



Cell 1 Regional Coastal Monitoring Programme Update Report 12: 'Partial Measures' Survey 2020



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**Scarborough Borough Council
June 2020**

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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
1 in 200 year	3.87	3.86	4.1	3.88
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
1 in 200 year	3.88	3.93	3.93	4.04
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).

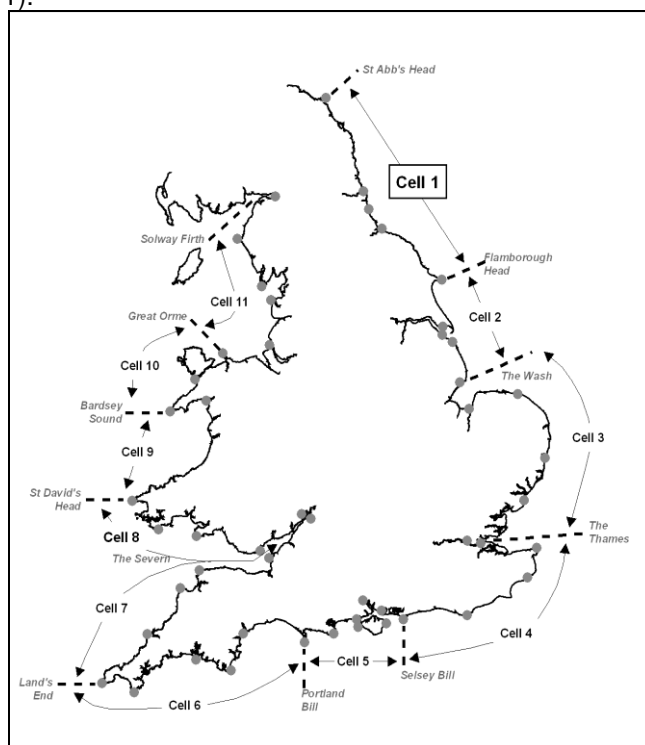


Figure 1 Sediment Cells in England and Wales

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	Jun 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	Oct-Nov 11	Feb 12	Mar-May 12	Jul 13	-
5	2012/13	Sep 12	Mar 13	Apr-May 13	May 13	-
6	2013/14	Oct-Nov 13	Feb 14	Mar-Apr 14	Jul 14	-
7	2014/15	Sep 14	Feb 15	Mar 15	Jul 15	-
8	2015/16	Sep 15	Feb 16	Mar-Apr 16	Jul 16	Jun 16
9	2016/17	Sep-Nov16	Feb 17	Feb-Apr 17	Jul 17	-
10	2017/18	Sep-Oct 17	Jan 18	Mar-May 18	Jun 18	-
11	2018/19	Sep-Oct 18	Mar 19	Mar-Apr 19	July 19	-
12	2019/20	Sep-Nov 19	Jan 20	Feb-Apr 20	Jun 20	

(*) The present report is **Update Report 12** and provides an analysis of the 2020 Partial Measures survey for Scarborough Council's frontage.

1. Introduction

1.1 Study Area

Scarborough Council's frontage extends from Staithes Harbour in the north, to Speeton in Filey Bay in the south. For the purposes of this report, it has been sub-divided into eight areas, namely:

- Staithes¹
- Runswick Bay
- Sandsend Beach, Uppang Beach and Whitby Sands
- Robin Hood's Bay
- Scarborough North Bay
- Scarborough South Bay
- Cayton Bay
- Filey Bay

1.2 Methodology

Along Scarborough Borough Council's frontage, the following surveying is undertaken:

- Full Measures survey annually each autumn/early winter comprising:
 - Beach profile surveys along 20 transect lines
 - Topographic survey at Runswick Bay
 - Topographic survey along the Sandsend to Whitby frontage
 - Topographic survey at Robin Hood's Bay
 - Topographic survey at Scarborough North Bay
 - Topographic survey at Scarborough South Bay
 - Topographic survey at Cayton Bay
 - Topographic survey at Filey Bay
- Partial Measures survey annually each spring comprising:
 - Beach profile surveys along 20 transect lines
 - Topographic survey at Runswick Bay
 - Topographic survey at Robin Hood's Bay
 - Topographic survey at Filey Bay (Town coverage)
- Cliff top survey bi-annually at:
 - Staithes
 - Robin Hoods Bay (new addition Spring 2010)
 - Scarborough South Bay (new addition Spring 2010)
 - Cayton Bay
 - Filey

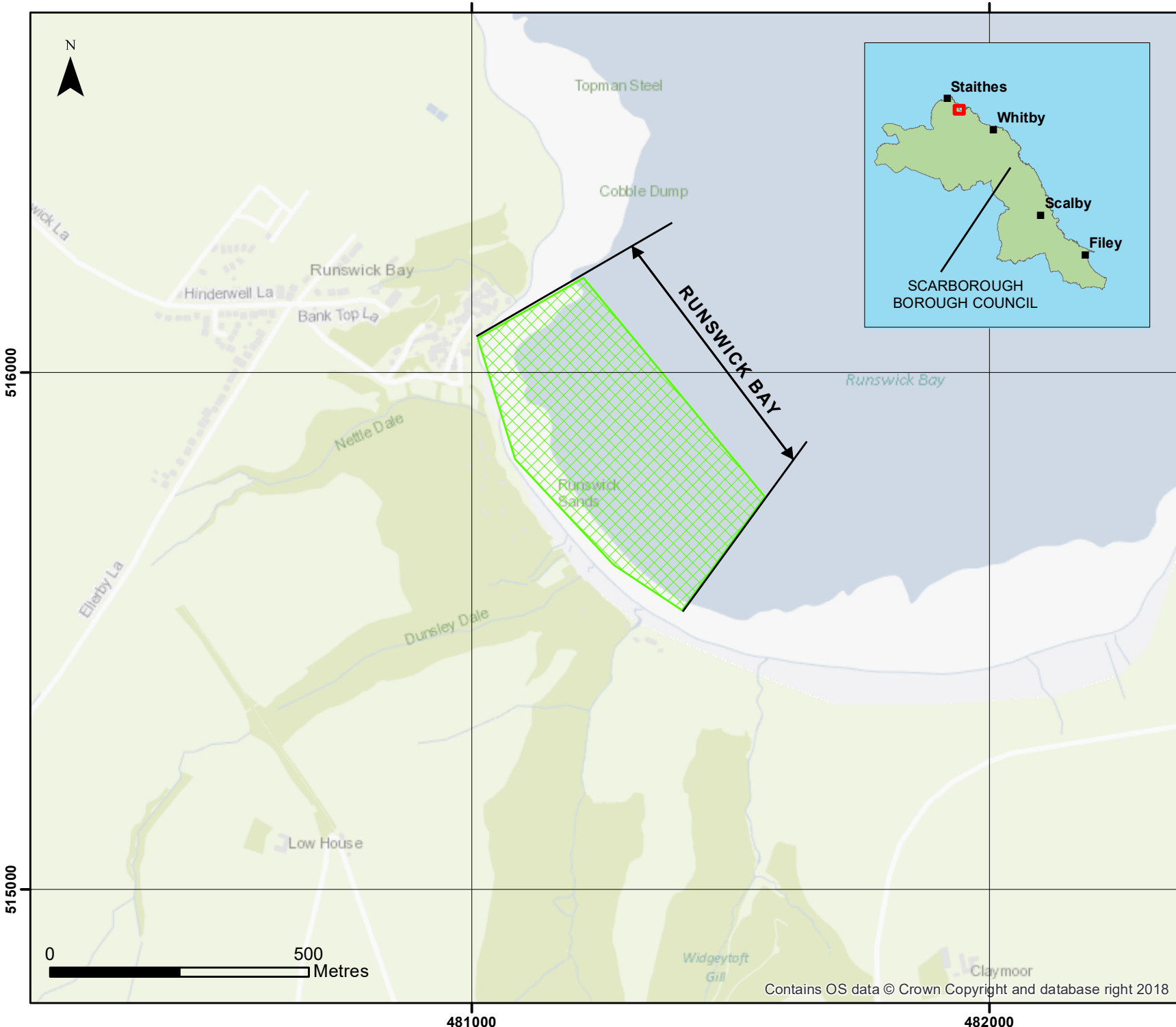
The location of these surveys is shown in Figure 2. The Partial Measures survey was undertaken along this frontage between 12th March and 28th April 2020, more specifically:

- Runswick Bay – 13th March 2020;
- Whitby – 25th April 2020;
- Robin Hood's Bay – 24th April 2020;
- Scarborough – 27th & 28th April 2020;
- Cayton Bay – 26th April 2020; and
- Filey – 12th & 13th March 2020.

During this time weather conditions varied considerably; refer to the survey reports for details of the weather conditions over this survey period. Data from the present survey are presented in a processed form in the Appendices.

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

Due to the Covid19 pandemic, all surveys were put on hold, effective from late March 2020. Only the surveys at Runswick Bay and Filey were completed prior to this point. In late April, the remaining surveys were completed under government social distancing guidelines.



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

Scarborough Borough Council Frontage

Analytical Report
Topo Surveys

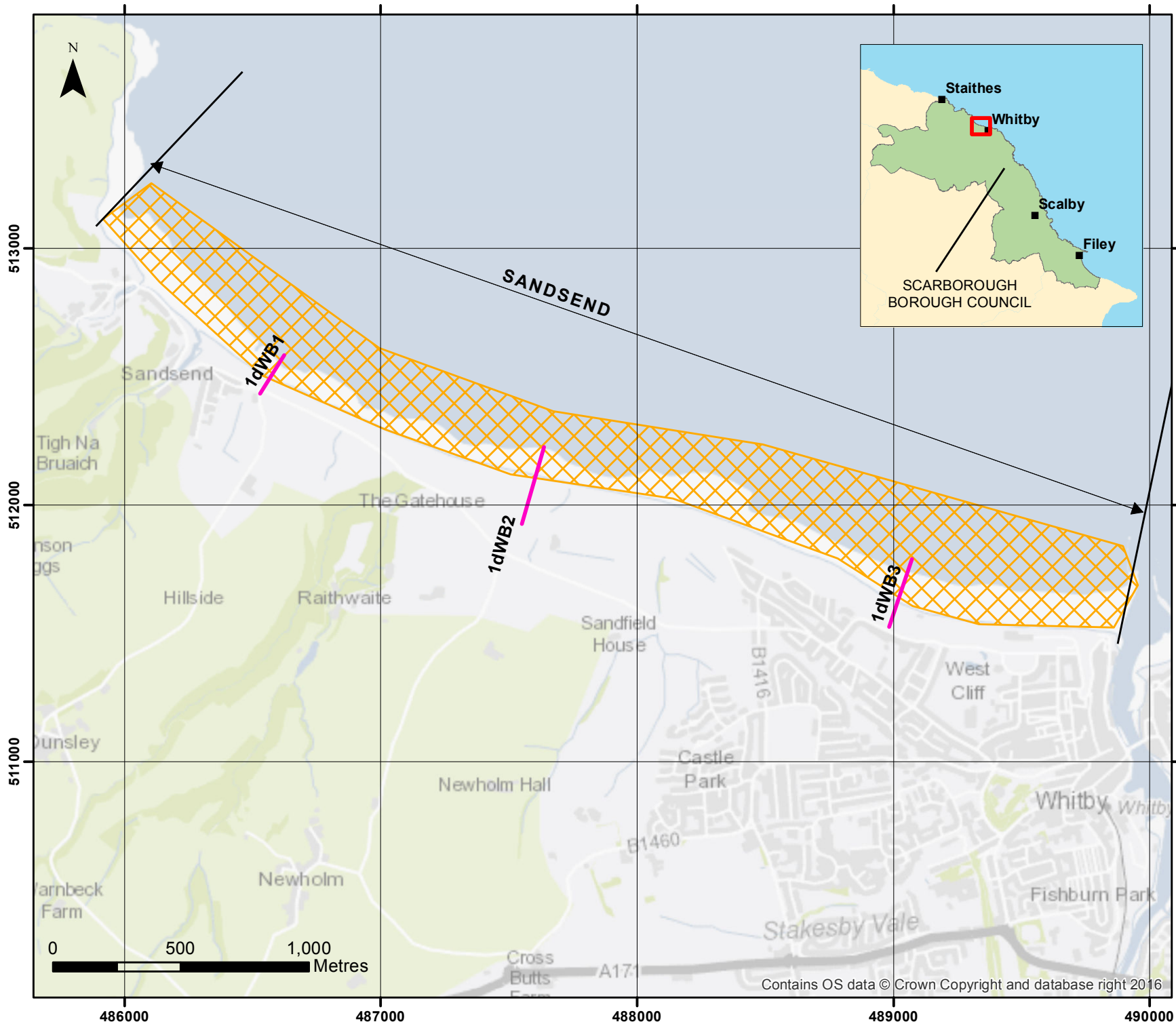
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Key

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

Scarborough Borough Council Frontage

Analytical Report
Topo Surveys

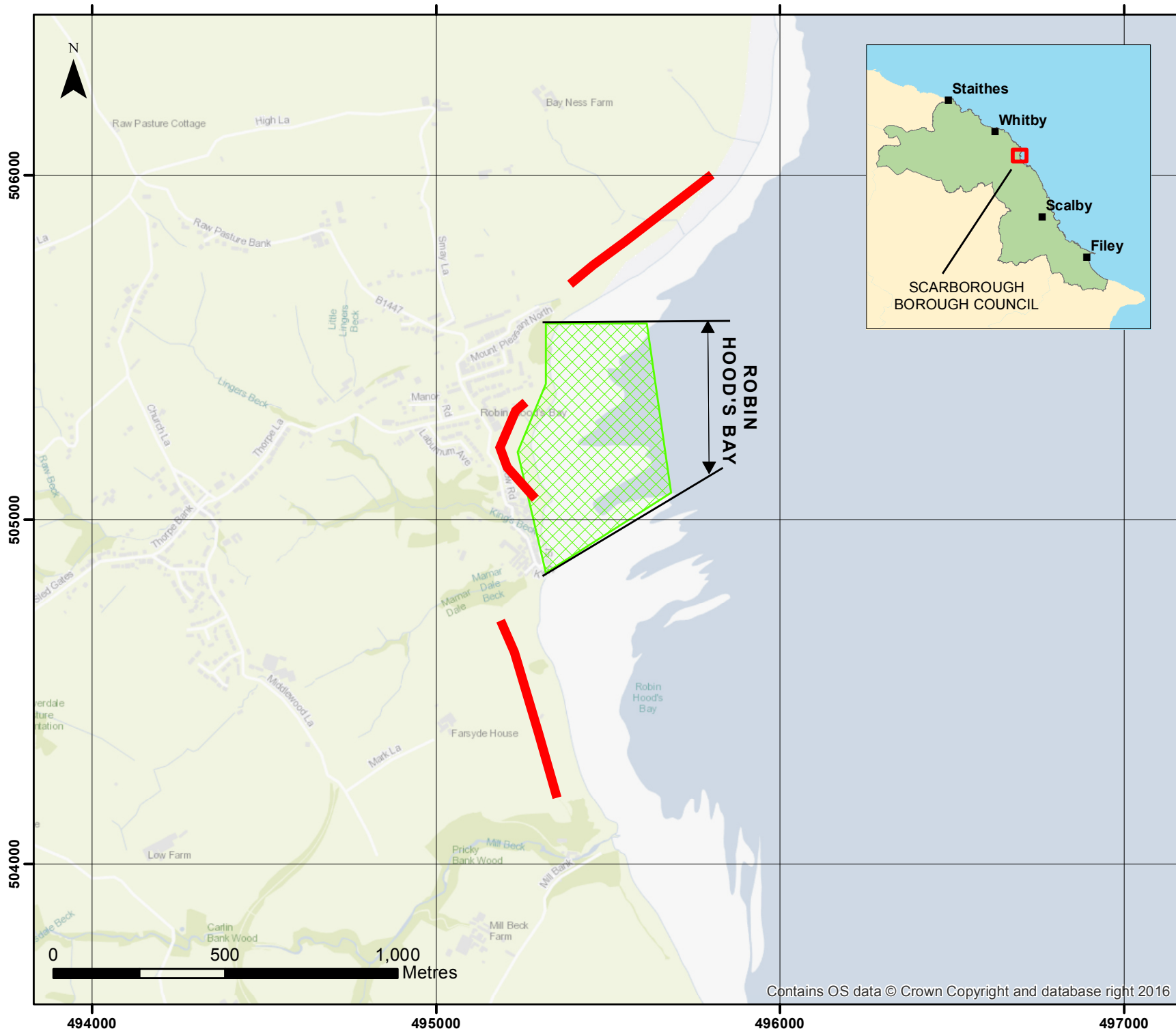
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Key

SURVEY LOCATIONS

Topographic Profiles

- Annual
- Bi-Annual

Topographic Surveys

- 6 monthly
- yearly

Cliff Top Monitoring Pegs

- @ 300 centres

(Indicative Survey Extents shown)

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Figure 2 - Map 3

Scarborough Borough Council Frontage

Analytical Report
Topo Surveys

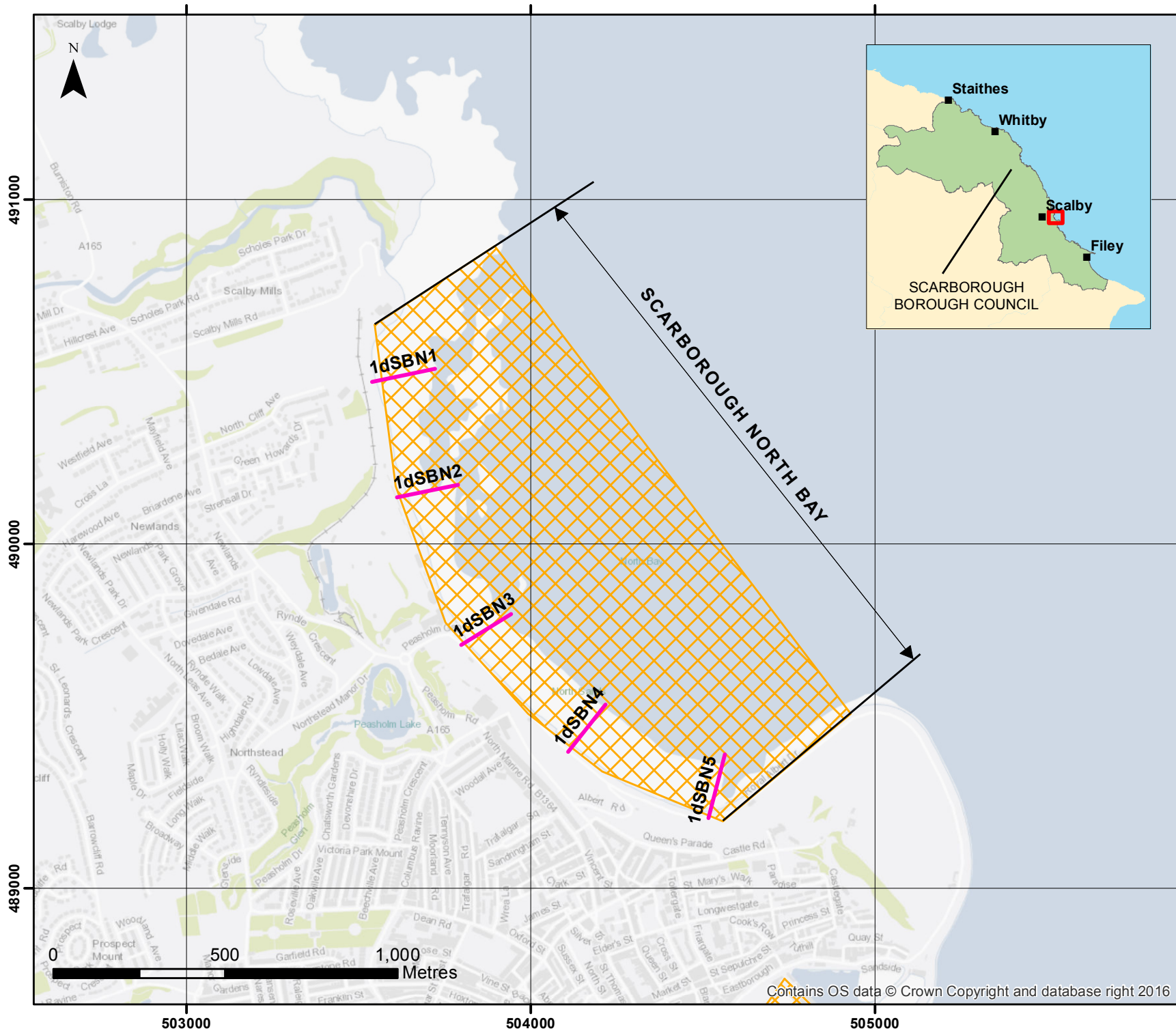
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Key

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 4

Scarborough Borough Council Frontage

Analytical Report Topo Surveys

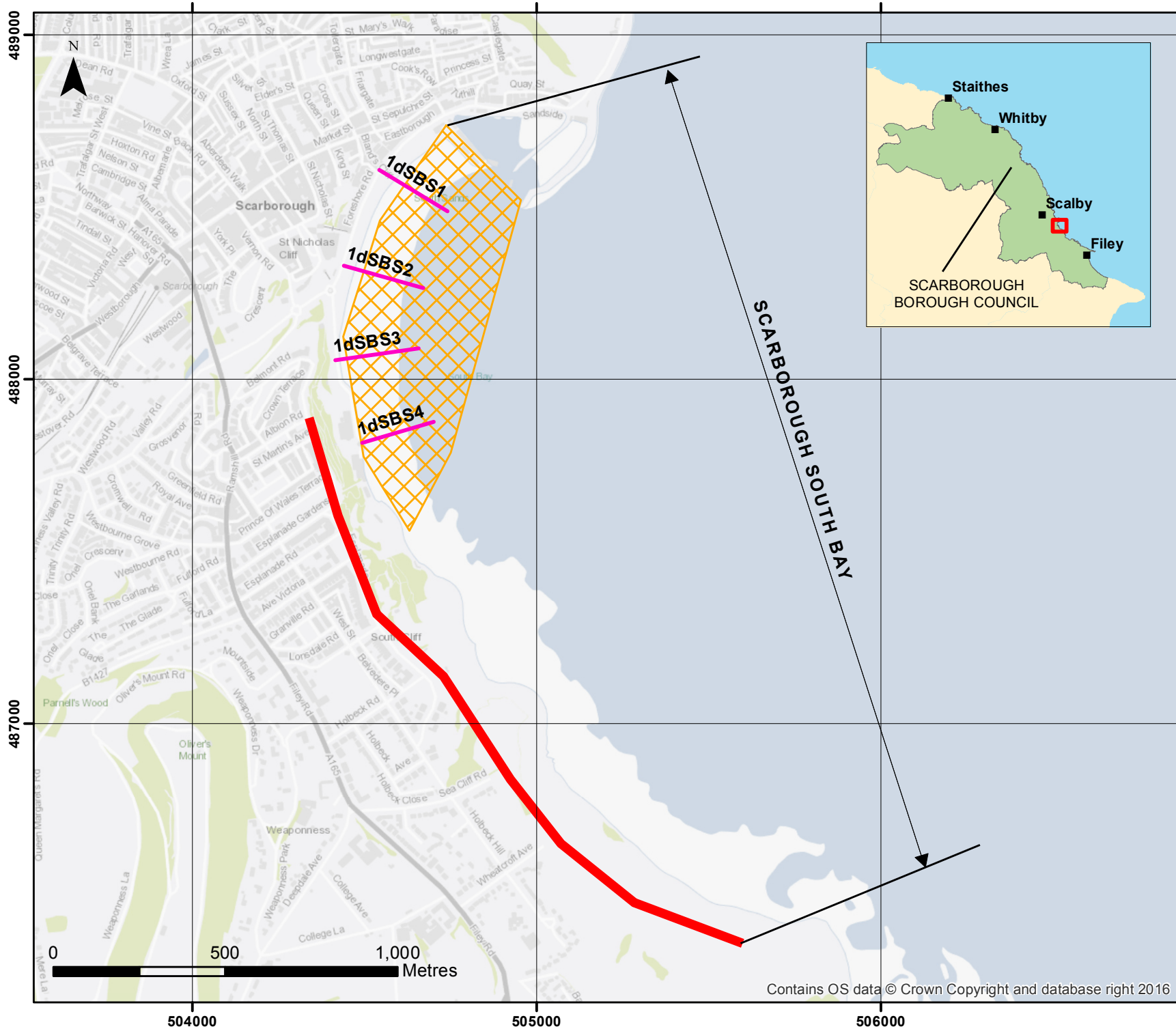
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Key

SURVEY LOCATIONS

Topographic Profiles

- Annual (Blue line)
- Bi-Annual (Pink line)

Topographic Surveys

- 6 monthly (Green grid)
- yearly (Orange grid)

Cliff Top Monitoring Pegs

- @ 300 metres (Red line)

(Indicative Survey Extents shown)

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Figure 2 - Map 5

Scarborough Borough Council Frontage

Analytical Report
Topo Surveys

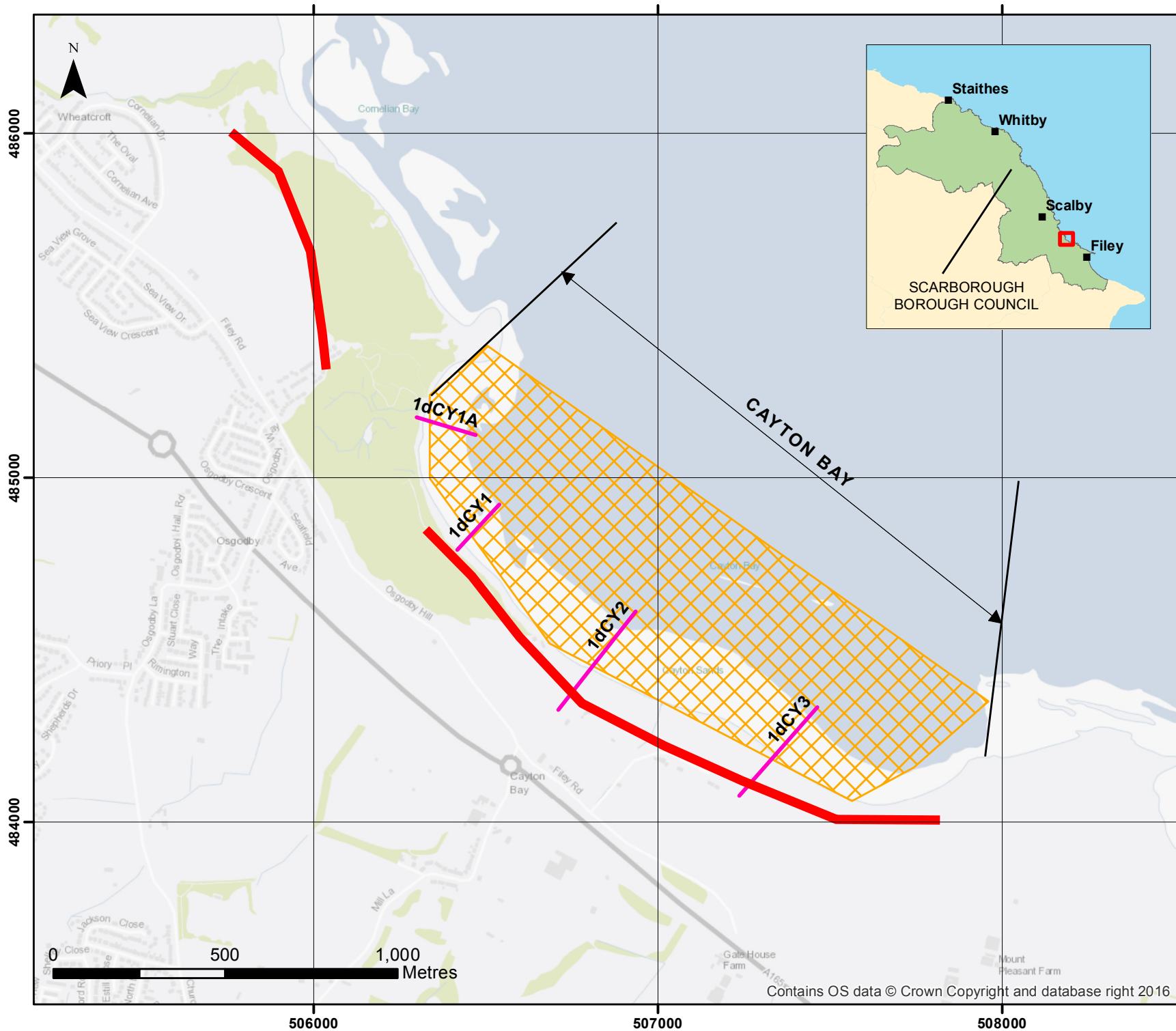
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Key

SURVEY LOCATIONS
Cliff Top Monitoring Pegs
 @ 300 centres

Topographic Profiles
 Annual
 Bi-Annual

Topographic Surveys
 6 monthly
 yearly
(Indicative Survey Extents shown)

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

Figure 2 - Map 6
Scarborough Borough Council Frontage
 Analytical Report
 Topo Surveys

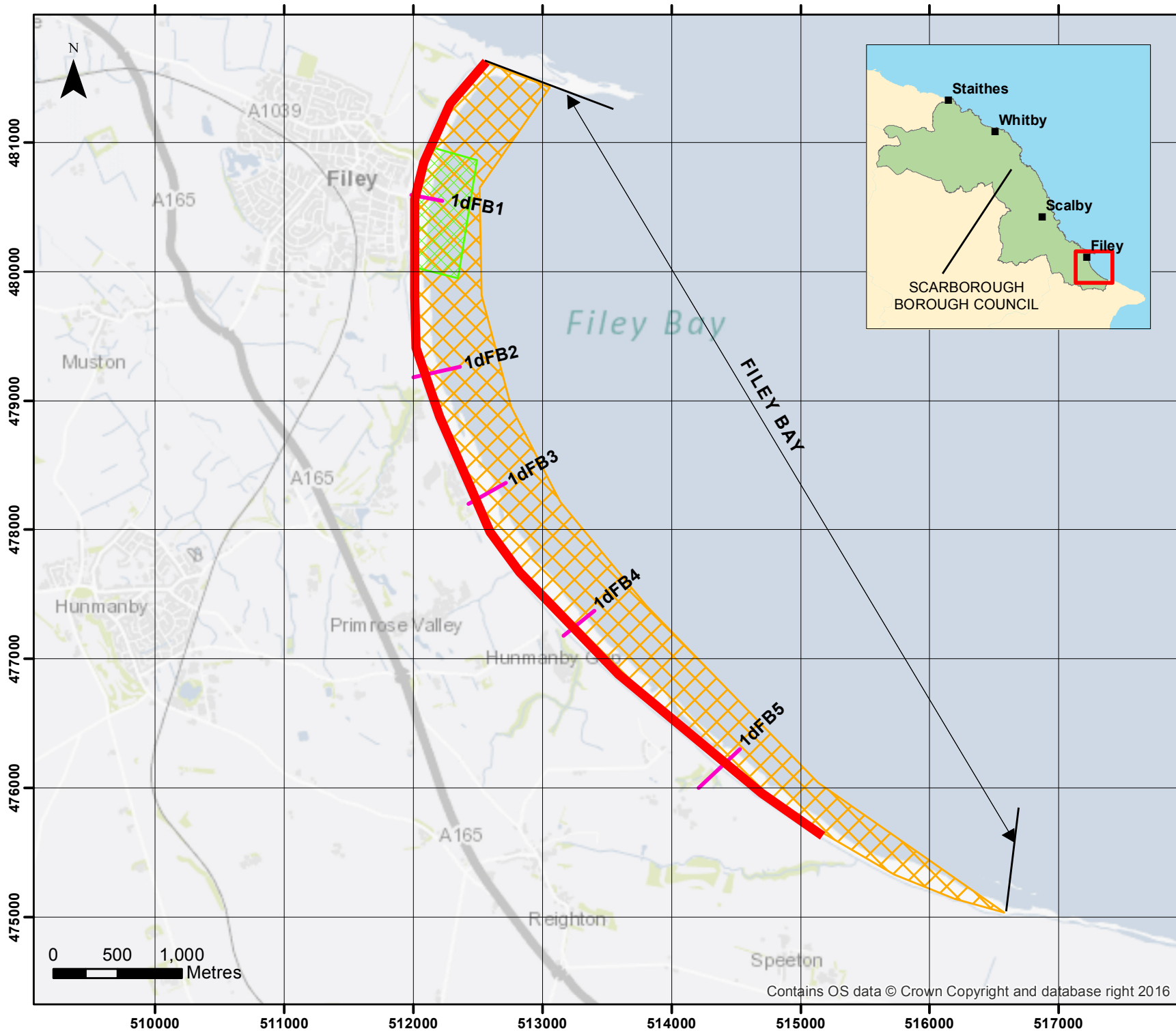
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Key

