



Cell 1 Regional Coastal Monitoring Programme Analytical Report 14: 'Full Measures' Survey 2021



Durham County Council

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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)
	Featherbed Rocks to Blackhall Colliery
HAT	3.0
MHWS	2.5
MHWN	1.4
MLWN	-0.7
MLWS	-2.0

Source: UKHO Admiralty Tide Tables, 2020

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.

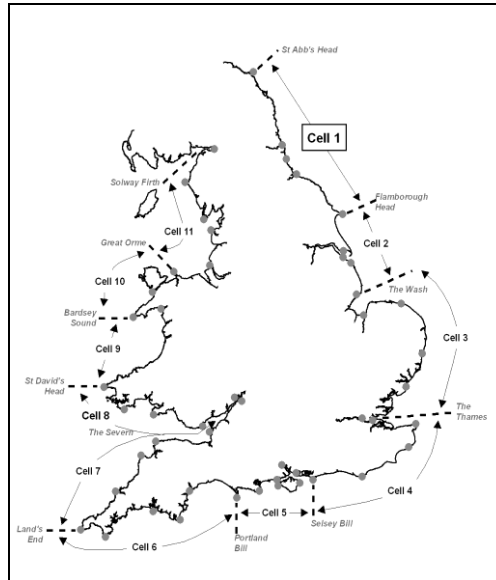


Figure 1 Sediment Cells in England and Wales

The programme commenced in its present guise in September 2008¹ and is managed by Scarborough Borough Council on behalf of the North East Coastal Observatory. It is funded by the Environment Agency, working in partnership with the following organisations:



¹ Prior to 2008, coastal monitoring was undertaken on a consistent basis across Northumberland and North Tyneside as part of the (then) Northumbrian Coastal Authorities Group's monitoring programme which commenced in 2002, whilst several authorities between the River Tyne and Flamborough Head undertook their own local monitoring programmes.

Royal HaskoningDHV has been appointed to provide Analytical Services in relation to the present phase of the Cell 1 Regional Coastal Monitoring Programme, between 2016 - 2027.

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	Mar 21	Jun 21	Aug 21
14	2021/22	Nov 21	Jan 22 (*)			

(*) The present report is **Analytical Report 14** and provides an analysis of the 2021 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 2021 Full Measures survey was undertaken along the Seaham and Easington frontage on the 3rd November 2021 and along the Blackhall frontage on the 4th November 2021. During the Seaham & Easington survey the weather was dry and overcast. The wind was force four from the north west and the sea state was calm. During the Blackhall survey, the weather was dry and sunny. The wind was force four from the north west. The sea state was calm.

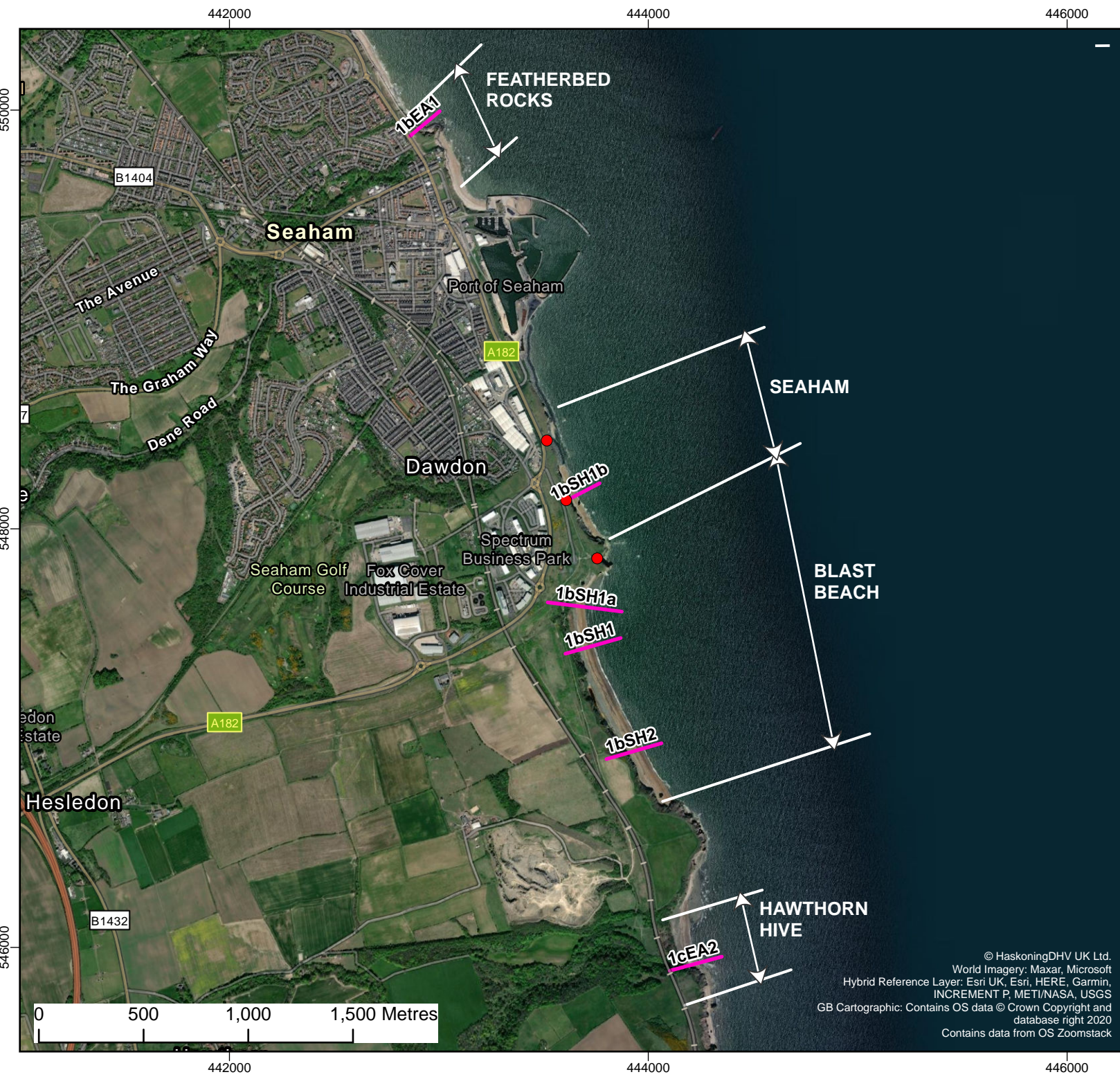
All data have been captured in a manner commensurate with the principles of the Environment Agency's *National Standard Contract and Specification for Surveying Services* and stored in a file format compatible with the software systems being used for the data analysis, namely SANDS and ArcGIS. This data 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.



SURVEY LOCATIONS

Topographic Profile

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

Topographic Area

- 6 monthly (Light Green)
- yearly (Orange)
- 5 yearly (Light Purple)

● Cliff Top Survey Points (refer to Figure 3 for details)

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

Title: **Figure 2 - Map 1**
FEATHERBED ROCKS TO HAWTHORN HIVE
Durham County Council Frontage

Report: **Survey Report**

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	n/a	TC	NJC	A4	1:25,000

Co-ordinate system: British National Grid

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 World Imagery: Maxar, Microsoft
 Hybrid Reference Layer: Esri UK, Esri, HERE, Garmin,
 INCREMENT P, METI/NASA, USGS
 GB Cartographic: Contains OS data © Crown Copyright and
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 Contains data from OS Zoomstack



SURVEY LOCATIONS

Topographic Profile

- Annual
- Bi-Annual

Topographic Area

- 6 monthly
- yearly
- 5 yearly

- Cliff Top Survey Points (refer to Figure 3 for details)

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

Title:

Figure 2 - Map 2

BLACKHALL COLLIERY

Durham County Council Frontage

Report:

Survey Report

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	n/a	TC	NJC	A4	1:25,000

Co-ordinate system: British National Grid

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World Imagery: Maxar, Microsoft
Hybrid Reference Layer: Esri UK, Esri, HERE, Garmin, INCREMENT P, METI/NASA, USGS
GB Cartographic: Contains OS data © Crown Copyright and database right 2020
Contains data from OS Zoomstack



SURVEY LOCATIONS

- Cliff Top Survey Points

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 World Imagery: Maxar, Microsoft
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 Contains data from OS Zoomstack
 Hybrid Reference Layer: Esri Community Maps Contributors, Esri UK, Esri, HERE, Garmin, INCREMENT P, METI/NASA, USGS

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

Title:

Figure 3 - Map 1

SEAHAM

Durham County Council Frontage

Report:

Survey Report

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	n/a	TC	NJC	A4	1:10,000

Co-ordinate system: British National Grid



2. Analysis of Survey Data

2.1 Featherbed Rocks

Survey Date	Description of Changes Since Last Survey	Interpretation
3 rd November 2021	<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 55m), rock armour sea defence (chainage 55m to 80m) and beach. Beyond the rock armour at chainage 80m, there has been little change to the beach over the summer of 2021, 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>3rd November 2021</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 (November 2021) survey.</p> <p>Between May 2021 and November 2021, only Point 1 showed any significant (>0.1m) movement, experiencing 0.14m recession. Point 2 and Point 3 experienced a 0.07m and 0.04m recession respectively, although this is considered within the margin of error of the monitoring technique.</p> <p>Appendix B provides results from the November 2021 survey, showing the distance from the ground control point to the edge of the cliff top along the defined bearing and changes in position since the November 2008 baseline survey.</p>	<p>Only post 1 showed any significant retreat (0.14m) during summer and autumn 2021 indicating the cliffs have been largely stable.</p> <p>Longer term trends: Long-term recession rates calculated from the data collected since November 2008 show retreat at 0.11m/yr. for Point 1, 0.01m/yr. for point 2 and 0.13m/yr. at Point 3. The rates of erosion over the summer of 2021 are in line with previous patterns.</p>

