



North East  
Coastal  
Observatory



**SCARBOROUGH**  
BOROUGH COUNCIL



**Royal  
HaskoningDHV**  
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## **Cell 1 Regional Coastal Monitoring Programme Update Report 14: 'Partial Measures' Survey 2022**

**Scarborough Borough Council  
August 2022**

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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)	Water Level (m AOD)	Water Level (m AOD)
	Sandsend Beach to Whitby Sands	Scarborough North Bay to Cayton Bay	Filey Bay
HAT	3.2	3.25	3.35
MHWS	2.6	2.45	2.95
MHWN	1.4	1.35	2.05
MLWN	-0.8	-0.95	-0.45
MLWS	-2.0	-2.35	-1.85

Source: UKHO Admiralty Tide Tables, 2020

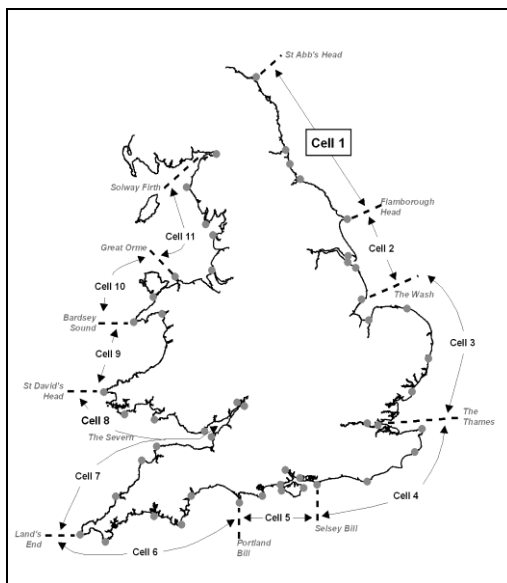


## Glossary of Terms

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 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:



<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:

To date the following reports have been produced:

**Table 1 Analytical, Update and Overview Reports Produced to Date**

Year		Full Measures		Partial Measures		Cell 1 Overview Report
		Survey	Analytical Report	Survey	Update Report	
1	2008/09	Sep-Dec 08	May 09	Mar-May 09	Jun 09	-
2	2009/10	Sep-Dec 09	Mar 10	Feb-Mar 10	Jul 10	-
3	2010/11	Aug-Nov 10	Feb 11	Feb-Apr 11	Aug 11	Sep 11
4	2011/12	Oct-Nov 11	Feb 12	Mar-May 12	Jul 13	-
5	2012/13	Sep 12	Mar 13	Apr-May 13	May 13	-
6	2013/14	Oct-Nov 13	Feb 14	Mar-Apr 14	Jul 14	-
7	2014/15	Sep 14	Feb 15	Mar 15	Jul 15	-
8	2015/16	Sep 15	Feb 16	Mar-Apr 16	Jul 16	Jun 16
9	2016/17	Sep–Nov16	Feb 17	Feb-Apr 17	Jul 17	-
10	2017/18	Sep-Oct 17	Jan 18	Mar-May 18	Jun 18	-
11	2018/19	Sep-Oct 18	Mar 19	Mar-Apr 19	July 19	-
12	2019/20	Sep-Nov 19	Jan 20	Feb-Apr 20	Jun 20	-
13	2020/21	Nov-Dec 20	Mar 20	Mar-Apr 21	Jun 21	Aug 2021
14	2021/22	Oct-Nov 21	Feb 22	Apr-May 22	Aug 22	

(\*) The present report is **Update Report 14** and provides an analysis of the 2022 Partial Measures survey for Scarborough Council's frontage.

## 1. Introduction

### 1.1 Study Area

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

- Staithes<sup>2</sup>
- Runswick Bay
- Sandsend Beach, Uppang Beach and Whitby Sands
- Robin Hood's Bay
- Scarborough North Bay
- Scarborough South Bay
- Cayton Bay
- Filey Bay

### 1.2 Methodology

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

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

The location of these surveys is shown in Figure 2. The Partial Measures survey was undertaken along this frontage between 5<sup>th</sup> April and 19<sup>th</sup> May 2022, more specifically:

- Runswick Bay – 5<sup>th</sup> April 2022
- Whitby – 16<sup>th</sup> May 2022;
- Robin Hood's Bay – 3<sup>rd</sup> May 2022;
- Scarborough – 17<sup>th</sup> May 2022;
- Cayton Bay – 19<sup>th</sup> May 2022; and
- Filey – 18<sup>th</sup> May 2022

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

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<sup>2</sup> The Staithes frontage straddles the boundary of jurisdiction of both Redcar & Cleveland Borough Council and Scarborough Borough Council.





**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 1**  
**RUNSWICK BAY**  
**Scarborough Borough 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

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**SURVEY LOCATIONS**

**Topographic Profile**

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

**Topographic Area**

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

- Cliff Top Survey Points (Red dot)

(refer to Figure 3 for details)

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

Title:

**Figure 2 - Map 2**

**SANDSEND TO WHITBY**

**Scarborough Borough 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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- 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 3**  
**ROBIN HOOD'S BAY**  
**Scarborough Borough Council Frontage**

Report:

Survey Report

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
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- SURVEY LOCATIONS**
- Topographic Profile**
- Annual (Blue line)
  - Bi-Annual (Pink line)
- Topographic Area**
- 6 monthly (Light Green)
  - yearly (Yellow)
  - 5 yearly (Light Purple)
- Cliff Top Survey Points (Red dot)
- (refer to Figure 3 for details)

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

Title: **Figure 2 - Map 4**  
**SCARBOROUGH NORTH BAY**  
**Scarborough Borough Council Frontage**

Report: **Survey Report**

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
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Co-ordinate system: British National Grid



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**SURVEY LOCATIONS**

**Topographic Profile**

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

**Topographic Area**

- 6 monthly (Light Green)
- yearly (Yellow)
- 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 5**  
**SCARBOROUGH SOUTH BAY**  
**Scarborough Borough Council Frontage**

Report: **Survey Report**

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
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Co-ordinate system: British National Grid

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**SURVEY LOCATIONS**

**Topographic Profile**

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

**Topographic Area**

- 6 monthly (Light Green)
- yearly (Yellow)
- 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 6**  
**CAYTON BAY**  
**Scarborough Borough Council Frontage**

Report: **Survey Report**

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	n/a	TC	NJC	A4	1:15,000

Co-ordinate system: British National Grid

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**SURVEY LOCATIONS**

**Topographic Profile**

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

**Topographic Area**

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

- Cliff Top Survey Points (Red dots)

(refer to Figure 3 for details)

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

Title:

**Figure 2 - Map 7**  
**FILEY BAY**  
**Scarborough Borough Council Frontage**

Report:

**Survey Report**

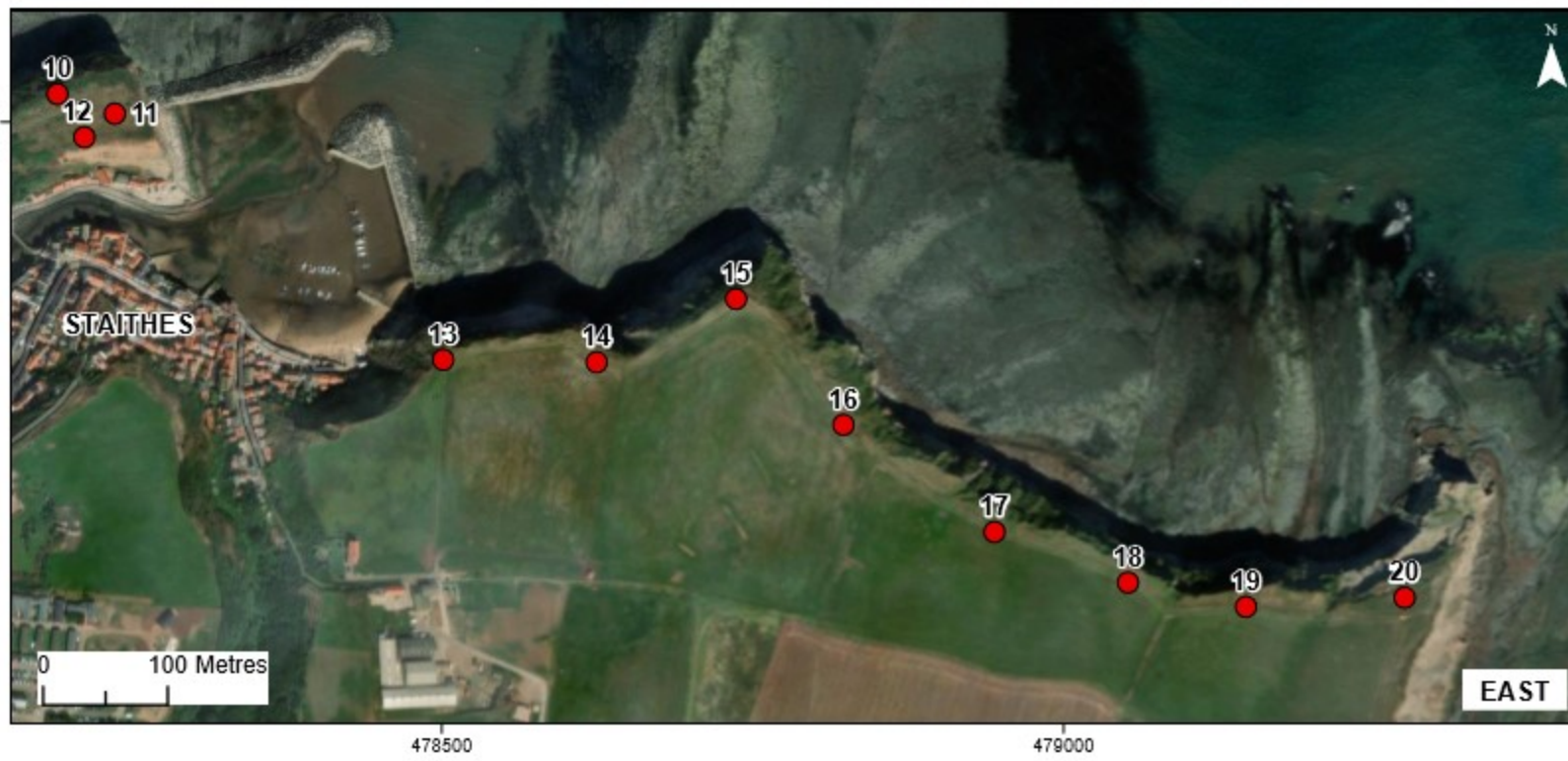
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**SURVEY LOCATIONS**

- Cliff Top Survey Points

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

Title:  
**Figure 3 - Map 1**  
**STAITHES**  
**Scarborough Borough Council Frontage**

Report:  
 Survey Report

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	n/a	TC	NJC	A4	1:6,000

Co-ordinate system: British National Grid







**SURVEY LOCATIONS**  
 ● Cliff Top Survey Points

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

Title:  
**Figure 3 - Map 2**  
**ROBIN HOOD'S BAY**  
**Scarborough Borough Council Frontage**

Report:  
 Survey Report

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

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**SURVEY LOCATIONS**

● Cliff Top Survey Points

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

Title:

**Figure 3 - Map 3**

**SCARBOROUGH SOUTH BAY**

**Scarborough Borough Council Frontage**

Report:

**Survey Report**

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	n/a	TC	NJC	A4	1:15,000

Co-ordinate system: British National Grid







**SURVEY LOCATIONS**  
 ● Cliff Top Survey Points

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

Title:  
**Figure 3 - Map 4**  
**CAYTON BAY**  
**Scarborough Borough Council Frontage**

Report:  
 Survey Report

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
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**SURVEY LOCATIONS**

- Cliff Top Survey Points

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

Title:  
**Figure 3 - Map 5**  
**FILEY BAY (NORTH)**  
**Scarborough Borough Council Frontage**

Report:  
 Survey Report

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
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**SURVEY LOCATIONS**  
 ● Cliff Top Survey Points

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

Title:  
**Figure 3 - Map 6**  
**FILEY BAY (SOUTH)**  
**Scarborough Borough Council Frontage**

Report:  
 Survey Report

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	n/a	TC	NJC	A4	1:20,000

Co-ordinate system: British National Grid



## 2. Analysis of Survey Data

### 2.1 Staithes

Survey Date	Description of Changes Since Last Survey	Interpretation
25 <sup>th</sup> April 2022	<p><b>Cliff-top Survey:</b></p> <p>Twenty ground control points have been established at Staithes for the purposes of cliff top monitoring. The separation between any two points is a nominal 100m. The cliff top surveys at Staithes are undertaken bi-annually. Data collection involves a distance offset measurement from the ground control point to the cliff edge along a fixed bearing.</p> <p>Appendix C provides results from the April 2022 survey, showing the distance from the ground control point to the edge of the cliff top along the defined bearing and changes in position since the November 2008 baseline survey and the previous October 2021 survey.</p> <p>The results provided in Appendix C show that the majority of the profiles show little or no erosion since the previous survey, with only 2 points experiencing erosion greater than the survey error (0.20m). These are Point 4 (0.27m) and Point 5 (0.30m), both located to the west of the survey extent. 12 of the 20 survey points noted apparent 'accretion' of the cliff top, this is likely to be due to difficulties in accurately identifying the cliff edge through vegetation.</p> <p>The long term recession rates show that three points at Staithes are now greater than 0.2m/year (Point 1 along the road to the west of Staithes (0.6m), Point 4 (0.20m) and Point 13 adjacent to the eastern breakwater at Staithes (0.23m)).</p>	<p>The recorded changes to the cliff top between October 2021 and April 2022 are generally small. There has been two points which show retreat of the cliff top greater than the survey error (Point 4 and Point 5).</p> <p><b>Longer term trends:</b> Table C1 in Appendix C presents the erosion rates calculated from the data collected since 2008. Points 1, 4, and 13 are the only locations with a significant recession rate, which ranges from 0.20 to 0.60m/yr.</p>

## 2.2 Runswick Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
5 <sup>th</sup> April 2022	<p><b>Topographic Survey:</b></p> <p>Runswick Bay is covered by a 6-monthly topographic survey. A consistently applied GIS processing routine has been used to create a digital ground model (DGM) (Appendix B - Map 1) and to calculate the differences between the current topographic survey (May 2022) and the previous survey (October 2021) to highlight areas and amounts of erosion and deposition. In all cases, a 5m resolution raster grid has been used to identify areas of erosion and accretion (Appendix B – Map 4).</p> <p>Appendix B - Map 4 shows that the northern third of the bay, fronting the rock armour, has been dominated by erosion with beach levels dropping up to 1.5m in places. To the south of this, the process of change is more varied with a general pattern of accretion on the lower beach and erosion on the upper beach. Immediately south of the rock armour accretion has also occurred at the toe of the cliff. The magnitude of change is comparable to that in the north of the bay.</p>	<p>The southern half of the bay appears to have experienced seasonal fluctuation with a drawdown of material from the upper beach to the lower beach typical of winter conditions.</p> <p>Overall, it appears the volume of sediment in the bay has remained stable despite the large swathes of change.</p> <p><b>Longer term trends:</b> The data collected since 2008 indicate a general pattern of winter drawdown and spring recovery with no measurable net longer-term change.</p>

## 2.3 Sandsend Beach, Upgang Beach and Whitby Sands

Survey Date	Description of Changes Since Last Survey	Interpretation
16 <sup>th</sup> May 2022	<p><b>Beach Profiles:</b></p> <p>The Sandsend, Upgang and Whitby frontage is covered by three beach profile lines for the Partial Measures survey (Appendix A). The profiles were surveyed in November 2021 (Full Measures) and in May 2022.</p> <p><b>Profile 1dWB1</b> is located around 400m south of Sandsend village. Since the previous survey, the beach level has dropped across the whole profile, from the toe of coastal defence (chainage 39m) to the end of the profile (chainage 193m). The magnitude of erosion varies from 0.7m at the toe of the coastal defence, to 0.25m in places on the mid beach. Overall, the profile is at a low level beach compared to the range recorded from previous surveys.</p> <p><b>Profile 1dWB2</b> is located in the centre of Upgang beach. The survey report notes that the cliff top area was not measured due to dense vegetation and explains the anomalies on the cliff face. At the toe of the cliffs, the upper beach has steepened causing a drop in level of up to 0.9m at chainage 166m. Between changes 167m and 179m the beach profile then plateaus, before a berm is formed at 188m. Seaward of the berm the beach profile has steepened since the previous survey, resulting in an apparent rise in level between changes 184m to 230m but a drop in level between 230m and 275m. Overall, the beach is at a medium level compared to the range recorded from previous surveys, with the exception of chainage 166m to 179m where it is at a very low level.</p> <p><b>Profile 1dWB3</b> is located on Whitby Sands. Up to chainage 88m, the profile is unchanged due to the presence of the coastal defence. Seawards of this, the beach level has dropped across the whole profile up to the end of the profile at chainage 236m. The magnitude of erosion varies between 0.1m and 0.55m. Compared to the range recorded from previous surveys, the beach up against the coastal defence is at a high level, whereas the lower beach is at a low level.</p>	<p>Over winter 21/22, the profiles have experienced a net erosion, particularly noticeable at Profiles <b>1dWB1</b> and <b>1dWB3</b>.</p> <p><b>Longer term trends:</b> The beach profiles appear to be reasonably stable showing only seasonal fluctuations.</p>



## 2.4 Robin Hood's Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
3 <sup>rd</sup> May 2022	<p><b>Topographic Survey:</b></p> <p>Data from the most recent topographic survey (Partial Measures, May 2022) have been used to create a digital ground model (DGM) (Appendix B – Map 2) using a Geographical Information System (GIS). A difference plot has also been produced using the DGM (Appendix B – Map 5) from the last topographic survey (October 2021) and the most recent survey (May 2022).</p> <p>The difference plot shows that the majority of the bay has experienced little change over winter 2021/22. Of the change that has occurred, it is low level and patchy in distribution, typical of the rocky outcrops that run perpendicular to the shore. The most intense change has occurred to east of the survey extent where locally levels have changes by up to +1.25m.</p>	<p>The distribution of change is very patchy, with little change over the rock promontories in the bay and localised areas of erosion and accretion in the north and south of the survey extent. The loss of material at the base of the cliff is likely to be due to the ongoing erosion of debris from cliff failures.</p> <p><b>Longer term trends:</b> The difference plots show a continuation of the trend of patchy distribution of erosion and accretion controlled by the nature of the rocky foreshore.</p>
3 <sup>rd</sup> May 2022	<p><b>Cliff-top Survey:</b></p> <p>Thirteen ground control points have been established at Robin Hood's Bay since 3<sup>rd</sup> March 2010 to monitor cliff top recession. The separation between any two points is a nominal 200m and monitoring is undertaken bi-annually. Appendix C provides results from the May 2022 survey showing change since the last survey in October 2021 and the baseline survey in March 2010 (Appendix C- Map 2). The accuracy of the survey technique means change of less than 0.2m is assumed to be error. Calculated advances of the cliff line are also assumed to be error associated with difficulty precisely identify the cliff top, particularly where vegetation is present.</p> <p>Since the previous, none of the 11 monitoring points show erosion (of greater than 0.2m) suggesting a period of stability. Point 11 was noted to have retreated the furthest since the previous survey at 0.11m however this remains within the margin of error. Notable advances were recorded at Point 1 (0.8m) and Point 5 (1.10m), however the survey report notes that Point 5 is located on a pile of deposited garden waste, and that Point 1 has overgrown undefined edges that are hard to distinguish, suggesting these readings are erroneous. The report notes 3,4 and 11 also have overgrown undefined edges.</p> <p>Despite the apparent 0.8m advancement since the previous survey, Point 1 is still the only point with significant long-term erosion, with total erosion of 4.5m since the baseline survey in 2010 and a rate of 0.45m/yr.</p>	<p>The cliff top has remained stable since the previous survey in October 2021, with none of 11 points recording more than 0.2m erosion.</p> <p><b>Longer term trends:</b> The erosion rates calculated from the changes since March 2010 show stability at most of the monitoring locations. The longer-term rates show that Point 1 has a recession rate of 0.45m/yr with other points having a rate of less than 0.1m/yr. This reflects localised and episodic cliff failure through rock fall.</p>

## 2.5 Scarborough North Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
17 <sup>th</sup> May 2022	<p><b>Beach Profiles:</b></p> <p>Scarborough North Bay is covered by five beach profile lines for the Partial Measures survey (Appendix A) that are monitored biannually. The previous Full Measures survey was undertaken in November 2021.</p> <p><b>Profile 1dSBN1</b> is located around 200m south of the Sea Life Centre. There has been significant accretion at the toe of the seawall (chainage 10m) and across the upper beach to chainage 59m. The magnitude of accretion peaks at chainage 15m with an increase in level of 0.8m. Between chainage 59m and the end of the profile at chainage 180m, there has been a consistent drop in level of approximately 0.1m. Overall, the beach is at a low level when compared to the range recorded from previous surveys with the exception of the upper beach where the recent accretion has resulted in the highest level on record between chainages 10m and 39m.</p> <p><b>Profile 1dSBN2</b> is located close to the former chair lift and is defended to chainage 8m. At the toe of the seawall the beach levels have dropped by 0.4m in level. The drop in level continues to chainage 46m, albeit at a reducing level of magnitude. Between chainages 46m and 90m the beach has remained relatively stable with any change limited to <math>\pm 0.1</math>m. Seaward of chainage 90m the rocky foreshore remains exposed. When comparing beach levels to the range recorded from previous surveys, the upper and middle beach is at a medium level and the lower beach at a low level.</p> <p><b>Profile 1dSBN3</b> is located near Royal Albert Drive. Between the toe of the seawall (chainage 13m) and chainage 80m, the beach has experienced alternating lengths of low level accretion and erosion, limited to <math>\pm 0.2</math>m. Seawards of chainage 80m, a berm has formed resulting in a consistent increase in level across the lower beach of approximately 0.6m. Overall, the beach is at a high level compared to the range recorded from previous surveys.</p> <p><b>Profile 1dSBN4</b> is located at the northern end of Clarence Gardens. The upper beach has experienced accretion of up to 0.45m between the toe of the seawall and the rocky outcrops at chainage 35m. The rocky outcrop remains exposed between chainage 35m and 58m. Seawards of chainage 58m, the beach has remained largely stable except for a minor drop in level between chainages 71m and 114m of 0.15m. Beach levels remain at a medium level when compared to the range recorded from previous</p>	<p>The beach in North Bay has undergone varying levels of accretion and erosion since the previous survey. The profile to the north has experienced the most significant accretion with the profile to the south experiencing the most significant erosion suggesting a possible general movement of sediment from south to north.</p> <p><b>Longer term trends:</b> The beach ranges from the higher to the lower end of the range of profiles, however all profiles shows that changes have been within the range of previously recorded surveys.</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>surveys.</p> <p><b>Profile 1dSBN5</b> is located to the south of Clarence Gardens. Since the previous survey, the profile has been dominated by erosion with a drop in beach level from toe of rock armour (chainage 28m) to chainage 120m experienced. The magnitude of change is approximately 0.3m in level. For a short length, between chainages 120m and 156m, the beach has accreted by up to 0.15m in level. The beach is at a medium level when compared to the range recorded from previous surveys.</p>	

## 2.6 Scarborough South Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
17 <sup>th</sup> May 2022	<p><b>Beach Profiles:</b></p> <p>Scarborough South Bay is covered by four beach profile lines for the Partial Measures survey (Appendix A). The profiles were last surveyed during the Full Measures survey of October 2021.</p> <p><b>Profile 1dSBS1</b> is located around 250m south of the West Pier. Over winter 2021/22, there has been a general smoothing of the profile resulting in alternating lengths of erosion and accretion. The profile has eroded on the upper and lower beach, between chainages 17m to 55m and 128m to 188m by up to 0.65m. Between chainages 55m and 128m the beach has accreted by up to 0.2m. Overall, the profile is at a medium level when compared to the range recorded from previous surveys.</p> <p><b>Profile 1dSBS2</b> is located on the shore fronting St Nicholas Cliff. There has been a general smoothing of the profile since the previous survey. The steep upper beach has slackened resulting in a drop in level at the toe of the seawall by 0.85m. This drop in level continues until chainage 35m before switching to accretion to chainages 110m. This accretion has filled a beach hollow identified in the previous survey resulting in a local increase in level of up to 0.7m. Seawards of chainage 145m, the lower beach has accreted by up to 0.3m in level. Overall, the beach is at a medium to high level when compared to the range of previous surveys.</p> <p><b>Profile 1dSBS3</b> is located 250m north of the Scarborough Spa complex. The profile has been dominated by accretion since the previous survey in October 2021. From the toe of the seawall at chainage 9m, to chainage 26m the beach level has dropped. This drop in beach level at the seawall has exposed a length of timber piles which have subsequently accelerated scour resulting in a drop of 0.85m locally. Between chainage 26m and 166m the beach has accreted, peaking at chainage 82m with an increase in level of 0.7m. Overall the beach is at high level when compared to the range of previous surveys except from at the toe of the seawall which is at a low to medium level.</p> <p><b>Profile 1dSBS4</b> is located on the beach in front of the Scarborough Spa Complex. The profile has been dominated by accretion over the winter 2021/2022, with an increase in level observed between chainage 10m to 163m. This increase in level is initially a low magnitude (+0.15m) until chainage 58m before increasing to 0.65m across the lower beach. Similar to profile 1dSBS3, the beach at the toe of the seawall has scoured causing a local drop of 0.35m in level.</p>	<p>The beach change over winter 2021/2022 is generally in line with seasonal fluctuations i.e., general drawdown of material during winter months with recovery in summer months. This is particular noticeable in the two most northern profiles. The southern two profiles have both been dominated by accretion suggesting a net gain of material across Scarborough South Bay,</p> <p><b>Longer term trends:</b> The observed changes in the profiles in South Bay are consistent with the seasonal fluctuations of sediment with a bay system.</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
17 <sup>th</sup> May 2022	<p><b>Cliff-top Survey:</b></p> <p>Thirteen cliff top monitoring control points have been established at Scarborough South Bay and from Cornelian Bay to Knipe Point. The separation between points is around 300m. The cliff top surveys at Scarborough South Bay are undertaken bi-annually. Appendix C provides results from the March 2010 baseline survey to May 2022, showing the distance from the ground control point to the edge of the cliff top along the defined bearing (Appendix C- Map 3). Error in the technique means change of less than 0.2m cannot be relied on. Calculated advances of the cliff line are also assumed to be error associated with difficulty precisely identify the cliff top, particularly where vegetation is present.</p> <p>Between October 2021 and May 2022, only one of the 11 monitoring points show erosion (of greater than 0.2m), suggesting a period of stability. It was Point 13, located at Knipe Point, that experienced a retreat of 0.23m over winter 21/22. Despite this it is still only Points 11 and 12 that show significant erosion since the baseline survey in March 2010 of 3.78m and 3.13m respectively, this is equivalent to long term erosion rates of 0.38m/yr and 0.31m/yr.</p>	<p>Only one of the survey points has shown erosion outside of the survey tolerance over the course of winter 2020/21.</p> <p><b>Longer term trends:</b> The recession rates for the longer term only show erosion at Points 11 and 12 of between 0.38 and 0.31m/yr. The rest of the study area has remained stable.</p>



