ROYAL HASKONING

Halcrow

Cell 1 Regional Coastal Monitoring Programme
Coastal Walkover Inspections 2010

REDCAR & CLEVELAND BOROUGH COUNCIL

Redcar and Cleveland Borough Council

Final Report

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Contents

Appendices

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Abbreviations and Acronyms

Acronym / Abbreviation	Definition
CAM	Condition Assessment Manual
NFCDD	National Flood and Coastal Defence Database

Asset Condition Grades

Grade	Condition Description
1	Very Good
2	Good
3	Fair
4	Poor
5	Very Poor

Glossary of Terms

Term	Definition
Beach nourishment	Artificial process of replenishing a beach with material from another source.
Berm crest	Ridge of sand or gravel deposited by wave action on the shore just above the normal high water mark.
Breaker zone	Area in the sea where the waves break.
Coastal squeeze	The reduction in habitat area which can arise if the natural landward migration of a habitat under sea level rise is prevented by the fixing of the high water mark, e.g. a sea wall.
Downdrift	Direction of alongshore movement of beach materials.
Ebb-tide	The falling tide, part of the tidal cycle between high water and the next low water.
Fetch	Length of water over which a given wind has blown that determines the size of the waves produced.
Flood-tide	Rising tide, part of the tidal cycle between low water and the next high water.
Foreshore	Zone between the high water and low water marks, also known as the inter-tidal zone.
Geomorphology	The branch of physical geography/geology which deals with the form of the Earth, the general configuration of its surface, the distribution of the land, water, etc.
Groyne	Shore protection structure built perpendicular to the shore; designed to trap sediment.
Mean High Water (MHW)	The average of all high waters observed over a sufficiently long period.
Mean Low Water (MLW)	The average of all low waters observed over a sufficiently long period.
Mean Sea Level (MSL)	Average height of the sea surface over a 19-year period.
Offshore zone	Extends from the low water mark to a water depth of about 15 m and is permanently covered with water.
Storm surge	A rise in the sea surface on an open coast, resulting from a storm.
Swell	Waves that have travelled out of the area in which they were generated.
Tidal prism	The volume of water within the estuary between the level of high and low tide, typically taken for mean spring tides.
Tide	Periodic rising and falling of large bodies of water resulting from the gravitational attraction of the moon and sun acting on the rotating earth.
Topography	Configuration of a surface including its relief and the position of its natural and man-made features.
Transgression	The landward movement of the shoreline in response to a rise in relative sea level.
Updrift	Direction opposite to the predominant movement of longshore transport.
Wave direction	Direction from which a wave approaches.
Wave refraction	Process by which the direction of approach of a wave changes as it moves into shallow water.

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). 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.

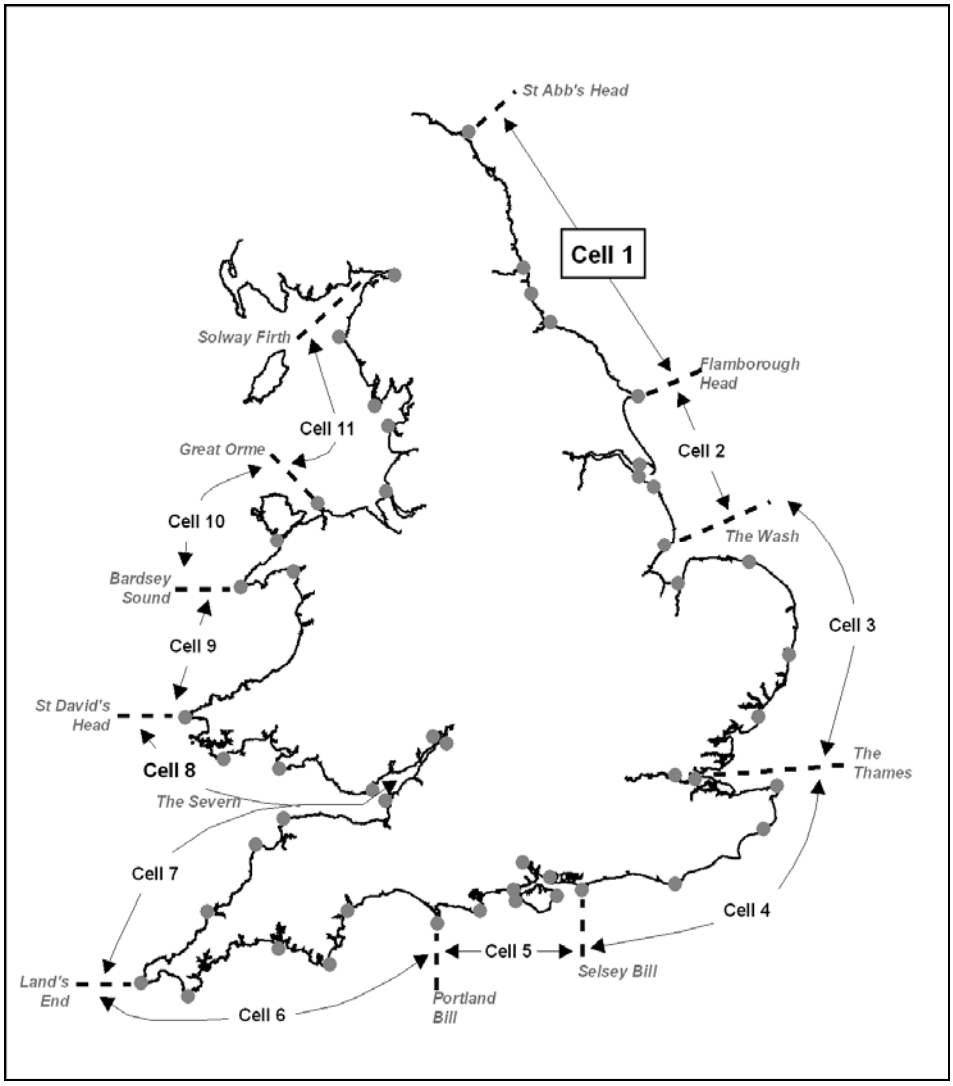

Figure 1 - Sediment Cells in England and Wales

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 data collection, analysis and reporting is being undertaken as a partnership between 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
- walk-over surveys

The present report is **Coastal Walkover Inspections 2010** and provides a summary of the main findings from the walkover inspections of Redcar and Cleveland Borough Council's frontage that are undertaken once every 2 years.

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.

1 Introduction

1.1 Study Area

This report documents the condition of the coastal cliffs and 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.

The majority of the frontage between the River Tees and Saltburn is characterised by natural undefended coastal slopes of varying profile and level, with extensive concrete and masonry sea defences at Redcar and local defences at Marske-by-the-Sea and Saltburn. South of Saltburn, the frontage is characterised by slope-over-wall cliffs comprising Lower Jurassic Lias clays and limestones overlain by glacial sediments. Between Skinningrove and Boulby the natural cliffs are largely replaced by extensive abandoned quarries cut back into the coastline. In places, the quarries are steep and extend down to sea level. East of Boulby the cliffs are lower, with the clear stratigraphy of the Lower Jurassic Lias rock and glacial sediment evident again.

The cliff behaviour units (CBUs) previously mapped along this stretch of coast in 2008 were adopted in this inspection, with adjustments made where units were found to deviate from the mapping.

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).

1.2 Methodology

This section outlines the approach taken by the slope and asset inspectors, respectively, for the Redcar and Cleveland Borough Council coastal frontage.

Coastal Slope Condition Assessment
The cliff condition assessment comprised a systematic walk-over of the whole coastline by a team of geomorphologists in August 2010. The weather conditions during this time were generally warm and fair. This inspection involved visual assessment of cliff activity and noting specific areas of elevated activity (e.g. landslides and tension cracks). All observations were documented with photographs (ground level obliques) and annotated field maps. Each unit was identified and classified according to the five point activity scale as defined in Table 1.1. This classification scheme is identical to that used in the Saltburn to Staithes assessment undertaken during the 2008 walk-over survey. Brief descriptions of the condition of the cliffs were also entered into the National Flood and Coastal Defence Database (NFCDD) for all areas of undefended coastline.

This report provides a summary of the cliff condition as assessed in August 2010, and of how this differs to assessments from previous years. A fuller discussion of geology and specific mechanisms of cliff failure can be found in previous reports (Halcrow 2002, Halcrow 2005, High Point Rendel 2002).

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

Table 1.1 Cliff activity classes used in the August 2010 assessment.

The inspection was primarily conducted from the cliff-top, due to access restrictions and health and safety concerns associated with steep cliff faces and tidally inundated beaches. The coastline is largely followed by the Cleveland Way cliff top footpath. Where the footpath moved inland the inspection kept to the cliff edge (as best as possible) to ensure the whole coastline was observed and activity recorded. The beach and foreshore were only directly inspected where safe access was possible, i.e. at Coatham, Marske-by-the-Sea, Saltburn-by-the-Sea, Skinningrove, and Staithes Harbour.

Coast Protection Asset Condition Assessment
The visual assessment of built assets was carried out by a team of asset inspectors and structural engineers in August and September 2010. The weather experienced during this period was mild and generally fair and dry. Assets were graded based on their condition (as defined in Table 1.2), residual life and urgency of repair work, following standard Environment Agency guidelines and the Condition Assessment Manual (CAM). This classification scheme is the same as that used during inspections in 2008 and that planned for future inspections. Inspections were made from both the seaward and landward side of defence where possible. Observations were photographed and all data were stored 'live' in the offline NFCDD Poweruser software using ruggedised laptops.

Asset descriptions provide an overview of findings, summarising each locality and identifying individual assets of poor condition, failing structures and assets that have the potential to fail. It is anticipated that this will help identify areas for investment, including repair work, replacement or the installation of a different asset type. This report will also highlight assets with a certain level of importance or interest.

Grade	Rating	Description
1	Very Good	Cosmetic defects that will have no effect on performance.
2	Good	Minor defects that will not reduce the overall performance of the asset
3	Fair	Defects that could reduce performance of the asset.
4	Poor	Defects that would significantly reduce the performance of the asset. Further investigation needed.
5	Very Poor	Severe defects resulting in complete performance failure

Table 1.2 Condition assessment grading used in the 2010 assessment

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.

In total 60 CBUs were observed during the 2010 walkover inspection of this frontage, of which 8 were classed as Totally Active, 21 as Partly Active and 31 as Locally or less active (Figure 1). Assets along this stretch of coastline include intermittent property, the Warsett Hill railway line, the lane at Cowbar, and the cliff top footpath.

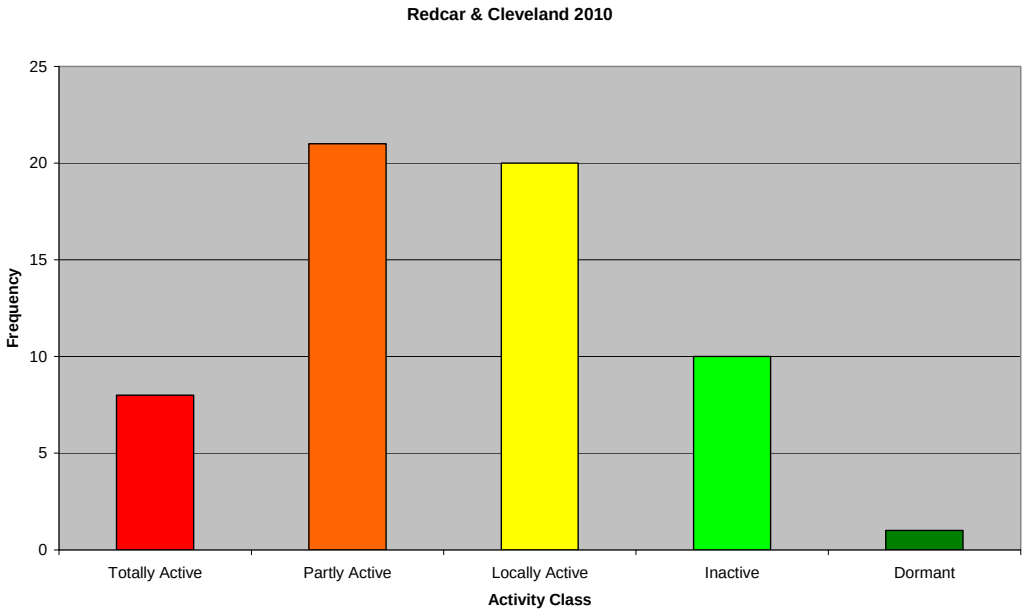

Figure 1. Frequency of cliff activity along the Redcar & Cleveland frontage in 2010

As in 2008, of particular concern is the activity observed at the following locations:

- 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.

Ongoing monitoring of these sites is recommended.

