



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

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Authors	
Alix Scullion	Royal HaskoningDHV
Dr Nick Cooper – Review & Approval	Royal HaskoningDHV



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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).

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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)
	Berwick upon Tweed to Goswick Sands	Holy Island	Goswick Sands to Embleton Bay
HAT	2.8	3.1	3.1
MHWS	2.2	2.4	2.4
MHWN	1.3	1.3	1.3
MLWN	-1.3	-1.0	-0.9
MLWS	-1.8	-1.7	-1.6

Water Level Parameter	Water Level (m AOD)	Water Level (m AOD)
	Boulmer to Druridge Bay	Lynemouth Bay to Blyth South Beach
HAT	3.05	3.0
MHWS	2.35	2.4
MHWN	1.25	1.3
MLWN	-0.85	-0.9
MLWS	-1.75	-1.8

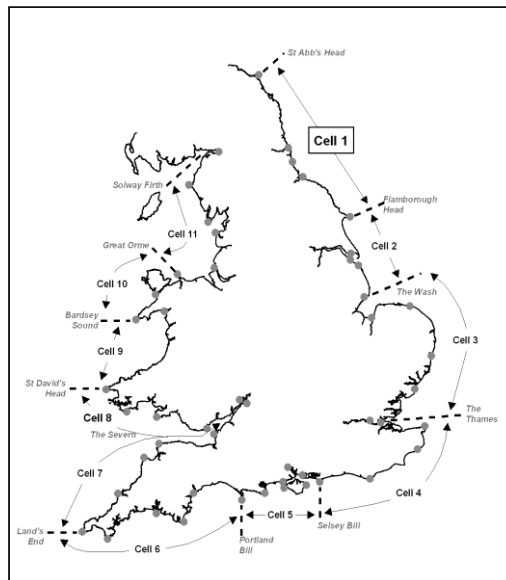
Source: UKHO Admiralty Tide Tables, 2020

## 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 seabed characterisation surveys
- aerial photography
- LiDAR Surveys
- walk-over cliff and coastal defence asset surveys

The beach profile surveys, topographic surveys and cliff top recession surveys are undertaken as a 'Full Measures' survey in autumn/early winter every year. Some of these surveys are then repeated the following spring as part of a 'Partial Measures' survey.

Each year, an Analytical Report is produced for each individual authority, providing a detailed analysis and interpretation of the 'Full Measures' surveys. This is followed by a brief Update Report for each individual authority, providing ongoing findings from the 'Partial Measures' surveys.

Annually, a Cell 1 Overview Report is also produced. This provides a region-wide summary of the main findings relating to trends and interactions along the entire Cell 1 frontage. To date the following reports have been produced:

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

Year		Full Measures		Partial Measures		Cell 1 Overview Report
		Survey	Analytical Report	Survey	Update Report	
1	2008/09	Sep-Dec 08	May 09	Mar-May 09		-
2	2009/10	Sep-Dec 09	Mar 10	Feb-Mar 10	Jul 10	-
3	2010/11	Aug-Nov 10	Feb 11	Feb-Apr 11	Aug 11	Sep 11
4	2011/12	Oct-Nov 11	Oct 12	Mar-May 12	Feb13	-
5	2012/13	Sep-Nov 12	Mar 13	Mar-Apr 13	Jun 13	
6	2013/2014	Sep-Oct 13	Feb 14	Mar-Apr 14	Jul 14	
7	2014/2015	Sep-Nov 14	Feb 15	Mar-Apr 15	Jul 15	
8	2015/2016	Sep-Dec 15	Feb 16	Mar-May 16	Jul 16	Jun 16
9	2016/2017	Aug-Nov 16	Mar 17	Feb-Apr 17	Jul 17	
10	2017/18	Sep-Dec 17	Mar 18	Feb-Apr 18	Jul 18	
11	2018/19	Sep-Dec 18	Feb 19	Feb-Apr 19	Jul 19	
12	2019/20	Aug-Dec 19	Mar 20	Mar-May 20	Jun 20	
13	2020/21	Oct-Dec 20	Feb 21	Mar 21	May 21	Aug 21
14	2021/2022	Aug-Oct 21	Feb 22			

(\*) The present report is **Analytical Report 14** and provides an analysis of the 2021 Full Measures survey for Northumberland County Council's frontage.

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

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

**Table 2 Sub-divisions of the Cell 1 Coastline**

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

# 1. Introduction

## 1.1 Study Area

Northumberland County Council's frontage extends from the Scottish border in the north to Hartley, just south of Blyth, in the south. For the purposes of this report and for consistency with previous reporting, it has been sub-divided into 15 areas, namely:

- Sandstell Point (Spittal A)
- Spittal (Spittal B)
- Goswick Sands
- Holy Island
- Bamburgh
- Beadnell Village
- Beadnell Bay
- Embleton Bay
- Boulmer
- Alnmouth Bay
- High Hauxley and Druridge Bay
- Lynemouth Bay
- Newbiggin-by-the-Sea
- Cambois
- Blyth South Beach

## 1.2 Methodology

Along the Northumberland frontage, the following surveying is undertaken:

Full Measures survey annually each autumn comprising:

- Beach profile surveys along 78 transect lines (commenced 2002)
- Beach profile surveys along an additional ten transect lines (commenced 2007)
- Beach profile surveys along an additional 26 transect lines (commenced 2010)
- Topographic survey along Holy Island (commenced 2004)
- Topographic survey along Alnmouth Bay (commenced 2005)
- Topographic survey along Sandstell Point (commenced 2009)
- Topographic survey along Lynemouth Bay (commenced 2020)
- Topographic survey along Newbiggin Bay (commenced 2010)

Partial Measures survey annually each spring comprising:

- Beach profile surveys along 29 transect lines (commenced 2002)
- Beach profile surveys along an additional ten transect lines (commenced 2007)
- Beach profile surveys along an additional one transect line (commenced 2010)
- Beach profile surveys along an additional two transect lines (commenced 2011)
- Topographic survey along Alnmouth Bay (commenced 2005)
- Topographic survey along Sandstell Point (commenced 2009)
- Topographic survey along Lynemouth Bay (to commence 2021)
- Topographic survey along Newbiggin Bay (commenced 2010)

Cliff top survey (bi-annually) at:

- Colliery spoil edge survey at Lynemouth Bay (commenced 2020)
- Cliff top survey at Newbiggin Point (commenced 2008)
- Cliff top survey at Cambois Bay (Sandy Bay) (commenced 2008)
- Cliff top survey at Cambois Bay (Cambois) (commenced 2009)



Sand extent survey (bi-annually) at:

- Edge of sand survey at Newbiggin Bay, Spital Carrs, (commenced 2011 to determine potential adverse impact on foreshore SSSI of the Newbiggin beach recharge scheme)

In addition to the above, laserscan surveys of the cliffs in Lynemouth have been undertaken on several occasions. These are reported separately to Northumberland County Council.

For all cliff-top surveys prior to Full Measures 2011, the data was previously saved in '.kmz' format for plotting and visual comparison in Google Earth. This data has been visualised in GIS, which revealed the quality was variable and reliable interpretations of short-term cliff change could not be made. For the present and future surveys, the data will be plotted in GIS and change will be qualified along a series of pre-defined transect lines. The resulting data on amount and rate of change is presented in tables and the survey results are compared.

The location of these surveys is shown in **Figure 2**. The Full Measures survey was undertaken on various dates along this frontage between 24<sup>th</sup> August and 8<sup>th</sup> October 2021. During this time, weather conditions varied considerably; refer to the survey reports for details of the weather conditions over this survey period.

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

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

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

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

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



**SURVEY LOCATIONS**

**Topographic Profile**

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

**Topographic Area**

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

- Cliff Top Edge Survey (Red line)
- Edge of Sand Survey (Yellow line)

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

Title:

**Figure 2 - Map 1**  
**SPITTAL A and B**  
**Northumberland County Council Frontage**

Report:

Survey Report

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	n/a	TC	NJC	A4	1:9,000

Co-ordinate system: British National Grid

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North East Coastal Observatory

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**SURVEY LOCATIONS**

**Topographic Profile**

- Annual
- Bi-Annual

**Topographic Area**

- 6 monthly
- yearly
- 5 yearly

- Cliff Top Edge Survey
- Edge of Sand Survey

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

Title:

**Figure 2 - Map 2**

**GOSWICK SANDS**

**Northumberland County Council Frontage**

Report:

**Survey Report**

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	n/a	TC	NJC	A4	1:35,000

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 (Orange)
- 5 yearly (Light Purple)

- Cliff Top Edge Survey (Red line)
- Edge of Sand Survey (Yellow line)

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

Title: **Figure 2 - Map 3**  
**HOLY ISLAND**  
**Northumberland County 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
- Bi-Annual

**Topographic Area**

- 6 monthly
- yearly
- 5 yearly

- Cliff Top Edge Survey
- Edge of Sand Survey

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

Title:

**Figure 2 - Map 4**

**BAMBURGH**

**Northumberland County 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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422000

424000

426000

630000

628000

626000

422000

424000

426000



**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 Edge Survey (Red line)
- Edge of Sand Survey (Yellow line)

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

Title:

**Figure 2 - Map 5**

**BEADNELL VILLAGE AND BAY**

**Northumberland County Council Frontage**

Report:

Survey Report

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

**Topographic Profile**

- Annual
- Bi-Annual

**Topographic Area**

- 6 monthly
- yearly
- 5 yearly

- Cliff Top Edge Survey
- Edge of Sand Survey

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

Title: **Figure 2 - Map 6**  
**EMBLETON BAY**  
**Northumberland 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



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**SURVEY LOCATIONS**

**Topographic Profile**

- Annual
- Bi-Annual

**Topographic Area**

- 6 monthly
- yearly
- 5 yearly

- Cliff Top Edge Survey
- Edge of Sand Survey

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

Title: **Figure 2 - Map 7**  
**BOULMER**  
**Northumberland County 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
- Bi-Annual

**Topographic Area**

- 6 monthly
- yearly
- 5 yearly

- Cliff Top Edge Survey
- Edge of Sand Survey

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

Title: **Figure 2 - Map 8**  
**ALNMOUTH BAY**  
**Northumberland County 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 (Orange)
- 5 yearly (Light Purple)

- Cliff Top Edge Survey (Red line)
- Edge of Sand Survey (Yellow line)

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

Title: **Figure 2 - Map 9**  
**HIGH HAUXLEY AND DRURIDGE BAY (NORTH)**  
**Northumberland County 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
- Bi-Annual

**Topographic Area**

- 6 monthly
- yearly
- 5 yearly

- Cliff Top Edge Survey
- Edge of Sand Survey

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

Title: **Figure 2 - Map 11**  
**HIGH HAUXLEY AND DRURIDGE BAY (SOUTH)**  
**Northumberland County Council Frontage**

Report: **Survey Report**

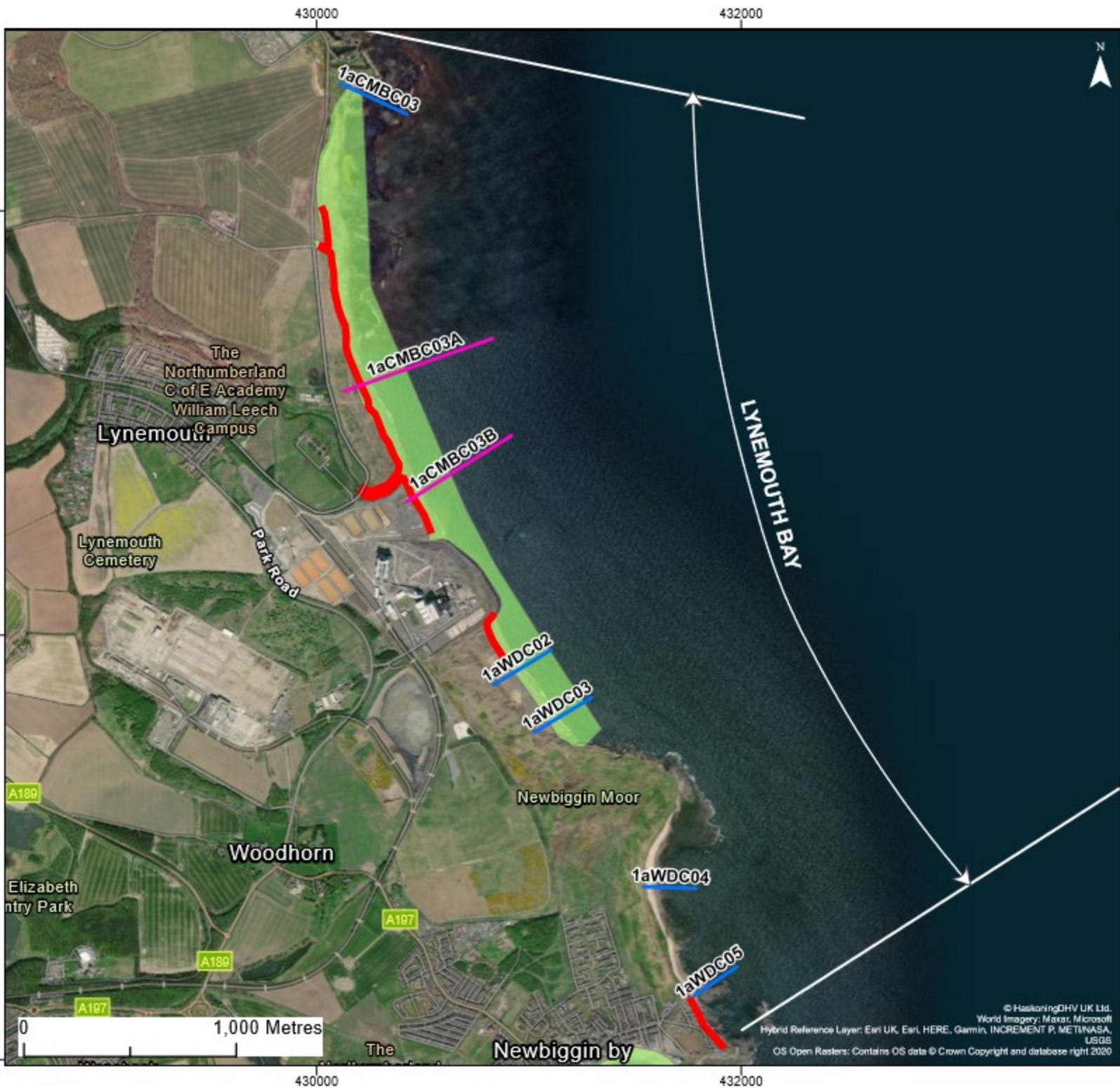
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**SURVEY LOCATIONS**

**Topographic Profile**

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

**Topographic Area**

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

- Cliff Top Edge Survey (Red line)
- Edge of Sand Survey (Yellow line)

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

Title:

**Figure 2 - Map 10**

**LYNEMOUTH BAY**

**Northumberland County Council Frontage**

Report:

Survey Report

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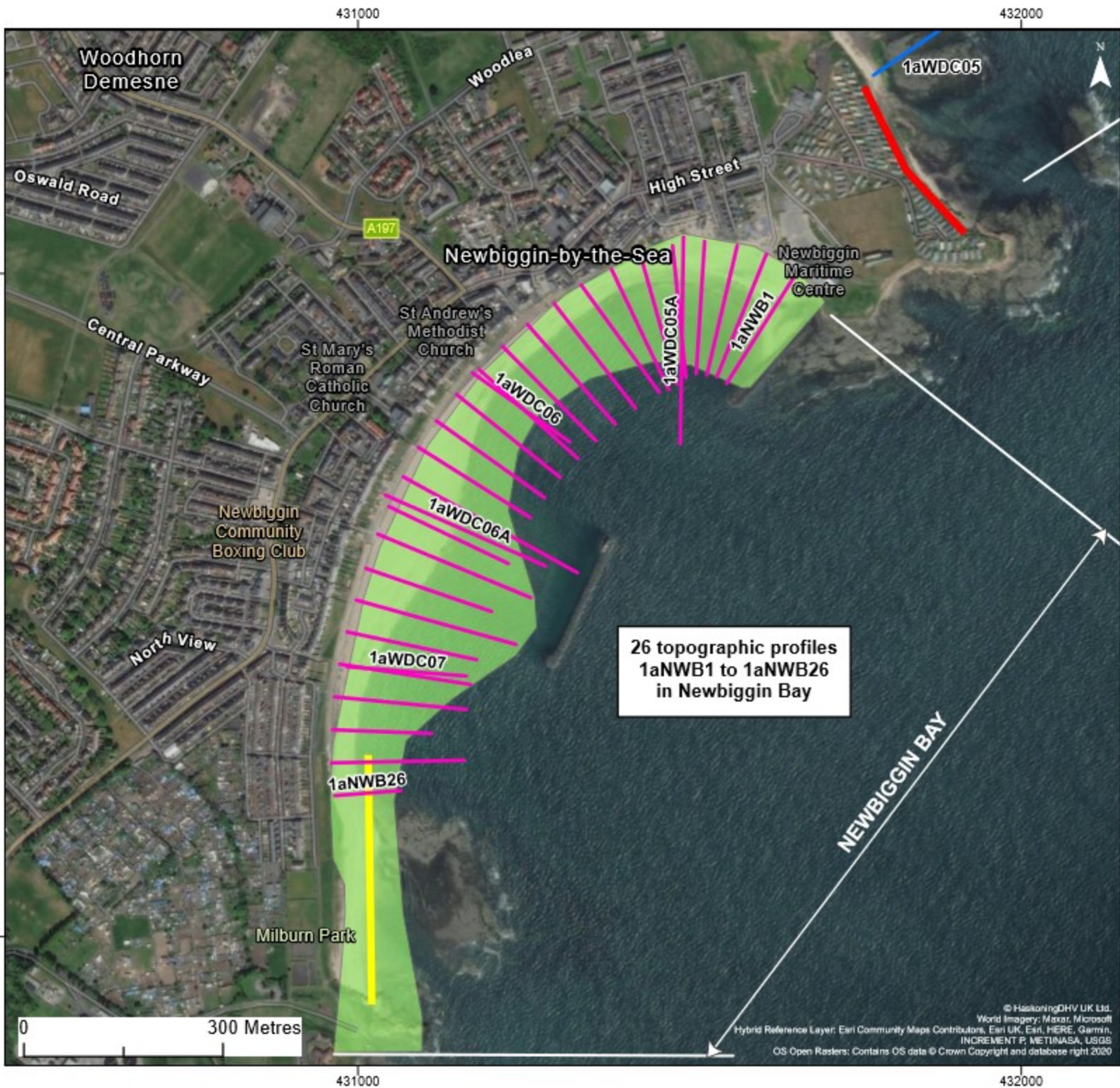
Co-ordinate system: British National Grid

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**SURVEY LOCATIONS**

**Topographic Profile**

- Annual
- Bi-Annual

**Topographic Area**

- 6 monthly
- yearly
- 5 yearly

- Cliff Top Edge Survey
- Edge of Sand Survey

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

Title:

**Figure 2 - Map 12**

**NEWBIGGIN BAY**

**Northumberland County Council Frontage**

Report:

**Survey Report**

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0	n/a	TC	NJC	A4	1:8,000

Co-ordinate system: British National Grid

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North East Coastal Observatory





**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 Edge Survey (Red line)
- Edge of Sand Survey (Yellow line)

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

Title:

**Figure 2 - Map 13**

**CAMBOIS BAY**

**Northumberland County Council Frontage**

Report:

Survey Report

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

Co-ordinate system: British National Grid

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Hybrid Reference Layer: Esri UK, Esri, HERE, Garmin, INCREMENT P, METNASSA, USGS  
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**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 Edge Survey (Red line)
- Edge of Sand Survey (Yellow line)

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

Title:

**Figure 2 - Map 14**

**BLYTH SOUTH BEACH**

**Northumberland County Council Frontage**

Report:

Survey Report

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

Co-ordinate system: British National Grid

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Hybrid Reference Layer: Esri UK, Esri, HERE, Garmin, INCREMENT P, METNASSA, USGS  
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## 2. Analysis of Survey Data

### 2.1 Sandstell Point (Spittal A)

Survey Date	Description of Changes Since Last Survey	Interpretation
<p>25<sup>th</sup> August 2021</p>	<p><b>Beach Profiles:</b></p> <p>Sandstell Point is covered by ten beach profile lines for the Full Measures survey (Appendix A). Profiles 1aBTBC02, 1aBTBC04, 1aBTBC05, and 1aBTBC06 were last surveyed during the Partial Measures Spring survey, 2021. Profiles 1aBTBC01, 1aBTBC03, and 1aBTBC7 to 10 were last surveyed during the Full Measures autumn survey 2020.</p> <p>Profiles <b>1aBTBC01</b> to <b>1aBTBC03</b> are located on the southern bank of the River Tweed in front of the dunes.</p> <p>At <b>1aBTBC01</b>, the dunes have remained mostly stable, with accretion occurring by up to 0.1m. The face of the foredune has retreated landward by 1.5m. From chainage 44m to the end of the survey at chainage 71m there has been minor erosion and accretion of the beach level by up to 0.1m. Overall, the profile is at a low level across the beach profile compared to the range recorded from previous surveys, particularly toward the lower foreshore where it is at its lowest level between chainages 64-69m.</p> <p>At profile <b>1aBTBC02</b> there has been minor erosion and accretion of up to 0.1m across the survey area (except in the dunes where a hollow has formed at chainage 35m with the erosion of 0.3m). The dunes are at a medium-high level, except at the hollow which is at its lowest level recorded. The rest of the profile is a medium level compared to the range recorded from previous surveys.</p> <p>At profile <b>1aBTBC03</b>, there has been some minor erosion and accretion within the dunes by up to 0.2m. The face of the foredune has retreated by up to 2.0m. The upper and middle beach profile has lowered by 0.3m to chainage 90m. Seaward of chainage 90m the beach has risen by &lt;0.1m to the end of the survey. Overall, the dunes are at a high level compared to the range recorded from previous surveys, however the dune front has shown continuous retreat since November 2018. The rest of the profile is at a medium level compared to the range recorded from previous surveys.</p>	<p>Since the last survey, the dunes on south bank of River Tweed have remained stable and relatively unchanged, except at profile 1aBTBC03 where the dune face is found to have retreated by around 2.0m. The beach sections of the profile generally show minor accretion and erosion and are generally at low to medium levels.</p> <p>The landward portion of the spit remains relatively unchanged at the landward end, with a flattening of the spit profile at the distal end.</p> <p>The pattern in the profiles along the open coast generally show erosion across the beach profile, except on the lower beach of 1aBTBC07 and 1aBTBC08 which have accreted. The dune toe has retreated between profiles 1aBTBC07-1aBTBC10.</p> <p><b>Longer term trends:</b> The dunes have remained stable over the past 12 years and are at a medium-high level compared to the range recorded from previous surveys. However, the seaward face of the dune at profile <b>1aBTBC03</b> has shown a landward recession since November 2018.</p> <p>Changes in beach levels are generally within the bounds of previous surveys.</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>Profiles <b>1aBTBC04</b> (longitudinal section) and <b>1aBTBC05</b> and <b>1aBTBC06</b> (both cross-sections) cover the spit at Sandstell Point.</p> <p>At profile <b>1aBTBC04</b>, there has been minor erosion of &lt;0.1m from the toe of the rock armour to chainage 65m. The dune front between chainages 65-140m has prograded by between 1.0m at the crest and 10.0m at the toe. The middle beach between chainage 140-407m has lowered in level by up to 1.2m. The toe of the spit has prograded by up to 6.0m. The most landward portion of the profile, and the toe of the spit is at a relatively high level compared to the range recorded from previous surveys. The central portion is at a medium level compared to the range recorded from previous surveys.</p> <p>Profiles <b>1aBTBC05</b> and <b>1aBTBC06</b> are transects across the spit, with the open sea on the right-hand side of the plot and the river channel to the left.</p> <p>At <b>1aBTBC05</b>, the crest of the spit has remained stable since the previous survey. The upper half of the riverside of the spit has prograded by approximately 10m due to the movement of material down the profile. The lower half of the riverside of the spit has eroded by up to 0.5m, leading to a slightly narrower base of the spit. There has been little change to the seaward face of the spit, with the exception of some erosion by up to 0.2m between chainages 217m and 230m. Overall the profile is broadly within the middle of its range recorded from previous surveys, both in terms of height and position.</p> <p>At profile <b>1aBTBC06</b>, the spit structure has grown in height, particularly toward the side of the open sea by up to 1.9m between chainages 225-305m. The previous spit crest from autumn 2020 has flattened between chainages 187-225m by up to 0.6m. The riverside of the spit has accreted by 0.8m. Overall, the spit profile is at a medium level compared to the range recorded from previous surveys.</p> <p>Profiles <b>1aBTBC07</b> to <b>1aBTBC10</b> are located along the open coast, at the intersection of the southern side of the spit at Sandstell Point and northern end of Spittal Beach.</p> <p>At profile <b>1aBTBC07</b>, there has been accretion of up to 0.1m within the dunes. On the upper beach between chainages 30-120m the upper beach profile has undergone sections of erosion and accretion by up to ±0.1m. Seaward of chainage 120m there has been increase in beach level by up to 0.5m to the end of the survey at chainage 267m. Overall, the dunes are at their highest level recorded. The rest of the beach profile is at a medium level compared to the range recorded on previous surveys.</p>	

Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>At profile <b>1aBTBC08</b>, there has been little change across the dunes to chainage 29m. The upper and middle beach, between chainages 29m and 100m has eroded by up to 0.5m. The lower beach between chainages 100-205m has risen by up to 0.3m. Seaward of chainage 205m, the beach has lowered by &lt;0.1m. Overall, the dunes are at a high level, whilst the rest of the profile is at a medium level compared to the range recorded on previous surveys.</p> <p>Profile <b>1aBTBC09</b> shows accretion at the dunes by up to 0.2m between the start of the survey and chainage 19m. The rest of the profile has lowered by up to 1.2m on the upper beach, 0.2m on the middle beach and 0.1m on the lower beach. Overall, the dunes are at a high level and the beach is at a relatively medium level compared to the range recorded on previous surveys.</p> <p>Profile <b>1aBTBC10</b> shows negligible change at the dunes to chainage 15m. The beach across the majority of the rest of the profile between chainages 15-206m has lowered by up to 0.4m on the upper beach, 1.0m across the middle beach and 0.1m on the lower beach. Seaward of chainage 206m the beach profile has accreted by up to 0.2m. Overall, the beach is at a medium-low level compared to the range recorded in previous surveys, except the dunes which are at a high level.</p>	
<p><b>Mar – Aug 2021</b></p>	<p><b>Topographic Survey:</b></p> <p>Due to the significant changes that have been observed from the beach profiles along the spit at Sandstell Point, and the three-dimensional nature of these changes, a topographic survey was introduced to the monitoring programme in November 2011. The previous survey was undertaken for the Partial Measures survey in spring 2021.</p> <p>Data from the most recent topographic survey (Full Measures, autumn 2021) have been used to create a digital ground model (DGM) (Appendix B – Map 1) using a Geographical Information System (GIS). A difference plot has also been produced using the DGM (Appendix B – Map 5) produced from the last topographic survey and the present survey.</p> <p>The difference plot for this survey generally shows; (i) little change in the dunes on the south bank of the River Tweed; (ii) a wide band of accretion on the riverward edge of the spit (up to 2.0m) and some lower magnitude patches of accretion on the lower spit facing the open sea; and (iii) large patches of erosion on the crest of the spit and on the upper and lower foreshore of the open beach.</p>	<p>Findings are relatively similar to those seen between autumn 2020 and spring 2021, except on the riverward edge of the spit which previously eroded by up to 1.75m.</p>

## 2.2 Spittal (Spittal B)

Survey Date	Description of Changes Since Last Survey	Interpretation
25 <sup>th</sup> August 2021	<p><b>Beach Profiles:</b></p> <p>Spittal B is covered by four beach profile lines for the Full Measures survey (Appendix A). Profiles 1aBTBC11 and 1aBTBC13 were last surveyed during the Partial Measures spring survey, 2021. Profiles 1aBTBC12 and 1aBTBC14 were last surveyed during the Full Measures autumn survey 2020.</p> <p>Profile <b>1aBTBC11</b> is located to the north of Spittal Beach. The dunes have undergone erosion and accretion by up to <math>\pm 0.1</math>m. The upper and middle beach has accreted by up to 0.6m to chainage 150m, before switching to erosion on the lower beach by up to 0.6m to the end of the survey. Overall, the profile is at a high level at the dunes, and a medium-high level over the remainder of the profile when compared with the range recorded from previous surveys.</p> <p>Profile <b>1aBTBC12</b> shows accretion of 1.0m from the toe of the seawall to 52m. Seaward of chainage 52m the middle and lower beach has lowered by up to 0.1m on the middle beach and 0.9m on the lower beach. Overall, the profile is at a medium-high level on the upper beach and a medium level on the middle and lower beach compared to the range recorded from previous surveys.</p> <p>Profile <b>1aBTBC13</b> shows alternating pattern of erosion and accretion across the beach profile. Accretion occurs between the start of the survey and chainage 17m (0.2m) and 51-126m (1.3m), whilst erosion has occurred between chainages 17-51m (1.1m) and 126-172m (0.5m). Overall, the profile is at a medium-high level on the upper beach compared with the range recorded from previous surveys, whilst the middle and lower beach is at a medium level compared with the range recorded from previous surveys.</p> <p>At profile <b>1aBTBC14</b>, a similar pattern of change has occurred as BTBC3. Accretion has occurred between the start of the survey and chainage 30m (0.7m) and between chainages 70-135m (0.8m) whilst erosion has occurred on the middle beach between 30-70m (1.0m). Overall, the upper and lower beach is at a high level compared to the range recorded from previous surveys, whilst the middle beach is at a low level.</p>	<p>Since the last survey, beach levels along Spittal have fluctuated, generally showing a steepening of the upper beach. Overall, the profiles show the beach is at a roughly medium level compared to previous surveys. The uppermost beach at 1aBTBC14 has recovered well since the extreme lows recorded in November 2018.</p> <p><b>Longer term trends:</b> At all profile locations along Spittal Beach, the changes observed from the present survey are within the bounds of previous surveys.</p>

## 2.3 Goswick Sands

Survey Date	Description of Changes Since Last Survey	Interpretation
7 <sup>th</sup> September 2021	<p><b>Beach Profiles:</b></p> <p>Goswick Sands are covered by six beach profile lines for the Full Measures survey (Appendix A). Profiles <b>1aBTBC16</b> and <b>1aBTBC19</b> were last surveyed during the partial measures spring survey, 2021. Profiles <b>1aBTBC15</b>, <b>1aBTBC17</b> to <b>1aBTBC18</b>, and <b>1aBTBC20</b> were last surveyed during the Full Measures autumn survey, 2020.</p> <p>The profiles along this frontage extend from <b>1aBTBC15</b> to <b>1aBTBC20</b> in a north to south direction. The seaward face of the dunes along the survey extent at Goswick Sands (profiles 1aBTBC15 to 1aBTBC20) have generally remained stable, with an advance of the dune toe by up to 0.4m at some profiles.</p> <p>At profile <b>1aBTBC15</b>, the dunes and foredune face have accreted in small sections by up to 0.4m, whilst the foredune crest has eroded by up to 0.1m. From the toe of the dunes to the end of the survey the beach has generally risen by between 0.1-0.3m except for a small section on the upper beach which has eroded by up to up to 0.1m between chainages 114-134m. Overall, the profile is at a high level compared to the range recorded from previous surveys, particularly between chainages 140-220m and 235-260m.</p> <p>At profile <b>1aBTBC16</b>, there has been accretion at the dune crest by up to 0.1m and the dune toe by up to 0.4m. Seaward of this point, the beach level has lowered by up to 0.1m on the upper and middle beach, increasing to 1.8m seaward of chainage 125m. Compared to the range recorded from previous surveys, the profile is at a high level in the dunes, a medium level on the upper beach and a low level on the lower beach.</p> <p>At profile <b>1aBTBC17</b>, there has been little change across the dunes, with small sections of accretion limited to 0.2m. The seaward face of the foredune remains stable and its toe remains high, with accretion of 0.3m at the toe of the dune to chainage 250m. The upper and lower beach has eroded by up to 0.4m on the upper, and 0.7m on the lower beach. The middle beach has risen by 0.3m. The toe of the foredune is at its most seaward position since records began. The rest of the beach profile is at a medium-high level compared to the range recorded from previous surveys.</p>	<p>Beach level change has varied along the length of Goswick Sands since the last survey. Greater movement has occurred in the north of the survey area. The upper and middle beach has generally accreted in the north and central survey area, whilst the lower beach tends toward erosion. At the southern end of Goswick Sands, the beach has remained stable with no discernible change to the profile form or position.</p> <p><b>Longer term trends:</b> The majority of change is a continuation of seasonal behaviour. The notable barrier feature developed further seaward in profile 1aBTBC18 in autumn 2015 has not attained its original height seen in 2003. Subsequent surveys have shown a gradual reduction in the feature's height, with the exception of the last survey (spring 2021) which has shown a rise in level.</p>



Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>At profile <b>1aBTBC18</b>, there has been minor change (<math>\pm 0.1\text{m}</math>) to the landward side of the foredune, with an accumulation of <math>&lt;0.1\text{m}</math> of sediment at the dune toe. Across the mid-beach between chainages 210m and 500m there has been a accretion by up to 0.2m. The lower beach has alternated between accretion and erosion to chainage 610m before lowering by up to 0.7m at the end of the survey. Overall, the seaward dune face remains at one of its most seaward positions recorded, the upper and middle beach are at a medium level compared to the range recorded from previous surveys, whilst the lower beach is at a low level.</p> <p>At profile <b>1aBTBC19</b> there has been very little change across the profile, with erosion or accretion limited to <math>\pm 0.1\text{m}</math>. The only exception is at the crest and toe of the dune which has accreted by up to 0.2m. Overall, the beach is at a medium level compared to the range recorded from previous surveys, whilst the dune crest is at its highest level recorded.</p> <p>At <b>1aBTBC20</b>, the beach has generally remained stable since the last survey, with accretion / erosion of 0.1m or less. Overall, the beach is at a high level across its length compared to the range recorded from previous surveys, particularly between chainages 230m and 420m where the beach has reached its highest recorded position.</p>	



## 2.4 Holy Island

Survey Date	Description of Changes Since Last Survey	Interpretation
10 <sup>th</sup> September 2021	<p><b>Beach Profiles:</b></p> <p>Holy Island is covered by eight beach profile lines for the Full Measures surveys (Appendix A). Profiles 1aBTBC21 and 1aBTBC23 were last surveyed during the Partial Measures spring survey, 2021. Profiles 1aBTBC22, 1aBTBC24 to 1aBTBC28 were last surveyed during the Full Measures autumn survey, 2020.</p> <p><b>1aBTBC21 to 1aBTBC23</b> are located on the northwest side of the island, along The Snook. <b>1aBTBC24 to 1aBTBC28</b> are located on the south side of the island in the vicinity of the castle and priory. <b>1aBTBC27</b> extends out to and across the small island upon which the remains of a chapel stand.</p> <p>At all profiles on the north side of the island, the dunes have not changed position since the last survey and have accreted on some dune crests by up to 0.3m. At profile <b>1aBTBC21</b> the face of the foredune has prograded seaward by 2.0m and accreted at the toe by up to &lt;0.2m. The rest of the profile has generally accreted by &lt;0.1m. Over much of this extent the profile is now at a medium level compared to the range from previously recorded surveys, except the dunes which are at a high level, particularly the crest of the foredune and the dune toe which is at its highest level recorded.</p> <p>The beach at profile <b>1aBTBC22</b> has remained stable with low levels of erosion (&lt;0.1m) across the beach profile. Similar to profile 1aBTBC21, the foredune has accreted by up to 0.2m, and the face of the foredune has prograded seaward by 2.0m. The profile is at its highest level recorded when compared with the range from previously recorded surveys.</p> <p>Similarly, the profile <b>1aBTBC23</b> has remained generally stable, with small sections of accretion/erosion across the profile limited to 0.1m. The profile is at a high level when compared with the range from previously recorded surveys.</p> <p>On the south side of the island, the dunes at profile <b>1aBTBC24</b> have remained generally stable since the last survey, with an erosion of the dune crest and beach profile by &lt;0.1m. The profile is at a low level when compared with the range from previously recorded surveys.</p>	<p>The dunes, sandy foreshore and sand flats around The Snook on Holy Island have remained stable in both form and position since the last survey.</p> <p>On the south side of the island, the backshore and beach have remained stable since the last survey. The largest area of change is the dune face at profile <b>1aBTBC26</b> which has prograded by 1.0m.</p> <p><b>Longer term trends:</b> Generally, the trends observed in the present survey are a continuation of those observed in the past, with the dunes and beach retaining the same form and position. The exception to this is at profile <b>1aBTBC21</b>, where the dune front and toe have advanced by up to c.29.0m through the accumulation of nearly 2.0m of sand since 2002, and <b>1aBTBC22</b> and <b>1aBTBC23</b>, where the advance of the dune toe is similar but less pronounced.</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>The dune crest at profile <b>1aBTBC25</b> has eroded by &lt;0.1m whilst the dune crest at <b>1aBTBC26</b> has remained stable and the dune dace has prograded by approximately 1.0m. The rest of the beach profiles have remained stable with low levels of erosion up to 0.1m. The survey report notes that the end of the survey at <b>1aBTBC26</b> was not surveyed due to thick mud.</p> <p>There have been minimal changes at <b>1aBTBC27</b> and <b>1aBTBC28</b>, with small areas of erosion and accretion across the dunes and beach profile of &lt;0.1m.</p> <p>Overall, the profiles are at a low-medium level compared to the range recorded from previous surveys, particularly between chainages 45-65m at 1aBTBC25 and 80-104m at 1aBTBC26 which are at their lowest levels recorded.</p>	
<p><b>Aug 2020 – Sept 2021</b></p>	<p><b>Topographic Survey:</b></p> <p>Holy Island causeway and the adjacent sand flats are covered by an annual topographic survey, which commenced in October 2004. The purpose of this survey was to determine whether raising the level of the causeway had any adverse impacts on the adjacent sand flats.</p> <p>Data from the most recent topographic survey (Full Measures, autumn 2021) have been used to create a DGM (Appendix B – Map 2) using a Geographical Information System (GIS). A difference plot has also been produced using the DGM (Appendix B – Map 6) produced from the last produced topographic survey (Full Measures, autumn 2020) and the present survey.</p> <p>The difference plot shows overall stability with minimal pockets of elevation change in the order of +/- 0.5m. The main area of change is in the centre of the South Low channel.</p>	<p>The topographic survey shows that the causeway has remained stable since the last survey.</p>

## 2.6 Bamburgh

Survey Date	Description of Changes Since Last Survey	Interpretation
9 <sup>th</sup> September 2021	<p><b>Beach Profiles:</b></p> <p>Bamburgh is covered by one beach profile line for the Full Measures survey (Appendix A). Profile 1aBTBC29 was last surveyed during the Full Measures autumn survey, 2020.</p> <p>Profile <b>1aBTBC29</b> is located approximately 750m south-east of the castle. The survey report noted that areas of dense vegetation restricted the survey. There have been small sections of erosion/accretion within the dunes limited to &lt;0.1m, with 0.2m of accretion at the toe of the foredune. The rest of the profile shows berm movement since the previous survey, with areas of alternating accretion (0.5m) and erosion (0.8m). The dunes and beach profile are at a high level compared to the range recorded from previous surveys.</p>	<p>The dunes at Bamburgh have remained stable, and the beach shows alternating erosion and accretion associated with the seasonal movement of berms. an increase in level across the profile. It is worth noting that data from previous years has been 1.048m too low due to a height error at the base station. This has been rectified.</p> <p><b>Longer term trends:</b> The 2021 profile shows that some sections of the seaward face of the dune are at their most seaward position since 2004. The beach is at a high level compared to earlier surveys.</p>

## 2.7 Beadnell Village

Survey Date	Description of Changes Since Last Survey	Interpretation
8 <sup>th</sup> September 2020	<p><b>Beach Profiles:</b></p> <p>Beadnell Village is covered by two beach profile lines for the Full Measures survey (Appendix A). Profile <b>1aBTBC31</b> was last surveyed during the Partial Measures spring survey, 2021. Profile <b>1aBTBC30</b> was last surveyed during the Full Measures autumn survey, 2020.</p> <p>Profile <b>1aBTBC30</b> is around 300m to the north of the village. There has been little change to the top of the dunes, with varying sections of erosion and accretion limited to <math>\pm 0.1</math>m. On the upper beach, from the toe of the dunes to chainage 112m there has been up to 0.2m of accretion. From chainage 112m to the end of the survey at chainage 212m, the beach level has lowered by up to 0.2m. Overall, the profile is at a medium-low level compared to the range recorded from previous surveys, whilst the lower beach is at a medium level.</p> <p>Profile <b>1aBTBC31</b> is in Nacker Hole and extends across the promenade and seawall. There has been no change from chainage 0m to 12m. At the toe of the seawall there has been accretion of <math>&lt; 0.1</math>m. Across the rest of the profile, the beach levels have generally risen by up to 0.2m to the patch of boulders seaward of 43m. Overall, the profile is at a medium level compared to the range recorded from previous surveys, except on the upper beach which is at a high level.</p>	<p>The dunes and beach to the south of Beadnell Village have generally remained stable.</p> <p><b>Longer term trends:</b> The changes observed since the last survey are within the bounds of previous surveys.</p>

## 2.8 Beadnell Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
8 <sup>th</sup> September 2021	<p><b>Beach Profiles:</b></p> <p>Beadnell Bay is covered by nine beach profile lines for the Full Measures survey (Appendix A). Profiles 1aBTBC33 to 1aBTBC34, 1aBTBC37 and 1aADC01 to 1aDC02 were last surveyed during the Partial Measures spring survey, 2021. Profiles 1aBTBC32, 1aBTBC35 to 1aBTBC36 and 1aBTBC38 were last surveyed during the Full Measures autumn survey, 2020.</p> <p><b>1aBTBC32 to 1aBTBC34</b> are located at the northern end of Beadnell Bay, in Beadnell Harbour.</p> <p>At profile <b>1aBTBC32</b>, the crest of the dune ridge has eroded by &lt; 0.1m, with a section of the upper dune face eroding by 0.2m. The dune toe and upper beach has accreted by up to 0.3m to chainage 25m since the last survey. Between chainages 25-38m the beach has lowered by up to 0.1m, before switching to accretion across the lower beach by up to 0.4m until the end of the survey at chainage 105m. Overall, the dune ridge is at a medium level, whilst the rest of the beach level is at a high level compared to the range recorded from previous surveys, particularly between 12-16m and 49-70m which are at their highest levels recorded.</p> <p>At profile <b>1aBTBC33</b>, the dunes have generally accreted by up to 0.1m, whilst the dune toe has prograded by 1.0m since the last survey. The beach profile generally shows alternating sections of erosion and accretion, limited to ±0.2m. Overall, the profile is at a high level compared to the range recorded from previous surveys, except the dune which is at a relatively medium level.</p> <p>At profile <b>1aBTBC34</b>, the dune has undergone erosion and accretion, by ±0.1m. The upper beach, between chainage 0m and chainage 34m has accreted by up to 0.5m. The middle beach between chainages 34 and 70m has varying sections of erosion and accretion up to 0.1m. The patch of boulders remains exposed between chainage 70-115m. The lower beach between 115m – 175m has accreted by up to 0.3m, whilst the beach has lowered seaward of this point by up to 0.4m. Overall, the dune is at a medium level compared to the range recorded from previous surveys. The rest of the beach profile is at a high level, particularly between chainages 14-20m and 134-158m.</p> <p><b>1aBTBC35 to 1aBTBC38</b> are located between Burn Carrs and the outfall of Brunton Burn/Long Nanny. The dunes along this northern section of coast have remained stable since the last survey.</p>	<p>Along the length of Beadnell Bay, the dunes have remained stable, with the greatest change recorded at the dune toe of 1aBTBC33 (prograded 1.0m). Beach levels generally remained stable throughout the bay with minor fluctuations indicating cross shore movement of sediment.</p> <p><b>Longer term trends:</b> Along the length of Beadnell Bay, the majority of the dune and beach form are similar to those observed in the past and the profile form and position is generally within the bounds of previous surveys. However, there are several sections along the north of the bay which exhibit their highest and lowest levels recorded.</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>At profile <b>1aBTBC35</b>, the dune face has eroded by approximately 0.1m from chainages -13m to -1m, whilst the dune toe has accumulated sediment by up to 0.1m to chainage 5m. A small berm has formed at chainage 20m with the accumulation of 0.3m of sediment to chainage 30m, before switching to erosion across the rest of the profile by up to 0.5m. Overall, the profile is at a high level compared to the range recorded from previous surveys, with the beach profile between chainages 17-28m being the highest level on record.</p> <p>At profile <b>1aBTBC36</b>, the dunes have undergone sections of erosion and accretion by up to <math>\pm 0.1</math>m to chainage 25m. The beach at the toe of the dunes has risen by up to 0.4m to chainage 52m. The upper and middle beach between chainages 25-213m has lowered by up to 0.3m. The lower beach seaward of chainage 213m has risen by up to 0.2m. Overall, the profile is at a high level compared to the range recorded from previous surveys, particularly at the toe of the dunes and lower beach which are at their highest level recorded.</p> <p>At profile <b>1aBTBC37</b>, the lower dune face and dune toe has accreted by up to 0.4m. The beach profile shows alternating sections of erosion and accretion, with the upper beach and mid-lower beach profile accreting by up to 0.4m. The upper-mid beach and lower beach profile has lowered by up to 0.9m. Overall, the profile alternates between a high to a low-level compared with the range recorded from previous surveys, with the upper beach being at the highest level recorded and the upper-mid beach being at the lowest level recorded.</p> <p>At profile <b>1aBTBC38</b>, the lower dune face and dune toe has accreted by up to 0.5m to chainage 28m. Seaward of this point the beach has generally lowered, except between chainages 60-105m which has accreted by up to 0.1m. The upper beach has eroded by up to 0.5m and the middle – lower beach has lowered by up to 0.7m. Overall, the profile is at a medium-high level, particularly between chainages 60-105m which is at its highest level recorded.</p> <p><b>1aADC01</b> and <b>1aADC02</b> are located south of the outfall of Brunton Burn/Long Nanny. The dunes have not changed form or position.</p> <p>At profile <b>1aADC01</b>, there has been very little change in the back dunes between chainages 0-258m, with some small areas of erosion and accretion limited to <math>\pm 0.1</math>m. The foredune remains stable, particularly on the lower face between chainages 258m and 315m where there has been accretion of up to 0.6m. The middle beach between chainages 315-422m has lowered by up to 0.5m and resulted in a steep upper-middle beach profile. The lower beach seaward of chainage 422m has accreted by</p>	

Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>up to 0.5m. When compared to the range of previously recorded results, the dunes, upper and lower beach are at a high level compared to the range recorded from previous surveys, particularly between chainages 280-340m and 465-555m which are at their highest level recorded. The middle beach is at a low level compared with the range recorded from previous surveys, particularly between chainages 365-415m which is at its lowest level recorded.</p> <p>At profile <b>1aADC02</b>, the dune has remained relatively stable since the previous survey, with only small sections of erosion at the crest and landward facing dune face by up to 0.1m. The beach profile has alternated between erosion and accretion limited to <math>\pm 0.3</math>m. Overall, the face of the foredune is in a similar position as April 2008, which is its most seaward position recorded. The rest of the profile is at a medium level compared with the range recorded from previous surveys.</p>	

## 2.9 Embleton Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
<p>9<sup>th</sup> September 2021</p>	<p><b>Beach Profiles:</b></p> <p>Embleton Bay is covered by two beach profile lines for the Full Measures survey (Appendix A). Profiles 1aADC03 and 1aADC04 were last surveyed during the Full Measures autumn survey, 2020.</p> <p><b>1aADC03</b> is located towards the north of the bay, north of Embleton Burn mouth. Profile <b>1aADC04</b> is located towards the south of the bay.</p> <p>At profile <b>1aADC03</b>, the dunes have remained stable, with only small sections of change limited to <math>\pm 0.1</math>m. There has been accretion on the upper beach (by up to 0.6m) and lower beach (by up to 0.2m). Erosion has occurred in the mid-upper beach (by up to 0.4m) and mid-lower beach (by up to 0.6m). Overall, the profile fluctuates between a high level on the upper beach, low level on the mid-upper beach and lower beach and a medium level on the rest of the profile.</p> <p>At profile <b>1aADC04</b>, the dunes have remained mostly stable, with a few small sections of erosion of up to 0.1m. The upper and middle beach has accreted from the toe of the dunes at chainage 150m to 239m by up to 0.7m. Seaward of this point the lower beach has lowered by up to 0.7m. Overall, the dune, middle and lower beach are at a low level (particularly seaward of chainage 254m which is at its lowest level recorded), whilst the upper beach is at a high level.</p>	<p>The dunes at Embleton Bay are generally stable, with small amount of erosion limited to <math>\pm 0.1</math>m.</p> <p>The beach levels generally exhibit a seasonal movement of sand bars across the beach profile.</p> <p><b>Longer term trends:</b> The dunes have remained stable over the longer term and beach levels are within the range of those surveyed since 2002.</p>



## 2.10 Boulmer

Survey Date	Description of Changes Since Last Survey	Interpretation
6 <sup>th</sup> September 2021	<p><b>Beach Profiles:</b></p> <p>Boulmer is covered by two beach profile lines for the Full Measures survey (Appendix A). These were added to the programme in October 2007. Profiles 1aADC04A to 1aADC04B were last surveyed during the Partial Measures spring survey, 2021.</p> <p>At profile <b>1aADC04A</b>, the middle beach between chainages 42-76m has lowered by up to 0.3m. The upper and lower beach have remained stable with relatively little change since the previous survey. The rock platform remains exposed from chainage 77m and changes in level seaward of this point are most likely related to variations in survey points. The autumn 2021 survey continues seaward along the rock platform to chainage 228m. Overall the profile is at a medium-high level compared to the range recorded from previous surveys.</p> <p>At profile <b>1aADC04B</b> there has been a small section of erosion from the toe of the rock armour to chainage 22m by up to 0.1m. The middle beach between chainages 22-76m has increased in level by up to 0.2m. The lower beach between chainages 76m and the rock platform at chainage 88m has lowered by up to 0.1m. Seawards of this point rock platform which remains exposed. Overall, the profile is at a high level compared to the range recorded from previous surveys.</p>	<p>The changes to beach profile are minimal, predominantly showing erosion at both profiles. The rock platform remains exposed at both profiles. .</p> <p><b>Longer term trends:</b> Beach elevations are generally medium-high in comparison to the long-term record of surveys.</p>

## 2.11 Alnmouth Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
6 <sup>th</sup> September 2021	<p><b>Beach Profiles:</b></p> <p>Alnmouth Bay is covered by ten beach profile lines for the Full Measures survey (Appendix A). Profiles <b>1aADC07</b> to <b>1aADC09</b> were last surveyed during the Partial Measures spring survey, 2021. Profiles <b>1aADC05</b>, <b>1aADC06</b> and <b>1aADC10</b> to <b>1aADC14</b> were last surveyed during the Full Measures autumn survey, 2020.</p> <p><b>1aADC05</b> and <b>1aADC06</b> are located in the small pocket beach that is situated between the rock outcrops of Seaton Point and Marden Rocks.</p> <p>At profile <b>1aADC05</b>, the survey report notes that the cliffs have not been surveyed due to unsafe loose material. They have therefore not been analysed. Between the toe of the cliffs at chainage 20m and the end of the survey at chainage 265m, the beach level has lowered (except for a small section between chainages 106-120m on the middle beach which has risen by 0.1m). Erosion ranges from 0.6m on the upper beach, 0.5m on the middle beach and 0.1m on the lower beach. The survey also measures a berm seaward of chainage 224m, which was present at a lower level in 2019. Overall, the upper and lower beach level are at their lowest levels recorded between chainages 42-65m and 130-175m. The middle beach is at a medium level compared to the range recorded from previous surveys.</p> <p>At profile <b>1aADC06</b> there has been accretion from the toe of the dune to chainage 30m by up to 0.4m. From chainage 30m to 121m there has been very little change, limited to <math>\pm 0.1</math>m. Seaward of chainage 121m, the beach has accreted by up to 0.4m. The entire beach profile is at a low level compared to the range recorded from previous surveys.</p> <p><b>1aADC07</b>, <b>1aADC08</b> and <b>1aADC09</b> are located to the north of Alnmouth Bay between Marden Rocks and the mouth of the River Aln Estuary.</p> <p>At profile <b>1aADC07</b>, the dunes have remained stable since the last survey. There has been accretion at the toe of the dunes by up to 0.4m to chainage 70m. The middle beach has eroded by up to 1.2m to chainage 180m. A berm has formed on the lower beach seaward of chainage 180m with the accretion of up to 0.8m. Overall the upper beach profile is at a high level, the middle beach is at a low-</p>	<p>To the north of Alnmouth Bay, the dune cliffs have remained relatively stable. The beach levels have generally lowered at 1aADC05 and remain stable at 1aADC06.</p> <p>North of the mouth of the River Aln Estuary, the dunes have remained stable since the last survey. Since the last survey, the beach has shown some mobility with the movement of berms across the foreshore.</p> <p>Immediately south of the mouth of the River Aln, the beach also shows movement of berms, with some sections at their lowest levels recorded.</p> <p>At the south of the bay, there has been accretion at the toe of the dunes at 1aADC12 and 1aADC13 and erosion across the rest of the profile. Profile 1aADC14 is generally stable, exhibiting accretion across most of the profile.</p> <p><b>Longer term trends:</b></p> <p>The cliffs in the far north of the bay have retreated slowly since 2002, by around 1-2m in total. The dunes have generally demonstrated long-term stability.</p> <p>Changes in beach profile form and position observed since the last survey are generally on the lower end of ranges seen in previous surveys, with several sections experiencing their lowest levels recorded.</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>medium level and the lower beach is at a high level compared to the range recorded from previous surveys, particularly between chainages 206-255m which is at its highest level recorded.</p> <p>At profile <b>1aADC08</b>, the dunes have remained stable since the previous survey, with a small amount of accretion across the foredune of less than 0.2m. The majority of the beach profile has undergone erosion up to 0.3m between chainage 12-123m. Seaward of chainage 122m the lower beach has accreted by up to 0.5m to the end of the survey 148m. Overall, the profile is at a low level compared to the range recorded from previous surveys.</p> <p>At profile <b>1aADC09</b>, the dunes have remained stable since the previous survey, with some accretion on the crest of up to 0.1m. The toe of the dunes has accreted by up to 0.2m to chainage 36m. A berm on the upper beach has been removed with the erosion of up to 0.2m. The middle beach has accreted by up to 0.3m between chainages 56-113m. The lower beach has eroded seaward of chainage 113m by up to 0.6m, leading to a steep lower beach profile. Overall, the profile is at a medium-high level across its full extent when compared to the range recorded from previous surveys. The Aln channel remains at a relatively landward position.</p> <p><b>1aADC10 to 1aADC14</b> are located between the south bank of the River Aln Estuary and the north breakwater of Warkworth Harbour at the mouth of the estuary of the River Coquet.</p> <p>At profile <b>1aADC10</b>, there has been alternating sections of erosion and accretion associated with the movement of berms. There has been 0.5m of accretion from the toe of the dunes to chainage 60m. Erosion takes place between chainages 60-125m (0.5m), 140-240m (0.3m) and 300-395m (1.3m). Accretion occurs between chainages 125-140m (0.3m), 240-300m (0.4m) and seaward of chainage 395m (0.2m). Overall, the profile is generally at a medium-high level when compared to the range recorded from previous surveys except between chainages 305-290m which is at its lowest level recorded.</p> <p>At profile <b>1aADC11</b>, the dunes have remained stable, with small sections of accretion and erosion by up to ±0.1m. There is a small section of accretion at the toe of the dunes by up to 0.3m to chainage 84m, before eroding across the rest of the profile by up to 0.9 on the upper beach, 0.1m on the middle beach and 0.8m on the lower beach. Overall, the profile fluctuates between a high and low level compared to the range recorded from previous surveys but is particularly low between 106-128m and 236-260m.</p>	<p>However, four profiles also exhibit small sections of record highs.</p>



Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>At profile <b>1aADC12</b>, the dune face has remained stable since the previous survey, however, there has been some erosion on the dune crest and at the dune toe by up to 0.3m. There has been accretion across the majority of the beach profile between chainages 55-140m by up to 0.7m. A small berm has formed on the upper beach at chainage 60m. Seaward of chainage 140m the lower beach has eroded by up to 1.4m and led to a steep lower beach profile. Overall, the upper and middle beach profile is at a high level compared to the range recorded from previous surveys, particularly between chainages 75-135m which is at its highest recorded level. The lower beach is at one of its lowest levels, second to October 2013.</p> <p>At profile <b>1aADC13</b>, the dunes and dune face have remained stable since the last survey. There has been accretion at the dune toe of up to 1.6m between chainages 155-200m, before a steep drop in profile since the previous survey seaward of this point. Erosion is up to 1.8m. Overall this profile shows the dune toe at its highest level recorded between chainages 165-190m, and the upper beach at its lowest level recorded (seaward of chainage 2014m).</p> <p>At profile <b>1aADC14</b>, there has been a small amount of accretion (up to 0.2m) on the crest of the dunes, and up to 0.3m on the lower face of the foredune. The upper beach has eroded by up to 0.3m between chainages 138-174m. The middle beach has accreted by up to 0.2m to chainage 280m, switching to a small section of erosion of less than 0.1m seaward of chainage 280m. The crest of the foredune is at its highest recorded level, however the rest of the profile is at a medium-low level compared to the range recorded from previous surveys.</p>	

Survey Date	Description of Changes Since Last Survey	Interpretation
<p><b>March – September 2021</b></p>	<p><b>Topographic Survey:</b></p> <p>The northern part of Alnmouth Bay (to the north of the River Aln Estuary) is covered by a bi-annual topographic survey, which commenced in April 2005. Data from the most recent topographic survey (Full Measures, autumn 2021) have been used to create a DGM (Appendix B – Map 3) using GIS. A difference plot has also been produced using the DGM (Appendix B – Map 7) comparing the last produced topographic survey (Partial Measures, spring 2021) with the present survey.</p> <p>The difference plot broadly shows alternating bands of discontinuous accretion and erosion throughout the survey extent. In general, the toe of the dunes is dominated by patchy erosion and accretion (<math>\pm 0.75</math>), which increases in magnitude toward the north (<math>\pm 1.5</math>m). The upper beach is dominated by low levels of accretion, except on the upper beach adjacent to the car park which shows low level erosion. The middle beach generally shows little change (<math>\pm 0.1</math>m) / low level erosion, increasing in magnitude toward the north of the bay to 1.5-1.75m. The northern edge of the Aln channel shows low level accretion at the mouth of the river, with erosion along the edge of the channel as the river routes northward across the beach.</p>	<p>The findings of the topographic survey broadly show discontinuous parallel bands of erosion and accretion across the survey extent, with no discernible pattern.</p>

## 2.12 High Hauxley & Druridge Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
<p>20<sup>th</sup> – 21<sup>st</sup> Sept 2021 -</p>	<p><b>Beach Profiles:</b></p> <p>High Hauxley to Druridge Bay is covered by nine beach profile lines for the Full Measures survey (Appendix A). Four of these (with 'A' or 'B' suffixes) were added to the programme in October 2007. All except 1aADC15 are resurveyed every 6-months.</p> <p>Profile <b>1aADC15</b> extends across the extensive dunes at Amble Links and foreshore. There has been some minor accretion and erosion across the dunes, within the range of <math>\pm 0.1\text{m}</math>. Generally, however the dunes have remained stable. The toe of the dune has lowered by 0.1m. The upper and middle beach from chainage 88m to 162m has undergone little change, limited to <math>\pm 0.1\text{m}</math> (except for a small section on the upper beach between 100-117m which accreted by up to 0.3m). The lower beach seaward of chainage 117m has accreted by up to 0.2m. Overall, the profile is at a low to medium level compared to the range recorded from previous surveys.</p> <p><b>1aADC15A, 1aADC16</b> and <b>1aADC16A</b> are located around Hauxley Haven. At all locations, the dunes have remained stable since the last survey (Partial Measures, spring 2020).</p> <p>At profile <b>1aADC15A</b>, the start of the survey is missing due to access restrictions and therefore it has not been analysed. There has been negligible change at the toe of the dune to chainage 25m. From chainage 25m to the end of the survey at chainage 199m the beach has lowered by up to 0.3m on the upper beach, &lt;0.1m on the middle beach and 0.7m on the lower beach. Overall, the profile is at a high level on the upper beach and a low level on the middle and lower beach compared to the range recorded from previous surveys.</p> <p>At profile <b>1aADC16</b>, the start of the survey is missing due to access restrictions and therefore it has not been analysed. Accretion has occurred at the toe of the dune and across the upper beach between chainages 74m and 160m by up to 0.4m. Seawards of this point, until the end of the survey at chainage 236m the beach has lowered by up to 0.3m of accretion. Overall, the beach is at a medium level compared to the range recorded from previous surveys.</p>	<p>At High Hauxley (profile 1aADC15), the dunes have remained stable and the beach profile is dominated by accretion.</p> <p>At Hauxley Haven (profiles 1aADC15A to 1aADC16A), the dunes have remained stable since the last survey. Overall, the profiles generally show accretion on the upper beach and erosion on the lower beach, except profile 1aADC15A which has eroded across the beach profile.</p> <p>In Druridge Bay, changes in beach levels generally showed variable sections of erosion and accretion associated with seasonal berm movement across the foreshore.</p> <p><b>Longer term trends:</b> At High Hauxley, Hauxley Haven and north and south Druridge Bay, the dunes have remained stable except for limited changes at the dune toe. The beach levels are mostly within the bounds of previous surveys.</p>



Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>At profile <b>1aADC16A</b>, there has been accretion from the toe of the rock revetment at chainage 80m to chainage 145m by up to 0.6m. Seaward of chainage 145m, the beach level has lowered by up to 0.5m. The profile is at a medium level compared to the range recorded from previous surveys.</p> <p><b>1aADC16B, 1aADC17 and 1aADC17A</b> are located to the north of Druridge Bay, between Bondi Carrs and Hadston Carrs and extend seawards from Togston Links. At all locations, the dunes have remained stable since the last survey (Partial Measures, spring 2021).</p> <p>At profile <b>1aADC16B</b>, there has been accretion between the rock exposures between chainage 79m-97m by between 0.1-0.3m. The beach levels between some rock exposures seaward of chainage have lowered by up to 0.2m. The survey extends to chainage 272m, exposing more rock exposures. Overall, the profile is at a medium to low level compared to the range recorded from previous surveys.</p> <p>At profile <b>1aADC17</b>, there has been small sections of erosion and accretion across the dunes limited to <math>\pm 0.1</math>m. At the toe of the dunes, there has been an accumulation of 0.6m of sediment to chainage 52m. Seaward of chainage 52m, there has been varying sections of accretion and erosion by <math>\pm 0.1</math>m. Overall, the profile is at a medium-low level compared to the range recorded from previous surveys, except on the upper beach which is at its highest level recorded.</p> <p>At profile <b>1aADC17A</b>, the upper and middle beach has experienced accretion, ranging from 0.4m on the upper beach to 0.3m on the middle beach. The lower beach has lowered by up to 0.3m, exposing the rock platform from chainage 228m. Overall, the profile is at a high level on the upper and lower beach, and a low level on the lower beach, when compared to the range recorded from previous surveys.</p> <p><b>1aCMB01 and 1aCMB02</b> are located in the southern section of Druridge Bay.</p> <p>At profile <b>1aCMB01</b>, the dunes appear to have experienced minor erosion / accretion of <math>\pm 0.1</math>m. The upper beach profile has accreted by up to 0.8m to chainage 250m, before switching to erosion across the rest of the profile by up to 0.9m which has led to a steeper beach profile than seen in spring 2021. The beach is at a high level on the upper beach and a medium level on the rest of the beach profile compared to the range recorded from previous surveys.</p> <p>At profile <b>1aCMB02</b>, the dune has remained mostly stable since the previous survey, with up to 0.2m of accretion on the landward side of the foredune. The toe of the dunes has accreted by up to 0.4m. A hollow on the middle beach has infilled by up to 0.5m and the lower beach has accreted by up to</p>	

Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>0.3m. A shallow berm on the mid-lower berm has lowered by up to 0.5m between chainages 260-340m. Overall, the profile is at a high level on the upper beach and a medium level on the middle and lower beach compared to the range recorded from previous surveys.</p>	

## 2.13 Lynemouth Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
8 <sup>th</sup> October 2022	<p><b>Beach Profiles:</b></p> <p>Lynemouth Bay is covered by six beach profile lines for the Full Measures survey (<b>Appendix A</b>). Profiles <b>CMBC03A</b> and <b>CMBC03B</b> were added to the programme in October 2007.</p> <p>Profiles <b>1aCMBC03a</b> to <b>1aWDC01</b> were last surveyed during the Partial Measures spring survey, 2020. Profiles <b>1aCMBC01</b> and <b>1aWDC02</b> to <b>1aWDC05</b> were last surveyed during the Full Measures autumn survey, 2020.</p> <p><b>1aCMBC03</b> is located just to the south of Snab Point. The profile extends across the cliff and the rock platform below. The profile has experienced very little change since the last survey, with only minor differences in positions of rock being recorded, indicating a stable cliff and rocky foreshore.</p> <p><b>1aCMBC03A</b> is located opposite Lynemouth and extends across the extensive area of historically tipped colliery spoil before reaching the foreshore. Generally, the colliery spoil areas from chainage 0m have not changed substantially in form since the last survey (Partial Measures, spring 2021). The toe of the colliery spoil cliff has receded by 0.5m. Across the remainder of the profile there has been a relatively consistent level of accretion between 0.4m on the upper beach and 1.0m on the lower beach. Overall, the profile is at a low level compared to the range recorded from previous surveys, particularly at the colliery spoil cliff toe which is at its most landward position recorded.</p> <p><b>1aCMBC03B</b> is located to the north of Lynemouth Power Station and extends across the extensive area of historically tipped colliery spoil before reaching the foreshore. The process of colliery spoil erosion has been progressively ongoing for some years. Since the last survey, the seaward face of the colliery spoil cliff has retreated by landwards by approximately 0.5-1.0m, which is now at its most landward position since Cell 1 survey records began (particularly toward the crest of the colliery spoil cliff). The rest of the beach profile has accreted by up to 0.4m on the upper beach to 0.6m on the lower beach. Overall, the profile is at a low level compared to the range recorded from previous surveys, particularly the face of the colliery spoil cliff which is at its most landward / lowest level recorded. The retreat of the colliery spoil has slowed somewhat compared to previous years.</p>	<p>To the south of Snab Point, the shoreline has not changed in form or position since the last survey.</p> <p>North of the Power Station, the toe of the historically tipped colliery spoil has receded landward by 0.5-1.0m. Across the remainder of the profiles, the beach has risen since the previous survey.</p> <p>It has been observed that between profile <b>1aCMBC03A</b> and the River Lyne, and along the riverbanks around the mouth of the river, the colliery spoil has eroded. This has exposed a considerable quantity of refuse material, including rubber tubing, plastics, construction waste and the like. This material has always been known to be present, but recently appears more exposed in the face of the colliery spoil at these locations. There is an ongoing remediation scheme at this location.</p> <p>To the south of the power station, between Lyne Sands and Beacon Point, profiles <b>1aWDC02</b> and <b>1aWDC03</b> have generally accreted on the top of the colliery spoil cliff, however the colliery spoil toe remains at one of its most landward positions recorded.</p> <p><b>Longer term trends:</b></p> <p>To the south of Snab Point, the changes observed from the present beach profiles are within the bounds of previous surveys. Total recession between the first survey in spring 2002 and the most recent survey in</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>Profile <b>1aWDC01</b> extended from seaward of the rock revetment down to low water but is no longer measured.</p> <p><b>1aWDC02</b> is located to the south of the Power Station. The dunes up to chainage 125m remain largely unchanged. The area of tipped colliery spoil between chainages 50-125m has risen by up to 0.3m, however the crest has eroded landward by up to 4.0m. The rest of the beach profile has lowered by up to 0.6m. The area of colliery tipped spoil is at its most landward position recorded and the beach profile is at a low level.</p> <p><b>1aWDC03</b> is located to the south of the Power Station and to the north of Beacon Point. On the landward side of the colliery spoil berm, from chainage 36m to 99m, there has been accretion by up to 0.2m. Accretion has occurred on the upper beach by up to 0.3m to chainage 146m, switching to erosion on the lower beach by up to 0.4m. The beach profile is at a low level compared to the range recorded from previous surveys (however the colliery spoil between chainages 35-99m is at its highest level recorded).</p> <p><b>1aWDC04</b> and <b>1aWDC05</b> are located between Beacon Point and Newbiggin Point.</p> <p>At profile <b>1aWDC04</b>, the dunes have remained generally stable, with small sections of accretion limited to less than 0.1m to chainage 42m. The profile shows the dune face remains steep, with a small section of erosion between chainages 42-51m by 0.3m. There has been accretion from the centre of the dune face to chainage 82m by up to 0.4m, switching to erosion seaward of chainage 82m by up to 0.3m. Overall, the profile is at a high level on the dunes, upper and middle beach compared to the range recorded from previous surveys, while the lower beach is at a low level recorded.</p> <p>At <b>1aWDC05</b>, the cliffed section has remained stable. There has been an accumulation of sand between chainages 10-30m by up to 0.2m. Seawards of chainage 30m the rock platform remains exposed, and the profile is largely unchanged. Overall, the profile is at a medium level compared to the range recorded from previous surveys.</p>	<p>autumn 2021 is 2.0m, with an increase in the annual rate of erosion up to last survey (0.12m/yr).</p> <p>Opposite Lynemouth, the colliery spoil has demonstrated a total recession between the first survey in autumn 2007 and the most recent survey in autumn 2021 of 30.0m overall. The rate of erosion has slightly decreased from 2.3m/yr to 2.1m/yr since the last survey. The backing coastal slopes have remained relatively stable over this time.</p> <p>To the north of the power station, total recession between the first survey in autumn 2007 and the most recent survey in autumn 2020 is 58m. The average annual rate of erosion is 4.1m/yr which is a slight reduction on the rate seen up to the last survey (4.3m/yr).</p> <p>To the south of the power station, the prominent colliery spoil berm has retreated landward since the first survey in spring 2002 to the most recent survey in autumn 2021 by up to 66m. The average annual rate of erosion has increased from 3.1m/r to 4.7m/yr at 1aWDC02 and increased from 3.1m/yr to 3.4m/yr at 1aWDC03.</p>
<p><b>May 2021 to October 2021</b></p>	<p><b>Beach Topographic Survey:</b></p> <p>Lynemouth Bay is covered by a 6-monthly topographic survey, which was added to the programme in December 2020. This first survey represents a useful pre-scheme baseline against which future</p>	<p>The seaward progradation of the shore in the lee of Headagee rock outcrops is facilitated by the shelter</p>



Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>beach topographic surveys can be compared to determine locations and rates of change (landward recession or foreshore lowering/accretion). Data from the most recent topographic survey (Full Measures, autumn 2021) have been used to create a digital ground model (DGM) (Appendix B – Map 4) using a Geographical Information System (GIS). A difference plot has also been produced using the DGM (Appendix B – Map 9) produced from the last topographic survey and the present survey.</p> <p><b>Appendix B (Map 4)</b> shows that the beach contours from the October 2021 survey are generally parallel to the shore, except for in the vicinity of the rock outcrops at Headagee towards the northern part of the bay. Here, the shoreline has prograded seawards in the lee of the rocks.</p> <p><b>Appendix B (Map 9)</b> shows that change to the north of the River Lyne is characterised by alternating patches of low magnitude erosion and accretion in the middle beach profile (at the colliery spoil cliffs), with little change on the upper and lower beach (<math>\pm 0.1\text{m}</math>). The largest area of erosion is found on the middle beach to the south of the Headagee rock outcrop. Accretion is concentrated on the middle beach in the lee of Headagee rock outcrop.</p> <p>A higher magnitude of accretion is located at the mouth of the River Lyne (1.0-1.25m). The beach profile between the River Lyne and the Power Station is dominated by low magnitude accretion (0.5-1.0m) on the middle and lower beach, with little change recorded on the upper beach (<math>\pm 0.1\text{m}</math>).</p> <p>There is a parallel band of erosion (0.5-1.25m) south of the Power Station on the upper to middle beach, at the location of the colliery spoil cliff. The southern extent of the profile is dominated by accretion across the beach profile by up to 1.5m.</p>	<p>against wave energy provided to the leeward side by these rocks.</p> <p><b>Longer term trends:</b> Future repeat surveys are expected to identify areas of the beach that are relatively stable (likely to be towards the northern end of the bay and in the lee of Headagee) and areas where landward recession continues to occur as the historically tipped colliery spoil is eroded on an ongoing basis.</p>
September 2021	<p><b>Colliery Spoil Edge Survey:</b></p> <p>Colliery spoil edge survey data was collected for a baseline survey in December 2020. Subsequent surveys have been taken in spring 2021 and autumn 2021 (Figure 3).</p> <p>In the very north of the bay, the colliery spoil forms a beach and the survey of the low cliffed edge of this spoil beach shows a progradation of sediment in the lee of the Headagee rock outcrops. The edge of the colliery spoil beach then merges back into the colliery spoil cliff toe just to the south of the rock outcrops. It has been observed empirically that the spoil beach is eroding landwards and the point where it merges into the cliff is moving northwards, causing the cliffs to become exposed and start eroding. Further north, the remaining spoil beach protects natural cliffs/ coastal slopes. The cliff</p>	<p>Where a spoil beach is present on the foreshore, the backing spoil cliffs or natural cliffs/dune are stable because they are not currently affected by marine processes.</p> <p>Where the spoil beach is absent, the backing colliery spoil cliffs are actively eroding, causing measurable landward recession.</p> <p><b>Longer term trends:</b> Since cliff top surveys began in December 2020, cliff movement has been greatest in</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>edge has remained stable in this part of the bay since the previous survey, with very little change recorded.</p> <p>In the centre of the bay (immediately north of the power station north towards Headagee the colliery spoil cliff is no longer protected by a distinct fronting colliery spoil beach (although the natural beach is very much intermixed with spoil, it does not form a distinct spoil beach like that present in the north of the bay). Colliery spoil between the Power Station and the River Lyne has remained relatively stable, with only small areas of recession by up to 0.5m. The greatest change is recorded opposite Lynemouth, where a 14m section eroded by up to 2.0m since the previous survey. This extent of change is beyond the landward of extent of the enabling works and must be deemed at least part erosion.</p> <p>In the south of the bay south of the power station) the colliery spoil extends some distance seaward of the backing (and underlying) natural dunes, forming a 'berm' (rather than a distinct cliff edge) at the seaward edge. This berm has been eroding landwards, but at a lesser rate than in the centre of the bay. There has been little movement in the colliery spoil edge since the previous survey.</p>	<p>the centre of the bay (north of the River Lyne) with up to 19.0m of cliff top retreat, whilst the northern and southern parts of the survey area have shown less movement with small sections of retreat up to 3.0m.</p> <p>Future repeat cliff top surveys are expected to help quantify rates of erosion (landward recession) of the historically tipped colliery spoil on a wider basis than is possible from the beach profile surveys alone.</p>



Figure 3 Lynemouth cliff top survey – autumn 2021 (north: left, centre: middle, and south: right)

## 2.14 Newbiggin-by-the-Sea

Survey Date	Description of Changes Since Last Survey	Interpretation
<p>24<sup>th</sup> August 2021</p>	<p><b>Beach Profiles:</b></p> <p>Newbiggin-by-the-Sea is covered by four beach profile lines for the Full Measures survey (Appendix A). Two of these, profiles <b>WDC05A</b> and <b>WDC06A</b>, were added to the programme in October 2007 specifically to help assess the performance of the capital scheme involving beach replenishment and construction of an offshore breakwater. Profiles <b>1aWDC05A</b> and <b>1aWDC06A</b> were last surveyed during the Partial Measures spring survey, 2021. Profiles <b>1aWDC06</b> and <b>1aWDC07</b> were last surveyed during the Full Measures autumn survey, 2020.</p> <p>In addition, a further 26 profiles (<b>1aNWB1</b> to <b>1aNWB26</b>) have been surveyed since September 2010 as part of a topographic survey of Newbiggin Bay. These profiles are not individually described.</p> <p>Beach profiling works were completed here in September 2012. Four areas were re-profiled; 2 sections to the east of profile <b>1aWDC05A</b>, one section at <b>1aWDC06A</b> and a narrow section at the top of <b>1aWDC07</b>.</p> <p><b>1aWDC05A</b> is in the north of Newbiggin Bay. There has been accretion at the toe of the seawall to chainage 11m by up to 0.2m. There is a small section of erosion on the upper beach between chainage 26-40m by up to 0.1m, switching to accretion on the middle beach by up to 0.4m between chainages 40-64m. Seaward of this point the beach has lowered by up to 0.3m. The rock platform remains exposed seaward of chainage 110m. The beach profile is at a medium-high level across the beach profile compared to the range recorded from previous surveys.</p> <p><b>1aWDC06</b> is located in the centre of the northern part of Newbiggin Bay, between the two breakwaters. There has been no change outside the range <math>\pm 0.1</math>m from the toe of the seawall to chainage 15m. On the upper and middle beach to chainage 52m there has been an even band of accretion by up to 0.4m. Seawards of chainage 52m, the lower beach has eroded since the previous survey by up to 0.4m, resulting in a marginally steeper beach profile. Overall, the profile is at a high level compared to the range recorded from the previous surveys.</p> <p><b>1aWDC06A</b> is located in the centre of Newbiggin Bay, behind the offshore breakwater. There has been very little change from the seawall to chainage 80m. There is accretion on the upper beach by</p>	<p>Since the last survey, the profiles have generally accreted on the upper beach, and eroded the lower beach at Newbiggin-by-the-Sea. Profiles have remained stable since the previous survey.</p> <p><b>Longer term trends:</b> Data since monitoring began in May 2002 reflects the change in beach width resulting from the beach nourishment scheme implemented at Newbiggin-by-the-Sea. This change is also reflected in the beach profile plot in Appendix A.</p> <p>The changes in beach profile form and position observed since the last survey are within the bounds of previous surveys, with all profiles at a medium-high level.</p>



Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>up to 0.6m between chainages 80-100m. The remainder of the beach profile has lowered by up to 0.2m on the middle beach and 0.4m on the lower beach, except for a small section between chainages 205-235m which has accreted by up to 0.2m. Overall the profile is generally at a high level when compared to the range recorded from previous surveys, particularly at the toe of the seawall which is at its highest level recorded</p> <p><b>1aWDC07</b> is located towards the south of Newbiggin Bay. The crest of the boulders has lowered by up to 0.1m, most likely caused by a movement in boulders. The rest of the beach profile has alternated between accretion and erosion by <math>\pm 0.1</math>m. Overall, the profile is at a medium level across much of its extent compared to the range of the surveys recorded.</p>	
<p><b>Mar-Aug 2021</b></p>	<p><b>Topographic Survey:</b></p> <p>Newbiggin-by-the-Sea is covered by bi-annual topographic survey, which commenced in September 2010. The surveys are planned to help assess the performance of a capital scheme constructed in 2007, which involved beach replenishment and construction of an offshore breakwater. Prior to incorporation in the programme, these surveys were undertaken on occasions between 2007 and 2010 as part of the scheme development.</p> <p>Data from the most recent topographic survey (Full Measures, autumn 2021) have been used to create a DGM (Appendix B – Map 4) using a GIS. A difference plot has also been produced using the DGM (Appendix B – Map 8) produced from the last produced topographic survey (Partial Measures, spring 2021) and the present survey.</p> <p>The difference plot shows the beach is dominated by little change (<math>\pm 0.1</math>m). Accretion occurs along the upper to middle beach from the north to the centre of the bay, and in the south of the bay by up to 1.25m. Erosion is found on the lower beach of the north, centre and south of the bay, with the largest magnitude of erosion occurring in the lee of the breakwater (up to 1.75m). Changes at Spital Carrs in the south is patchy, with no discernible pattern.</p>	<p>The topographic survey shows areas of both gain and loss across the beach of generally low magnitude. Overall, the beach has remained mostly stable, with the centre undergoing the most erosion (limited to (-1.75m).</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
<p><b>August 2021</b></p>	<p><b>Sand Extent Survey:</b></p> <p>Spital Carrs is located to the south of Newbiggin Bay and is covered by a bi-annual sand extent survey, which commenced in 2012. The survey was designed to address concerns that the beach recharge scheme undertaken in the Newbiggin Bay may have impacts on the Spital Carrs SSSI and SPA if sand from the recharge scheme moves to the south. The sand extent survey therefore identifies the boundary of the sand beach on the rock platform.</p> <p>Data from the most recent sand extent survey (Full Measures, autumn 2021) has been plotted onto aerial imagery (refer to Appendix C – Map 1). The plot shows there has been a retreat of the limit of sand cover between the spring 2021 and the autumn 2021 survey across the majority of the survey extent, with the majority of the section at its most landward position recorded. The greatest area of retreat is in the lower half of the survey where 44.5m of retreat has occurred. There has been some advance in the north of the survey extent, by up to 15.0m.</p>	<p>Since the last survey, there has generally been retreat of sand cover across the survey extent. It is expected to advance during the summer, however this should be closely monitored.</p> <p><b>Longer term trends:</b> Since 2014, there has been a general trend in the south of the survey area for advance in the summer and retreat in the winter. Similar to the autumn 2020 survey, the autumn 2021 survey does not fit this general trend in the south, however the northern part of the survey extent has advanced.</p>
<p><b>September 2021</b></p>	<p><b>Cliff-top Survey:</b></p> <p>Cliff top survey data collected for baseline survey (autumn, 2008), the previous Partial Measures survey (spring 2021) and the present Full Measures survey (autumn, 2021) is presented in this report.</p> <p>The cliff top survey is carried out as a continuous cliff edge line survey at the Newbiggin Caravan Park at Newbiggin Point. The results from the cliff top monitoring are anticipated to have an accuracy of <math>\pm 0.2\text{m}</math> due to the technique used. Furthermore, problems in precisely locating the cliff top, due to vegetation growth or the indistinct form of the cliff top, have also affected the data quality.</p> <p>There has been very little change in the position of the cliff top since the previous survey in spring 2021 and the present Full Measures survey in autumn 2021. Up to 1.0m of accretion has been noted at the cliff edge adjacent to the northernmost tip of the concrete armour blocks. This is most likely a slump in the cliff edge, which could threaten the caravan which is located immediately behind.</p>	<p>Since the last survey there has been relatively little movement recorded.</p> <p><b>Longer term trends:</b> Since surveys began in October 2008, cliff movement has been greatest in the north of the survey area with up to 3.3m of cliff top retreat, whilst the central and southern parts of the survey area have shown less movement with retreat of less than 2.0m.</p>

## 2.15 Cambois Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
22 <sup>nd</sup> September 2021	<p><b>Beach Profiles:</b></p> <p>Cambois Bay is covered by seven beach profile lines for the Full Measures survey (Appendix A). Profiles. All profiles are resurveyed every 12-months.</p> <p><b>1aWDC08</b> and <b>1aWDC09</b> are located to the north of the River Wansbeck estuary in front of Sandy Bay Caravan Park. The survey report notes that the cliff was not surveyed at profile 1aWDC08 or 1aWDC09 due to loose material and therefore has not been analysed.</p> <p><b>1aWDC08</b> extends from the cliff across the rock revetment onto the foreshore. There has been erosion across the upper and middle beach by up to 0.5m to chainage 128m. Seaward of this point the lower beach has accreted by up to 0.3m. Overall, the profile is at a medium level compared to the previous surveys, except the lower beach between chainages 128-170m which is at its highest recorded level.</p> <p><b>1aWDC09</b> extends from the cliffs at the very southern end of the Caravan Park. There has been accretion at the toe of the boulders by up to 0.5m to chainage 79m. The upper-mid beach has lowered by up to 0.7m, and the lower beach has lowered by up to 0.8m. There are small sections of accretion across the beach limited to 0.2m. Overall, the beach level alternates between a high and low level, reaching its highest level recorded between chainages 29-69m and its lowest level between chainages 92-135m.</p> <p>Profiles <b>1aWDC10</b> to <b>1aWDC14</b> are all located along Cambois Bay, between the River Wansbeck and River Blyth estuaries. The survey report notes that the cliff was not surveyed at profile 1aWDC10 due to loose material and therefore has not been analysed.</p> <p><b>1aWDC10</b> is located on the southern side of the Wansbeck Estuary, just to the south of Cambois House. There has been erosion from the cliff toe to the end of the survey by up to 1.0m on the upper beach and up to 0.6m on the lower beach, resulting in the removal of two beach berms. Overall, the profile is at a low level on the upper beach compared to the range recorded from previous surveys, however the lower beach is at a medium-high level.</p>	<p>The cliff top to the north of the River Wansbeck has not been assessed due to safety concerns during the time of the survey. Beach levels north of the River Wansbeck have undergone variable change since the previous survey.</p> <p>To the south of the Wansbeck Estuary, beach levels have generally lowered, except for the upper beach of profile 1aWDC11 which is at its highest level recorded.</p> <p>At the centre of Cambois Bay, the cliff top and cliff face has remained stable. Beach levels have lowered across 1aWDC12, whereas the upper and lower beach of 1aWDC13 have risen.</p> <p>At the southern extent of Cambois Bay, beach levels have accreted on the middle beach, and lowered on the upper and lower beach.</p> <p><b>Longer term trends:</b> Beach profiles in the north of the survey area are at higher levels compared to those in the south, suggesting a south-north movement of sediment or a greater input of sediment (possibly from the River Wansbeck) in the north of the survey area. Several profiles during the autumn 2021 survey show progressive erosion of the till and dune cliffs.</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
	<p><b>1aWDC11</b> extends across the rock revetment fronting the now disused foundry. There has been accretion across the upper beach profile, between chainage 44m to 110m, by up to 0.6m. From this point to the end of the survey at chainage 265m the beach has lowered by up to 0.9m. The upper beach profile is at a high level compared to the range recorded from previous surveys, particularly between chainages 60-89m which is at its highest level recorded. The middle to lower beach is at a medium-low level.</p> <p><b>1aWDC12</b> is situated approximately mid-way along Cambois Bay. Since the last survey, the beach level from the toe of the cliff to chainage 45m has accreted by up to 0.1m. Seaward of this point the beach has lowered by between 0.1m on the upper beach to 1.0m on the lower beach. Overall, the profile is at a medium- level on the upper and middle beach compared to the range recorded from previous surveys, while the lower beach is at a low level.</p> <p>At <b>1aWDC13</b> is located to the centre-south of Cambois Bay. There has been a retreat of the dune face by up to 1m in places, with a slight accretion at the toe by up to 1.0m. The upper and lower beach has risen by up to 0.6m on the upper beach, and 0.5m on the lower beach. The middle beach has lowered by up to 1.0m forming a depression at chainage 120m. The upper and lower beach is at a medium level, whilst the middle beach is at a low level when compared with the range of previously recorded results, particularly between chainages 90-120m which is at its lowest level recorded</p> <p><b>1aWDC14</b> is located to the south of Cambois Bay, at North Blyth. There has been a lowering of the beach at the toe of the cliff by up to 0.6m. The upper beach has lowered by up to 0.1m to the patch of boulders at chainage 35m. The middle beach has accreted by up to 0.1m, however the boulder patch remains exposed. The lower beach has lowered by up to 0.2m to the end of the survey. Overall, the cliff face has remained stable since the previous survey. The beach is at a medium level a compared to the range recorded from previous surveys.</p>	
September 2021	<p><b>Cliff-top Survey:</b> Cliff top survey data collected for baseline survey (spring, 2009), the previous Partial Measures survey (spring 2021) and the present Full Measures survey (autumn, 2021) is presented in this report.</p> <p>The cliff top survey is carried out as a continuous cliff edge line survey in two locations within Cambois Bay; at Sandy Bay Caravan Park to the north of the River Wansbeck estuary, and Cambois Bay from south of the River Wansbeck to the breakwater at the southern end of the bay. The results</p>	<p>Since the last survey in spring 2021, there has been a few isolated sections of landward retreat in cliff top position recorded for Sandy Bay Caravan Park, with a maximum retreat of 1.0m. Cambois Bay appears to have been relatively stable along its full</p>



Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>from the cliff top monitoring are anticipated to have an accuracy of <math>\pm 0.2\text{m}</math> due to the technique used. Furthermore, problems in precisely locating the cliff top, due to vegetation growth or the indistinct form of the cliff top, have also affected the data quality.</p> <p>There has been relatively little change between the spring 2021 and autumn 2021 survey, with only a few small sections (&lt;1.0m long) of cliff edge eroding by &lt;1.0m. Most changes are recorded adjacent to Sandy Bay Caravan Park. During December 2019 it was noted that a slip in the cliff top had occurred to the north of the survey area at Sandy Bay Caravan Park. The location of the slip is thought to be approximately 100m north of the northernmost corner of the caravan park. The slippage has encroached onto the public footpath in this area. It was noted that the slippage had already been taped off in December 2019, with signs placed by Northumberland County Council alerting footpath users to the unstable cliff edge. It is recommended that this slip and the wider area is monitored to ensure public safety along this popular coastal footpath.</p> <p>Along the Cambois Bay frontage the cliff tops have remained relatively stable along much of the extent of the survey. There are small, isolated areas of retreat limited to &lt;1.0m.</p>	<p>frontage with isolated areas of retreat limited to 1.0m.</p> <p><b>Longer term trends:</b> At Sandy Bay Caravan Park the cliff top retreat has been more significant in the southern part of the survey area with up to 10m of erosion since 2008, whilst the northern part has eroded by c.1.0-3.0m.</p> <p>In Cambois Bay, the area of greatest cliff top retreat since the surveys began in 2009 is the centre of the bay opposite Ridley Terrace, Cambois, where up to 12.0m of erosion has occurred. The north and south of the bay have retreat more typically c.1.0-5.0m.</p>

## 2.16 Blyth South Beach

Survey Date	Description of Changes Since Last Survey	Interpretation
23 <sup>rd</sup> September 2021	<p><b>Beach Profiles:</b></p> <p>Blyth South Beach is covered by six beach profile lines for the Full Measures survey (Appendix A). All profiles are resurveyed every 6-months.</p> <p><b>1aBVBC01</b> is located towards the north of South Beach, in front of the area of land owned by the Port of Blyth. There have been some minor changes to the form of the dunes, limited to <math>\pm 0.1\text{m}</math>, but their position remains unchanged since the last survey (Partial Measures, spring 2021). The upper beach from the dune toe at chainage 35m to chainage 75m has accreted by up to 0.8m. The middle beach has lowered between chainages 75-112m by up to 0.3m. The mid-lower beach between chainages 112-160m has accreted by up to 0.6m, before switching to erosion seaward of chainage 160m by up to 0.8m. Overall, the profile is at a high level on the upper and mid-lower beach compared to the range recorded from previous surveys. Conversely, the middle and lower beach is at a low level.</p> <p><b>1aBVBC02</b> shows an accumulation of sediment from the toe of the sea defence to chainage 99m by up to 0.6m. Seaward of this point, the lower beach has lowered by up to 1.3m. Overall, the upper and middle profile is generally at a high level compared to the range recorded from previous surveys, particularly between chainages 16-48m which is at its highest level recorded. The lower beach is at a low level compared to the range recorded from previous surveys.</p> <p>At <b>1aBVBC03</b> there have been no significant changes to the position and form of the dunes since the last survey (Partial Measures, spring 2021), with small sections of accretion limited to 0.1m. The dunes remain at their most landward extent since 2002. Meggies Burn channel is still visible at chainage 89m but has infilled slightly by up to 0.1m, and up to 0.5m on the seaward side of the burn to chainage 140m. Between chainages 140-222m the beach has lowered by up to 1.3m, removing a middle beach berm from the previous survey. The lower beach seaward of chainage 222m has accreted by up to 1.0m. Overall, the upper and lower beach is at a high level compared to previous surveys. The middle beach is at a low level. Anecdotal evidence suggests previously covered WWII defences in the vicinity of this profile are now exposed as the channel of Meggies Burn cuts across the foreshore. This is a known issue with the channel of Meggies Burn, which has migrated northward</p>	<p>Since the last survey, the dunes and dune face at Blyth South Beach have remained largely stable, retaining the same form and position and some small areas of accretion limited to 0.2m.</p> <p>There has been variable accretion and erosion across the beach at Blyth South Beach, associated with the seasonal migration of berms across the profile.</p> <p><b>Longer term trends:</b> At Blyth South Beach, the dunes have generally demonstrated a long-term trend of stability.</p> <p>The changes in beach profile form and position observed since the last survey are generally within the bounds of previous surveys, however the beach between chainage 16-48m at 1aBVBC02 is at its highest level recorded. Meggies Burn continues to change in width and position across the foreshore, and there are concerns that it is threatening to undermine one of the beach groynes.</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>and is threatening to undermine one of the beach groynes. This is best observed from analysis of the Cell 1 aerial photography, rather than from the profile surveys.</p> <p>At <b>1aBVBC04</b>, there has been erosion by up to 0.1m on the dune crest and 0.5m at the dune toe, however, there has been no significant change to the position of the dunes since the last survey (Partial Measures, spring 2021). The upper beach between chainages 60m and 130m there has been up to 0.4m of erosion, causing a steepening of the profile across the upper beach. The middle beach between chainages 130-180m has accreted by up to 0.6m. Seawards of this point the beach has lowered by up to 0.9m. Overall, the dune crest is at a medium level, whilst the beach profile is generally at a medium-low level compared to the range recorded from previous surveys.</p> <p>At <b>1aBVBC05</b>, there has been little change to the form or position of the dunes since the last survey (Partial Measures, spring 2021), with minor sections of accretion on the dune face of up to 0.2m. The upper to middle beach has risen by up to 0.8m to chainage 200m, before switching to erosion on the lower beach by up to 0.6m. The dunes remain at a high level compared to the range recorded from previous surveys. The beach profile is at a medium level compared to the range recorded from previous surveys.</p> <p>At profile <b>1aBVBC06</b>, there has been no significant change to the position or form of the dunes since the last survey (Partial Measures, spring 2021). From the toe of the dunes at chainage 90m across the upper beach to chainage 150m, there has been accretion by up to 1.0m. The middle beach has lowered by up to 1.0m to chainage 219m, before switching to accretion on the lower beach by up to 0.5m to the end of the survey. The dunes, upper and middle beach are at a relatively high level, whilst the lower beach is at a relatively low level when compared to the range recorded from previous surveys.</p>	

## 4. Problems Encountered and Uncertainty in Analysis

### Individual Profiles

- At profiles BTBC19 and BTBC20, the survey report states that the offshore extent of the survey is limited by a drain. This drain is likely a runnel which separates the barrier feature in the lower foreshore from the rest of the beach.
- At BTBC26, the survey report notes that it was unsafe to survey the end of the section as the mud was too thick.
- At BTBC29, the survey report notes that areas of dense vegetation restricted the survey.
- At profile ADC05 there was unsafe loose material which prevented the survey of the cliff face.
- Profiles ADC08 and ADC09 end at the river.
- The start of sections AD15A and ADC16 were unable to be surveyed due to access being denied by homeowner.
- At profile ADC16B, the section starts at a new fence.
- Profile WDC01 is no longer measured.
- At profiles WDC08 – WDC10, there was unsafe loose material which prevented the survey of the cliff face.
- Profile WDC10 terminates at a river.
- At profile BVBC05 the surveyors were unable to measure an area at the end of the section due to soft sand and deep water.

### Topographic Survey

- The surveyors report notes that the concrete sea wall was buried in places so the guardrail was picked up to identify the back of the beach at Newbiggin-by-the-Sea.

### Cliff Top Surveys

- Cambois, Newbiggin, and Sandy Bay cliff tops have now been combined into one survey area.
- At Cambois Bay, the surveyors noted that very thick dense vegetation at north end of the cliffs hindered surveying. This was also noted in all previous reports.

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

At Lynemouth, the refuse in amongst the colliery spoil has become exposed in the cliff face prompting Northumberland County Council to develop a waste management scheme at Lynemouth Bay to prevent this material being released into the wider environment, causing unwanted adverse aesthetic and environmental effects. A *Site Restoration & Aftercare* report was submitted which recommended that enhanced coastal monitoring be undertaken to define the ongoing rates of coastal erosion along the frontage, both before and after the waste management scheme is implemented.

It was recommended that the pre-existing Cell 1 monitoring will continue at Lynemouth Bay and, from December 2020 onwards, was enhanced with the following additions:

- 6-monthly topographic survey of the beach (from the toe of the cliffs/slopes down to low water);

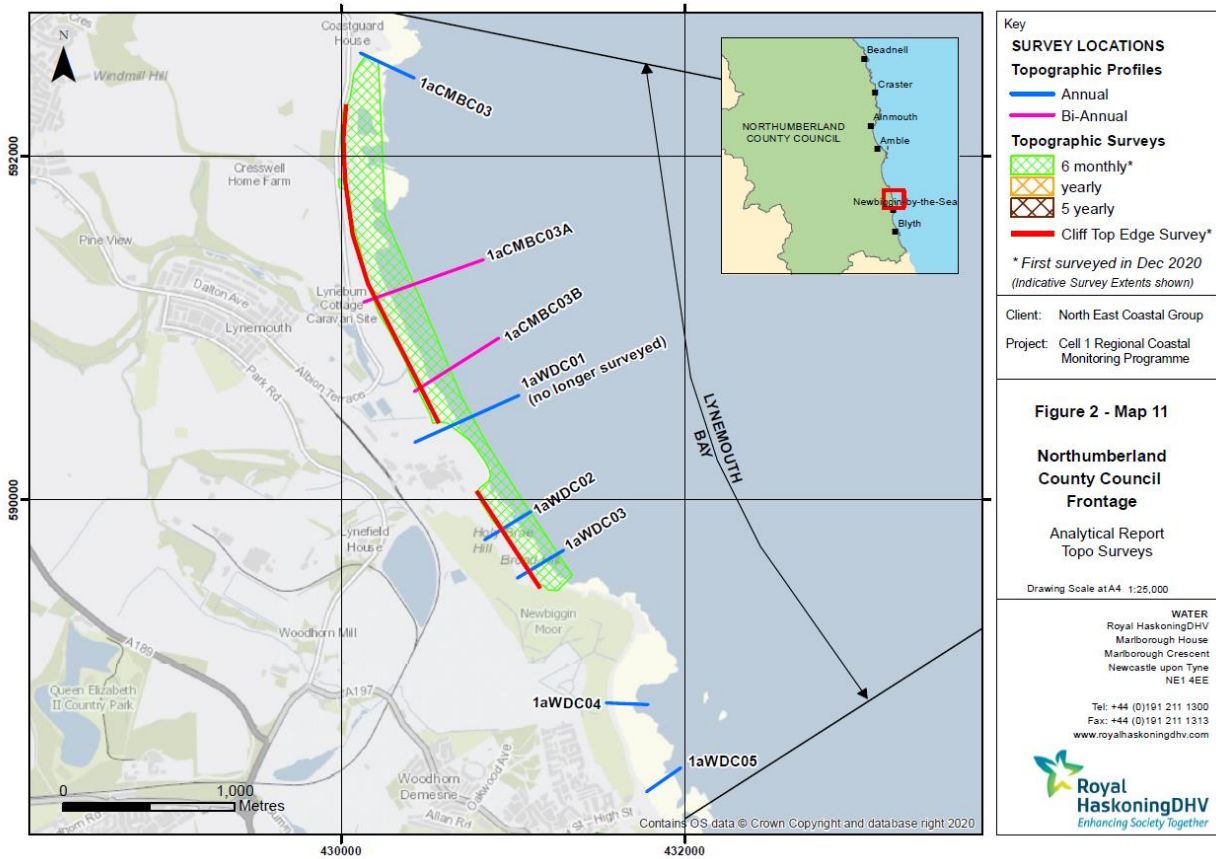


- 6-monthly survey of the cliff-top and/or cliff-toe position of the colliery spoil cliffs.

A baseline bathymetric survey will also be undertaken in 2023, extending profile 1aCMBC03B seaward to the 20m sea bed contour along a shore-normal corridor.

The scope of the enhanced coastal monitoring is shown in **Figure 6**.

All surveys within the proposed construction works area will temporarily be suspended during the construction works and will re-commence thereafter upon completion of the waste management scheme.



**Figure 6 – Scope of Enhanced Coastal Monitoring**

## 6. Conclusions and Areas of Concern

- At Sandstell Point (Spittal A), the recorded profiles and topographic survey present no causes for concern. However, the seaward face of the dune at profile **1aBTBC03** has shown a continued landward recession since November 2018.
- At Spittal (Spittal B), the recorded profiles present no causes for concern.
- At Goswick Sands, the recorded profiles present no causes for concern. The barrier feature in the seaward end of profile 1aBTBC18 shows movement and is likely to be a cyclical feature.
- At Holy Island, the recorded profiles and topographic survey present no causes for concern.
- At Bamburgh, the recorded profiles present no causes for concern. It is worth noting that data from previous years has been 1.048m too low due to a height error at the base station (see **Section 4** above). This has been rectified.
- At Beadnell Village, the recorded profiles present no causes for concern.
- At Beadnell Bay, the recorded profiles present no causes for concern.
- At Embleton Bay, the recorded profiles present no cause for concern
- At Boulmer, the recorded profiles present no cause for concern.
- At Alnmouth Bay, the northern profiles have remained stable, exhibiting a seasonal redistribution of sediment across the profiles. Towards the centre of the bay, beach levels have remained stable with some movement of berms at 1aADC07. Similarly, in the south, profiles have remained stable. The recorded profiles present no cause for concern.
- At High Hauxley & Druridge Bay, the profiles have remained stable since the previous survey, generally showing variable change across the profile associated with a seasonal movement of sediment. The recorded profiles present no cause for concern.
- At Lynemouth Bay, the recorded profiles show a retreat of the toe of the colliery spoil bank north of the power station by 0.5-1.0m and is now at its most landward position recorded. The cliff top survey shows that where the spoil beach is absent, the backing cliffs are eroding, often at a measurable rate. To monitor this trend, repeat cliff top/colliery spoil edge surveys were recommended to help quantify rates of erosion of the historically tipped colliery spoil on a wider basis than is possible from the beach profile surveys alone. Between spring 2021 and autumn 2021 the spoil cliff has remained stable in the north and very south of the bay. In the centre of the bay it has generally remained stable, except for one 14m section which has eroded by 2.0m since the previous survey.
- At Newbiggin-by-the-Sea, profiles have generally accreted on the upper beach, and eroded on the lower beach. Changes are within the range of previously recorded results. Results from the sand extent survey show that there has generally been retreat across the majority of the survey extent, with a small section of advance in the northern extent. There has been no significant movement in cliff top position since the previous survey.
- There are a few isolated sections of landward retreat at Sandy Bay Caravan Park, however change is limited to <1.0m.
- At Cambois Bay, the cliffs have not been assessed due to safety concerns. Beach levels have undergone variable change to the north of the river, and generally lowered to the south of the river. The profiles present no cause for concern.
- At Blyth South Beach, the profiles range in level compared to previous surveys, however they the seaward edge of Meggies Burn is at its highest level recorded. The profiles present no causes for concern. There is known to be an issue with the channel of Meggies Burn extending across the foreshore and in places undermining the beach groyne, although this is best observed from analysis of the Cell 1 aerial photography, rather than from the profile surveys.

## **Appendices**

# Appendix A

## Beach Profiles

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

Code	Description
S	Sand
M	Mud
G	Gravel
GS	Gravel & Sand
MS	Mud & Sand
B	Boulders
R	Rock
SD	Sea Defence
SM	Saltmarsh
W	Water Body
GM	Gravel & Mud
GR	Grass
D	Dune (non-vegetated)
DV	Dune (vegetated)
F	Forested
X	Mixture
FB	Obstruction
CT	Cliff Top
CE	Cliff Edge
CF	Cliff Face
SH	Shell
ZZ	Unknown



# Beach Profile

Location: 1aBTBC01

Date: 25/08/2021 Inspector: AG

Low Tide:

Low Tide Time:

Wind

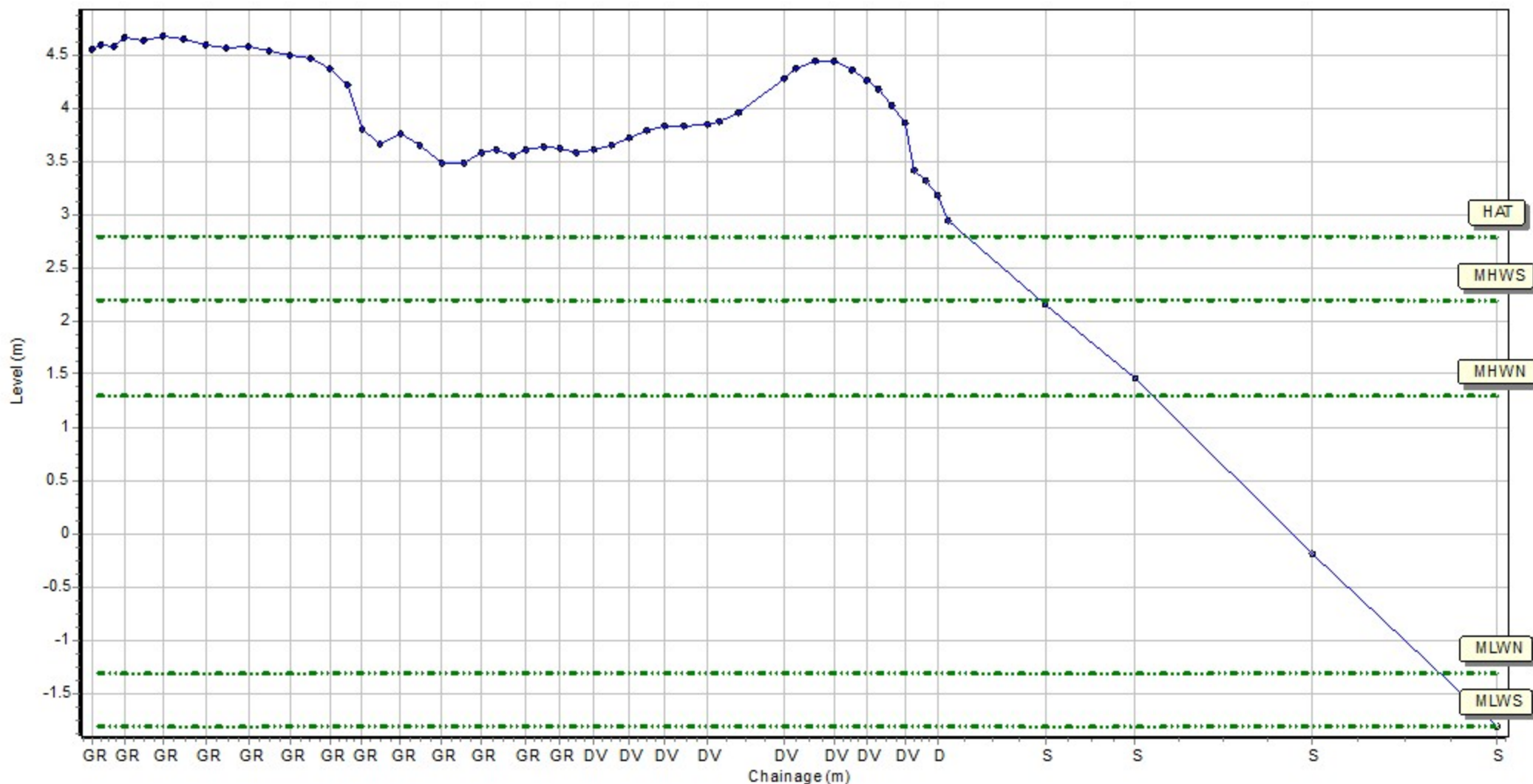
Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 400275.192 Northing: 651875.262 Profile Bearing: 347 ° from North



# Beach Profile

Location: 1aBTBC02

Date: 25/08/2021 Inspector: AG

Low Tide:

Low Tide Time:

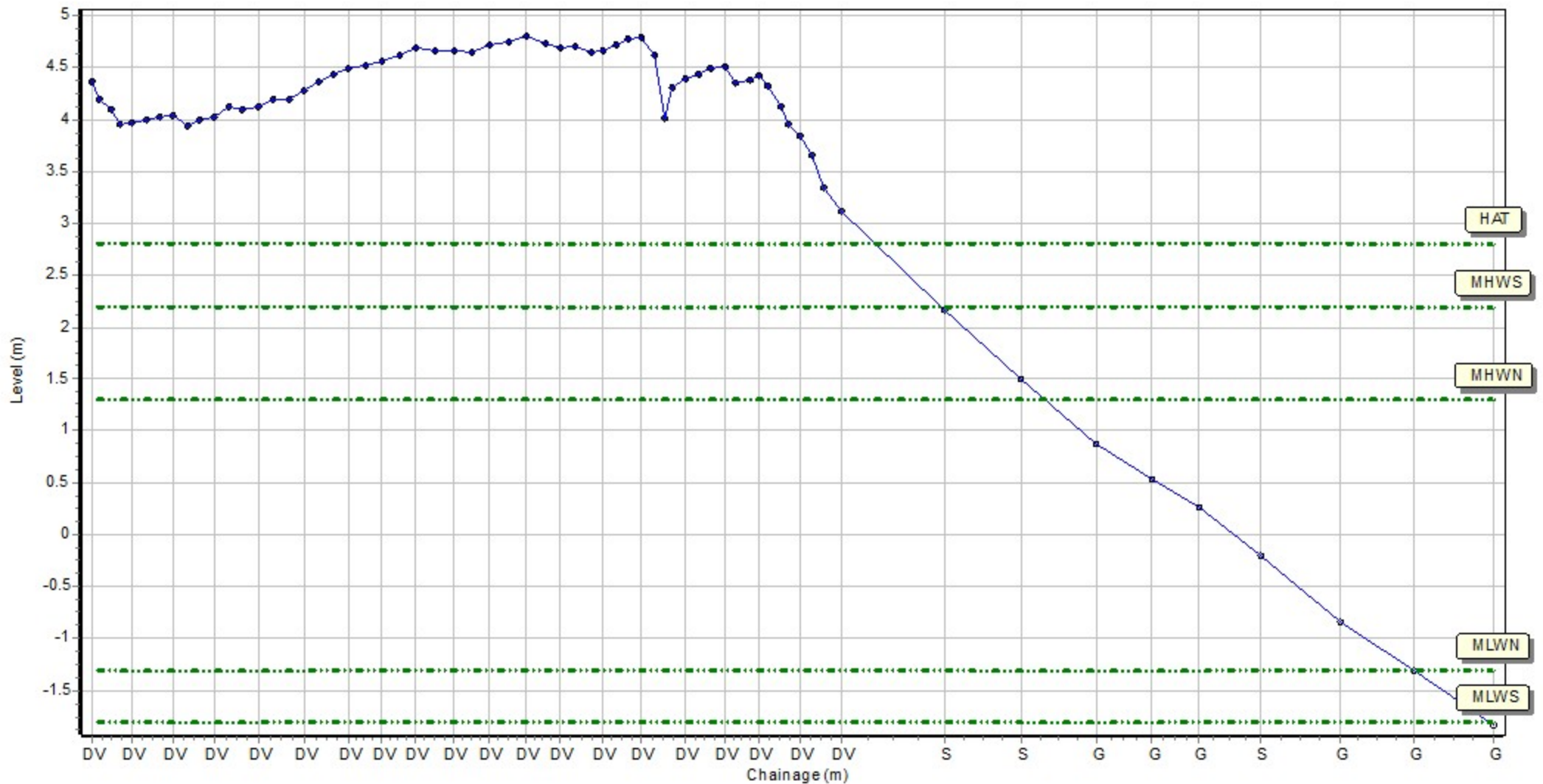
Wind Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 400388.132 Northing: 651916.302 Profile Bearing: 334 ° from North



# Beach Profile

Location: 1aBTBC03

Date: 25/08/2021 Inspector: AG

Wind Sea State:

Low Tide:

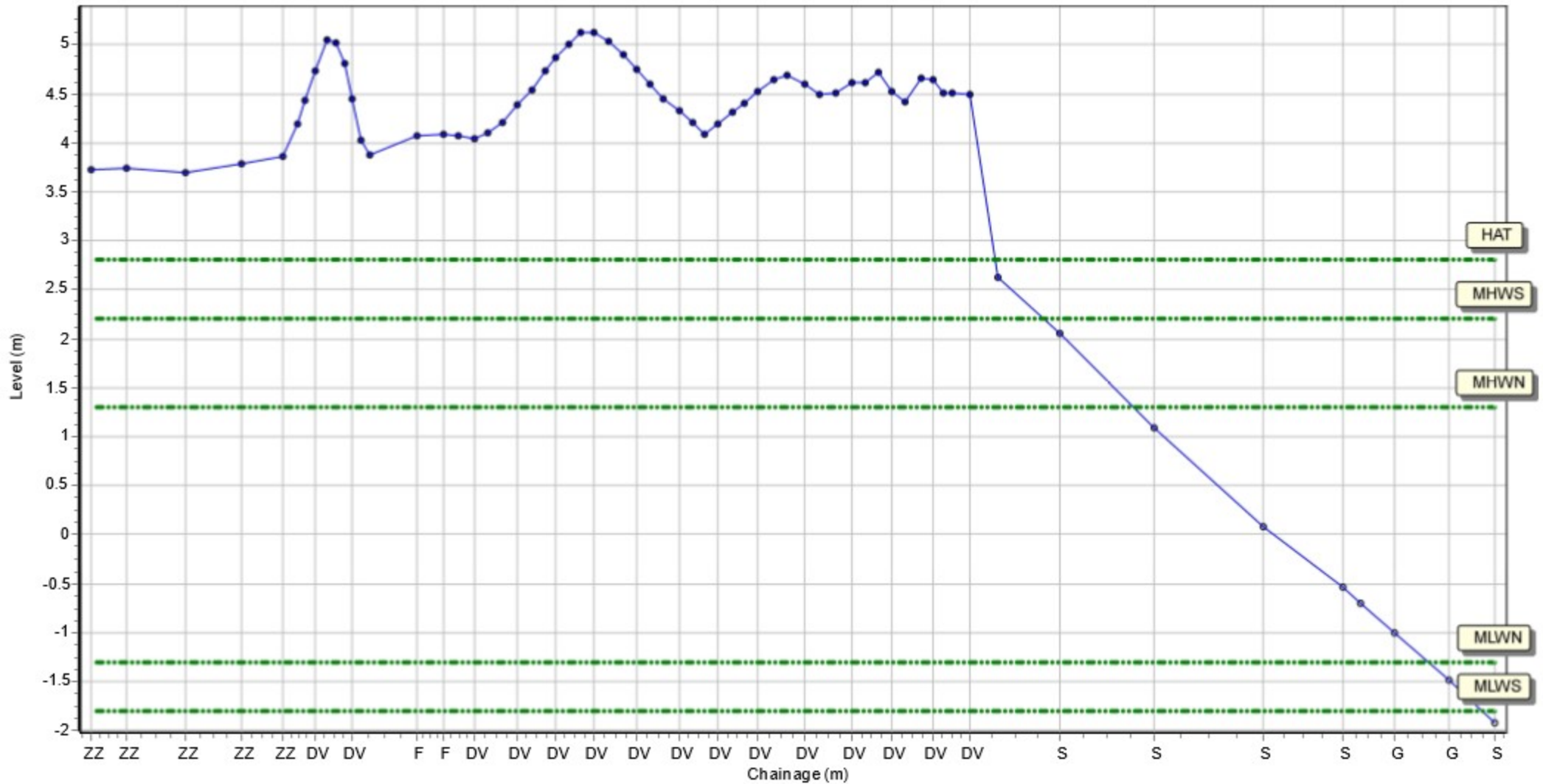
Low Tide Time:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 400455.187 Northing: 651937.742 Profile Bearing: 330 ° from North







# Beach Profile

Location: 1aBTBC05

Date: 25/08/2021

Inspector: AG

Low Tide:

Low Tide Time:

Wind

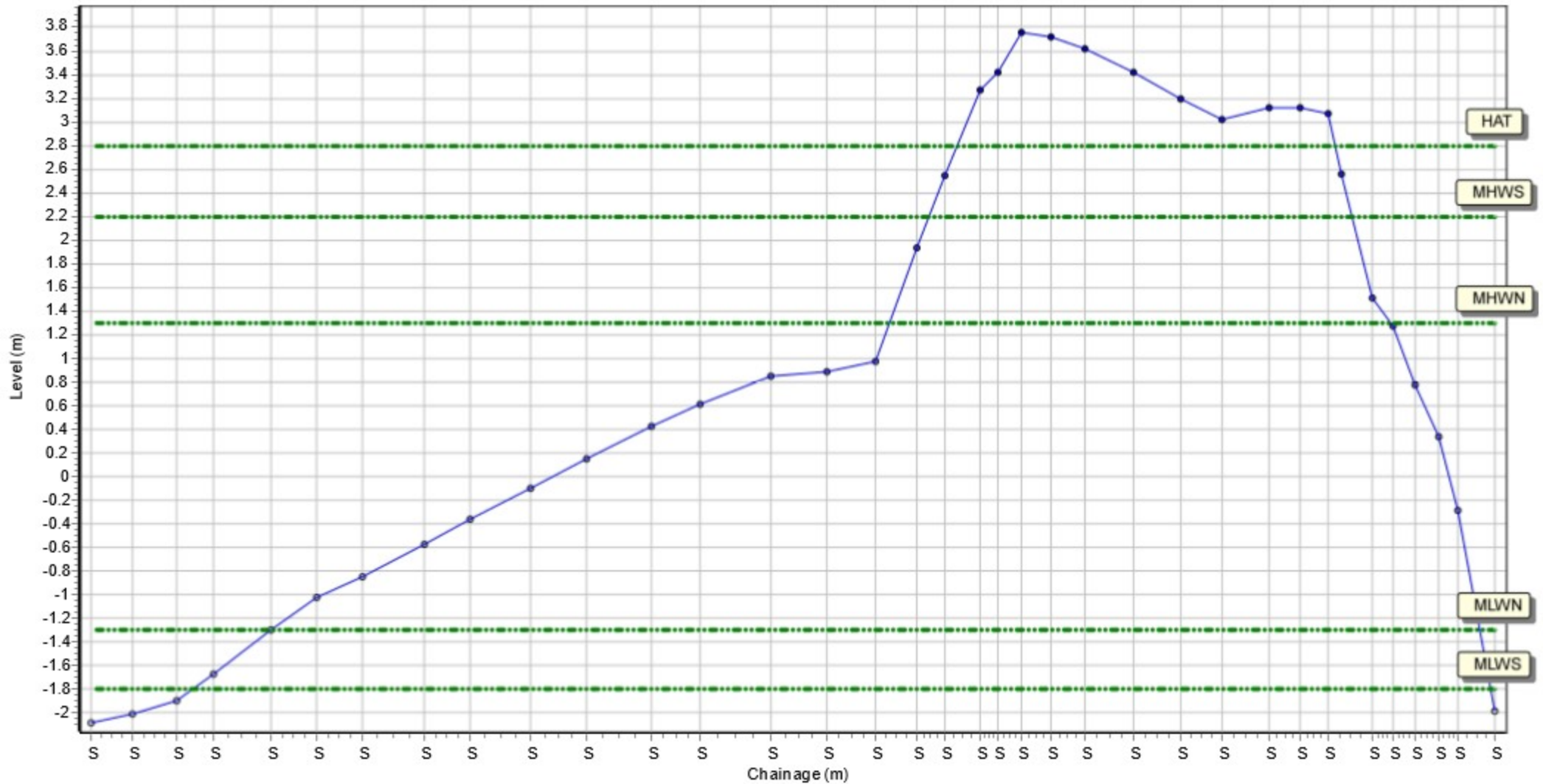
Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 400678.665 Northing: 651969.27 Profile Bearing: 298 ° from North





# Beach Profile

Location: 1aBTBC06

Date: 25/08/2021 Inspector: AG

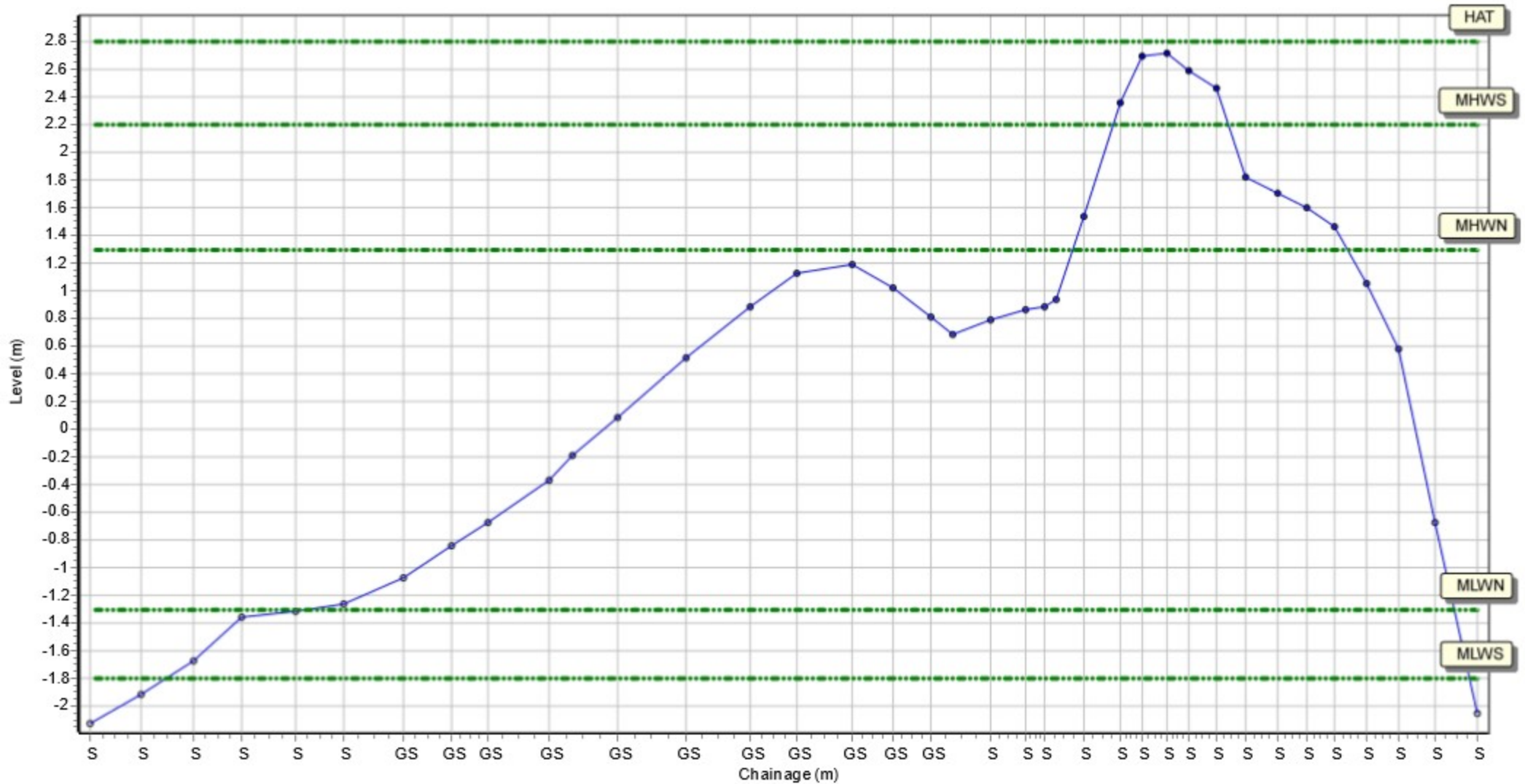
Low Tide: Low Tide Time:

Wind Sea State:

Visibility: Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 400825.582 Northing: 652135.224 Profile Bearing: 295 ° from North



# Beach Profile

Location: 1aBTBC07

Date: 25/08/2021 Inspector: AG

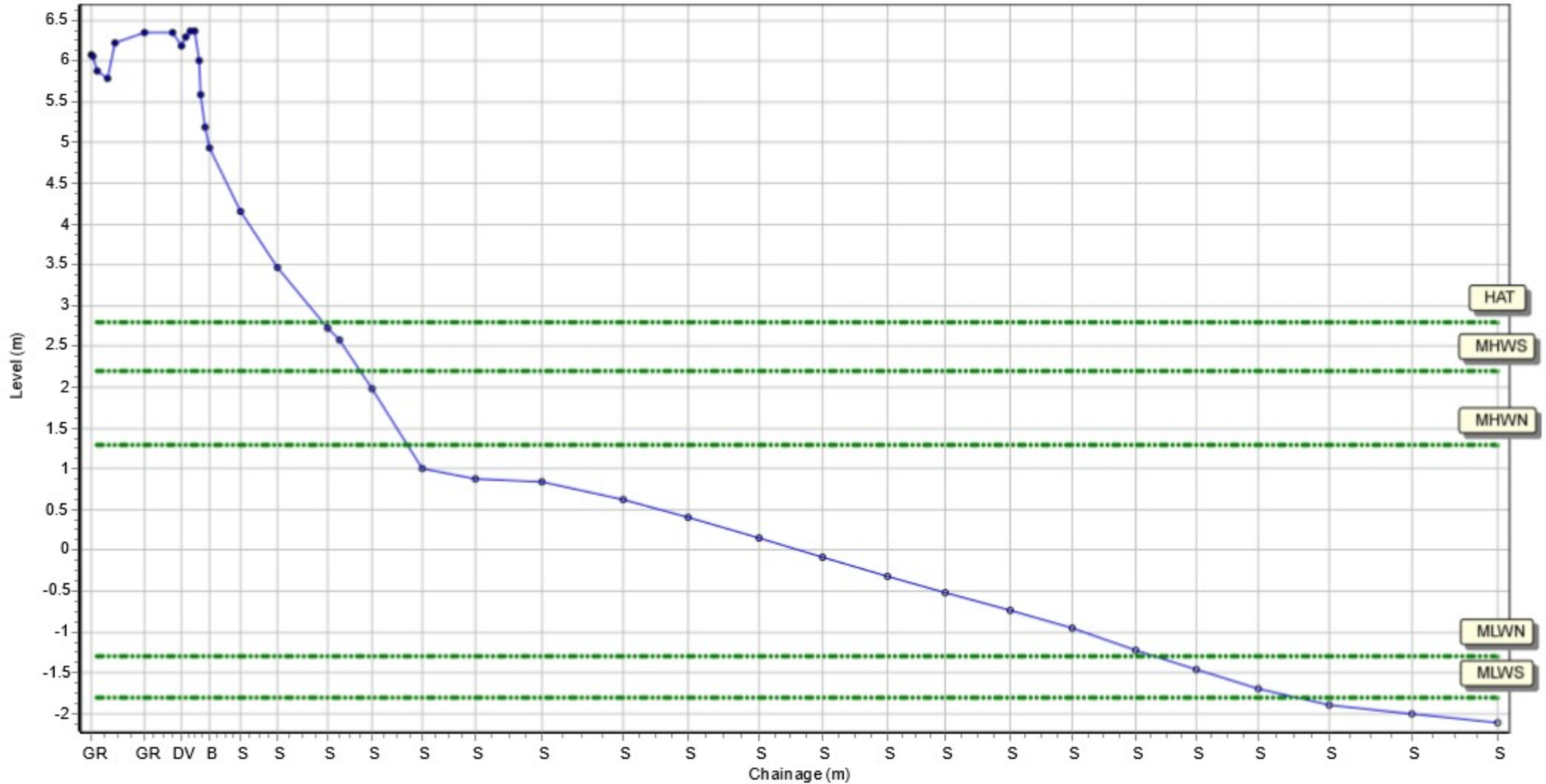
Wind Sea State:

Low Tide: Low Tide Time:

Visibility: Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 400559.428 Northing: 651953.804 Profile Bearing: 67 ° from North



# Beach Profile

Location: 1aBTBC08

Date: 25/08/2021

Inspector: AG

Low Tide:

Low Tide Time:

Wind

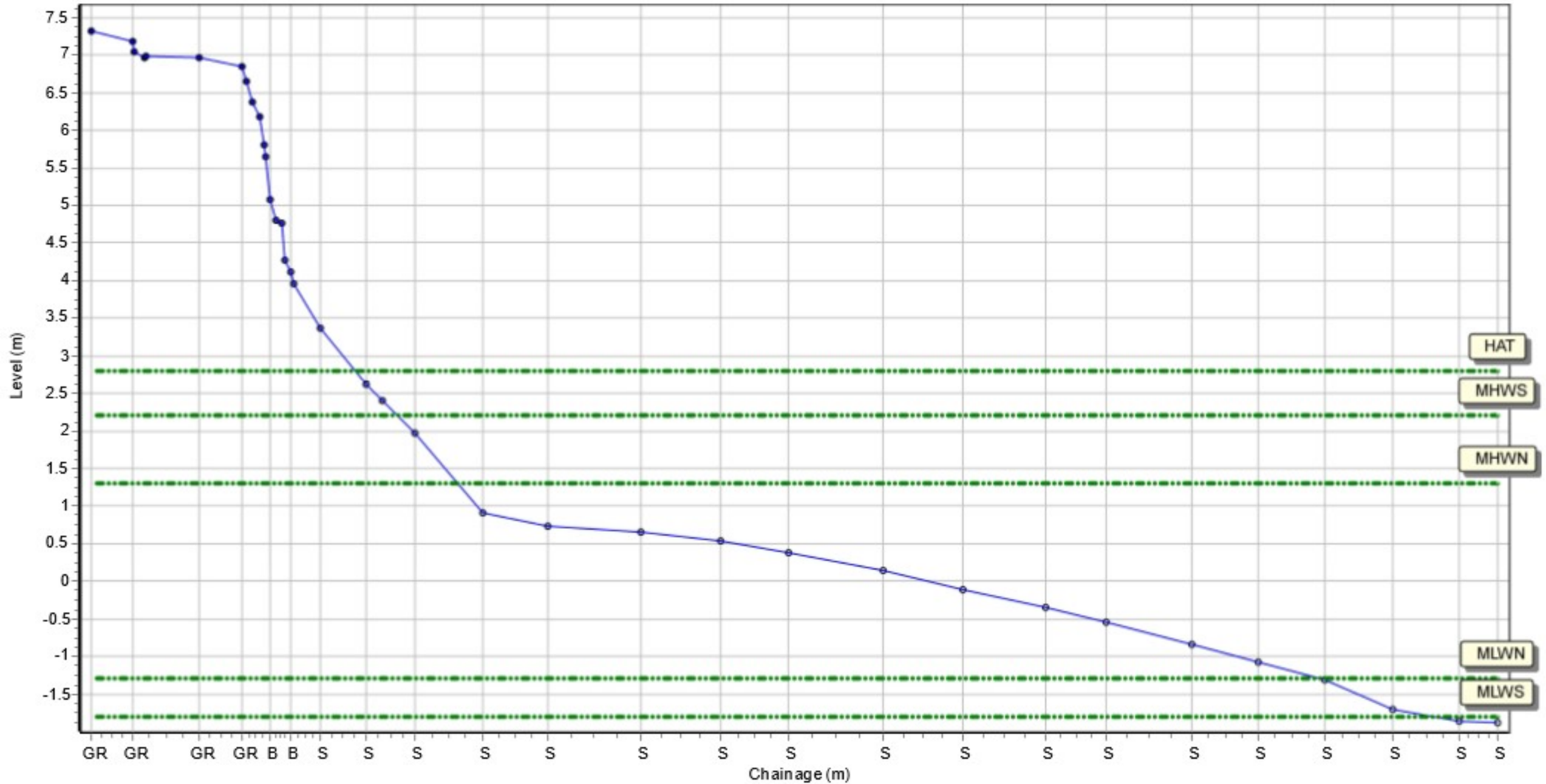
Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 400568.995 Northing: 651908.786 Profile Bearing: 68 ° from North



# Beach Profile

Location: 1aBTBC09

Date: 25/08/2021

Inspector: AG

Low Tide:

Low Tide Time:

Wind

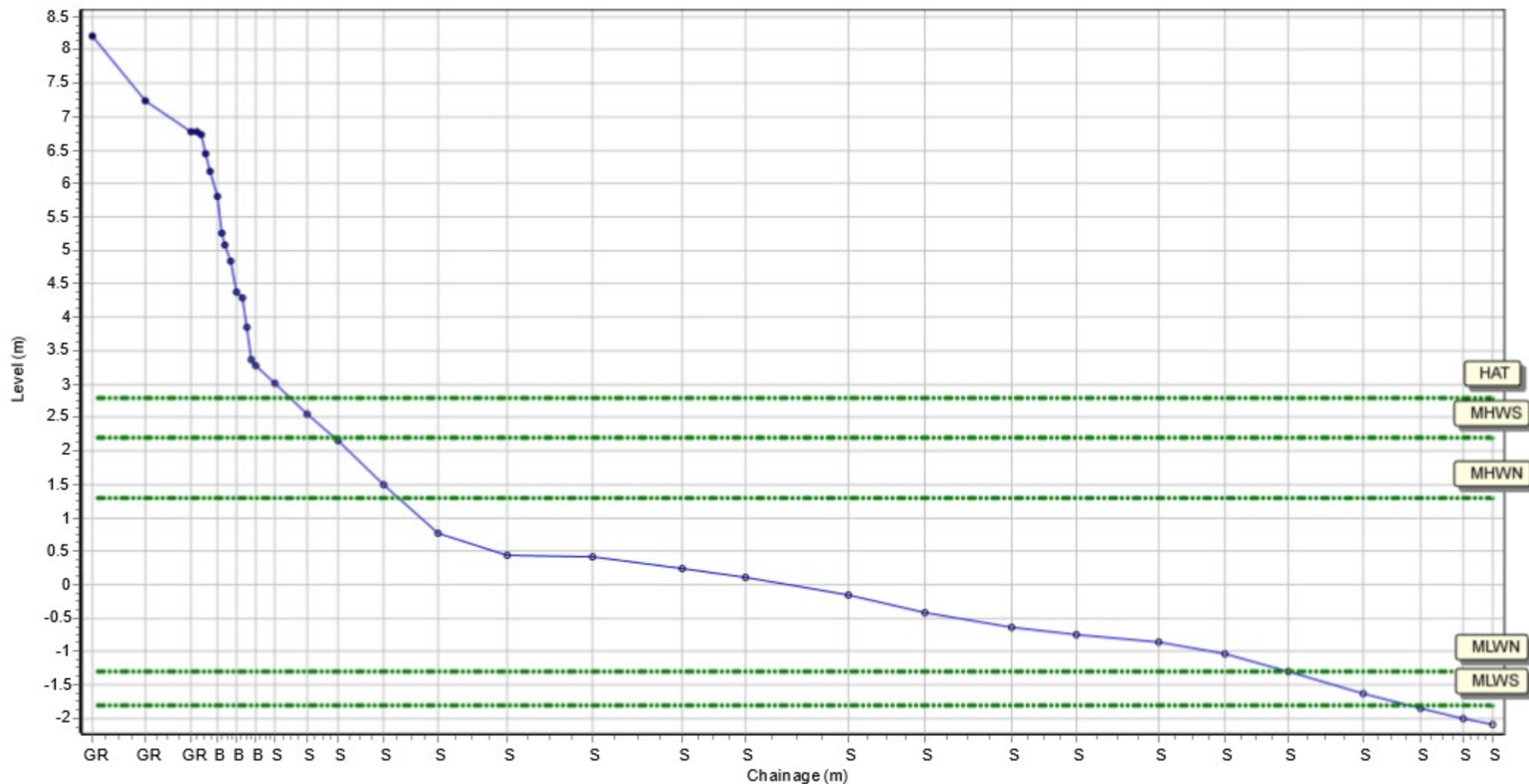
Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 400587.135 Northing: 651868.576 Profile Bearing: 70 ° from North





# Beach Profile

Location: 1aBTBC10

Date: 25/08/2021 Inspector: AG

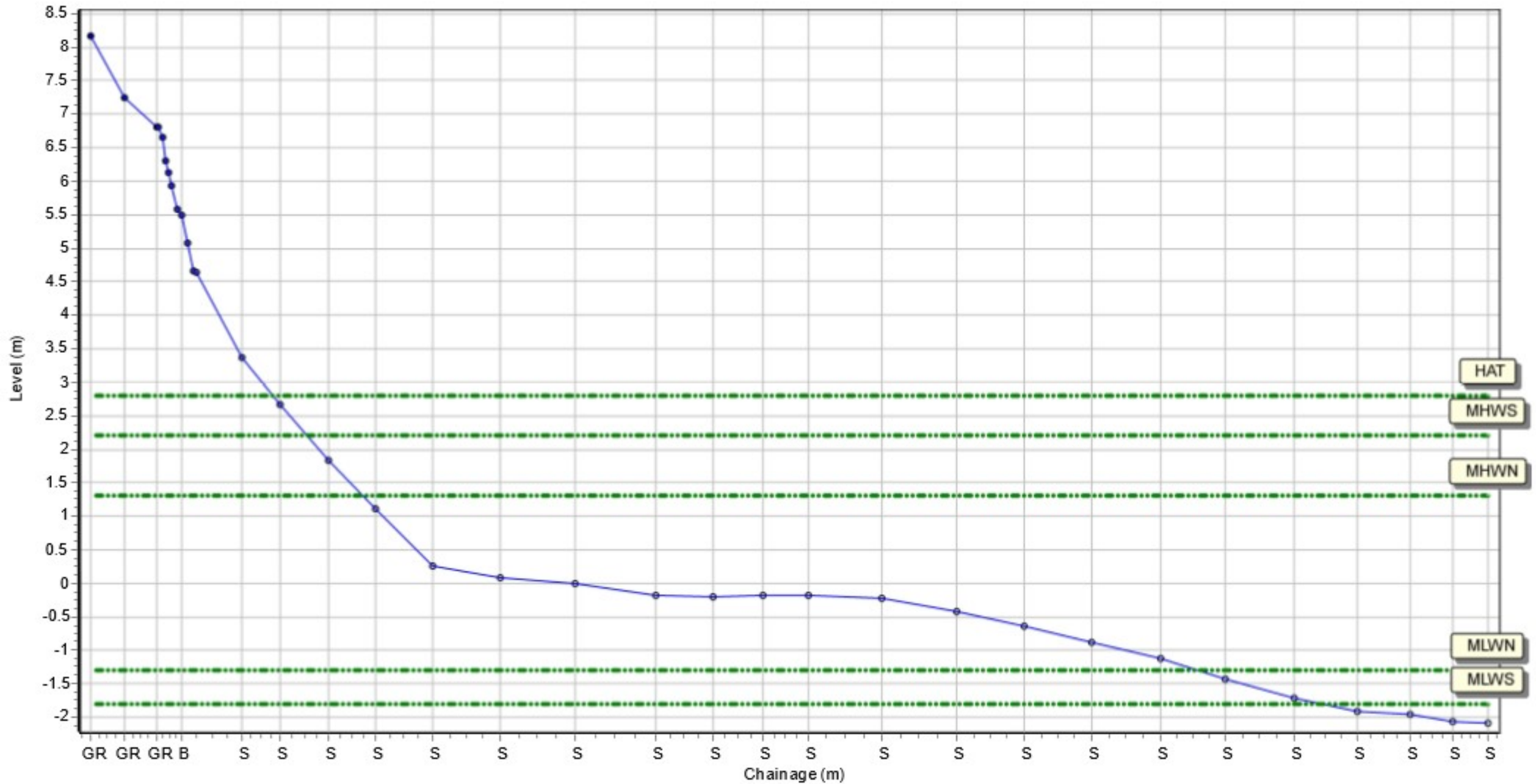
Wind Sea State:

Low Tide: Low Tide Time:

Visibility: Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 400603.233 Northing: 651816.609 Profile Bearing: 69 ° from North





# Beach Profile

Location: 1aBTBC11

Date: 25/08/2021 Inspector: AG

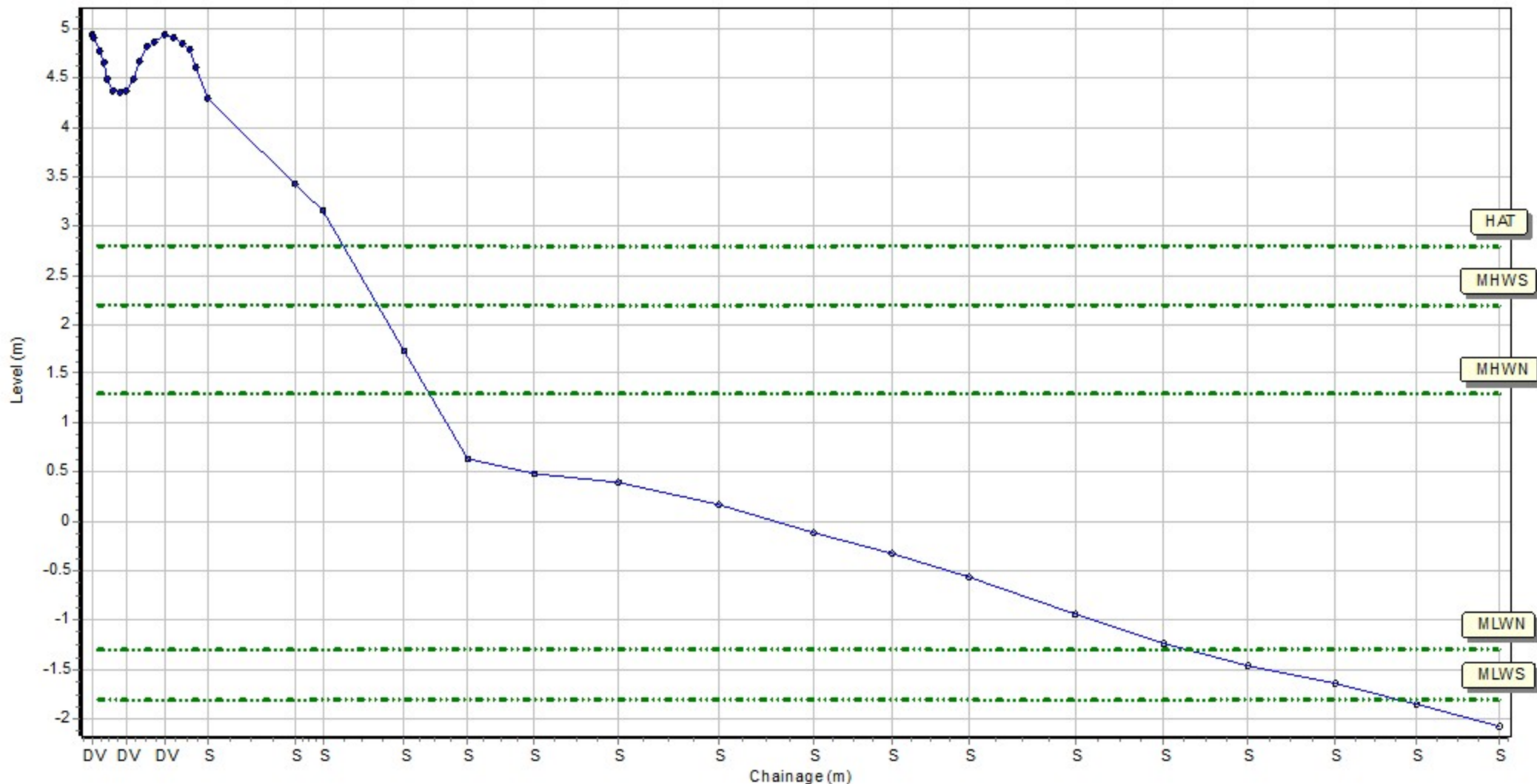
Wind Sea State:

Low Tide: Low Tide Time:

Visibility: Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 400638.037 Northing: 651699.812 Profile Bearing: 66 ° from North



# Beach Profile

Location: 1aBTBC12

Date: 25/08/2021 Inspector: AG

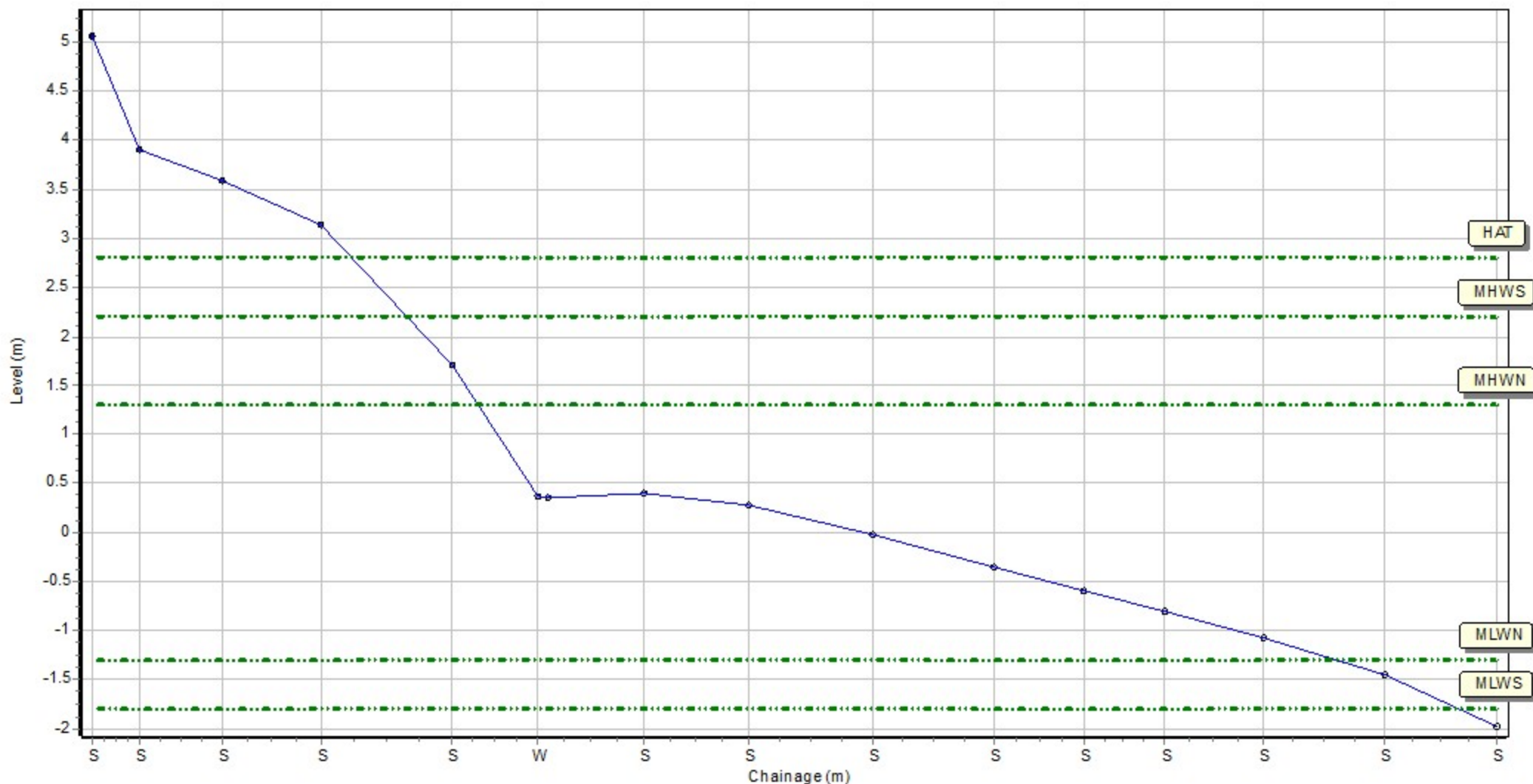
Low Tide: Low Tide Time:

Wind Sea State:

Visibility: Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 400693.518 Northing: 651579.795 Profile Bearing: 63 ° from North



# Beach Profile

Location: 1aBTBC13

Date: 25/08/2021 Inspector: AG

Low Tide:

Low Tide Time:

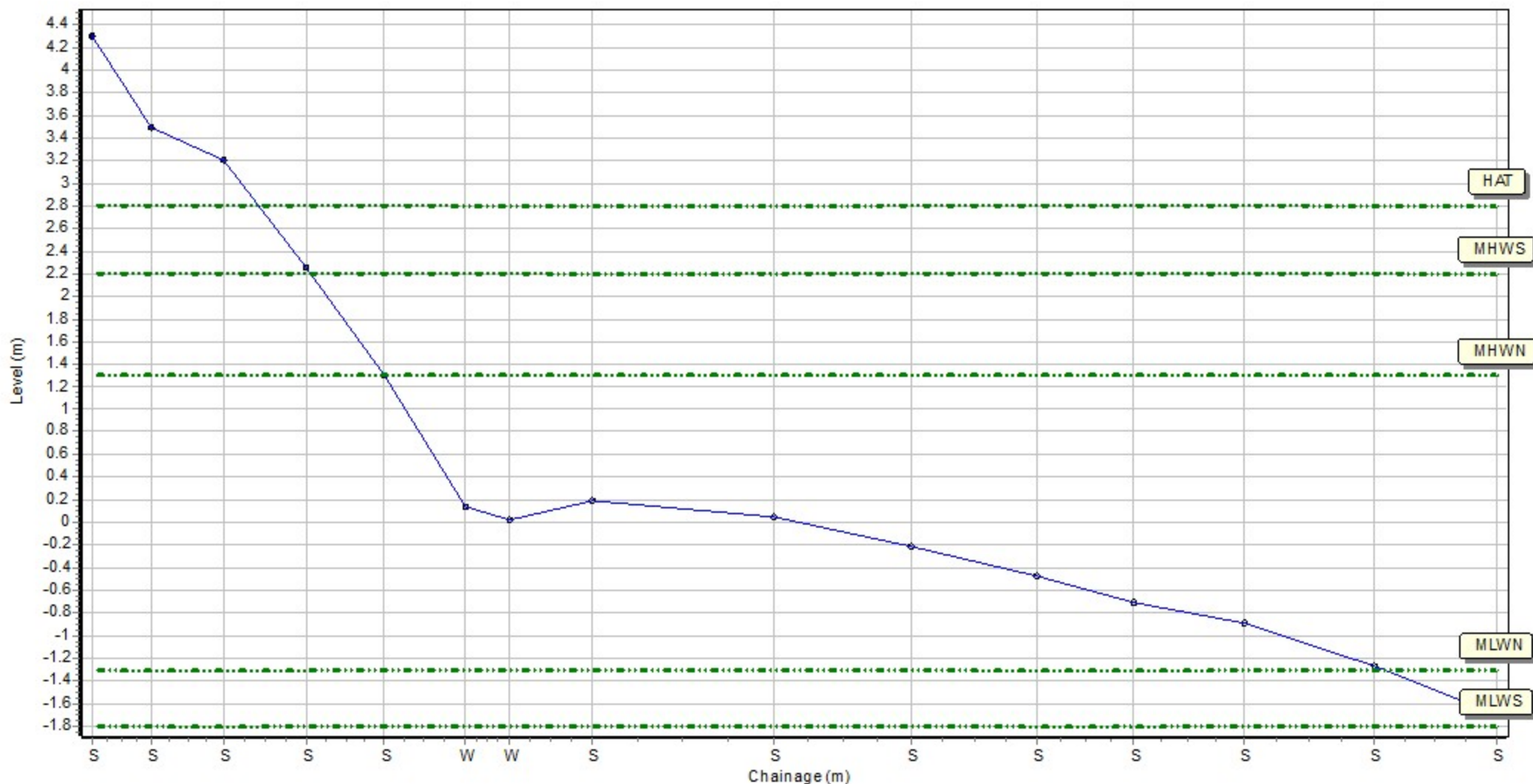
Wind Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 400820.787 Northing: 651312.459 Profile Bearing: 65 ° from North



# Beach Profile

Location: 1aBTBC14

Date: 25/08/2021 Inspector: AG

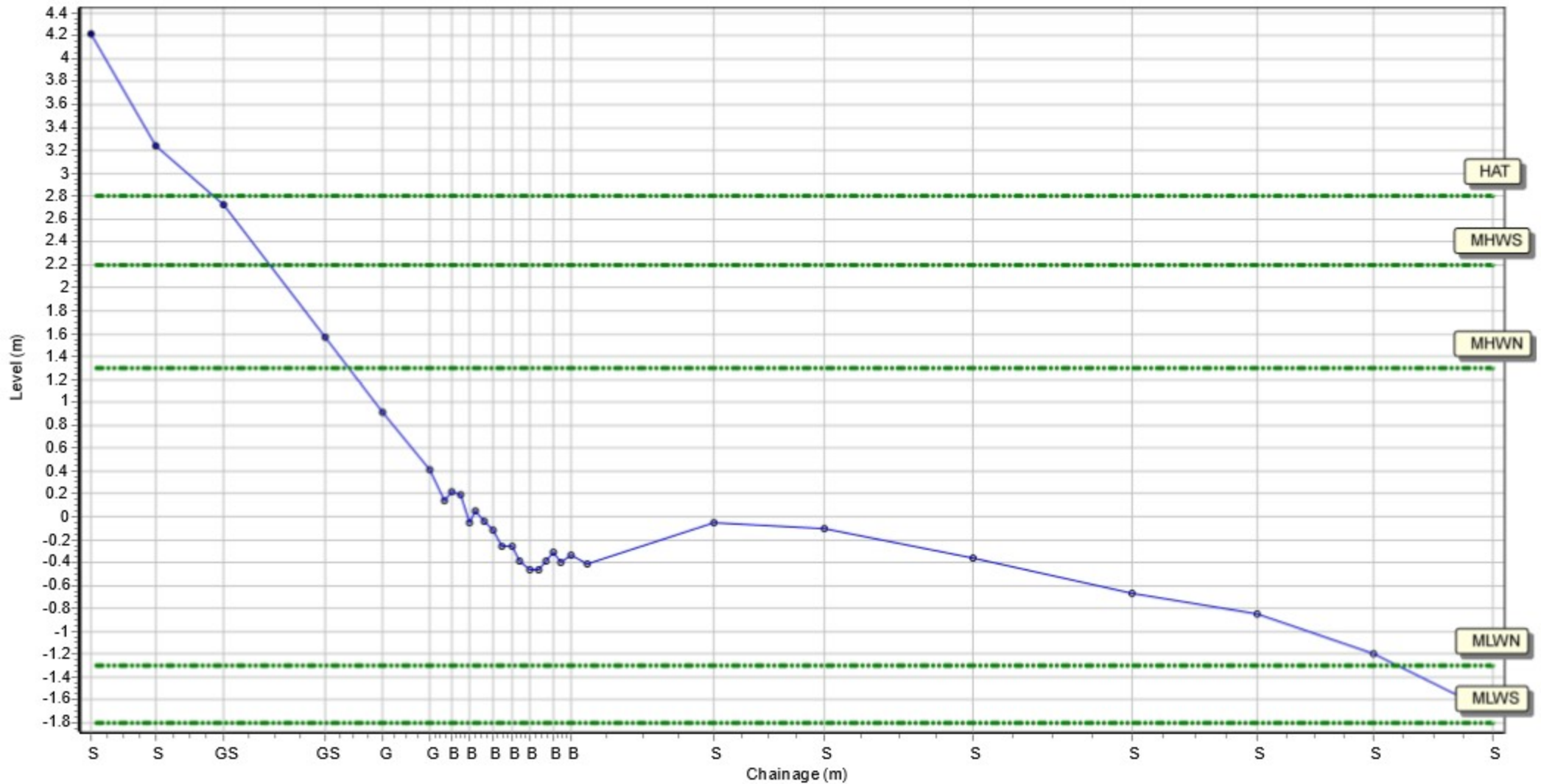
Low Tide: Low Tide Time:

Wind Sea State:

Visibility: Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 401030.513 Northing: 651003.409 Profile Bearing: 60 ° from North



# Beach Profile

Location: 1aBTBC15

Date: 07/09/2021 Inspector: AG

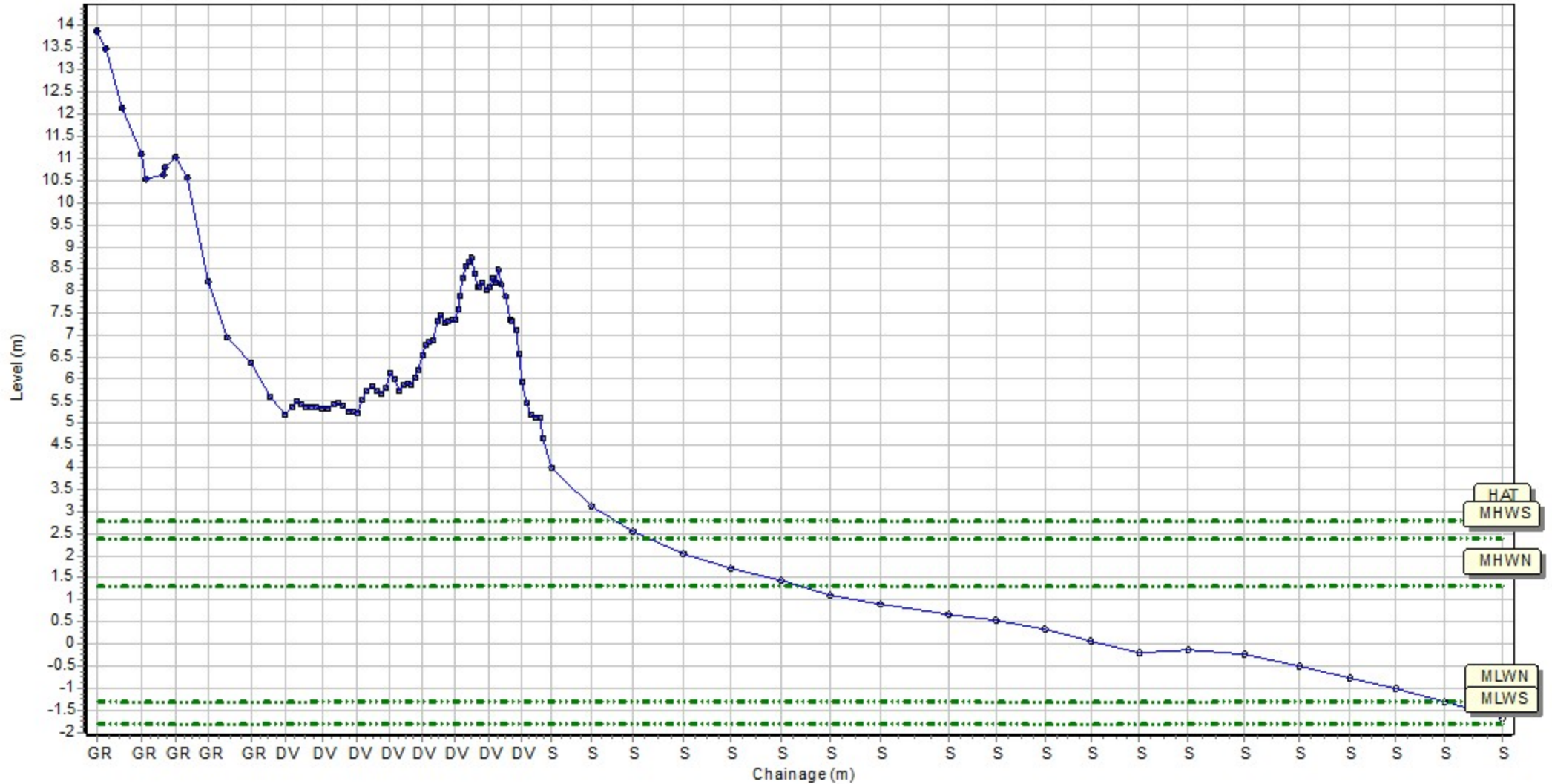
Low Tide: Low Tide Time:

Wind Sea State:

Visibility: Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 402663.736 Northing: 648593.739 Profile Bearing: 40 ° from North





# Beach Profile

Location: 1aBTBC16

Date: 07/09/2021 Inspector: AG

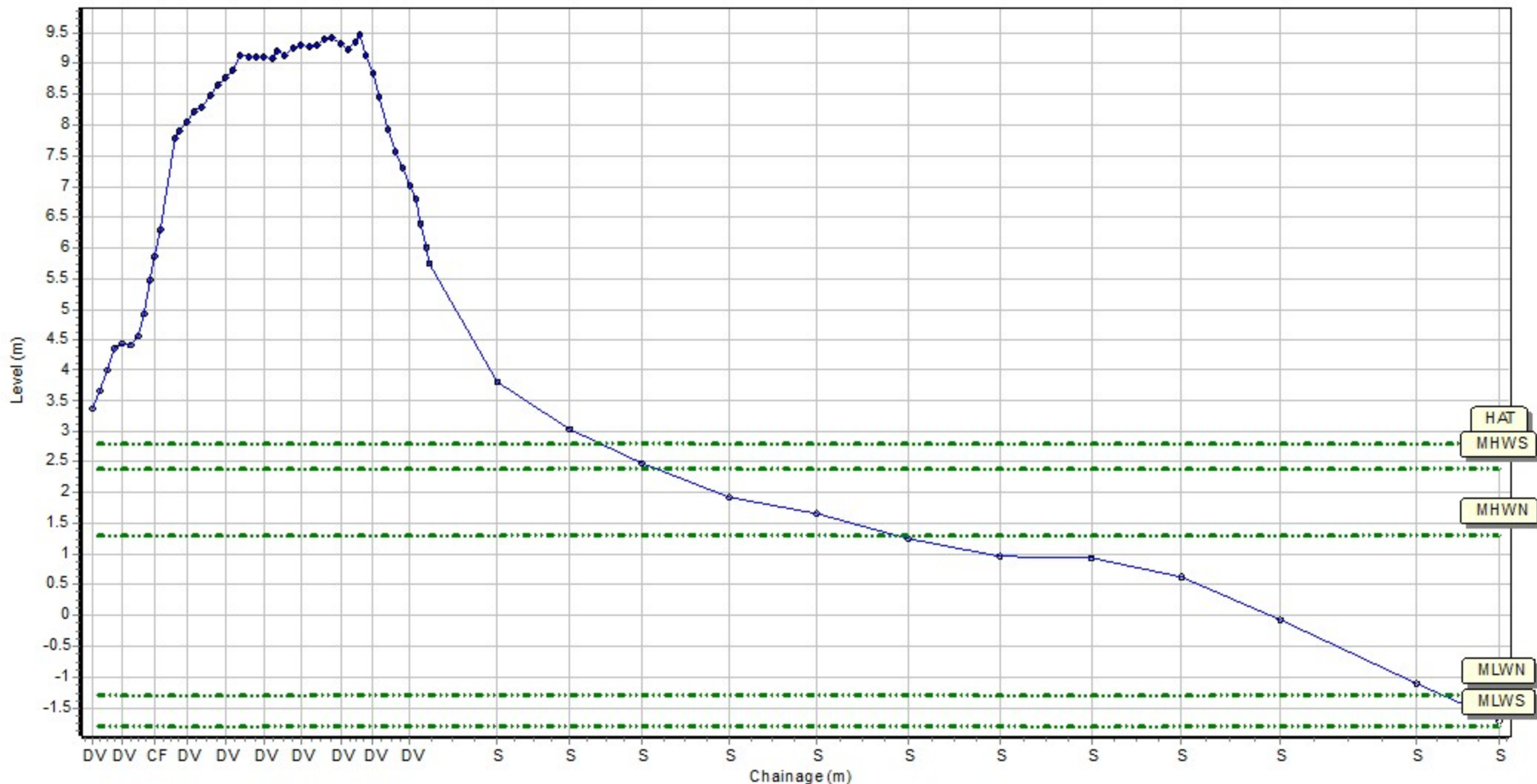
Low Tide: Low Tide Time:

Wind Sea State:

Visibility: Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 403565.671 Northing: 647735.833 Profile Bearing: 53 ° from North



# Beach Profile

Location: 1aBTBC17

Date: 07/09/2021 Inspector: AG

Low Tide:

Low Tide Time:

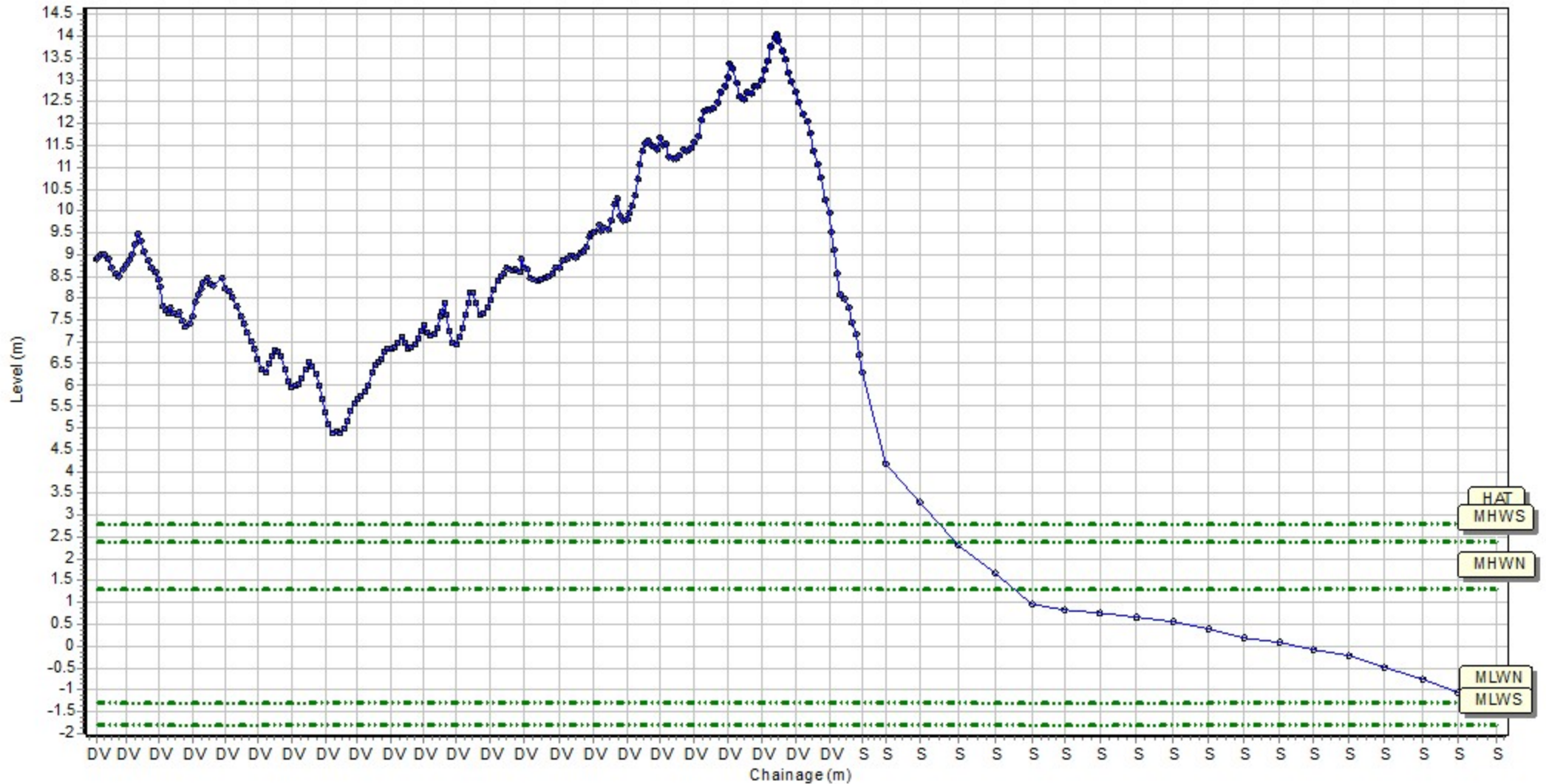
Wind Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 404433.939 Northing: 646713.965 Profile Bearing: 51 ° from North



# Beach Profile

Location: 1aBTBC18

Date: 07/09/2021 Inspector: AG

Low Tide:

Low Tide Time:

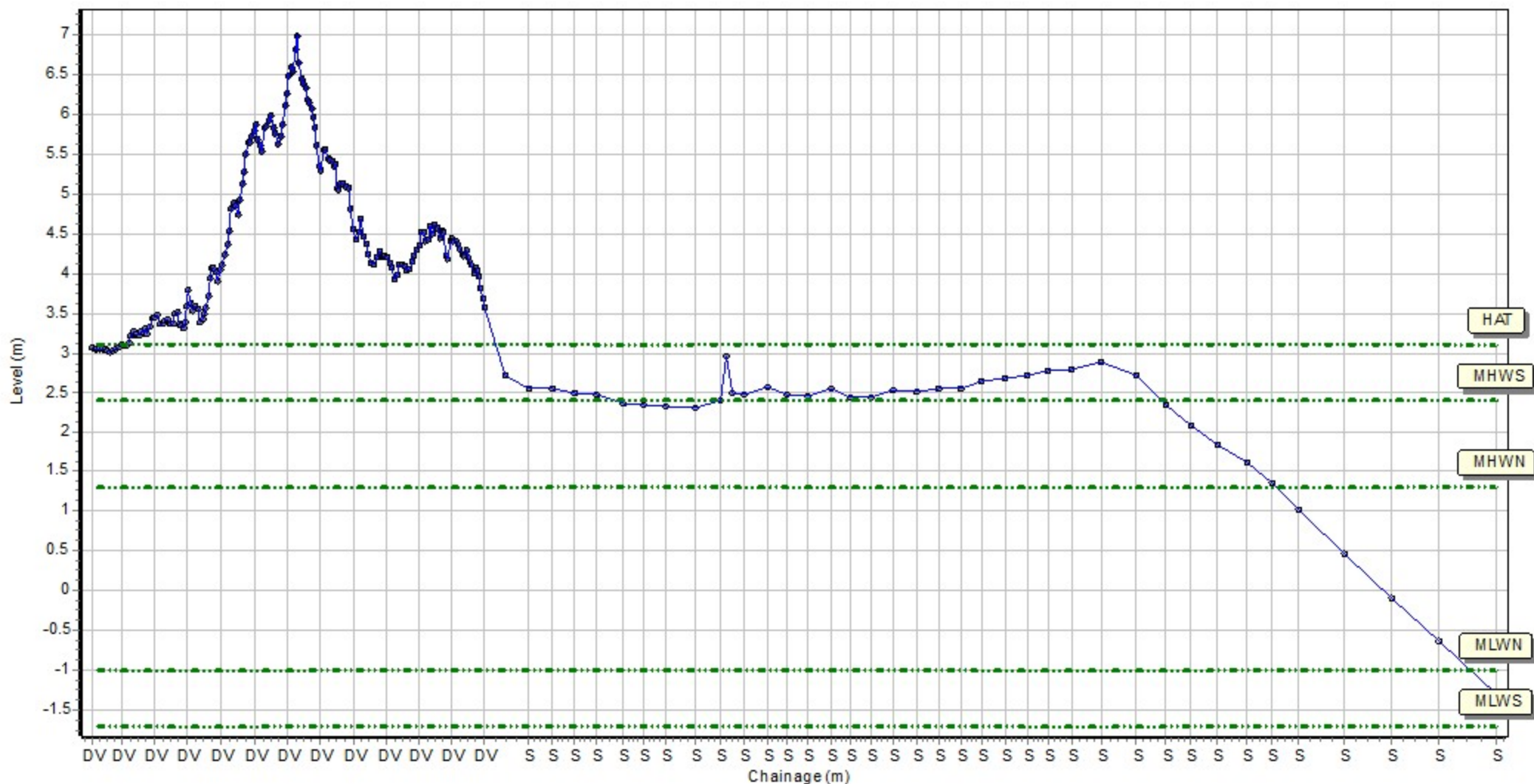
Wind Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 405985.759 Northing: 645466.297 Profile Bearing: 38 ° from North



# Beach Profile

Location: 1aBTBC19

Date: 09/09/2021 Inspector: AG

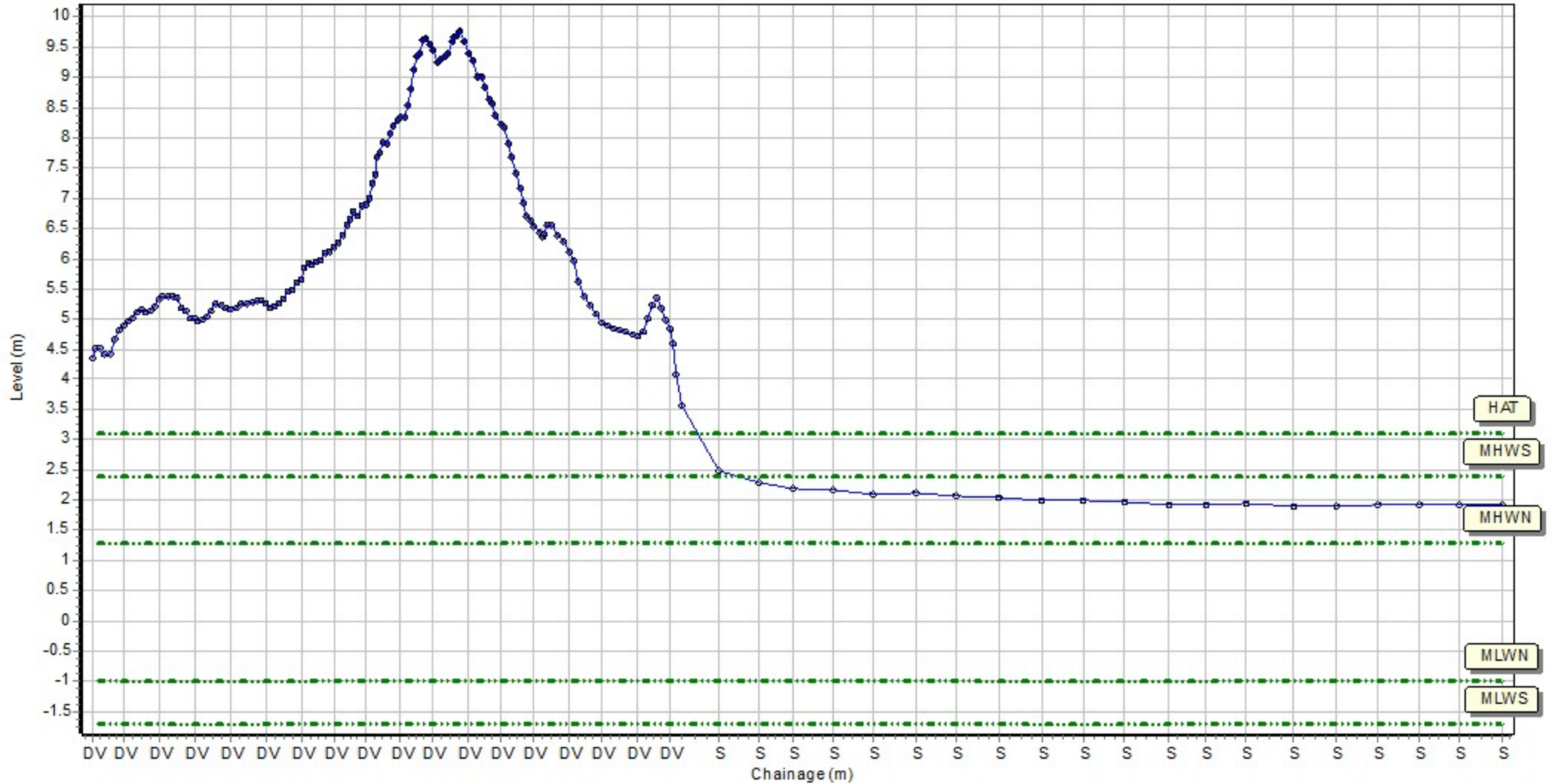
Low Tide: Low Tide Time:

Wind Sea State:

Visibility: Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 407091.566 Northing: 644616.133 Profile Bearing: 34 ° from North









# Beach Profile

Location: 1aBTBC21

Date: 10/09/2021 Inspector: AG

Wind Sea State:

Low Tide:

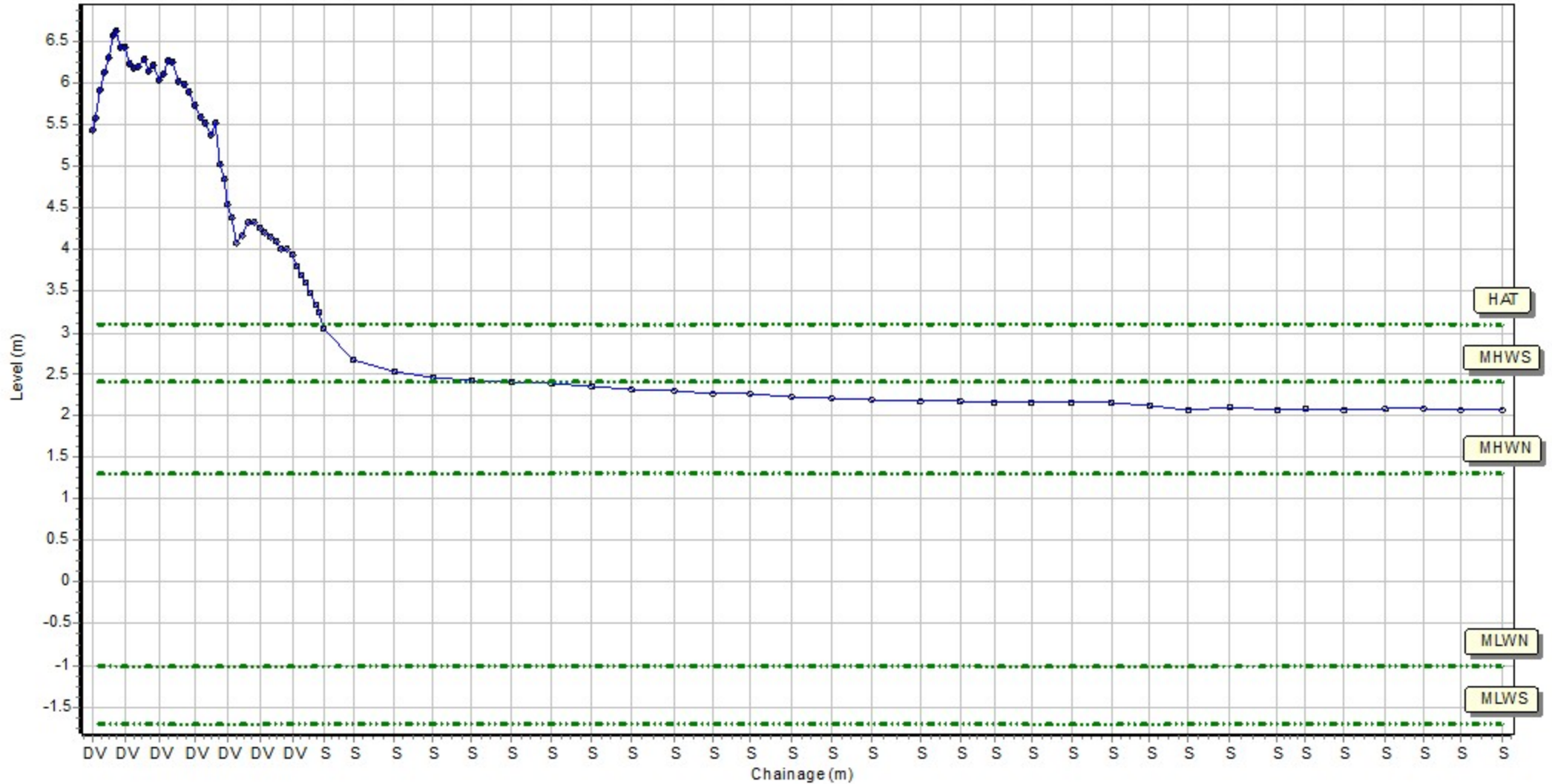
Low Tide Time:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 409501.341 Northing: 643847.61 Profile Bearing: 33 ° from North



# Beach Profile

Location: 1aBTBC22

Date: 10/09/2021 Inspector: AG

Low Tide:

Low Tide Time:

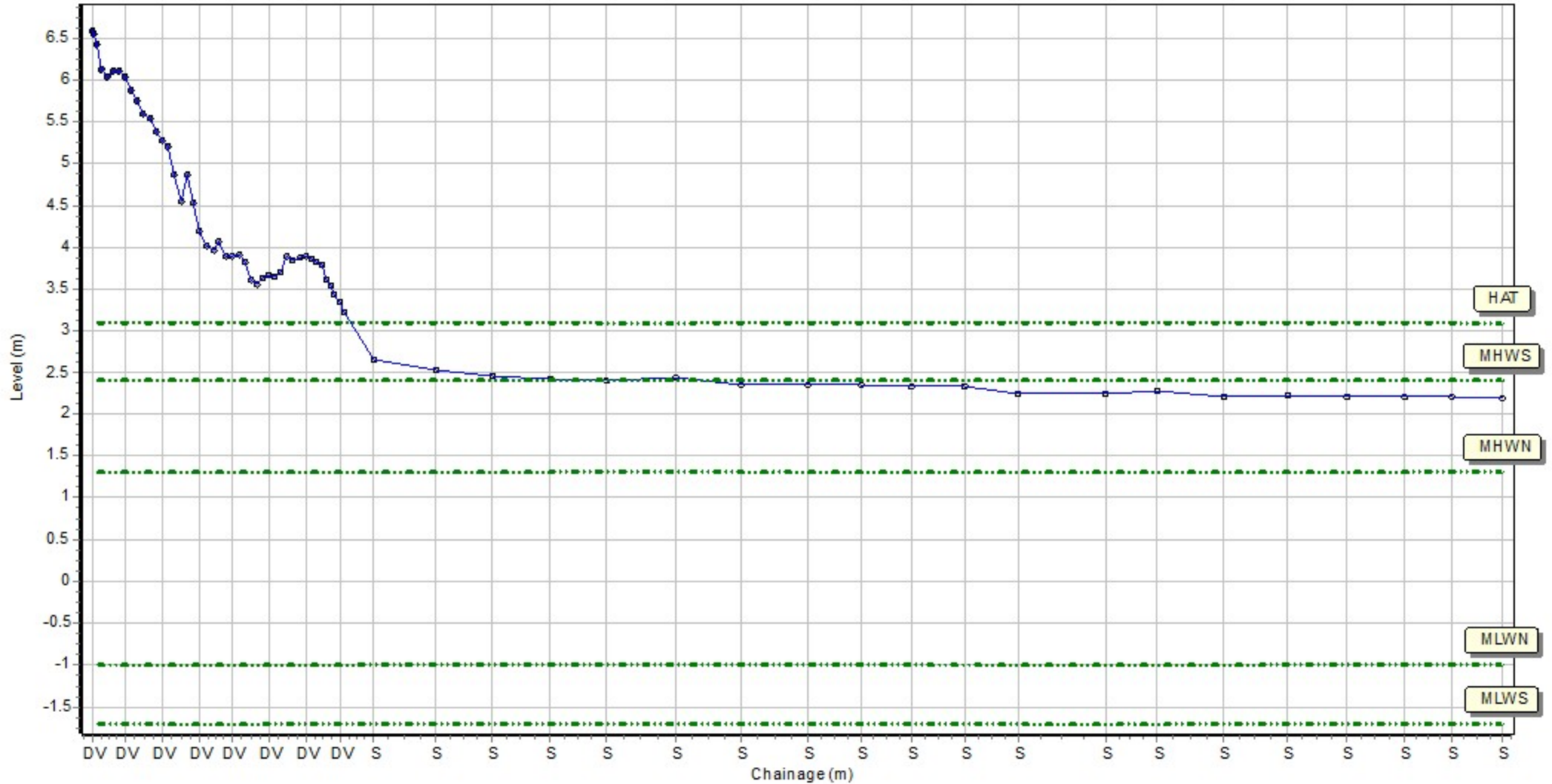
Wind Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 410213.981 Northing: 643697.867 Profile Bearing: 27 ° from North



# Beach Profile

Location: 1aBTBC23

Date: 10/09/2021 Inspector: AG

Wind Sea State:

Low Tide:

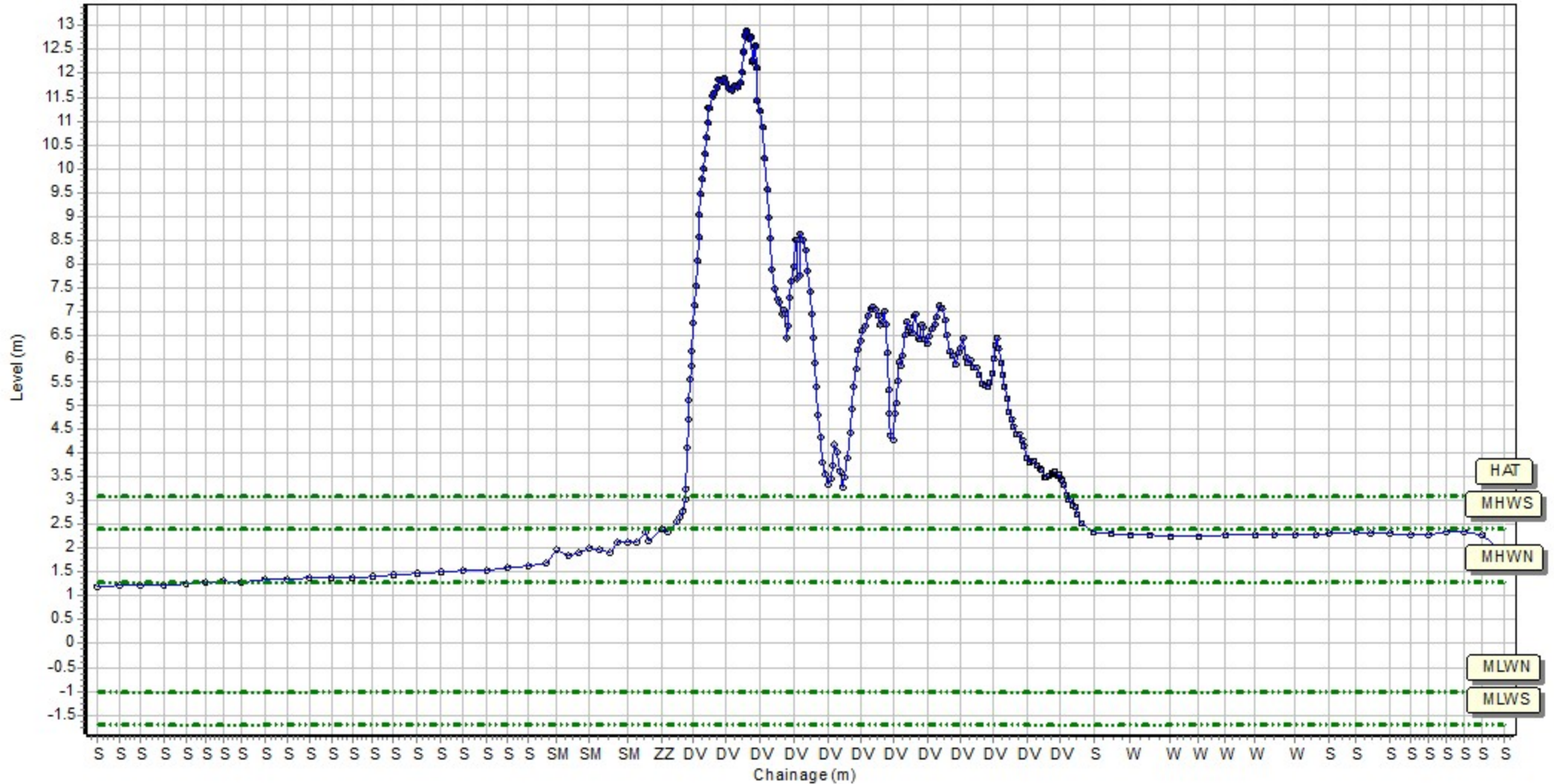
Low Tide Time:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 411084.123 Northing: 643008.731 Profile Bearing: 0 ° from North



# Beach Profile

Location: 1aBTBC24

Date: 10/09/2021 Inspector: AG

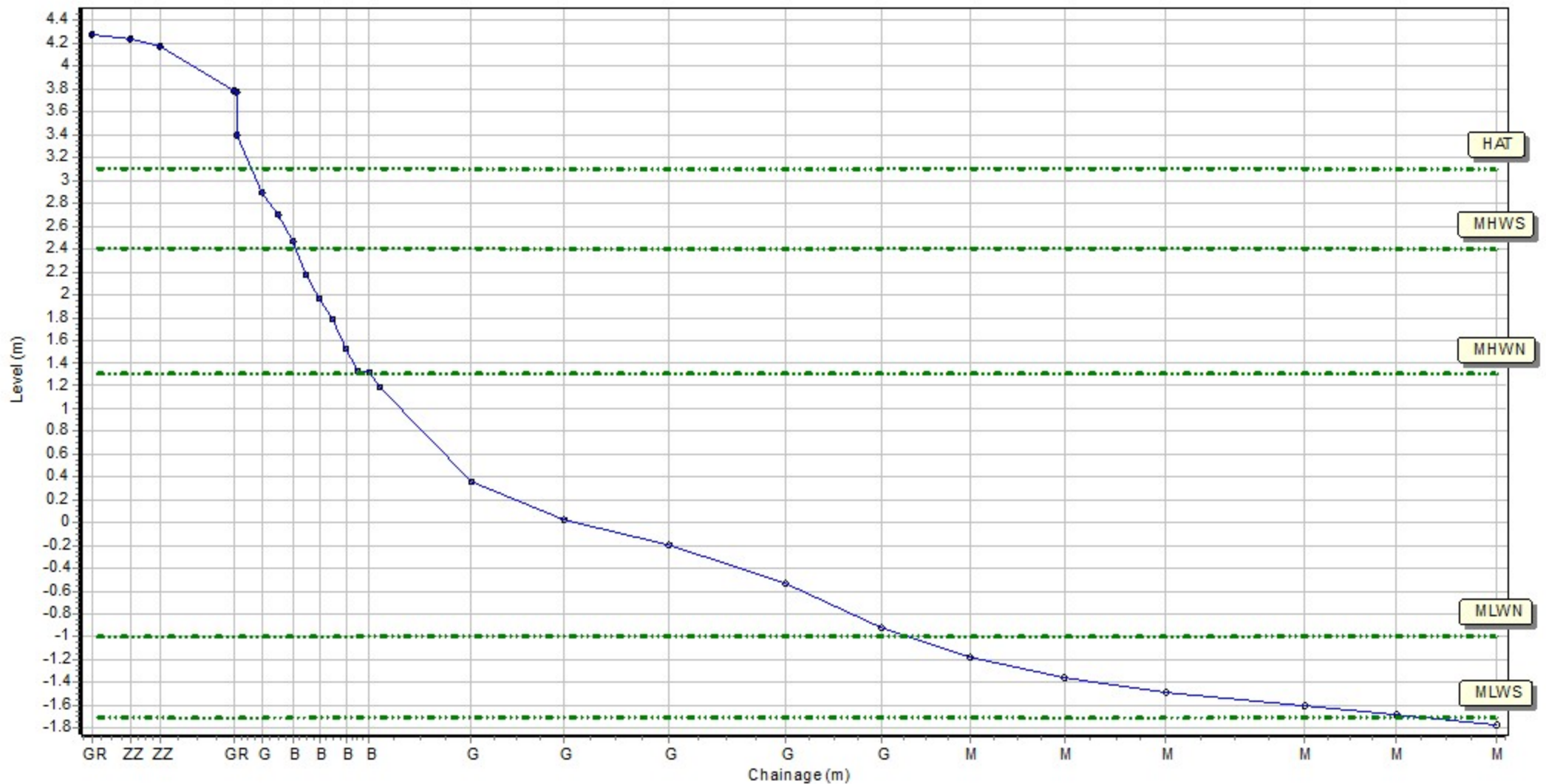
Low Tide: Low Tide Time:

Wind Sea State:

Visibility: Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 413330.108 Northing: 641794.909 Profile Bearing: 227 ° from North









# Beach Profile

Location: 1aBTBC26

Date: 10/09/2021 Inspector: AG

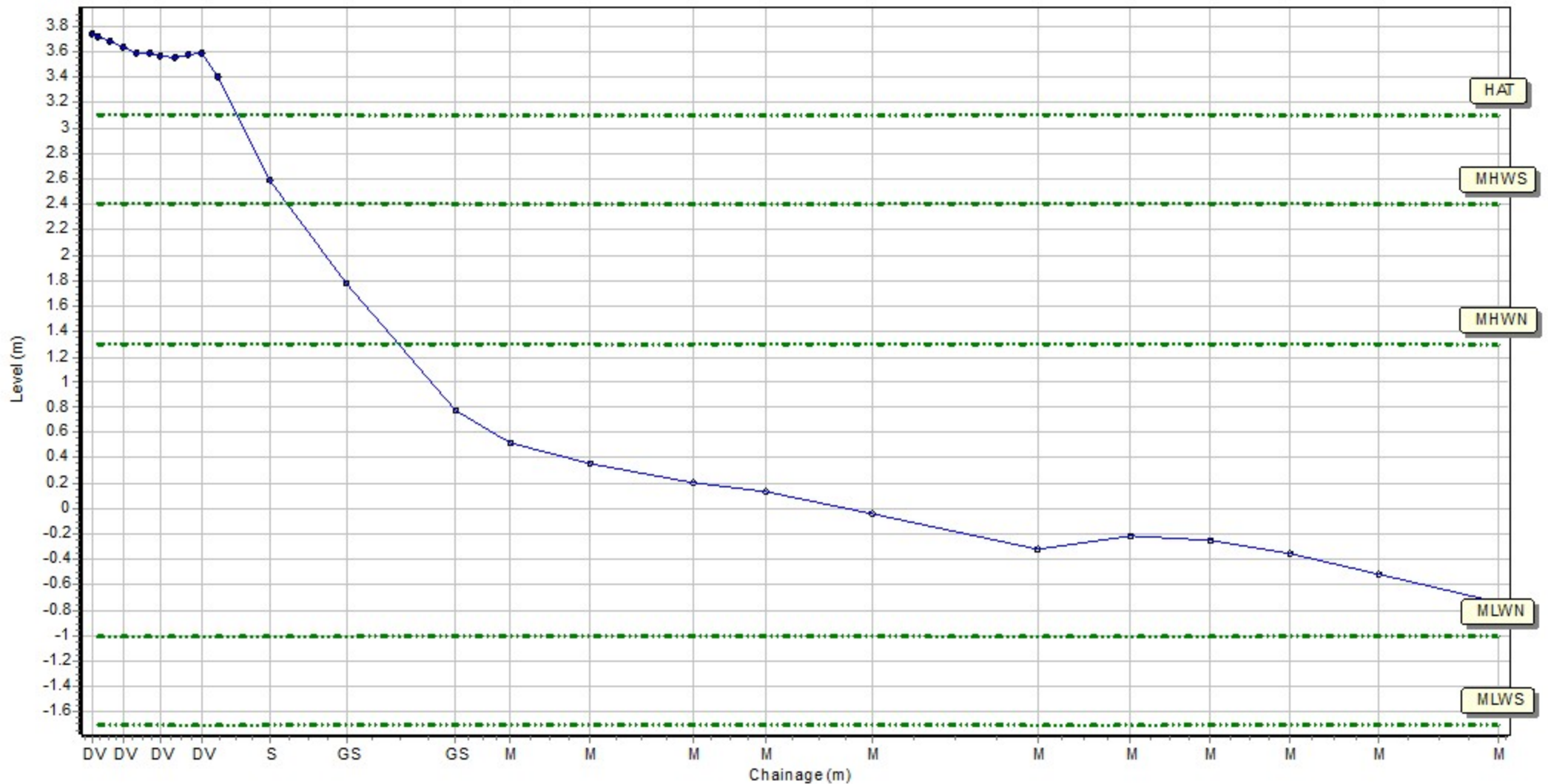
Low Tide: Low Tide Time:

Wind Sea State:

Visibility: Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 412895.322 Northing: 641784.343 Profile Bearing: 122 ° from North



# Beach Profile

Location: 1aBTBC27

Date: 10/09/2021 Inspector: AG

Low Tide:

Low Tide Time:

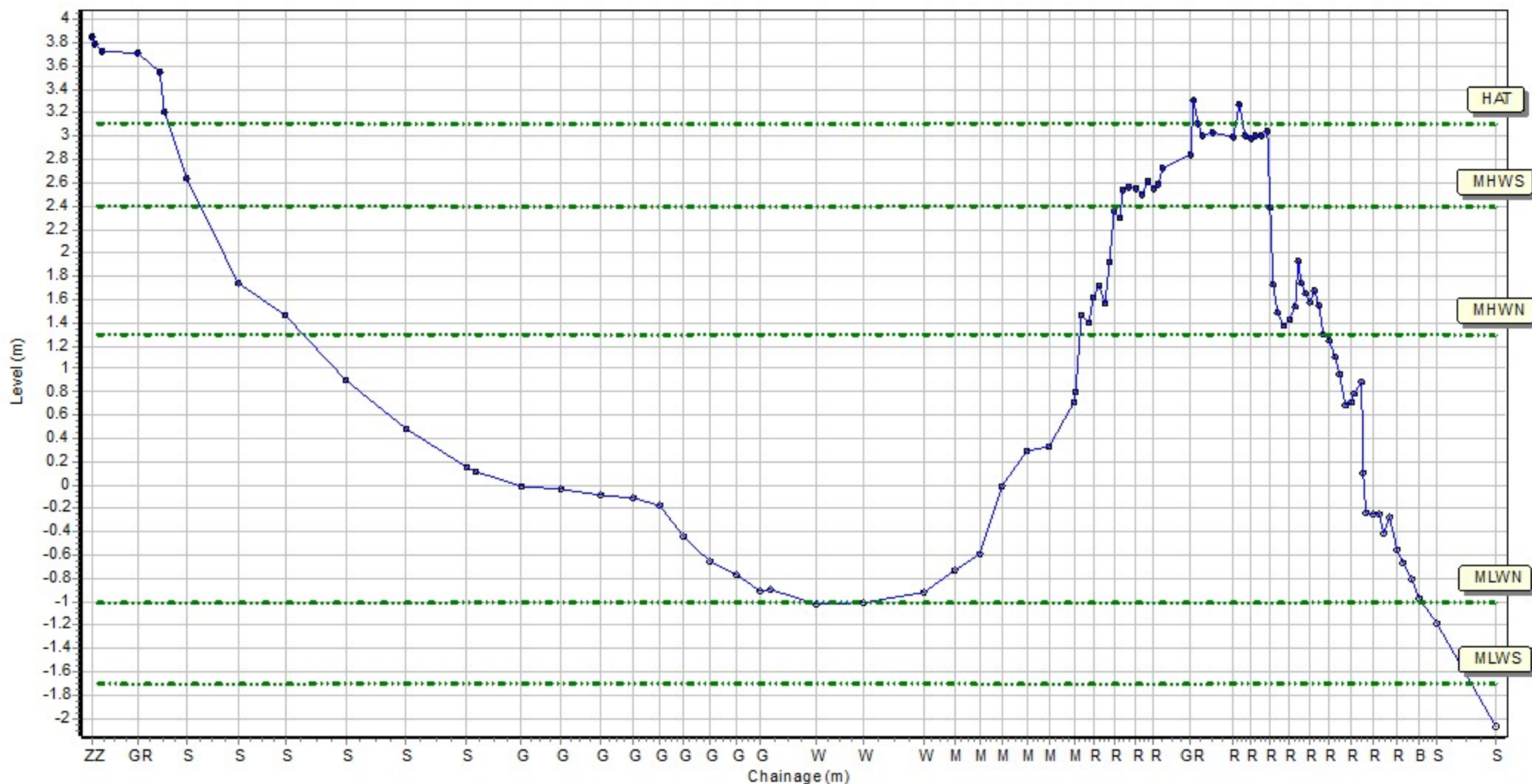
Wind Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 412475.398 Northing: 641733.834 Profile Bearing: 227 ° from North



# Beach Profile

Location: 1aBTBC28

Date: 10/09/2021 Inspector: AG

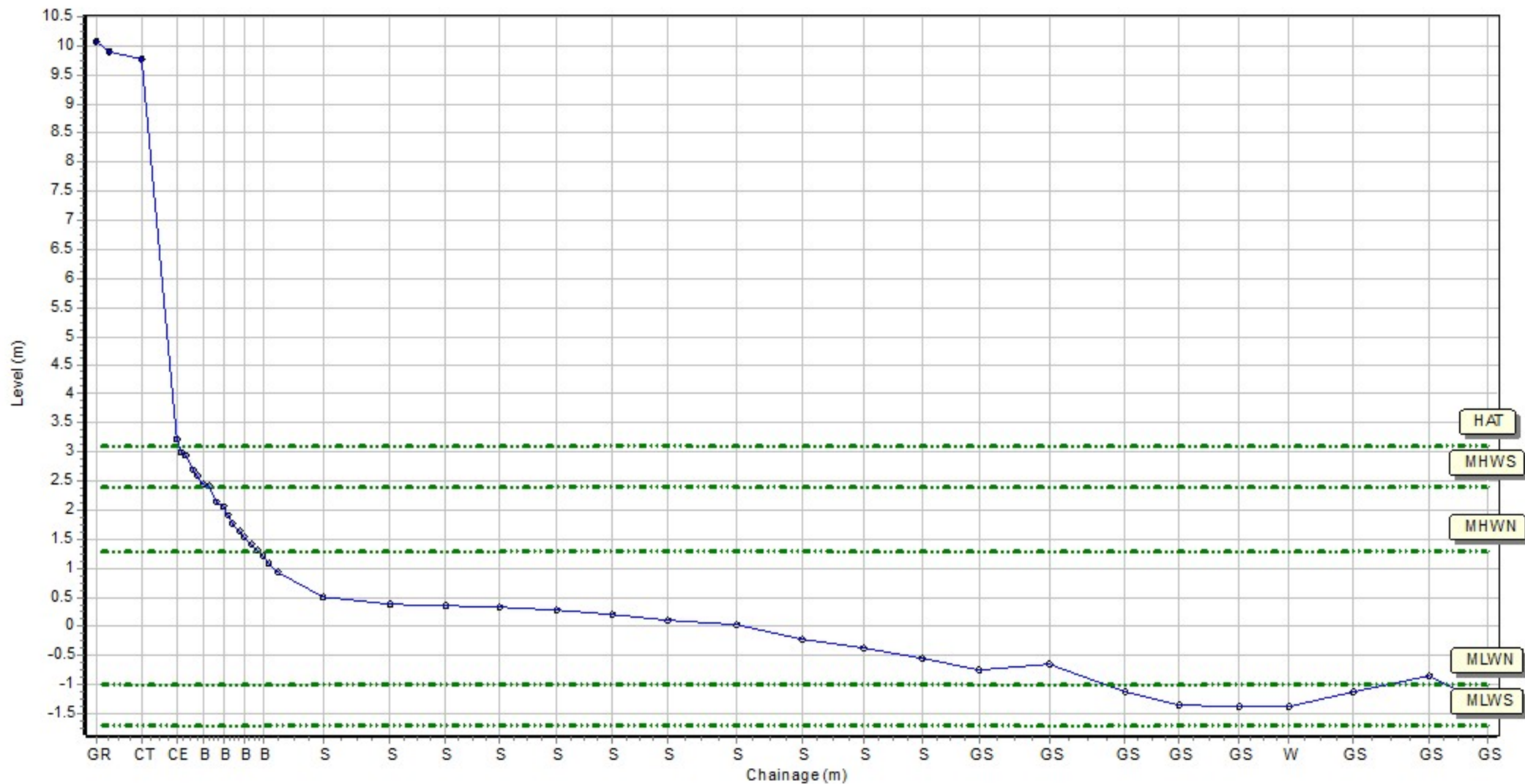
Low Tide: Low Tide Time:

Wind Sea State:

Visibility: Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 412324.036 Northing: 641984.353 Profile Bearing: 245 ° from North



# Beach Profile

Location: 1aBTBC29

Date: 09/09/2021 Inspector: AG

Low Tide:

Low Tide Time:

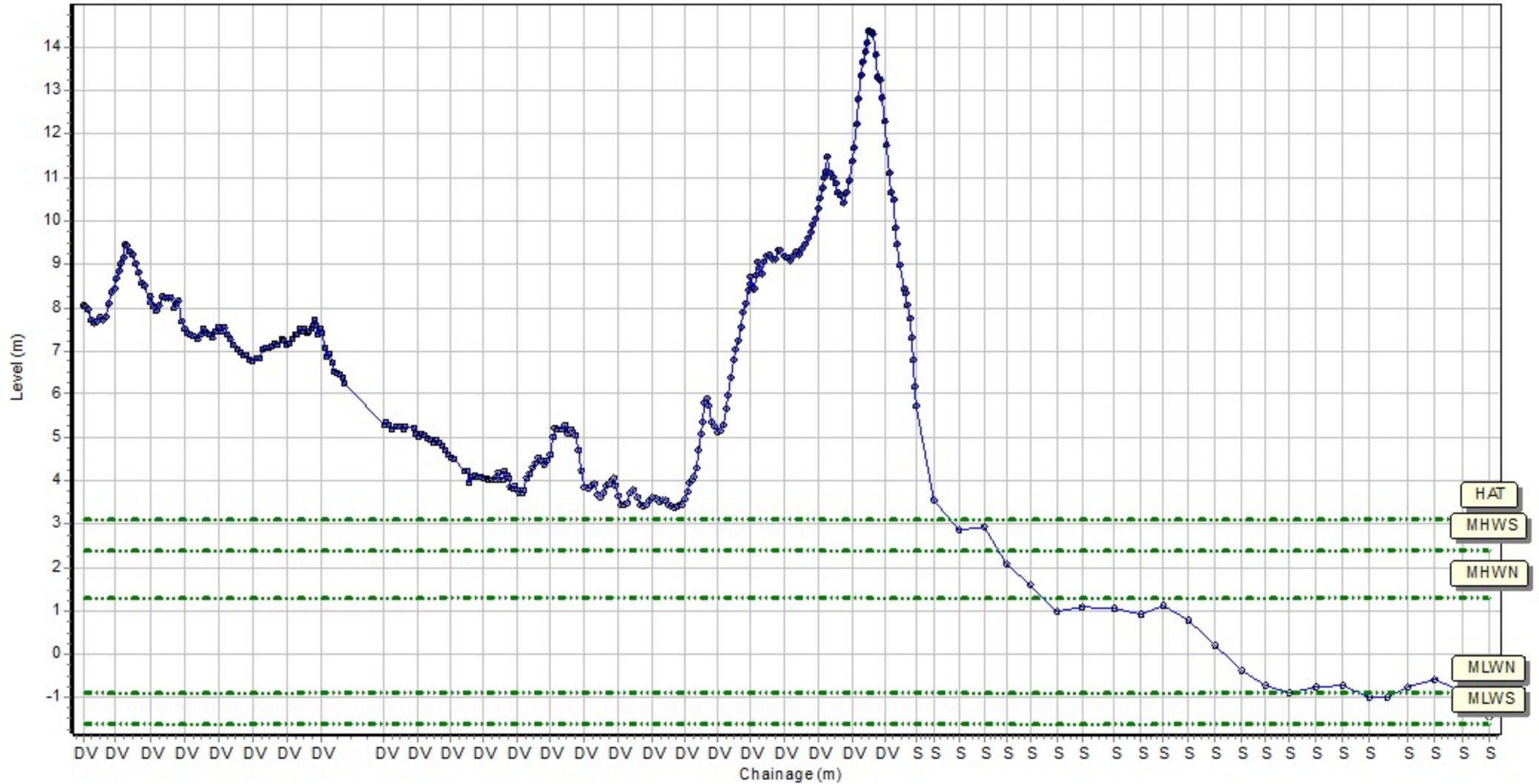
Wind Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 418972.296 Northing: 634628.46 Profile Bearing: 31 ° from North





# Beach Profile

Location: 1aBTBC30

Date: 08/09/2021 Inspector: AG

Low Tide:

Low Tide Time:

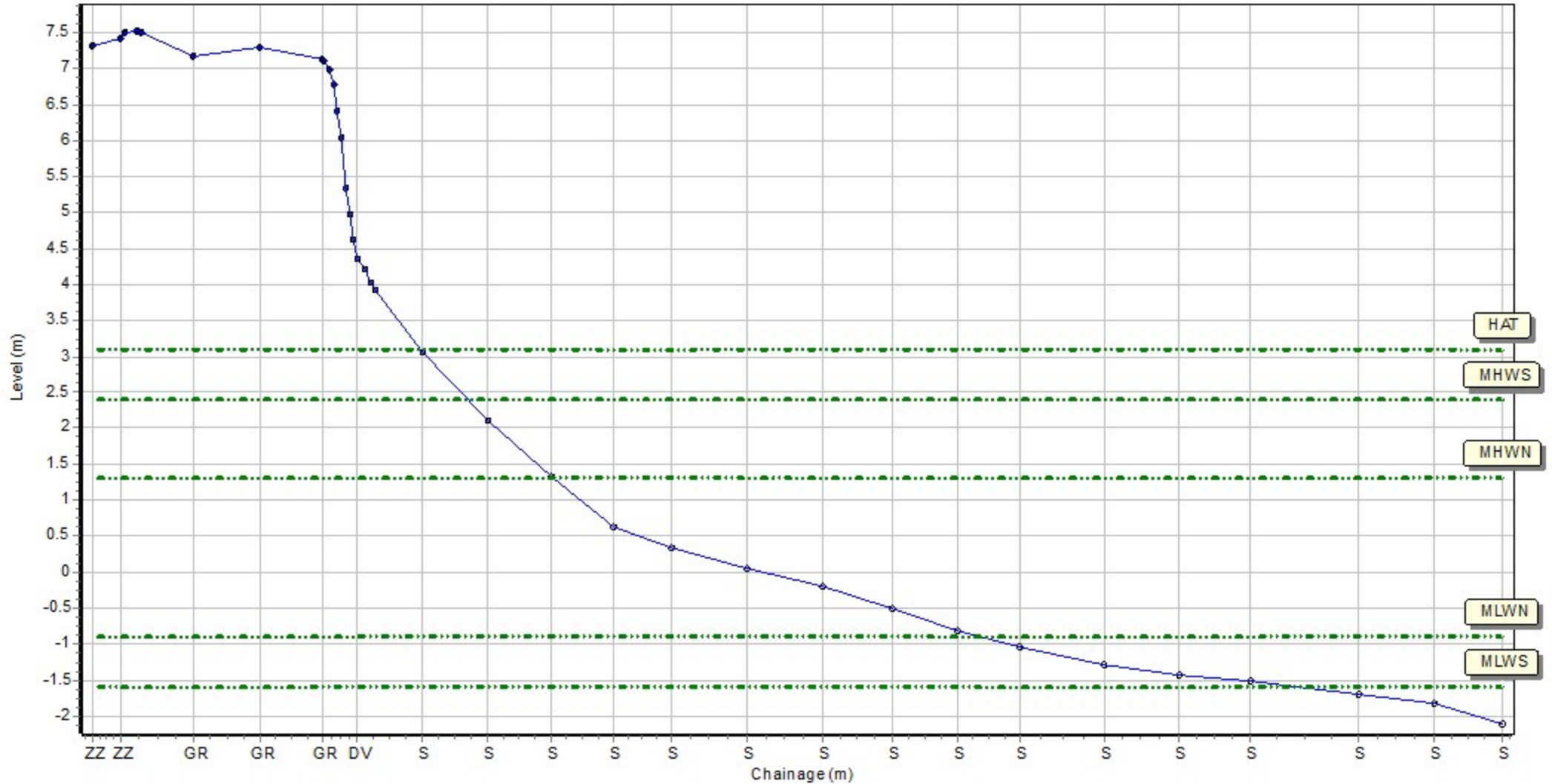
Wind Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 423056.791 Northing: 629887.437 Profile Bearing: 71 ° from North





# Beach Profile

Location: 1aBTBC31

Date: 08/09/2021 Inspector: AG

Low Tide:

Low Tide Time:

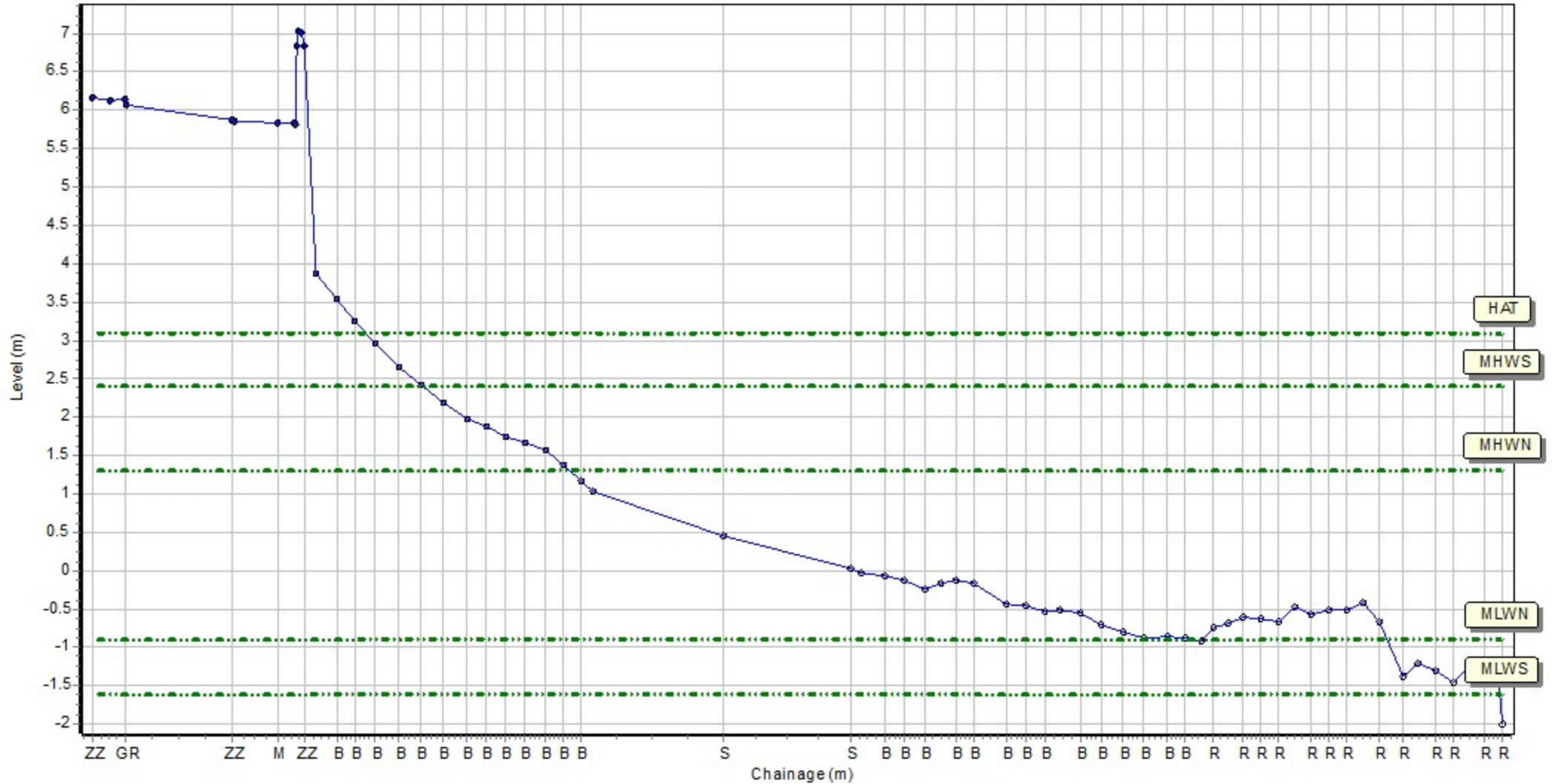
Wind Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 423579.204 Northing: 628973.295 Profile Bearing: 56 ° from North



# Beach Profile

Location: 1aBTBC32

Date: 08/09/2021 Inspector: AG

Low Tide:

Low Tide Time:

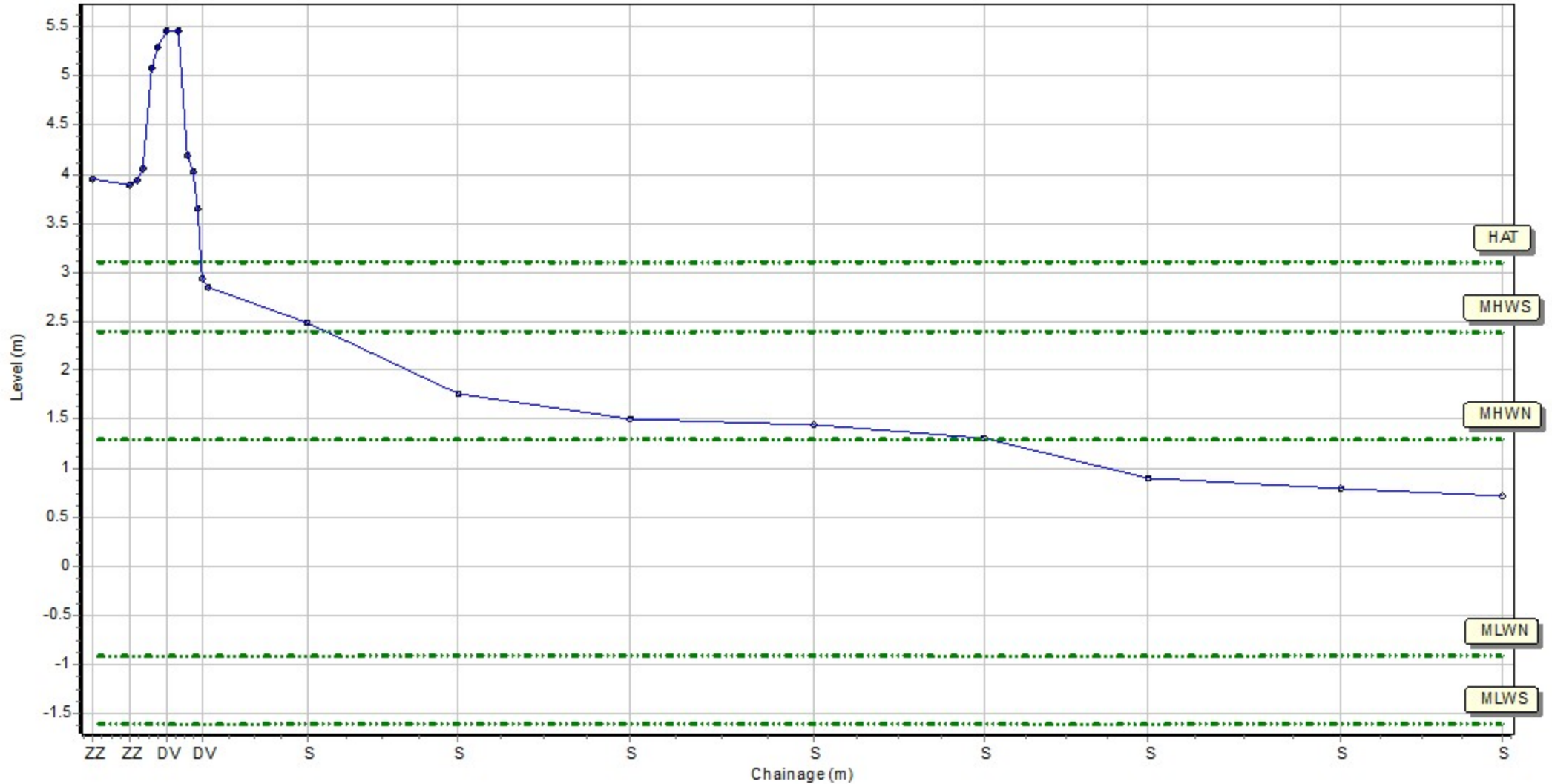
Wind Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 423738.386 Northing: 628624.99 Profile Bearing: 279 ° from North



# Beach Profile

Location: 1aBTBC33

Date: 08/09/2021 Inspector: AG

Low Tide:

Low Tide Time:

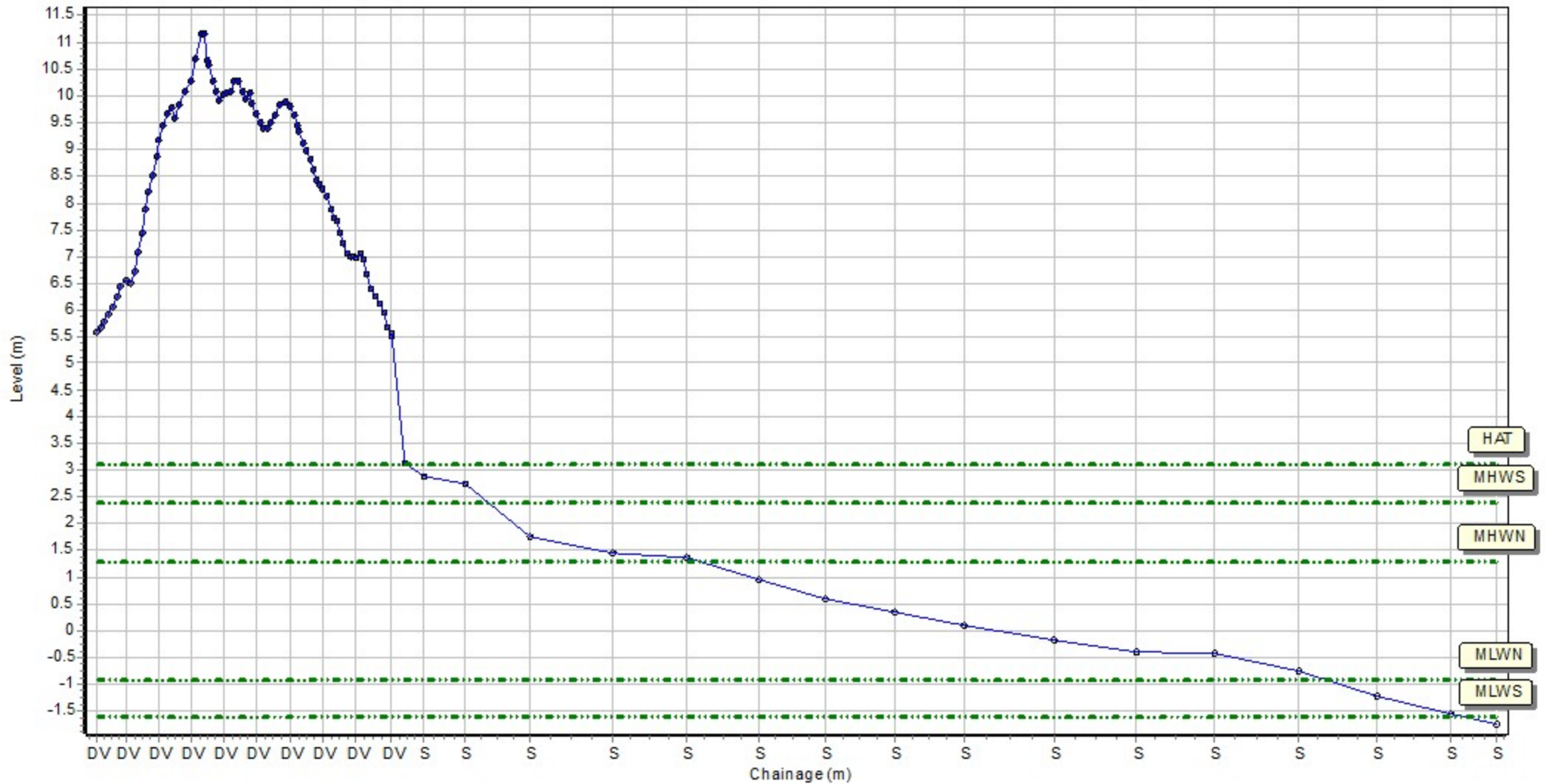
Wind Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 423672.571 Northing: 628761.646 Profile Bearing: 204 ° from North



# Beach Profile

Location: 1aBTBC34

Date: 08/09/2021 Inspector: AG

Low Tide:

Low Tide Time:

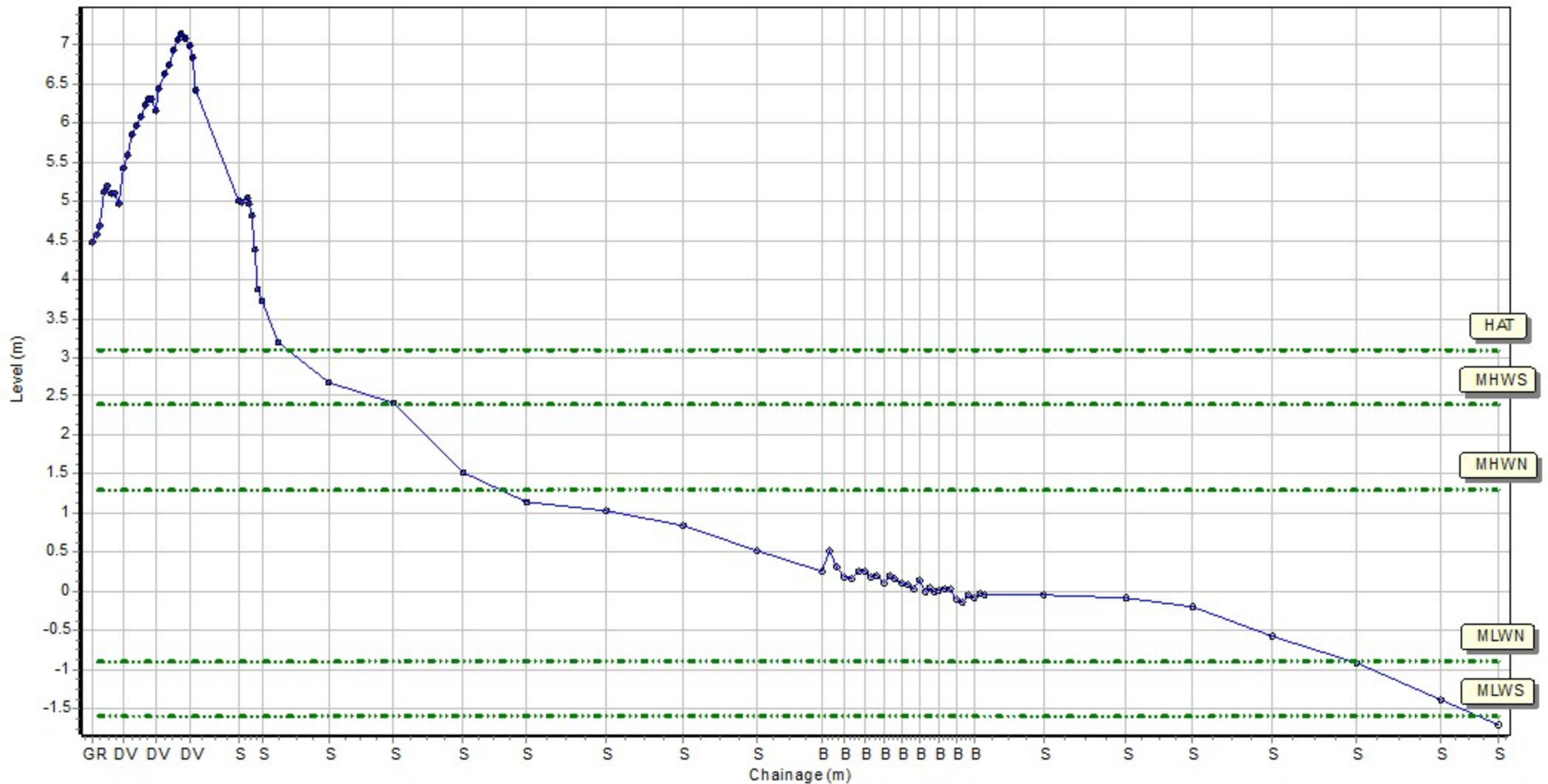
Wind Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 423434.960 Northing: 628693.15 Profile Bearing: 160 ° from North



# Beach Profile

Location: 1aBTBC35

Date: 08/09/2021 Inspector: AG

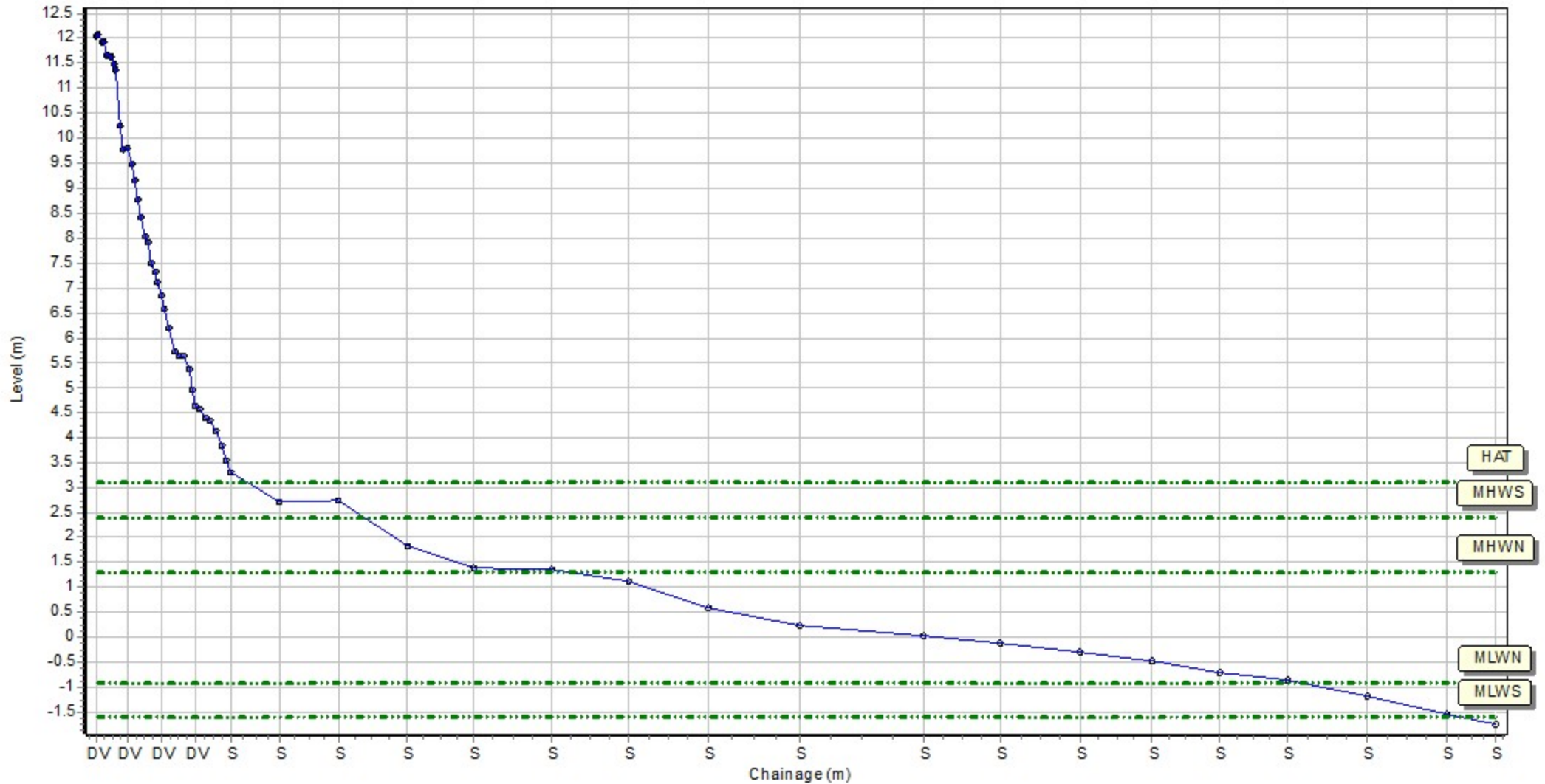
Low Tide: Low Tide Time:

Wind Sea State:

Visibility: Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 423171.083 Northing: 628414.273 Profile Bearing: 105 ° from North





# Beach Profile

Location: 1aBTBC36

Date: 08/09/2021 Inspector: AG

Low Tide:

Low Tide Time:

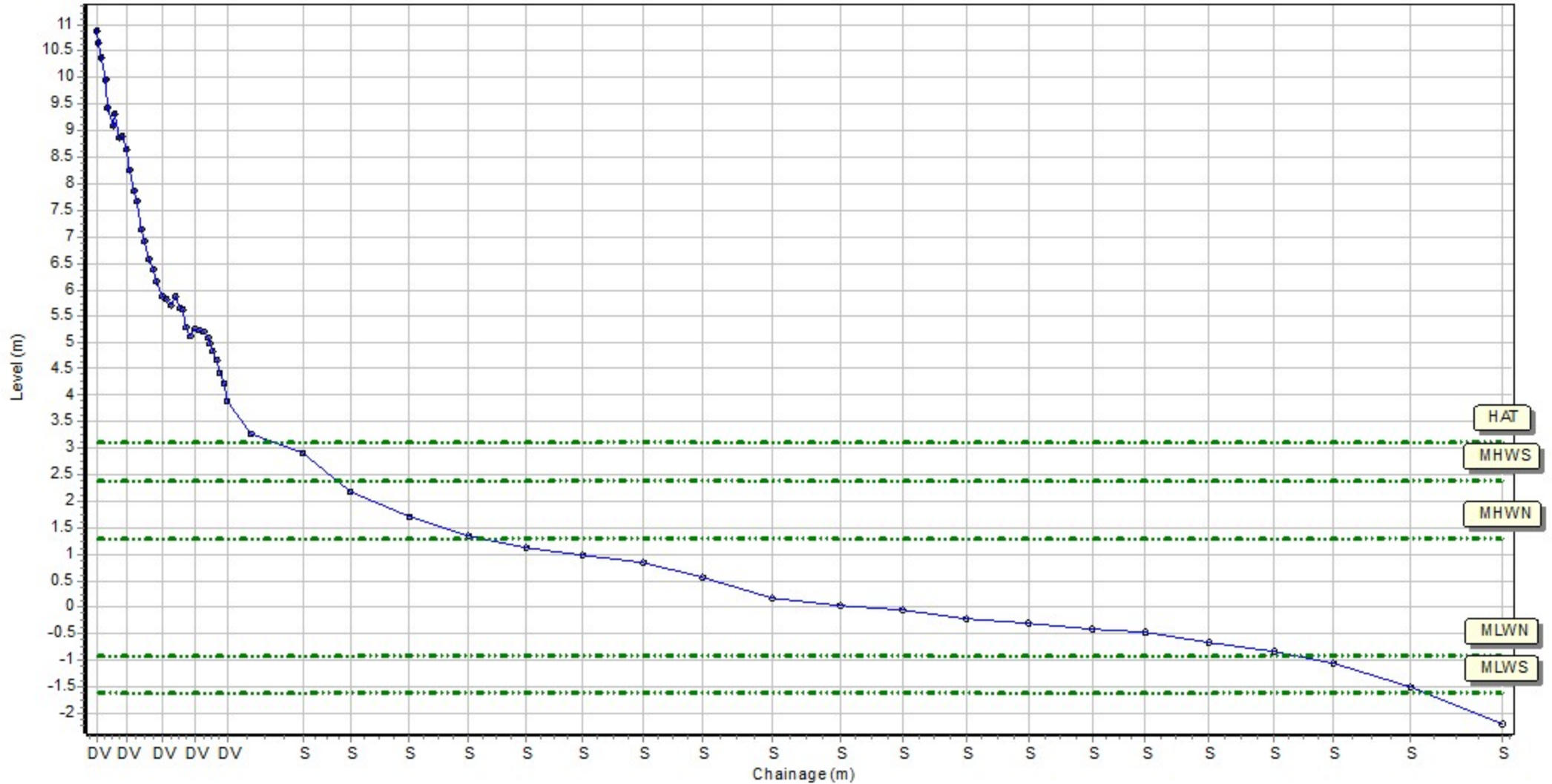
Wind Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 423094.516 Northing: 628204.644 Profile Bearing: 106 ° from North



# Beach Profile

Location: 1aBTBC37

Date: 08/09/2021 Inspector: AG

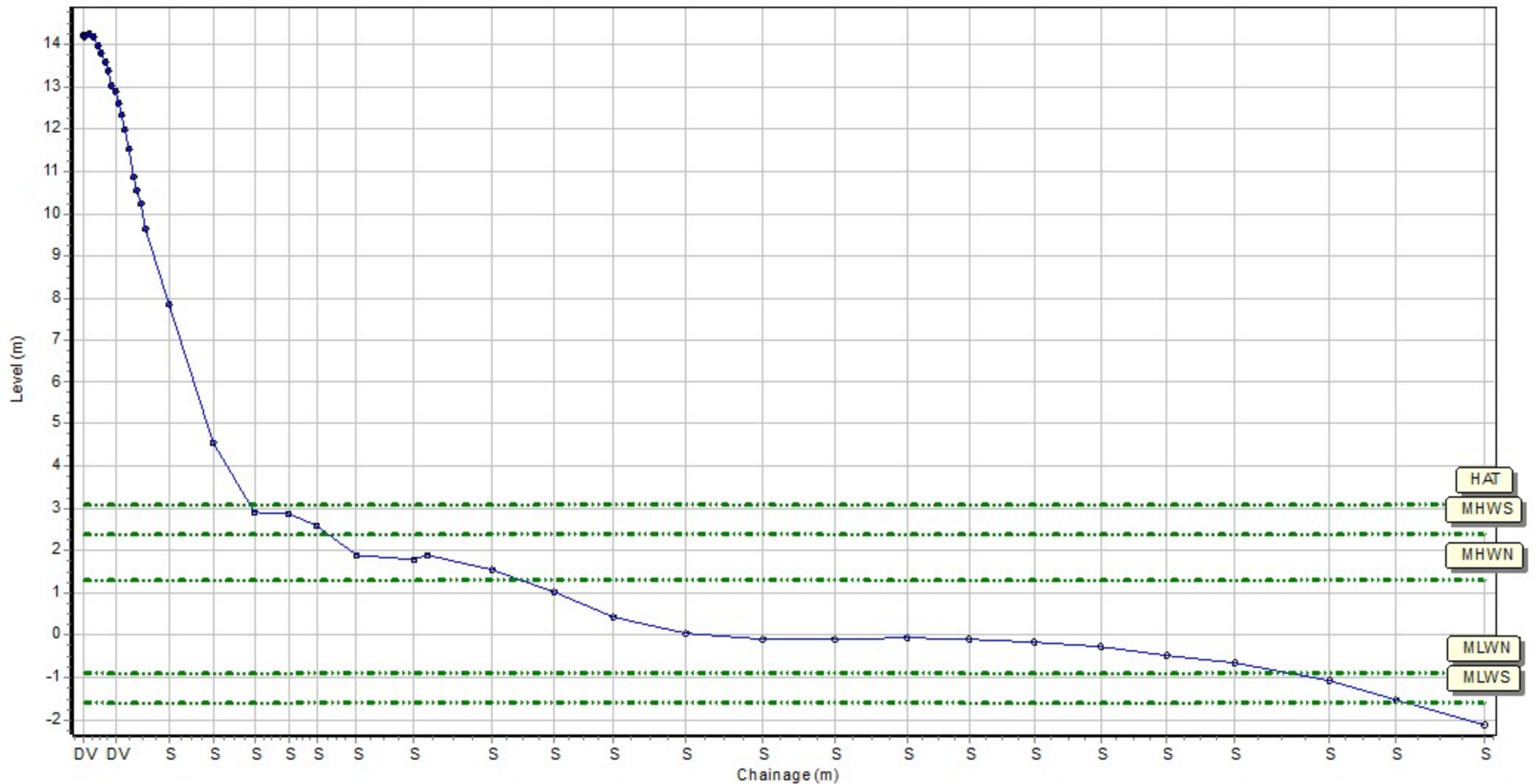
Low Tide: Low Tide Time:

Wind Sea State:

Visibility: Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 423060.156 Northing: 628006.169 Profile Bearing: 96 ° from North





# Beach Profile

Location: 1aADC01

Date: 08/09/2021 Inspector: AG

Low Tide:

Low Tide Time:

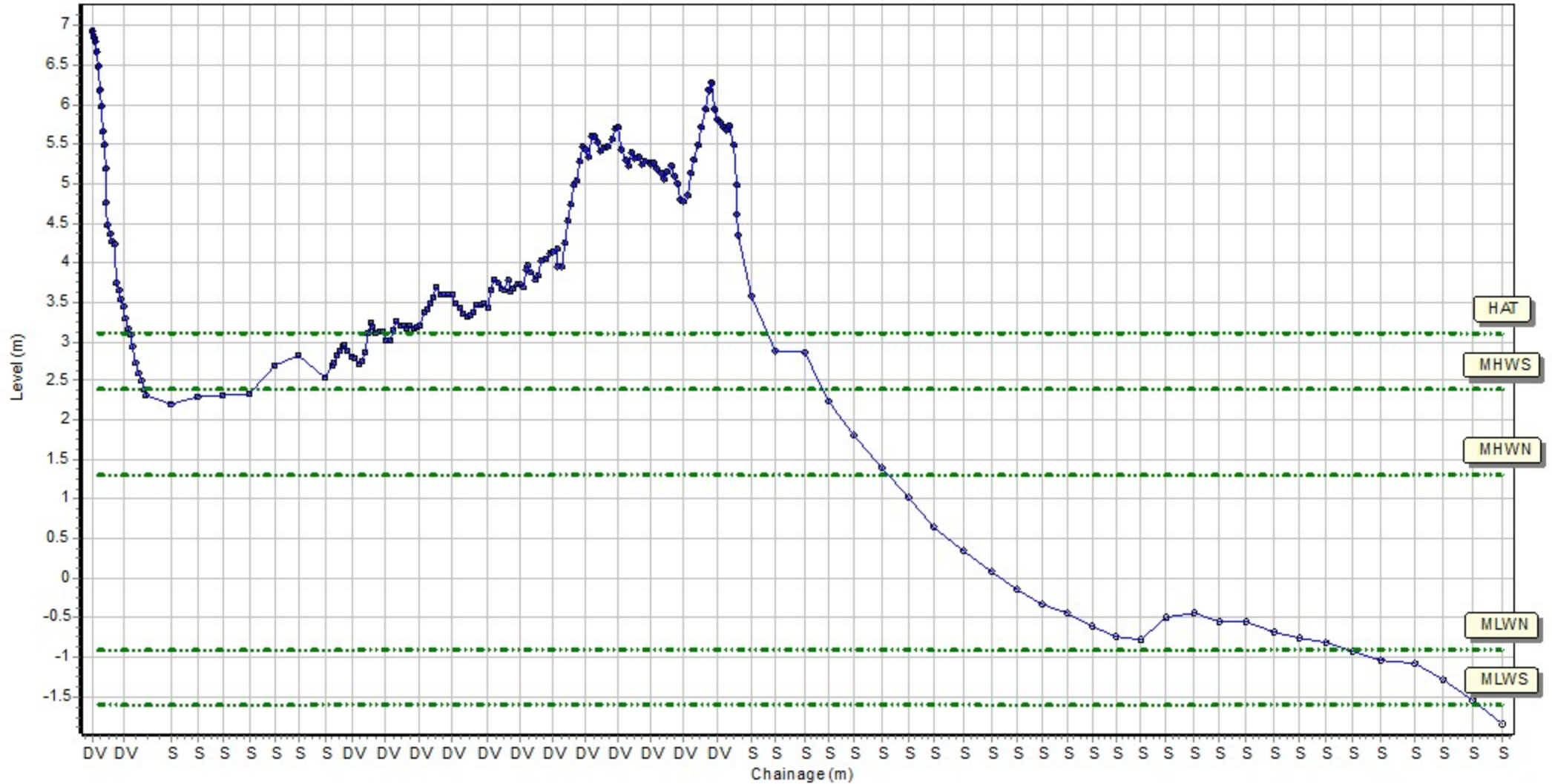
Wind Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 422824.294 Northing: 627077.805 Profile Bearing: 77 ° from North





# Beach Profile

Location: 1aADC02

Date: 08/09/2021 Inspector: AG

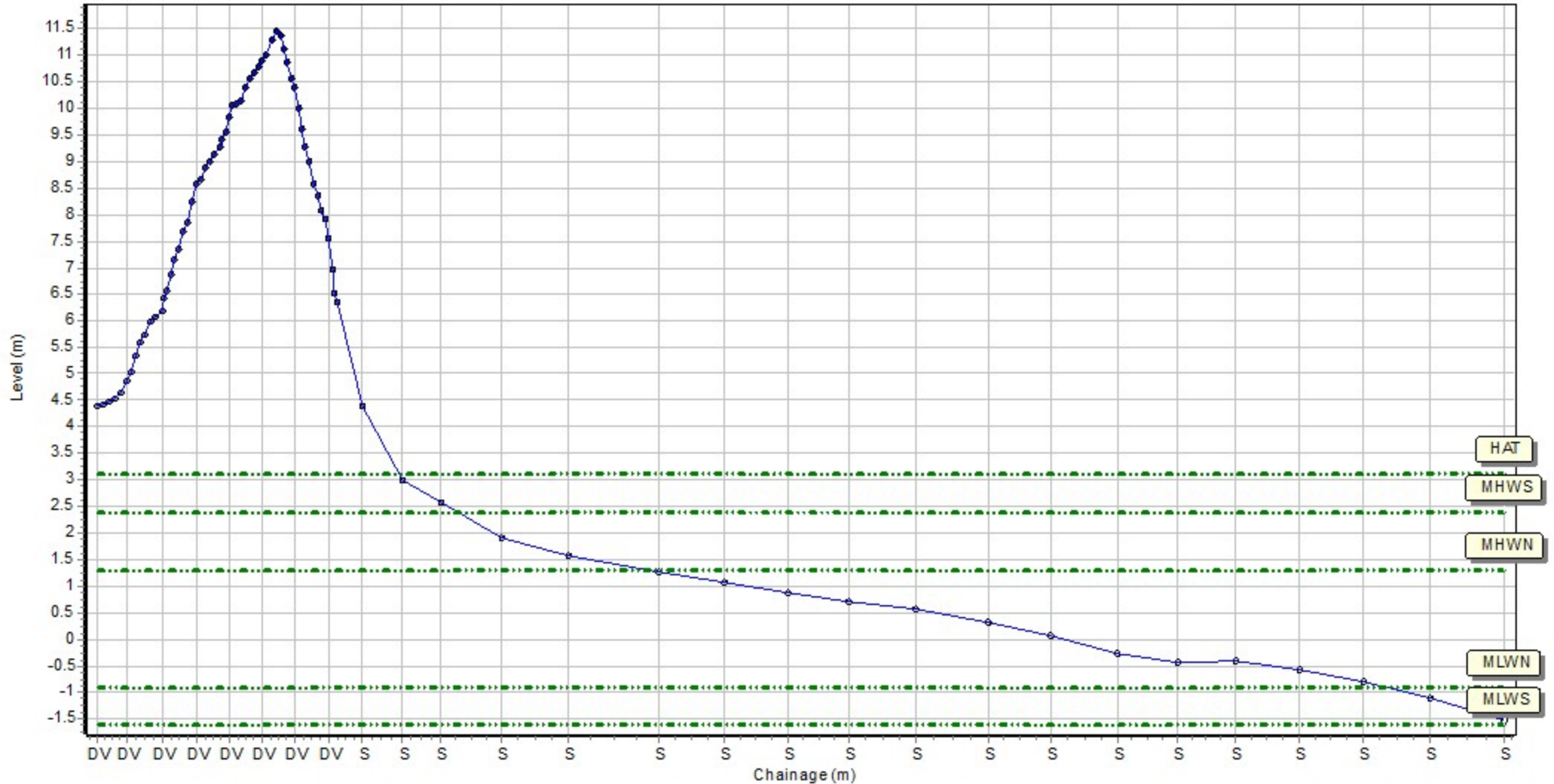
Low Tide: Low Tide Time:

Wind Sea State:

Visibility: Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 423387.925 Northing: 626385.049 Profile Bearing: 56 ° from North





# Beach Profile

Location: 1aADC03

Date: 09/09/2021 Inspector: AG

Low Tide:

Low Tide Time:

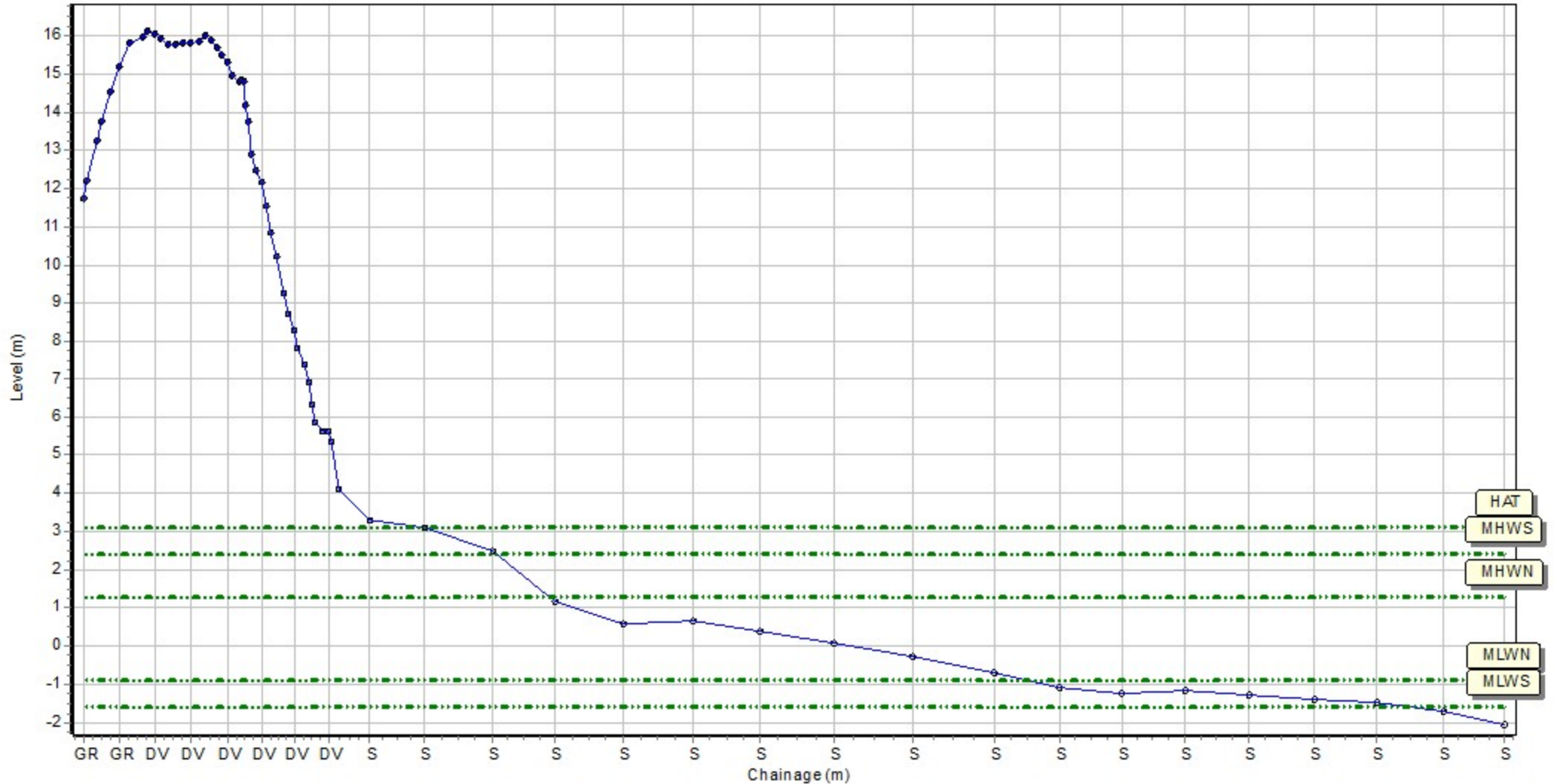
Wind Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 424282.669 Northing: 623628.714 Profile Bearing: 112 ° from North



# Beach Profile

Location: 1aADC04

Date: 09/09/2021 Inspector: AG

Low Tide:

Low Tide Time:

Wind

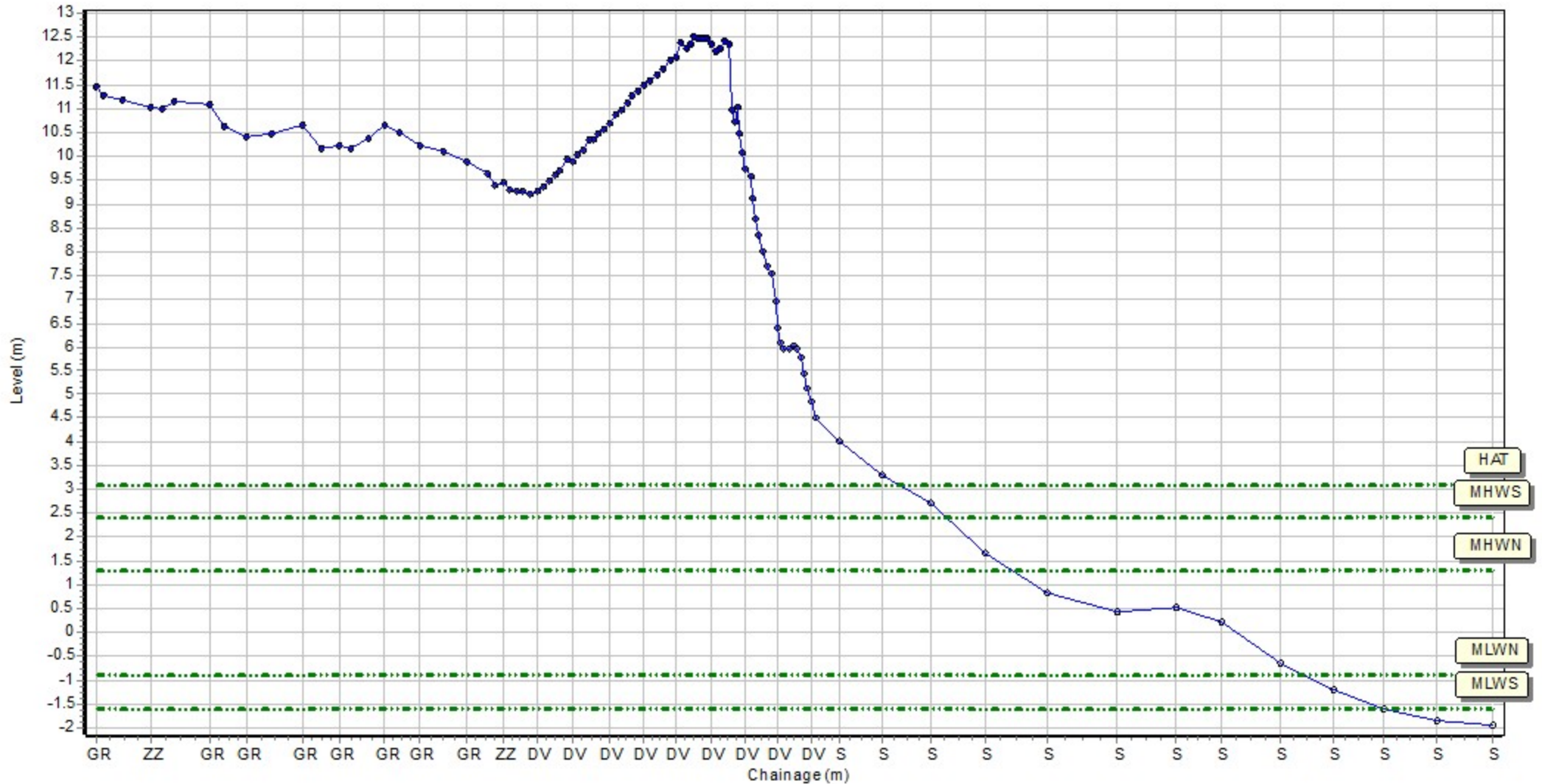
Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 424479.626 Northing: 622434.173 Profile Bearing: 50 ° from North



# Beach Profile

Location: 1aADC04A

Date: 06/09/2021 Inspector: AG

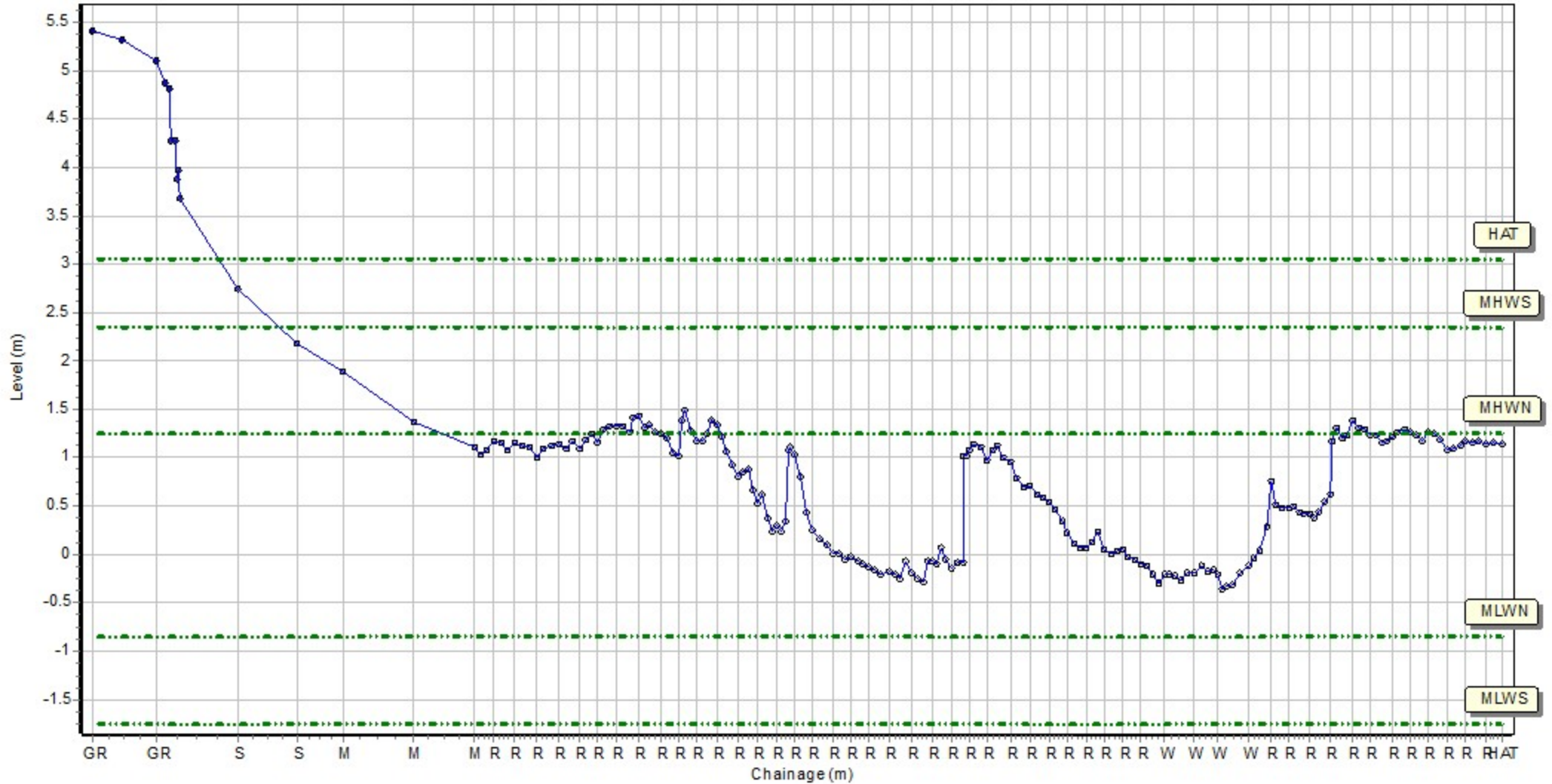
Low Tide: Low Tide Time:

Wind Sea State:

Visibility: Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 426649.592 Northing: 614336.9 Profile Bearing: 93 ° from North







# Beach Profile

Location: 1aADC05

Date: 06/09/2021 Inspector: AG

Low Tide:

Low Tide Time:

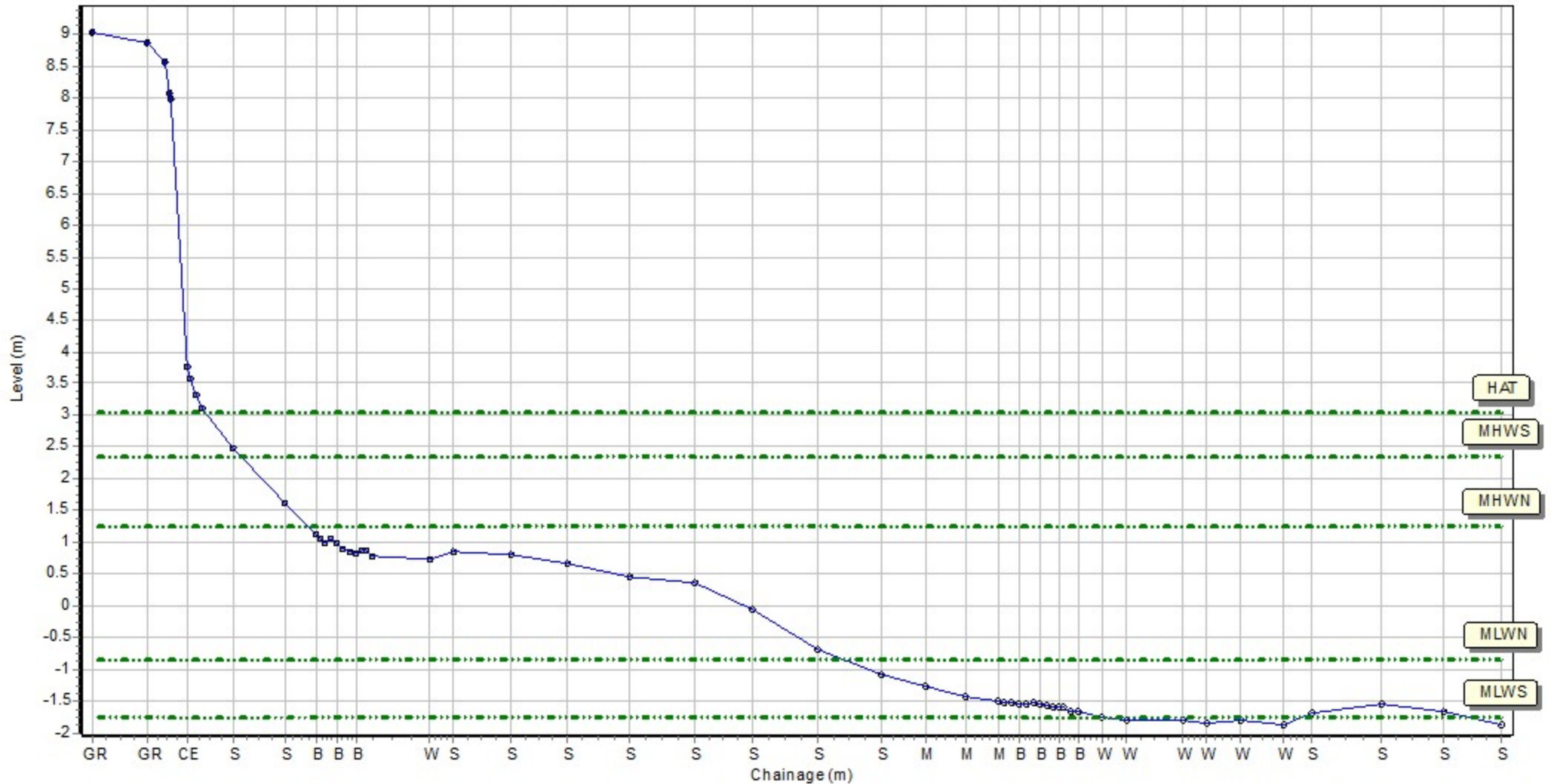
Wind Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 426185.186 Northing: 612543.216 Profile Bearing: 142 ° from North





# Beach Profile

Location: 1aADC06

Date: 06/09/2021 Inspector: AG

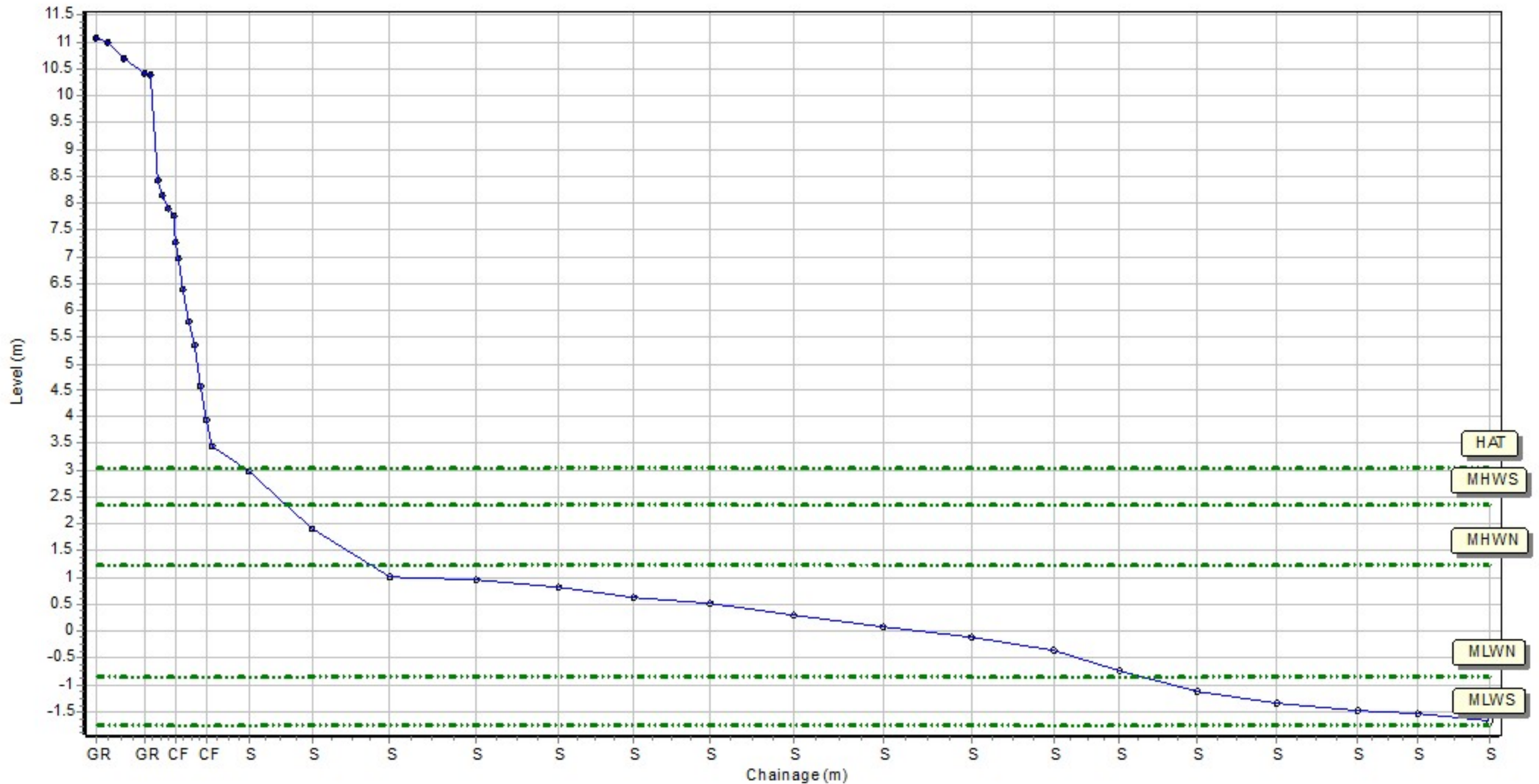
Low Tide: Low Tide Time:

Wind Sea State:

Visibility: Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 425950.4 Northing: 612302.499 Profile Bearing: 122 ° from North





# Beach Profile

Location: 1aADC08

Date: 06/09/2021 Inspector: AG

Low Tide:

Low Tide Time:

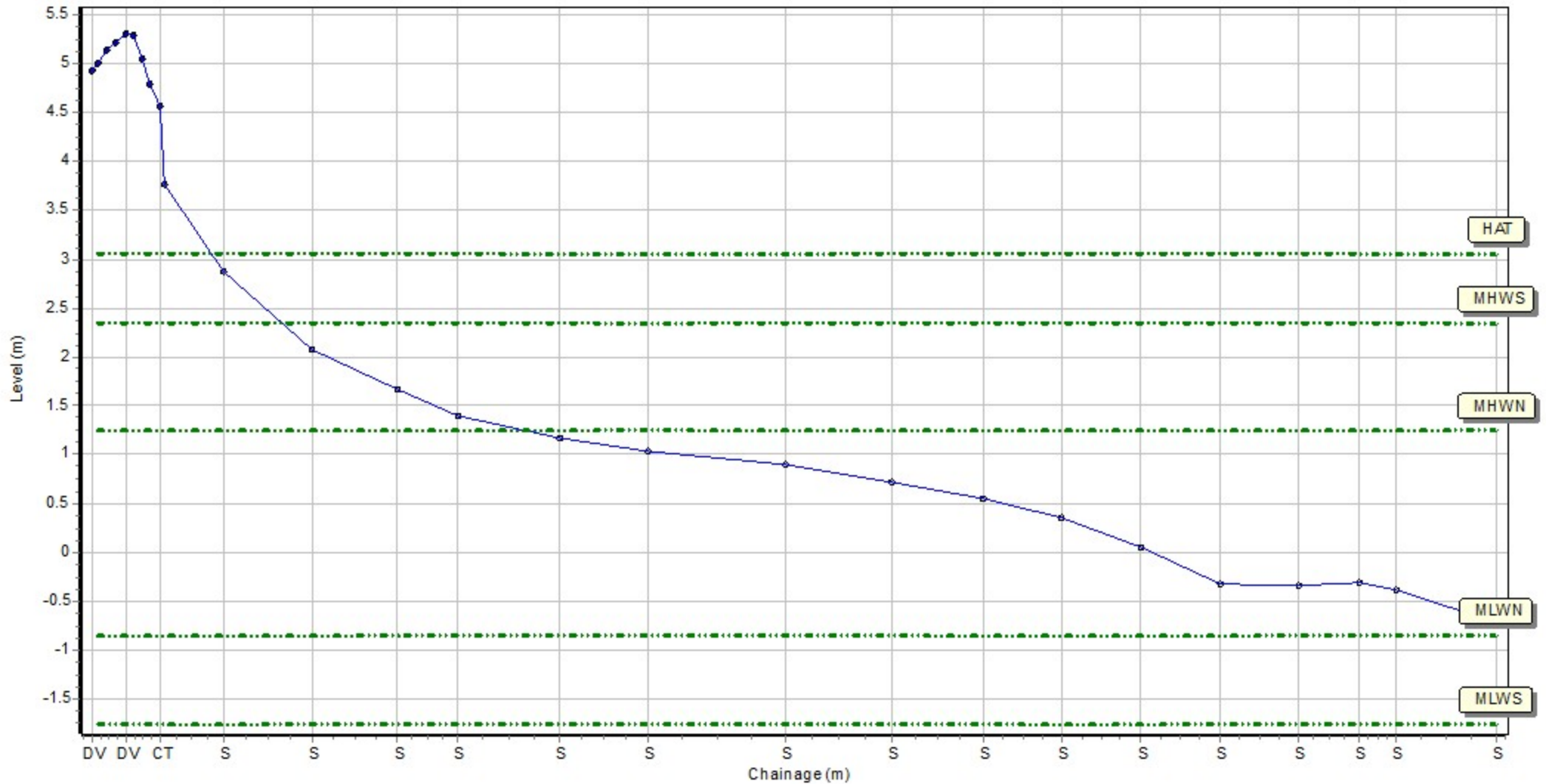
Wind Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 425031.727 Northing: 610632.355 Profile Bearing: 112 ° from North



# Beach Profile

Location: 1aADC09

Date: 06/09/2021 Inspector: AG

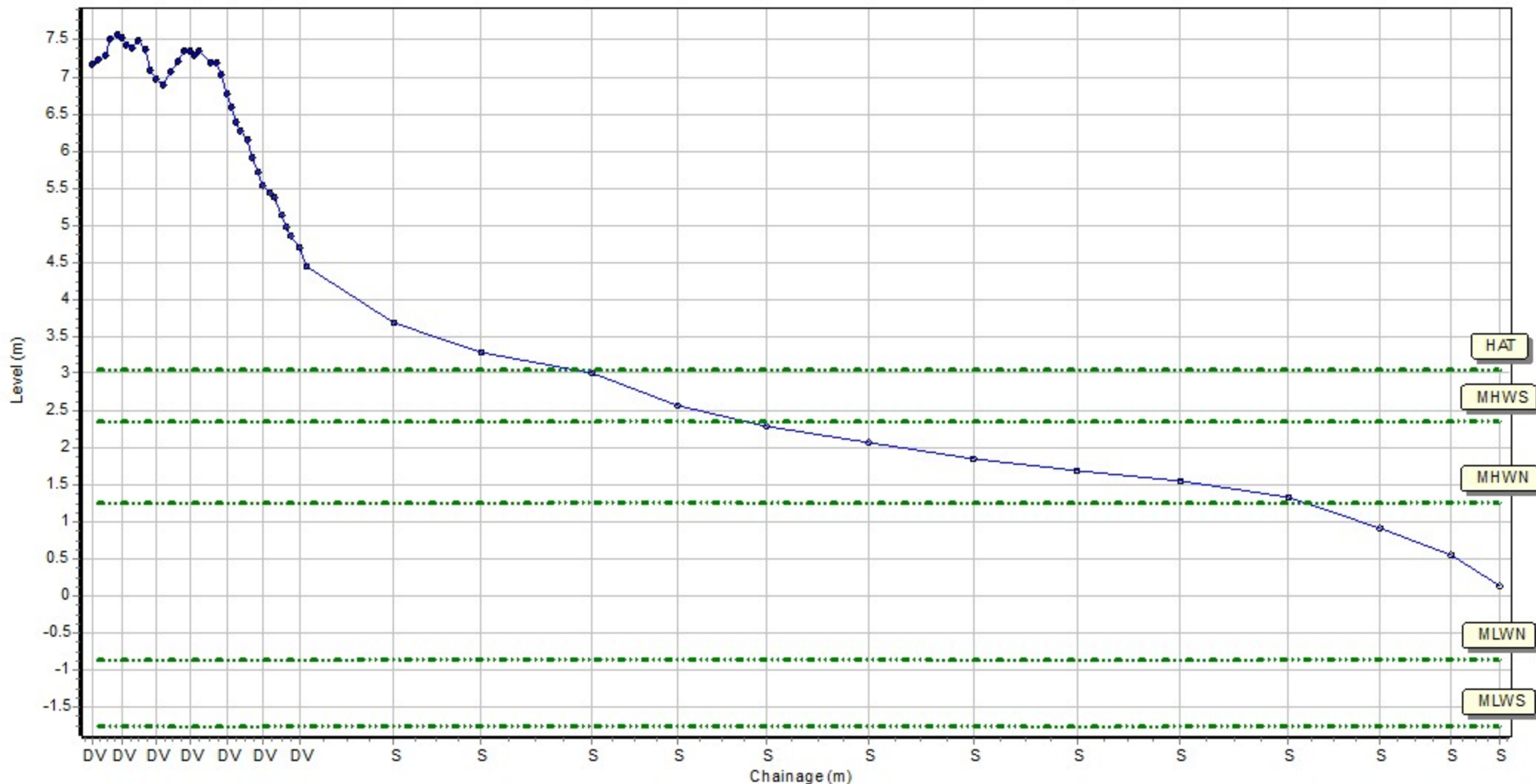
Low Tide: Low Tide Time:

Wind Sea State:

Visibility: Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 424802.33 Northing: 610353.259 Profile Bearing: 120 ° from North







# Beach Profile

Location: 1aADC11

Date: 11/09/2021 Inspector: AG

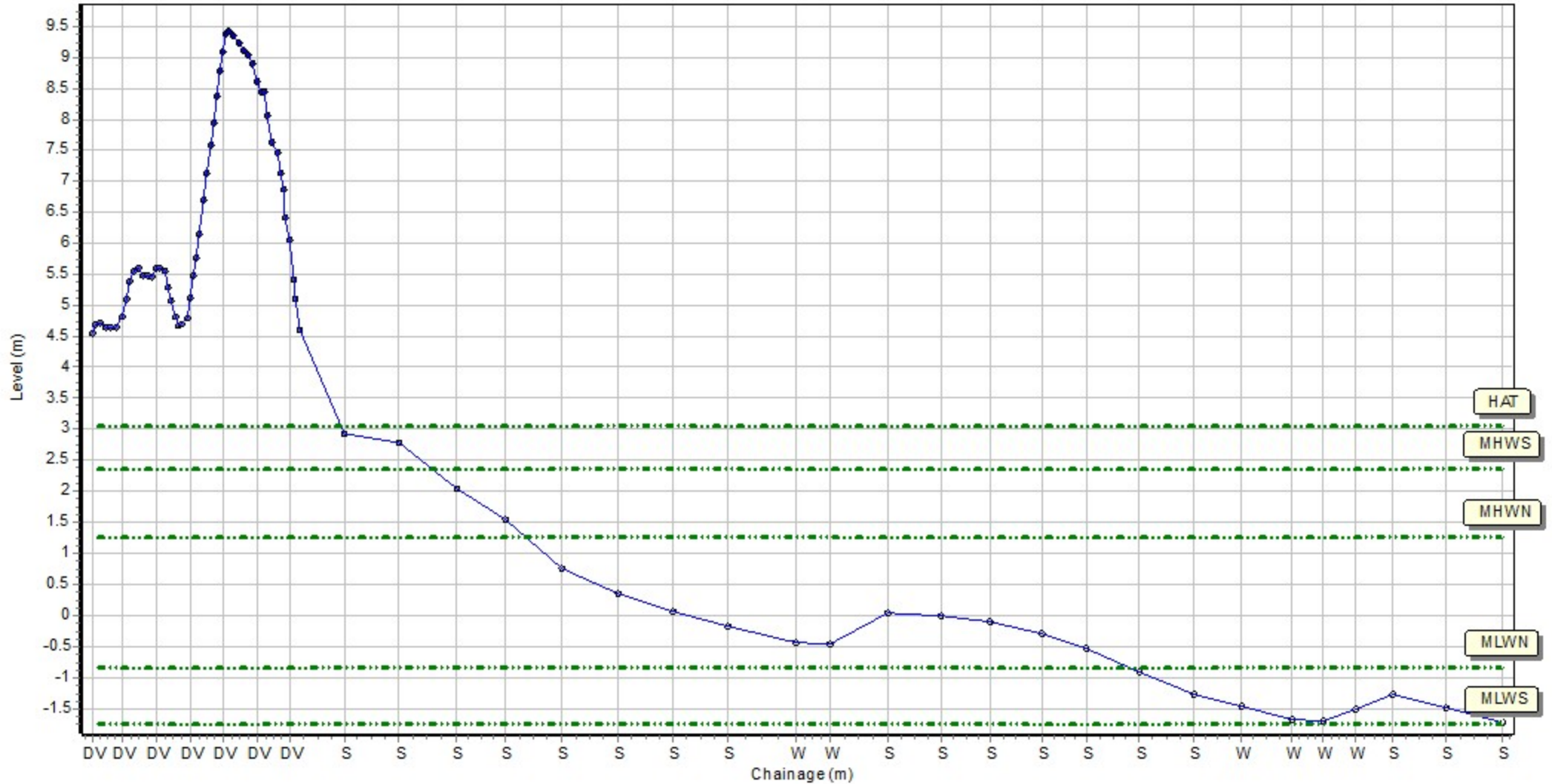
Low Tide: Low Tide Time:

Wind Sea State:

Visibility: Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 424966.878 Northing: 609097.685 Profile Bearing: 71 ° from North



# Beach Profile

Location: 1aADC12

Date: 11/09/2021 Inspector: AG

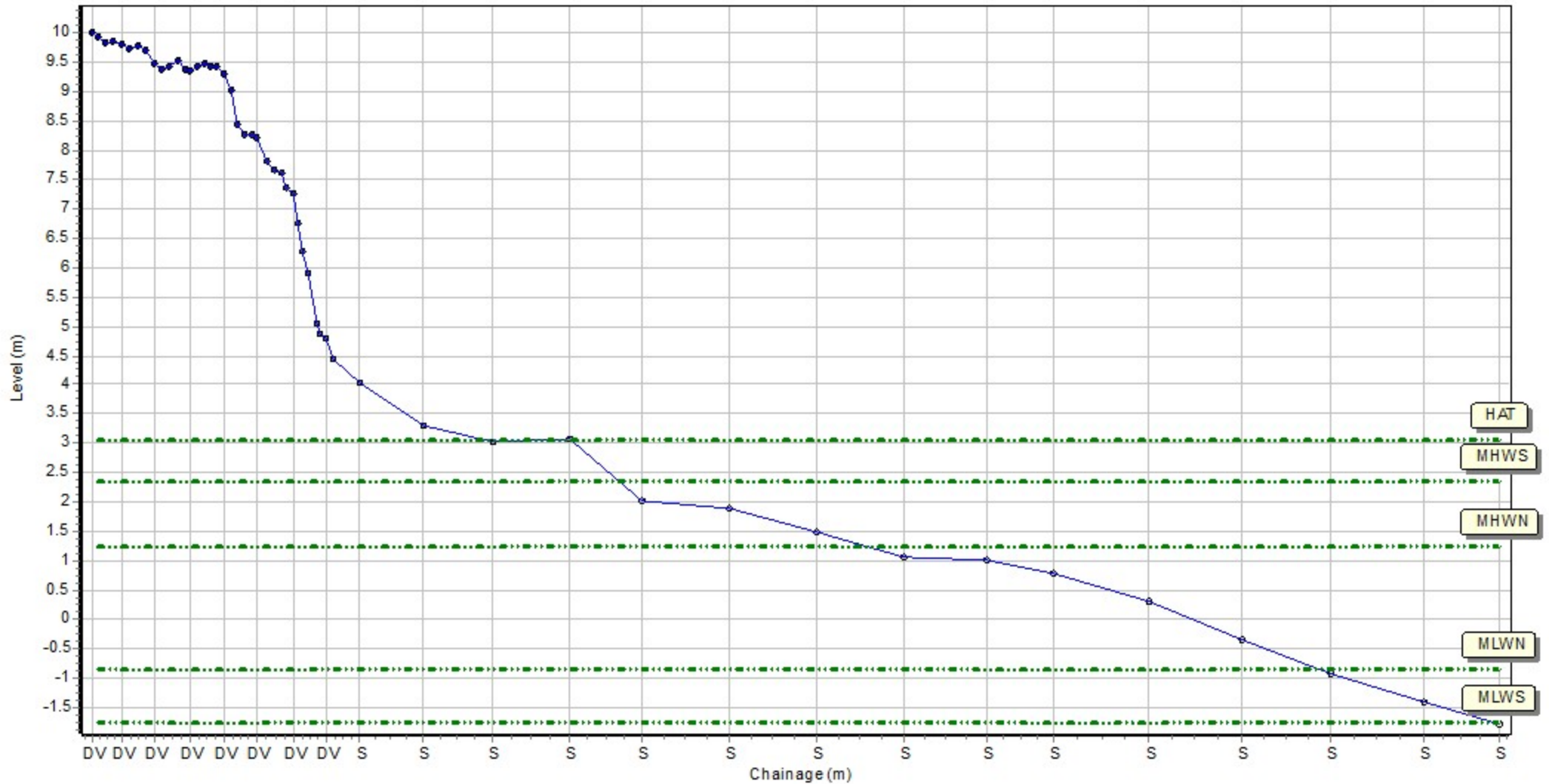
Low Tide: Low Tide Time:

Wind Sea State:

Visibility: Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 425376.479 Northing: 607303.998 Profile Bearing: 67 ° from North



# Beach Profile

Location: 1aADC13

Date: 11/09/2021 Inspector: AG

Low Tide:

Low Tide Time:

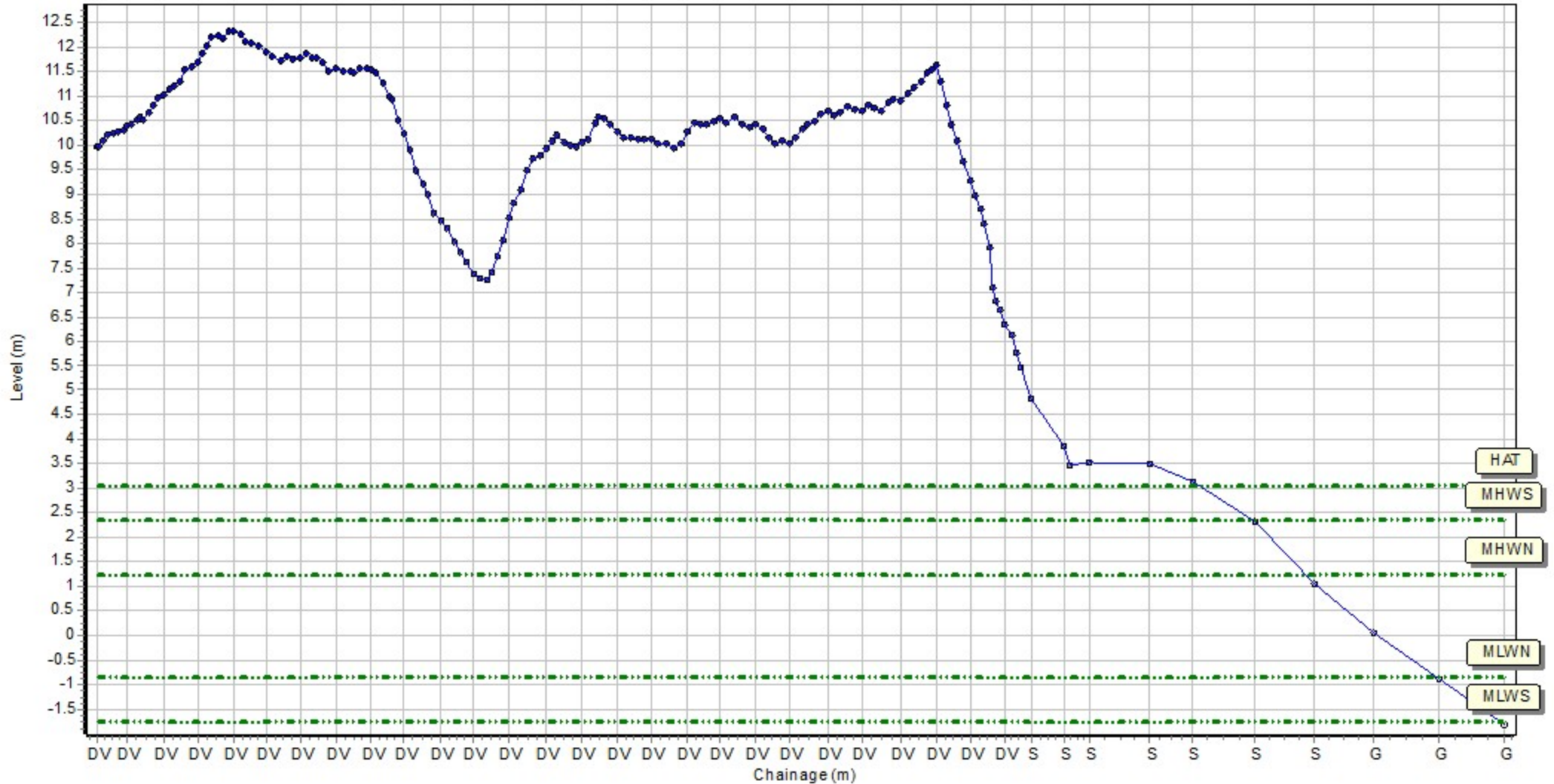
Wind Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 425859.769 Northing: 606033.935 Profile Bearing: 63 ° from North



# Beach Profile

Location: 1aADC14

Date: 11/09/2021 Inspector: AG

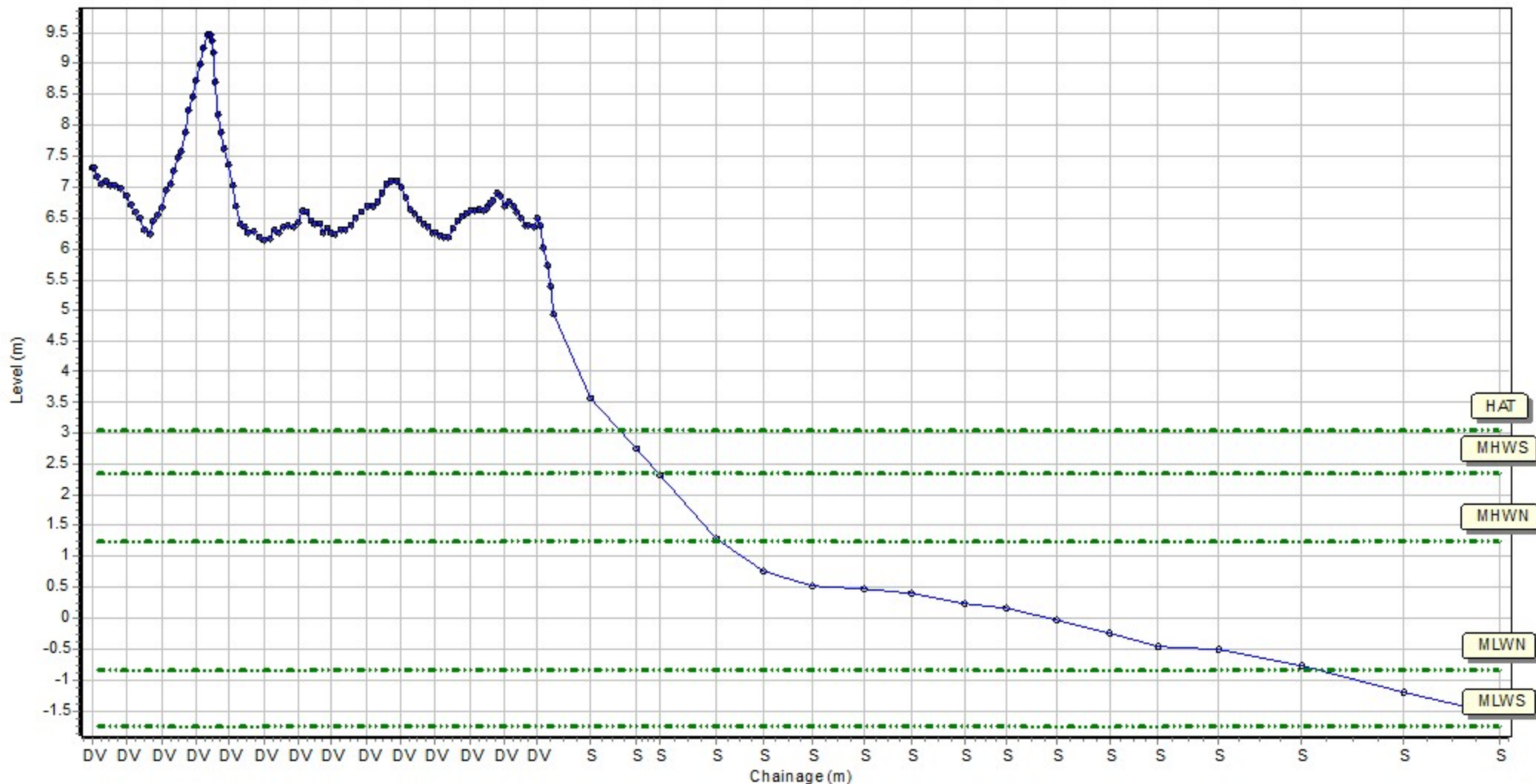
Wind Sea State:

Low Tide: Low Tide Time:

Visibility: Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 426469.136 Northing: 605263.954 Profile Bearing: 59 ° from North





# Beach Profile

Location: 1aADC15

Date: 20/09/2021 Inspector: AG

Low Tide:

Low Tide Time:

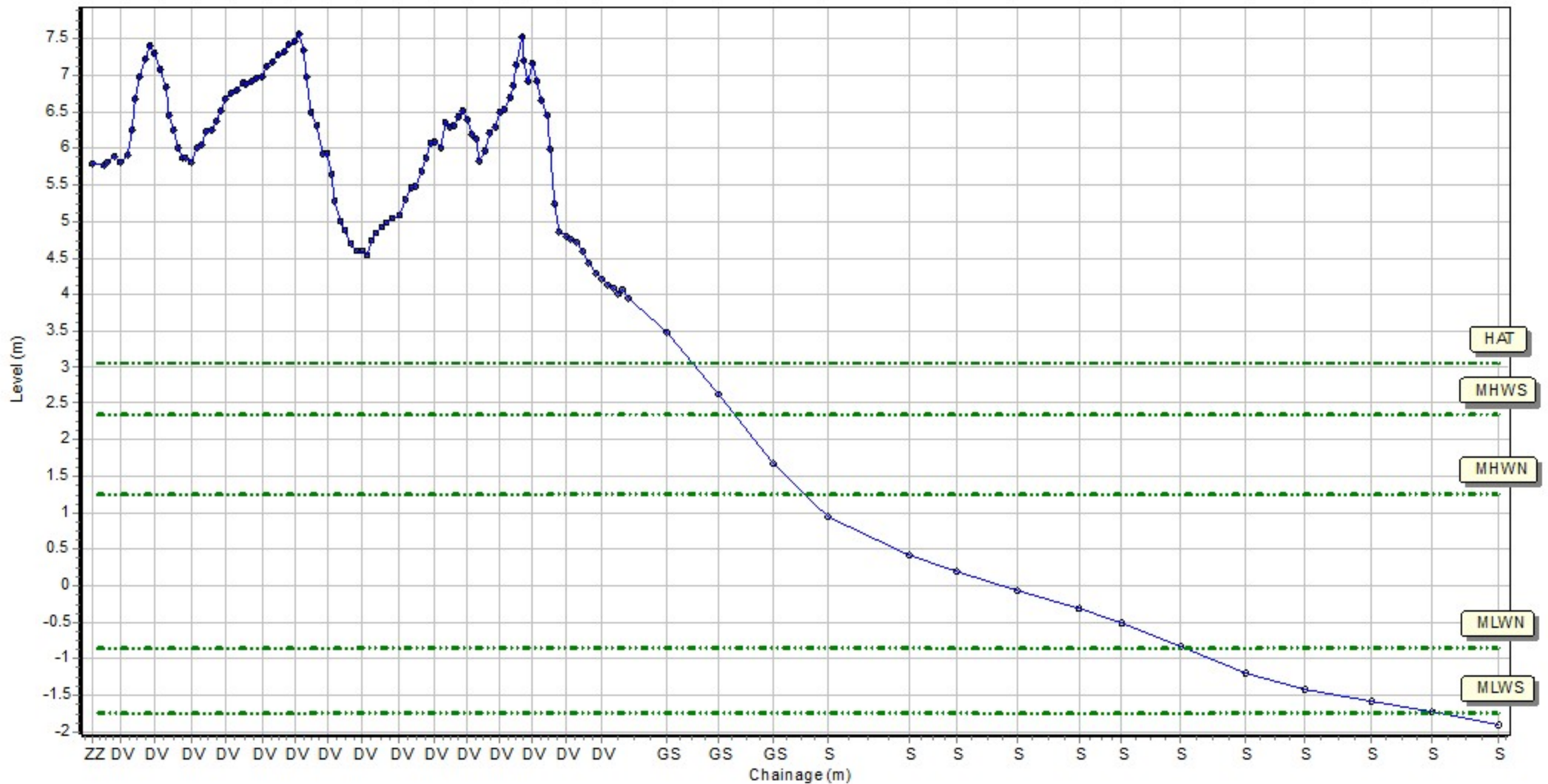
Wind Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 427956.742 Northing: 603743.758 Profile Bearing: 46 ° from North





# Beach Profile

Location: 1aADC15A

Date: 20/09/2021 Inspector: AG

Low Tide:

Low Tide Time:

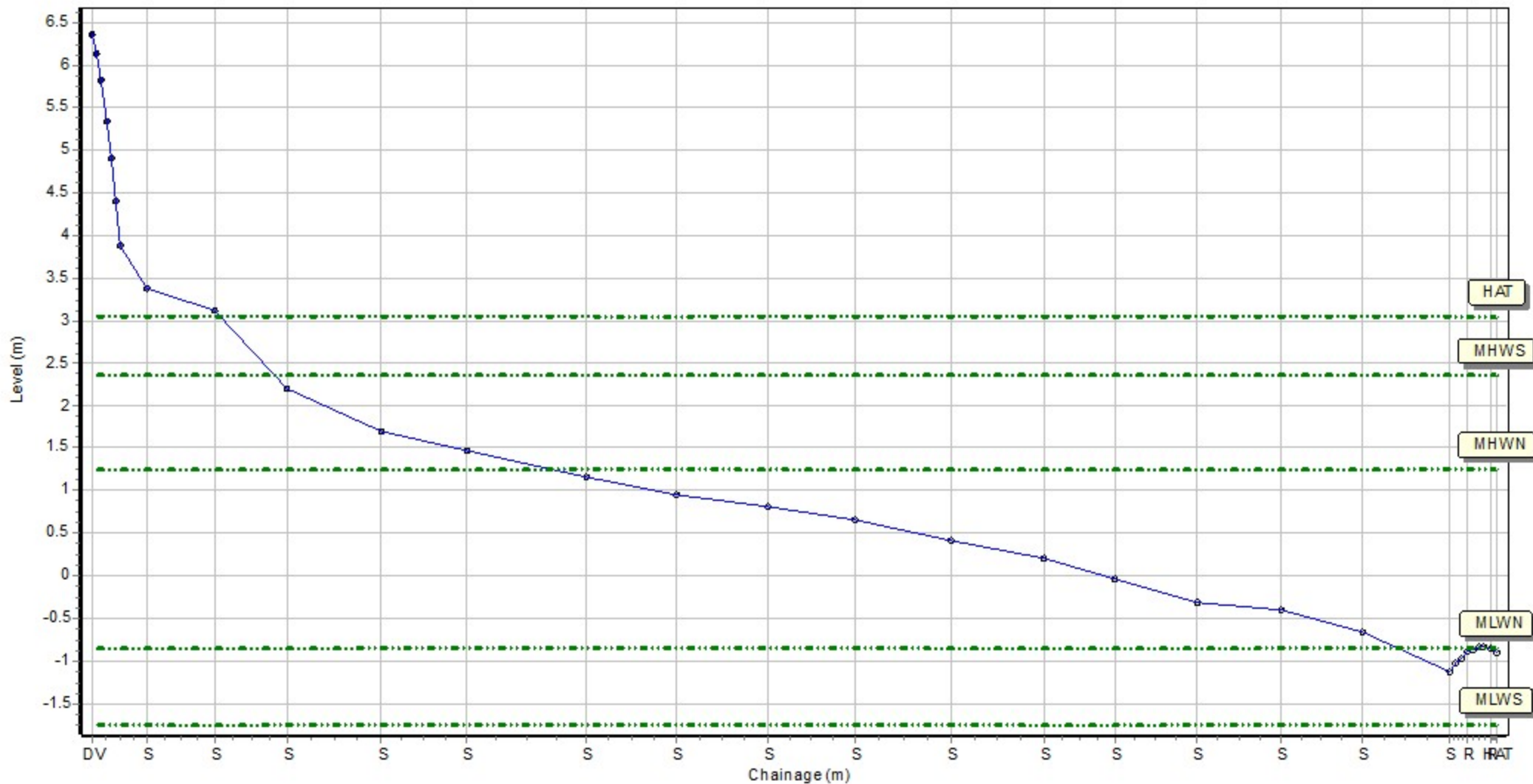
Wind Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 428642.365 Northing: 603069.145 Profile Bearing: 90 ° from North



# Beach Profile

Location: 1aADC16

Date: 20/09/2021 Inspector: AG

Wind Sea State:

Low Tide:

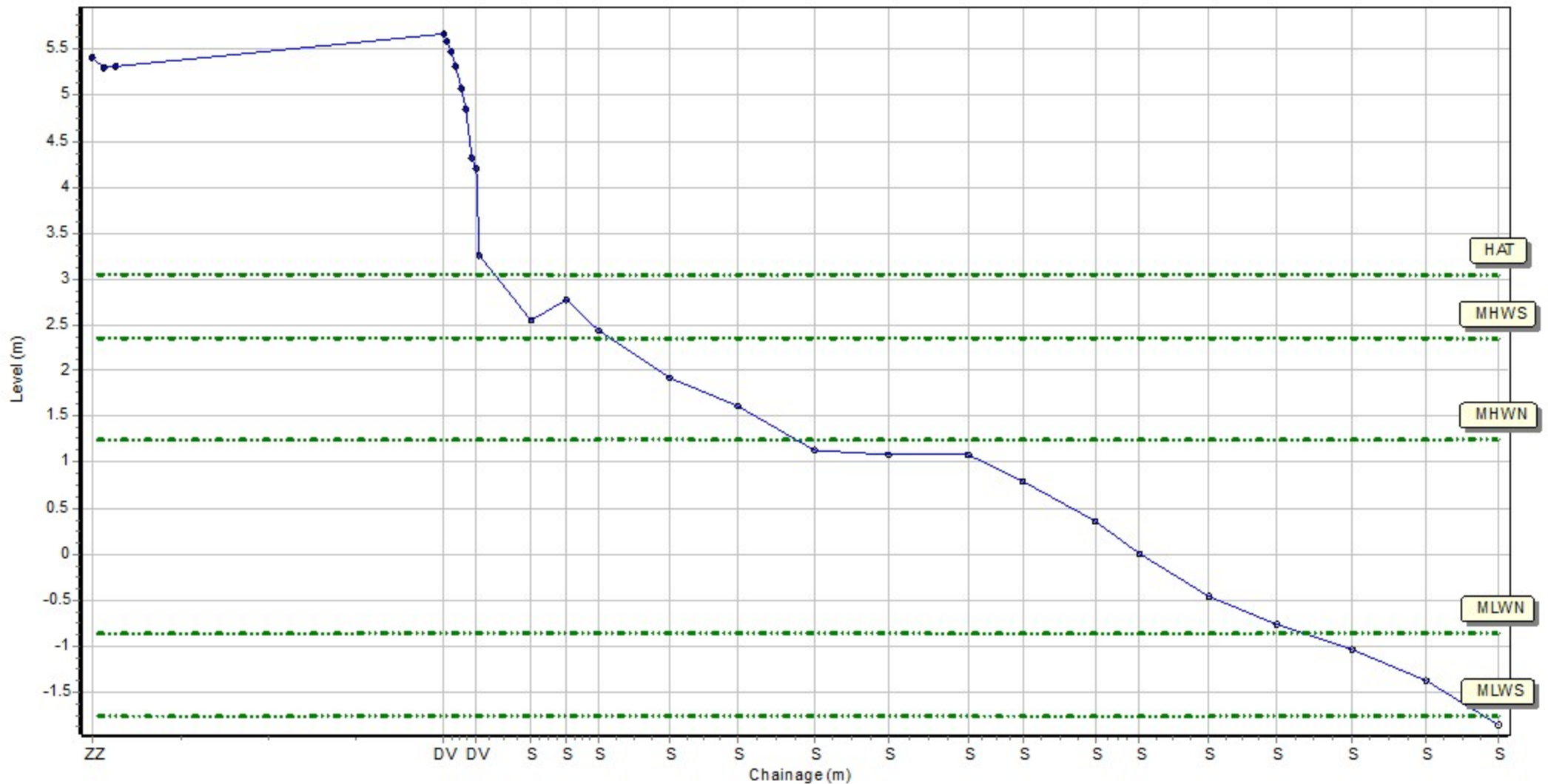
Low Tide Time:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 428575.092 Northing: 602921.577 Profile Bearing: 93 ° from North





# Beach Profile

Location: 1aADC16B

Date: 20/09/2021 Inspector: AG

Low Tide:

Low Tide Time:

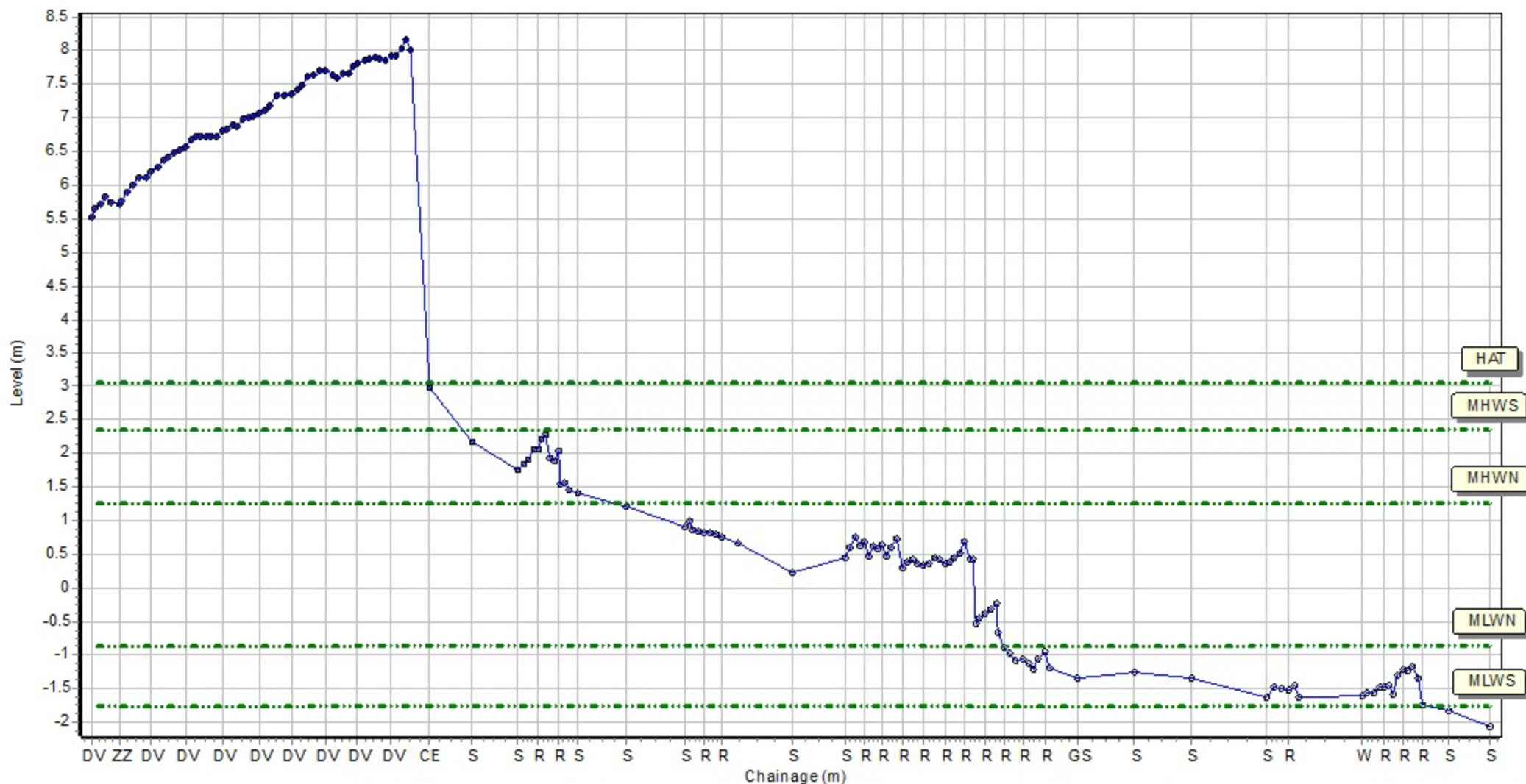
Wind Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 428440.457 Northing: 601948.341 Profile Bearing: 144 ° from North



# Beach Profile

Location: 1aADC17

Date: 20/09/2021 Inspector: AG

Wind Sea State:

Low Tide:

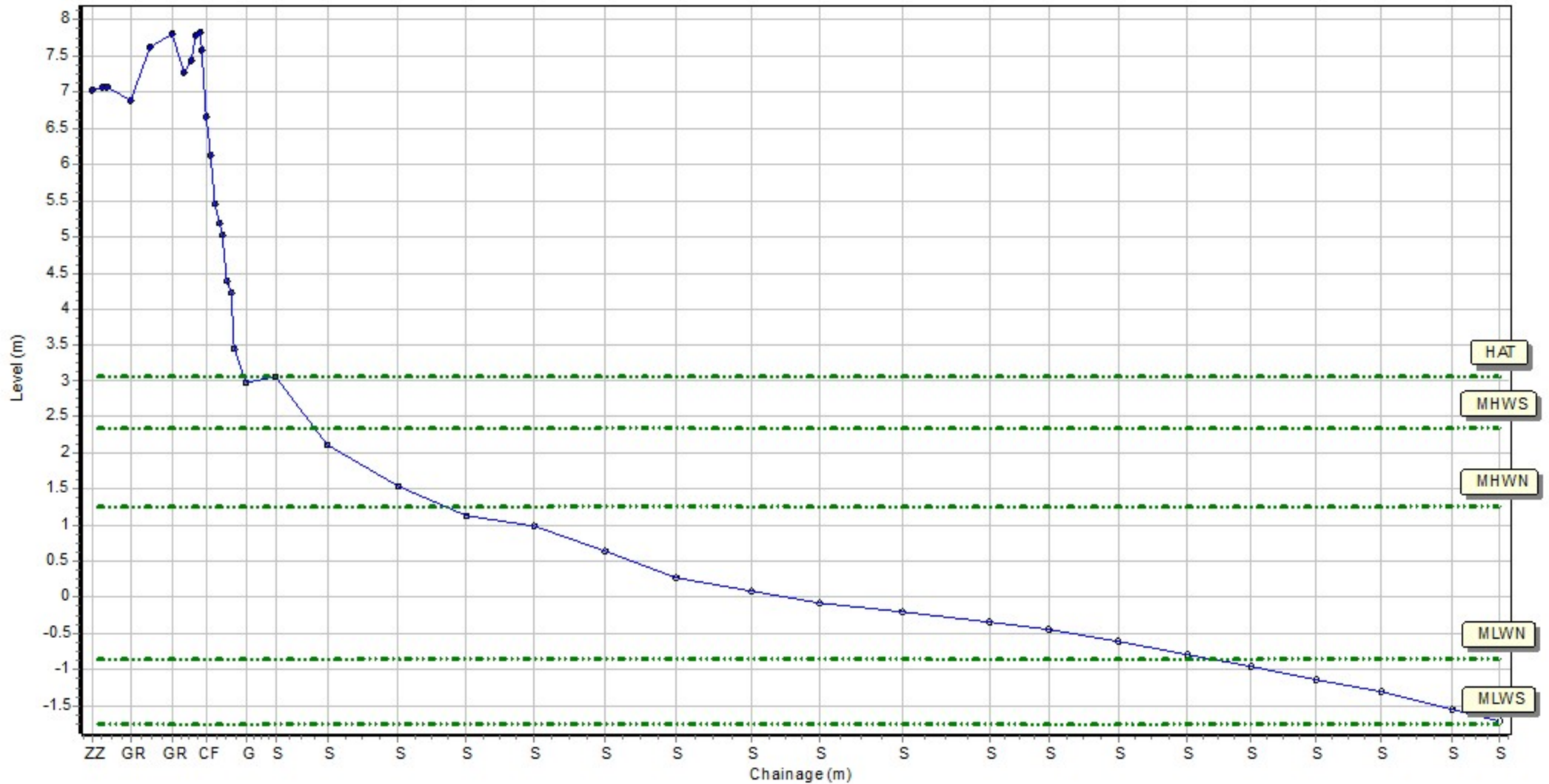
Low Tide Time:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 428116.847 Northing: 601565.465 Profile Bearing: 114 ° from North





# Beach Profile

Location: 1aADC17A

Date: 20/09/2021 Inspector: AG

Low Tide:

Low Tide Time:

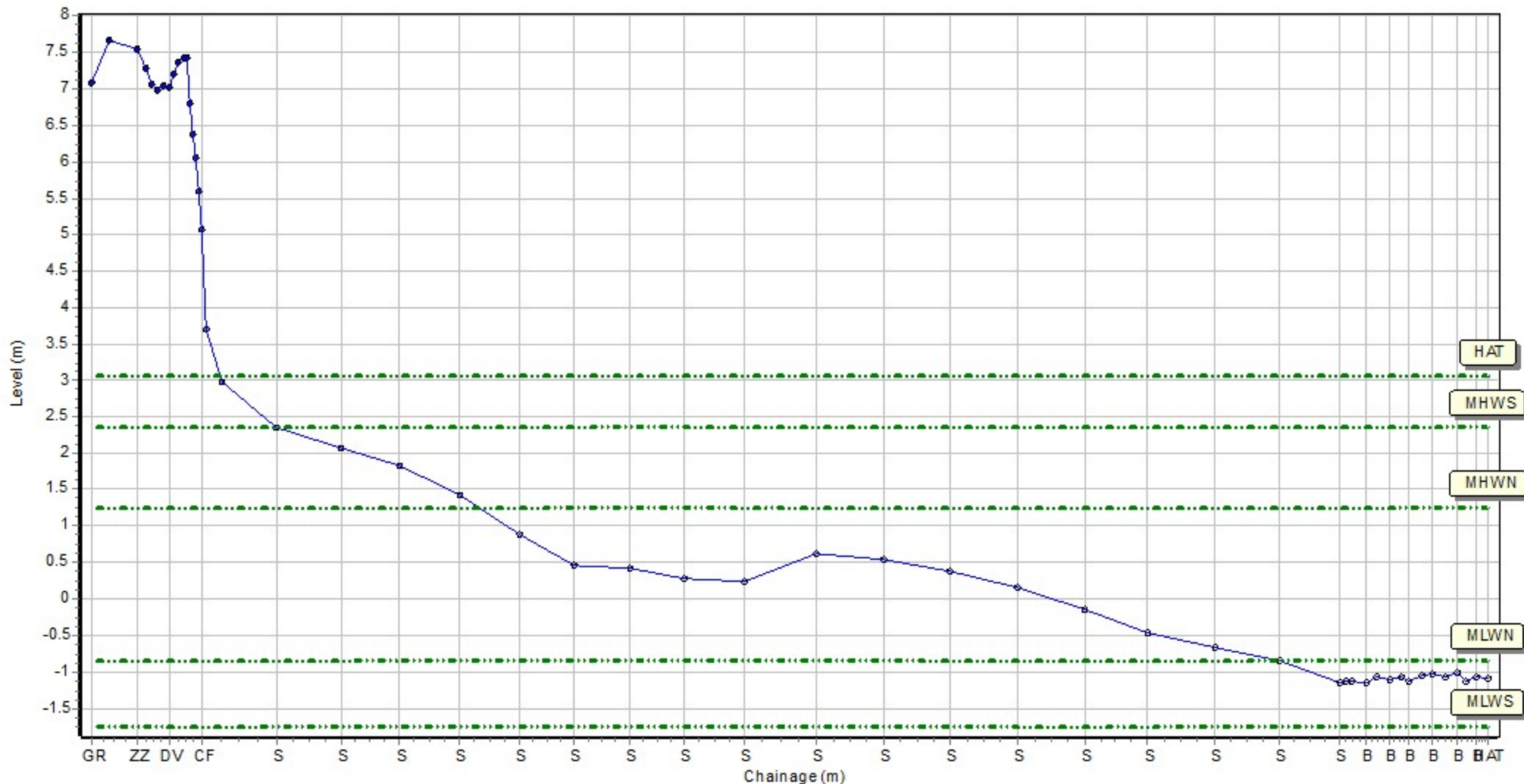
Wind Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 427947.662 Northing: 601040.259 Profile Bearing: 109 ° from North



# Beach Profile

Location: 1aCMBC01

Date: 21/09/2021 Inspector: AG

Low Tide:

Low Tide Time:

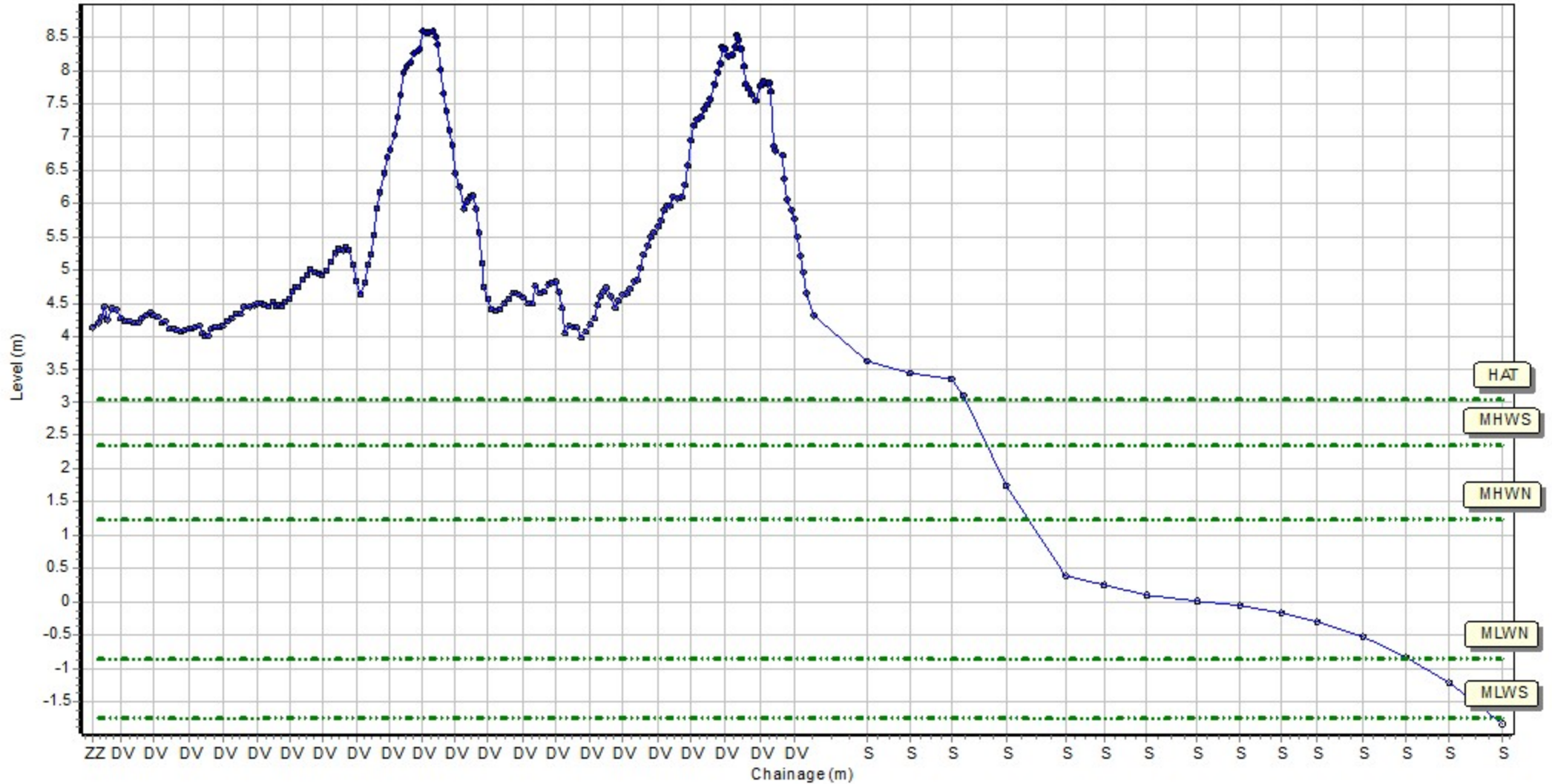
Wind Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 427552.578 Northing: 596402.769 Profile Bearing: 59 ° from North





# Beach Profile

Location: 1aCMBC03

Date: 08/10/2021 Inspector: AG

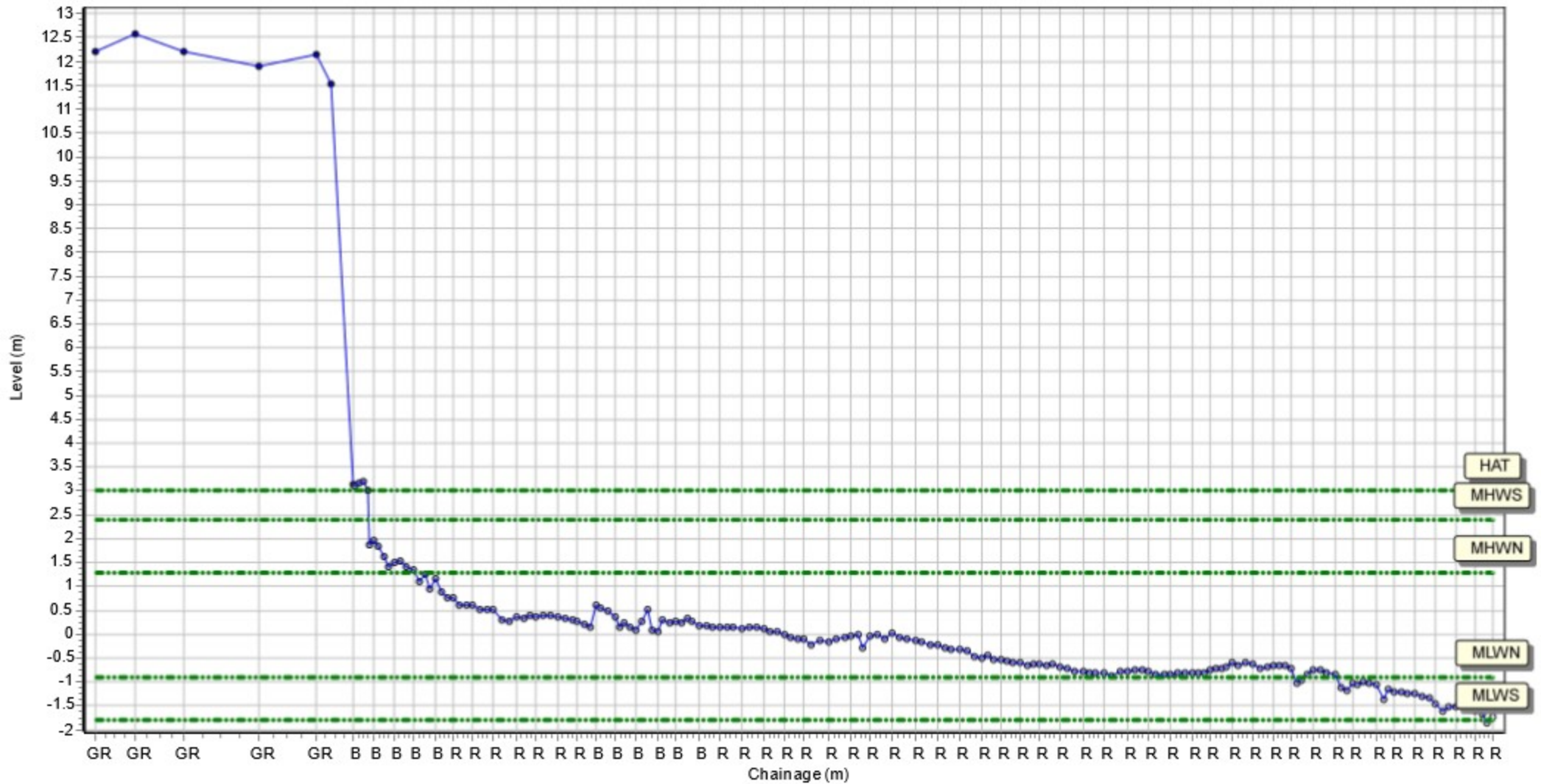
Low Tide: Low Tide Time:

Wind Sea State:

Visibility: Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 430118.859 Northing: 592587.445 Profile Bearing: 115 ° from North





# Beach Profile

Location: 1aCMBC03A

Date: 08/10/2021 Inspector: AG

Low Tide:

Low Tide Time:

Wind

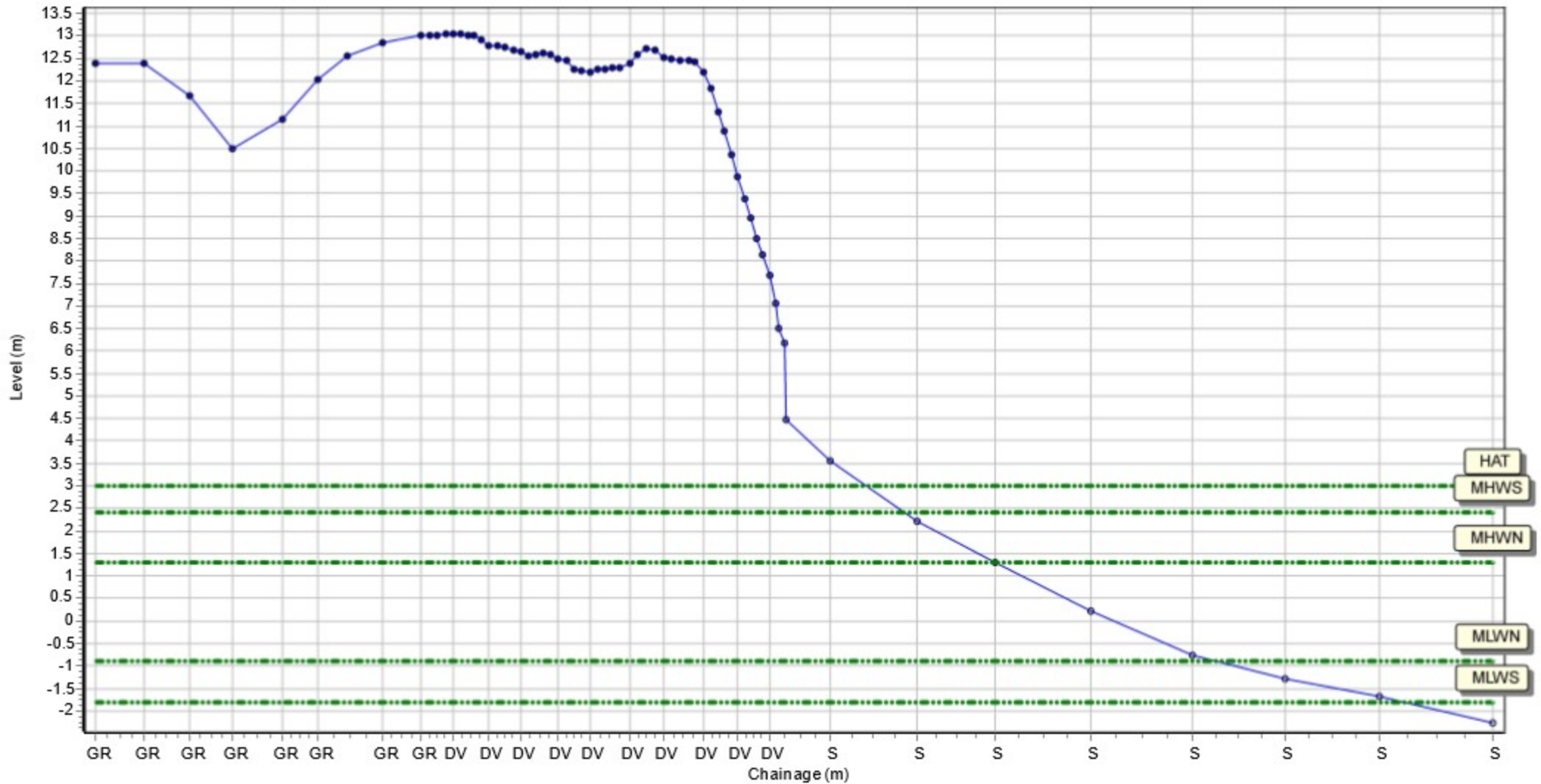
Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 430128.317 Northing: 591148.463 Profile Bearing: 70 ° from North





# Beach Profile

Location: 1aCMBC03B

Date: 08/10/2021 Inspector: AG

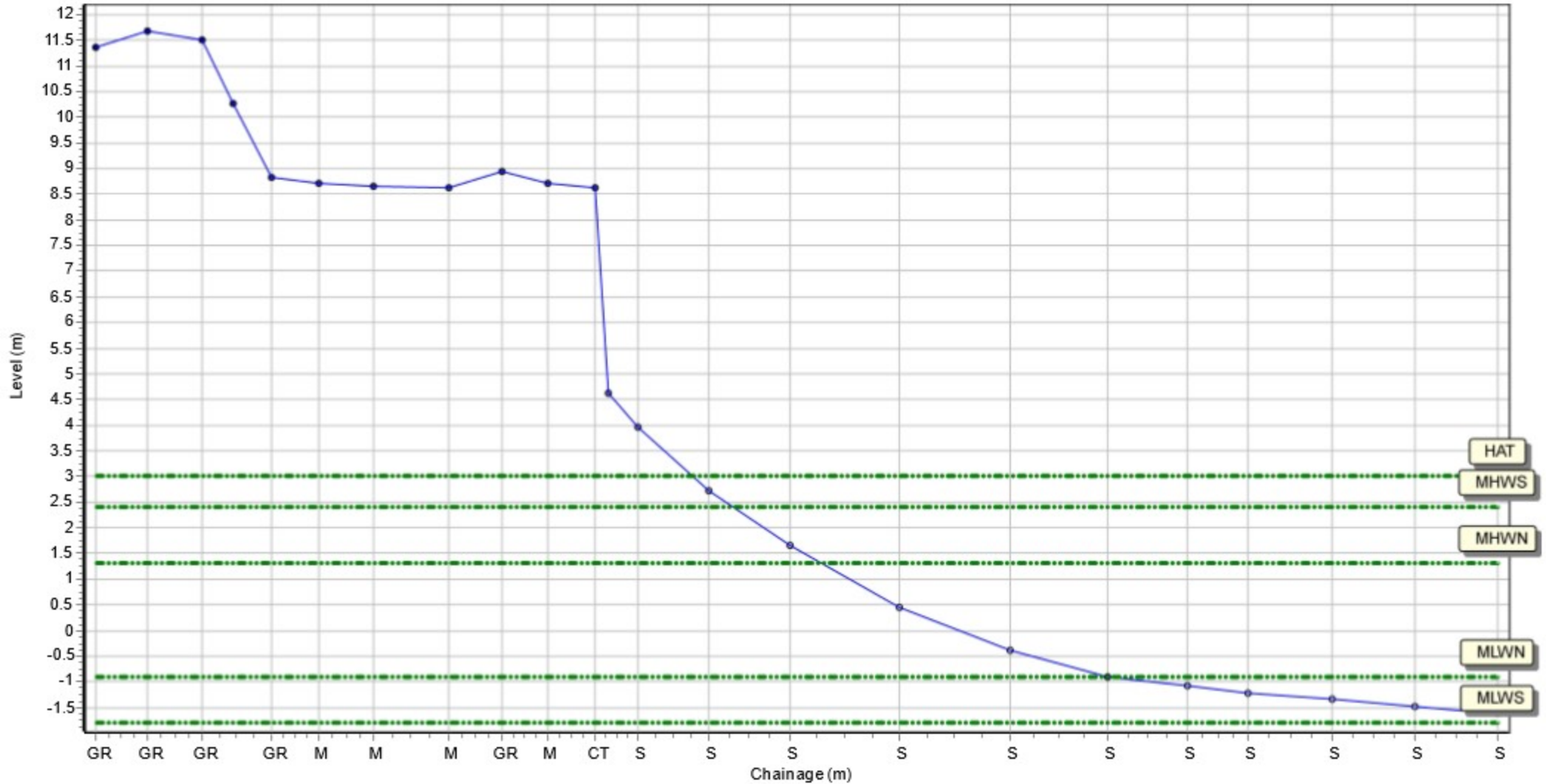
Low Tide: Low Tide Time:

Wind Sea State:

Visibility: Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 430478.518 Northing: 590661.474 Profile Bearing: 58 ° from North



# Beach Profile

Location: 1aWDC02

Date: 21/09/2021 Inspector: AG

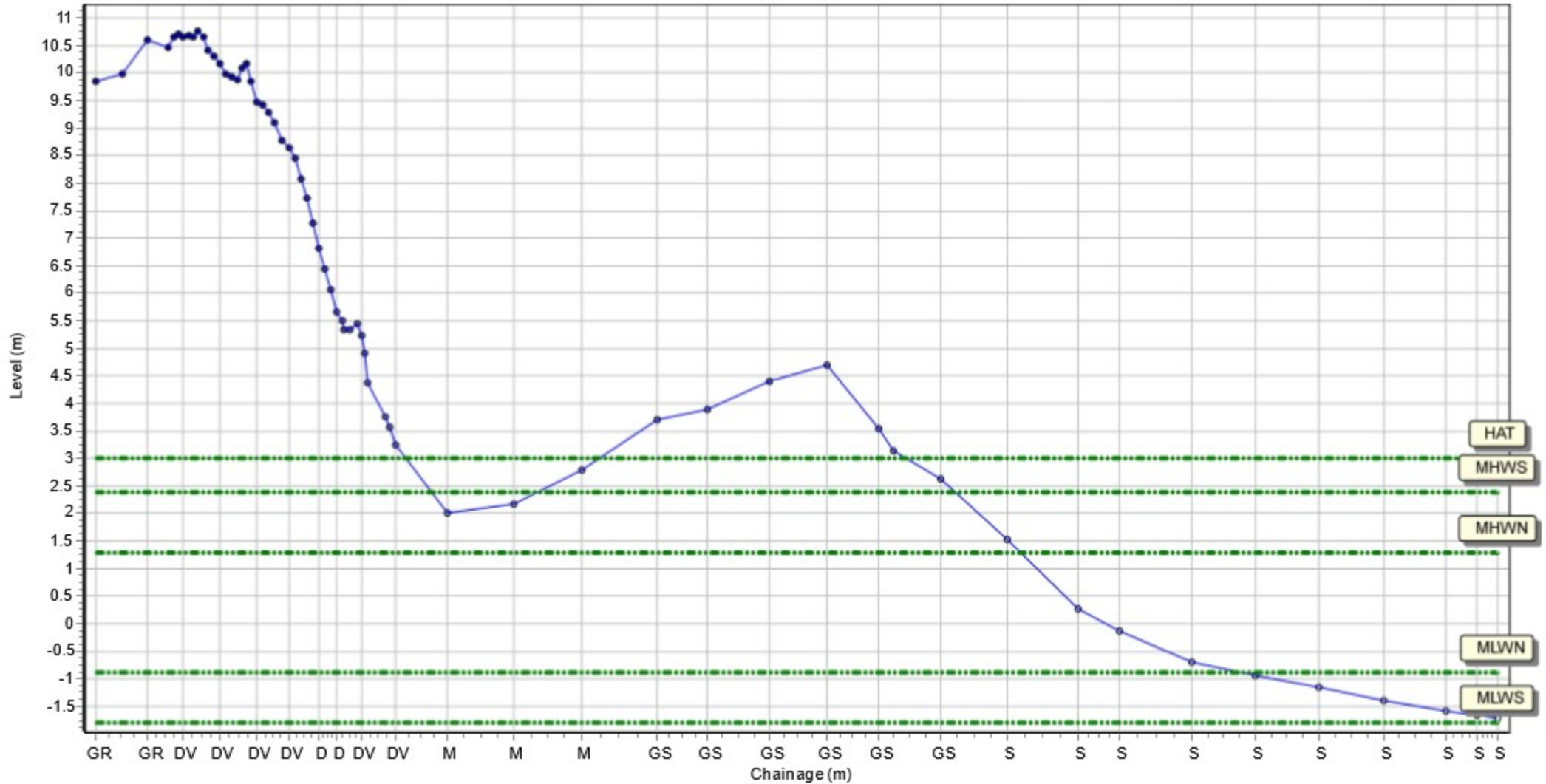
Wind Sea State:

Low Tide: Low Tide Time:

Visibility: Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 430807.97 Northing: 589773.192 Profile Bearing: 59 ° from North



# Beach Profile

Location: 1aWDC03

Date: 21/09/2021

Inspector: AG

Low Tide:

Low Tide Time:

Wind

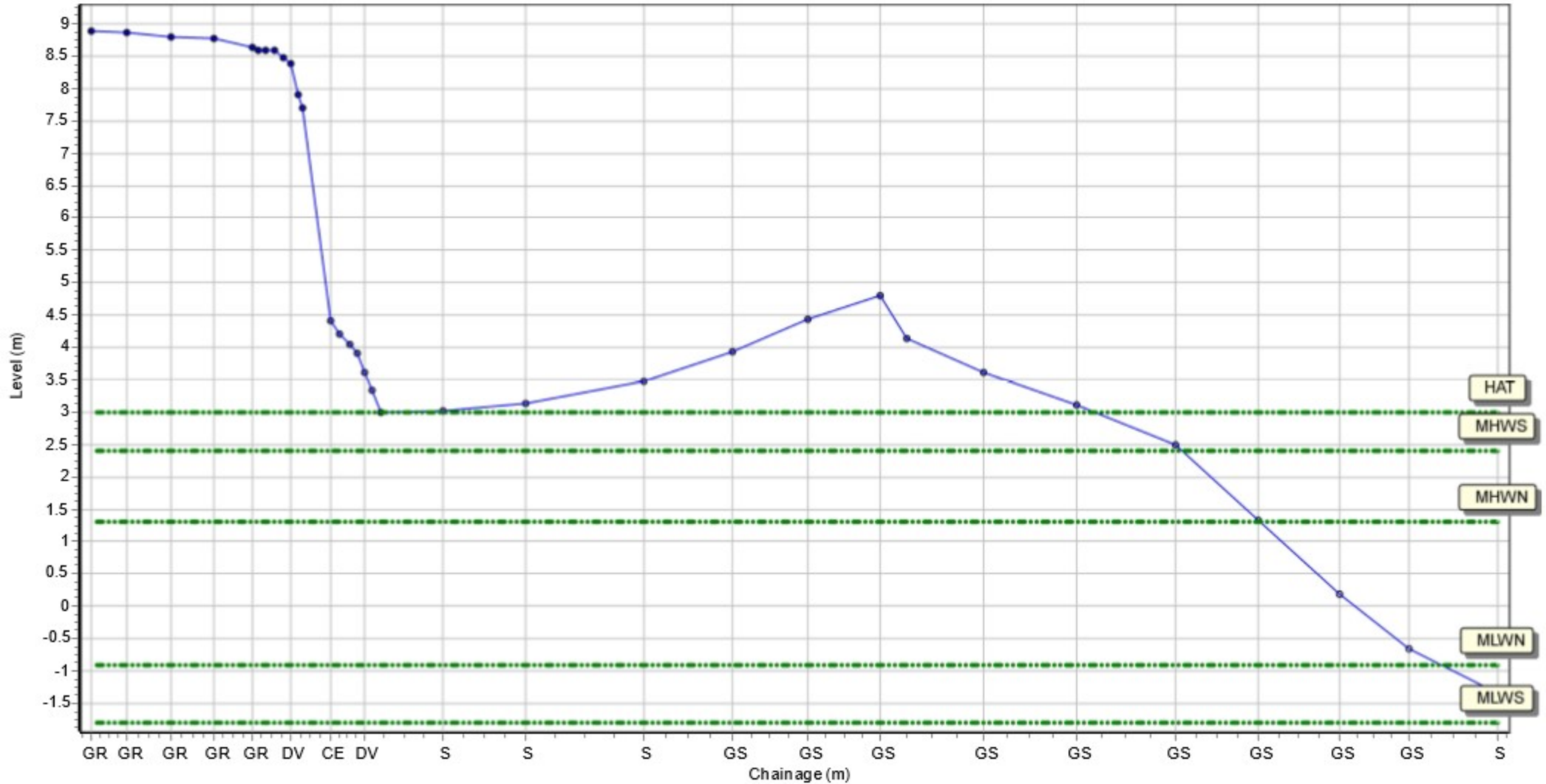
Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 430998.77 Northing: 589548.265 Profile Bearing: 58 ° from North



# Beach Profile

Location: 1aWDC04

Date: 24/08/2021 Inspector: AG

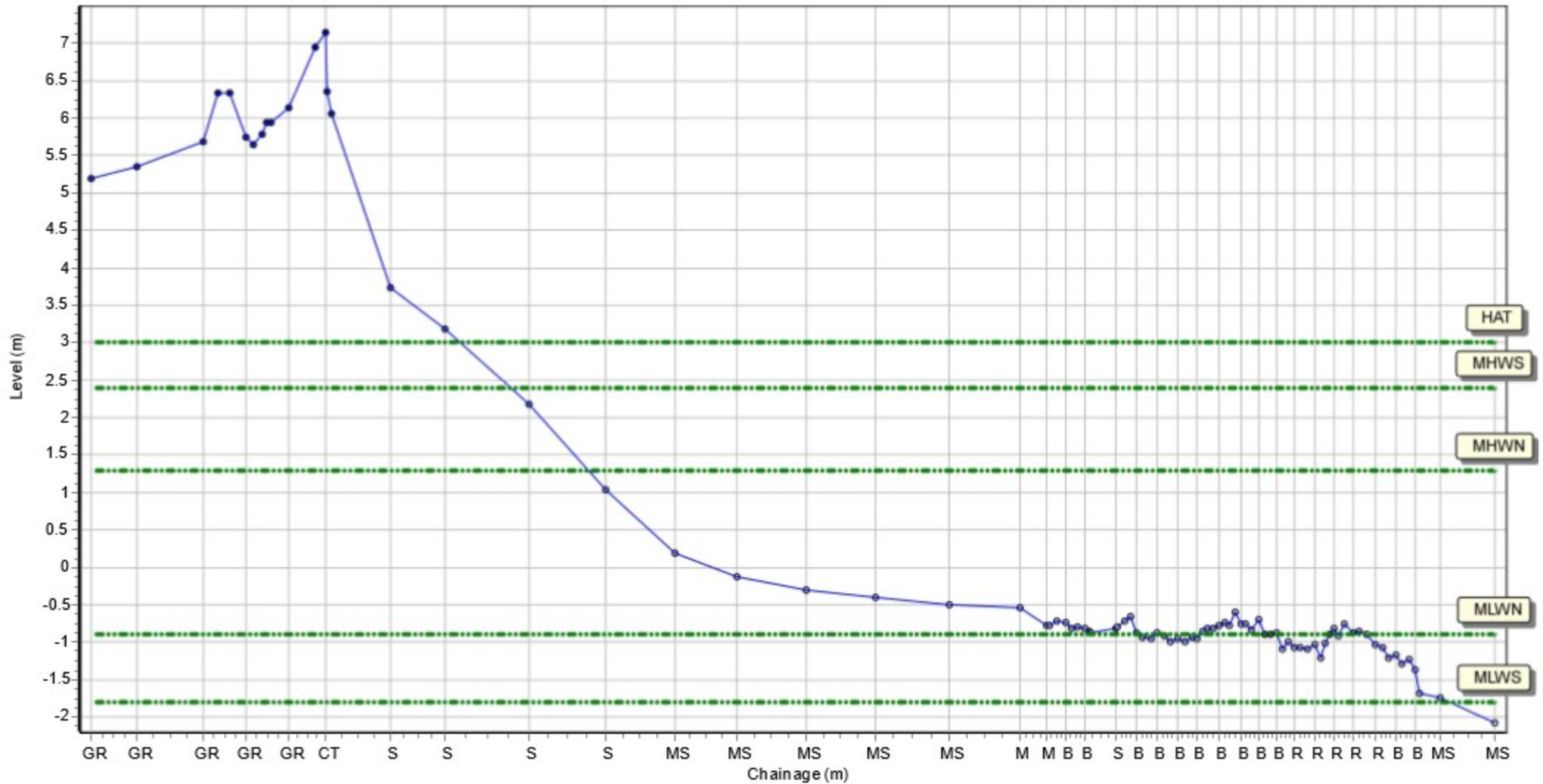
Wind Sea State:

Low Tide: Low Tide Time:

Visibility: Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 431518.807 Northing: 588823.532 Profile Bearing: 92 ° from North









# Beach Profile

Location: 1aWDC05A

Date: 24/08/2021 Inspector: AG

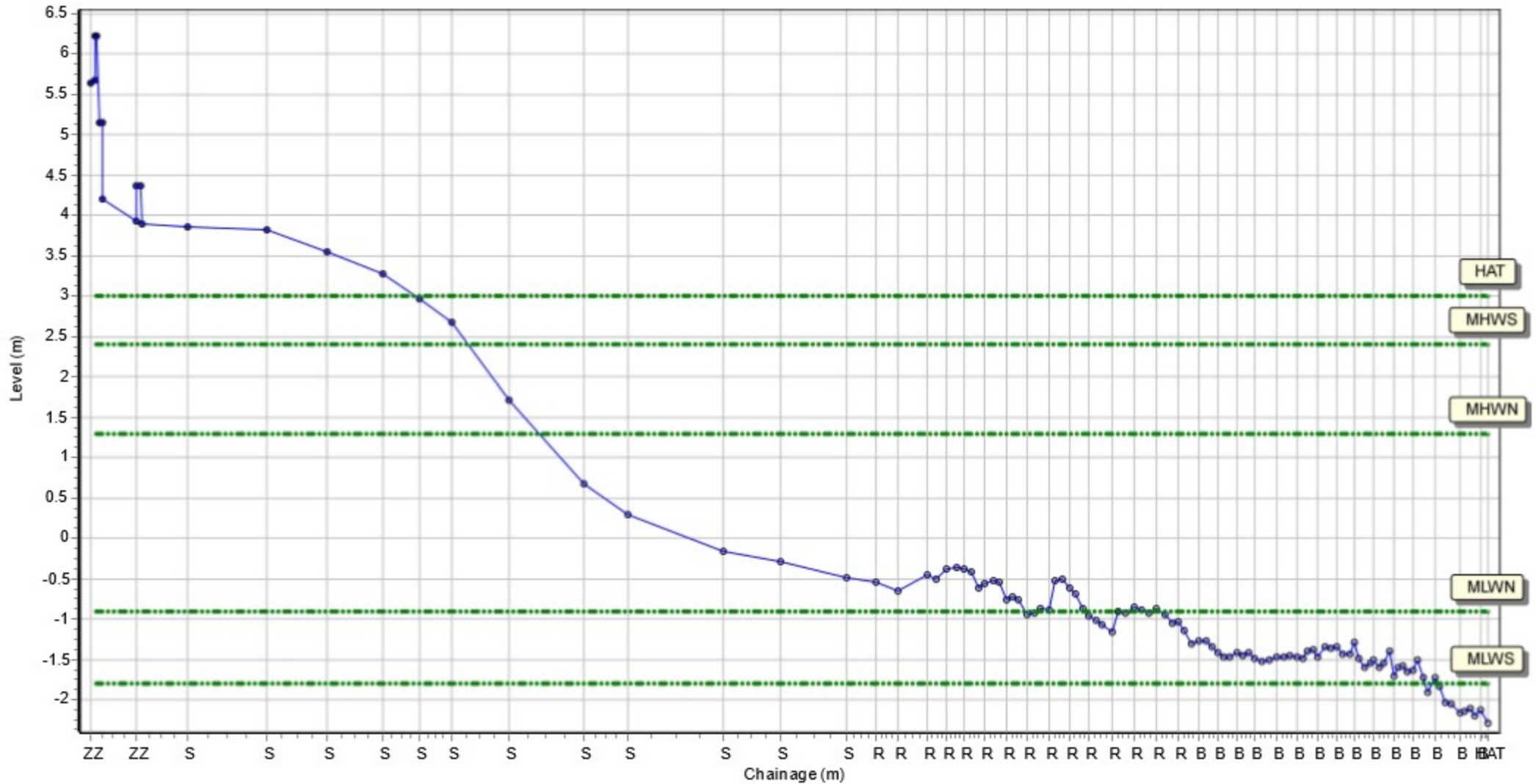
Wind Sea State:

Low Tide: Low Tide Time:

Visibility: Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 431490.829 Northing: 588054.668 Profile Bearing: 181 ° from North



# Beach Profile

Location: 1aWDC06

Date: 24/08/2021

Inspector: AG

Low Tide:

Low Tide Time:

Wind

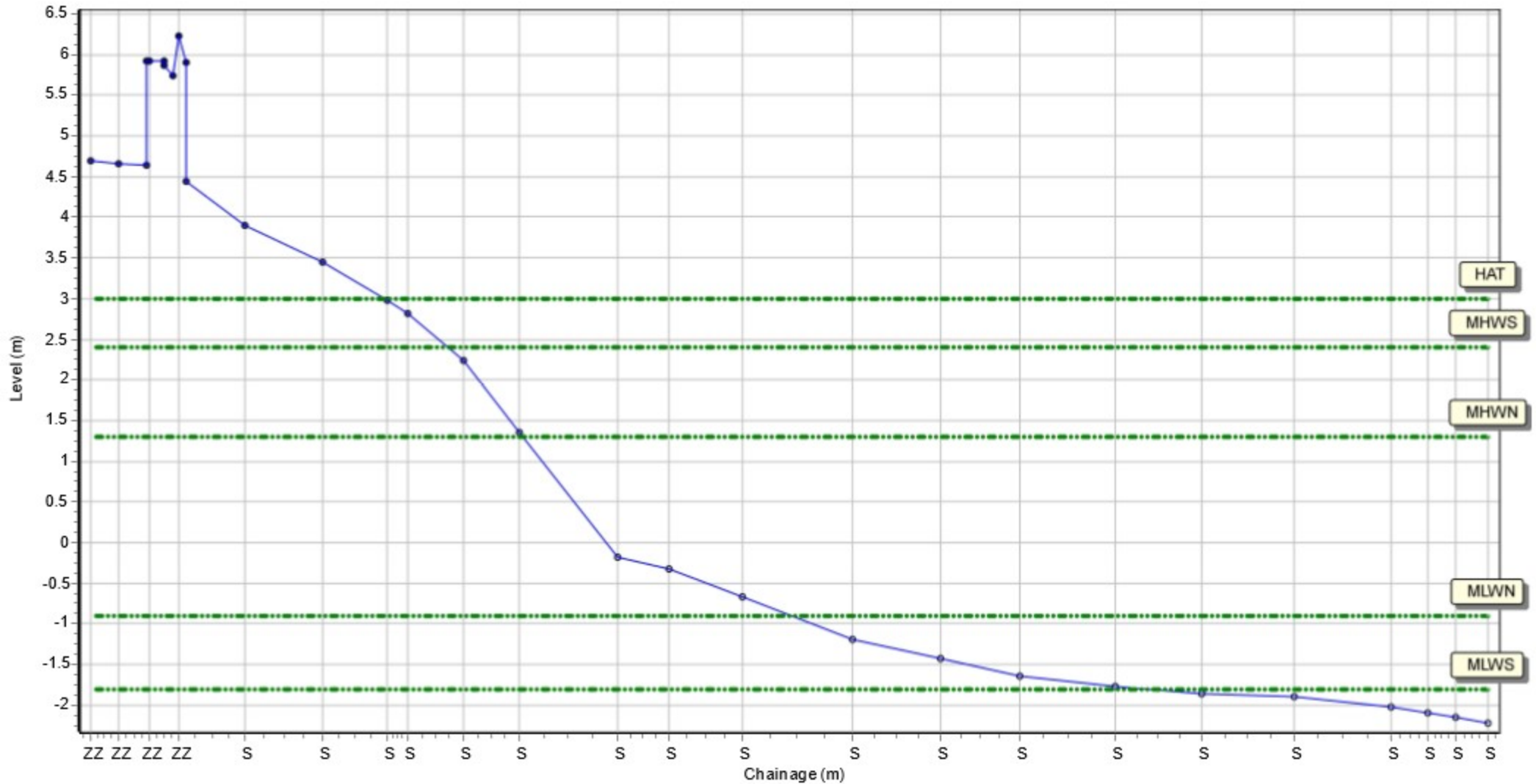
Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 431176.409 Northing: 587860.146 Profile Bearing: 125 ° from North



# Beach Profile

Location: 1aWDC06A

Date: 24/08/2021 Inspector: AG

Low Tide:

Low Tide Time:

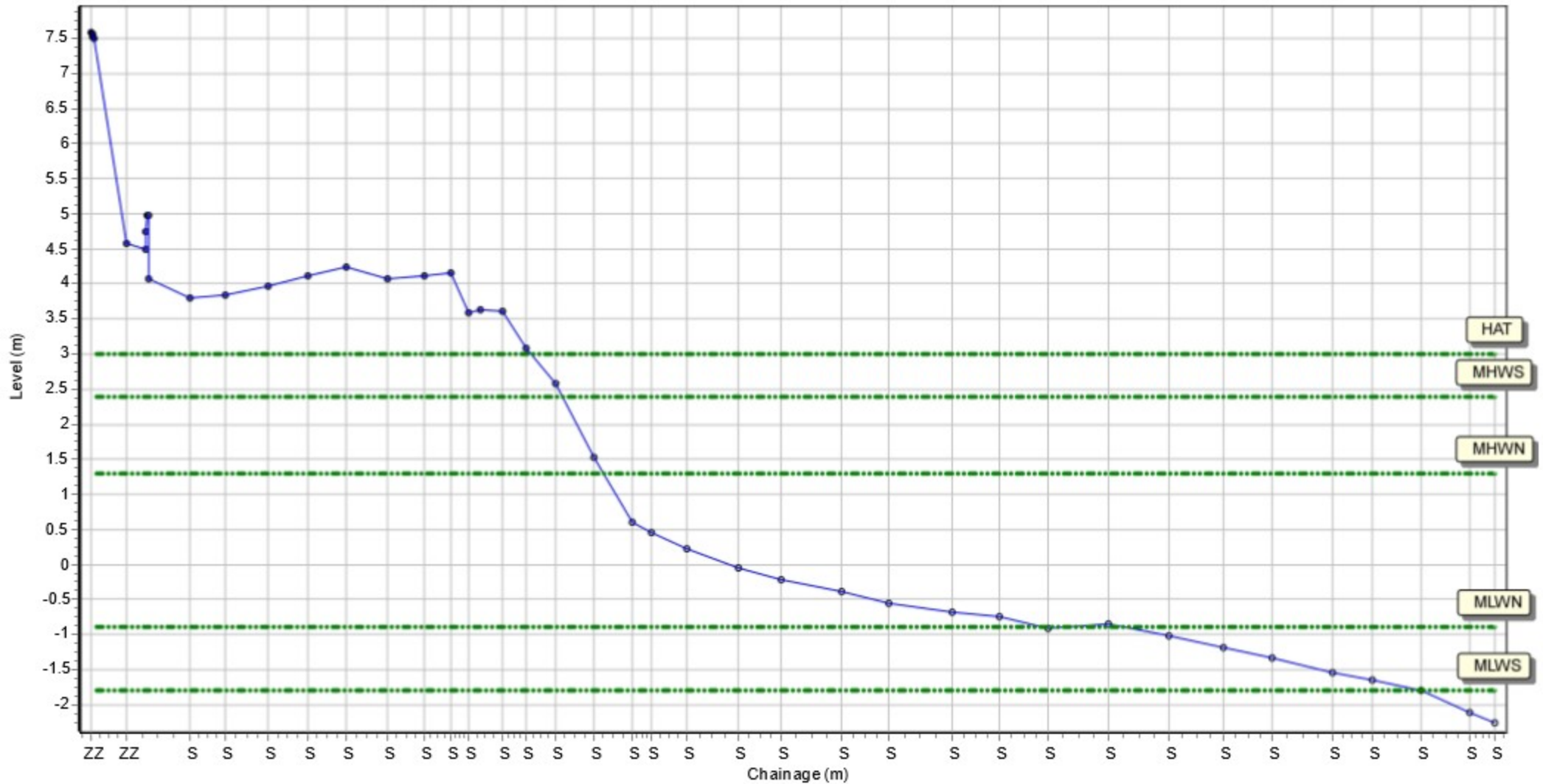
Wind Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 431040.809 Northing: 587666.014 Profile Bearing: 114 ° from North



# Beach Profile

Location: 1aWDC07

Date: 24/08/2021

Inspector: AG

Low Tide:

Low Tide Time:

Wind

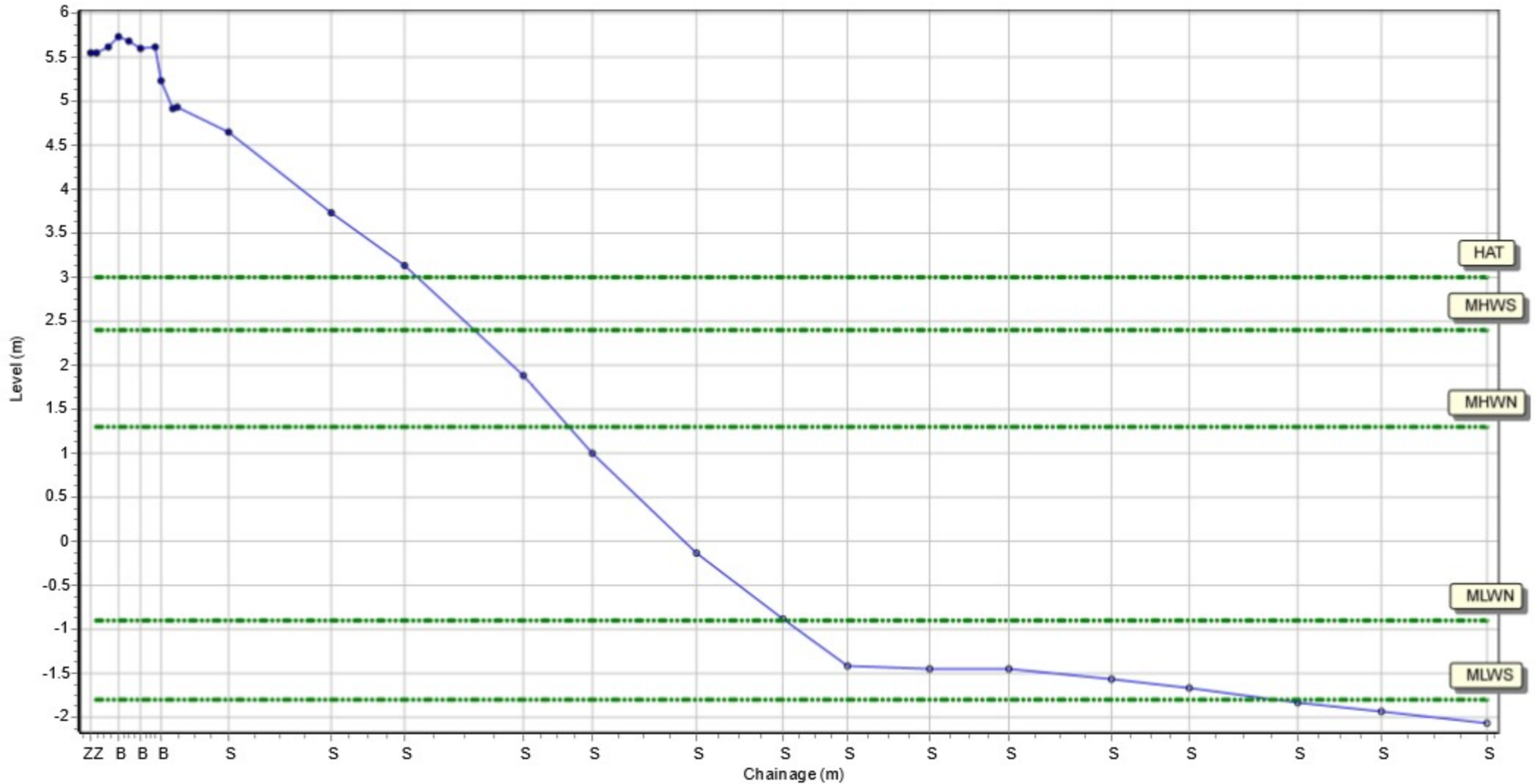
Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 430972.923 Northing: 587417.667 Profile Bearing: 103 ° from North













# Beach Profile

Location: 1aNWB4

Date: 24/08/2021

Inspector: AG

Low Tide:

Low Tide Time:

Wind

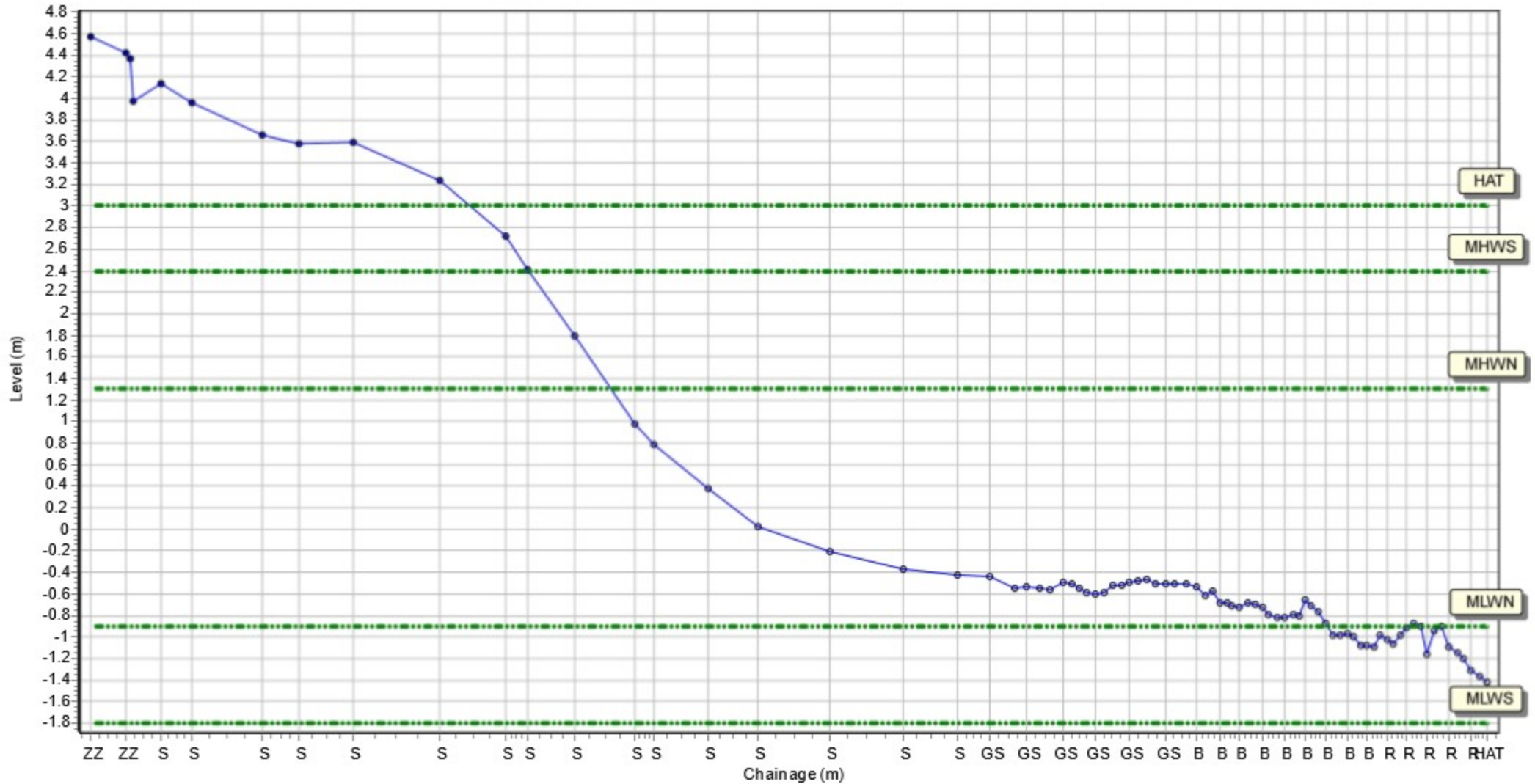
Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 431523.116 Northing: 588054.727 Profile Bearing: 184 ° from North



# Beach Profile

Location: 1aNWB5

Date: 24/08/2021

Inspector: AG

Low Tide:

Low Tide Time:

Wind

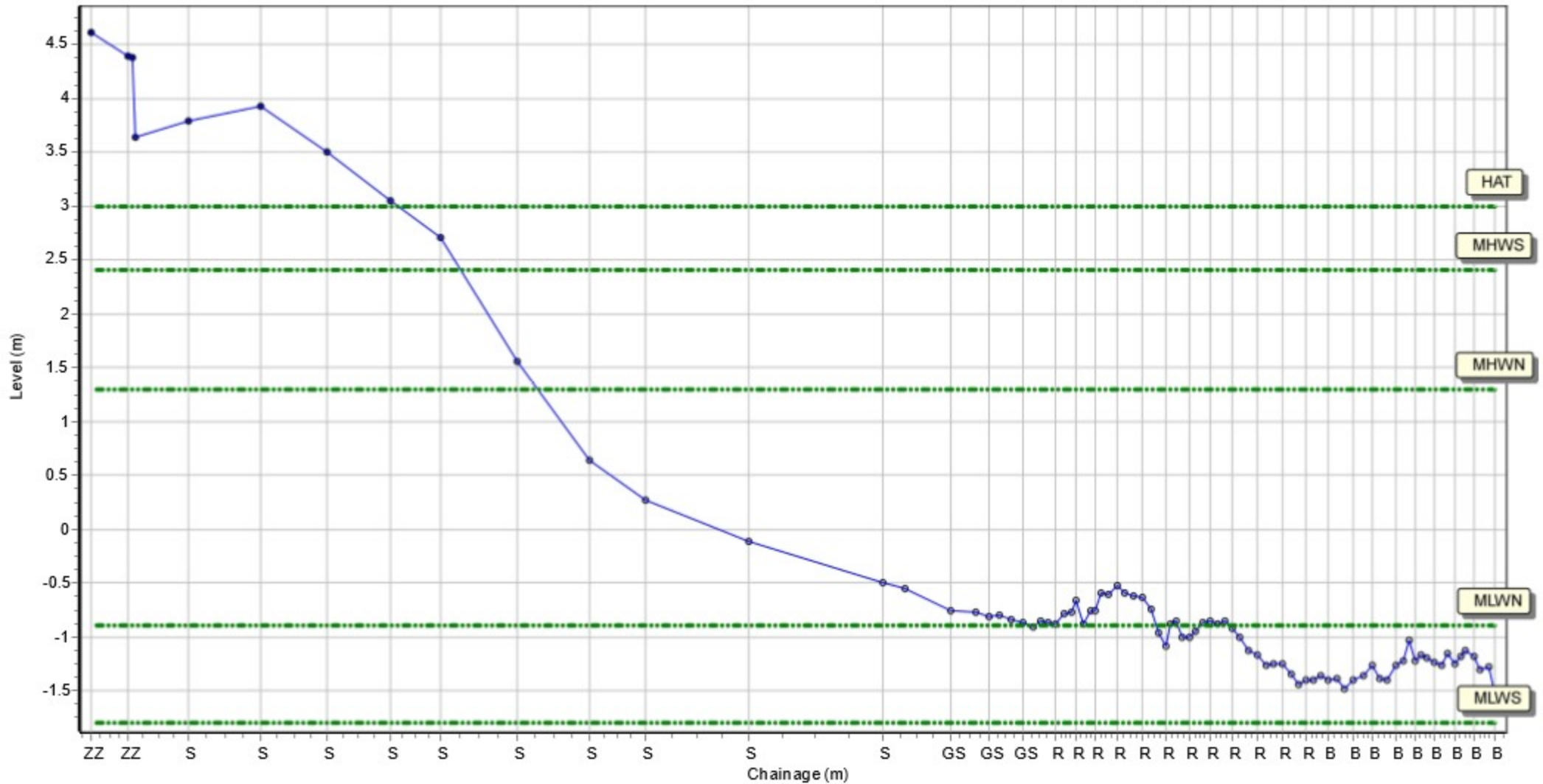
Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 431473.586 Northing: 588048.504 Profile Bearing: 174 ° from North





# Beach Profile

Location: 1aNWB6

Date: 24/08/2021

Inspector: AG

Low Tide:

Low Tide Time:

Wind

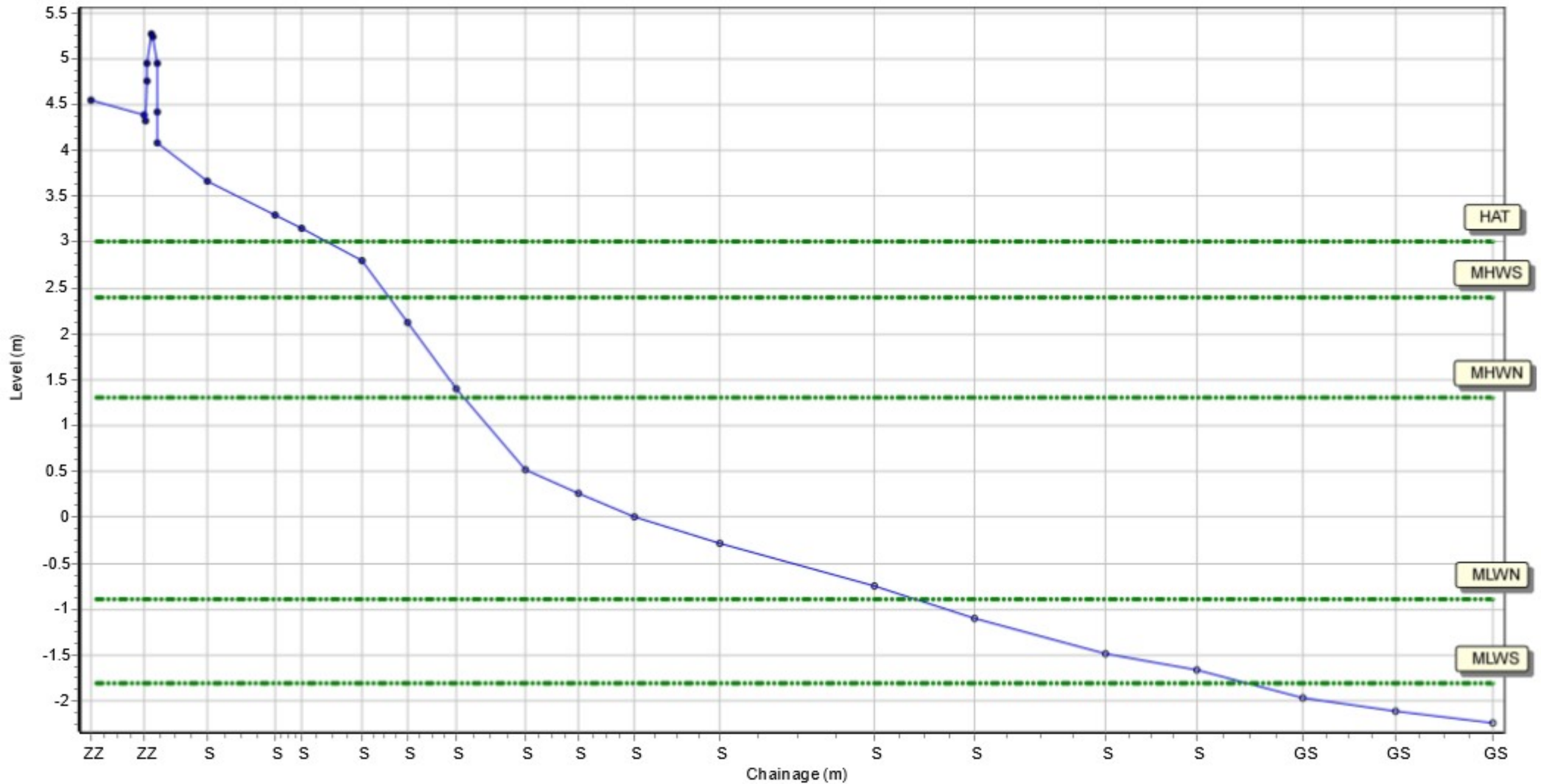
Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 431424.56 Northing: 588032.268 Profile Bearing: 164 ° from North



