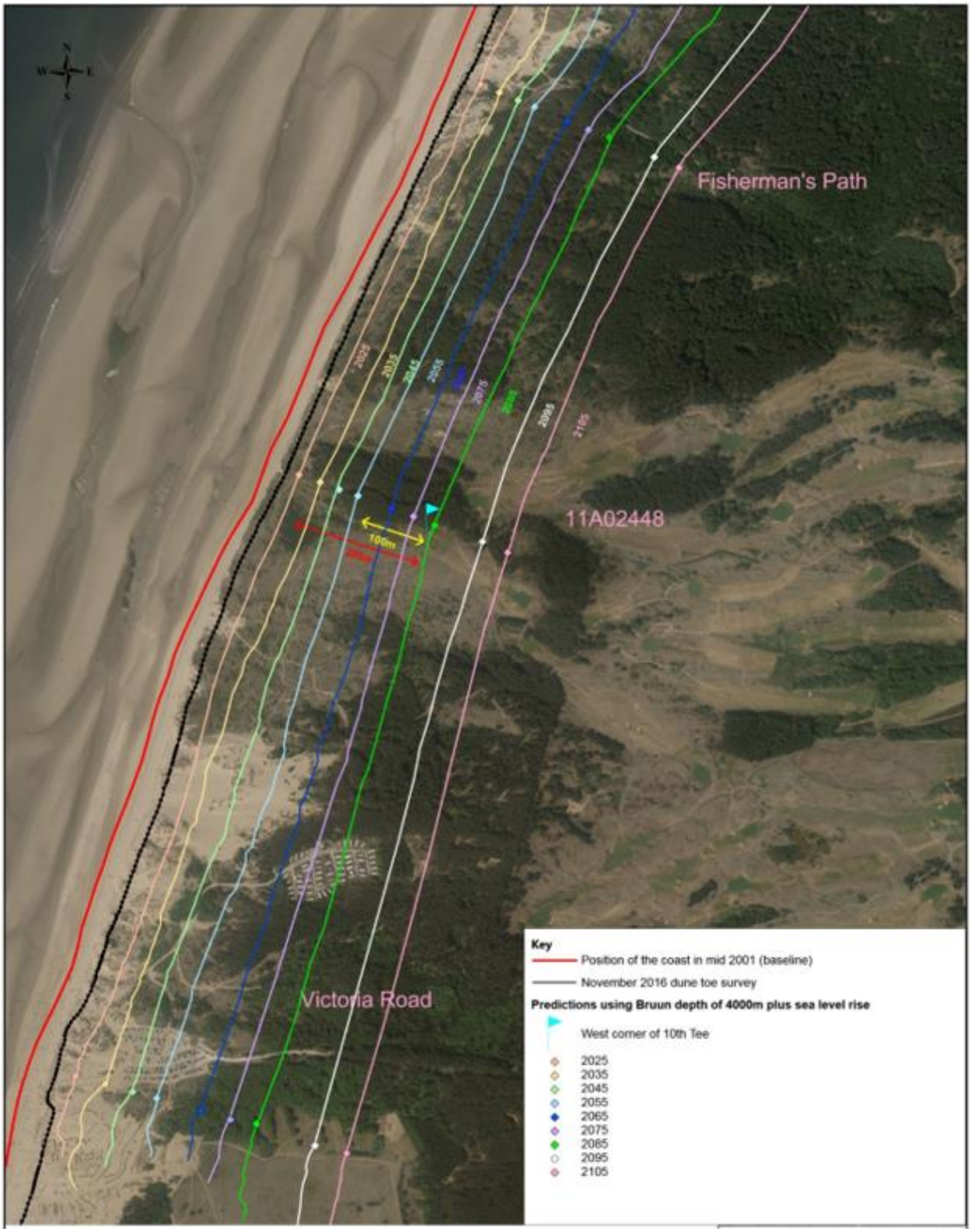


Figure 2.5: Erosion predictions affecting Formby Golf Club, with a base date of 2017. (source: Sefton Council)

2.1.1.4 Historic change

Figure 3-4 shows the location of previous holes on the course, taken in 2020, some of which have been lost due to coastal erosion.

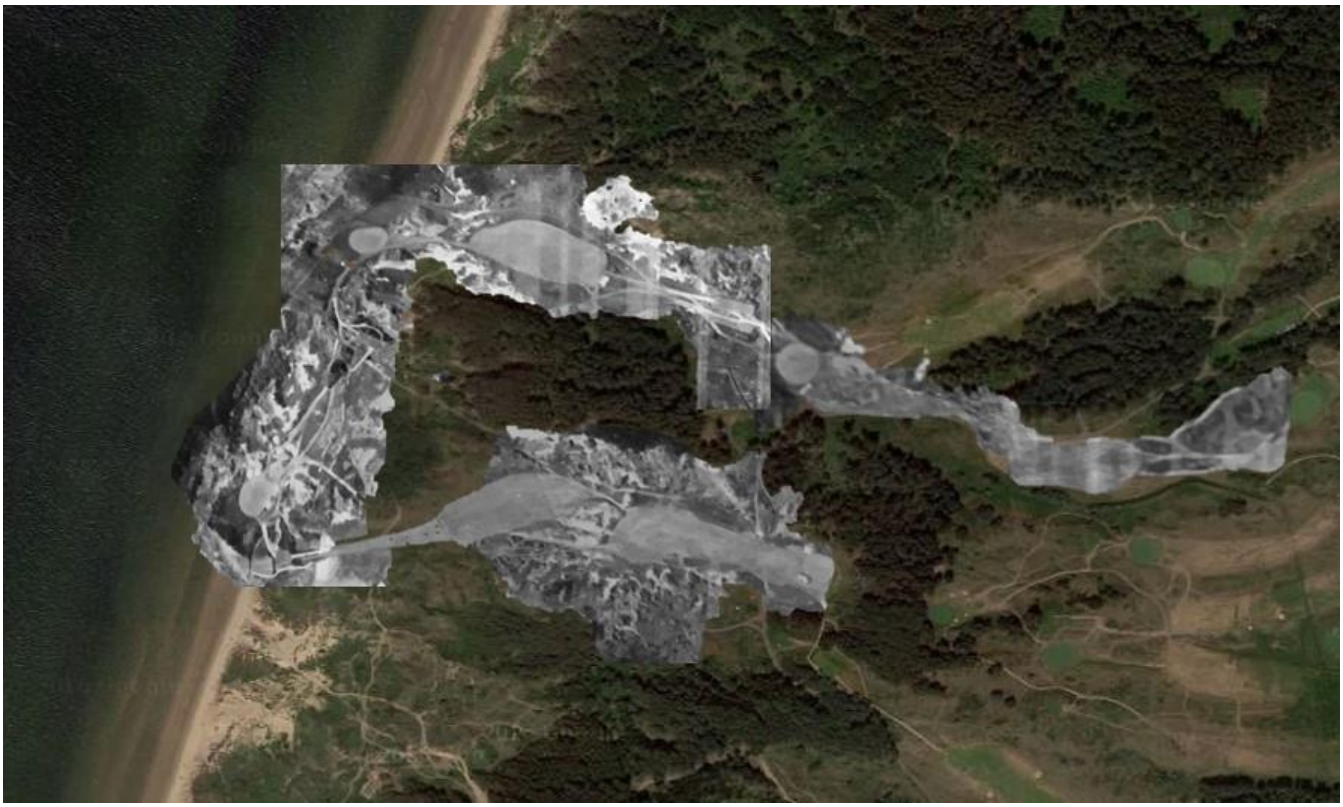


Figure 2.6 Aerial photography from 2020 overlain by historical aerial photography from the 1960s to show the extent of erosion at the Formby course

