



## **Cell 1 Regional Coastal Monitoring Programme Update Report 15: 'Partial Measures' Survey 2023**



**Durham County Council**

**May 2023**

## Contents

Disclaimer .....	i
Abbreviations and Acronyms.....	ii
Water Levels Used in Interpretation of Changes .....	ii
Glossary of Terms.....	iii
Preamble .....	iv
1. Introduction.....	1
1.1 Study Area .....	1
1.2 Methodology.....	1
2. Analysis of Survey Data .....	2
2.1 Featherbed Rocks .....	2
2.2 Seaham (Dawdon) .....	3
2.3 Blast Beach .....	4
2.4 Hawthorne Hive.....	5
3. Problems Encountered and Uncertainty in Analysis .....	6
4. Recommendations for 'Fine-tuning' the Monitoring Programme .....	6
5. Conclusions and Areas of Concern .....	6

## Appendices

Appendix A	Beach Profiles
Appendix B	Cliff Top Survey

## List of Figures

Figure 1	Sediment Cells in England and Wales
Figure 2	Survey Locations
Figure 3	Cliff Top Survey Locations

## List of Tables

Table 1	Analytical, Update and Overview Reports Produced to Date
Table 2	Sub-division of the Cell 1 Coastline

Authors	
Tom Ward	Royal HaskoningDHV
Dr Nick Cooper – Review & Approval	Royal HaskoningDHV

## **Disclaimer**

Royal HaskoningDHV has prepared this report in accordance with the instructions of our client North Yorkshire Council (NYC) for the client's sole and specific use. Any other persons who use any information contained herein do so at their own risk. Royal HaskoningDHV has used reasonable skill, care and diligence in the interpretation of data provided to them and accepts no responsibility for the content, quality or accuracy of any Third party reports, monitoring data or further information provided either to them by NYC or, via NYC from a Third party source, for analysis under this term contract.

Data and reports collected as part of the Cell 1 Regional Coastal Monitoring Programme are available to download via the North East Coastal Observatory via the webpage: [www.northeastcoastalobservatory.org.uk](http://www.northeastcoastalobservatory.org.uk).

The North East Coastal Observatory does not "license" the use of images or data or sign license agreements. The North East Coastal Observatory generally has no objection to the reproduction and use of these materials (aerial photography, wave data, beach surveys, bathymetric surveys, reports), subject to the following conditions:

1. North East Coastal Observatory material may not be used to state or imply the endorsement by North East Coastal Observatory or by any North East Coastal Observatory employee of a commercial product, service, or activity, or used in any manner that might mislead.
2. North East Coastal Observatory should be acknowledged as the source of the material in any use of images and data accessed through this website, please state "Image/Data courtesy of North East Coastal Observatory". We recommend that the caption for any image and data published includes our website, so that others can locate or obtain copies when needed. We always appreciate notification of beneficial uses of images and data within your applications. This will help us continue to maintain these freely available services. Send e-mail to [Robin.Siddle@northyorks.gov.uk](mailto:Robin.Siddle@northyorks.gov.uk)
3. It is unlawful to falsely claim copyright or other rights in North East Coastal Observatory material.
4. North East Coastal Observatory shall in no way be liable for any costs, expenses, claims, or demands arising out of the use of North East Coastal Observatory material by a recipient or a recipient's distributees.
5. North East Coastal Observatory does not indemnify nor hold harmless users of North East Coastal Observatory material, nor release such users from copyright infringement, nor grant exclusive use rights with respect to North East Coastal Observatory material.
6. North East Coastal Observatory material is not protected by copyright unless noted (in associated metadata). If copyrighted, permission should be obtained from the copyright owner prior to use. If not copyrighted, North East Coastal Observatory material may be reproduced and distributed without further permission from North East Coastal Observatory.

## 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

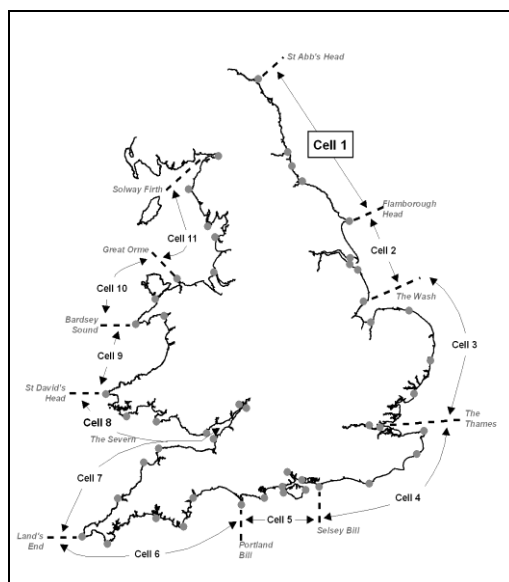
Source: UKHO Admiralty Tide Tables, 2020

## 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 2008<sup>1</sup> and is managed by North Yorkshire Council on behalf of the North East Coastal Observatory. It is funded by the Environment Agency, working in partnership with the following organisations:



<sup>1</sup> 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.

At the end of each phase of the programme, 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 1	Sep 11
4	2011/12	Sep 11	Aug 12	Mar-May 12	Feb 13	-
5	2012/13	Sep 12	Feb 13	Mar-Apr 13	May 13	-
6	2013/14	Oct 13	Feb 14	Mar-Apr 14	Jul 14	-
7	2014/15	Nov 14	Feb 15	Mar 15	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	Apr 18	Jun 18	Nov 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	May 21	Aug 21
14	2021/22	Nov 21	Jan 22	Apr 22	Jun 22	
15	2022/23	Nov 22	Jan 23	March 23	May 23(*)	

(\*) The present report is **Update Report 15** and provides an analysis of the 2023 Partial Measures survey for Durham County Council's frontage.

## 1. Introduction

### 1.1 Study Area

Durham Council's frontage extends from Ryhope Dene to Crimdon Beck. For the purposes of this report, 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 each autumn/early winter comprising:
  - Beach profile surveys along nine transect lines
- Partial Measures survey annually 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 Partial Measures survey was undertaken along this frontage on 10<sup>th</sup> March 2023. During the survey the weather was dry and overcast, with a force 4 wind from the northwest and a slight sea state.