2.3 Blast Beach

Survey Date	Description of Changes Since Last Survey	Interpretation
<p>3rd November 2021</p>	<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 2021 Full Measure Survey showed that there has been local accretion of up to 0.8m in level between chainages 37m up to the concrete blocks at chainage 59m. Seaward of the concrete blocks, the lower foreshore has experienced little to no change. The accretion on the upper beach means the levels are now at medium level compared with the previous survey range. The lower beach remains at a low level.</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 remained stable as far as the eroding face of the spoil deposit at 140m chainage. Between 140m chainage and 176m the beach face has been eroded by 1m in level since Spring 2021, as a result the beach berm deposited at chainage 155m has been eroded. From 176m chainage to the end of the survey at chainage 250m, the rocks are exposed across the foreshore and remain stable. The November 2021 profile is very low compared to the range of previously recorded profiles. The November 2021 profile is very similar to the Full Measures profile in October 2020 and October 2019, suggesting seasonal patterns.</p> <p>At 1bSH1, the profile shows that the whole cliff face, from chainage 19m to 38m, has appeared to retreat 2m since the May 2021 survey. This is actually due to the surveyor in May 2021 picking a slightly seaward definition of the cliff edge and is an apparent change rather than a real change. From chainages 50m to 76m at the colliery spoil face, there has been no change. At chainage 76m, erosion has exaggerated the cliffing in the colliery spoil which is now 0.6m in height. Seawards of colliery spoil cliffing, the beach has experienced wide scale erosion up to 2.2m in level in places. The rocky foreshore</p>	<p>The crest of the spoil material on all profiles across Blast Beach appears to have remained stable since the Spring 2021 survey. The beach material fronting the spoil has experienced varying erosion and accretion across the bay. To the north, the beach profiles (1bSH1a and 1bSH1) show significant erosion up to 2.2m in places. In contrast the southern profile shows accretion of up to 1.1m level on the lower beaches.</p> <p>Longer term trends: The cliffs behind Blast Beach are currently inactive because they are fronted by colliery spoil. 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 trend was continued in the November 2021 and so should remain area of focus.</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>from chainage 120m to 170m is exposed. From chainage 76m to 100m the beach is at its lowest compared the previous survey range.</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 (120m chainage) there has little to no change, limited to ± 0.1m. Seaward of 120m the beach prolife has experienced wide scale accretion, peaking at chainage 177m where the accretion is up to 1.1m in level. Overall, the prolife is at a high level compared to the range recorded from previous surveys, with the crest of the upper beach remaining at the highest recorded between chainage 110m and 120m.</p>	

2.4 Hawthorne Hive

Survey Date	Description of Changes Since Last Survey	Interpretation
<p>3rd November 2021</p>	<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. Since the previous survey in May 2021, the upper beach levels, between chainages 95m and 150m, appear to show signs of recovery. The beach has accreted by up to 1m in level at chainage 115m. The rocky foreshore remains exposed from chainage 150m to the end of the survey at chainage 240m and remains stable. Overall, the profile is at a medium level when compared to the range recorded from previous surveys.</p>	<p>In November 2021, the rocky foreshore from chainage 150m remains stable. The upper beach levels show signs of recovery since the previous survey in May 2021 where the levels were recorded to be at the lowest level on record.</p> <p>Longer term trends: The upper beach levels were recorded to be notably low in 2014, 2018 and more recently in May 2021. On all occasion the beach levels appeared to recovery. In November 2021 the beach was recorded to accrete up to 1m in places since the latest dip. Despite the recovery the profiles show the beach is undergoing progressive erosion.</p> <p>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
4 th November 2021	<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 2021 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, causing the crest of the spoil to retreat 2m. A similar level of erosion is observed from the spoil face to chainage 160m where there has been a drop in level of up to 0.4m. This has resulted in this section of the profile being at its lowest when compared to the range of previous surveys. Seawards of chainage 160m the boulder foreshore has experience little change limited to the local movement of the rocks.</p> <p>Profile 1cBH2 exhibits no change in the cliff profile. The cliffed-edge of the spoil beach has retreated landwards by approximately 5m since October 2020. There is around 30m of material from the eroding face at the back of the beach to the cliff toe. From the toe of the spoil face, now at chainage 156m, across the upper beach to chainage 189m there has been erosion of up to 0.7m in level. Seawards of chainage 189m, the mid to lower beach has accreted as a result of the draw down of material from the upper beach. The maximum accretion is 1.2m in level at chainage 207m. The profile is generally low when compared with the range of previously recorded results particularly at the spoil face and upper beach. The mid to lower beach is medium when compared with the previous results.</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. In the November 2021 profile there has been no change at the toe of the cliff at chainage 128m. The profile suggest that the channel bed has accreted by 0.3m in level, however the surveyors noted that access was limited in this area due to deep water</p>	<p>Profile 1cBH1 shows slumping and erosion across the spoil face with the beach profile continuing to become shallower year on year. The spoil face has retreated 2m between May and November 2021.</p> <p>Similarly, the spoil face at profile 1cBH2 has retreated 5m, leaving 30m of material to the cliff toe. This erosion has caused drawn down of material resulting in accretion of the lower beach.</p> <p>1cBH3 shows continued migration of the Castle Eden Burn channel, the beach berm forming the seaward edge has retreated 2m landwards.</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. There is approximately 24m of spoil between the eroding face and cliff toe at profile 1cBH1 and 30m at 1cBH2, with both experiencing further erosion in 2021.</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>and therefore this change may not be reflective of actual changes. The berm that forms the seaward edge of the channel and beach has shifted 2m landward since the previous survey, narrowing the channel. When comparing the levels of the beach to the range from previous it appears the beach is at its lowest on record, however this not necessarily due to loss of material but more a reflection of the beach berm shifting landwards.</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 is 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, only post 1 showed any significant retreat (0.14m) during summer and autumn 2021 indicating the cliffs have been largely stable.
- 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.
- At Hawthorne Hive the levels on the foreshore have recovered since the latest low in May 2021 showing signs of accretion up to 1m. The levels are now back towards the middle of the range of previous surveys. 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 (2m at profile 1cBH1 and 5m at profile 1cBH2) . In the south of the bay, mound of beach material has retreated landward, narrowing the channel. 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

Beach Profile

Location: 1bEA1

Date: 03/11/2021

Inspector: AG

Low Tide:

Low Tide Time:

Wind

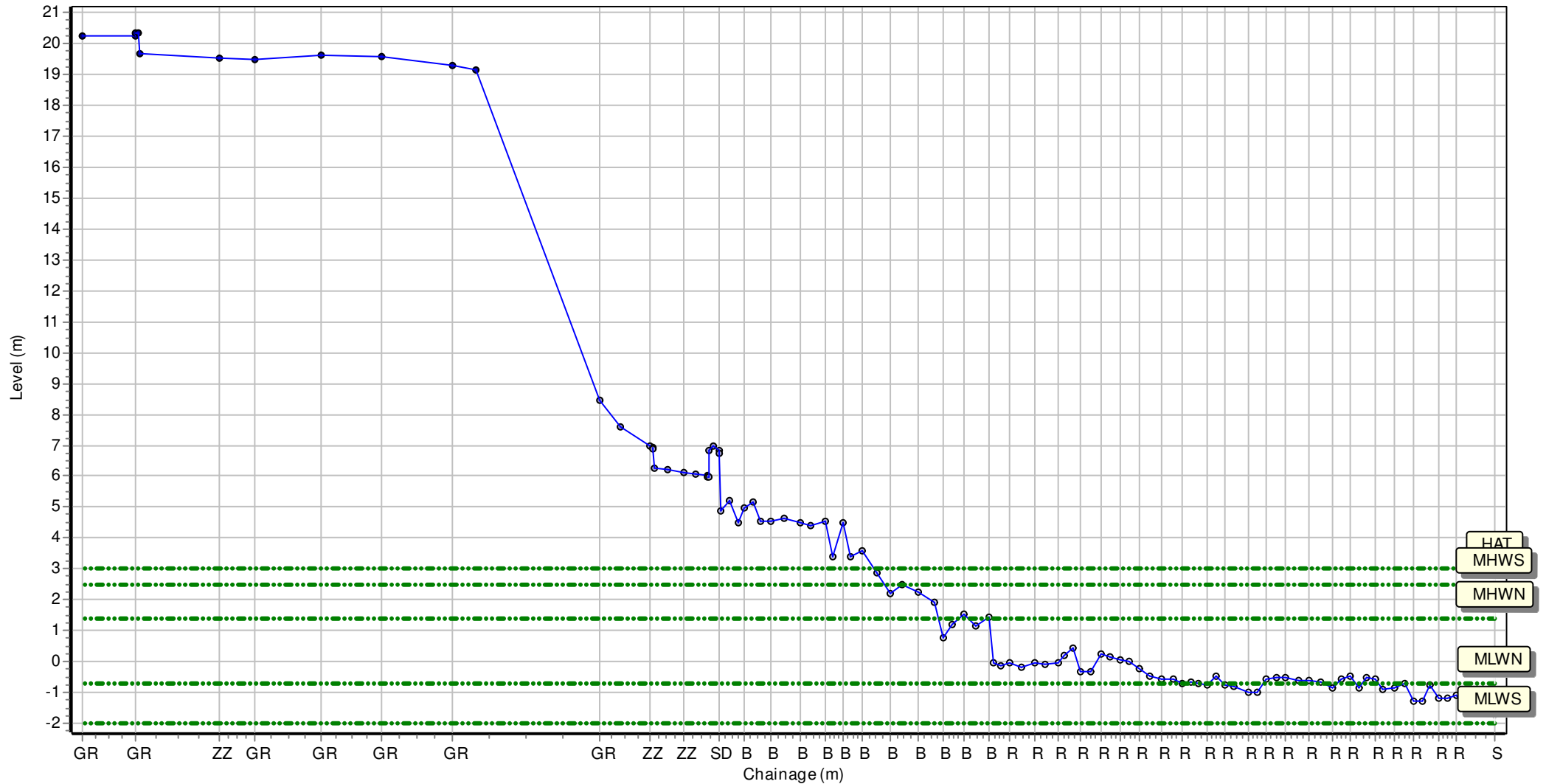
Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

