



**Cell 1 Regional Coastal Monitoring Programme
Update Report 13: 'Partial Measures' Survey 2021**



Redcar and Cleveland Council

May 2021

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Abbreviations and Acronyms

Acronym / Abbreviation	Definition
AONB	Area of Outstanding Natural Beauty
DGM	Digital Ground Model
HAT	Highest Astronomical Tide
LAT	Lowest Astronomical Tide
MHWN	Mean High Water Neap
MHWS	Mean High Water Spring
MLWS	Mean Low Water Neap
MLWS	Mean Low Water Spring
m	metres
ODN	Ordnance Datum Newlyn

Water Levels Used in Interpretation of Changes

Water Level Parameter	Water Level (m AOD)			
	Hartlepool Headland to Saltburn Scar	Skinningrove	Hummersea Scar to Sandsend Ness	Sandsend Ness to Saltwick Nab
HAT	3.25	3.18	3.15	3.10
MHWS	2.65	2.68	2.65	2.60
MLWS	-1.95	-2.13	-2.15	-2.20
Water Level Parameter	Water Level (m AOD)			
	Saltwick Nab to Hundale Point	Hundale Point to White Nab	White Nab to Filey Brigg	Filey Brigg to Flamborough Head
HAT	3.10	3.05	3.05	3.10
MHWS	2.60	2.45	2.45	2.50
MLWS	-2.20	-2.35	-2.35	-2.30

Source: *River Tyne to Flamborough Head Shoreline Management Plan 2.*
Royal Haskoning, February 2007.

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 intertidal 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).

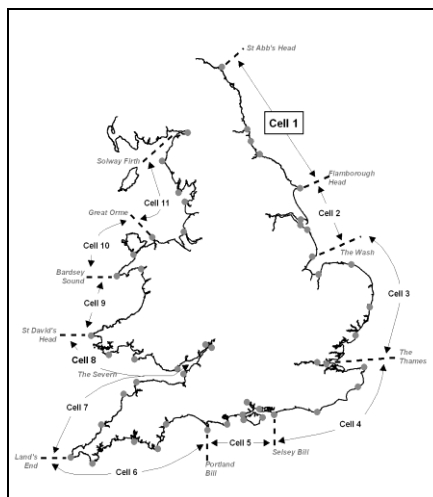


Figure 1 Sediment Cells in England and Wales

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 seabed characterisation surveys
- aerial photography
- LiDAR surveys
- walk-over cliff and coastal defence asset surveys

The beach profile surveys, topographic surveys and cliff top recession surveys are undertaken as a 'Full Measures' survey in autumn/early winter every year. Some of these surveys are then repeated the following spring as part of a 'Partial Measures' survey.

To date the following reports have been produced:

Table 1 Analytical, Update and Overview Reports Produced to Date

Year		Full Measures		Partial Measures		Cell 1 Overview Report
		Survey	Analytical Report	Survey	Update Report	
1	2008/09	Sep-Dec 08	May 09	Mar-May 09		
2	2009/10	Sep-Dec 09	Mar 10	Feb-Mar 10	Jul 10	
3	2010/11	Aug-Nov 10	Feb 11	Feb-Apr 11	Aug 11	Sep 11
4	2011/12	Sep-Oct 11	Oct 12	Mar-May 12	Feb 13	
5	2012/13	Sep 2012	Mar 13	Feb- Mar 13	May 13	
6	2013/14	Oct-Nov 13	Feb 14	Mar-Apr 14	Jul 14	
7	2014/15	Sep-Oct 14	Feb 15	Mar-Apr	Jul 15	
8	2015/16	Sep-Oct 15	Feb 16	Mar 16	Jul 16	Jun 16
9	2016/17	Sep-Nov 16	Feb 17	Mar 17	Jul 17	
10	2017/18	Oct 17	Mar 18	Mar-May 18	Jun 18	
11	2018/19	Sep 18	Mar 19	Mar-Apr 19	May 19	
12	2019/20	Sep-Nov 19	Jan 20	Mar-May 20	Aug 20	
13	2020/21	Oct-Dec 20	Feb 21	Mar 21	May 21(*)	Expected Summer 21

(*) The present report is **Update Report 13** and provides an analysis of the 2021 Partial Measures survey for Redcar and Cleveland Council's frontage.

1. Introduction

1.1 Study Area

South Gare Breakwater at the mouth of the River Tees estuary to Cowbar Nab at Staithes. For the purposes of this report, it has been sub-divided into six areas, namely:

- Coatham Sands
- Redcar Sands
- Marske Sands
- Saltburn Sands
- Cattersty Sands (Skinningrove)
- Staithes¹

1.2 Methodology

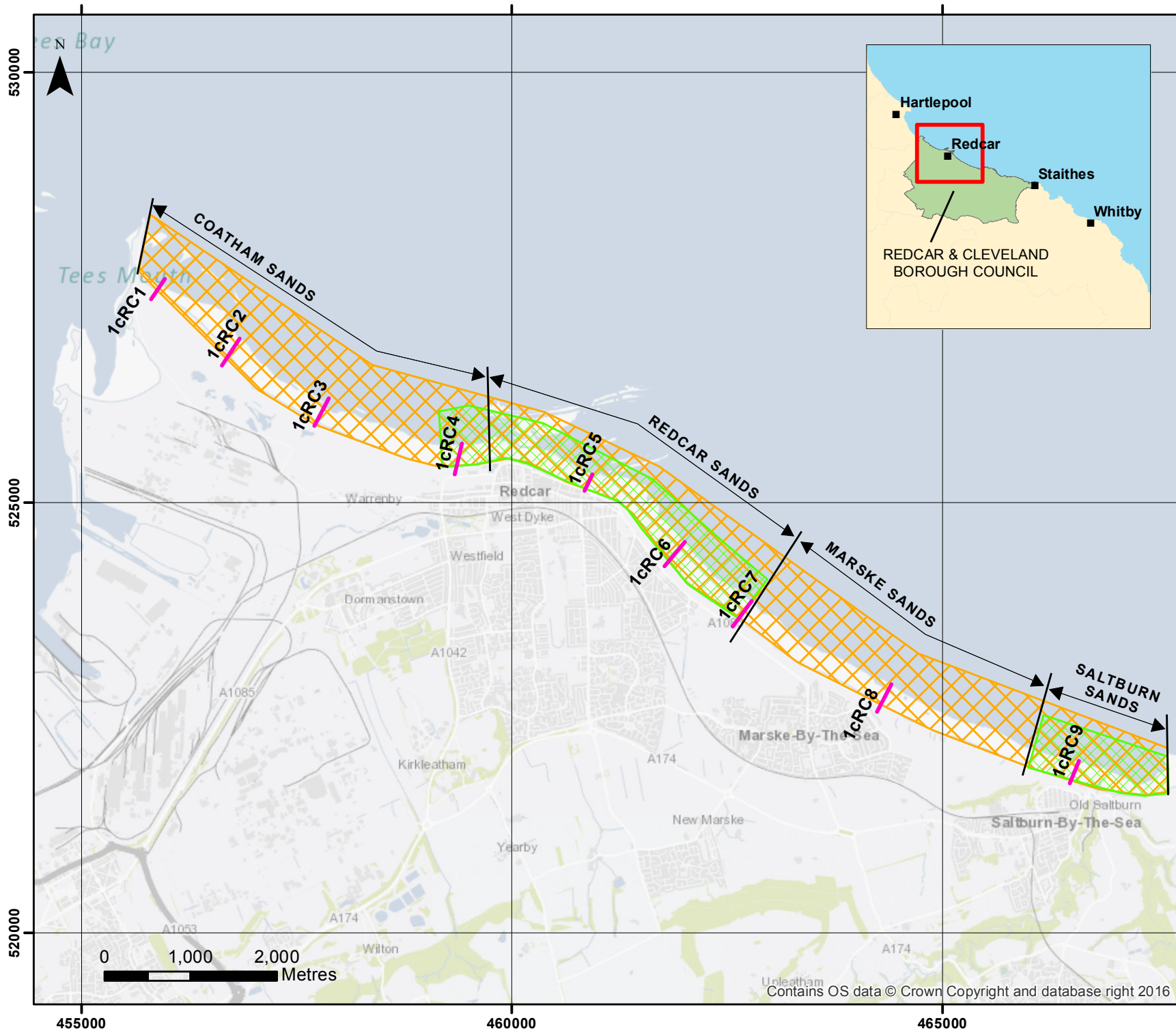
Along Redcar & Cleveland Borough Council's frontage, the following surveying is undertaken:

- Full Measures survey annually each autumn/early winter comprising:
 - Beach profile surveys along nine transect lines
 - Topographic survey along Coatham Sands
 - Topographic survey along Redcar Sands
 - Topographic survey along Marske Sands
 - Topographic survey along Saltburn Sands
 - Topographic survey at Skinningrove along Cattersty Sands
- Partial Measures survey annually each spring comprising:
 - Beach profile surveys along nine transect lines
 - Topographic survey along Redcar Sands
 - Topographic survey along Saltburn Sands
 - Topographic survey at Skinningrove along Cattersty Sands
- Cliff top survey (biannually) at:
 - Staithes

The location of these surveys is shown in Figure 2 and 3. The Partial Measures survey was undertaken along this frontage between 15th and 17th March at Redcar (Coatham Sands, Redcar Sands, Markse Sands and Saltburn Sands), 12th March at Skinningrove and 22nd March at Staithes. During the surveys the weather was varied with varying sea states. Specific weather conditions are detailed in the survey reports.

Processed data from the present survey are presented in the Appendices.

¹ The Staithes frontage straddles the boundary of jurisdiction of Redcar & Cleveland Borough Council and Scarborough Borough Council



Key

SURVEY LOCATIONS

Topographic Profiles

- Annual
- Bi-Annual

Topographic Surveys

- 6 monthly
- yearly
- 5 yearly

(Indicative Survey Extents shown)

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Figure 2 - Map 1

Redcar & Cleveland Borough Council Frontage

Analytical Report
Topo Surveys

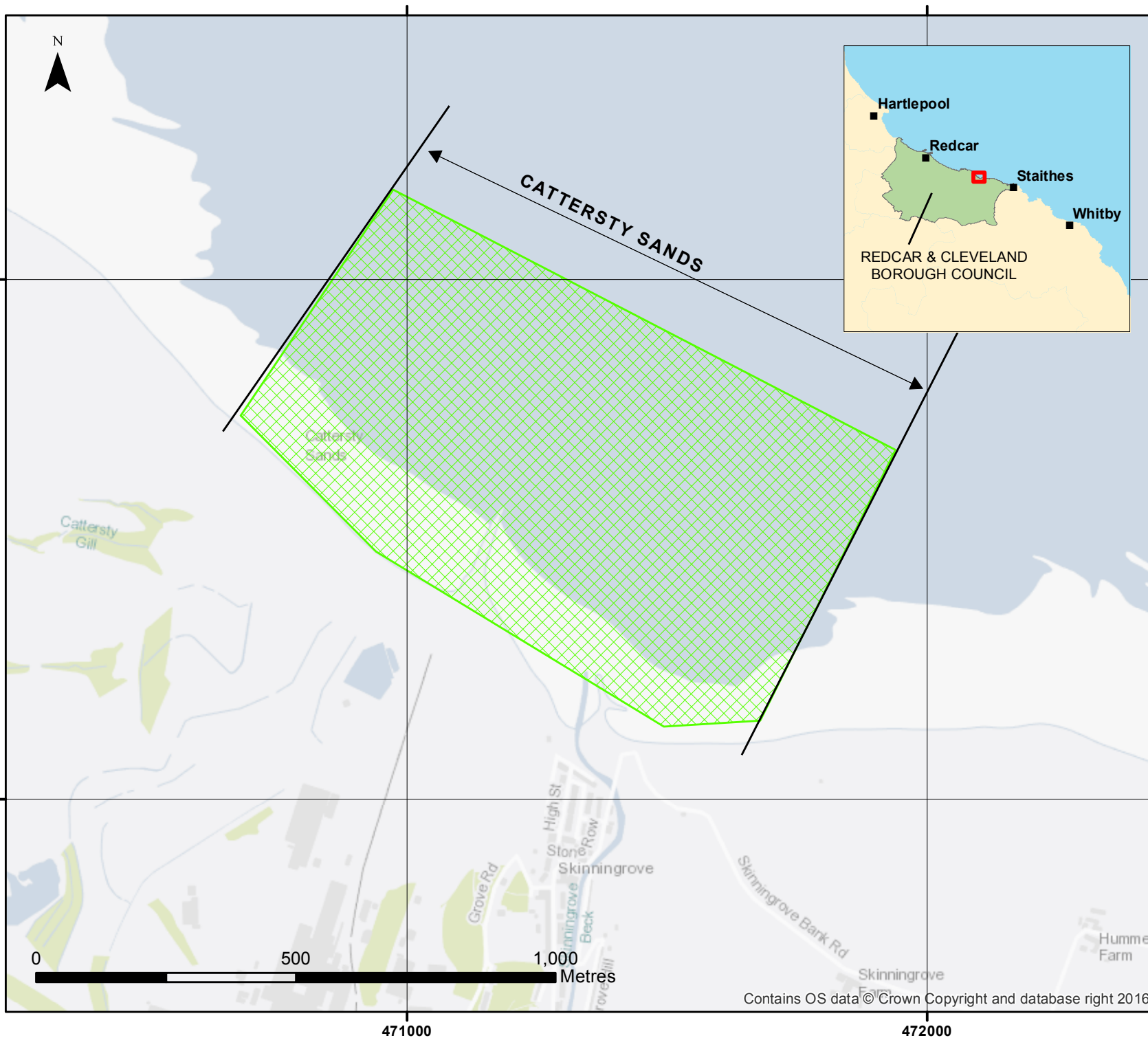
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Key

SURVEY LOCATIONS

Topographic Profiles

- Annual
- Bi-Annual

Topographic Surveys

- 6 monthly
- yearly
- 5 yearly

(Indicative Survey Extents shown)