Anecdotal evidence suggests that 15 metres of coastline was lost during two storms in a three-month period in the winter of 2013/2014; 10 metres was lost on the first storm, and further 5 metres on the second.

2.1.2 Surrounding area

The golf course is located within the Sefton Coast Site of Specific Scientific Interest (SSSI) and Special Area of Conservation. Directly to the north of the course is the Ainsdale Sand Dune National Nature Reserve (NNR) and the Ribble and Alt Estuaries Ramsar Site. The beach fronting the golf course is part of the Ribble and Alt Estuaries Special Protection Area.

The Sefton coastal footpath runs through the dunes and onto the beach. Towards the north western corner of the golf course it joins another footpath and runs inland along the northern boundary of the golf club, where it then continues towards the north east running alongside the railway line. These public footpaths are shown in Figure 2.7. There is currently a 10-year agreement with Sefton Council for access to the existing coastal footpath. The National Coastal Path programme are currently looking at adopting the coastal path. This will change the access rights and will lead to the path potentially being moved inland if it is affected by coastal erosion. This would then start to interact with the golf course itself. A change to the status could also increase the number of users of the path, with an increased likelihood of

users deviating from the path and causing localised erosion of the dunes which could reduce the dunes' integrity and make them more susceptible to erosion during storm events.

Directly to the south west of the course there is a caravan park (Freshfields caravan park), car park and public toilet facilities as shown in Figure 2.7.

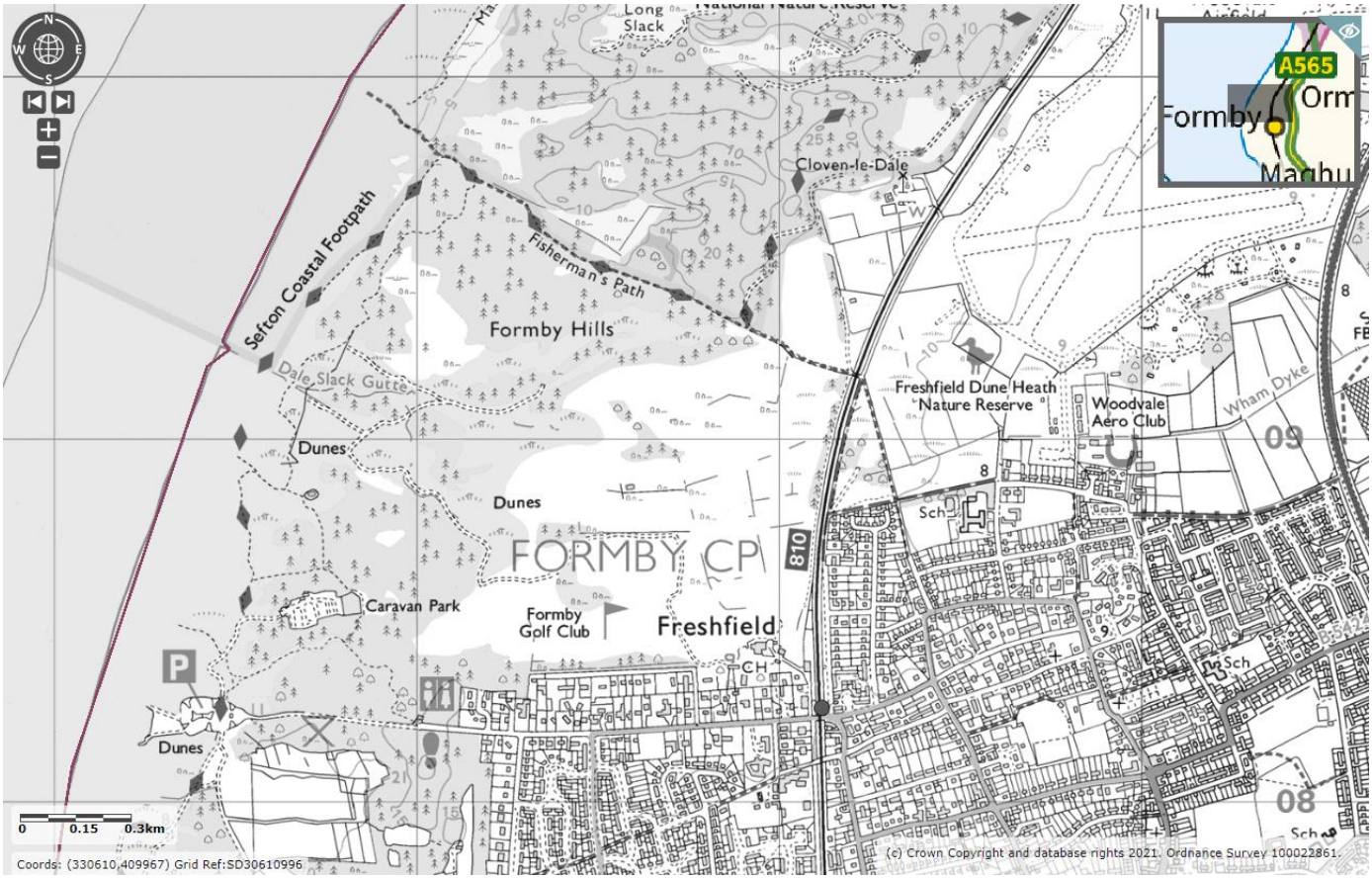


Figure 2.7 Formby golf club and surrounding area (source: https://magic.defra.gov.uk/MagicMap.aspx)

2.2 Management framework

Table 2.1 provides a summary of the information taken from the North West England and North Wales Shoreline Management Plan.