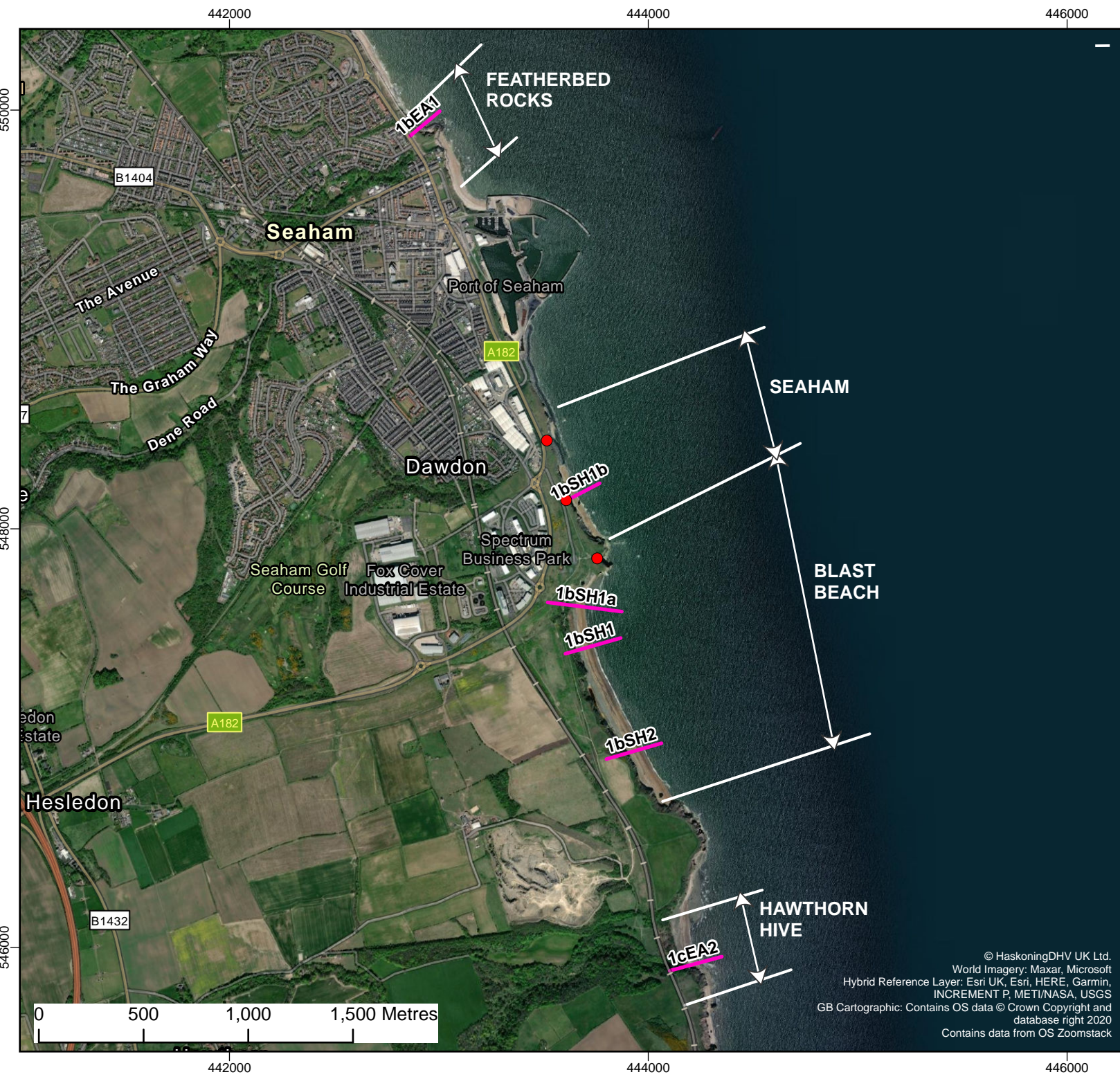
All data have been captured in a manner commensurate with the principles of the Environment Agency's *National Standard Contract and Specification for Surveying Services* and stored in a file format compatible with the software systems being used for the data analysis, namely SANDS and ArcGIS. This data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

The Update Report presents the following:

- 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
- key conclusions and highlighting of 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

Royal HaskoningDHV  
Enhancing Society Together

North East Coastal Observatory

© HaskoningDHV UK Ltd.  
 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**

**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

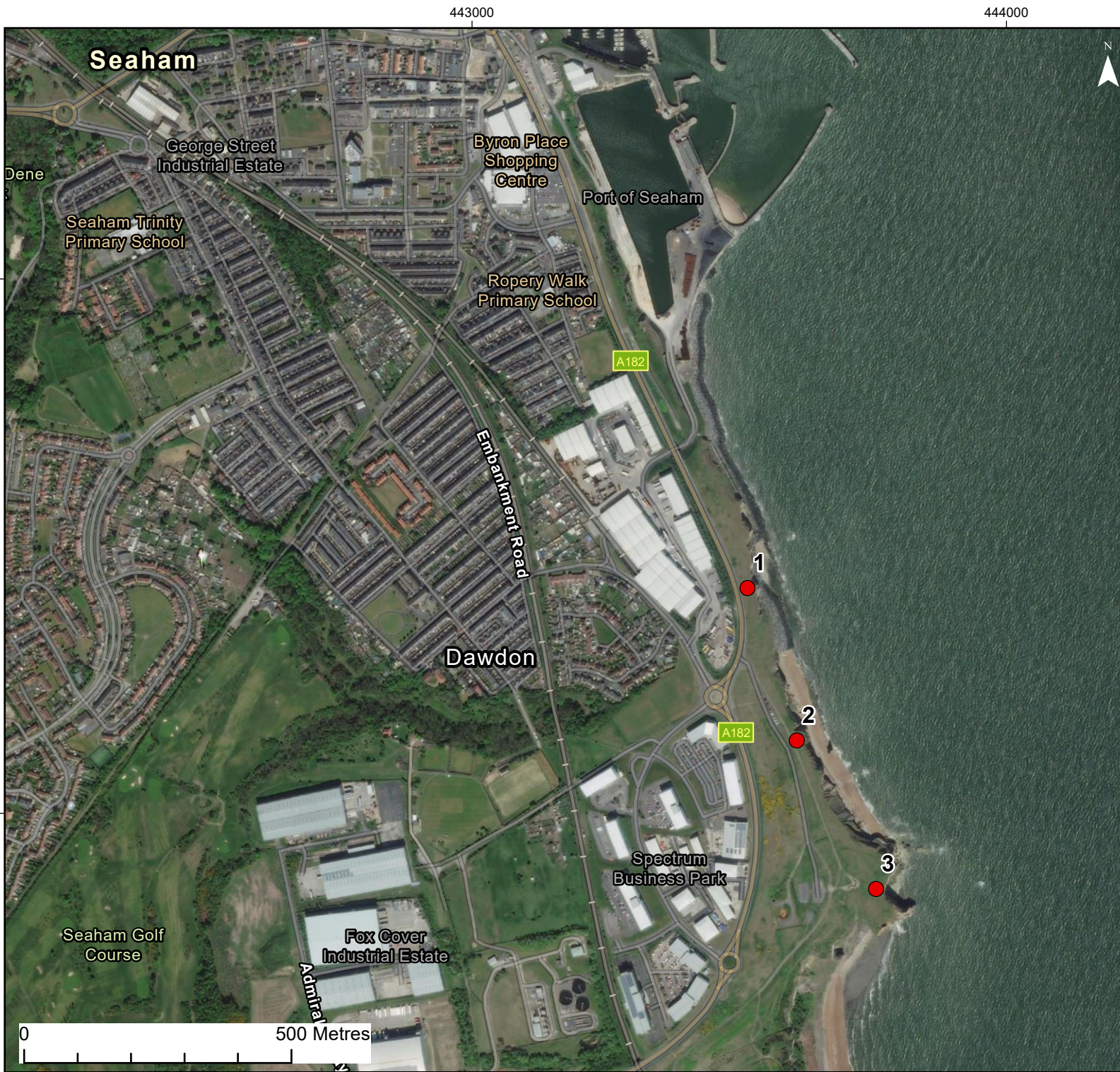
Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	n/a	TC	NJC	A4	1:25,000

Co-ordinate system: British National Grid

Royal HaskoningDHV  
Enhancing Society Together

North East Coastal Observatory

© HaskoningDHV UK Ltd.  
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

© HaskoningDHV UK Ltd.  
 World Imagery: Maxar, Microsoft  
 GB Cartographic: Contains OS data © Crown Copyright and database right 2020  
 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
10 <sup>th</sup> March 2023	<p><b>Beach Profiles:</b></p> <p>Featherbed Rocks is monitored by one beach profile line (<b>1bEA1</b>) during the Partial Measures survey (Appendix A). The previous survey was November 2022.</p> <p>Over the winter months, Profile <b>1bEA1</b> has experienced very little change. Chainage 0m to 55m covers the cliff top, cliff face and promenade and remains largely constant due to protection offered by the rock armour. It is assumed small variabilities observed in the cliff face is due to the margin of error of the survey technique rather than true change. The uneven profile at the base of the sea wall between 55m and 80m is due to the rock armour. Beyond 90m there remains no sediment over the shore platform which is reflected in an uneven profile.</p>	<p>Very little to no change has occurred at Profile 1bEA1 since the previous survey. The rocky foreshore remains exposed fronting the defended section.</p> <p><b>Longer term trends:</b></p> <p>The rocky nature of the foreshore means it is unlikely to undergo significant changes in morphology unless sediment is deposited. Previous monitoring indicates that a veneer beach tends to accumulate over the summer and is stripped off by winter storms, giving rise to small and localised changes in profile. Although the veneer beach has not been observed for a number of years. The upper part of the profile, which covers the cliff, promenade and rock armour remains unchanged, as does the lower part of the profile which covers the rocky foreshore.</p>