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Figure 2 - Map 2

Redcar & Cleveland Borough Council Frontage

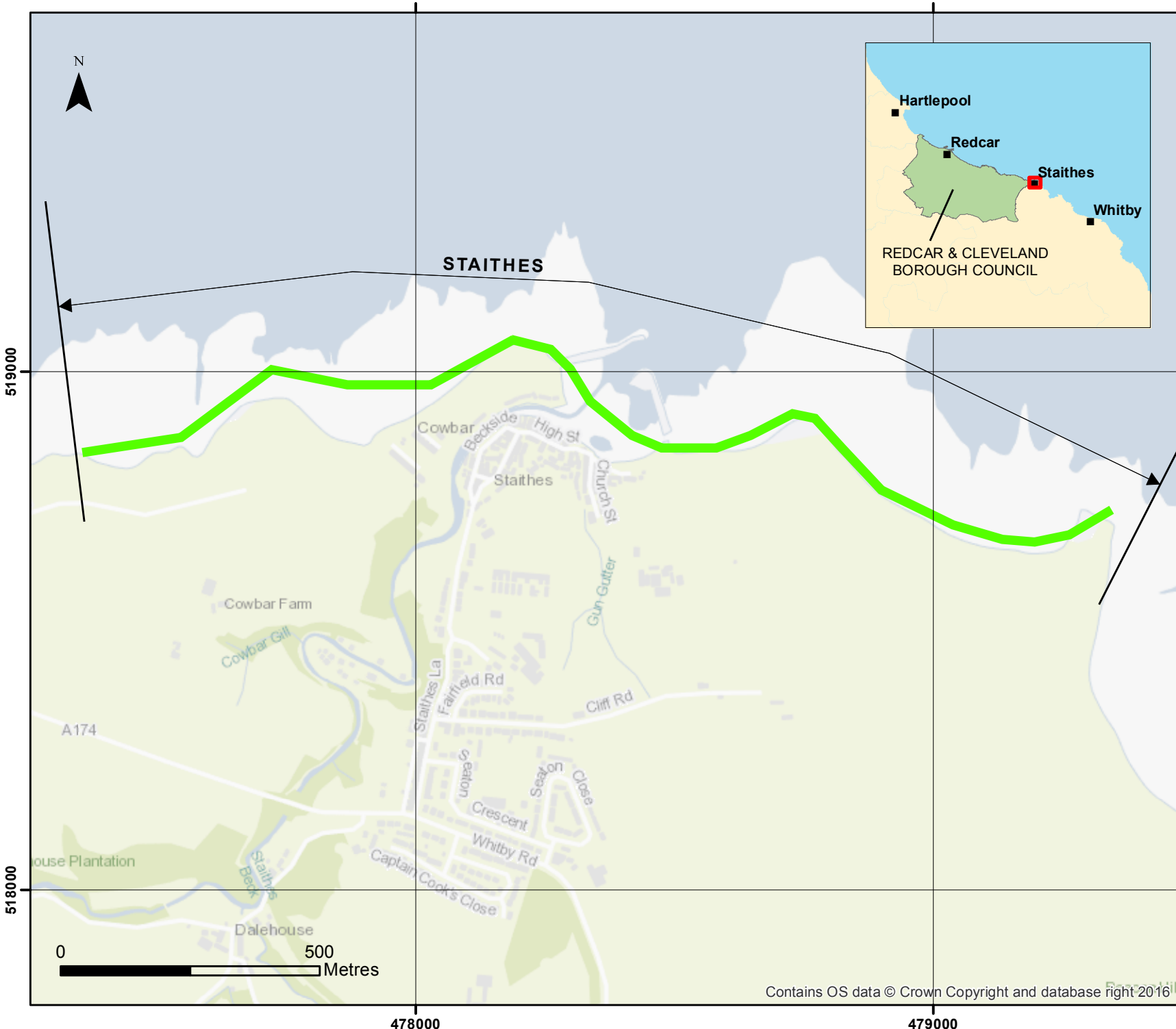
Analytical Report
Topo Surveys

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Key

SURVEY LOCATIONS

Frequency

- @ 50
- @ 100
- @ 300

(Indicative Survey Extents shown)

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

Figure 2 - Map 3

Redcar & Cleveland Borough Council Frontage

Analytical Report
 Topo Surveys

Drawing Scale at A4 1:10,000

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2. Analysis of Survey Data

2.1 Coatham Sands

Survey Date	Description of Changes Since Last Survey	Interpretation
15 th – 17 th March 2021	<p>Beach Profiles:</p> <p>Coatham Sands is covered by four beach profiles during the Partial Measures survey (1cRC1 to 1cRC4; Appendix A) that were last surveyed in autumn 2020.</p> <p>Profile 1cRC1 is located 300m southeast of the South Gare Breakwater, in the lee of the German Charlies slag banks. The upper profile to 105m chainage is dominated by dunes that have remained stable since 2009. The highest dune (chainage 60m) is unchanged since October 2013. Since the previous survey, the foredune between 70m and 105m chainage has remained stable, with an accretion of up to 0.4m across the dunes and 0.1m accretion on its seaward face which is now at its highest level recorded. The upper beach between chainage 105m and 151m has accreted by up to 0.3m and the lower beach seaward of chainage 232m has accreted by up to 1.2m. The middle beach between chainages 151-232m has lowered by up to 0.5m. Overall, the profile is at a high level compared to the range of previously recorded results, particularly between chainages 90-140m and 232-305m which are at their highest level recorded.</p> <p>At profile 1cRC2 the dunes have remained largely stable with accretion of up to 0.5m on the foredunes between chainage 67m and 95m since the previous survey. The upper beach between chainage 95m and 137m has accreted by up to 0.4m, forming a small berm at chainage 125m which is now at its highest level recorded. The middle and lower beach seaward of chainage 125m has lowered by up to 0.5m. Overall the beach is at a medium-high level compared to the range recorded from previous surveys, whilst the dunes remain at their highest recorded levels, particularly the foredune.</p> <p>Profile 1cRC3 showed the main dune has remained stable since April 2014. The crest and seaward face of the foredune has experienced some minor accretion of up to 0.1m to chainage 100m since the previous survey. The majority of the profile seaward of chainage 100m has lowered by up to 0.2m on the middle beach and 0.6m on the lower beach. A hollow at chainage 245m has infilled by up to 0.4m. Overall the profile is at a medium-high level compared with the range recorded from previous surveys. The dunes, which have remained stable over the winter of 2020/21, are at a high level compared to the range recorded from previous surveys. The lower beach berm from chainage 235m to the end of the</p>	<p>Generally, the profiles show a variable trend of accretion and erosion, with most changes limited to the range recorded from previous surveys. Generally, the beach profiles show accretion within the dunes and at the dune toe, and erosion across the middle beach. The central profiles (1cRC2 and 1cRC3) have lowered on the lower beach, whilst 1cRC1 and 1cRC4 have accreted. The dune areas all show stability or some accretion on the foredunes over the winter of 2020/21 and are at their highest recorded level at all profiles.</p> <p>Longer term trends:</p> <p>All beach profiles at Coatham show the dunes are stable or accreting on their seaward extent. The beaches to the west show a typical longer-term trend of progressive accretion. The beaches in the centre and to the east have a more fluctuating long-term pattern.</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>survey at 260m is the highest recorded level in this location.</p> <p>Profile 1cRC4 is located at the beginning of the defended section at Coatham and Redcar. There has been accretion of up to 0.2m at the base of the seawall throughout the winter of 2020/21. An upper beach berm has migrated seaward by approximately 30m. The middle beach has lowered by up to 0.2m to chainage 190m, before switching to accretion on the lower beach by up to 0.5m. Overall the profile is at a high level across the upper beach, a low level on the middle beach and a medium level on the lower beach when compared to the range recorded from previous surveys.</p>	

2.2 Redcar Sands

Survey Date	Description of Changes Since Last Survey	Interpretation
<p>15th – 17th March 2021</p>	<p>Beach Profiles:</p> <p>Redcar Sands is covered by three beach profiles (1cRC5 to 1cRC7; Appendix A), with 1cRC7 being approximately on the boundary with the Marske Sands area. They were last surveyed in autumn 2020.</p> <p>At profile 1cRC5 the sea defences constructed in 2012 remain unchanged as far as 20m chainage. There has been accretion at the toe of the sea defence of 0.1m to chainage 36m. From chainage 36m to 97m there has been a lowering of the middle beach by up to 0.3m, exposing a patch of rocks at chainage 75m. The lower beach has accreted by up to 0.4m to chainage 145m. The rock exposure seawards of chainage 145m remains exposed and the low levels reported seawards of this point in October 2019 remain. Overall, the profile is at a medium level compared to the range recorded from previous surveys.</p> <p>Profile 1cRC6 has not changed landward of 55m chainage since the last survey due to the presence of the sea defence, with very little to no change at the toe of the sea defence to chainage 90m. Seaward of this point, the upper middle and lower beach have lowered evenly by up to 0.3m. Overall, the profile is at a medium level compared with the range of previously recorded results.</p> <p>Profile 1cRC7 is undefended. The profile has not changed landward of 67m chainage since the last survey. There has been a lowering of the upper beach by up to 1.0m and the lower beach by up to 1.0m. The middle beach between chainages 190-230m has accreted by up to 0.3m. The profile is at a medium level compared with the range of previously recorded results.</p>	<p>Profiles at Redcar shows erosion to be the dominant process, however beach profiles remain within the bounds of the previous results.</p> <p>Longer term trends:</p> <p>Profiles 1cRC5 and 1cRC7 show movement of beach berms across the profile.</p>
<p>March 2021</p>	<p>Topographic Survey:</p> <p>Redcar Sands is covered by a 6-monthly topographic survey. Data have been used to create a DGM (Appendix B – Map 1) using a GIS. The DGM shows that the beach topography is broadly parallel to the shore, although there is a slight embayment with a slightly steeper beach between the two headlands at Coatham Rocks and Redcar Rocks.</p> <p>The GIS has also been used to calculate the differences between the current topographic survey (autumn 2020) and the most recent (spring 2021) topographic survey, as shown in Appendix B – Map 4, to identify areas of erosion and accretion.</p>	<p>The topographic difference plots show that the beach has remained relatively stable with erosion being the dominant process, with localised areas of accretion in the west of the survey area. This broadly confirms the pattern shown by beach profiles.</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>The difference plot shows that erosion is dominant across the frontage, with accretion (up to 0.75m) limited to the middle and lower beach west of Coatham Rocks. The area of greatest change is around the Redcar Rocks and at Ayton Hole with erosion of up to 1.5m, however erosion is more typically limited to 0.75m.</p>	

2.3 Marske Sands

Survey Date	Description of Changes Since Last Survey	Interpretation
15 th – 17 th March 2021	<p>Beach Profiles:</p> <p>Marske Sands is covered by two beach profiles during the Partial Measures survey (1cRC7 to 1cRC8; Appendix A). 1cRC7 is on the boundary with the Redcar Sands area.</p> <p>Profile 1cRC7 is located along The Stray and has been discussed in Section 2.2.</p> <p>Profile 1cRC8 is largely unchanged as far as 50m chainage. Since April 2014 the dune face (chainage 50m) has remained stable, which contrasts with the winter of 2013/14 when 10m of recession was recorded. From chainage 50m at the base of the cliff to 87m on the upper beach, there has been minor accretion of less than 0.1m of material. The upper beach between chainage 87m and 111m has experienced no change. Seawards of chainage 111m there has been a lowering of the beach profile by up to 1.4m on the middle beach and 0.4m on the lower beach. The profile is generally at a medium level when compared to the range recorded from previous surveys, except the lower beach which is at a low level, particularly between chainages 165-190m which is at its lowest level recorded.</p>	<p>The cliffed face of the dune remained stable at both 1cRC7 and 1cRC8 following the recession over the winter of 2013/14.</p> <p>Profile 1cRC8 shows erosion across the beach since the previous survey.</p> <p>Longer term trends:</p> <p>The October 2013 and April 2014 profiles were amongst the lowest seen at 1cRC8 due to the exceptionally stormy winter of 2013/14. The beach has recovered with medium beach levels in 2021.</p>

2.4 Saltburn Sands

Survey Date	Description of Changes Since Last Survey	Interpretation
<p>15th – 17th March 2021</p>	<p>Beach Profiles:</p> <p>Saltburn Sands is covered by one beach profile (1cRC9; Appendix A).</p> <p>Overall profile 1cRC9 has experienced no change over the section covered by the sea defence as far as 20m chainage. There has been accretion of up to 0.2m at the toe of the seawall to chainage 30m. Seawards of chainage 30m there has been erosion of up to 0.4m across the beach profile. The beach lies at a low level when compared to the previous surveys.</p>	<p>The profile has remained stable over the winter of 2020/21, with an even erosion of up to 0.4m across the majority of the beach profile. Overall, the beach is at a low level but appears relatively stable when compared with the previous surveys.</p> <p>Longer term trends: The profile plots show net erosion, although there are periods of recovery.</p>
<p>Mar 2021</p>	<p>Topographic Survey:</p> <p>Saltburn Sands is covered by a 6-monthly topographic survey. Data have been used to create a DGM (Appendix B – Map 2). The beach topography consists of shore parallel contours, with a small change at the mouth of the channel. This DGM has been compared against the previous (autumn 2020) survey in Appendix B – Map 5.</p> <p>The difference plot comparing the DGMs shows that since autumn 2020 erosion has dominated across the frontage. Accretion is limited to the upper beach of the central survey area at Skelton Beck and lower beach in the east of the survey area. The far east of the profile has experienced little change. Change across the frontage is generally limited to $\pm 0.75\text{m}$, except for a patch of erosion on the lower beach in the west of the survey area which is up to 1.25m.</p>	<p>The difference plot indicates that there has generally been accretion, however change is generally limited to $\pm 0.75\text{m}$. This confirms the pattern shown in the profile.</p>

2.5 Cattersty Sands

Survey Date	Description of Changes Since Last Survey	Interpretation
12 th March 2020	<p>Topographic Survey:</p> <p>Cattersty Sands is covered by a 6-monthly topographic survey. Data have been used to create a DGM (Appendix B – Map 3). For the most part the beach contours are shore-parallel, and steeper east of the breakwater than west of it. Two deviations from the shore parallel pattern occur where the channel outflow crosses the beach and in the furthest east part of the survey where the contours indicate an embayment. The survey report notes that “<i>strong onshore winds restricted the depth which was achievable on the day</i>”.</p> <p>The spring 2021 DGM has been compared against the previous (autumn 2020) survey in Appendix B – Map 8. In the west of the survey extent there has been a wide band of erosion on the upper to middle beach and little change ($\pm 0.1\text{m}$) on the lower beach. There has been some accretion against the western face of the breakwater on the lower beach and at the toe of the dunes in the centre of the western survey area. Generally, the changes on the western side of the breakwater are limited to $\pm 0.75\text{m}$.</p> <p>To the east of the breakwater the changes at Cattersty are more complex. The dominant process between the breakwater and the groyne is change limited to $\pm 0.1\text{m}$, with erosion being limited to directly adjacent (to the east) of the breakwater and directly downstream of the road bridge at Skinningrove Beck. To the east of the groyne, a narrow band of erosion has been experienced on the middle beach fronting the cliffs. The upper beach varies between patches of erosion and accretion, whilst the lower beach has experienced little change ($\pm 0.1\text{m}$). There is a large patch of accretion in the lee (to the west) of the groyne. The changes to the east of the breakwater are in the order $\pm 1.00\text{m}$.</p>	<p>The data shows that there has been a mixture of accretion and erosion throughout the frontage. Generally, beach levels have remained reasonably stable. The most notable area of erosion has occurred as a wide band on the upper to middle beach to the west of the groyne. There has also been some erosion in the riverbed and the river mouth.</p> <p>Longer term trends: The long-term trend shows that on the north-west side of the breakwater there is erosion on the upper beach and accretion on the lower beach. On the south-east side of the breakwater there is a long-term pattern of accretion on the mid beach with erosion in the channel mouth.</p> <p>The winter erosion dominates the overall behaviour of the beach but the calmer weather in the summer months should lead to some accretion. If the erosion of the upper beach continues it is likely to drive cliff failures which would add material to the upper beach for redistribution.</p>

