

**Cell 1 Regional Coastal Monitoring Programme
Update Report 10: 'Partial Measures' Survey 2018**



Redcar and Cleveland Council

June 2018

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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	Skinninggrove	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).

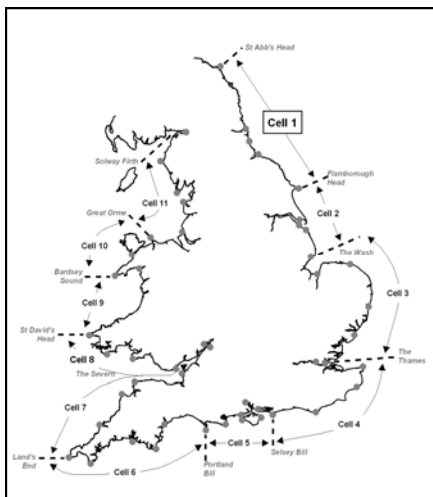


Figure 1 Sediment Cells in England and Wales

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 sea bed characterisation surveys
- aerial photography
- walk-over 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 ^(*)	

^(*) The present report is **Update Report 10** and provides an analysis of the 2018 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)
- Staithes ¹

1.2 Methodology

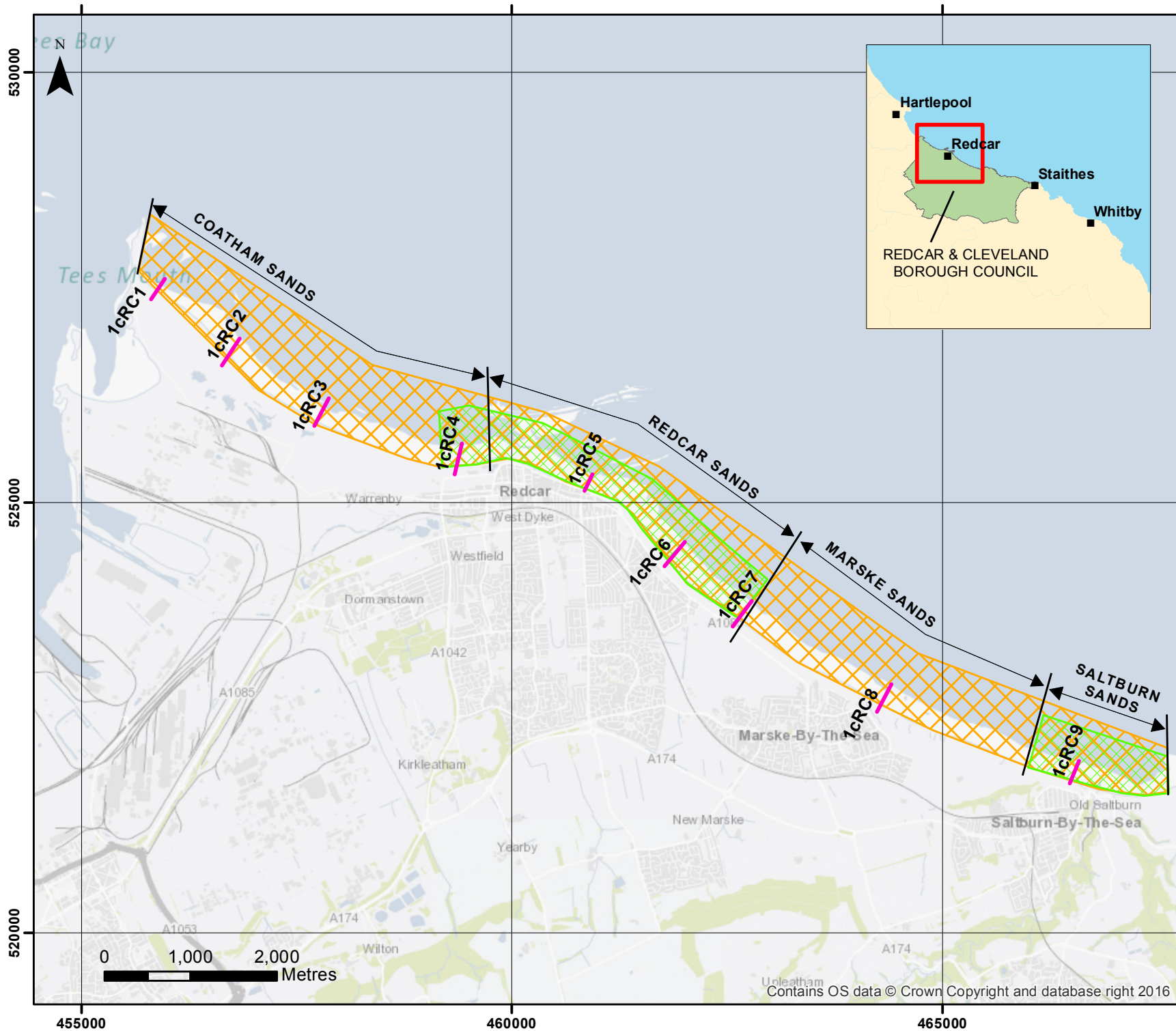
Along Redcar & Cleveland Borough Council's frontage, the following surveying is undertaken:

- 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. The Partial Measures survey was undertaken along this frontage on 2nd May at Skinningrove, 4th to 6th April at Redcar (Coatham Sands, Redcar Sands, Marske Sands and Saltburn Sands) and 23rd March 2018 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

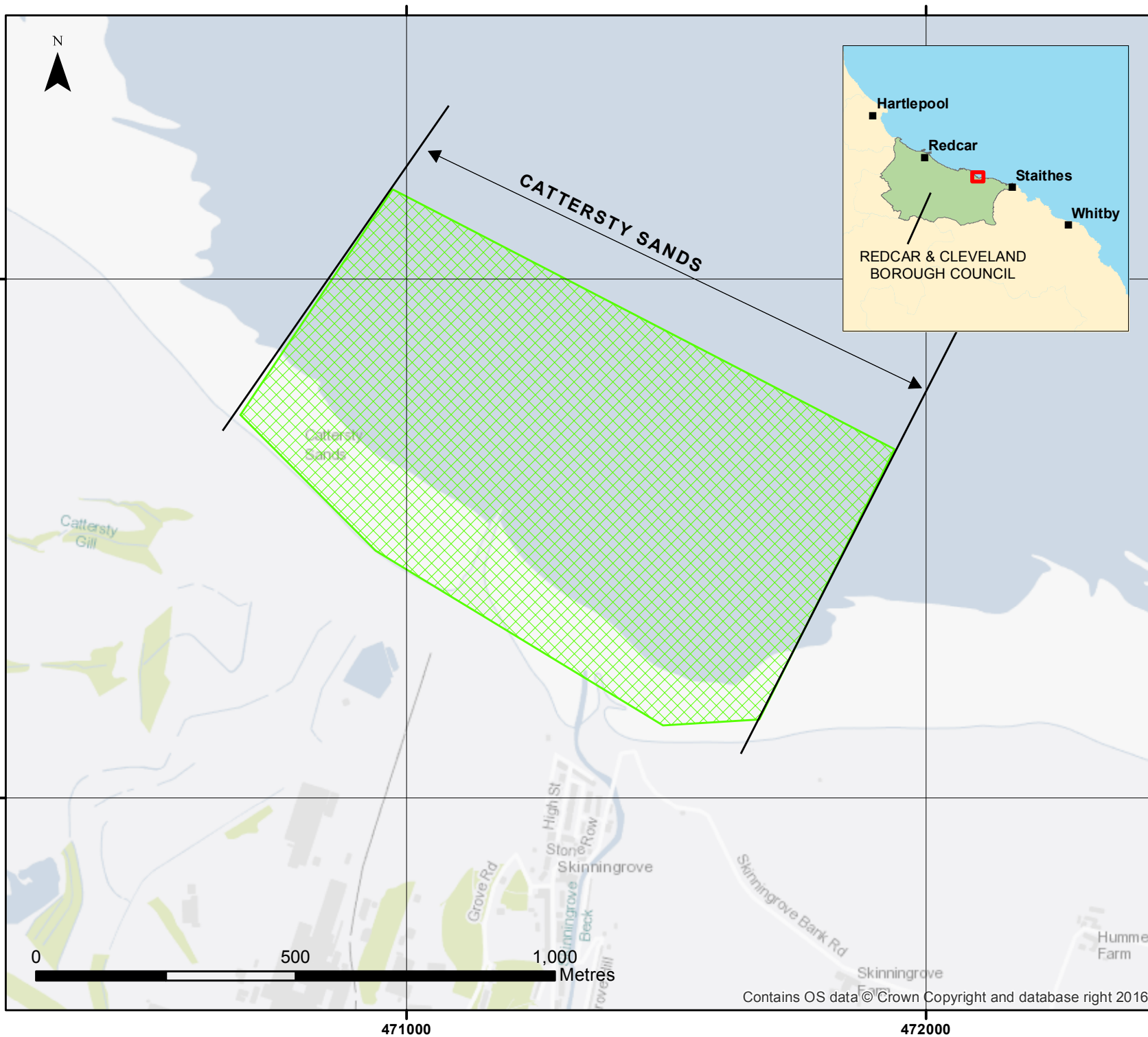
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Key

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

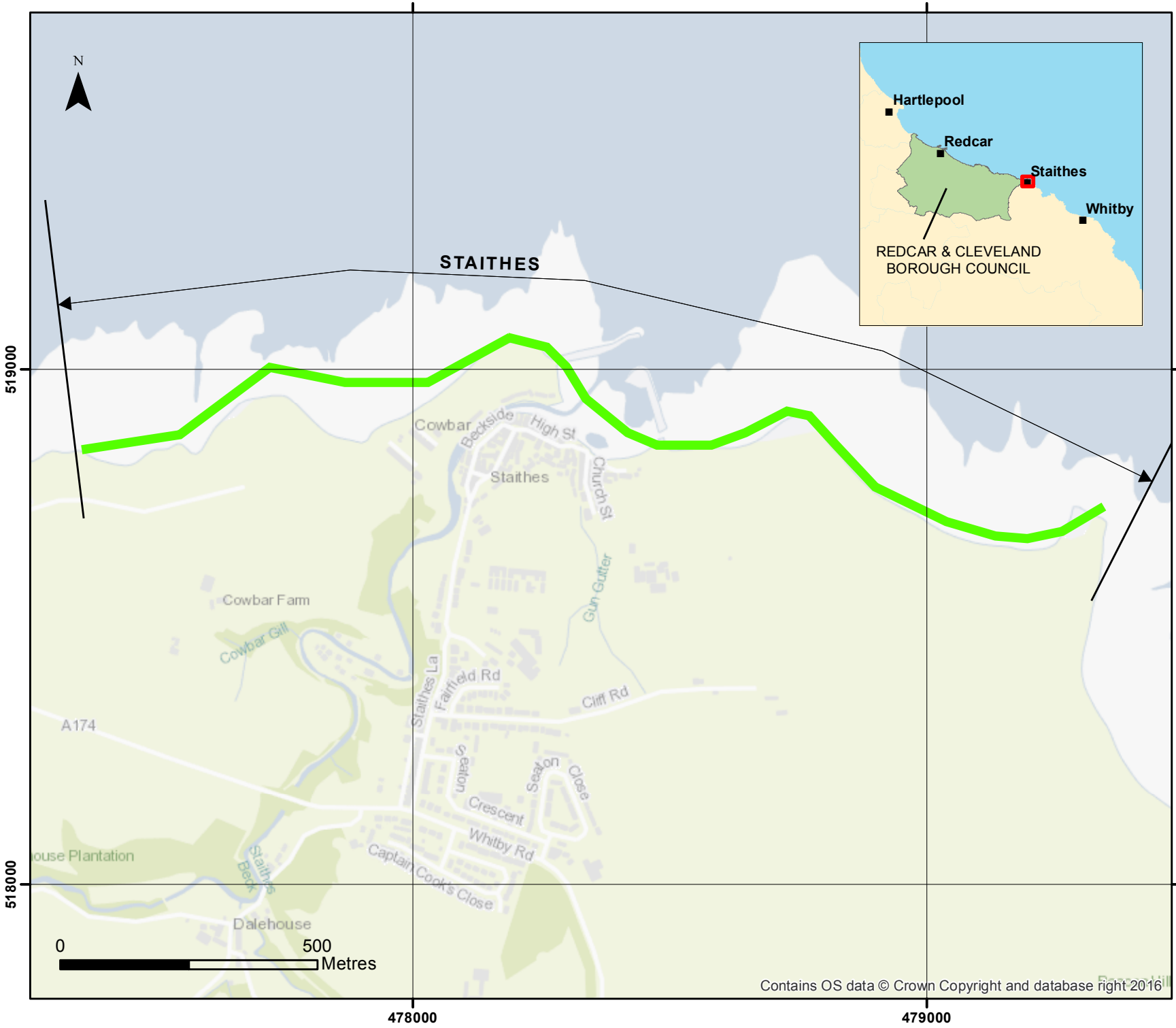
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Topo Surveys

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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
6 th April 2018	<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 October 2017.</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), closest to the beach, is unchanged since October 2013. The foredune between 70m and 105m chainage has increased in height by up to 0.3m, and is at its highest recorded level. Between 105m and 210m chainage the upper beach has eroded by up to 0.8m since October 2017, removing the berm previously surveyed. From 210m to the end of the profile at 310m chainage the lower beach level is at its highest recorded level, having accreted by up to 1.4m, steepening the lower beach and forming a more convex shape to the profile.</p> <p>At profile 1cRC2 the dunes have remained largely stable with accretion of up to 0.6m on the foredunes between chainage 30m and 100m since the previous survey. The beach profile is dominated by erosion of up to 0.8m, creating a smoother profile. Overall the beach is at a medium-low level compared to the range recorded from previous surveys, however the dunes are at their highest recorded levels.</p> <p>Profile 1cRC3 showed the main dune has remained stable since April 2014, with the foredune between chainage 16m and 51m showing accretion of up to 0.6m since the previous survey. The beach between 51m and 288m has dropped since October 2017 by up to 0.8m, with the toe of the beach seawards of chainage 288m showing very little change. A lower beach berm has formed between chainage 240m and the end of survey at chainage 330m. The dunes are at a high level compared to the range recorded from previous surveys, however the upper beach is at its lowest recorded level, and the lower beach at a more medium level.</p>	<p>Overall the beaches are healthy. The dune areas all show accretion on the foredunes over the winter of 2017/18, which conforms to a wider trend towards stability. The dunes are at their highest recorded levels for all profiles.</p> <p>All of the profiles show erosion as the dominant process on the beach since the previous survey. Profiles RC1 and RC4, however, do show accretion at the toe of the beach. The beach levels of the western profiles, RC1 and RC2, are within their previously recorded range, however the eastern profiles, RC3 and RC4, show their lowest recorded levels in the upper-mid beach.</p> <p>Longer term trends:</p> <p>All of the Redcar profiles 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> <p>The erosion in the east of the bay with low beach levels is not consistent with previous observations of an eastwards net transfer of material at Coatham sands.</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>Profile 1cRC4 is located at the beginning of the defended section at Coatham and Redcar. No change has occurred landward of the base of the seawall. The beach levels at the toe of the seawall have increased slightly by up to 0.2m. Between chainage 60m and 240m there has been erosion of up to 0.3m. Seawards of chainage 240m there has been accretion of up to 0.4m. Overall the profile is at a medium-low level compared to the range recorded from previous surveys, with the middle section at its lowest recorded levels (chainage 70m to 160m). However, the toe of the beach from chainage 290m is at its highest recorded level.</p>	

