



**Walk-over Visual Inspections of Selected Assets  
following Storm Surge of  
5th December 2013**



**Redcar and Cleveland  
Borough Council  
Supplementary Report**

**December 2013**

# Redcar and Cleveland Borough Council

## Cell One Coast Protection Assets Walk-over Visual Inspections of Selected Assets following Storm Surge of 5th December 2013

### Contents Amendment Record

This report has been issued and amended as follows:

Issue	Revision	Description	Date	Signed
1	0	First Issue	02/14	AP

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## Preamble

The Cell 1 Regional Coastal Monitoring Programme covers approximately 300km of the north east 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 1-1*). 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 sediment to varying thicknesses, softer rock cliffs and extensive landslide complexes.

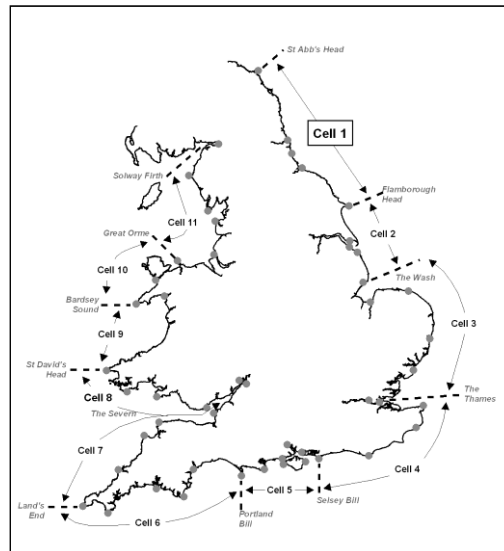


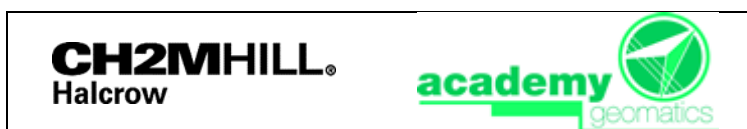
Figure 1-1: Sediment Cells in England and Wales

The work commenced with a three-year monitoring programme in September 2008 that was managed by Scarborough Borough Council on behalf of the North East Coastal Group. This initial phase has been followed by a five-year programme of work, which started in October 2011. The work is funded by the Environment Agency, working in partnership with the following organisations:



The original three year programme of work was undertaken as a partnership between Royal Haskoning, Halcrow and Academy Geomatics. For the current five year programme of work the data collection

associated with beach profiles, topographic surveys and cliff top surveys is being undertaken by Academy Geomatics. The analysis and reporting for the programme is being undertaken by Halcrow.



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
- walk-over surveys

In addition, separate reports are produced for other 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 sediment data collection, and aerial photography.

The present report provides a summary of the main findings of the Coastal Walk-over visual Inspections of assets of Redcar and Cleveland Borough Council's frontage that were carried out in September to November 2012.

On 5<sup>th</sup> December 2013 a significant storm surge, driven by strong northerly winds, coincided with one of the highest astronomical tides of the year. The normal astronomical tide level prediction for Whitby on the afternoon of 5<sup>th</sup> December (circa 1730hrs) was expected to be 2.8mAOD but the actual real-time (unchecked data) recorded sea level was 4.3mAOD, implying a 1.5m storm surge element. The surge event was accompanied by strong winds and large waves and resulted in reported damage to several coastal assets and significant geomorphological activity on the beaches and cliffs along Redcar and Cleveland Council's frontage. Visual inspection of the geomorphological activity status of the cliffs at Staithes and between Saltburn and Redcar was undertaken on Thursday 19 December 2013 and this report provides the results of that inspection.

# 1. Introduction

A storm surge on 5<sup>th</sup>/6<sup>th</sup> December 2013 caused significant damage to built and natural coastal defences along the north east coast of England. After the storm surge Scarborough BC requested Halcrow to visit selected locations and update inspection reports that were previously undertaken in 2012. This included visits to selected cliff and coastal slopes between Cowbar and Redcar.

It should be noted that although only selected locations have been visited for this report, the whole coastline will be subjected to repeat inspections under the Cell 1 Monitoring Programme later in 2014.

Although many parts of the coast were not inspected for this report, for consistency and to enable easy cross-referencing to the previous reports the format of this report follows that of the 2012 coastal inspection report, and for those locations visited, photographs and findings from the 2012 cliff inspections have been included to illustrate the baseline, with new text and photograph captions highlighted in bold text.

## 1.1. Methodology

### *Background*

Coastal Walkover Inspections have previously been undertaken every 2 years since 2002 between Scottish Border to River Tyne, and every 2 years since 2008 between River Tyne and Flamborough Head. The most recent inspection of the Redcar and Cleveland frontage was 2012. The approach to the inspections for this update is consistent with the previous work. The asset and slope inspectors have included Chartered Engineers (focusing mainly on the built coastal protection structures) and Engineering Geomorphologists (focusing mainly on the natural cliffs and coastal slopes) ensuring suitable skills are applied to each length of frontage.

### *Tide, surge and wave conditions*

Information on the exceptional tide, surge and wave conditions that occurred during the December 2013 storm are available from coastal monitoring instrumentation deployed under the Cell 1 Regional Monitoring at Whitby and Scarborough and also from national monitoring at the Tyne / Tees Cefas wave buoy. Further information on analyses of these data will be included in the 2013 wave data analysis update report which will be published under the regional monitoring programme later in 2014. However, for completeness of this report highlighted information from the near-real time telemetry data has been included in Section 2.2.

### *Coastal Slope Condition Assessment*

In 2012 a Coastal Slope Condition Assessment was undertaken by systematic walk-over inspection of the whole coastline by a team of geomorphologists who are familiar with the site having undertaken previous inspections in this area. The inspection involved visual assessment of cliff activity and noting specific areas of activity (e.g. landslides and tension cracks). All observations were documented with photographs and field notes. Each unit was identified, photographed and classified according to the five point activity scale as defined in Table 1.1. This classification scheme is the same as that used in previous cliff activity assessments undertaken by Halcrow for Scarborough Borough Council in Cell 1 (Halcrow 2002, Halcrow 2005, Halcrow 2010).

The 2012 Coastal Slope Condition Assessment walkover survey for the Redcar and Cleveland Borough Council frontage between Saltburn Sands (eastern side of Hazel Grove) in the north, to Cowbar Nab, Staithes in the south was conducted between 26<sup>th</sup> and 27<sup>th</sup> September 2012. The remainder of the natural coast assets between South Gare breakwater and Saltburn were inspected on 15<sup>th</sup> October 2012. The weather during that time was generally mild and dry. The 2012 inspection, full details of which are presented in Halcrow (2013), has been used as the baseline for this selective update. For the locations visited in December 2013 photographs from the 2012 inspection have been included in this report to illustrate changes. **The December 2013 Visual inspections of the status of the cliffs at Cowbar / Staithes and between Saltburn and Redcar was undertaken on Thursday 19 December 2013.**



For ease of reference and consistency with previous reports the photographs presented in this report have also been bordered with the colours from the key indicated below. Maps showing current activity and change in cliff activity since the last survey are provided in Appendix A.