SURVEY LOCATIONS

Topographic Profiles

- Annual
- Bi-Annual

Topographic Surveys

- 6 monthly
- yearly

Cliff Top Monitoring Pegs

- @ 300 centres

(Indicative Survey Extents shown)

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Figure 2 - Map 7

Scarborough Borough Council Frontage

Analytical Report
Topo Surveys

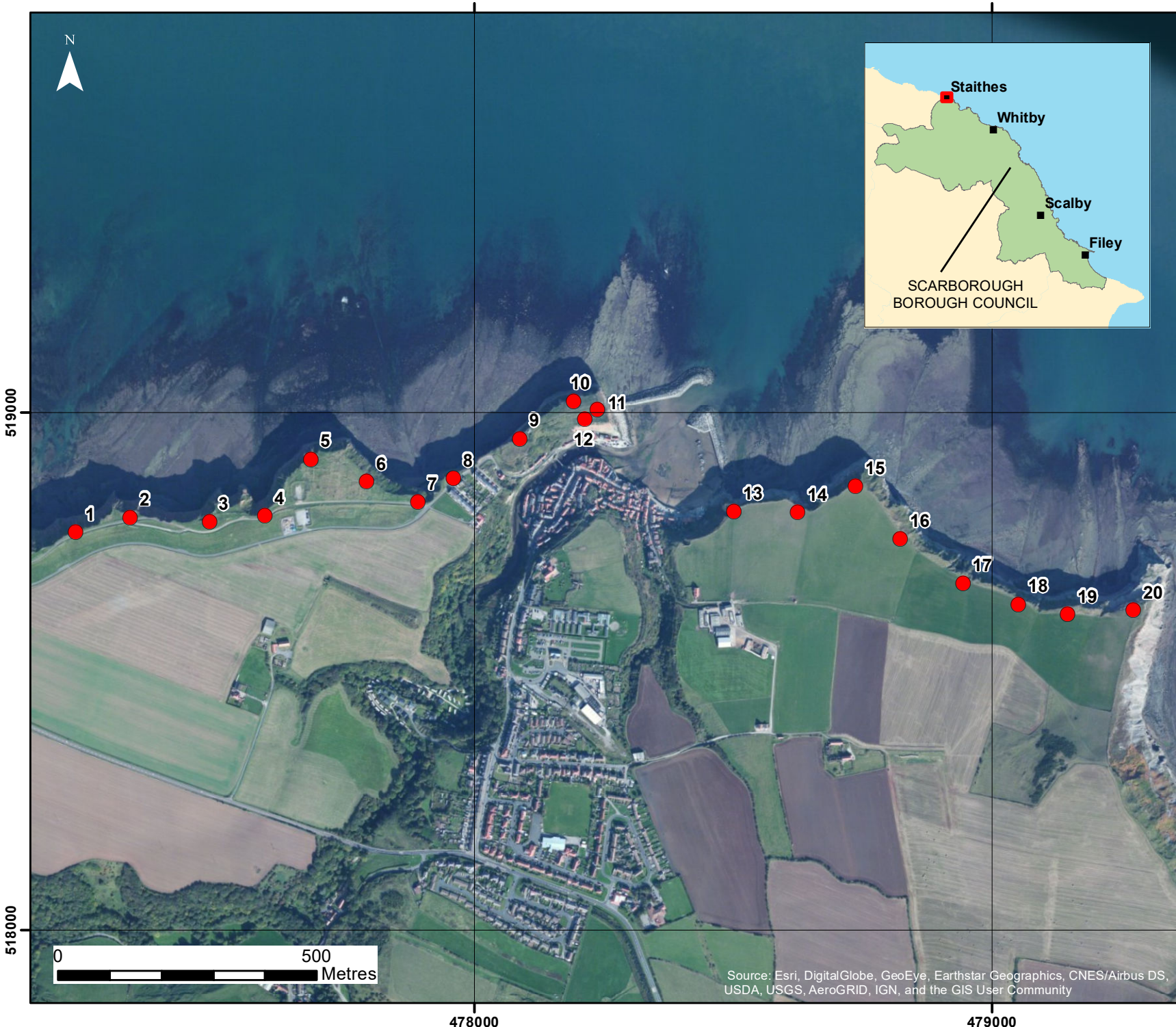
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Key
 ● Cliff Top Survey Locations

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

Figure 3 - Map 1

STAITHES
Scarborough Borough Council Council Frontage

Cliff Top Survey Locations

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
 ● Cliff Top Survey Locations

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

Figure 3 - Map 2

ROBIN HOOD'S BAY

**Scarborough
 Borough Council
 Council Frontage**

Cliff Top Survey Locations

Drawing Scale at A4 1:10,000

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Key
 ● Cliff Top Survey Locations

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

Figure 3 - Map 3
SCARBOROUGH SOUTH BAY

**Scarborough
 Borough Council
 Council Frontage**

Cliff Top Survey Locations

Drawing Scale at A4 1:15,000

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Key
 ● Cliff Top Survey Locations

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

Figure 3 - Map 4

CAYTON BAY
Scarborough Borough Council Council Frontage

Cliff Top Survey Locations

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Key
 ● Cliff Top Survey Locations

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

Figure 3 - Map 5

FILEY BAY NORTH

**Scarborough
 Borough Council
 Council Frontage**

Cliff Top Survey Locations

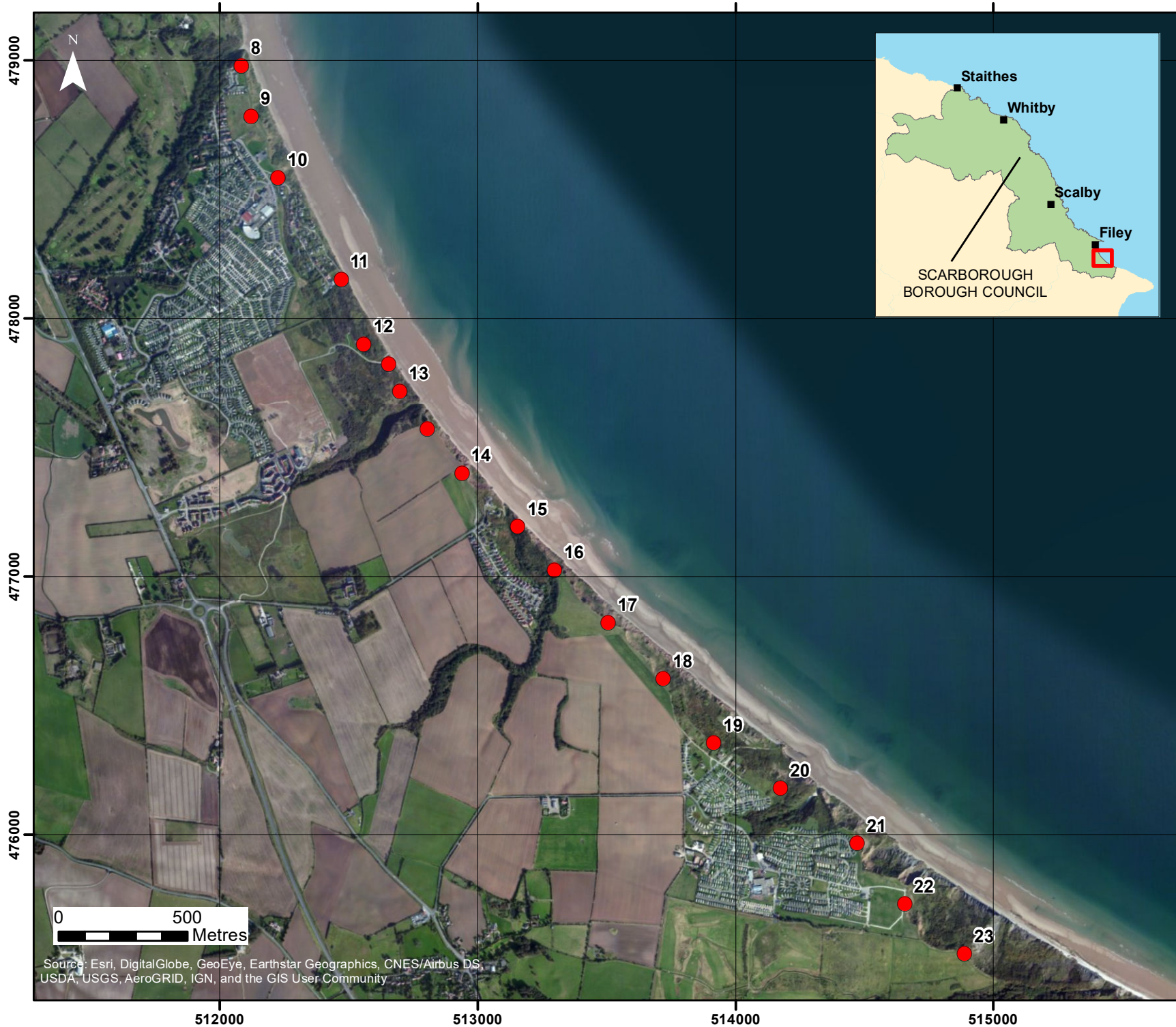
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Key
 ● Cliff Top Survey Locations

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

Figure 3 - Map 6

FILEY BAY SOUTH

Scarborough Borough Council Council Frontage

Cliff Top Survey Locations

Drawing Scale at A4 1:20,000

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2. Analysis of Survey Data

2.1 Staithes

Survey Date	Description of Changes Since Last Survey	Interpretation
16 th March 2020	<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 2020 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 2019 survey.</p> <p>The results provided in Appendix C show that the majority of the profiles show little or no erosion, <0.1m. Five points show erosion of above 0.1m; at the eastern end of the survey extent Point 2 shows erosion of 0.12m, whilst Points 4 and 5 show erosion of 0.58m and 0.24m respectively. At the western end of the survey extent at Old Nab Points 19 and 20, have experienced 0.32m and 0.2m of erosion respectively. Several points noted negative erosion, (Points 7, 14, 15, 17 and 18), this is likely to be due to difficulties in accurately identifying the cliff edge through vegetation. Point 8 which has experienced some apparent activity in recent years appears to be stable with less than 0.1m of change from the previous (November 2019) survey result.</p> <p>Notably, Points 9 to 12, at Cowbar Nab were accessible on this occasion. These points have not been surveyed since before September 2016 meaning that there is no calculation of change over the winter of 2019/ 20 specifically. However, a comparison with the baseline survey (of November 2008) is possible. Point 9 and 10 have both experienced negative movement when compared with the November 2008 survey, whilst Point 11 has experienced 0.3m of erosion over the same period. Point 12 has experienced less than 0.1m of erosion since 2008. The long-term recession rates show that none of the points at Cowbar Nab show recession of greater than 0.1m/year. Although these results do appear to suggest that the cliffs at Cowbar Nab have remained relatively inactive over this period, survey photographs show there is still recent activity on the upper slopes and headscarp in this location. Most</p>	<p>The recorded changes to the cliff top between November 2019 and March 2020 are generally small. There has been one point which shows retreat greater than 0.5m, and three which show retreat greater than or equal to 0.2m. One point shows minor retreat less than 0.2m.</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 0.18 to 0.57m/yr. Elsewhere long-term rates are typically < 0.1m/year.</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
	notably this is seen in the photograph of VMP9, which is taken looking south west toward VMP8	

2.2 Runswick Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
13 th March 2020	<p>Topographic Survey:</p> <p>Runswick Bay is covered by a 6-monthly topographic survey. A consistently applied GIS processing routine has been used to create a digital ground model (DGM) (Appendix B - Map 1) and to calculate the differences between the current topographic survey (Spring 2020) and the previous survey (Autumn 2019) to highlight areas and amounts of erosion and deposition. In all cases, a 5m resolution raster grid has been used to identify areas of erosion and accretion. (Appendix B – Map 3).</p> <p>Appendix B - Map 1b shows shore parallel areas of change across the survey extent. Across much of the upper beach, accretion has been the dominant process. In the north, towards the Runswick Bay Sailing Club, there has been a narrow band of erosion on the upper beach. The mid and lower beach is dominated by erosion across the full extent of the survey. The magnitude of erosion is greater in the south of the bay. In the central bay there is a sand bank like feature which has experienced some accretion and some erosion, although the changes in this location are limited to $\pm 0.25\text{m}$.</p>	<p>The lower beach has experienced some drawdown whereas the upper beach appears to have been replenished somewhat. The pattern indicates some seasonal draw down; however, natural recovery on the upper beach demonstrates that at least some of the material has been retained or indeed moved shoreward up the beach. More extreme changes may be noted to the south of the surveyed extent or below MLW.</p> <p>Longer term trends: The data collected since 2008 indicate a general pattern of winter drawdown and spring recovery with no measurable net longer-term change. The trends from this survey are broadly comparable with observations since 2013.</p>

2.3 Sandsend Beach, Upgang Beach and Whitby Sands

Survey Date	Description of Changes Since Last Survey	Interpretation
25 th April 2020	<p>Beach Profiles:</p> <p>The Sandsend, Upgang and Whitby frontage is covered by three beach profile lines for the Partial Measures survey (Appendix A). The profiles were surveyed in November 2019 (2019 Full Measures) and in April 2020.</p> <p>Profile 1dWB1 is located around 400m south of Sandsend village. There has been some minor accretion of up to 0.2m at the toe of the Sandsend Road coastal defence to chainage 42m. Between chainage 42m and 90m there has been erosion of up to 0.3m. Seaward of chainage 90m, until chainage 175m, there has been continued erosion of up to 0.8m, resulting in the loss of the lower beach berm recorded previously on the lower beach. The seaward toe of the profile, from chainage 180m to the end of the survey at chainage 198m has experienced some minor accretion. Overall the profile is at a medium level compared to the range recorded from previous surveys.</p> <p>Profile 1dWB2 is located in the centre of Upgang beach. The survey report notes that two areas of the section were not measured due to dense vegetation on an area of the cliff face. The profile remained stable to the face of the cliff at 142m chainage. Directly at the toe of the cliff there has been minor accretion of 0.1m between chainage 142m and 154m. Across the mid-beach, from chainage 154m to 193m there has been erosion of up to 0.4m. Between chainage 192m and 205m there has been a small amount of change of ± 0.1m. The lower beach has been dominated by the seaward drawdown of material. From chainage 205m to 265m a previously recorded lower beach berm has been eroded by 0.9m, with material moving to the toe of the beach. Between chainage 265m and the end of the survey at chainage 325m there has been up to 0.4m of accretion and the toe has advanced seawards. Overall the beach is at a medium – high level compared to the range recorded from previous surveys, with winter drawdown from the upper-mid beach to lower beach evident. The toe of the profile, from chainage 295m to 322m is at its highest recorded level.</p> <p>Profile 1dWB3 is located on Whitby Sands, directly fronting the seawall there has been up to 0.9m of accretion at the toe of the seawall. From chainage 89m to 110m there has been between 0.4m and 0.9m of accretion. Seawards of this point the level of accretion remains at around 0.4m up to chainage 140m. From chainage 140m to 235m there has been between 0.1m and 0.2m of erosion. The toe of the beach, from chainage 235m until the end of the survey at chainage 263m has experienced minor accretion of up to 0.2m. The beach is at a high level on the upper beach when compared with the range</p>	<p>Generally, the profiles are in the mid-range of previous survey results, with the exception of the most easterly profile which is at a low level across much of its extent.</p> <p>The changes noted are generally in line with seasonal fluctuations previously noted.</p> <p>Longer term trends:</p> <p>The beach profiles appear to be reasonably stable showing only seasonal fluctuations.</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>of previously recorded surveys. Conversely, for much of the remainder of the profile the beach level is low, most notably from chainage 203m to 208m where the beach is at its lowest recorded level compared to the range recorded from previous surveys.</p>	

2.4 Robin Hood's Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
24 th April 2020	<p>Topographic Survey:</p> <p>Data from the most recent topographic survey (Partial Measures, Spring 2020) have been used to create a digital ground model (DGM) (Appendix B – Map 2) using a Geographical Information System (GIS). A difference plot has also been produced using the DGM (Appendix B – Map 5) from the last topographic survey (Full Measures, Autumn 2019) and the present survey.</p> <p>The difference plot shows some changes in level between Autumn 2019 and Spring 2020 with a general patchy distribution of erosion and accretion across the survey extent. The majority of the bay has seen very little change ($\pm 0.25\text{m}$) over the winter of 2019/20, associated with rocky outcrops that run perpendicular to the shore. The main patches of erosion are in the north of the survey extent on the upper beach and some localised patches on the upper beach fronting the village. There has been some accretion on the upper – mid beach directly fronting the northernmost slipway. The most significant area of change is in the south east of the survey area on the lower beach where there has been up to 1.0m of accretion.</p>	<p>The distribution of change is very patchy. There has been little change over the rock promontories in the bay, although there has been localised erosion and accretion in the south east of the survey extent. The loss of material at the base of the cliff is likely to be due to the ongoing erosion of debris from cliff failures.</p> <p>Longer term trends: The difference plots show a continuation of the trend of patchy distribution of erosion and accretion. Overall, the observed changes are of limited magnitude and within the range of changes previously seen. The long-term difference between Autumn 2008 and Spring 2020 shows stability with accretion limited to the defended part of the frontage.</p>
24 th April 2020	<p>Cliff-top Survey:</p> <p>Thirteen ground control points have been established at Robin Hood's Bay since 3rd March 2010 to monitor cliff top recession. The separation between any two points is a nominal 200m and monitoring is undertaken bi-annually. Appendix C provides results from the April 2020 survey showing change since the last survey in September 2019 and the baseline survey in March 2010 (Appendix C- Map 2). The accuracy of the survey technique means change of less than 0.1m is assumed to be error. Five of the monitoring points show erosion (of greater than 0.1m). Points 3 and 4, located adjacent the Cleveland Way footpath north of Dungeon Hole at the northern end of the village have showed 0.48m and 0.28m of recession respectively. Points 7, 8 and located above the northern slipway show recession of 0.18m, 0.33m and 0.39m respectively.</p> <p>The survey report notes that VMP5 is located on a pile of deposited garden waste, and that VMP 3, 4, 5 and 7 have undefined edges that are hard to distinguish. From inspecting the survey photographs it is clear that the growth of vegetation in the spring can hinder accurate measurement in these locations. The recession recorded in Spring 2020 when compared with the long-term change from March 2010 to</p>	<p>The cliff top has been largely stable since the previous survey in October 2019, with no significant erosion recorded across the survey extent.</p> <p>Longer term trends: The erosion rates calculated from the changes since March 2010 show stability at most of the monitoring locations. The longer-term rates show that point 1 has a recession rate of 0.44m/yr with other points having a rate of less than 0.1m/yr. This reflects localised and episodic cliff failure through rock fall.</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>the present survey, indicates a more balanced picture of long-term stability.</p> <p>Only Point 1 shows significant long-term erosion, with total erosion of 4.38m since the baseline survey in 2010 and a rate of 0.44m/yr.</p>	

2.5 Scarborough North Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
27 th April 2020	<p>Beach Profiles:</p> <p>Scarborough North Bay is covered by five beach profile lines for the Partial Measures survey (Appendix A) that are monitored biannually. The previous Full Measures survey was undertaken in March 2019.</p> <p>Profile 1dSBN1 is located around 200m south of the Sea Life Centre. There has been a drop in beach level of 0.m immediately in front of the seawall from chainage 11m to chainage 18m. From this point to chainage 60m, an upper beach berm has formed, with accretion of up to 0.6m across this length. Between chainage 60m and the end of the survey at chainage 78m there has been up to 0.9m of erosion, so much that the seaward to of the beach is at its most landward position. Overall the upper beach is at a medium – high level, whereas the lower beach is at a low level when compared to the range recorded from previous surveys.</p> <p>Profile 1dSBN2 is located close to the former chair lift. There has been accretion across the upper beach, with 0.2m at the toe of the seawall from chainage 8m to chainage 12m. Across the upper beach, from this point to chainage 62m, there has been up to 1.1m of lowering. Material from the upper beach appears to have moved down the beach, this is evidenced by a berm of up to 0.5m depth formed on the mid-beach, between chainage 62m and 96m. Seawards of this point, the lower beach has experienced further erosion, with the rocky platform exposed from chainage 100m. The upper and mid beach are in the middle of the range of previously recorded results, whilst the lower beach is at a low level. The profile remains within the range of previously recorded results.</p> <p>Profile 1dSBN3 is located near Royal Albert Drive. There has been accretion of up to 1.7m at the base of the seawall tapering across the upper beach to chainage 60m. Between chainages 60m and 95m there has been a shallow band of erosion up to 0.2m in depth. There has been little change between chainage 95m and 120m. Seaward of this point until the end of the survey at chainage 172m there has been up to 1.0m of accretion. Overall the beach is at a medium – high level compared to the range recorded from previous surveys with the toe of the profile being at a high level.</p> <p>Profile 1dSBN4 is located at the northern end of Clarence Gardens. The upper beach has experienced erosion of up to 0.2m between the toe of the seawall and the rocky outcrops at chainage 35m. There has been little change between the outcrops at chainage 35m to 55m, with the exception of some minor</p>	<p>The beach in North Bay has generally been dominated by a moderate level of erosion, likely associated with winter drawdown. The northern profiles tend to show more erosion across their full extent, suggesting material has moved offshore. In the south of the bay erosion has been more limited across the profile. All profiles demonstrate trends which are indicative of seasonal draw-down processes. The Spring 2020 survey shows that changes have been within the range of previously recorded surveys.</p> <p>Longer term trends: The beach is towards the lower end of the range of profiles with changes typical of seasonal drawdown and recovery.</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>accretion of 0.2m around chainage 45m. Seawards of the rock exposure, from chainage 55m to 115m there has been erosion of up to 0.3m. The length of rock exposed has not increased. On the mid beach between chainage 115m 125m there has been no change. On the lower beach, seawards of chainage 125m to the end of the survey at chainage 160m there has been 0.2m of erosion. Beach levels are at a medium to low level compared to the range recorded from previous surveys, with the toe of the beach being notably low. The results remain within the range recorded from previous surveys.</p> <p>Profile 1dSBN5 is located to the south of Clarence Gardens. There has been little change at the toe of the seawall from chainage 30m to 41m. On the upper beach, from chainage 41m to chainage 93m there has been a small amount of erosion, up to 0.2m. Between chainage 93m and 130m there has been accretion of up to 0.2m. Seawards of this point until the end of the survey at 140m there has been a small amount of erosion of up 0.1m to 0.2m. Overall the profile is at a medium to high level compared to the range recorded from previous surveys with little notable change since the previous survey.</p>	

2.6 Scarborough South Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
28 th April 2020	<p>Beach Profiles:</p> <p>Scarborough South Bay is covered by four beach profile lines for the Partial Measures survey (Appendix A). The profiles were last surveyed during the Full Measures survey of November 2019.</p> <p>Profile 1dSBS1 is located around 250m south of the West Pier. There has been 0.7m of accretion at the base of the sea defence from chainage 14m to 41m. From chainage 41m to chainage 110m there has been some minor erosion of up to 0.1m, however the mid-beach has remained largely unchanged. The lower beach, seaward of chainage 110m to the end of the survey at chainage 190m has experienced erosion, increasing towards the seaward end of the profile. The toe of the beach has experienced 0.4m of erosion, meaning it has moved landward by approximately 50m. Overall the profile is at a medium level compared to the range recorded from previous surveys, with a slight high point between chainage 60m and 90m.</p> <p>Profile 1dSBS2 is located on the shore fronting St Nicholas Cliff. At the toe of the sea wall and in the upper beach (chainage 4m to 20m) there has been accretion of up to 0.5m. Across the mid-beach from chainage 20m to 110m there is a trend of shallow accretion generally of up to 0.2m. Seawards of chainage 110m, to the end of the survey at chainage 185m there has been erosion of between 0.1m and 0.2m. When compared with the range from previously recorded surveys, the profile is generally at a medium level across its entirety, with the exception of chainage 136m to 142m which is the lowest on record.</p> <p>Profile 1dSBS3 is located 250m north of the Scarborough Spa complex. At the base of the seawall there has been accretion of up to 0.3m from chainage 10m to 18m. Across the upper beach, from chainage 18m to 62m there has been little change, with some minor erosion up to 0.1m. The mid-beach has experienced accretion between chainage 62m and 125m of up to 0.4m leading to creation of a shallow berm in this location. Seaward of this point, a lower beach berm has moved seaward, such that between chainage 125m and 148m has experienced a low level of erosion up to 0.2m. At the toe of the beach there has been some accretion of up to 0.3m, caused by drawdown of the lower beach berm. The profile is at a medium level when compared to the range recorded from previous surveys.</p> <p>Profile 1dSBS4 is located on the beach in front of the Scarborough Spa Complex. There has been no</p>	<p>All of the profiles show some erosion; however, the trend is in line with seasonal fluctuations and profiles have tended to remain within the range of previously recorded surveys.</p> <p>The lower beach in profiles SBS3 and SBS4 show slight accretion on the lower beach indicative of beach draw-down processes.</p> <p>Longer term trends: The observed changes in the profiles in South Bay are consistent with the seasonal fluctuations of sediment with a bay system.</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>change at the toe of the seawall, however from chainage 14m to 25m there has been some accretion of up to 0.2m caused by the landward retreat of a shallow berm on the upper beach. Between chainage 25m and 40m there has been no change. The mid-beach is dominated by erosion of up to 0.3m from chainage 40m to 110m. Seaward of this point from chainage 110m to the end the survey at chainage 150m, there has been a low level of accretion of up to 0.2m. Overall the beach is at a medium level compared to the range recorded from previous surveys, with the exception of the upper beach at the toe of the seawall which is low. However, this area of the upper beach remains within the range recorded from previous surveys.</p>	
<p>28th April 2020</p>	<p>Cliff-top Survey:</p> <p>Thirteen cliff top monitoring control points have been established at Scarborough South Bay and from Cornelian Bay to Knipe Point. The separation between points is around 300m. The cliff top surveys at Scarborough South Bay are undertaken bi-annually. Appendix C provides results from the March 2010 baseline survey to April 2020, showing the distance from the ground control point to the edge of the cliff top along the defined bearing (Appendix C- Map 3). Error in the technique means change of less than 0.1m cannot be relied on. Calculated advances of the cliff line are also assumed to be error associated with difficulty precisely identify the cliff top, particularly where vegetation is present.</p> <p>The recorded changes between November 2019 and April 2020 were within the survey error of ± 0.1m for all but one points. Only Point 3 had experienced erosion outside this range, with 0.23m recorded in the Spring 2020 survey. Point 1 was also surveyed for the first time since March 2018 due to completion of the Scarborough Spa Slope Stabilisation works which had prohibited access to this point over the previous two years. Only Points 11 and 12 show significant erosion since the baseline survey in March 2010 of 3.60m and 2.91m respectively, this is equivalent to long term erosion rates of 0.4m/yr and 0.3m/yr.</p>	<p>Only one of the points has shown erosion outside of the survey tolerance over the course of winter 2019/20.</p> <p>Longer term trends: The recession rates for the longer term only show erosion at Points 11 and 12 of between 0.4 and 0.3m/yr. The rest of the study area has remained stable.</p>

2.7 Cayton Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
26 th April 2020	<p>Beach Profiles:</p> <p>Cayton Bay is covered by four beach profile lines for the Partial Measures survey (Appendix A). The previous survey was undertaken in November 2019.</p> <p>Profile 1dCY1A is located on the beach below Knipe Point at the north of the bay and was added to the programme in November 2015. There has been seaward movement of the upper beach berm, with 0.2m of erosion between chainage 4m and 10m, extenuating a narrow channel / depression on the upper beach. The crest of the berm sits at chainage 14m, seawards of which, up to chainage 65m, accretion of up to 0.2m has partially covered the rocky outcrops on the upper beach. The mid and lower beach has been dominated by erosion. Between chainage 65m and 100m, 0.3m of erosion has removed the shallow berm previously recorded in this location. From chainage 100m to 165m the erosion varies between 0.1m and 0.4m, typically around 0.2m. This has caused some loss of definition to the lower beach berm such that the berm now has a very wide, shallow profile. At the toe of the beach, from chainage 165m to the end of the survey at 170m there has been some minor accretion of 0.2, caused by the flattening of the lower beach berm. Overall the profile is at a medium - low level compared to the range recorded from previous surveys.</p> <p>Profile 1dCY1 is located on the beach in front of Tenants' Cliff in the north of the Bay. Between chainage 5m and 20m there has been some minor movement of material moving from the toe of the cliff onto the upper beach. From chainage 20m to 45m there has been accretion further loss of up to 0.4m which has caused a shallow depression to be infilled. These changes reflect the trend seen in previous surveys of material lost from the cliff face being redistributed from the toe of the cliff across the upper beach. Seawards of this point until chainage 120m there has been up to 0.2m of erosion across the mid beach. The rocky outcrops remain covered. The most seaward extent of the survey (from chainage 120m until the end of the survey at chainage 135m) has remained unchanged with the rock platform exposed as it was in the previous (Autumn 2019) survey. The profile is at a medium level across much of its extent, but remains low on the lower beach where the rock platform is exposed.</p> <p>Profile 1dCY2 is close to the former pumping station in the middle of Cayton Bay. There has been some accumulation of material at the toe of the cliff, indicated potential losses from the face of the cliff, however this reflects the long-term trend in this location. At the toe of the cliff at chainage 117m there</p>	<p>With the exception of the most northerly profile (1dCY1A) the profiles show some accumulation of material at the toe of the cliffs, with redistribution of this material across the upper beach evident. Elsewhere the upper-mid beach has typically experienced erosion with some accretion on the lower beach, typical of draw-down processes. The magnitude of changes in the Spring 2020 Partial Measures survey is low. The profiles remain within the bounds of the range from the previous surveys.</p> <p>Longer term trends:</p> <p>Following notably low levels in March 2018 and 2019 beach levels on the upper beach appear to be recovering, with the exception of the most northerly profile. There is evidence that material lost from the cliff face accumulates at the toe of the cliffs and is redistributed across the upper beach. Additional cliff failures will feed additional material onto the beach and drive erosion of the cliff top.</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>has been 0.8m of accretion. There has been further accretion, on the upper beach, of between 0.2m and 0.6m up to chainage 195m. Seawards of this point, from chainage 195m to 290m there has been up to 0.3m of erosion. . From this point until the end of the survey at chainage 330m change has been limited to ± 0.1m. Overall the profile is at a medium-high level compared to the range recorded from previous surveys, with a short section of the lower beach, between chainage 292m and 298m being the highest on record.</p> <p>Profile 1dCY3 is located around 600m southeast of the pumping station. The cliffed part of the profile remains unchanged. From the toe of the cliff at 120m chainage to chainage 155m there has been minor accretion of up to 0.3m. Between chainage 155m and 180m there has been up to 0.2m of erosion leading to loss of a small berm previously recorded in this location. For the remainder of the profile there has been minor erosion and accretion, within ± 0.1m. The majority of the beach is at a relatively medium-low level compared to the range recorded from previous surveys.</p>	
26 th April 2020	<p>Cliff-top Survey:</p> <p>Eight ground control points have been established within Cayton Bay for the purposes of cliff top monitoring. The separation between any two points is typically around 300m. The cliff top surveys at Cayton Bay are undertaken bi-annually. Appendix C provides results from the April 2020 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 2019 survey. The accuracy of the technique means results of less than 0.1m are not considered reliable.</p> <p>Dense vegetation means that point 2 has not been surveyed since the March 2018 survey. All remaining points, except Point 3 have experienced change within the survey tolerance of ± 0.1m. Point 3 shows cliff recession of 0.76m since November 2019. This point is located adjacent the boundary fence directly above the old pumping station, inspection of the survey photographs does not indicate significant activity in this area. It is likely that this reading is anomalous due to inaccurate measurements in previous surveys.</p>	<p>Only Point 3 has shown erosion outside of the survey tolerance. Inspection of the survey photographs indicates that this may be an anomalous result as there is no evidence of activity. The remainder of the locations have been stable since November 2019.</p> <p>Longer term trends: The recession rates show that locations 4 and 6 have significant rates of 0.1 to 0.3m/yr. Due to the presence of dense vegetation at point 2 it has not been possible to survey since March 2018 Historically this has been an area of activity.</p>