## 2.7 Cayton Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
19 <sup>th</sup> May 2022	<p><b>Beach Profiles:</b></p> <p>Cayton Bay is covered by four beach profile lines for the Partial Measures survey (Appendix A). The previous survey was undertaken in November 2021.</p> <p><b>Profile 1dCY1A</b> is located on the beach below Knipe Point at the north of the bay and was added to the programme in November 2015. The berm on the upper beach has accreted since the previous survey with the seaward face advancing 2m. Between chainages 20m and 65m, the beach level has dropped by up to 0.3m in level, exposing a 15m length of rocky foreshore. The rocky foreshore also remains exposed between chainage 65m and 75m. The lower beach, seaward of chainage 100m, has steepened causing a drop in level of 0.6m at chainage 146m. Overall the beach is at a very low level when compared to the range of previous surveys.</p> <p><b>Profile 1dCY1</b> is located on the beach in front of Tenants' Cliff in the north of the Bay. The survey report notes that "<i>the top of section 1 could not be measured due to dense vegetation</i>". At the toe of the cliff, between chainages 0m and 21m, large stones/ boulders have been deposited on the upper beach causing the profile line in this location to become irregular. Seawards of chainage 21m the profile has remained stable with any change limited to within <math>\pm 0.1</math>m. The rocky foreshore remains exposed from chainages 96m onwards. The profile is at a high level on the upper beach but remains low on the mid-lower beach where the rock platform is exposed.</p> <p><b>Profile 1dCY2</b> is close to the former pumping station in the middle of Cayton Bay. The survey report notes that "<i>the middle of section 2 could not be measured due to the ground makeup, soft mud flows and unstable grass</i>". As a result, any change to the cliff face should be interpreted with caution. However, the photos suggest that the cliff is actively eroding. The beach profile itself is split into the three distinct sections of distinct change. The upper beach, between chainages 120m and 180m, has accreted, increasing in level by up to 0.4m. On the middle beach, between chainage 180m and 260m, the beach has remained stable with no change recorded. On the lower beach, seawards of chainage 260m, the beach has eroded, dropping in level by up to 0.3m. Overall, the profile is at a high level on the upper and middle beach compared to the range recorded from previous surveys, but low on the lower beach.</p>	<p>The two most easterly profiles (1dCY2 and 1dCY3) appear to have experienced drawdown of material from the upper beach to the lower beach, typical of seasonal patterns. Profiles 1dCY1a and 1dCY1 have been dominated by erosion with very low beach levels, exposing the rocky foreshore in several locations.</p> <p><b>Longer term trends:</b></p> <p>Following notably low levels in March 2018 and 2019 beach levels on the upper beach appear to be recovering, with the exception of the most northerly profile. There is evidence that material lost from the cliff face accumulates at the toe of the cliffs and is redistributed across the upper beach. Additional cliff failures will feed additional material onto the beach and drive erosion of the cliff top.</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
	<p><b>Profile 1dCY3</b> is located around 600m southeast of the pumping station. The remains of a WW2 pill box are located at the toe of the cliff and are picked up on the profile between chainage 123m and 126m. Seawards of the pill box, the beach level have dropped consistently to chainage 222m by 0.3m in level. At chainage 222m a beach berm is formed, 0.5m in height. The beach has then steepened seaward of this causing a drop in level of 0.5m by chainage 288m. Overall, the beach is at a low level when compared to the range of previous surveys with the exception of the beach berm at chainage 222m which is at a high level.</p>	
<p><b>19<sup>th</sup> May 2022</b></p>	<p><b>Cliff-top Survey:</b></p> <p>Eight ground control points have been established within Cayton Bay for the purposes of cliff top monitoring. The separation between any two points is typically around 300m. The cliff top surveys at Cayton Bay are undertaken bi-annually. Appendix C provides results from the May 2022 survey showing the distance from the ground control point to the edge of the cliff top along the defined bearing and changes in position since the November 2008 baseline survey and the previous November 2021 survey. The accuracy of the technique means results of less than 0.2m are not considered reliable.</p> <p>Dense vegetation means that point 2 has not been surveyed since the March 2018 survey. Of the remaining points, only Point 3 and Point 4 have experienced change greater than survey tolerance of <math>\pm 0.2</math>m with a retreat of 0.60m and 0.22m respectively.</p>	<p>Two of the seven monitoring points have shown erosion outside of the survey tolerance since November 2021. Both points (3 and 4) are located in the centre of the bay potential indicating a localised increased in erosion.</p> <p><b>Longer term trends:</b> The recession rates show that only Point 4 (0.29m/yr) has a long term recession rate greater than the survey tolerances.</p>

## 2.8 Filey Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
18 <sup>th</sup> May 2022	<p><b>Beach Profiles:</b></p> <p>Filey Bay is covered by five beach profile lines for the Partial Measures survey (Appendix A). The previous programmed survey (Full Measures) was undertaken in November 2021.</p> <p>Profile <b>1dFB1</b> is located in front of Filey town in the north of the bay. The beach level at the toe of the seawall has dropped locally 0.7m in level since the previous survey. Between chainages 27m and 110m, the beach has remained largely stable, with change limited to accretion of up to +0.1m. Seaward of 110m, the beach has generally smoothed out causing alternating bands of accretion and erosion. Accretion has occurred between chainage 110m and 155m of up to 0.25m in level before switching to erosion of a similar magnitude up to chainage 220m. Overall, the beach is at medium level when compared to the range of previous surveys.</p> <p>Profile <b>1dFB2</b> is located north of Primrose Valley Holiday Village. The survey report notes that chainages 0m to 9m and 12m to 21m were inaccessible due to dense vegetation. The profile shows that the cliff face, between chainage 22m and 66m, has remained largely stable. The beach level at the toe of the slope has dropped 0.3m in level exposing more of the eroding mud toe. There has been no other significant change across the profile, with any change limited to <math>\pm 0.1</math>m. The profile remains at a very high level relative to the range recorded from previous surveys.</p> <p>Profile <b>1dFB3</b> is located in front of Flat Cliffs hamlet. The survey report notes that chainages 0m to 9m and 12m to 21m were inaccessible due to dense vegetation. From the toe of the cliff at chainage 34m to chainage 180m, the beach remained largely stable, experiencing only a minor drop in level of <math>\sim 0.1</math>m. Seawards of this point, the beach has formed a more undulating profile. A drop in level of up to 0.25m in level has occurred between chainage 180m to 234m, before switching to an increase in level of 0.25m between chainages 234m and 290m. Seawards of 290m the beach has again dropped by 0.25m in level. The profile remains at a high to very high level when compared to the range recorded from previous surveys. The section between chainage 255m to 290m is at its highest level on record.</p> <p>Profile <b>1dFB4</b> is located near Humanby Gap. The survey report notes that “<i>the middle of section 4 is unable to be measured from chainage 4m to approx. 26m, due to the cliff face being unsafe</i>”. Overall, the beach profile across the upper beach has experienced a minor drop in level (0.2m) with two shallow</p>	<p>The two most northern profiles have remained largely stable since the previous survey, with beach levels remaining at a high, healthy level. Locally, beach levels have dropped at the toe of the seawall, probably due to the refraction of wave energy on the hard defences through the winter. This is a pattern that have been observed previously.</p> <p>The three most southernly profiles show a similarly pattern of shallow berm formation on the middle and lower beaches with all beach levels remaining within the range of previously recorded surveys.</p> <p><b>Longer term trends:</b></p> <p>Past trends dominated by migrating sand bars continue to the present day.</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>berms forming on the lower beach. The berms have resulted in alternating lengths of erosion and accretion when comparing the profile of the previous survey. Accretion has occurred between chainage 133m to 155m and then again between chainage 202m to 262m. With erosion occurring between 155m and 202m. . Overall, the profile is at a medium level when compared with the range from previous surveys except from the crest of the lower beach berm between chainage 203m and 227m being the highest recorded level</p> <p>Profile <b>1dFB5</b> is located close to Reighton Gap. The survey report notes that “<i>the middle of section 5 was unable to be measured from chainage 59m to c. 205m, due to undergrowth and bushes</i>”. At the toe of the cliff toe between chainage 208-240m, there has been little change, limited to <math>\pm 0.1</math>m. On the beach itself, the formation of several berms has caused the profile to undulate resulting in alternating lengths of accretion and erosion when comparing to the previous survey. Erosion has occurred between chainages 245m to 265m and again between 295m and 352m. Accretion has occurred between chainage 265m to 295m and again seaward of chainage 352m. the magnitude of change is limited to 0.5m in level. Overall, the beach is at a medium level when compared to the range of previous surveys.</p>	
<p><b>18<sup>th</sup> May 2022</b></p>	<p><b>Topographic Survey:</b></p> <p>Data from the most recent topographic survey (Partial Measures, May 2022) have been used to create a digital ground model (DGM) (Appendix B – Map 3) using a Geographical Information System (GIS). The topographic plot shows the gently sloping shore parallel bathymetry in front of Filey town. A difference plot has also been produced using the DGM (Appendix B – Map 6) comparing the last topographic survey (Full Measures, November 2021) to the present survey (May 2022).</p> <p>Overall, the beach within the survey extents has remained largely stable over winter 2021/22 with change of <math>\pm 0.1</math>m dominating the area. Of the change that has occurred, accretion has been the governing process, with three shoreline bands of “gain” evident. The vast majority of this accretion is between +0.25m and +0.5m in level. Erosion has occurred very locally at the toe of the sea defences and at a low level on the lower sections of the beach.</p>	<p>The localised erosion on the upper beach adjacent to the sea wall has been observed in previous surveys. Changes in this part of the beach are probably due to the refraction of wave energy on the hard defences through the winter.</p> <p><b>Longer term trends:</b></p> <p>The erosion of the upper beach, close to the sea wall as observed over the winters of 2014/15 to 2016/17, 2018/19, 2019/20 and 2020/21 does not reflect the long-term trend between autumn 2008 and autumn 2016 that shows accretion on the upper beach and erosion on the lower beach. The atypical pattern seen in recent years is possibly a result of changes in wave climate.</p>



Survey Date	Description of Changes Since Last Survey	Interpretation
18 <sup>th</sup> May 2022	<p><b>Cliff-top Survey:</b></p> <p>Twenty-eight ground control points have been established within Filey Bay for the purposes of cliff top monitoring. This includes the installation of three additional locations in September 2010: points 12A (as a replacement for point 13 which can no longer be accessed due to vegetation growth), 24 &amp; 25 (to the north of Filey Bay at Filey Brigg). A further replacement for monitoring point 13, 13A, has been added in 2014.</p> <p>The maximum separation between any two points is nominally 300 m. The cliff top surveys at Filey Bay are undertaken every six months. Data collection involves a distance offset measurement from the ground control point to the cliff edge along a fixed bearing. The accuracy of the technique means results of less than 0.2m are not reliable. The survey report notes that Points 5, 12, 12A and 13 were inaccessible due to heavy vegetation.</p> <p>Between the November 2021 and the current survey, three of the 28 markers showed erosion greater than the survey error of 0.2m. These were Point 16, Point 20 and Point 22 which retreated 0.25m, 0.81m and 0.91m respectively. The survey photographs from these areas, particularly Points 20 and 22, show that the cliff top is heavily vegetated. This suggests that identifying the precise edge of the cliff top would be difficult indicating that the reading may be erroneous.</p>	<p>Over the winter of 2020/21, three monitoring points showed erosion greater than the survey error. Points 20 and 22 both experienced significant change greater than 0.8m, however the survey photos suggest that precisely locating the cliff top may have been difficult. .</p> <p><b>Longer term trends:</b></p> <p>The greatest long-term recession rate is seen at Point 7 at Muston Sands, where 0.45m/yr has been recorded. Point 13A has also recorded a high average recession rate of 0.29m/yr.</p> <p>Points 10, 14, 16, 18, 22 and 23 have all experienced average recession retreats between 0.1m/yr and 0.16m/yr.</p>

### 3. Problems Encountered and Uncertainty in Analysis

#### Individual Profiles

- At Whitby, the cliff top area of profile 1dWB2 was not measured due to dense vegetation.
- At Scalby the cliff edge was very overgrown resulting in areas that were unable to be surveyed.
- At Cayton Bay:
  - the top of profile 1dCY1 cannot be measured due to dense vegetation;
  - the middle of profile 1dCY2 could not be measured due to the ground make-up, soft mud flows, and unstable grass;
  - the middle of profile 1dCY3 could not be measured due to the ground make-up, soft mud flows, unstable grass, and landslips;
- At Filey Bay:
  - the first 2m of profile 1dFB1 was fenced off due to ongoing construction
  - the surveyor was unable to measure profile 1dFB2 between chainage 0 to 9m and 12m and 21m due to dense vegetation.
  - the surveyor was unable to measure profile 1dFB3 between chainage 0 to 14m and 21m and 29m due to dense vegetation.
  - the surveyor was unable to measure profile 1dFB4 between chainage 4 to 26m, due to the cliff face being unsafe.
  - the surveyor was unable to measure profile 1dFB5 between 59m and 205m due to dense undergrowth and bushes.

#### Cliff Top Surveys

- At Robin Hoods Bay:
  - the dumping of waste vegetation at monitoring point 5 is a known source of error.
  - the survey report notes that VMPs 1, 3, 4 and 11 have undefined edges that are hard to distinguish.
- At Cayton Bay:
  - VMP2 was not surveyed due to dense vegetation prohibiting access.
- At Filey Bay:
  - VMPs 5, 12, 12A and 13 were inaccessible due to heavy vegetation.

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

No changes are recommended at the present time.

### 5. Conclusions and Areas of Concern

- At Staithes, the recorded changes to the cliff top between October 2021 and April 2022 are generally small. There has been two points which show retreat of the cliff top greater than the survey error (Point 4 and Point 5).
- At Runswick Bay, the southern half of the bay appears to have experienced seasonal fluctuation with a drawdown of material from the upper beach to the lower beach typical of winter conditions. Overall, it appears the volume of sediment in the bay has remained stable despite the large swathes of change.
- At Sandsend, Uppgang and Whitby, the profiles have experienced a net erosion, particularly noticeable at Profiles 1dWB1 and 1dWB3 over winter 2021/22.
- At Robin Hoods Bay, the distribution of change is highly variable. There has been little change over the rock promontories in the bay, and localised patches of erosion and accretion in the north and south of the survey extent. The cliff top has remained stable since the previous survey in October 2021, with none of 11 points recording more than 0.2m erosion.
- At Scarborough North Bay, the beach has undergone varying levels of accretion and erosion since the previous survey. The profile to the north has experienced the most significant accretion with the profile

to the south experiencing the most significant erosion suggesting a possible general movement of sediment from south to north.

- At Scarborough South Bay, the beach change over winter 2021/2022 is generally in line with seasonal fluctuations i.e., general drawdown of material during winter months with recovery in summer months. This is particularly noticeable in the two most northern profiles. The southern two profiles have both been dominated by accretion suggesting a net gain of material across Scarborough South Bay,
- At Cayton Bay, the two most easterly profiles (1dCY2 and 1dCY3) appear to have experienced drawdown of material from the upper beach to the lower beach, typical of seasonal fluctuations. Profiles 1dCY1a and 1dCY1 have been dominated by erosion with very low beach levels, exposing the rocky foreshore in several locations. Two of the seven monitoring points have shown erosion outside of the survey tolerance since November 2021. Both points (3 and 4) are located in the centre of the bay potentially indicating a localised increase in erosion.
- At Filey, the two most northern profiles have remained largely stable since the previous survey, with beach levels remaining at a high, healthy level. Locally, beach levels have dropped at the toe of the seawall, probably due to the reflection of wave energy on the hard defences through the winter. The three most southerly profiles show a similar pattern of shallow berm formation on the middle and lower beaches with all beach levels remaining within the range of previously recorded surveys. Over the winter of 2020/21, three monitoring points showed erosion greater than the survey error. Points 20 and 22 both experienced significant change greater than 0.8m, however the survey photos suggest that precisely locating the cliff top may have been difficult

## **Appendices**

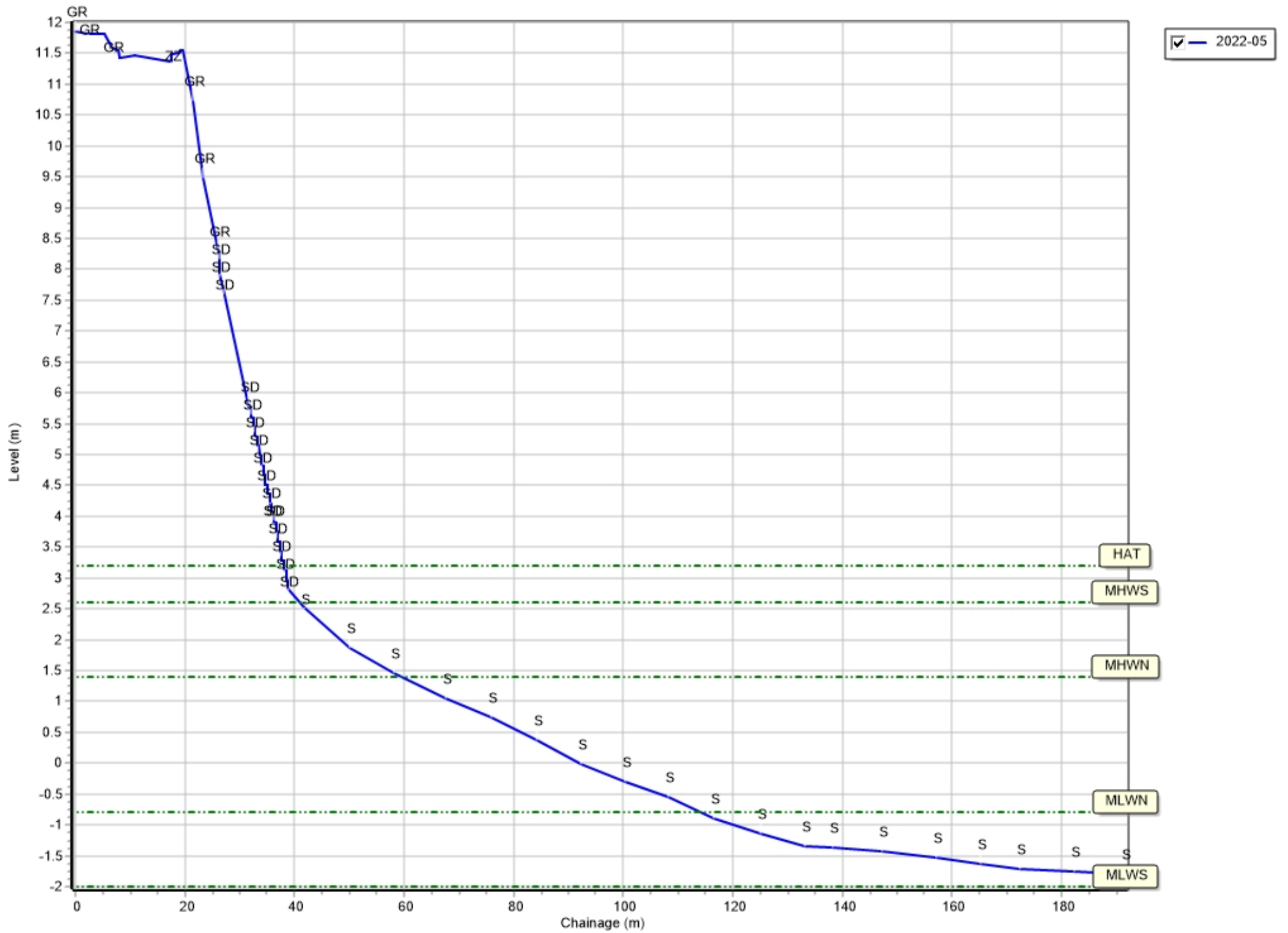
**Appendix A**  
**Beach Profiles**



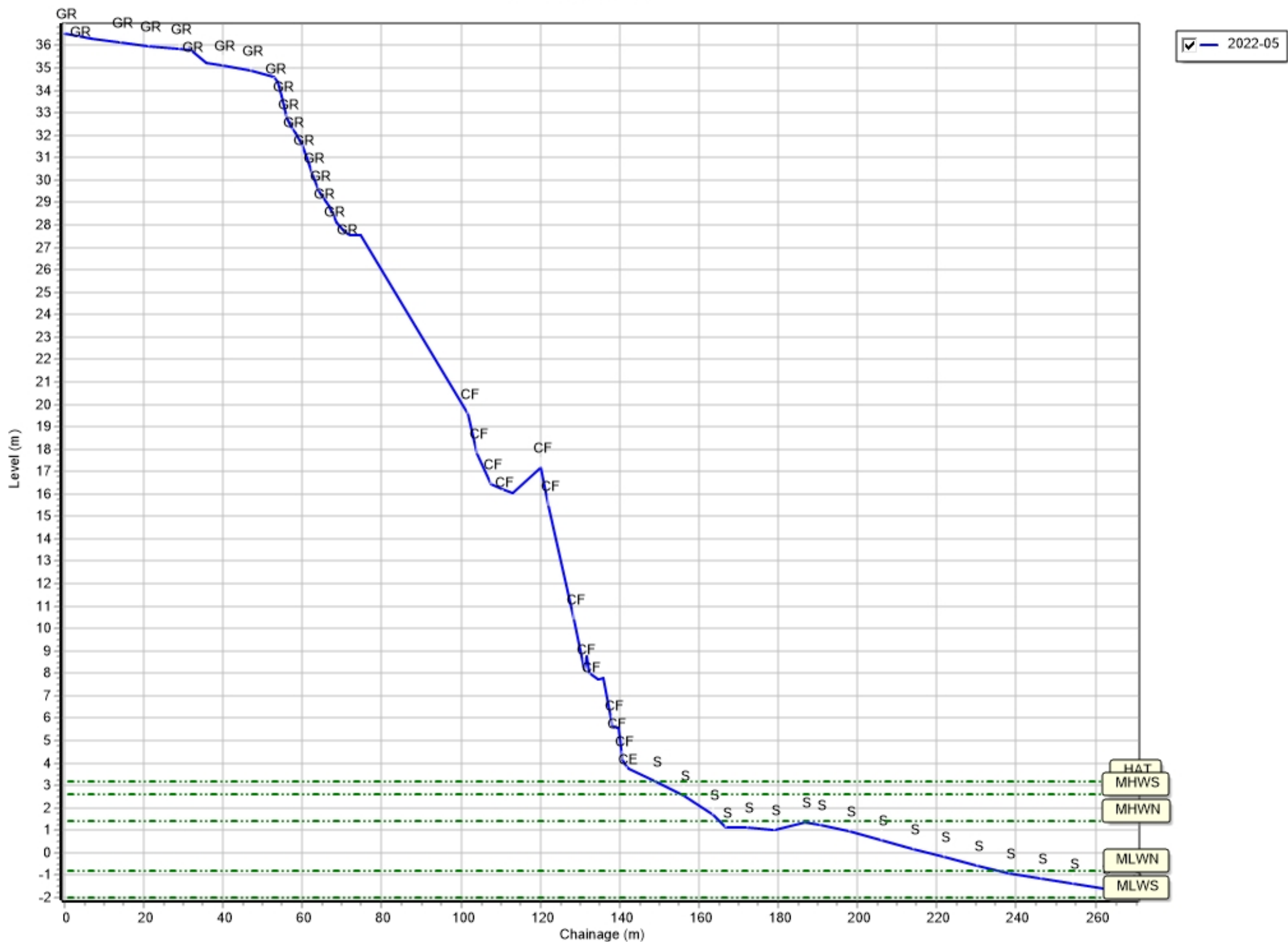
The following sediment feature codes are used on some profile plots:

<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

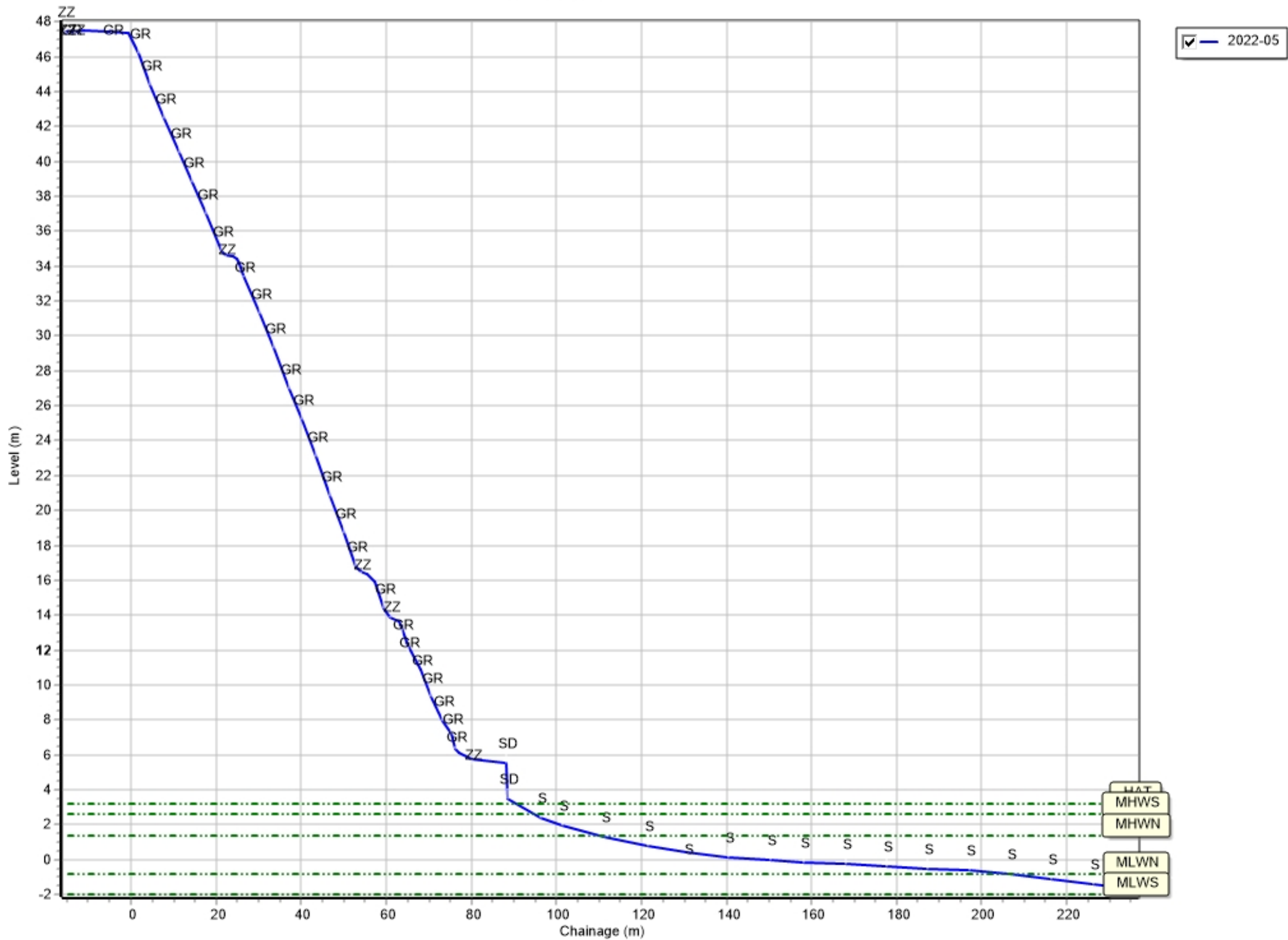
# Profiles: 1dWB1



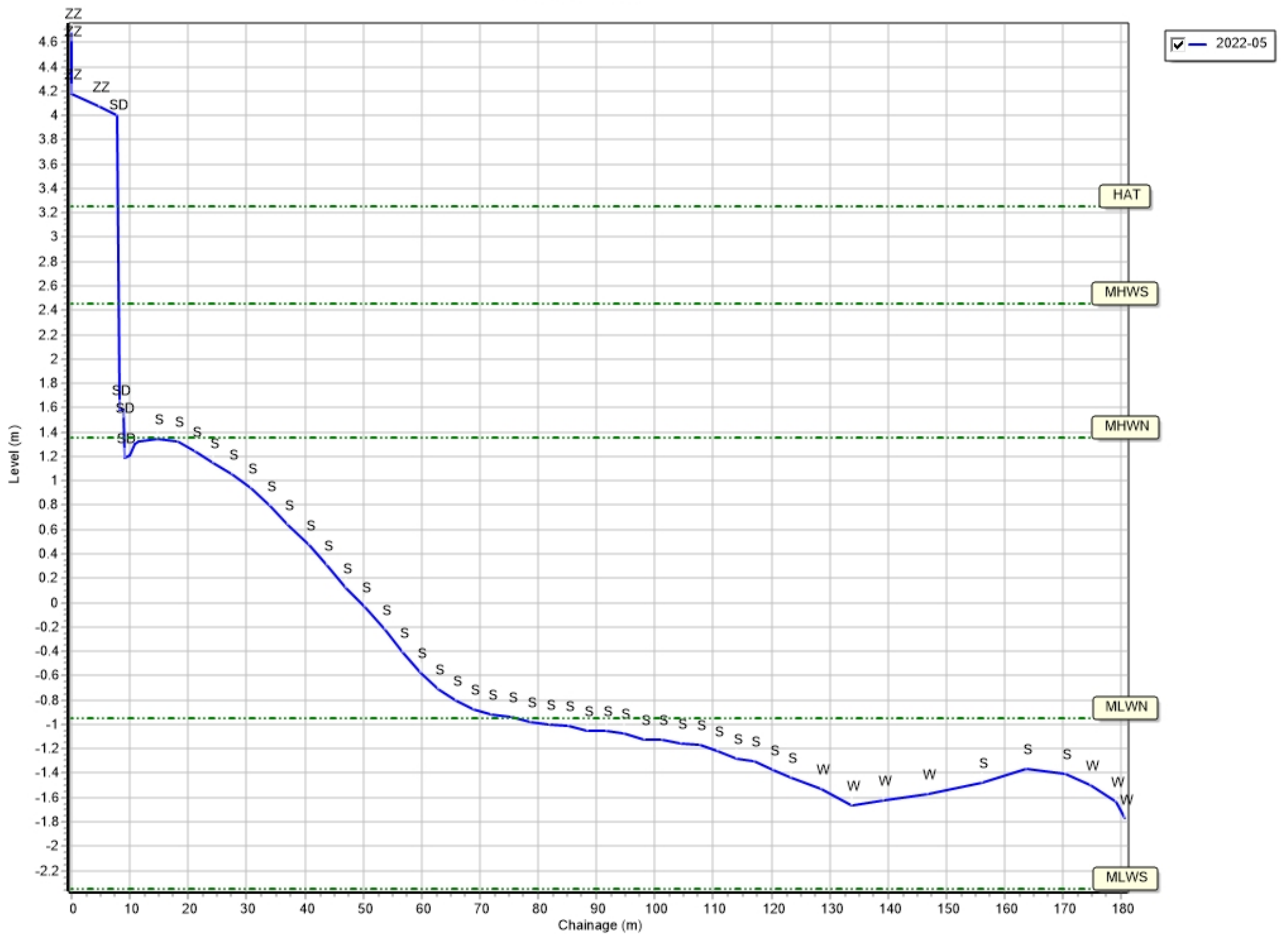
Profiles: 1dWB2



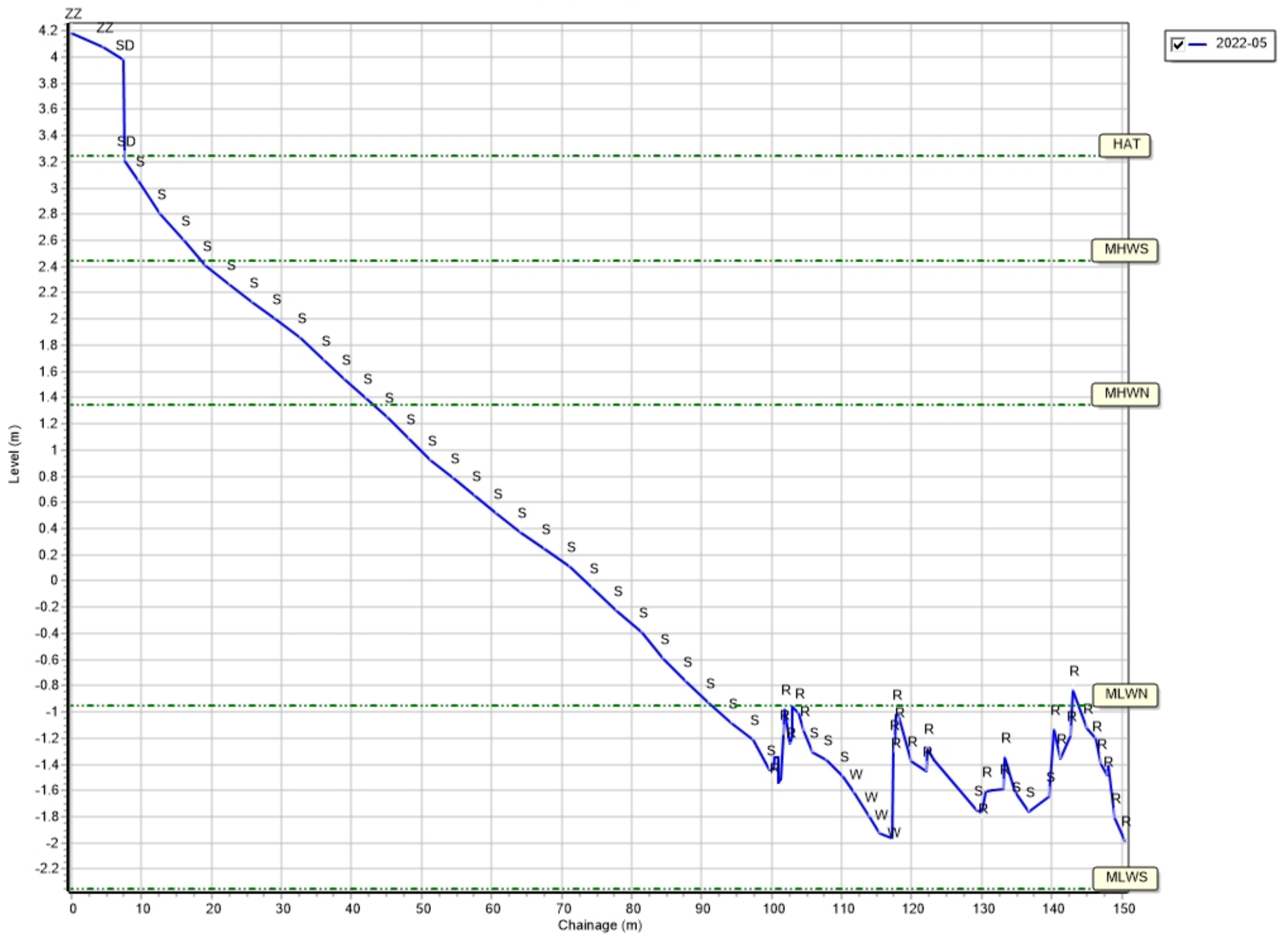
# Profiles: 1dWB3



# Profiles: 1dSBN1

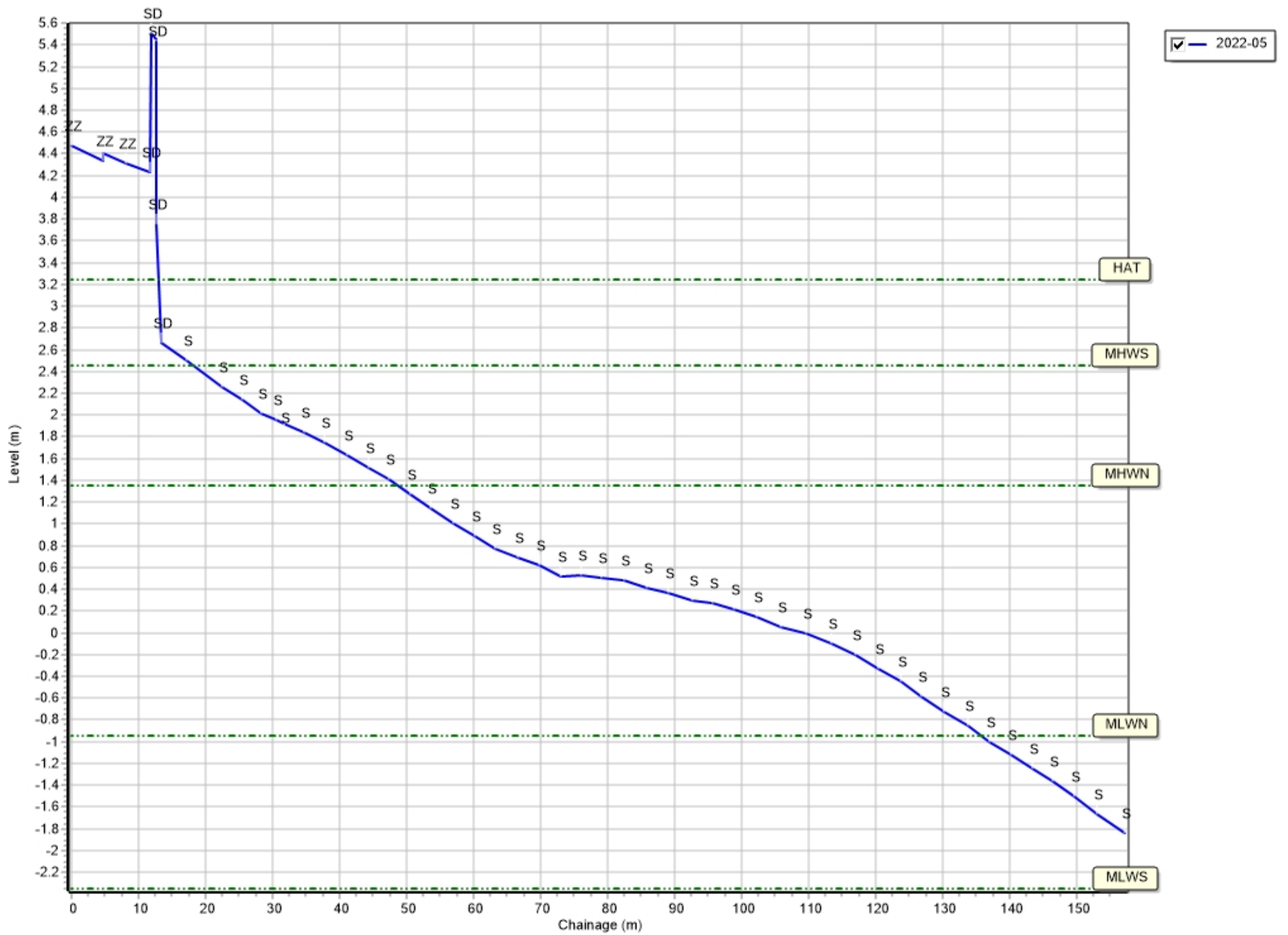


# Profiles: 1dSBN2





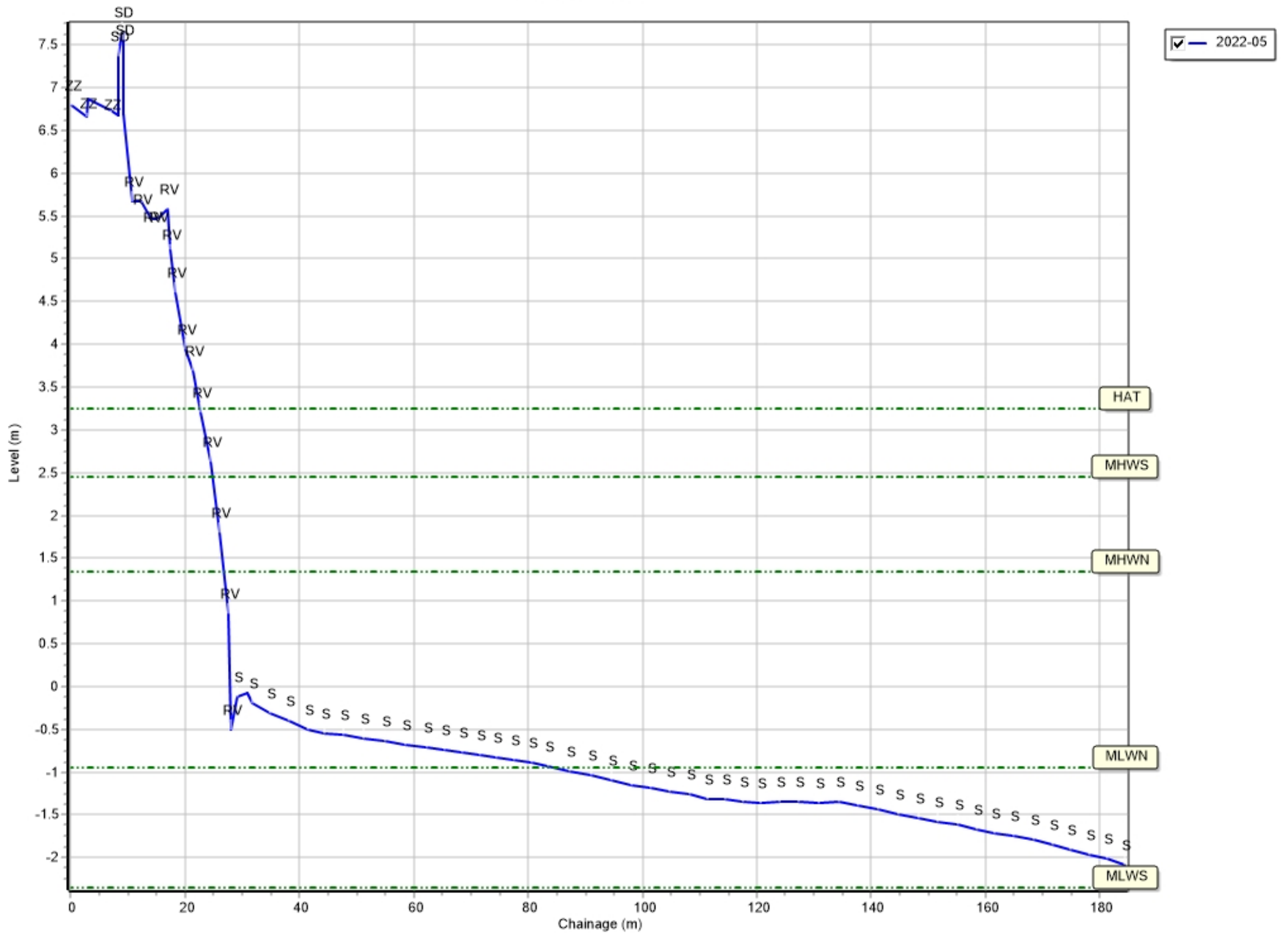
Profiles: 1dSBN3



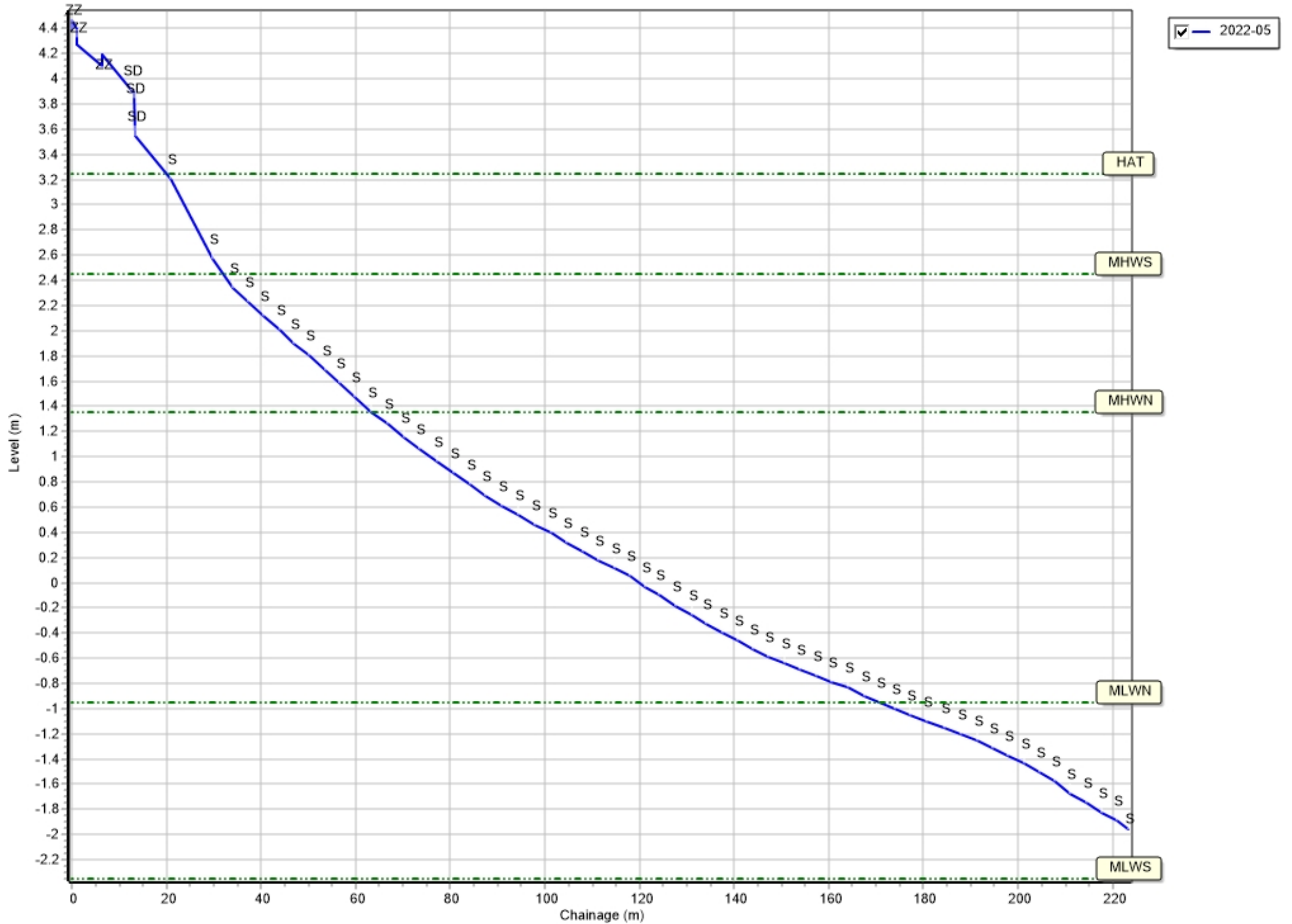
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# Profiles: 1dSBN5

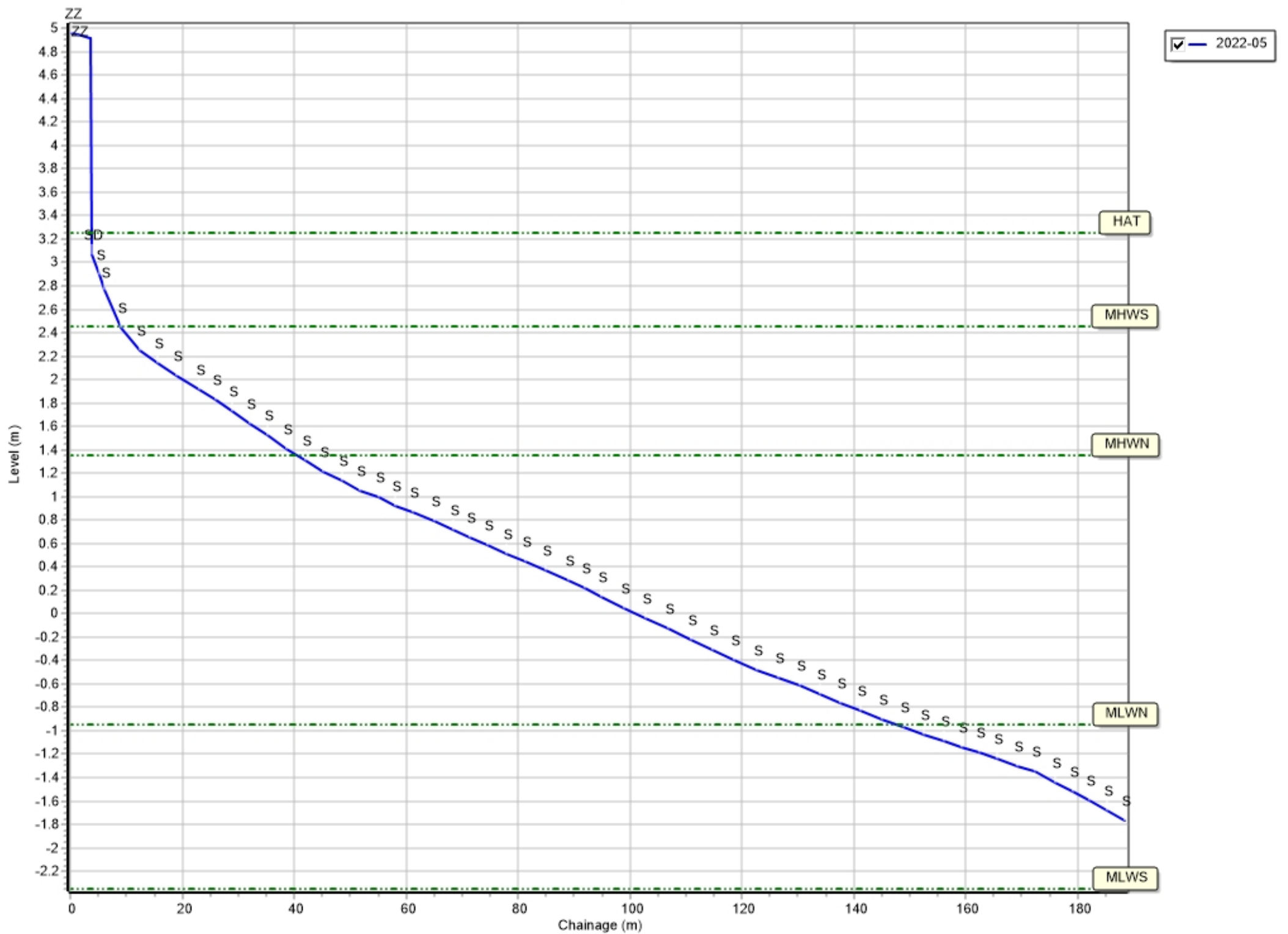


# Profiles: 1dSBS1

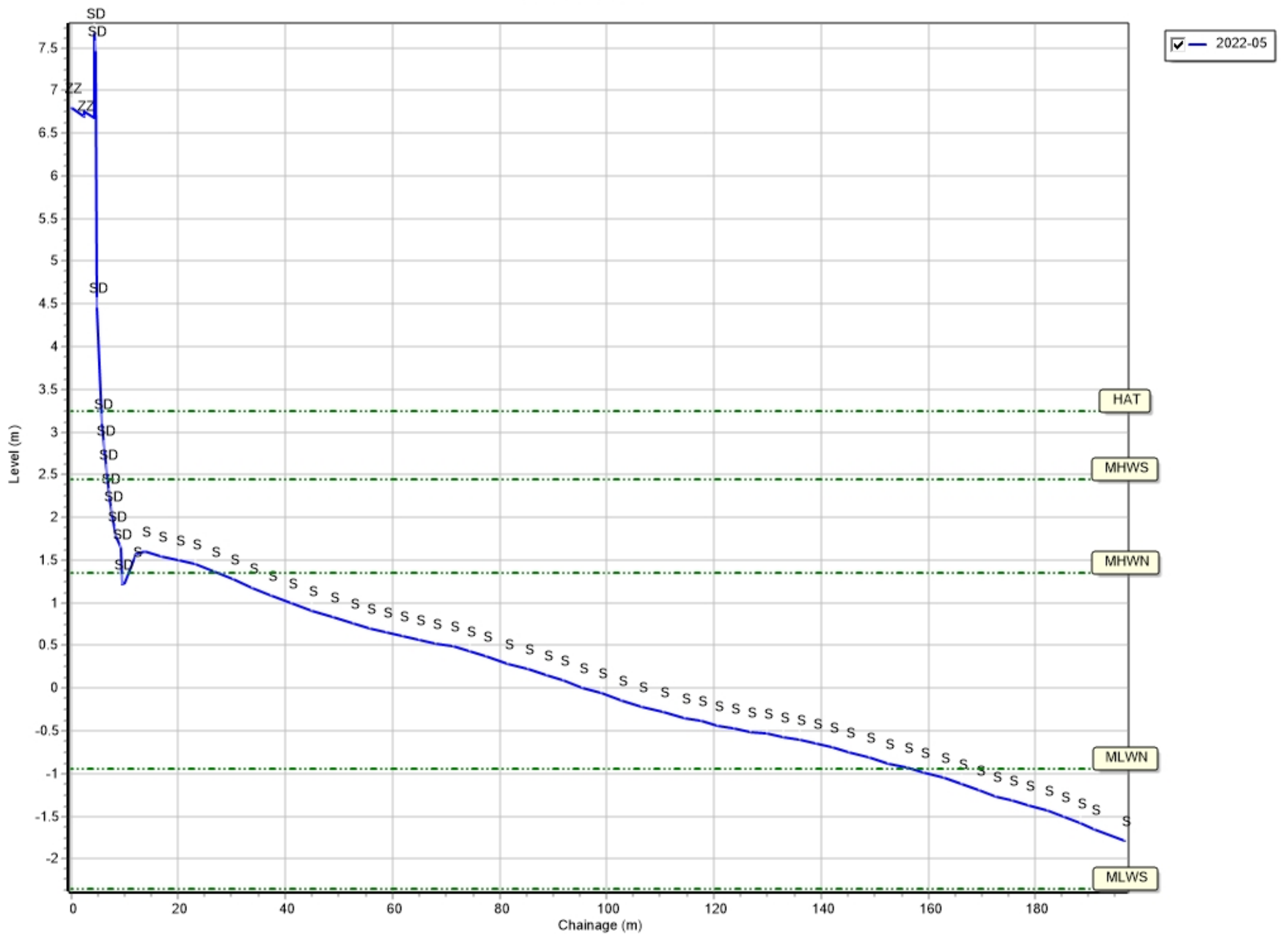




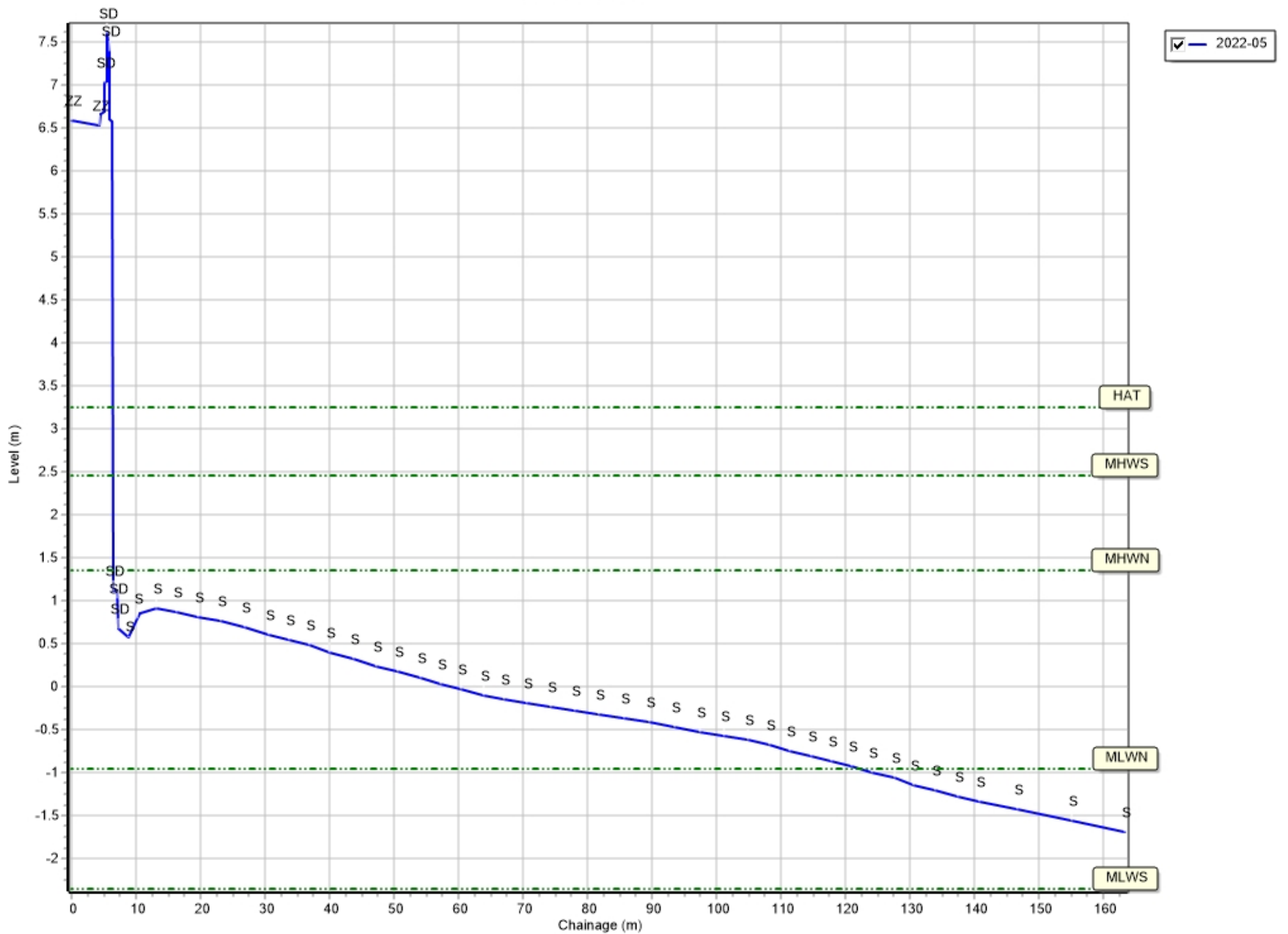
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# Profiles: 1dSBS3