Table 2.1 Management framework

North West England and North Wales Shoreline Management Plan 2	
Policy Unit 11a8.3 and 11a8.4 (Hightown, River Alt to the Alt Pumping Station	
What is the management intent?	Through limited intervention and dune management. Maintain Alt training walls. Additional training walls may be required to deflect the Alt channel in the future.
What is the SMP Policy?	Short term - policy to 2025 is Hold The Line
	Medium term -policy to 2055 is Hold The Line
	Long term - policy to 2105 is Hold The Line
Policy Unit 11a9.1 (Formby Dunes)	

North West England and North Wales Shoreline Management Plan 2	
What is the management intent?	Allowing the natural evolution of this area is the long-term plan, with minimal intervention if local problems occur, which may involve dune management or relocation of assets at risk. By managing the natural roll back of the dune system, the impacts on the human assets can be minimised whilst maintaining the natural character of the frontage. This intent maintains the amenity value of the dunes and maintains the natural processes and supports the natural dune development which supports designated areas. It would not be economically justified or technically feasible to defend the dune system from erosion.
What is the SMP Policy?	Short term – Managed Realignment. Allow the dune system to evolve naturally with limited intervention to manage dunes and manage adaptation in the erosion risk zone (such as relocating paths and car parks), subject to consents.
	Medium term – Managed Realignment. Allow the dune system to evolve naturally with limited intervention to manage dunes and manage adaptation in the erosion risk zone (such as relocating paths and car parks), subject to consents.
	Long term – Managed Realignment. Allow the dune system to evolve naturally with limited intervention to manage dunes and manage adaptation in the erosion risk zone (such as relocating paths and car parks), subject to consents.
Has there been a change to the SMP Policy? If yes, what has changed?	No
Have there been any Strategies or Plans completed subsequent to the SMP?	National Trust's 2015 Shifting Shores Report
Policy Unit 11b1.1 (Southport)	
What is the management intent?	Manage coastal flood and erosion risk to Southport & associated facilities - Maintain defences as required.
What is the SMP Policy?	Short term - policy to 2025 is Hold the Line
	Medium term -policy to 2055 is Hold the Line
	Long term - policy to 2105 is Hold the Line

This suggests that coastal processes and wider coastal management are likely to influence management and use of the golf course. A key question for the golf course is whether minimal intervention in terms of dune management could be allowed to buy time for relocating assets at risk (ie. is this seen as a "local problem"). This will need to be resolved with the Coastal Group and in consultation with Natural England and other stakeholders.

2.3 Coastal processes

2.3.1 How the coast works

Formby is located on an exposed area of the coast, with the Ribble and Alt Estuaries to the north and the River Mersey to the south. Tidal flows from both sides influence the behaviour of the coast at this point. It is understood that the undefended coastline releases sediment.

The Shoreline Management Plan states that:

- The coast is macro-tidal, with a mean spring range of around 9 metres at Formby Point (located approximately 1.5 kilometres to the south of the golf course frontage).
- The flood tidal steams flow landwards and then diverge around Formby Point and flow towards the Mersey and Ribble Estuaries.
- There is a complex array of shoreline processes which are significant in influencing the response of the soft shorelines.
- There is a littoral sediment divide at Formby Point which is likely to be associated with sediment circulation cells of the Ribble and Mersey Estuaries. Sand is therefore moved alongshore north and south from here, therefore in a northward direction along the golf course frontage.
- Fine sand is also transported northwards onto the offshore banks which lie to the south of the Ribble Estuary.
- The coastline is susceptible to storm surges because of the shallow nature of the eastern Irish Sea and large tidal ranges. The most significant erosion occurs when storm surges coincide with significant wave activity (ie. during periods of high winds).
- Although there are few man-made defences along the shoreline, the whole of the coastline has been affected by reclamation works, construction of training walls and subsequent dredging within both the Mersey and Ribble estuaries, which have exacerbated (but are unlikely to have caused) the present trend of erosion at Formby Point.
- Material dredged from the Mersey over the past two centuries has been dumped offshore, which, together with the training works, is believed to have contributed to silting up of the Formby Channel and the resultant reduction in sediment supply to Formby Point. Natural changes in forcing factors are also proposed as a driver of the erosion trend, and it is difficult to conclusively identify the relative contribution of either factor to the erosional trend.

The National Trust's Shifting Shores work (https://www.nationaltrust.org.uk/formby/features/shifting-shores-at-formby) indicates that the sand dunes naturally roll back inland at a rate of around 4 metres per year, providing some of the best mobile sand dune habitat in the United Kingdom, which creates homes for some very rare wildlife including Natterjack Toads, Sand Lizards and Northern Dune Tiger Beetles. It also produces a steep sided sand wall that acts as a natural sea defence for the residential area of Formby. The movement can create complications too, as the roll back of the sand dunes can bury paths, car parks and other features.

The coastal erosion risk and evidence of historic change is described in sections 2.1.1.3 and 2.1.1.4 respectively.

There are no existing flood and coastal erosion risk management measures on this stretch of coast.

2.3.2 How is the course influenced by the coast?

As discussed in section 2.1.1.3, the Shoreline Management Plan outlines the predicted changes for a No Active Intervention scenario in this area. Given the management framework outlined in section 2.2, this scenario is useful for understanding the future evolution of this section of coast and the potential impact on the golf course.

In the short term (up to 2025), there is no evidence to suggest significant changes in the offshore or nearshore bathymetry which means that the current trends of erosion are expected to continue. Sea level rise is also not expected to be cause significant changes to the current trends. The Shoreline

Management Plan predicts a total erosion of between 40 and 70 metres up to 2030 along this section of coast (Formby Point) with continued accretion of the areas to the north and south.

In the medium term (up to 2055), sea level rise and climate change are likely to increase erosion rates at Formby Point due to higher water levels and more frequent storm events. The erosion of the dunes will continue to release sediment to the beaches to the north and south. The orientation of the coastline will change to progressively flatter in form. There is likely to be increased dune instability as the coast erodes, resulting in increased wind-blown sand and further development of sand sheets in the back-dune areas. In the longer term (up 2105) current trend of erosion of Formby Point is likely to continue, with continued accretion and dune progradation to the north and south. There is uncertainty around the predicted erosion and accretion rates in the long term because they will be dependent upon any future changes in the frequency and strength of storm events (which is when the majority of dune erosion takes place).

2.3.3 How does the course influence the coast?

The golf course is currently undefended and located well inland, and is therefore not influencing the wider functioning of the coast. The undefended natural dunes are eroding and therefore releasing sediment into the wider system. They also provide a natural defence function to the course.

2.4 Environmental and socio-economic constraints and opportunities

2.4.1 Key features

2.4.1.1 Terrestrial and coastal ecology

DEFRA's Magic website (https://magic.defra.gov.uk/) indicates that:

- The golf course is within a Priority Habitat Inventory-Coastal Sand Dunes area. This indicates that the area has been identified in the Natural Environment and Rural Communities Act (2006) Section 41 habitats of principal importance.
- The Ainsdale Sand Dunes National Nature Reserve is located to the north of the golf course.
- The course is in a Site of Special Scientific Interest (SSSI) therefore all changes would require agreement from Natural England.