Rank	Activity Class	Description
1	Dormant	Protected cliffline or landslide complex with no visible evidence of landslide activity.
2	Inactive	Relict cliffs or landslides with vegetated slopes and localised erosion of the toe or failure of the headscarp.
3	Locally Active	Retreating cliffline with localised small landslides or areas of erosion.
4	Partly Active	Retreating cliffline with very common smaller-scale landslides or areas of intense erosion.
5	Totally Active	Retreating cliff line almost entirely affected by large-scale landsliding or intense erosion.

Table 1.1. Cliff activity classes used in 2012 assessment and December 2013 update

**No assessment of the condition of the built coastal defences was undertaken for this update report.**

## 1.2. Study Area

This report provides an update to the condition of the coastal cliffs and natural assets along Redcar and Cleveland Borough Council's frontage, which extends from the South Gare Breakwater in the north, to Cowbar Nab, Staithes in the south. **For this update inspections were undertaken at Cowbar / Staithes and between Saltburn and Redcar only.** An overview of the study area is provided in Figure 1-1 below, which also shows the SMP2 Management Areas. Detailed maps of the cliff units are in Appendix A.

The naming convention for CBUs in this region is as follows: For CBU E59/6 the prefix relates to FutureCoast unit E59 and the suffix 6 relates to the specific area as defined in this case by the headland at Redhouse Nab (between Boulby and Cowbar).

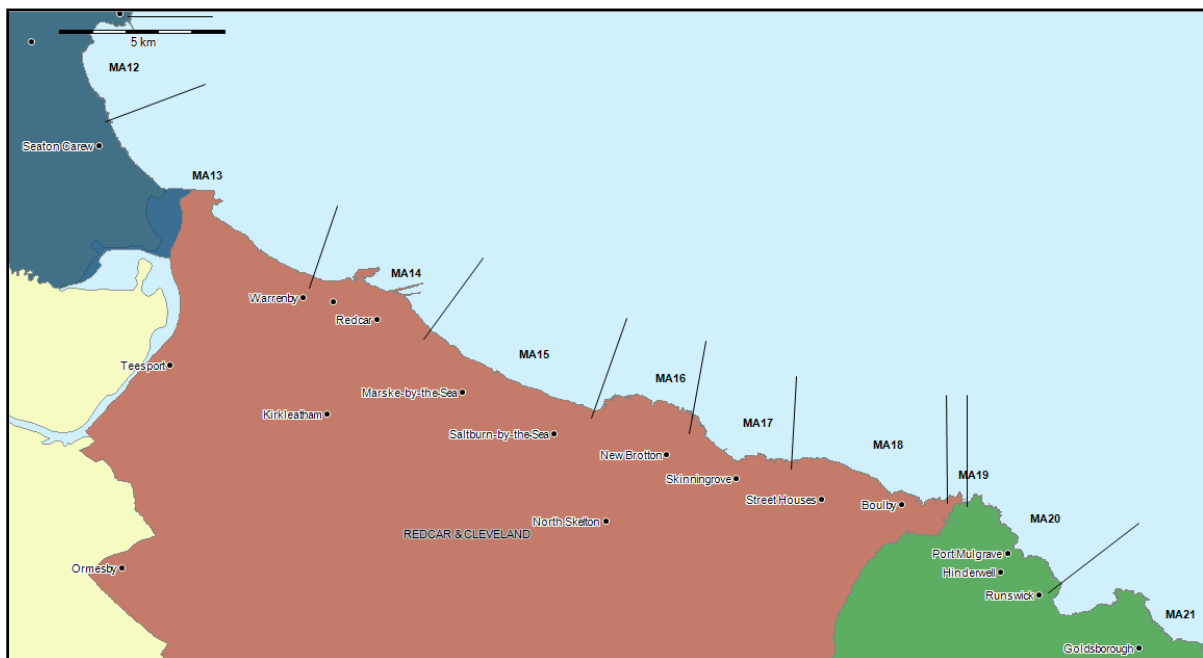


Figure 1-1: Study Area showing SMP2 Management Areas



## 2. Overview

### 2.1 Coastal Slope Condition Assessment

Variation in activity levels observed within this area reflects the diverse geology, past landslide activity and history of land-use.

The previous inspections in 2010 and 2012 highlighted the following areas as at higher risk of cliff activity in the vicinity of key assets and recommended regular monitoring:

- Hunt Cliff and Warsett Hill where the railway line runs close to the cliff edge.
- Between Boulby and Cowbar where intense erosion was observed and parts of Cowbar Lane continue to be lost. Setback of the road has been necessary. This poses a significant risk to local traffic as it is the only access road to Cowbar.
- Boulby Grange, where the cliff top has shown recession and may begin to threaten the Cleveland Way footpath.

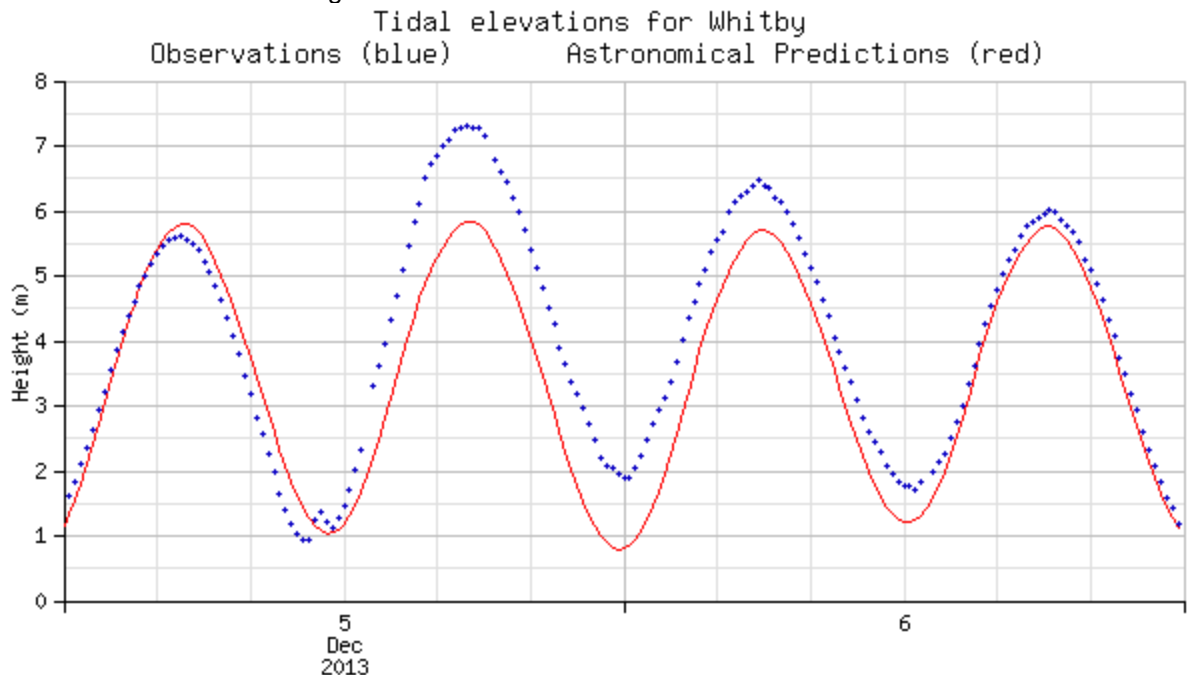
**The December 2013 inspection focused on the cliffs between Redcar and Saltburn and at Staithes. During that inspection, the following areas were elevated or downgraded in status or noted for their sustained activity. Detail and photographs of the relevant cliff units can be found in section 3.**