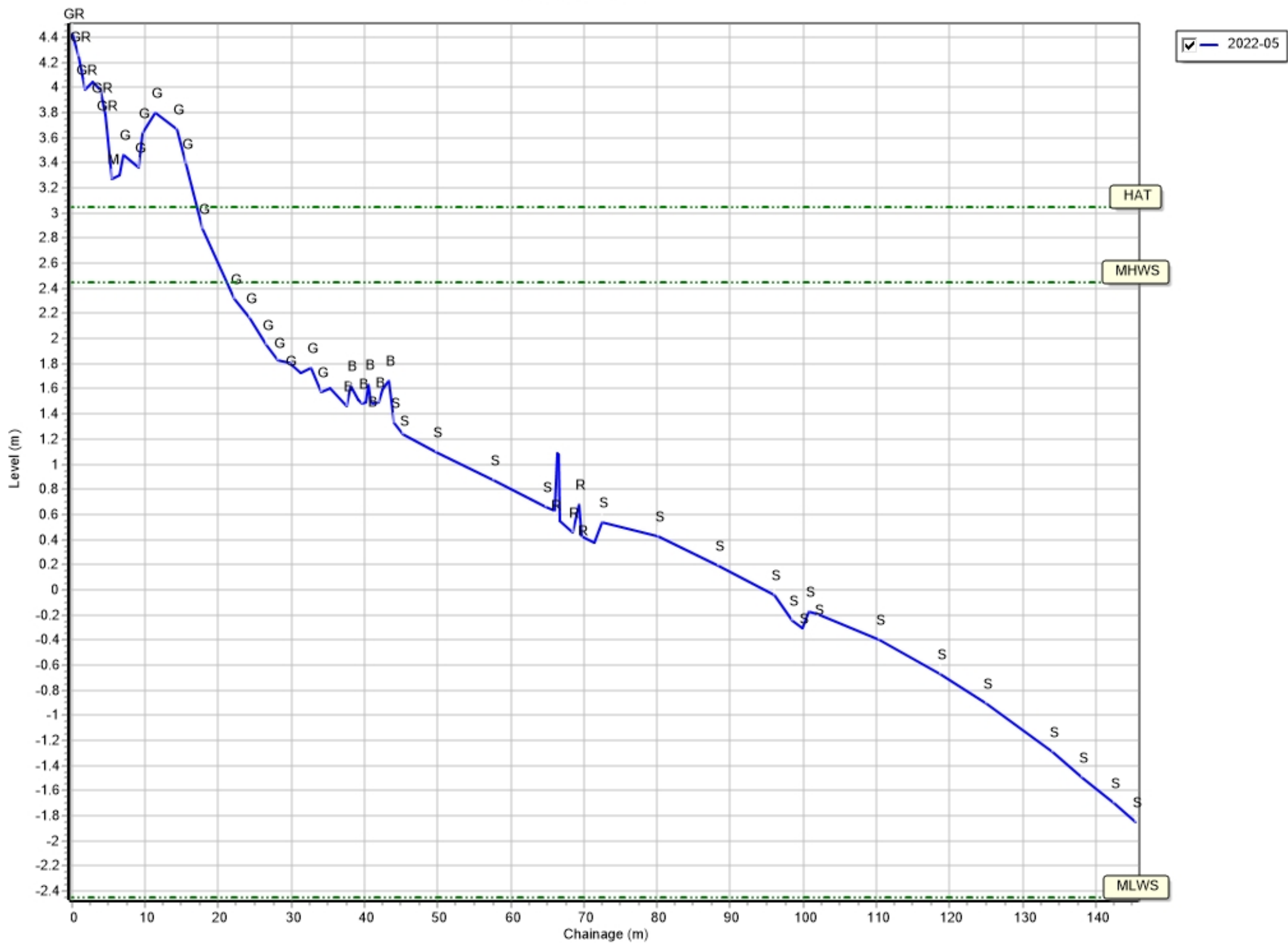


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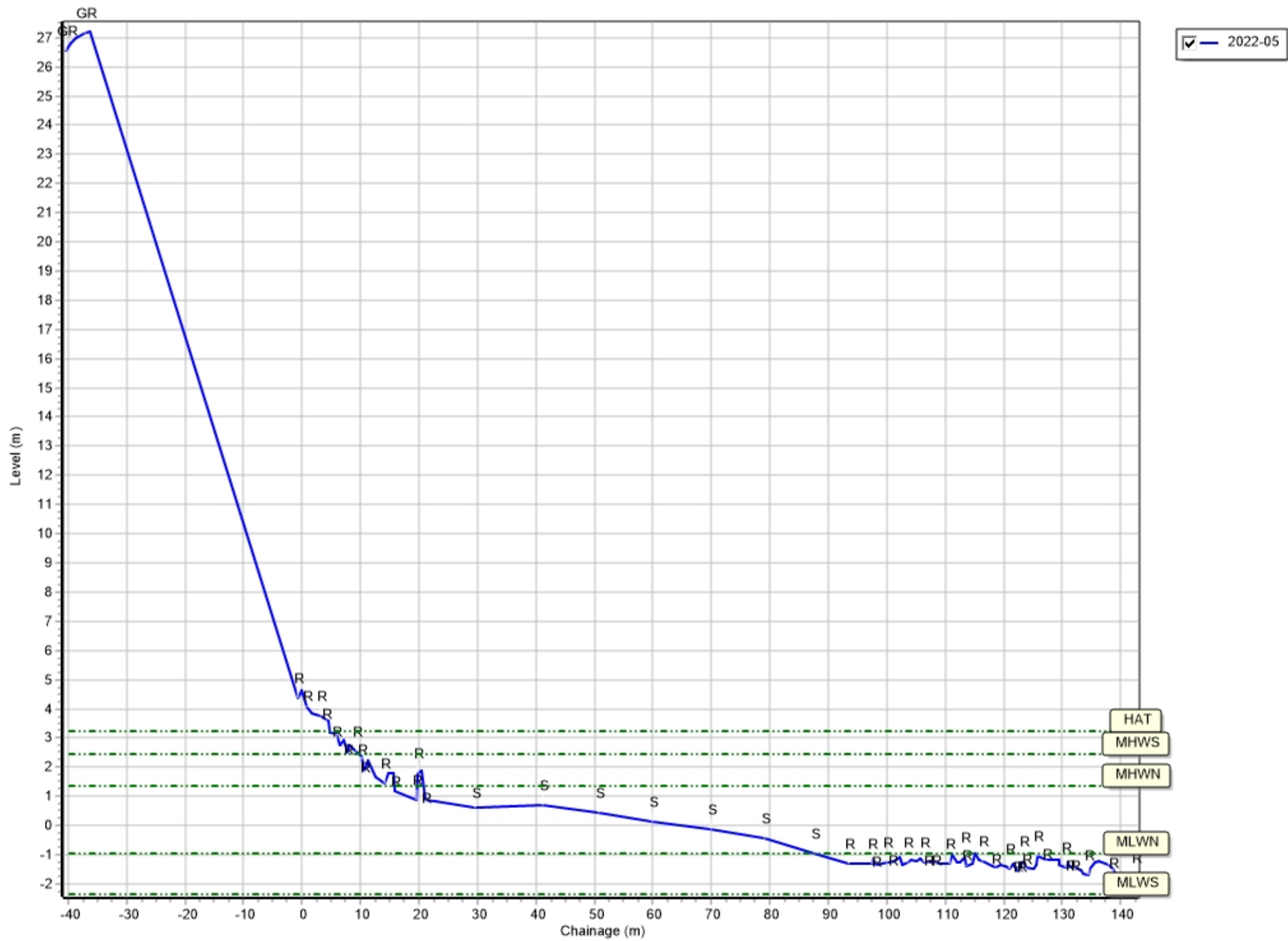




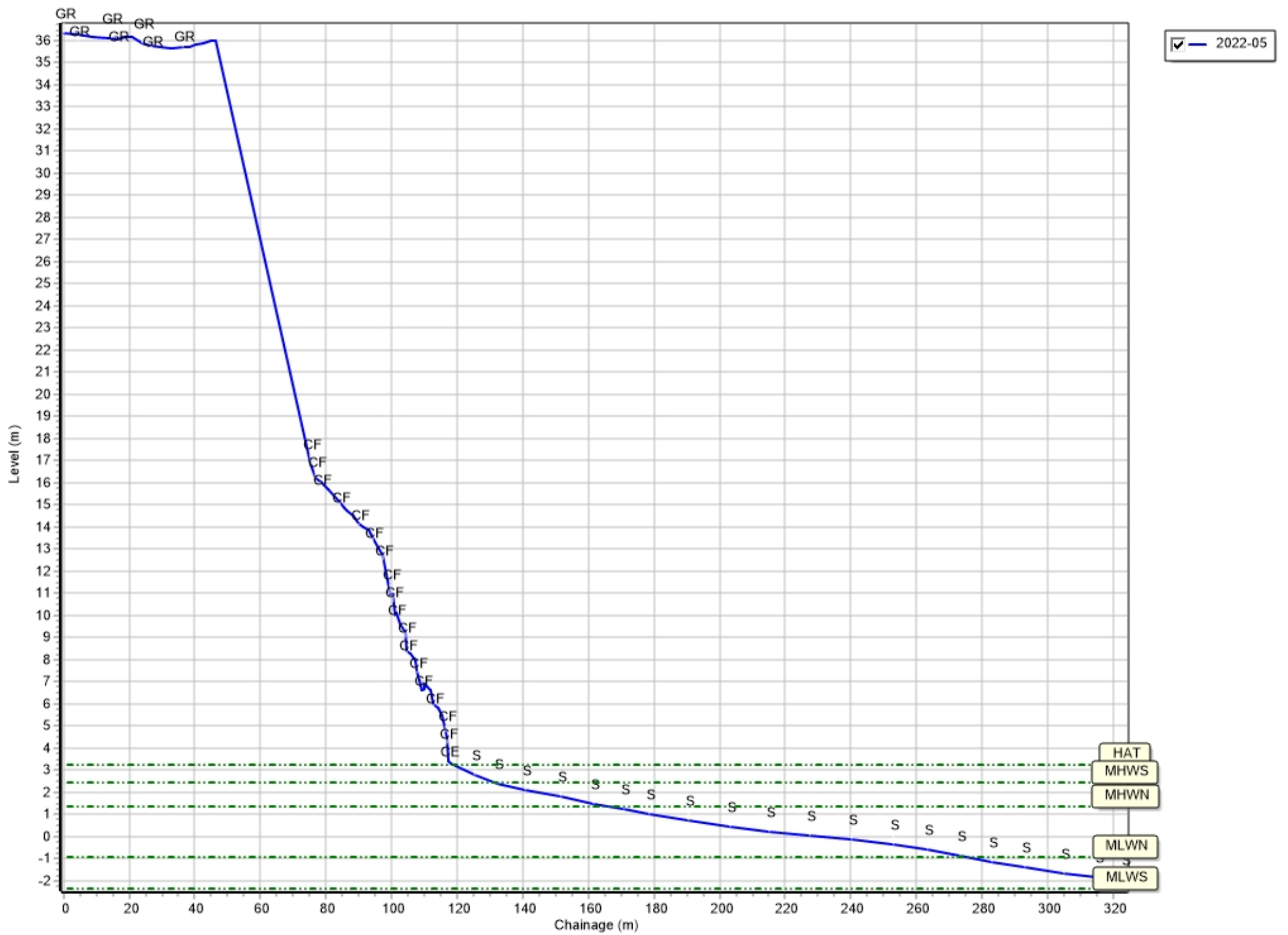
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# Profiles: 1dCY1

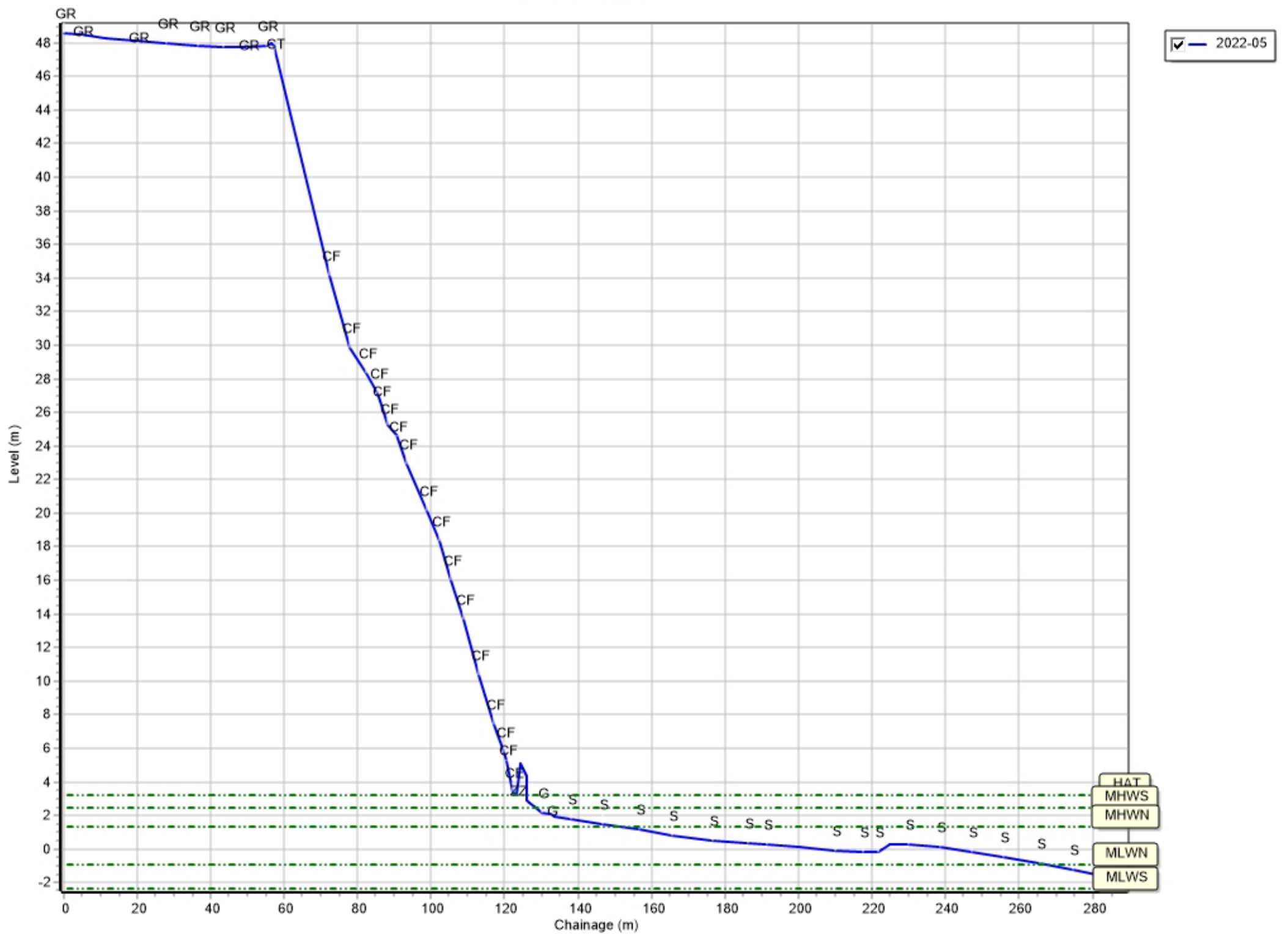


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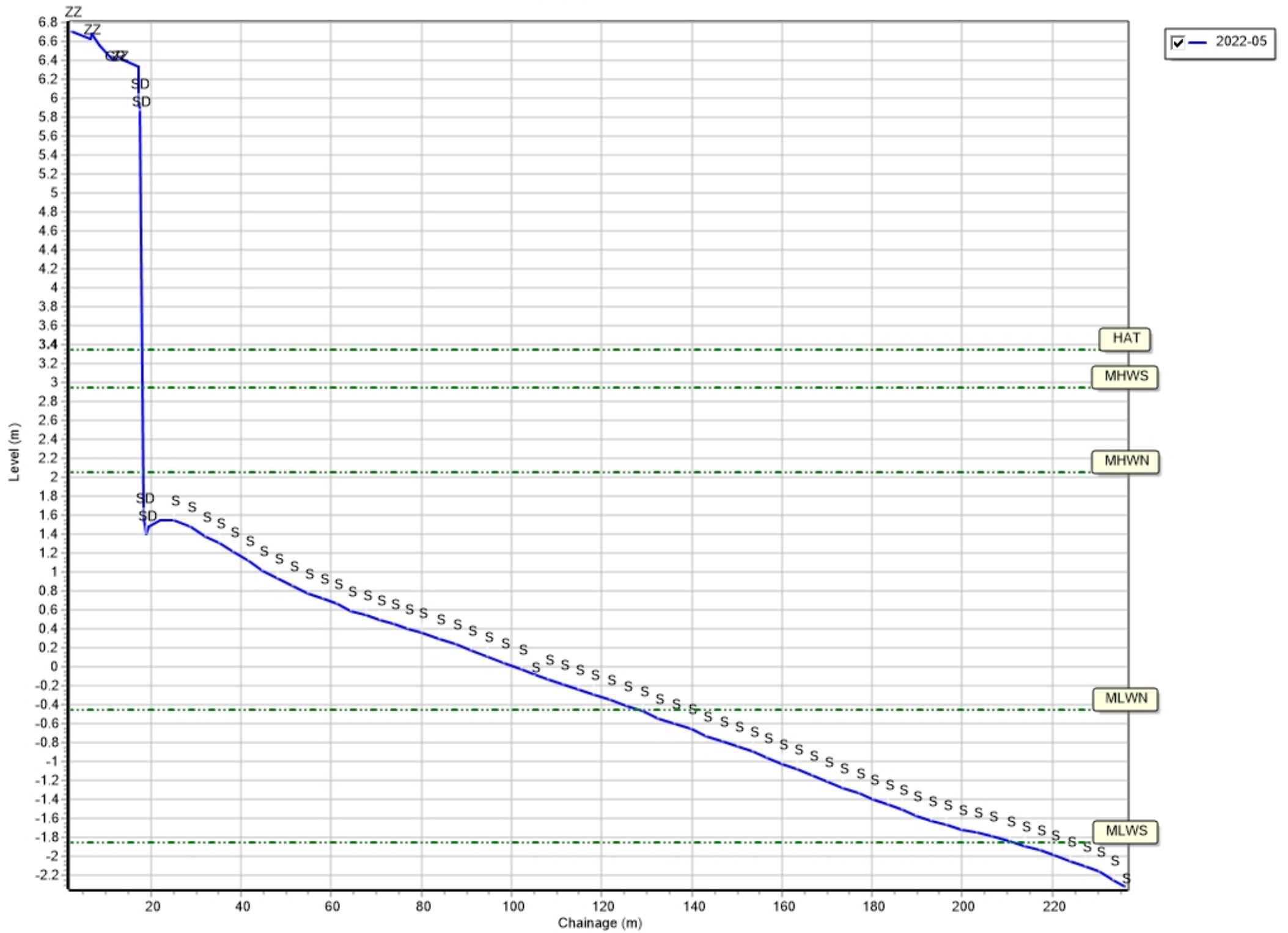