2.6 Staithes

Survey Date	Description of Changes Since Last Survey	Interpretation
22 nd March 2021	<p>Cliff-top Survey:</p> <p>Twenty ground control points have been established at Staithes for the purposes of cliff top monitoring. The separation between any two points is a nominal 100m. The cliff top surveys at Staithes are undertaken bi-annually. Data collection involves a distance offset measurement from the ground control point to the cliff edge along a fixed bearing.</p> <p>Appendix C provides results from the March 2021 survey, showing the distance from the ground control point to the edge of the cliff top along the defined bearing and changes in position since the November 2008 baseline survey and the previous November 2020 survey.</p> <p>The results provided in Appendix C show that the majority of the profiles show little or no erosion since the previous survey, with only 2 points experiencing erosion greater than the survey error (0.20m). These are located at Point 8 at Cowbar Nab in the west of the survey extent (0.94m) and Point 19 in the far east of the survey area (0.31m). Several points noted apparent 'accretion' of the cliff top (Points 12, 13, 16 and 18), this is likely to be due to difficulties in accurately identifying the cliff edge through vegetation.</p> <p>The long term recession rates show that two points at Staithes are greater than 0.2m/year (Point 1 along the road to the west of Staithes (0.53m) and Point 13 adjacent to the eastern breakwater at Staithes (0.20m)).</p>	<p>The recorded changes to the cliff top between November 2020 and March 2021 are generally small. There has been two points which show retreat of the cliff top greater than the survey error (Point 8 and Point 19).</p> <p>Longer term trends: Table C1 in Appendix C presents the erosion rates calculated from the data collected since 2008. Points 1, 4, and 13 are the only locations with a significant recession rate, which ranges from 0.17 to 0.53m/yr.</p>

3. Problems Encountered and Uncertainty in Analysis

Topographic Survey

- The survey report at Cattersty notes that strong onshore winds restricted the depth which was achievable on the day.

Cliff Top Surveys

- The cliff top surveys at Staithes are assumed to have an accuracy of ± 0.2 m due to the methodology.
- Survey points 9 to 12 at Staithes were previously cordoned off by the National Trust due to a landslip on the headland. However, access to these points has been permitted since spring 2020.

4. Recommendations for 'Fine-tuning' the Monitoring Programme

- No further recommendations are made at this stage for the fine-tuning of the monitoring programme.

5. Conclusions and Areas of Concern

- At Coatham Sands the profiles have undergone variable erosion and accretion. The dunes have remained stable and shown some accretion on the foredune over the winter of 2020/21 which are now at their highest levels recorded.
- Across Redcar Sands, erosion has been the dominant process, however the levels here remain within the bounds of previously recorded results.
- At Marske Sands the cliffed face of the dune remained stable, despite some slight slumping of material at the toe of the dune. Profile 1cRC8 has shown erosion across the beach profile, with the lower beach at its lowest level recorded.
- At Saltburn Sands, the profile has lowered evenly however remains relatively stable when compared to previous surveys.
- Across Cattersty Sands there has been a mixture of erosion and accretion. The most notable area of erosion is along the upper to middle beach to the west of the breakwater. There has been some erosion on the riverbed and river mouth. Changes east of the breakwater are less discernible, with little change (± 0.1 m) dominating to west of the groyne and patchy accretion and erosion to the east of the groyne.
- At Staithes, the recorded changes to the cliff top between November 2020 and March 2021 are generally small. There has been two points which show retreat greater than the survey error (Point 8: 0.94m and Point 19: 0.31m). Points 1, 4 and 13 show long term average erosion rates of between 0.17m/year and 0.53m/year since 2008.

Appendices

Appendix A
Beach Profiles

The following sediment feature codes are used on some profile plots:

Code	Description
S	Sand
M	Mud
G	Gravel
GS	Gravel & Sand
MS	Mud & Sand
B	Boulders
R	Rock
SD	Sea Defence
SM	Saltmarsh
W	Water Body
GM	Gravel & Mud
GR	Grass
D	Dune (non-vegetated)
DV	Dune (vegetated)
F	Forested
X	Mixture
FB	Obstruction
CT	Cliff Top
CE	Cliff Edge
CF	Cliff Face
SH	Shell
ZZ	Unknown

Beach Profile

Location: 1cRC1

Date: 17/03/2021

Inspector: AG

Low Tide:

Low Tide Time:

Wind

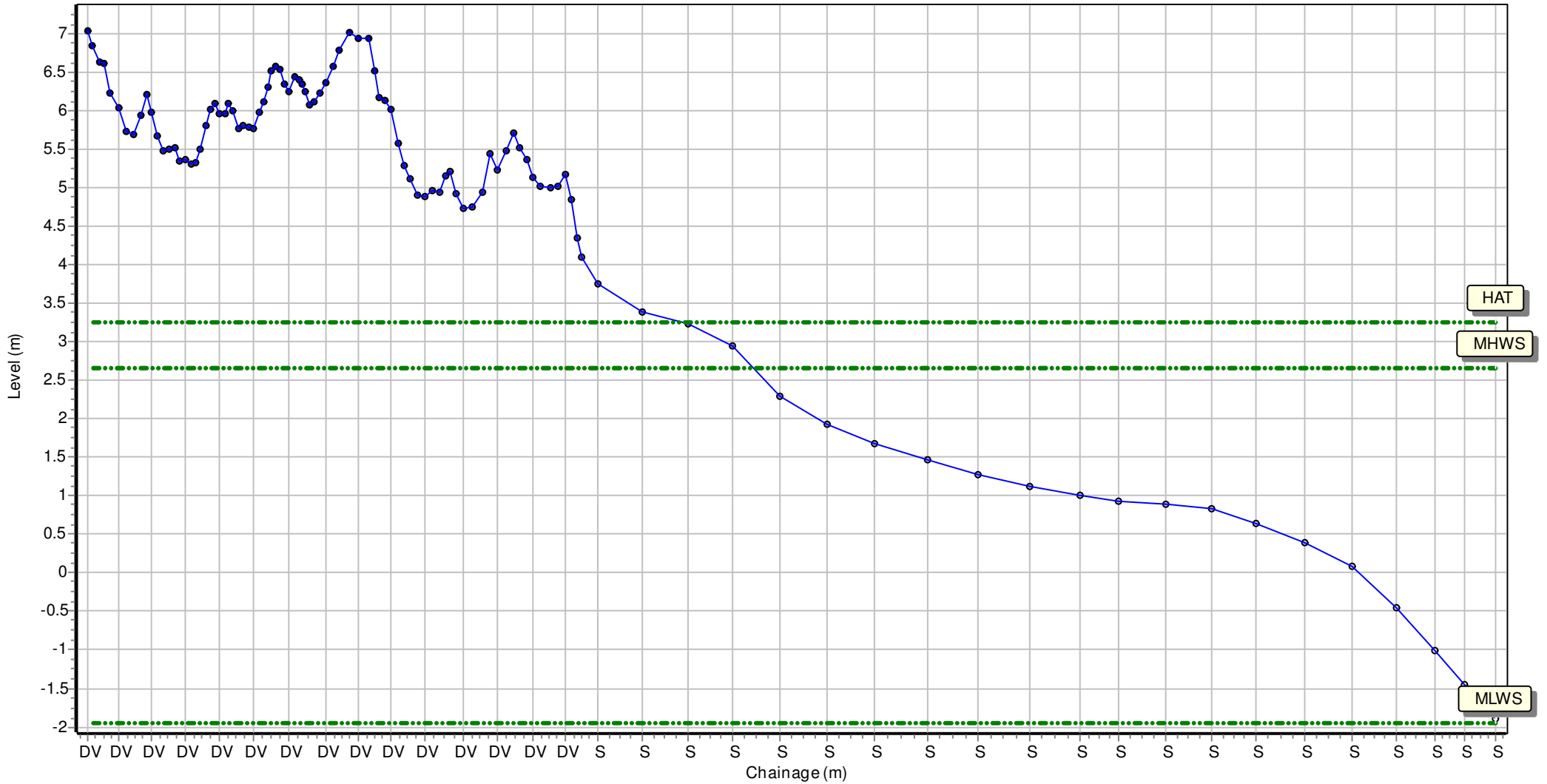
Sea State:

Visibility:

Rain:

Summary: 2021 Partial Measures Topo Survey

Easting: 455811.436 Northing: 527373.402 Profile Bearing: 34 ° from North



Beach Profile

Location: 1cRC2

Date: 17/03/2021

Inspector: AG

Low Tide:

Low Tide Time:

Wind

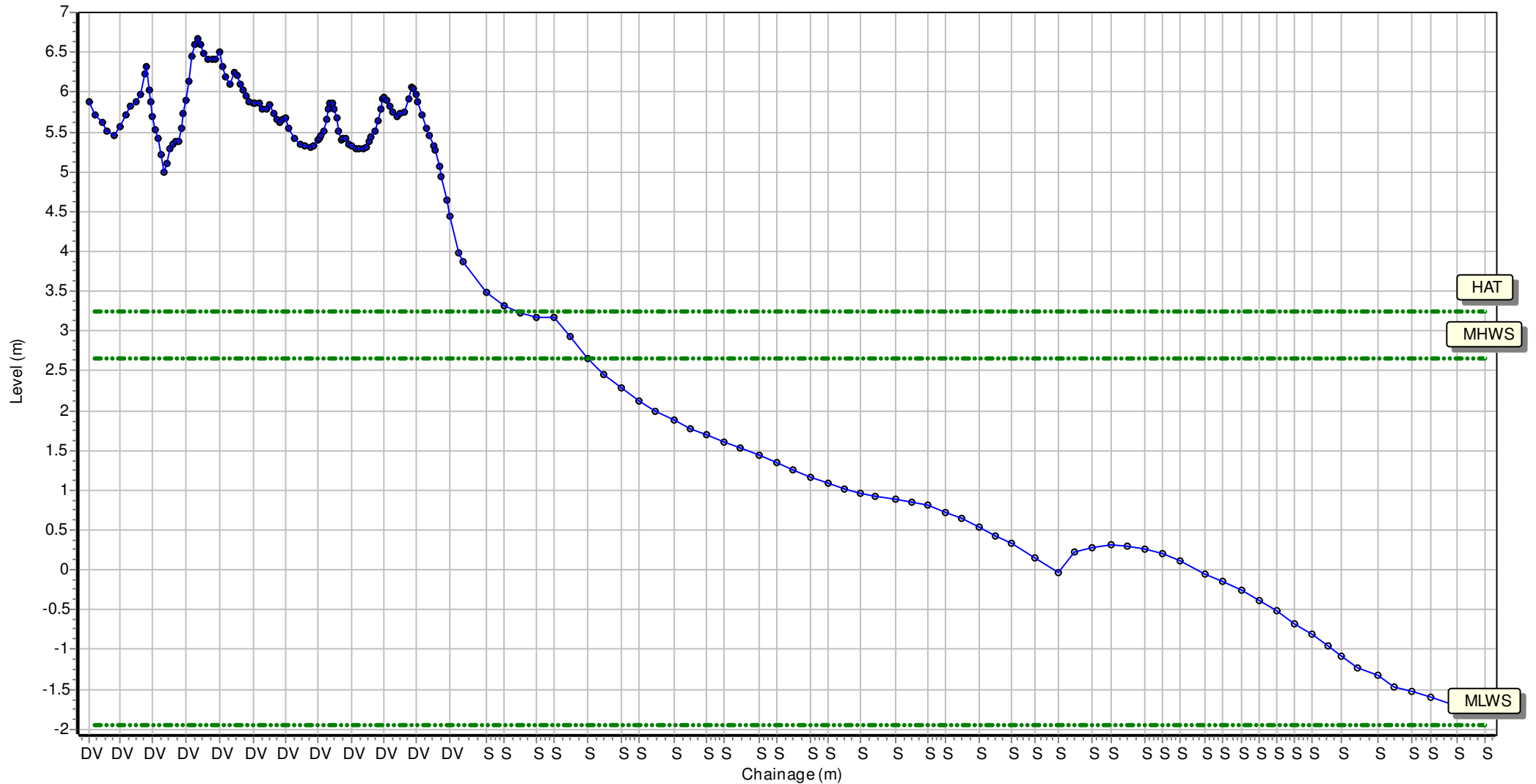
Sea State:

Visibility:

Rain:

Summary: 2021 Partial Measures Topo Survey

Easting: 456633.253 Northing: 526599.577 Profile Bearing: 34 ° from North



Beach Profile

Location: 1cRC3

Date: 17/03/2021

Inspector: AG

Low Tide:

Low Tide Time:

Wind

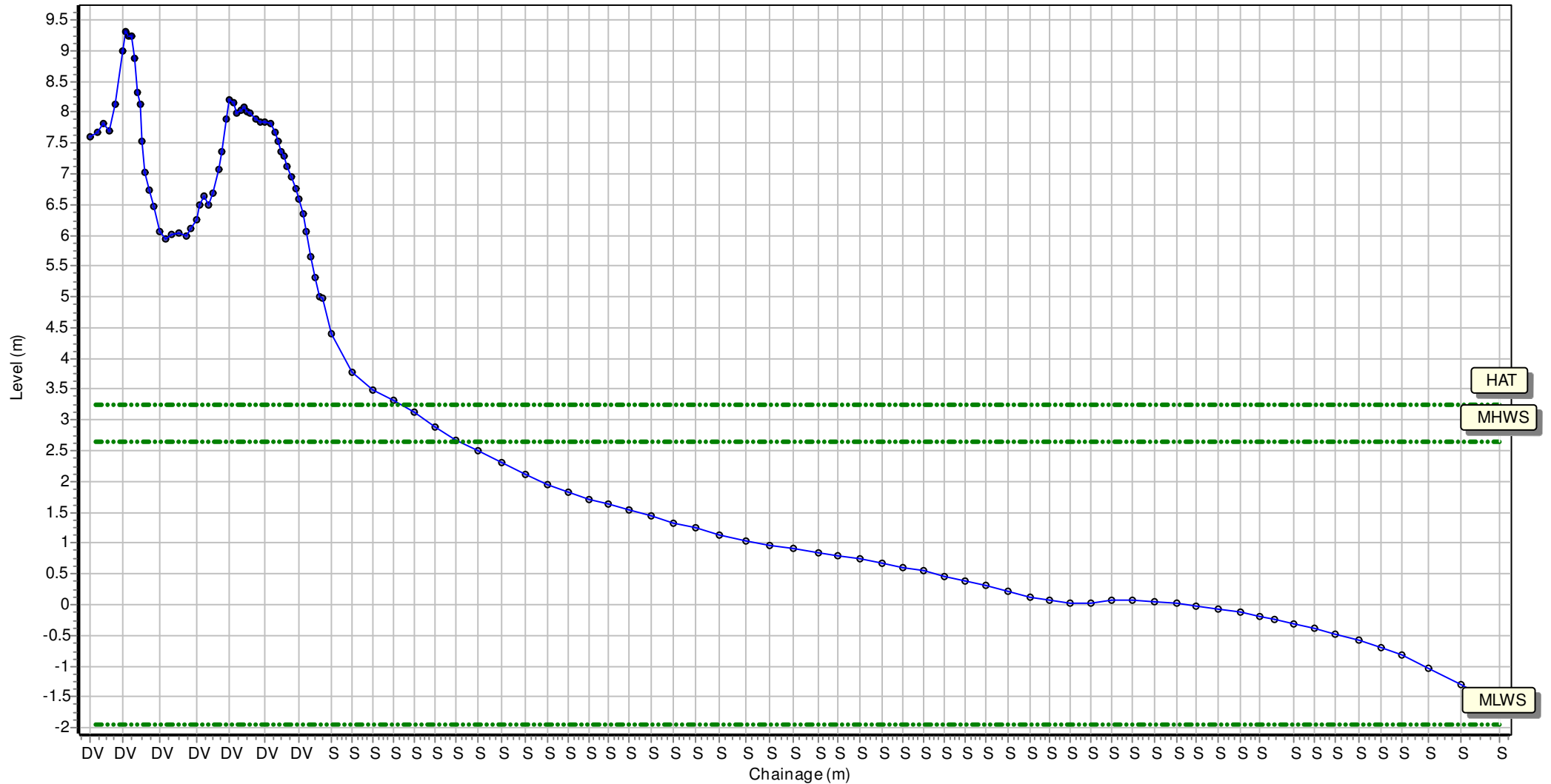
Sea State:

Visibility:

Rain:

Summary: 2021 Partial Measures Topo Survey

Easting: 457706.365 Northing: 525898.597 Profile Bearing: 28 ° from North



Beach Profile

Location: 1cRC4

Date: 17/03/2021

Inspector: AG

Low Tide:

Low Tide Time:

Wind

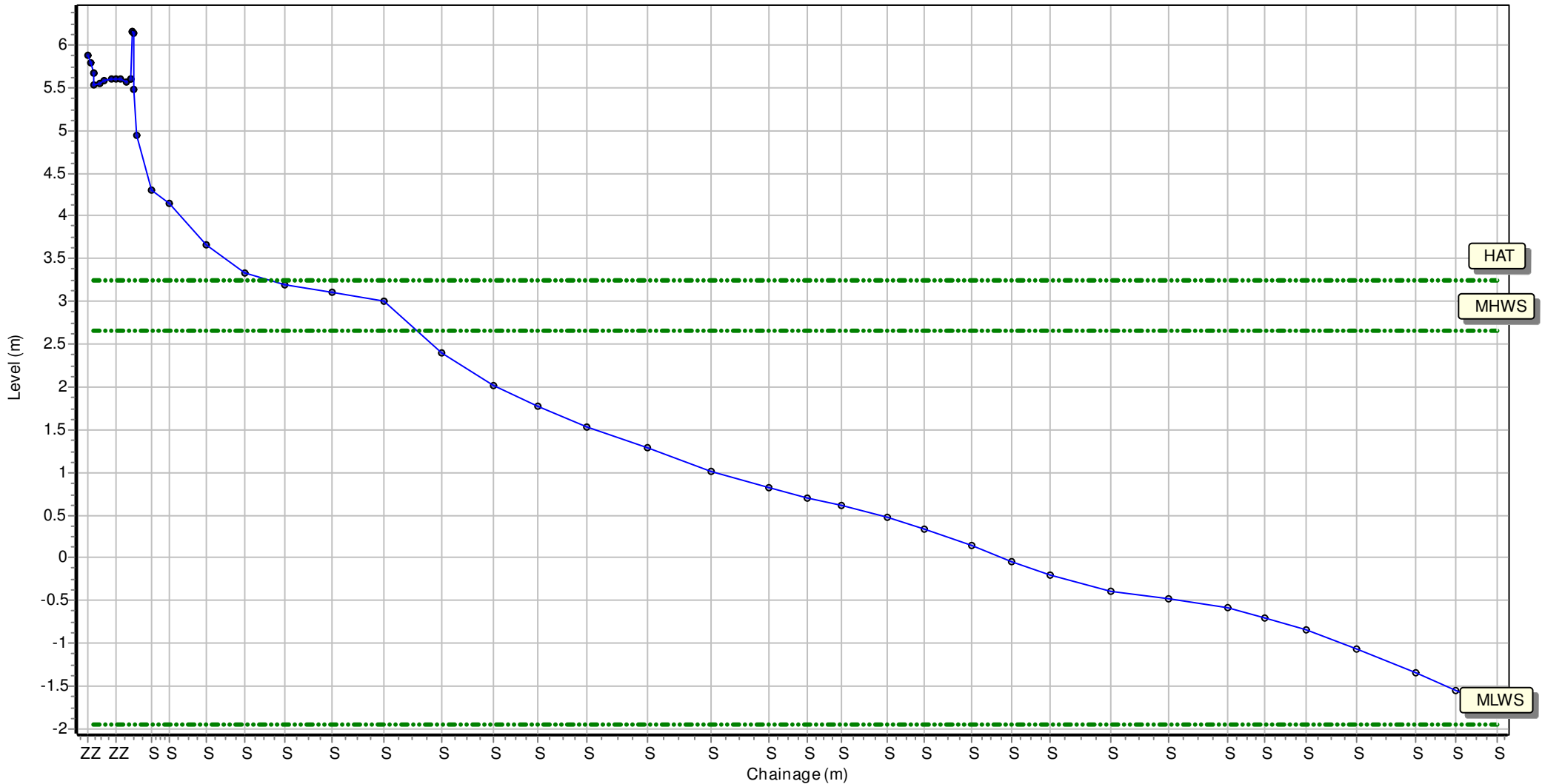
Sea State:

Visibility:

Rain:

Summary: 2021 Partial Measures Topo Survey

Easting: 459337.597 Northing: 525336.99 Profile Bearing: 13 ° from North



Beach Profile

Location: 1cRC5

Date: 17/03/2021

Inspector: AG

Low Tide:

Low Tide Time:

Wind

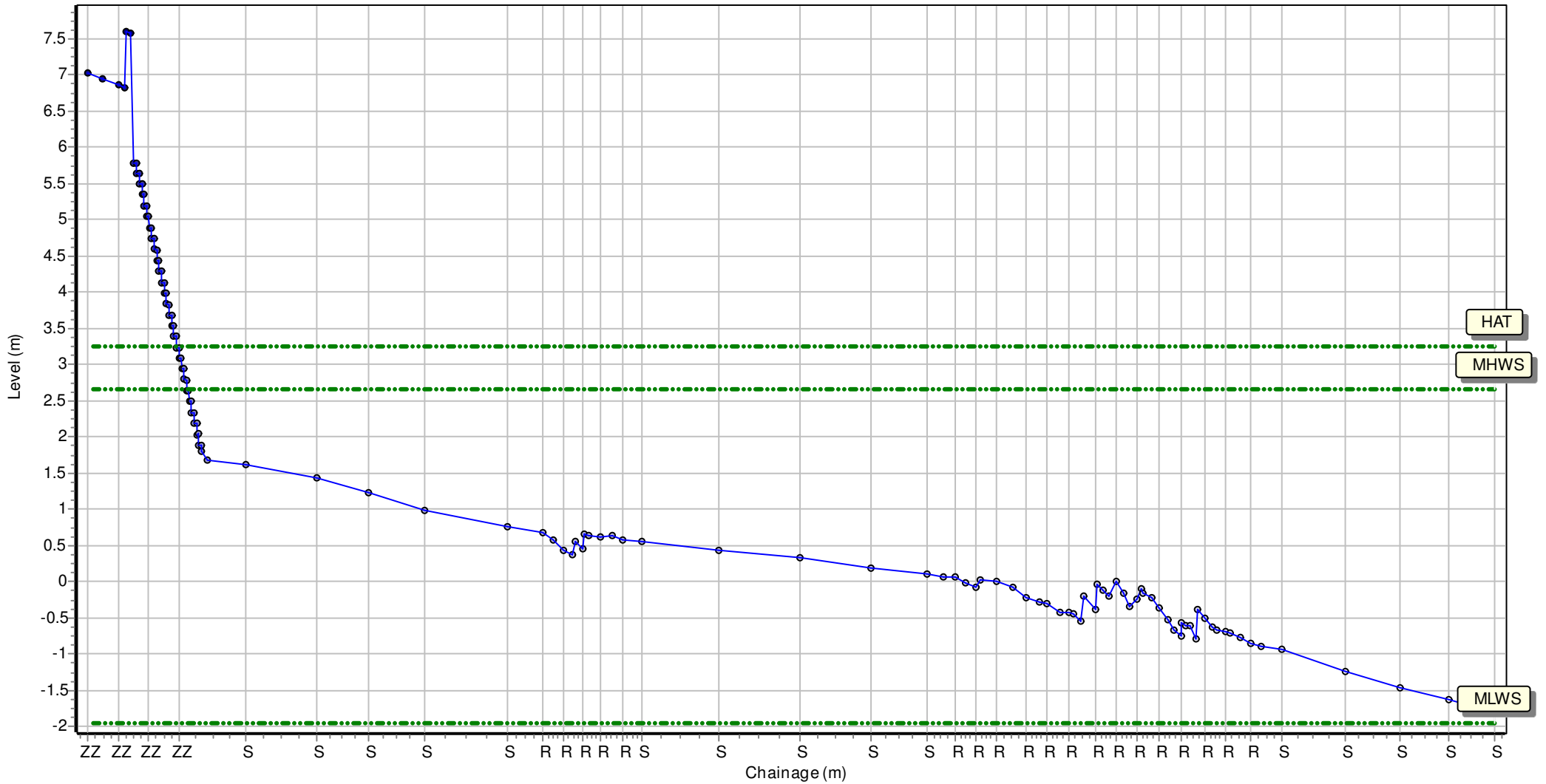
Sea State:

Visibility:

Rain:

Summary: 2021 Partial Measures Topo Survey

Easting: 460845.21 Northing: 525146.997 Profile Bearing: 26 ° from North



Beach Profile

Location: 1cRC7

Date: 17/03/2021

Inspector: AG

Low Tide:

Low Tide Time:

Wind

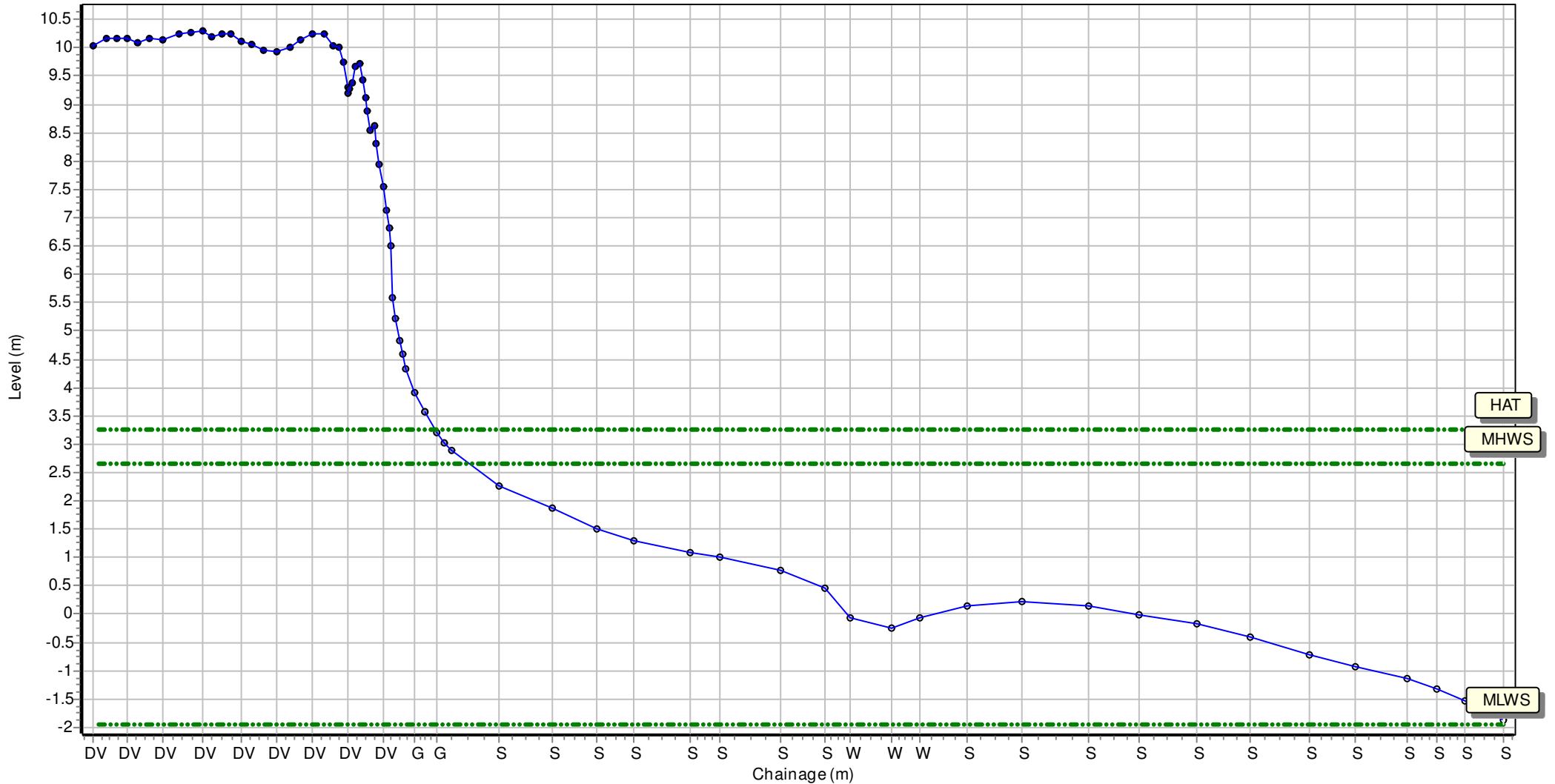
Sea State:

Visibility:

Rain:

Summary: 2021 Partial Measures Topo Survey

Easting: 462568.453 Northing: 523568.436 Profile Bearing: 37 ° from North



Beach Profile

Location: 1cRC8

Date: 17/03/2021

Inspector: AG

Low Tide:

Low Tide Time:

Wind

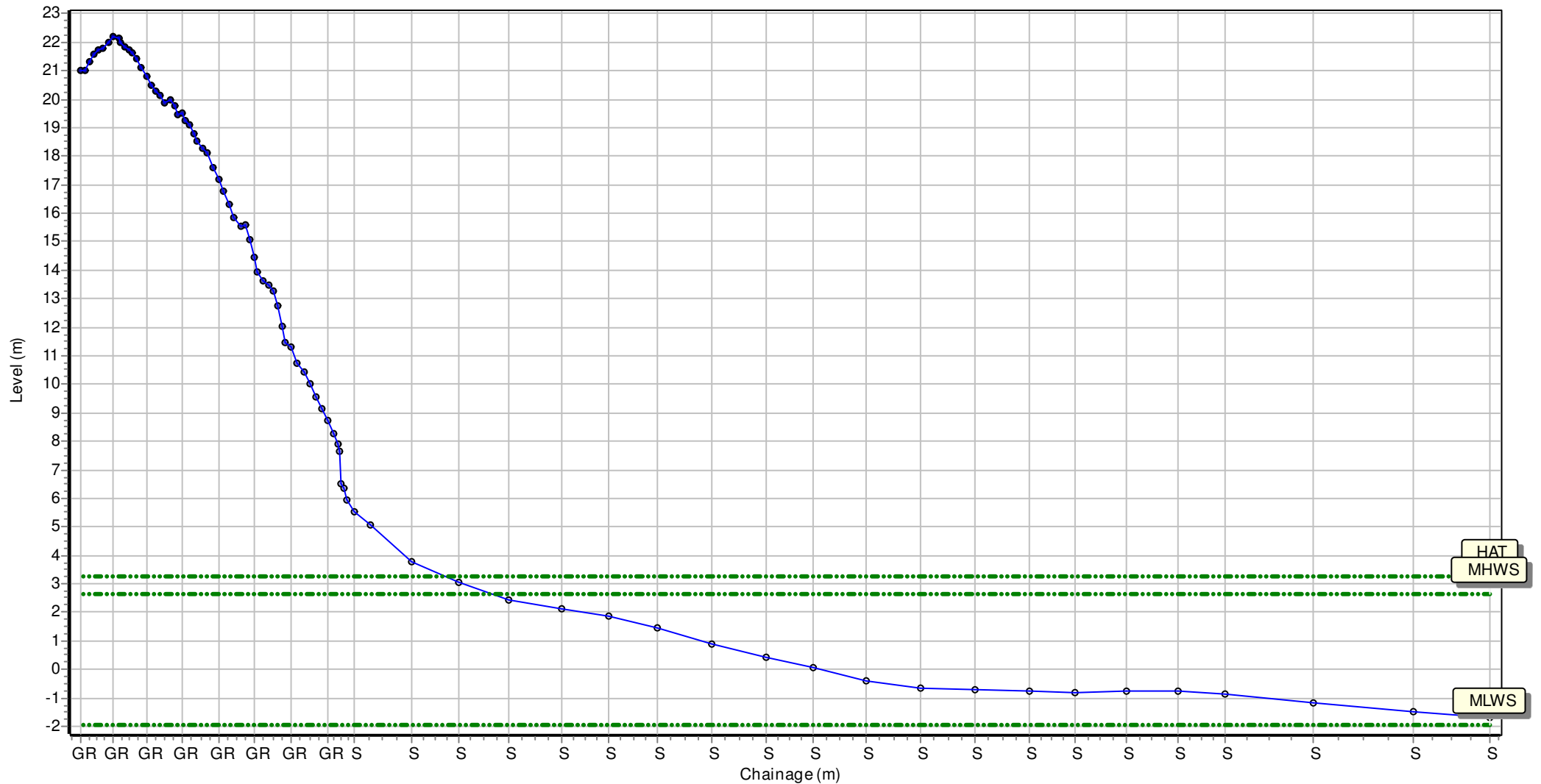
Sea State:

Visibility:

Rain:

Summary: 2021 Partial Measures Topo Survey

Easting: 464245.579 Northing: 522578.097 Profile Bearing: 28 ° from North



Beach Profile

Location: 1cRC9

Date: 17/03/2021

Inspector: AG

Low Tide:

Low Tide Time:

Wind

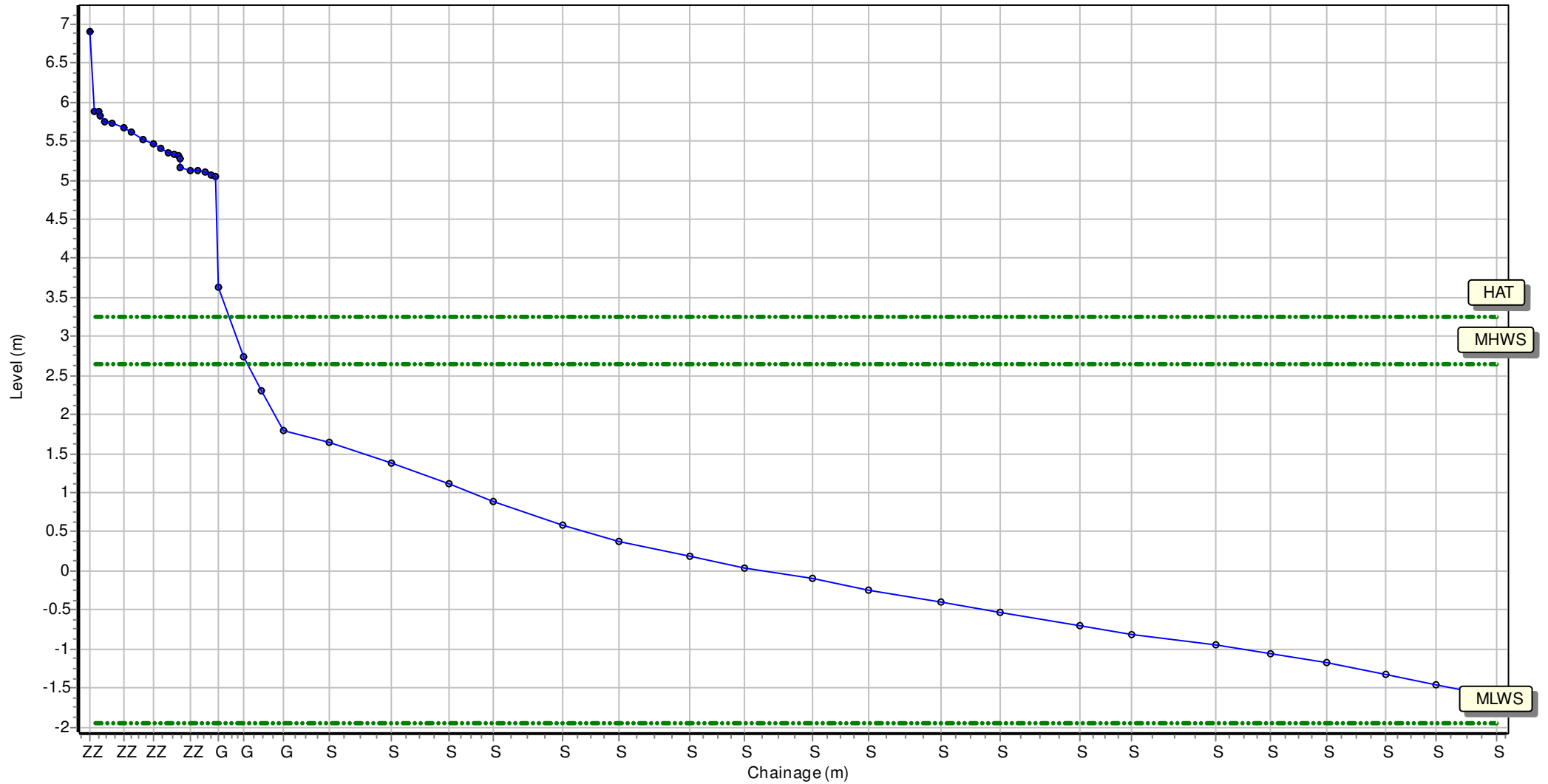
Sea State:

Visibility:

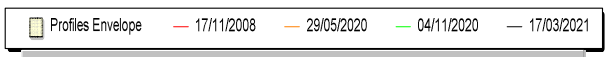
Rain:

Summary: 2021 Partial Measures Topo Survey

Easting: 466477.532 Northing: 521748.87 Profile Bearing: 22 ° from North



Beach Profiles: 1cRC1



HAT

MHWS

MLWS

SANDS

Beach Profiles: 1cRC2



Profiles Envelope 17/11/2008 29/05/2020 04/11/2020 17/03/2021

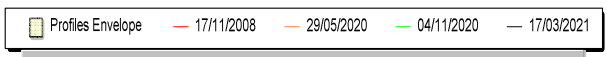
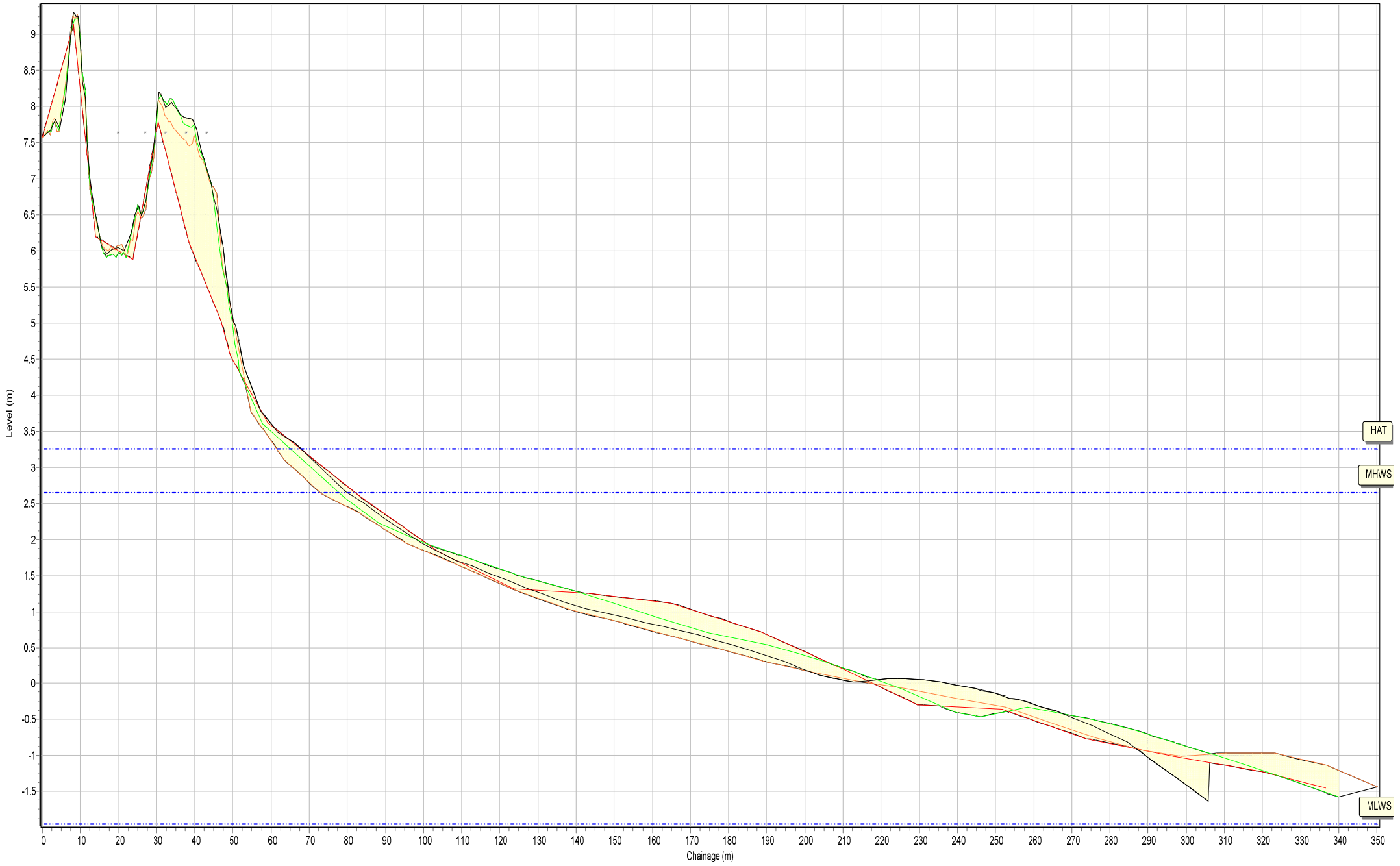
HAT