- **Redcar Sands – The coastal slopes behind the new defences (unit E52/11) have been downgraded in activity status from ‘Inactive’ to ‘Dormant’ as no minimal evidence of erosion and no indications of slope movement were identified here. Unit E52/10, immediately to the south east, was elevated in activity status from ‘Locally Active’ to ‘Partly Active’ due to consistent erosion throughout the unit and local exposure of the glacial till platform.**
- **Marske Sands – The low cliffs in unit E52/9 were downgraded in activity status from ‘Locally Active’ to ‘Inactive’ due to the absence of significant erosion or failure here. Unit E52/5 was elevated to a status of ‘Locally Active’ as toe erosion was consistent throughout the unit albeit the upslope extent of this erosion, and its effects in terms of destabilising the upper slope, seemed limited at this point in time. Unit E52/4 retained its status of ‘Partly Active’ due to large parts of the cliffs still being well vegetated. However, toe erosion was substantial, extending in sandy materials to several metres in height, albeit in these areas the upper cliff continued to be well vegetated. In areas of more cohesive materials, toe erosion seemed to be less in terms of upslope extent, but the oversteepening through removal of the toe appeared to have initiated failures in the midslope.**
- **Saltburn Sands – Unit E52/1 has been downgraded from an activity status of ‘Locally Active’ to ‘Inactive’ due to the absence of recent ground movements. The glacial till cliffs of unit E53/4 to the east of the town have been elevated in status from ‘Locally Active’ to ‘Partly Active’ to consistent toe erosion throughout the unit and slumping in the midslope.**

## 2.2 Tide and wave conditions during the 5th / 6th December 2013 surge

### Recorded sea levels during the surge

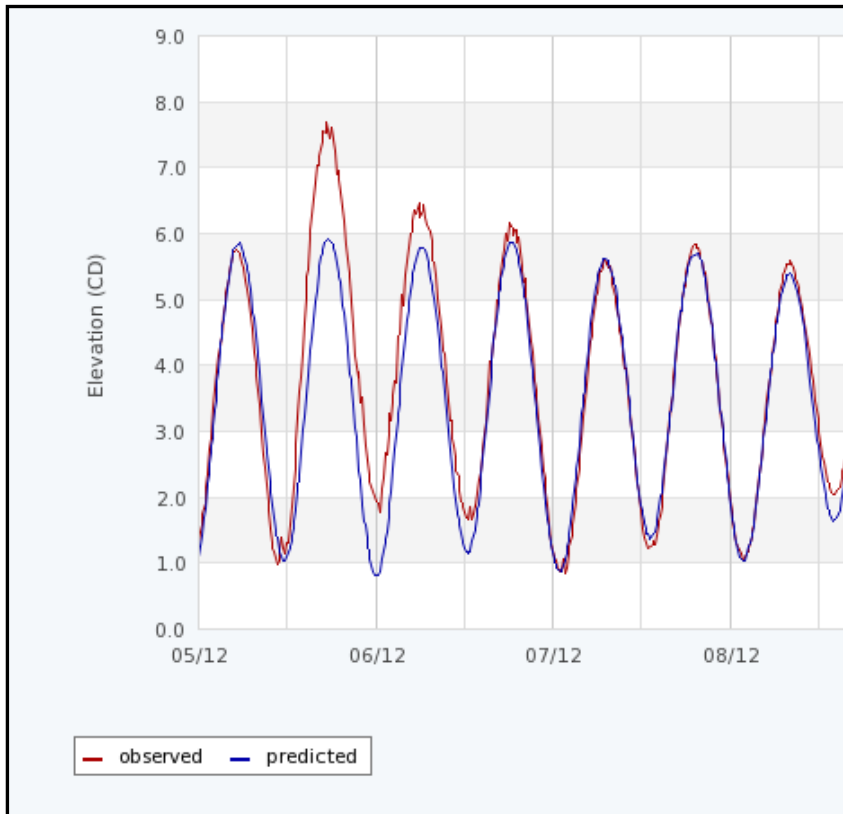
Whitby: There is a Class A tide gauge located at Whitby that forms part of the National monitoring programme, with real-time and checked historical data published regularly on the internet. Figure 2-1 below shows predicted and recorded tide levels for Whitby during the December 5th / 6th storm surge event. Note that Chart datum is 3.0m below Ordnance Datum.



**Figure 2-1 Predicted and near real time measurements of tide level (mCD) at Whitby on 5<sup>th</sup> to 6<sup>th</sup> December 2013.** Image and data courtesy of National tide and Sea Level Facility at the National Oceanography Centre

<http://www.ntsfl.org/data/realtime?port=Whitby&from=20131205&span=4>

Scarborough: There is a tide gauge in Scarborough Harbour that has been present since about 2006, and has been managed under the Cell 1 regional monitoring programme since 2012. Data is displayed in near real-time on both the Channel Coastal observatory and North east coastal observatory websites. Figure 2-2 below shows real time recorded and predicted recorded levels.