The National Trust has identified the rare species which live in the mobile dune habitats of the Sefton coast, including:

- Natterjack toads;
- Sand lizards; and
- Great Crested newts.

All of these creatures are protected, and it is an offence to pick up, disturb, harm or kill either the animals themselves or their eggs, or to disturb or destroy their breeding or resting places (https://www.nationaltrust.org.uk/formby/features/sand-dune-wildlife-of-formby).

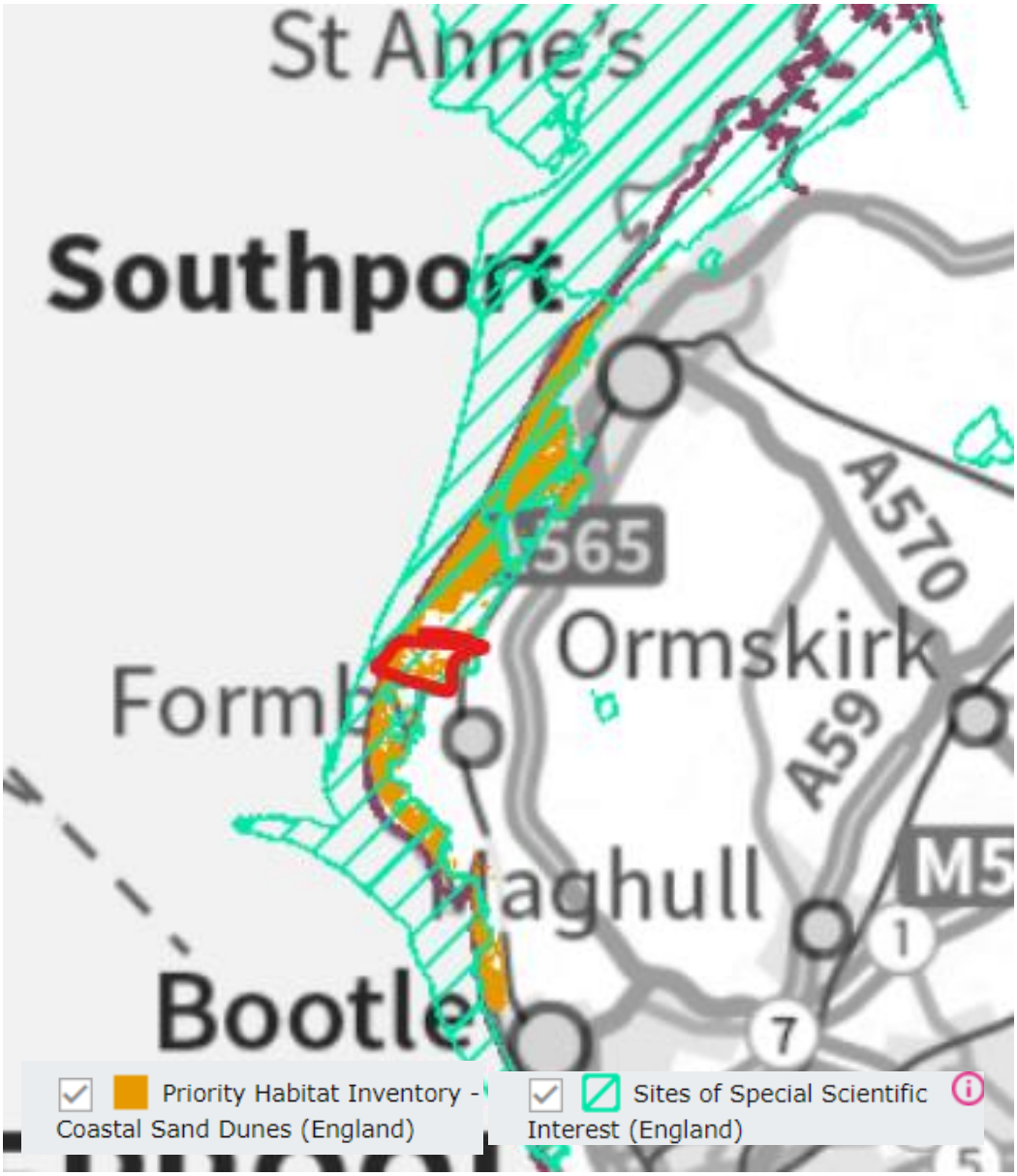


Figure 2.8 Location of coastal sand dunes and SSSI designated area. The golf course location is shown in red.

2.4.1.2 Public rights of way

The public rights of away in the surrounding area are discussed in section 2.1.2.

2.4.1.3 Coastal and sedimentary processes

As discussed in section 2.3.2, the dunes are undefended and the frontage releases sediment into the wider coastal system.

2.4.1.4 Recreational use/access

Recreational use and access are discussed in section 2.1.2.

2.4.2 Opportunities

There are opportunities associated with the potential management of the intertidal and nearshore, upper beach and dune face, and within the dune ecosystems. These opportunities could include measures that

would increase the resilience of the site (making it more robust and self-sustainable) and encourage and enhance biodiversity.

Through increasing the resilience of different ecosystem components to climate change, there are likely to be the following benefits to the ecosystem itself (through encouraging a nature-based solution it is possible to gain a more robust and sustainable system that encourages natural succession through the dune system) and any other surrounding receptors (such as nearby coastal communities):

- Attenuates and/or dissipates waves from the sea.
- Flooding and wave spray from the sea is reduced or eliminated, protecting the more inland components of the sand dune ecosystem and/or coastal communities.
- Provides sediment or width for natural resilient dune development.
- Maintains variation and ensures biological diversity and longevity.
- Indirect maintenance of wildlife by encouraging natural vegetation growth within the dune system.
- Larger area of the ecosystem available to sequester carbon which generates biological productivity.
- Creates habitats and food source for surrounding fauna.
- Maintains nutrient cycles within the soil.

The golf course is likely to benefit from these in the following ways:

- Protection of golf course assets from extreme weather events from offshore (i.e. destruction by waves, flooding etc.).
- Long-term financial and time savings due to not having to actively maintain hard defences as the nature-based solution becomes self-sustaining.
- Potential to obtain funding for considering the protection of down-drift areas and thinking about a more strategic scheme (which would involve other funding partners).
- Opportunity to raise the profile of the relevant golf course if supporting research on nature-based solutions.

Through encouragement of and enhancing biodiversity of the intertidal and nearshore environment, there are likely to be the following benefits to the intertidal and nearshore itself and any other surrounding receptors (such as nearby coastal communities):

- Encourages a more resilient system.
- Development of more biodiversity.

2.5 Encourages sediment Golf course aspirations

In 2017, the Club Council, chaired by the Captain and including the Chair of all Committees, decided to undertake a survey of members as the primary input in defining the club's future focus and priorities. This survey was carried out in February 2018 with the results being published in April of the same year. The overwhelming feedback from the membership was that the course is the most important element of the club, and this is where development should be concentrated, and improvements made in the future.