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



Beach Profile

Location: 1bSH1B

Date: 03/11/2021 Inspector: AG

Low Tide:

Low Tide Time:

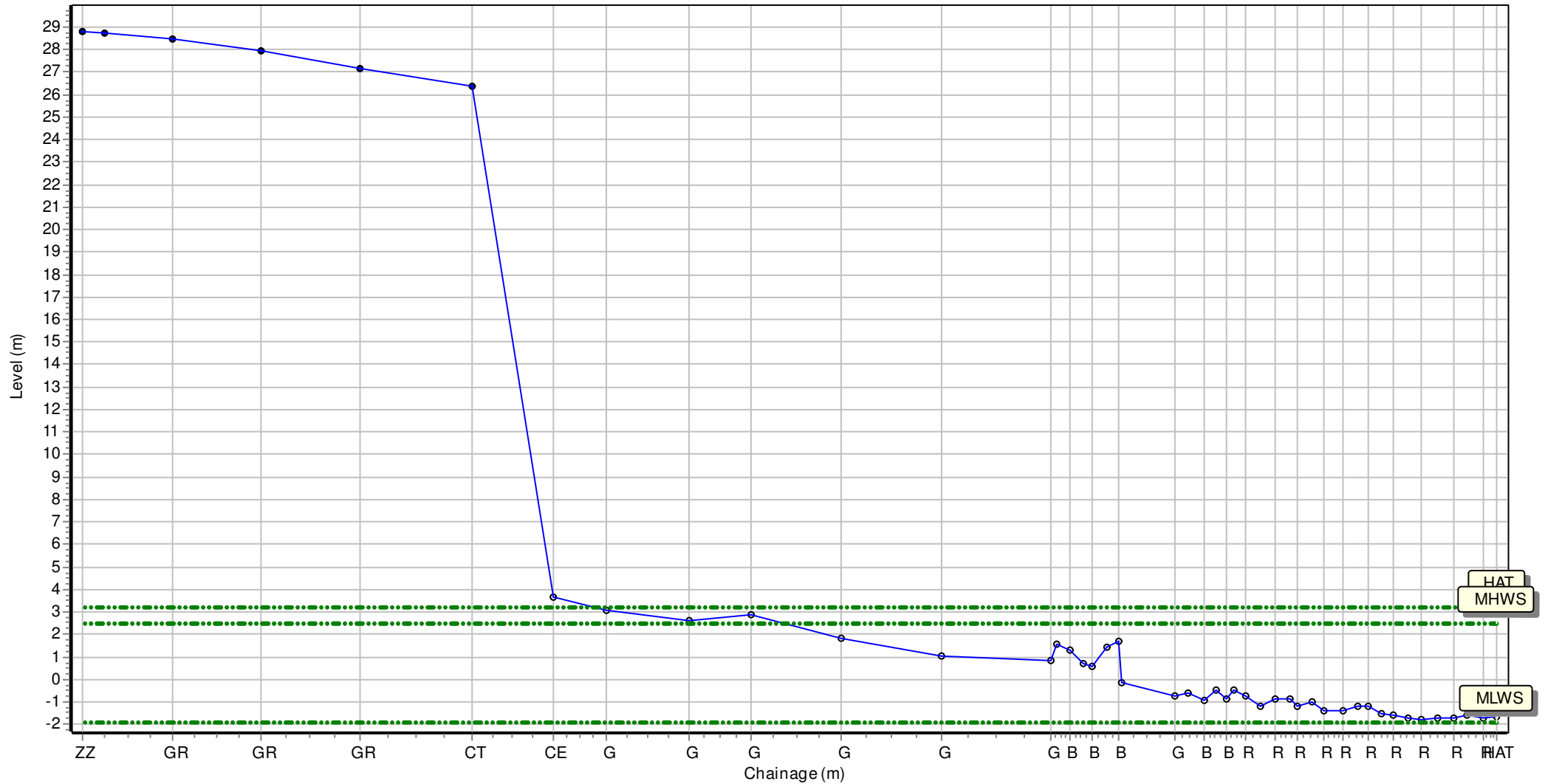
Wind Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

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



Beach Profile

Location: 1bSH1A

Date: 03/11/2021

Inspector: AG

Low Tide:

Low Tide Time:

Wind

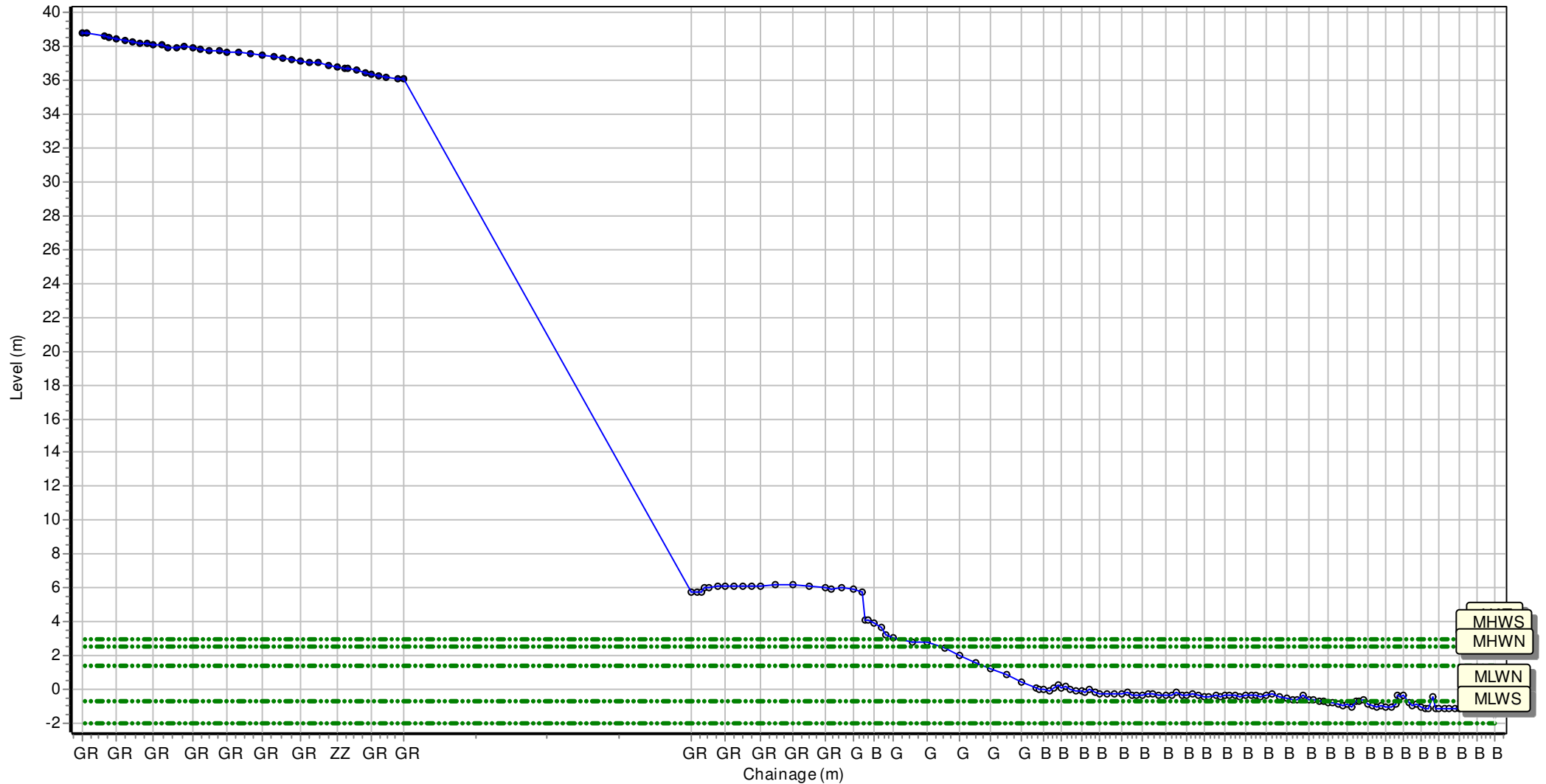
Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

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



Beach Profile

Location: 1bSH1

Date: 03/11/2021

Inspector: AG

Low Tide:

Low Tide Time:

Wind

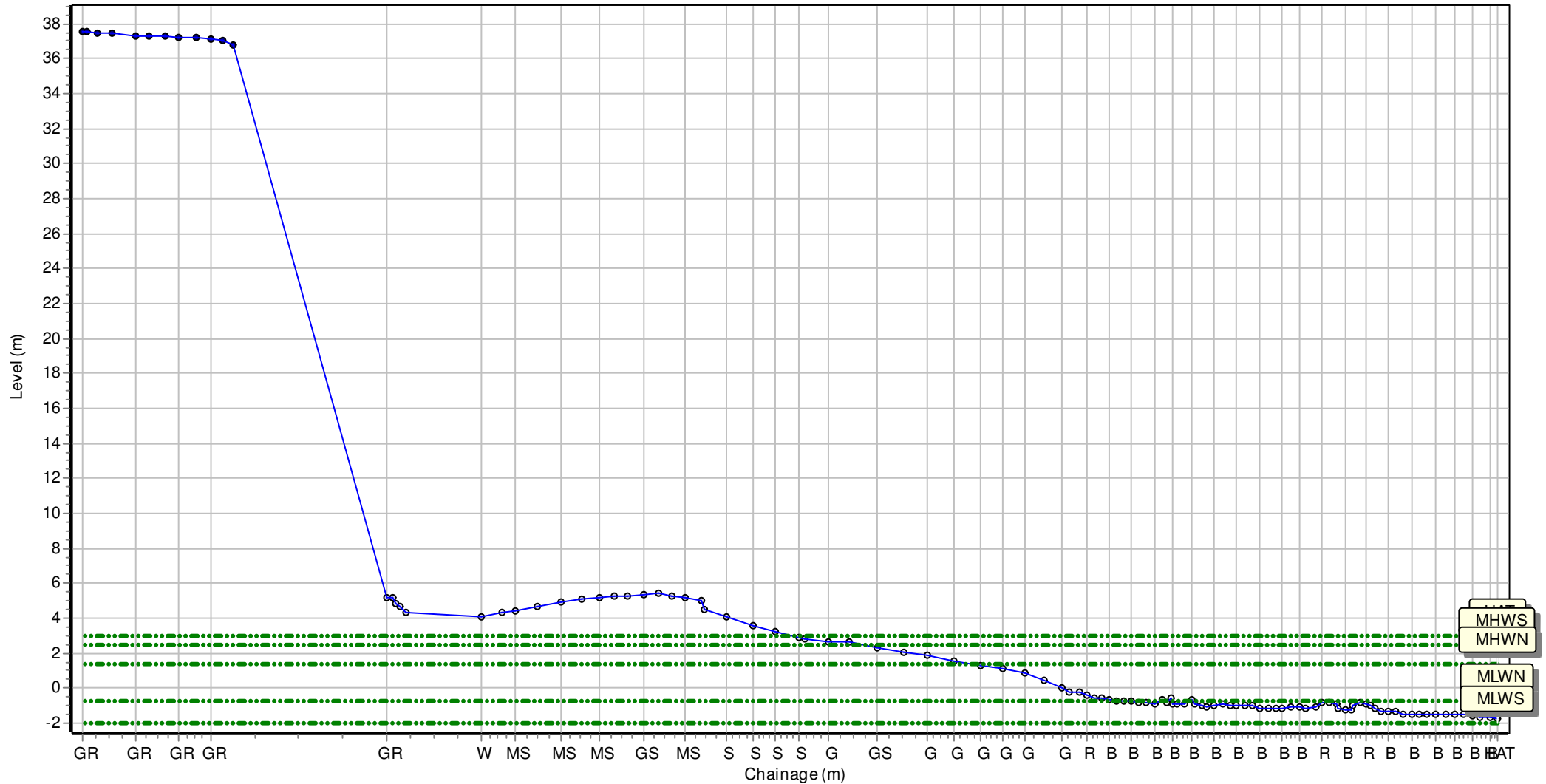
Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 443613.742 Northing: 547404.589 Profile Bearing: 74 ° from North



Beach Profile

Location: 1bSH2

Date: 03/11/2021 Inspector: AG

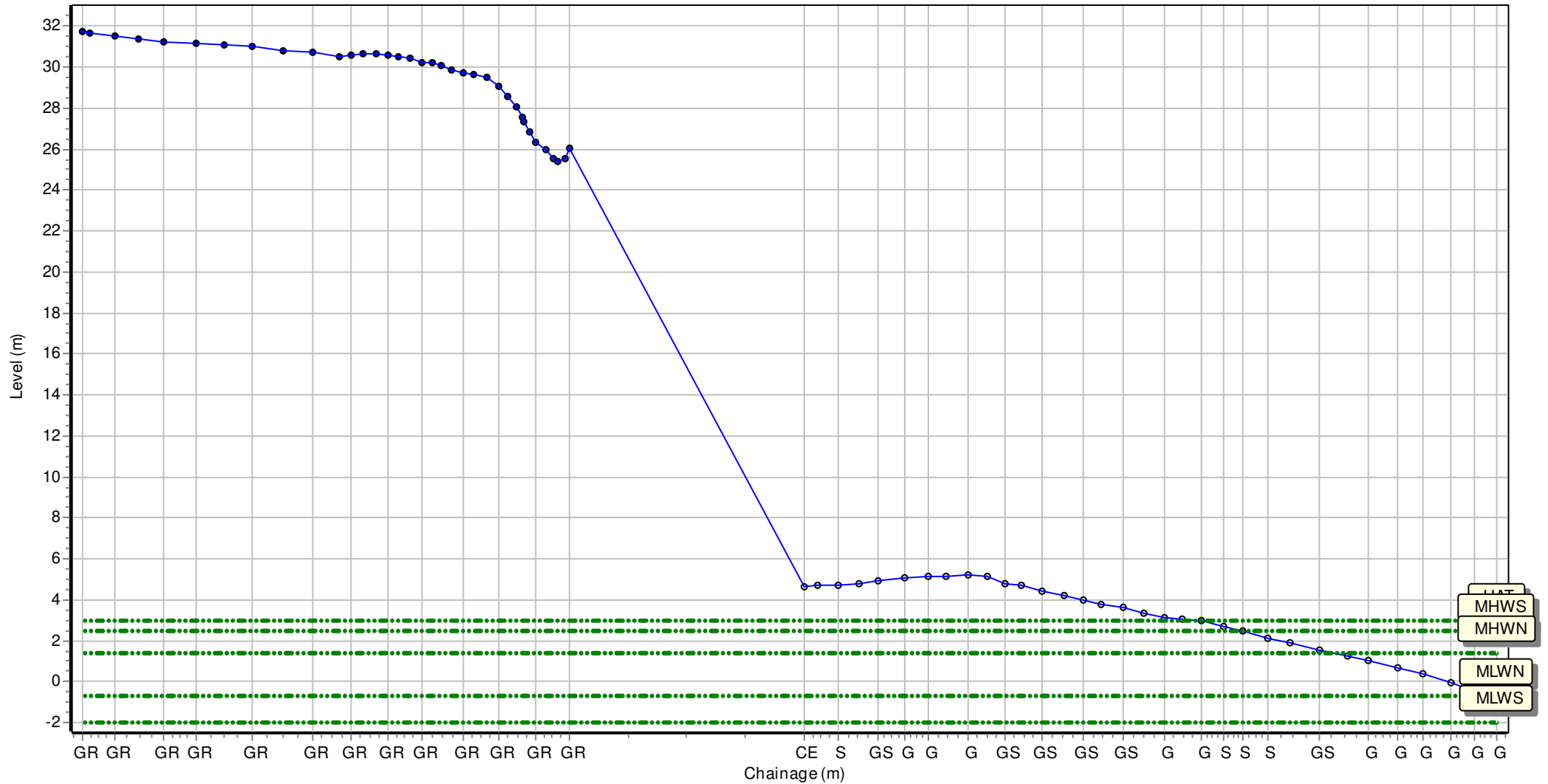
Low Tide: Low Tide Time:

Wind Sea State:

Visibility: Rain:

Summary: 2021 Full Measures Topo Survey

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



Beach Profile

Location: 1cBH1

Date: 04/11/2021 Inspector: AG

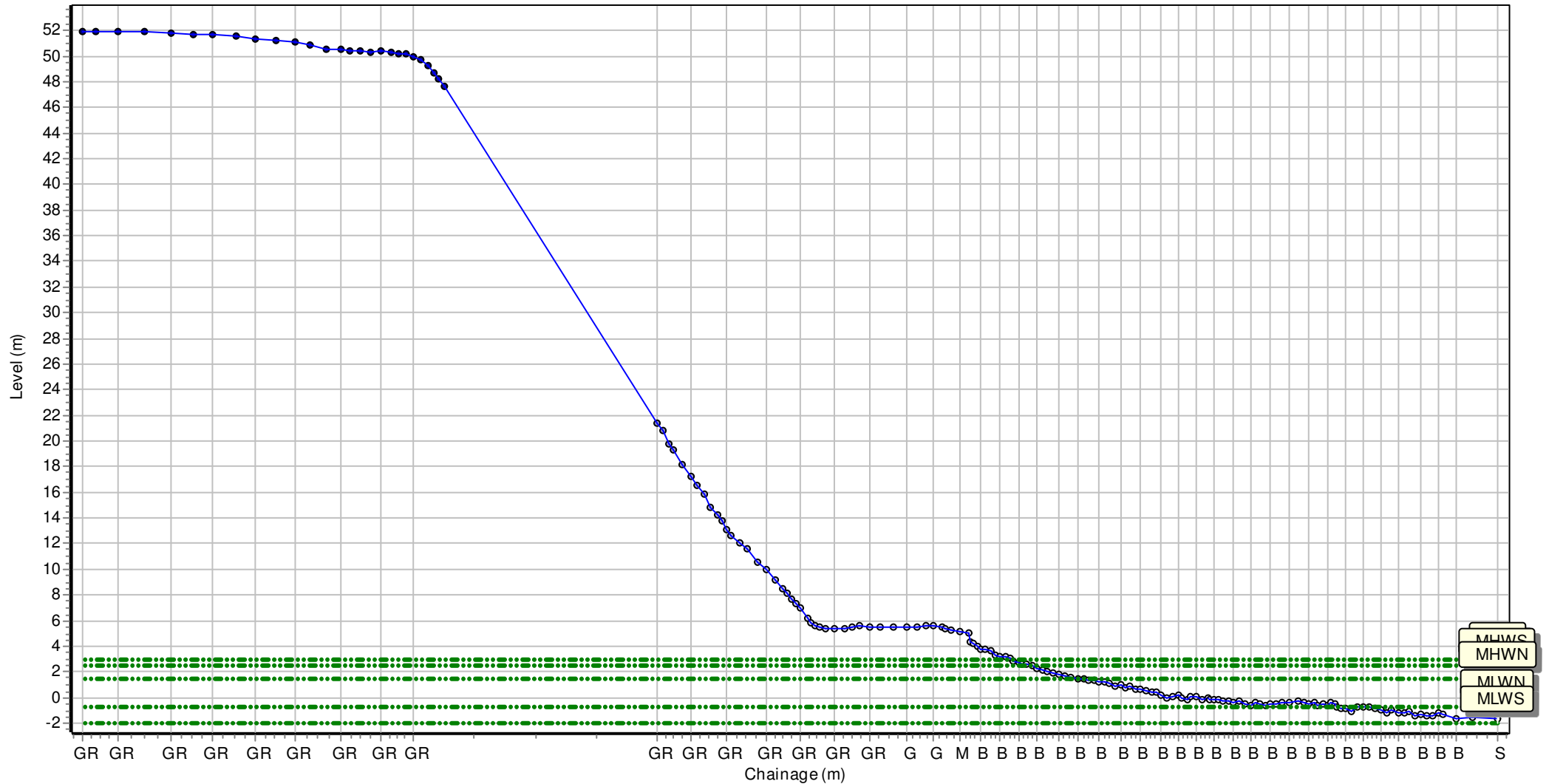
Low Tide: Low Tide Time:

Wind Sea State:

Visibility: Rain:

Summary: 2021 Full Measures Topo Survey

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



Beach Profile

Location: 1cBH2

Date: 04/11/2021

Inspector: AG

Low Tide:

Low Tide Time:

Wind

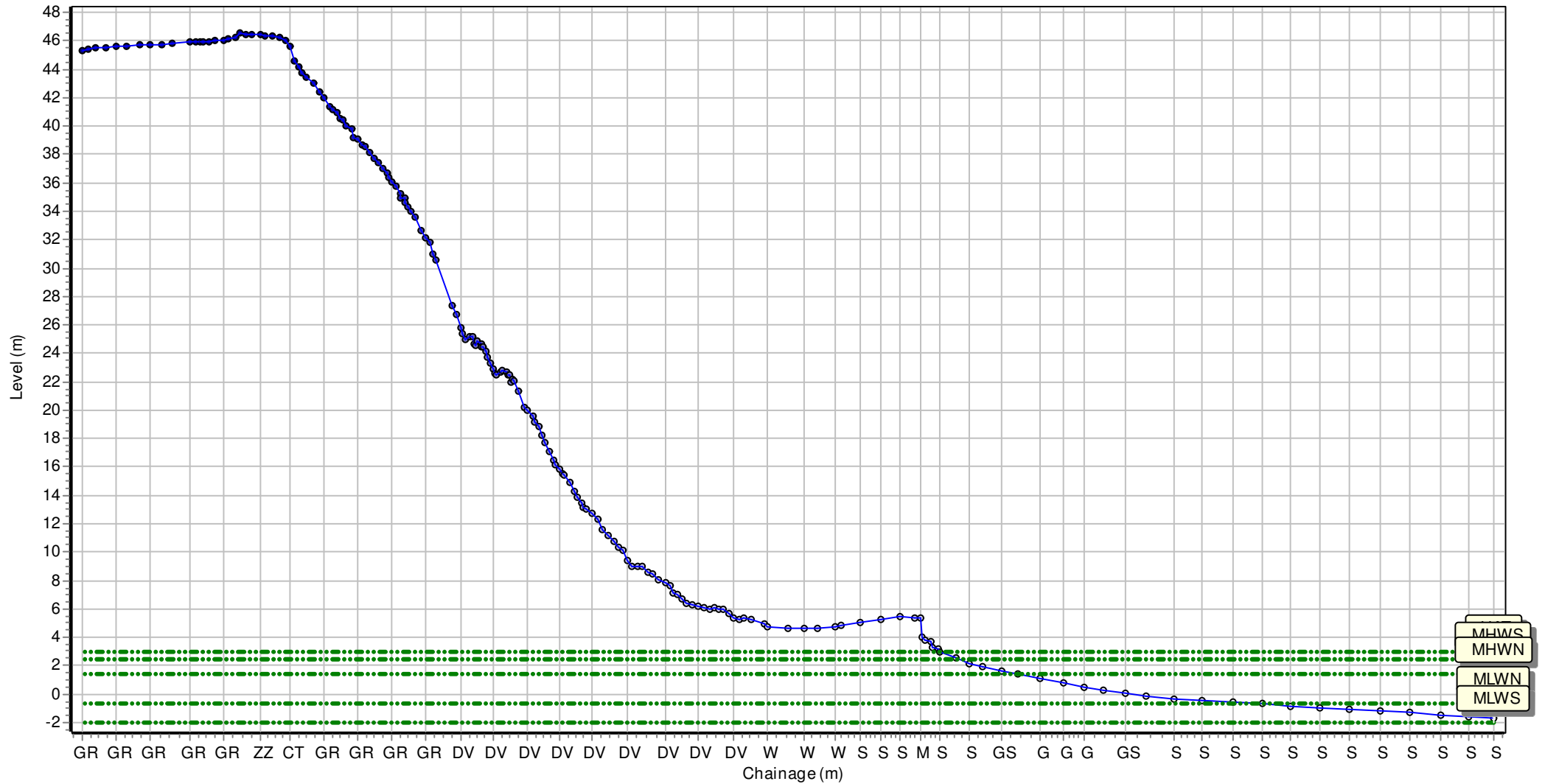
Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

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



Beach Profile

Location: 1cBH3

Date: 04/11/2021 Inspector: AG

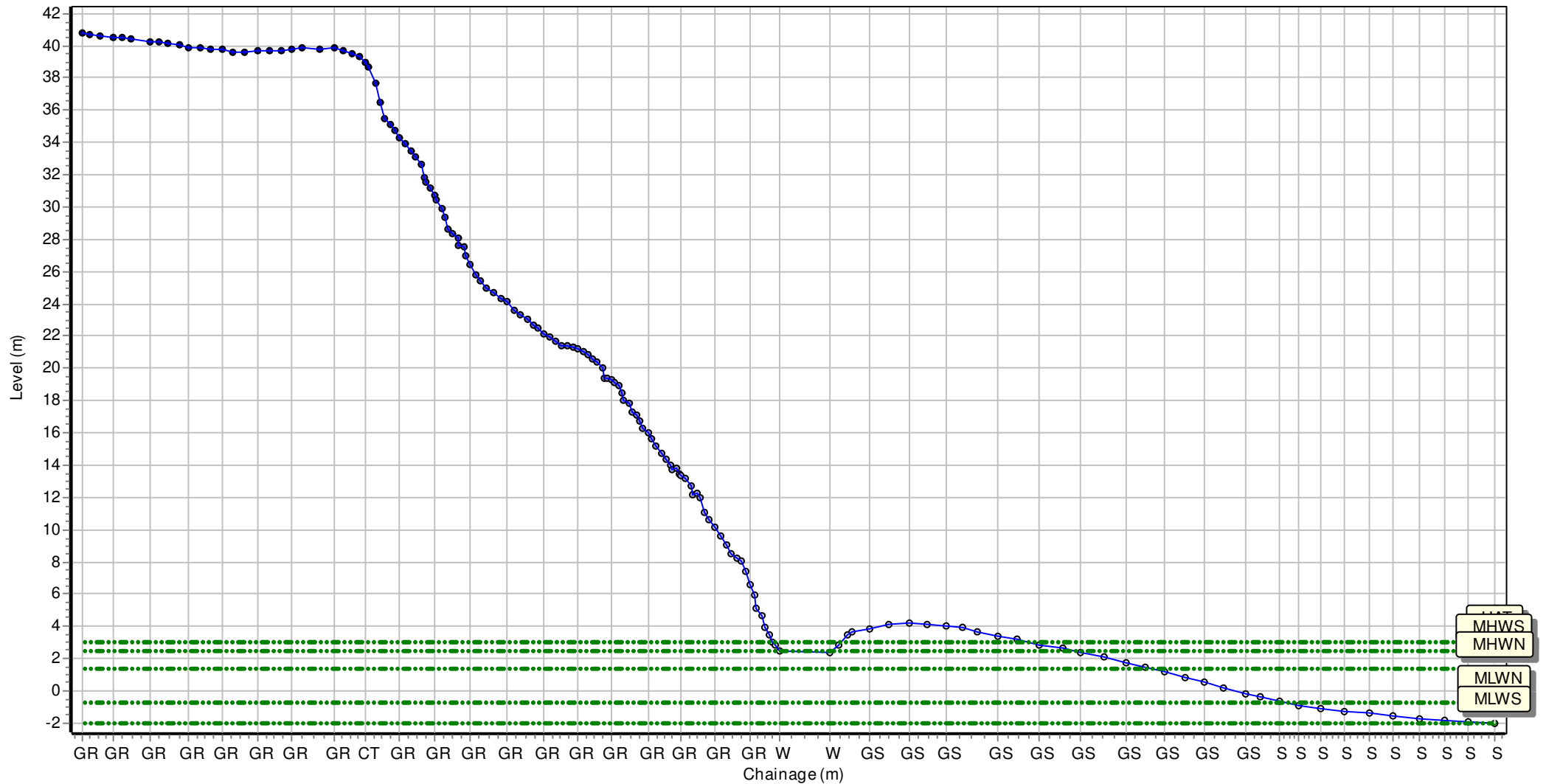
Low Tide: Low Tide Time:

Wind Sea State:

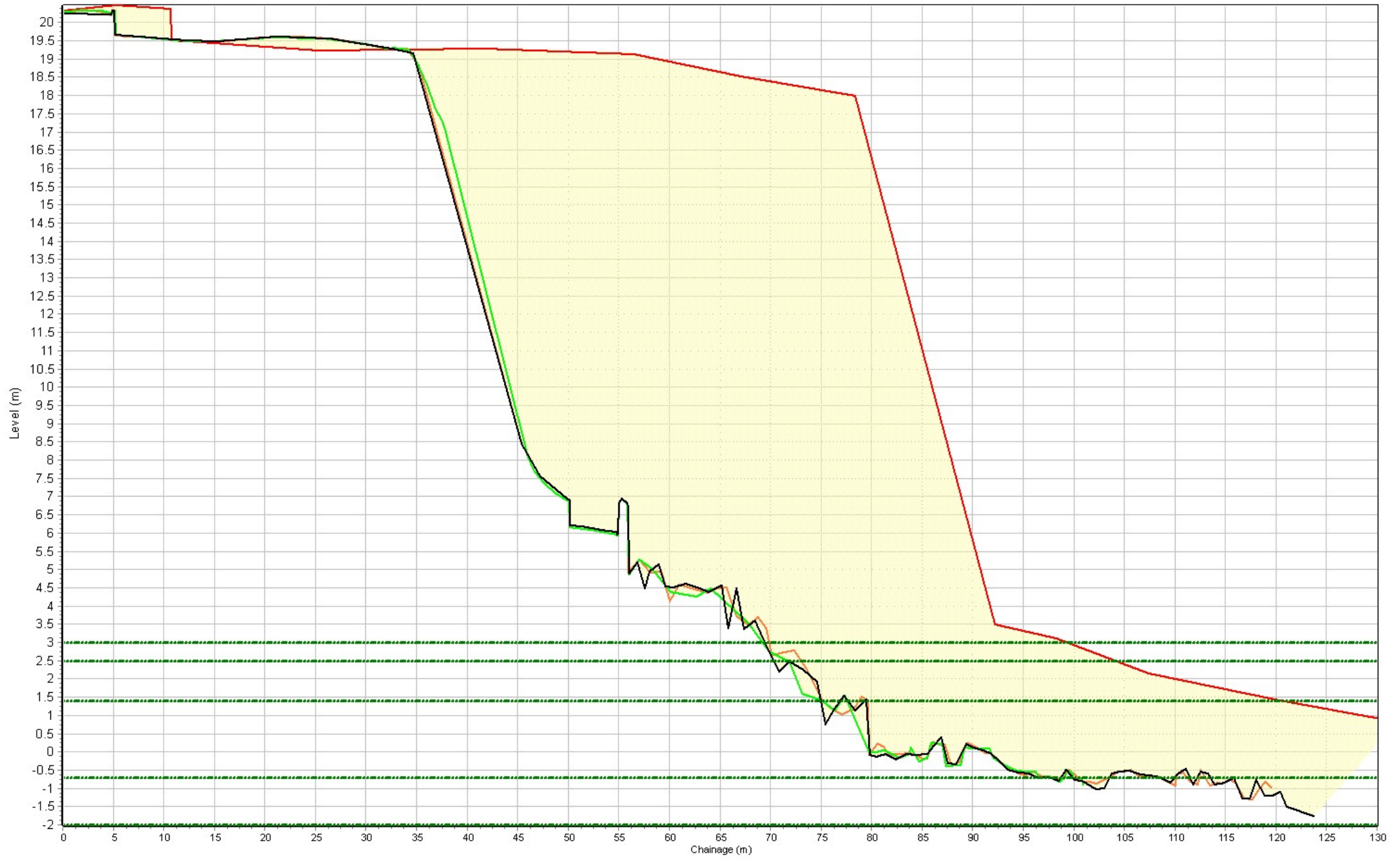
Visibility: Rain:

Summary: 2021 Full Measures Topo Survey

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



Profiles: 1bEA1



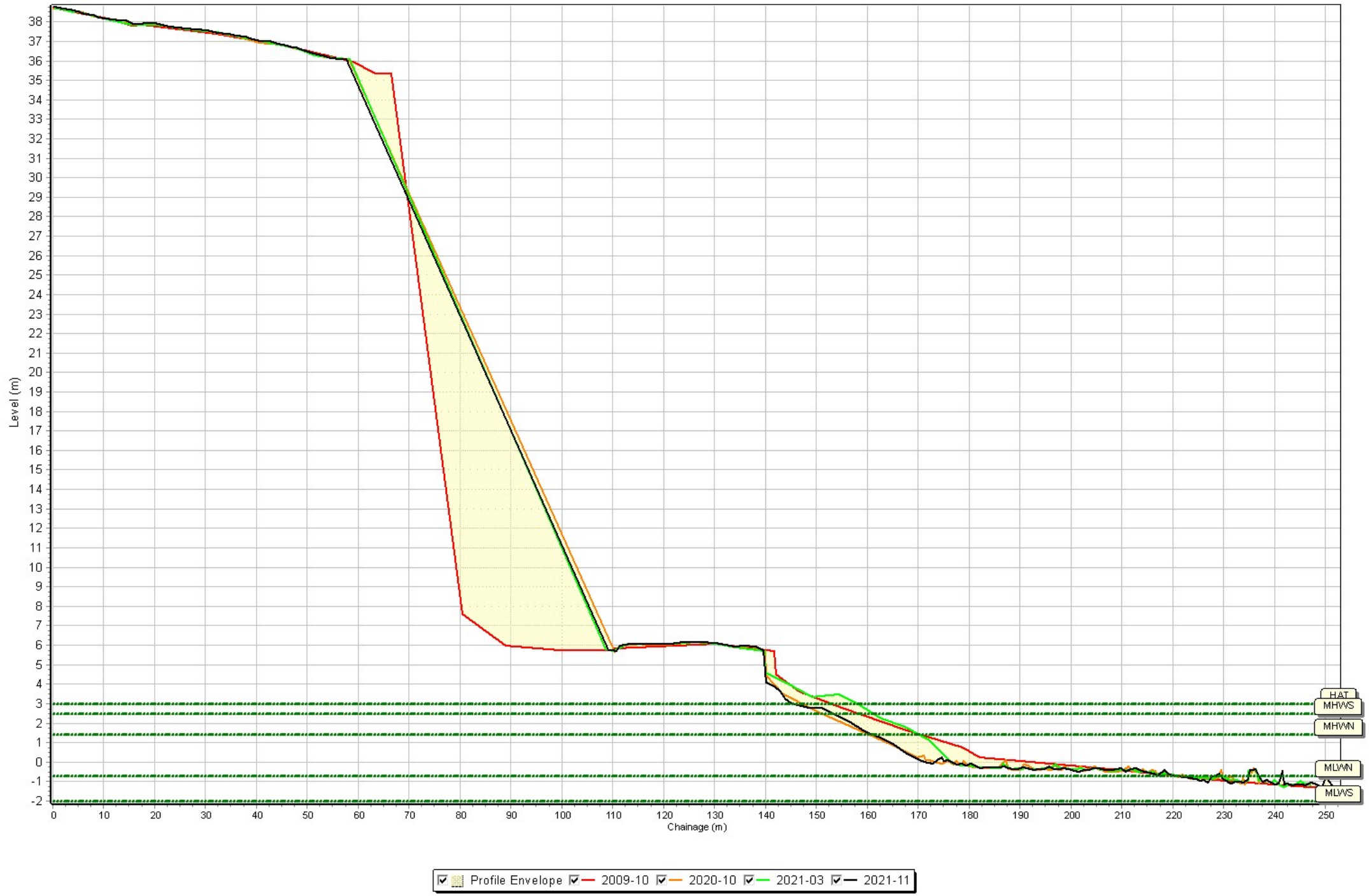
Profile Envelope 2008-12 2020-10 2021-03 2021-11

