



Cell 1 Coatham Dunes Report 2018



A great place to live, work & play

March 2018

Scarborough Borough Council

Cell 1 Regional Coastal Monitoring Programme Coatham Dunes Report 2018

Contents Amendment Record

This report has been issued and amended as follows:

Issue	Revision	Description	Date	Authorised
1	0	First issue	23/03/2018	<i>N. J. Cooper</i>
1	1	Minor typographic edits	26/03/2018	<i>N. J. Cooper</i>

Contents

Disclaimer	iv
Preamble	v
1. Introduction	1
2. Aerial Photography	1
3. Historic Maps	14
4. Conclusions	15

Disclaimer

Royal HaskoningDHV has prepared this report in accordance with the instructions of our client Scarborough Borough Council (SBC)¹ for the client's sole and specific use. Any other persons who use any information contained herein do so at their own risk. Royal HaskoningDHV has used reasonable skill, care and diligence in the interpretation of data provided to them and accepts no responsibility for the content, quality or accuracy of any Third party reports, monitoring data or further information provided either to them by SBC or, via SBC from a Third party source, for analysis under this term contract.

Data and reports collected as part of the Cell 1 Regional Coastal Monitoring Programme are available to download via the North East Coastal Observatory via the webpage:
www.northeastcoastalobservatory.org.uk.

The North East Coastal Observatory does not "license" the use of images or data or sign license agreements. The North East Coastal Observatory generally has no objection to the reproduction and use of these materials (aerial photography, wave data, beach surveys, bathymetric surveys, reports), subject to the following conditions:

1. North East Coastal Observatory material may not be used to state or imply the endorsement by North East Coastal Observatory or by any North East Coastal Observatory employee of a commercial product, service, or activity, or used in any manner that might mislead.
2. North East Coastal Observatory should be acknowledged as the source of the material in any use of images and data accessed through this website, please state "Image/Data courtesy of North East Coastal Observatory". We recommend that the caption for any image and data published includes our website, so that others can locate or obtain copies when needed. We always appreciate notification of beneficial uses of images and data within your applications. This will help us continue to maintain these freely available services. Send e-mail to Robin.Siddle@scarborough.gov.uk
3. It is unlawful to falsely claim copyright or other rights in North East Coastal Observatory material.
4. North East Coastal Observatory shall in no way be liable for any costs, expenses, claims, or demands arising out of the use of North East Coastal Observatory material by a recipient or a recipient's distributees.
5. North East Coastal Observatory does not indemnify nor hold harmless users of North East Coastal Observatory material, nor release such users from copyright infringement, nor grant exclusive use rights with respect to North East Coastal Observatory material.

North East Coastal Observatory material is not protected by copyright unless noted (in associated metadata). If copyrighted, permission should be obtained from the copyright owner prior to use. If not copyrighted, North East Coastal Observatory material may be reproduced and distributed without further permission from North East Coastal Observatory.

¹ Scarborough Borough Council is acting as client on behalf of all Local Authorities within 'Coastal Cell 1'.

Preamble

The Cell 1 Regional Coastal Monitoring Programme covers approximately 300km of the northeast coastline, from the Scottish Border (just south of St. Abb's Head) to Flamborough Head in East Yorkshire. This coastline is often referred to as 'Coastal Sediment Cell 1' in England and Wales (Figure 0-1). Within this frontage the coastal landforms vary considerably, comprising low-lying tidal flats with fringing salt marshes, hard rock cliffs that are mantled with glacial till to varying thicknesses, softer rock cliffs, and extensive landslide complexes.