2.2 Redcar Sands

Survey Date	Description of Changes Since Last Survey	Interpretation
6 th April 2018	<p>Beach Profiles:</p> <p>Redcar Sands is covered by three beach profiles (RC5 to RC7; Appendix A), with RC7 being approximately on the boundary with the Marske Sands area. They were last surveyed in October 2017.</p> <p>At profile 1cRC5 the sea defences constructed in 2012 remain unchanged as far as 20m chainage. There has been erosion at the toe of the sea defence of 0.6m. The upper beach berm previously recorded at chainage 90m has moved by around 50m up the beach, covering up previously exposed rock outcrops. A secondary berm has formed at chainage 120m. Seawards of the rock exposure at chainage 155m there has been significant accretion of up to 1.6m. Overall the upper beach is at a relatively medium level compared to the range recorded from previous surveys, with the lower beach seawards of the rock exposure at chainage 155m having its highest recorded levels.</p> <p>The profile at 1cRC6 has not changed landward of 55m chainage since the last survey due to the presence of the sea defence. There has been accretion at the toe of the sea defence of up to 0.6m. The rest of the beach profile from chainage 75m is dominated by erosion, with beach levels dropping by up to 0.8m. The profile has been smoothed out. The upper beach is at a high level compared to the range recorded from previous surveys, the mid beach between chainage 80m and 150m is at its lowest recorded level, and the lower beach is at a relatively medium level.</p> <p>Profile 1cRC7 is undefended. The dune face at 60m chainage remained stable since October 2014. Between chainage 70m and 90m there has been up to 0.4m of accretion. The rest of the profile shows erosion of up to 1.2m, removing the berms present on the previous survey at chainage 100m and 170m, and moving the toe of the beach landwards by around 80m. Overall the beach profile is at a relatively low-medium level compared to the range recorded from previous surveys.</p>	<p>All of the profiles, except RC5, show erosion but remain largely within the bounds of the previous profiles. Profile RC5 shows the movement of berms and accretion on the lower beach.</p> <p>Longer term trends:</p> <p>Profiles RC5 and RC7 show movement of beach berms, across the profile with some evidence for gradual accretion.</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
<p>April 2018</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 1a) 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 (Spring 2018) and the most recent (Autumn 2017) topographic survey, as shown in Appendix B – Map2a, to identify areas of erosion and accretion.</p> <p>The difference plot is dominated by erosion, with some smaller areas of accretion on the lower beach from Redcar Rocks to the western extent of the survey area. . The area of greatest change is in the centre of the plot between West Scar and Redcar Rocks, with erosion of up to 2.0m.</p>	<p>The topographic difference plots show that erosion has dominated since the previous survey which confirms the pattern shown by beach profiles.</p>

2.3 Marske Sands

Survey Date	Description of Changes Since Last Survey	Interpretation
6 th April 2018	<p>Beach Profiles:</p> <p>Marske Sands is covered by two beach profiles during the Partial Measures survey (RC7 to RC8; Appendix A). RC7 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 110m chainage. Seawards of chainage 110m there has been erosion across the rest of the profile, of up to 1.5m, forming a depression at chainage 160m. Since April 2014 the dune face (chainage 55m) has remained stable, which contrasts with the winter of 2013/14 when 10m of recession was recorded. The profile is relatively low in the upper beach compared to the range recorded from previous surveys (chainage 55m to 180m), with the depression between chainage 135m and 185m showing the lowest recorded levels., the profile is at a more medium-high level on the lower beach.</p>	<p>The cliffed face of the dune remained stable at both RC7 and RC8 following the recession over the winter of 2013/14.</p> <p>RC8 shows erosion, with a depression forming in the mid beach.</p> <p>Longer term trends:</p> <p>The April 2014 profiles were amongst the lowest seen at 1cRC8, due to the December 2013 storm surge. The beach had recovered but the March 2018 storms have resulted in comparatively low levels again.</p>

2.4 Saltburn Sands

Survey Date	Description of Changes Since Last Survey	Interpretation
6 th April 2018	<p>Beach Profiles:</p> <p>Saltburn Sands is covered by one beach profile (RC9; Appendix A).</p> <p>Overall Profile 1cRC 9 has experienced no change over the section covered by the sea defence as far as 20m chainage. There has been slight accretion at the toe of the seawall. Seawards of chainage 30m there has been erosion of up to 0.9m across the rest of the profile. The section of beach between chainage 35m and 180m is the lowest recorded compared to the previous surveys, the rest of the profile is at a relatively low level.</p>	<p>The drop in beach level at RC9 over the winter of 2017/18 was relatively high, which could potentially be due to the March 2018 storms. Overall, the beach level is low and has been eroding at a low rate since 2008.</p> <p>Longer term trends: The profile plots show net erosion, although there are periods of recovery. The profile for April 2018 is the lowest recorded in the upper and mid beach.</p>
April 2018	<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 2a). 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 2017) survey in Appendix B – Map 2b.</p> <p>The difference plot comparing the DGMs shows that since Autumn 2017 the recorded changes on the beach have been dominated by erosion, with some small areas of accretion at the very top of the beach, and in the mid beach at the western end of the survey area and to the east of the outfall of Skelton Beck. The magnitude of erosion is fairly uniform across the survey area.</p>	<p>The difference plot indicates that erosion has dominated over the winter of 2017/18, which confirms the pattern shown in the profile.</p>

2.5 Cattersty Sands

Survey Date	Description of Changes Since Last Survey	Interpretation
<p>May 2018</p>	<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 3a). 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.</p> <p>The Spring 2018 DGM has been compared against the previous (Autumn 2017) survey in Appendix B – Map 3b. The comparison between DGMs shows that the beach is dominated by erosion, with the greatest magnitude recorded to the east of the breakwater. There are small patches of accretion across the survey area, but no continuous areas.</p>	<p>The data shows erosion has dominated across the survey area. The distribution of change is likely to be linked to the movement of material seaward during the winter, and in particular the March 2018 storms.</p> <p>Longer term trends: The long-term trend shows that on the north-west side of the breakwater there is erosion in the upper beach and accretion in the lower beach. On the south-east side of the breakwater there is a long-term pattern of accretion in 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

<p>23rd March 2018</p>	<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 2018 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 September 2017 survey.</p> <p>The results provided in Appendix C show that the majority of the profiles show little or no erosion, <0.1m. The exception is at Point 17, where retreat of 0.12m was recorded. Several points (1, 2, 3, 14, 15, and 20) have recorded negative movement; this is likely to be due to difficulties in accurately identifying the cliff edge through vegetation.</p>	<p>The recorded changes to the cliff top between September 2017 and March 2018 are generally small. There has been only one point which shows minor retreat.</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 is 0.2m/yr for all three points.</p>
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3. Problems Encountered and Uncertainty in Analysis

Topographic Survey

No significant problems were reported with the topographic surveys.

Cliff Top Surveys

The cliff top surveys at Staithes are assumed to have a limit of accuracy of ± 0.1 m due to the methodology. Erosion can reliably be measured at only one location but as monitoring progresses, underlying patterns in erosion will become more evident. The following points were highlighted in the survey reports:

- Survey points 9 to 12 at Staithes have been cordoned off by the National Trust due to a landslip on the headland and could not be surveyed, as was the case for the September 2017 survey.

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

- All of the beaches have been dominated by erosion over the winter of 2017/18 and it is likely that much of that can be attributed to the March 2018 severe storms. Anecdotal evidence suggests that beach levels in the Redcar area were particularly badly hit by the March 2018 storms, with the remains of a petrified forest which once stretched to Hartlepool being exposed, as reported in the local and national news.
- At Redcar all the profiles show erosion as the dominant process on the beach since the previous survey. However there has been some accretion at the toe of the beach at both ends of the bay. The dunes are stable or accreting on their seaward extent.
- At Redcar Sands, all of the profiles, except RC5, show erosion but remain largely within the bounds of the previous profiles. Profile RC5 shows the movement of berms and accretion on the lower beach. The topographic change plots show that erosion has dominated since the previous survey, which supports the pattern seen in the beach profiles.
- At Marske Sands, the cliffed face of the dune remained stable at both RC7 and 8 following the recession caused by the winter storms of 2013/14. RC8 shows erosion with a depression forming in the mid beach.
- At Saltburn Sands, the profile plots show erosion has dominated. The profile for March 2018 is one of the lowest recorded.
- At Cattersty Sands, the plot for the bay shows erosion has dominated across the beach. The distribution of change is likely to be linked to the movement of material seaward during the winter.
- At Staithes, the recorded changes to the cliff top between September 2017 and March 2018 are generally small. Only one point has shown recession greater than the survey error. There are erosion rates which are calculated from the data collected since 2008. Points 1, 4, and 13 have a recession rate of 0.2m/yr.

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: 06/04/2018

Inspector: AG

Low Tide:

Low Tide Time:

Wind

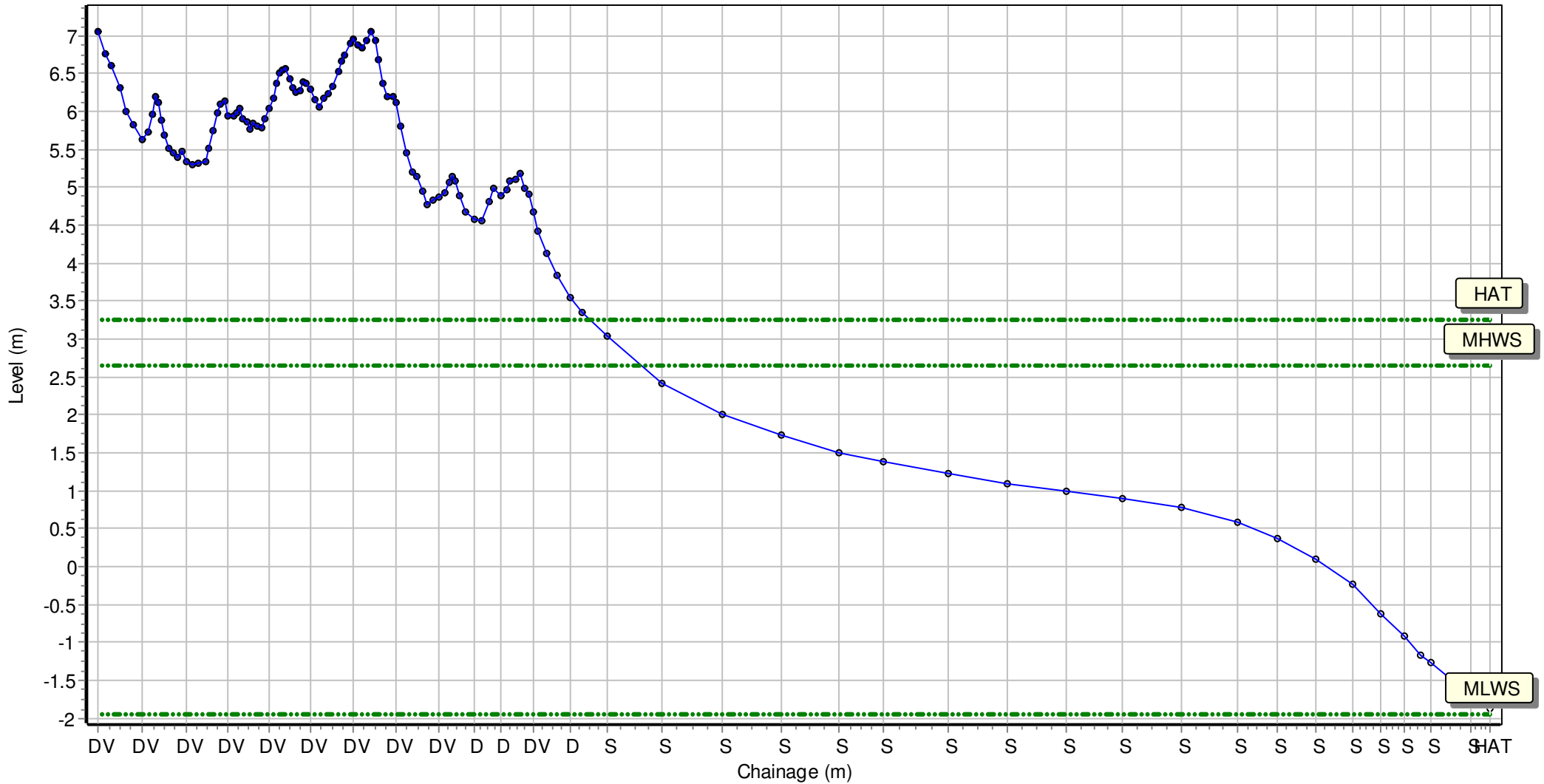
Sea State:

Visibility:

Rain:

Summary: 2018 Partial Measures Topo Survey

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



Beach Profile

Location: 1cRC2

Date: 06/04/2018

Inspector: AG

Low Tide:

Low Tide Time:

Wind

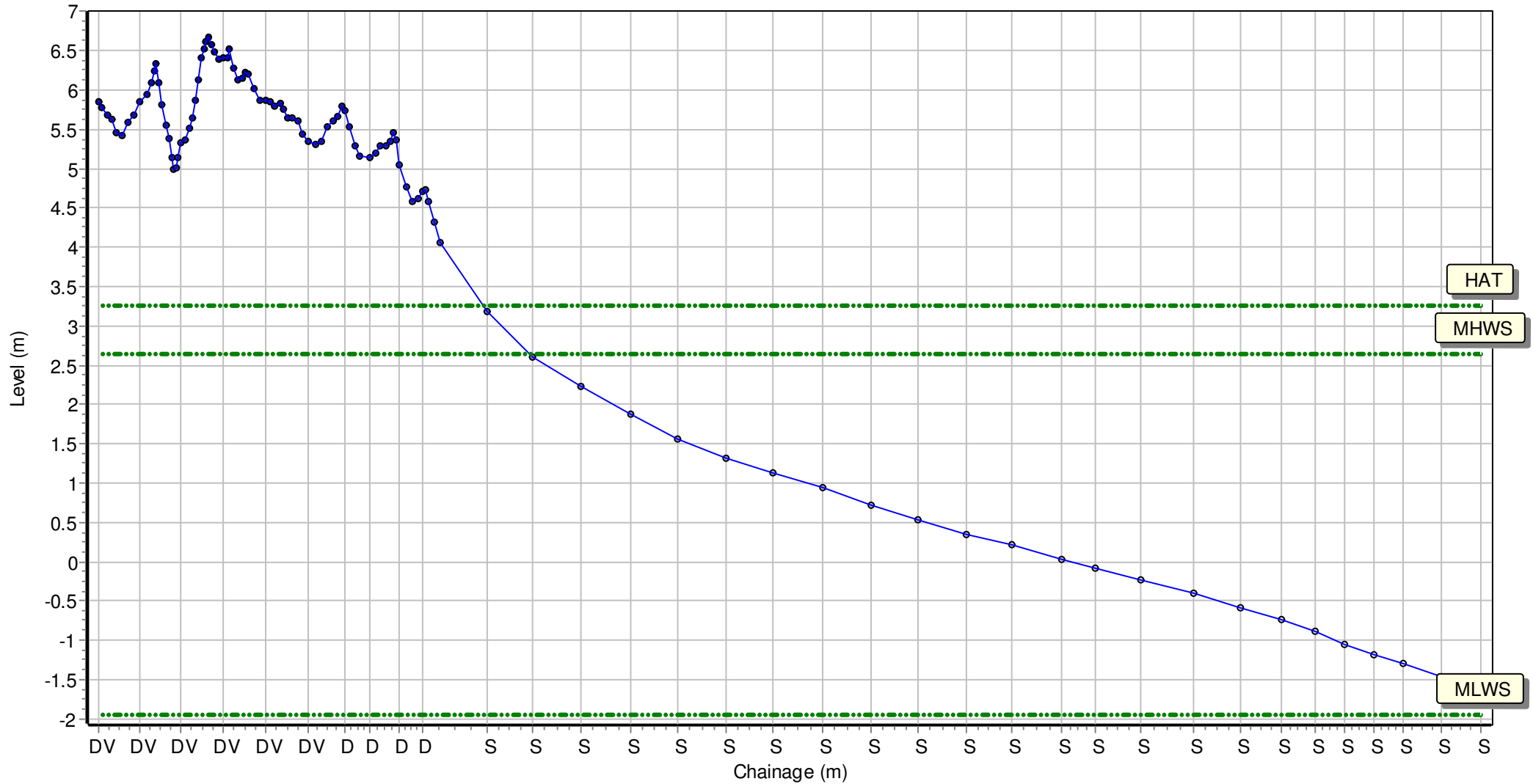
Sea State:

Visibility:

Rain:

Summary: 2018 Partial Measures Topo Survey

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



Beach Profile

Location: 1cRC3

Date: 06/04/2018

Inspector: AG

Low Tide:

Low Tide Time:

Wind

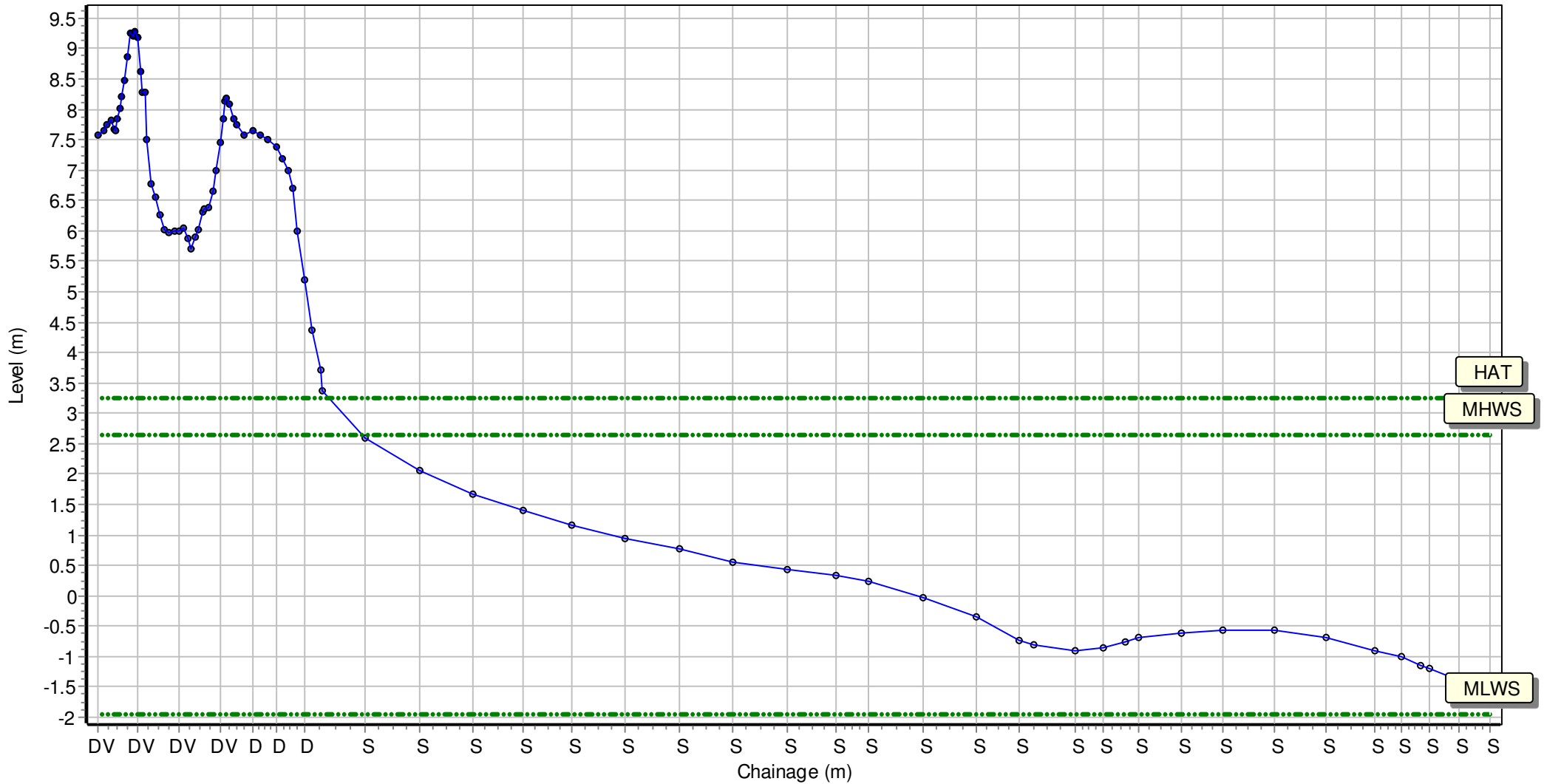
Sea State:

Visibility:

Rain:

Summary: 2018 Partial Measures Topo Survey

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



Beach Profile

Location: 1cRC4

Date: 06/04/2018

Inspector: AG

Low Tide:

Low Tide Time:

Wind

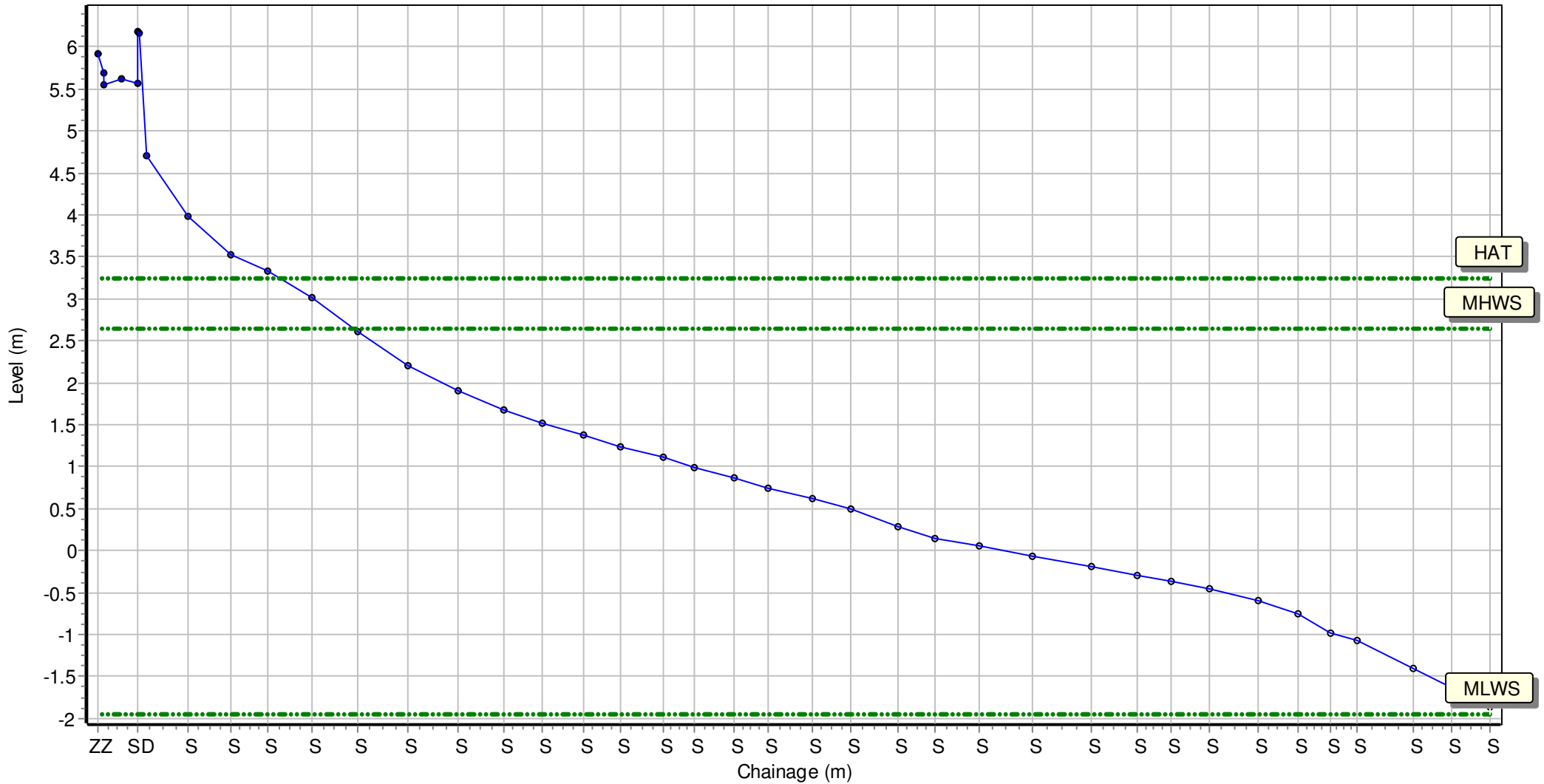
Sea State:

Visibility:

Rain:

Summary: 2018 Partial Measures Topo Survey

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



Beach Profile

Location: 1cRC5

Date: 06/04/2018

Inspector: AG

Low Tide:

Low Tide Time:

Wind

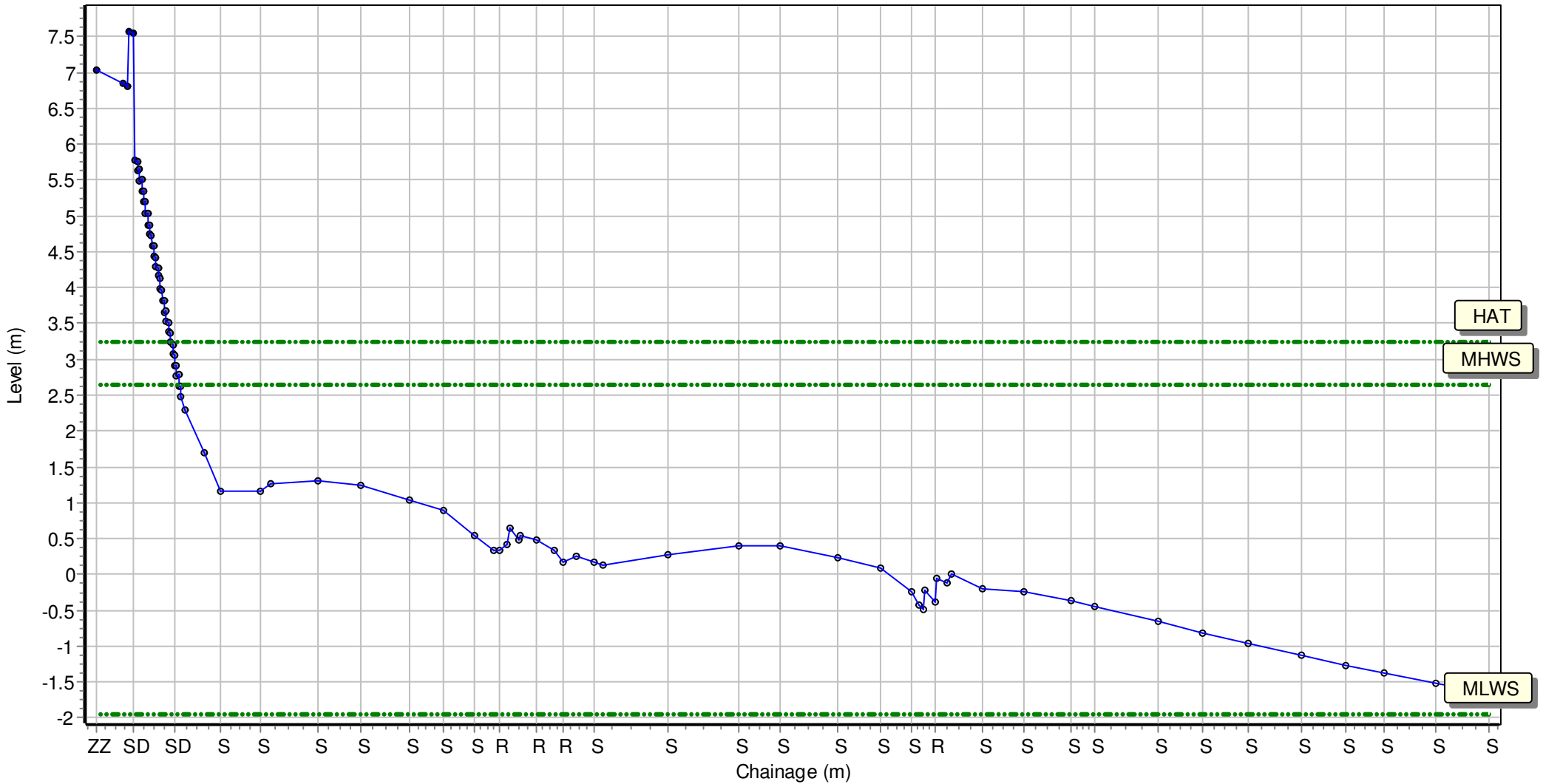
Sea State:

Visibility:

Rain:

Summary: 2018 Partial Measures Topo Survey

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



Beach Profile

Location: 1cRC6

Date: 06/04/2018

Inspector: AG

Low Tide:

Low Tide Time:

Wind

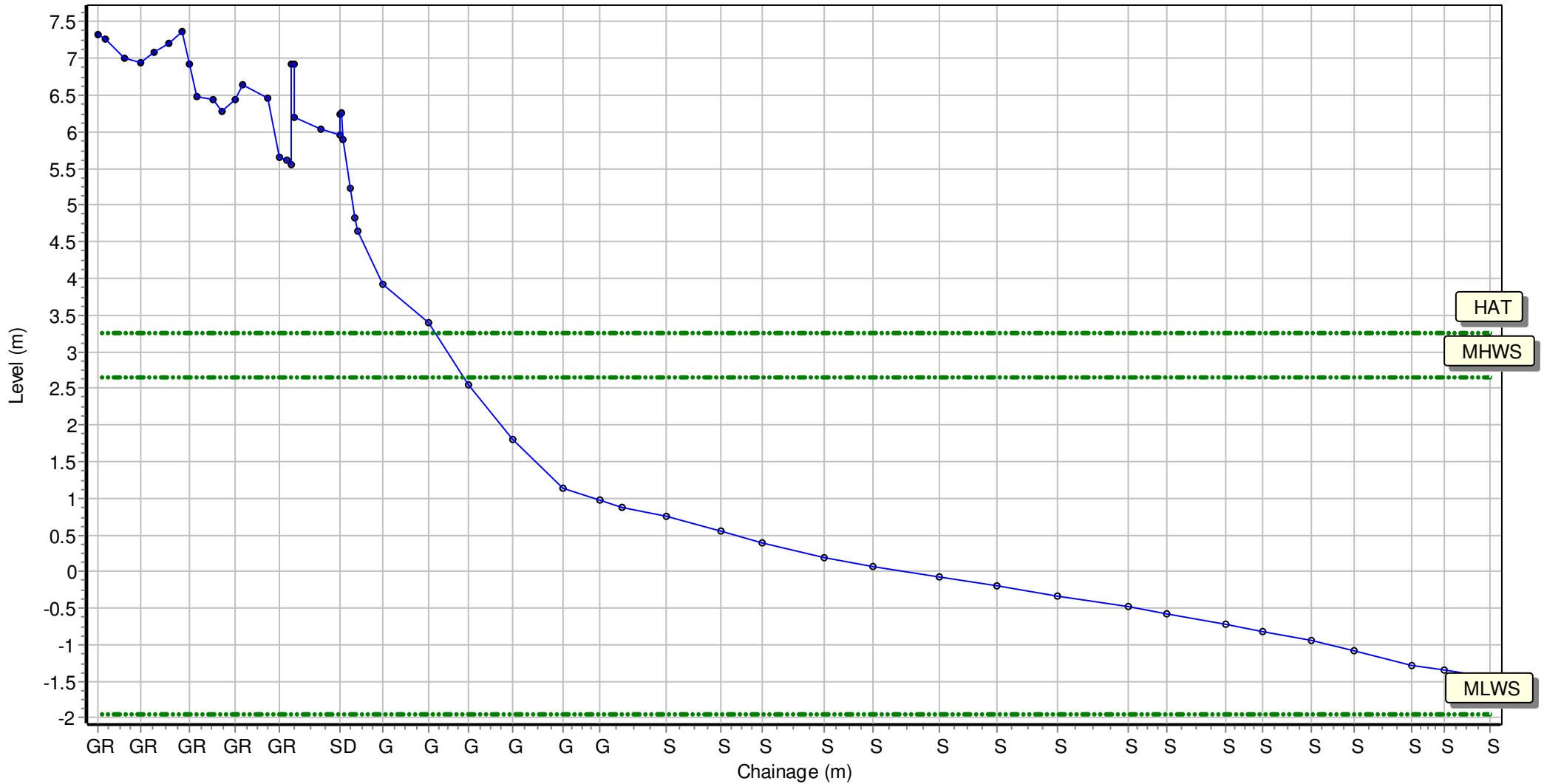
Sea State:

Visibility:

Rain:

Summary: 2018 Partial Measures Topo Survey

Easting: 461776.835 Northing: 524269.592 Profile Bearing: 39 ° from North



Beach Profile

Location: 1cRC7

Date: 06/04/2018

Inspector: AG

Low Tide:

Low Tide Time:

Wind

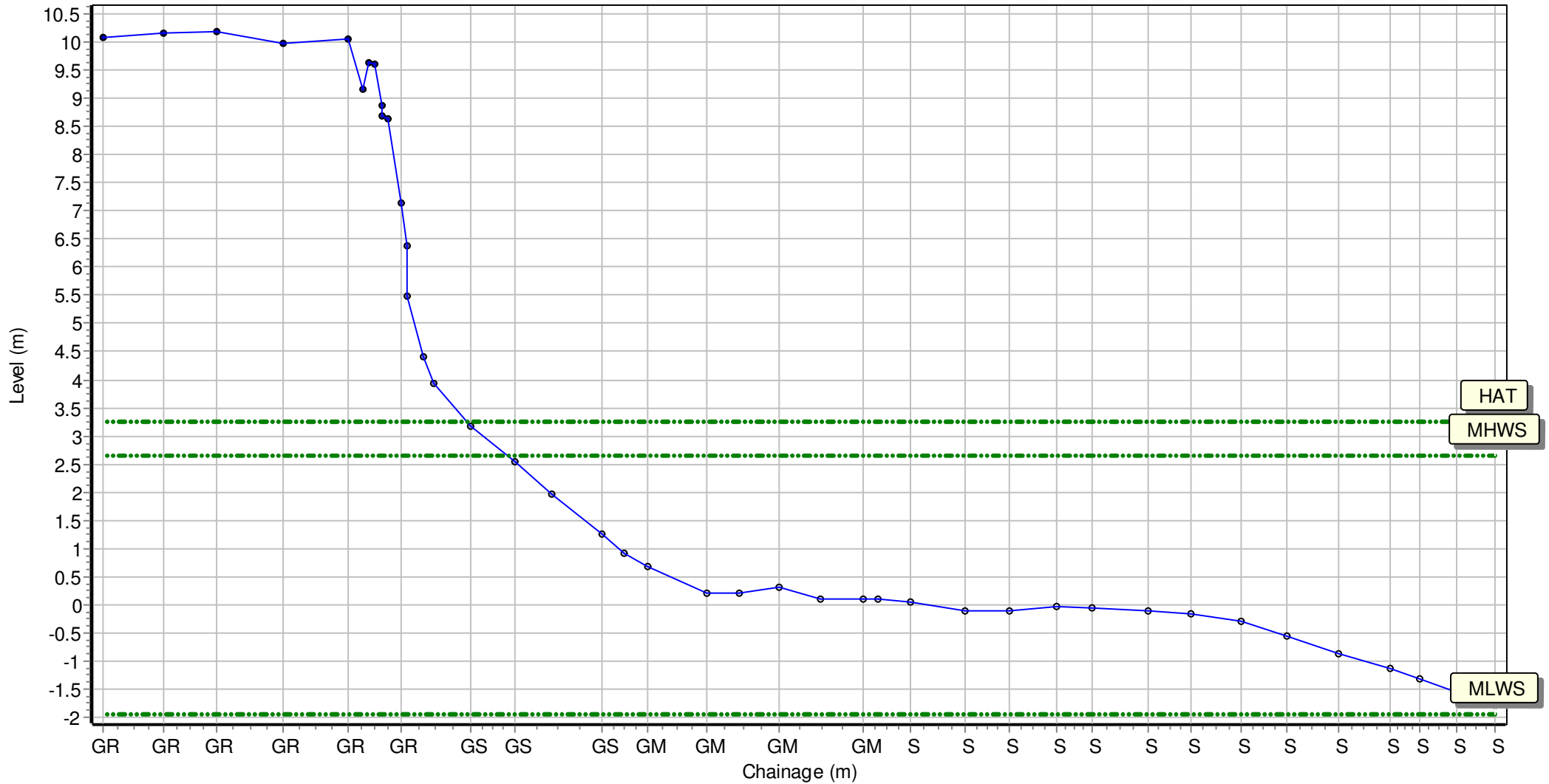
Sea State:

Visibility:

Rain:

Summary: 2018 Partial Measures Topo Survey

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



Beach Profile

Location: 1cRC8

Date: 06/04/2018

Inspector: AG

Low Tide:

Low Tide Time:

Wind

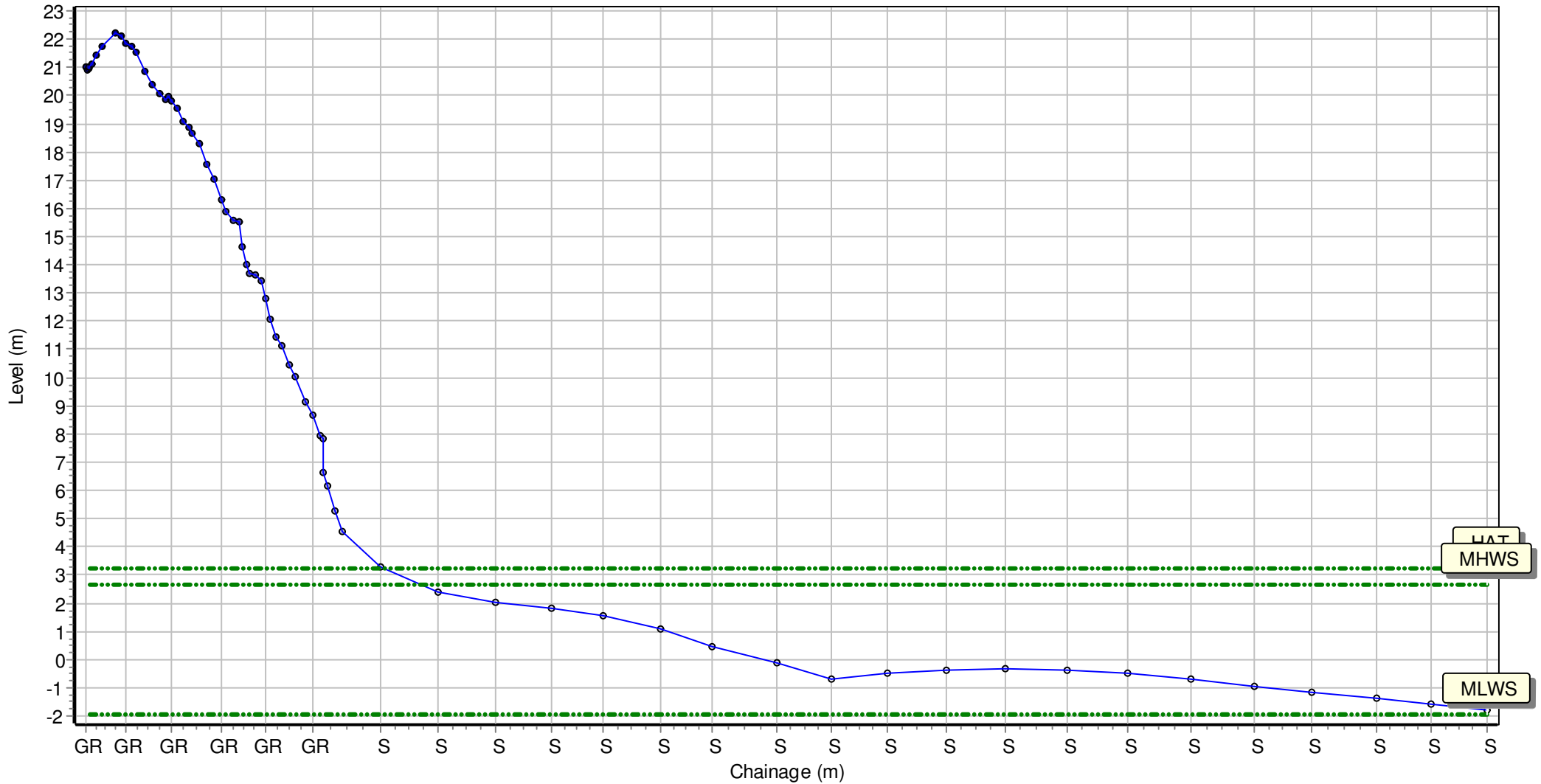
Sea State:

Visibility:

Rain:

Summary: 2018 Partial Measures Topo Survey

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



Beach Profile

Location: 1cRC9

Date: 06/04/2018

Inspector: AG

Low Tide:

Low Tide Time:

Wind

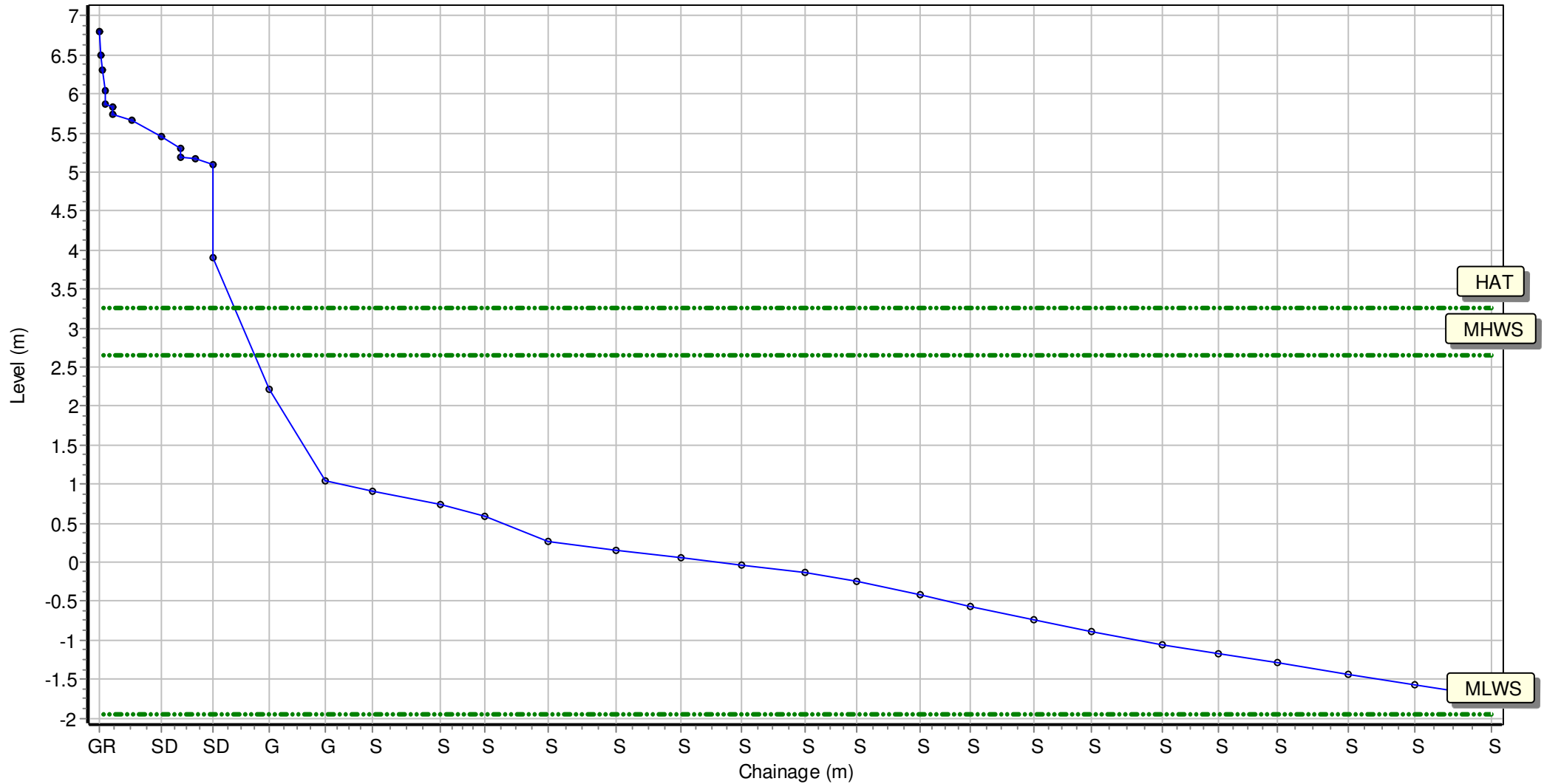
Sea State:

Visibility:

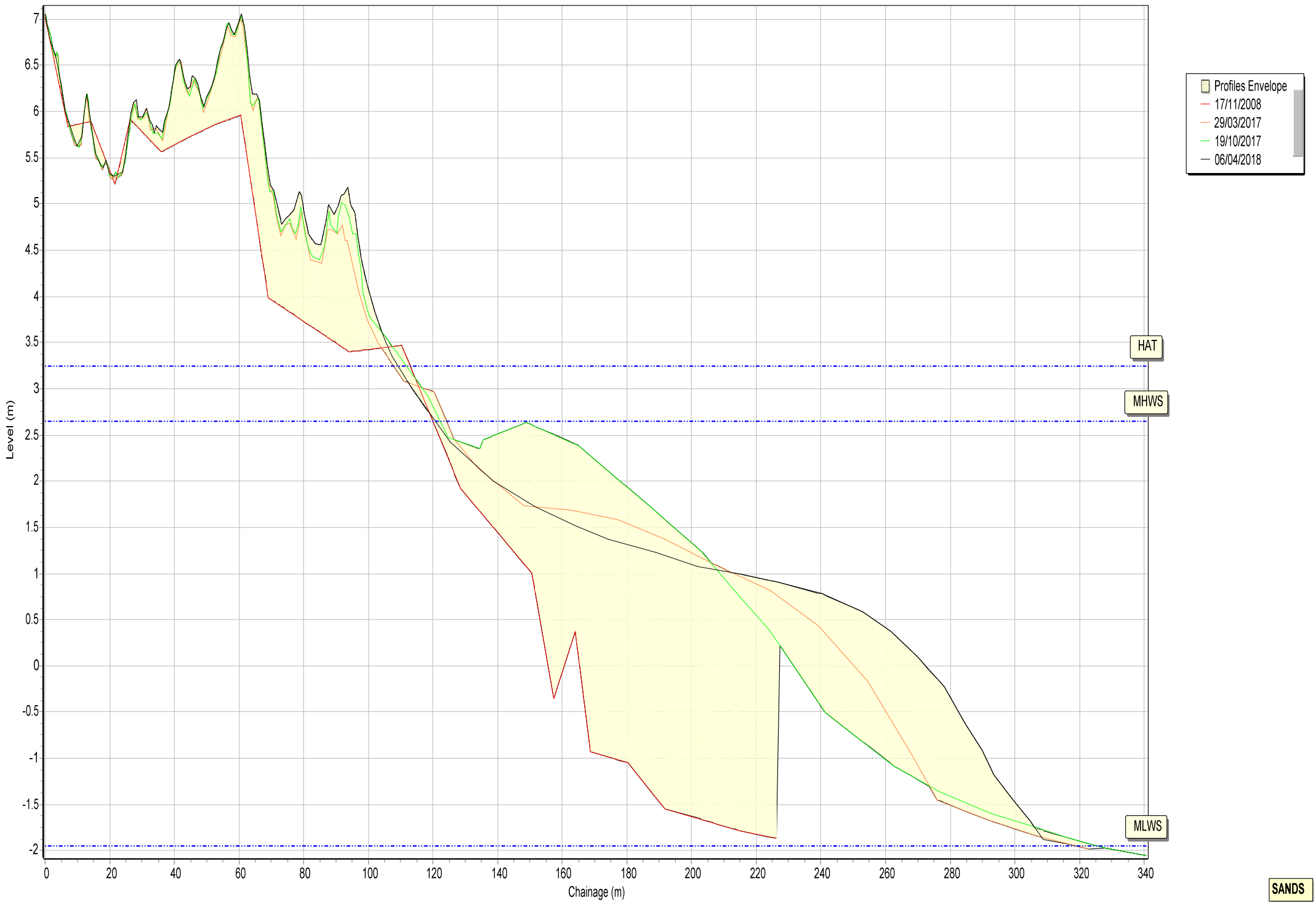
Rain:

Summary: 2018 Partial Measures Topo Survey

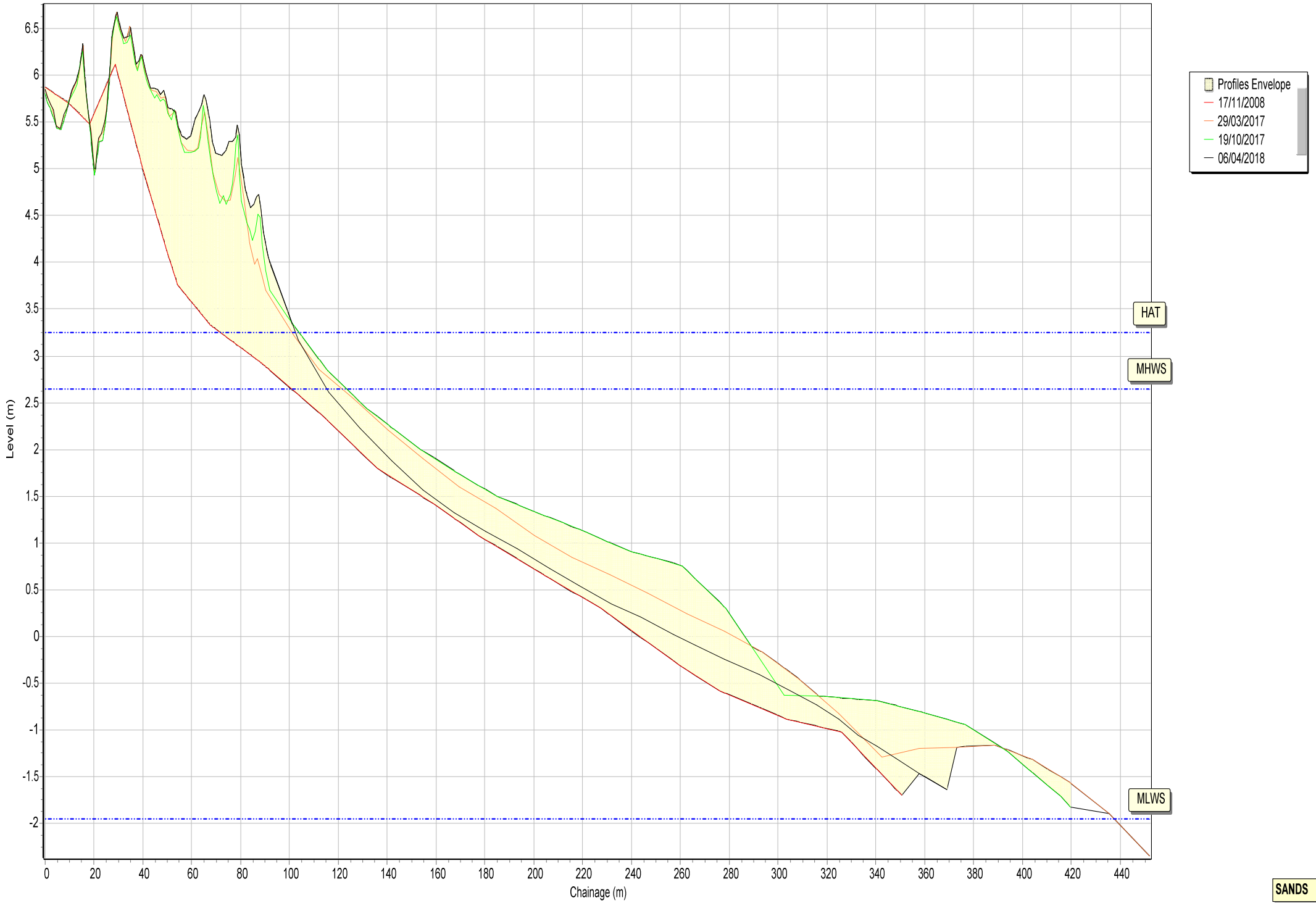
Easting: 466477.532 Northing: 521748.87 Profile Bearing: 22 ° from North