The strategic business plan's main objective is therefore to "provide a course of tournament condition for the duration of the summer months and to continue to invest in the practice facilities" and to secure the future of the golf course until 2100. To ensure that the club continues to be considered as one of the best courses in the United Kingdom by both members and visitors, the focus is on:

- Improving the ranking position by improving course condition.
- Extending the length of the best condition playing season. This would see an improvement in the current playing season (March to October) as weather and maintenance work will permit.
- Improve the winter condition with firmer greens throughout the period and tidier maintenance.

The provision for coastal erosion is considered of high importance for the long-term health of the club. An objective of the strategic plan is therefore to work closely with Formby Ladies Golf Club, Sefton Council, Natural England, the National Trust, and other stakeholders, to monitor the coastline for erosion, keeping the membership informed and acting as required, incorporating any actions into the strategic plan for the committee.

3 Management requirements and options

3.1 Is there a problem (need for change)?

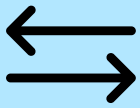
As discussed in section 2.1.1.3, Sefton Council predicts that the coastline will have eroded back to the 10th tee by 2085. If a buffer of 150 metres is selected to ensure no disruption to play as a result of windblown sand, this point is predicted to be reached by 2040. This is not in line with the strategic business plan's main objective of securing the future of the course until 2100.

3.2 Management objectives

The management objectives are to secure the future of the course and provide uninterrupted play until 2100.

3.3 Appraisal criteria

Table 3.1 Appraisal criteria

Criteria		Description
	Design life, adaptability	• Secure the future of the golf course until 2100.
	Potential additional benefits	• Winter condition of the greens. • Length of the best condition playing season.
	Consentability	• Likelihood of achieving planning permissions and the necessary consents. This will include assessing impacts to the course and to others. • Consistency with the overall intent of management of the Shoreline Management Plan.
	Golf course profile	• Impact on club's ranking position – the hierarchy of golf courses in Great Britain and Ireland in terms of ranking, plus the top 100 lists of golf courses by Golf World, Golf Monthly, plus others.

3.4 Identify potential management approaches

3.4.1 Long list of approaches

3.4.1.1 Do Nothing

A Do Nothing approach would mean accepting the loss of elements of the course and undertaking remedial works to the course as and when required, and accepting the loss of individual holes once the remedial works become too frequent.

3.4.1.2 Do Minimum

The Do Minimum approach would mean implementing small-scale soft/nature-based solutions. The trigger for implementing such measures would need to be developed; it would be based on identifying the at risk holes/tees/greens and the state of the dune, defining a buffer needed to allow implementation of any measure, and then regular monitoring of dune condition and erosion to ascertain when that buffer is reached. Potential measures are outlined in the Golf Course Coastal Solutions Catalogue and could include:

- Vegetation planting;
- Fencing for dune succession.

These softer Do Minimum measures could also be suitable for a rolling programme that slows down erosion and moves landward with the natural movement of the dune system. Therefore, although the lifespan of the measures is relatively short, once they fail new measures, potentially on a different alignment, could be implemented. Alternatively, a Do Nothing or Do Something approach could be followed. The pathway chosen would be dependent upon the implementation of the wider golf course adaptation plan.

3.4.1.3 Do Something

Course re-design (relocating assets at risk)

There are a number of options which could be considered in order to re-design the course to re-locate the 9th green and 10th hole tee complex which is at risk over the period to 2100. This could be incorporated within a wider re-design which considers multiple benefits (rather than solely responding to coastal erosion risk).

Holding the line with hard defences

This would involve replacing the existing dune defence with a hard defence (rock revetment or similar) to protect the golf course to a given standard. This is unlikely to be acceptable considering the Shoreline Management Plan's intent of management, the accompanying policy and site designations.

Land purchase

All of the club's spare land is at risk of erosion. Land purchase would therefore be in the form of land purchase elsewhere and fully relocating the course and club.

Beach nourishment

Nourishment of the beach could support the coastal defence function of the dune line. A higher and wider beach could absorb wave energy, reduce the likelihood and height of waves being able to reach the toe of the dunes to cause erosion. This may be costly if regular renourishments are required, and any impact on designated habitats would have to be reviewed.

3.4.2 Long list to short list

Do Nothing is ruled out at this stage because the future impacts on the course are difficult to predict and manage and this uncertainty will impact on the course's profile, reputation and membership and lead to reactive decisions which could lead to more problems in the future.

The Do Something approach of holding the line with hard defences (section 3.4.1.3) would have a significant impact on the adjacent sections of coast from the short term. The creation of a hard point on this naturally eroding section of coast would lead to beach lowering, changes to sediment processes and impacts on adjacent sections of coast, while also being difficult technically to sustain.

The Do Something approach of land purchase (section 3.4.1.3) is ruled out because of its significant cost and the impact on the course's profile, reputation and membership. Beach nourishment is also ruled out due to the extremely large volume of sediment that would be required and the significant uncertainties with how that sediment would then interact and be lost within the wider coastal system.

The following short list of options is therefore taken forward to the next stage of appraisal (consequences assessment in section 4 and full appraisal in section 5).

- Do Minimum.
- Do Something – course re-design (relocating assets at risk).

The assessment starts to identify that the suitability of options can vary over time. This relates to how the coast is predicted to develop over time and associated uncertainties; but also to the time it takes to plan for larger scale measures, including generating funding or achieving consent. Because of this, it will be useful to think of packages of measures that can be implemented over time.

4 The coast's response to the management approaches

4.1 Do Minimum

The Do Minimum approaches aim to support the natural functioning of the dune system. They are relatively short-term solutions leaving the dunes to respond to external influences. As discussed in section 3.4.1.2, assuming that they are implemented as a rolling programme into the future to allow the overall adaptation plan to be delivered, the coastal response into the longer term would be similar to a slowed-down and more managed version of Do Nothing.

4.2 Do Something – Course re-design (relocating assets at risk)

Assuming that a re-design would move the club's assets fully out of the risk zone, the re-design would not impact on the functioning of the coast. There is, therefore, unlikely to be any impact on the functioning of the coast.

5 Appraisal of management approaches

5.1 Appraisal methodology

A qualitative appraisal has been undertaken against the criteria defined in section 3.3. The following scoring has then been used to summarise the results of the appraisal:

- Red shading – option does not meet defined criterion;
- Amber shading – option does meet defined criterion in some aspects, but there are aspects which are negative or undesirable; and
- Green shading – option fully meets defined criterion.

The appraisal is carried out for each individual option, but it considers the short, medium and long term. This will then enable the formation of a package (or sequence) of measures that can be implemented over time. This is discussed further in section 6.

The results are presented in section 5.2 below.