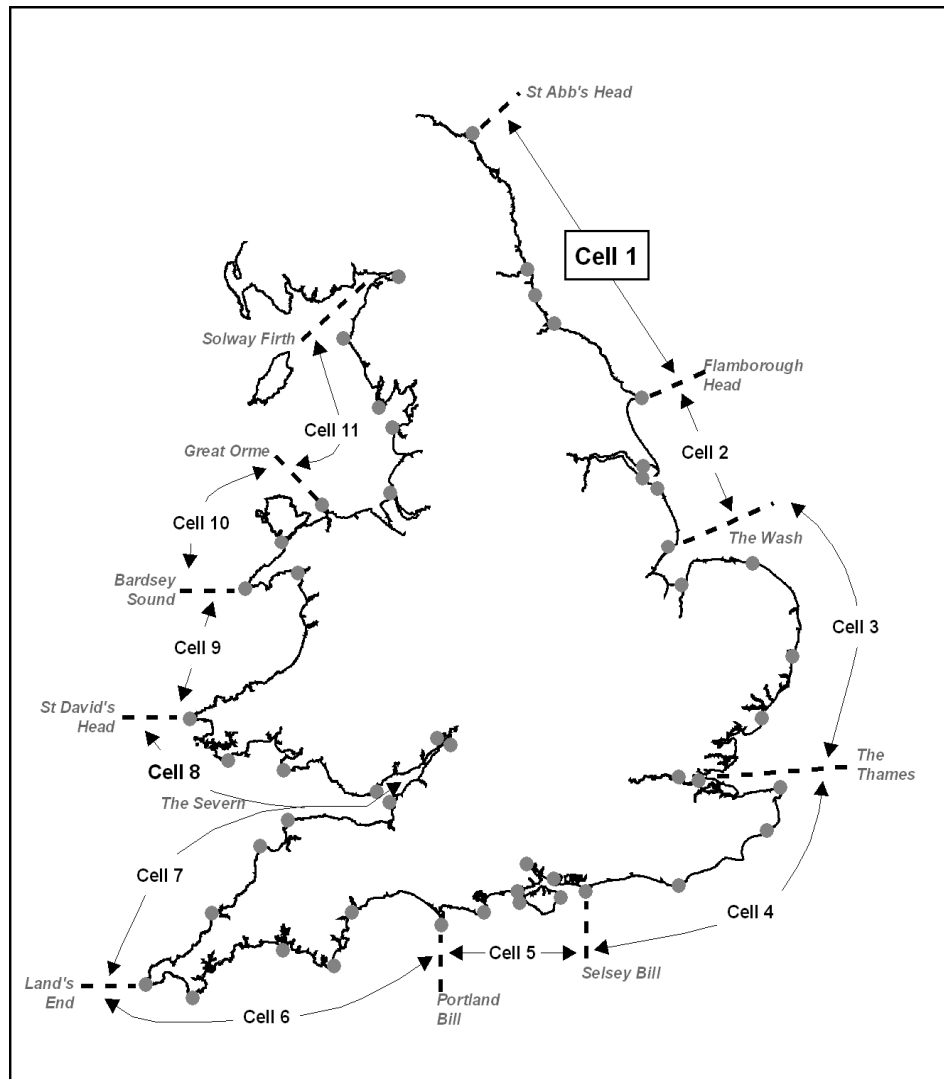


Figure 0-1 - Sediment Cells in England and Wales

The programme commenced in its present guise in September 2008 and is managed by Scarborough Borough Council on behalf of the North East Coastal Group. It is funded by the Environment Agency, working in partnership with the following organisations.



The main elements of the Cell 1 Regional Coastal Monitoring Programme involve:

- beach profile surveys
- topographic surveys
- cliff top recession surveys
- real-time wave data collection
- bathymetric and sea bed characterisation surveys
- aerial photography
- LiDAR survey
- walk-over inspection surveys

Royal HaskoningDHV has been appointed to provide Analytical Services in relation to the Cell 1 Regional Coastal Monitoring Programme 2016 - 2021.

Separate reports are produced for elements of the programme as and when specific components are undertaken, such as beach profile, topographic and cliff top surveys, wave data collection, bathymetric and sea bed characterisation surveys, and walk-over inspection surveys.

The present report is in addition to the above regular reports and covers a bespoke analysis of the coastal changes along the dunes at Coatham Sands in the borough of Redcar & Cleveland.

1. Introduction

The purpose of this report is to provide findings from a review of historic and contemporary maps and aerial photos to determine changes in land use and coastal erosion at the dunes along Coatham Sands, in the borough of Redcar & Cleveland.