2.2 Coast Protection Asset Condition Assessment

As identified in the 2008 inspection, the South Gare Breakwater at the northern end of Coatham Sands (Asset Ref No 1221C901C0506C01) remains in poor condition which is further deteriorating and requires urgent remedial works. A detailed survey of the structure is recommended as this will identify if local, isolated repairs are sufficient or whether a broader strategy/scheme which considers the condition and performance of the whole structure is more appropriate.

The assets protecting the Redcar frontage were inspected during the 2008 inspection although these assets were not inspected as part of the present study as extensive Environment Agency funded capital works to upgrade the 2.7km of assets from Coatham to the eastern extent of The Stray were to commence imminently.

The timber groynes along Redcar Sands to the east of Redcar (Asset Ref No 1221C901C0603C01) remain in poor condition identified in 2008, with large numbers of planks missing and piles beginning to split although higher beach levels encountered during the 2010 inspections obscured some of these defects.

As during the previous inspection, the masonry seawall protecting much of the frontage at Saltburn (Asset Ref No's 1221C901C0703C02 to 1221C901C0704C06) requires repointing in places. East of Skelton Beck there are sea defences which in 2008 displayed extensive defects. These defects have now been repaired in an ad-hoc fashion.

At Skinningrove, the jetty continues to show evidence of significant cracking, deformation and corrosion in places (Asset Ref No. 1221D901D0201C02). Although It is disused as a jetty, access is still possible and so consideration should be given to public health and safety. It is strongly recommended that the jetty is once again secured to prevent public access.

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.

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 all CBUs in the study area are shown in Appendix A. Data concerning change in coastal slope condition are provided in Appendix B. A full assessment of cliff condition has been entered into NFCDD.

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

- Totally Active
- Partly Active
- Locally Active
- Inactive
- Dormant

Coast Protection Asset Condition Assessment
Brief descriptions and photographs are presented for key assets and those where there are significant defects or where the condition has changed significantly since the previous inspection. Photographs have been bordered with colours in order to show their condition as follows:

- 5 – Very poor
- 4 – Poor
- 3 – Fair
- 2 – Good
- 1 – Very good

Coast protection asset condition data is also provided in Appendix C, additionally any changes in condition are highlighted in Appendix D. A full assessment of coast protection asset condition has been entered into NFCDD.

3.1 Coatham Sands

Coastal Slope Condition Assessment

As reported in 2008, the sand dunes (E52/11) were generally stable with a good coverage of established vegetation. Minor erosion, loss of vegetation and lowering of dune crests was evident locally where members of the public access the beach most frequently (the northern and southern extents of the dunes). A healthy beach level was maintained throughout Coatham Sands.

E52/11 View towards Redcar (Inactive)

E52/11 Local lowering of dunes and loss of vegetation due to pedestrian access (Inactive)

Coast Protection Asset Condition Assessment

The northern extent of the Redcar & Cleveland frontage is marked by the South Gare Breakwater.

The structure was generally in poor condition throughout with significant cracking, spalling, loss of mortar and sealant and exposure of reinforcing steel to many of the concrete and masonry elements and undercutting and local slumping of the slag embankments.

The western side of the breakwater appeared in worse condition than the eastern side due to the defects observed in the slag embankment section of the structure. Large sections of in-situ concrete render were missing from the western side of the breakwater, which had exposed the earth/rubble core of the structure and was beginning to undercut the crest road. Failure of a concrete toe and apron has exacerbated the damage, with evidence of washing out of significant amounts of infill material. These defects were identified locally in the 2008 inspection and appear to have become more extensive in the interim as undercutting and local slope failure was evident throughout the western side of the breakwater. This area requires urgent attention to limit further damage.

Extensive local slope failure on west side of structure (Asset Ref No 12221C901C0506C01)

Undercutting of slag embankment on west side of structure (Asset Ref No 12221C901C0506C01)

Several pre-cast concrete seawall units were missing towards the seaward extent of the structure exposing cracked and rust stained concrete walls beneath with extensive spalling of concrete.

Extensive spalling of concrete at head of breakwater (Asset Ref No 12221C901C0506C01)

Missing pre-cast concrete units at head of breakwater(Asset Ref No 12221C901C0506C01)

Local in situ concrete pours were evident to the eastern side of the structure, replacing the missing deck slabs and infilling/covering the voids identified in the 2008 inspection.

Voids present in deck - 2008 (Asset Ref No 12221C901C0506C01)

Slab repairs to deck on east side of structure – 2010 (Asset Ref No 12221C901C0506C01)

A detailed survey of the structure was beyond the scope of the present inspection and a full structural survey of the breakwater is recommended in order to establish the full extent of the damage and identify appropriate remedial works.

To the west of Redcar, the defences comprise a grouted stone revetment with a concrete wall along the crest. Beach levels were higher than during the 2008 inspections, obscuring most of the revetment element. The concrete wall was generally in good condition although missing a section towards its northern extent. This appeared to be used as an access point to the beach, resulting in a loss of beach material and exposure of the revetment. Beach levels were lower towards the south of the asset, exposing more of the revetment which appeared in fair condition with minor grout loss and vegetation growth.

Gap in concrete wall and exposed revetment
(Asset Ref No 12221C901C0601C01)

Loss of concrete render exposing grouted stone
(Asset Ref No 12221C901C0601C01)

3.2 Redcar

Coastal Slope Condition Assessment
There are no coastal slopes along the defended length of frontage at Redcar.

Coast Protection Asset Condition Assessment
The existing sea defences at Redcar were not covered as part of the current asset inspections as major Environment Agency funded capital works to upgrade 2.7km of assets from Coatham to the eastern extent of The Stray were to commence imminently.

East Redcar to Saltburn-by-the-Sea

Coastal Slope Condition Assessment
The CBUs between Redcar and Saltburn show evidence of recent instability. And the units E52/10 to E52/8 are classified as Locally Active. Most of the movement of the slopes appears to be localised minor headscarp failure. Signs are present along The Stray warning members of the public of landslips.

Extensive burrowing by Sand Martins was observed in the softer material towards the crest of the coastal slopes. This weakening of the material had exacerbated local headscarp failure. The coastline had receded notably surrounding a concrete outfall structure at Mill Howle.

E52/10 Sand Martin activity evident in upper slope face (Locally Active)

E52/10 Local headscarp failure (Locally Active)

E52/10 Erosion of natural slopes surrounding outfall structure at Mill Howle (Locally Active)

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. From Marske to Saltburn the crest level of the coastal slopes increases and the slopes become vegetated with localised erosion at the toe. CBUs E52/6 to E52/4 are classified as Inactive.

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

E52/5:Coastal slopes viewed looking north (Inactive)

E52/4: Coastal slopes viewed looking south (Inactive)

Coast Protection Asset Condition Assessment

The defence assets to the east of Redcar comprise of a grouted stone revetment with an insitu concrete render. The concrete render was missing in places, exposing the grouted stone below which showed some minor loss of grout and stones. The 2008 inspection identified local undercutting and void formation at the toe of the structure although this was not observed in the 2010 inspection due to higher beach levels.

Loss of concrete render exposing grouted stone with minor voids (Asset Ref No 1221C901C0602C01)

Loss of concrete render. Local infill repairs evident (Asset Ref No 1221C901C0602C01)

Missing concrete render – evidence of local patch repairs (Asset Ref No 1221C901C0701C01)

The frontage along Zetland Park and The Stray is protected by a grouted stone revetment with a concrete render which was in fair condition. The render appeared to have been lost locally, exposing the rock revetment below. Minor void formation was evident locally due to material loss and some vegetation growth was evident in some of these voids. Local infill repairs were observed and appeared to be performing well. The paving forming the promenade and the low concrete wall to its rear were in good condition suggesting no global movement or instability of the revetment.

The timber groynes along Redcar Sands showed evidence of damage with both natural and human contributors – evidence of fire damage was observed at the landward end of several groynes. Broken and missing boards became more prevalent moving southwards along the groyne field. The groynes appeared to be operating effectively as the beach level was generally healthy throughout, with increasing levels moving southwards. Beach levels were higher than during the 2008 inspections as the sheet piles around the base of the piles were generally buried.

Fire damage and missing/broken timbers (Asset Ref No 1221C901C0701C01)

The masonry revetment (Asset Ref No 12221C901C0702C02) to the north west of the beach access at Marske was in poor condition with extensive loss of blocks and erosion of the material below. Vegetation growth within the voids obscured a large proportion of the structure. The low beach level exposed the masonry wall below the revetment which showed evidence of local settlement although this was of the same magnitude as observed in 2008 which suggests the structure is stable.

Missing masonry blocks with erosion and vegetation growth below (Asset Ref No 12221C901C0702C02)

Local settlement of masonry structure (Asset Ref No 12221C901C0702C02)

Crack in concrete wall below coastal slope (Asset Ref No 12221C901C0702C03)

The concrete wall (Asset Ref No 12221C901C0702C03 at the toe of the vegetated slope was cracked through its full height. This defect was reported in the 2008 inspections and appeared to be of the same width and extent. The slope above (CBU E52/7) showed no evidence of recent movement or any placement of excessive loading on the structure.

The masonry wall to the southeast of the beach access at Marske (Asset Ref No 12221C901C0702C01) has a large settlement crack and missing bricks to the seaward end and is in similar condition to that reported in 2008. Minor scour appeared to be occurring to the rear of the wall.

Masonry wall with cracks and missing masonry at seaward extent (Asset Ref No 12221C901C0702C01)

3.3 Saltburn-by-the-Sea

Coastal Slope Condition Assessment

The CBUs in and around Saltburn-by-the-Sea do not show much evidence of recent instability. The units above Saltburn Sands are all classified as Inactive. Despite the presence of cracks in some of the footpaths, these units are defended at the toe by a sea wall and are well vegetated (E52/3b, E52/3a, E52/2). CBU E52/1 shows more activity, with loose materials and localised erosion at the head of the large mound situated just east of Saltburn Gill, and is consequently classified as Locally Active. To the east, CBU E53/5 is defended, heavily vegetated and showing no signs of recent instability, it is therefore classified as Dormant.

E52/3a looking up at well vegetated cliffs from Saltburn Sands (Inactive)

E52/1 erosion at the head of the mound just east of Saltburn Gill (Locally Active)

Coast Protection Asset Condition Assessment

A 600m long masonry seawall protects much of the frontage at Saltburn, running from 1221C901C0703C02 at Hazel Grove Foot in the west, through 1221C901C0704C04 which is the Lower Promenade until it reaches the pier, and finishes with 1221C901C0704C04 and 1221C901C0704C06 at Skelton Beck. The Saltburn Pier is of timber and steel construction and fixes to the sea wall north of Skelton Beck. Beach gravel deposits are located at the toe of the wall throughout its length.

There is an outfall which exits at Hazel Grove Foot and is protected by a trash screen. At the time of inspection the screen was partially blinded, therefore it is recommended that this be cleared. Other recommended actions include repointing of masonry blockwork and re-sealing the expansion joints between in-situ concrete promenade slabs. There are several other small defects which should be noted and repaired – a small section of a lower hand railing is missing and occasional coping stones are missing or have been repaired.

Partially blinded outfall exiting through sea wall at Hazel Grove Foot
(Asset Ref No 1221C901C0703C02)

Cracked wing wall in slipway attached to sea wall at Hazel Grove Foot
(Asset Ref No 1221C901C0703C02)

View looking east along Lower Promenade
(Asset Ref No 1221C901C0704C04)

View looking west along Lower Promenade
(Asset Ref No 1221C901C0704C04)

Example of area where repointing is needed
(Asset Ref No 1221C901C0704C04)

One section where a section of hand rail is missing
(Asset Ref No 1221C901C0704C04)

Example of coping repair
(Asset Ref No 1221C901C0704C04)

Example of area where coping is loose
(Asset Ref No 1221C901C0704C04)

View of pier and sea wall.
(Asset Ref No 1221C901C0704C04)

Pier abutment
(No asset reference for pier)

Area of repair, and potential area of deformation
(Asset Ref No 1221C901C0704C01)

Example of area where coping is missing
(Asset Ref No 1221C901C0704C06)

East of the Skelton Beck outfall is the limit of the Saltburn defences. Here, in 2008, the coastal protection consisted of heavily eroded sections of concrete defences, displaying large amounts of excavation, undercutting, major cracking and in some parts, total collapse (Asset Ref No. 1221C901C0704C05). Urgent remedial work was required to prevent damage to adjacent property. In 2010 it was observed that large scale works had been completed, but that these works did not appear to have been carried out by professional contractors. It is unknown whether official consent for the works was granted.

2010: View of repairs – mass concrete and rubble
(Asset Ref No. 1221C901C0704C05)

2010: Undercutting and excavation of concrete defences
(Asset Ref No. 1221C901C0704C05)

2010: Repairs visible, but defence still shows evidence of cracking and erosion
(Asset Ref No. 1221C901C0704C05)

View of sea wall
(Asset Ref No. 1221C901C0704C03)

The slipway adjacent to the public house in the above photographs shows signs of erosion and washout. The photographs overleaf illustrate this.