5.2 Appraisal results

5.2.1 Do Minimum

Table 5.1 Do Minimum appraisal

Criteria	Appraisal results	Appraisal results		
		Short term	Medium term	Long term
Design life, adaptability	• This approach does not secure the golf course until 2100. The impacts will be seen in the medium to long term.			
Potential additional benefits	• This approach offers no opportunity for improvement to the winter conditions of the greens, practice facilities or length of the best condition playing season. Works could be undertaken in the short term but any improvements made could become at risk in the medium to long term.			
Consentability	• This approach could be compatible with the Shoreline Management Plan's intent of management, but this is dependent upon the nature of the works and the length of time they are expected to remain in place.			
Golf course profile	• There is no opportunity to improve the club's ranking position			

5.2.2 Do Something – Course re-design (relocating assets at risk)

Table 5.2 Do Something – Course re-design appraisal

Criteria	Appraisal results	Appraisal results		
		Short term	Medium term	Long term
Design life, adaptability	• A course re-design would allow a plan to be put in place to secure the golf course until 2100.			
Potential additional benefits	• Opportunities for improvement to the winter conditions of the greens or length of the best condition playing season could all be incorporated in the plan for the re-design. It is assumed that a re-design would not be implemented until the medium term hence the low score in the short term.			
Consentability	• Adapting the course layout to account for future coastal erosion would be fully compatible with the Shoreline Management Plan's intent of management.			
Golf course profile	• A new course layout could improve the club's ranking position by attracting a wider membership or through the hosting of different tournaments and competitions. It is assumed that a re-design would not be implemented until the medium term hence the low score in the short term.			

5.3 Compare and consider different approaches to develop a preferred management approach

	Design life, adaptability	Potential additional benefits	Consentability	Golf course profile
Do Minimum				
Do Something – course re-design				

The Do Minimum approaches (section 5.2.1) of vegetation planting, fencing for dune succession, and other approaches identified through the solutions catalogue, have the potential to provide benefit in the short term, particularly if planned and implemented using a structured evidence-based approach. These soft measures could also be suitable for a rolling programme that slows down the erosion. Once an implemented approach fails, another Do Minimum style approach could be implemented in combination with works to adapt the course.

The Do Something approach of a course re-design allows the club to move the holes which are at risk to 2100 out of the risk zone. It also allows the club to review what's important for the future of the course in terms of the provision of facilities and making improvements to the current course offering. This is fully in line with the Shoreline Management Plan's intent of management and provides the mobile sand dunes space within which they can respond to external forcings.

6 The preferred approach

6.1 Detailed description

The preferred approach is a decision-pathway approach. In the short term, this involves developing a masterplan for the future of the course, including a new layout to be implemented when required and based on erosion predictions which are to be reviewed and updated annually.

Regarding the implementation trigger, Sefton Council predict that the coastline will have eroded back to the 10th tee by around 2085 (section 2.1.1.3). It will be important to translate this to a range rather an absolute date to reflect future uncertainties. The club have identified that a 150-metre buffer is needed between the eroding coast and the 10th tee to ensure no disruption to play as a result of windblown sand. Predictions from Sefton Council are that this buffer trigger (the implementation trigger) will be reached around 2040, therefore construction of a new course layout will need to commence around 2035.

The predictions of future coastal erosion and the impact on when the implementation trigger will be reached will need to be reviewed over the coming years based on analysis of monitoring results, in consultation with Sefton Council.

This trigger-based approach also allows the club to explore what would be possible in terms of implementing some of the Do Minimum type approaches to delay the need to implement a new course layout. There would be significant benefit of doing this in partnership with other key stakeholders with the aim of delivering multiple benefits. An approach which stimulates or supports dune vegetation, for example, would slow down erosion (delaying the trigger) and may limit windblown sand (potentially reducing the width of the buffer) and could be designed to work for/to enhance the natural habitat.

The decision-pathway approach is summarised below.

Short term:

- Engage an architect to develop the masterplan.
- Undertake an annual review of the coastal monitoring data to update the estimate for the implementation trigger (currently 2035).
- Initiate conversations with the Coastal Group, Sefton Council and other stakeholders to explore the opportunity for implementing the Do Minimum approaches to slow down erosion and effectively delay the current prediction for the implementation trigger.

Once clarity is achieved (short-medium term):

- If there are opportunities for implementing the Do Minimum approaches, re-assess the masterplan and refine areas where such approaches would be beneficial and continue to review the monitoring data to assess the benefit of the approaches on delaying the implementation trigger and reducing the need for a wind-blown sand buffer.
- If Do Minimum approaches will not be possible, continue as per the short term until the implementation trigger is reached.

The new layout should be designed to have a lifespan of approximately 60 years, which will inform how far inland it needs to be located. The golf club feel that this is the right balance between frequency of investment in subsequent re-designs and uncertainty with regards to erosion rates, linked to sea level rise and other climate change variables such as increased frequency of storm events.

This text box explains the approach that Formby Golf Club has already been taking in reality, to illustrate how the findings of the CCMP can be implemented in practice.

