



**Cell 1 Regional Coastal Monitoring Programme
Analytical Report 13: 'Full Measures' Survey 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)			
	River Tyne to Frenchman's Bay	Frenchman's Bay to Souter Point	Souter Point to Chourdon Point	Chourdon Point to Hartlepool Headland
1 in 200 year	3.41	3.44	3.66	3.91
HAT	2.85	2.88	3.18	3.30
MHWS	2.15	2.18	2.48	2.70
MLWS	-2.15	-2.12	-1.92	-1.90

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). Within this frontage the coastal landforms vary considerably, comprising low-lying tidal flats with fringing salt marshes, hard rock cliffs that are mantled with glacial sediment to varying thicknesses, softer rock cliffs and extensive landslide complexes.

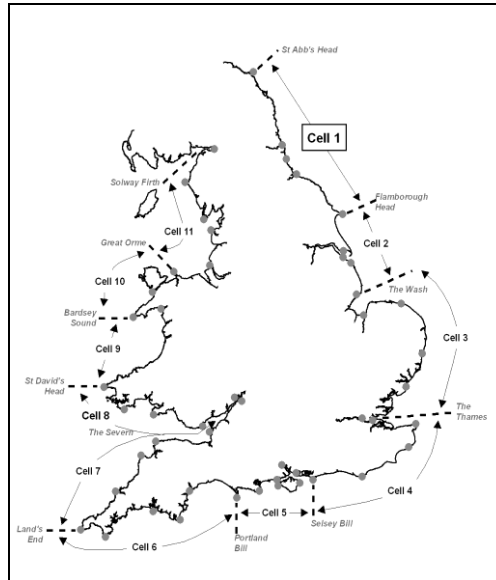


Figure 1 Sediment Cells in England and Wales

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





The main elements of the Cell 1 Regional Coastal Monitoring Programme involve:

- beach profile surveys
- topographic surveys
- cliff top recession surveys
- real-time wave data collection
- bathymetric and sea bed characterisation surveys
- aerial photography
- 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.

Each year, an Analytical Report is produced for each individual authority, providing a detailed analysis and interpretation of the 'Full Measures' surveys. This is followed by a brief Update Report for each individual authority, providing ongoing findings from the 'Partial Measures' surveys. Annually, a Cell 1 Overview Report is also produced. This provides a region-wide summary of the main findings relating to trends and interactions along the entire Cell 1 frontage.

To date the following reports have been produced:

Table 1 Analytical, Update and Overview Reports Produced to Date

Year		Full Measures		Partial Measures		Cell 1 Overview Report
		Survey	Analytical Report	Survey	Update Report	
1	2008/09	Sep-Dec 08	May 09	Mar-May 09		-
2	2009/10	Sep-Dec 09	Mar 10	Feb-Mar 10	Jul 10	-
3	2010/11	Aug-Nov 10	Feb 11	Feb-Apr 11	Aug 11	Sep 11
4	2011/12	Sep 11	Aug 12	Mar-May 12	Feb 13	
5	2012/13	Sept 12	Feb 13	Mar-Apr 13	May 2013	
6	2013/14	Oct 13	Feb 14	Mar-Apr 14	Jul 14	
7	2014/15	Nov 14	Feb 15	Mar15	Jun 15	
8	2015/16	Nov 15	Feb 16	Apr 16	Jul 16	Jun 16
9	2016/17	Aug / Sep 16	Jan 17	Mar 17	Jul 17	
10	2017/18	Sep 17	Feb 18	April 18	Jun 18	
11	2018/19	Oct & Dec 18	Jan 19	Apr 19	May 19	
12	2019/20	Oct & Nov 19	Jan 20	May 20	Jul 20	
13	2020/21	Oct 20	Jan 21(*)			

(*) The present report is **Analytical Report 13** and provides an analysis of the 2020 Full Measures survey for County Durham Council's frontage.

In addition, separate reports are produced for other elements of the programme as and when specific components are undertaken, such as wave data collection, bathymetric and sea bed sediment data collection, aerial photography, and walk-over visual inspections.

For purposes of analysis, the Cell 1 frontage has been split into the sections listed in Table 2.

Table 2 Sub-divisions of the Cell 1 Coastline

Authority	Zone
Northumberland County Council	Spittal A
	Spittal B
	Goswick Sands
	Holy Island
	Bamburgh
	Beadnell Village
	Beadnell Bay
	Embelton Bay
	Boulmer
	Alnmouth Bay
	High Hauxley and Druridge Bay
	Lynemouth Bay
	Newbiggin Bay
	Cambois Bay
Blyth South Beach	
North Tyneside Council	Whitley Sands
	Cullercoats Bay
	Tynemouth Long Sands
	King Edward's Bay
South Tyneside Council	Littehaven Beach
	Herd Sands
	Trow Quarry (incl. Frenchman's Bay)
	Marsden Bay
Sunderland Council	Whitburn Bay
	Harbour and Docks
	Hendon to Ryhope (incl. Halliwell Banks)
Durham County Council	Featherbed Rocks
	Seaham
	Blast Beach
	Hawthorn Hive
	Blackhall Colliery
Hartlepool Borough Council	North Sands
	Headland
	Middleton
	Hartlepool Bay
Redcar & Cleveland Borough Council	Coatham Sands
	Redcar Sands
	Marske Sands
	Saltburn Sands
	Cattersty Sands (Skinningrove)
Scarborough Borough Council	Staithes
	Runswick Bay
	Sandsend Beach, Uppang Beach and Whitby Sands
	Robin Hood's Bay
	Scarborough North Bay
	Scarborough South Bay
	Cayton Bay
	Filey Bay

1. Introduction

1.1 Study Area

Durham County Council's frontage extends from Ryhope Dene to Crimdon Beck. For the purposes of this report and for consistency with previous reporting, it has been sub-divided into five areas, namely:

- Featherbed Rocks
- Seaham (Dawdon)
- Blast Beach
- Hawthorn Hive
- Blackhall Colliery

1.2 Methodology

Along Durham County Council's frontage, the following surveying is undertaken:

- Full Measures survey annually (since 2008) each autumn/early winter comprising:
 - Beach profile surveys along nine transect lines
- Partial Measures survey annually (since 2009) each spring comprising:
 - Beach profile surveys along six transect lines
- Cliff top survey bi-annually at:
 - Seaham (Dawdon)

The location of these surveys is shown in Figure 2. The 2020 Full Measures survey was undertaken along the Seaham and Easington frontage on the 17th October 2020 and along the Blackhall frontage on the 16th October 2020. During the Seaham & Easington survey the weather was dry and overcast. The wind was force three from the north and the sea state was smooth. During the Blackhall survey, the weather was overcast with showers. The wind was force three from the north. The sea state was slight.

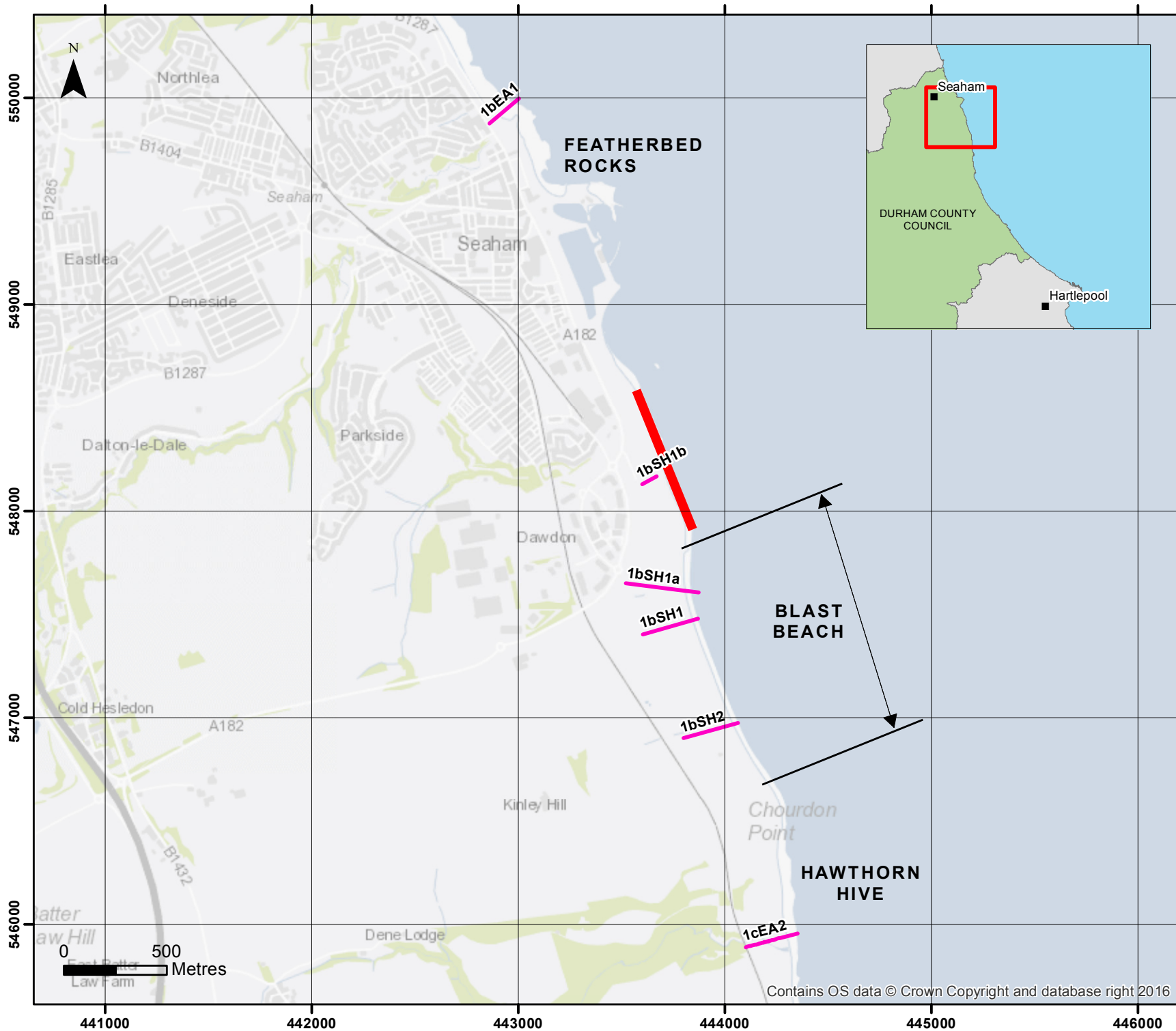
All data have been captured in a manner commensurate with the principles of the Environment Agency's *National Standard Contract and Specification for Surveying Services* and stored in a file format compatible with the software systems being used for the data analysis, namely SANDS and ArcGIS. This data collection approach and file format is comparable to that being used on other regional coastal monitoring programmes, such as in the South East and South West of England.

Upon receipt of the data from the survey team, they are quality assured and then uploaded onto the programme's website for storage and availability to others and also input to SANDS and GIS for subsequent analysis.

The Analytical Report is then produced following a standard structure for each authority. This involves:

- description of the changes observed since the previous survey and an interpretation of the drivers of these changes (Section 2);
- documentation of any problems encountered during surveying or uncertainties inherent in the analysis (Section 3);
- recommendations for 'fine-tuning' the programme to enhance its outputs (Section 4); and
- providing key conclusions and highlighting any areas of concern (Section 5).

Data from the present survey are presented in a processed form in the Appendices.