Void and cracking slipway
(Asset Ref No. 1221C901C0704C05)

Void within slipway
(Asset Ref No. 1221C901C0704C05)

3.3.1 Cliffs northeast of Saltburn

Coastal Slope Condition Assessment

East of Saltburn the cliffs are of composite form, being characterised by an upper till layer overlying a steep, lower hard rock layer. The till unit is subject to landsliding, which results in staining of the lower cliffs and the formation of large debris cones at the toe. Some of the basal debris cones have become vegetated and therefore stabilised over time. These cliffs are classified as Locally (E53/4, E53/3, E53/1) and Partly Active (E53/2). The Locally Active units feature some slumping within the till, and consequent recession of the headscarp. The Partly Active unit (E53/2) is characterised by lesser vegetation cover on the upper till layer and lower debris cones, and staining down much of the cliff length.

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

E53/2 Lower debris cones and staining of the cliff in the distance (Partly Active)

Coast Protection Asset Condition Assessment

There are no coastal assets within this area.

3.3.2 *Hunt Cliff and Warsett Hill*[1]

Coastal Slope Condition Assessment

These high, steep cliffs are particularly active and are thus all classified as Partly (E54/3a, E54/2a) or Totally Active (E54/4, E54/3b, E54/2b). The cliffs are characterised by an upper till layer which is generally thin, supports some vegetation, and features localised failures. The lower part of the cliff is largely devoid of vegetation, steep and exposed, with erosion occurring down the entire face. There is evidence of localised and relatively recent rock fall activity. The railway line runs very close to the cliff edge as it curves around Warsett Hill within unit E54/3a. This unit features a vegetated rockfall toe which is currently acting to protect the steep rock face behind. If it were not for the protective influence offered by this feature, this unit would be classified as Totally Active like the adjacent units.

E54/4 looking northwest along Hunt Cliff (Totally Active)

E54/3b looking southeast along Warsett Hill (Totally Active)

E54/3a looking down the cliff at the vegetated debris flow lobe at cliff base (Partly Active)

E54/2a some vegetation cover on the upper part of the cliff (Partly Active)

Coast Protection Asset Condition Assessment

There are no coastal assets within this area.

[1] Please note this refers to the Warsett Hill located west of Skinningrove, not the hill of the same name located east of Skinningrove.

3.4 Cattersty Cliff and Skinningrove

Coastal Slope Condition Assessment

The cliffs in this area decline in elevation towards Skinningrove and are generally less active than those around Warsett Hill. Most units are classified as Locally (E54/1, E55/3, E56/2b) or Partly Active (E55/2, E55/1). The CBUs in the north of this area are characterised by a vegetated thin upper layer of till, which sits above the Lower Jurassic rocks. Lower down the cliff, the hard rock stratigraphy is largely obscured by large relict debris lobes which are undergoing marine erosion at the toe (E54/1, E55/3).

The basal debris cones become less extensive, more sparsely vegetated and steeper, further south. Most of these debris cones show evidence of recent activity and are subject to marine trimming at the toe. The upper till layer is thicker here than further north and the bedrock surface dips down to beach level. As a result the upper part of the cliffs is subject to greater localised slumping and headscarp recession (Partly Active- E55/2, E55/1).

The unit above Cattersty Sands (immediately west of the jetty) (E56/2a) is classified as Inactive. The cliffs here have a shallower gradient with extensive vegetation cover. They are also provided protection at their base by a set of embryo dunes. The development of these dunes and lack of erosional activity within this unit may be due to the protection afforded by the adjacent jetty.

Unit E56/1 is located to the east of the jetty and adjacent to the mouth of the beck. The slopes within this unit are well vegetated and have a stepped appearance which may suggest prior industrial disturbance. There is some evidence of recent sliding activity at the cliff toe, despite the rock armour defences in places here. Thus, this unit is classified as Locally Active (E56/1).

E54/1 looking northwest (Locally Active)

E55/2 looking southeast towards Skinningrove, steep debris cones at cliff base (Partly Active)

E56/2a looking southeast towards Skinningrove, showing shallow vegetated slopes and dunes at the toe (Inactive)

E56/1 recent activity at the cliff toe (Locally Active)

Coast Protection Asset Condition Assessment

Within this area, coastal defences are present around Skinningrove village, but there are none west of the large jetty. The original mining breakwater (or 'jetty') is located 400m northwest of the village, although still present, it is redundant, and does not appear to be actively maintained. There are gates (currently broken open) which are in place to prevent access onto the jetty by the public. The jetty is constructed of concrete and sheet piles and shows evidence of significant cracking, deformation and corrosion in places (Asset Ref No. 1221D901D0201C02). It is recommended that this asset be confirmed as redundant, and that it is secured once again in order to prevent access by the public.

Jetty – view from NW side
(Asset Ref No. 1221D901D0201C02)

Landward end of jetty – showing movement
(Asset Ref No. 1221D901D0201C02)

Looking landward along the jetty, showing open gates in background
(Asset Ref No. 1221D901D0201C02)

Looking seaward along the jetty, washout visible in foreground
(Asset Ref No. 1221D901D0201C02)

The rest of the coastal defences at Skinningrove are generally in a sound condition. The majority of defences are rock armour revetments (Asset Ref No's 1221D901D0202C01 and 1221D901D0202C02) including a fishtail breakwater (Asset Ref No. 1221D901D0202C05) and some smaller rock armour along the local watercourse, Skinningrove Beck. The rock armour all appears to be tightly packed and does not appear to have suffered from significant deformation or rock displacement.

Tightly packed rock armour in good condition, from jetty to village
(Asset Ref No. 1221D901D0202C01)

Rock armour along Beck with small wall behind in Skinningrove village
(Asset Ref No. 1221D901D0202C02)

Fishtail breakwater
(Asset Ref No. 1221D901D0202C05)

Fishtail breakwater
(Asset Ref No. 1221D901D0202C05)

East of the breakwater there are two further assets, a shingle ridge (Asset Ref No. 1221D901D0202C04) and a concrete wall (Asset Ref No. 1221D901D0202C03). The inspection team was unable to inspect the toe of this wall, as beach levels were relatively high. The promenade was significantly cracked in places and there was a void, approximately 700mm deep. The retaining wall behind appeared to be sound at present.

Beach ridge with concrete wall beyond
(Asset Ref Nos. 1221D901D0202C04 and 1221D901D0202C03)

View along wall looking eastwards
(Asset Ref No. 1221D901D0202C03)

Top of wall with void location indicated
(Asset Ref No. 1221D901D0202C03)

Void, showing 700mm depth
(Asset Ref No. 1221D901D0202C03)

3.5 Skinningrove to Boulby

Coastal Slope Condition Assessment

The cliffs within this section are predominantly classified as Locally Active (E57/6, E57/5-2, E58/6, E58/5upper, E58/4upper, E58/2upper) or Partly Active (E57/7, E57/1, E58/5lower, E58/4lower, E58/3upper and lower, E58/2lower, E58/1b, E58/1a). To the west of The Warren, the cliffs are characterised by an upper till layer which supports some vegetation cover with localised zones of slumping and consequent recession at the headscarp. The lower rock layer is lacking vegetation cover, and has evidence of activity. To the east of The Warren, the cliffs rise to become some of the highest in Britain. Here the complex cliff systems owe their character to the large abandoned alum quarries which were operational in this area during the 19th Century. The upper parts of the quarry units are backed by steep sandstone cliffs and feature heavily vegetated, undulating terrain, possibly the product of past rockfalls. These upper units are generally classified as Locally Active. The underlying cliff faces (lower units) descending to the sea are steeper, and comprise exposed shales which are heavily weathered and prone to ongoing and intense erosion. As a result they are classified as Partly Active.

Below Rockhole Hill there is a single unit classified as Totally Active (E58/1c). Large block detachments are visible with tension cracks at the head. The slopes are largely devoid of vegetation cover and undergoing active erosion down their entire length.

E57/7 looking southeast across the bay at Skinningrove (Partly Active)

E57/6 looking west across the well vegetated upper slopes (Locally Active) (Note this unit has moved down a class since 2008)

E57/3 well vegetated upper slopes (Locally Active)

E57/1 steep, exposed lower slopes (Partly Active)

E58/5upper looking across to the east (Locally Active)

E58/2upper evidence of past rockfall (Locally Active)

E58/2lower steeper, more active lower cliff face (Partly Active)

E58/1c below Rockhole Hill - highly active lower slopes (Totally Active)

E58/1a expansive bare face with ongoing fresh activity (Partly Active)

Coast Protection Asset Condition Assessment
There are no coastal protection assets within this area.

3.6 Boulby to Cowbar Nab

Coastal Slope Condition Assessment

In the coastal section between Boulby and Cowbar Nab the cliffs are much lower than those adjacent to the west. The majority of CBUs within this area are classified as Partly Active. They are characterised by a soft upper till unit which supports a variable vegetation cover and is subject to landsliding and consequent headscarp recession. Lower down the cliff the harder rock unit is largely bare except where covered by debris cones, reflecting localised rockfall activity.

Within unit E58/1a there has been recent failure at the headscarp and associated cliff top recession. In time, this may lead to the loss of the Cleveland Way footpath immediately west of the buildings at Boulby Grange and at some point could threaten the properties.

An area of particular concern along this stretch is adjacent to Cowbar Lane. Here units E59/3 and E59/4 are both classified as Totally Active. They are characterised by an upper till unit which is undergoing severe erosion and there is evidence of recent rockfall from the lower part of the cliff. This is resulting in the loss of the now abandoned parts of Cowbar Lane. The cliff repairs present within the till cap at units E59/1 to E60/1b (Partly Active) noted during the 2008 inspection are still helping to maintain the stability of the upper part of this cliff section. Rock armour is also locally present along the toe of unit E60/1b, which is acting to protect the base of the cliffs, but is not able to prevent failures in the till materials above.

E59/8 looking towards Staithes from Boulby (Partly Active)

E58/1a recent headscarp activity and risk to footpath at Boulby Grange (Partly Active)

E59/5 failure and active headscarp recession within the upper till part of the cliff (Partly Active)

E59/4 fresh failures within the till and rockfall from lower cliff face (Totally Active) (Note: this unit was previously classified as Partly Active in 2008)

E59/3 ongoing loss of abandoned road at Cowbar (Totally Active)

E59/1 and E60/1b cliff repairs in the till cap at Cowbar (Partly Active)

E60/1b ongoing till failure and rock toe defences along Cowbar Nab (Partly Active)

Coast Protection Asset Condition Assessment
There are no coastal assets within this area.

4 Comparison with Previous Assessments

Coastal Slope Condition Assessment

The previous cliff condition assessment undertaken in summer 2008 is available for comparison with this inspection. The majority of CBUs along this stretch of coastline have not changed significantly since 2008 and have therefore been given the same classification as before, as shown in Appendix B.

The exceptions are units E57/5 at Hummersea Cliff and E59/4 along Cowbar Lane. Unit E57/5 has been downgraded from Partly to Locally Active. The upper part of this unit is well vegetated and as a whole the unit is no more active than the adjacent units. It has therefore been moved down a class in line with the Locally Active adjacent units. Unit E59/4 has been upgraded from Partly to Totally Active. This reflects the presence of numerous fresh failures and gullying within the upper till and recent rockfall activity from the lower cliff. The abandoned part of Cowbar Lane is also under threat here.

E59/4 Classified as Partly Active in 2008

E59/4 Reduced vegetation cover and staining of cliffs – classified as Totally Active in 2010

Coast Protection Asset Condition Assessment

Previous coast protection asset condition data was available from 2008 within NFCDD to allow comparison.

Saltburn-by-the-Sea

Most assets in this area show little change in condition since 2008 when they were last inspected and recorded in the NFCDD. No asset had changed significantly enough for the condition grade to be improved or lowered. Asset Ref No. 1221C901C0704C05 has been repaired since 2008, as a result the visual condition appears to have improved, however, the informal nature of the repairs and the existence of gaps at joints and erosion at the toe resulted in the condition grade remaining at 4, which is categorised as Poor.

2008: Undercutting and excavation of concrete defences
(Asset Ref No. 1221C901C0704C05)

2010: Undercutting and excavation of concrete defences (Asset Ref No. 1221C901C0704C05)

2008: Partial collapse of concrete defences and failure of unprotected cliffs above
(Asset Ref No. 1221C901C0704C05)

2010: Total collapse of part of concrete defences and failure of unprotected cliffs
(Asset Ref No. 1221C901C0704C05)

2008: Property at risk behind eroded concrete defences (Asset Ref No. 1221C901C0704C05)

2010: Repairs visible, but defence still shows evidence of cracking and erosion (Asset Ref No. 1221C901C0704C05)

Skinningrove

Most assets in this area show little change in condition since 2008 when they were last inspected and recorded in the NFCDD. No asset had changed significantly enough for the condition grade to be improved or lowered.