2.8 Filey Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
12 th and 13 th March 2020	<p>Beach Profiles:</p> <p>Filey Bay is covered by five beach profile lines for the Partial Measures survey (Appendix A). The previous programmed survey (Full Measures 2019) was undertaken in October 2019.</p> <p>Profile 1dFB1 is located in front of Filey town in the north of the bay. There has been accretion of up to 0.6m immediately at the base of the sea wall. Between chainage 25m and 60m there has been further accretion of up to 0.2m. Seawards of chainage 60m to 135m a wide shallow berm has formed, although accretion is limited to 0.3m. From chainage 135m to 170m there has been a low level of erosion of up to 0.2m. The toe of the beach, seawards from chainage 170m until the end of the survey at chainage 210m has accreted by up to 0.3m. The upper and mid-beach is at a high level, whilst the lower beach is at a medium level, compared to the range recorded from previous surveys. The section between chainage 83m and 131m being the highest on record.</p> <p>Profile 1dFB2 is located north of Primrose Valley Holiday Village. The surveyor was unable to measure the middle of section 1dFB2 between chainage 12m and 20m due to dense vegetation. There has been no change at the toe of the cliff. On the upper beach from chainage 80m to 170m there has been erosion of between 0.2m and 0.4m. Seawards of chainage 170m to 230m there has been accretion of up to 0.2m. The remainder of the profile, from chainage 230m to the end of the survey at chainage 295m has experienced no significant change. Overall the profile is at a medium to high level relative to the range recorded from previous surveys.</p> <p>Profile 1dFB3 is located in front of Flat Cliffs hamlet. There has been a significant smoothing of the profile over the winter of 2019/2020. At the toe of the seawall there has been accretion of up to 0.3m, up to chainage 50m. From this point to chainage 95m up to 0.3m of erosion has led to the loss of an upper beach berm previously recorded in this location. Between chainage 95m and 150m a hollow depression has been infilled with up to 0.8m of accretion. From this point until the end of the survey at chainage 298m there has been erosion of 0.1 to 0.3m from the lower beach berm and toe of the beach. Overall the profile is at a high level relative to the range recorded from previous surveys, with the exception of chainage 2378m to 257m which is at its lowest recorded level.</p> <p>Profile 1dFB4 is located near Humanby Gap. The survey report notes that “the middle of section 4 is</p>	<p>All of the profiles have remained relatively stable over the winter of 2019/20 with a general trend of accretion, particularly between previously recorded beach berms. There have been some areas of minor erosion however this has tended to fall well within the range recorded from the previous surveys, with a few isolated areas being the lowest and highest on record.</p> <p>Longer term trends:</p> <p>Past trends dominated by migrating sand bars continue to the present day.</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>unable to be measured from chainage 4m to approx. 25m, due to the cliff face being unsafe". There has been accretion of up to 0.2m on the upper beach from the toe of the cliff at chainage 28m to chainage 62m. From chainage 62m to chainage 100m there has been minor erosion of up to 0.1m. Between chainage 100m and 190m there has been up 0.7m of erosion, infilling the hollow depression previously recorded in this location. From chainage 190m to 245m there has been erosion of up to 0.4m. A lower beach berm has formed, approximately 0.3m high, at the toe of the beach, from chainage 245m to the end of the survey at chainage 277m. The profile is at a medium to high level, with the crest of the lower beach berm between chainage 249m and 256m being the highest recorded level, when compared with the range from previous surveys.</p> <p>Profile 1dFB5 is located close to Reighton Gap. The survey report notes that "the middle of profile 5 was unable to be measured from chainage 63m to c. 217m, due to undergrowth and bushes". There has been erosion at the toe of the cliff of up to 0.5m. From chainage 227m to 340m there has been accretion of up to 0.3m. There has been no change on the lower-mid beach, between chainage 340m and 360m. From this point, until the end of the survey at chainage 445m there has been 0.5m of accretion. Overall the profile is at a medium level compared to the range recorded from previous surveys.</p>	
<p>12th and 13th March 2020</p>	<p>Topographic Survey:</p> <p>Data from the most recent topographic survey (Partial Measures, Spring 2020) have been used to create a digital ground model (DGM) (Appendix B – Map 3) using a Geographical Information System (GIS). The topographic plot shows the gently sloping shore parallel bathymetry in front of Filey town. A difference plot has also been produced using the DGM (Appendix B – Map 6) comparing the last topographic survey (Full Measures, Autumn 2019) to the present survey.</p> <p>There has been very little change across the frontage with the majority of the survey extent has seen changes limited to ± 0.1m. There has been some accretion of up to +0.5m, on the mid beach, and notably on the upper beach at the north of the survey extent. Erosion is generally less prevalent, with a narrow band on the lower beach in the north of the survey area and occasional patchy areas in the central and southern survey area. In the south of the survey area, fronting Royal Parade there are two small localised areas of erosion, and a larger area of accretion on the upper beach. The magnitude of change across the survey area is small.</p>	<p>The localised erosion on the upper beach adjacent to the sea wall has been observed in previous surveys. Changes in this part of the beach are probably due to the refraction of wave energy on the hard defences through the winter. Overall the beach has experienced very minor changes, with a low level of accretion, or no significant change over much of the survey area.</p> <p>Longer term trends:</p> <p>The erosion of the upper beach, close to the sea wall as observed over the winters of 2014/15 to 2016/17, 2018/19 and 2019/20 does not reflect the long-term trend between Autumn 2008 and Autumn 2016 that shows accretion on the upper beach and erosion on the lower beach. The atypical pattern seen in recent years probably reflects changes in wave</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
		climate.
12 th and 13 th March 2020	<p>Cliff-top Survey:</p> <p>Twenty-three ground control points were established within Filey Bay for the purposes of cliff top monitoring in November 2008. Additional points were added in September 2010 and March 2011 (as shown in Appendix C – Maps 5 and 6) taking the total number of ground control points in Filey Bay to 28. The maximum separation between points is 300m. The cliff top surveys at Filey Bay are undertaken bi-annually. Appendix C provides results from the March 2020 survey. The accuracy of the technique means results of less than 0.1m are not reliable. Furthermore, indications of an advancing cliff are erroneous and related to problems in precise identification of the cliff edge, particularly where vegetation is present.</p> <p>Between the September 2019 and the current survey nine of the 28 markers showed erosion greater than (or equal to) the survey error (0.1m); Point 10 and 12A showed erosion of 0.1m, Point 17 showed erosion of 0.13m, whilst Point 7 and 19 both showed erosion of 0.15m and Point 23m showed erosion of 0.18m. Notably, Point 2 and Point 22 showed erosion of 0.25m and 0.46m respectively. The largest recorded erosion though was located at Point 13A where 2.57m of erosion was recorded. The survey photographs from this area show the headscarp of the soft till cliffs has slipped. The high level of activity along this frontage is possibly attributable to the extreme wet weather which was experienced throughout late January and February of 2020. Indeed, the survey photographs generally show that the activity is recent and as such most likely occurred after Christmas 2019.</p>	<p>Over the winter of 2019/20 seven monitoring points showed erosion between, of 0.1m and 2.6m.</p> <p>Longer term trends:</p> <p>The greatest long-term recession rate is seen at Point 7 at Muston Sands, where 0.42m/yr has been recorded. Point 13A has also recorded a high average recession rate of 0.24m/yr. Elsewhere Points 10 and Point 14 have experienced 0.15m/yr and 0.12m/yr respectively. Whilst Points 16 (near Hunmanby Gap) and Point 23 (near Reighton Gap), have both experienced average recession rates of 0.11m/yr.</p>

3. Problems Encountered and Uncertainty in Analysis

Individual Profiles

At Runswick Bay the rock revetment works were completed in the summer of 2018.

At Whitby two areas of profile 1dWB2 were not measured due to dense vegetation on an area of the cliff face.

At Scalby the cliff edge was very overgrown resulting in areas that were unable to be surveyed.

At Cayton Bay:

- the top of profile 1dCY1 cannot be measured due to dense vegetation;
- The middle of profile 1dCY2 could not be measured due to the ground make-up, soft mud flows, and unstable grass;
- The middle of profile 1dCY3 could not be measured due to the ground make-up, soft mud flows, unstable grass, and landslips;
- Profile 1dCY3 was measured to cliff edge on top and as close to the cliff face at the bottom as possible.

At Filey Bay:

- The surveyor was unable to measure the middle of section 1dFB2 between chainage 12m and 20m due to dense vegetation.
- The middle of section 4 is unable to be measured from chainage 4m to approx. 25m, due to the cliff face being unsafe.
- The middle of profile 5 was unable to be measured from chainage 63m to c. 217m, due to undergrowth and bushes.

Cliff Top Surveys

At Staithes:

- Survey points 9 to 12 at Staithes have been cordoned off by the National Trust due to a landslip on the headland. however, in the Spring 2020 survey Points 9 to 12 have been surveyed for the first time since before September 2016.

At Robin Hoods Bay:

- The dumping of waste vegetation at monitoring point 5 is a known source of error.
- The survey report notes that VMPs 3, 4, 5, and 7 have undefined edges that are hard to distinguish

At Scarborough South Bay:

- VMP1 was surveyed for the first time since March 2018 due to completion of the Scarborough Spa Slope Stabilisation Scheme.

At Cayton Bay:

- VMP2 was not surveyed due to dense vegetation prohibiting access.

At Filey Bay:

- Points; 5, 12 and 13 were inaccessible due to heavy vegetation.

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

No changes are recommended at the present time.

5. Conclusions and Areas of Concern

- At Staithes, the recorded changes to the cliff top between November 2019 and March 2020 are generally small. There has been one point which shows retreat greater than or equal to 0.5m. Three points show retreat of between 0.2m and 0.5m and one point which shows retreat of between 0.1m and 0.2m. Points 1, 4 and 13 show long term average erosion rates of between 0.2m/year and 0.6m/year since 2008. Notably Points 9 to 12 (at Cowbar Nab) were surveyed in the Partial Measures 2020 survey as access was again available. When compared with the baseline survey none of the 4 points show recession of greater than 0.1m.
- At Runswick Bay the lower beach has experienced drawdown whilst the upper beach has experienced some accretion. The changes are in keeping with the longer-term trend of winter drawdown and spring recovery.
- At Sandsend, Uppgang and Whitby, the profiles show seasonal fluctuation. Beach levels dropped at the toe of the new defence at Sandsend following the March 2018 severe storms ('Beast from the East'), exposing the concrete toe beam. Throughout 2019 these levels recovered somewhat, and the Spring 2020 survey shows some further accretion. Profile B3 at Whitby Sands has experienced a low level of erosion. The profiles are generally at a medium level compared to the range recorded from previous surveys, with the lower beach at the most westerly profile at its lowest recorded level .
- At Robin Hoods Bay, the distribution of change is highly variable. There has been little change over the rock promontories in the bay, although there has been localised erosion and accretion in the south east of the survey extent. The loss of material at the bottom base of the cliff is likely to be due to the ongoing erosion of debris from earlier cliff failures.
- At Scarborough North Bay, the northernmost profiles are dominated by erosion across their full extent. Towards the south of the bay erosion is more limited to the lower beach. All profiles indicate a general trend of seasonal drawdown. The Spring 2020 survey shows that changes have been within the range of previously recorded surveys.
- The profiles at Scarborough South Bay show erosion, however changes remain in line with seasonal fluctuations and the profiles remain within the range recorded from previous surveys. All profiles are generally within the range of recorded results and changes are generally in line with seasonal drawdown. Only one of the points has shown erosion outside of the survey tolerance over the course of winter 2019/20. Points 11 and 12 show long term recession rates of 0.4m/yr and 0.3m/yr respectively.
- The beach profiles in Cayton Bay typically show accretion on the upper and lower beach with erosion on the mid beach. This trend is indicative of two process firstly; the accumulation of material caused by losses from the cliff face and secondly, winter drawdown of material from the mid-beach to the lower beach. The most northerly profile does not fit this trend, and has experienced more significant erosion on the upper beach. All profiles remained within the range recorded from previous surveys. The cliff monitoring shows that only point 3, underwent recession outside the survey tolerance of 0.1m over the winter of 2019/20. Inspection of the survey photographs and previous survey results indicate this is likely to be an anomalous result. Locations 4 and 6 all have significant rates of 0.1m/yr to 0.3m/yr.

- At Filey the profiles have generally remained stable with some experiencing accretion, particularly between the previously recorded beach berms. The general trend across the surveyed extent is that the beach profile is now smoother with fewer notable berm features. All profiles remain largely within the range recorded from the previous surveys, with a few isolated areas experiencing the lowest and highest levels on record. The topographic difference plot shows some minor erosion and accretion, however across much of the beach there has been no notable change. The cliff survey notes a higher level of activity, with seven points in the showing movement of between 0.1m and 2.46m. The largest area of recession being at Point 13 which has experienced 2.46m of erosion. This appears to have been caused by a shallow seated slip along the headscarp of the cliff. The increased level of activity is possibly caused by high levels of rainfall in January and February which will have destabilised the upper reaches of these cliffs. The greatest long-term recession rate is seen at Point 7 at Muston Sands, where 0.42m/yr has been recorded. Point 13A has also recorded a high average recession rate of 0.24m/yr. Elsewhere Points 10 and Point 14 have experienced 0.15m/yr and 0.12m/yr respectively. Whilst Points 16 (near Hunmanby Gap) and Point 23 (near Reighton Gap), have both experienced average recession rates of 0.11m/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: 1dWB1

Date: 25/04/2020

Inspector: AG

Low Tide:

Low Tide Time:

Wind

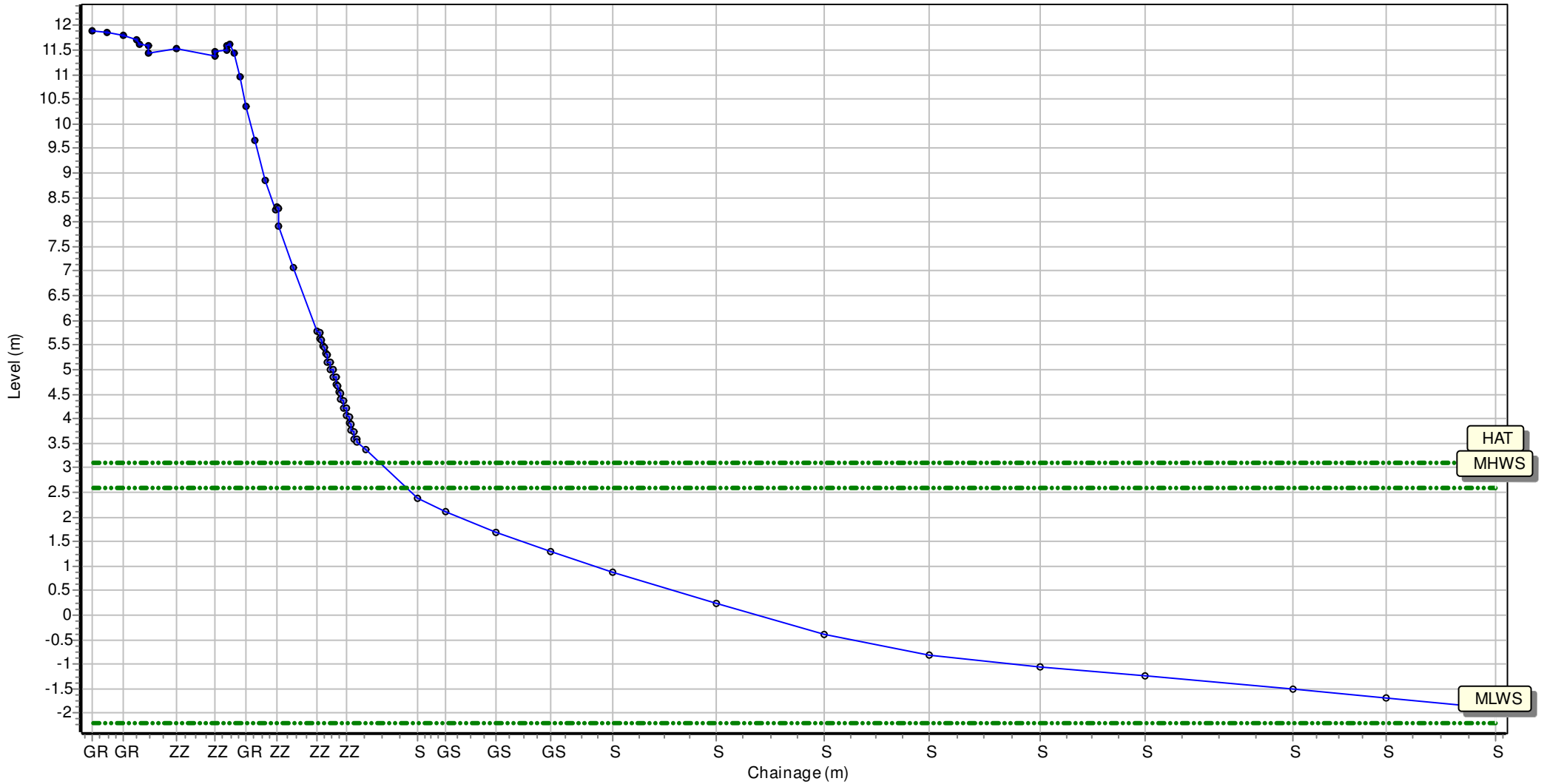
Sea State:

Visibility:

Rain:

Summary: 2020 Partial Measures Topo Survey

Easting: 486535.075 Northing: 512437.797 Profile Bearing: 32 ° from North



Beach Profile

Location: 1dWB2

Date: 25/04/2020

Inspector: AG

Low Tide:

Low Tide Time:

Wind

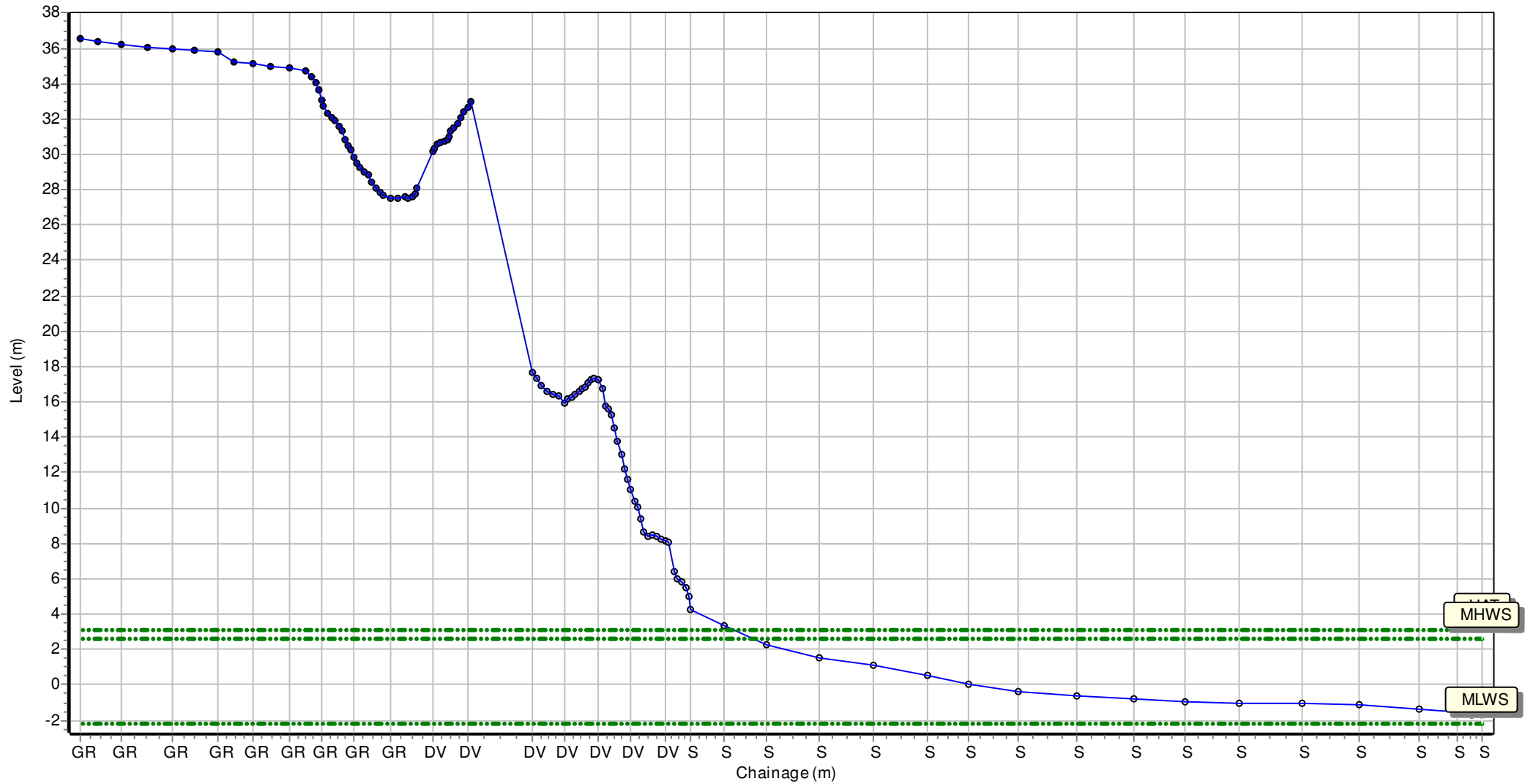
Sea State:

Visibility:

Rain:

Summary: 2020 Partial Measures Topo Survey

Easting: 487550.221 Northing: 511927.902 Profile Bearing: 16 ° from North



Beach Profile

Location: 1dWB3

Date: 25/04/2020

Inspector: AG

Low Tide:

Low Tide Time:

Wind

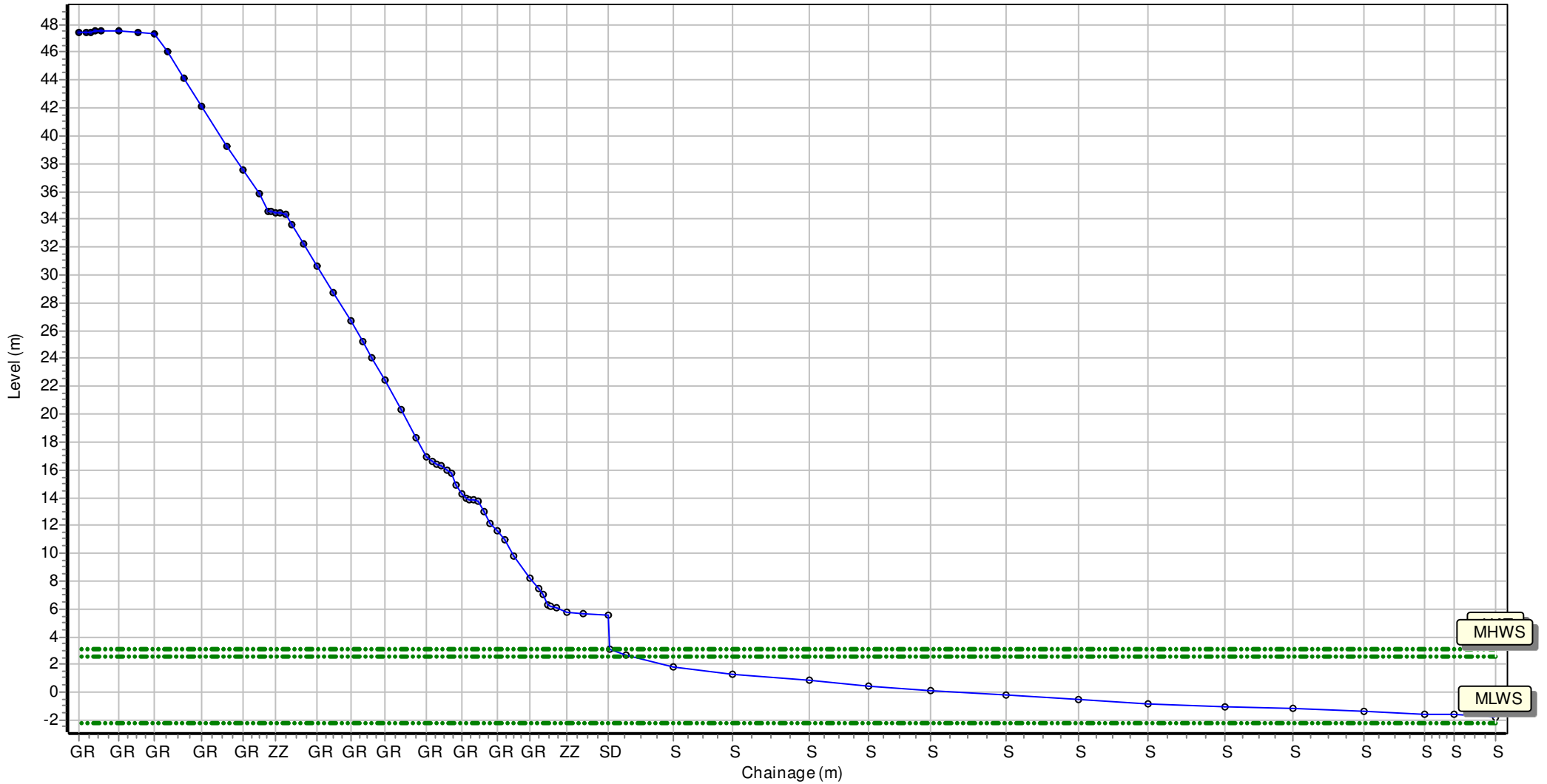
Sea State:

Visibility:

Rain:

Summary: 2020 Partial Measures Topo Survey

Easting: 488983.57 Northing: 511527.047 Profile Bearing: 19 ° from North



Beach Profile

Location: 1dSBN1

Date: 27/04/2020

Inspector: AG

Low Tide:

Low Tide Time:

Wind

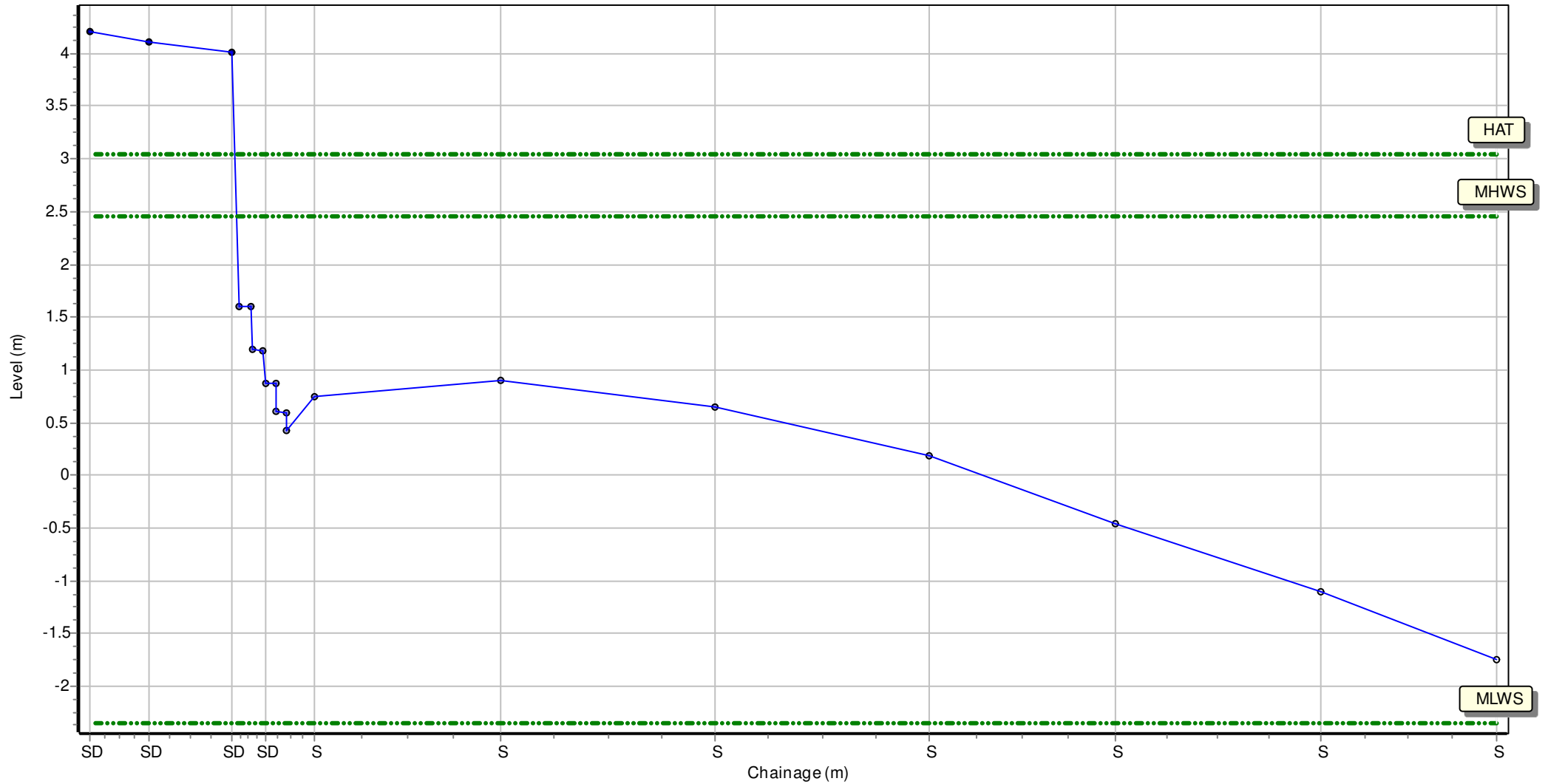
Sea State:

Visibility:

Rain:

Summary: 2020 Partial Measures Topo Survey

Easting: 503543.363 Northing: 490470.74 Profile Bearing: 79 ° from North



Beach Profile

Location: 1dSBN2

Date: 27/04/2020

Inspector: AG

Low Tide:

Low Tide Time:

Wind

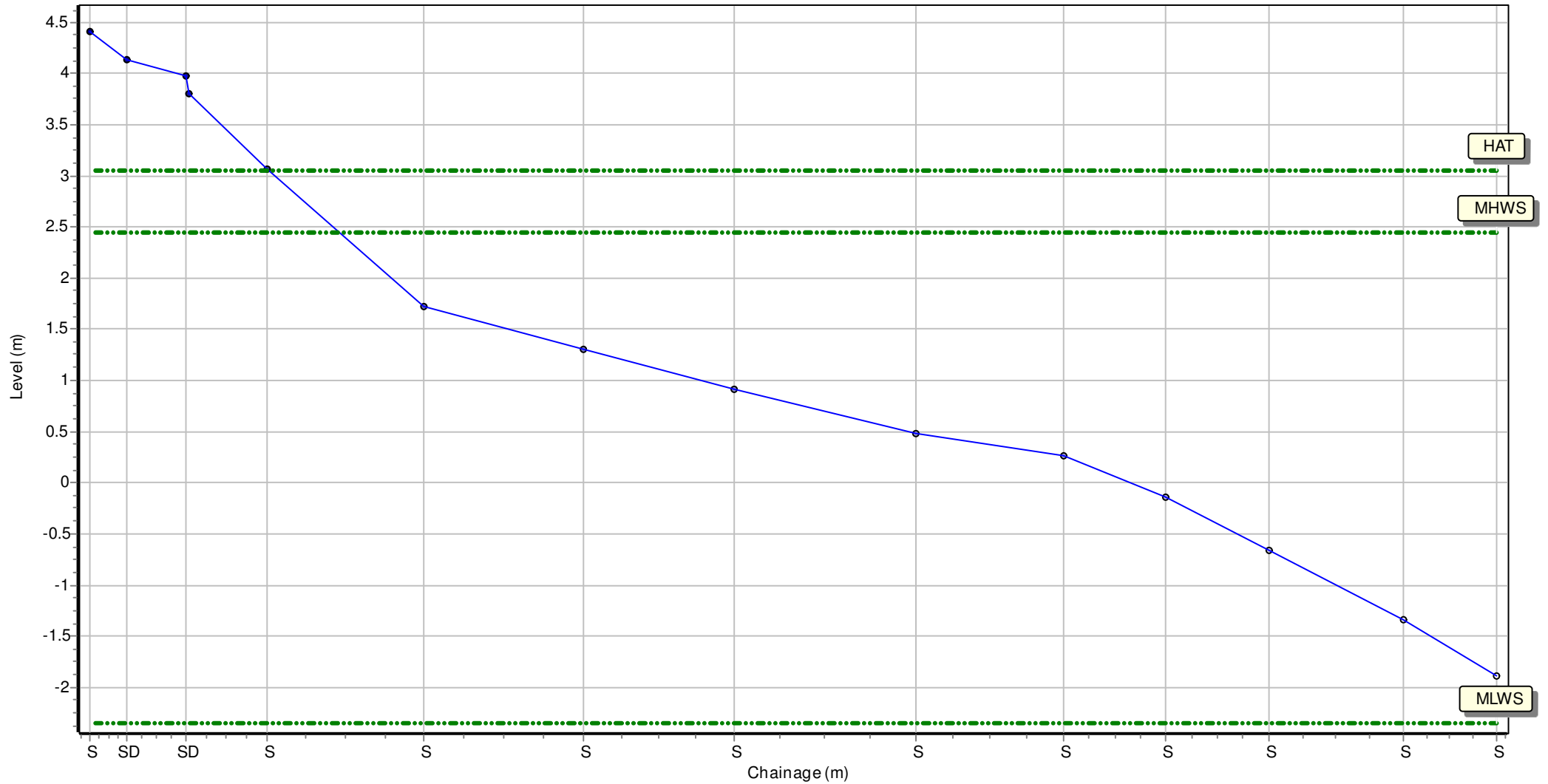
Sea State:

Visibility:

Rain:

Summary: 2020 Partial Measures Topo Survey

Easting: 503616.346 Northing: 490135.674 Profile Bearing: 78 ° from North



Beach Profile

Location: 1dSBN3

Date: 27/04/2020

Inspector: AG

Low Tide:

Low Tide Time:

Wind

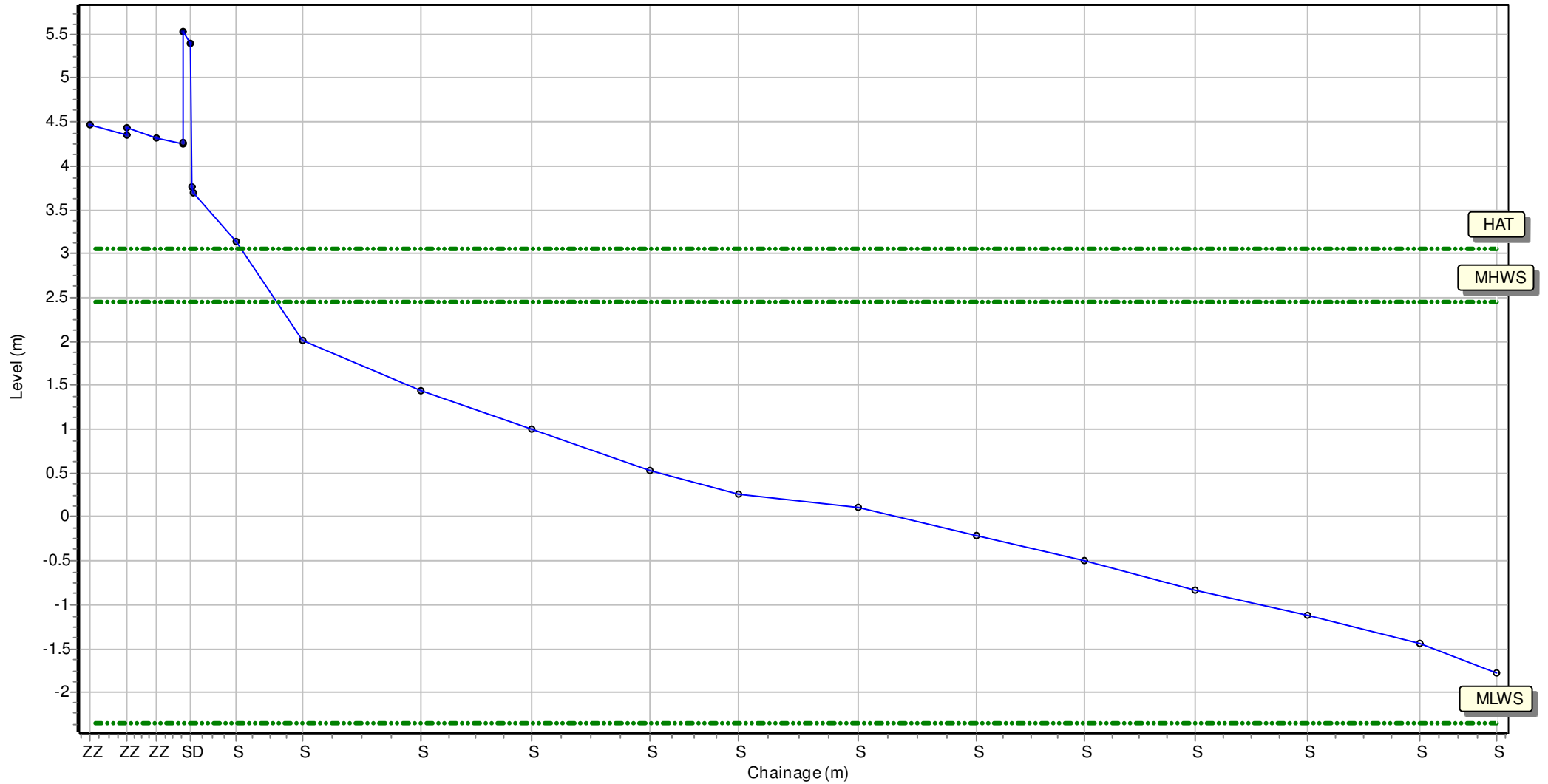
Sea State:

Visibility:

Rain:

Summary: 2020 Partial Measures Topo Survey

Easting: 503803.958 Northing: 489708.315 Profile Bearing: 58 ° from North



Beach Profile

Location: 1dSBN4

Date: 27/04/2020

Inspector: AG

Low Tide:

Low Tide Time:

Wind

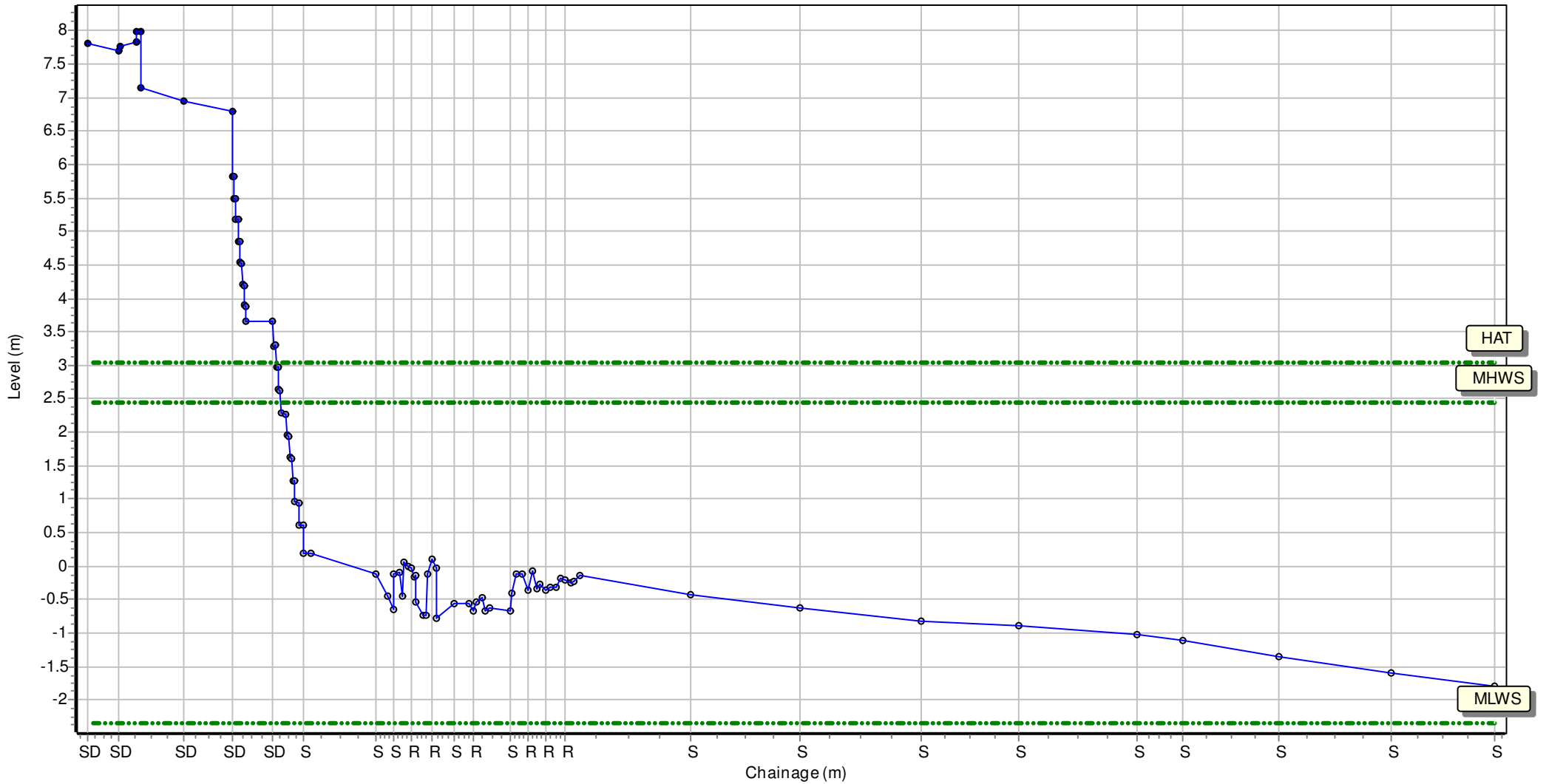
Sea State:

Visibility:

Rain:

Summary: 2020 Partial Measures Topo Survey

Easting: 504111.79 Northing: 489397.699 Profile Bearing: 38 ° from North



Beach Profile

Location: 1dSBN5

Date: 27/04/2020

Inspector: AG

Low Tide:

Low Tide Time:

Wind

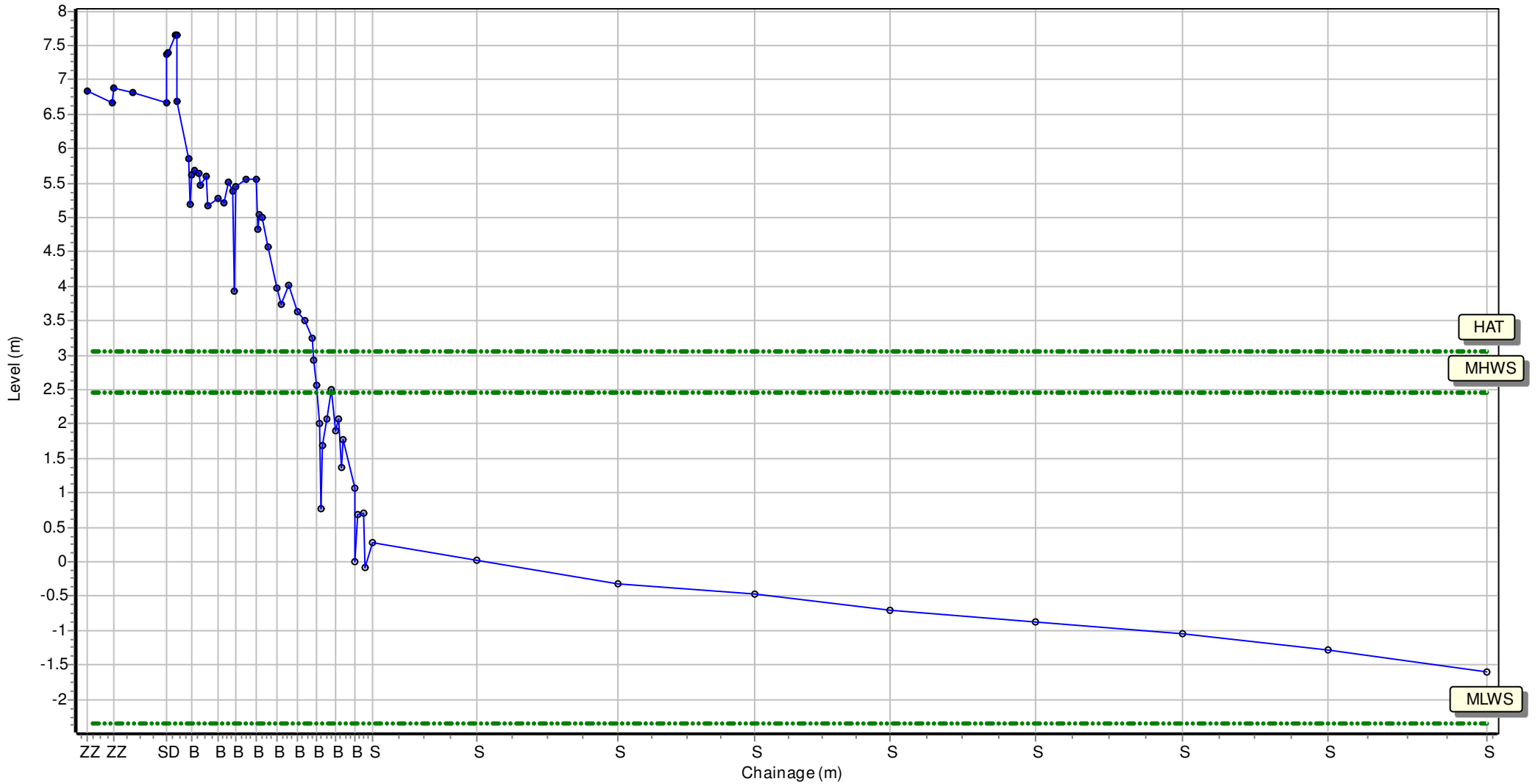
Sea State:

Visibility:

Rain:

Summary: 2020 Partial Measures Topo Survey

Easting: 504515.599 Northing: 489205.724 Profile Bearing: 14 ° from North



Beach Profile

Location: 1dSBS1

Date: 28/04/2020

Inspector: AG

Low Tide:

Low Tide Time:

Wind

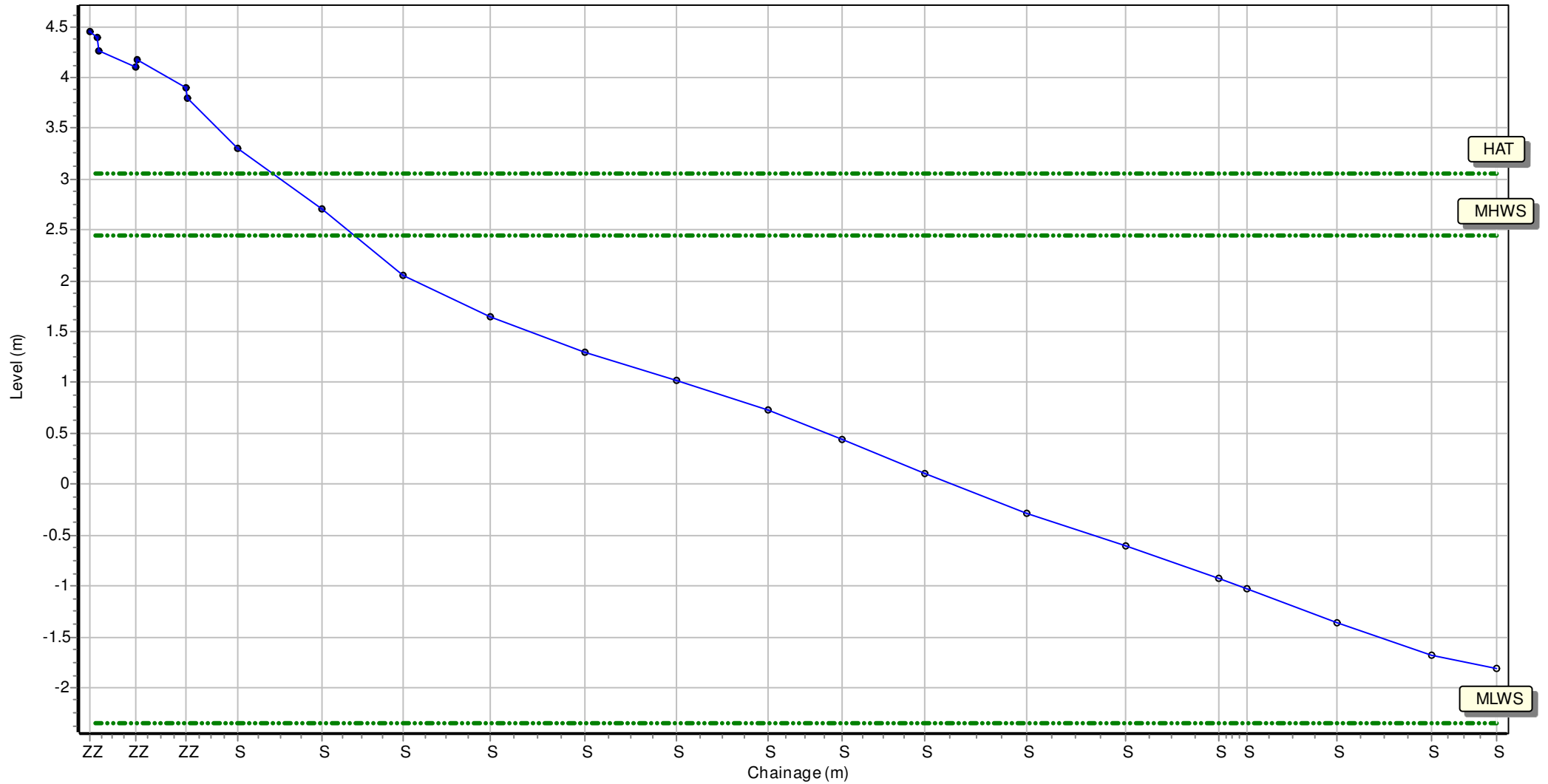
Sea State:

Visibility:

Rain:

Summary: 2020 Partial Measures Topo Survey

Easting: 504544.727 Northing: 488604.814 Profile Bearing: 120 ° from North



Beach Profile

Location: 1dSBS2

Date: 28/04/2020

Inspector: AG

Low Tide:

Low Tide Time:

Wind

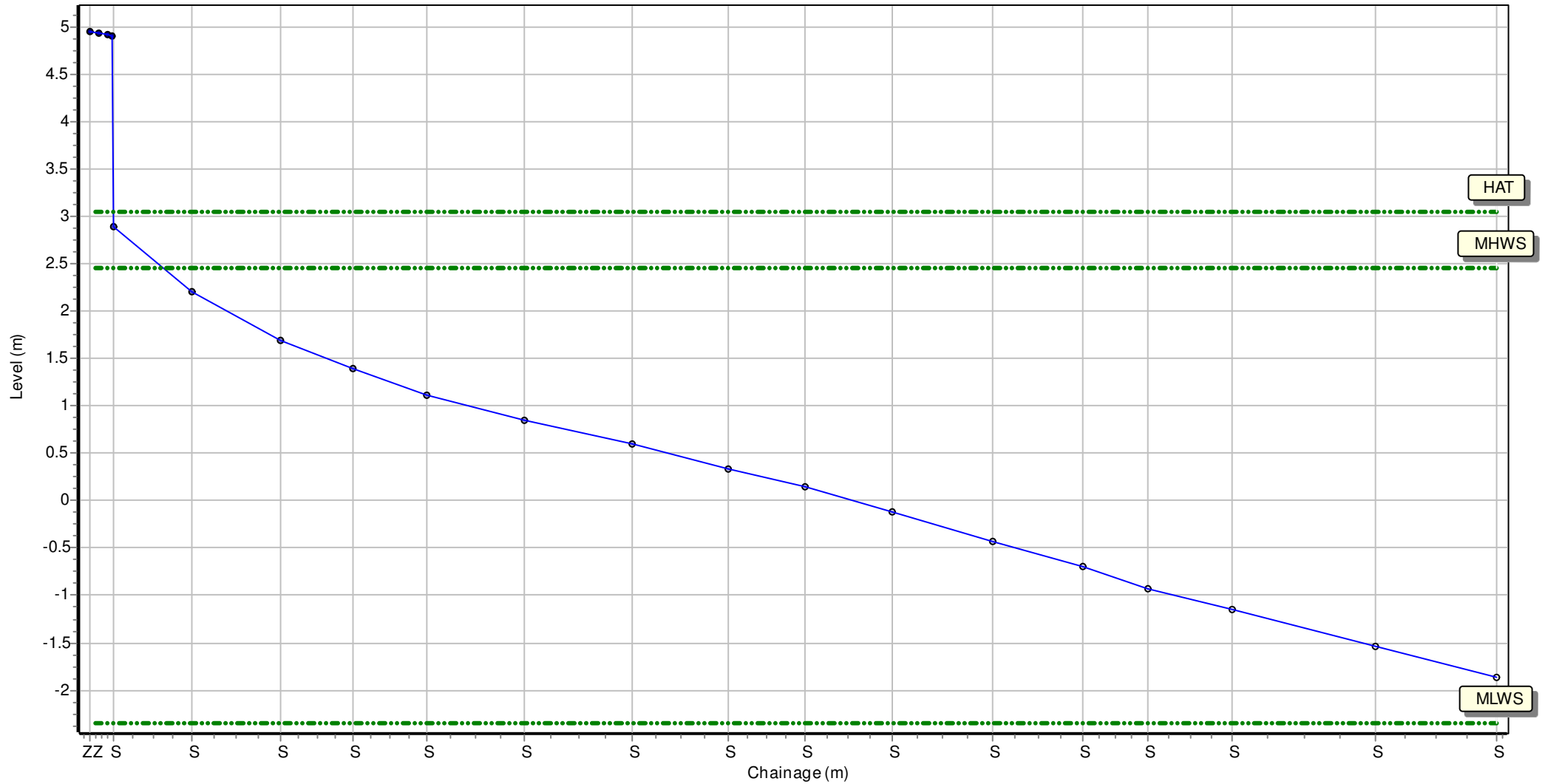
Sea State:

Visibility:

Rain:

Summary: 2020 Partial Measures Topo Survey

Easting: 504443.218 Northing: 488326.371 Profile Bearing: 105 ° from North



Beach Profile

Location: 1dSBS3

Date: 28/04/2020

Inspector: AG

Low Tide:

Low Tide Time:

Wind

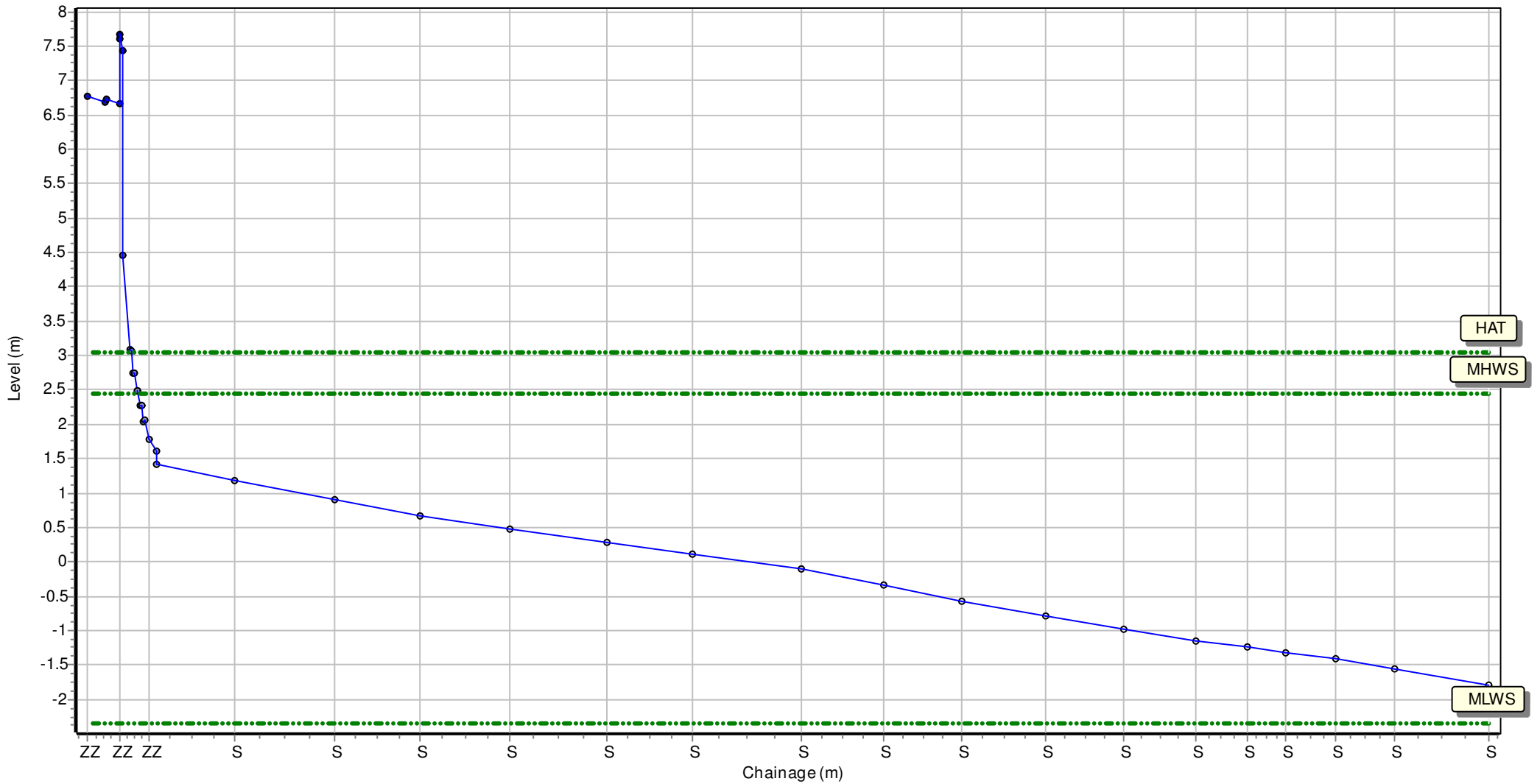
Sea State:

Visibility:

Rain:

Summary: 2020 Partial Measures Topo Survey

Easting: 504423.086 Northing: 488057.66 Profile Bearing: 83 ° from North



Beach Profile

Location: 1dSBS4

Date: 28/04/2020

Inspector: AG

Low Tide:

Low Tide Time:

Wind

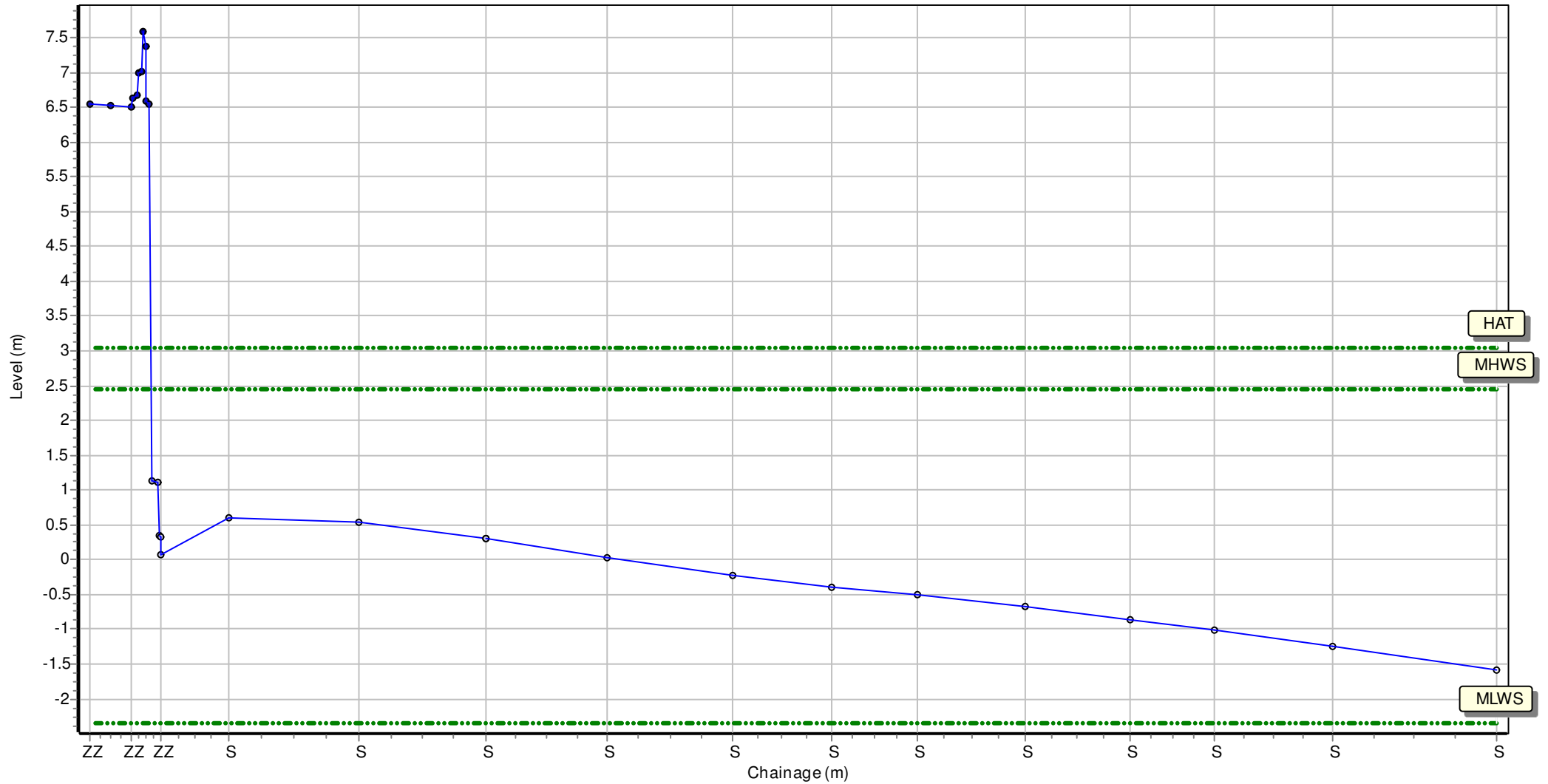
Sea State:

Visibility:

Rain:

Summary: 2020 Partial Measures Topo Survey

Easting: 504494.785 Northing: 487816.983 Profile Bearing: 74 ° from North



Beach Profile

Location: 1dCY1

Date: 26/04/2020

Inspector: AG

Low Tide:

Low Tide Time:

Wind

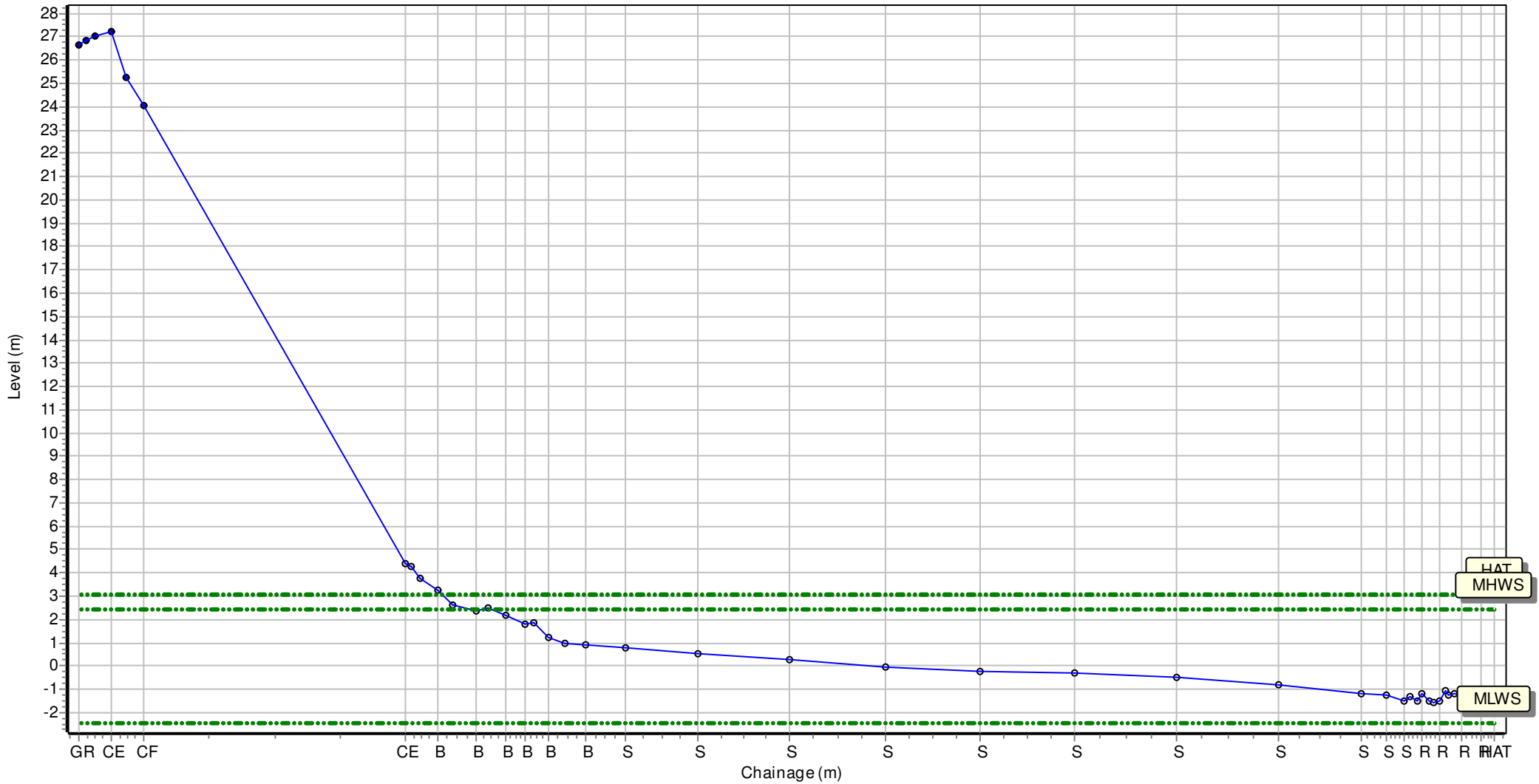
Sea State:

Visibility:

Rain:

Summary: 2020 Partial Measures Topo Survey

Easting: 506420.411 Northing: 484793.941 Profile Bearing: 43 ° from North



Beach Profile

Location: 1dCY1A

Date: 26/04/2020

Inspector: AG

Low Tide:

Low Tide Time:

Wind

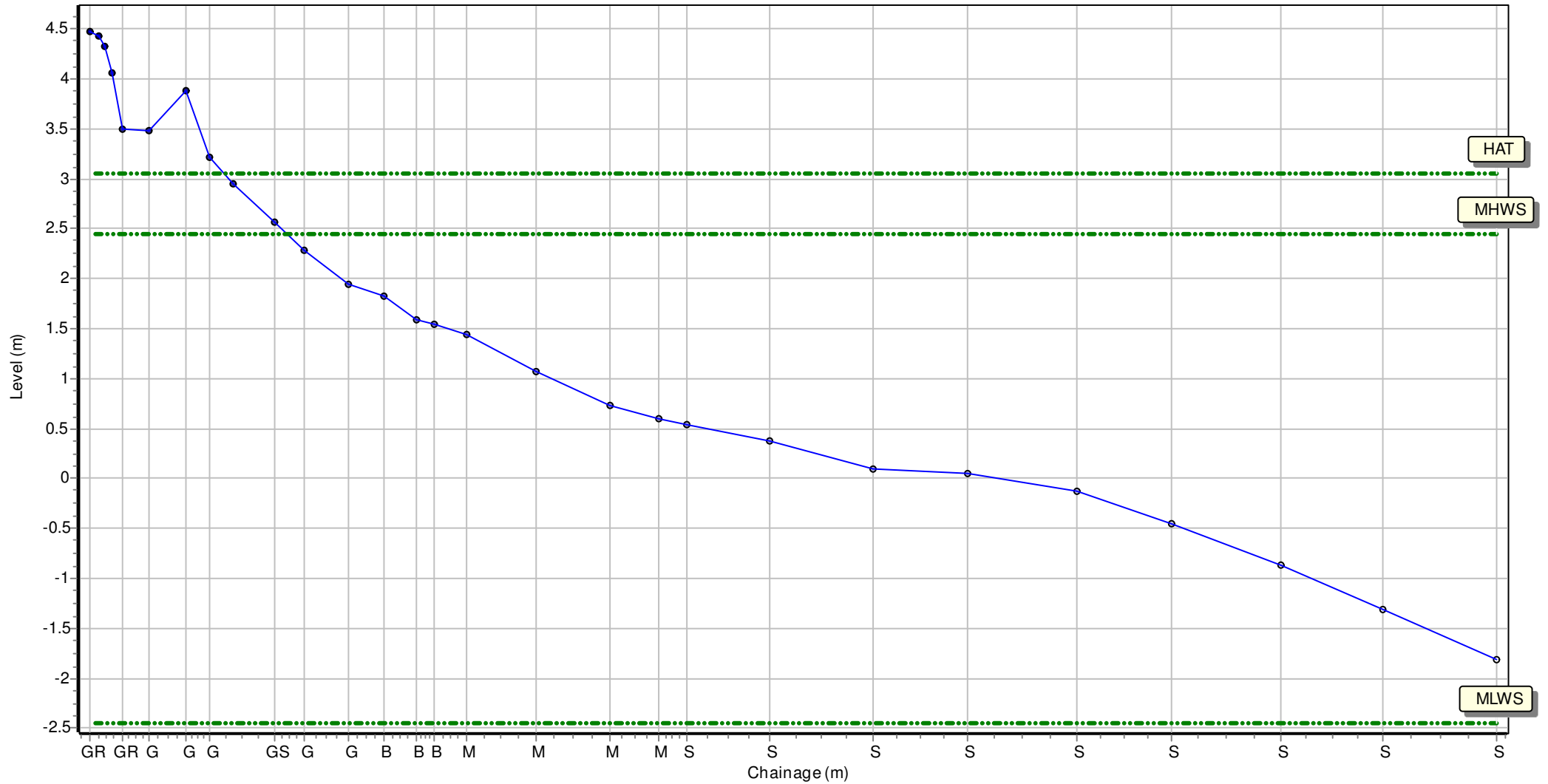
Sea State:

Visibility:

Rain:

Summary: 2020 Partial Measures Topo Survey

Easting: 506298.519 Northing: 485175.932 Profile Bearing: 107 ° from North



Beach Profile

Location: 1dCY2

Date: 26/04/2020

Inspector: AG

Low Tide:

Low Tide Time:

Wind

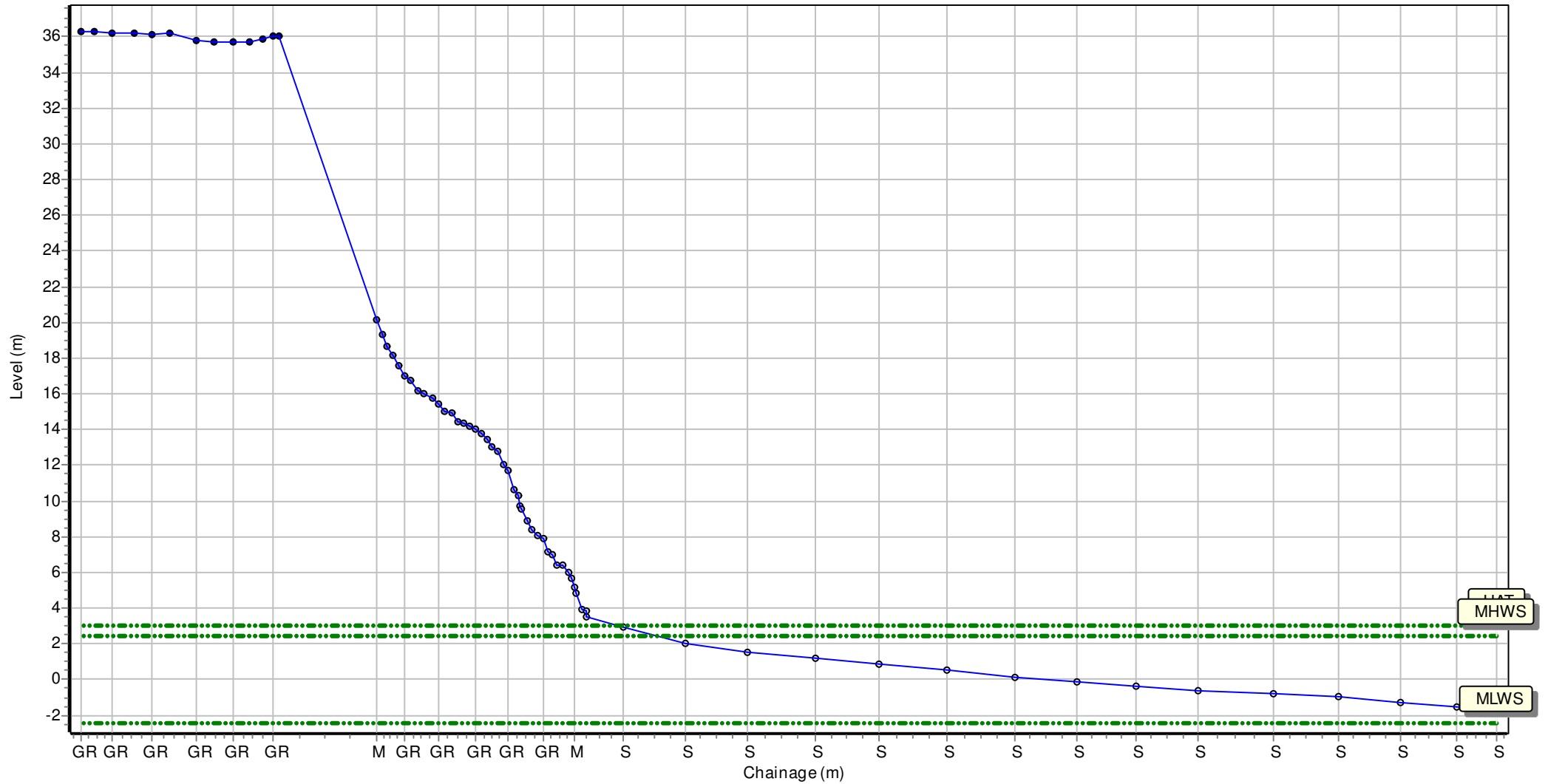
Sea State:

Visibility:

Rain:

Summary: 2020 Partial Measures Topo Survey

Easting: 506712.583 Northing: 484325.966 Profile Bearing: 38 ° from North



Beach Profile

Location: 1dCY3

Date: 26/04/2020

Inspector: AG

Low Tide:

Low Tide Time:

Wind

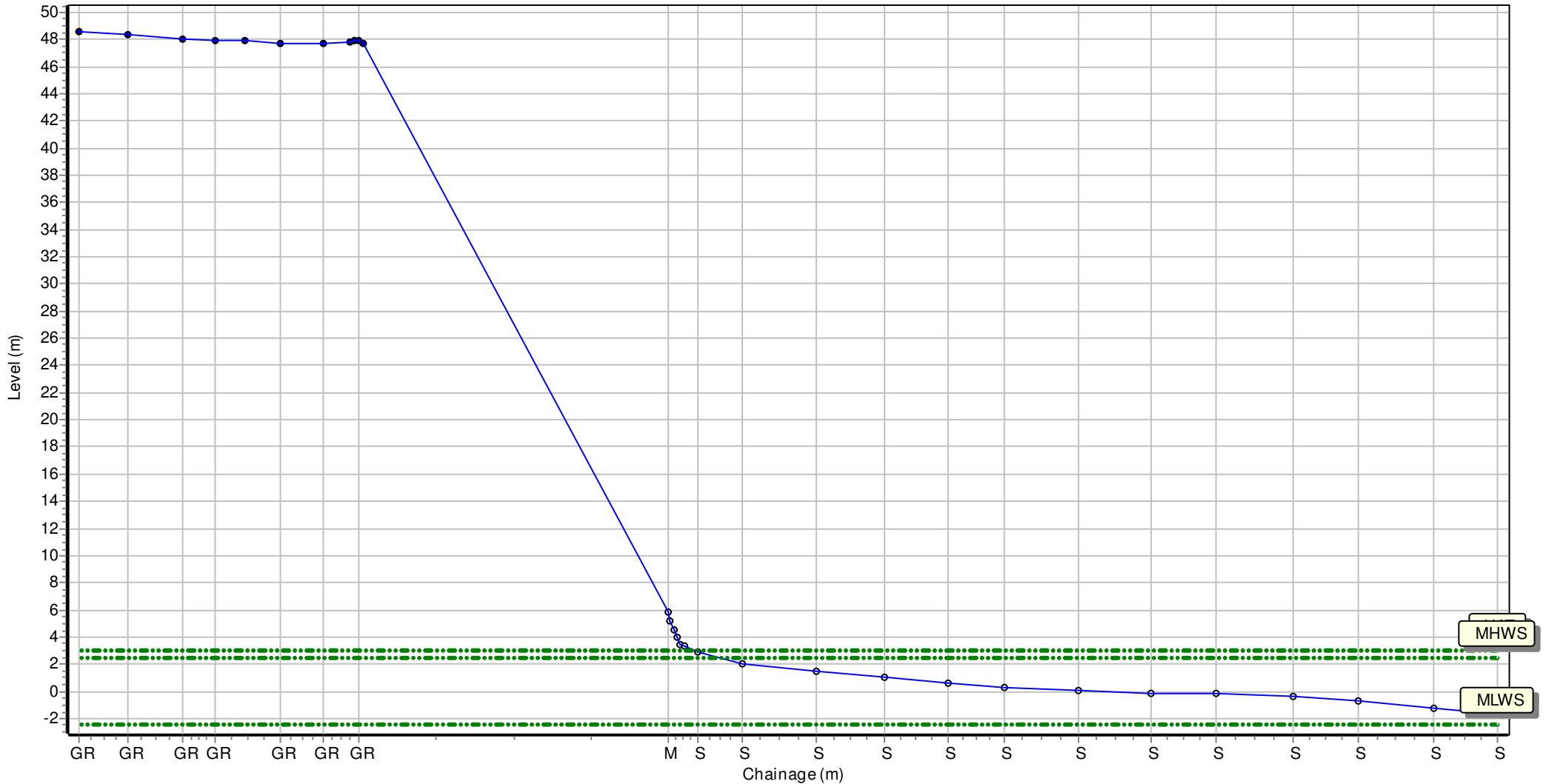
Sea State:

Visibility:

Rain:

Summary: 2020 Partial Measures Topo Survey

Easting: 507242.203 Northing: 484080.896 Profile Bearing: 42 ° from North



Beach Profile

Location: 1dFB1

Date: 13/03/2020

Inspector: AG

Low Tide:

Low Tide Time:

Wind

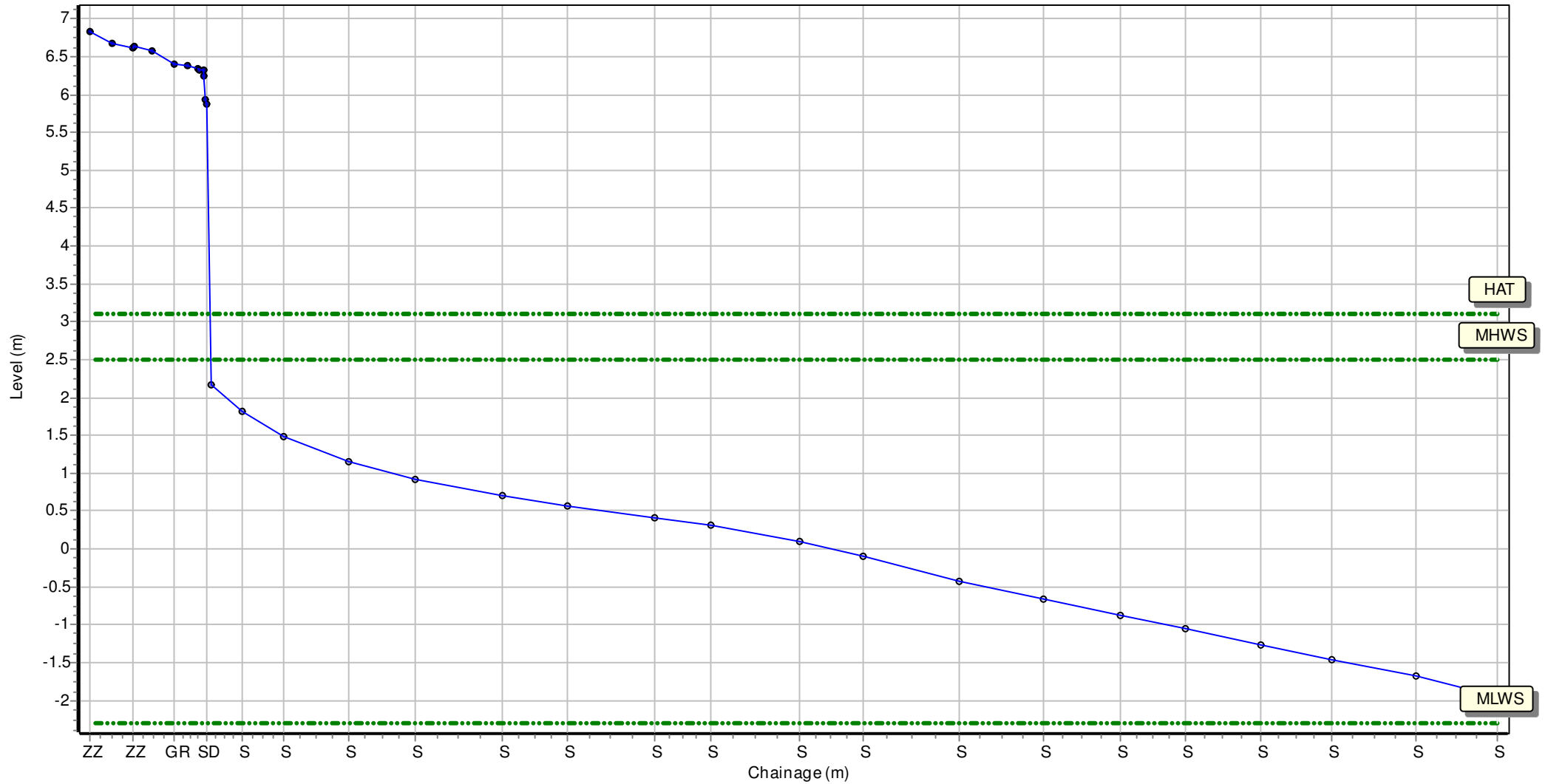
Sea State:

Visibility:

Rain:

Summary: 2020 Partial Measures Topo Survey

Easting: 511989.528 Northing: 480590.964 Profile Bearing: 100 ° from North



Beach Profile

Location: 1dFB2

Date: 13/03/2020

Inspector: AG

Low Tide:

Low Tide Time:

Wind

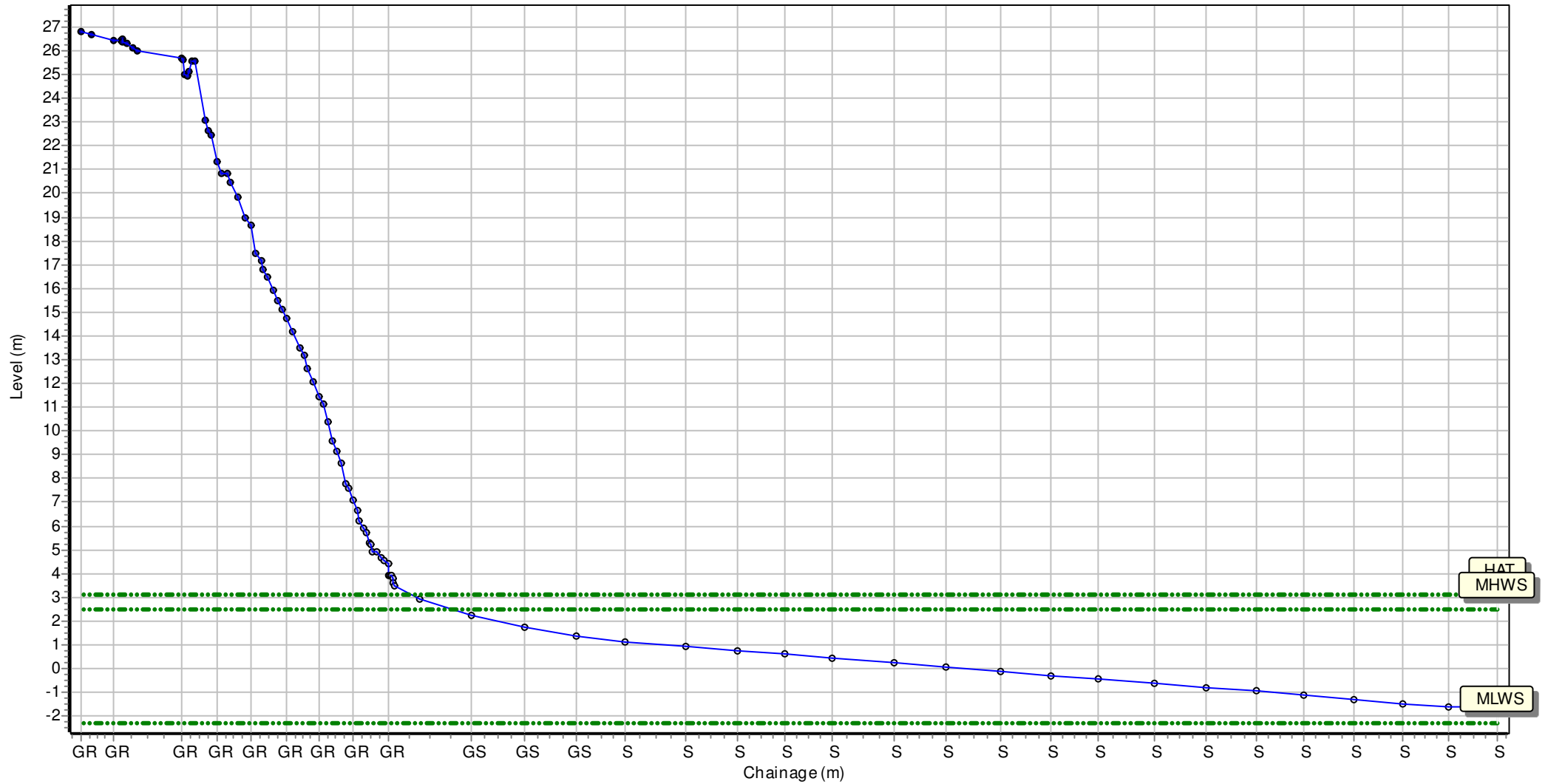
Sea State:

Visibility:

Rain:

Summary: 2020 Partial Measures Topo Survey

Easting: 512005.564 Northing: 479181.575 Profile Bearing: 77 ° from North



Beach Profile

Location: 1dFB3

Date: 13/03/2020

Inspector: AG

Low Tide:

Low Tide Time:

Wind

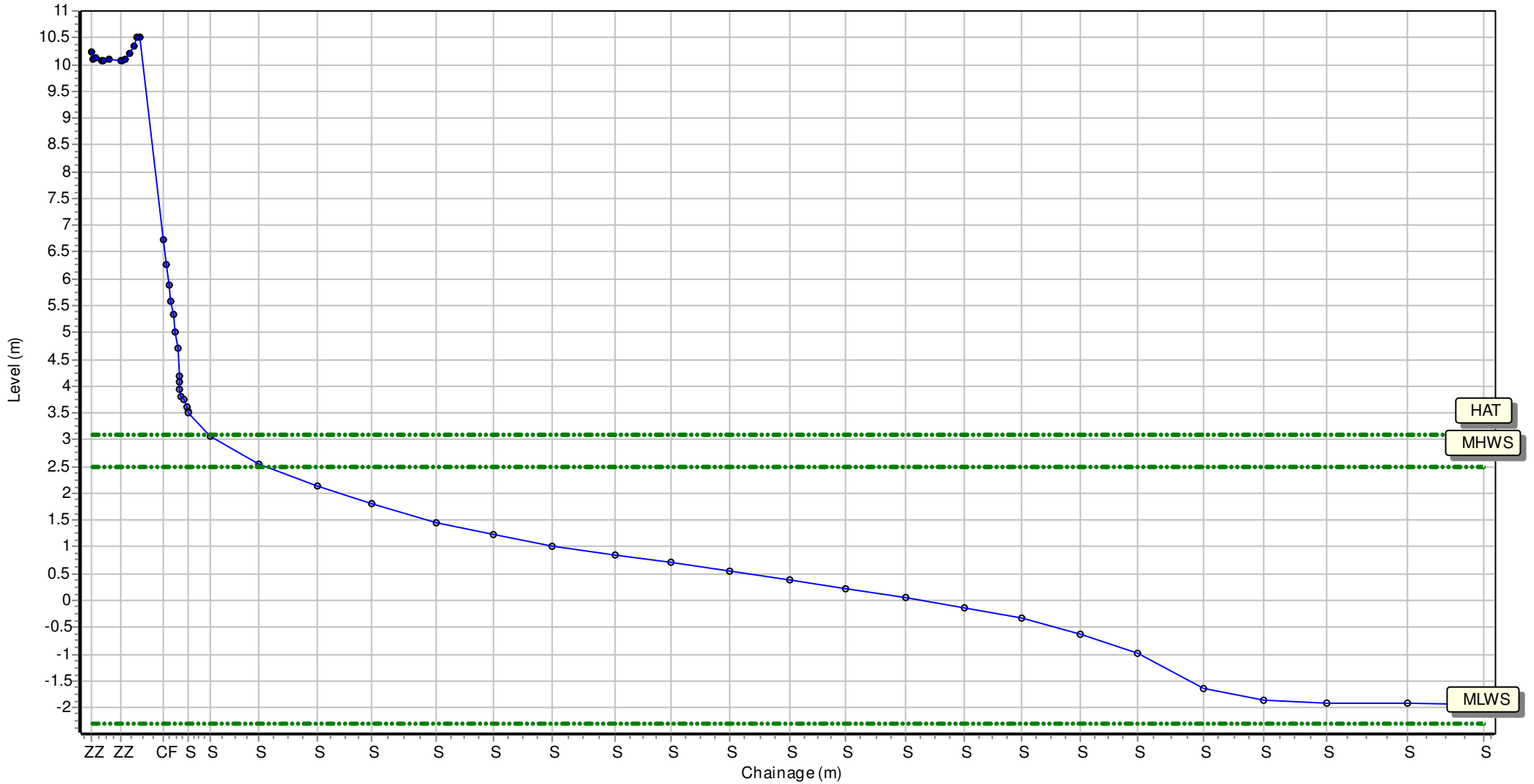
Sea State:

Visibility:

Rain:

Summary: 2020 Partial Measures Topo Survey

Easting: 512429.303 Northing: 478202.148 Profile Bearing: 61 ° from North



Beach Profile

Location: 1dFB4

Date: 13/03/2020

Inspector: AG

Low Tide:

Low Tide Time:

Wind

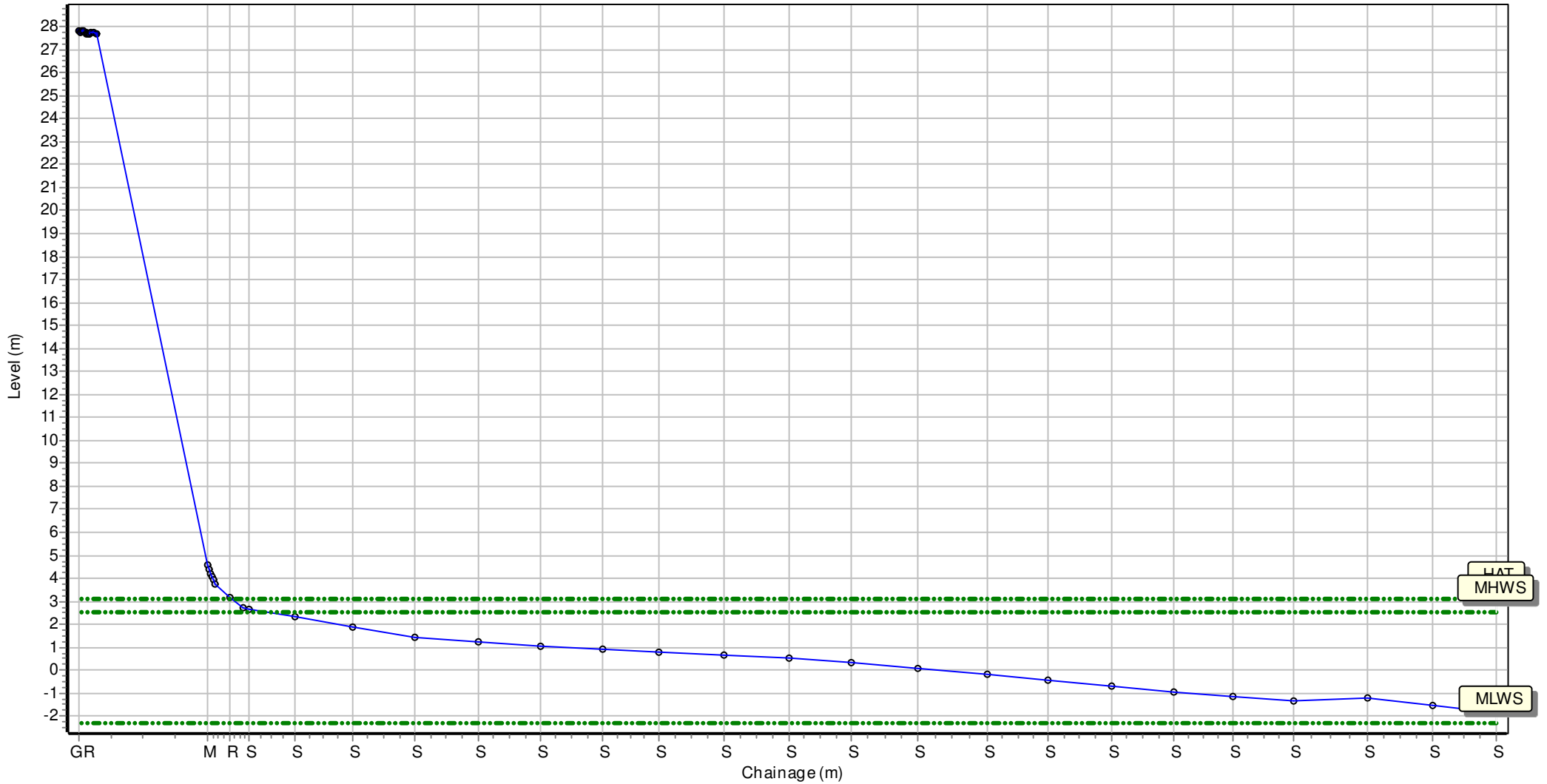
Sea State:

Visibility:

Rain:

Summary: 2020 Partial Measures Topo Survey

Easting: 513165.53 Northing: 477182.418 Profile Bearing: 51 ° from North



Beach Profile

Location: 1dFB5

Date: 13/03/2020

Inspector: AG

Low Tide:

Low Tide Time:

Wind

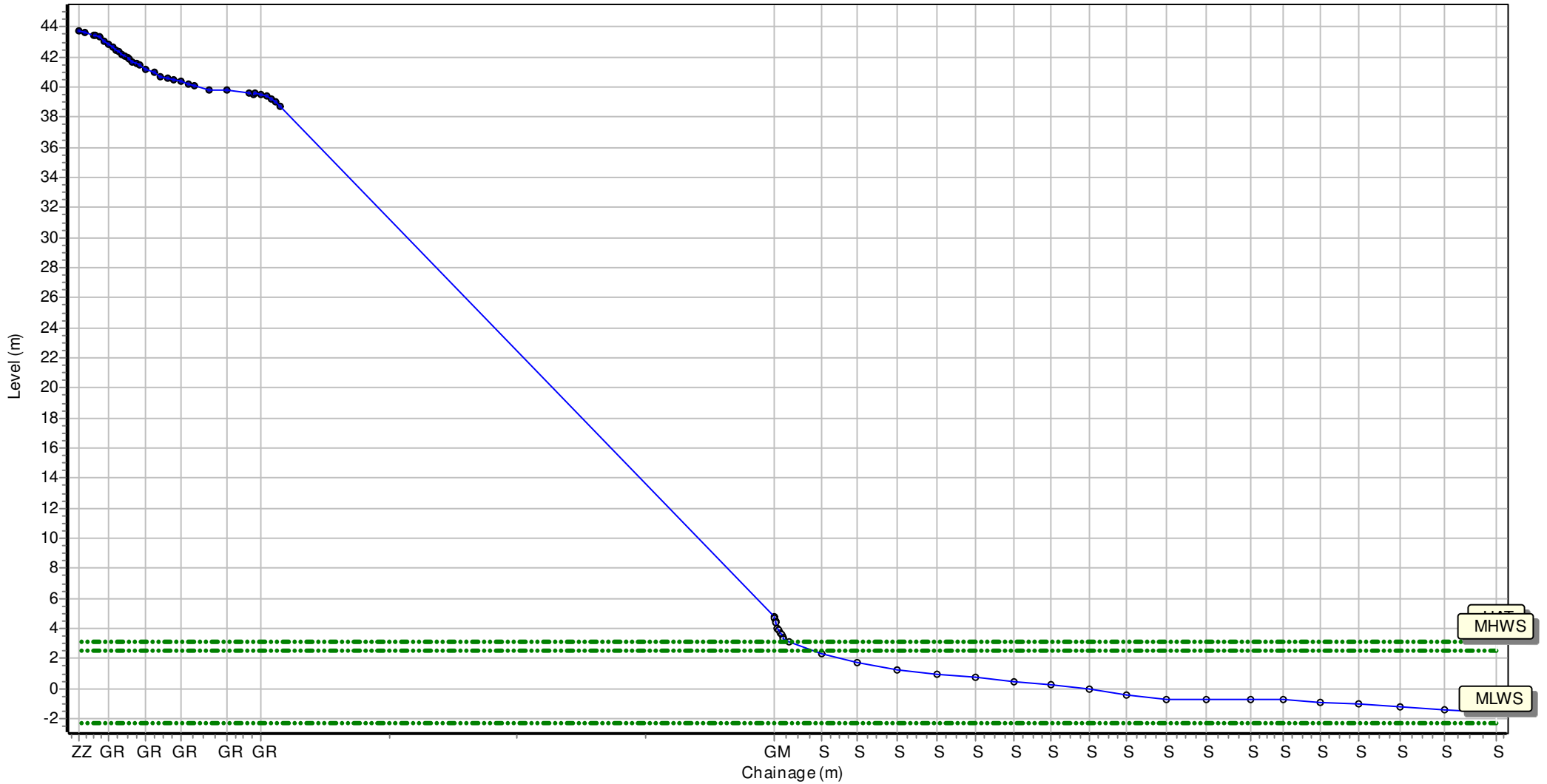
Sea State:

Visibility:

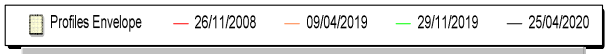
Rain:

Summary: 2020 Partial Measures Topo Survey

Easting: 514207.792 Northing: 476001.334 Profile Bearing: 47 ° from North



Beach Profiles: 1dWB1

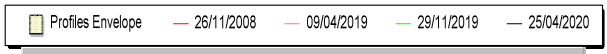
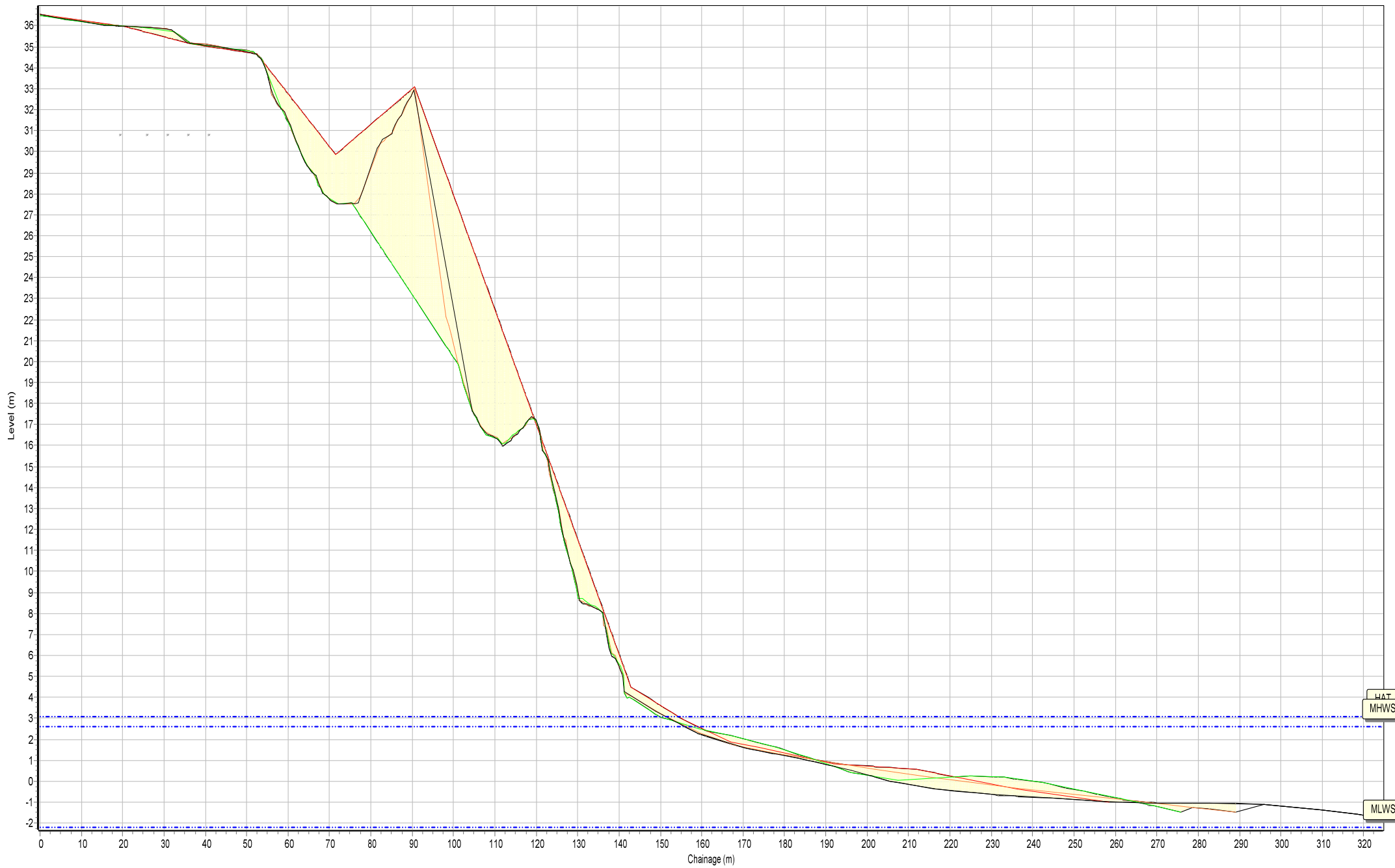


HAT

MHWS

MLWS

Beach Profiles: 1dWB2

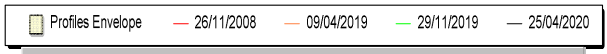
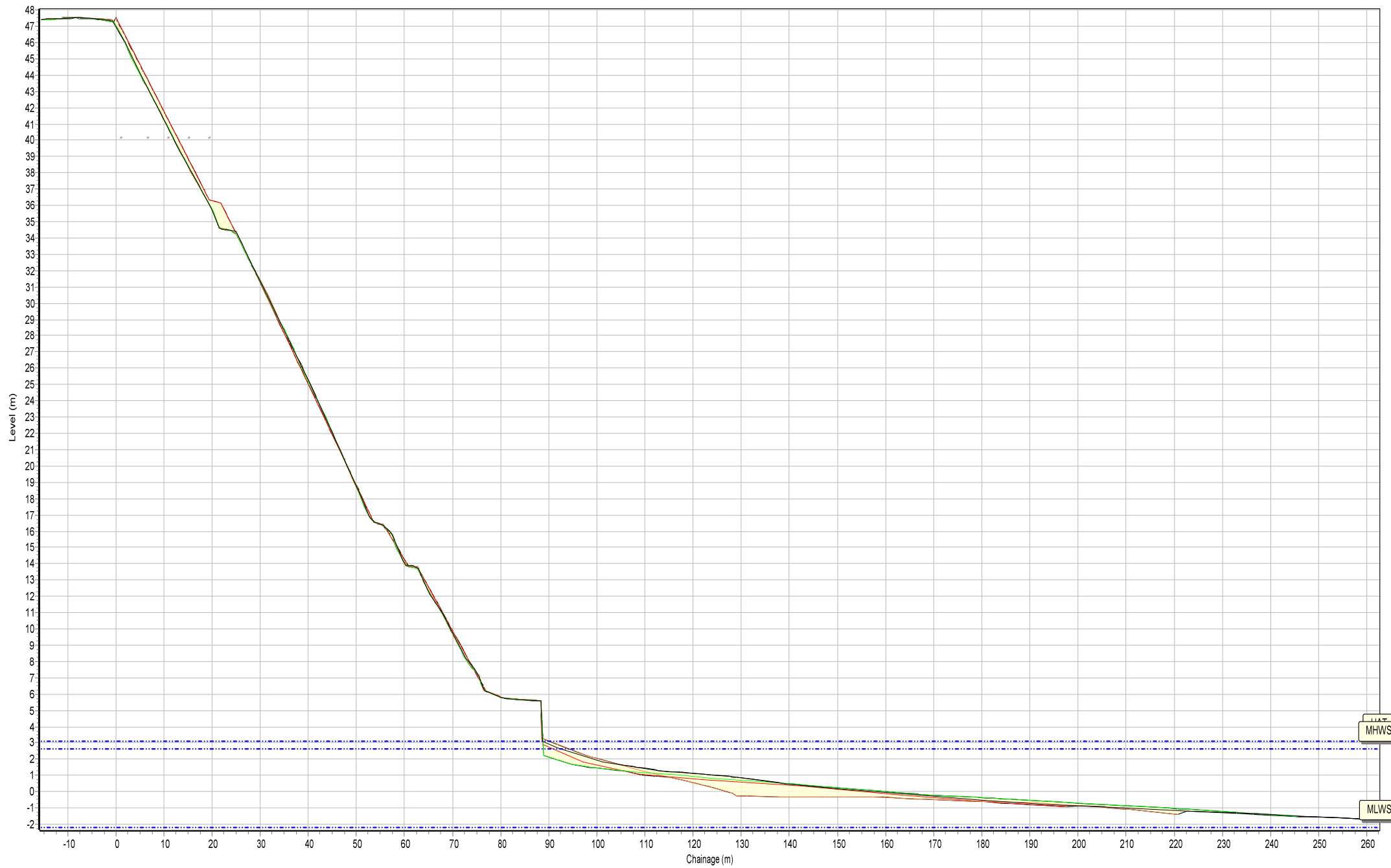


HAT
MHWS

MLWS

SANDS

Beach Profiles: 1dWB3



Beach Profiles: 1dSBN1



Profiles Envelope 15/11/2008 20/03/2019 30/09/2019 27/04/2020

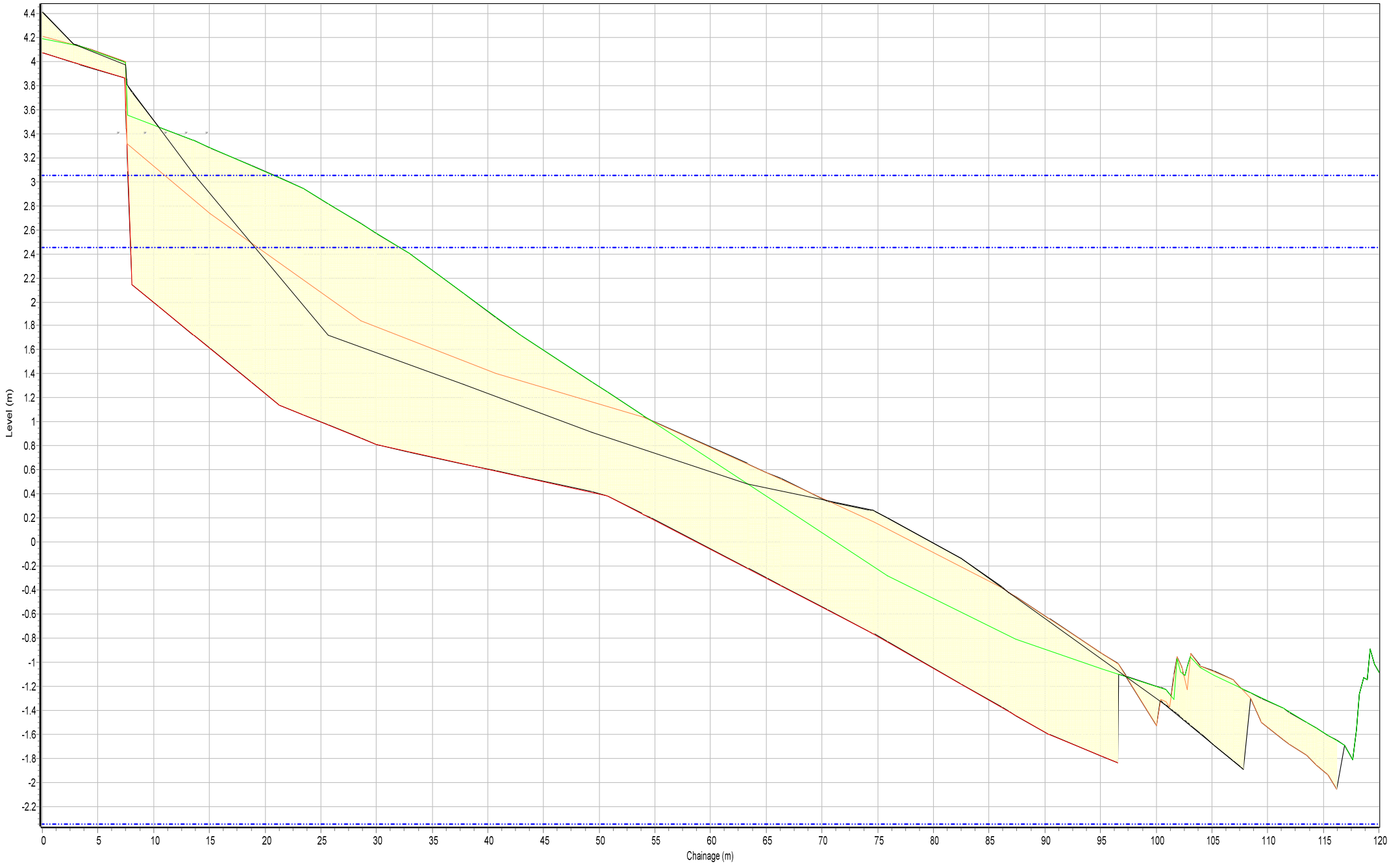
HAT

MHWS

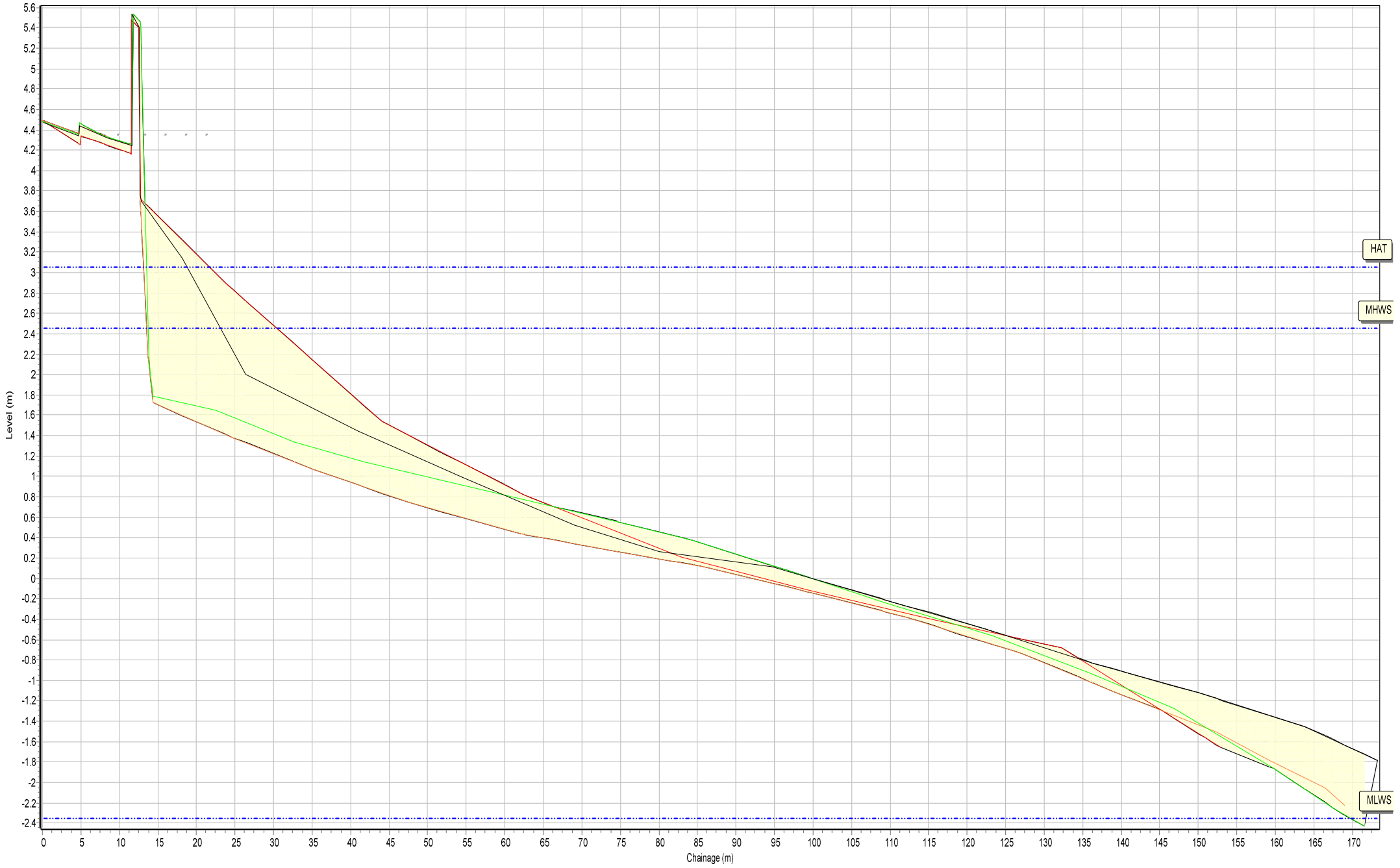
MLWS

SANDS

Beach Profiles: 1dSBN2



Beach Profiles: 1dSBN3



Beach Profiles: 1dSBN4



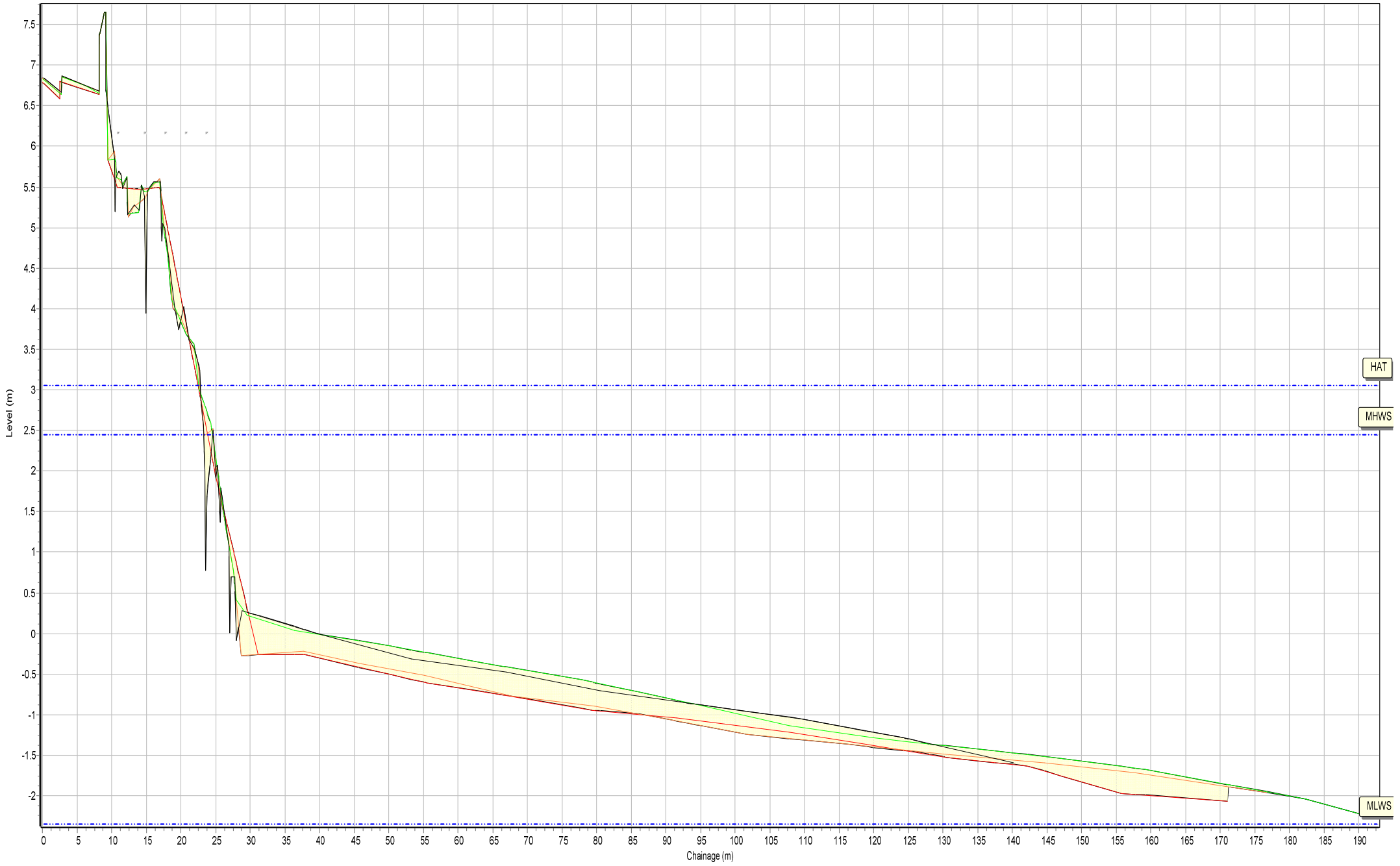
HAT

MHWS

MLWS

SANDS

Beach Profiles: 1dSBN5



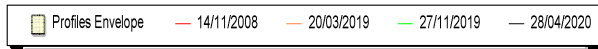
HAT

MHWS

MLWS

SANDS

Beach Profiles: 1dSBS1



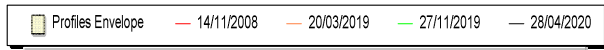
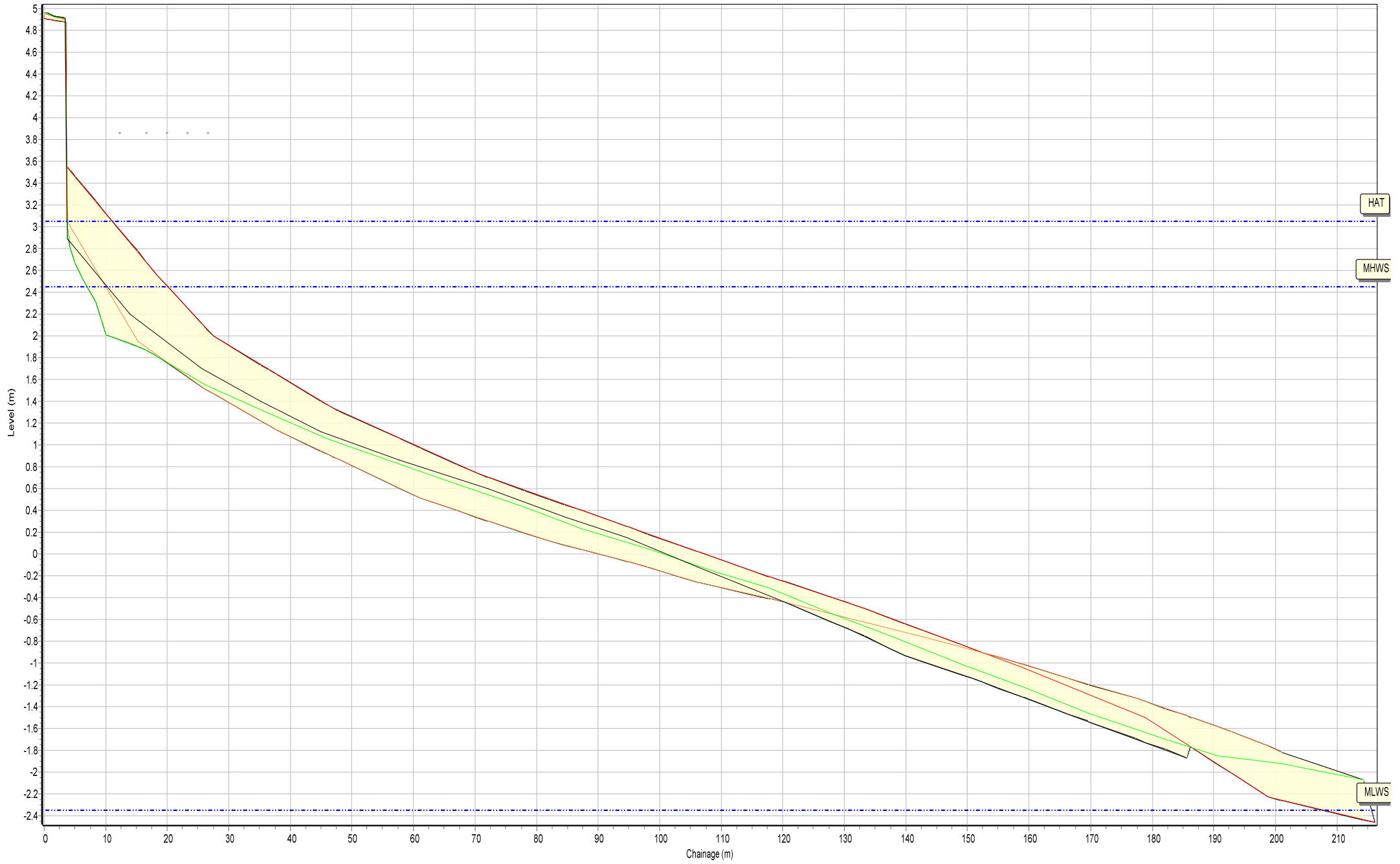
HAT