# Profiles: 1dCY3



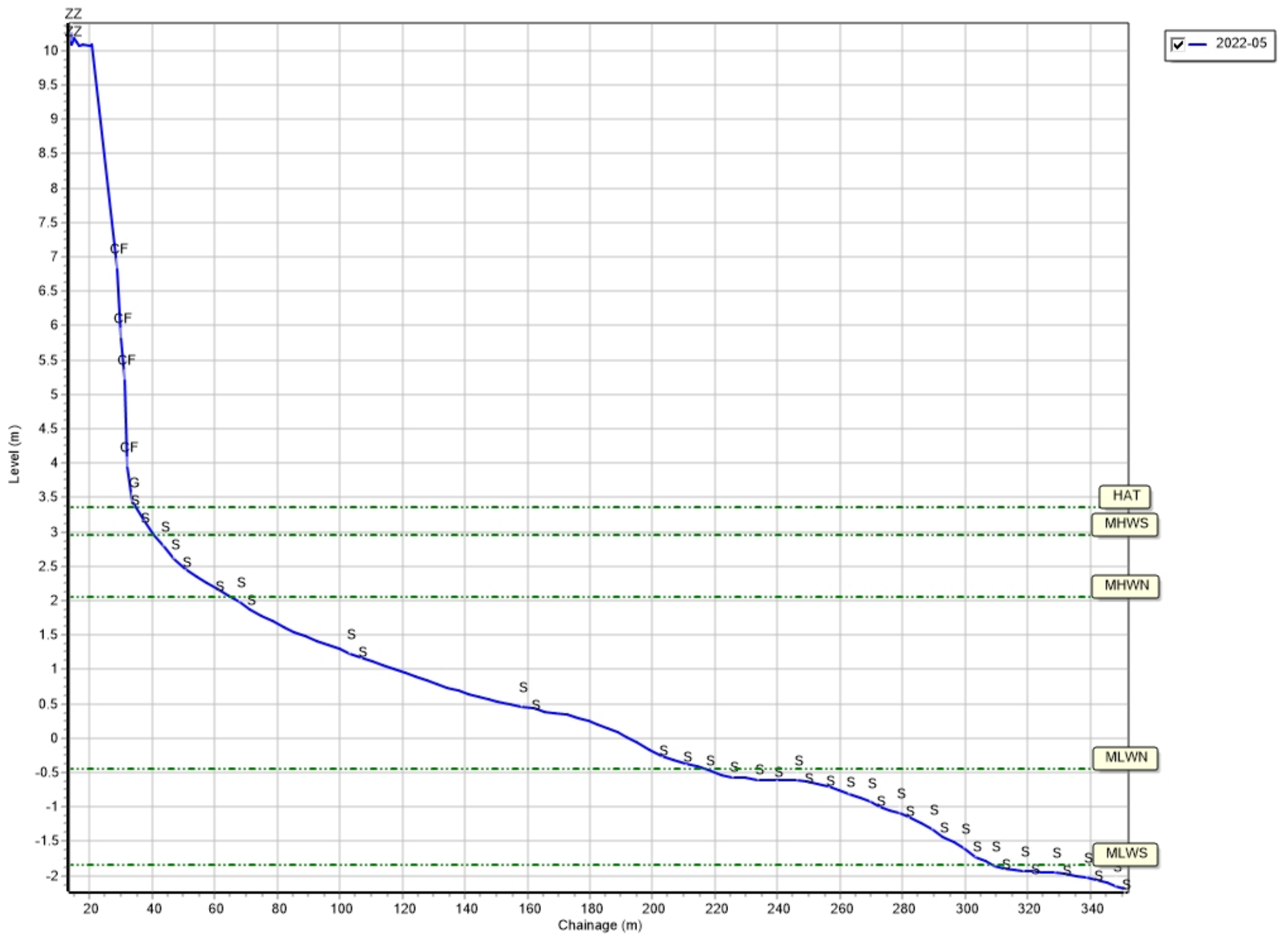
# Profiles: 1dFB1



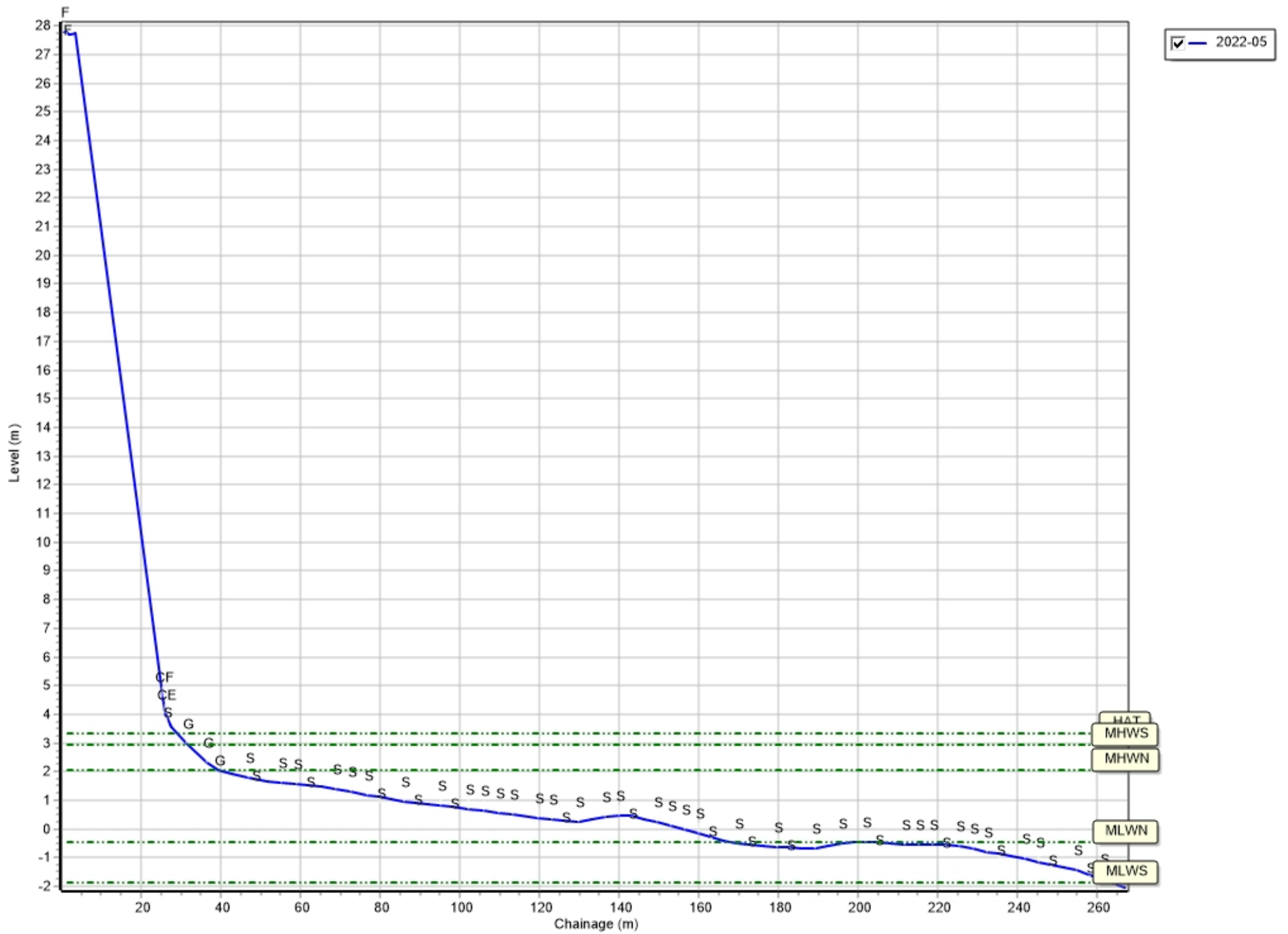




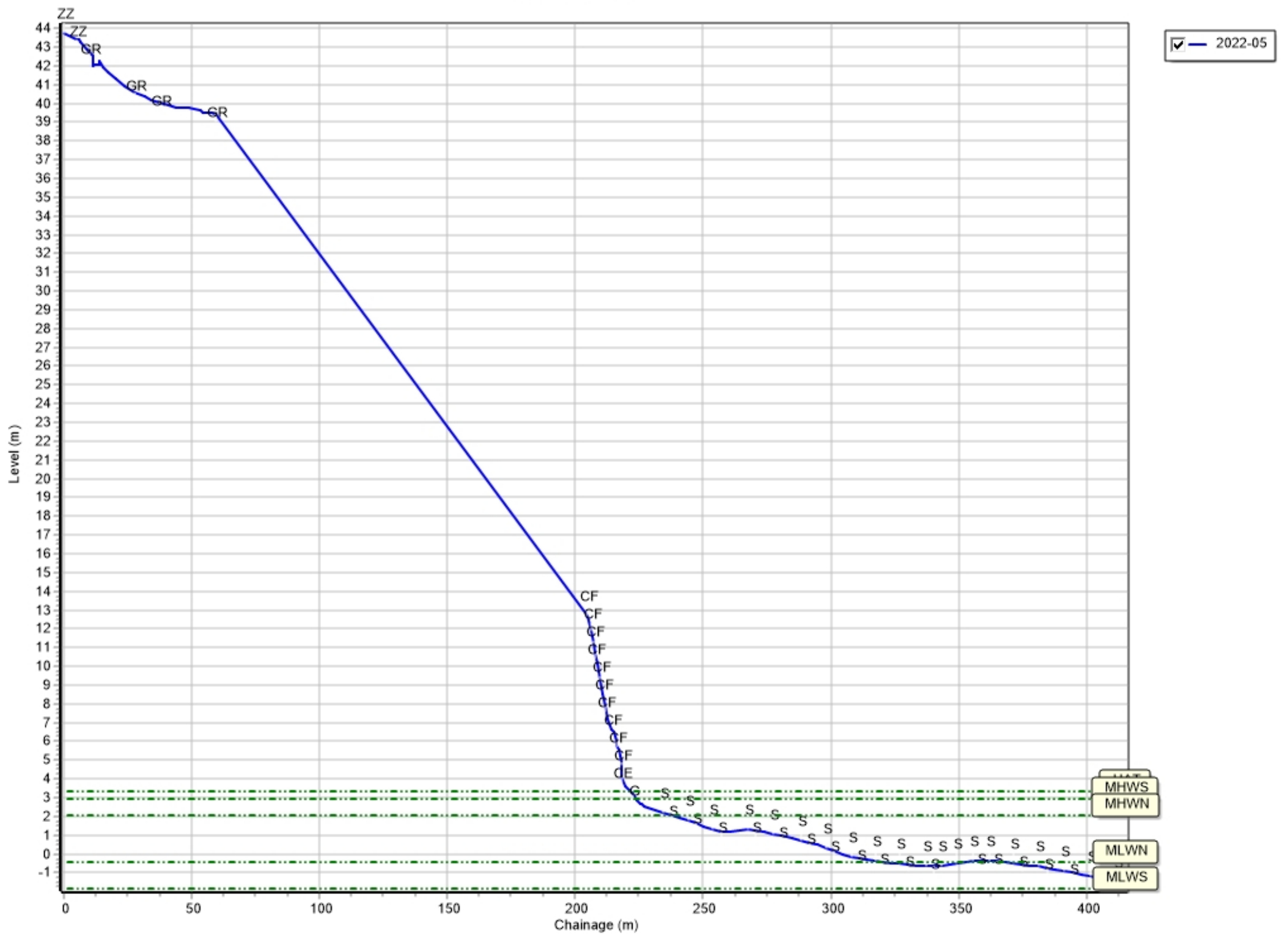
# Profiles: 1dFB3



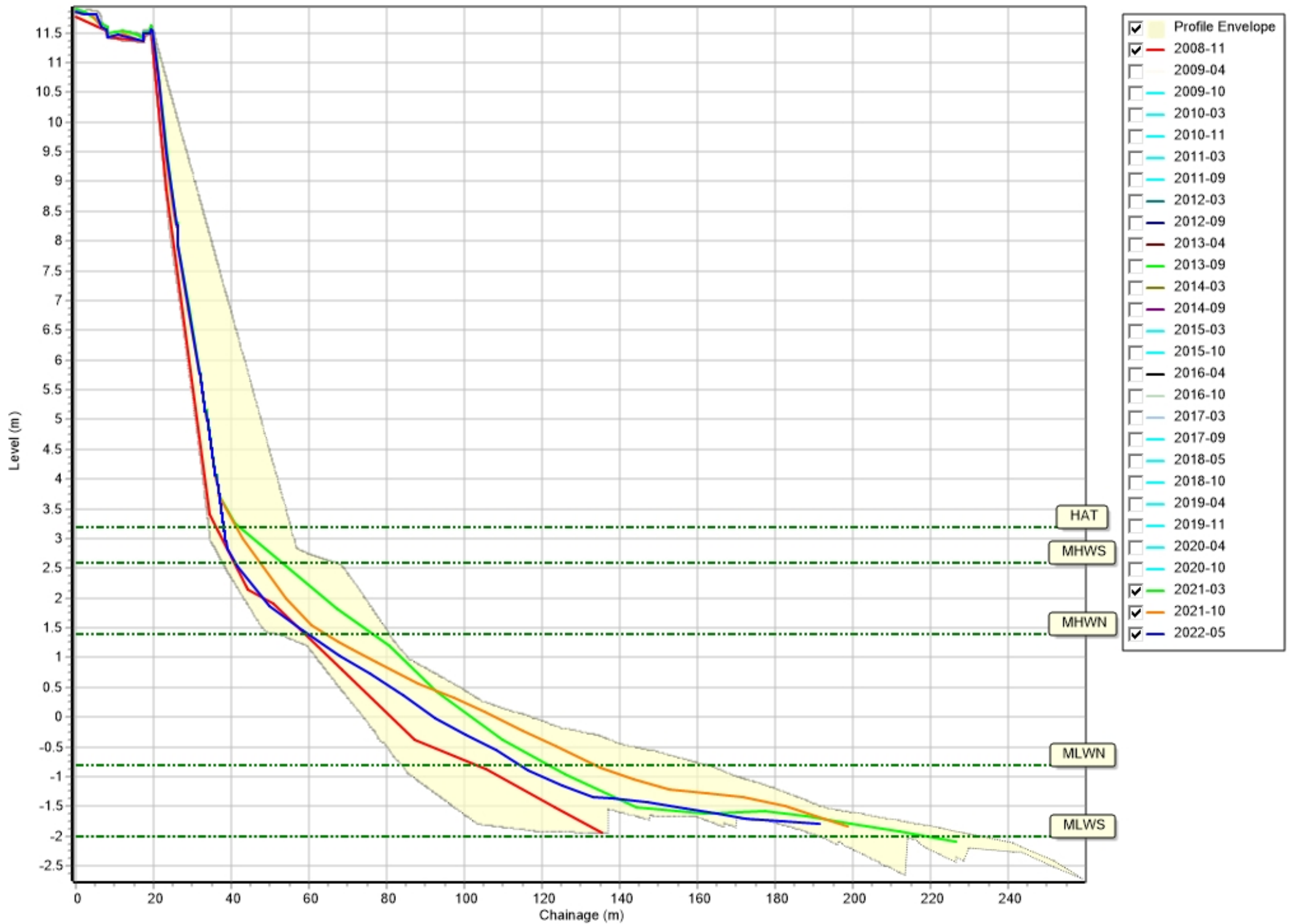
# Profiles: 1dFB4



# Profiles: 1dFB5

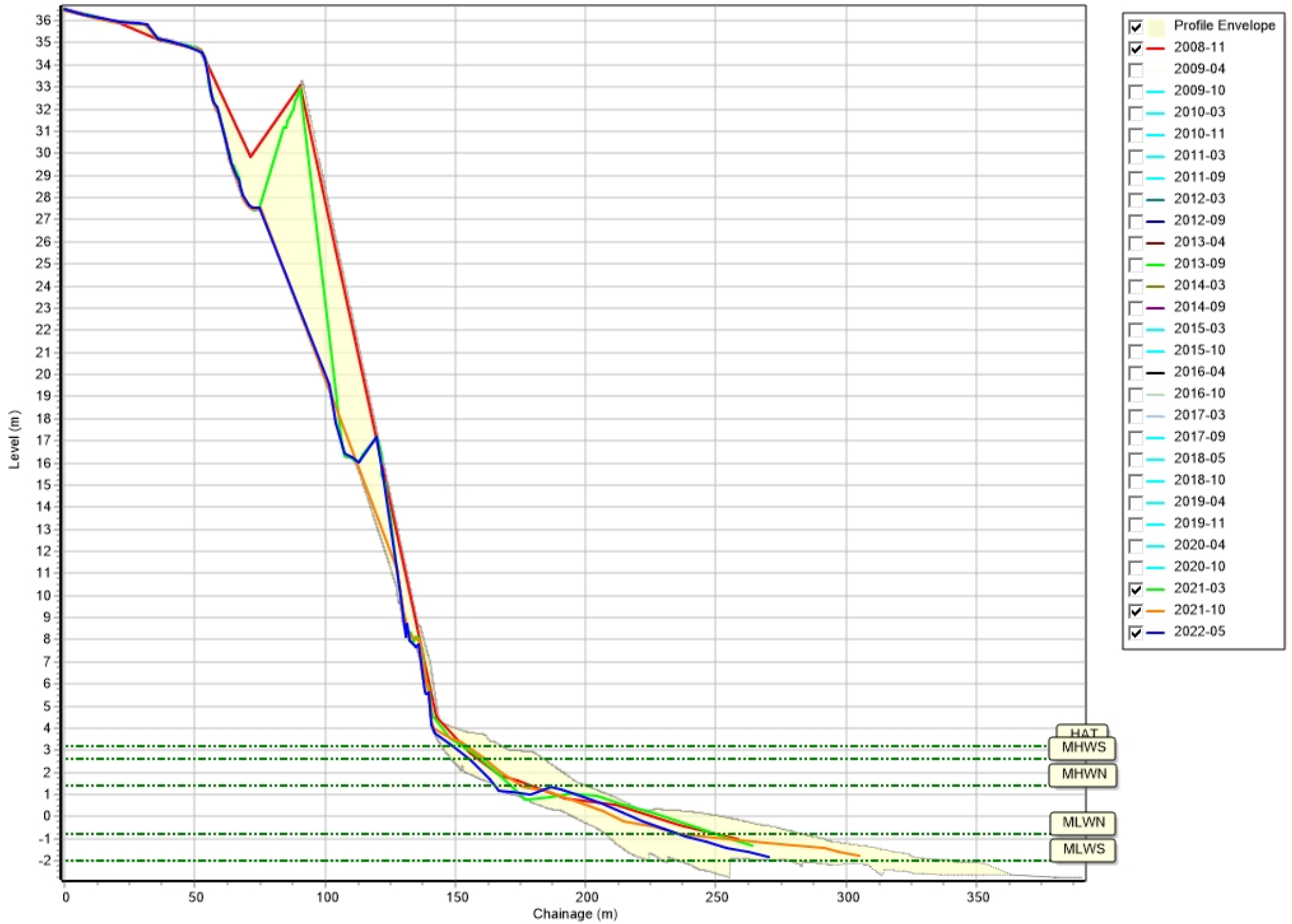


Profiles: 1dWB1





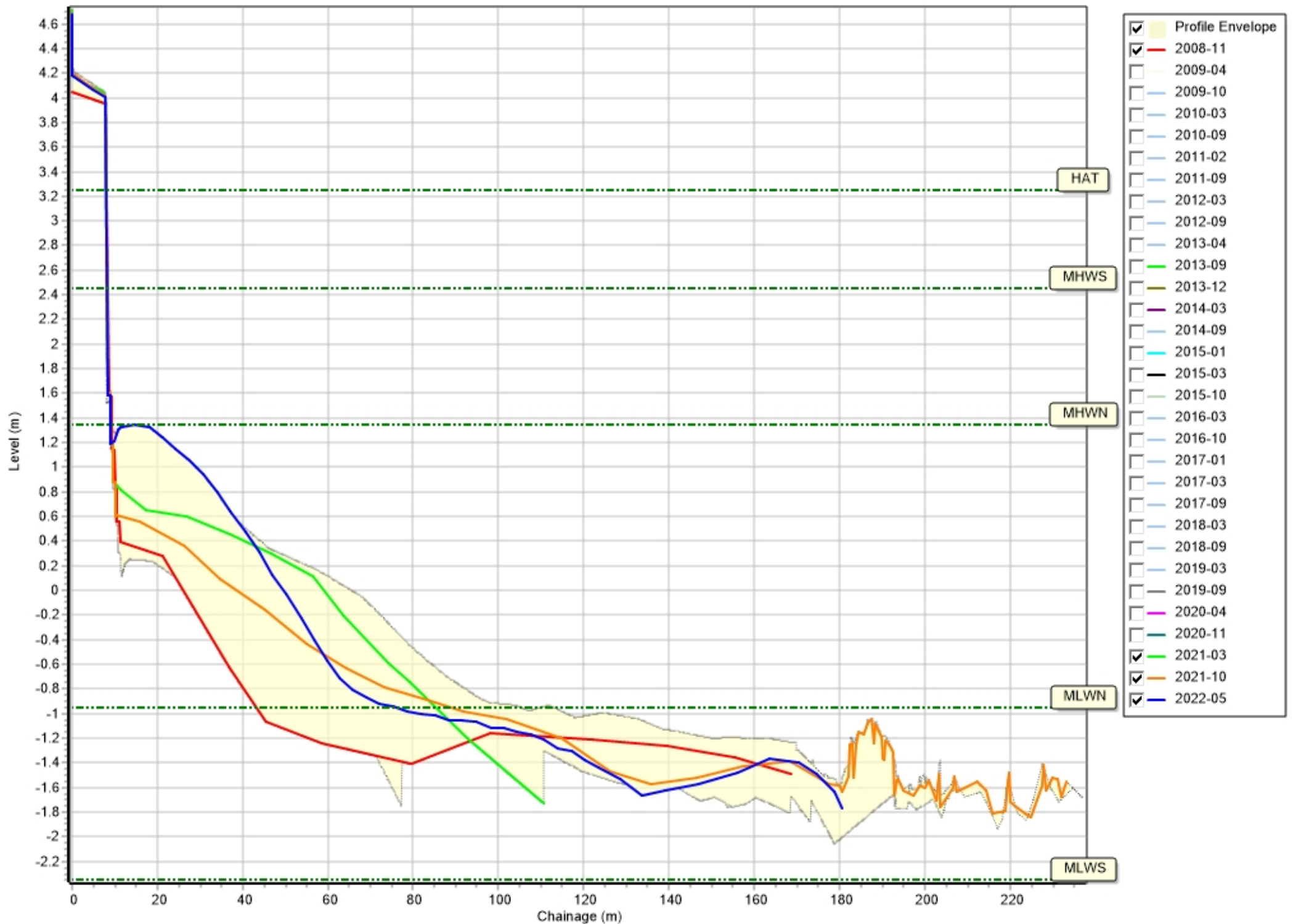
# Profiles: 1dWB2



Profiles: 1dWB3



Profiles: 1dSBN1