Profiles: 1bSH1B

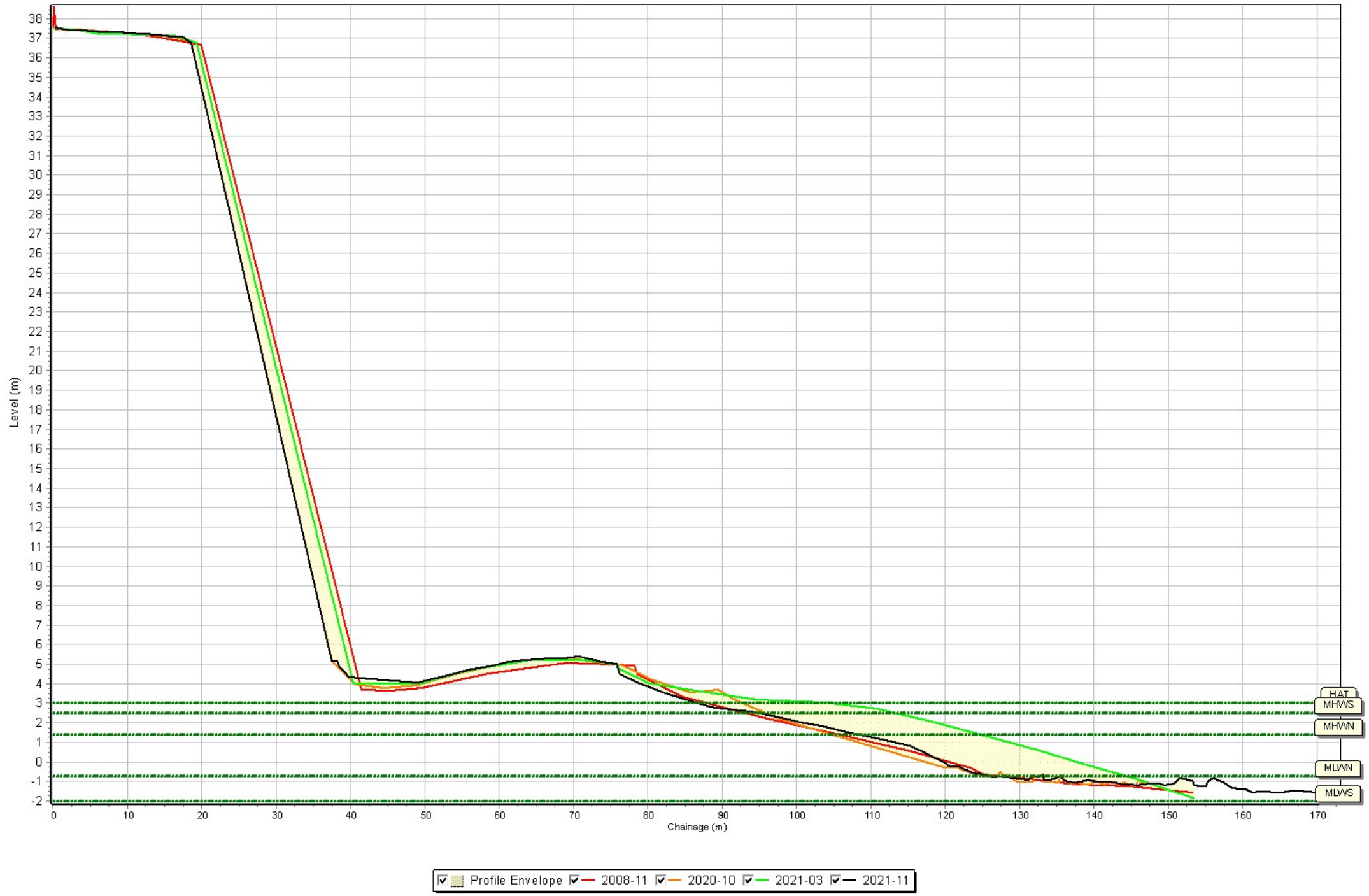


Profile Envelope 2015-10 2020-10 2021-03 2021-11

Profiles: 1bSH1A



Profiles: 1bSH1

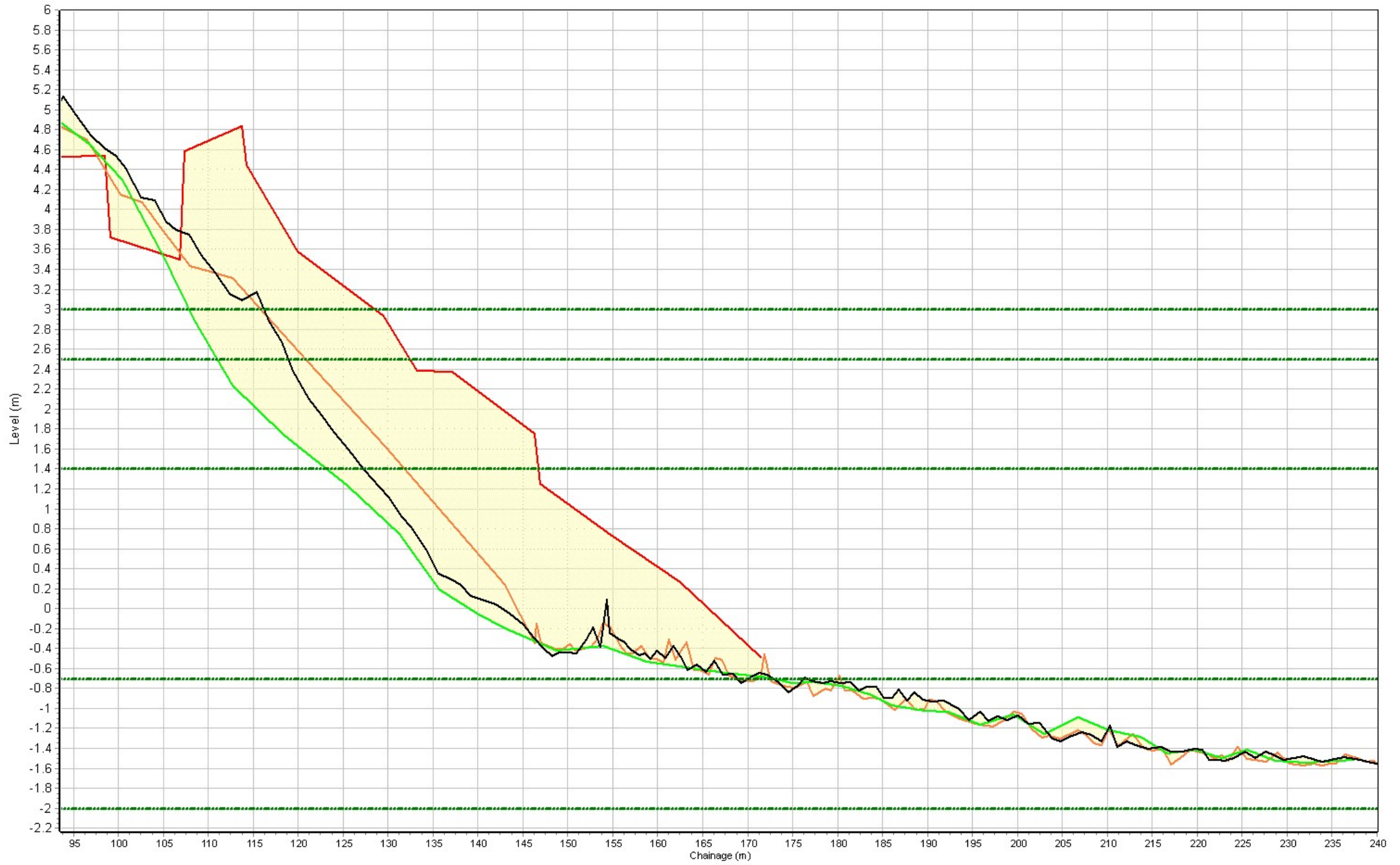


Profiles: 1bSH2



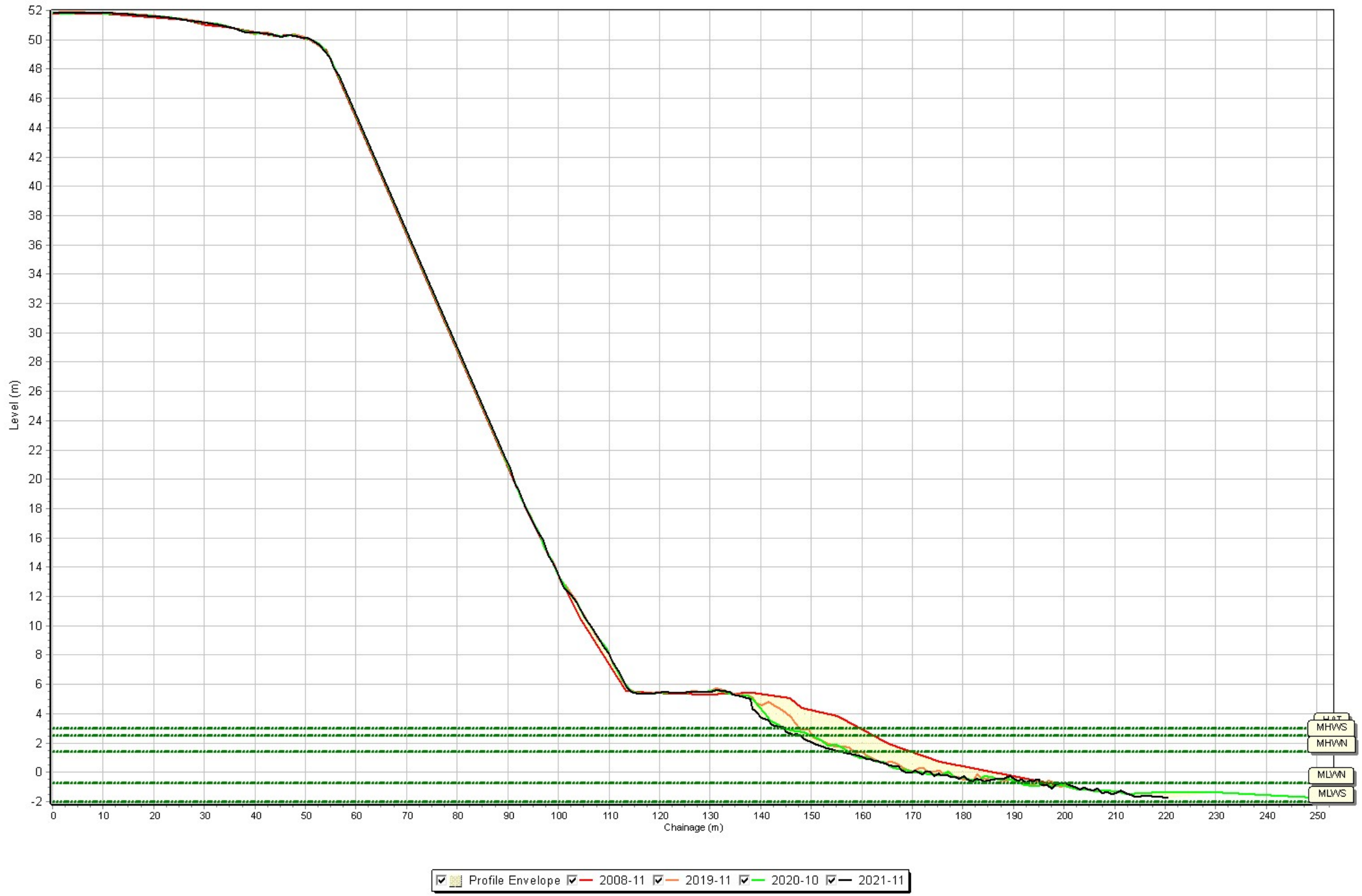
Profile Envelope 2008-11 2020-10 2021-03 2021-11