## 2.2 Seaham (Dawdon)

Survey Date	Description of Changes Since Last Survey	Interpretation
10 <sup>th</sup> March 2023	<p><b>Cliff-top Survey:</b></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. The cliff top surveys at Dawdon are undertaken bi-annually.</p> <p>Measurements are taken from a fixed ground control point along a fixed bearing to the edge of the cliff top. Appendix B provides results from the March 2023 survey showing the position from the ground control point to the edge of the cliff top along the defined bearing and changes since the November 2008 baseline survey.</p> <p>The cliff monitoring data shows that zero of the three control point experienced significant change over the winter of 2022/23. Points 1 and 2 demonstrate a slight advance seaward since November 2022 (0.08m and 0.02m respectively). However, this is within the margin of error of the survey technique and thus unlikely to be true change. Point 3 experienced a negligible retreat of 0.03m which is again comfortably within the survey error of <math>\pm 0.2</math>m.</p>	<p>The control points have remained stable since the previous survey with zero of the three control points experiencing significant change (<math>&gt;0.2</math>m)</p> <p><b>Longer term trends:</b></p> <p>There is more confidence in the long-term pattern of change, where the cumulative measured erosion is greater than the error inherent in the technique.</p> <p>Points 1 and 3 have shown an average recession rate of 0.08m/yr and 0.09/yr since monitoring began in 2008, whilst Point 2 has shown an average recession rate of 0.02m/yr.</p>

## 2.3 Blast Beach

Survey Date	Description of Changes Since Last Survey	Interpretation
10 <sup>th</sup> March 2023	<p><b>Beach Profiles:</b></p> <p>Blast Beach is covered by four beach profile lines during the Partial Measures survey (Appendix A).</p> <p>Profile <b>1bSH1B</b>, added in October 2015, is adjacent to the sewage works south of Seaham. The profile consists of cliff to chainage 30m followed by a gravelly beach, the beach is bisected by a concrete obstruction at chainage 59m. The 2023 Partial Measures survey showed that there has been consistent erosion of the of the upper beach until the concrete obstruction of up to 0.5m in level. Seaward of the concrete blocks, the beach has again been eroded by 0.25m in level over a 5m length. From chainage 66m onwards the rocky foreshore has experienced little to no change. Overall, the beach is at a very low level when compared to the range of the previous surveys, particular between chainage 29m and 44m which is at the lowest level on record.</p> <p>Profile <b>1bSH1A</b> was added to the programme during the Full Measures survey in September 2009. It is located to the north of the previously-established <b>1bSH1</b>. The Survey Report notes dense vegetation restricts access to the cliff top and cliff base. The 2023 Partial Measures survey showed that the eroding face of the spoil deposit has not retreated any further since the previous survey in November 2022. However, the berm at the toe of spoil face has been eroded away, resulting in a drop in level of up to 2m in places. Seawards of chainage 170m the rocky foreshore remains exposed and has experienced little change.</p> <p>A similar pattern of change is observed at profile <b>1bSH1</b>. The eroding face of the spoil deposit has not retreated any further since the previous survey in November 2022. However, the has significantly dropped in level by up to 1.5m in places. The drop in level has resulted in the rocky foreshore being exposed from chainage 117m onwards.</p> <p>At profile <b>1bSH2</b> dense vegetation again restricted access to the cliff tops skewing the profile across the cliff face up chainage 97m. The residual colliery spoil berm, between changes 100m and 135m has remained largely stable, with all changed limited to <math>\pm 0.15</math>m. Seaward of this, change is limited to <math>\pm 0.2</math>m with erosion occurring between chainage 135m and 163m before switching to accretion to chainage 187m. Overall, the beach is at a medium level compared to the range recorded from previous surveys.</p>	<p>The latest Partial Measures survey showed that erosion has dominated the profiles through Winter 22/23. This is particular noticeable at the northern end Blast Beach where upper beach has dropped in level across by profiles by up 2m. Despite this dramatic drop in level, the colliery spoil face has not retreated over this time period.</p> <p>The change to the south of Blast Beach appears less significantly with all change limited to <math>\pm 0.2</math>m</p> <p>The rocky foreshore is exposed across all profiles.</p> <p><b>Longer term trends:</b></p> <p>The cliffs behind Blast Beach are currently inactive because they are fronted by colliery spoil. The sea cliffs will eventually reactivate as ongoing erosion of the colliery spoil removes the protection it affords to the cliffs. In the past this has been deemed most likely to occur at the southern end of the bay where the spoil was more rapidly eroding. The (previously) accumulating sediment seaward of the colliery spoil in the northern part of the bay was thought to 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.</p>

## 2.4 Hawthorne Hive

Survey Date	Description of Changes Since Last Survey	Interpretation
10 <sup>th</sup> March 2023	<p><b>Beach Profiles:</b></p> <p>Hawthorne Hive is covered by one beach profile line <b>1cEA2</b> during the Partial Measures survey (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>Until the Partial Measures survey in April 2013, a channel was present between 95m and 105m chainage, but it has infilled. The survey shows that over the winter months, the upper beach, from chainage 101m to 150m, has accreted by up to 0.6m. Seaward of chainage 150m the rocky foreshore remains exposed. Overall, the beach is at a medium level compared to the range recorded from previous surveys.</p>	<p>Since the previous survey in November 2022, where beach levels were at a very low level, the profile at Hawthorne Hive appears to have undergone a period of recovery with upper beach accreting by up to 0.6m in level.</p> <p><b>Longer term trends:</b></p> <p>Contrary to the results of this survey, the profiles generally show the beach is undergoing progressive erosion.</p> <p>The infilling and incision of the channel seems to be an episodic process and is likely to reflect a combination of annual and seasonal variations in the flow of Hawthorn Burn and storm events which move sediment onshore to block the outflow of the burn.</p>

### **3. Problems Encountered and Uncertainty in Analysis**

#### **Individual Profiles**

- The surveyor noted difficulties accessing the cliff tops of sections SH1, SH2 and SH1A and the cliff base of SH1A due to dense vegetation.
- At Hawthorne Hive the surveyor was unable to measure the start of Section EA2 due to vegetation cover.

#### **Cliff Top Surveys**

- Whilst there is low confidence in the short-term erosion rates due to the error in the method, longer-term data are more reliable and suggest erosion rates of almost 0.1m/yr.

### **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 shore platform remains exposed seaward of the rock armour. As a result of the absence of superficial beach sediment, there has been very little change since the previous survey.
- At Seaham Cliffs, the control points have remained stable with none of the three control points experiencing significant change (>0.2m) since the previous survey.
- Along Blast Beach, the latest Partial Measures survey showed that erosion has dominated the profiles through Winter 22/23. This is particularly noticeable at the northern end Blast Beach where the upper beach has dropped in level across by profiles by up to 2m. Despite this dramatic drop in level on the upper beach, the colliery spoil face has not retreated over this time period.
- Since the previous survey in November 2022, where beach levels were at a very low level, the profile at Hawthorne Hive appears to have undergone a period of recovery with upper beach accreting by up to 0.6m in level.