The asset causing most cause for concern is the old jetty which is currently assessed as being in Condition Grade 4 (Poor), as it was in 2008. The condition has not altered significantly but it is highlighted here for reference.

In addition it was noted that the rock armour and wall sea defences along the watercourse in Skinningrove although in good condition appear low and may be easily overtopped by a high tide.

Looking landward along the jetty, showing open gates in background (Asset Ref No. 1221D901D0201C02)

Looking seaward along the jetty, washout visible in foreground (Asset Ref No. 1221D901D0201C02)

5 Problems Encountered and Uncertainty in Analysis

Coastal Slope Condition Assessment
Views of the lower part of the cliffs between units E58/5lower to E58/1c were sometimes limited. This is a result of the steep, complicated terrain of the Loftus Alum Quarries. At these locations, judgements about cliff behaviour activity status were made based on the clearly visible cliff sections and using the Cell One 2010 Aerial Survey oblique images.

Coast Protection Asset Condition Assessment
Very few problems were encountered on site during the asset condition assessment. Access issues posed the largest potential problems although most assets were located in public spaces and were easily accessible. Local tide tables provided key information for the appropriate planning of each day's inspections. The main Redcar frontage was not inspected because the existing defences are due o be replaced by a major capital scheme that is scheduled to start imminently.

6 Conclusions and Recommended Actions

Ongoing monitoring is recommended at the most active cliff sites, such as:

- Hunt Cliff and Wassett Hill, where the railway line runs close to the cliff edge.
- Boulby to Cowbar, where intense erosion was observed and parts of Cowbar Lane continue to be lost.
- Boulby Grange, where the cliff top has shown recession and may begin to threaten the Cleveland Way footpath.

Urgent remedial works are recommended to the South Gare Breakwater, which remains in poor condition. The timber groynes along Redcar Sands also remain in poor condition, but may be addressed during the imminent capital scheme.

The masonry seawall protecting much of Saltburn requires repointing.

East of Skelton Beck, the defects identified in 2008 have been repaired in an ad-hic fashion, whilst at Skinningrove the jetty continues to show evidence of significant cracking, deformation and corrosion in places and it is recommended that consideration is given to public access restrictions on heath and safety grounds.

Two-yearly walk-over inspections are recommended into the future to assess ongoing deterioration and coastal erosion, as well as the performance of general repairs and the imminent capital scheme at Redcar.

Recommendations for individual assets are given in the table below:

Coatham Sands

Asset Reference	Asset Type	Urgency	Recommendations	Residual Life	Overall Cond	Worst Cond
1221C901C0506C01	**Breakwater**	**High**	**Detailed structural survey. Urgent remedial work to prevent further undercutting and slope failure to western side. Extensive concrete repairs.**	**6 - 10**	**4**	**4**
1221C901C0601C01	Seawall	Routine	Infill voids, replace missing concrete render. Infill gap in wall at northern extent.	>20	3	3

East Redcar to Marske-by-the-Sea

Asset Reference	Asset Type	Urgency	Recommendations	Residual Life	Overall Cond	Worst Cond
1221C901C0602C01	Revetment	Routine	Infill minor voids and replace missing grout. Replace concrete render throughout. Investigate void formation beneath beach level.	11-20	3	3
1221C901C0603C01	Revetment	Routine	Local repairs to render. Remove vegetation, replace missing grout and infill minor voids. Repair/replace timber groynes.	>20	3	3
1221C901C0702C03	Seawall	Routine	Infill cracks. Monitor wall for lateral movement. Repoint masonry wall.	>20	4	4
1221C901C0702C02	Seawall	Routine	Remove vegetation, replace missing masonry element, repoint masonry wall	11-20	3	3
1221C901C0702C01	Seawall	Routine	Infill crack. Reconstruct/tidy seaward extent. Monitor scour to rear.	11-20	3	3

Saltburn

Asset Reference	Asset Type	Urgency	Recommendations	Residual Life	Overall Cond	Worst Cond
1221C901C0703C02	Seawall	Routine	Continue active monitoring, repair cracks if they worsen. Clear trash screen.	>20	3	3
1221C901C0704C01	Seawall	Routine	Repoint masonry blockwork. Investigate if deformation is occurring.	>20	2	3
1221C901C0704C03	Seawall	Routine	Prevent undercutting of the slipway, repair cracking in slipway surface	11 - 20	2	3
1221C901C0704C04	Seawall	Routine	Repoint masonry blockwork. Repair handrails. Repair coping.	>20	2	3
1221C901C0704C05	**Seawall**	**High**	Infill holes/gaps, repair cracking. **Urgent** remedial work is required to prevent damage to adjacent property. Investigate whether consent was obtained for repair works. Repair void in slipway.	**1 - 5**	**4**	**4**
1221C901C0704C06	Wall	Routine	Repair cracking, repoint. Replace missing coping.	>20	3	3

Skinningrove

Asset Reference	Asset Type	Urgency	Recommendations	Residual Life	Overall Cond	Worst Cond
1221D901D0201C02	Jetty	Routine	Make safe, re-secure to prevent public access. Continue to monitor to ensure public safety.	1 - 5	4	4
1221D901D0202C02	Rock armour	Routine	Investigate protection level. Improve if required.	>20	2	3
1221D901D0202C03	Seawall	Routine	Repair cracking/void in concrete surface	11 - 20	3	4
1221D901D0202C04	Shingle	Routine	Investigate protection level. Improve if required	>20	2	2

Appendix A
Coastal Slope Condition

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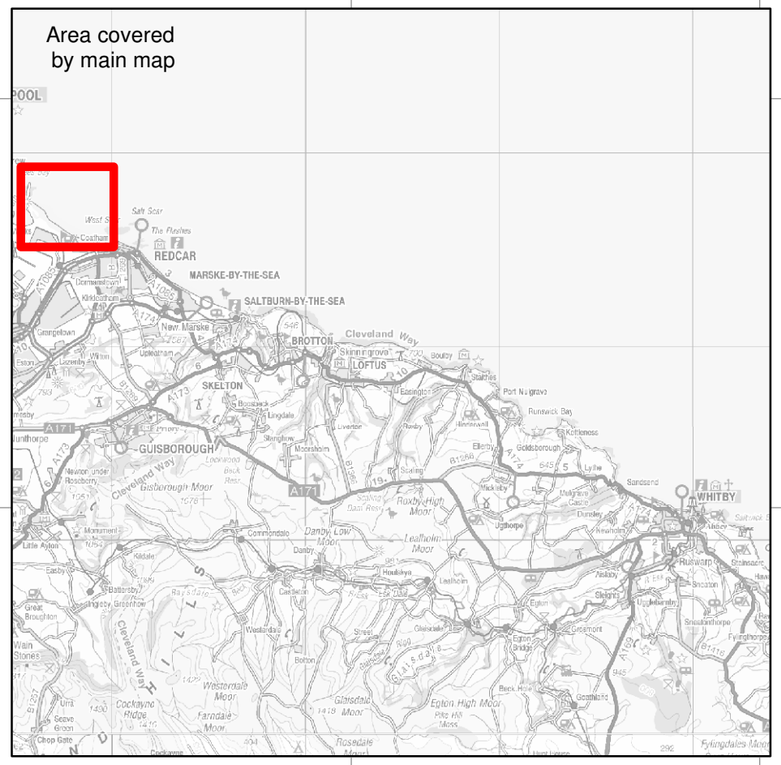

0 0.25 0.5 1 1.5 Km

E52/11

Coatham Sands

Redcar

Legend

Cliff Activity Status 2010

- Dormant
- Inactive
- Locally Active
- Partly Active
- Totally Active

Client: Cell One (Redcar and Cleveland Borough Council)

Project: Cell One Coastal Slope Condition Analysis 2010

Map 1 - Coatham Sands to Redcar

Coastal Slope Condition 2010

Drawing Scale 1:15,000 at A3

Drawn by:	TC	Date:	13 Dec 2010
Checked by:	MD	Date:	13 Dec 2010
Approved by:	NC	Date:	13 Dec 2010

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GIS Filename: Map1.mxd

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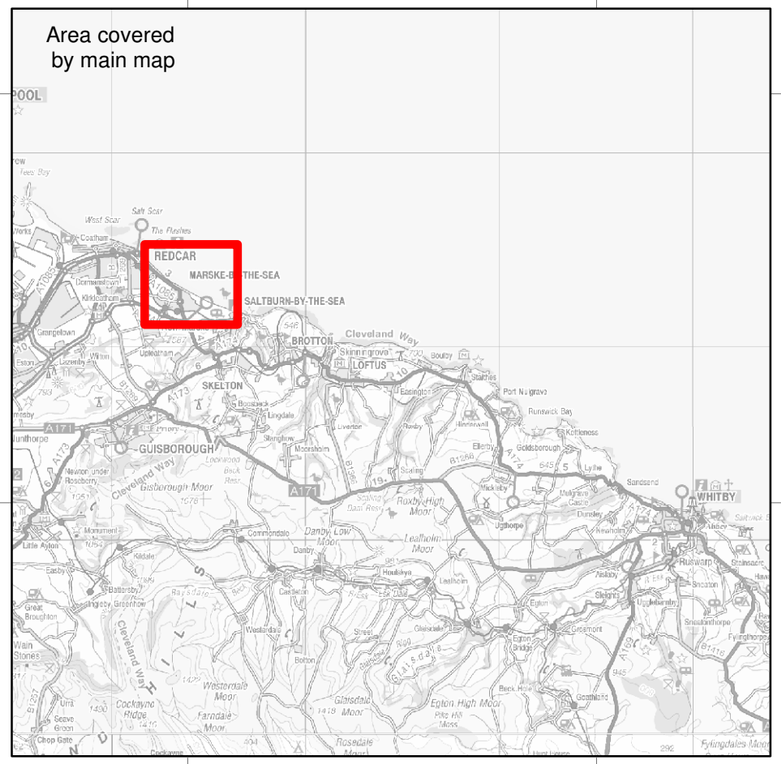
Area covered by main map



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Redcar

Marske-by-the-Sea

Saltburn-by-the-Sea

E52/10
E52/9
E52/8
E52/7
E52/6
E52/5
E52/4

Legend

Cliff Activity Status 2010

- Dormant
- Inactive
- Locally Active
- Partly Active
- Totally Active

Client: Cell One (Redcar and Cleveland Borough Council)

Project: Cell One Coastal Slope Condition Analysis 2010

Map 2 - Redcar to Saltburn

Coastal Slope Condition 2010

Drawing Scale 1:15,000 at A3

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Approved by:	NC	Date:	13 Dec 2010

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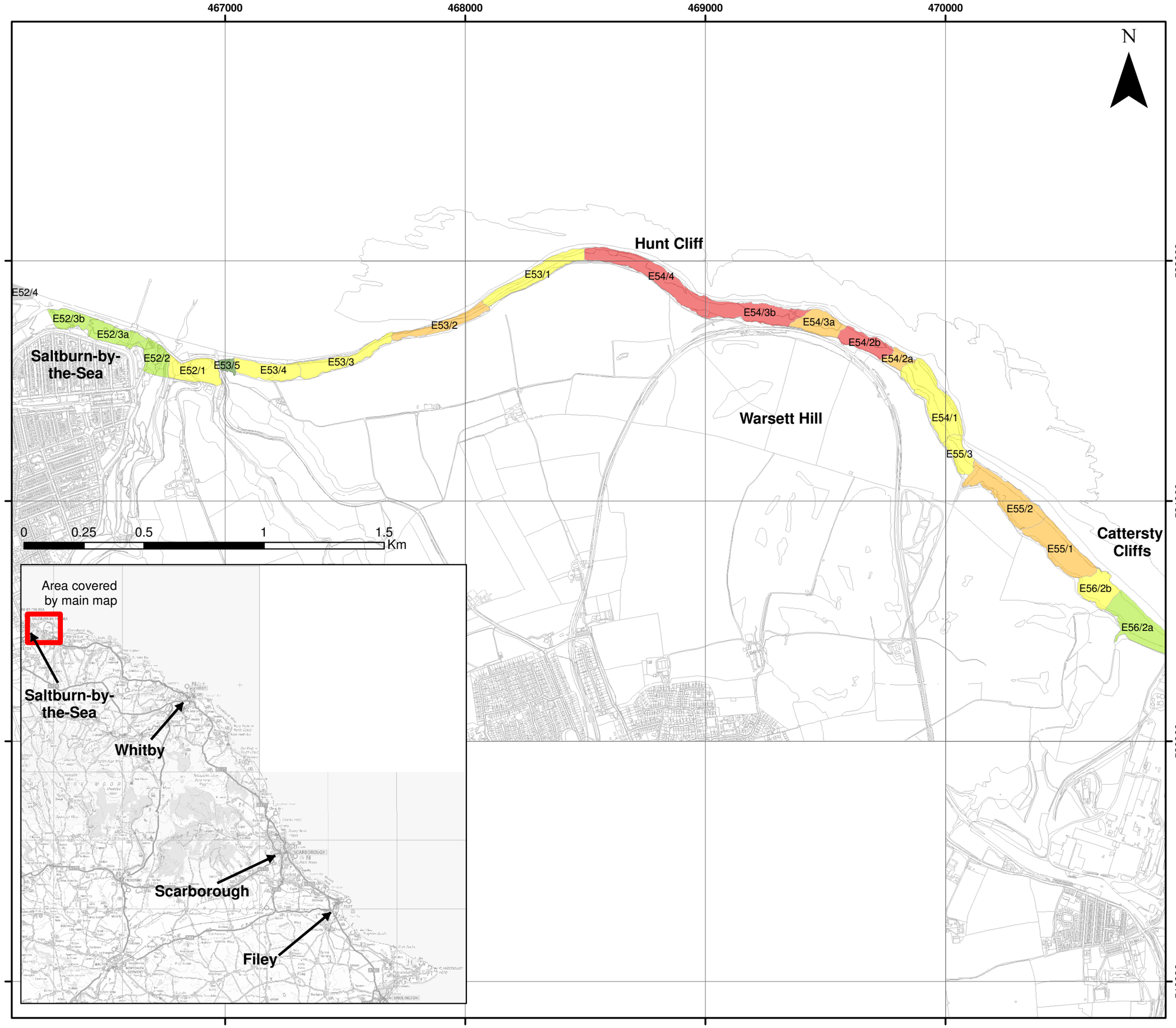