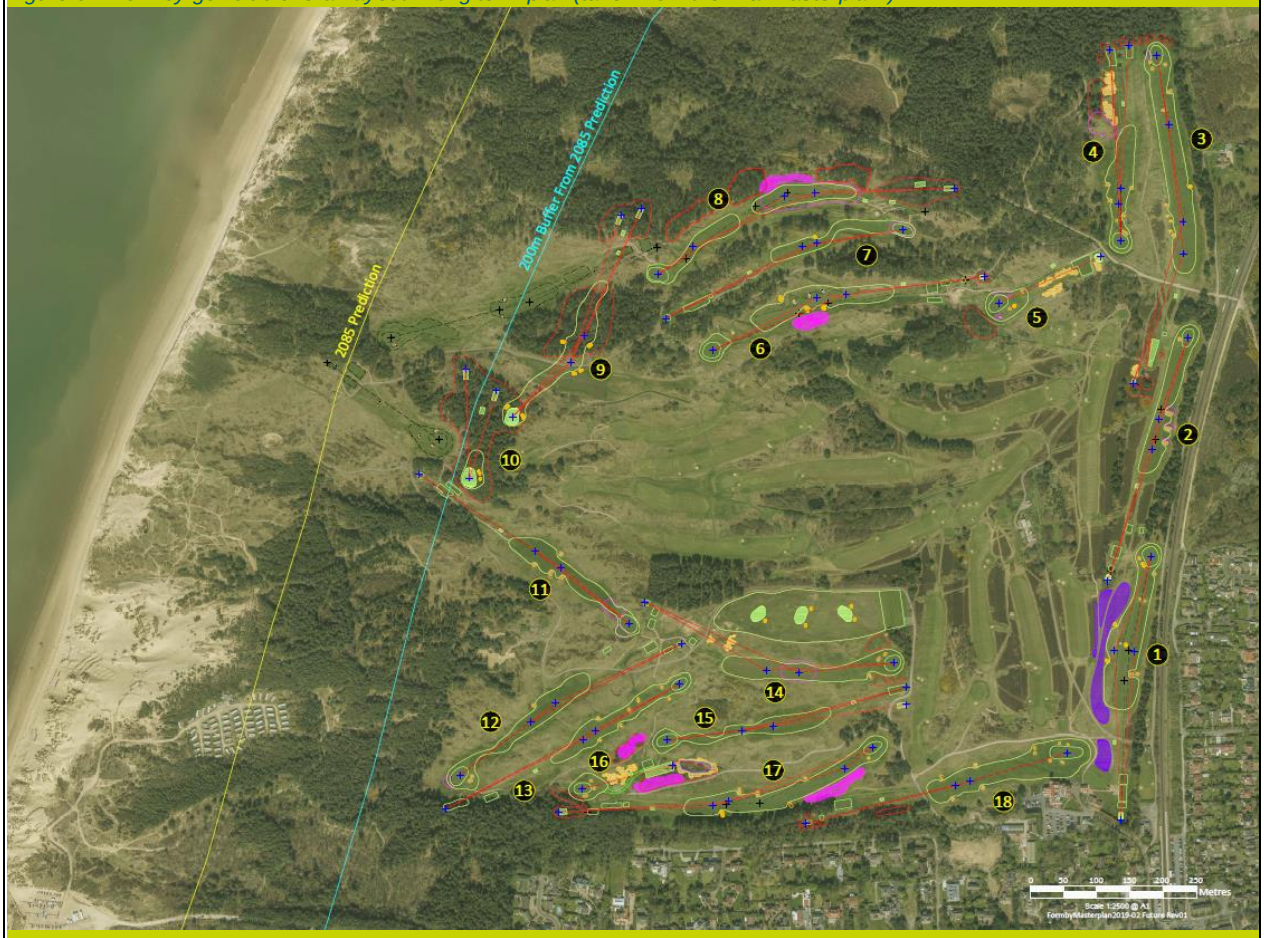
In October 2018 Formby Golf Club commissioned international golf course architects Mackenzie & Ebert to evaluate each one of the holes at Formby with a view to putting together a 7-10 year plan for course improvements. The Masterplan aimed to provide an guide for the club to work to in terms of their commitment to the course and improving the facilities. As well as improving the course, the Masterplan also aimed to provide a better member and visitor experience to boost the rating of the course in the various golf course ranking lists to position it as highly as possible in what is an increasingly competitive market. The Masterplan brief also included the impact of erosion on the Club's property, with possible new holes being required to replace holes which are in danger.

Development of the Masterplan with the architects was led by the club's Course Development Steering Group; a project management group responsible for working with the architects and taking any proposal back to the full club Council who were the ultimate decision-making body. The architects reported back to the membership in June 2019 alongside costings from the Course Development Steering Group, the Course Manager and Green & Estate Committee for the proposed 6 years of developments and improvements.

The life of the Masterplan is up to 2100; ie. coastal erosion should not threaten the new layout until 2100. The Sefton Council prediction is that the coastline will be at the back of the 10th tee in 2085. A further 15 years of erosion on top of the 150-metre buffer therefore needs to be accommodated.

It is recognised that the uncertainty around coastal erosion predictions increases into the future. Sea level rise could lead to an average erosion rate of 4.5 metres per year (compared to the current rate of 2.5 metres per year). Based on a potential range of 2.5 to 4.5 metres per year over 15 years, the total erosion could be between 37.5 and 67.5 metres. The club are working with a total erosion estimate of 50 metres, plus the 150-metre buffer, taken from the current 10th tee. This provides the Masterplan's new course boundary as shown in Figure 6.1.

Figure 6.1 Formby golf club overall layout – long term plan (taken from the final Masterplan[1])



Formby golf club would also like to explore opportunities for delaying the need to fully implement the new course layout as outlined in the Masterplan. Any delays would further extend the lifespan of the new layout and push the significant investment further into the future. They would like to consider some of the Do Minimum options discussed in section 3.4.1.2. Any approaches will need to be discussed in detail with Natural England, but could involve working with the National Trust to implement protection/stabilisation methods on the sea side of the dunes, or options such as vegetation planting on the landward side. There are also local options associated with protecting the 10th fairway from tidal inundation through the creation of a robust vegetated mature 'natural dune' or local land raising.

The Course Development Steering Committee will need to initiate discussion with Natural England and the North West and North Wales Coastal Group to discuss what could be possible.

6.2 Action plan

The action plan for taking forward the preferred approach is outlined in Table 6.1.

[1] *Final Masterplan Proposals for the course at Formby Golf Club, Mackenzie & Ebert, April 2019*

Table 6.1 Action plan

Reference numbers			Location		Action description	Primary action objective	Action theme	Action owner	Linked organisations	Timings and progress tracking			
Main unique reference (parent no.)	Sub-action reference (child no.)	Overall unique reference no. (parent + child)	Name	Coordinates						When should it be started?	Completion date	Action progress status	Action status commentary
1	01	1.01	All	N/A	Develop terms of reference for procurement process to contract golf course architect	Initiate procurement of architect	Develop new masterplan	Course Development Steering Group	-	ASAP	2018	Complete	-
1	02	1.02	All	N/A	Initiate procurement process and contract golf course architect.	Select preferred architect	Develop new masterplan	Course Development Steering Group	-	ASAP	2018	Complete	-
1	03	1.03	All	N/A	Develop masterplan and obtain views of the membership	Development of masterplan	Develop new masterplan	Course Development Steering Group	-	ASAP	2019	Complete	-
1	04	1.04	All	N/A	Agree final masterplan	Finalise masterplan	Develop new masterplan	Course Development Steering Group	-	ASAP	2019	Complete	-
2	01	2.01	All	N/A	Develop trigger-based approach	Confirm implementation trigger	Decision pathway	Course Development Steering Group	-	ASAP	2019	Complete	-
2	02	2.01	All	N/A	Annual review of coastal monitoring data to confirm implementation trigger prediction	Review coastal erosion scenarios	Decision pathway	Course Development Steering Group Sefton Council	-	ASAP	To be reviewed annually	Ongoing	Annual review required
3	01	3.01	N/A	N/A	Consultation with Sefton Council, Coastal Group and other stakeholders to gain clarity on SMP policy and opportunities.	Collect evidence to inform decision-making	Data collection	Course Development Steering Group	Sefton Council Coastal Group Plus other stakeholders	ASAP	2021	Ongoing	-