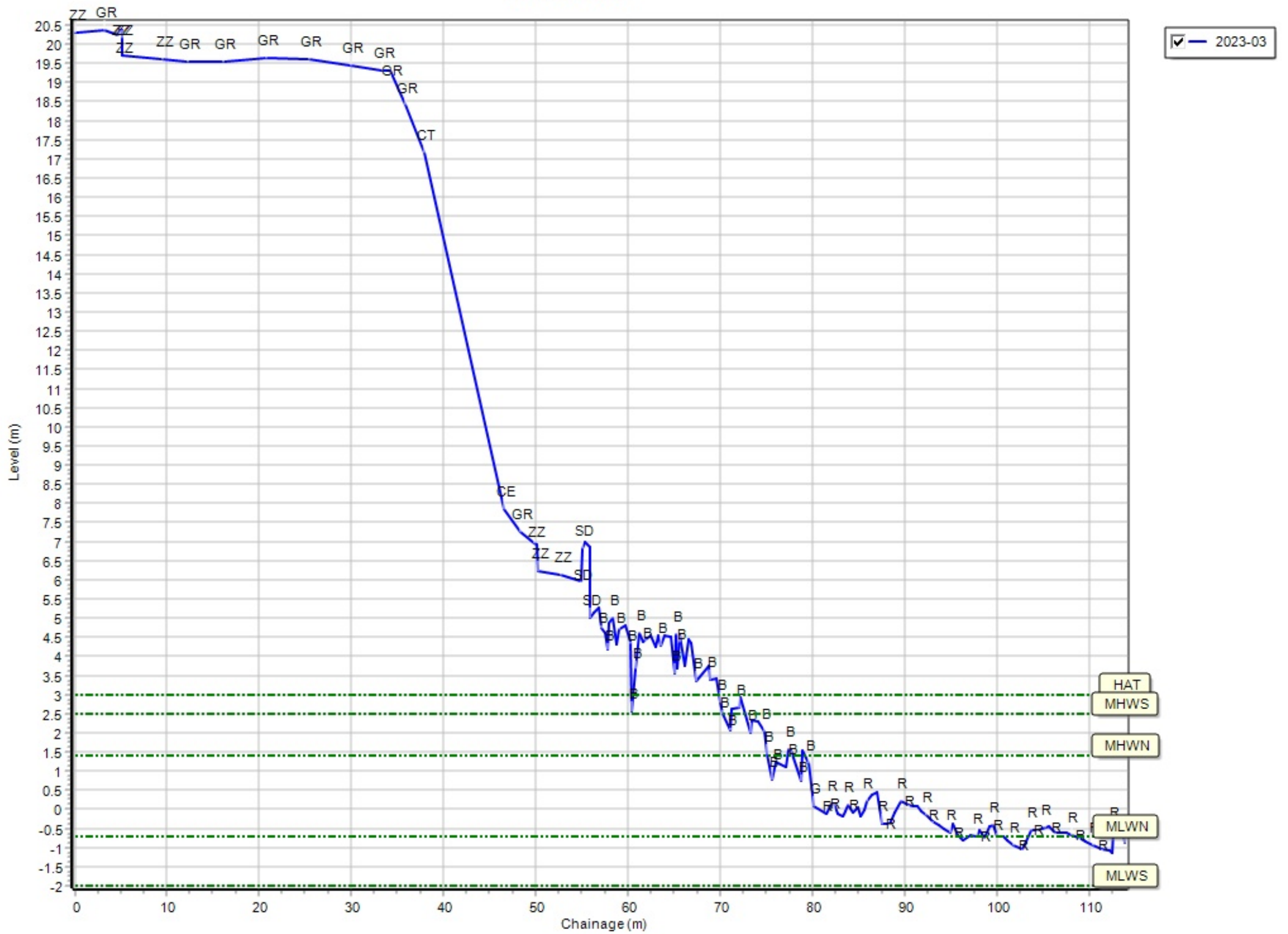
## **Appendices**

**Appendix A**  
**Beach Profiles**

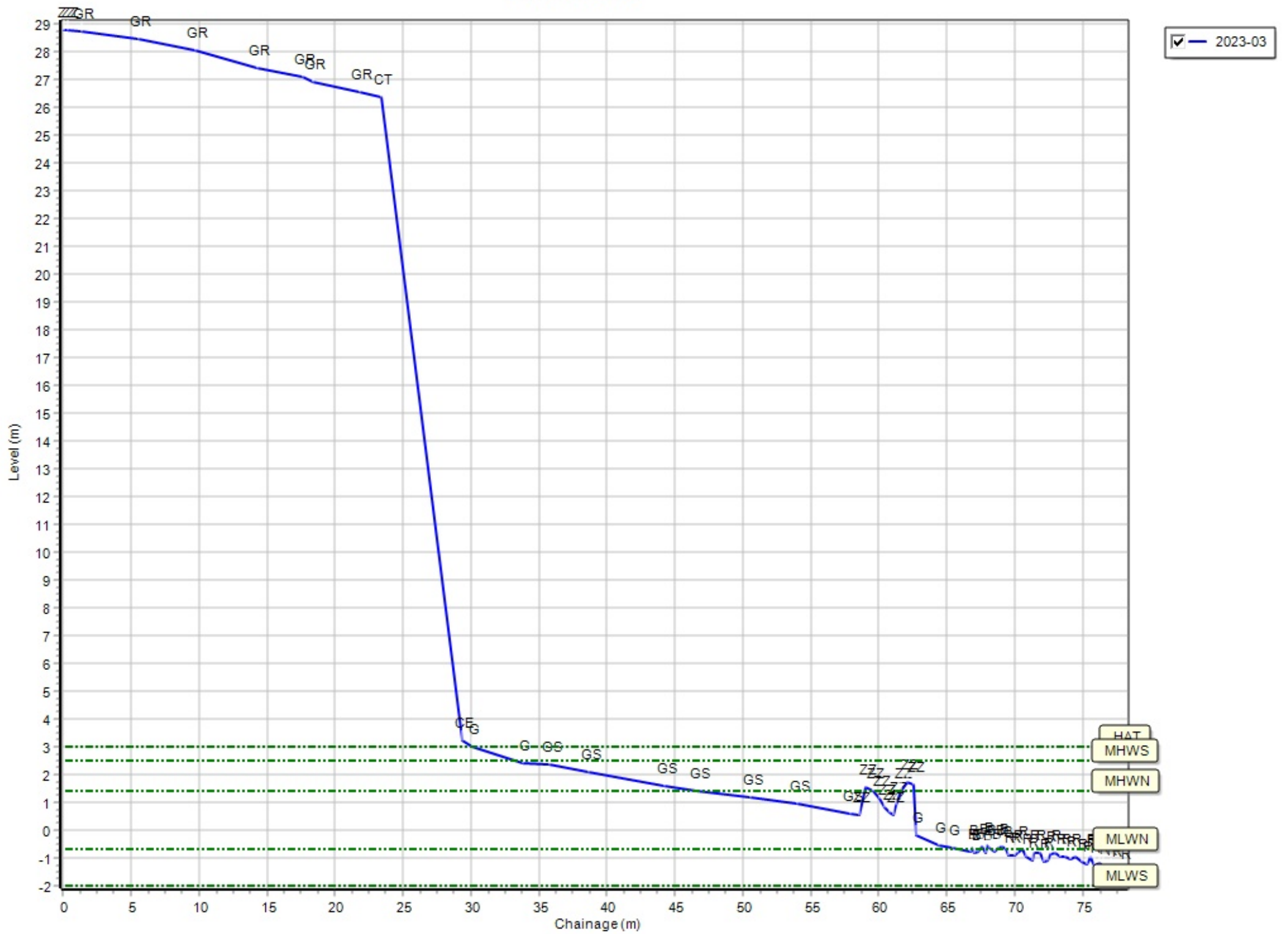
The following sediment feature codes are used on some profile plots:

<b>Code</b>	<b>Description</b>
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