All available aerial photos (historic and contemporary) from the Cell 1 Regional Coastal Monitoring Programme were downloaded from the North East Coastal Observatory website and viewed 'side by side' in ArcGIS to identify, describe and, where sufficient coastal change exists, quantify changes in the dunes along Coatham Sands, paying particular attention to the Majuba area towards the east of the frontage and any areas of identified change post 2013 and 2017 storm surges.

In addition, the selection of historic maps that is available from the National Library of Scotland website (which contains historic maps for the whole of the UK) was viewed on-screen for similar changes. [Note that the historic maps are not reproduced in this report due to copyright reasons].

2. Aerial Photography

1940

In the 1940 aerial imagery, the dunes adjacent to South Gare had not built out along the seaward edge of the spit in the manner that is observed in the present day, but instead occupied a bulbous shape, with a distinct ingress of sea water into a saline lagoon, with only a thin azimuth of land between the lagoon and the Bran Sands area of the River Tees estuary (Figure 1).

The Warrenby Slag Works are present in the 1940 imagery and slag deposits appear to push the shoreline seaward in locations immediately adjacent to the works, although the coastline here was still somewhat landward of its present day position in 1940 (Figure 2).

In the Majuba area, the present day caravan park had not been constructed in 1940 and whilst a seawall appeared to be present from the Redcar frontage towards the area of the present day Majuba car park, the car park itself was also not constructed at this time (Figures 3 & 4). It is notable that the dunes at this location were experiencing some vegetation loss and encroachment by the sea in the 1940s, even before the caravan park was built on this area.

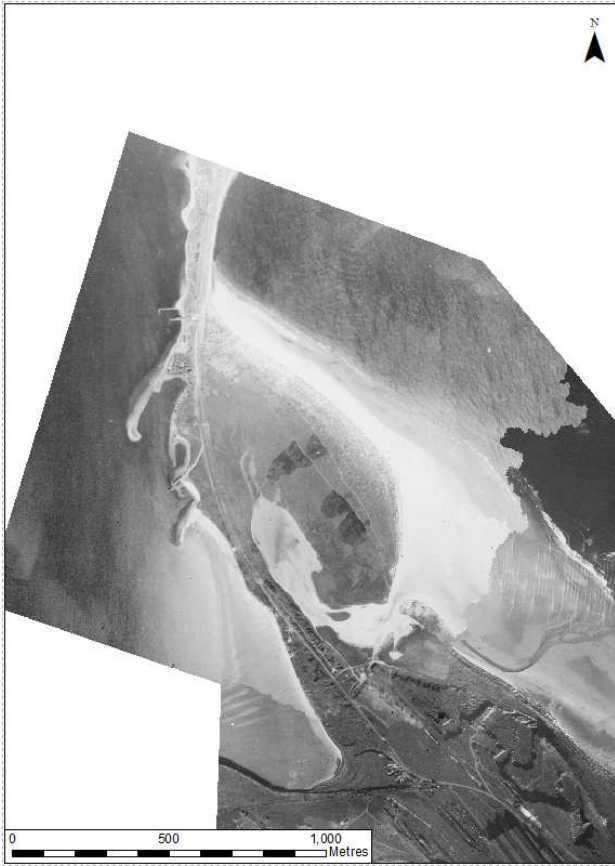


Figure 1 – South Gare, 1940 (left) and 2017 (right)