MHWS

MLWS

SANDS

Beach Profiles: 1cRC3



HAT

MLWS

MLWS

SANDS

Beach Profiles: 1cRC4



HAT

MHWS

MLWS

SANDS

Beach Profiles: 1cRC5



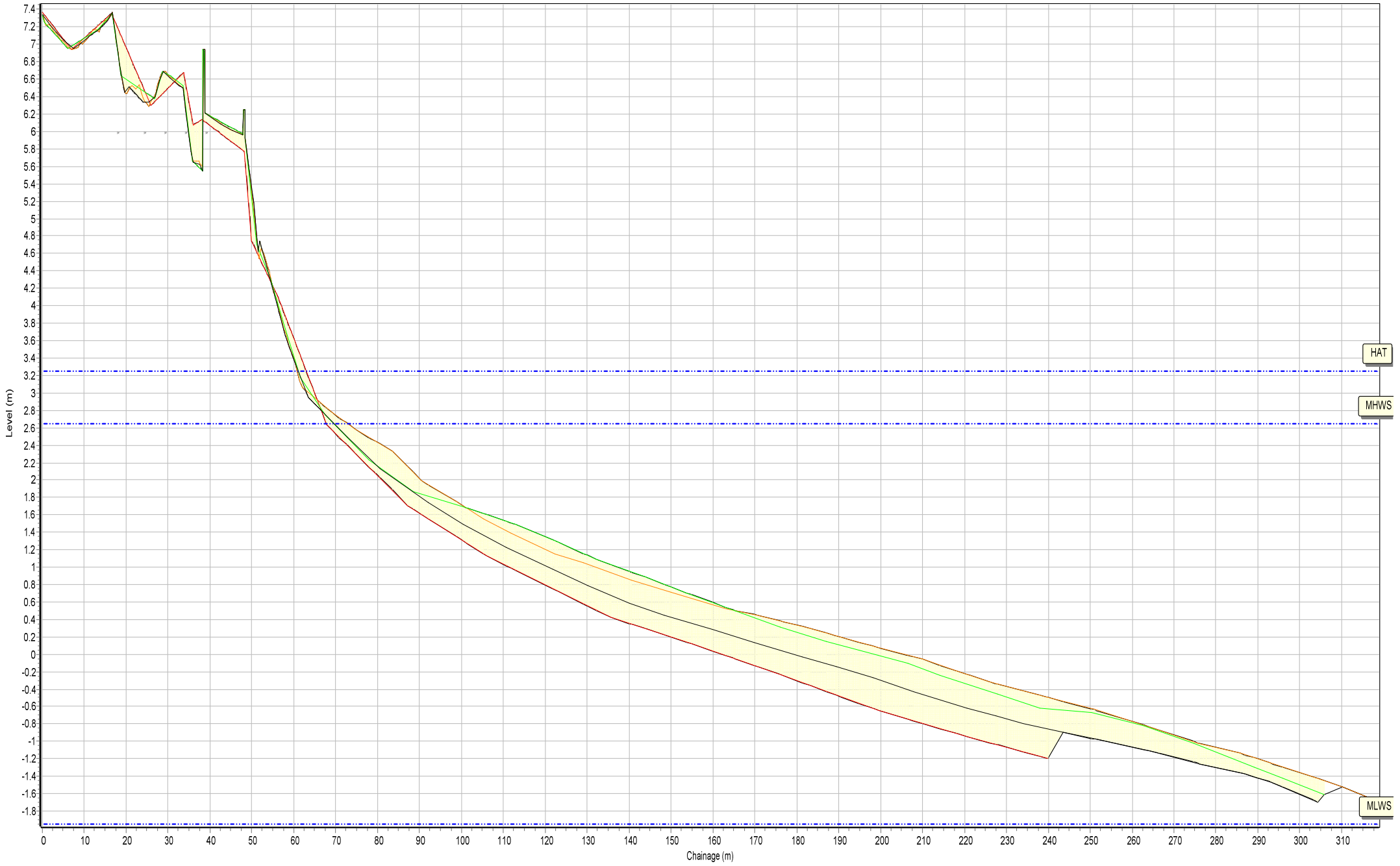
HAT

MHWS

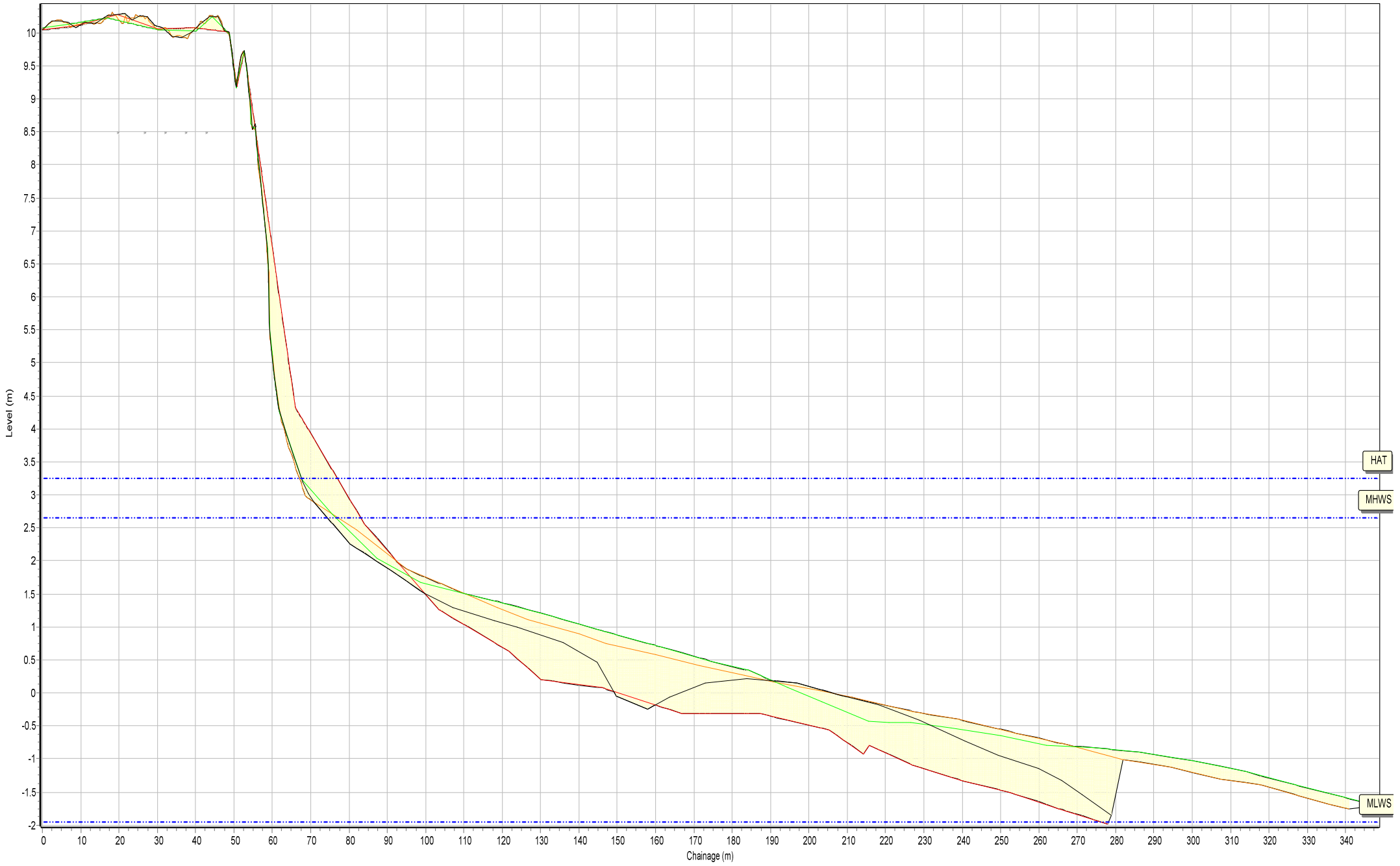
MLWS

SANDS

Beach Profiles: 1cRC6



Beach Profiles: 1cRC7



Profiles Envelope 17/11/2008 29/05/2020 04/11/2020 17/03/2021

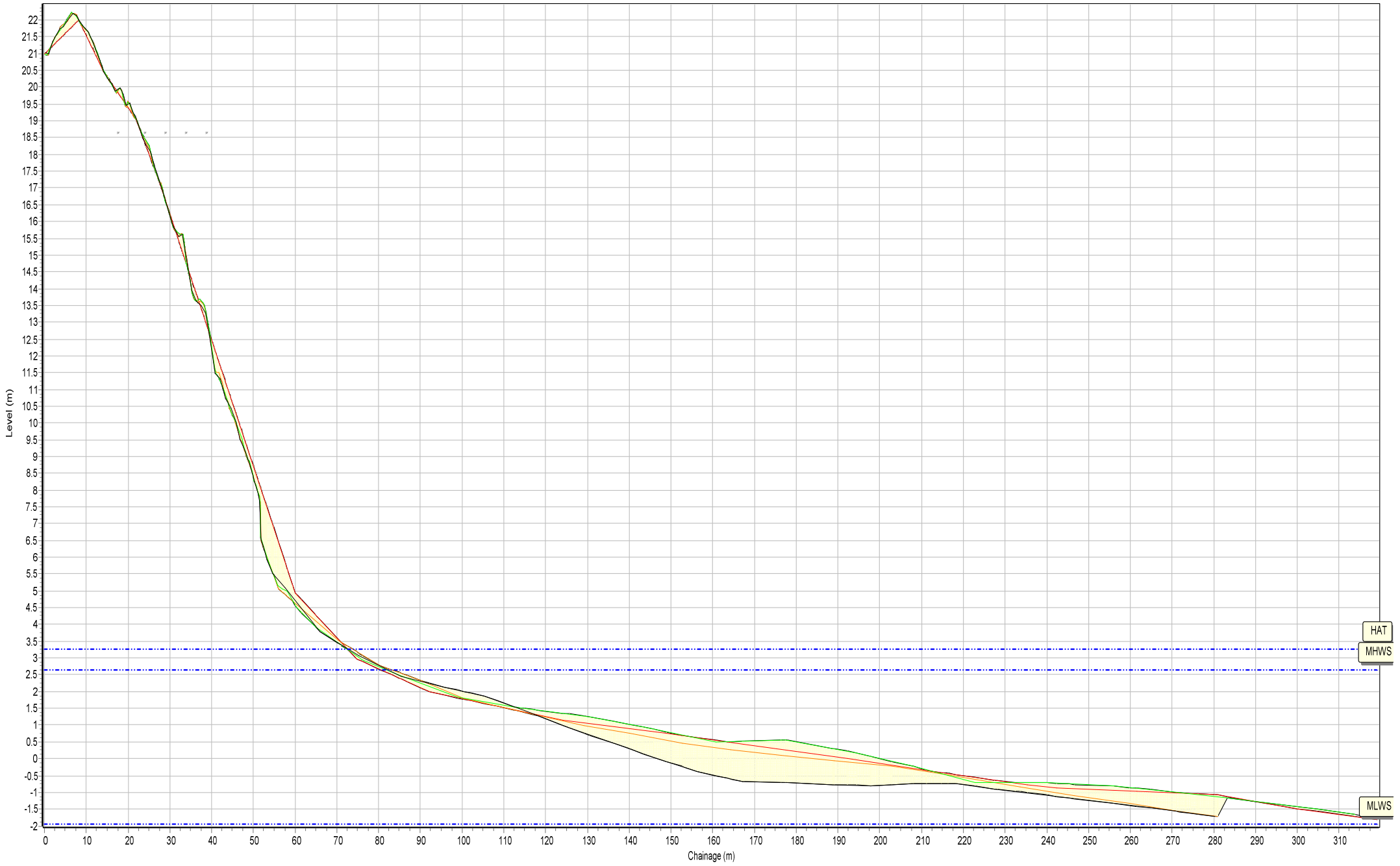
HAT

MHWS

MLWS

SANDS

Beach Profiles: 1cRC8



Profiles Envelope 17/11/2008 29/05/2020 04/11/2020 17/03/2021

HAT

MHWS

MLWS

SANDS

Beach Profiles: 1cRC9



Profiles Envelope 17/11/2008 29/05/2020 04/11/2020 17/03/2021

HAT

MHWS

MLWS

SANDS

Appendix B
Topographic Survey

526000

524000

460000

462000

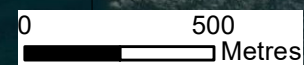
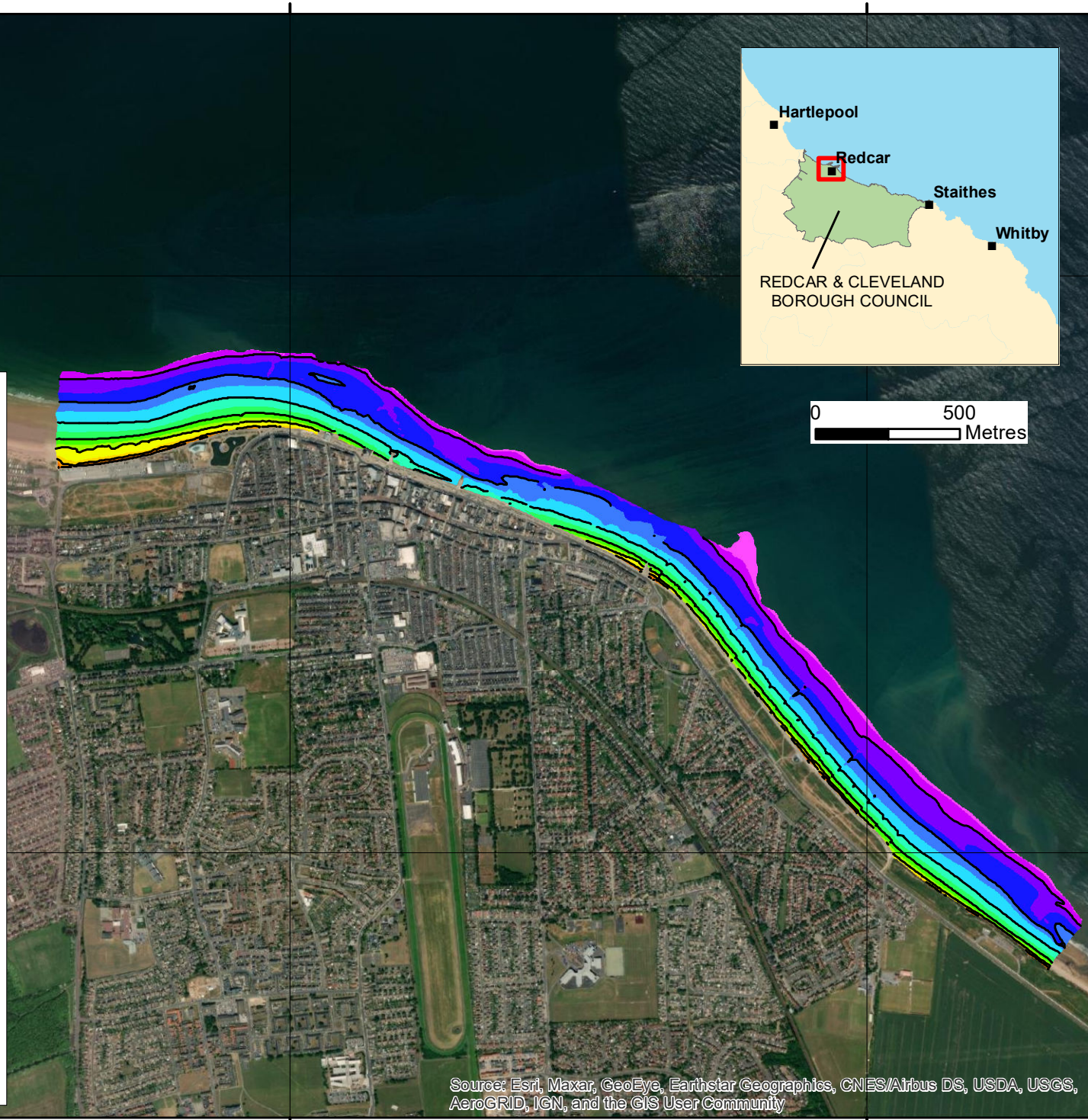
TOPOGRAPHIC SURVEY

March 2021

Contours at 1m interval

Elevation (mOD)

- 5.6 - 6
- 5.1 - 5.5
- 4.6 - 5
- 4.1 - 4.5
- 3.6 - 4
- 3.1 - 3.5
- 2.6 - 3
- 2.1 - 2.5
- 1.6 - 2
- 1.1 - 1.5
- 0.51 - 1
- 0.01 - 0.5
- 0.49 - 0
- 0.9 - -0.5
- 1.4 - -1
- 1.9 - -1.5
- 2.4 - -2
- 2.6 - -2.5