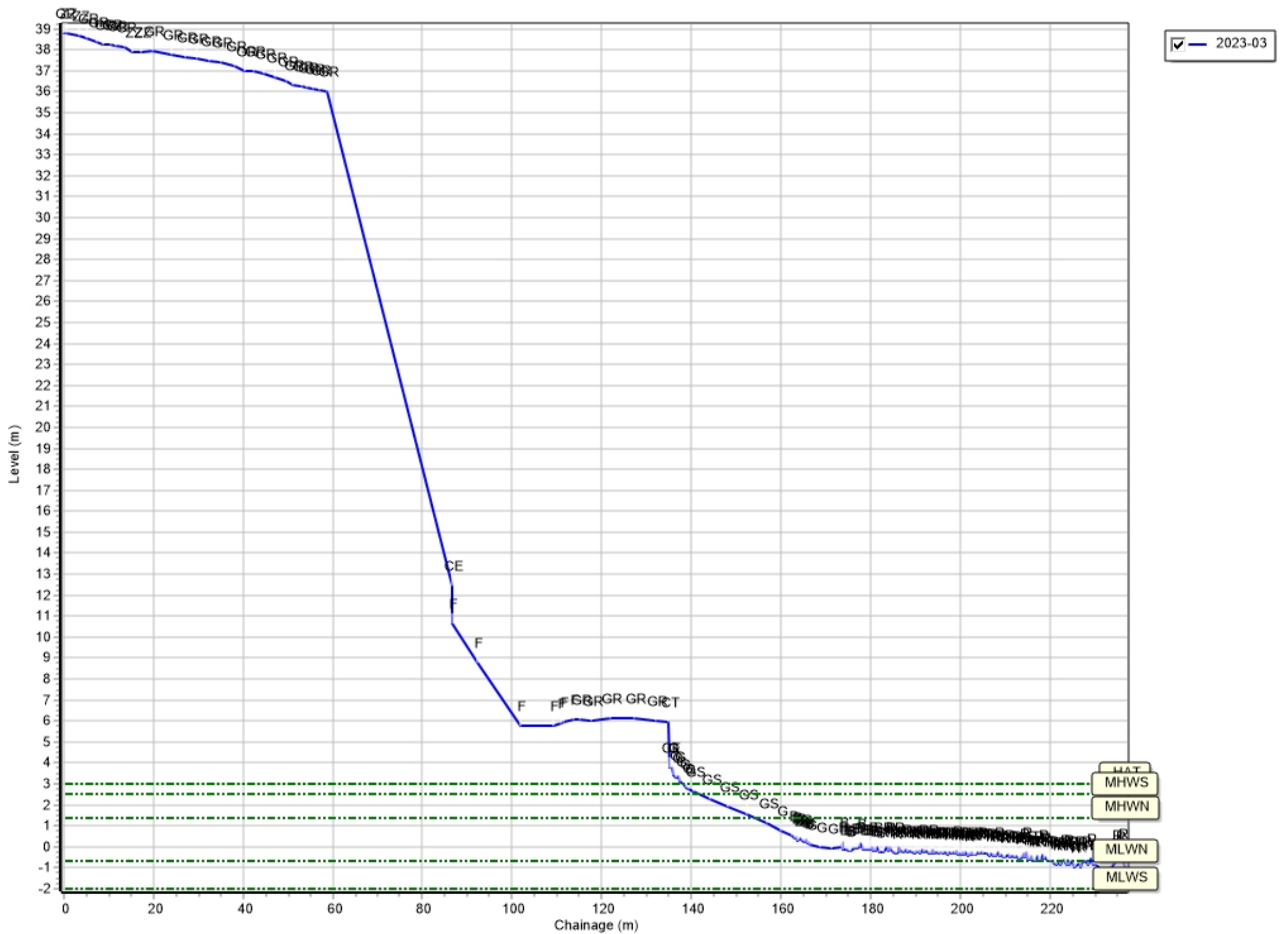
# Profiles: 1bEA1



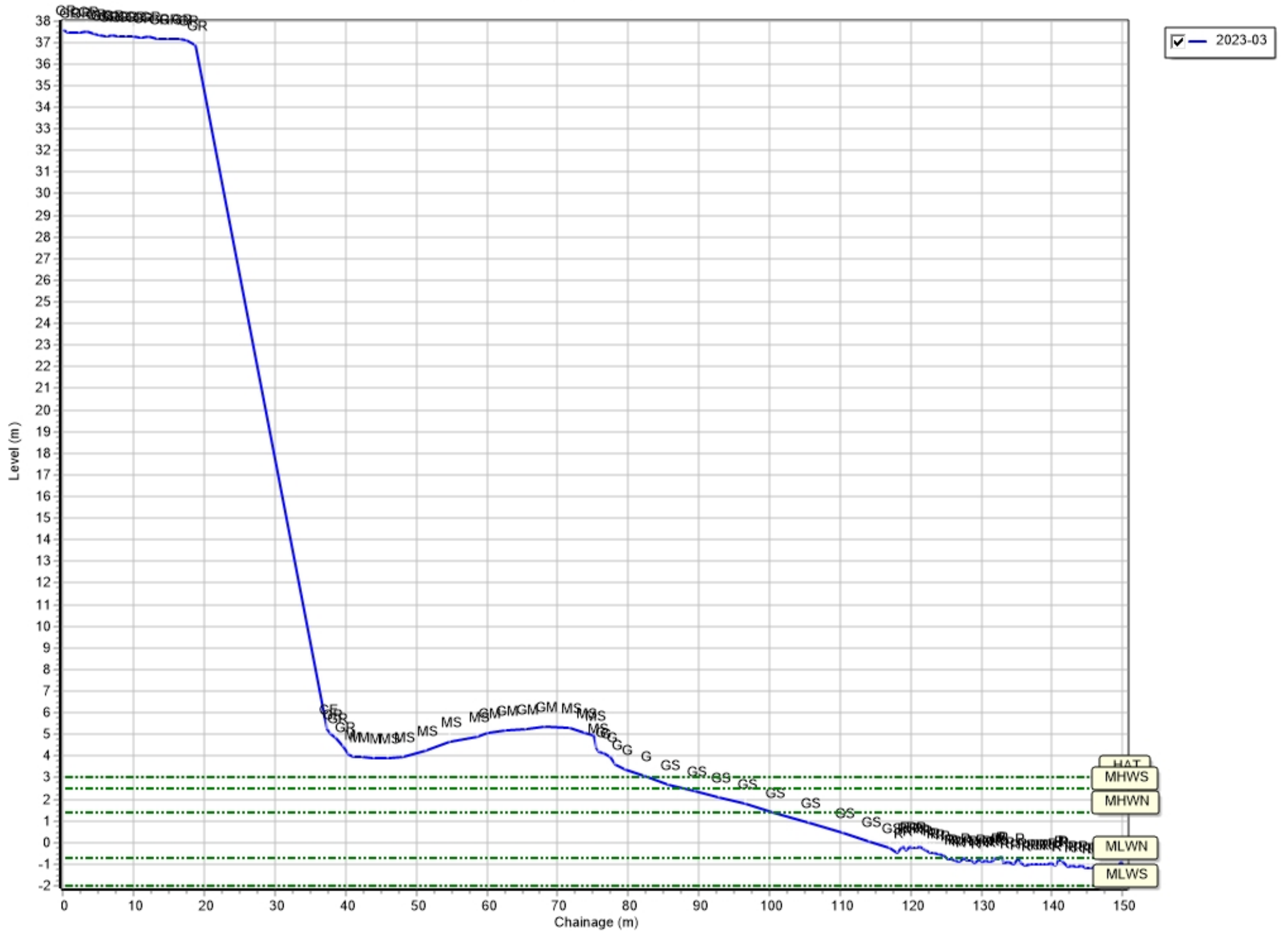
# Profiles: 1bSH1B



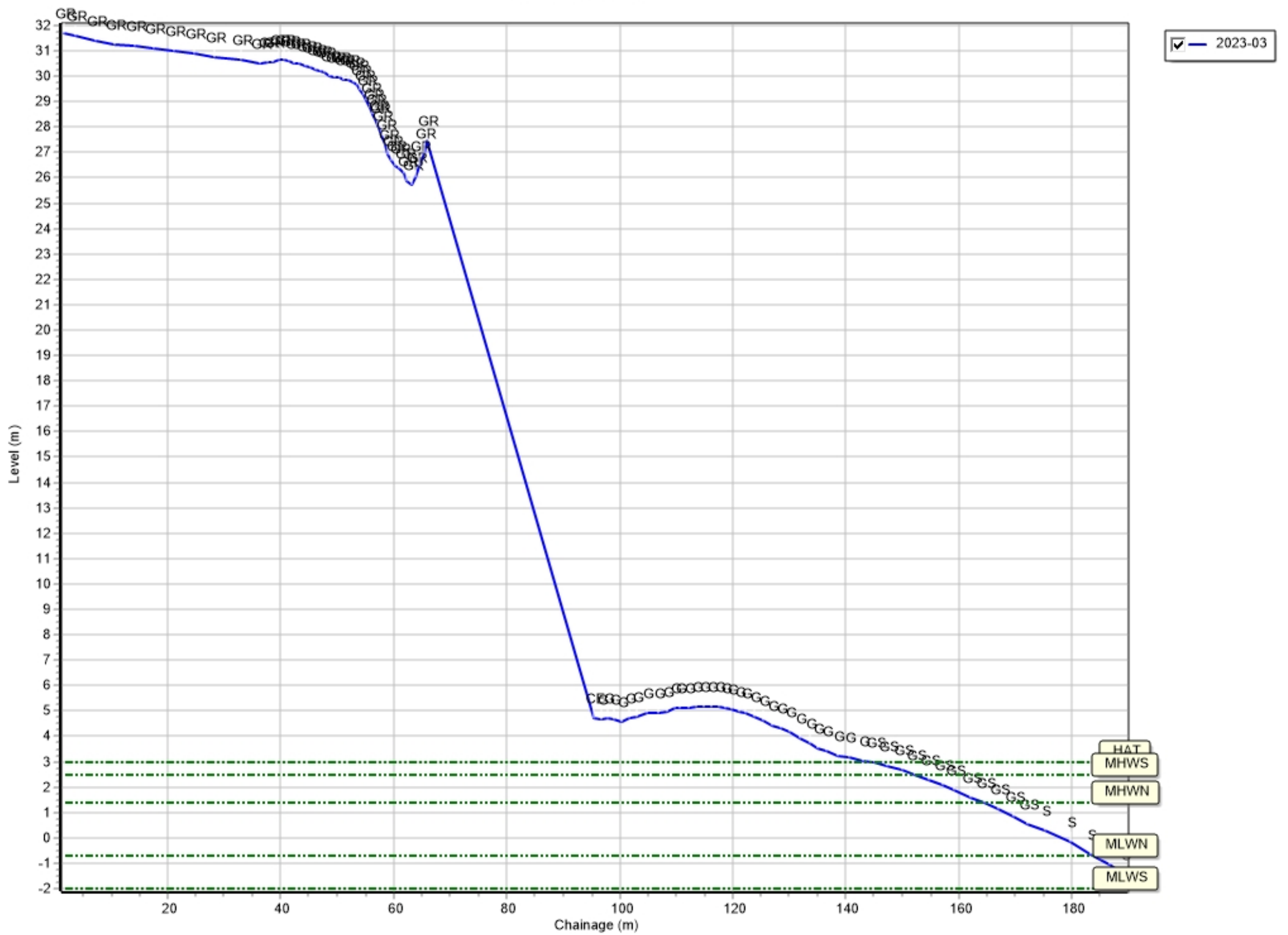
# Profiles: 1bSH1A



# Profiles: 1bSH1

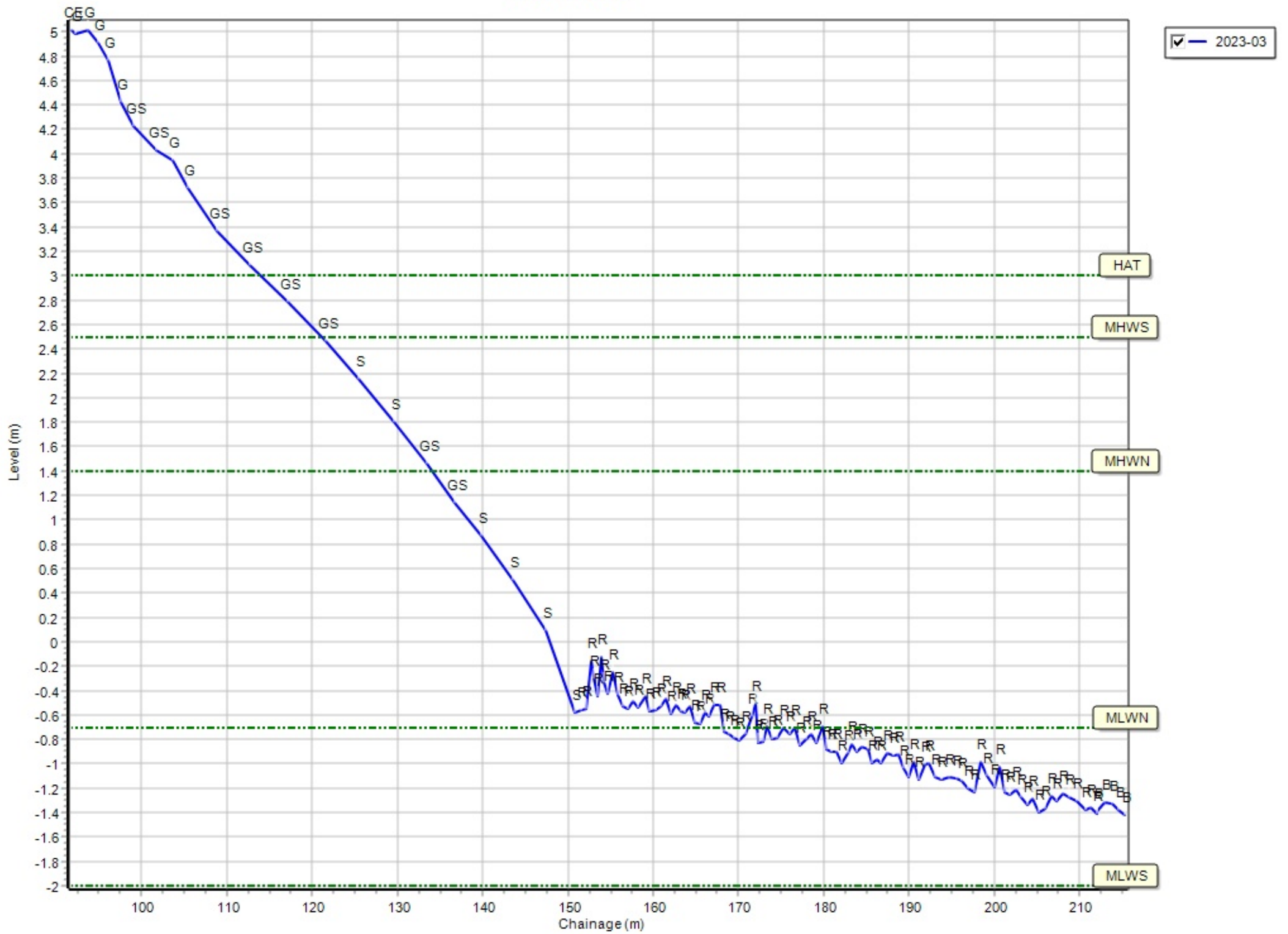


# Profiles: 1bSH2

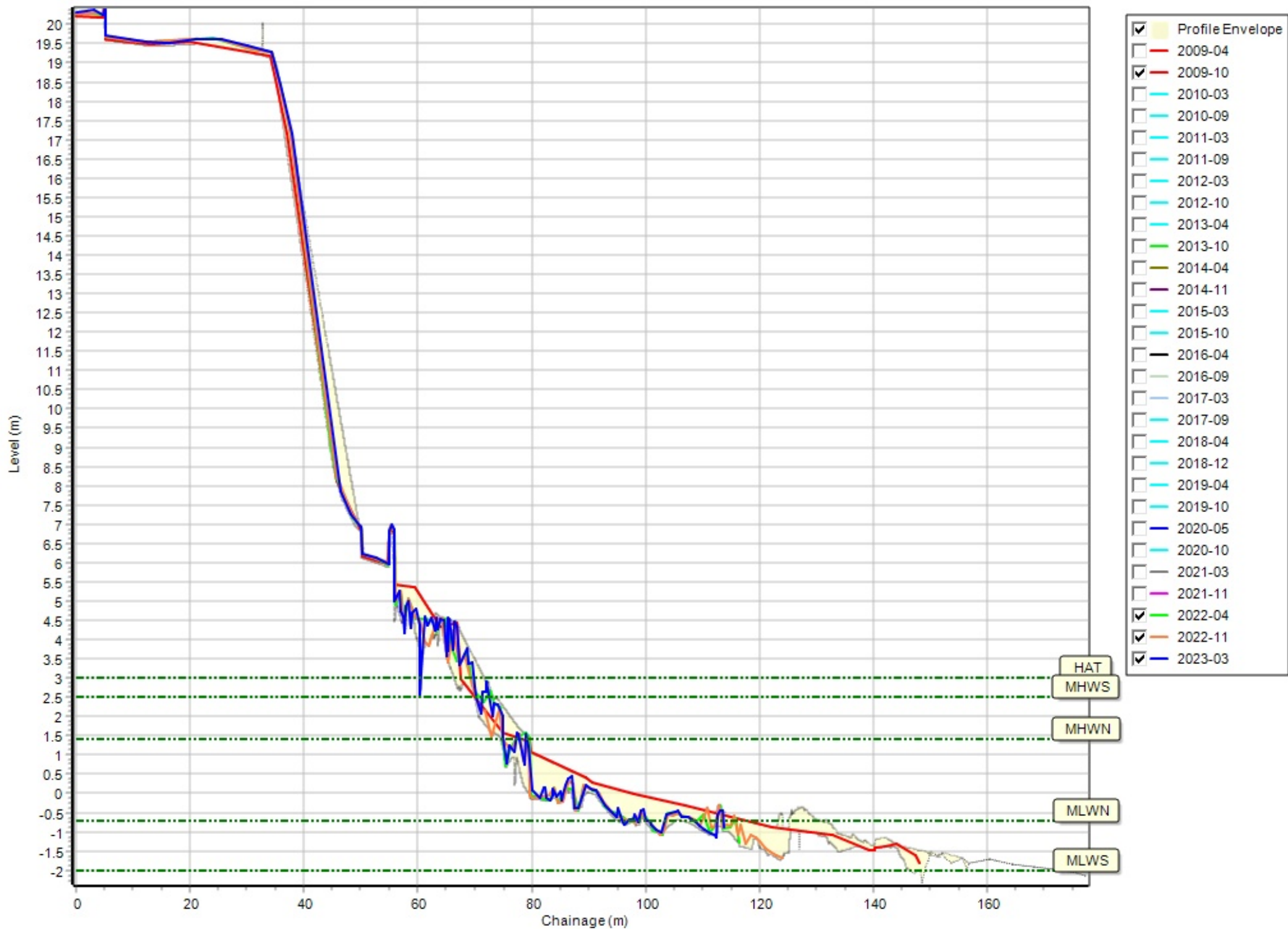




# Profiles: 1cEA2

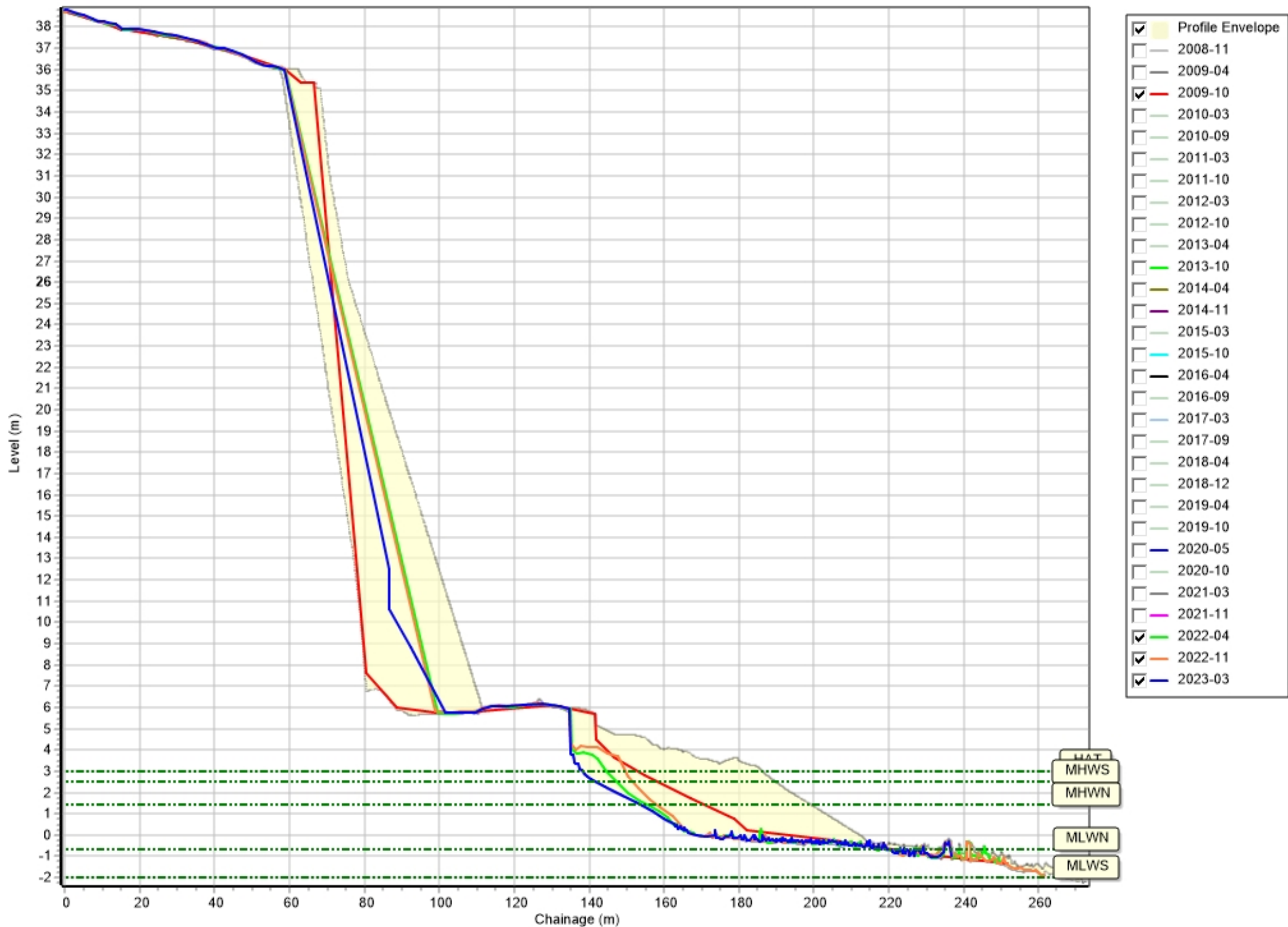