Legend

Cliff Activity Status 2010

- Dormant
- Inactive
- Locally Active
- Partly Active
- Totally Active
- Not inspected in 2010

Client: Cell One (Redcar and Cleveland Borough Council)

Project: Cell One Coastal Slope Condition Analysis 2010

Map 3 - Saltburn to Cattersty Cliffs

Coastal Slope Condition 2010

Drawing Scale 1:15,000 at A3

Drawn by:	AW	Date:	Nov 2010
Checked by:	RJ	Date:	Nov 2010
Approved by:	PRF	Date:	Nov 2010

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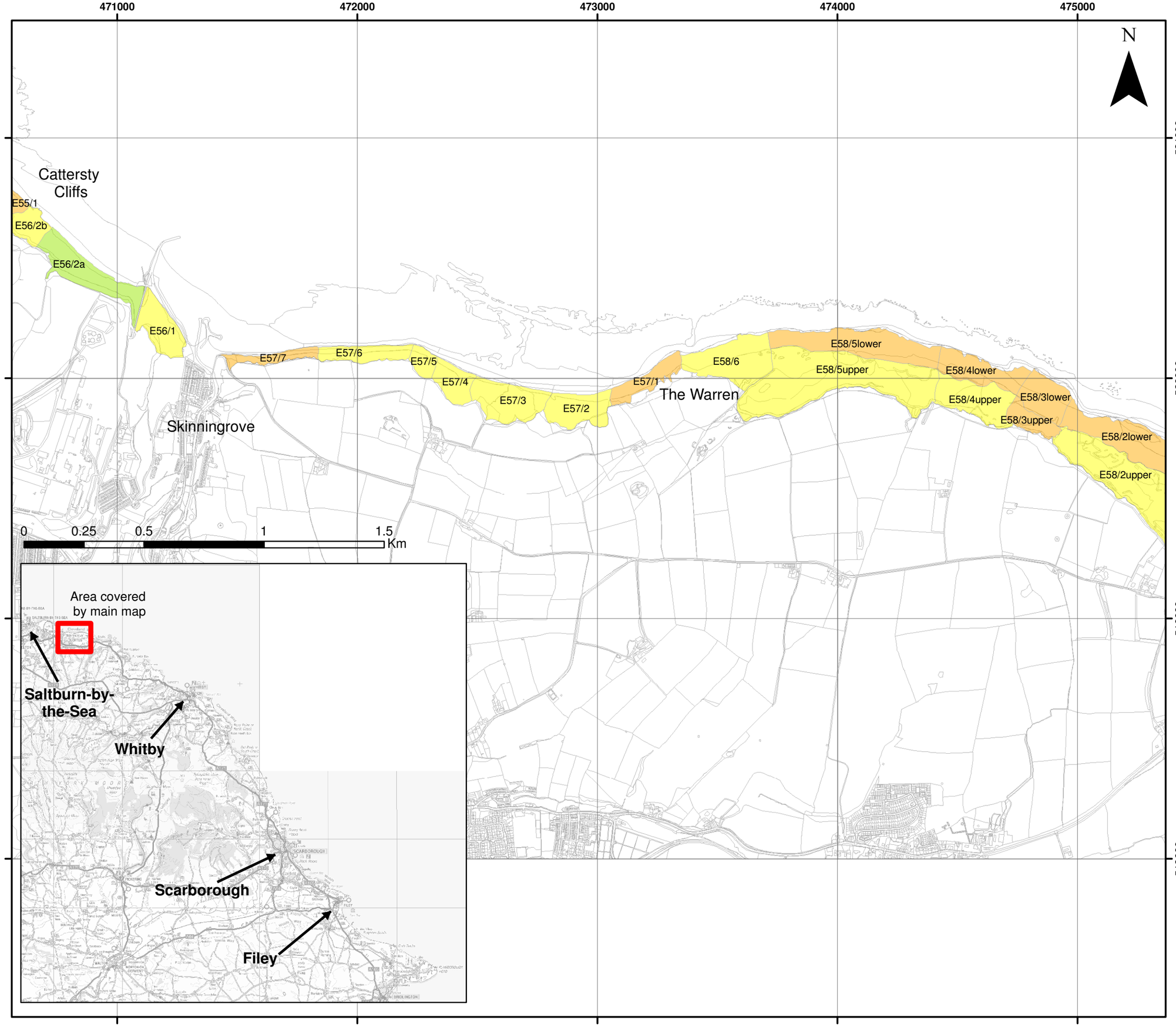

Legend

Cliff Activity Status 2010

- Dormant
- Inactive
- Locally Active
- Partly Active
- Totally Active

Client: Cell One (Redcar and Cleveland Borough Council)

Project: Cell One Coastal Slope Condition Analysis 2010

Map 4 - Cattersty Cliffs to Loftus Alum Quarries

Coastal Slope Condition 2010

Drawing Scale 1:15,000 at A3

Drawn by:	AW	Date:	Nov 2010
Checked by:	RJ	Date:	Nov 2010
Approved by:	PRF	Date:	Nov 2010

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GIS Filename: RCBC Map 2.mxd

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E58/1a
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E59/6
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E59/1
E60/1a
MU4/1a
E60/1b
MU4/1b
MU4/2
MU4/3

Loftus Alum Quarries

Boulby

Redhouse Nab

Cowbar Lane

Cowbar

Staithes

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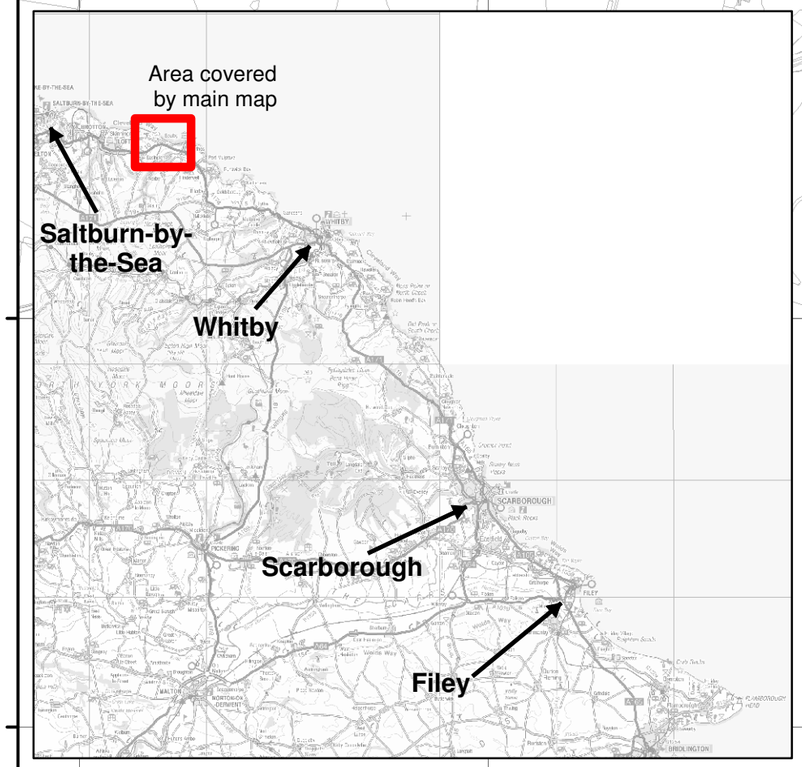

Legend

Cliff Activity Status 2010

- Dormant
- Inactive
- Locally Active
- Partly Active
- Totally Active

Client: Cell One (Redcar & Cleveland Borough Council)

Project: Cell One Coastal Slope Condition Analysis 2010

Map 5 - Loftus Alum Quarries to Staithes

Coastal Slope Condition 2010

Drawing Scale 1:15,000 at A3

Drawn by:	AW	Date:	Nov 2010
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Approved by:	PRF	Date:	Nov 2010

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GIS Filename: RCBC Map 3.mxd

Appendix B
Coastal Slope Condition Change Analysis

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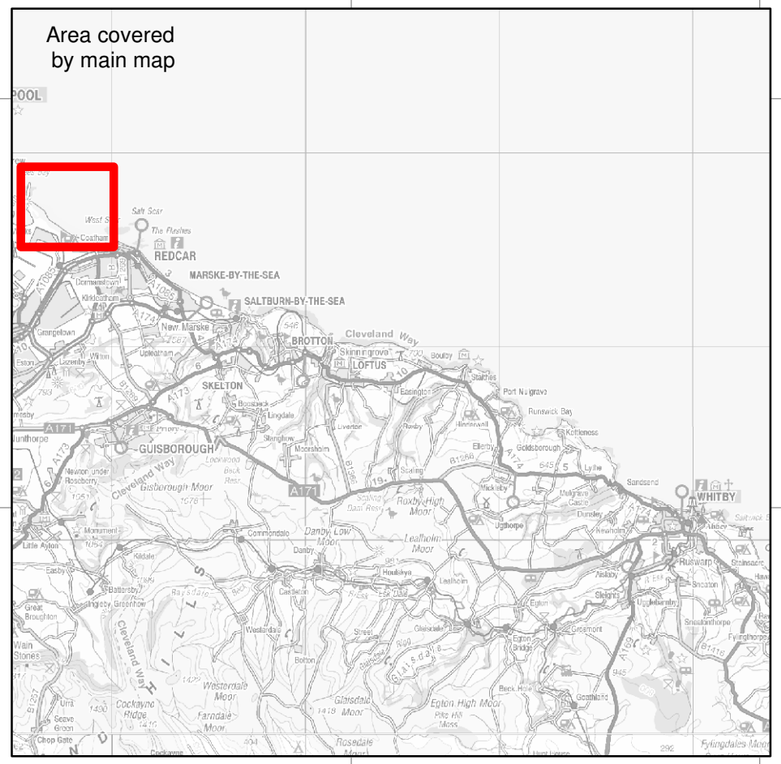

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E52/11

Coatham Sands

Redcar

Legend

Cliff Activity Status 2010

- Major increase in activity
- Minor increase in activity
- No Change
- Minor decrease in activity
- Major decrease in activity

Client: Cell One (Redcar and Cleveland Borough Council)

Project: Cell One Coastal Slope Condition Analysis 2010

Map 6 - Coatham Sands to Redcar

Coastal Slope Condition
Change Analysis 2008 to 2010

Drawing Scale 1:15,000 at A3

Drawn by:	TC	Date:	13 Dec 2010
Checked by:	MD	Date:	13 Dec 2010
Approved by:	NC	Date:	13 Dec 2010

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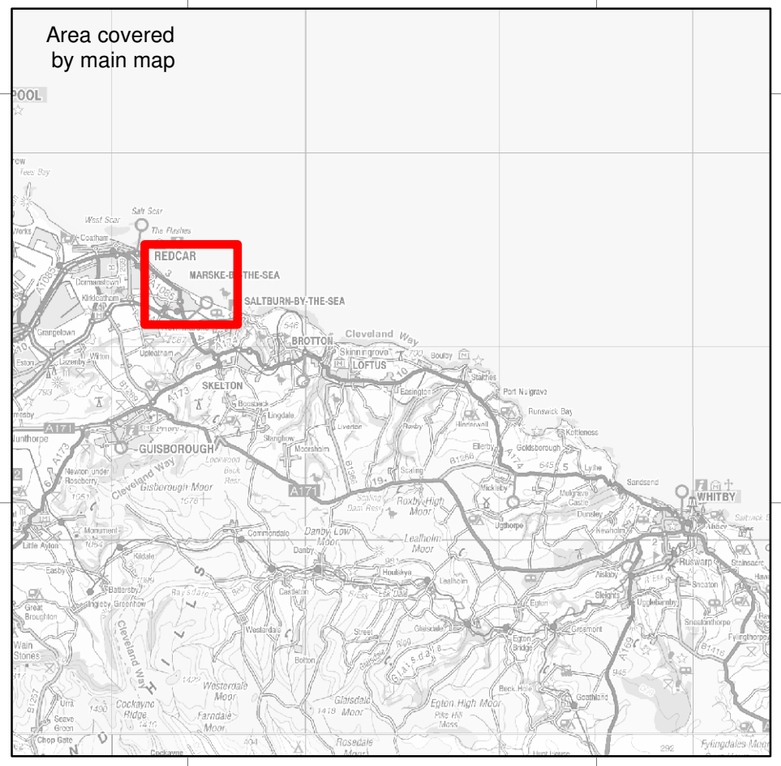
Area covered by main map