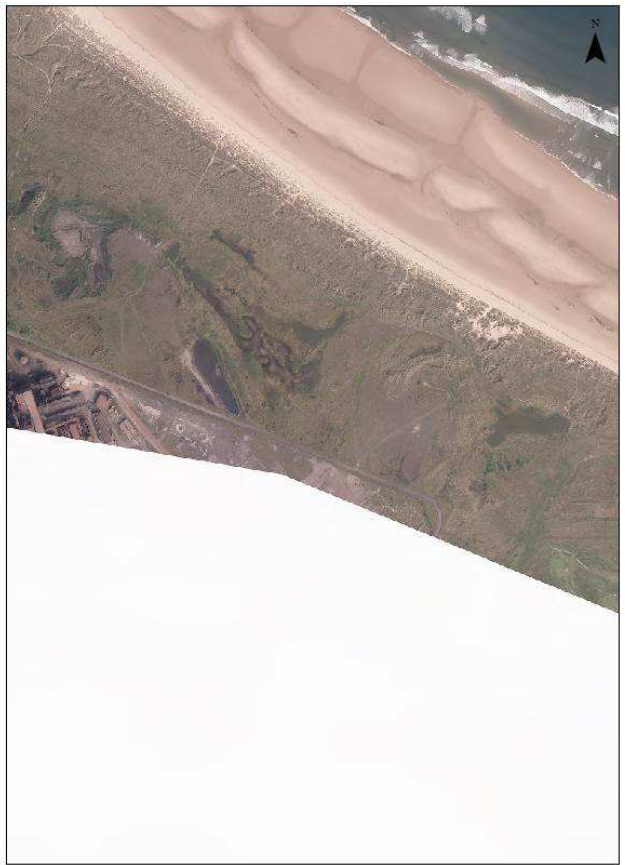


Figure 2 – Warrenby Slag Works, 1940 (left) and 2017 (right)

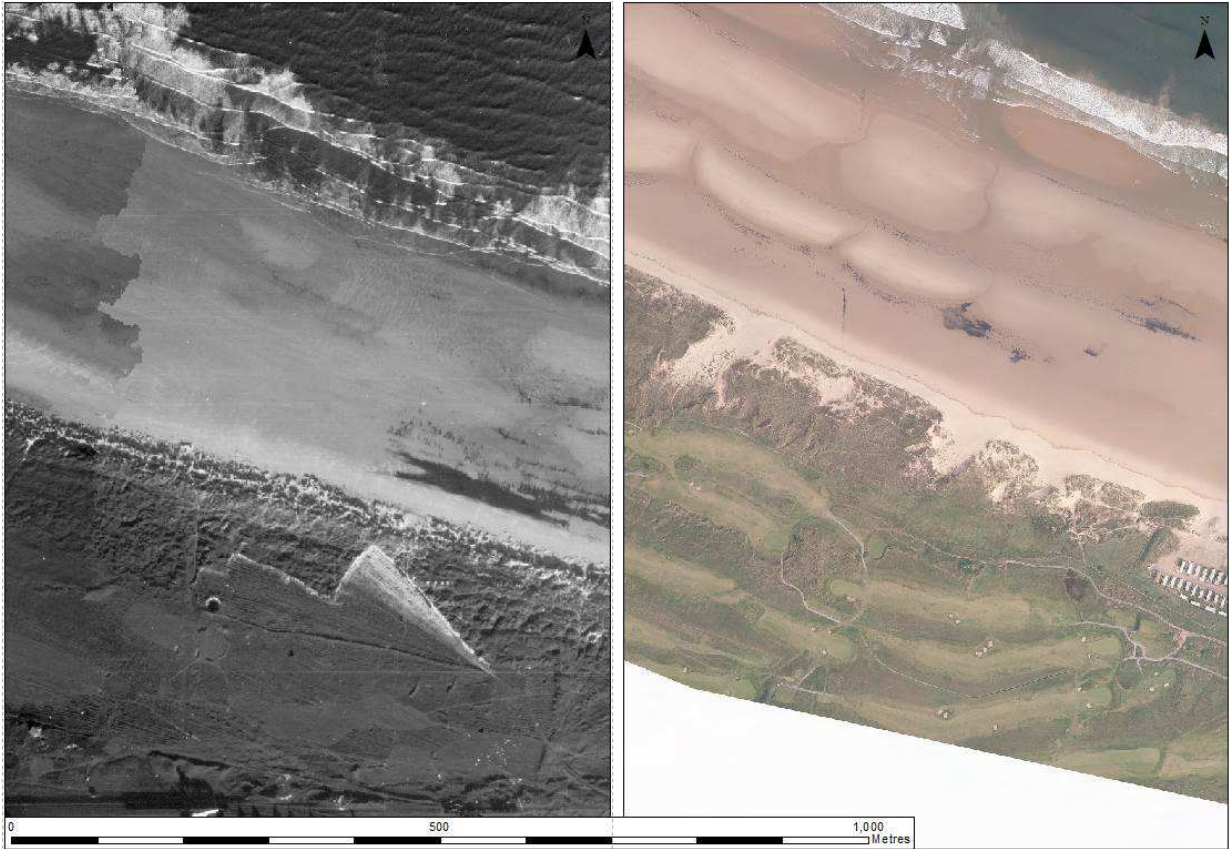


Figure 3 – Majuba Area (west), 1940 (left) and 2017 (right)