Key

SURVEY LOCATIONS

Topographic Profiles

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

Topographic Surveys

- 6 monthly (Green cross-hatch)
- yearly (Orange cross-hatch)
- 5 yearly (Brown cross-hatch)

Cliff Top Monitoring Pegs

- @ 300 (Red line)

(Indicative Survey Extents shown)

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Figure 2 - Map 1

Durham County Council Frontage

Analytical Report Topo Surveys

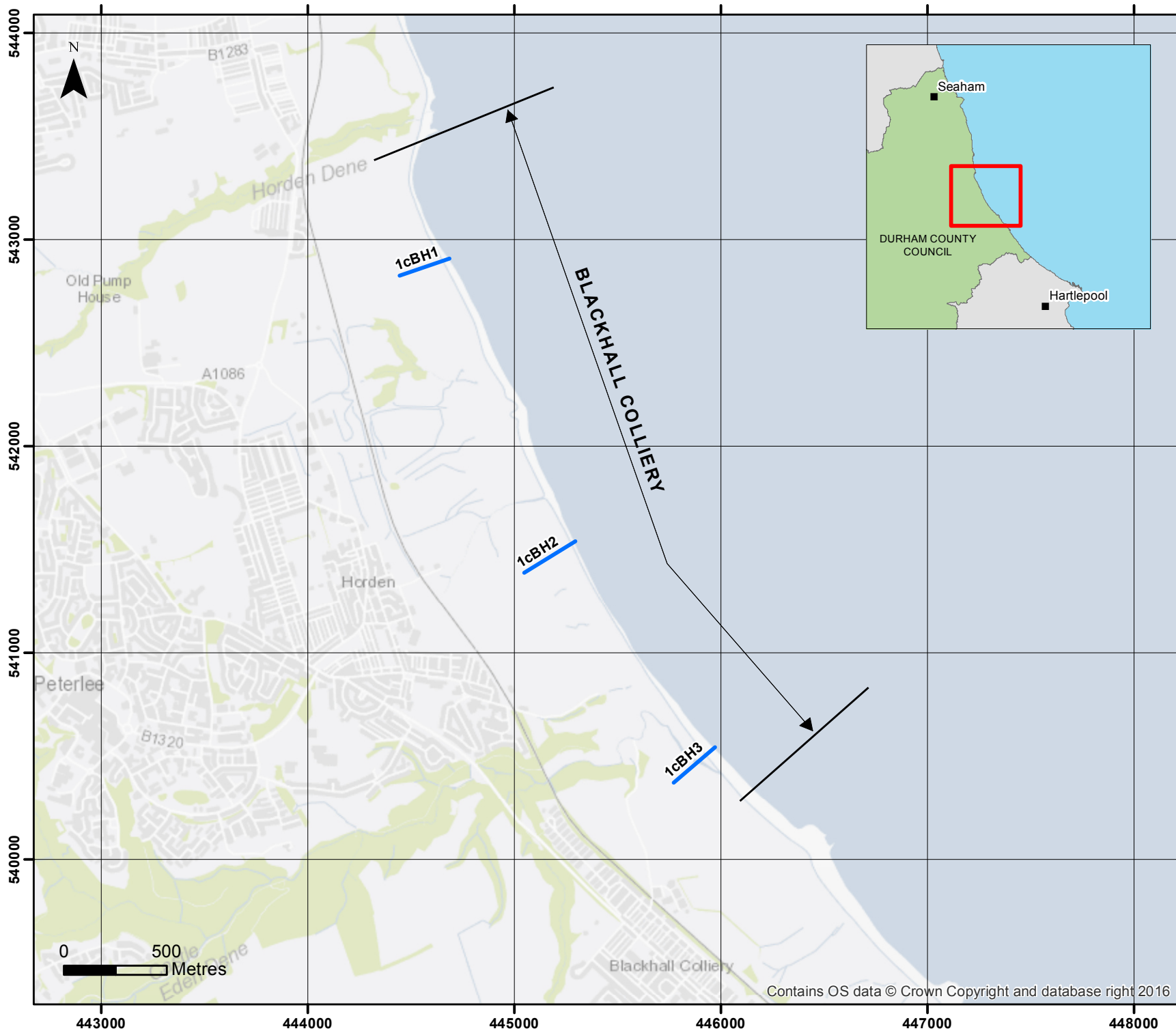
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Key

SURVEY LOCATIONS

Topographic Profiles

- Annual
- Bi-Annual

(Indicative Survey Extents shown)

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Figure 2 - Map 2

Durham County Council

Frontage

Analytical Report

Topo Surveys

Drawing Scale at A4 1:25,000

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Key
 ● Cliff Top Survey Locations

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

Figure 3 - Map 1

SEAHAM

Durham County Council Frontage

Cliff Top Survey Locations

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

2. Analysis of Survey Data

2.1 Featherbed Rocks

Survey Date	Description of Changes Since Last Survey	Interpretation
17 th October 2020	<p>Beach Profiles:</p> <p>One beach profile line 1bEA1, located at Featherbed Rocks (Appendix A), has been monitored since April 2009. The profile extends across the cliff top and cliff face then extends across the promenade (chainage 55), rock armour sea defence (chainage 55 to 80) and beach. At the base of the sea wall rock armour extends as far as 80m chainage. Beyond 80m there has been little change over the summer of 2020, the beach profiles reflect the rocky nature of the foreshore and that there is no beach over the shore platform. Previous surveys have shown accumulations of material at the base of the revetment, but this has not been present since the 2012 Full Measures survey.</p>	<p>The rocky nature of this foreshore means it is unlikely to undergo significant changes in morphology unless sediment is deposited upon it. A veneer beach has previously been present here but has not been recorded since the 2012 Full Measures survey.</p> <p>Longer term trends: Between 2010 and 2012 a thin veneer beach was present. Since 2013 the profiles recorded have all been low exposing the rocky shore platform along much of its length.</p>

2.2 Seaham (Dawdon)

Survey Date	Description of Changes Since Last Survey	Interpretation
<p>17th October 2020</p>	<p>Cliff-top Survey:</p> <p>Three ground control points have been established along the cliff top at Dawdon (Figure B1). The separation between any two points is nominally 300m. These cliff top surveys are intended to inform on erosion rates of the undefended sea cliffs extending south of the rock armour revetment to the south of Seaham Harbour.</p> <p>The cliff top surveys at Dawdon are undertaken bi-annually. Measurements are taken from a fixed ground control point along a fixed bearing to the edge of the cliff top. Appendix B provides information about the ground control points and results from between the 2008 (baseline) cliff top survey and the current (October 2020) survey.</p> <p>Between May 2020 and November 2020 none of the posts showed any significant (>0.1m) movement.</p> <p>Appendix C provides results from the October 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.</p>	<p>None of the three monitoring locations showed any significant retreat (>0.1m) during summer and autumn 2020 indicating the cliffs have been locally stable.</p> <p>Longer term trends: Long-term recession rates calculated from the data collected since November 2008 show retreat at 0.1m/yr. for Point 1 and 0.1m/yr. at Point 3 at the margins of the bay and no change at Point 2 in the centre of the bay.</p>

2.3 Blast Beach

Survey Date	Description of Changes Since Last Survey	Interpretation
17 th October 2020	<p>Beach Profiles:</p> <p>Blast Beach is covered by four beach profile lines (Appendix A). All of the profiles along Blast Beach exhibit similar forms, with a rock cliff, wide colliery spoil beach with a distinct low cliff at its eroding seaward edge, and a mixed gravel and sand foreshore extending to MLW. The survey report notes that; <i>'dense vegetation restricts access to the cliff tops of section SH1 and SH1A and the cliff bottom of SH1A'</i> and <i>'SH2 cliff top vegetation has made it [the cliff top] no longer safe to survey'</i>.</p> <p>Profile 1bSH1b was added to the programme during the Full Measures survey in October 2015. The profile is adjacent to the sewage works south of Seaham. The profile is cliff to 30m and then gravel beach between 30m and 60m chainage. The 2020 Full Measure Survey showed that there has been 0.6m of accretion in level from the toe of the cliff and across the upper beach between chainage 30m and 37m. Across the remainder of the upper beach profile between chainage 37m and 60m there has been erosion of up to 0.2m in level. Seaward of the two concrete blocks (shown on the profiles as a protrusion in the profile between 59m and 63m chainage) there has been little change. There has been some erosion of up to 0.4m in level of previously accreted material on the foreshore between chainage 70m and 78m. Elsewhere on the lower beach the rocky foreshore remains exposed. It is worth noting that the Full Measures 2020 survey extends a further 25m seawards than the Partial Measures 2020 survey, although the more recent survey profile remains well within the range of previously recorded results.</p> <p>Profile 1bSH1a was added to the programme during the Full Measures survey in September 2009. It is located to the north of the previously-established 1bSH1. The upper beach has a very similar profile to the previous year as far as the eroding face of the spoil deposit at 140m chainage. Between 140m chainage and 180m the beach face has been eroded by 0.8m in level which since the previous Spring 2020 Partial Measures survey. This has resulted in a landward retreat of up to 8m across the face of the mid-beach from the eroding spoil face up to chainage 175m. From 175m chainage to the end of the survey at chainage 2360m, the rocks are exposed across the foreshore. The autumn 2020 profile is at the low end of the range of previously recorded profiles, with the section between the chainages of 146m and 175m being the lowest on record.</p>	<p>The cliffs behind Blast Beach are currently inactive because they are fronted by colliery spoil. The crest of the spoil material on profiles 1bSH1 and SH1a has remained stable since 2009. Profile 1bSH2 has been progressively eroding since 2009, however has remained more stable since November 2014 showing ongoing accretion in the lower beach.</p> <p>There has been little net change since the May 2020 survey for profiles 1bSH1b and 1bSH1 and 1bSH2. Profile 1bSH1a appears to have been affected more significantly by erosion.</p> <p>At profile 1bSH1 the beach has experienced some lowering across the mid-beach.</p> <p>The beach at profile SH2 has shown an increase in level in its mid and lower sections, whilst the upper beach levels remain stable.</p> <p>Longer term trends: The sea cliffs will eventually reactivate as on-going erosion of the colliery spoil removes the protection it affords to the cliffs. This is most likely to occur at the southern end of the bay where the spoil is most rapidly eroding. The accumulating sediment seaward of the colliery spoil in the northern part of the bay will offer the cliffs more protection. However, since the winter of 2014 there has been a reversal in the trend with erosion in the north of the bay and accretion in the south; this may yet be a short-term change.</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>There has been no change to profile 1bSH1 up to chainage 80m. There has been no discernible change to the cliff face or the shallow trench which runs along the upper beach. Photographs of the profile show attenuated water in this trench. At chainage 80m there has been erosion of up to 0.2m on the upper slopes of the spoil face. This drawdown of material from the upper sections has caused accretion of 0.4m in level on the mid-beach leading to formation of a small berm between chainage 85m and 93m. Seawards from this point to chainage 125m there has been a consistent erosion of 0.6m in level. At the most seaward end of the profile, from chainage 125m to the end of the survey at chainage 146m, the rocky foreshore remains exposed. The profile is at a low level compared the range recorded from previous surveys, with the section between chainage 100m and chainage 125m being the lowest on record. It is also notable that the toe of the steadily eroding beach face is now at its most landward position.</p> <p>At profile 1bSH2 the survey report notes that vegetation of the cliff top has meant that the cliff top is no longer safe to survey. This has resulted in anomalous readings on the profile between chainage 64m and the toe of the cliff at chainage 95m. Between the toe of the cliff and the crest of the of upper beach there has been a small amount of erosion of up to 0.3m in level. At the crest of the upper beach there are two anomalous readings between chainage 110m and 115m. The survey photographs show the beach to be boulder strewn in this location and the readings are likely caused by changes in the position of these boulders. The crest in the beach has shown progressive net erosion since 2009, with the crest retreating landwards by around 30m. However, the 2020 Full Measures survey shows that the crest has remained stable over the summer and autumn of 2020. Seawards from the crest between chainage 118m and 130m there has been a small amount of accretion of 0.1m in level. Seawards from chainage 130m the level of accretion increases to 0.6m from chainage 130m to 160m before decreasing to 0.4m from chainage 160m until the end of the survey at chainage 190m. Overall, the profile is at a medium level compared to the range recorded from previous surveys with the crest of the upper beach being the highest recorded reading between chainage 110m and 120m.</p>	