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Redcar

E52/10

E52/9

E52/8

E52/7

E52/6

E52/5

E52/4

Marske-by-the-Sea

Saltburn-by-the-Sea

Legend

Cliff Activity Status 2010

- Major increase in activity
- Minor increase in activity
- No Change
- Minor decrease in activity
- Major decrease in activity

Client: Cell One (Redcar and Cleveland Borough Council)

Project: Cell One Coastal Slope Condition Analysis 2010

Map 7 - Redcar to Saltburn

Coastal Slope Condition Change Analysis 2008 to 2010

Drawing Scale 1:15,000 at A3

Drawn by:	TC	Date:	13 Dec 2010
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Approved by:	NC	Date:	13 Dec 2010

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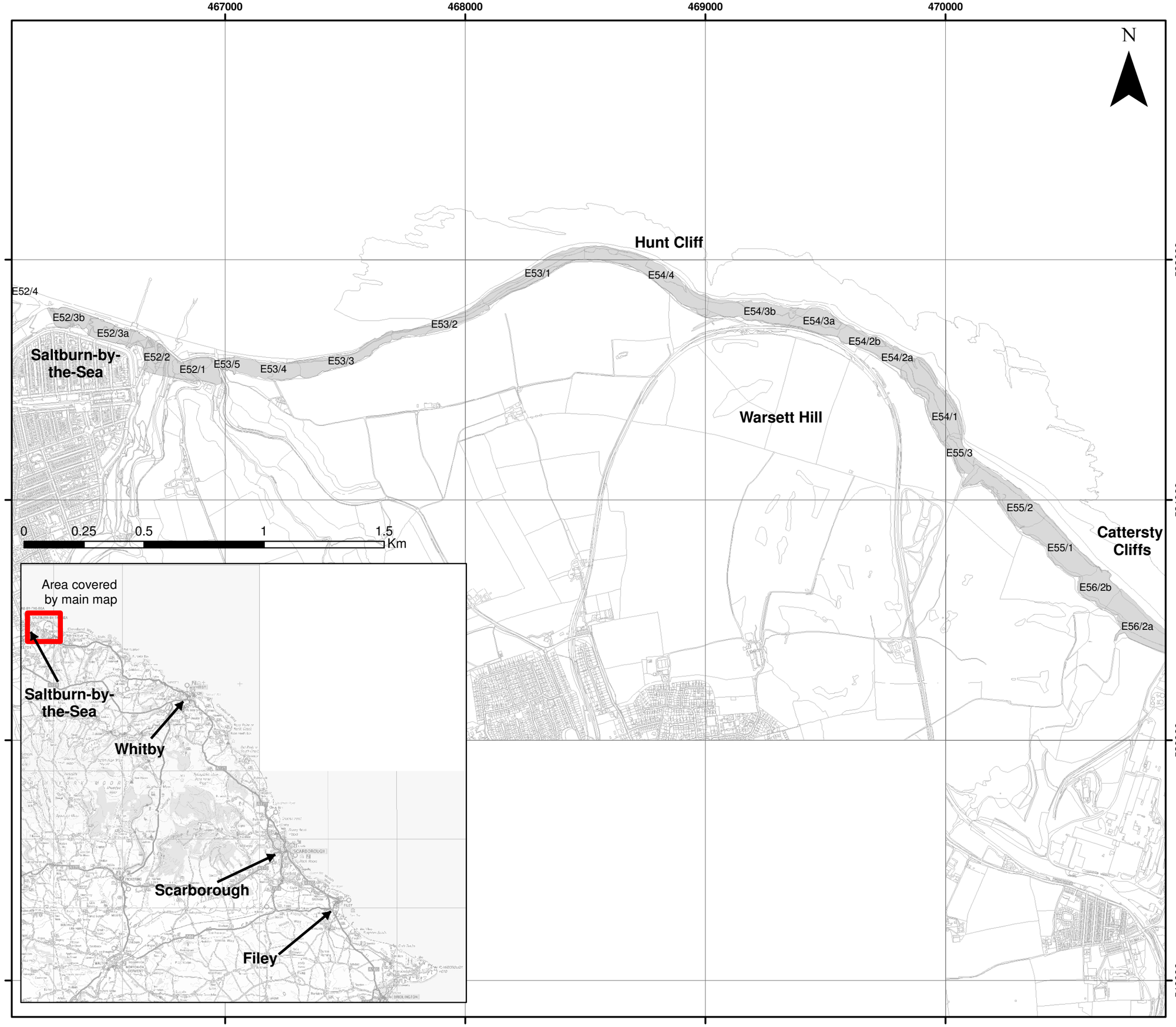

Legend

Cliff Activity Status 2010

- Major increase in activity
- Minor increase in activity
- No change
- Minor decrease in activity
- Major decrease in activity

Client: Cell One (Redcar and Cleveland Borough Council)

Project: Cell One Coastal Slope Condition Analysis 2010

Map 8 - Saltburn to Cattersty Cliffs

Coastal Slope Condition Change Analysis 2008 to 2010

Drawing Scale 1:15,000 at A3

Drawn by:	AW	Date:	Nov 2010
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Approved by:	PRF	Date:	Nov 2010

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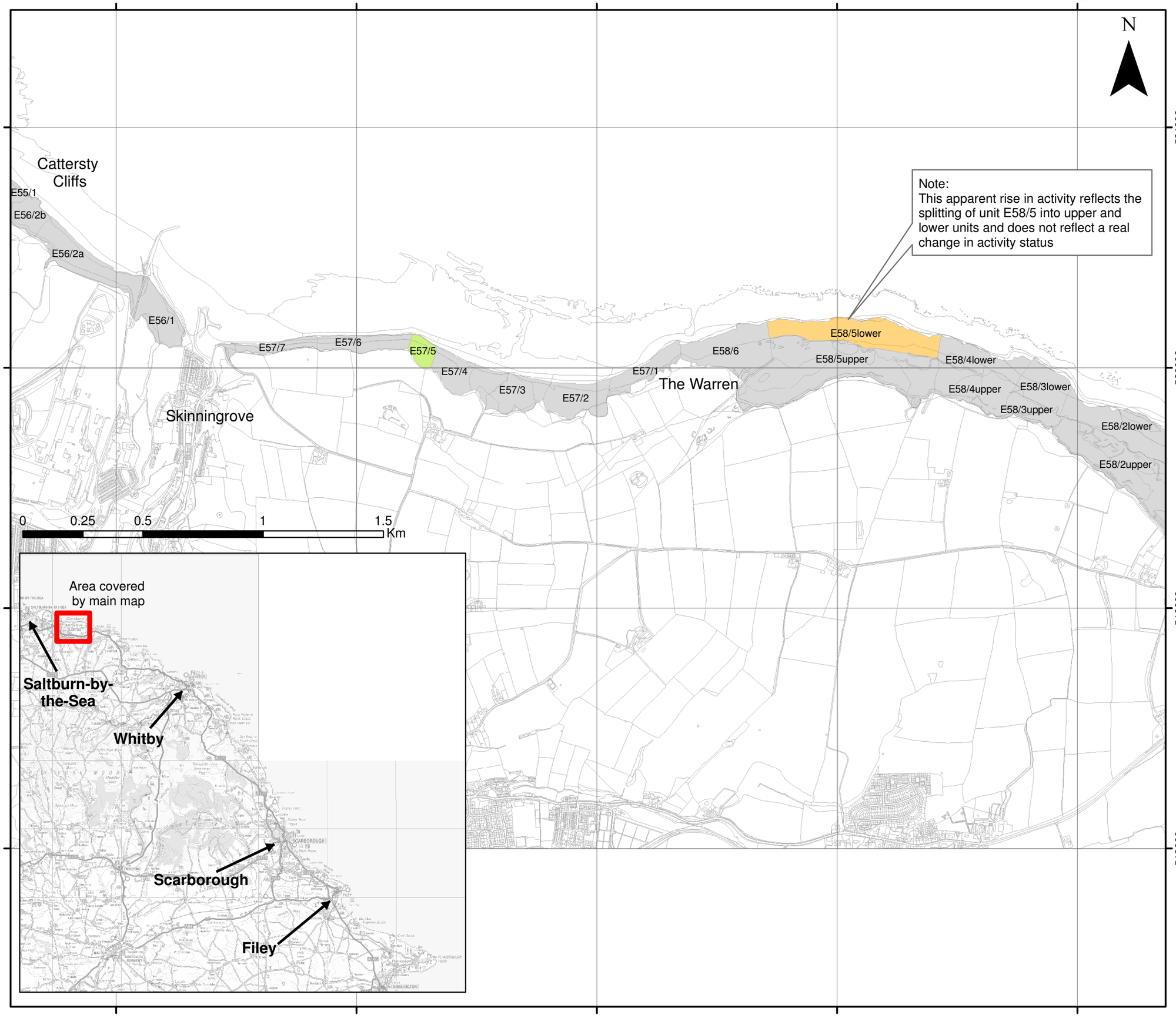

Legend

Cliff Activity Status 2010

- Major increase in activity
- Minor increase in activity
- No change
- Minor decrease in activity
- Major decrease in activity

Client: Cell One (Redcar and Cleveland Borough Council)

Project: Cell One Coastal Slope Condition Analysis 2010

Map 9 - Cattersty Cliffs to Loftus Alum Quarries

Coastal Slope Condition Change Analysis 2008 to 2010

Drawing Scale 1:15,000 at A3

Drawn by:	AW	Date:	Nov 2010
Checked by:	RJ	Date:	Nov 2010
Approved by:	PRF	Date:	Nov 2010

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GIS Filename: RCBC Map 5_Change.mxd

474000 475000 476000 477000 478000

521000 520000 519000 518000 517000

N

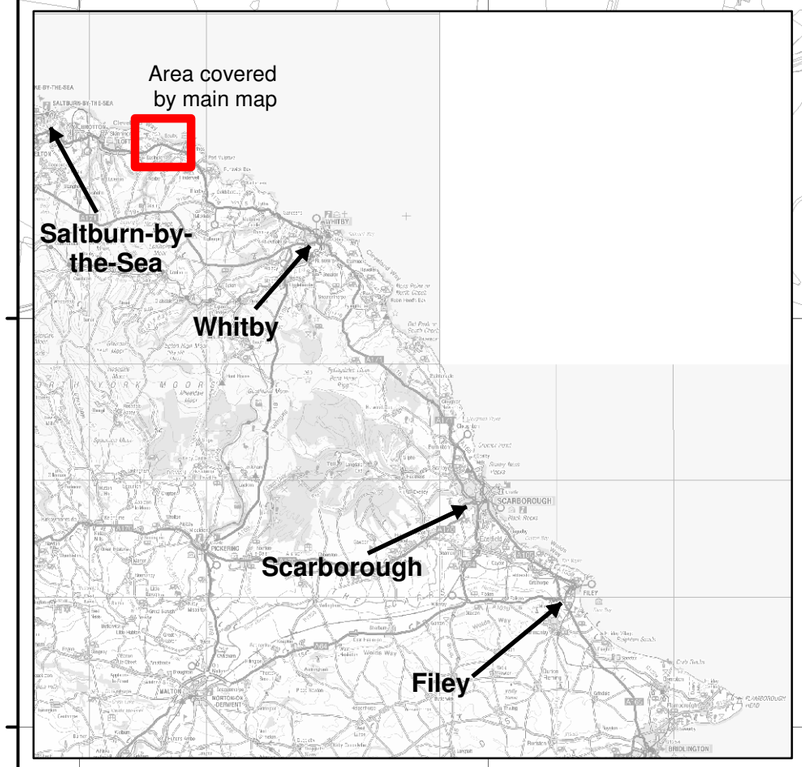
Note:
This apparent rise in activity reflects the splitting of unit E58/5 into upper and lower units and does not reflect a real change in activity status

Note:
This apparent rise in activity reflects a mistake made in classification in 2008 and does not reflect a real change in activity status