Beach Profiles: 1cRC1

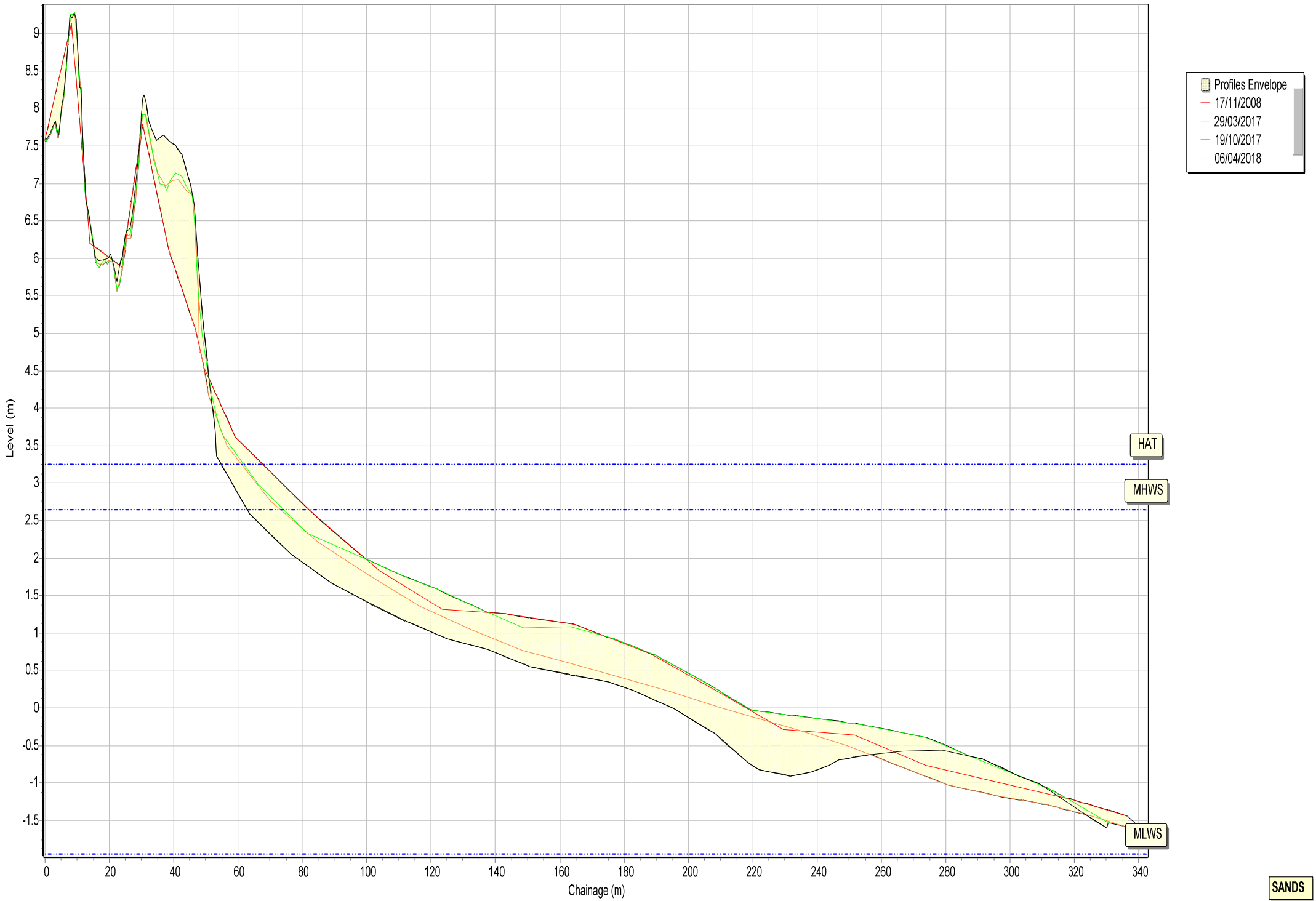


Beach Profiles: 1cRC2



SANDS

Beach Profiles: 1cRC3



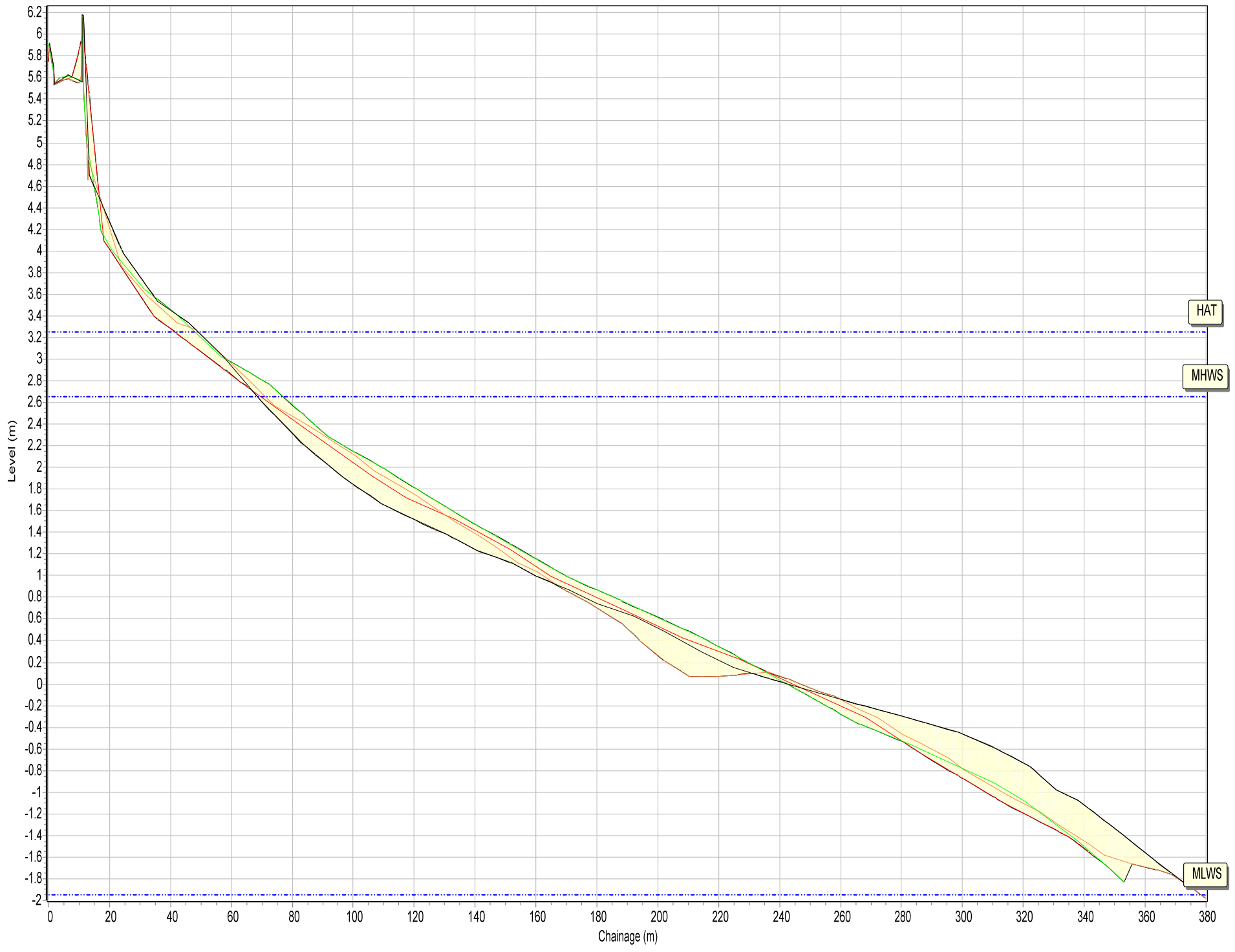
HAT

MHWS

MLWS

SANDS

Beach Profiles: 1cRC4



Profiles Envelope
17/11/2008
29/03/2017
19/10/2017
06/04/2018

HAT

MHWS

MLWS

SANDS

Beach Profiles: 1cRC5



Profiles Envelope
17/11/2008
29/03/2017
19/10/2017
06/04/2018

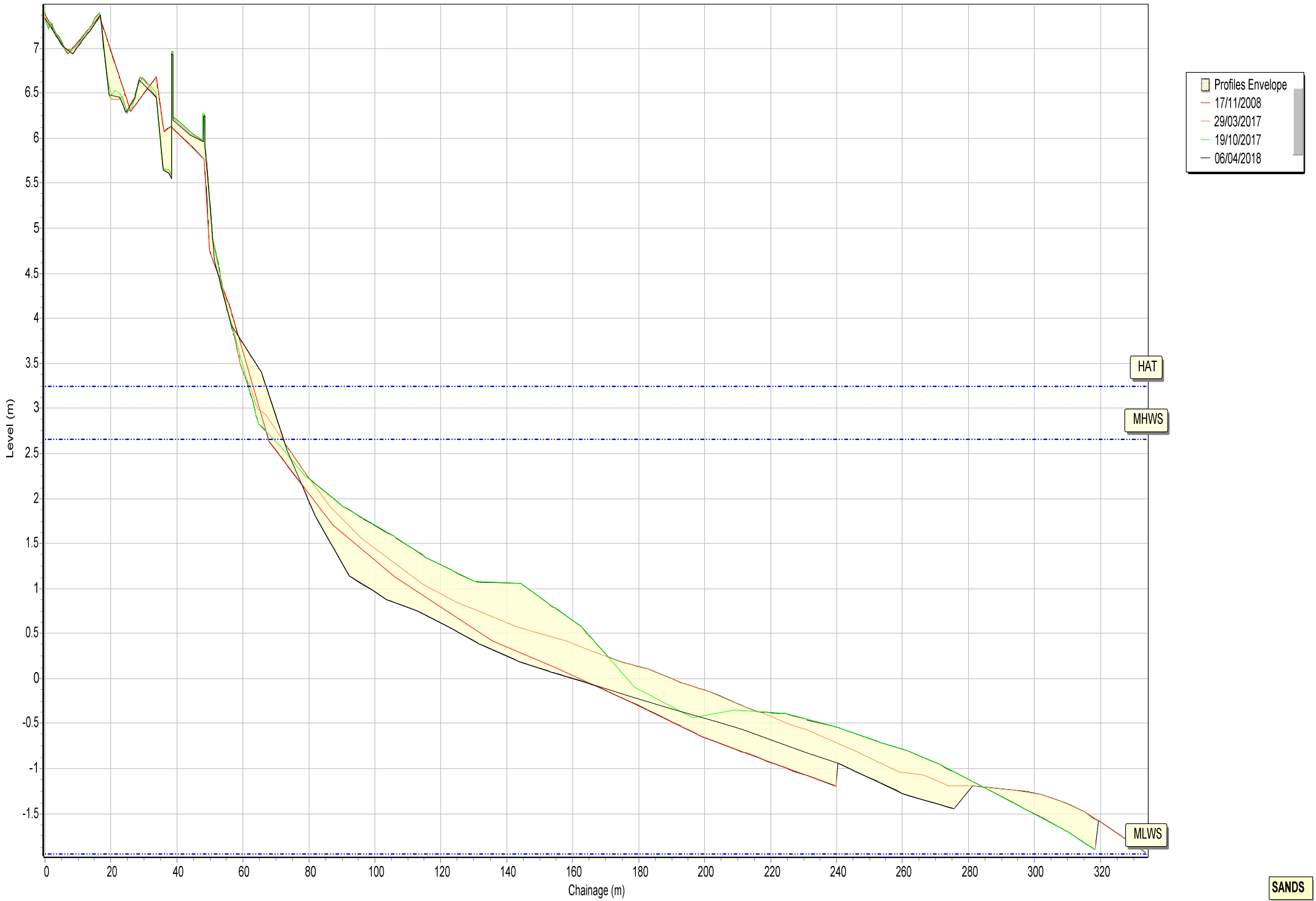
HAT

MHWS

MLWS

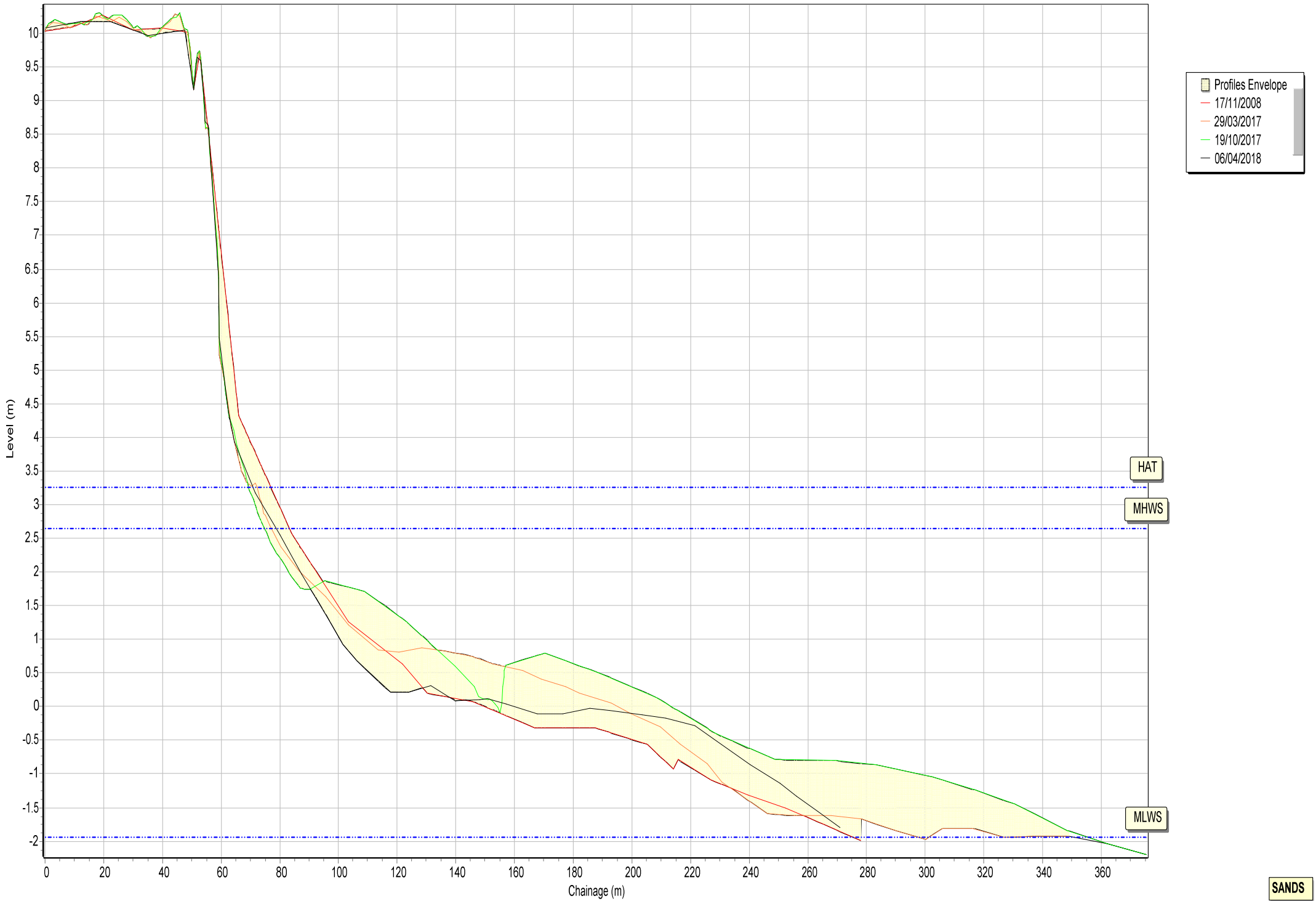
SANDS

Beach Profiles: 1cRC6



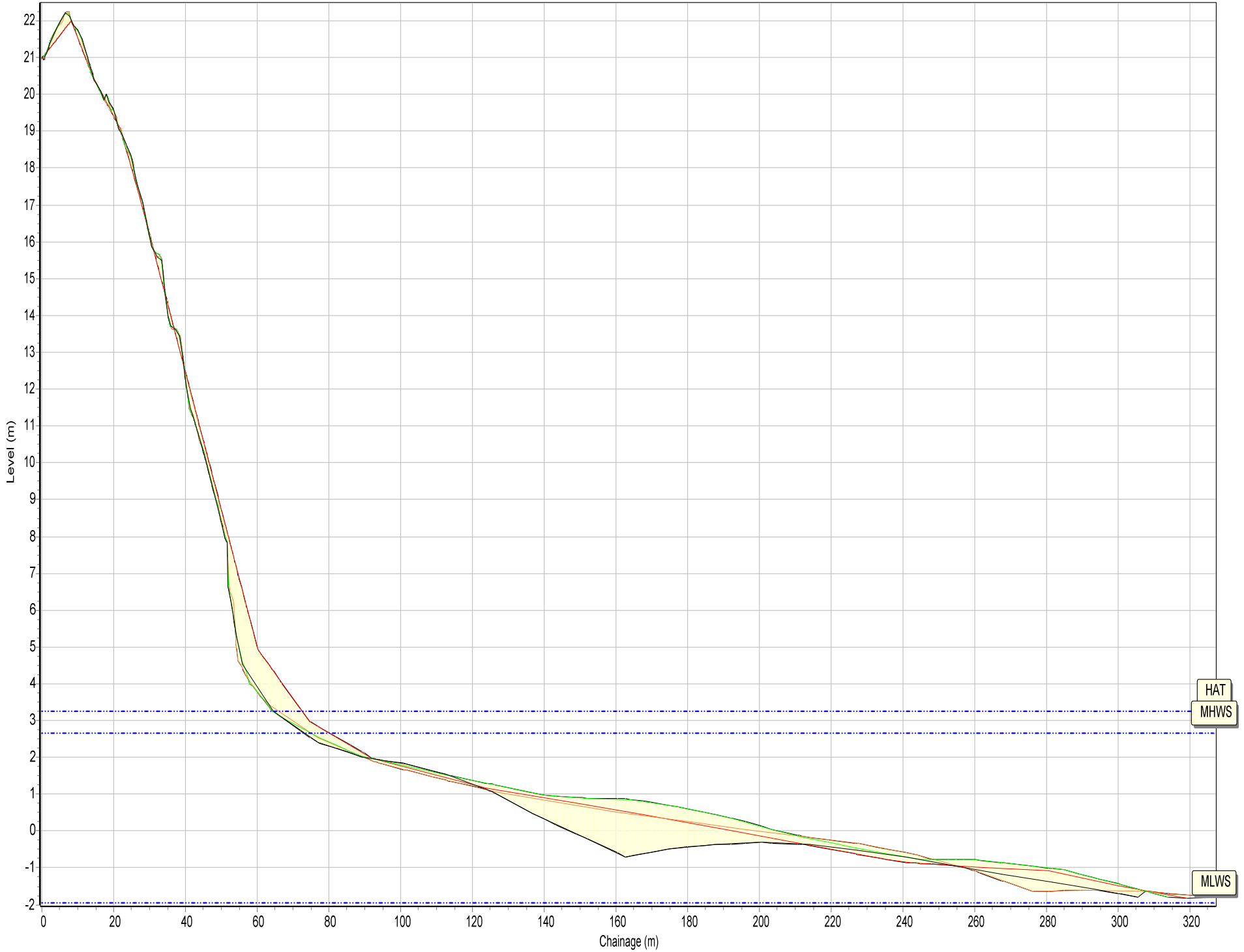
SANDS

Beach Profiles: 1cRC7



SANDS

Beach Profiles: 1cRC8



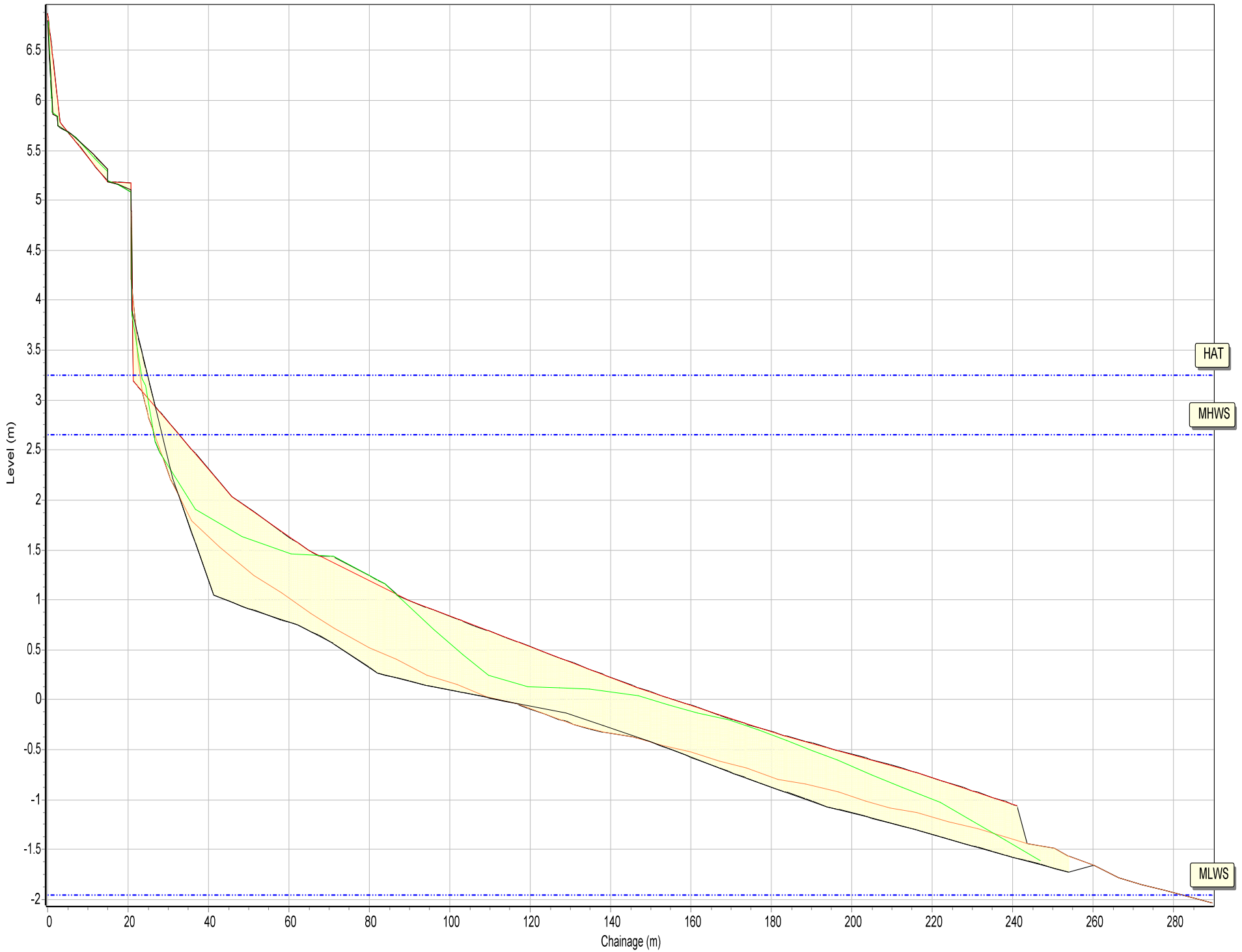
Profiles Envelope
17/11/2008
29/03/2017
19/10/2017
06/04/2018