Figure 4 – Majuba Area (east), 1940 (left) and 2017 (right)

1999

By the time of the next available aerial photography from the Cell 1 Regional Coastal Monitoring Programme in 1999, the shore adjacent to the South Gare was undergoing change (Figure 5). It appears that sand or slag may have been artificially deposited to the east of the South Gare at this time, although the present day alignment had not yet been fully attained.

There had been continued progradation of the shore in the centre of the frontage, in the vicinity of the Warrenby Slag Works and the frontage by 1999 was appearing much more like a 'natural' dune system, with vegetated sand at the seaward limit, as opposed to a probable sand/slag mix present at the shore face in 1940 (Figure 6).

Both the caravan park and the car park had been constructed in the Majub area by 1999.



Figure 5 – South Gare, 1999 (left) and 2017 (right)



Figure 6 – Warrenby Slag Works, 1999 (left) and 1940 (right)

2009

By 2009, the shore adjacent to South Gare had continued to experience change, again likely in the form of sand/slag deposition and, due to the presence of the German Charlies in the nearshore, natural sand deposition in the now-sheltered areas. This resulted in quite a growth in the shore adjacent to the South Gare and stability in the dunes at the western end of the frontage (Figure 7).

Elsewhere along the frontage there was little change from 1999 to 2009, other than some exacerbation of areas of blow outs or bare dune vegetation to the immediate west of the caravan park in the Majuba area (Figure 8).



Figure 7 – South Gare, 2009 (left) and 1999 (right)



Figure 8 – Worsening of blow outs along eastern Coatham Sands, 2009 (left) and 1999 (right)

2010

There was little discernable change along the dunes in Coatham Sands between 2009 and 2010.

2012

The shore adjacent to South Gare appeared to contain greater quantities of material (sand/slag) and was more widely vegetated in 2012 than in 2010 (Figure 9).

At the Majuba area (Figures 10 & 11), part of the dunes adjacent to the caravan park were covered with hard-top and being used for car parking and portacabins in 2012. Presumably this was the Contractor's compund for the duration of construction of the Redcar Sea Defence Scheme. It is also noticeable that the seaward row of caravans seen in the 2010 imagery had been removed by 2012, indicating a risk from erosion or sea flooding at that time.



Figure 9 – South Gare, 2012 (left) and 2010 (right)



Figure 10 – Majuba Area (west), 2012 (left) and 2010 (right)



Figure 11 – Majuba Area (east), 2012 (left) and 2010 (right)

2015

The shore adjacent to South Gare showed some further growth between 2012 and 2015 (Figure 12), but elsewhere along the Coataham Sands frontage there was no significant difference in the shore between the 2012 and 2015 imagery, indicating that if the December 2013 storm did cause localised damage, there had been natural recovery by 2015.

Following completion of the Redcar Sea Defence Scheme, the Contractor's portacabins at the caravan park in the Majuba area had been removed by 2015, but the hard-top remained intact. The most seaward row of caravans seen in the 2015 imagery had been restored since being (temporarily) removed before the 2012 imagery (Figure 13).



Figure 12 – South Gare, 2015 (left) and 2012 (right)



Figure 13 – Majuba Area, 2015 (left) and 2012 (right)

2017

In the immediate lee of the South Gare breakwater, the trend continued to be one of accretion in the shelter of the structure, with a notable increase in the extent of dune vegetation (Figure 14). Some areas of ‘scalped’ dune evident in the 2017 aerial photography was also present in the photography that was collected in 2015 and appears not to have worsened. Arguably in some areas (e.g. Figure 15) it may have marginally recovered, although remaining heavily scalped.