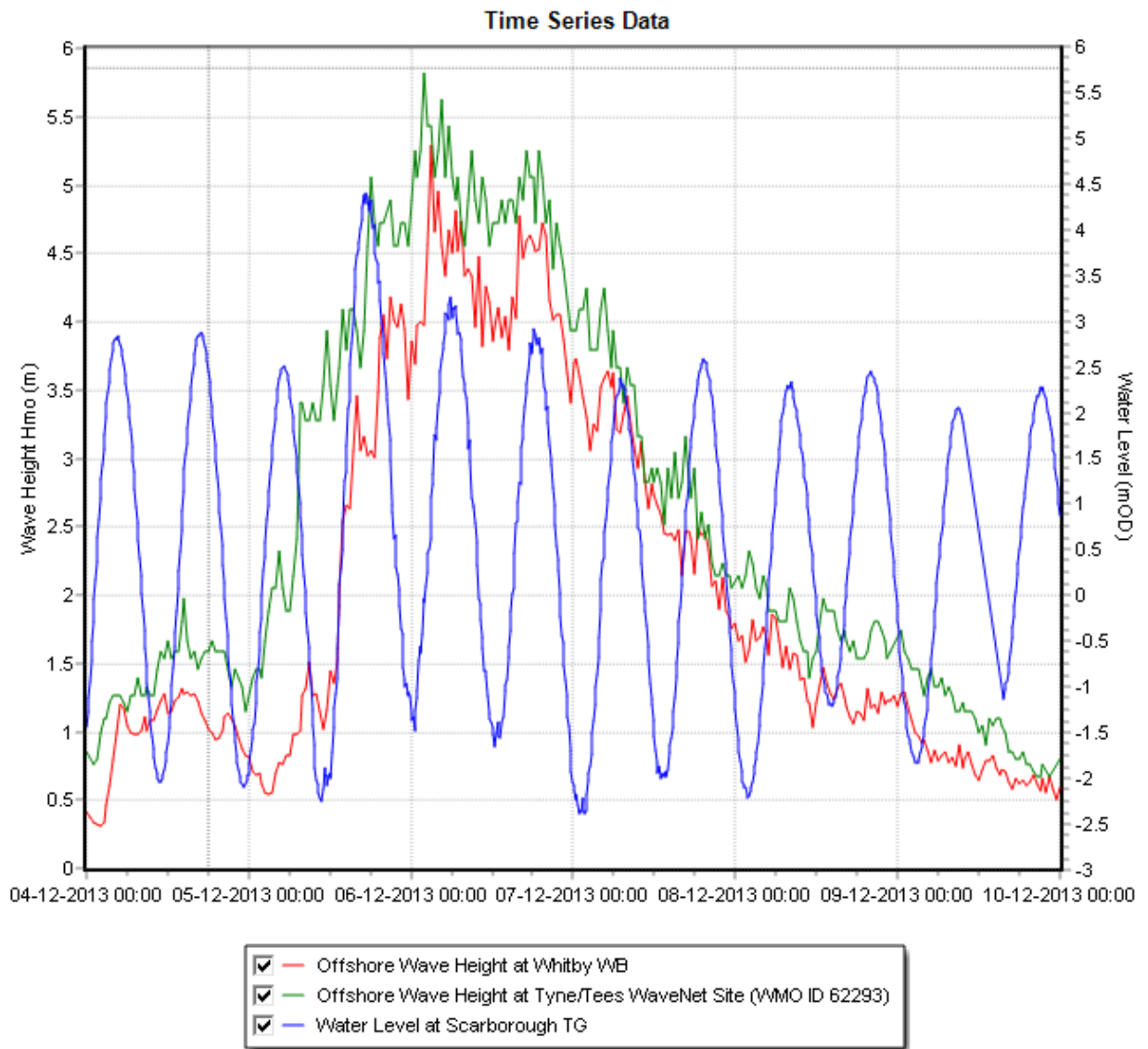
**Figure 2-2 Predicted and near real-time measurements of tide data at Scarborough for the December 5<sup>th</sup>/ 6<sup>th</sup> storm surge.** Image courtesy of Channel Coastal Observatory ([http://www.channelcoast.org/data\\_management/real\\_time\\_data/charts\\_neco/?chart=111&tab=tides&start=1386201600&end=1386806400&disp\\_option=&datum=chart](http://www.channelcoast.org/data_management/real_time_data/charts_neco/?chart=111&tab=tides&start=1386201600&end=1386806400&disp_option=&datum=chart))

The annual tide gauge report for the Scarborough tide gauge (CCO, 2014, <http://www.northeastcoastalobservatory.org.uk/Default.aspx?view=pnlTexts&text=Reports>) indicates that the maximum water level recorded was 4.39m OD on 05-Dec-2013 at 17:20. The surge (difference between predicted and measured) was 1.66m at the time of the maximum water level, but the maximum surge height recorded occurred during the rising tide and was 1.75m on 05-Dec-2013 at 15:50. The highest previously recorded tide level since the gauge was deployed in 2003 occurred in 2005 and was 3.66m OD.

The EA (2011) Coastal Flood Boundary condition extreme water level data for Scarborough (Chainage 3750) indicates that the 1 in 100 (1% AEP) level = 4.0mOD, 1 in 200 (0.5%) = 4.2mOD, 1 in 500 (0.2%)= 4.3mOD, 1 in 1000 (0.1%) = 4.5mOD. However, the confidence at 1% AEP is +/-0.3m and at 0.1% AEP +/- 0.5m. This therefore suggests that in terms of maximum recorded water level the event may have been a 1 in 200 (1% AEP) or rarer event. At Whitby the results are similar as the recorded level of approx. 4.3mOD compares to the EA (2011) CFB levels for the 1 in 200 and 1 in 500 levels of 4.1mOD and 4.3mOD, which both have confidence level of +/-0.3m.

#### **Recorded Wave data during the storm surge**

There are three wave buoys in the region that record wave data, these being the offshore Tyne / Tees Cefas WaveNet buoy and the Whitby and Scarborough wave buoys deployed under the Cell 1 regional monitoring programme. Figure 2-3 below shows the recorded wave data at Whitby and Tyne Tees, plotted together with recorded tide levels from Scarborough. It is interesting to note that the peak wave heights were not exceptionally large at the time of the maximum surge and that larger waves occurred on the following two high waters.



**Figure 2-3 Recorded wave data at Tyne Tees and Whitby plotted together with water level data for Scarborough**






### 3. Condition Assessment

This section provides an account of observations made on the condition of cliffs and coastal assets within Redcar and Cleveland Borough Council's coastline, running from north to south. For this update report only locations where either the coastal slopes were inspected by Halcrow in December 2013 have been included in this report. Information extracted from the 2012 report to give the baseline for each location and comments from the December 2013 inspections are given in bold text.

#### *Coastal Slope Condition Assessment*

Brief descriptions and photographs are provided, with reference made to groups of CBUs of similar activity. Location and activity status of the CBUs referenced in the study area are shown on maps 1 to 2 in Appendix A. These maps also show change in activity.

Photographs have been bordered with colours in order to show their activity status, as follows:

	Totally Active
	Partly Active
	Locally Active
	Inactive
	Dormant

#### 3.1 Coatham Sands

This frontage was not included in the December 2013 inspections.

#### 3.2 Redcar

This frontage was not included in the December 2013 inspections.

#### 3.3 East Redcar to Saltburn-by-the-Sea

##### *Coastal Slope Condition Assessment*

**Refer to Map 1 in Appendix A for locations described.**

The 2012 inspection report found that the CBUs between Redcar and Saltburn showed evidence of recent instability. The units E52/10 to E52/8 between Redcar east and Marske are classified as Locally Active. Most of the movement of the slopes appeared to be localised simple cliff failures. Signs were present along The Stray south of Mill Howle warning members of the public of landslips. Further south in this section, at E52/9 and E52/8 the cliffs are afforded some protection by the increasingly wide cobble beach at the toe, see photos below. Immediately to the north of Marske, E52/7 is classified as Dormant as it is defended at its toe by low level sand dunes and a series of masonry and concrete walls and shows no evidence of landslide activity. At the headland at Marske, E52/6 there are low accreting dunes protecting the cliff toe.