Profiles: 1cEA2

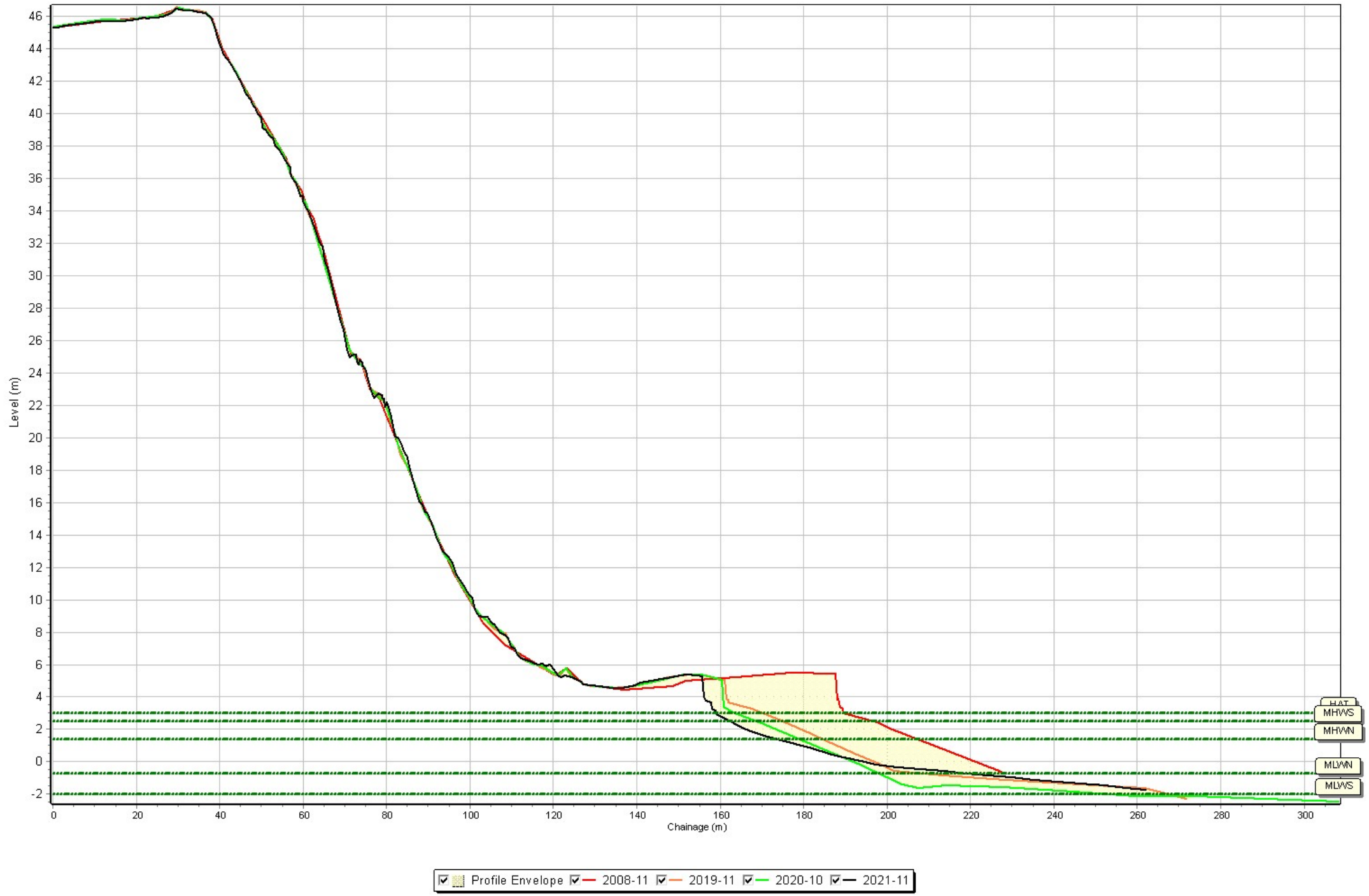


Profile Envelope 2008-12 2020-10 2021-03 2021-11

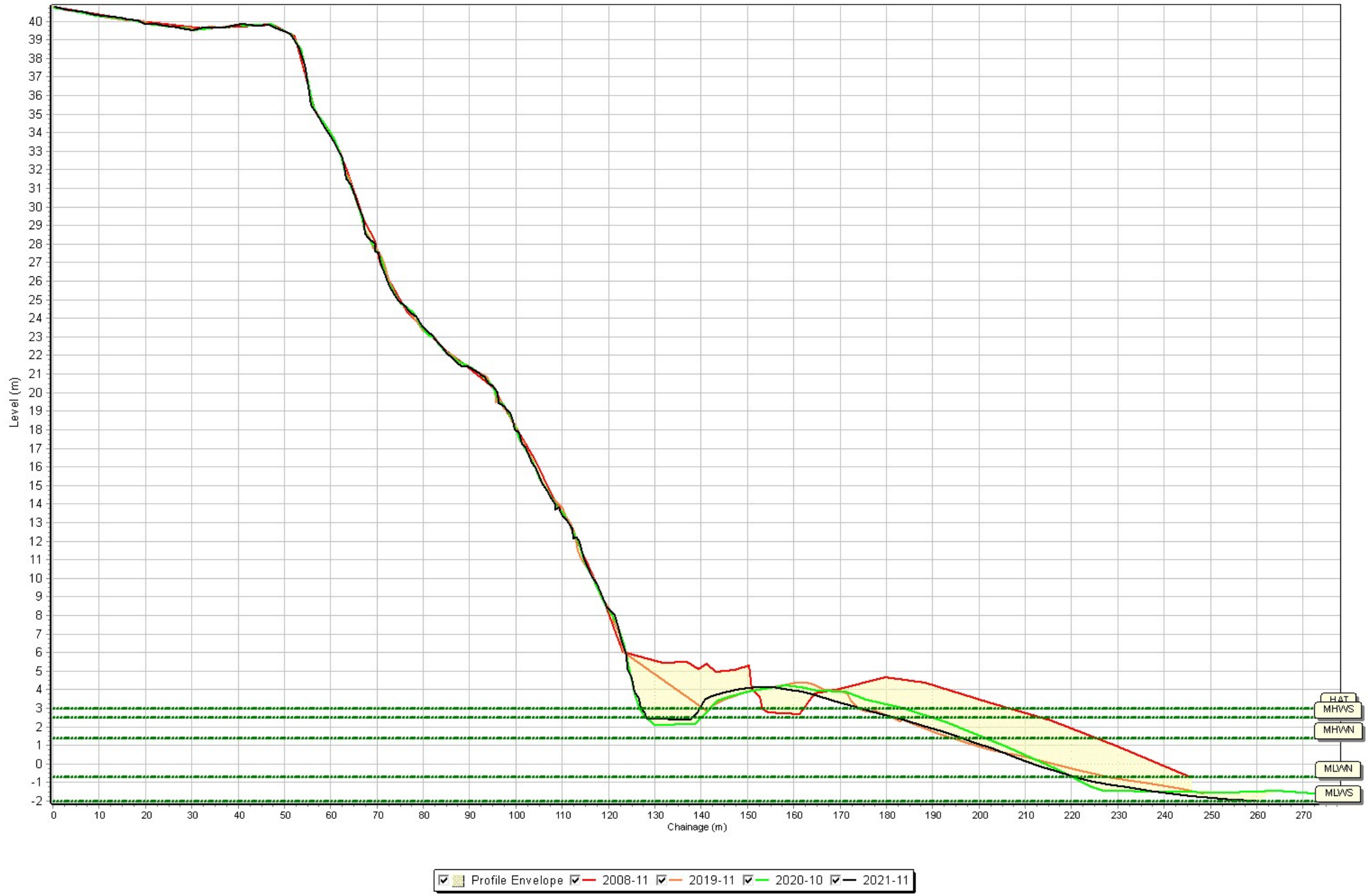
Profiles: 1cBH1



Profiles: 1cBH2



Profiles: 1cBH3



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	Mar 2021	Nov 2021	Nov 2008 - Nov 2021	Mar 2021 - Nov 2021	Nov 2008 - Nov 2021
1	443515.4	548421.7	70	16.1	15.08	14.94	1.16	0.14	0.11
2	443607.8	548136.3	90	13.3	13.28	13.21	0.09	0.07	0.01
3	443756.1	547858.5	95	14.8	13.52	13.48	1.32	0.04	0.13