Some areas that were anecdotally described as ‘breaching’ or ‘severely eroding’ during the January 2017 storms, were clearly in such a state before the 2015 photography was collected and thus the damage to these dunes cannot be ascribed to the January 2017 storms alone (Figures 16 to 2-10).



Figure 14 – Vegetation growth on dunes in the lee of South Gare Breakwater between 2017 (left) and 2015 (right)

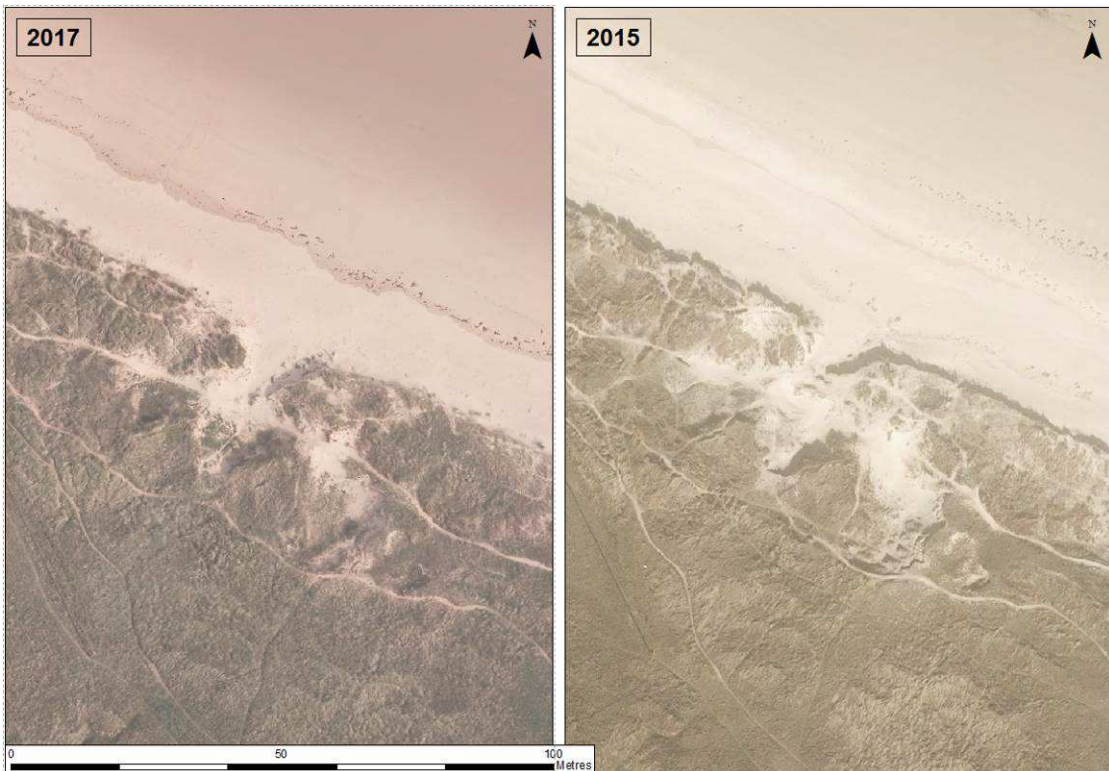


Figure 15 – ‘Scalloping’ of dunes along Coatham Sands in 2017 (left) and 2015 (right)



Figure 16 – Damage to dunes along Coatham Sands in 2017 (left) and 2015 (right)



Figure 17 – Damage to dunes along Coatham Sands in 2017 (left) and 2015 (right)



Figure 18 – Dune condition fronting western section of caravan park along Majuba Area in 2017 (left) and 2015 (right)



Figure 19 – Dune condition fronting eastern section of caravan park along Majuba Area in 2017 (left) and 2015 (right)

3. Historic Maps

OS One Inch, 1885 – 1903

In the first available historic map, the morphology of the Tees estuary is very different from the present day, with extensive areas of inter-tidal mud flat and salt marsh exposed at low tide, especially across Seal Sands and Bran Sands.