E58/5lower
E58/5upper
E58/4lower
E58/4upper
E58/3lower
E58/3upper
E58/2lower
E58/2upper
E58/1c
E58/1b
E58/1a
E59/9
E59/8
E59/7
E59/6
E59/5
E59/4
E59/3
E59/2
E59/1
E60/1a
MU4/1a
E60/1b
MU4/1b
MU4/3
MU4/2

Loftus Alum Quarries
Boulby
Redhouse Nab
Cowbar Lane
Cowbar
Staithes

0 0.25 0.5 1 1.5 Km



Legend

Cliff Activity Status 2010

- Major increase in activity
- Minor increase in activity
- No change
- Minor decrease in activity
- Major decrease in activity

Client: Cell One (Redcar and Cleveland Borough Council)

Project: Cell One Coastal Slope Condition Analysis 2010

Map 10 - Loftus Alum Quarries to Staithes

Coastal Slope Condition Change Analysis 2008 to 2010

Drawing Scale 1:15,000 at A3

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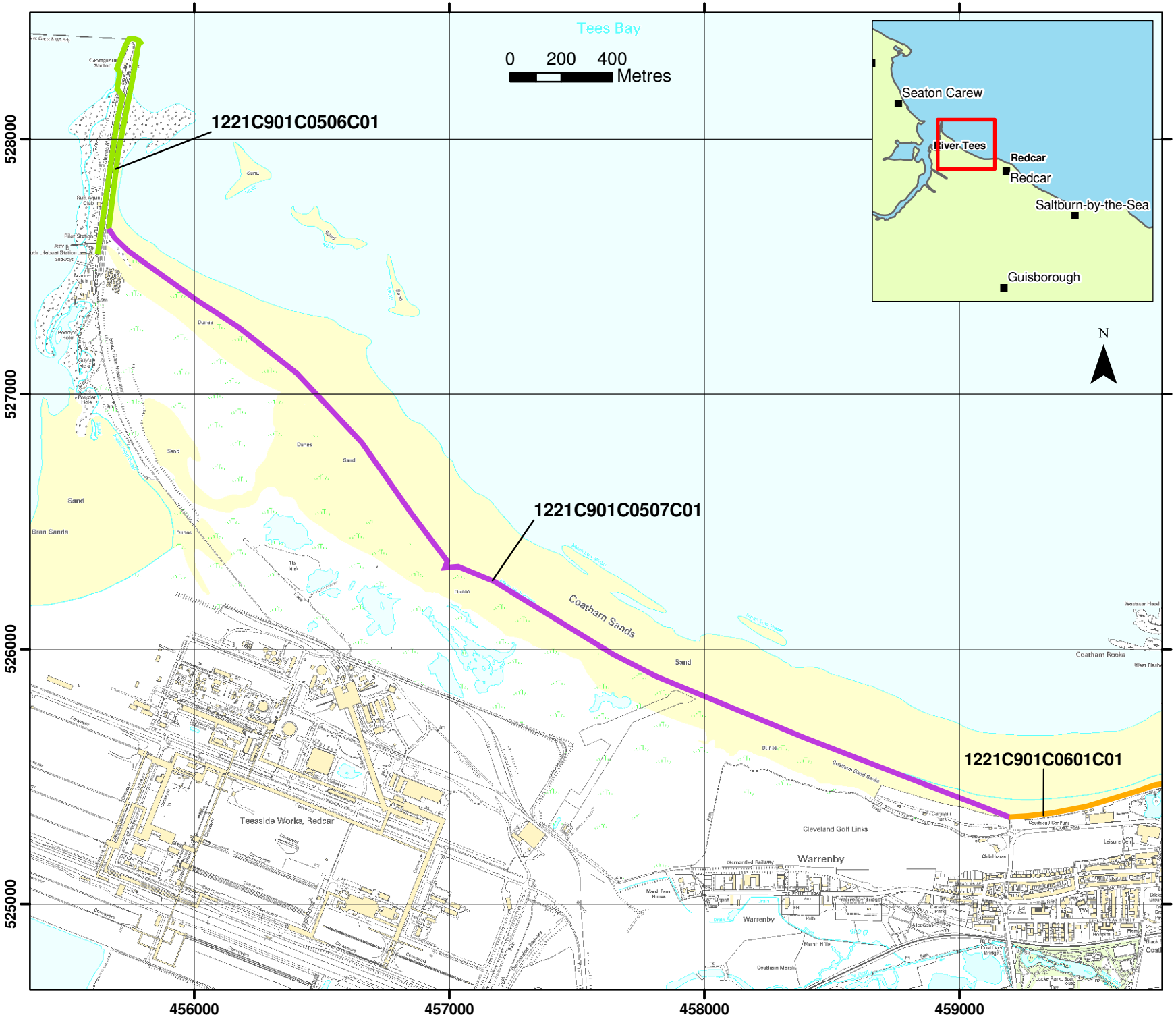
GIS Filename: RCBC Map 6_Change.mxd

Appendix C
Coast Protection Asset Condition



Legend

Asset location

NFCDD Asset Number

Client: Cell One (Redcar and Cleveland Borough Council)

Project: Cell One Coastal Slope Condition Analysis 2010

Map 11 - Redcar & Cleveland Council Frontage

Asset Inspection Report 2010

Drawing Scale 1:20,000 at A4

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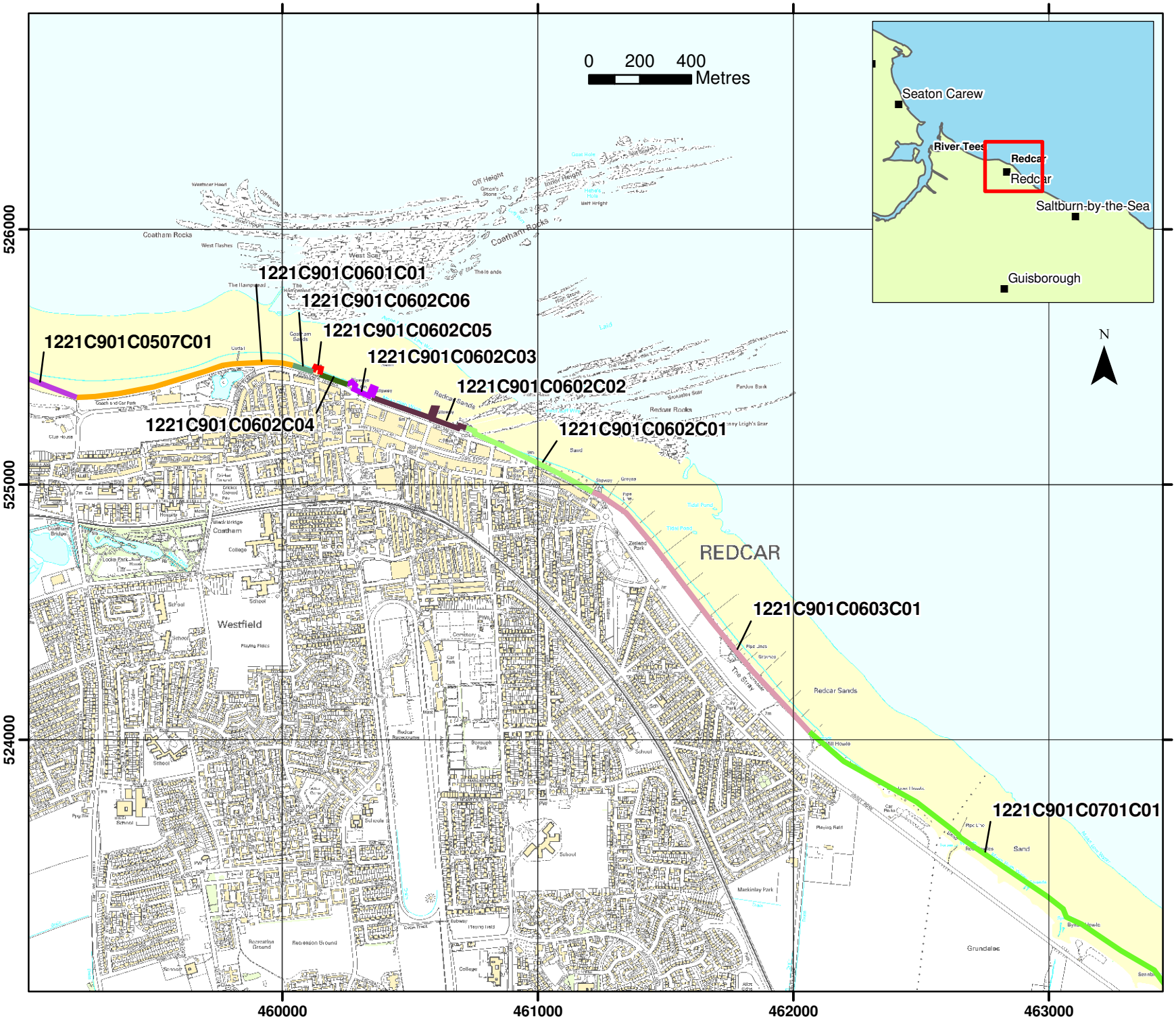

Legend

Asset location

NFCDD Asset Number

Client: Cell One (Redcar and Cleveland Borough Council)

Project: Cell One Coastal Slope Condition Analysis 2010

Map 12 - Redcar & Cleveland Council Frontage

Asset Inspection Report 2010

Drawing Scale 1:20,000 at A4

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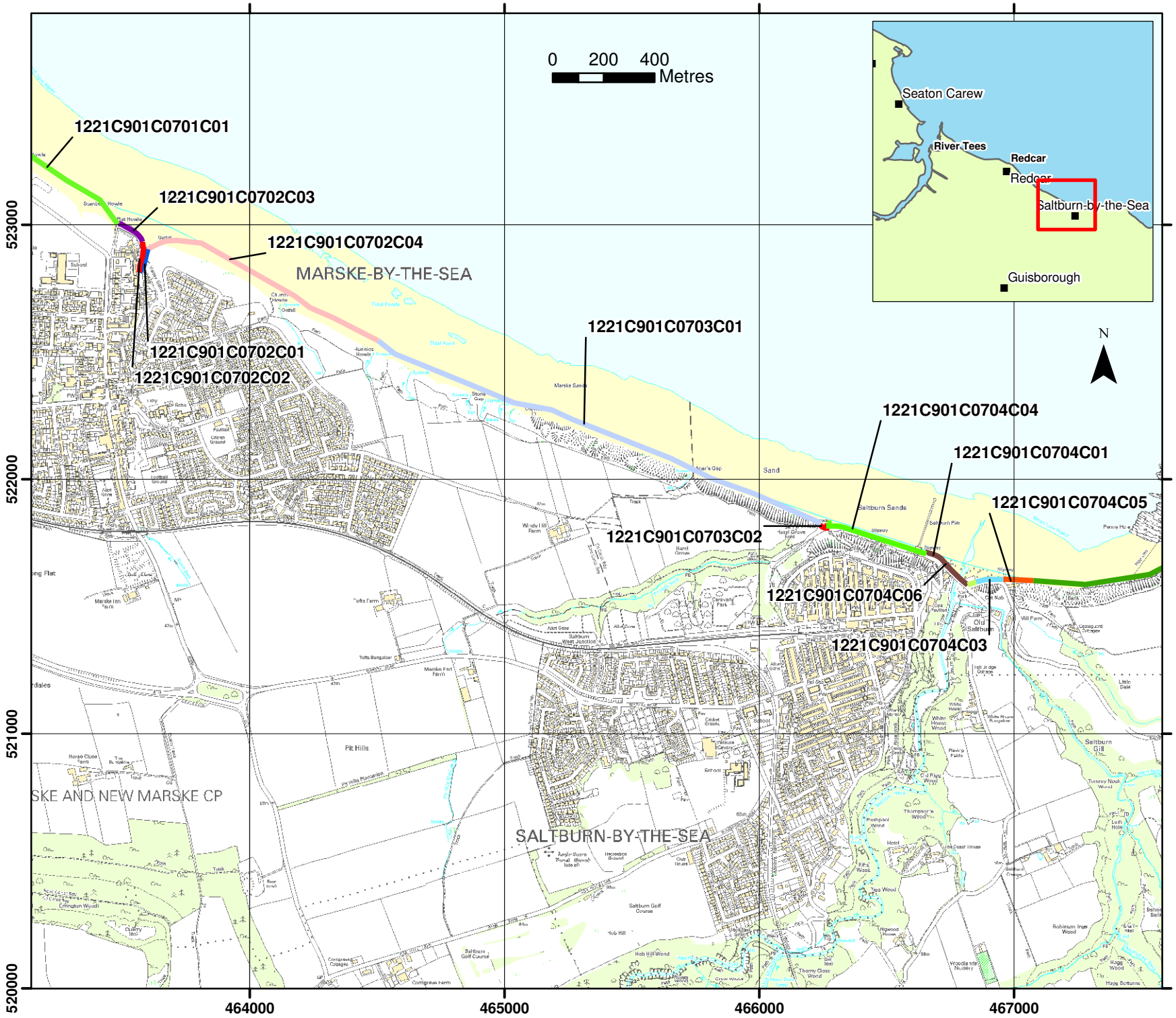