MHWS

MLWS

SANDS

Beach Profiles: 1dSBS2



Beach Profiles: 1dSBS3



Beach Profiles: 1dSBS4



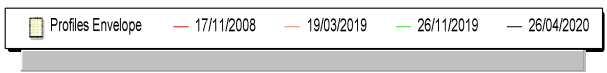
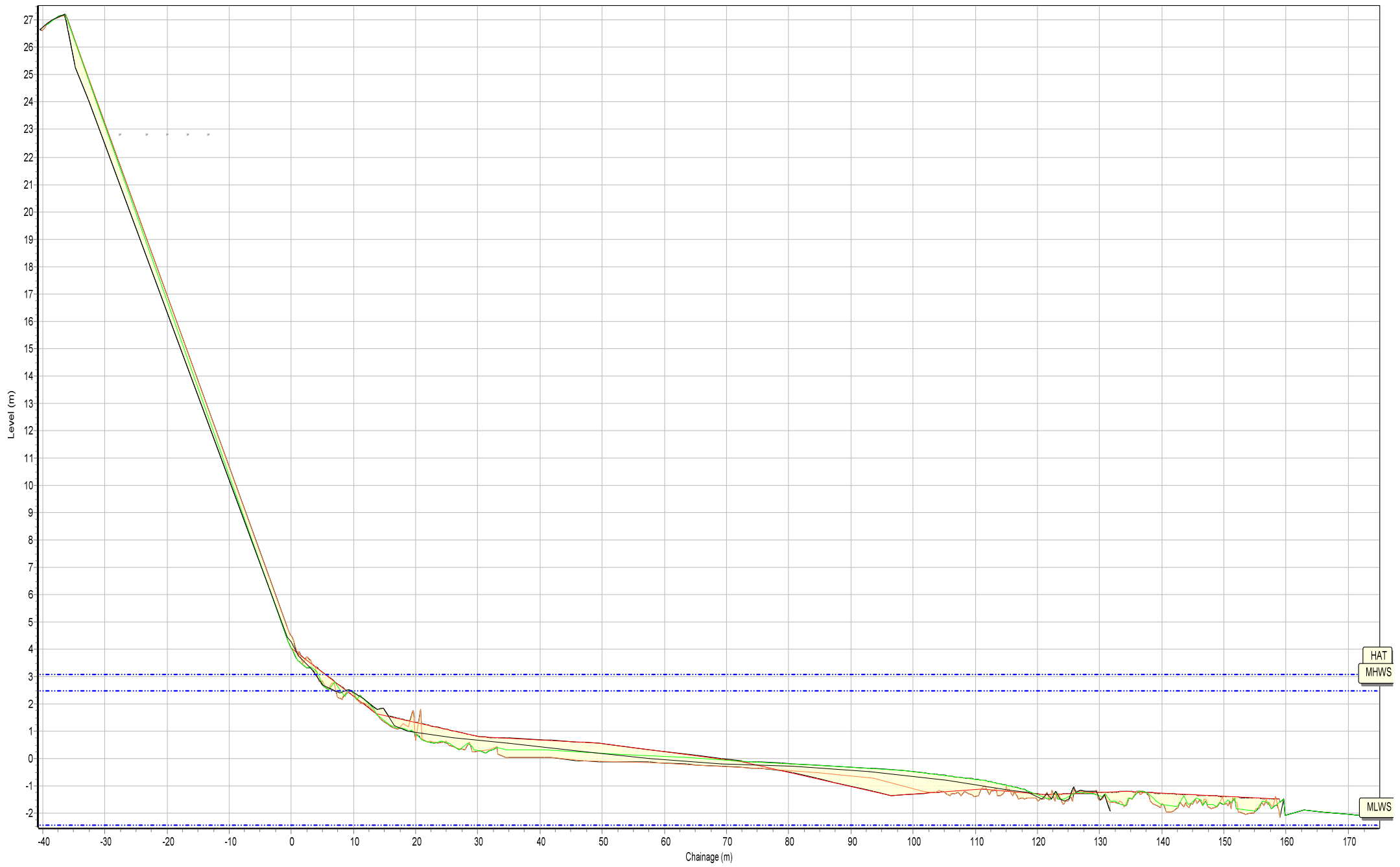
HAT

MHWS

MLWS

SANDS

Beach Profiles: 1dCY1



HAT
MHWS

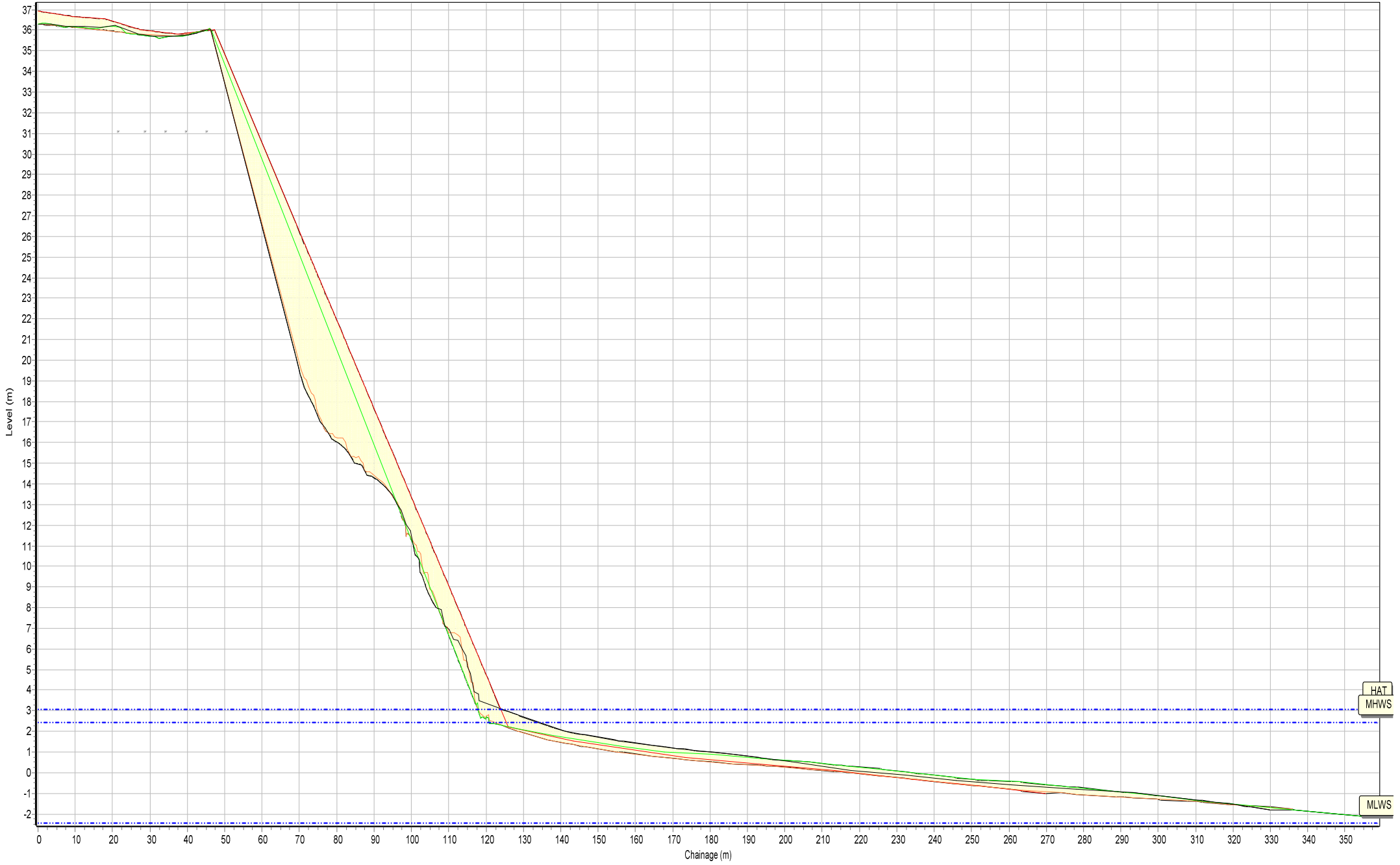
MLWS

SANDS

Beach Profiles: 1dCY1A



Beach Profiles: 1dCY2



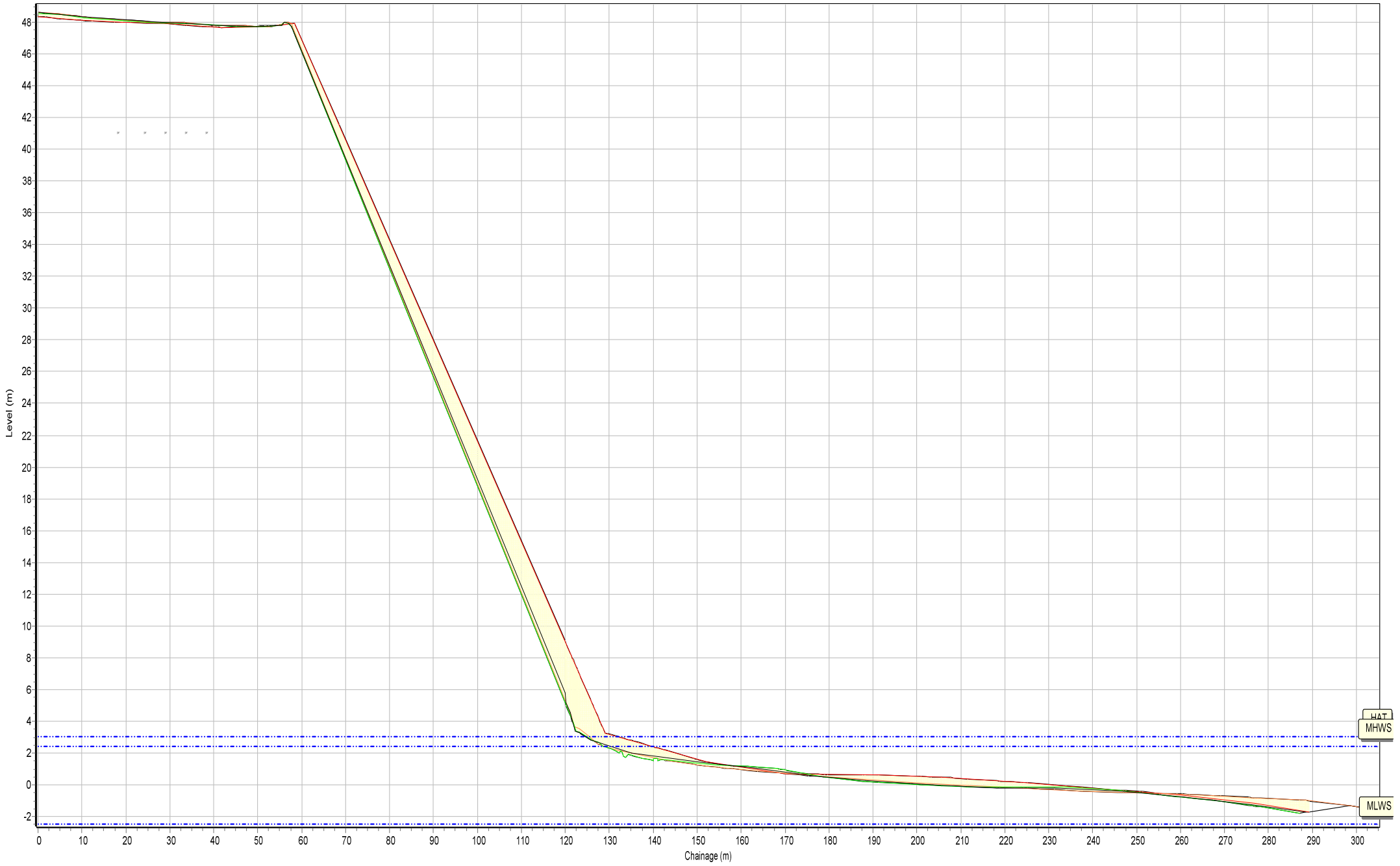
Profiles Envelope 17/11/2008 19/03/2019 26/11/2019 26/04/2020

HAT
MHWS

MLWS

SANDS

Beach Profiles: 1dCY3



HAT

MHWS

MLWS

SANDS

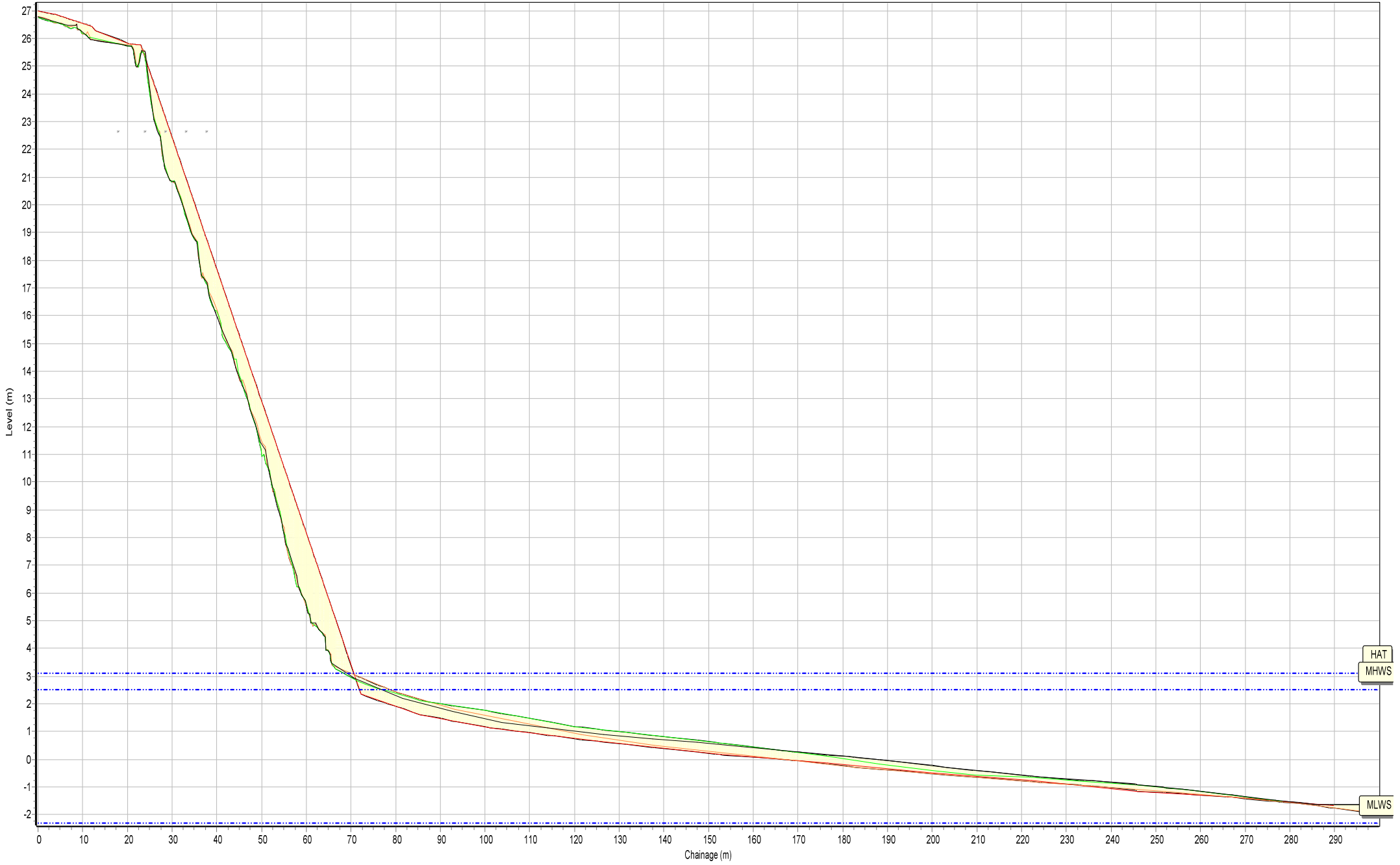
Beach Profiles: 1dFB1



Profiles Envelope 26/11/2008 21/03/2019 03/10/2019 13/03/2020

SANDS

Beach Profiles: 1dFB2



Profiles Envelope 26/11/2008 21/03/2019 03/10/2019 13/03/2020

HAT
MHWS

MLWS

SANDS

Beach Profiles: 1dFB3



Profiles Envelope 26/11/2008 21/03/2019 03/10/2019 13/03/2020

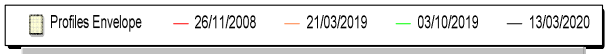
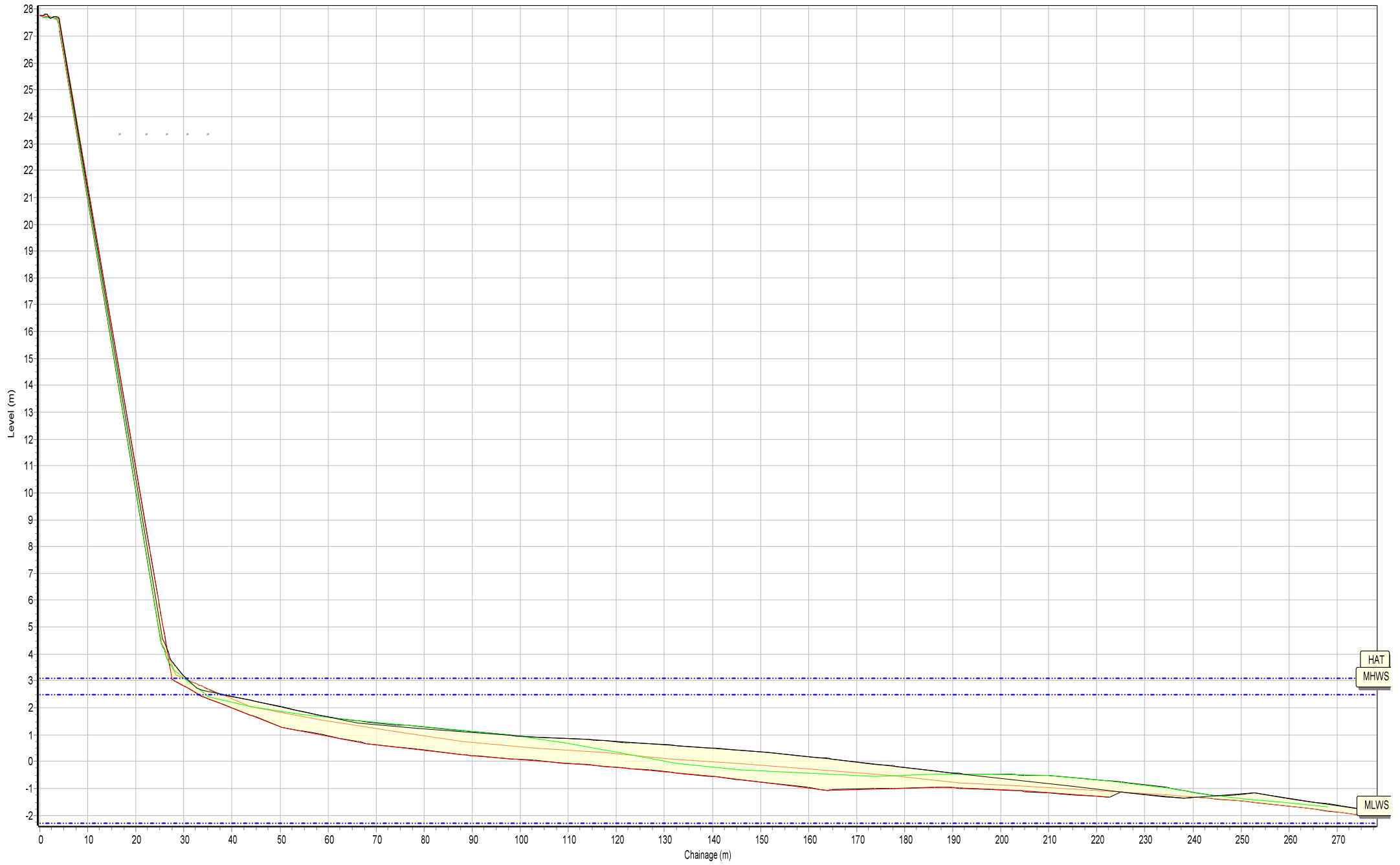
HAT

MHWS

MLWS

SANDS

Beach Profiles: 1dFB4

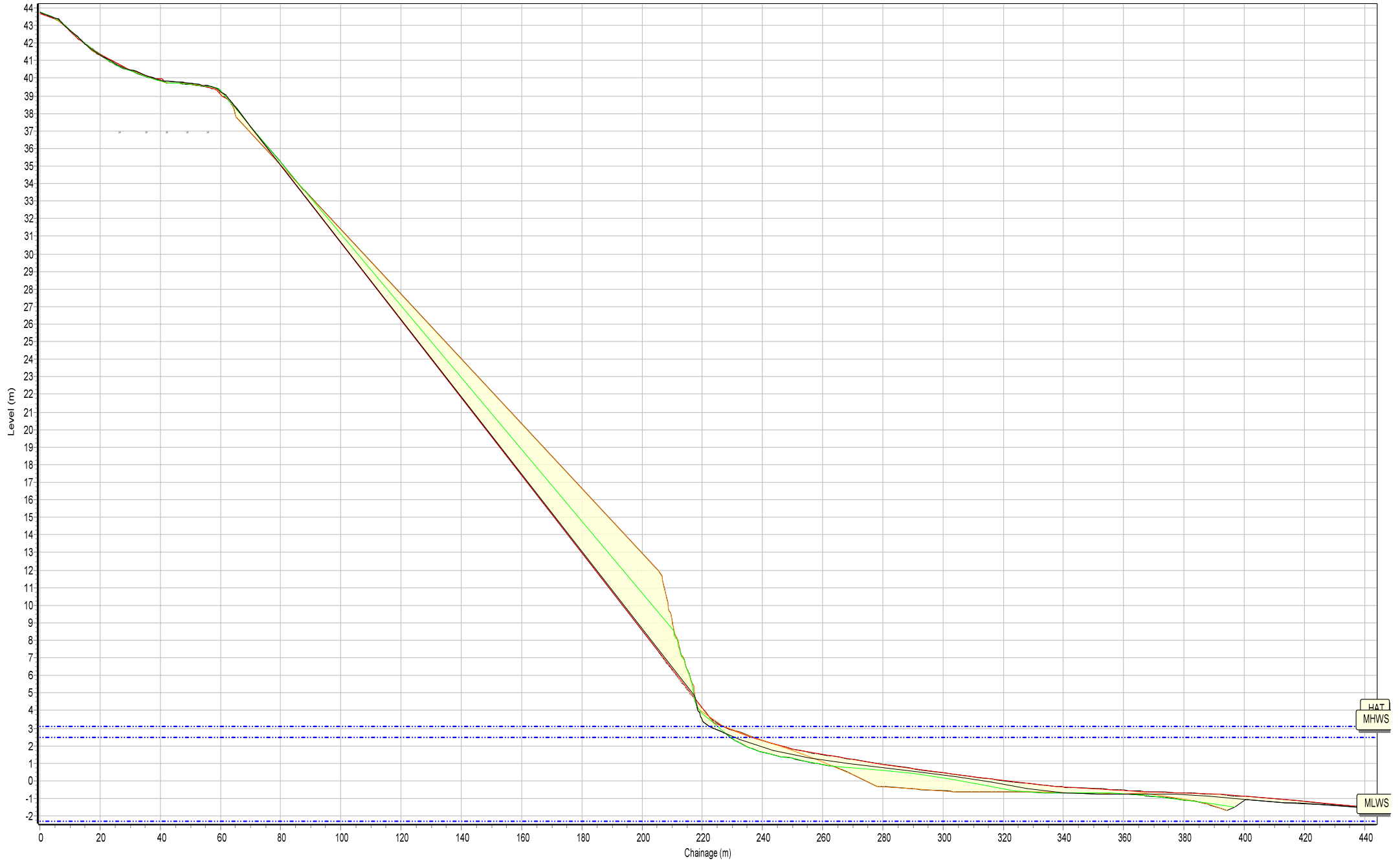


HAT
MHWS

MLWS

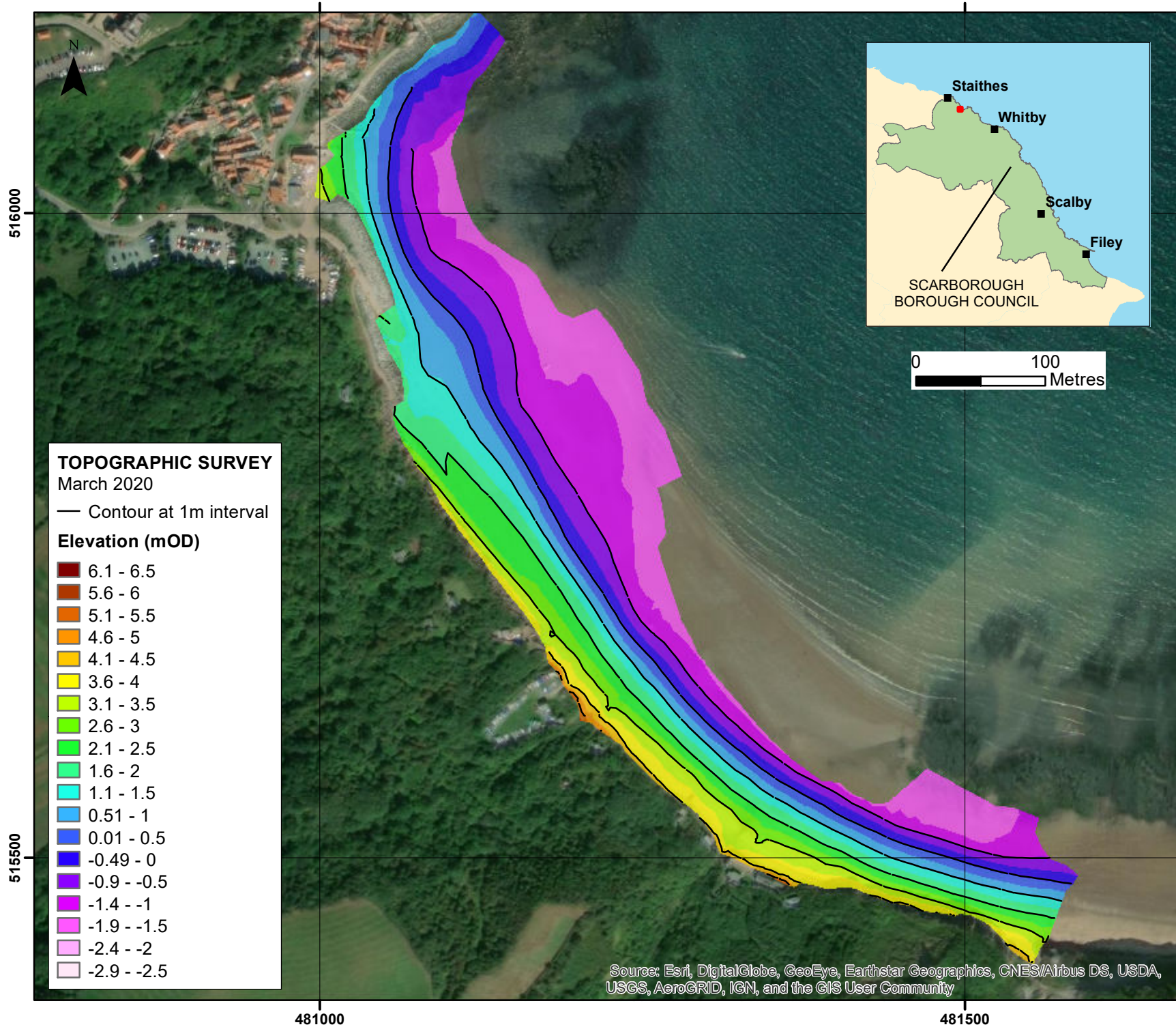
SANDS

Beach Profiles: 1dFB5



SANDS

Appendix B
Topographic Survey



Key

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

Appendix B - Map 1

RUNSWICK BAY

Scarborough Borough Council Frontage

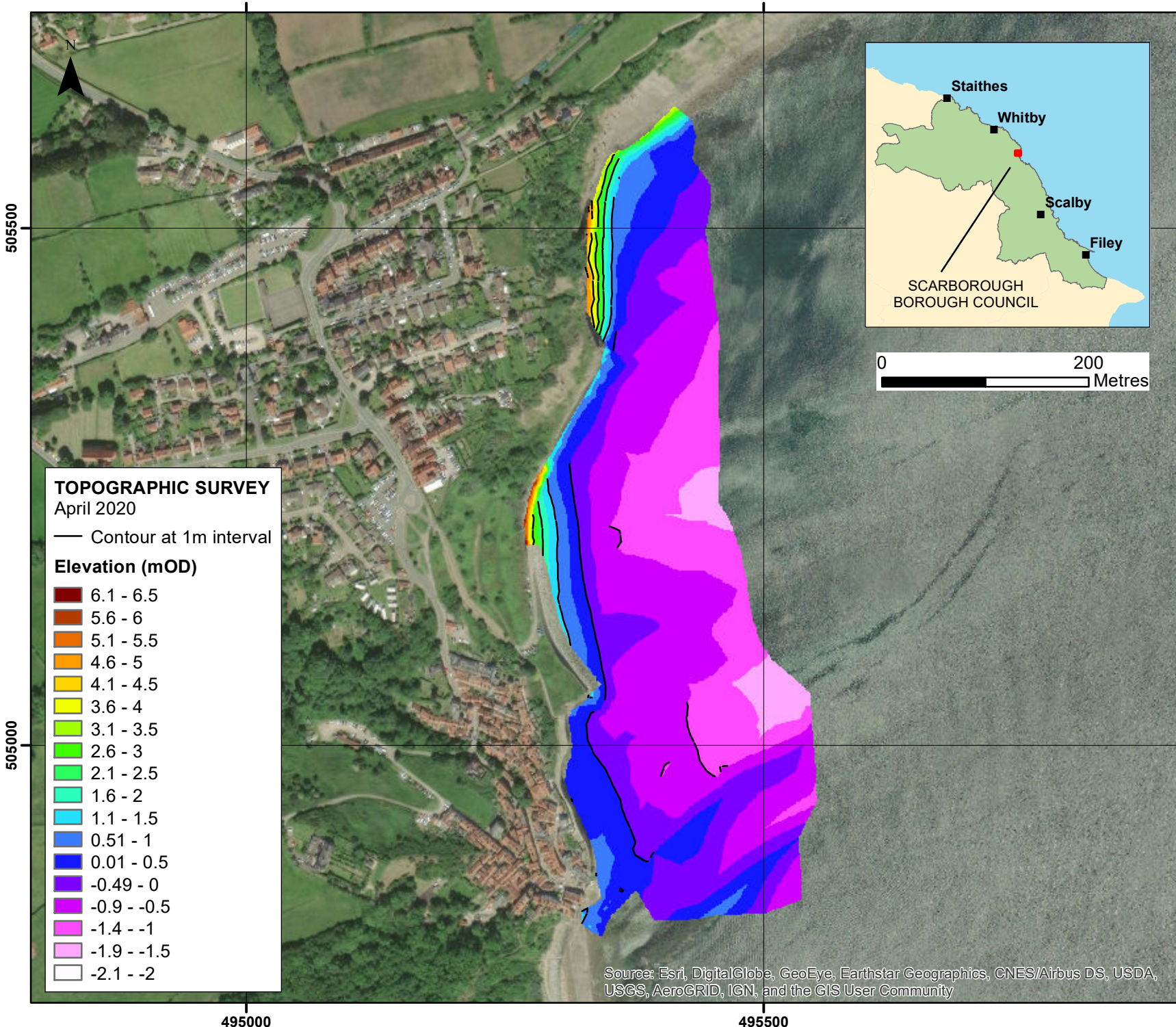
Update Report
'Partial Measures' Survey 2020