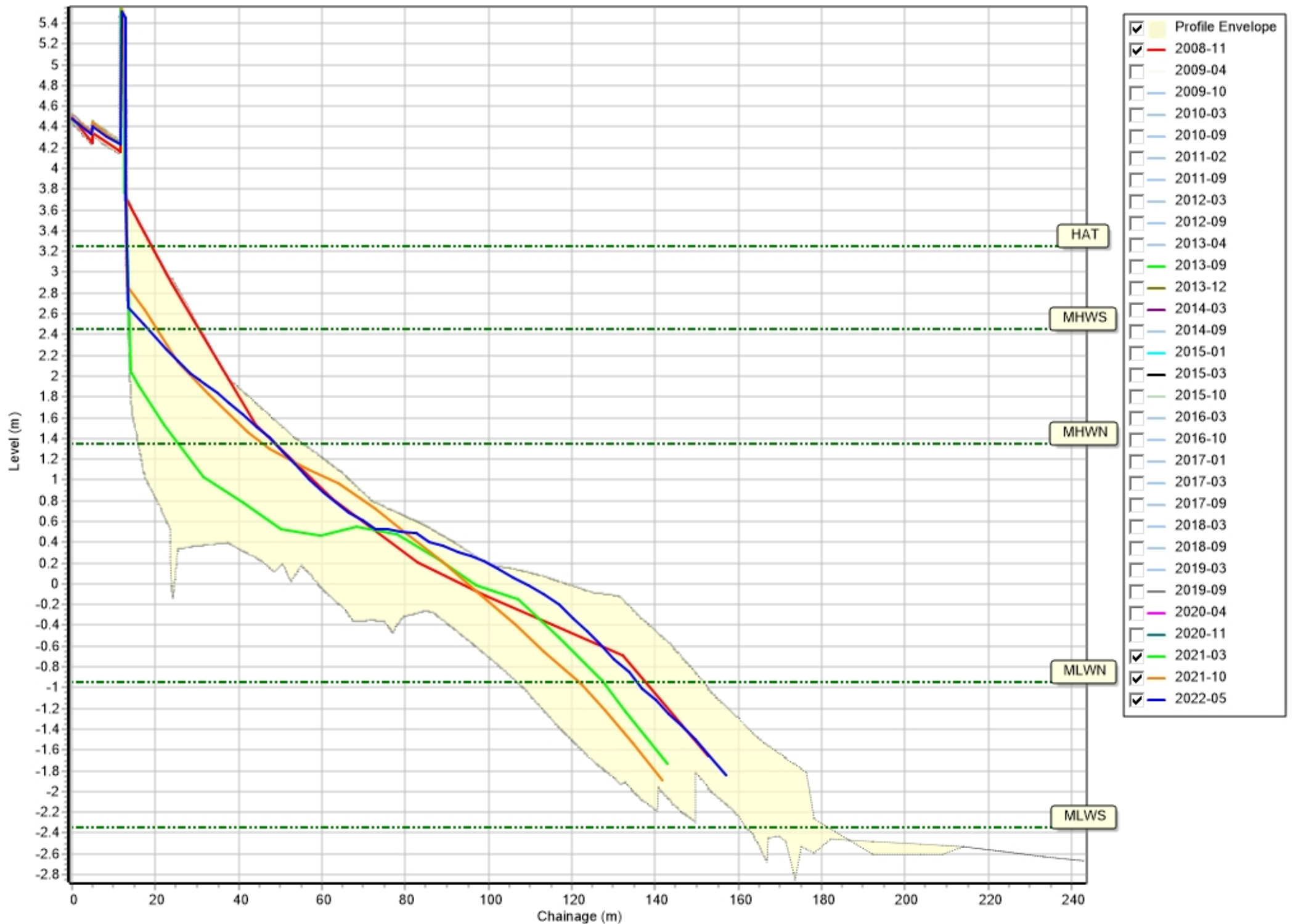


Profiles: 1dSBN2





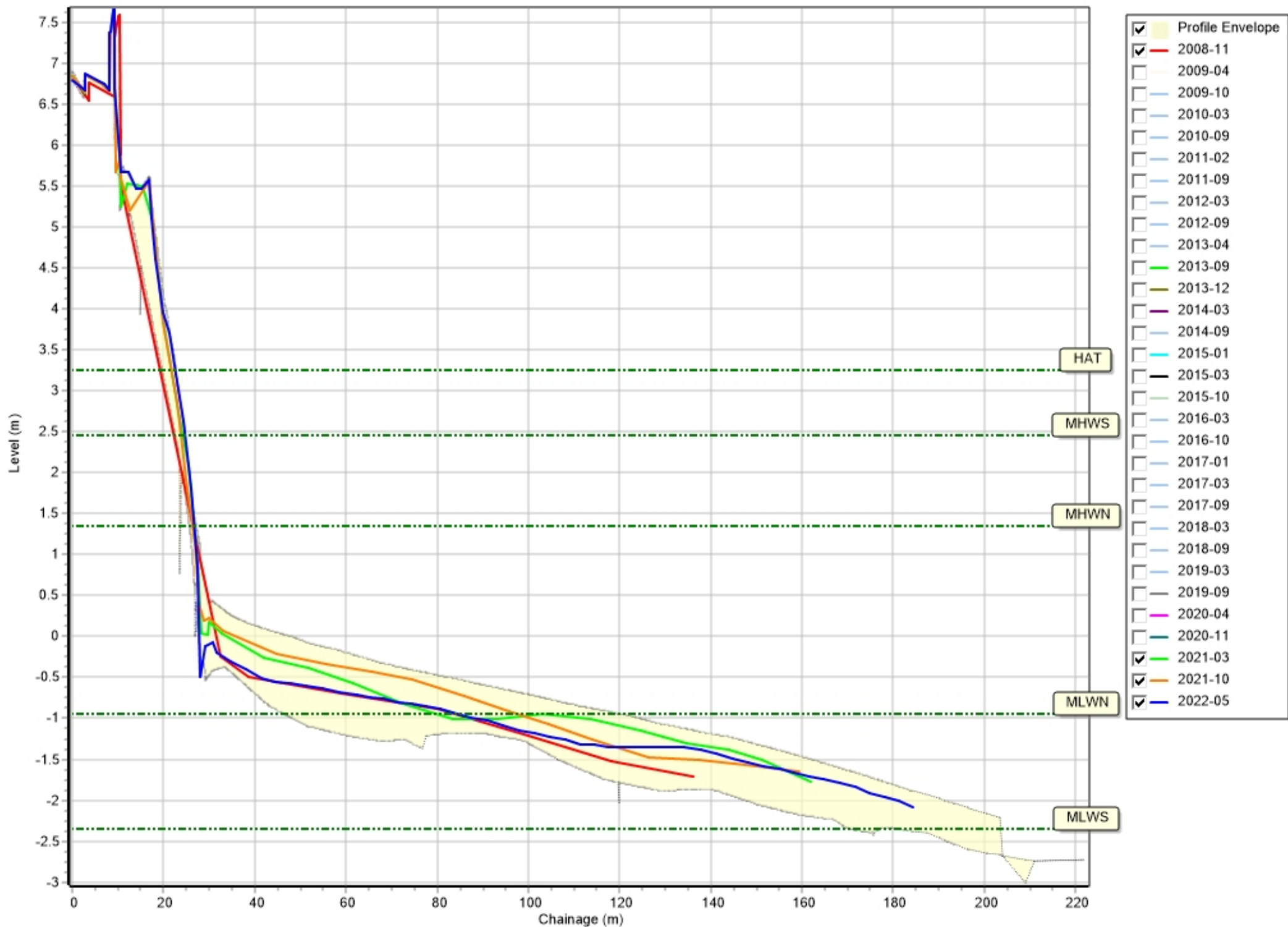
Profiles: 1dSBN3



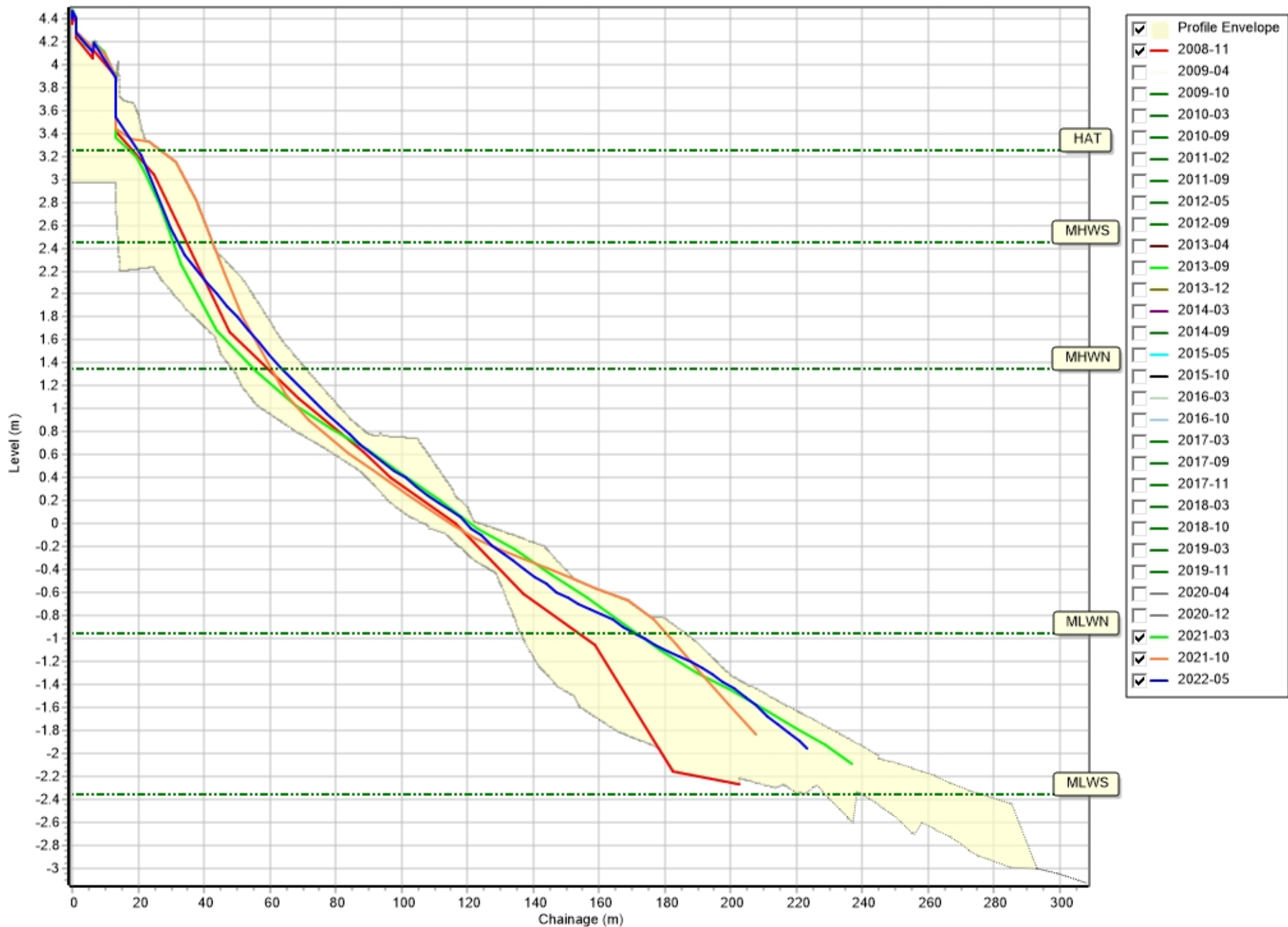
Profiles: 1dSBN4



Profiles: 1dSBN5

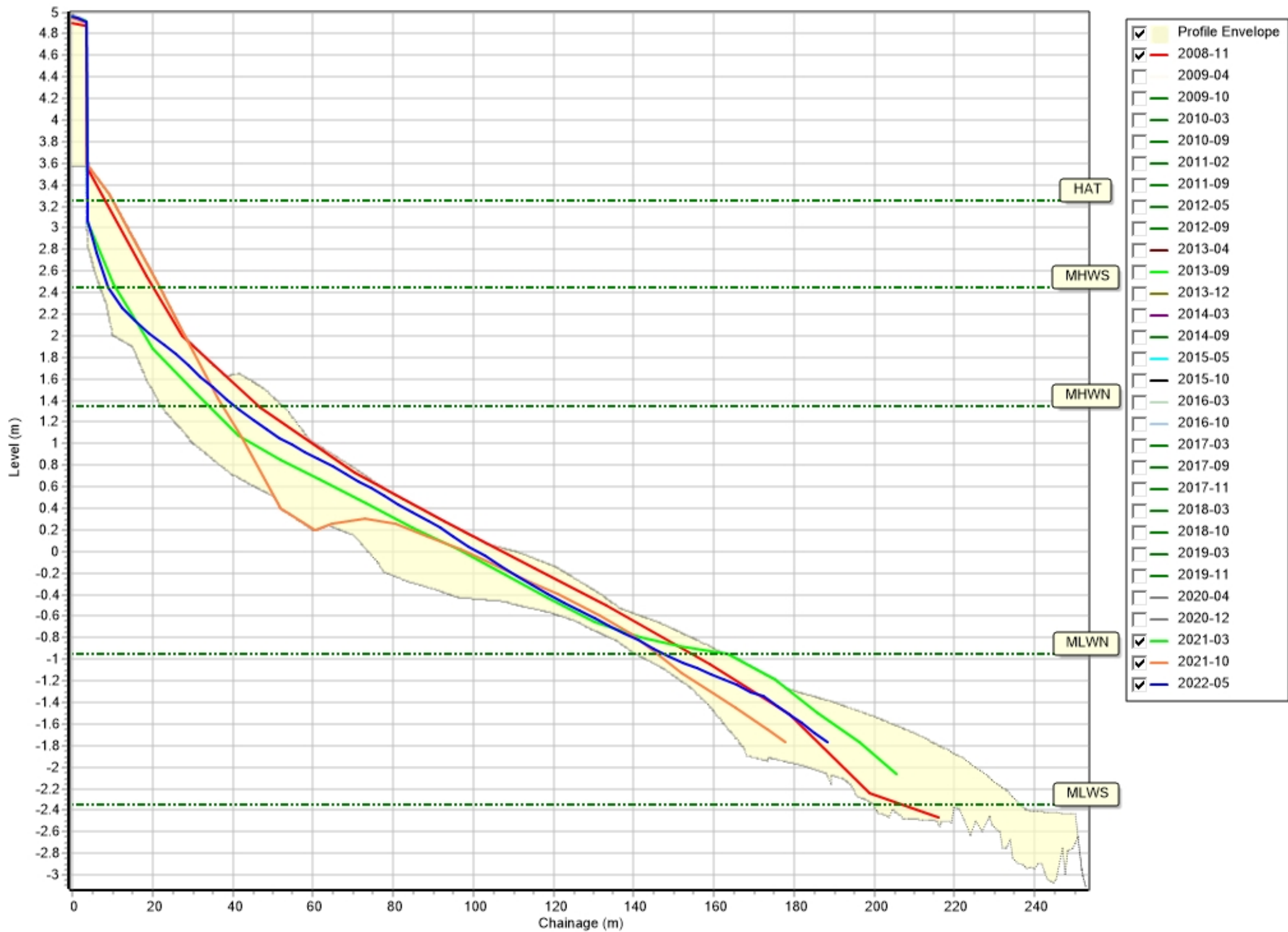


Profiles: 1dSBS1

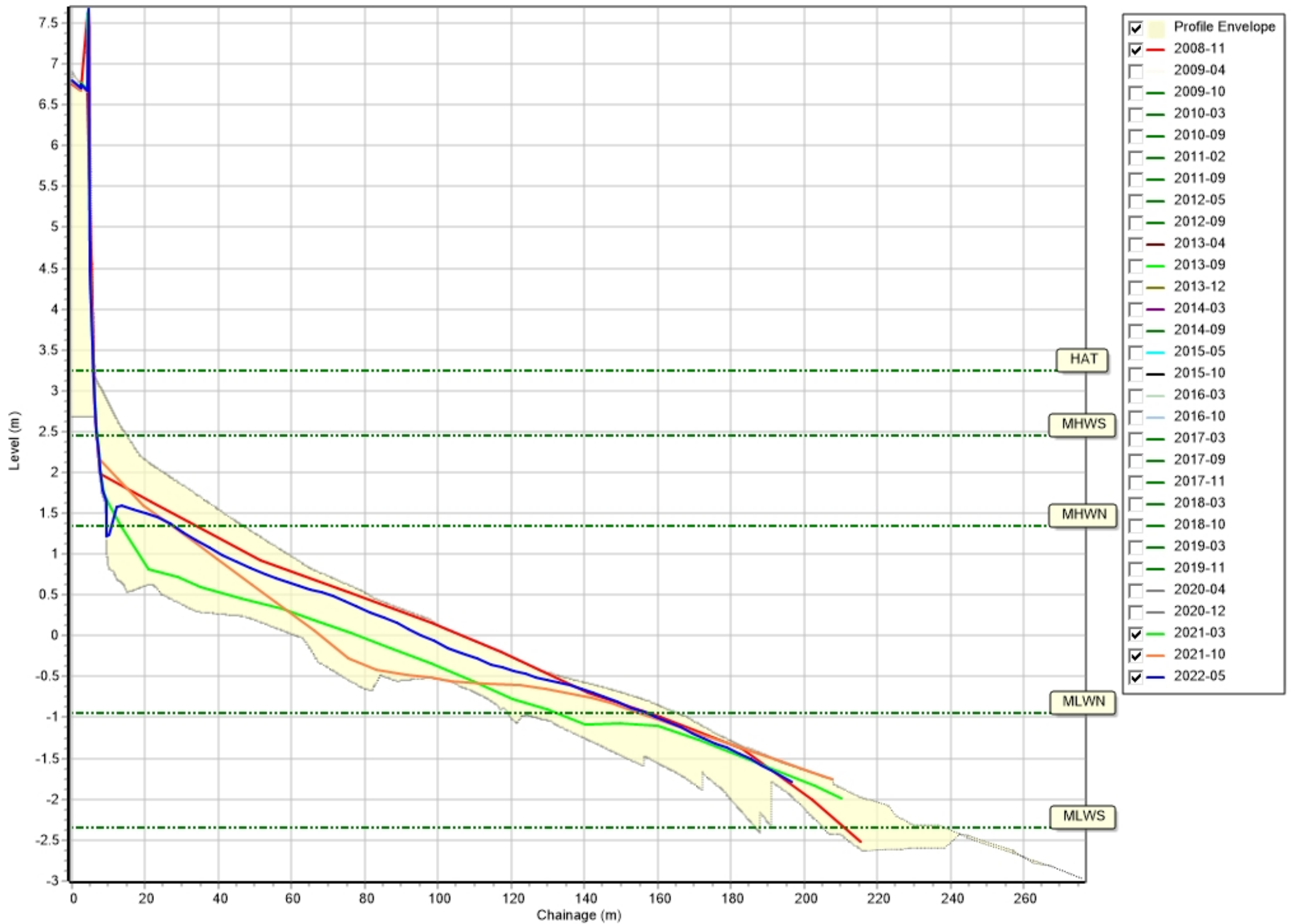




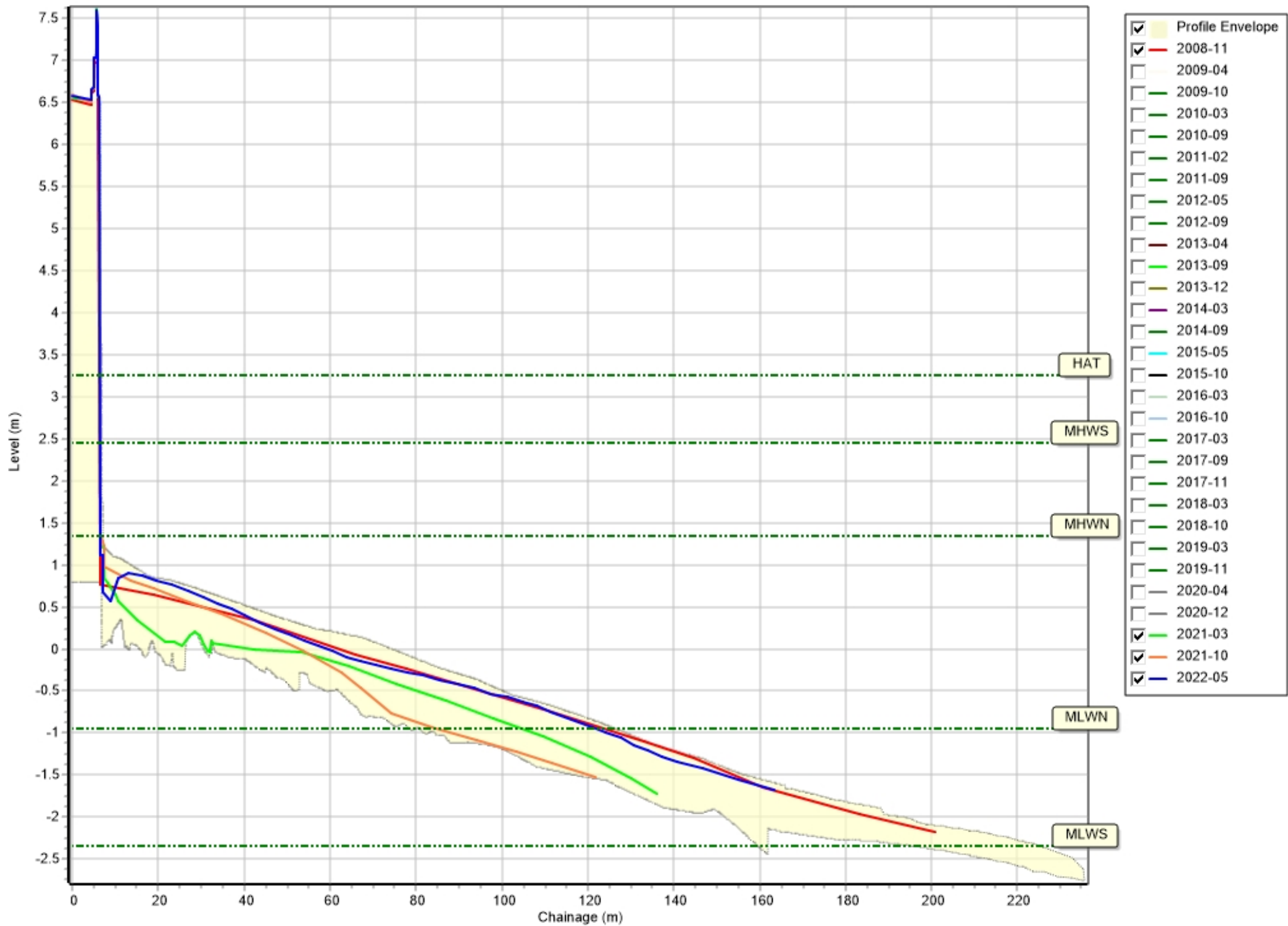
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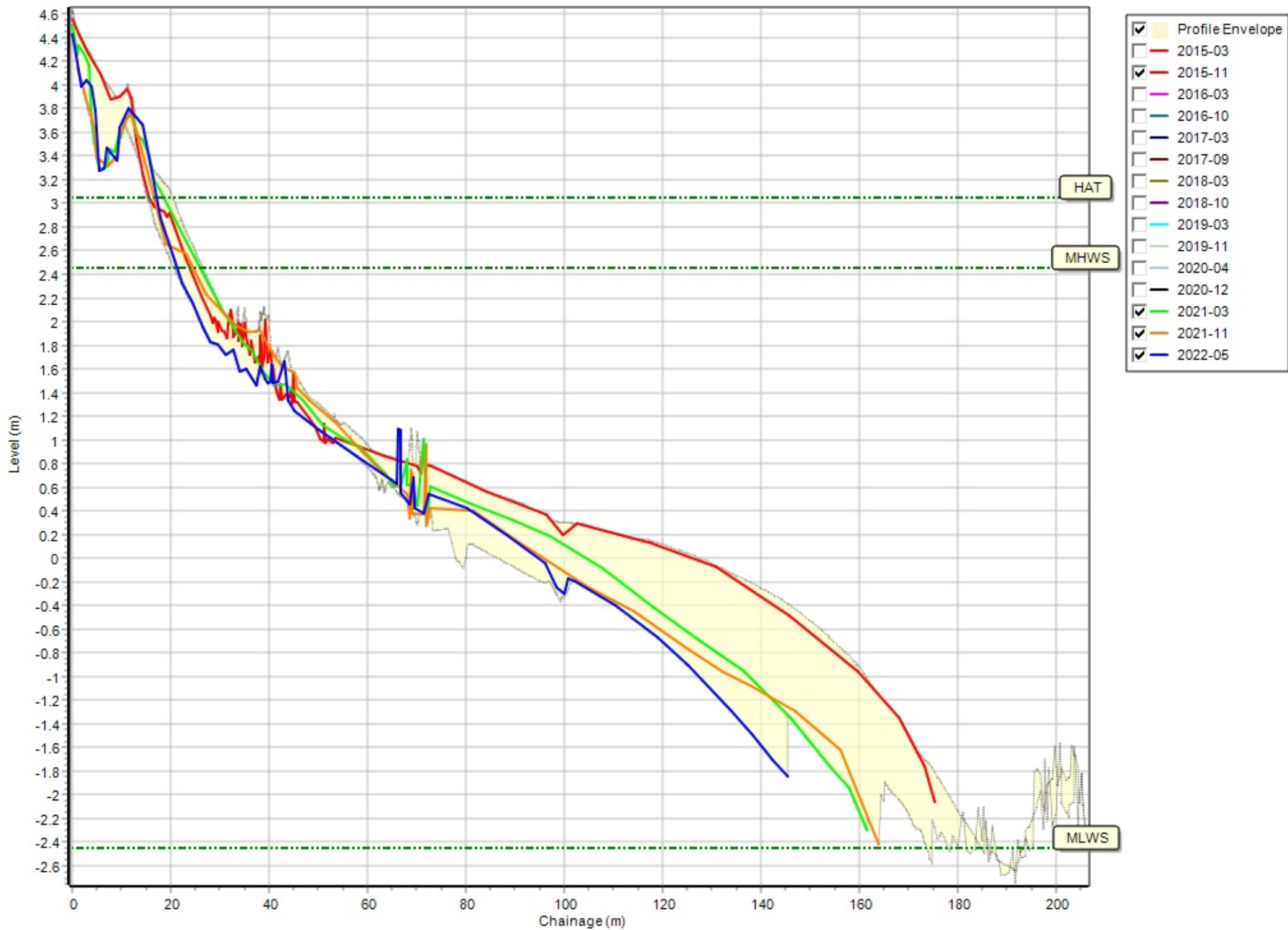
Profiles: 1dSBS3