Key

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

Appendix B - Map 1

REDCAR SANDS

Redcar and Cleveland Borough Council Frontage

Update Report
 'Partial Measures' Survey 2021

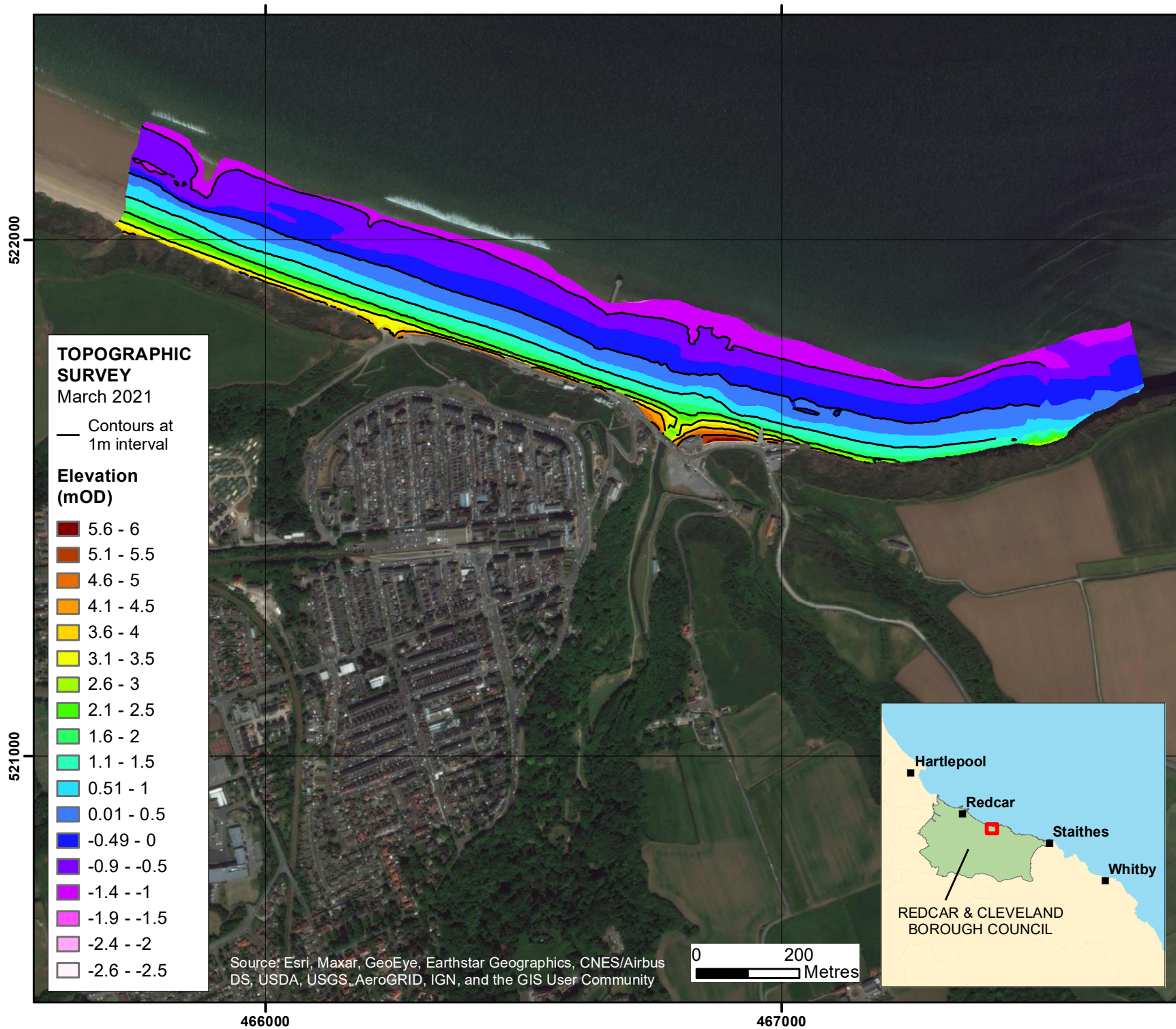
Drawing Scale at A4 1:20,000

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www.royalhaskoningdhv.com



Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



Key

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

Appendix B - Map 2

SALTBURN SANDS

Redcar and Cleveland Borough Council Frontage

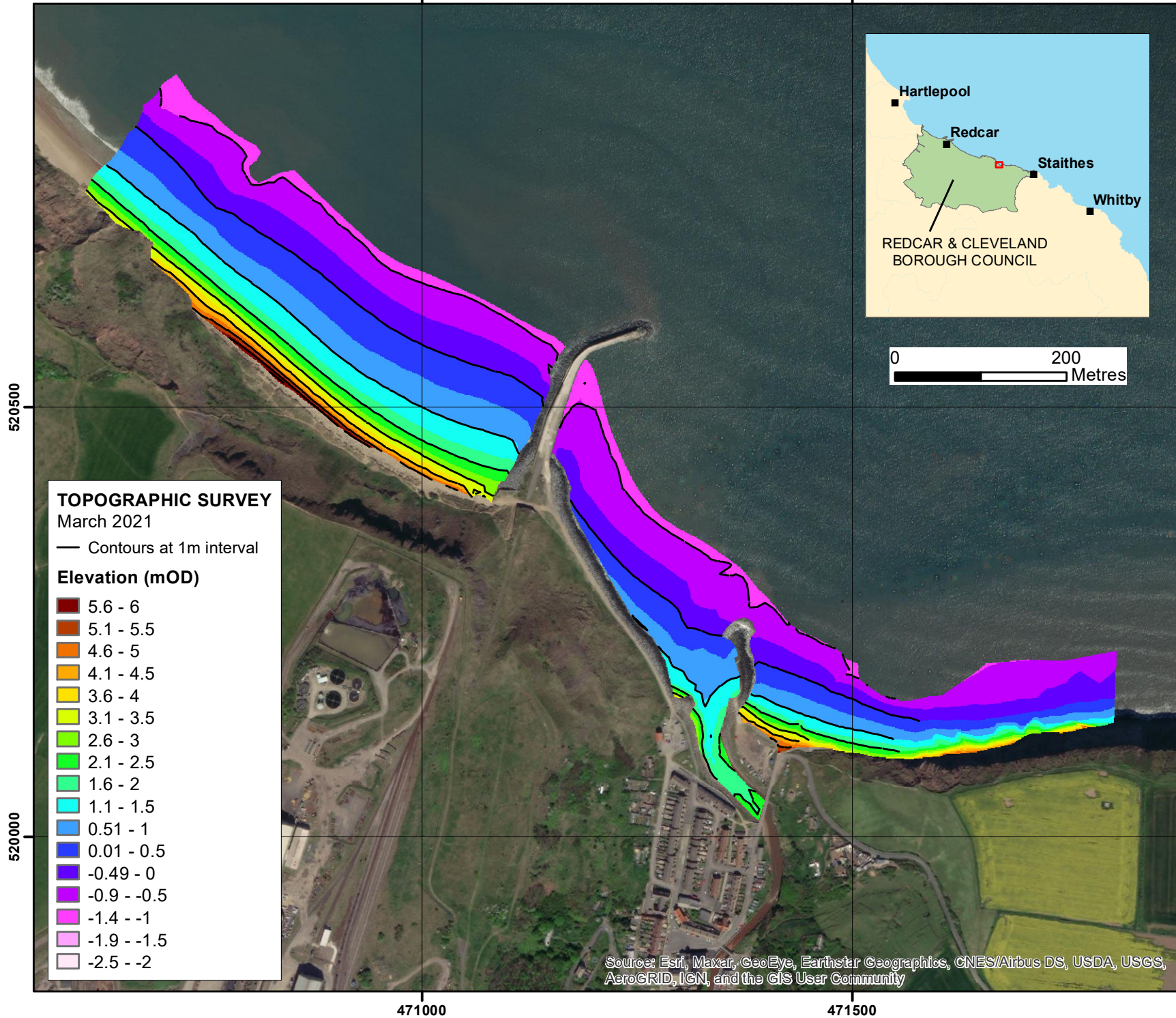
Update Report
'Partial Measures' Survey 2021

Drawing Scale at A4 1:10,000

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Key

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

Appendix B - Map 3
CATTERSTY SANDS

Redcar and Cleveland Borough Council Frontage

Update Report
'Partial Measures' Survey 2021

Drawing Scale at A4 1:6,000

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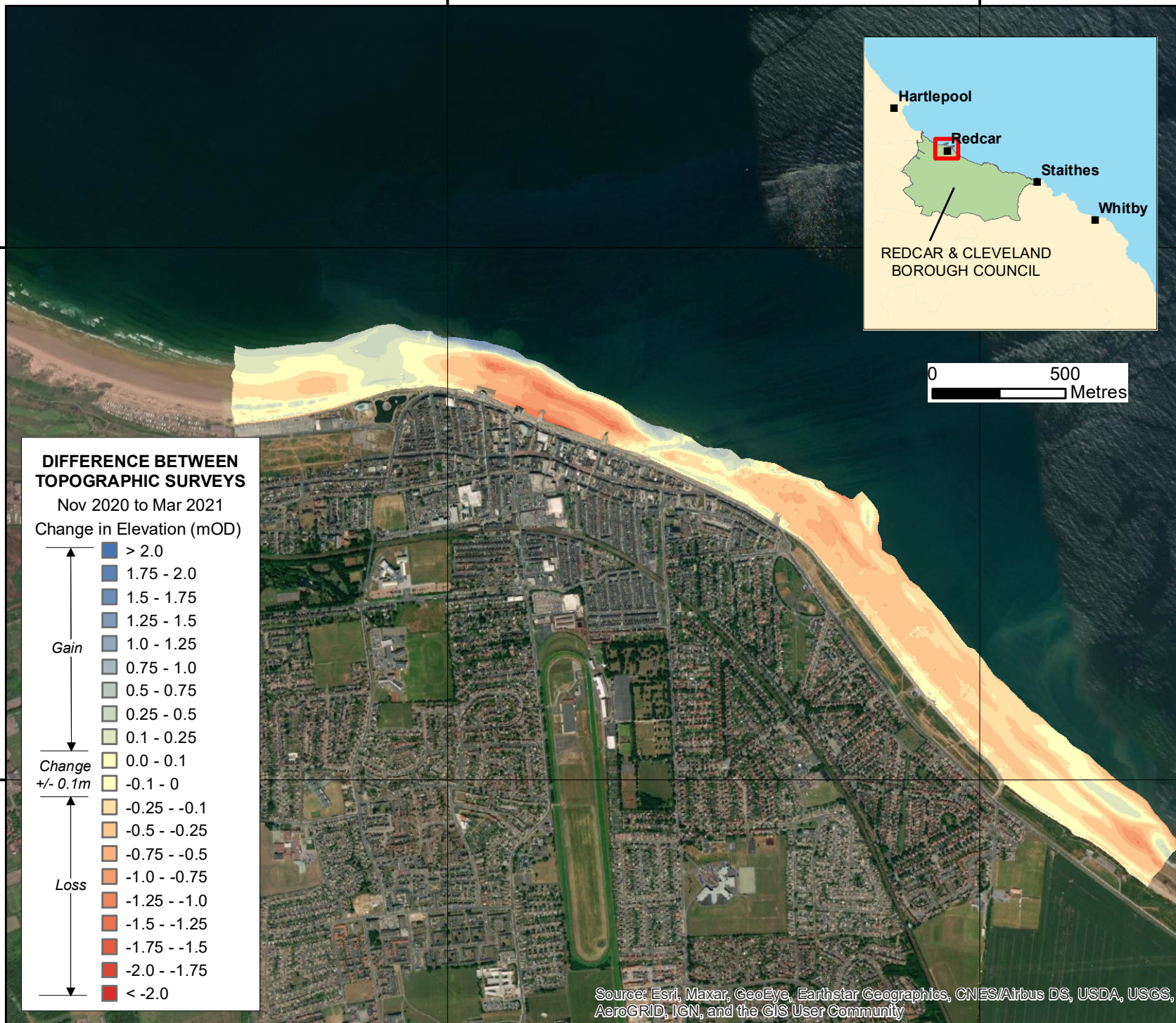


526000

524000

460000

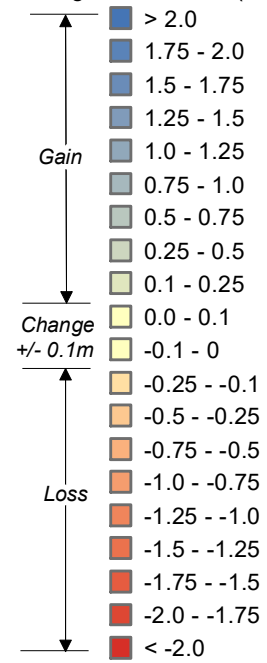
462000



DIFFERENCE BETWEEN TOPOGRAPHIC SURVEYS

Nov 2020 to Mar 2021

Change in Elevation (mOD)