2.4 Hawthorne Hive

Survey Date	Description of Changes Since Last Survey	Interpretation
17 th October 2020	<p>Beach Profiles:</p> <p>Hawthorne Hive is monitored by beach profile 1cEA2 (Appendix A). The survey report notes “<i>unable to measure start of Section EA2 as the vegetation has choked out the section line and route over cliff faces</i>” and therefore all surveys following October 2012 start at 95m chainage.</p> <p>In previous years there was a channel which crossed the profile; however, since April 2013 it has been infilled. There has been some periodic accretion of up to 0.4m in level on the upper beach at the landward end of the profile between chainage 100m and 106m and again between chainage 108m and 120m. The lower mid-beach between chainage 120m and 145m has experienced a more consistent low level of erosion of between 0.1m and 0.2m. The rocky foreshore remains exposed from chainage 150m to the end of the survey at chainage 280m. Overall, the profile is at a medium level when compared to the range recorded from previous surveys.</p>	<p>The beach levels in October 2020 appear to have remained relatively stable since the previous survey (May 2020). Longer term trends: The upper beach level has recovered since the lows of 2014. In December 2018 it was recorded that beach levels were notably low, 10 months later in October 2019 the beach levels have largely recovered and have remained relatively stable since then. Limited cliff erosion occurs in this section and therefore sediment supply is limited to erosion of colliery spoil. Storm events which may block the channel and varying flows in Hawthorne Burn are likely to continue to episodically block the channel and change its course across the beach.</p>

2.5 Blackhall Colliery

Survey Date	Description of Changes Since Last Survey	Interpretation
16th October 2020	<p>Beach Profiles:</p> <p>Blackhall Colliery is covered by three beach profile lines (Appendix A). As at Blast Beach, profiles are dominated by colliery spoil and exhibit similar forms with a rock cliff, wide spoil beach with a distinct cliff at the eroding face of the colliery spoil, and a gravel and sand foreshore that extends to MLW. The survey report notes that the surveyor was <i>'unable to survey part of section BH1 and BH2 due to dense vegetation'</i> furthermore, the surveyor was <i>'unable to survey part of section BH3 due to deep water at the back of the beach'</i>.</p> <p>1cBH1 is located near Horden Point and the Full Measures 2020 survey shows that the profile has remained stable up to the toe of the cliff at chainage 115m. Between chainage 115m and the crest of the upper beach at chainage 131m there has been no discernible change. Across the face of the colliery spoil there has been some slumping and erosion, between chainage 140m and 150m there has been a reduction in level of 1m. Elsewhere across the profile, from chainage 150m to around chainage 200m there has been some movement across the rocky foreshore. From chainage 215m to the end of the survey at chainage 250m there appears to have been accretion of beach material, forming a lower beach berm. Overall, the profile is at a high level on the upper and lower beach and a low level across the upper beach when compared to the range recorded in previous surveys. Due to the continued loss of material from the mid beach the section of beach between chainage 1380m and 180m is at its lowest recorded level, and there are other sporadic instances of extremely low levels across the lower-mid beach when compared with the range of previously recorded results. This drawdown of material has caused the lower beach between chainage 230m and 250m to be at its highest recorded level.</p> <p>Profile 1cBH2 exhibits no change in the cliff profile. The cliffed-edge of the spoil beach has retreated landwards by approximately 1m since November 2019. There is around 35m of material from the eroding face at the back of the beach to the cliff toe. From the toe of the spoil face at chainage 160m across the upper beach to chainage 200m there has been a consistent erosion of 0.3m in level which is leading to recession of the beach face. Seawards of chainage 200m to chainage 261m the level of erosion increases to 0.5m. The toe of the beach from chainage 261m until the end of the survey at chainage 310m has experienced some seaward progradation, Meaning the lower beach has extended</p>	<p>Profile 1cBH1 shows slumping and accumulation across the spoil face with the beach profile continuing to become shallower year on year. No significant retreat of the spoil face was recorded in October 2020; however, the changes are in line with the general trend of retreat.</p> <p>1cBH3 shows continued migration of the Castle Eden Burn channel and the beach face is dominated by erosion. Profile 1cBH2 is also dominated by erosion, though to a less significant extent.</p> <p>Each of the three profiles has experienced accretion on the lower beach, caused by the slumping and drawdown of material from the spoil slope.</p> <p>There has been little change to the gradients of the profiles.</p> <p>Longer term trends: The surveys show that the spoil beach along much of the Blackhall Colliery shore is progressively eroding but continues to protect the cliffs in the short term. The spoil face has now moved landward by between 10m and 30m (since 2008), and now lies seaward of the cliff toe by approximately 8m to 40m.</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>seaward by around 50m since the previous survey. The profile is generally low when compared with the range of previously recorded results. Between chainages 160m and 260m and again between chainages 275m and 310m the profile is at its lowest recorded level. The crest of the upper beach, to the rear of the eroding spoil face remains at a high level and between chainages 140m and 155m the profile is at its highest recorded level.</p> <p>The profile 1cBH3 shows that since 2008 there has been episodic migration, infilling and scouring of the outflow of Castle Eden Burn, which crosses the profile. There appears to have been erosion of the cliff toe since November 2019. However, from inspection of the October 2020 survey photographs it appears that water levels in the Castle Eden Burn channel during the 2020 survey were lower than in the November 2019 survey and this has enabled a more accurate survey of the channel edge. As such it is not thought that the toe of the cliff has experienced any erosion since the previous survey. The seaward edge of the channel is marked by a shallow berm, the 2020 Full Measure survey records; no change to the landward face of the berm, erosion of 0.3m to the crest, and accretion to the seaward face. The seaward face of the berm, between chainages 171m and 210m has experienced accretion of up to 0.6m. The lower beach from chainage 210m to 240m has experienced erosion of up to 1m. Seawards of this point, at the toe of the profile between chainages 240m and 275m, a very shallow platform of material has accumulated. Overall, the profile is generally at a low level compared to the range recorded from previous surveys because of the progressive recession of this beach and the landward migration of the Burn channel. Between chainage 210m and 240m the profile is at its lowest recorded level, whereas between chainages 151m and 152m and again between chainages 260m and 275m the profile is at its highest recorded level.</p>	

3. Problems Encountered and Uncertainty in Analysis

The cliff top position surveys at Dawdon are assumed to have a limit of accuracy of $\pm 0.1\text{m}$ due to the techniques used. The accuracy of short-term recession data are therefore limited, but longer-term recession rates will become more reliable as further data is obtained (see section 1.3).

At Blast Beach 1bSH1, 1bSH1A and 1bSH2 there was no access to the cliff top and at the cliff bottom of 1bSH1A due to dense vegetation.

At Hawthorne Hive the surveyor was unable to measure the start of Section 1cEA2 as the vegetation has choked out the section line and route over cliff faces.

At Blackhall the surveyor was unable to access part of sections 1cBH1 and 1cBH2 due to dense vegetation. The surveyor was also unable to survey part of Section BH3 due to deep water at the back of the beach.

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

No changes are recommended at the present time.

5. Conclusions and Areas of Concern

- At Featherbed Rocks the rocky shore platform continues to be exposed and the veneer beach present in earlier surveys has been absent since autumn 2012.
- At Seaham cliffs there has been recession along ground control points 1 and 3 at the margins of the bay of 0.1m/yr since the records began in November 2008. No significant change has occurred at ground control point 2 at the centre of the bay. Further years of data collection will help to understand the long term trends on these cliffs and the stability of the bay.
- At the Blast Beach colliery spoil still prevents the sea from acting directly at the natural cliff toe; however, it can be expected that the cliffs will reactivate in coming years following erosion of the spoil deposit. Since winter 2014 there has been a reversal in the long-term trends with erosion at the northern end of the bay and accretion at the southern end, which makes it more difficult to predict which section of cliff will reactivate first.
- On the 26th November 2019, Teesside Live reported that a section of clifftop footpath north of Hartlepool had been closed due to cracks appearing close to the cliff edge. The National Trust issued a statement on social media alerting the public to the dangers in this location: *"Please be aware – a section of the coastal footpath near Easington Colliery car park is becoming unsafe due to ongoing erosion, heading north / left as you join the path from the car park"* the statement goes on to say that *"access to the beach has not been affected"* and *"please take care if walking in this areas, particularly during poor weather"*. Currently the only monitoring undertaken of this section of cliff is the bi-annual walkover survey undertaken as part of the Cell One Coastal Monitoring Programme. It is recommended that this section of footpath is diverted landward into the adjacent farm land. Furthermore, it is also recommended that this section of cliff line and beach is observed closely by The National Trust due to the risk to the public and proximity to the popular car park and nature reserve at Easington.
- At Hawthorne Hive the levels on the foreshore have recovered since April and November 2014 and have remained stable since the previous survey in May 2020, they are now in the middle of the range of recorded beach levels. However, it is likely that the long-term trend of progressive erosion will continue on this profile.
- At Blackhall Colliery, the seaward face of the colliery spoil deposit continues to erode in the northern part of the bay. In the south of the bay, mound of beach material continues

to erode, and the channel has been moving landward. The channel is likely to scour the beach sediments under high flows, but become infilled again by wave action under storm conditions.

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: 1bEA1

Date: 17/10/2020 Inspector: AG

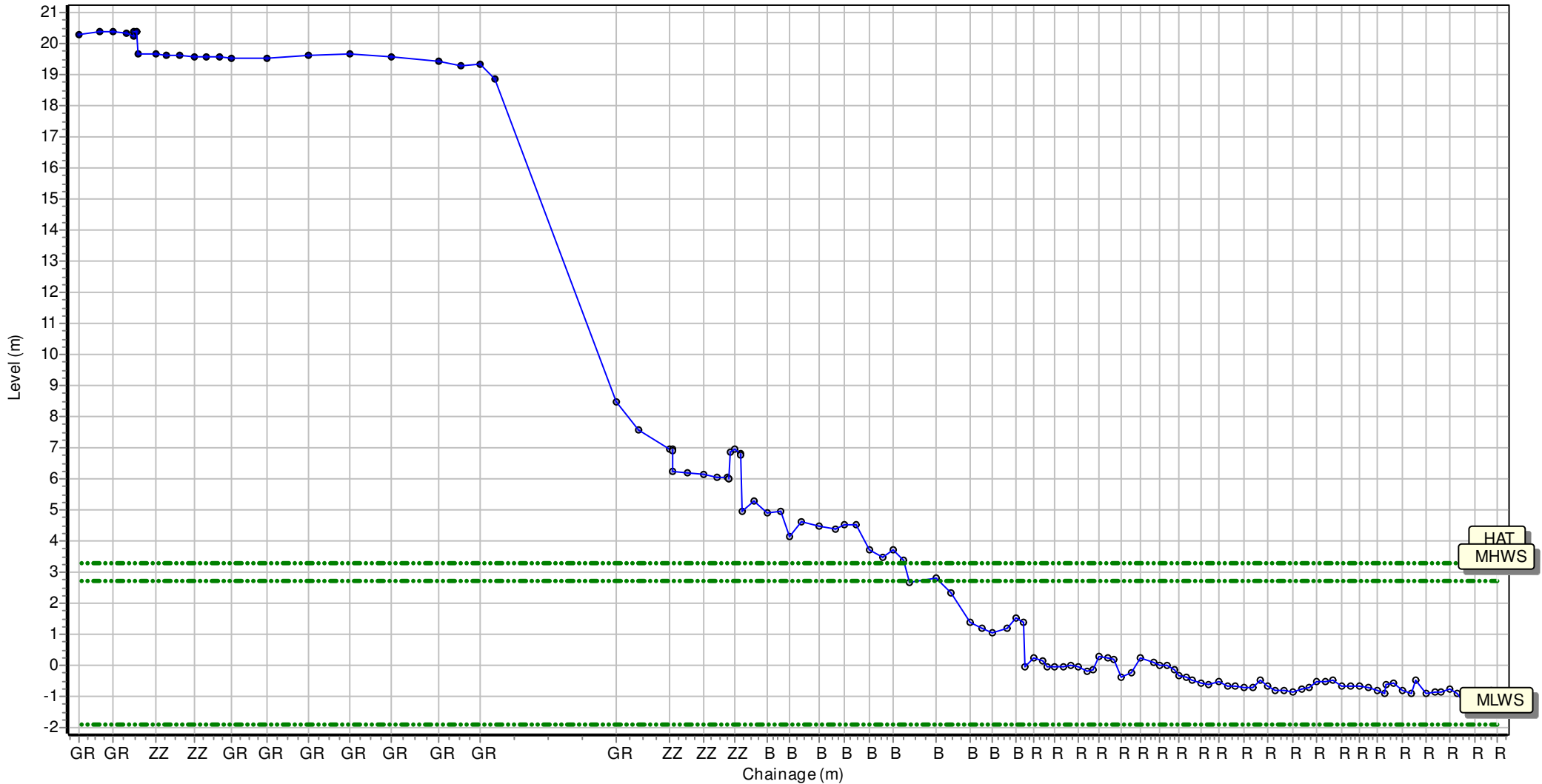
Low Tide: Low Tide Time:

Wind Sea State:

Visibility: Rain:

Summary: 2020 Full Measures Topo Survey

Easting: 442861.92 Northing: 549874.593 Profile Bearing: 50 ° from North



Beach Profile

Location: 1bSH1B

Date: 17/10/2020

Inspector: AG

Low Tide:

Low Tide Time:

Wind

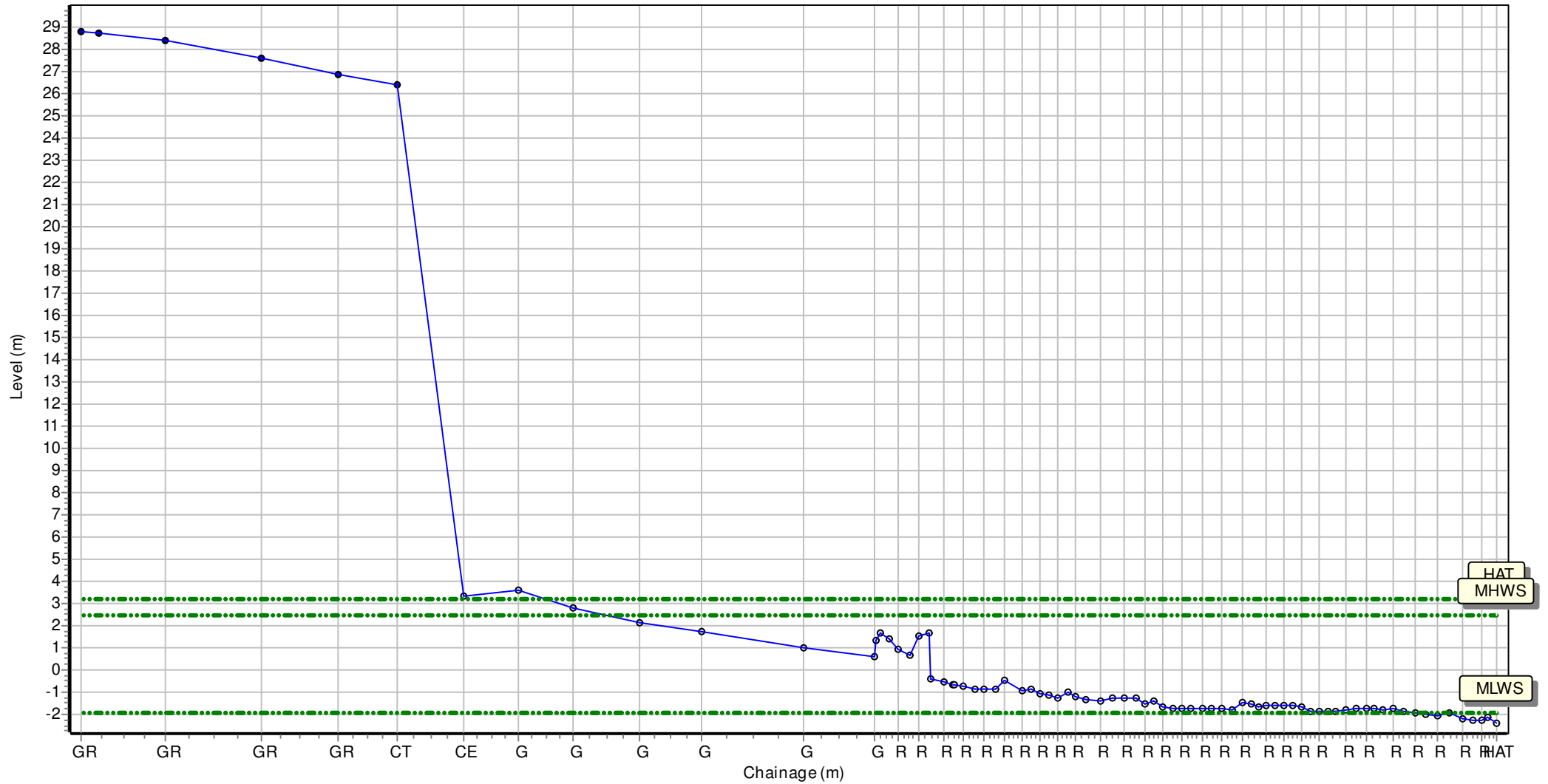
Sea State:

Visibility:

Rain:

Summary: 2020 Full Measures Topo Survey

Easting: 443599.944 Northing: 548130.378 Profile Bearing: 63 ° from North



Beach Profile

Location: 1bSH1A

Date: 17/10/2020

Inspector: AG

Low Tide:

Low Tide Time:

Wind

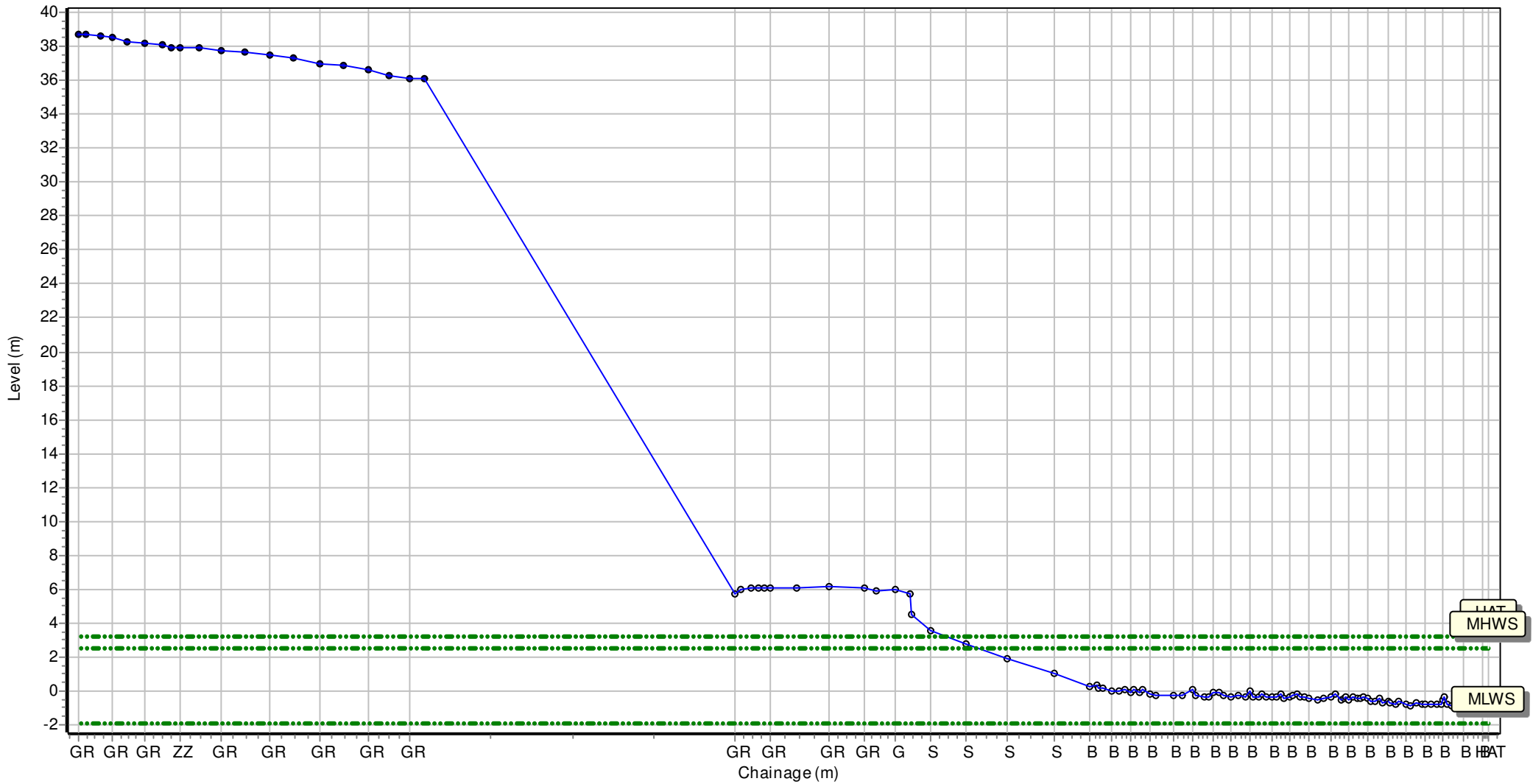
Sea State:

Visibility:

Rain:

Summary: 2020 Full Measures Topo Survey

Easting: 443519.427 Northing: 547648.502 Profile Bearing: 97 ° from North



Beach Profile

Location: 1bSH2

Date: 17/10/2020

Inspector: AG

Low Tide:

Low Tide Time:

Wind

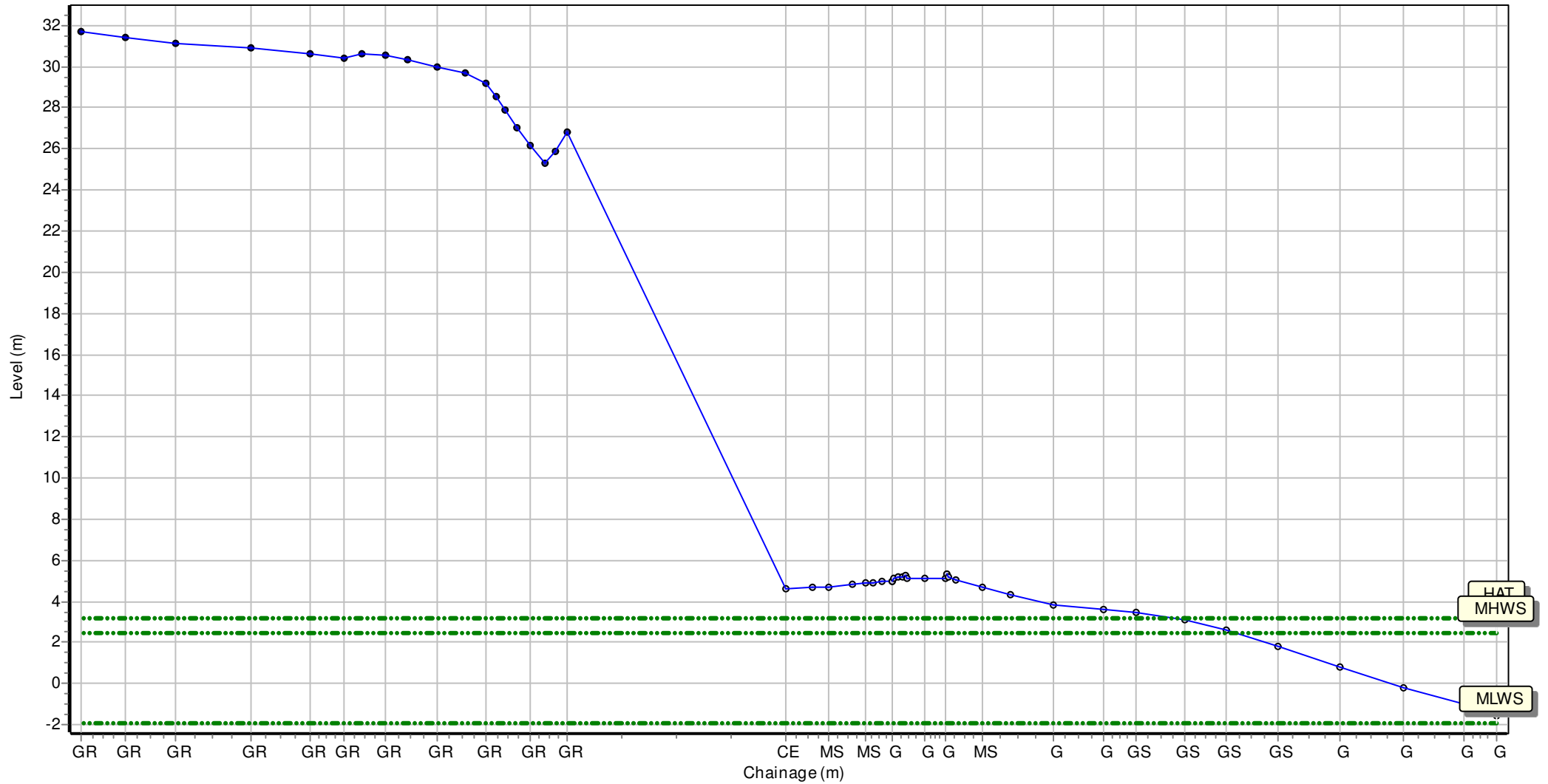
Sea State:

Visibility:

Rain:

Summary: 2020 Full Measures Topo Survey

Easting: 443806.533 Northing: 546899.552 Profile Bearing: 74 ° from North



Beach Profile

Location: 1cEA2

Date: 17/10/2020

Inspector: AG

Low Tide:

Low Tide Time:

Wind

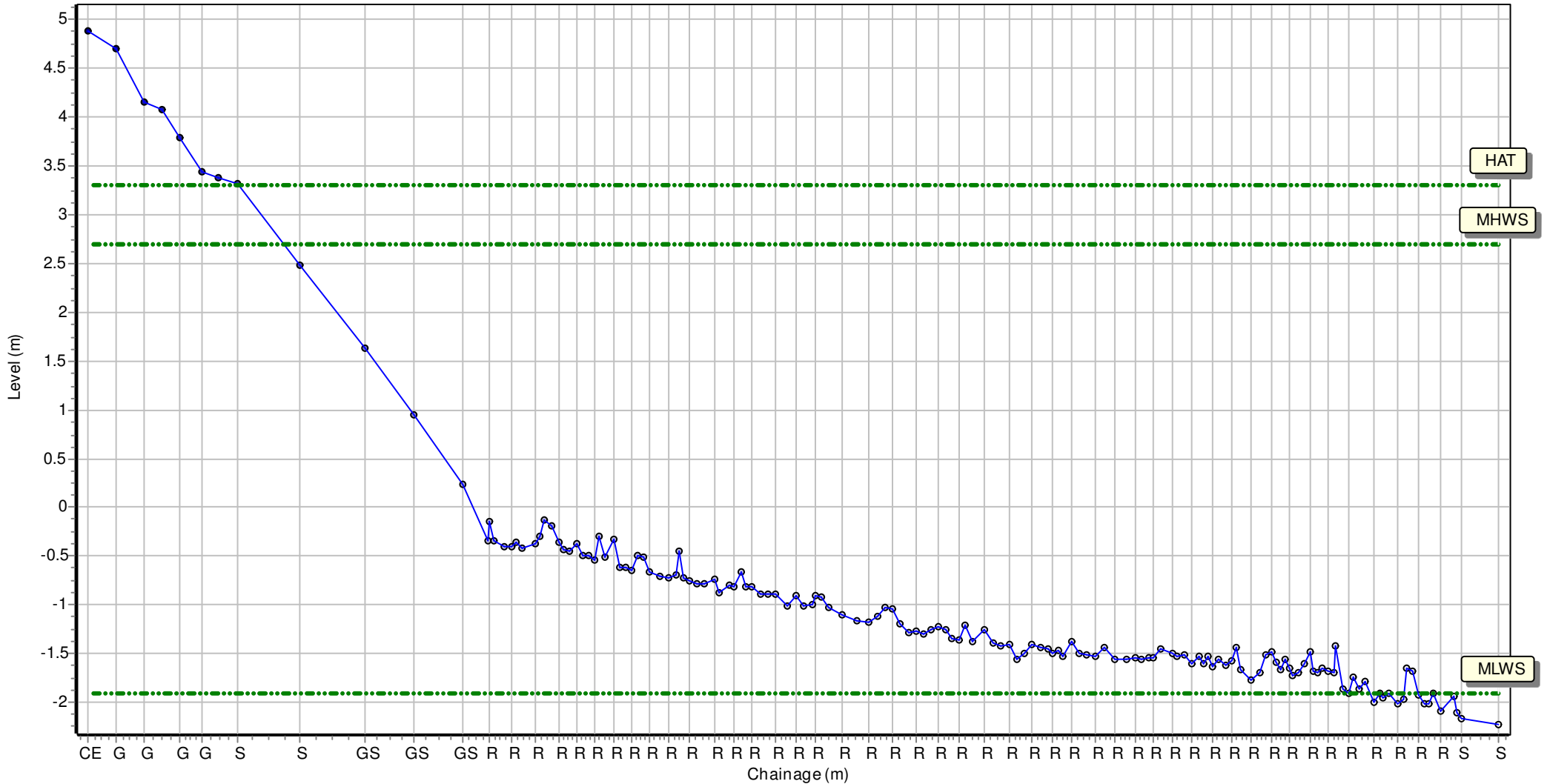
Sea State:

Visibility:

Rain:

Summary: 2020 Full Measures Topo Survey

Easting: 444101.532 Northing: 545888.48 Profile Bearing: 75 ° from North



Beach Profile

Location: 1cBH1

Date: 16/10/2020 Inspector: AG

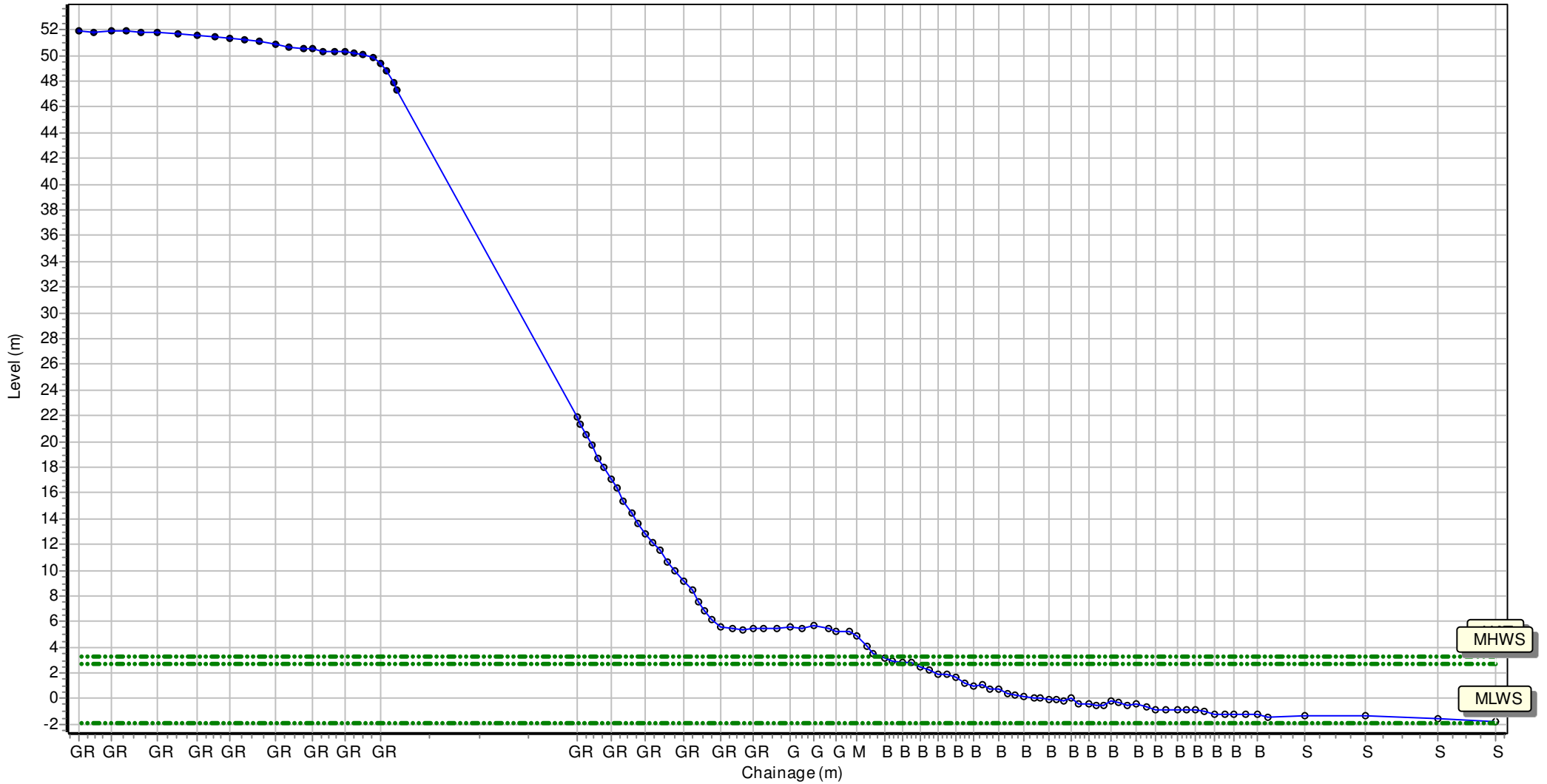
Low Tide: Low Tide Time:

Wind Sea State:

Visibility: Rain:

Summary: 2020 Full Measures Topo Survey

Easting: 444443.313 Northing: 542826.089 Profile Bearing: 71 ° from North



Beach Profile

Location: 1cBH2

Date: 16/10/2020 Inspector: AG

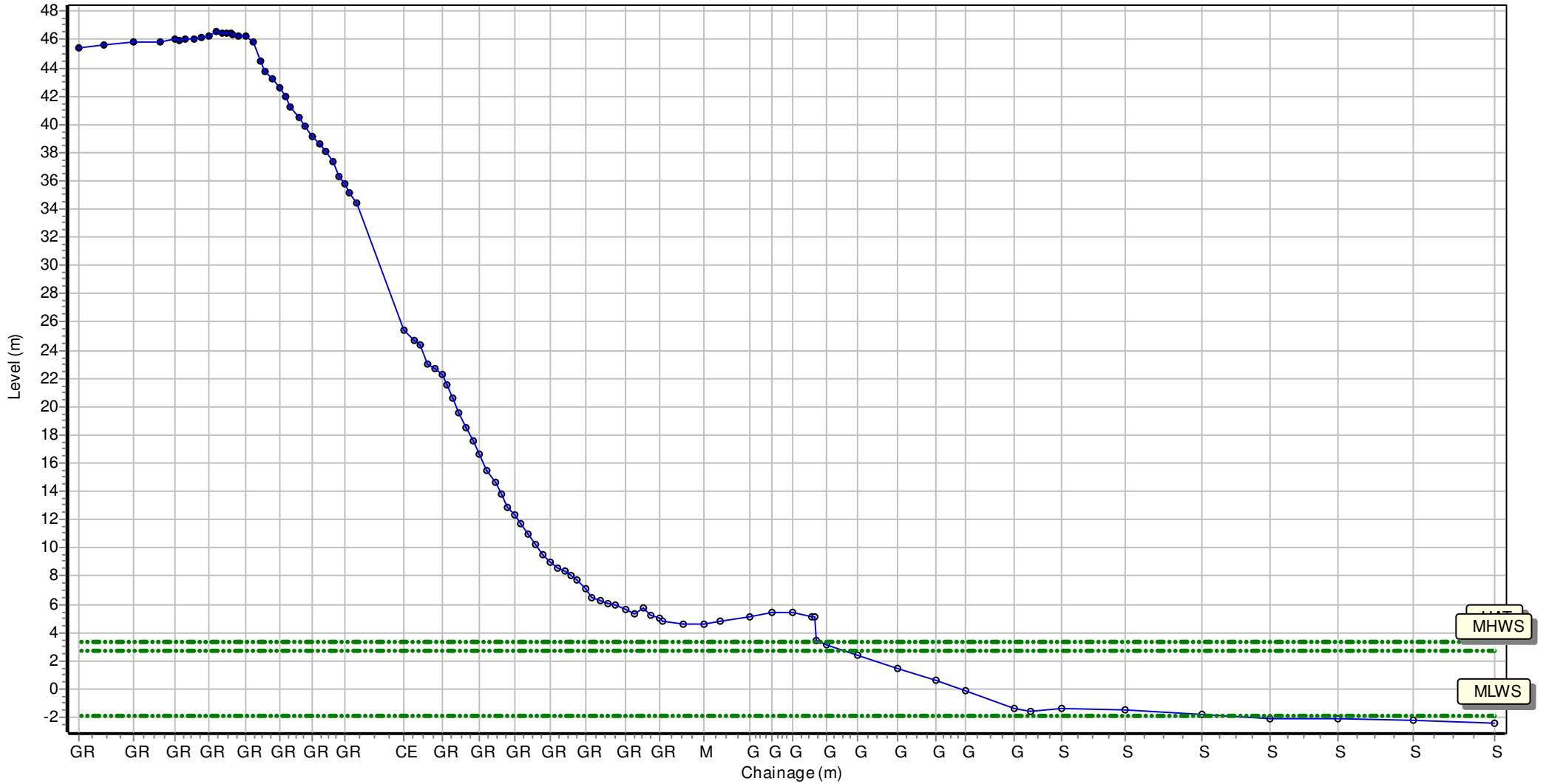
Low Tide: Low Tide Time:

Wind Sea State:

Visibility: Rain:

Summary: 2020 Full Measures Topo Survey

Easting: 445046.836 Northing: 541386.805 Profile Bearing: 58 ° from North



Beach Profile

Location: 1cBH3

Date: 16/10/2020

Inspector: AG

Low Tide:

Low Tide Time:

Wind

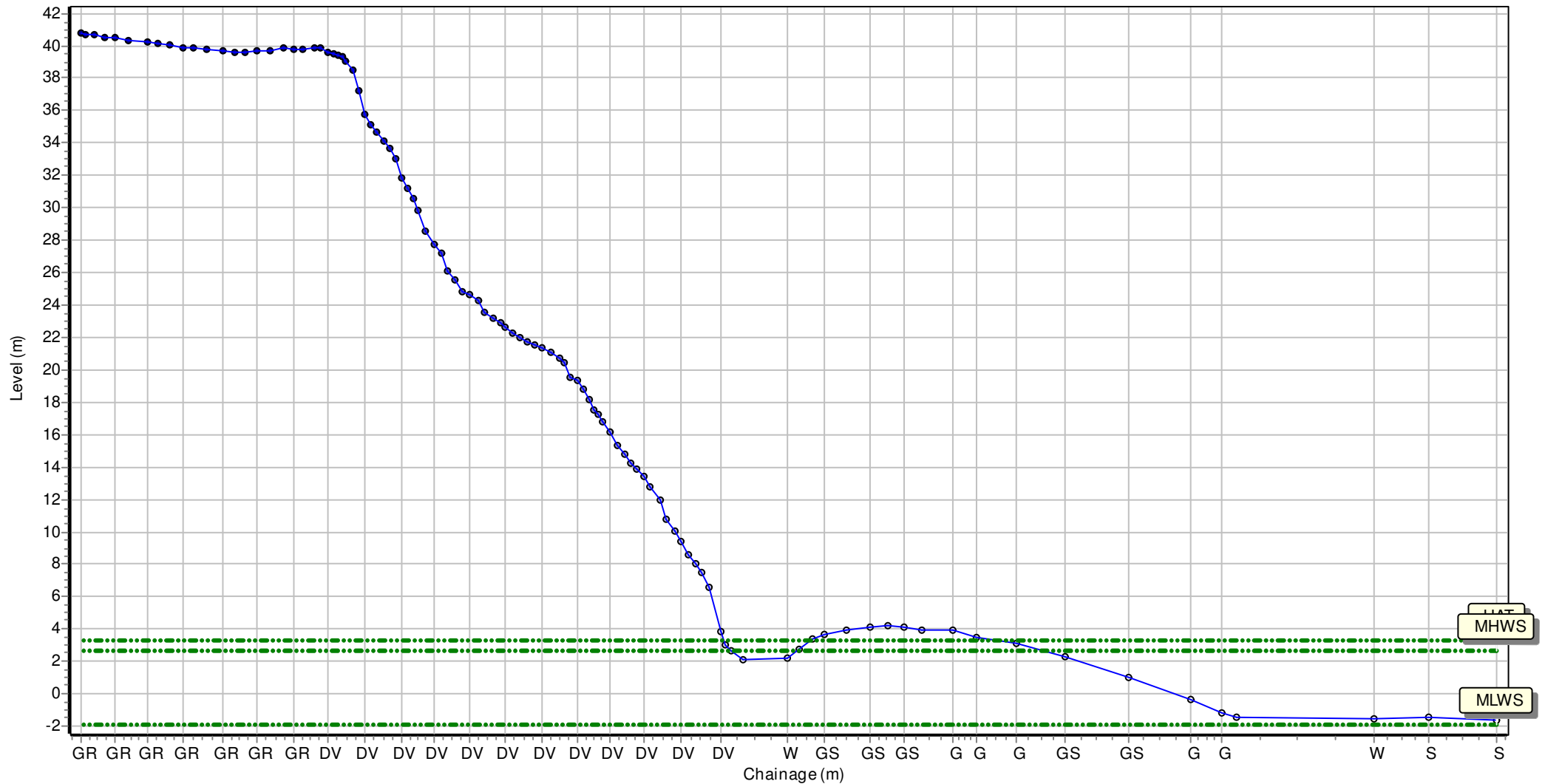
Sea State:

Visibility:

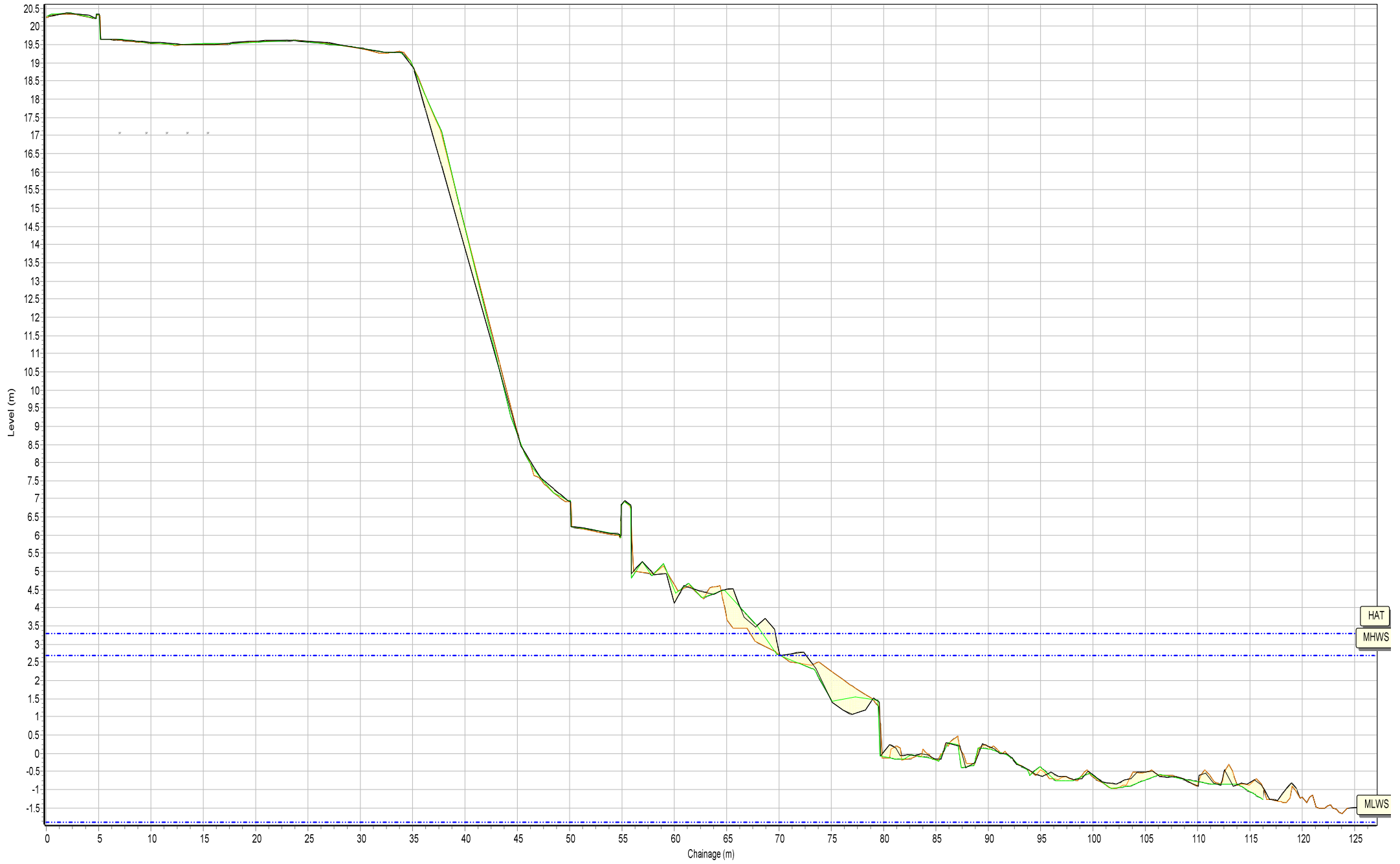
Rain:

Summary: 2020 Full Measures Topo Survey

Easting: 445771.315 Northing: 540371.473 Profile Bearing: 49 ° from North



Beach Profiles: 1bEA1

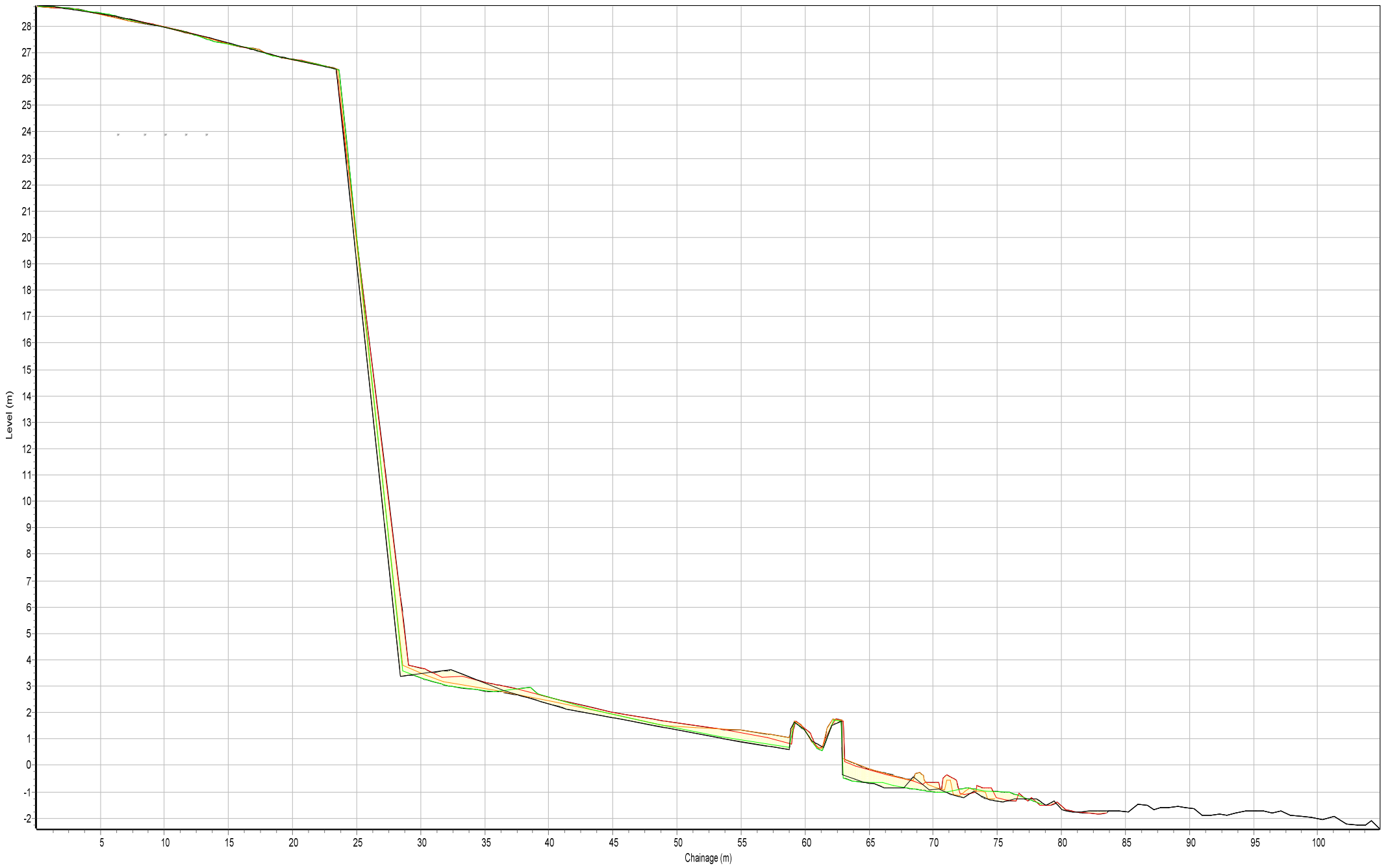


HAT
MHWS

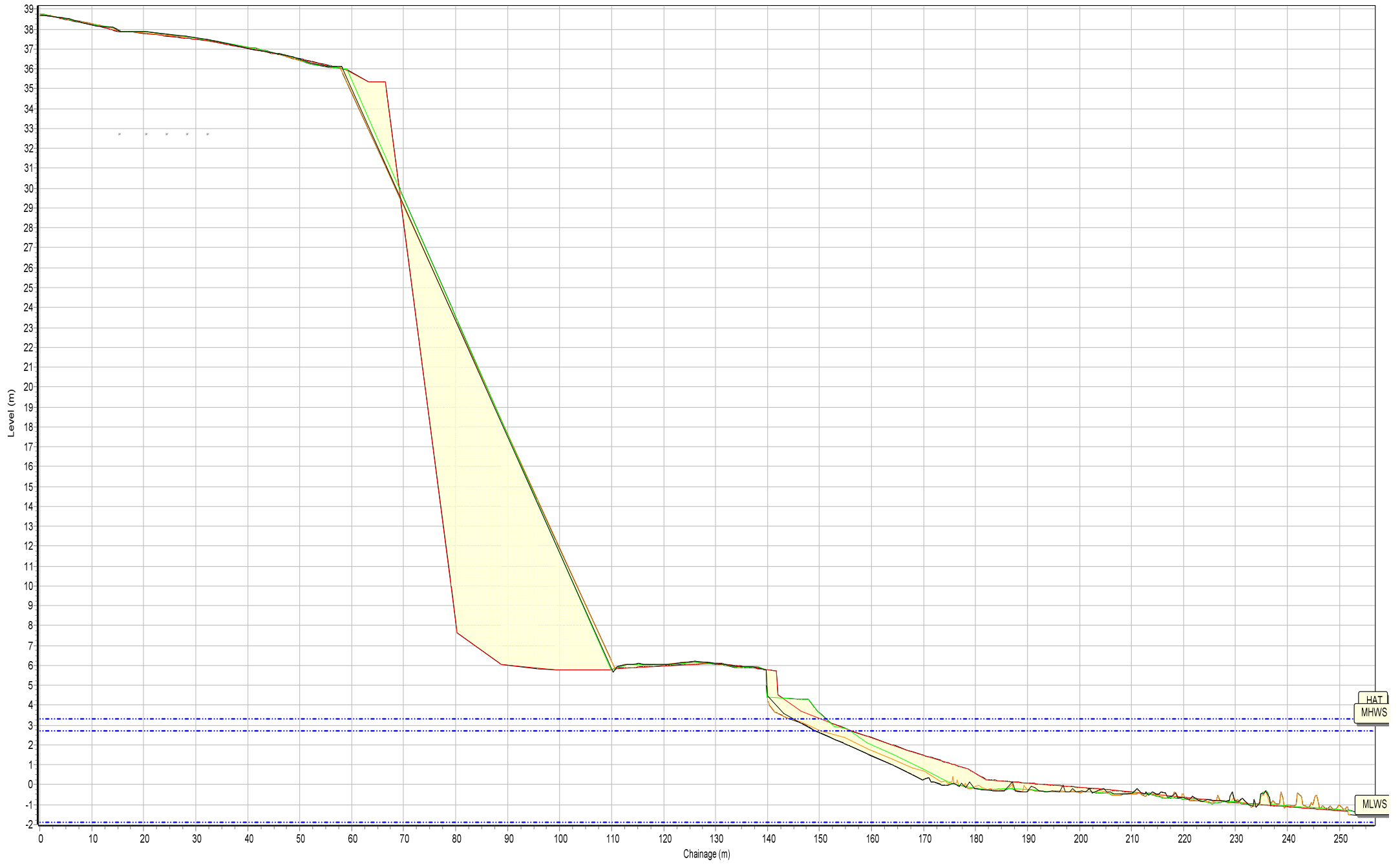
MLWS

SANDS

Beach Profiles: 1bSH1B



Beach Profiles: 1bSH1A



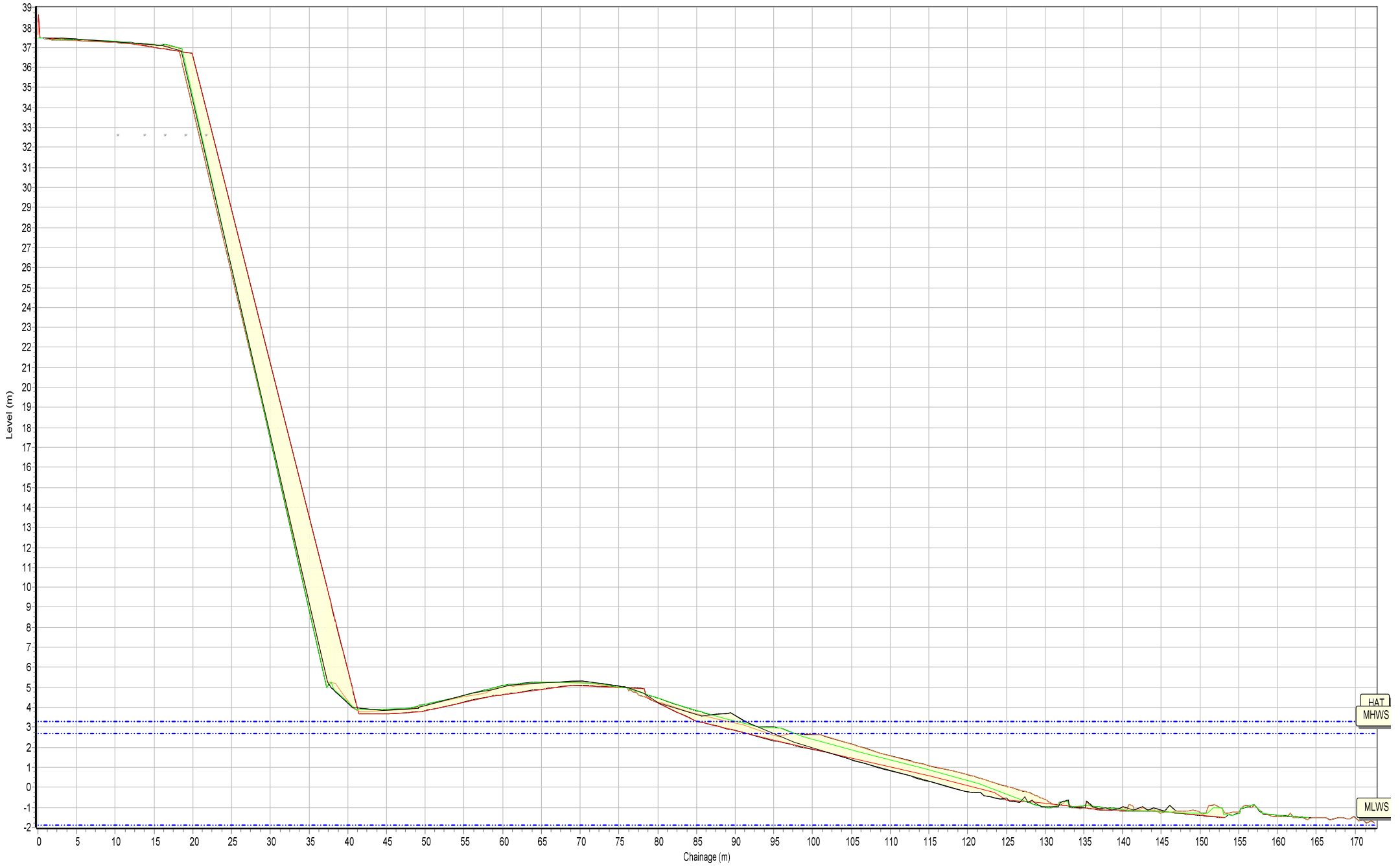
Profiles Envelope 21/10/2009 14/10/2019 23/05/2020 17/10/2020