HAT
MHWS

MLWS

SANDS

Beach Profiles: 1cRC9



Profiles Envelope
17/11/2008
29/03/2017
19/10/2017
06/04/2018

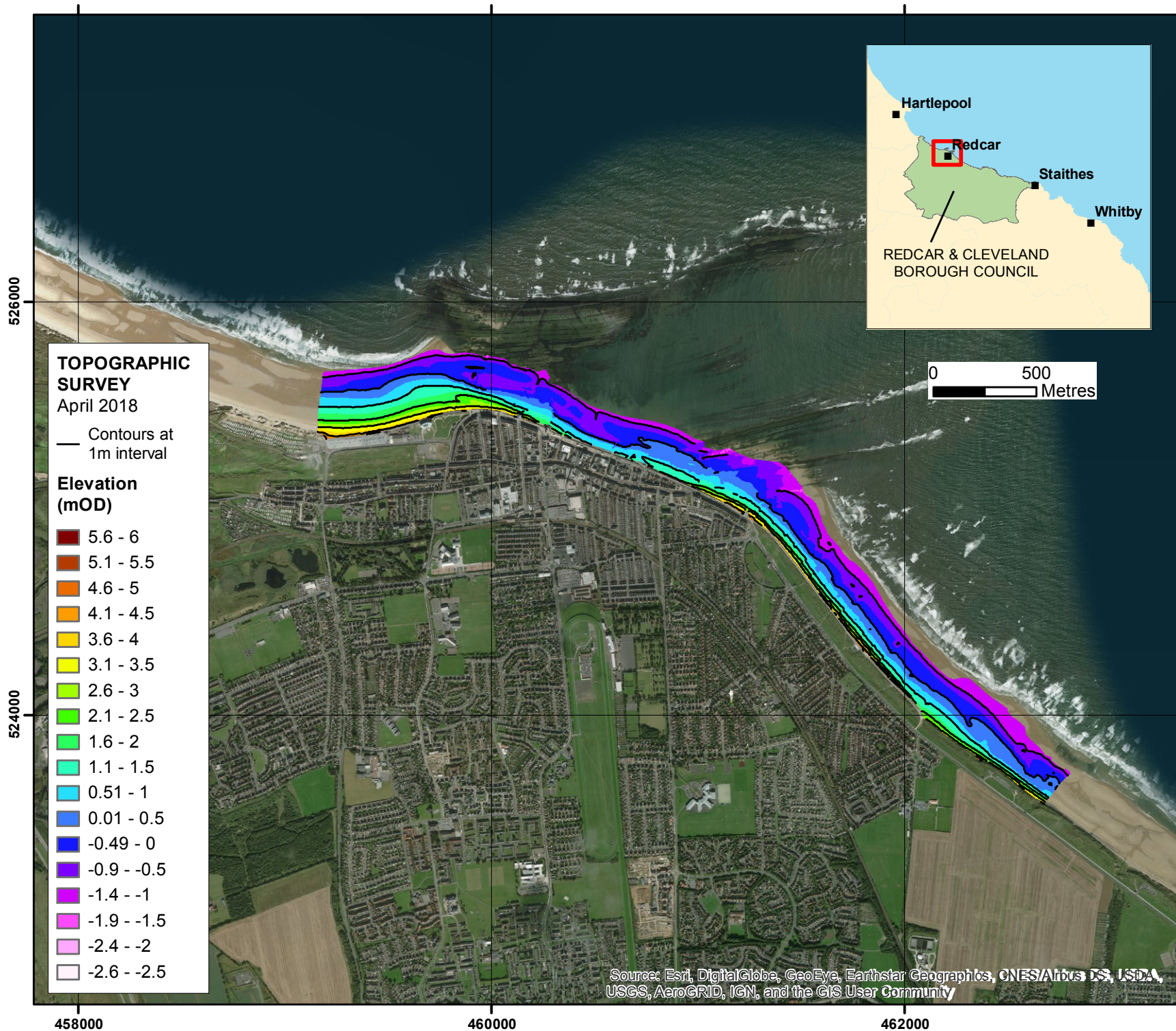
HAT

MHS

MLWS

SANDS

Appendix B
Topographic Survey



Key

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

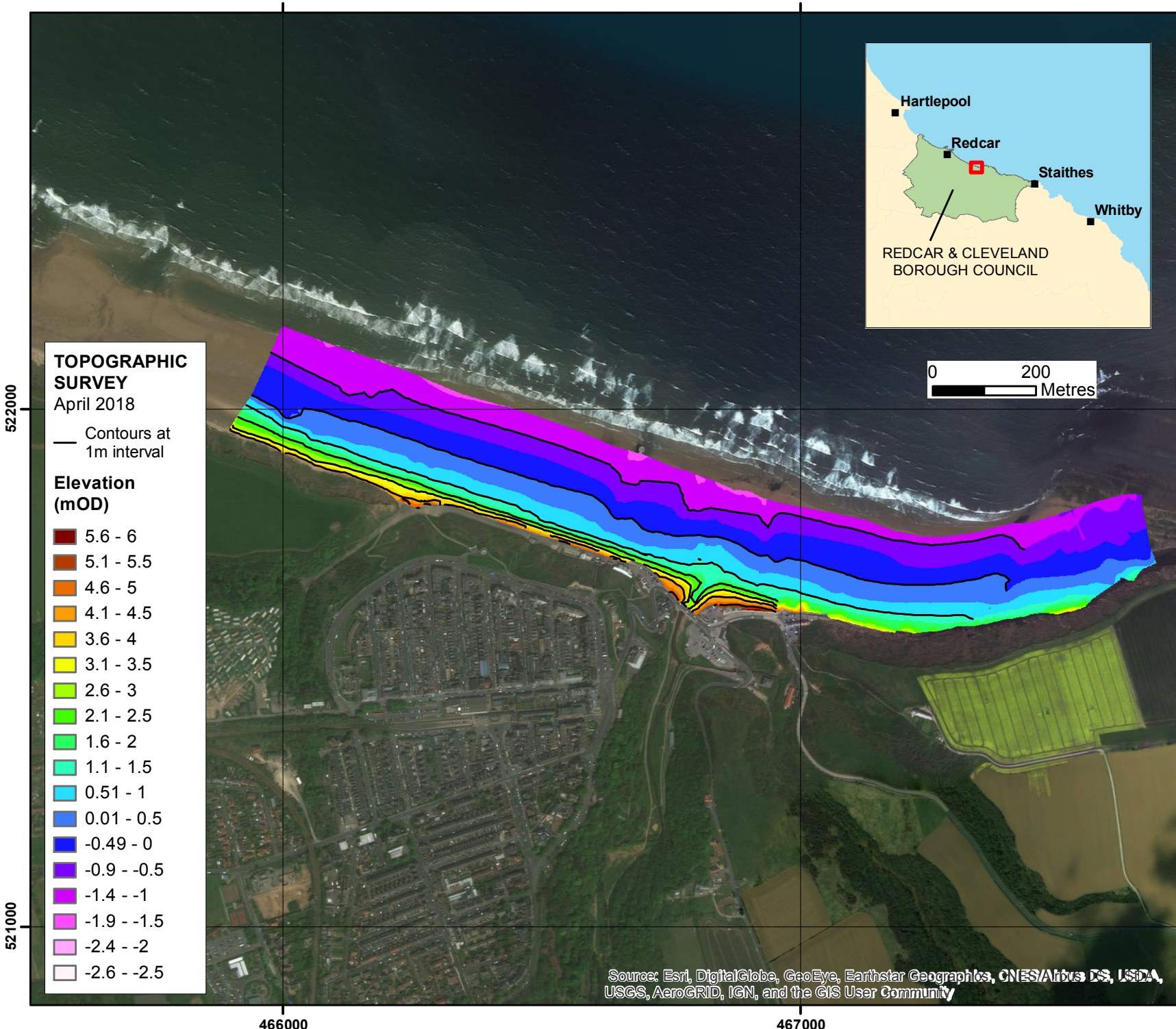
Appendix B - Map 1
REDCAR SANDS
Redcar and Cleveland Borough Council Frontage
Update Report
'Partial Measures' Survey 2018

Drawing Scale at A4 1:25,000

WATER
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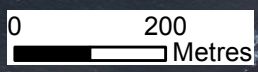


TOPOGRAPHIC SURVEY
April 2018

— 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 2
SALTBURN SANDS
Redcar and Cleveland Borough Council Frontage
Update Report
'Partial Measures' Survey 2018

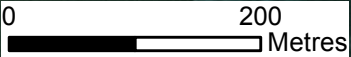
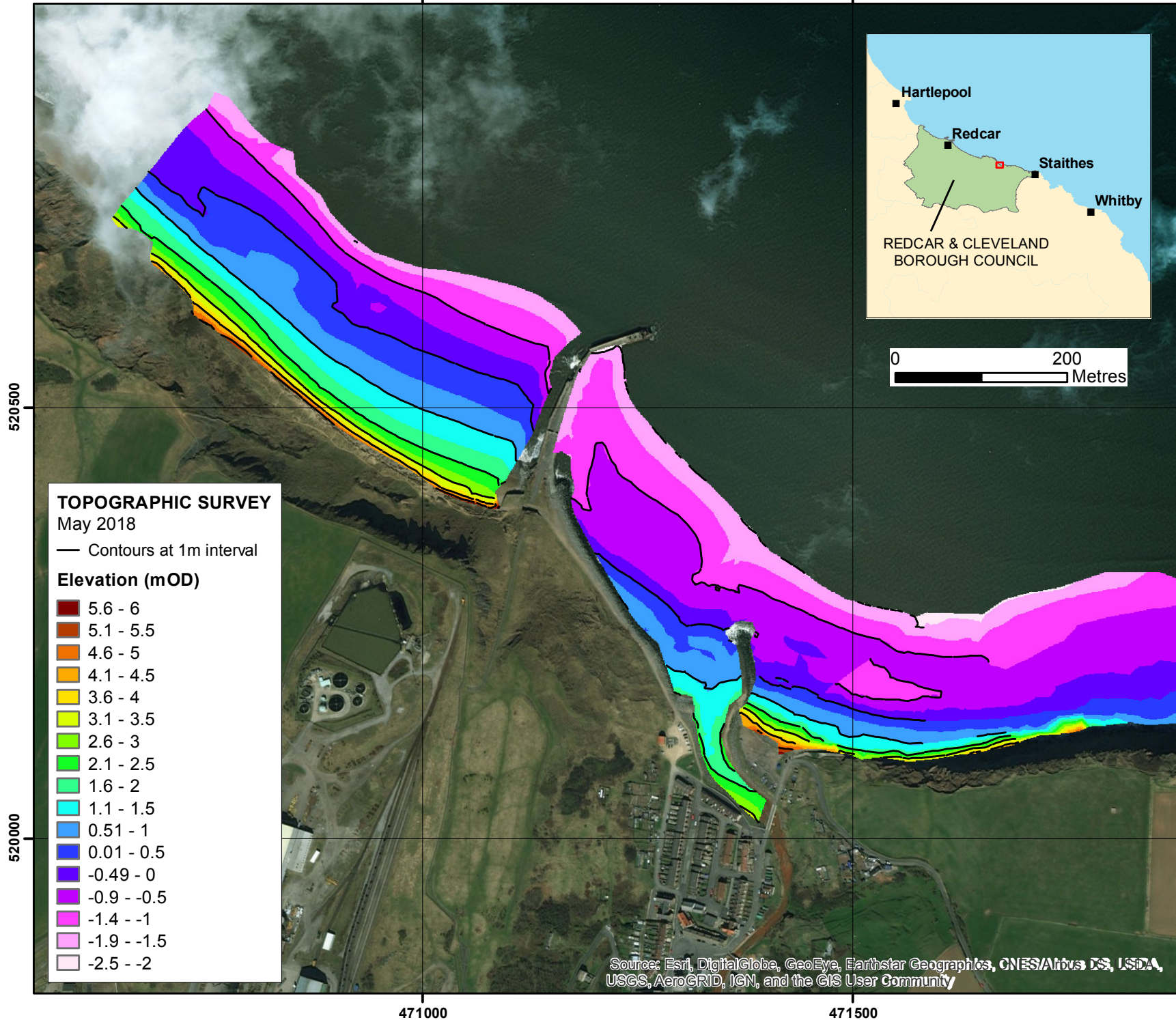
Drawing Scale at A4 1:10,000

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Source: Esri, DigitalGlobe, 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 3
CATTERSTY SANDS
Redcar and Cleveland Borough Council Frontage