South Gare appears to be a natural spit at the mouth of the Tees estuary, with rail tracks along its length. The German Charlies slag banks were not present in the nearshore zone at this time and so the sand accumulated in the lee of the spit was more parallel with the spit than in the present day (the beach immediately in the lee of the German Charlies has built out as a small embayment in the present day).

At the root of the spit the Mean High Water (MHW) mark was in a considerably more landward position than in the present day, indicating that sand dune accretion has occurred at this western end of the frontage over the long term. However, this accretion has not only occurred in the vicinity of the spit at Tees Mouth; along the whole length between the spit and what is now known as the Majuba Road car park the historic MHW line was more landward than in the present day (although the width of progradation decreases with progression to the east so that the historic MHW mark is very close to the present day in the vicinity of the caravan park).

The line of MHW is not a smooth 'bay' shape, but does have some jagged undulations towards the western section, perhaps indicating some differences in the topography or maybe even a former channel mouth.

Conversely, along Majuba Road towards Redcar (and beyond to the east), the historic MHW mark was more seaward than in the present day, indicating net recession of the shore in this area.

OS Six Inch, 1888 – 1913 & OS 25 Inch, 1892 - 1914

The improved scale of the OS six inch mapping from a similar period, shows the South Gare Breakwater clearly present and the dunes in the vicinity of the present day caravan park named as Coatham Bank. The MHW mark was considerably landward of its present day position from Tees Mouth to the present day caravan park, indicating accretion along this length, with recession evident further to the east. The point at which the dunes switch from accretion to erosion between the historic maps and the present day is exactly at the western end of the Majuba Road car park.

OS 1:25,000, 1937 – 1961 & OS One Inch 7th Series, 1955 - 1961

By the time of this map, the German Charlies had been placed and started to modify the morphology of the dunes in their lee. The jagged undulation in line of MHW was particularly pronounced just to the west of Warrenby Slag Works which by now were present (and presumably responsible for the German Charlies slag banks).

Even at this time, the MHW was landward of its present day position along most of the frontage, but the 'switch-point' between the accretion and erosion had migrated to the western end of the caravan park. This indicates that the caravan park frontage has been under some pressure since around the mid 1950s.

4. Conclusions

Analysis of historic maps from the National Library of Scotland website (which contains historic maps for the whole of the UK) and aerial photographs from the Cell 1 Regional Coastal Monitoring Programme reveals the following key findings:

- Coatham Sands has, in places along its length, been strongly influenced by historic deposition of slag from local ironworks. This means that large parts of the dunes must be a mix (in some manner) of slag deposits and natural marine-deposited and subsequently wind-blown sand.
- Accretion due to natural processes and/or progradation due to slag deposition has particularly been observed to the immediate east of South Gare, but is evident to some extent along the whole of Coatham Sands until reaching the Majuba car park. These processes were exacerbated when slag was deposited off the South Gare thereby creating the German Charlies which caused even calmer conditions conducive to natural accretion of sand at the western end.
- The most vulnerable section of Coatham Sands is undoubtedly the Majuba area. Historically, to the west of the car park the frontage experienced progradation and to the east (along the car park frontage) it experienced recession. However, the zone of transition between progradation and recession appears to have migrated westwards over time, meaning that more of the caravan park frontage and area to the immediate west has been exposed.
- However, the 'scalped' nature of some sections of the dunes, especially towards the eastern end, has existed for some considerable time and cannot be ascribed to the effects of the December 2003 or January 2017 storms alone.
- The Majuba area, where it is understood there is an historic landfill at the core of the dunes with a covering of wind-blown sand, does appear to have lost vegetation (marginally) between 1999 and 2009 (Figure 20), perhaps due to local blow outs or storm erosion. However, the broad configuration of the dunes here has been roughly in its present condition consistently, with only minor changes, for some considerable time as shown by the similarities between the 2009 and 2017 photography (Figure 20). From previous field visits it is known that the historic waste material has become exposed on the seaward face where the covering of blown sand is absent, but this is not visible from the aerial photography.



Figure 20 - Majuba Area, 1999 (top), 2009 (middle) and 2017 (bottom)