HAT
MHWS

MLWS

SANDS

Beach Profiles: 1bSH1



HAT
MHWS

MLWS

SANDS

Beach Profiles: 1bSH2

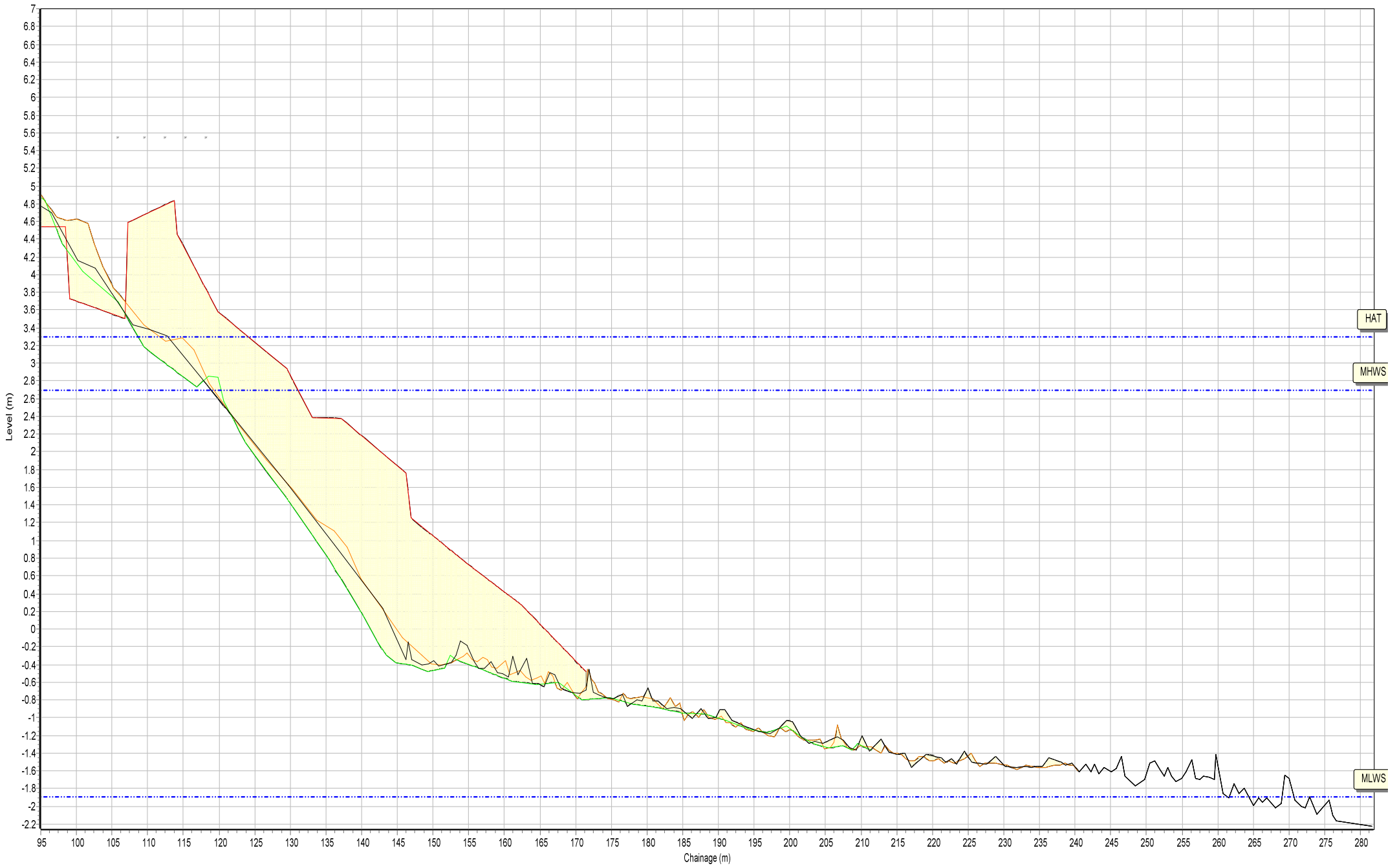


HAT
MHWS

MLWS

SANDS

Beach Profiles: 1cEA2



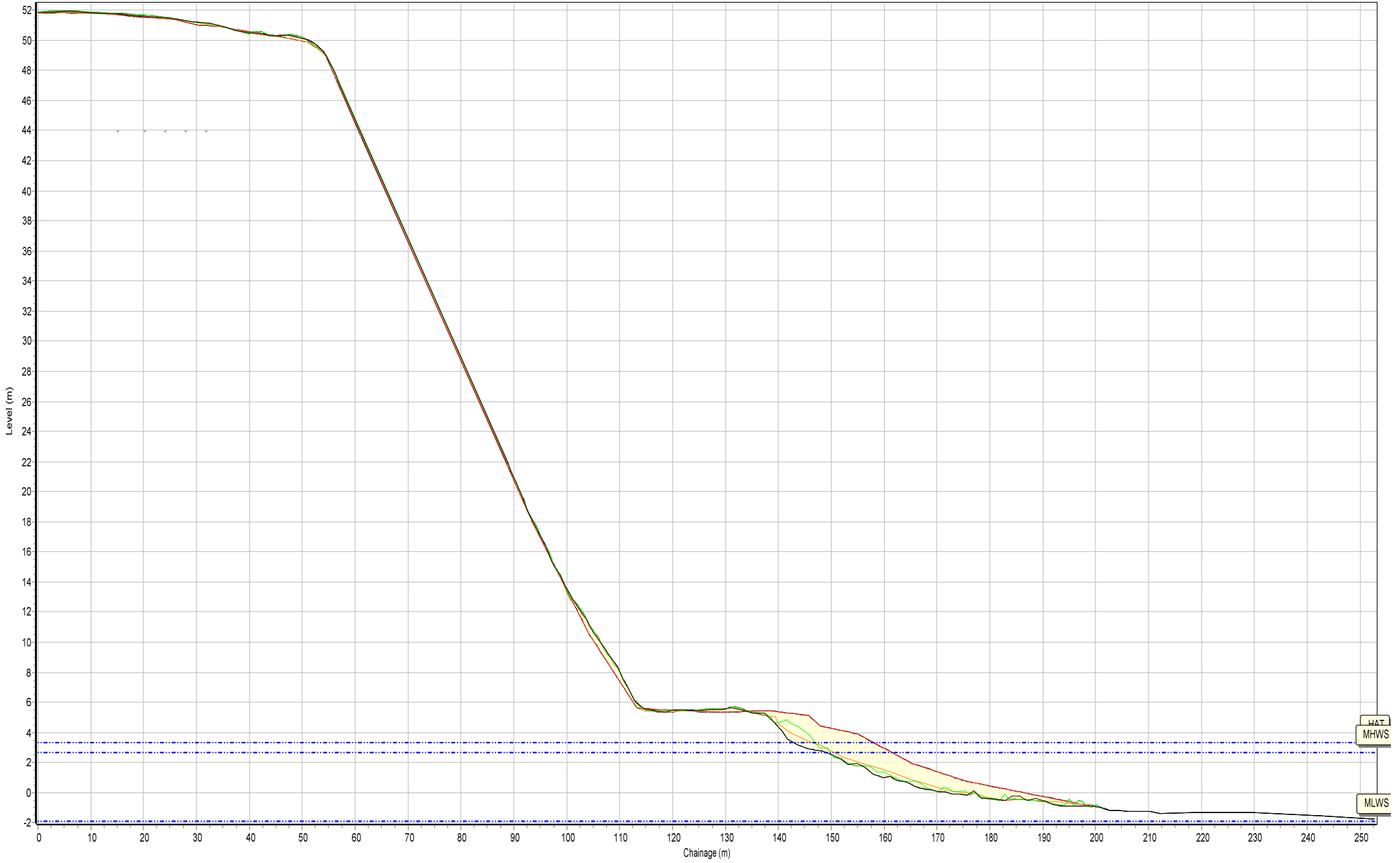
HAT

MHWS

MLWS

SANDS

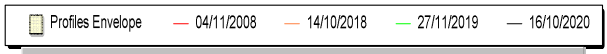
Beach Profiles: 1cBH1



HAT
MHWS
MLWS

SANDS

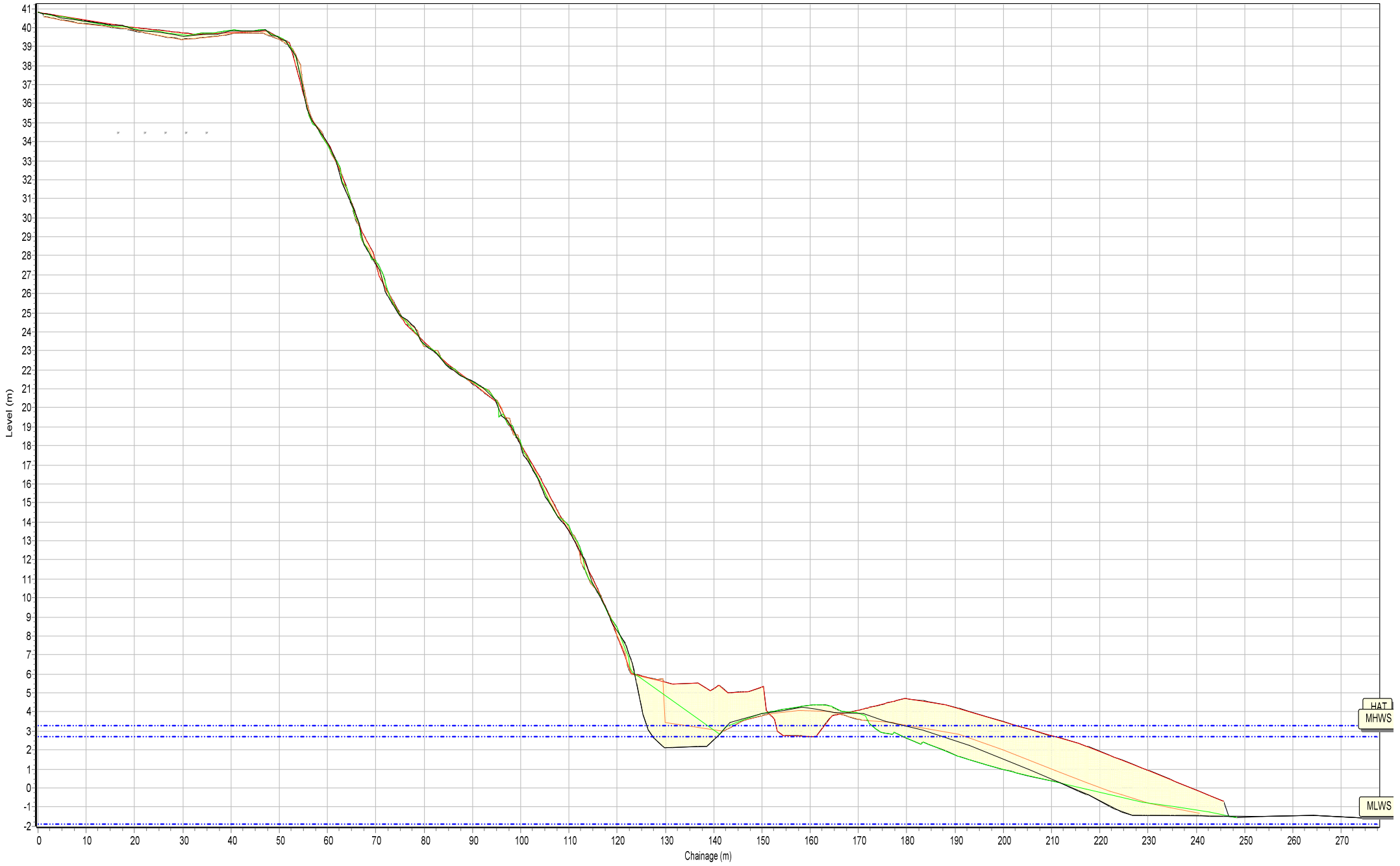
Beach Profiles: 1cBH2



HAT
MHWS
MLWS

SANDS

Beach Profiles: 1cBH3



HAT
MHWs
MLWS

SANDS

Appendix B
Cliff Top Survey

Cliff Top Survey

Seaham

Three ground control points have been established on the Seaham frontage (Figure B1). The maximum separation between any two points is nominally 300m.

The cliff top surveys at Seaham are undertaken biannually. Measurements are taken from a fixed ground control point along a fixed bearing to the edge of the cliff top.

Table B1 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 B1 – Cliff Top Surveys at Seaham

Ground Control Points				Distance to Cliff Top (m)			Total Erosion (m)		Erosion Rate (m/year)
Ref	Easting	Northing	Bearing	Baseline Survey	Previous Survey	Present Survey	Baseline to Present	Previous to Present	Baseline to Present
			(°)	Nov 2008	May 2020	Oct 2020	Nov 2008 - Oct 2020	May 2020 - Oct 2020	Nov 2008 - Oct 2020
1	443515.4	548421.7	70	16.1	15.04	14.99	1.11	0.05	0.10
2	443607.8	548136.3	90	13.3	13.24	13.26	0.04	-0.02	0.00
3	443756.1	547858.5	95	14.8	13.55	13.58	1.22	-0.03	0.12