Profiles: 1dSBS4

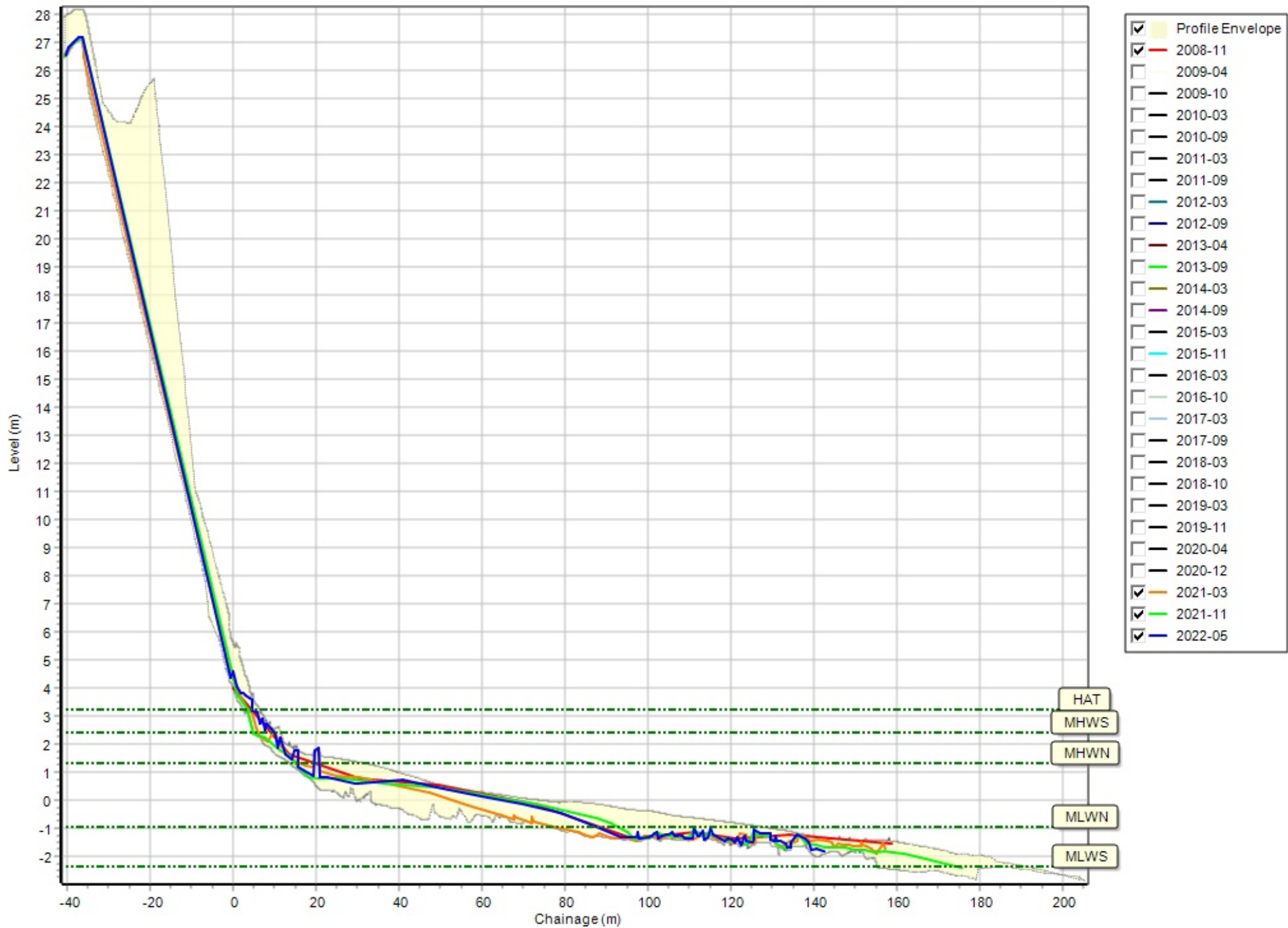


Profiles: 1dCY1A

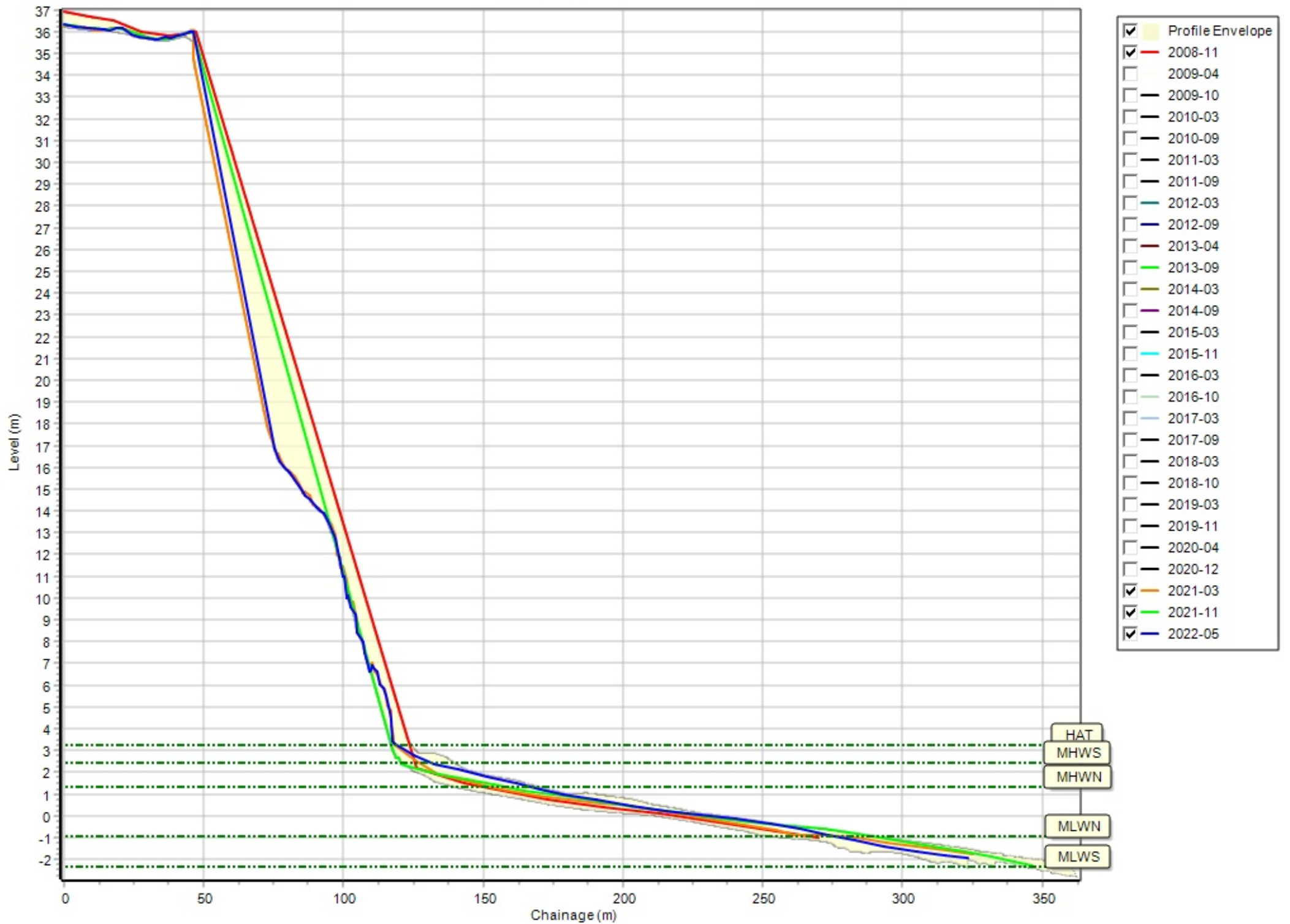




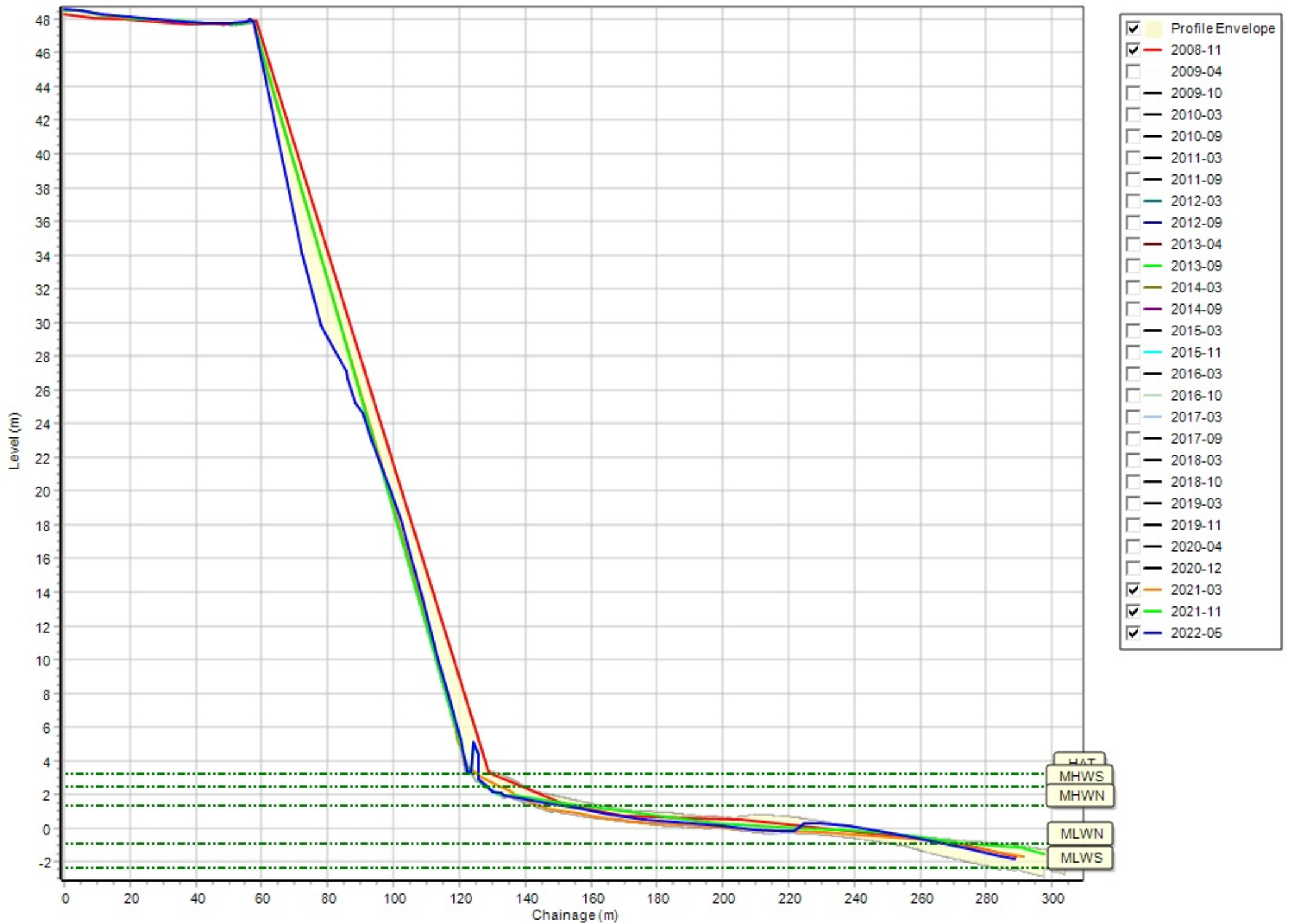
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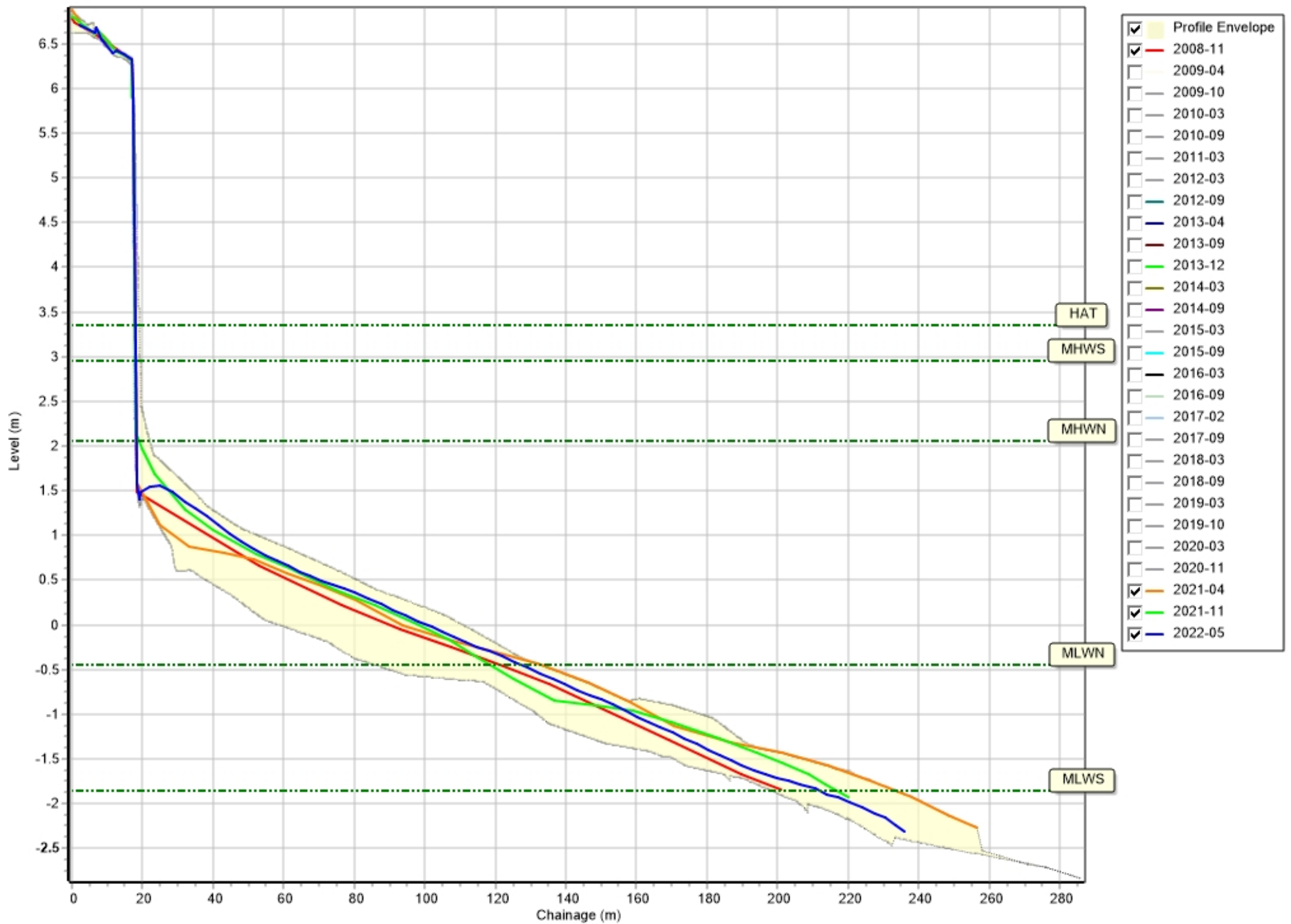
### Profiles: 1dCY2



Profiles: 1dCY3

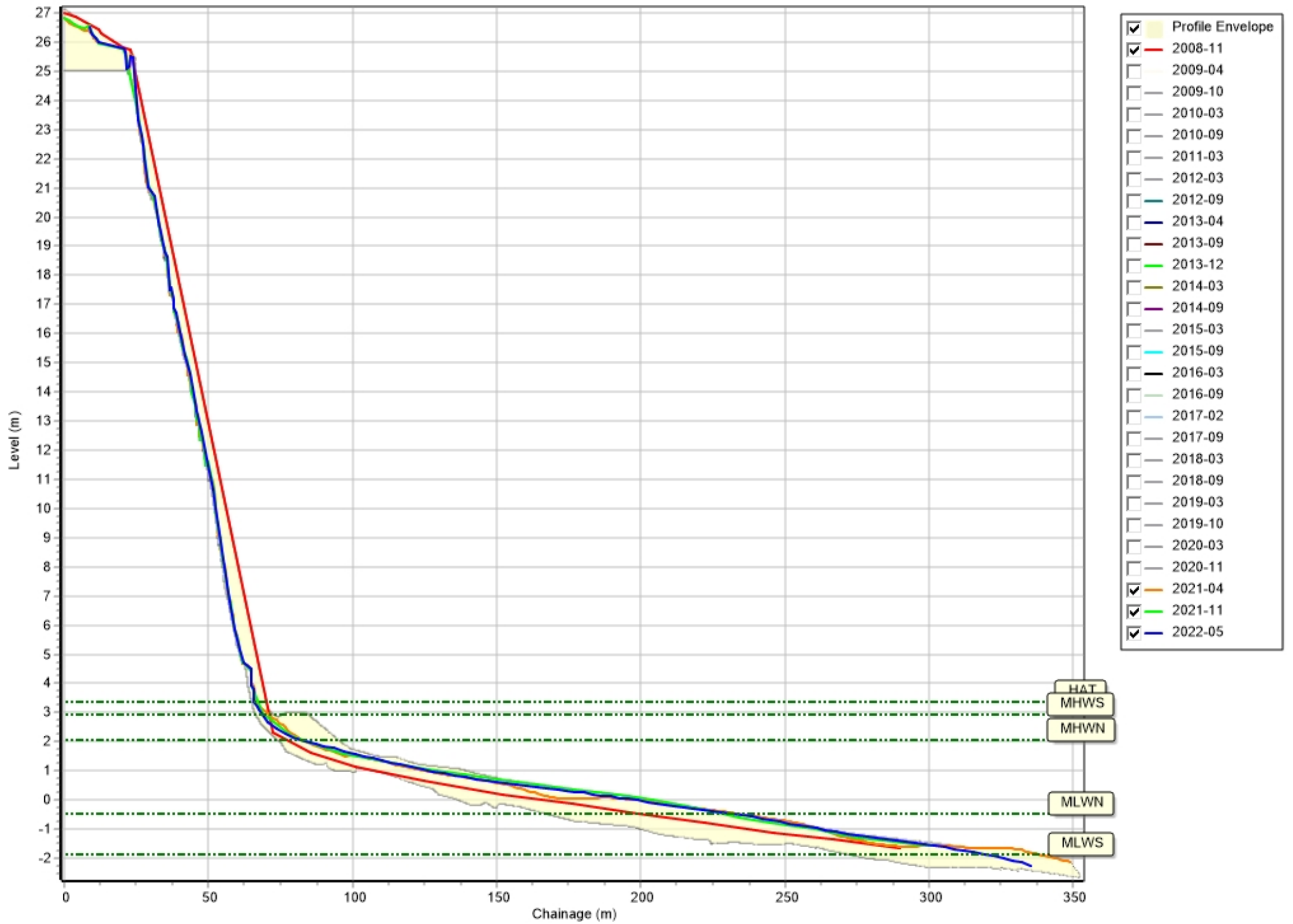


Profiles: 1dFB1

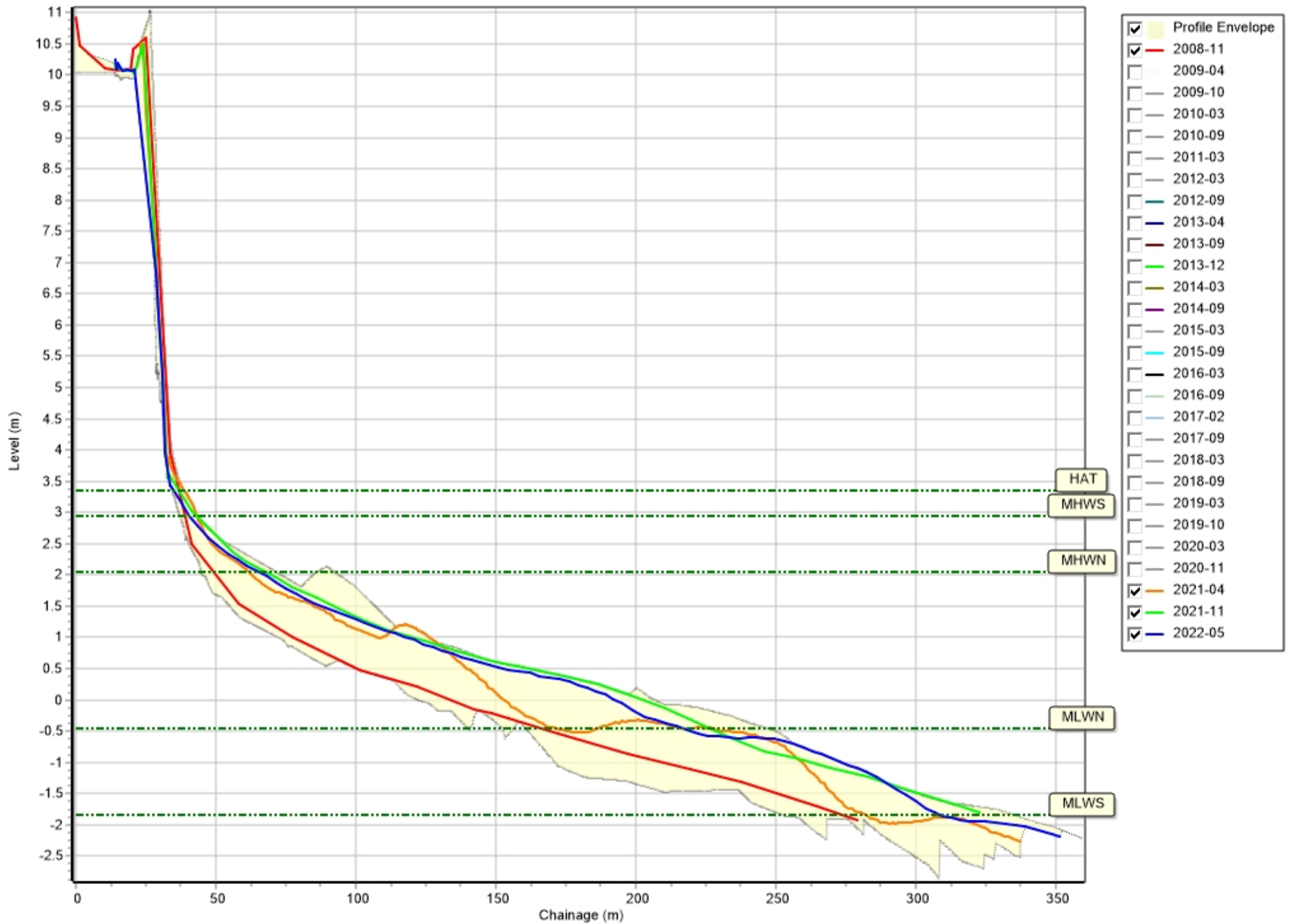




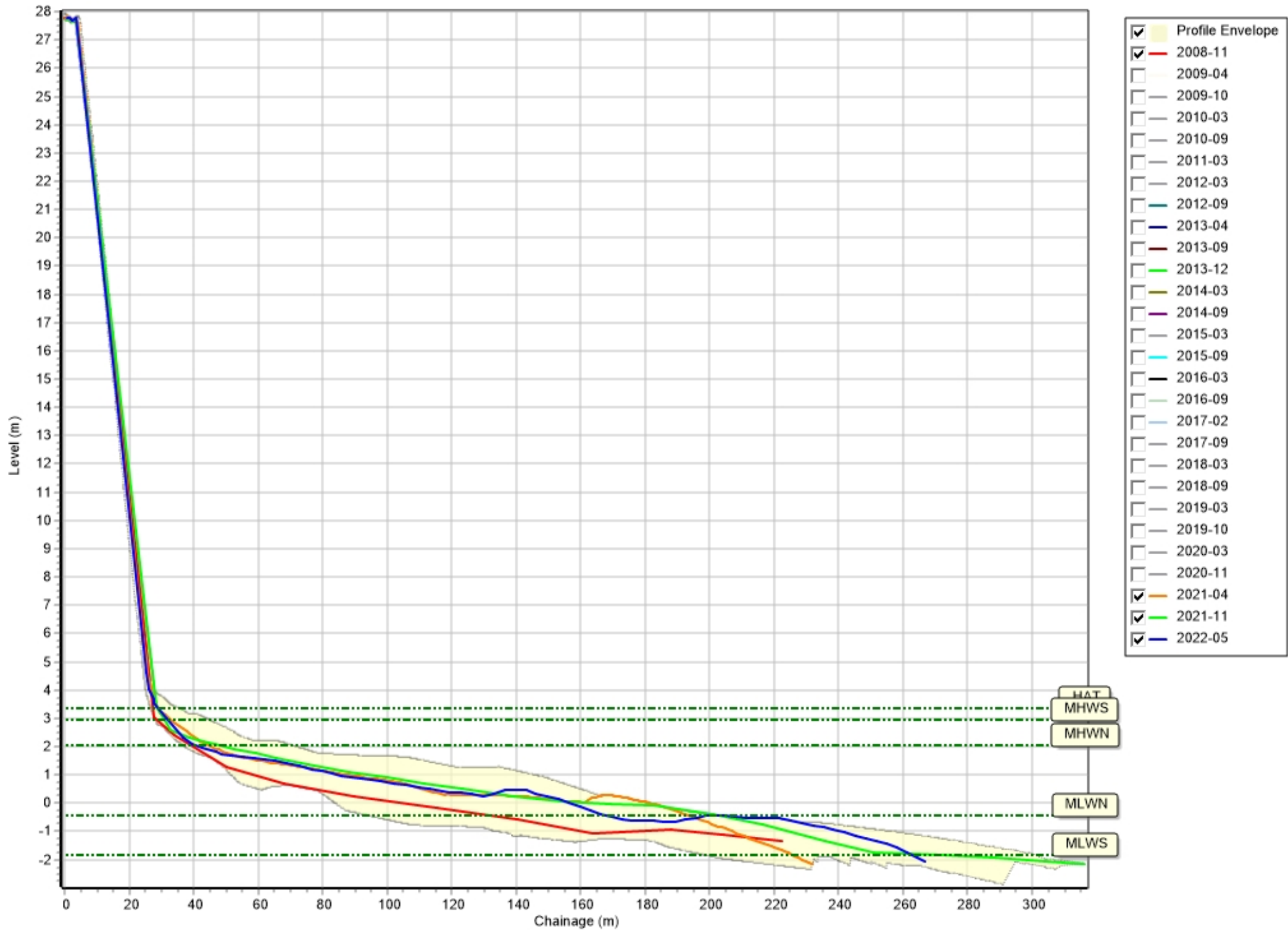
# Profiles: 1dFB2



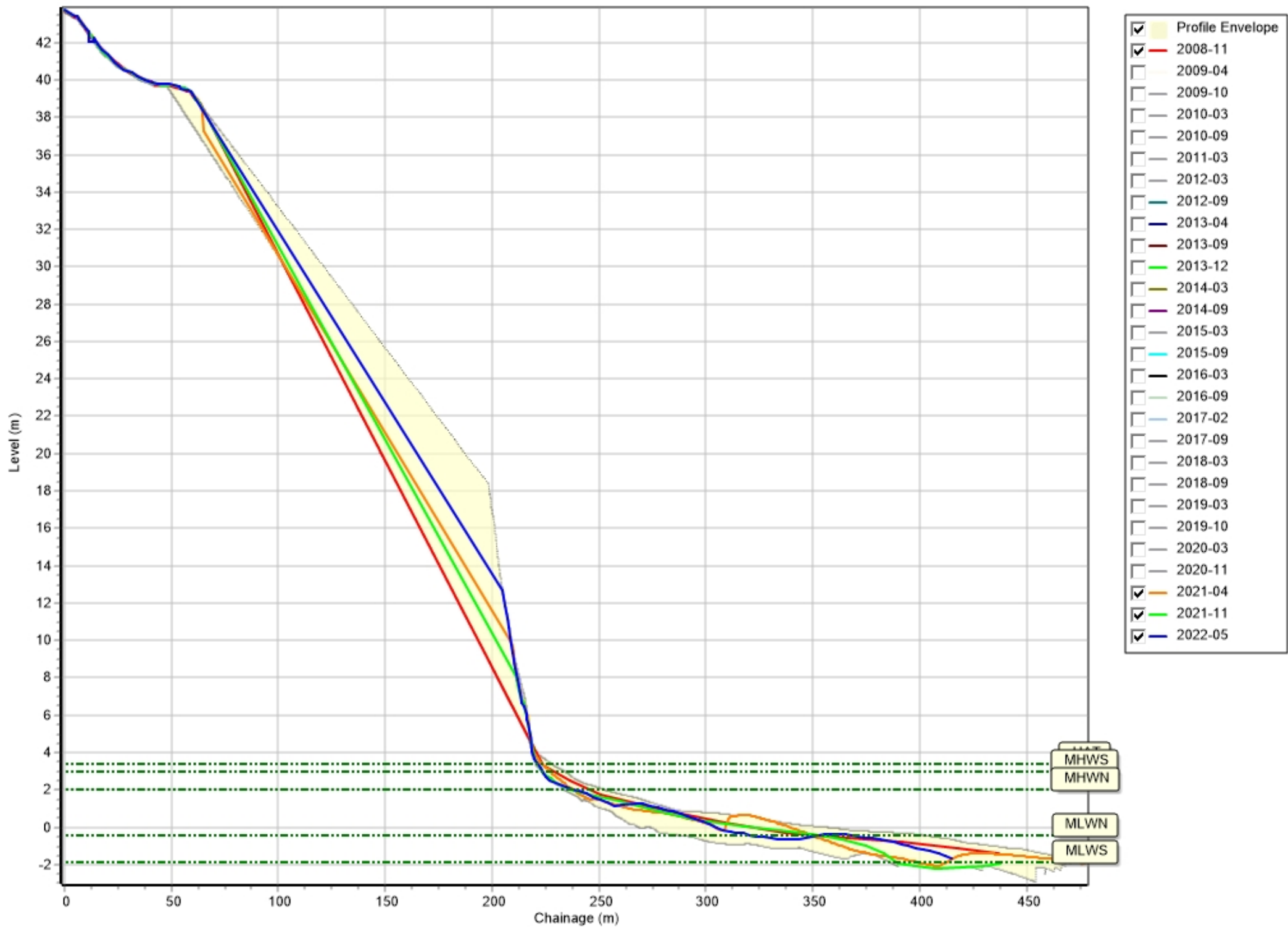
Profiles: 1dFB3



Profiles: 1dFB4



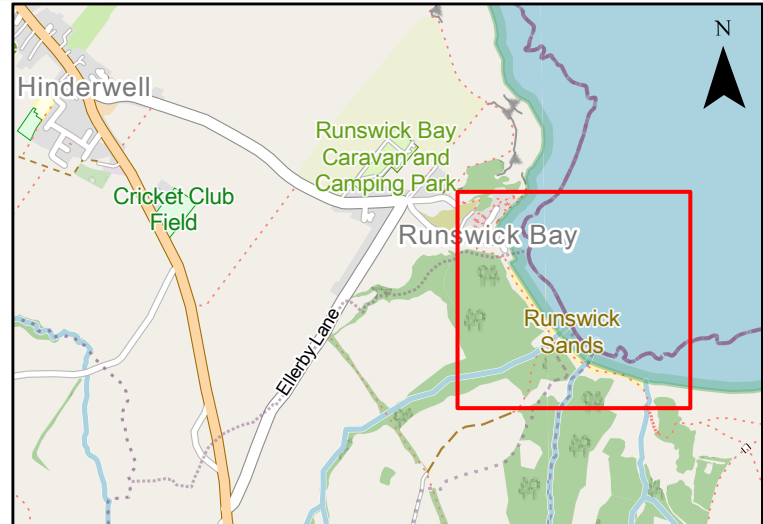
# Profiles: 1dFB5





**Appendix B**  
**Topographic Survey**





**TOPOGRAPHIC SURVEY (May 2022)**

**Elevation (mOD)**

- 5.51 - 6
- 5.01 - 5.5
- 4.51 - 5
- 4.01 - 4.5
- 3.51 - 4
- 3.01 - 3.5
- 2.51 - 3
- 2.01 - 2.5
- 1.51 - 2
- 1.01 - 1.5
- 0.501 - 1
- 0.001 - 0.5
- 0.499 - 0
- 0.99 - -0.5
- 1.49 - -1
- 1.63 - -1.5

**Contours (mOD)\***

- 1.0m interval
- 0.25m interval

\* Contours only cover sandy beach areas.

Client:  
North East Coastal Group

Project:  
Cell 1 Regional Coastal Monitoring Programme

Title:  
**Appendix B - Map 1**  
**RUNSWICK BAY**  
**Scarborough Borough Council Frontage**

Report:  
Update Report  
'Partial Measures' Survey 2022

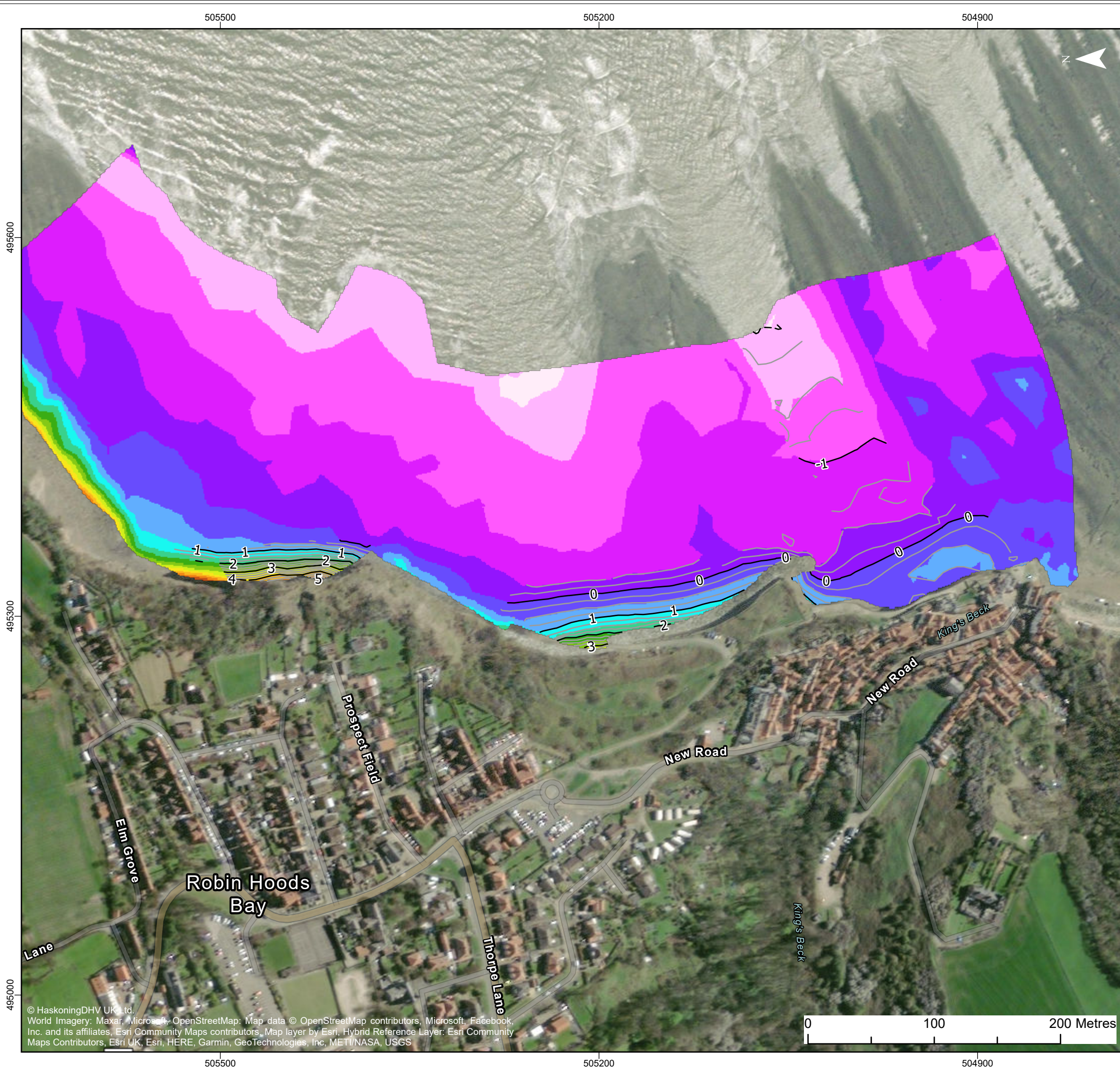
Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	16/06/2022	TC	NJC	A3	1:3,000

Co-ordinate system: British National Grid

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**TOPOGRAPHIC SURVEY (May2022)**

Elevation (mOD)	Contours (mOD)*
5.6 - 6	— 1.0m interval
5.1 - 5.5	— 0.25m interval
4.6 - 5	
4.1 - 4.5	
3.6 - 4	
3.1 - 3.5	
2.6 - 3	
2.1 - 2.5	
1.6 - 2	
1.1 - 1.5	
0.51 - 1	
0.01 - 0.5	
-0.49 - 0	
-0.9 - -0.5	
-1.4 - -1	
-1.9 - -1.5	
-2.3 - -2	

\* Contours only cover sandy beach areas.