# Profiles: 1bEA1

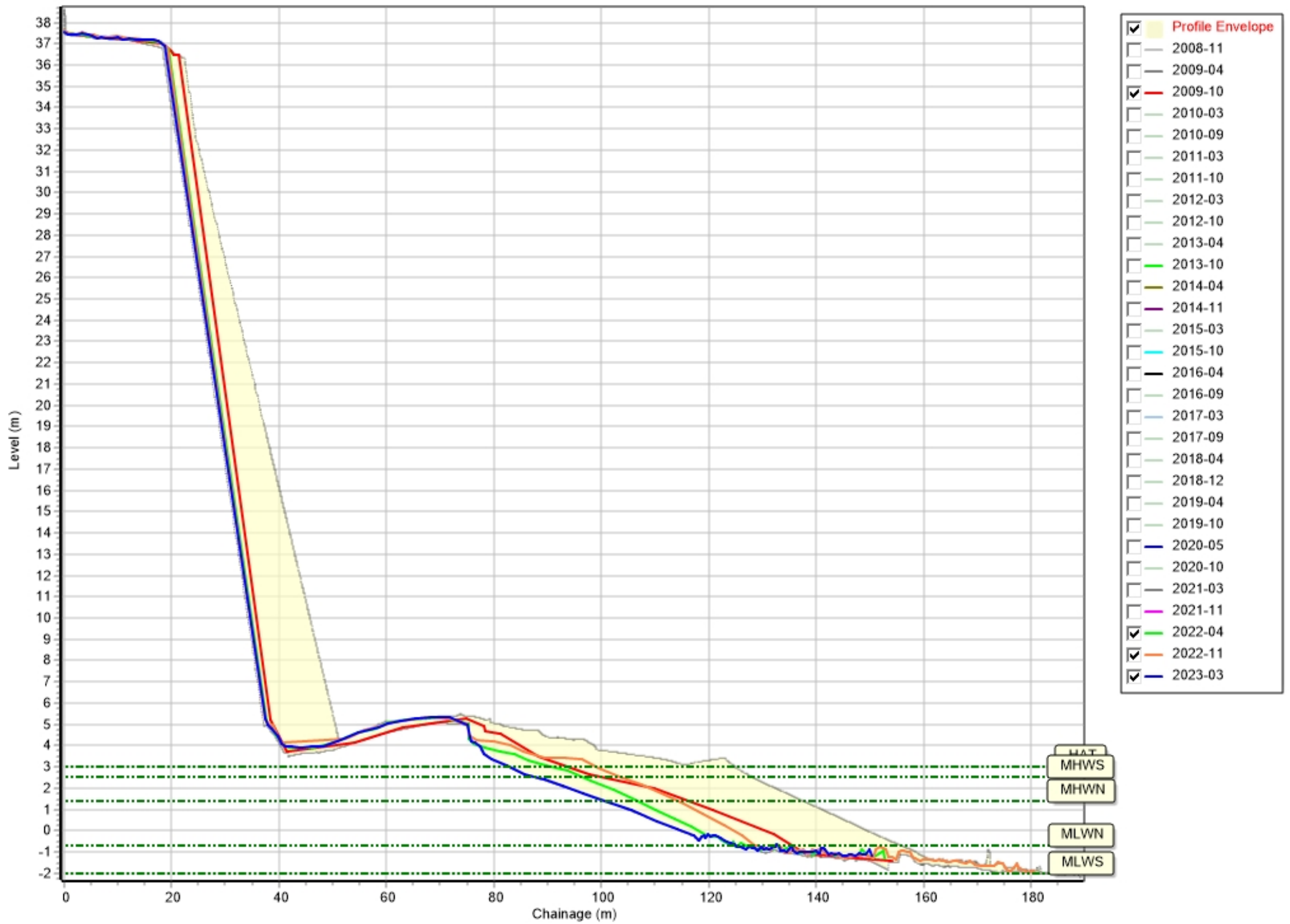




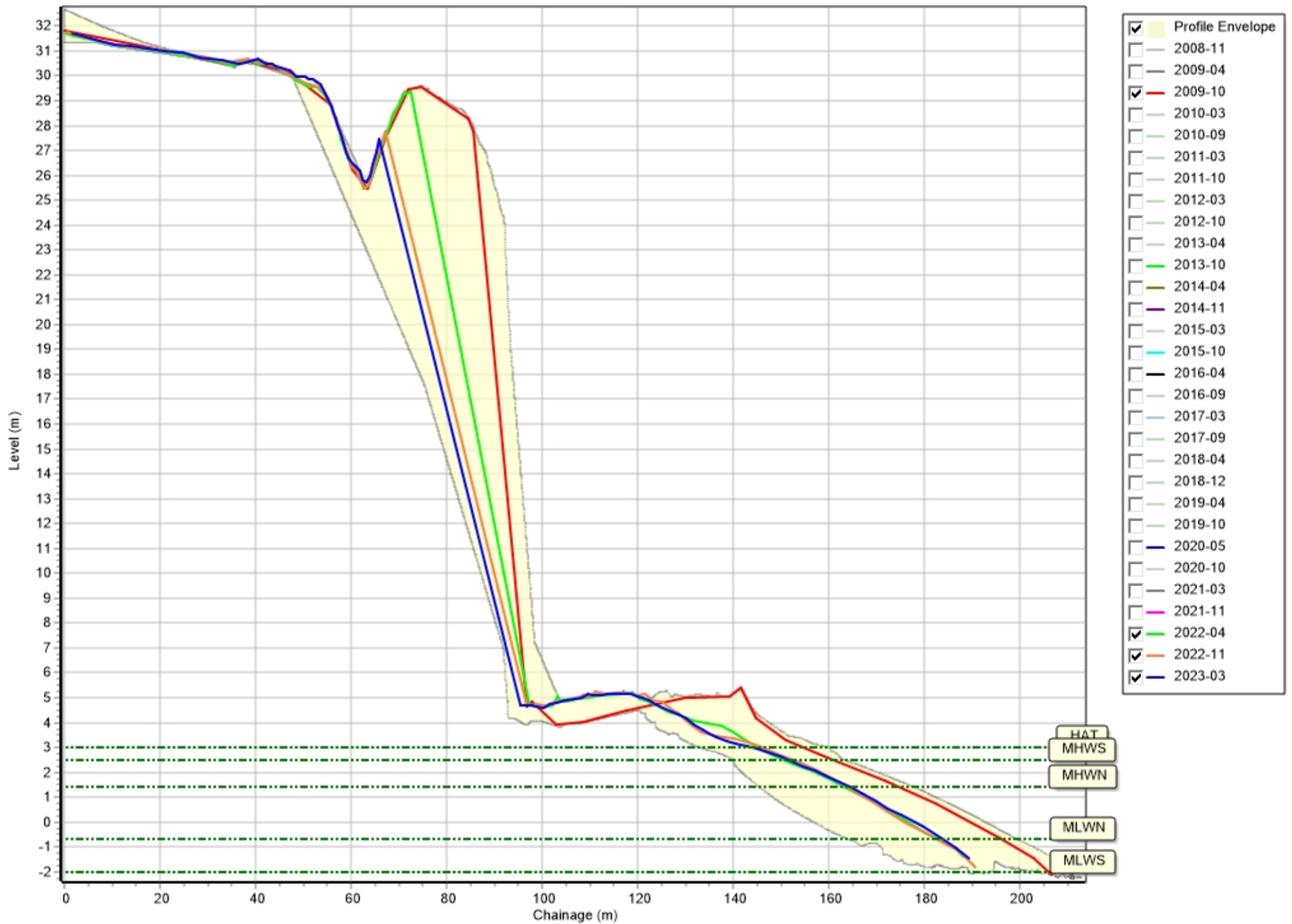
# Profiles: 1bSH1A



# Profiles: 1bSH1



# Profiles: 1bSH2



Profiles: 1cEA2



**Appendix B**  
**Cliff Top Survey**



## Cliff Top Survey

### Seaham (Dawdon)

Three ground control points have been established at Dawdon (Figure B1). The maximum separation between any two points varies along the coast, reflecting the degree of risk from erosion.

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.

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 Dawdon**

Ground Control Points				Distance to Cliff Top (m)			Total Erosion (m)		Erosion Rate (m/year)
Ref	Easting	Northing	Bearing	Baseline Survey	Previous Survey	Present Survey	Baseline to Present	Previous to Present	Baseline to Present
			(°)	Nov 2008	Nov 2022	Mar 2023	Nov 2008 - Mar 2023	Nov 2022 - Mar 2023	Nov 2008 - Mar 2023
1	443515.4	548421.7	70	16.1	14.86	14.94	1.16	-0.08	0.08
2	443607.8	548136.3	90	13.3	12.95	12.97	0.33	-0.02	0.02
3	443756.1	547858.5	95	14.8	13.43	13.40	1.40	0.03	0.09