Legend

Asset location

NFCDD Asset Number

Client: Cell One (Redcar and Cleveland Borough Council)

Project: Cell One Coastal Slope Condition Analysis 2010

Map 13 - Redcar & Cleveland Council Frontage

Asset Inspection Report 2010

Drawing Scale 1:20,000 at A4

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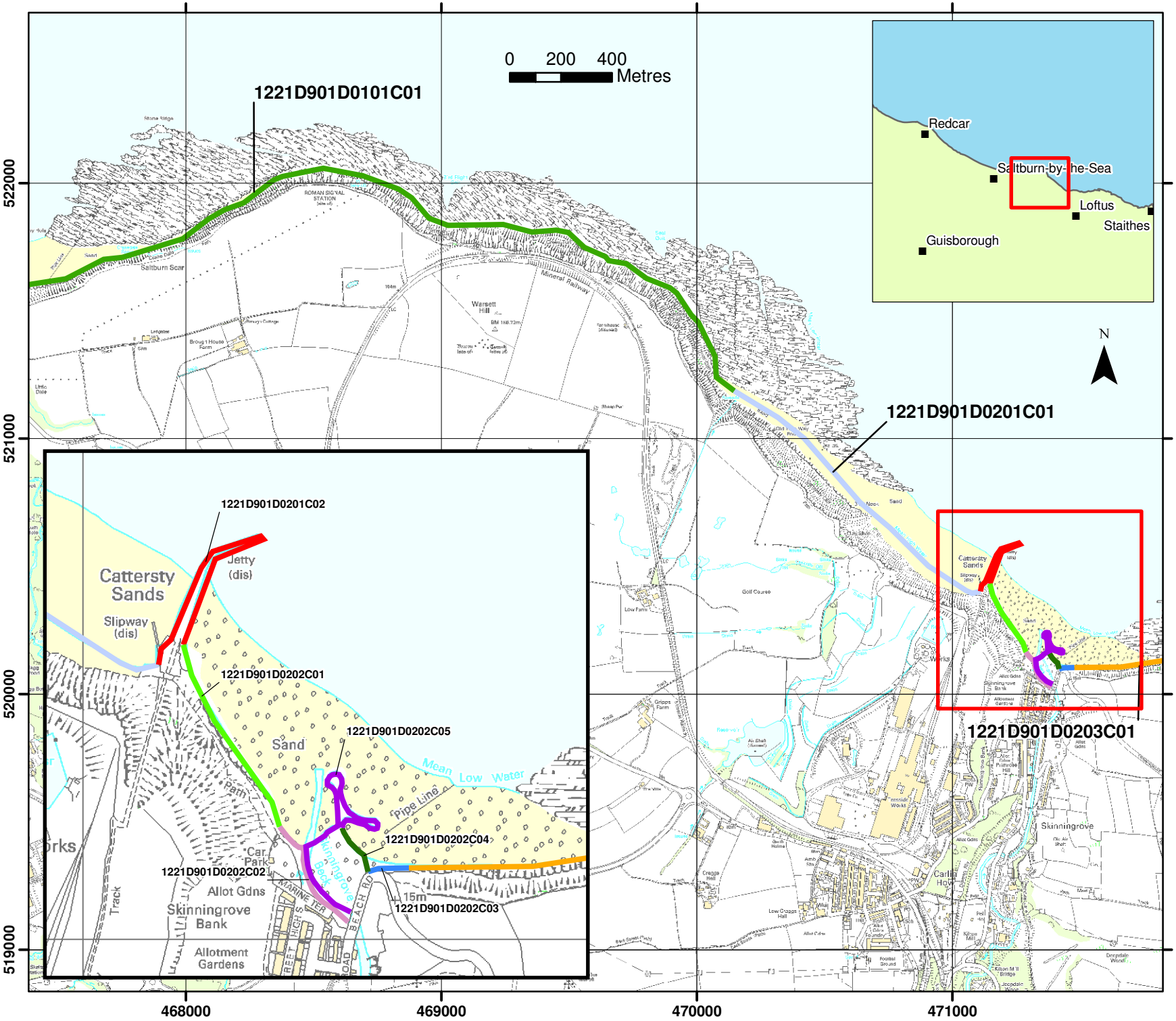

Legend

Asset location

NFCDD Asset Number

Client: Cell One (Redcar and Cleveland Borough Council)

Project: Cell One Coastal Slope Condition Analysis 2010

Map14 - Redcar & Cleveland Council Frontage

Asset Inspection Report 2010

Drawing Scale 1:20,000 at A4

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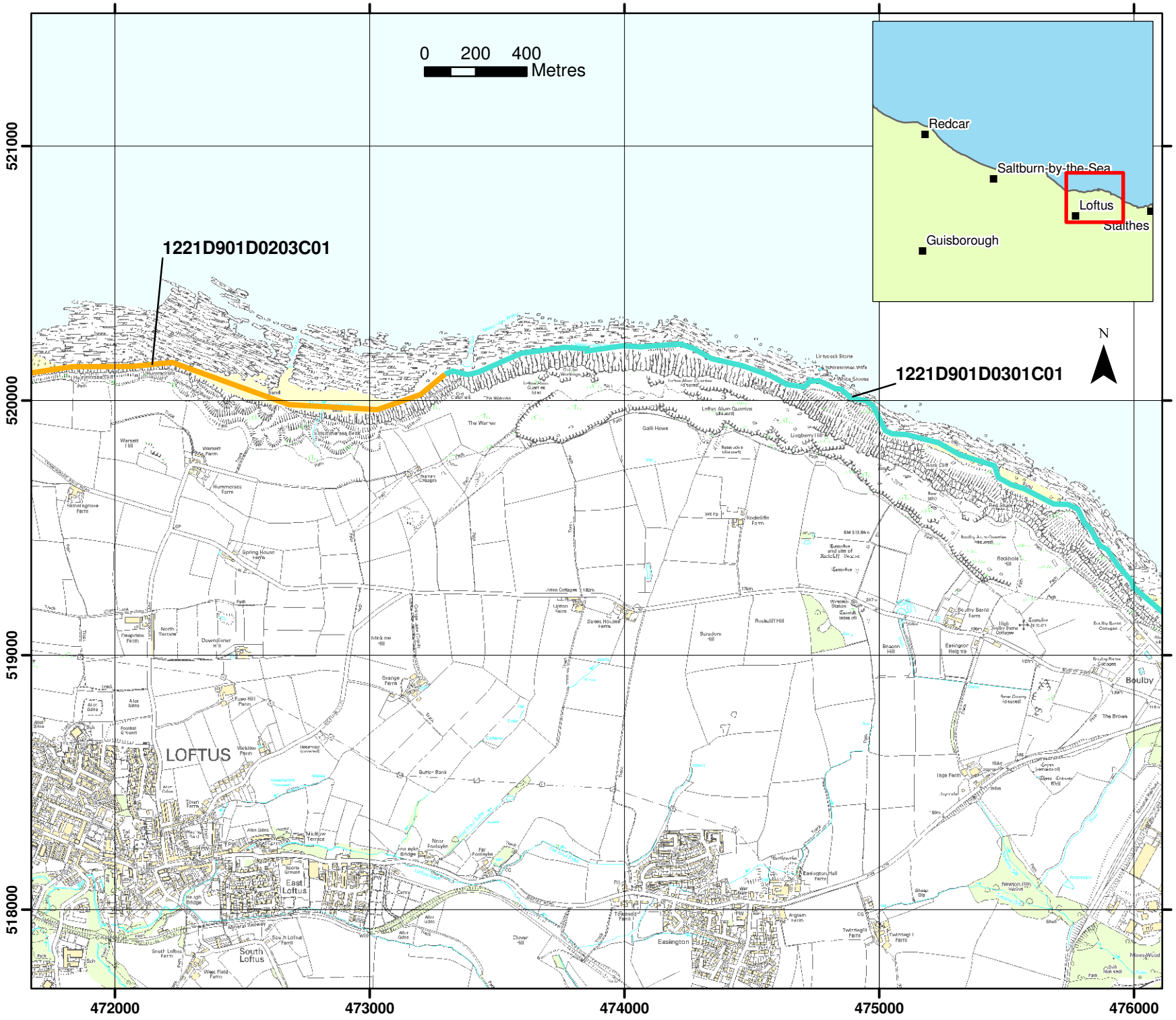

Legend

Asset location

NFCDD Asset Number

Client: Cell One (Redcar and Cleveland Borough Council)

Project: Cell One Coastal Slope Condition Analysis 2010

Map 15 - Redcar & Cleveland Council Frontage

Asset Inspection Report 2010

Drawing Scale 1:20,000 at A4

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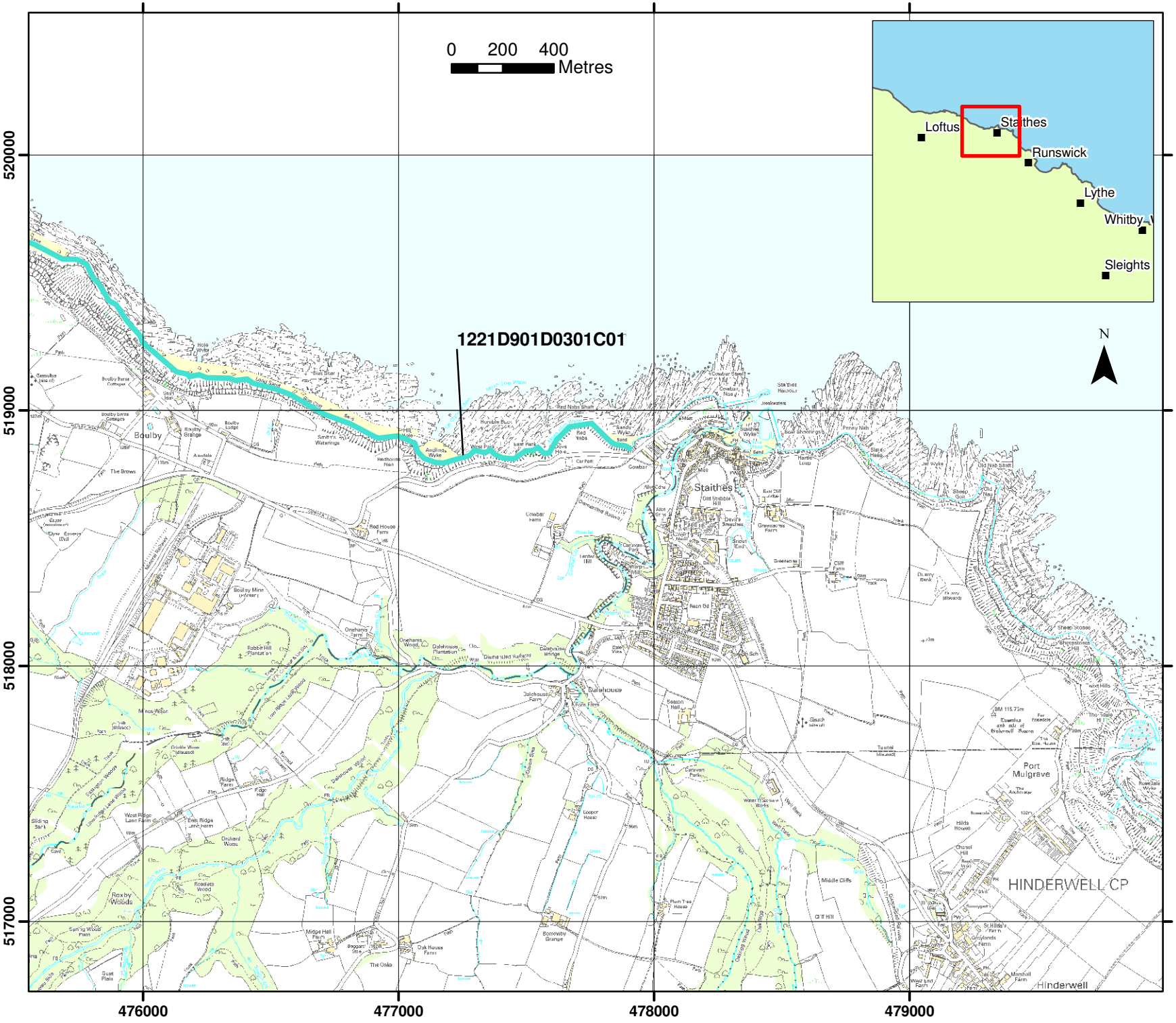

Legend

Asset location

NFCDD Asset Number

Client: Cell One (Redcar and Cleveland Borough Council)

Project: Cell One Coastal Slope Condition Analysis 2010

Map 16 - Redcar & Cleveland Council Frontage

Asset Inspection Report 2010

Drawing Scale 1:20,000 at A4

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