Glossary

Adaptation	A change in the way that an individual, community or feature such as a habitat, functions to fit a changed environment.
Biodiversity	The diversity of plant and animal life.
Climate change	Long-term change in the patterns of average weather. It is relevant to shoreline management because of its effect on sea levels, current patterns and storminess.
Coastal Change Management Area (CCMA)	Identification by Local Planning Authorities of an area where the shoreline is likely to change significantly over the next 100 years as required by the National Planning Policy Framework.
Coastal margin	Broadly defined as the interface between the land and sea.
Coastal squeeze	A situation where the coastal margin is squeezed between a fixed inland boundary (for example a sea wall or higher ground) and the rising sea level.
Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019	The 2019 Regulations make the necessary changes to the Conservation of Habitats and Species Regulations 2017 to make them operable from 1st January 2021. The 2017 Regulations are one of the pieces of domestic law that transposed the land and marine aspects of the Habitats Directive (Council Directive 92/43/EEC) and certain elements of the Wild Birds Directive (Directive 2009/147/EC) (known as the Nature Directives).
Control point	Geographical feature, either natural or artificial, that determines the shape of the shoreline.
Downdrift	In the direction of longshore movement of beach materials.
Ecosystem	Organisation of the biological community and the physical environment in a specific geographical area.
Environmental impact assessment	Detailed studies that predict the effects of a development project on the environment.
Erosion	The natural process of removal of material from a feature / system by weathering, solution, corrosion or transportation. The affected feature or

	system tends to reduce in size either horizontally or vertically, as a result of the material remove from it."
Feature	Something tangible that provides a service to society in one form or another, or, more simply, benefits certain aspects of society by its very existence.
Foreshore	Zone between the high water and low water marks.
Geomorphology/morphology	The branch of physical geography/geology that deals with the form of the Earth, the general configuration of its surface, the distribution of the land, water etc.
Heritage assets	Property, plant and equipment of historical, cultural, artistic or educational significance.
Hinterland	Area inland of the shoreline.
Historic environment	All aspects of the environment resulting from the interaction between people and places through time, including all surviving physical remains of past human activity, whether visible, buried or submerged and deliberately planted or managed flora.
Integrated	An approach that tries to take all issues and interests into account. In taking this approach, managing one issue adds value to the way another is dealt with.
Intent of management	The effect on land use and environment that the SMP aims to achieve.
Intertidal zone	The part of the shore that lies between the highest and lowest tides.
Longshore	Along or parallel to the shore.
Mean high water	Average of all high waters observed over a sufficiently long period.
Mean low water	Average of all low waters observed over a sufficiently long period.
Mean sea level	Average height of the sea surface over a 19-year period.

Mitigation	Practical measures taken to offset the effect of a policy on physical assets. The term mitigation has a specific meaning for particular types of physical asset: • For wildlife, mitigation may be any process or activity designed to avoid, reduce or remedy adverse environmental effects of the plan. • For the historic environment, mitigation may be 'preservation by investigation' for archaeological features or 'preservation by recording' followed by abandonment, demolition or re-location for listed buildings. There is no effective mitigation for the loss of historic landscapes.
National site network	Sites designated as a Special Area of Conservation (SAC) or Special Protection Area (SPA) in the UK no longer form part of the European Union's Natura 2000 ecological network. The 2019 Regulation (see "Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019" above) have created a national site network on land and at sea, including both the inshore and offshore marine areas in the UK. This includes existing SACs and SPAs and new SACs and SPAs designated under the 2019 Regulations.
Objective	A desired state to be achieved in the future. An objective is set, through consultation with key parties, to encourage the resolution of an issue or range of issues.
Present Value (PV)	The value of a stream of benefits or costs when discounted back to the present day.
Residual life	Period of time until a defence has deteriorated to a state in which it no longer performs its function.
Sustain	Refers to some function of a feature. A feature may change, but the function is not allowed to fail.
Topography	Configuration of a surface including its relief and the position of its natural and man-made features.
Adaptation	A change in the way that an individual, community or feature such as a habitat, functions to fit a changed environment.
Biodiversity	The diversity of plant and animal life.

Climate change	Long-term change in the patterns of average weather. It is relevant to shoreline management because of its effect on sea levels, current patterns and storminess.
Coastal Change Management Area (CCMA)	Identification by Local Planning Authorities of an area where the shoreline is likely to change significantly over the next 100 years as required by the National Planning Policy Framework.
Coastal squeeze	A situation where the coastal margin is squeezed between a fixed inland boundary (for example a sea wall or higher ground) and the rising sea level.
Control point	Geographical feature, either natural or artificial, that determines the shape of the shoreline.
Downdrift	In the direction of longshore movement of beach materials.
Ecosystem	Organisation of the biological community and the physical environment in a specific geographical area.
Environmental impact assessment	Detailed studies that predict the effects of a development project on the environment.
Erosion	The natural process of removal of material from a feature / system by weathering, solution, corrosion or transportation. The affected feature or system tends to reduce in size either horizontally or vertically, as a result of the material remove from it."
European Union (EU) Habitats directive	European legislation on the conservation of habitats.
European Annex I priority habitats	Annex I of the European Habitats directive defines certain habitats as being 'priority' because they are considered to be particularly vulnerable and are mainly, or exclusively, found within the European Union.
Feature	Something tangible that provides a service to society in one form or another, or, more simply, benefits certain aspects of society by its very existence.
Foreshore	Zone between the high water and low water marks.

Geomorphology/morphology	The branch of physical geography/geology that deals with the form of the Earth, the general configuration of its surface, the distribution of the land, water etc.
Heritage assets	Property, plant and equipment of historical, cultural, artistic or educational significance.
Hinterland	Area inland of the shoreline.
Historic environment	All aspects of the environment resulting from the interaction between people and places through time, including all surviving physical remains of past human activity, whether visible, buried or submerged and deliberately planted or managed flora.
Integrated	An approach that tries to take all issues and interests into account. In taking this approach, managing one issue adds value to the way another is dealt with.
Intent of management	The effect on land use and environment that the SMP aims to achieve.
Intertidal zone	The part of the shore that lies between the highest and lowest tides.
Longshore	Along or parallel to the shore.
Mean high water	Average of all high waters observed over a sufficiently long period.
Mean low water	Average of all low waters observed over a sufficiently long period.
Mean sea level	Average height of the sea surface over a 19-year period.
Mitigation	Practical measures taken to offset the effect of a policy on physical assets. The term mitigation has a specific meaning for particular types of physical asset: • For wildlife, mitigation may be any process or activity designed to avoid, reduce or remedy adverse environmental effects of the plan. • For the historic environment, mitigation may be 'preservation by investigation' for archaeological features or 'preservation by recording' followed by abandonment, demolition or re-location for listed buildings. There is no effective mitigation for the loss of historic landscapes.

Objective	A desired state to be achieved in the future. An objective is set, through consultation with key parties, to encourage the resolution of an issue or range of issues.
Present Value (PV)	The value of a stream of benefits or costs when discounted back to the present day.
Residual life	Period of time until a defence has deteriorated to a state in which it no longer performs its function.
Sustain	Refers to some function of a feature. A feature may change, but the function is not allowed to fail.
Topography	Configuration of a surface including its relief and the position of its natural and man-made features.