Drawing Scale at A4 1:4,000

WATER
Royal HaskoningDHV
Marlborough House
Marlborough Crescent
Newcastle upon Tyne
NE1 4EE

Tel: +44 (0)191 211 1300
Fax: +44 (0)191 211 1313
www.royalhaskoningdhv.com





TOPOGRAPHIC SURVEY
April 2020

— Contour at 1m interval

Elevation (mOD)

6.1 - 6.5
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
-2.1 - -2

Key

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

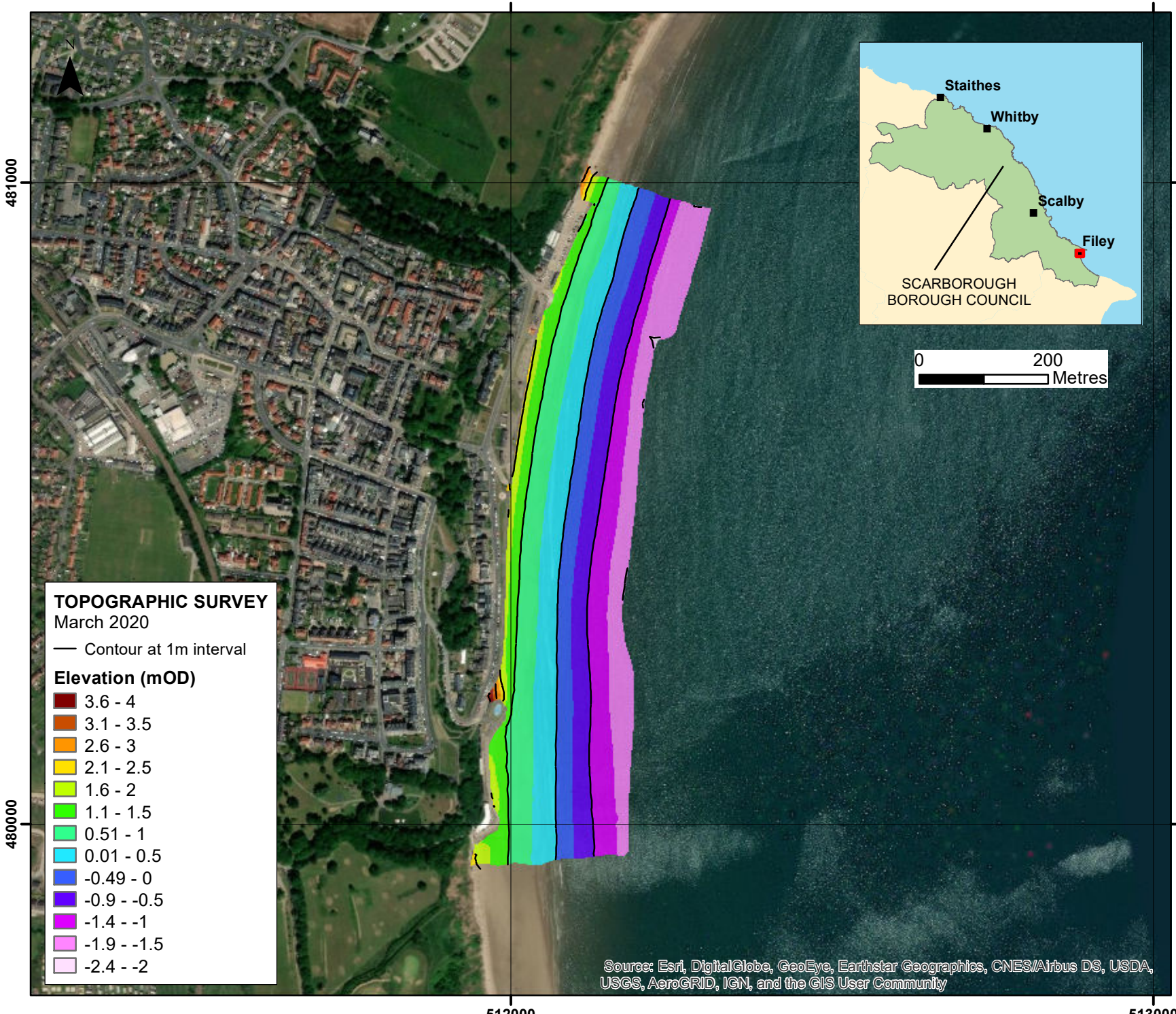
Appendix B - Map 2
ROBIN HOOD'S BAY
Scarborough Borough Council Frontage
Update Report
'Partial Measures' Survey 2020
Drawing Scale at A4 1:5,000

WATER
Royal HaskoningDHV
Marlborough House
Marlborough Crescent
Newcastle upon Tyne
NE1 4EE

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



TOPOGRAPHIC SURVEY
March 2020

— Contour at 1m interval

Elevation (mOD)

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



Key

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

Appendix B - Map 3

FILEY BAY

Scarborough Borough Council Frontage

Update Report
'Partial Measures' Survey 2020

Drawing Scale at A4 1:8,000

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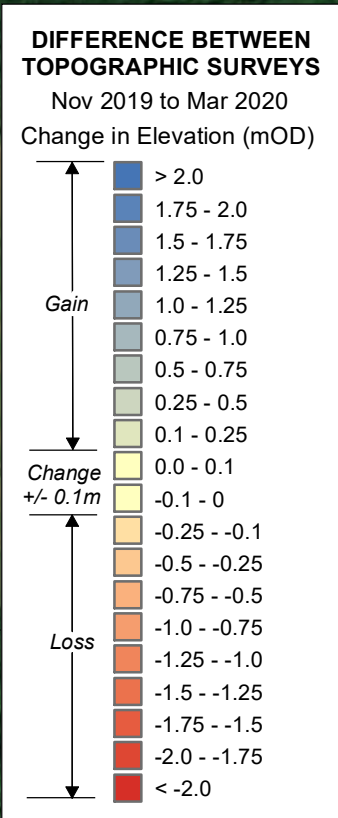
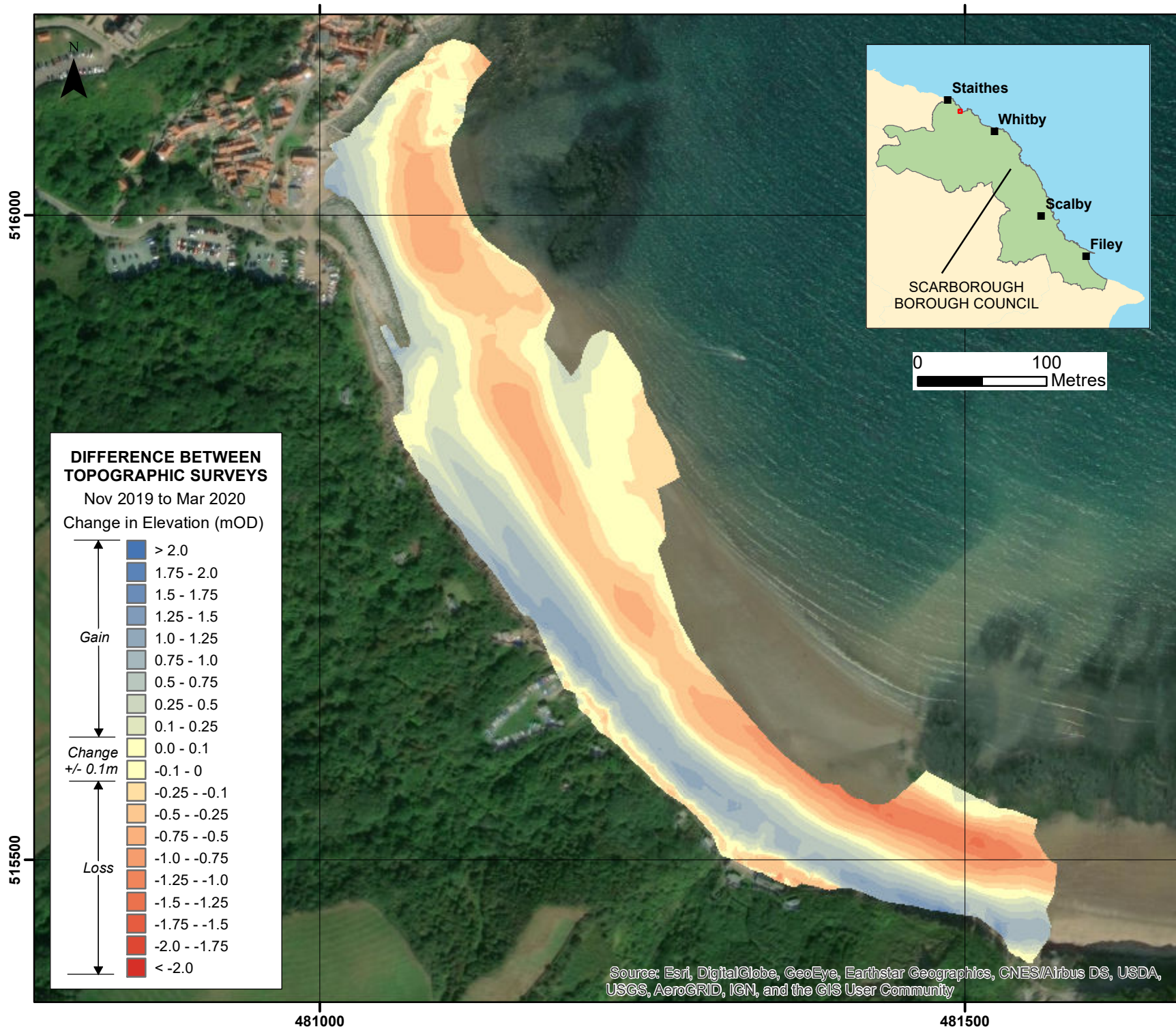
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

512000

513000

481000

480000



Key

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

Appendix B - Map 4
RUNSWICK BAY
Scarborough Borough Council Frontage
 Update Report
 'Partial Measures' Survey 2020

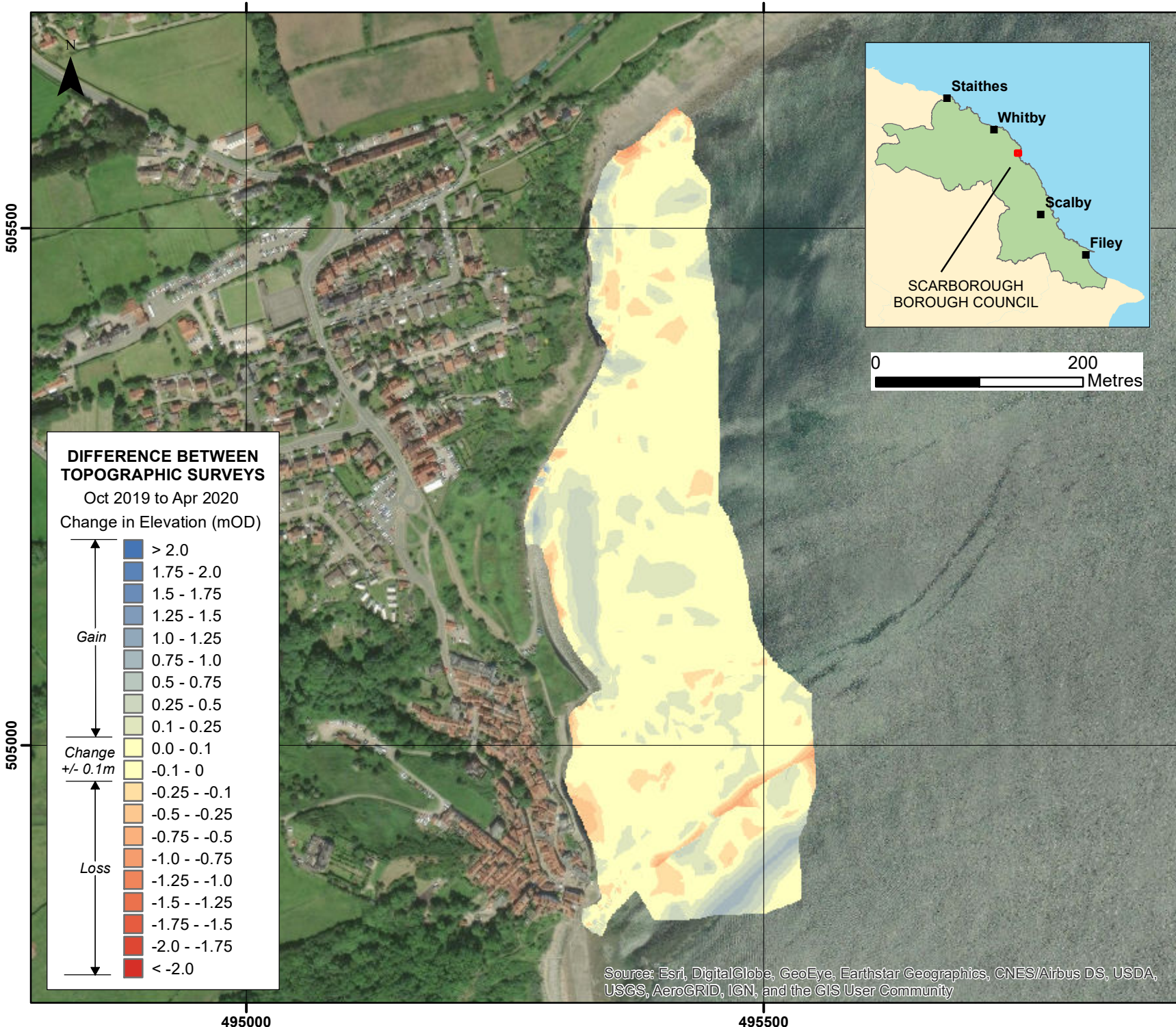
Drawing Scale at A4 1:4,000

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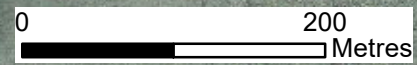
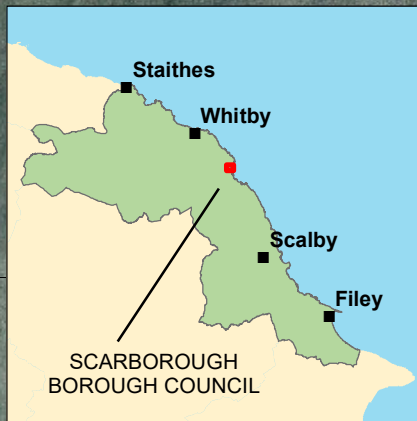


Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



DIFFERENCE BETWEEN TOPOGRAPHIC SURVEYS
 Oct 2019 to Apr 2020
 Change in Elevation (mOD)

Gain	> 2.0
	1.75 - 2.0
	1.5 - 1.75
	1.25 - 1.5
	1.0 - 1.25
	0.75 - 1.0
	0.5 - 0.75
	0.25 - 0.5
	0.1 - 0.25
	0.0 - 0.1
Change ± 0.1m	-0.1 - 0
	-0.25 - -0.1
	-0.5 - -0.25
	-0.75 - -0.5
	-1.0 - -0.75
	-1.25 - -1.0
	-1.5 - -1.25
	-1.75 - -1.5
	-2.0 - -1.75
	< -2.0
Loss	



Key

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

Appendix B - Map 5
ROBIN HOOD'S BAY
Scarborough Borough Council Frontage
 Update Report
 'Partial Measures' Survey 2020

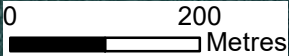
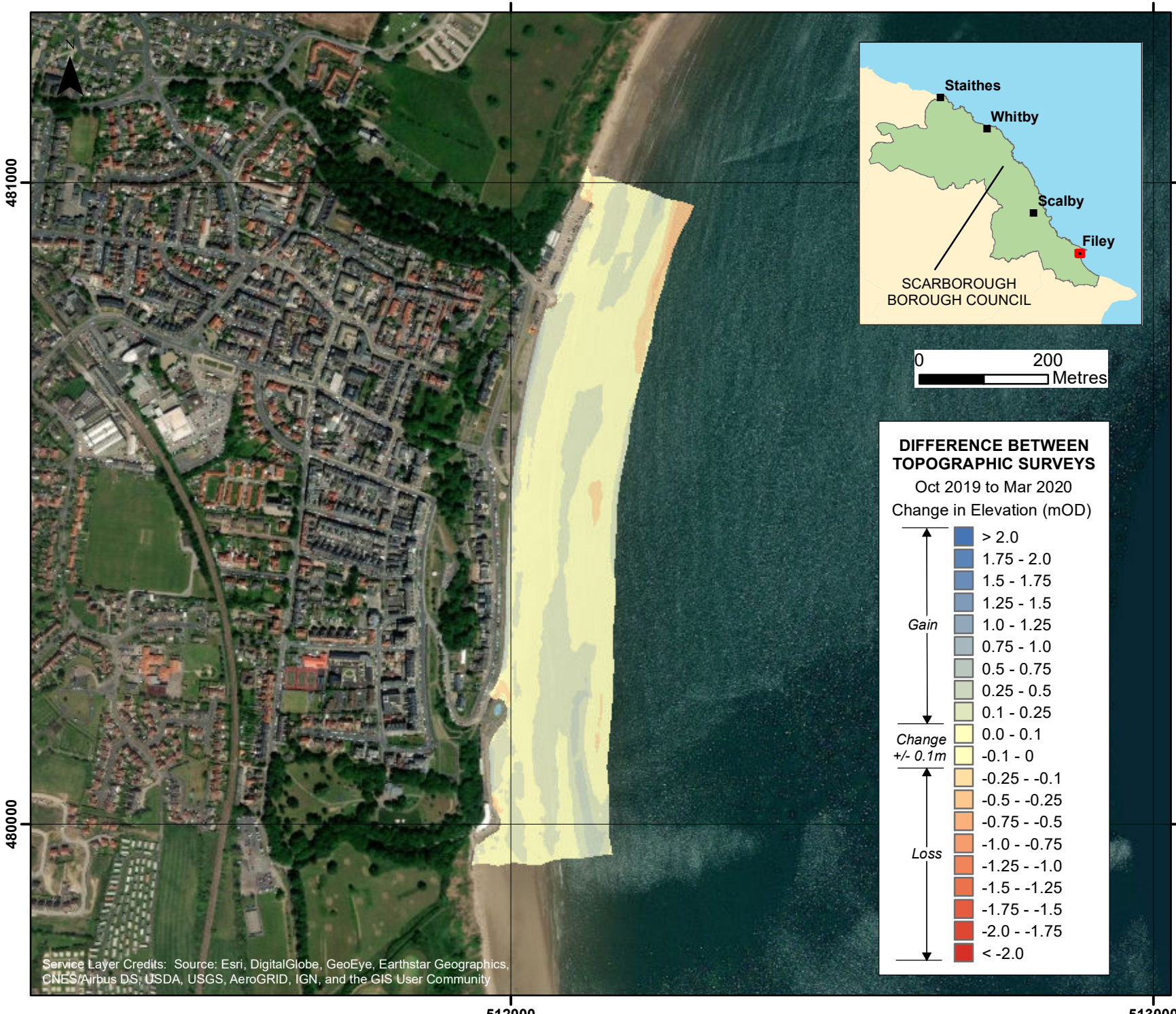
Drawing Scale at A4 1:5,000

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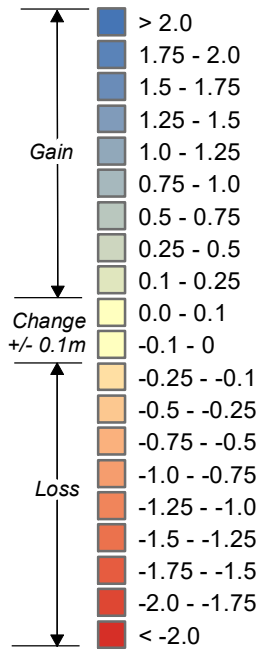
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DIFFERENCE BETWEEN TOPOGRAPHIC SURVEYS

Oct 2019 to Mar 2020

Change in Elevation (mOD)



Key

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

Appendix B - Map 6

FILEY BAY

Scarborough Borough Council Frontage

Update Report
 'Partial Measures' Survey 2020

Drawing Scale at A4 1:8,000

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Appendix C
Cliff Top Survey

Cliff Top Survey

Staithes

Twenty ground control points have been established at Staithes (Figure C1). The maximum separation between any two points is nominally 100m.

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 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	Oct 2019	March 2020	Nov 2008 – March 2020	Oct 2019 – March 2020	Nov 2008 – March 2020
1	477228	518769	320	1.90	-4.87	-4.90	6.80	0.03	0.57
2	477334	518798	0	10.90	10.78	10.66	0.24	0.12	0.02
3	477487	518789	350	7.10	8.09	8.00	-0.90	0.09	0.00
4	477594	518801	340	5.90	4.37	3.79	2.11	0.58	0.18
5	477683	518911	350	8.40	8.35	8.11	0.29	0.24	0.02
6	477792	518867	30	8.60	8.55	8.50	0.10	0.05	0.01
7	477891	518828	60	7.70	7.20	7.29	0.41	-0.09	0.03
8	477959	518873	350	8.70	9.56	9.50	-0.80	0.06	0.00
9	478088	518950	350	7.60	UTS	8.07	-0.47	UTS	0.00
10	478191	519023	340	8.40	UTS	9.59	-1.19	UTS	0.00
11	478237	519007	60	6.90	UTS	6.60	0.30	UTS	0.03
12	478213	518988	150	6.10	UTS	6.07	0.03	UTS	0.00

13	478501	518809	15	11.40	8.73	8.65	2.75	0.08	0.23
14	478624	518807	20	7.50	7.46	7.47	0.03	-0.01	0.00
15	478737	518858	60	6.10	6.26	6.32	-0.22	-0.06	0.00
16	478823	518757	60	8.00	8.50	8.46	-0.46	0.04	0.00
17	478944	518671	30	9.30	9.08	9.13	0.17	-0.05	0.01
18	479052	518630	20	9.20	9.18	9.25	-0.05	-0.07	0.00
19	479147	518610	0	14.20	14.36	14.04	0.16	0.32	0.01
20	479274	518618	20	11.40	11.34	11.14	0.26	0.20	0.02

Cliff Top Survey

Robin Hoods Bay

Thirteen ground control points have been established at Robin Hoods Bay (Figure C2). The maximum separation between any two points varies along the coast, reflecting the degree of risk from the erosion. The cliff top surveys at Robin Hoods Bay 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 C2 provides baseline information about these ground control points and results from the 2010 (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 C2 – Cliff Top Surveys at Robin Hoods Bay

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
ROBIN HOODS BAY				Mar 2010	Sep 2019	Apr 2020	Nov 2008 - April 2020	Sep 2019 - April 2020	Nov 2008 - April 2020
1	495799.5	506002.2	130	11.60	7.23	7.22	4.38	0.01	0.44
2	495549.2	505807.3	135	9.30	9.02	9.02	0.28	0.00	0.03
3	495456.3	505740	130	5.00	5.35	4.87	0.13	0.48	0.01
4	495389.9	505683.7	140	6.30	6.59	6.31	-0.01	0.28	0.00
5	495259.4	505342.5	130	11.30	13.13	14.00	-2.70	-0.87	0.00
6	495231.2	505315.7	95	5.90	5.80	5.73	0.17	0.07	0.02
7	495184.8	505210.7	85	6.40	7.32	7.14	-0.74	0.18	0.00
8	495206.5	505153	75	5.00	5.34	5.01	-0.01	0.33	0.00
9	495287.8	505060.5	80	4.30	4.69	4.30	0.00	0.39	0.00
10	495187.8	504708.8	70	3.10	2.45	2.39	0.71	0.06	0.07
11	495226.2	504615.7	120	3.80	3.30	3.97	-0.17	-0.67	0.00
12	495297.5	504380.2	80	11.00	11.04	10.99	0.01	0.05	0.00
13	495350.4	504193	55	3.70	3.80	3.75	-0.05	0.05	0.00

Cliff Top Survey

Scarborough South Bay

Thirteen ground control points have been established at Scarborough South Bay (Figure C3). The maximum separation between any two points varies along the coast, reflecting the degree of risk from the erosion. The cliff top surveys at Scarborough South Bay 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 C3 provides baseline information about these ground control points and results from the 2010 (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 C3 – Cliff Top Surveys at Scarborough South Bay

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
SCARBOROUGH SOUTH BAY				Mar 2010	Nov 2019	Apr 2020	Nov 2008 - Apr 2020	Nov 2019 - Apr 2020	Nov 2008 - Apr 2020
1	504339.5	487887.3	70	7.00	UTS	6.96	0.04	N/A	0.00
2	504422.3	487603.7	80	4.80	4.84	4.82	-0.02	0.02	0.00
3	504534.8	487318.3	40	15.10	15.11	14.88	0.22	0.23	0.02
4	504730.2	487137.9	55	9.60	9.65	9.65	-0.05	0.00	0.00
5	504922.9	486837.8	60	8.80	8.58	8.57	0.23	0.01	0.02
6	50571.1	486652.1	75	3.80	3.67	3.86	-0.06	-0.19	0.00
7	505284.3	486480	35	7.00	6.67	6.83	0.17	-0.16	0.02
8	505597.9	486363.4	30	8.60	8.46	8.56	0.04	-0.10	0.00
9	505758.6	486005.1	45	9.10	8.48	8.50	0.60	-0.02	0.06
10	505896	485889.6	15	14.80	14.70	14.68	0.12	0.02	0.01
11	505990	485657.1	80	4.70	1.08	1.10	3.60	-0.02	0.36
12	506024.9	485421.8	55	6.10	3.16	3.19	2.91	-0.03	0.29
13	506036	485315.3	90	7.00	7.00	7.06	-0.06	-0.06	0.00

Cliff Top Survey

Cayton Bay

Eight ground control points have been established at Cayton Bay (Figure C4). The maximum separation between any two points varies along the coast, reflecting the degree of risk from the erosion.

The cliff top surveys at Cayton Bay 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 C4 provides baseline information about these ground control points and results from the 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 C4 – Cliff Top Surveys at Cayton Bay

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
CAYTON BAY				Nov 2008	Nov 2019	Apr 2020	Nov 2008 - Apr 2020	Nov 2019 - Apr 2020	Nov 2008 - Apr 2020
1	506325.5	484849.7	50	4.00	3.57	3.91	0.09	-0.34	0.01
2	506459.4	484715.9	65	5.00	UTS	UTS	UTS	UTS	UTS
3	506597.4	484538.6	65	5.00	6.28	5.52	-0.52	0.76	0.00
4	506778.1	484345.5	21	9.00	5.87	5.86	3.14	0.01	0.26
5	507018.6	484221.6	342	7.70	8.03	8.06	-0.36	-0.03	0.00
6	507242.3	484121.7	2	7.40	5.88	5.91	1.49	-0.03	0.12
7	507518.2	484008.2	25	7.50	7.58	7.56	-0.06	0.02	0.00
8	507818.7	484006	1	5.50	5.40	5.78	-0.28	-0.38	0.00

Cliff Top Survey

Filey Bay

Twenty-eight ground control points have been established in Filey Bay (Figure C5 and C6). The maximum separation between any two points varies along the coast, reflecting the degree of risk from the erosion.

The cliff top surveys at Filey Bay 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 C5 provides baseline information about these ground control points and results from the 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 C5 – Cliff Top Surveys in Filey Bay

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
FILEY				Nov 2008	Sept 2019	March 2020	Nov 2008 - March 2020	Sep 2019 - March 2020	Nov 2008 - March 2020
1	512444.9	481630.9	130	8.70	8.40	8.44	0.26	-0.04	0.02
2	512306.7	481490.3	144	7.60	7.83	7.58	0.02	0.25	0.00
3	512153.6	481234.6	122	8.30	8.05	8.02	0.28	0.03	0.02
4	512029.2	480959.9	115	7.40	7.22	7.25	0.15	-0.03	0.01
5	511895.4	479888	89	7.10	UTS	UTS	UTS	UTS	UTS
6	511908.5	479597.1	48	6.70	5.47	5.63	1.07	-0.16	0.09
7	511991.4	479310.4	69	6.70	1.84	1.69	5.01	0.15	0.42
8	512083.4	478981.5	66	10.20	10.01	10.29	-0.09	-0.28	0.00
9	512121.3	478786.3	76	8.30	8.39	8.37	-0.07	0.02	0.00
10	512226.2	478547.9	74	7.50	5.85	5.75	1.75	0.10	0.15
11	512471.4	478153.5	53	6.60	6.65	6.67	-0.07	-0.02	0.00
12*	512558.9	477901.9	66	7.70	UTS	UTS	UTS	UTS	UTS

12A*	512655.8	477822.4	67	13.90	13.12	13.02	0.88	0.10	0.07
13**	512697.6	477719	34	4.20	UTS	UTS	UTS	UTS	UTS
13A*	512805.5	477572.1	32	13.42	13.06	10.49	2.93	2.57	0.24
14	512939.4	477400.9	66	8.00	6.38	6.51	1.49	-0.13	0.12
15	513157	477192.7	51	5.20	4.59	4.57	0.63	0.02	0.05
16	513299.5	477024.6	30	7.70	6.38	6.40	1.30	-0.02	0.11
17	513507.7	476821.1	34	10.70	10.33	10.20	0.50	0.13	0.04
18	513721	476602.3	31	7.20	6.08	6.12	1.08	-0.04	0.09
19	513916.6	476354.1	51	6.60	6.37	6.22	0.38	0.15	0.03
20	514174.8	476179.4	32	7.00	6.96	6.91	0.09	0.05	0.01
21	514471.5	475965.7	66	7.60	7.46	7.42	0.18	0.04	0.02
22	514656.2	475728.8	101	8.10	8.12	7.66	0.44	0.46	0.04
23	514889.5	475537.6	60	9.10	7.95	7.77	1.33	0.18	0.11
24*	512603.7	481665.9	14	19.90	19.80	19.86	0.04	-0.06	0.00
25*	512607.1	481648.9	184	17.20	16.95	16.93	0.27	0.02	0.02
26*	512301.9	481825.5	18	11.00	10.88	10.87	0.13	0.01	0.01
27*	512475.8	481712.1	20	11.60	11.51	11.61	-0.01	-0.10	0.00

NOTE: *base line for 12A and 24-27 is March 2011

**Surveyor's report has previously stated that 'VMP 13 was unable to be measured due to vegetation growth and land shape change'