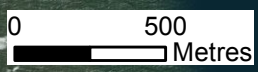
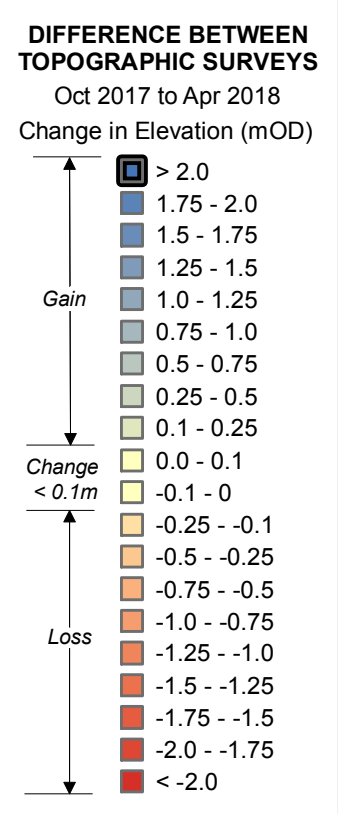
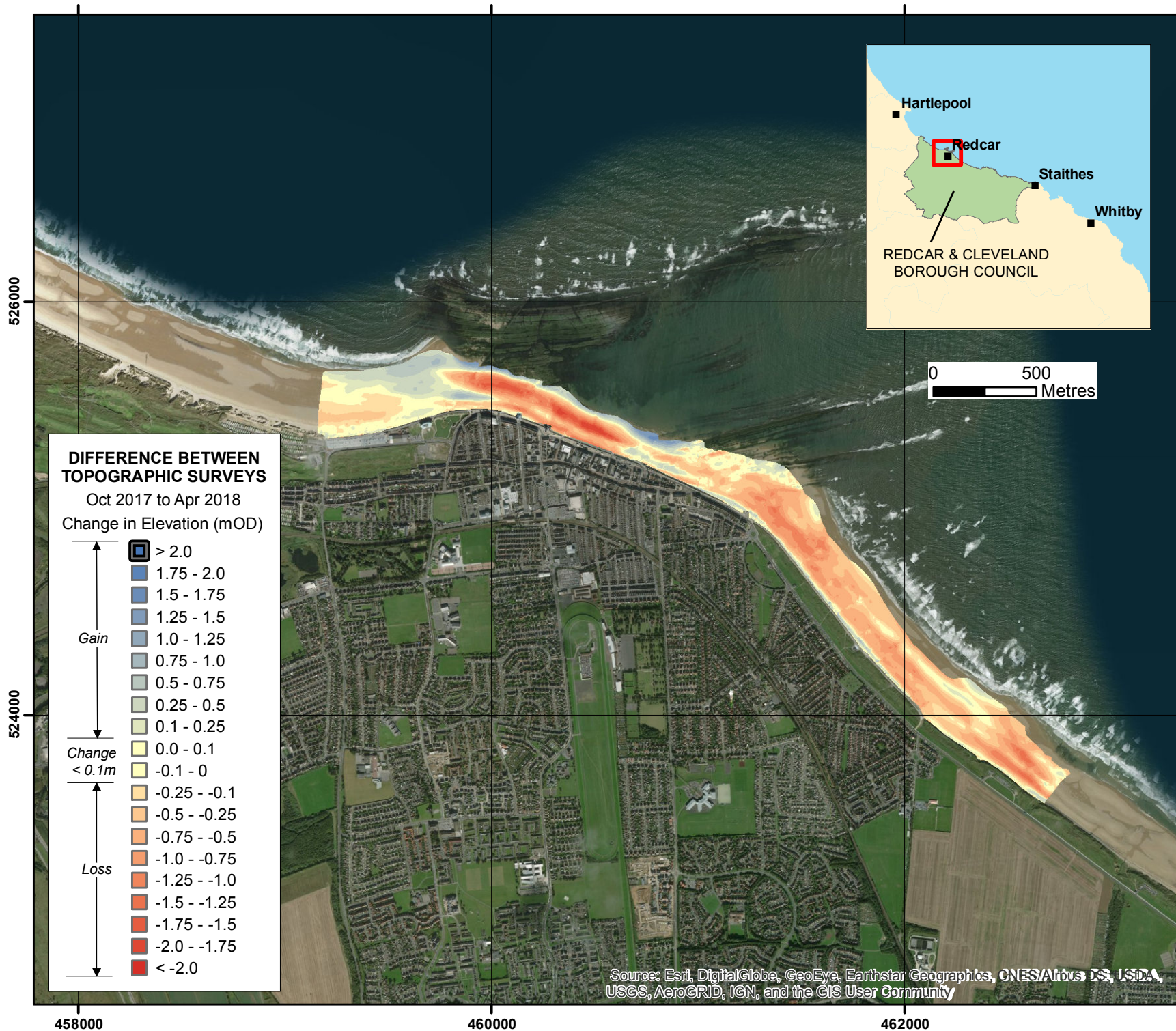
Update Report
'Partial Measures' Survey 2018

Drawing Scale at A4 1:6,000

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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 2018

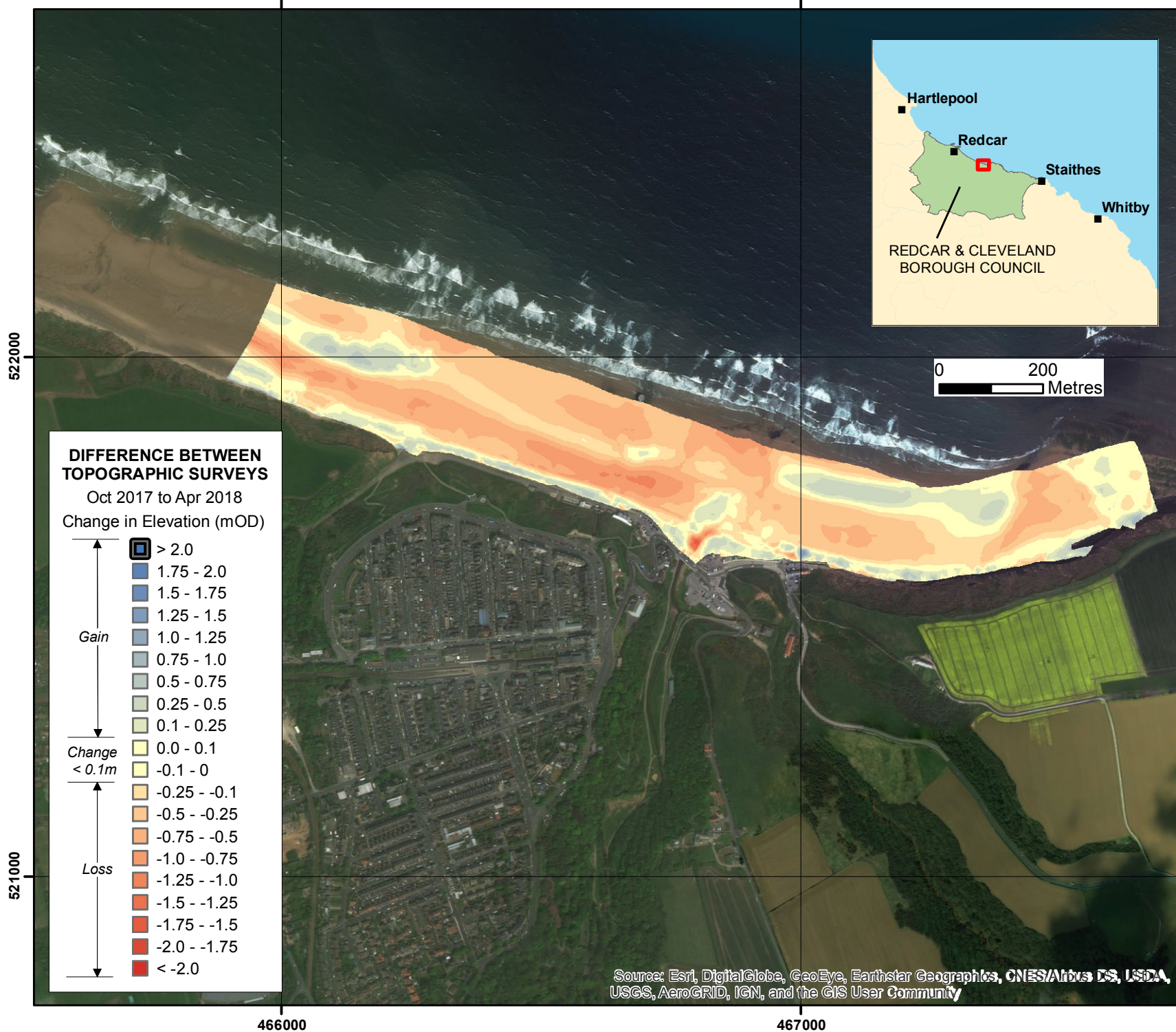
Drawing Scale at A4 1:25,000

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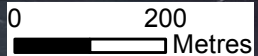
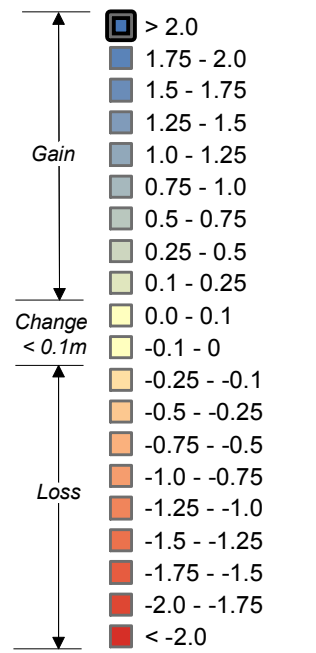


Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



DIFFERENCE BETWEEN TOPOGRAPHIC SURVEYS

Oct 2017 to Apr 2018
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 2018

Drawing Scale at A4 1:10,000

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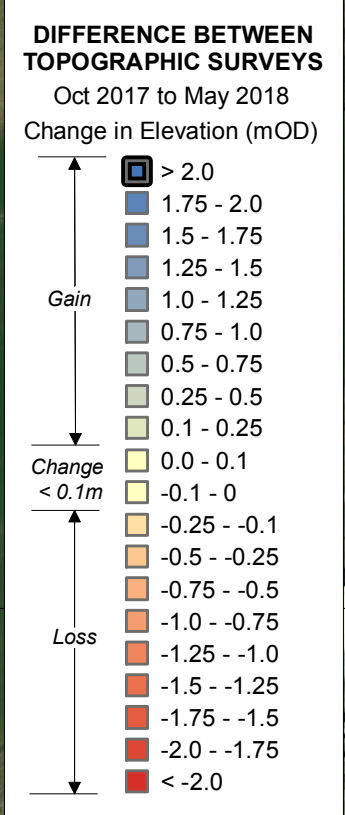
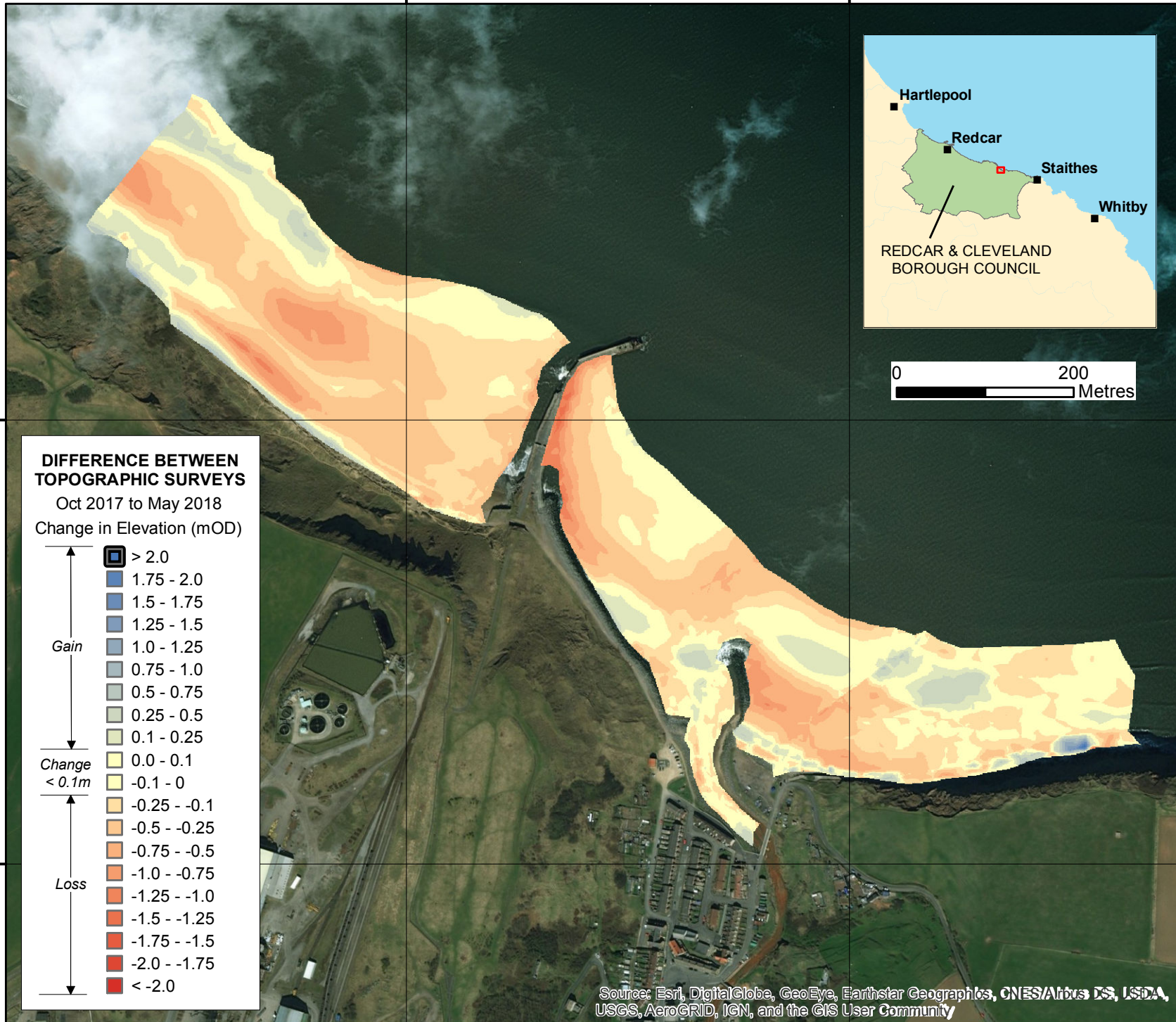
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

520500

520000

471000

471500



Key

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

Appendix B - Map 6
CATTERSTY SANDS
Redcar and Cleveland Borough Council Frontage
 Update Report
 'Partial Measures' Survey 2018

Drawing Scale at A4 1:6,000

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

Appendix C
Cliff Top Survey

Cliff Top Survey

Staithe

Twenty ground control points have been established at Staithe (Figure C1). The maximum separation between any two points varies along the coast, reflecting the degree of risk from the erosion.

The cliff top surveys at Staithe 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
STAITHES				Nov 2008	Sep 2017	Mar 2018	Nov 2008 - Mar 2018	Sep 2017 - Mar 2018	Nov 2008 - Mar 2018
1	477228	518769	320	1.9	-0.15	0.04	1.86	-0.19	0.19
2	477334	518798	0	10.9	10.74	10.78	0.12	-0.04	0.01
3	477487	518789	350	7.1	8	8.02	-0.92	-0.02	0.00
4	477594	518801	340	5.9	4.26	4.24	1.66	0.02	0.17
5	477683	518911	350	8.4	8.73	8.68	-0.28	0.05	0.00
6	477792	518867	30	8.6	8.41	8.39	0.21	0.02	0.02
7	477891	518828	60	7.7	7.34	7.31	0.39	0.03	0.04
8	477959	518873	350	8.7	9.64	9.64	-0.94	0.00	0.00
9	478088	518950	350	7.6	No Access	No Access	No Access	0	-0.06
10	478191	519023	340	8.4	No Access	No Access	No Access	0	-0.04
11	478237	519007	60	6.9	No Access	No Access	No Access	0	0.02
12	478213	518988	150	6.1	No Access	No Access	No Access	0	-0.14
13	478501	518809	15	11.4	9.03	9.02	2.38	0.01	0.24
14	478624	518807	20	7.5	7.46	7.5	0.00	-0.04	0.00
15	478737	518858	60	6.1	6.16	6.17	-0.07	-0.01	0.00
16	478823	518757	60	8	8.67	8.67	-0.67	0.00	0.00
17	478944	518671	30	9.3	9.21	9.09	0.21	0.12	0.02
18	479052	518630	20	9.2	9.25	9.18	0.02	0.07	0.00
19	479147	518610	0	14.2	14.37	14.29	-0.09	0.08	0.00
20	479274	518618	20	11.4	11.33	11.36	0.04	-0.03	0.00