From Marske to Saltburn the crest level of the coastal slopes increases and the slopes become vegetated with localised erosion at the toe. In 2012 CBUs E52/6 and E52/5 were classified as Inactive, whilst E52/4 is partly active.

**Whilst not evaluated in 2012, unit E52/11 was identified for inspection following the storm surge in December 2013. The tide was high at the time of inspection making the beach difficult to inspect. However, principal observations were that substantial amounts of coarse material had accumulated against the defences several that pipes**

were exposed on the beach and exposures of fine material (substrate) indicated possible localised beach lowering. However, the new defences in this unit appeared to have experienced no damage and the small slope on the landward side of the defence only showed signs of very patchy erosion, which is possibly not related to the storm surge. As such this unit was downgraded from 'Inactive' to 'Dormant'.



**MU52/11 – Intact Defences. December 2013.**  
(Dormant)



**MU52/11 – Exposed pipe (one of several).**  
Provides reference for beach level.(Dormant)

**Unit E52/10 is a low till cliff which is experiencing erosion throughout the whole unit. This unit gently protrudes relative to the rest of the coast and forms a very subtle headland. In some areas coarse material has accumulated significantly at the back of the beach but in many areas the till platform (concealed beneath the coarse material where present) was exposed. This unit has been elevated in status from 'Locally Active' to 'Partly Active' due to the whole unit showing signs of erosion.**

**Units E52/9 and E52/8 are still afforded greater protection than E52/10 by relatively wide beach which appears to have had a more substantial sand proportion than may have been the case during previous inspections. Very little activity was identified in unit E52/9 and therefore this unit's activity status has been downgraded to 'inactive'. Unit E52/8, showed toe erosion throughout the length of the unit, but which was limited in terms of its height in the cliff and has therefore retained its 'Locally Active' status.**

**Unit E52/7 is still protected by walls and low dunes at its toe and shows no signs of activity. It therefore continues to be classified as dormant.**

Unit E52/5 showed very little evidence of erosion except at the very toe and has therefore retained an 'Inactive' status. This unit has a higher and steeper beach than Unit E52/5 to the south, which has experienced more severe toe erosion albeit without further instability in the upper cliff. As such the activity status of unit E52/5 has been elevated from 'Inactive' to 'Locally Active'.

Unit E52/4 has retained its activity status of 'Partly Active' on the basis that the toe erosion has been very substantial, particularly where the lower cliff is comprised of sand (primarily the northern part of the unit). Where the cliff is formed of more cohesive materials (i.e. clay and silt, derived from glacial till), the upslope extent of toe erosion is less but this oversteepening of the toe appears to have a greater impact in terms of failures initiating in the from the mid and upper slopes. It is possible therefore that the unconsolidated more sandy material, being less cohesive, is more susceptible to toe erosion from marine action, but the more cohesive materials experience failure in the upper slope during wet weather, exacerbated by the removal of support at the toe, even though the upslope extent of this toe erosion is more limited.





E52/10 Interface between new seawall and cliff at Mill Howle (Locally Active) October 2012



E52/9 Cobble beach gives some protection to Locally active cliff October 2012



**E52/10 – Comprehensively eroding unit, with some coarse material at back of beach and less extensive exposures of till platform (see right). December 2013 (Partly Active).**



**E52/10 – More severe recent erosion and local exposure of till platform. December 2013 (Partly Active)**



**E52/9 - December 2013. (Inactive)**



**E52/8 – Consistent toe erosion throughout unit but limited in its extent upslope. December 2013 (Locally Active)**





E52/7 Sand dunes and walls to toe of vegetated slope (Dormant) Photo from 2010



E52/7 Sand dunes and walls to toe of vegetated slope (Dormant) Photo October 2012



**E52/7 – December 2013. (Dormant)**



**E52/7 - December 2013. (Dormant)**



E52/6: Coastal slopes viewed looking north (Inactive) September 2012



E52/5: Coastal slopes viewed looking south (Inactive) September 2012



**E52/6 - Northern part of unit looking north. This unit was noted to have a steeper beach than units to the south with only limited, inconsistent erosion at its toe. December 2013**



**E52/5 – Substantial and consistent toe erosion, but little evidence of instability in the upper cliff. This level of erosion was consistent throughout the unit. December 2013 (Locally Active).**



**E52/4: Coastal slopes viewed looking east to Saltburn (partly active) September 2012**



**E52/4: Coastal slopes viewed looking north west from Saltburn (partly active) September 2012**



**E52/4 – Significant toe erosion in sandy material and turf detachments above. Northern part of unit. December 2013. (Partly Active).**



**E52/4 - Southern part of unit showing less toe erosion in more cohesive materials but shallow failures further up in the cliff. December 2013. (Partly Active).**



**E52/4 – View looking northwards from south end of unit to show beach condition. December 2013 (Partly Active)**

### **3.4 Saltburn-by-the-Sea**

#### *Coastal Slope Condition Assessment*

In 2012 it was reported that the CBUs in and around Saltburn-by-the-Sea do not show much evidence of recent instability.

Units **E52/3b, E52/3a, E52/2** above Saltburn Sands were in 2012, as previously in 2010 classified as Inactive. These units are defended at the toe by a sea wall and are well vegetated. Small cracks were seen in some of the footpath surfaces, but this is related to normal wear and not erosion or ground movement. **During the December 2013 post-storm surge inspection it was noted that there were several unvegetated areas in the upper cliff where shallow failures had exposed underlying material. It was also noted throughout this section that the surge had caused damage to the defences.**

CBU **E52/1** showed more activity in 2012, with loose materials and localised erosion at the head of the large mound situated just east of Saltburn Gill and remained classified as Locally Active. **However, during the post-storm surge inspection in 2013, such activity was not noted and therefore the activity status of this unit has been downgraded to 'Inactive'.**

To the east, CBU **E53/5** was classified as Dormant in 2010. In 2012 there had been recent shallow slumping on the cliff face and the unit was reclassified as Locally Active. The slumping had occurred despite the presence of toe protection and probably occurred in response to the wet weather experienced in the latter half of 2012. **The slump scar had not completely revegetated by the time of the December 2013 inspection and therefore the status of 'Locally Active' has been retained.**





**E52/3b** from the stable and well vegetated cliffs above Saltburn Sands (Inactive) September 2013



**E52/3a** the stabilised slopes close to the Cliff Lift (Inactive) September 2013



**E52/3b** – Stabilised slopes with no evidence of instability. However, damage to sea wall experienced during surge as indicated by ongoing repairs. December 2013. (Inactive)