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

Title:

**Appendix B - Map 2**

**ROBIN HOOD'S BAY**

**Scarborough Borough Council Frontage**

Report:

Update Report  
'Partial Measures' Survey 2022

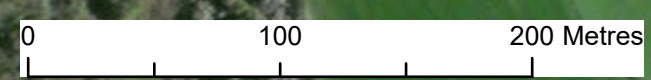
Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	16/06/2022	TC	NJC	A3	1:3,000

Co-ordinate system: British National Grid

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**North East Coastal Observatory**

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**TOPOGRAPHIC SURVEY (May 2022)**

<b>Elevation (mOD)</b>	<b>Contours (mOD)*</b>
3.6 - 4	— 1.0m interval
3.1 - 3.5	— 0.25m interval
2.6 - 3	
2.1 - 2.5	
1.6 - 2	
1.1 - 1.5	
0.51 - 1	
0.01 - 0.5	
-0.49 - 0	
-0.9 - -0.5	
-1.4 - -1	
-1.9 - -1.5	
-2.3 - -2	

\* Contours only cover sandy beach areas.

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

Title:

**Appendix B - Map 3**

**FILEY**

**Scarborough Borough Council Frontage**

Report:

Update Report  
'Partial Measures' Survey 2022

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	16/06/2022	TC	NJC	A3	1:5,000

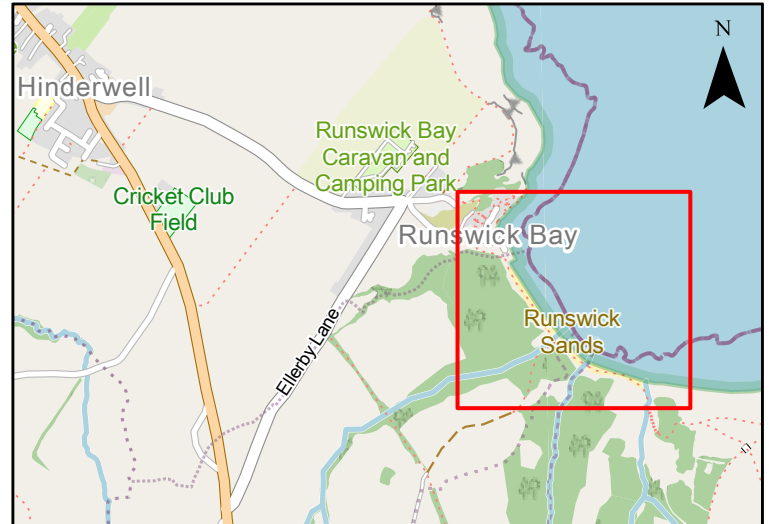
Co-ordinate system: British National Grid

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**North East Coastal Observatory**

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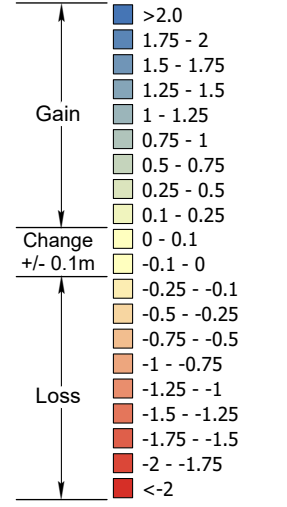




**Difference between topographic surveys**

(Oct 2021 to May 2022)

**Change in Elevation (mOD)**



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

Title:

**Appendix B - Map 4**

**RUNSWICK BAY**

**Scarborough Borough Council Frontage**

Report:

Update Report  
'Partial Measures' Survey 2022

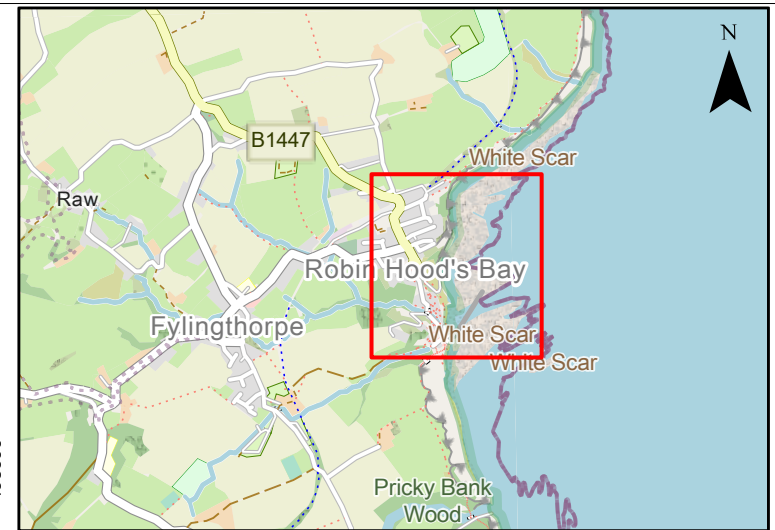
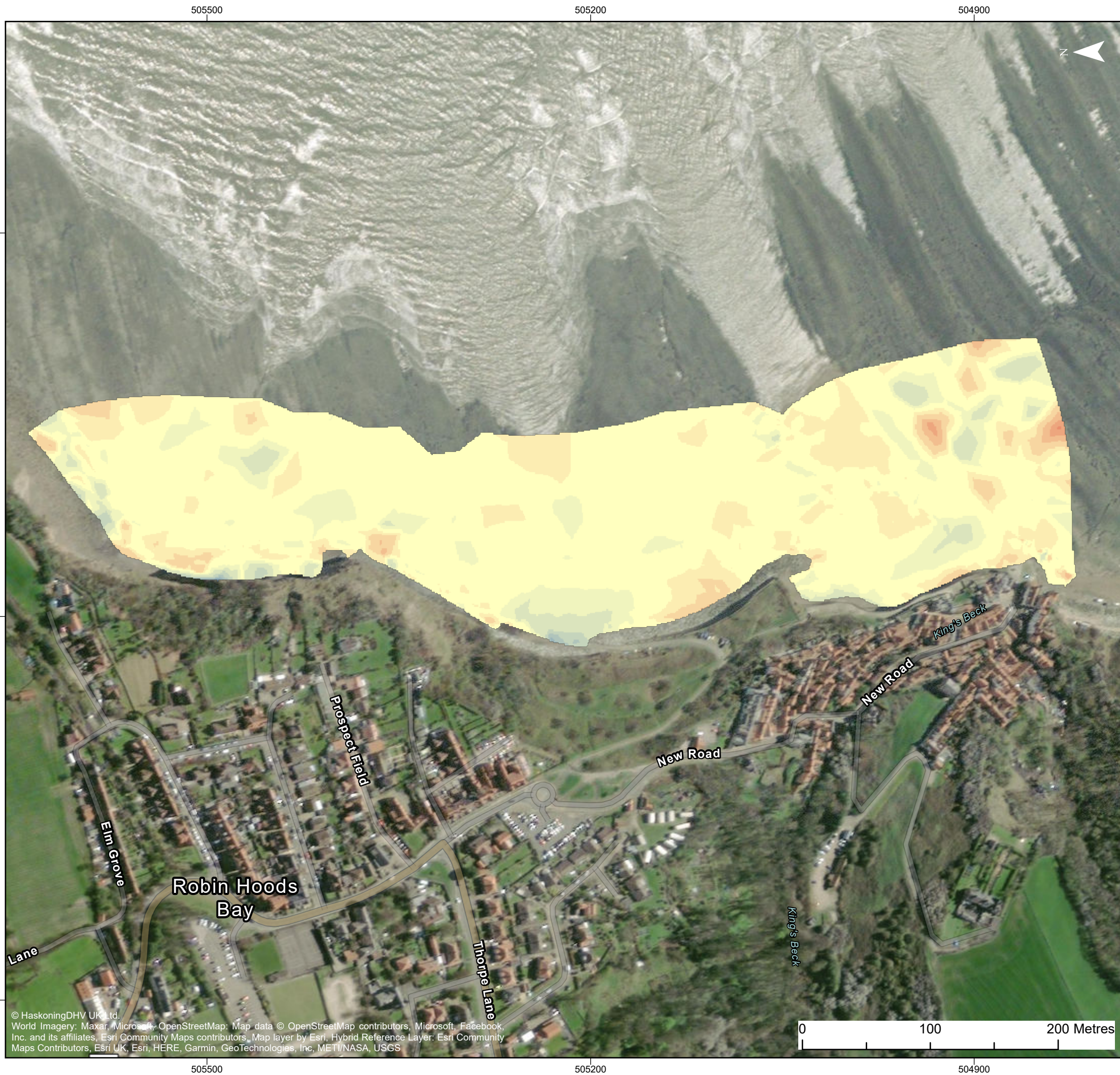
Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	16/06/2022	TC	NJC	A3	1:3,000

Co-ordinate system: British National Grid



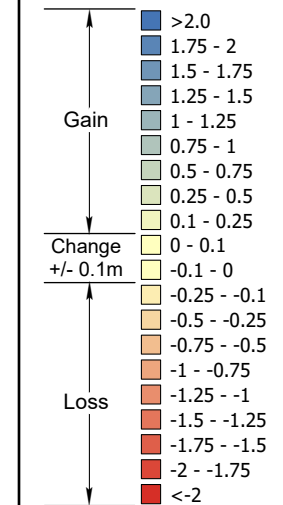
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**Difference between topographic surveys**  
(Oct 2021 to May 2022)

**Change in Elevation (mOD)**



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

Title:

**Appendix B - Map 5**

**ROBIN HOOD'S BAY**

**Scarborough Borough Council Frontage**

Report:

Update Report  
'Partial Measures' Survey 2022

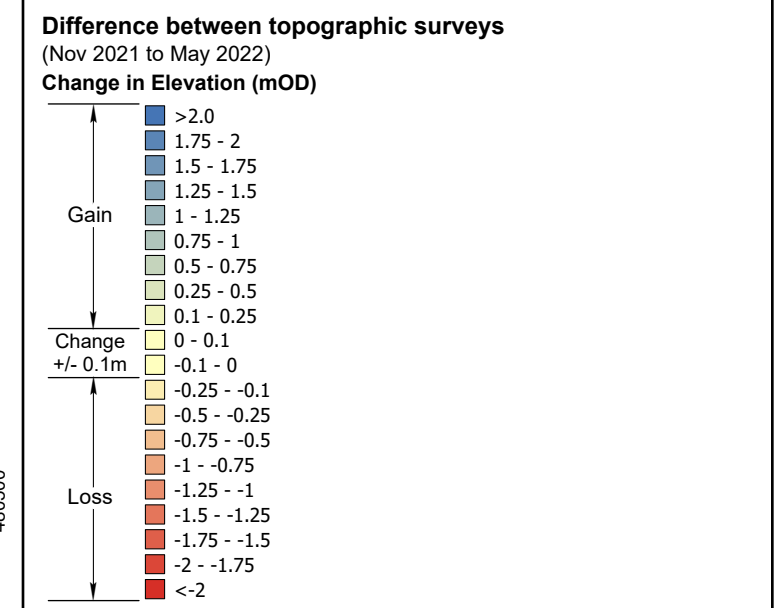
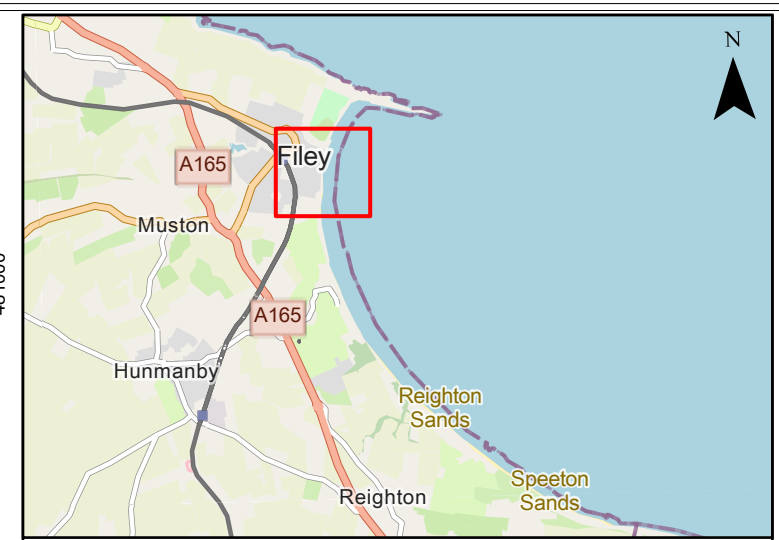
Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	16/06/2022	TC	NJC	A3	1:3,000

Co-ordinate system: British National Grid



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

Title:

**Appendix B - Map 6**

**FILEY**

**Scarborough Borough Council Frontage**

Report: Update Report  
'Partial Measures' Survey 2022

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	16/06/2022	TC	NJC	A3	1:5,000

Co-ordinate system: British National Grid





**Appendix C**  
**Cliff Top Survey**

## Cliff Top Survey

### Staithes

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

The cliff top surveys at Staithes are undertaken bi-annually. Measurements are taken from a fixed ground control point along a fixed bearing to the edge of the cliff top.

Table C1 provides baseline information about these ground control points and results from the 2008 (baseline) survey showing the position from the ground control point to the edge of the cliff top along the defined bearing. Future reports will show results from subsequent surveys and provide a means of assessing erosion since the baseline survey.

**Table C1 – Cliff Top Surveys at Staithes**

Ground Control Points				Distance to Cliff Top (m)			Total Erosion (m)		Erosion Rate (m/year)
Ref	Easting	Northing	Bearing (°)	Baseline Survey	Previous Survey	Present Survey	Baseline to Present	Previous to Present	Baseline to Present
STAITHES				Nov 2008	Oct 2021	April 2022	Nov 2008 - April 2022	Oct 2021 - Apr 2022	Nov 2008 - April 2022
1	477228	518769	320	1.90	-5.40	-5.35	7.25	-0.05	0.60
2	477334	518798	0	10.90	10.58	10.71	0.19	-0.13	0.02
3	477487	518789	350	7.10	7.96	8.07	-0.97	-0.11	0.00
4	477594	518801	340	5.90	3.74	3.47	2.43	0.27	0.20
5	477683	518911	350	8.40	8.55	8.25	0.15	0.30	0.01
6	477792	518867	30	8.60	8.54	8.50	0.10	0.04	0.01
7	477891	518828	60	7.70	7.20	7.30	0.40	-0.10	0.03
8	477959	518873	350	8.70	8.56	8.52	0.18	0.04	0.02
9	478088	518950	350	7.60	8.05	7.90	-0.30	0.15	0.00
10	478191	519023	340	8.40	8.48	8.58	-0.18	-0.10	0.00
11	478237	519007	60	6.90	6.66	6.69	0.21	-0.03	0.02
12	478213	518988	150	6.10	6.56	6.55	-0.45	0.01	0.00
13	478501	518809	15	11.40	8.67	8.67	2.73	0.00	0.23



14	478624	518807	20	7.50	7.27	7.35	0.15	-0.08	0.01
15	478737	518858	60	6.10	6.12	6.38	-0.28	-0.26	0.00
16	478823	518757	60	8.00	8.12	8.65	-0.65	-0.53	0.00
17	478944	518671	30	9.30	8.78	8.70	0.60	0.08	0.05
18	479052	518630	20	9.20	9.06	9.27	-0.07	-0.21	0.00
19	479147	518610	0	14.20	13.94	14.04	0.16	-0.10	0.01
20	479274	518618	20	11.40	11.10	11.18	0.22	-0.08	0.02

## Cliff Top Survey

### Robin Hoods Bay

Thirteen ground control points have been established at Robin Hoods Bay (Figure C2). The maximum separation between any two points varies along the coast, reflecting the degree of risk from the erosion. The cliff top surveys at Robin Hoods Bay are undertaken bi-annually. Measurements are taken from a fixed ground control point along a fixed bearing to the edge of the cliff top.

Table C2 provides baseline information about these ground control points and results from the 2010 (baseline) survey showing the position from the ground control point to the edge of the cliff top along the defined bearing. Future reports will show results from subsequent surveys and provide a means of assessing erosion since the baseline survey.

**Table C2 – Cliff Top Surveys at Robin Hoods Bay**

Ground Control Points				Distance to Cliff Top (m)			Total Erosion (m)		Erosion Rate (m/year)
Ref	Easting	Northing	Bearing (°)	Baseline Survey	Previous Survey	Present Survey	Baseline to Present	Previous to Present	Baseline to Present
ROBIN HOODS BAY				Mar 2010	Oct 2021	May 2022	Nov 2008 - May 2022	Oct 2021 - May 2022	Nov 2008 - May 2022
1	495799.5	506002.2	130	11.60	6.30	7.10	4.50	-0.80	0.45
2	495549.2	505807.3	135	9.30	8.90	8.91	0.39	-0.01	0.04
3	495456.3	505740	130	5.00	5.10	5.07	-0.07	0.03	0.00
4	495389.9	505683.7	140	6.30	5.89	5.86	0.44	0.03	0.04
5	495259.4	505342.5	130	11.30	13.02	14.12	-2.82	-1.10	0.00
6	495231.2	505315.7	95	5.90	5.73	5.68	0.22	0.05	0.02
7	495184.8	505210.7	85	6.40	7.15	7.14	-0.74	0.01	0.00
8	495206.5	505153	75	5.00	5.02	5.11	-0.11	-0.09	0.00
9	495287.8	505060.5	80	4.30	4.25	4.47	-0.17	-0.22	0.00
10	495187.8	504708.8	70	3.10	2.18	2.12	0.98	0.06	0.10
11	495226.2	504615.7	120	3.80	2.09	1.98	1.82	0.11	0.18
12	495297.5	504380.2	80	11.00	10.61	10.58	0.42	0.03	0.04
13	495350.4	504193	55	3.70	3.62	3.55	0.15	0.07	0.02

## Cliff Top Survey

### Scarborough South Bay

Thirteen ground control points have been established at Scarborough South Bay (Figure C3). The maximum separation between any two points varies along the coast, reflecting the degree of risk from the erosion. The cliff top surveys at Scarborough South Bay are undertaken bi-annually. Measurements are taken from a fixed ground control point along a fixed bearing to the edge of the cliff top.

Table C3 provides baseline information about these ground control points and results from the 2010 (baseline) survey showing the position from the ground control point to the edge of the cliff top along the defined bearing. Future reports will show results from subsequent surveys and provide a means of assessing erosion since the baseline survey.

**Table C3 – Cliff Top Surveys at Scarborough South Bay**

Ground Control Points				Distance to Cliff Top (m)			Total Erosion (m)		Erosion Rate (m/year)
Ref	Easting	Northing	Bearing (°)	Baseline Survey	Previous Survey	Present Survey	Baseline to Present	Previous to Present	Baseline to Present
SCARBOROUGH SOUTH BAY				Mar 2010	Oct 2021	May 2022	Nov 2008 - May 2022	Oct 2021 - May 2022	Nov 2008 - May 2022
1	504339.5	487887.3	70	7.00	6.98	6.98	0.02	0.00	0.00
2	504422.3	487603.7	80	4.80	4.81	4.84	-0.04	-0.03	0.00
3	504534.8	487318.3	40	15.10	15.13	15.11	-0.01	0.02	0.00
4	504730.2	487137.9	55	9.60	9.56	9.57	0.03	-0.01	0.00
5	504922.9	486837.8	60	8.80	8.55	8.50	0.30	0.05	0.03
6	50571.1	486652.1	75	3.80	3.55	3.57	0.23	-0.02	0.02
7	505284.3	486480	35	7.00	6.60	6.60	0.40	0.00	0.04
8	505597.9	486363.4	30	8.60	8.34	8.37	0.23	-0.03	0.02
9	505758.6	486005.1	45	9.10	8.46	8.46	0.64	0.00	0.06
10	505896	485889.6	15	14.80	14.68	14.70	0.10	-0.02	0.01
11	505990	485657.1	80	4.70	0.91	0.92	3.78	-0.01	0.38
12	506024.9	485421.8	55	6.10	3.10	2.97	3.13	0.13	0.31
13	506036	485315.3	90	7.00	6.94	6.71	0.29	0.23	0.03



## Cliff Top Survey

### Cayton Bay

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

The cliff top surveys at Cayton Bay are undertaken bi-annually. Measurements are taken from a fixed ground control point along a fixed bearing to the edge of the cliff top.

Table C4 provides baseline information about these ground control points and results from the 2008 (baseline) survey showing the position from the ground control point to the edge of the cliff top along the defined bearing. Future reports will show results from subsequent surveys and provide a means of assessing erosion since the baseline survey.

**Table C4 – Cliff Top Surveys at Cayton Bay**

Ground Control Points				Distance to Cliff Top (m)			Total Erosion (m)		Erosion Rate (m/year)
Ref	Easting	Northing	Bearing (°)	Baseline Survey	Previous Survey	Present Survey	Baseline to Present	Previous to Present	Baseline to Present
CAYTON BAY				Nov 2008	Nov 2021	May 2022	Nov 2008 - May 2022	Nov 2021 - May 2022	Nov 2008 - May 2022
1	506325.5	484849.7	50	4.00	3.68	3.59	0.41	0.09	0.03
2	506459.4	484715.9	65	5.00	UTS	UTS	UTS	UTS	UTS
3	506597.4	484538.6	65	5.00	6.17	5.57	-0.57	0.60	0.00
4	506778.1	484345.5	21	9.00	5.78	5.56	3.44	0.22	0.29
5	507018.6	484221.6	342	7.70	8.10	8.01	-0.31	0.09	0.00
6	507242.3	484121.7	2	7.40	5.78	5.79	1.61	-0.01	0.13
7	507518.2	484008.2	25	7.50	7.52	7.57	-0.07	-0.05	0.00
8	507818.7	484006	1	5.50	5.34	5.39	0.11	-0.05	0.01

## Cliff Top Survey

### Filey Bay

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

The cliff top surveys at Filey Bay are undertaken bi-annually. Measurements are taken from a fixed ground control point along a fixed bearing to the edge of the cliff top.

Table C5 provides baseline information about these ground control points and results from the 2008 (baseline) (and 2011 baseline for profiles 12A and 24-27) survey showing the position from the ground control point to the edge of the cliff top along the defined bearing. Future reports will show results from subsequent surveys and provide a means of assessing erosion since the baseline survey.

**Table C5 – Cliff Top Surveys in Filey Bay**

Ground Control Points				Distance to Cliff Top (m)			Total Erosion (m)		Erosion Rate (m/year)
Ref	Easting	Northing	Bearing (°)	Baseline Survey	Previous Survey	Present Survey	Baseline to Present	Previous to Present	Baseline to Present
FILEY				Nov 2008	Nov 2021	May 2022	Nov 2008 - May 2022	Nov 2021 - May 2022	Nov 2008 - May 2022
1	512444.9	481630.9	130	8.70	8.50	8.38	0.32	0.12	0.03
2	512306.7	481490.3	144	7.60	7.52	7.61	-0.01	-0.09	0.00
3	512153.6	481234.6	122	8.30	7.26	8.05	0.25	-0.79	0.02
4	512029.2	480959.9	115	7.40	7.02	6.93	0.47	0.09	0.04
5	511895.4	479888	89	7.10	UTS	UTS	UTS	UTS	UTS
6	511908.5	479597.1	48	6.70	5.56	5.62	1.08	-0.06	0.09
7	511991.4	479310.4	69	6.70	1.34	1.36	5.34	-0.02	0.45
8	512083.4	478981.5	66	10.20	9.64	10.19	0.01	-0.55	0.00
9	512121.3	478786.3	76	8.30	8.41	8.29	0.01	0.12	0.00
10	512226.2	478547.9	74	7.50	5.82	5.82	1.68	0.00	0.14
11	512471.4	478153.5	53	6.60	6.77	6.72	-0.12	0.05	0.00
12*	512558.9	477901.9	66	7.70	UTS	UTS	UTS	UTS	UTS
12A*	512655.8	477822.4	67	13.90	UTS	UTS	UTS	UTS	UTS

13**	512697.6	477719	34	4.20	UTS	UTS	UTS	UTS	UTS
13A*	512805.5	477572.1	32	13.42	9.91	9.91	3.51	0.00	0.29
14	512939.4	477400.9	66	8.00	6.32	6.19	1.81	0.13	0.15
15	513157	477192.7	51	5.20	4.61	4.60	0.60	0.01	0.05
16	513299.5	477024.6	30	7.70	6.05	5.80	1.90	0.25	0.16
17	513507.7	476821.1	34	10.70	10.34	10.17	0.53	0.17	0.04
18	513721	476602.3	31	7.20	6.14	5.99	1.21	0.15	0.10
19	513916.6	476354.1	51	6.60	6.48	6.31	0.29	0.17	0.02
20	514174.8	476179.4	32	7.00	6.91	6.10	0.90	0.81	0.08
21	514471.5	475965.7	66	7.60	7.38	7.40	0.20	-0.02	0.02
22	514656.2	475728.8	101	8.10	7.81	6.90	1.20	0.91	0.10
23	514889.5	475537.6	60	9.10	7.73	7.72	1.38	0.01	0.12
24*	512603.7	481665.9	14	19.90	19.78	19.82	0.08	-0.04	0.01
25*	512607.1	481648.9	184	17.20	16.96	16.99	0.21	-0.03	0.02
26*	512301.9	481825.5	18	11.00	10.76	10.80	0.20	-0.04	0.02
27*	512475.8	481712.1	20	11.60	11.28	11.26	0.34	0.02	0.03

NOTE: \*baseline for 12A and 24-27 is March 2011

\*\*Surveyor's report has previously stated that 'VMPs 5, 12 and 13 were inaccessible due to heavy vegetation'