Key

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

Appendix B - Map 4
REDCAR SANDS
Redcar and Cleveland Borough Council Frontage

Update Report
 'Partial Measures' Survey 2021

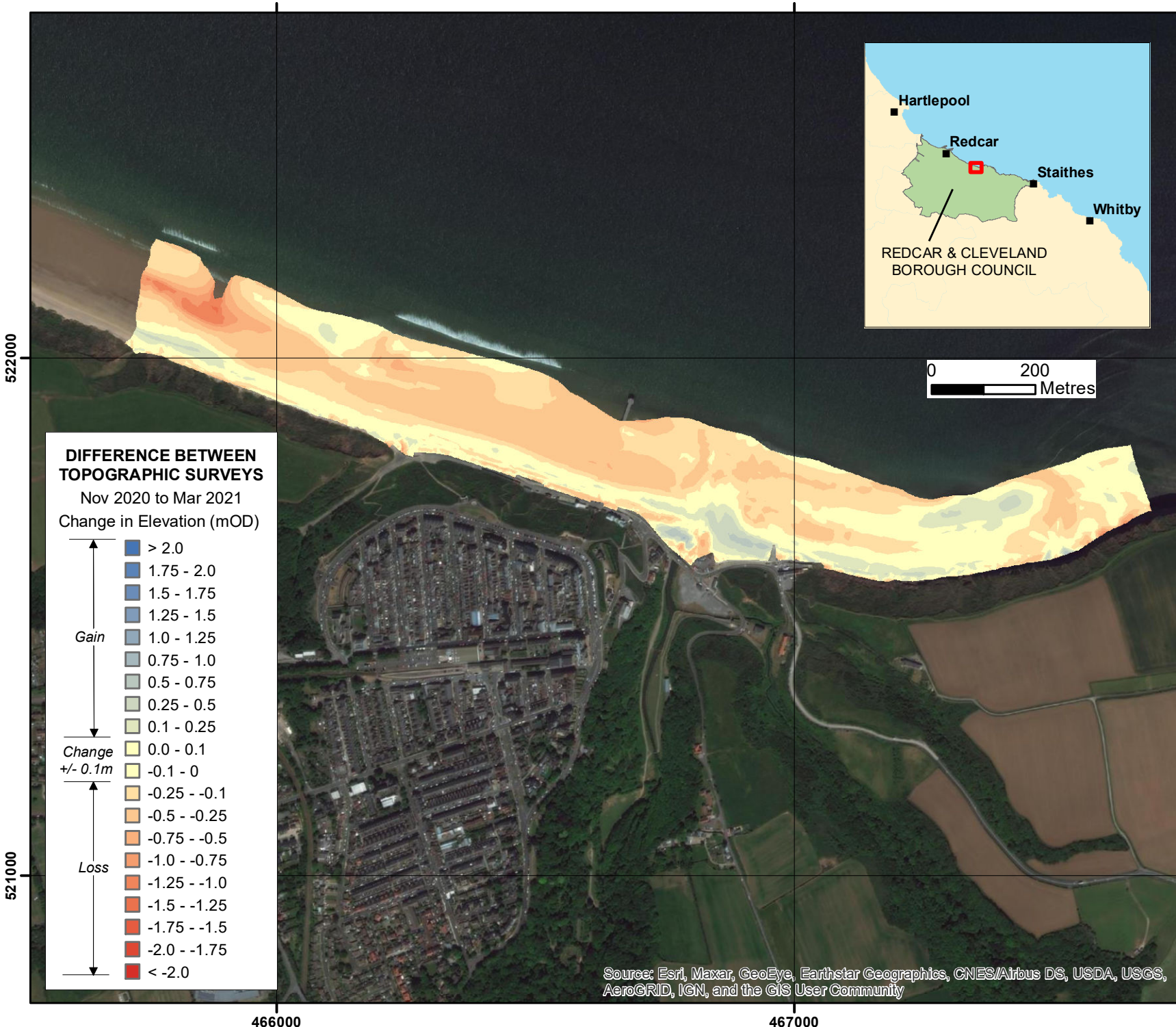
Drawing Scale at A4 1:20,000

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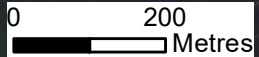
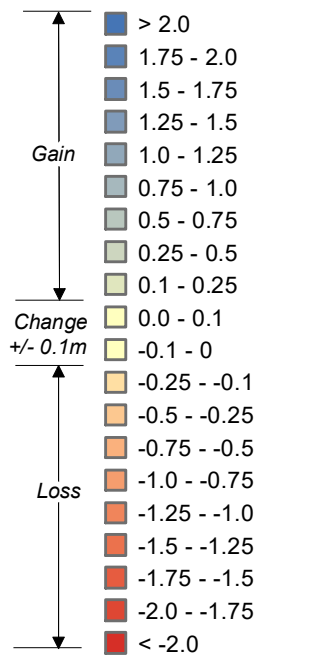


Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



DIFFERENCE BETWEEN TOPOGRAPHIC SURVEYS

Nov 2020 to Mar 2021
Change in Elevation (mOD)



Key

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

Appendix B - Map 5
SALTBURN SANDS
Redcar and Cleveland Borough Council Frontage

Update Report
'Partial Measures' Survey 2021

Drawing Scale at A4 1:10,000

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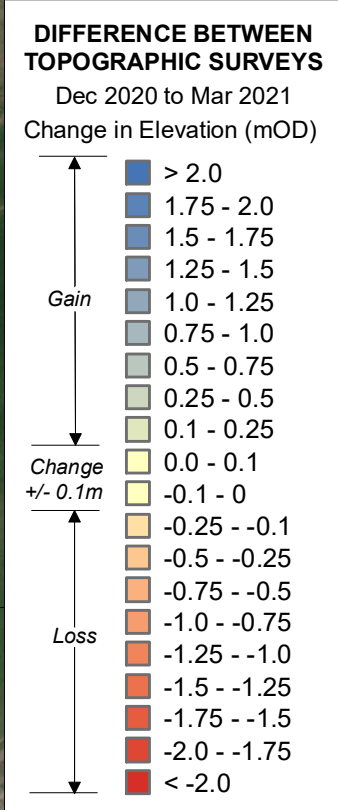
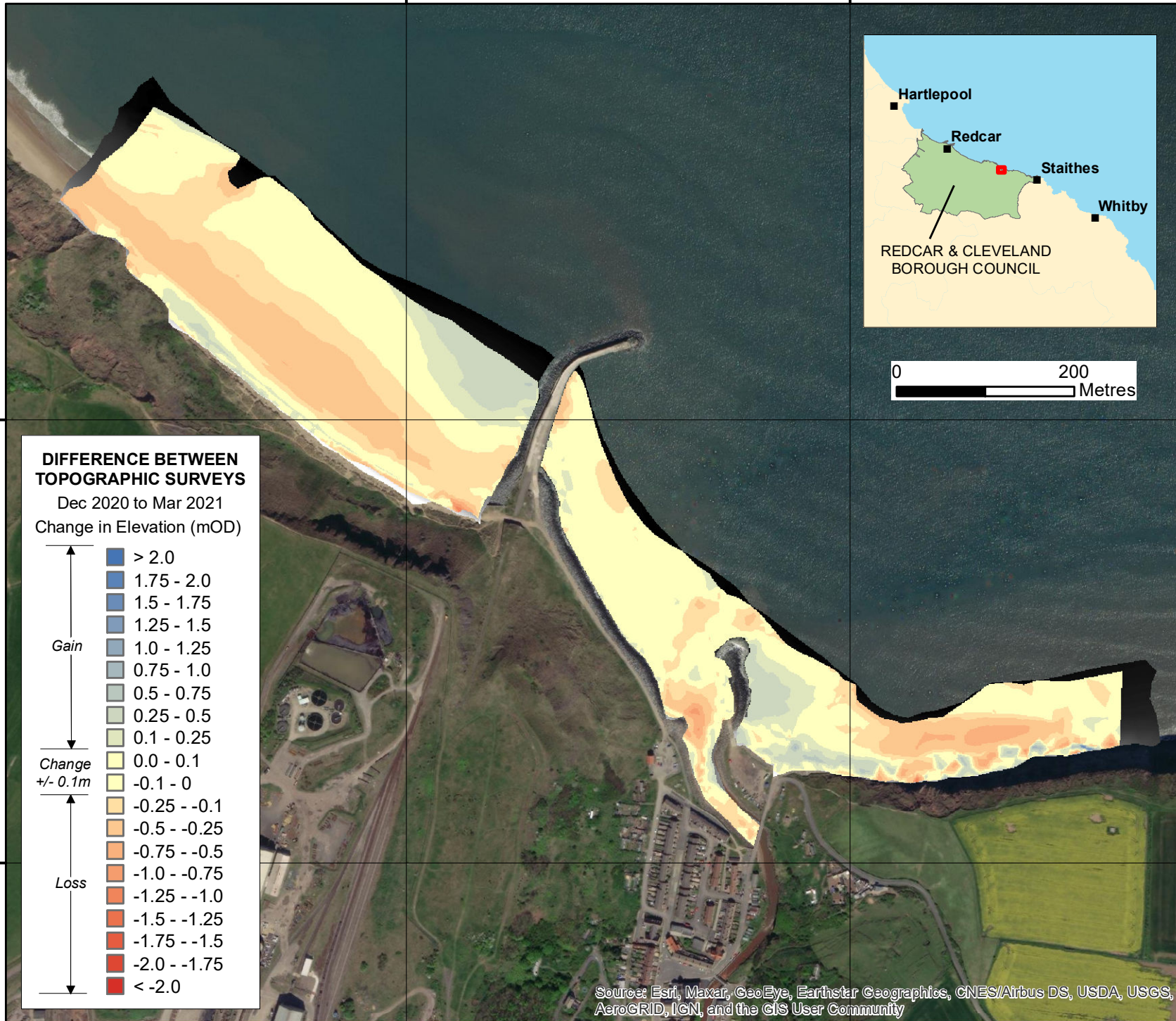
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

520500

520000

471000

471500



Key

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

Appendix B - Map 8
CATTERSTY SANDS
Redcar and Cleveland Borough Council Frontage
Update Report
'Partial Measures' Survey 2021

Drawing Scale at A4 1:6,000

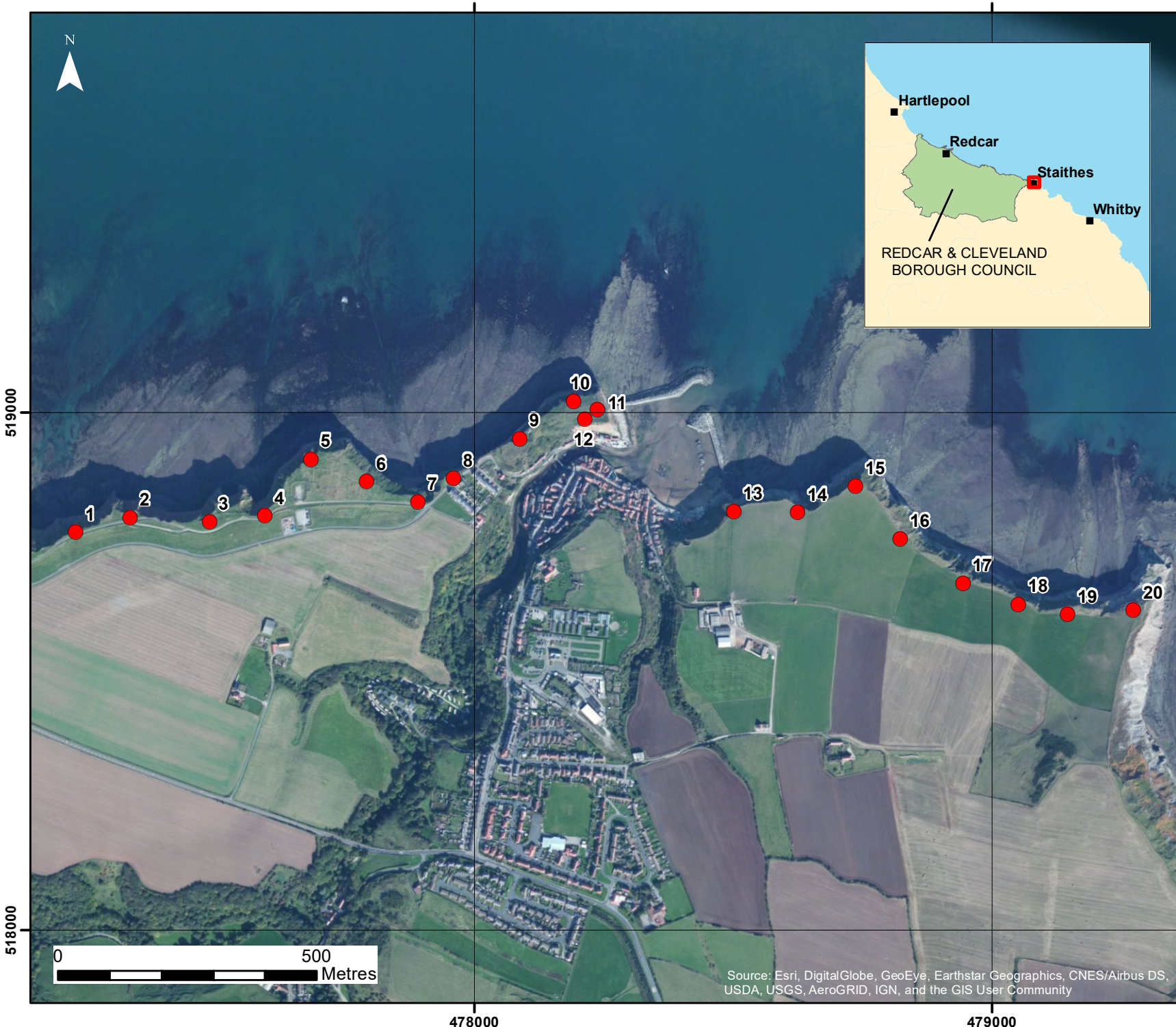
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Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Appendix C
Cliff Top Survey



Key
 ● Cliff Top Survey Locations

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

Figure 3 - Map 1

STAITHES

Redcar and Cleveland Borough Council Council Frontage

Cliff Top Survey Locations

Drawing Scale at A4 1:10,000

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 Fax: +44 (0)191 211 1313
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Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Cliff Top Survey

Twenty ground control points have been established at Staithes (Figure 3 – Map 1). The maximum separation between any two points varies along the coast, reflecting the degree of risk from the erosion. The cliff top surveys at Staithes are undertaken bi-annually. Measurements are taken from a fixed ground control point along a fixed bearing to the edge of the cliff top.

Table C1 provides baseline information about these ground control points and results from the November 2008 (baseline) survey showing the position from the ground control point to the edge of the cliff top along the defined bearing. Future reports will show results from subsequent surveys and provide a means of assessing erosion since the baseline survey.

Table C1 – Cliff Top Surveys at Staithes

Ground Control Points				Distance to Cliff Top (m)			Total Erosion (m)		Erosion Rate (m/year)
Ref	Easting	Northing	Bearing (°)	Baseline Survey	Previous Survey	Present Survey	Baseline to Present	Previous to Present	Baseline to Present
				Nov 2008	Nov 2020	March 2021	Nov 2008 – Mar 2021	Nov 2020 - Mar 2021	Nov 2008 – Mar 2021
1	477228	518769	320	1.90	-5.21	-5.05	-6.95	0.16	-0.53
2	477334	518798	0	10.90	10.57	10.59	-0.31	0.02	-0.02
3	477487	518789	350	7.10	7.99	8.02	0.92	0.03	0.07
4	477594	518801	340	5.90	3.72	3.7	-2.2	-0.02	-0.17
5	477683	518911	350	8.40	8.24	8.24	-0.16	0	-0.01
6	477792	518867	30	8.60	8.32	8.51	-0.09	0.19	-0.01
7	477891	518828	60	7.70	7.2	7.31	-0.39	0.11	-0.03
8	477959	518873	350	8.70	9.43	8.49	-0.21	-0.94	-0.02
9	478088	518950	350	7.60	7.94	7.91	0.31	-0.03	0.02
10	478191	519023	340	8.40	8.48	8.59	0.19	0.11	0.01
11	478237	519007	60	6.90	6.59	6.64	-0.26	0.05	-0.02
12	478213	518988	150	6.10	6.34	6.54	0.44	0.2	0.03
13	478501	518809	15	11.40	8.47	8.78	-2.62	0.31	-0.20
14	478624	518807	20	7.50	7.45	7.32	-0.18	-0.13	-0.01
15	478737	518858	60	6.10	6.28	6.37	0.27	0.09	0.02
16	478823	518757	60	8.00	8.3	8.64	0.64	0.34	0.05
17	478944	518671	30	9.30	8.75	8.71	-0.59	-0.04	-0.05
18	479052	518630	20	9.20	9.03	9.27	0.07	0.24	0.01
19	479147	518610	0	14.20	14.34	14.03	-0.17	-0.31	-0.01
20	479274	518618	20	11.40	11.03	11.18	-0.22	0.15	-0.02