**E52/3b** – Stabilised, defended slopes. December 2013. (Inactive).



**MU52/3a – Views from North (top left) to south (bottom right). Slope is defended but minor shallow instability noticed at several places in units. Repairs ongoing adjacent to cliff lift. Note accumulation of large volumes of coarse material (in piles, bottom right photo). December 2013. (Inactive).**



**E52/2** the stable cliffs above Saltburn Sands (Inactive) September 2013



**E52/1** looking up at well vegetated cliffs from Saltburn Sands (Locally Active) September 2013



**E52/2 – Stable Cliffs. December 2013.  
(Inactive)**



**E52/2 – Sea wall damaged during storm surge at toe of E52/2. December 2013.  
(Inactive)**



**E52/1 – Little evidence of activity at this point 'Inactive'. December 2013. (Inactive)**





**E53/5** has slumped, leaving open cracks in the cliff face and resulting in instability classified as Locally Active. September 2012



**E53/5** – Slump identified in previous survey not yet completely revegetated therefore ‘Locally Active’ Status has been retained. December 2013

### **3.5 Cliffs northeast of Saltburn**

#### *Coastal Slope Condition Assessment*

Northeast of Saltburn the cliffs have a slope-over-wall form, with a weak till overlying a steep hard rock cliff. The till is subject to periodic mudslides, which result in material falling over and staining the cliffs and deposition of a debris apron along the cliff toe. The debris apron is partly-vegetated, indicating periodic activity in the form of wave erosion and debris falls.

Unit **53/4** was noted in 2012 as having been subject to recent localised mudsliding in the till. The unit therefore remained classified as Locally Active until 2012. **However, widespread toe erosion was noted in this unit, along with failure of a substantial parts of the mid and**



upper slopes, therefore the activity status of this unit has been elevated to 'Partly Active'.

Unit 53/3 and 53/2 also have a slope-over-wall form. The units were classified in 2012 as Locally Active (53/3) and Partly Active (53/2) reflecting the degree of mudslide activity in the till and wave erosion of the resulting debris cone. The Partly Active unit (E53/2) is characterised by widespread mudslide activity in the till. **Only unit E53/3 was inspected during the post storm surge inspection in December 2013 and this unit retained the same characteristics and therefore a status of 'Locally Active' was retained.**

Unit 53/1 was showing signs of developing mudslides in the upper till section in 2012.



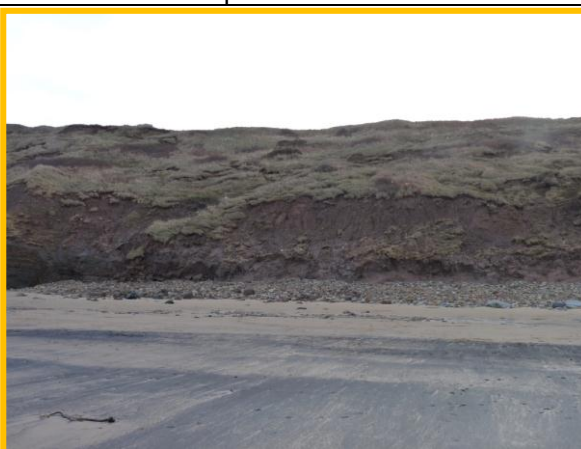
**E53/4** Slumping in the till layer of the cliff northeast of Saltburn (Locally Active).  
September 2012



**E53/3 and E53/2** The rock part of the cliff is steep and exposed. The till part is much shallower and vegetated (Locally Active).  
September 2012



**E53/4 – Continued slumping of the till cliffs (northern end of the unit). Toe erosion has been consistent throughout the unit and therefore the activity status has been elevated to Partly Active. December 2013.**



**E53/4 – Continued slumping of the till cliffs (southern end of the unit). Toe erosion has been consistent throughout the unit and therefore the activity status has been elevated to Partly Active. December 2013.**



**E53/3 – Northern part of unit. December 2013.  
(Locally Active)**



**E53/3 – Central part of unit. December 2013.  
Note streaking down cliff due to  
erosion/failure of till. (Locally Active).**



**E53/1 Instability in the upper till section of this unit (Locally Active).**

### **3.6 Hunt Cliff and Warsett Hill, west of Skinningrove**

This area was not included in the December 2103 inspections

### **3.7 Cattersty Cliff and Skinningrove**

This area was not included in the December 2103 inspections

### **3.8 Skinningrove to Boulby**

This area was not included in the December 2103 inspections

### **3.9 Boulby to Cowbar Nab**

This area was not included in the December 2103 inspections

### 3.10 Management Unit 4 – Staithes and Cowbar

#### *Coastal Slope Condition Assessment*

This Management Unit comprises the high cliffs of Cowbar Nab and those behind and immediately to the east of Staithes (Appendix A Map 2).

The eastward facing end of Cowbar Nab (MU4/1a and E60/1a) features exposed, bedded and jointed rock and has very limited vegetation cover. There is ongoing erosion of softer material at the headscarp and evidence of recent rockfall activity from the blocky lower face is present along the walkway beneath the cliff face. As a result this unit was classified in 2012 as Totally Active, as it was in 2008.

**During the post-surge inspection in December 2013, it was noted that in these units there had been relatively recent rockfalls and that there were significant talus deposits. Displaced rock armour and a rockfall block was noted on the path beneath these units, although it is not completely evident whether these blocks had been purposefully moved or had come to rest there. Given this high level of activity, the ‘Totally Active’ status for these units has been retained.**

**Unit MU4/1b** is the south facing side of Cowbar Nab which runs adjacent to Staithes Beck. This unit is sheltered from the wave action because it is upstream of the harbour walls. The cliff does fail occasionally and has been given a classification of Partly Active. Further upstream from MU4/1b a rockfall has occurred on the steep slope adjacent to Staithes Beck. **No change in the level of activity following the December 2013 storm surge here was noted and therefore the ‘Partly Active’ status has been retained.**

**Unit MU4/2** sits behind Staithes Harbour and is classified as Partly Active. This cliff is generally well vegetated with small localised patches of erosion. The eastern end of the unit is more exposed than the rest of the unit because of its position in the bay and is more prone to erosion. Failed material is evident in at the toe of the cliff and recent activity has been reported by residents of the eastern part of High St. The unit has been re classified from Locally Active to Partly Active to reflect this recent phase activity, which was likely to have been triggered by the exceptionally wet weather of 2012. **Following the December 2013 storm surge, this unit appeared to conform to the same description albeit with less evidence of talus at the toe which may have been removed during the surge.**

Further east, beyond the extent of Staithes harbour is unit **MU4/3**. The face of this unit is almost entirely exposed and showing signs of active erosion. Unlike any of the other cliffs within this Management Unit, this section is not protected at the toe and is therefore subject to marine erosion. This unit was classified as Partly Active in the 2009 and 2012 walkover surveys. **During the post December 2013 storm surge survey, evidence of rockfall accumulations at the base of the cliff were noted, along with evidence of recent failure in the overlying tills, indicated by exposed material at the top of the cliff and ‘streaking’ on the cliff face.**





**MU4/1a** - Exposed and active end of Cowbar Nab, the southern half (Totally Active). Sept 2012



**E60/1a** - The northern half of Cowbar Nab. The cliff face is showing signs of erosion (Totally Active) Sept 2012



**MU4/2** –Vegetated cliff with localised erosion, behind Staithes harbour (Partly Active). Sept 2012



**MU4/2** – There have been a number of recent failures in this management unit, which is now classed as Partly Active. Sept 2012



**MU4/1a** - The southern part of Cowbar Nab after the December 2013 surge – note fresh scarring in cliff face (Totally Active)



**E60/1a**- The northern part of Cowbar Nab after the December 2013 surge. Note relatively fresh scarring and talus accumulation on left of photo. (Totally Active)



**MU4/1a - Close up photo of talus accumulation behind rock armour after the December 2013 surge. (Totally Active)**



**MU4/1a - Displaced rock armour and rockfall block on path after the December 2013 surge. (Totally Active)**



**MU4/1a - Beach condition after the December 2013 storm surge. (Totally Active)**



**MU4/1b – No noticeable change in activity status following the surge. (Partly Active)**



**MU4/2 – Cliff behind Staithes harbour. No notable change post December 2013 surge except lack of talus accumulation. (Partly Active)**



**MU4/2 - Beach condition post December 2013 storm surge. Note absence of talus at base of cliff. (Partly Active)**





**MU4/3 – undefended cliff east of Staithes Harbour. Note red-brown ‘streaking’ on cliffs from failures in till.**

## **4. Comparison with Previous Assessments**

### *Coastal Slope Condition Assessment*

The previous cliff condition assessment undertaken in summer 2010 and September 2012 is available for comparison with this inspection.

#### **Following the storm surge of 5th December 2013:**

Unit E52/11 has been downgraded in activity status from 'Inactive' to 'Dormant' as minimal evidence of erosion and no indications of slope movement were identified here.

Unit E52/10 has been elevated in activity status from 'Locally Active' to 'Partly Active' due to consistent erosion of the cliff face throughout the unit and local exposure of the glacial till platform.

Unit E52/9 has been downgraded in activity status from 'Locally Active' to 'Inactive' due to the absence of significant erosion or failure.

Unit E52/5 was elevated to a status of 'Locally Active' as toe erosion was consistent throughout the unit albeit the upslope extent of this erosion, and its effects in terms of destabilising the upper slope, seemed limited at this point in time.

Unit E52/4 retained its status of 'Partly Active' due to large parts of the cliffs still being well vegetated. However, toe erosion was substantial, extending in sandy materials to several metres in height, albeit in these areas the upper cliff continued to be well vegetated. In areas of more cohesive materials, toe erosion seemed to be less in terms of upslope extent, but the oversteepening through removal of the toe appeared to have initiated failures in the midslope.

Unit E52/1 has been downgraded from an activity status of 'Locally Active' to 'Inactive' due to the absence of recent ground movements.

Unit E53/4 to the east of the town have been elevated in status from 'Locally Active' to 'Partly Active' to consistent toe erosion throughout the unit and slumping in the midslope.

## **5. Problems Encountered and Uncertainty in Analysis**

### *Coastal Slope Condition Assessment*

During the December 2013 inspection the only problems encountered concerned the combined tidal pattern and limited daylight hours. The tidal pattern restricted access to the cliff toe and assessment of beach condition at those sites visited in the late afternoon, although where it was felt necessary these sites were revisited at the next low tide during daylight hours. Low light and higher tides also made photographs of the whole of some of the larger units difficult. However, several closer shots were taken where this was the case to ensure a comprehensive record. Neither of these issues had a significant impact on the assessment of the cliffs activity status.



## 6. ***Conclusions and Recommended Actions***

### *Findings for Coastal Slopes*

It is recommended that monitoring of the entire frontage should be continued regularly by interpretation of data collected by aerial survey under the Cell One programme and the next planned walkover inspection in 2014.

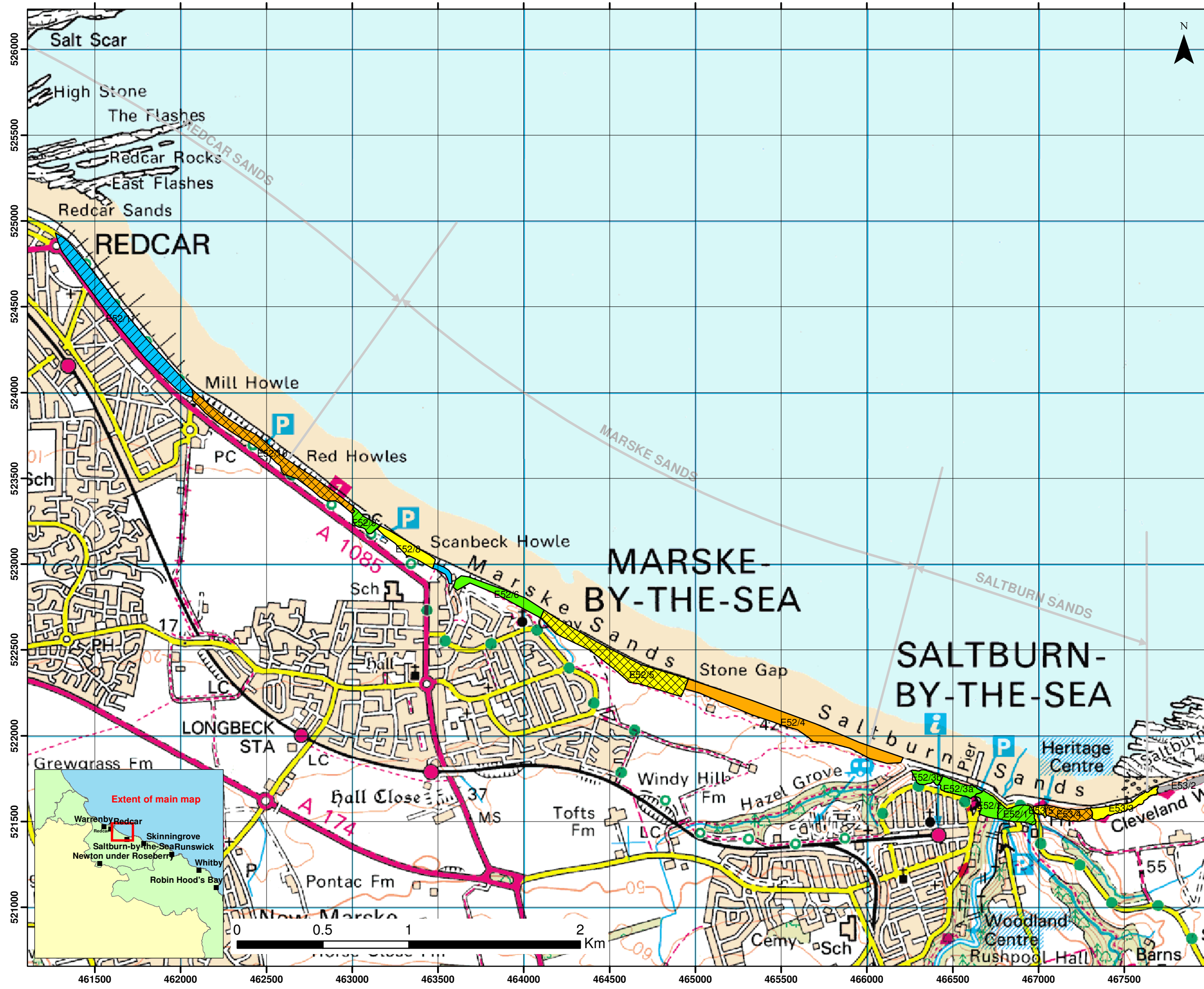
Activity levels remain high for most of this stretch of coastline. As a result it is recommended that the entire frontage be regularly inspected. Areas of particular concern are located at units E54/3a and in the vicinity of E59/3. The former is where the railway line runs extremely close to the cliff edge around Warsett Hill. The latter is classified as Partly Active and is where parts of the abandoned Cowbar Lane are being lost to erosion and failure. Close monitoring of the cliff top position near to the buildings at Boulby Grange (E58/1a) would also be beneficial given the proximity of the headscarp to the footpath here.

**It is recommended that particular attention be paid during the scheduled regular 2014 inspection to the condition of the units highlighted in section 4 and those mentioned immediately above. It is likely that the steepening of the cliff profile through erosion of the toe in many of these units will be a contributory factor in future failures of the upper cliff during prolonged wet periods.**

## **Appendix A**

### **Coastal Slope Condition**

#### **Maps 1 – 2**



**KEY**

**Cliff activity**

**December 2013**

- Totally active
- Partly active
- Locally active
- Inactive
- Dormant
- Not inspected

**Change due to surge**

**Sept 2012 to Dec 2013**

- Increase in activity
- Reduction in activity
- No change in activity

Client: North East Coastal Group  
 Project: Cell 1 Regional Coastal Monitoring Programme 2011 to 2016

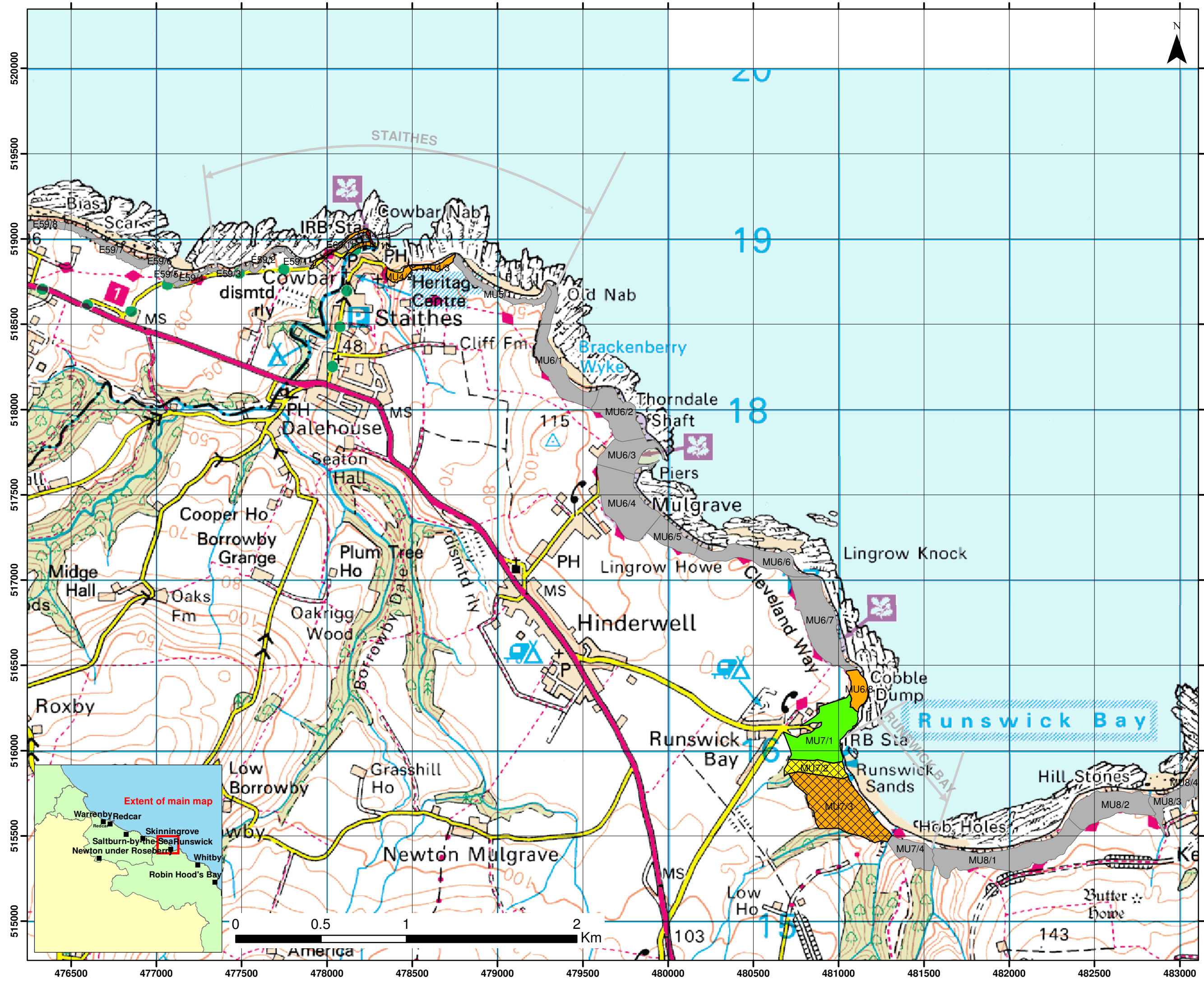
**Post Storm Surge  
 Cliff Inspection  
 December 2013  
 Redcar & Cleveland  
 Borough Council**

Map 1 - Redcar Cliff Activity

**Halcrow**  
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**KEY**

**Cliff activity**

**December 2013**

- Totally active
- Partly active
- Locally active
- Inactive
- Dormant
- Not inspected

**Change due to surge**  
**Sept 2012 to Dec 2013**

- Increase in activity
- Reduction in activity
- No change in activity

Client: North East Coastal Group  
 Project: Cell 1 Regional Coastal Monitoring Programme 2011 to 2016

**Post Storm Surge  
 Cliff Inspection  
 December 2013  
 Redcar and Cleveland  
 Borough Council**

Map 2 - Staithe and Runswick Bay Cliff Activity

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