# Beach Profile

Location: 1aNWB7

Date: 24/08/2021

Inspector: AG

Low Tide:

Low Tide Time:

Wind

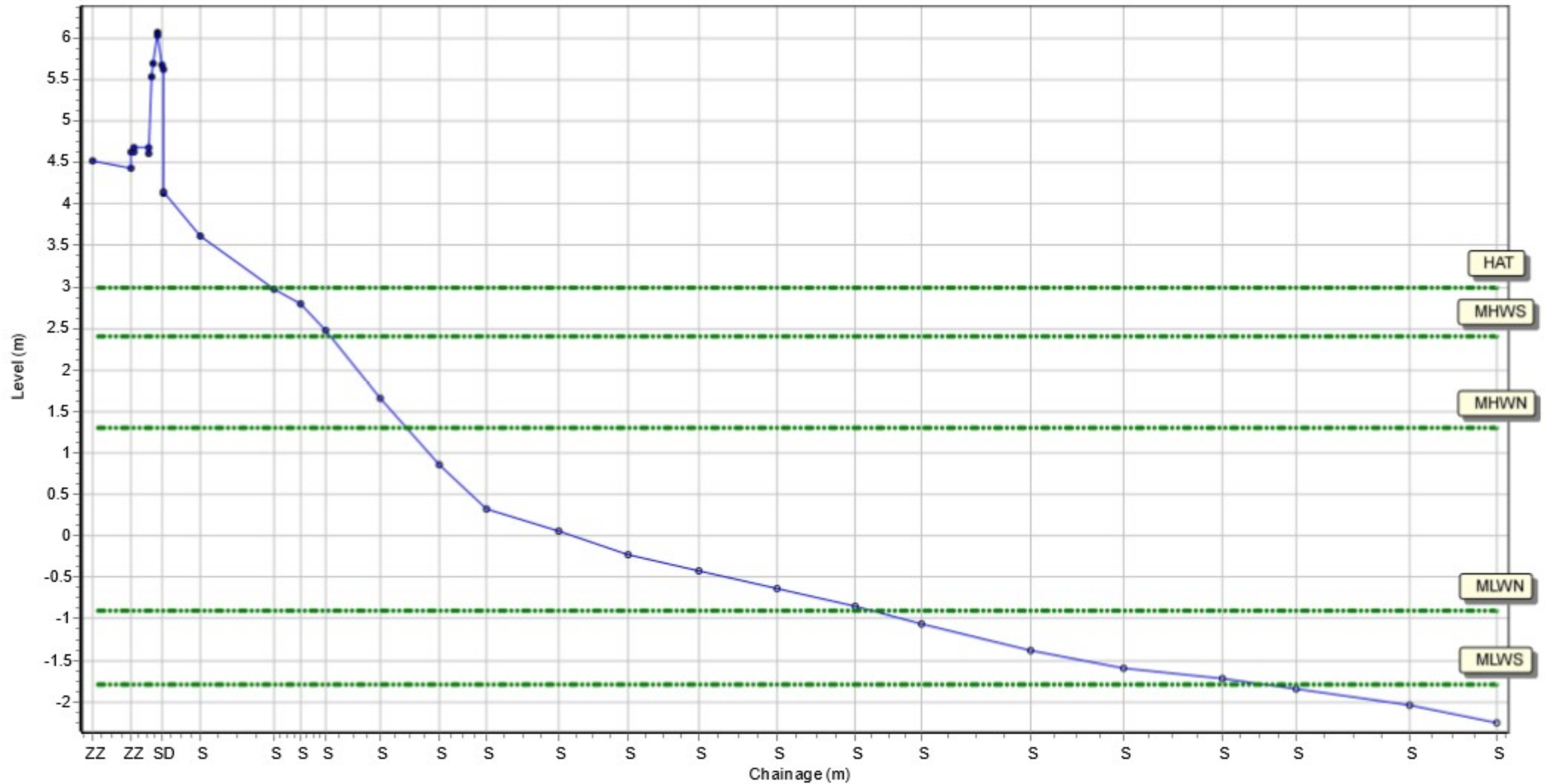
Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 431379.622 Northing: 588011.712 Profile Bearing: 165 ° from North



# Beach Profile

Location: 1aNWB8

Date: 24/08/2021

Inspector: AG

Low Tide:

Low Tide Time:

Wind

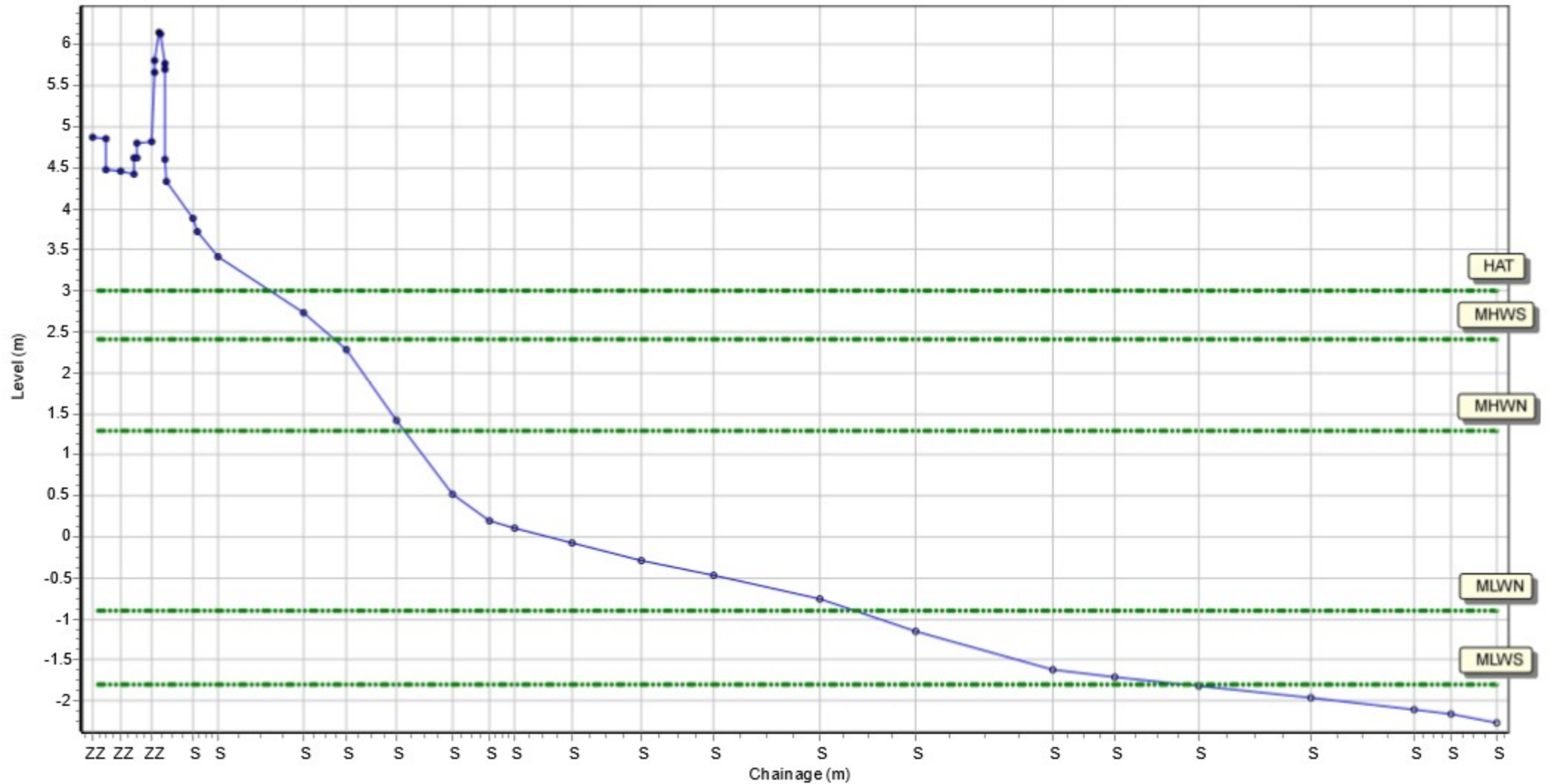
Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 431332.62 Northing: 587988.039 Profile Bearing: 144 ° from North



# Beach Profile

Location: 1aNWB9

Date: 24/08/2021 Inspector: AG

Low Tide:

Low Tide Time:

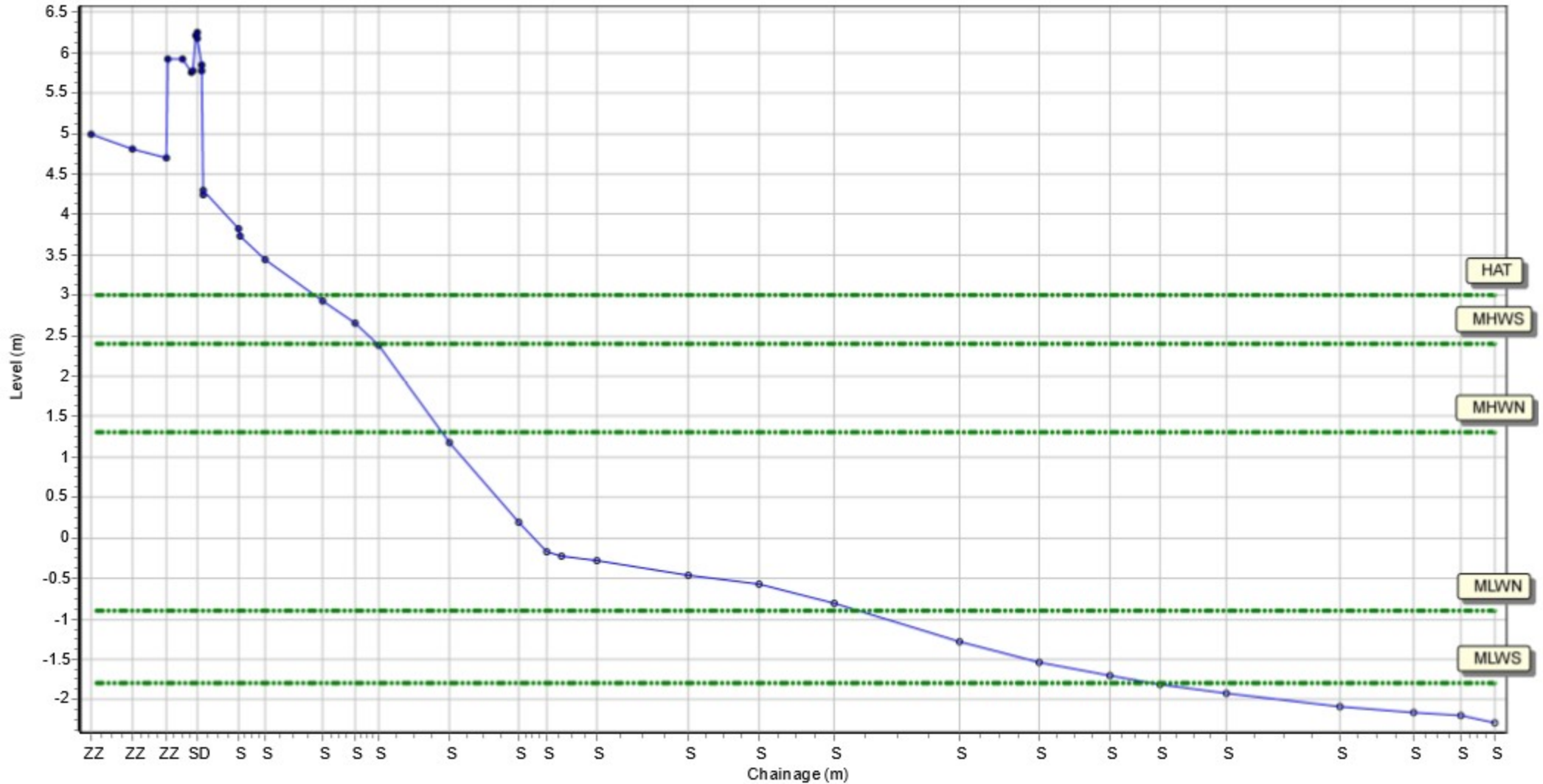
Wind Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 431288.421 Northing: 587963.979 Profile Bearing: 142 ° from North





# Beach Profile

Location: 1aNWB10

Date: 24/08/2021 Inspector: AG

Wind Sea State:

Low Tide:

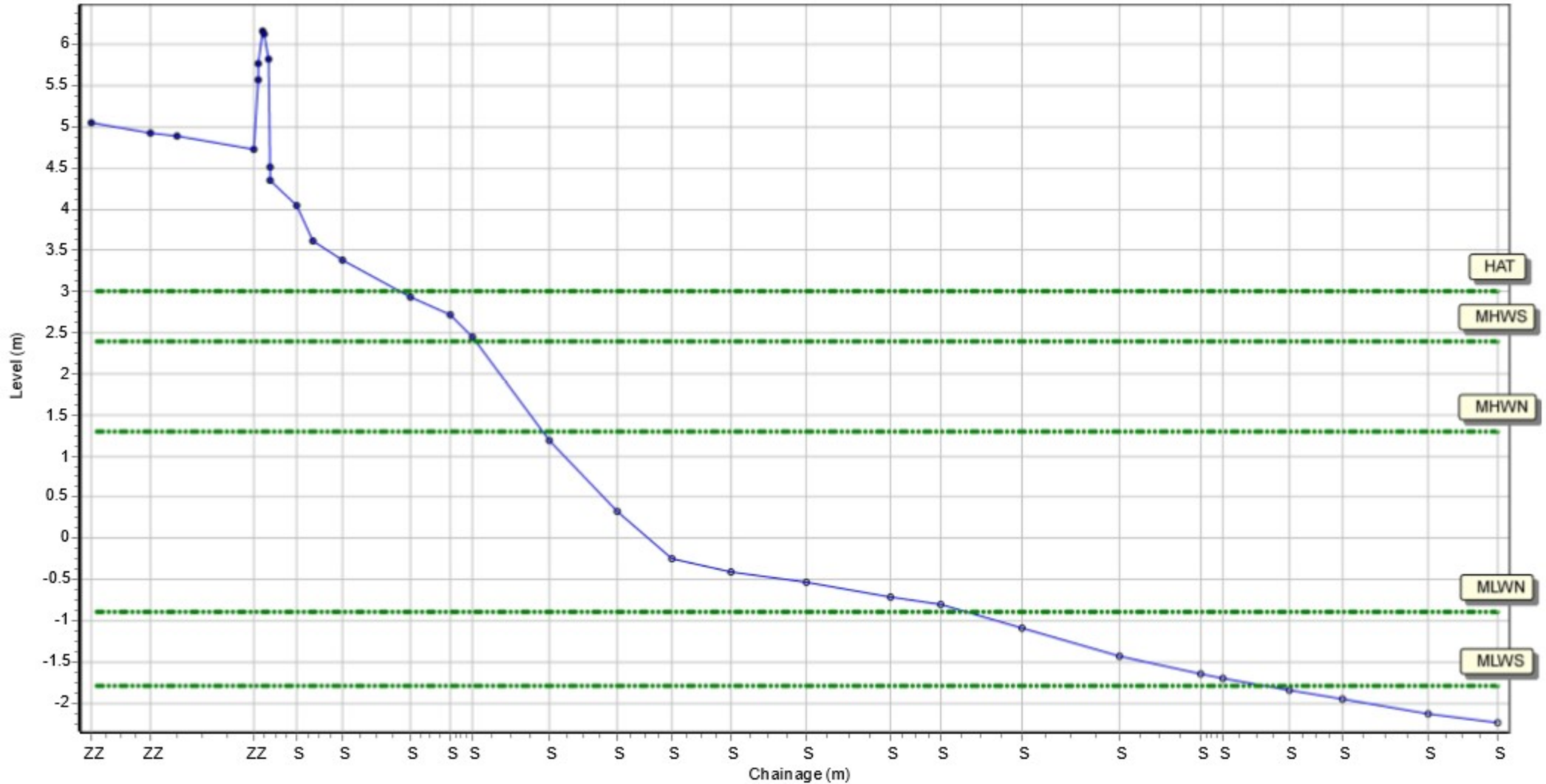
Low Tide Time:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 431244.074 Northing: 587936.575 Profile Bearing: 139 ° from North



# Beach Profile

Location: 1aNWB11

Date: 24/08/2021

Inspector: AG

Low Tide:

Low Tide Time:

Wind

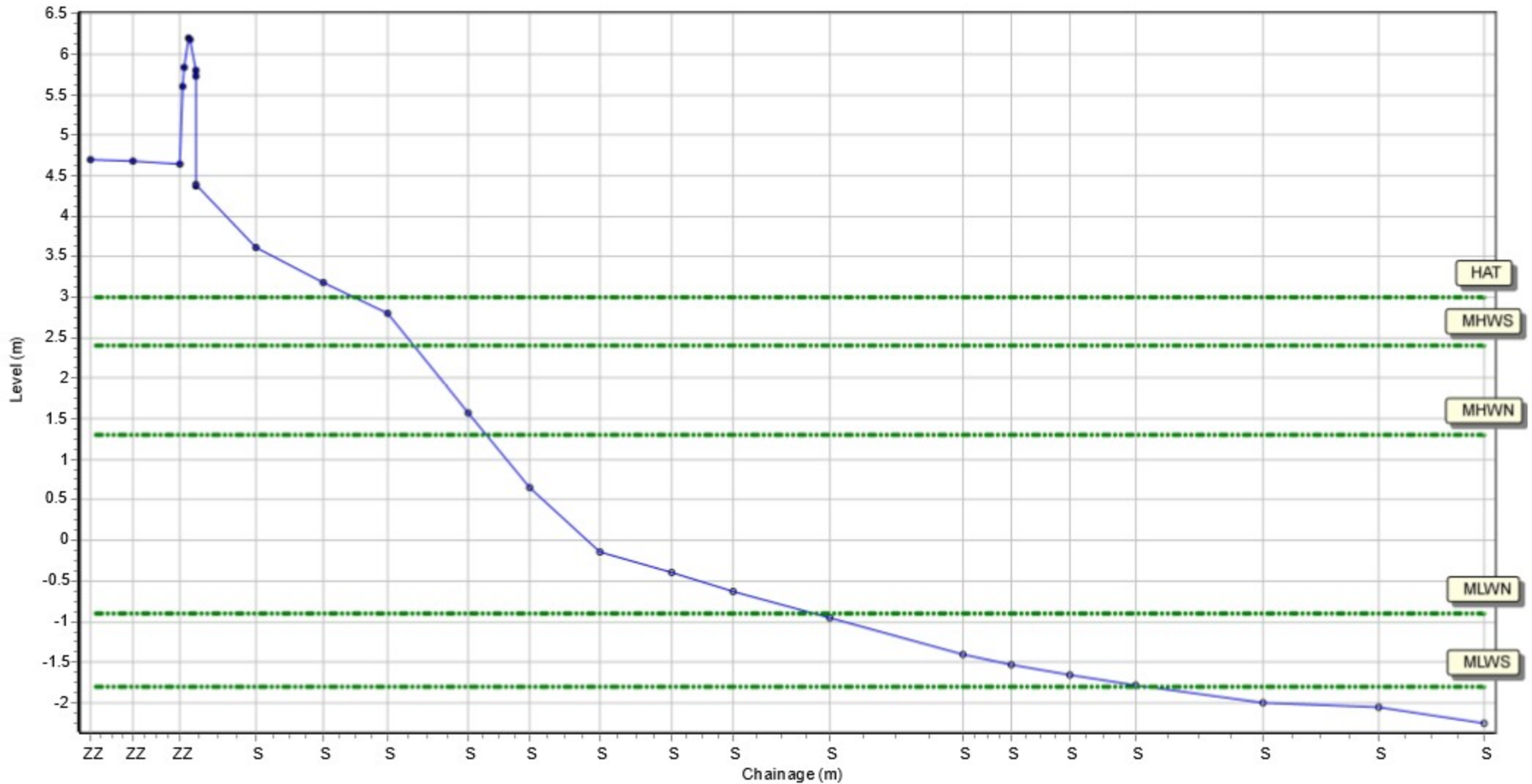
Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 431211.343 Northing: 587896.891 Profile Bearing: 135 ° from North



# Beach Profile

Location: 1aNWB12

Date: 24/08/2021

Inspector: AG

Low Tide:

Low Tide Time:

Wind

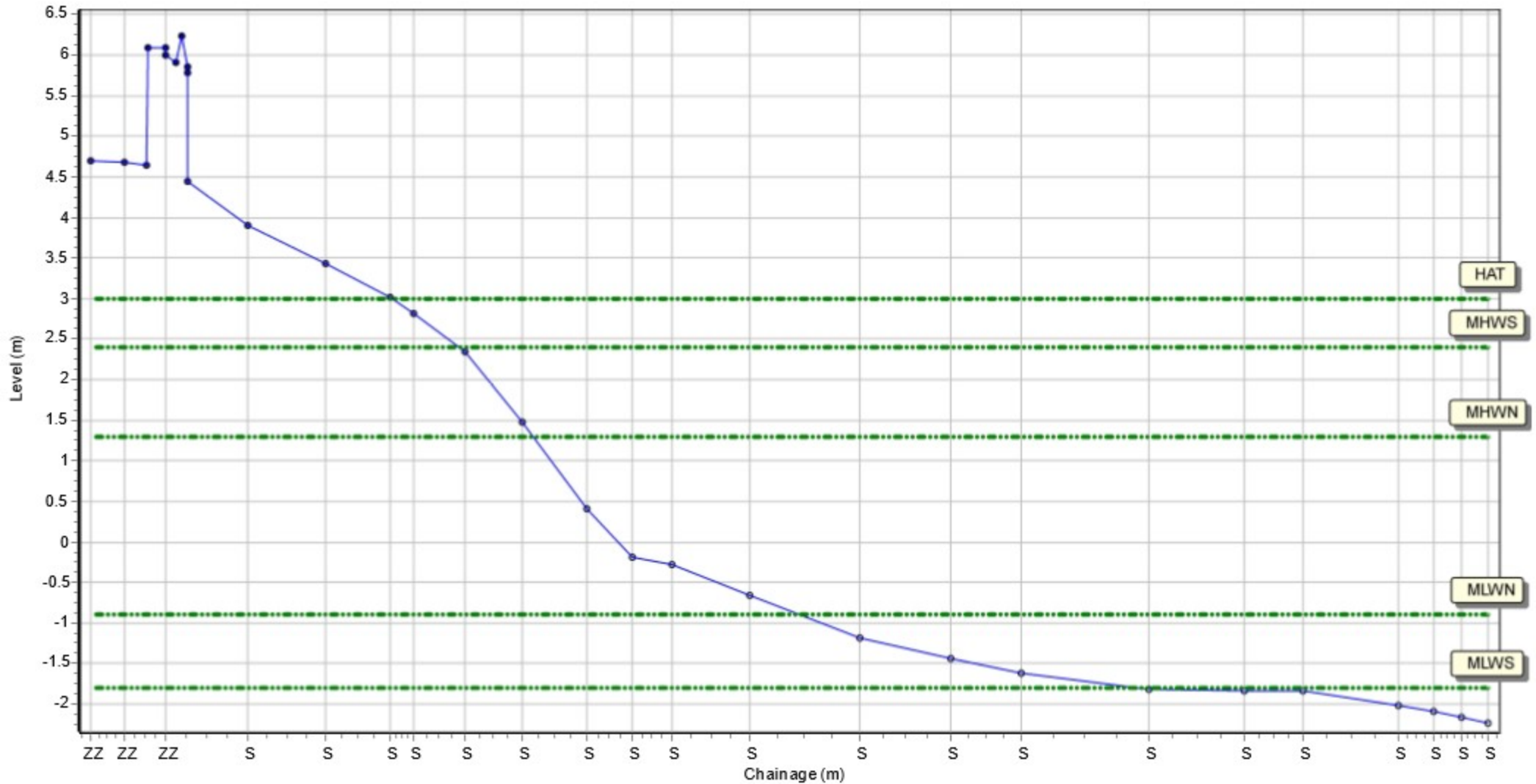
Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 431176.844 Northing: 587860.651 Profile Bearing: 132 ° from North



# Beach Profile

Location: 1aNWB13

Date: 24/08/2021 Inspector: AG

Wind Sea State:

Low Tide:

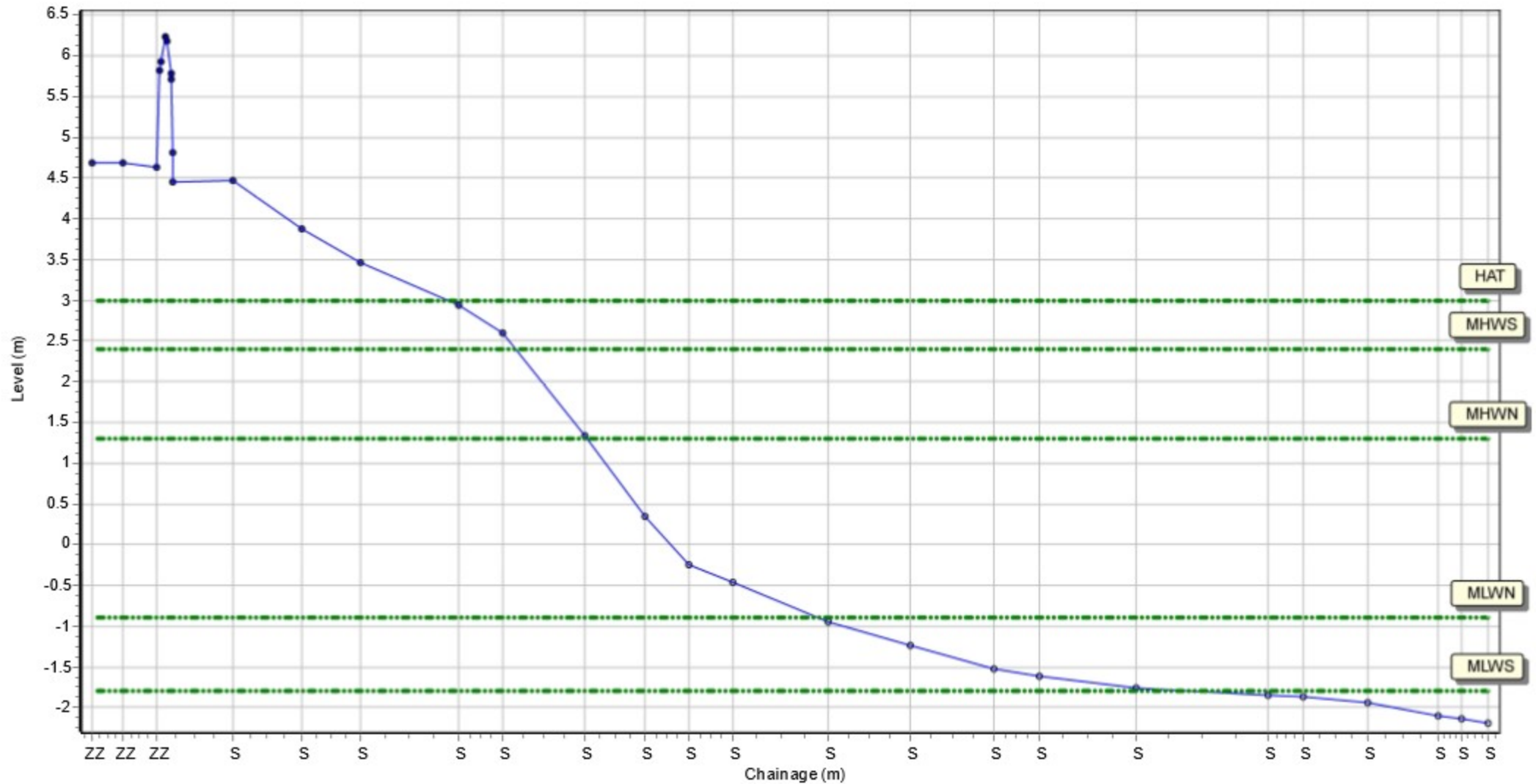
Low Tide Time:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 431143.784 Northing: 587821.594 Profile Bearing: 129 ° from North





# Beach Profile

Location: 1aNWB14

Date: 24/08/2021

Inspector: AG

Low Tide:

Low Tide Time:

Wind

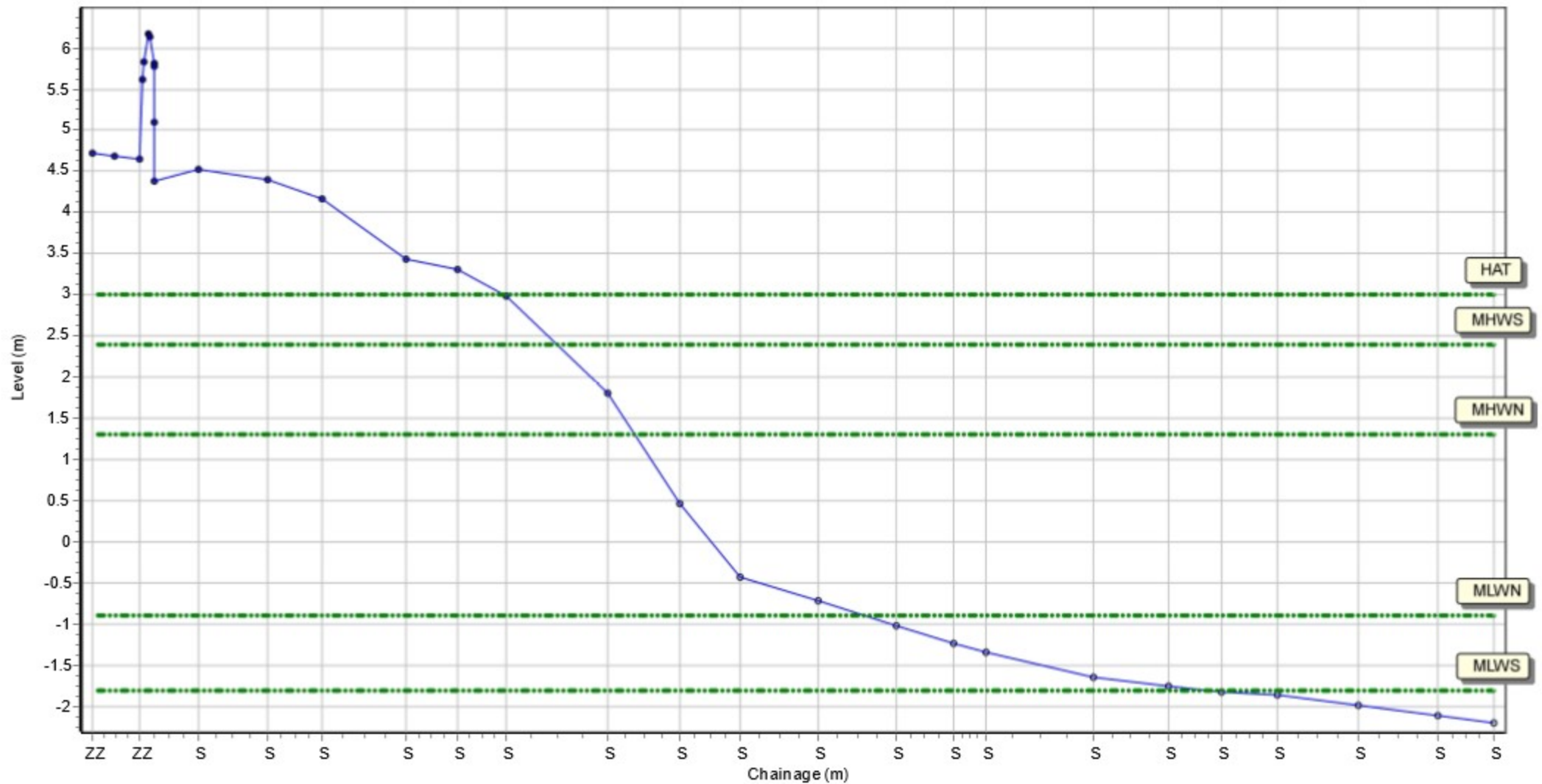
Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 431113.86 Northing: 587780.727 Profile Bearing: 115 ° from North



# Beach Profile

Location: 1aNWB15

Date: 24/08/2021

Inspector: AG

Low Tide:

Low Tide Time:

Wind

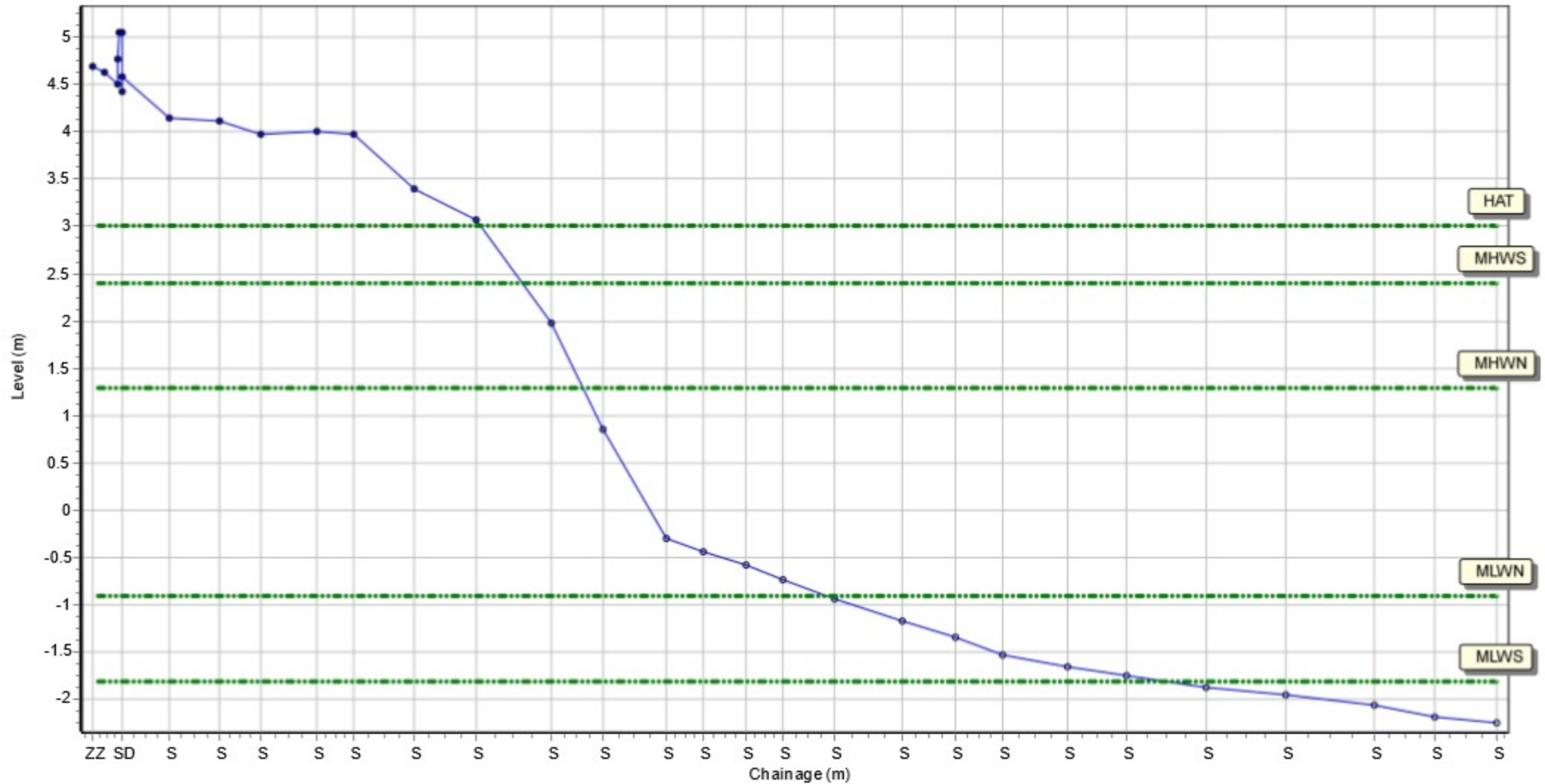
Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 431088.458 Northing: 587739.577 Profile Bearing: 125 ° from North



# Beach Profile

Location: 1aNWB16

Date: 24/08/2021

Inspector: AG

Low Tide:

Low Tide Time:

Wind

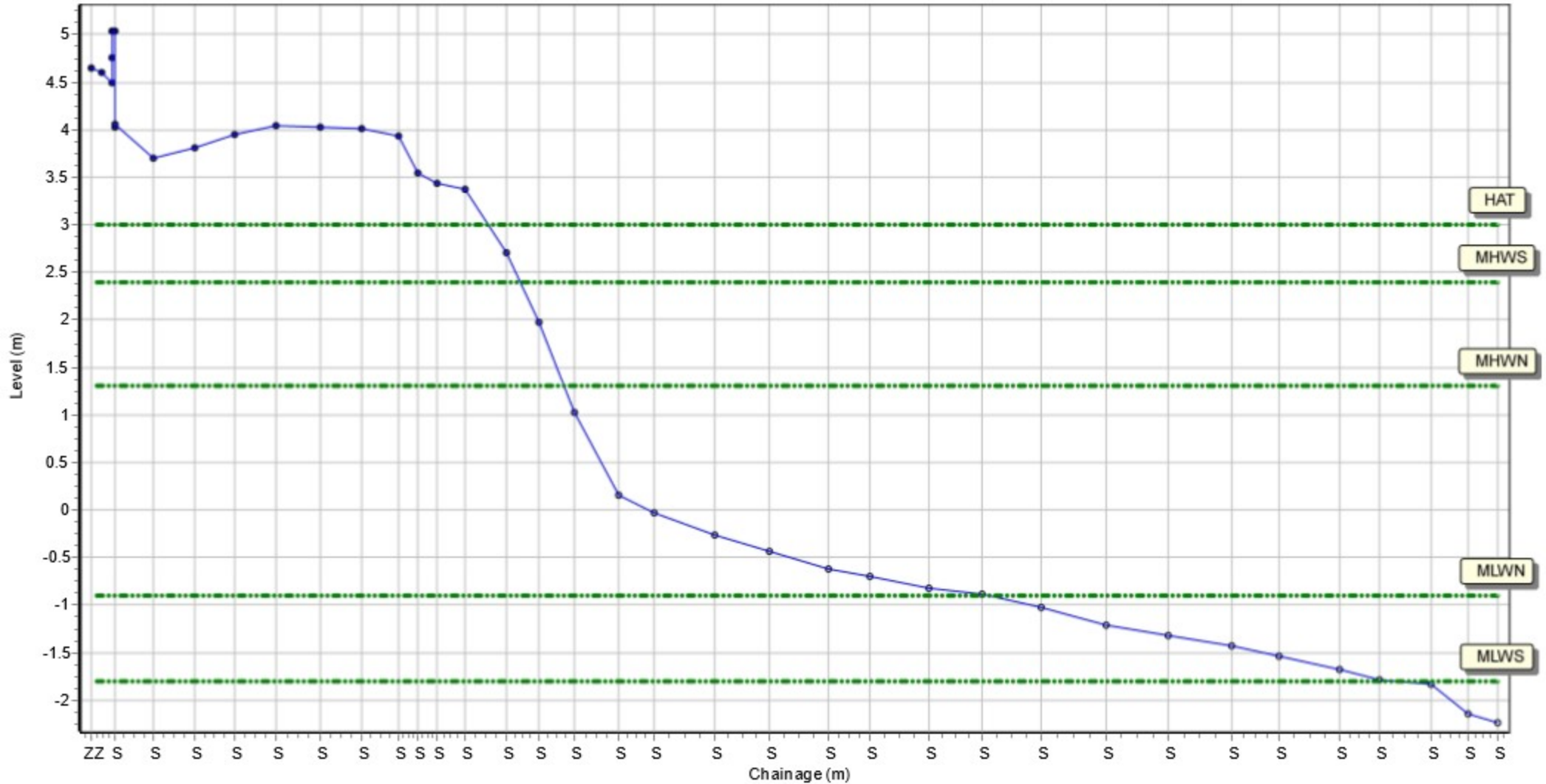
Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 431063.789 Northing: 587695.893 Profile Bearing: 119 ° from North



# Beach Profile

Location: 1aNWB17

Date: 24/08/2021 Inspector: AG

Wind Sea State:

Low Tide:

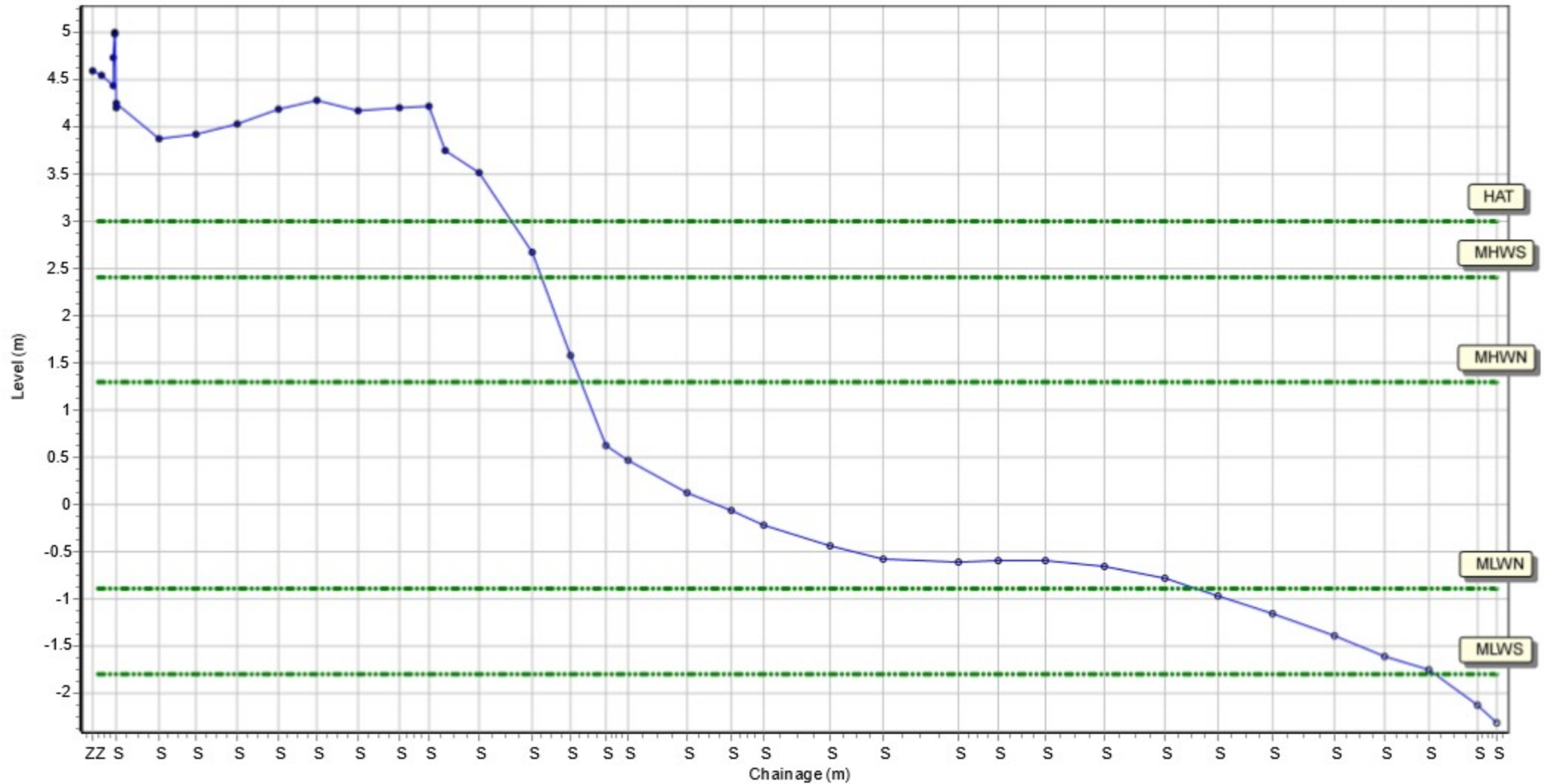
Low Tide Time:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 431042.191 Northing: 587650.627 Profile Bearing: 116 ° from North





# Beach Profile

Location: 1aNWB18

Date: 24/08/2021 Inspector: AG

Wind Sea State:

Low Tide:

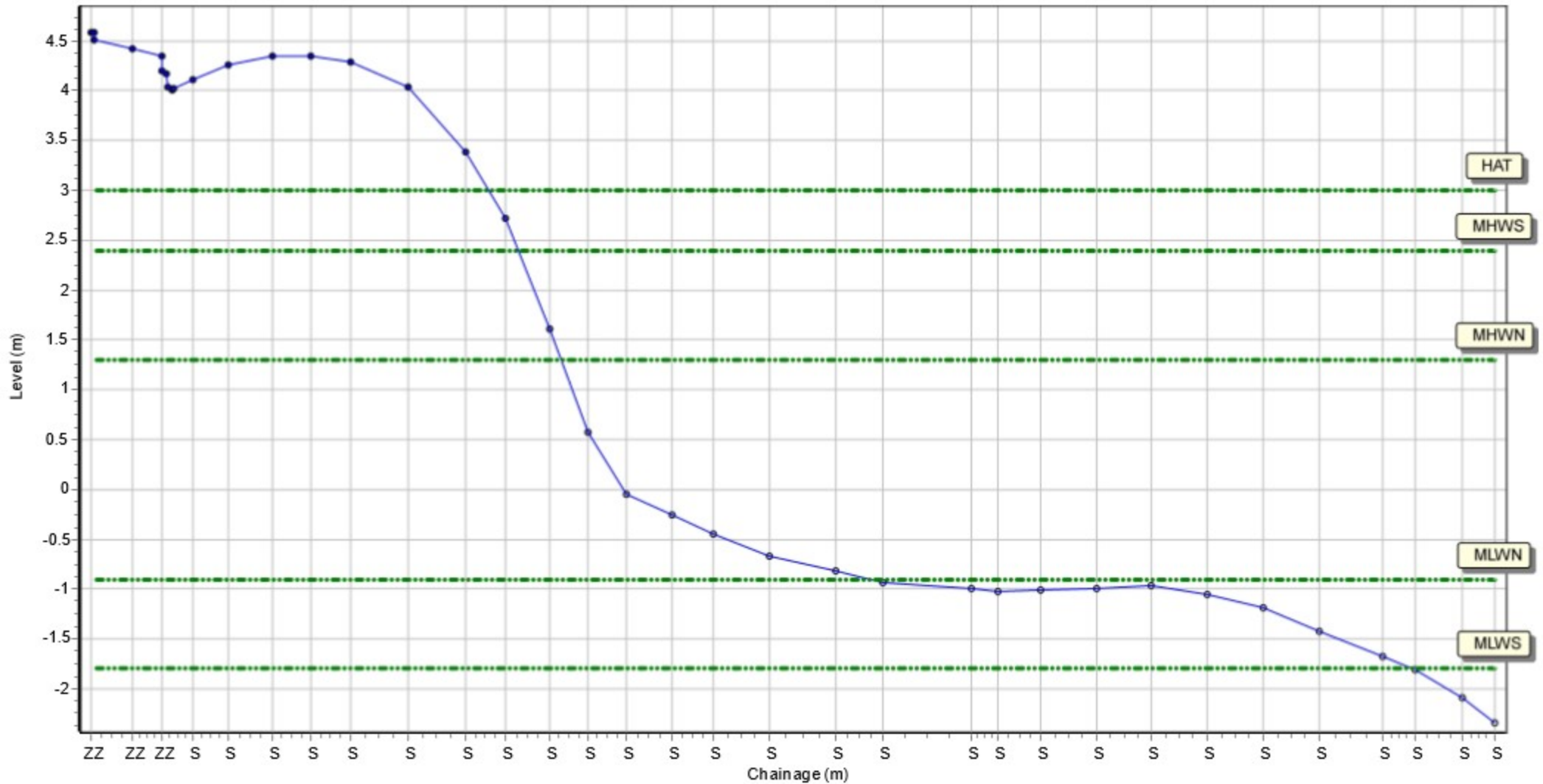
Low Tide Time:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 431024.999 Northing: 587608.929 Profile Bearing: 113 ° from North



# Beach Profile

Location: 1aNWB19

Date: 24/08/2021 Inspector: AG

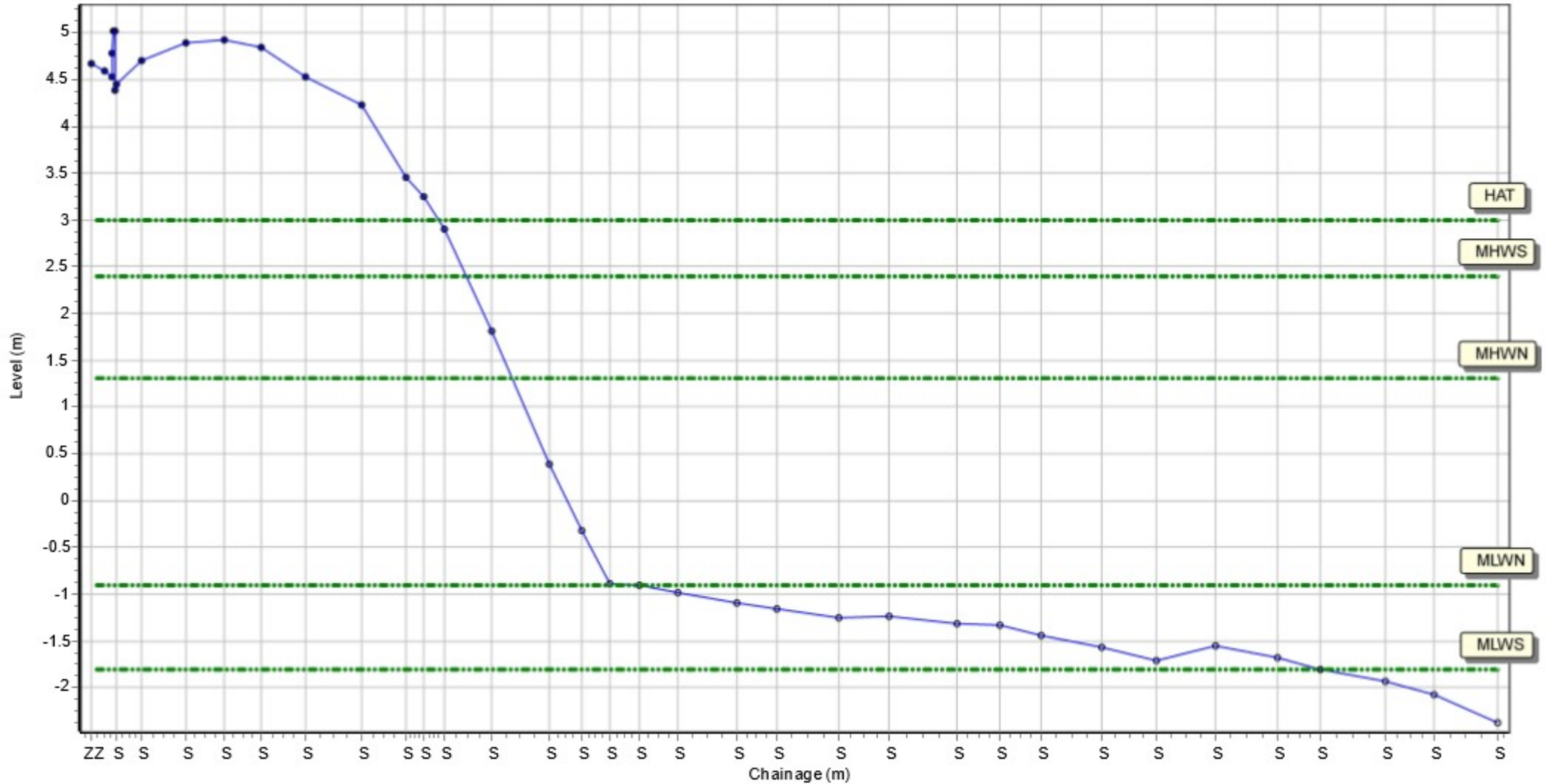
Low Tide: Low Tide Time:

Wind Sea State:

Visibility: Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 431007.485 Northing: 587556.656 Profile Bearing: 109 ° from North



# Beach Profile

Location: 1aNWB20

Date: 24/08/2021

Inspector: AG

Low Tide:

Low Tide Time:

Wind

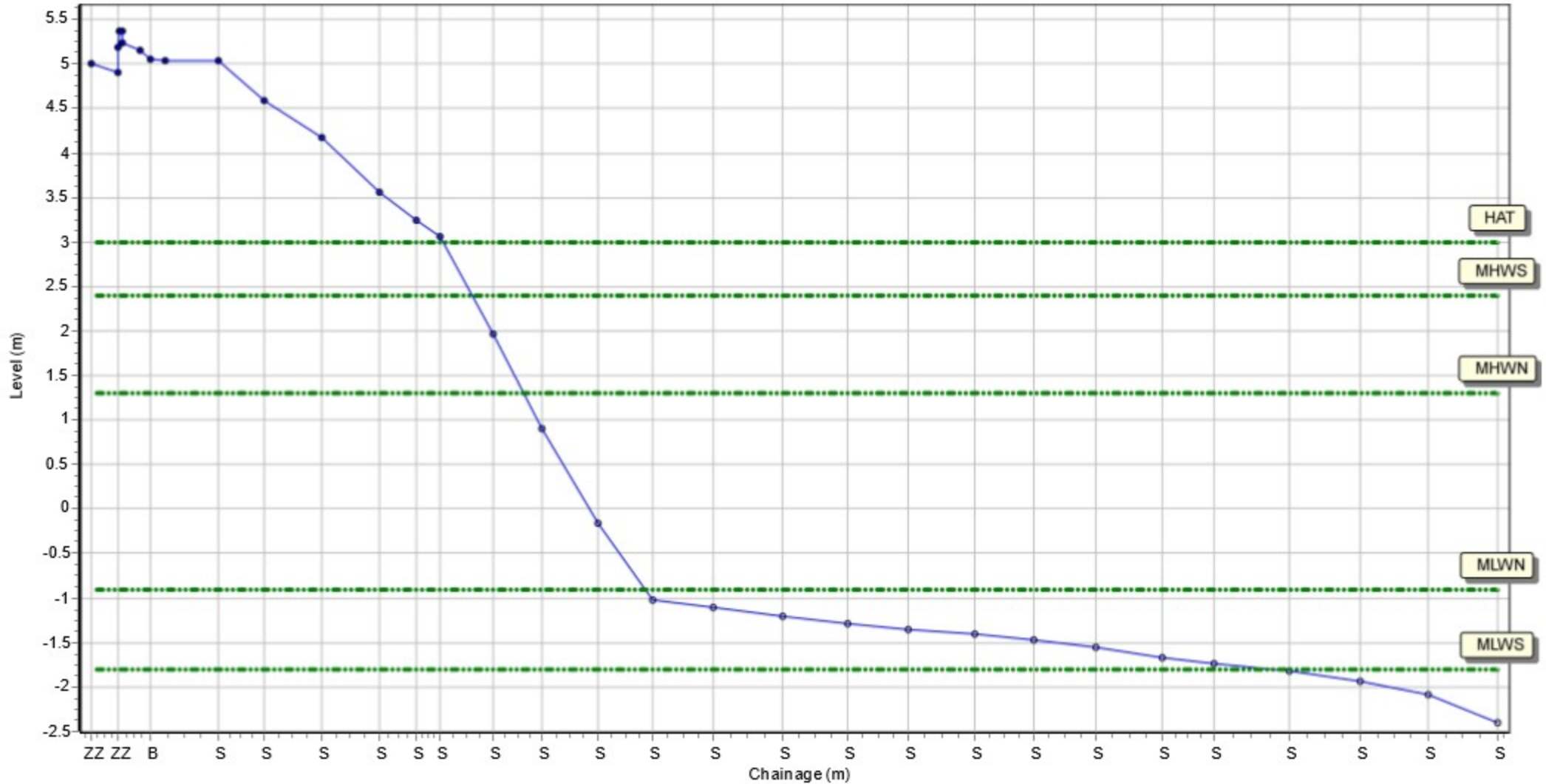
Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 430992.437 Northing: 587508.87 Profile Bearing: 102 ° from North



# Beach Profile

Location: 1aNWB21

Date: 24/08/2021

Inspector: AG

Low Tide:

Low Tide Time:

Wind

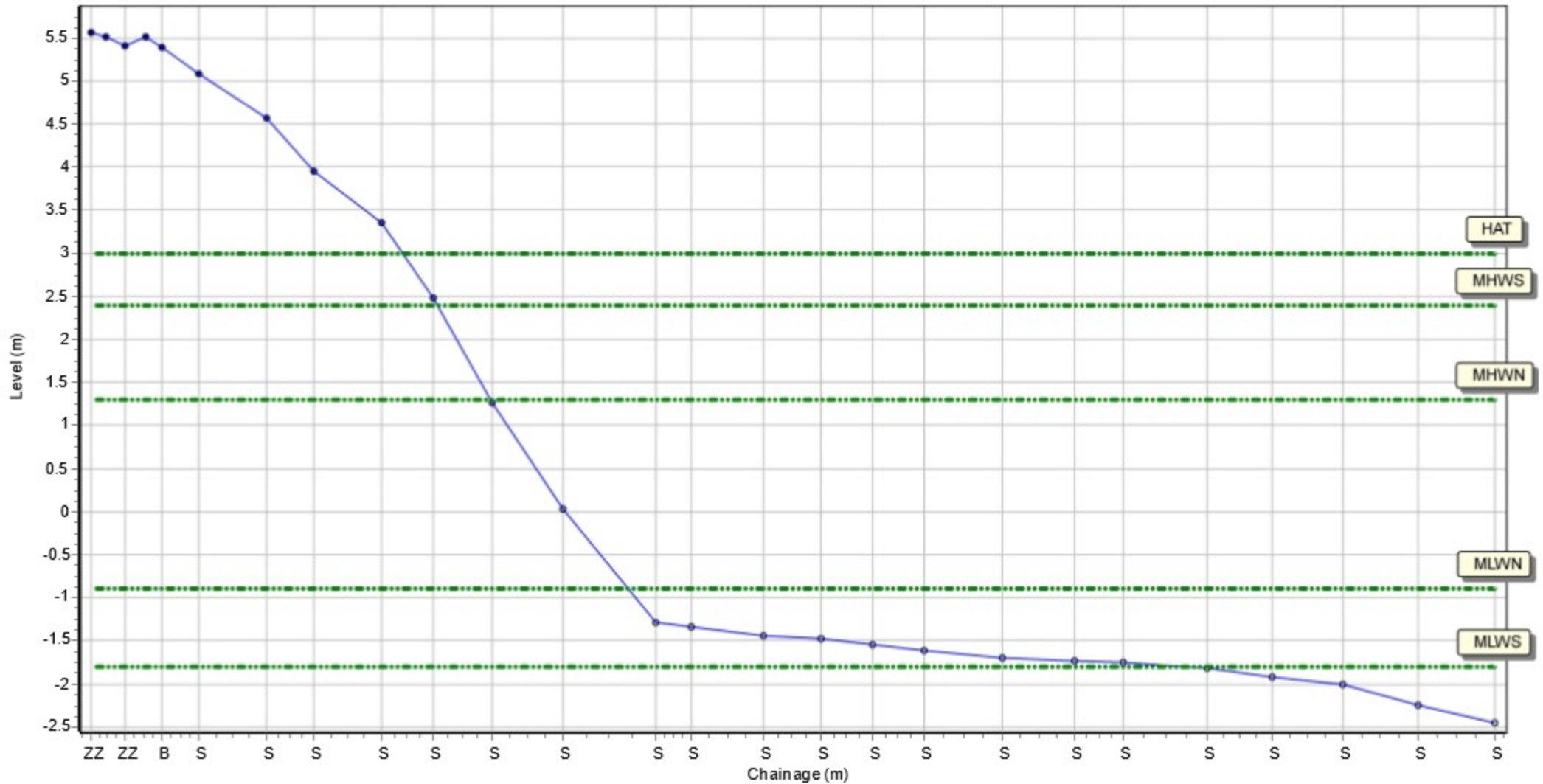
Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 430978.85 Northing: 587460.577 Profile Bearing: 102 ° from North





# Beach Profile

Location: 1aNWB22

Date: 24/08/2021

Inspector: AG

Low Tide:

Low Tide Time:

Wind

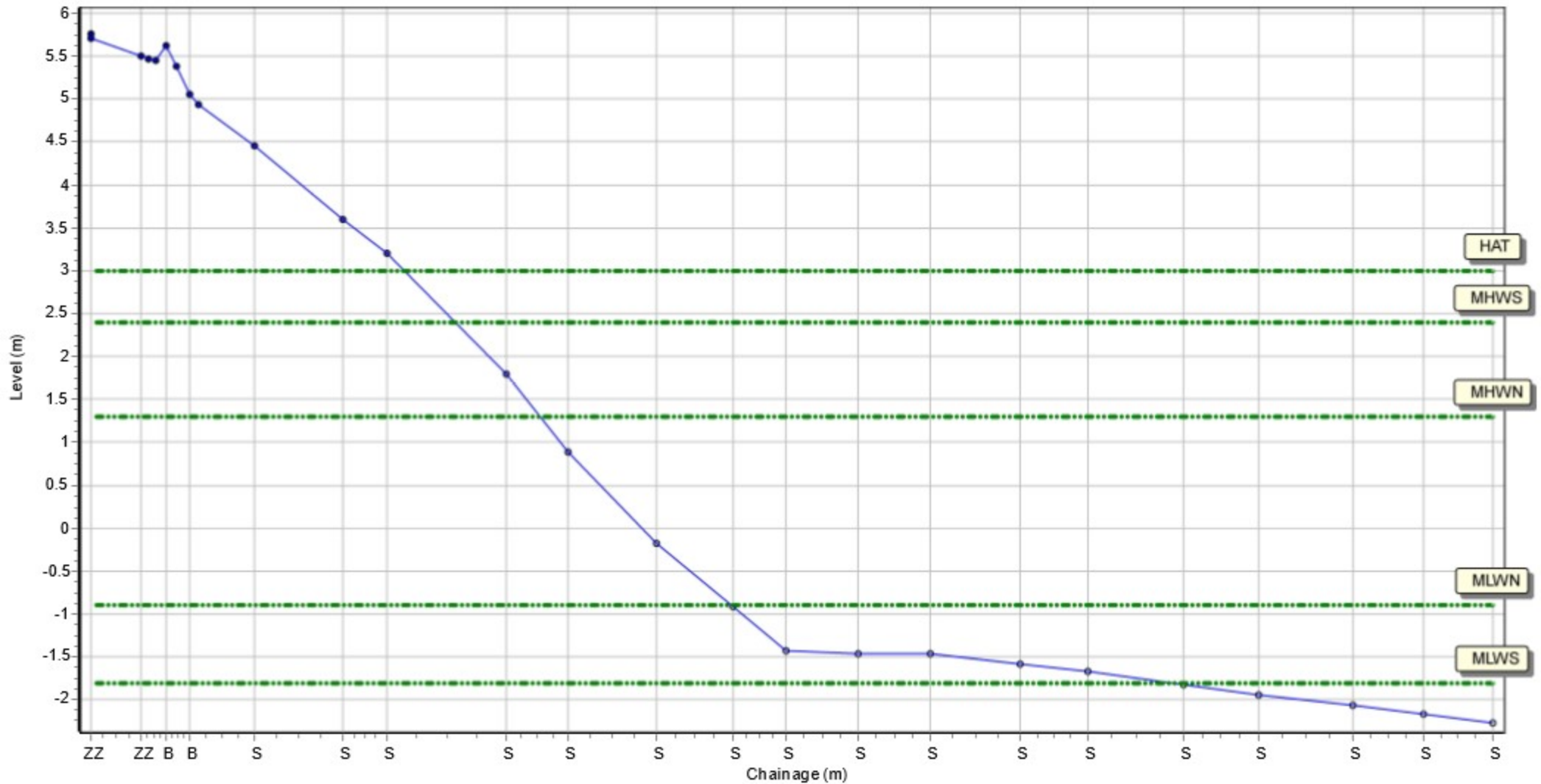
Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 430967.686 Northing: 587411.684 Profile Bearing: 99 ° from North



# Beach Profile

Location: 1aNWB23

Date: 24/08/2021

Inspector: AG

Low Tide:

Low Tide Time:

Wind

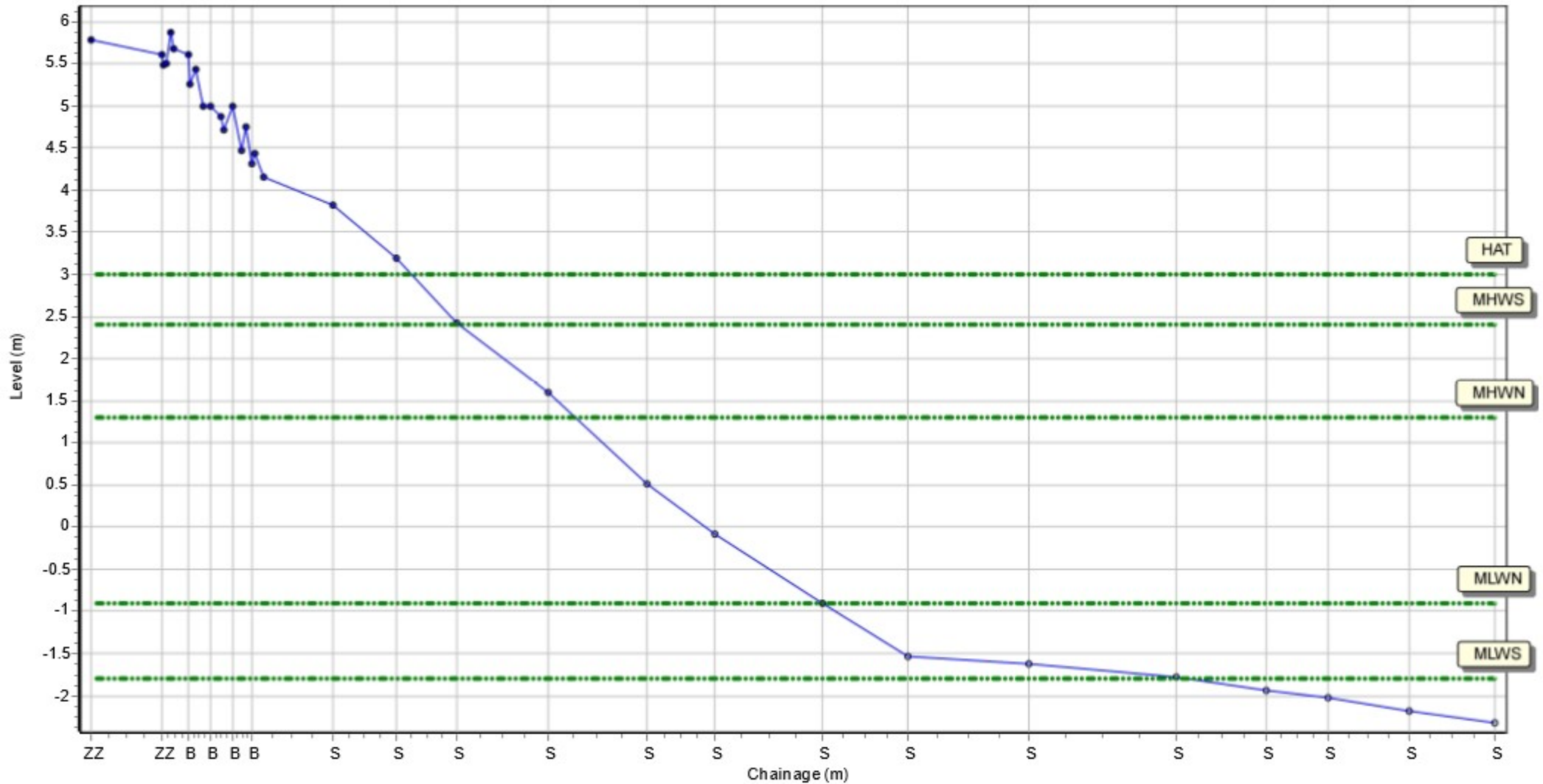
Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 430959.877 Northing: 587362.168 Profile Bearing: 96 ° from North



# Beach Profile

Location: 1aNWB24

Date: 24/08/2021 Inspector: AG

Wind Sea State:

Low Tide:

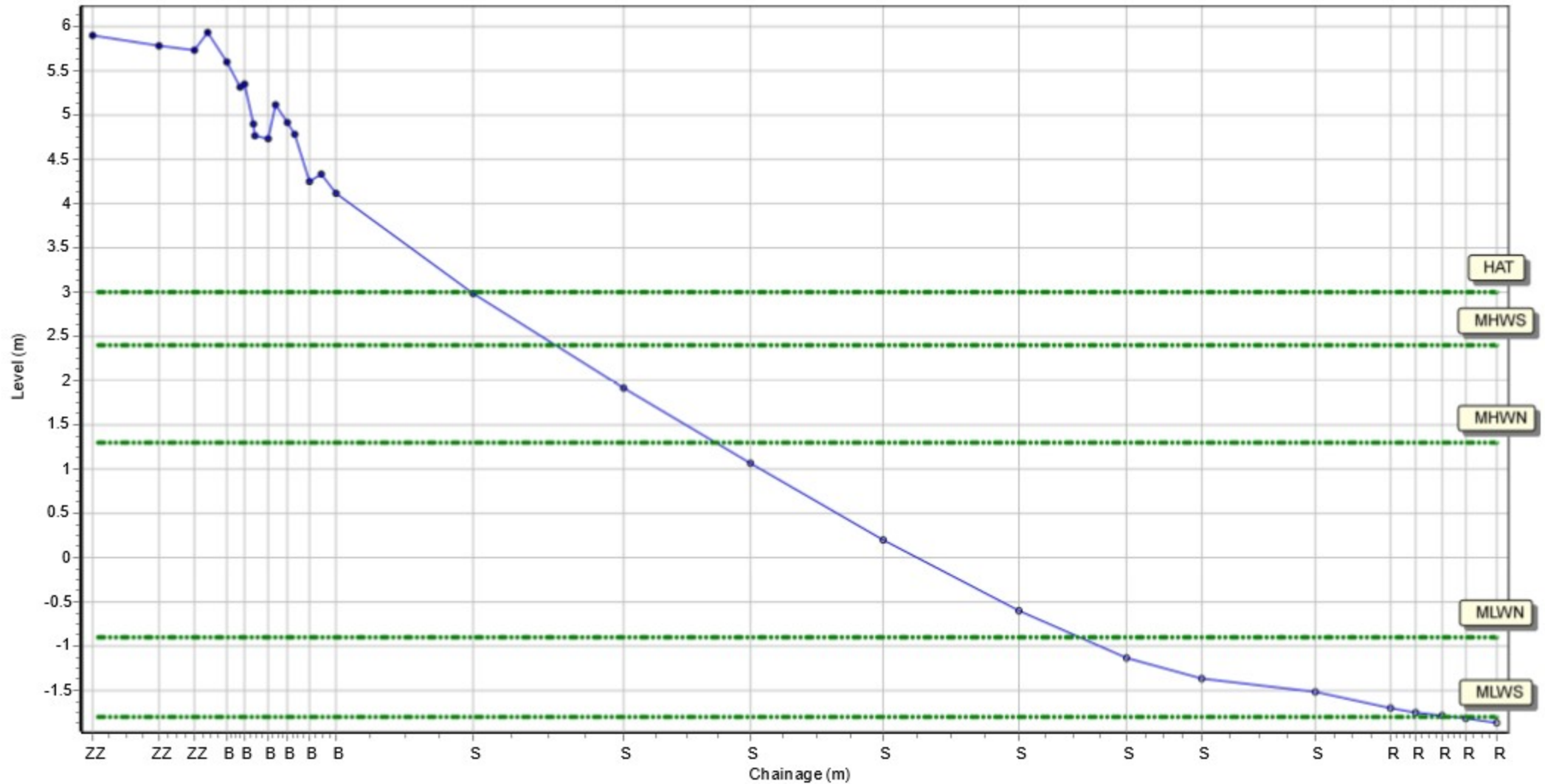
Low Tide Time:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 430956.511 Northing: 587312.153 Profile Bearing: 92 ° from North











# Beach Profile

Location: 1aWDC09

Date: 22/09/2021

Inspector: AG

Low Tide:

Low Tide Time:

Wind

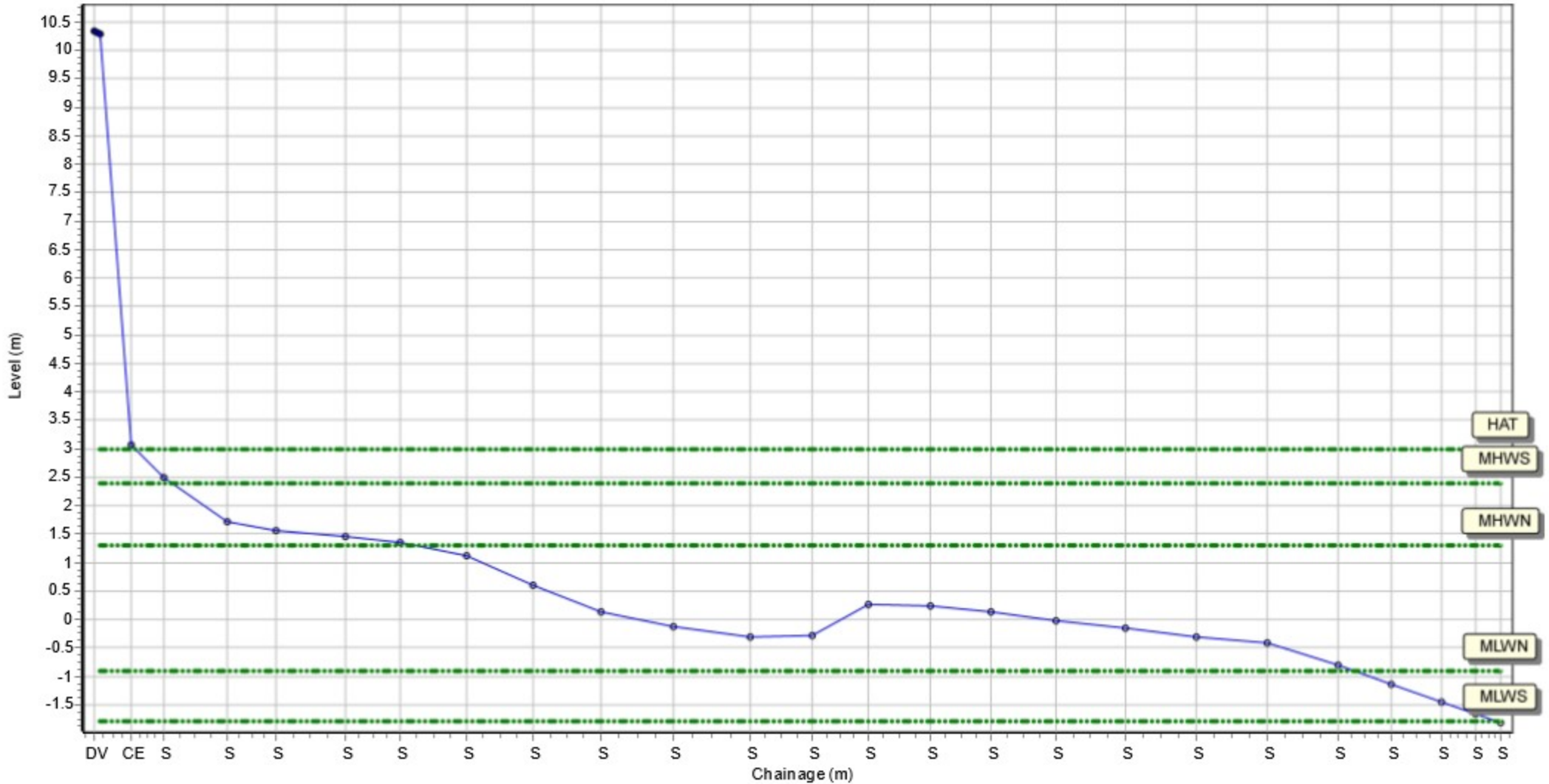
Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 430361.278 Northing: 585559.12 Profile Bearing: 130 ° from North



# Beach Profile

Location: 1aWDC10

Date: 22/09/2021

Inspector: AG

Low Tide:

Low Tide Time:

Wind

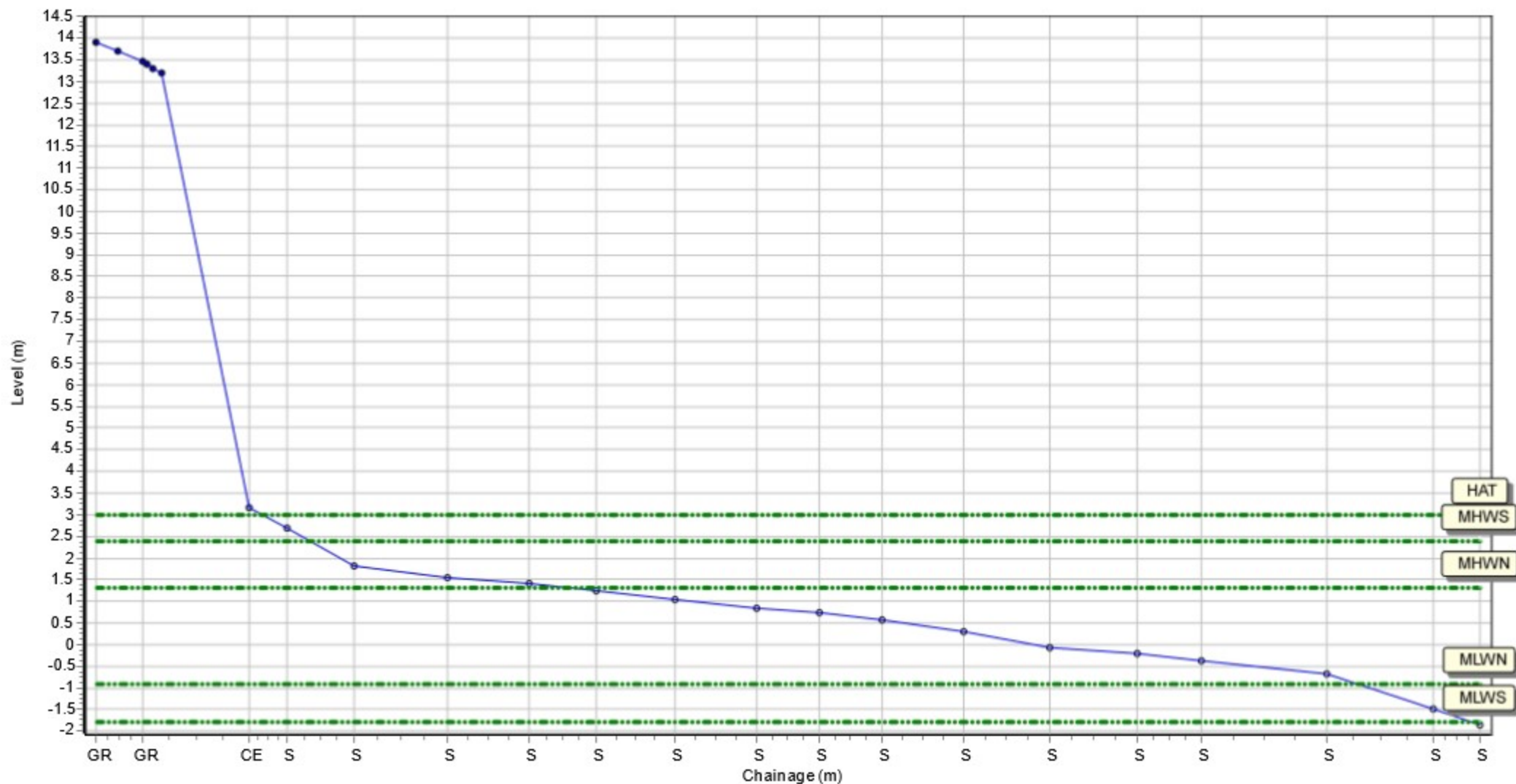
Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 430247.175 Northing: 585191.003 Profile Bearing: 71 ° from North





# Beach Profile

Location: 1aWDC11

Date: 22/09/2021 Inspector: AG

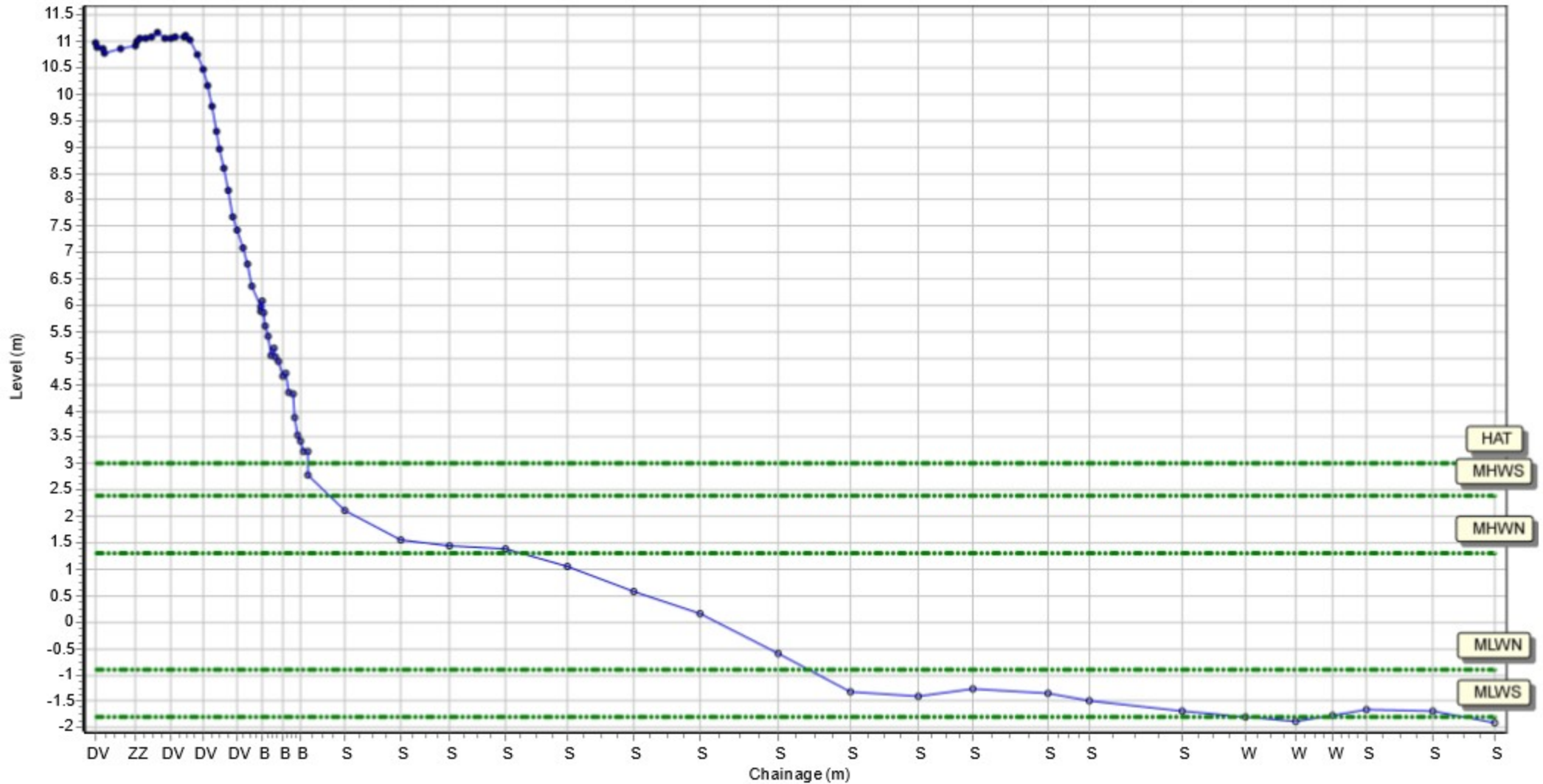
Low Tide: Low Tide Time:

Wind Sea State:

Visibility: Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 430397.4 Northing: 584739.609 Profile Bearing: 74 ° from North



# Beach Profile

Location: 1aWDC12

Date: 22/09/2021

Inspector: AG

Low Tide:

Low Tide Time:

Wind

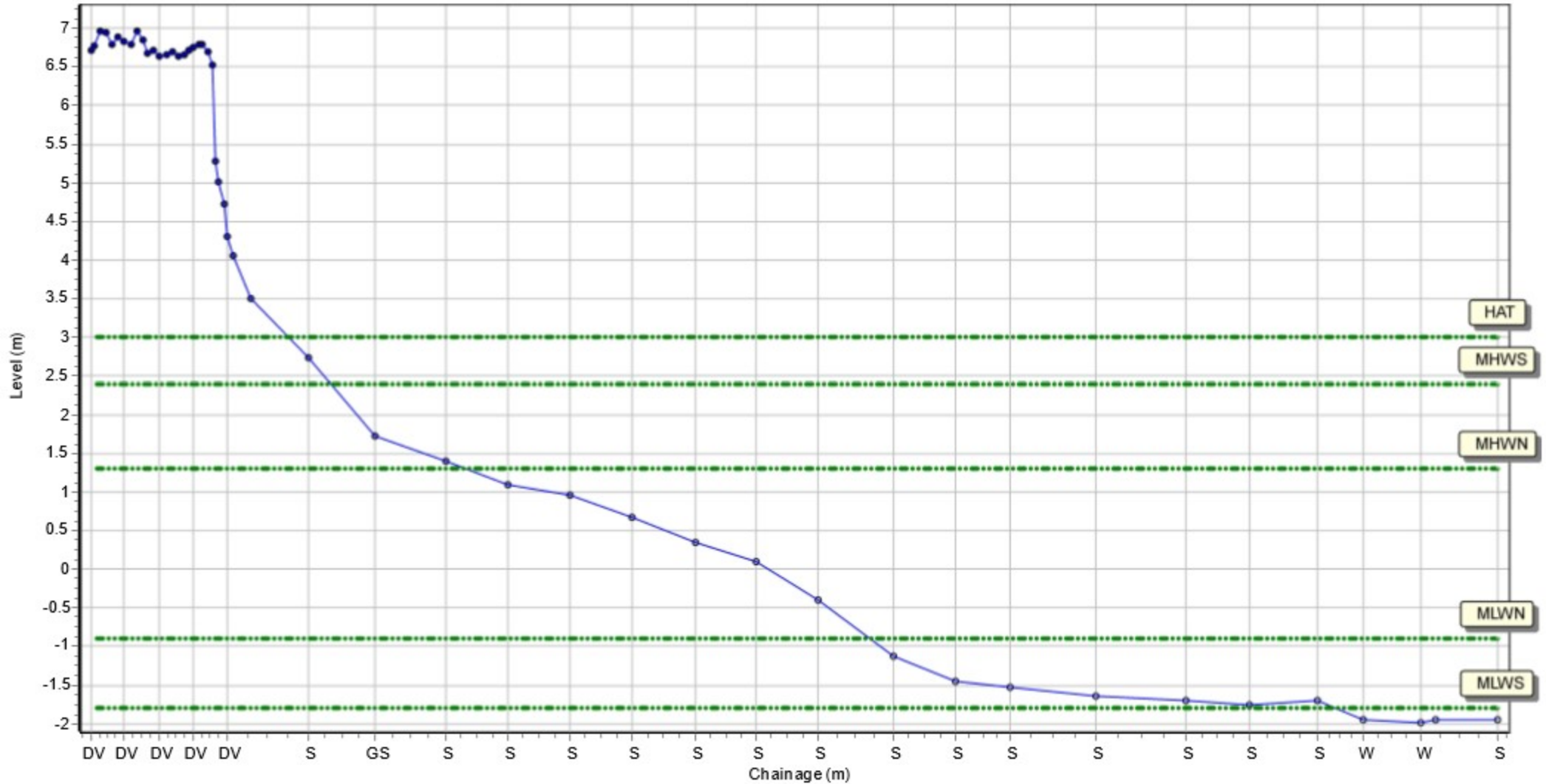
Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 430549.164 Northing: 584058.468 Profile Bearing: 73 ° from North



# Beach Profile

Location: 1aWDC13

Date: 22/09/2021

Inspector: AG

Low Tide:

Low Tide Time:

Wind

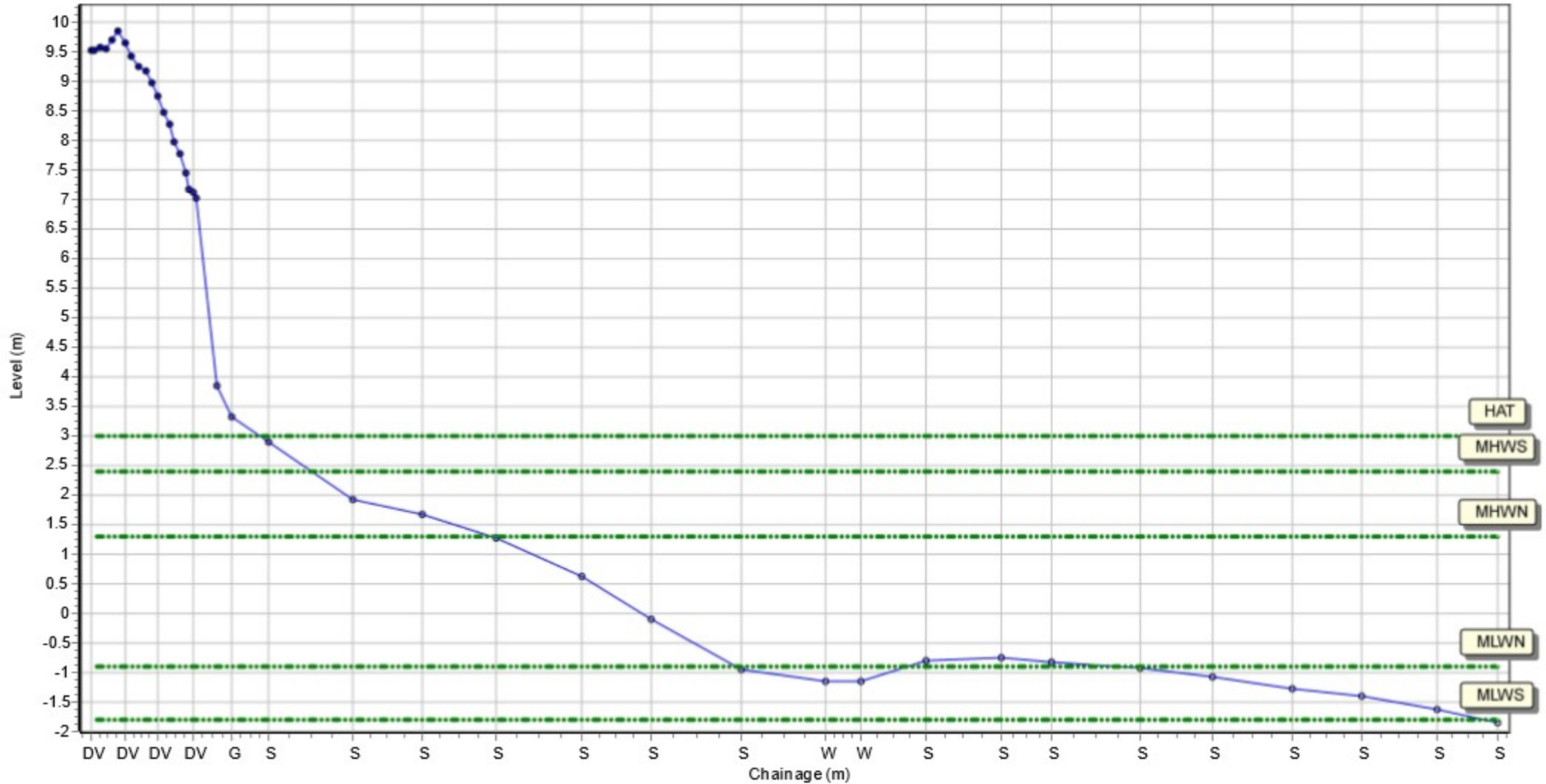
Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 430983.324 Northing: 583146.489 Profile Bearing: 62 ° from North



# Beach Profile

Location: 1aWDC14

Date: 22/09/2021

Inspector: AG

Low Tide:

Low Tide Time:

Wind

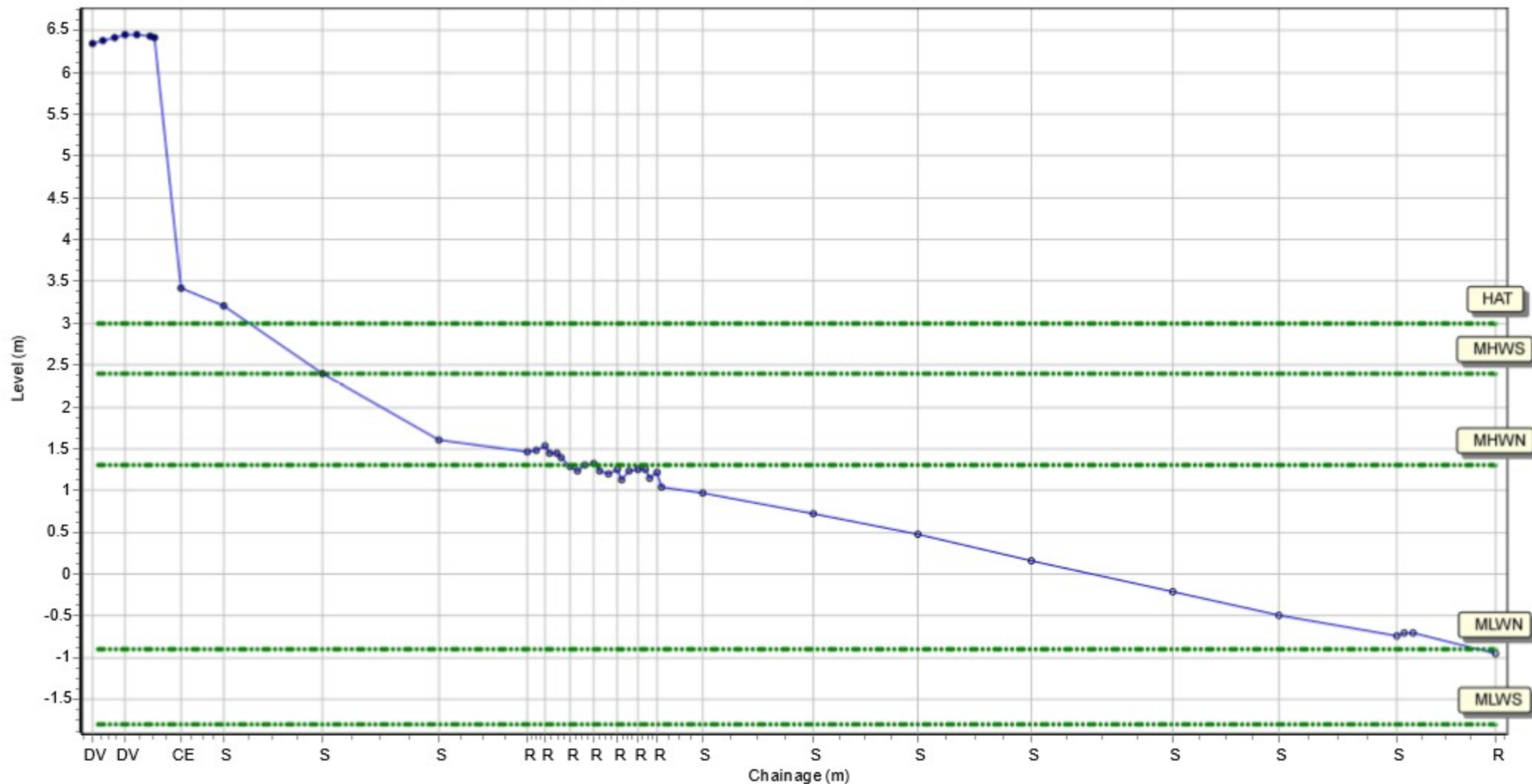
Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 431317.646 Northing: 582642.372 Profile Bearing: 62 ° from North





# Beach Profile

Location: 1aBVBC01

Date: 23/09/2021 Inspector: AG

Wind Sea State:

Low Tide:

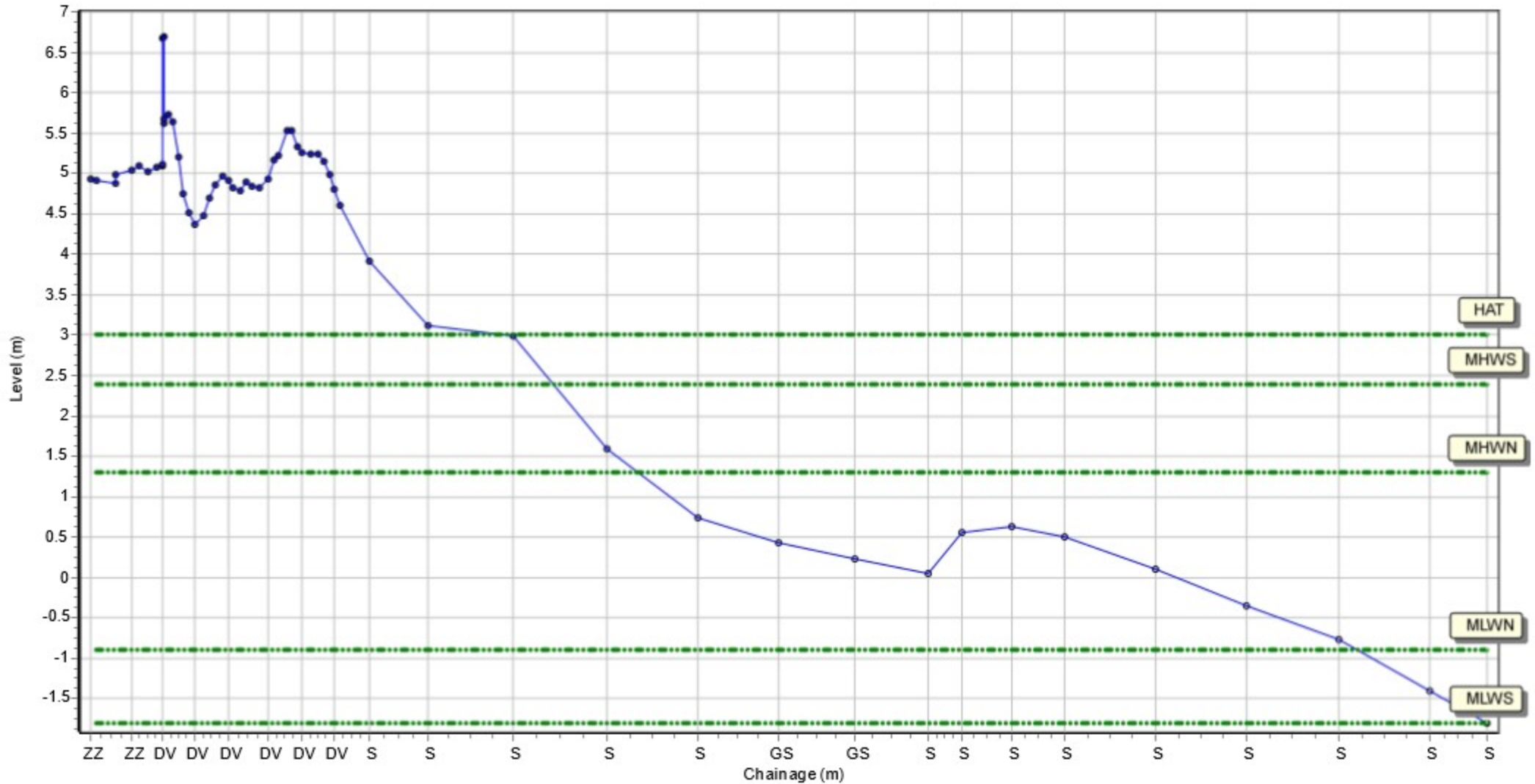
Low Tide Time:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 432171.107 Northing: 580411.515 Profile Bearing: 113 ° from North



# Beach Profile

Location: 1aBVBC02

Date: 23/09/2021

Inspector: AG

Low Tide:

Low Tide Time:

Wind

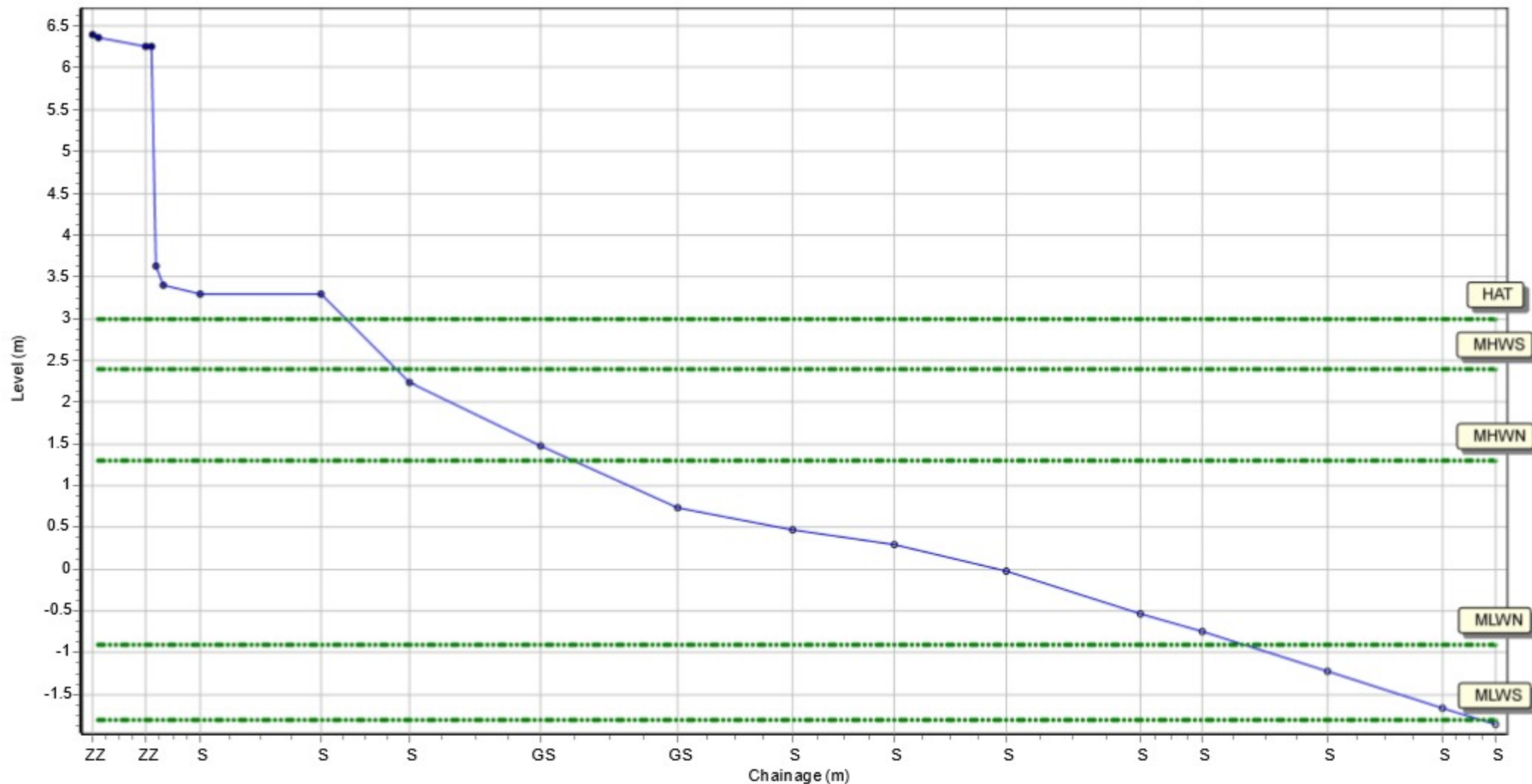
Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 432072.788 Northing: 579668.162 Profile Bearing: 77 ° from North



# Beach Profile

Location: 1aBVBC03

Date: 23/09/2021 Inspector: AG

Wind Sea State:

Low Tide:

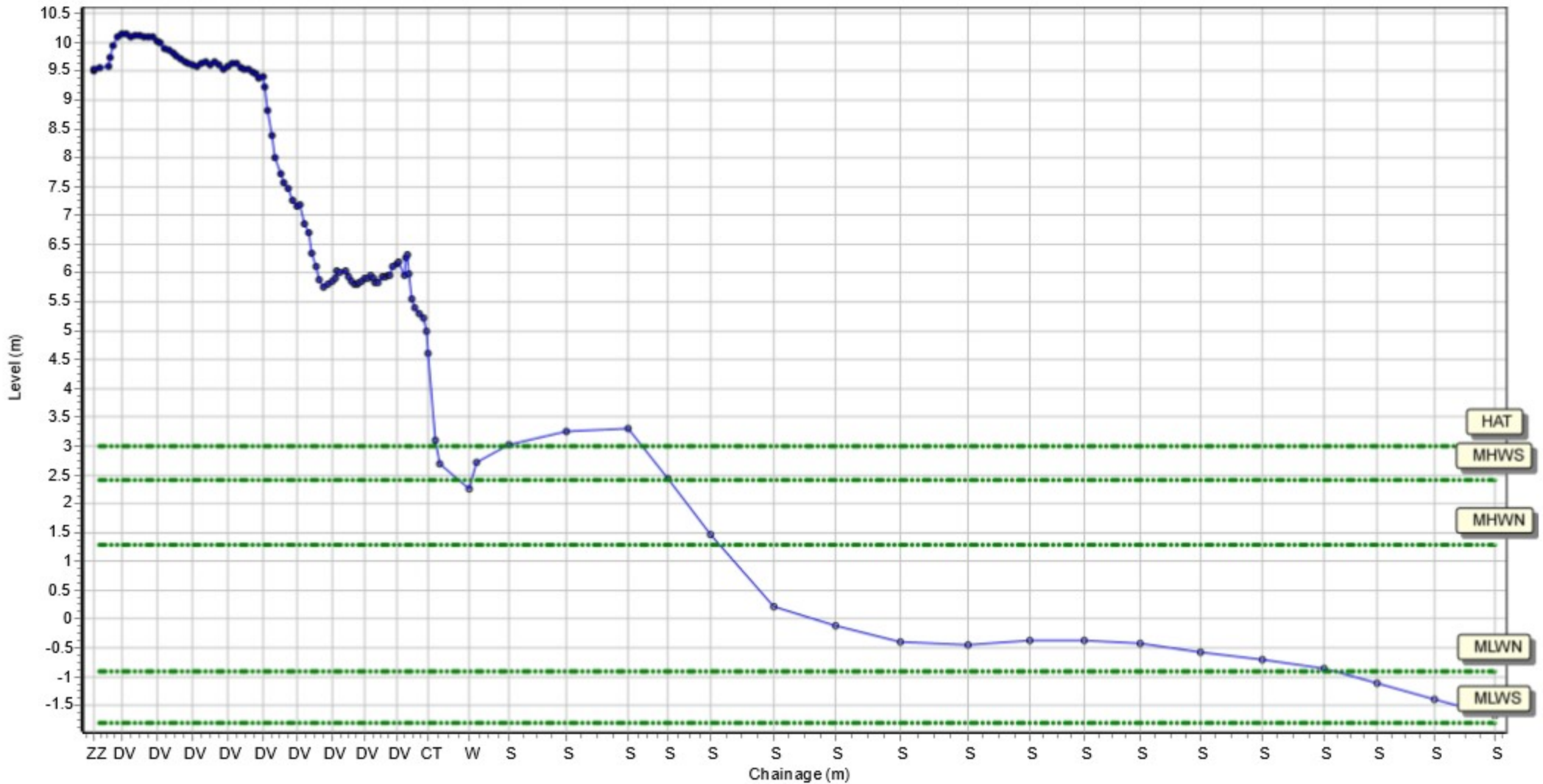
Low Tide Time:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 432120.659 Northing: 578982.375 Profile Bearing: 71 ° from North



# Beach Profile

Location: 1aBVBC04

Date: 23/09/2021 Inspector: AG

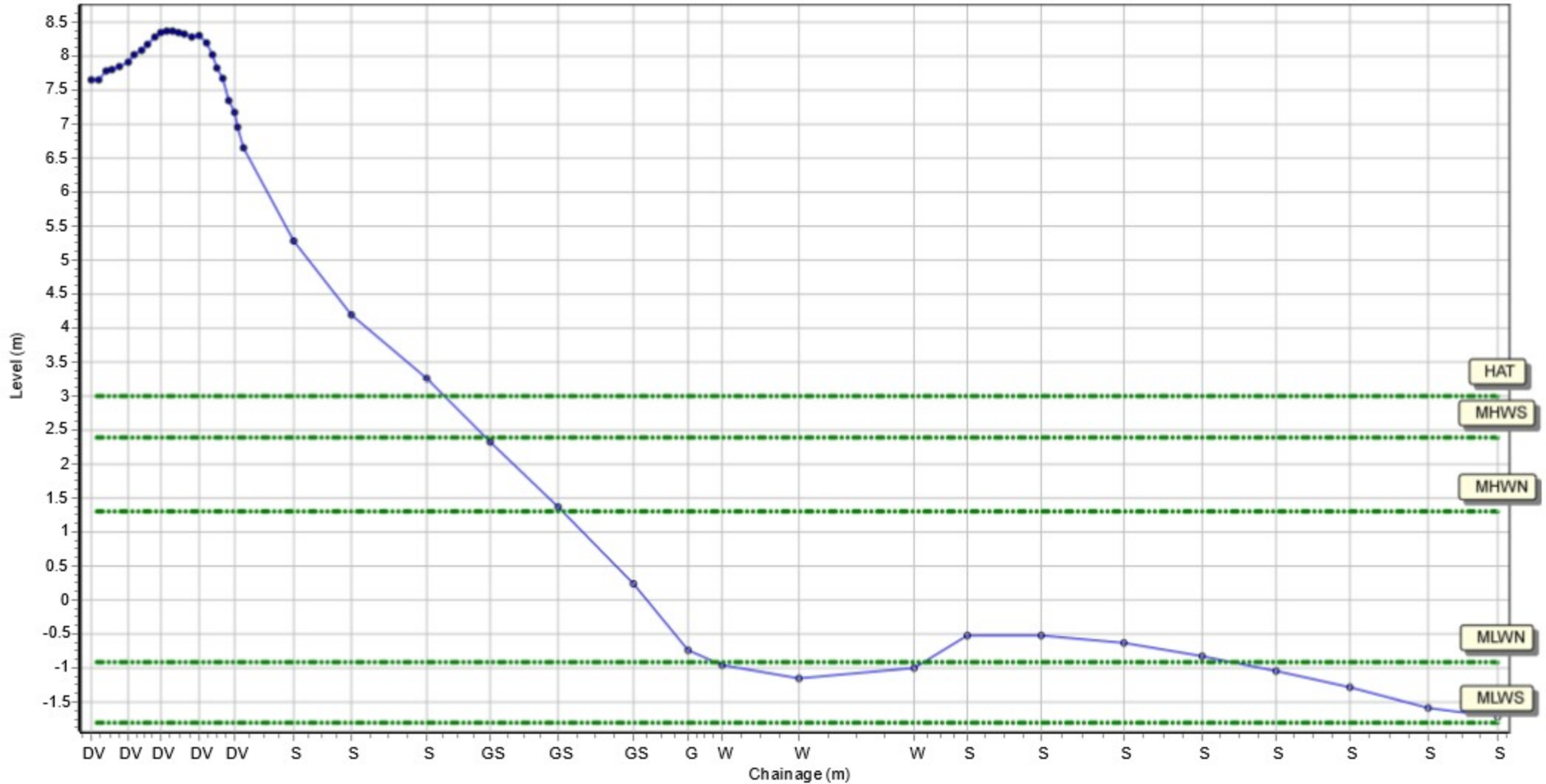
Wind Sea State:

Low Tide: Low Tide Time:

Visibility: Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 432398.19 Northing: 578463.878 Profile Bearing: 60 ° from North





# Beach Profile

Location: 1aBVBC05

Date: 23/09/2021

Inspector: AG

Low Tide:

Low Tide Time:

Wind

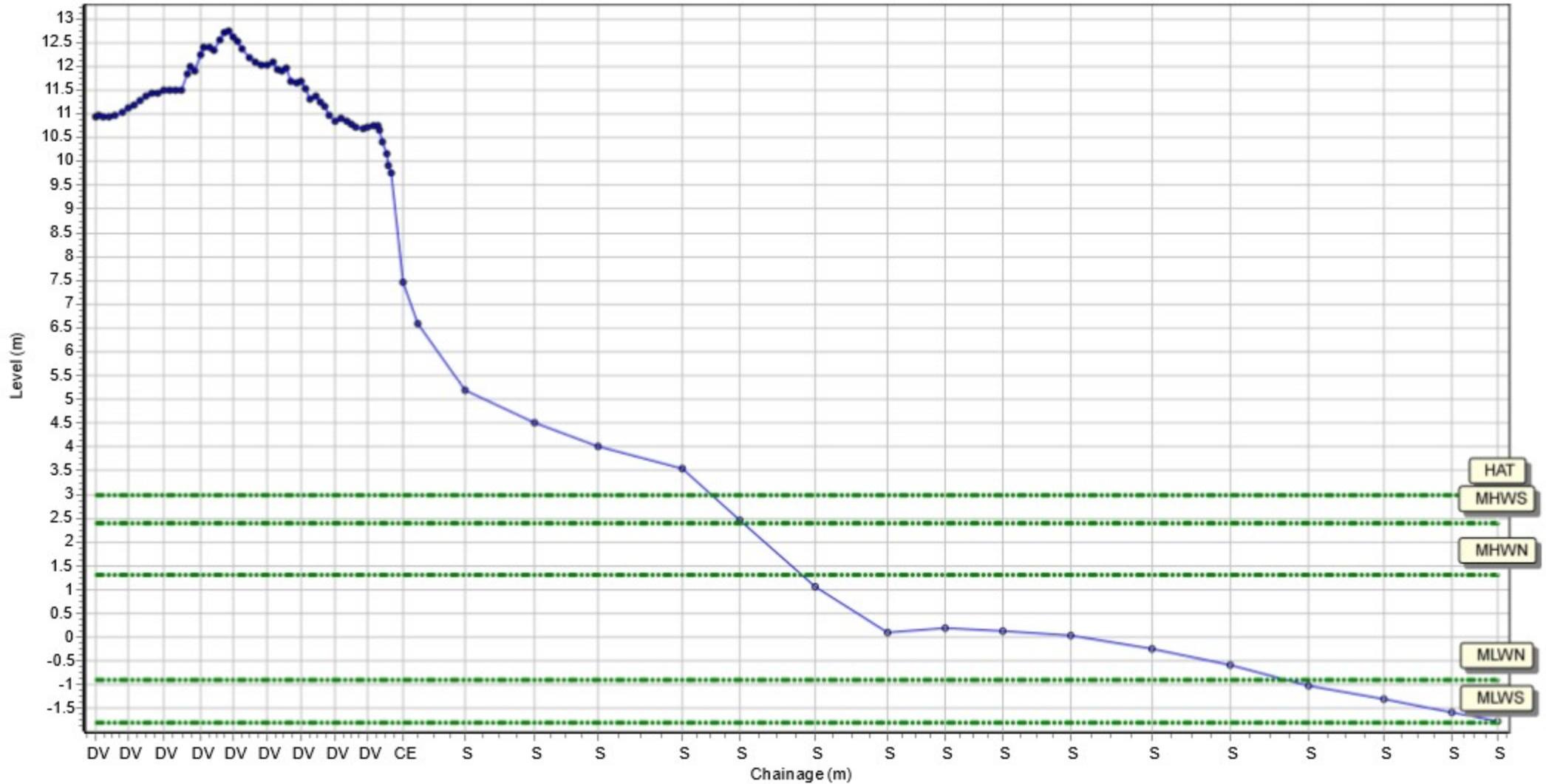
Sea State:

Visibility:

Rain:

Summary: 2021 Full Measures Topo Survey

Easting: 432667.046 Northing: 577891.873 Profile Bearing: 60 ° from North





Profiles: 1aBTBC01



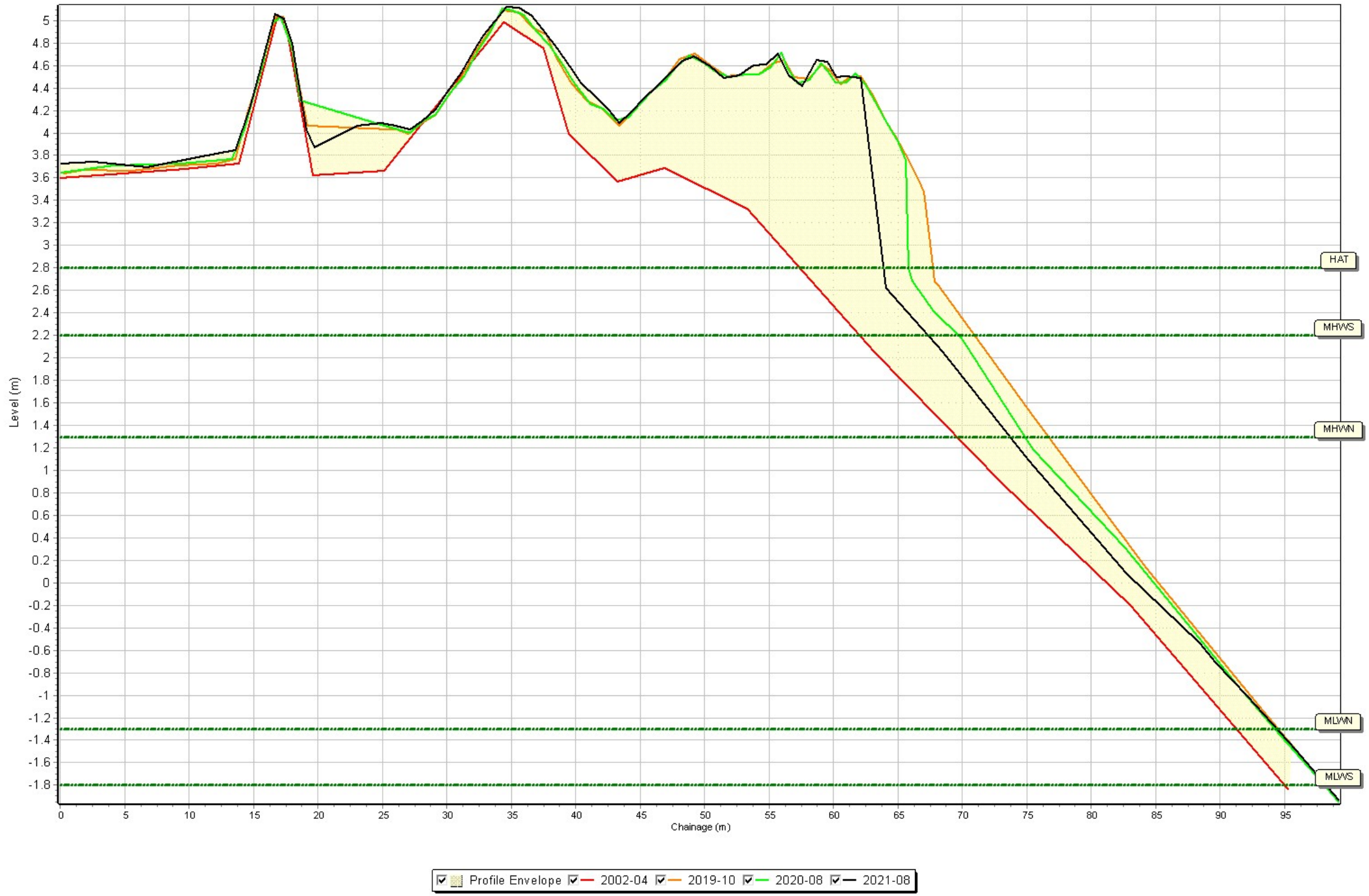
Profiles: 1aBTBC02



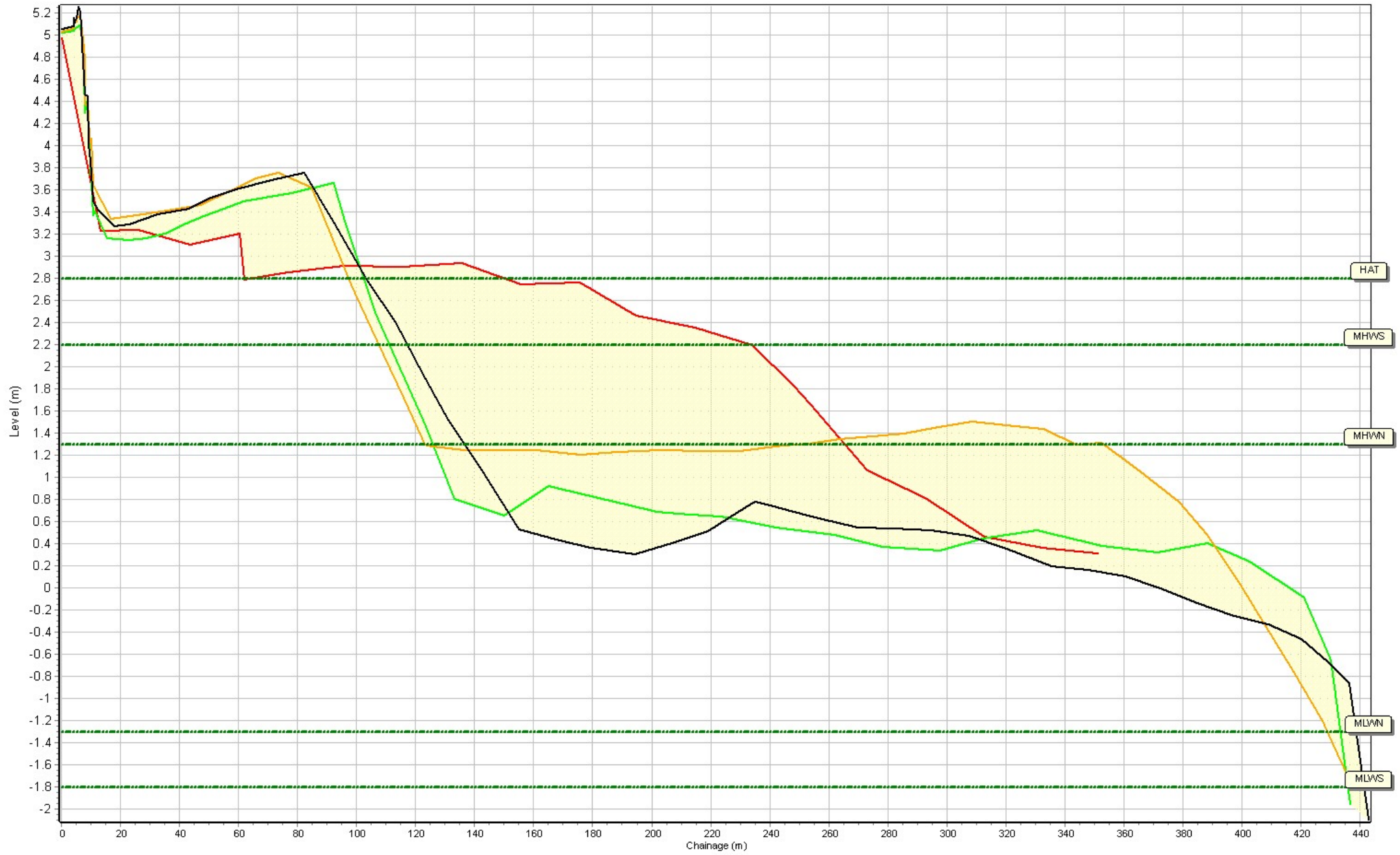
Profile Envelope  2002-04  2020-08  2021-03  2021-08



Profiles: 1aBTBC03

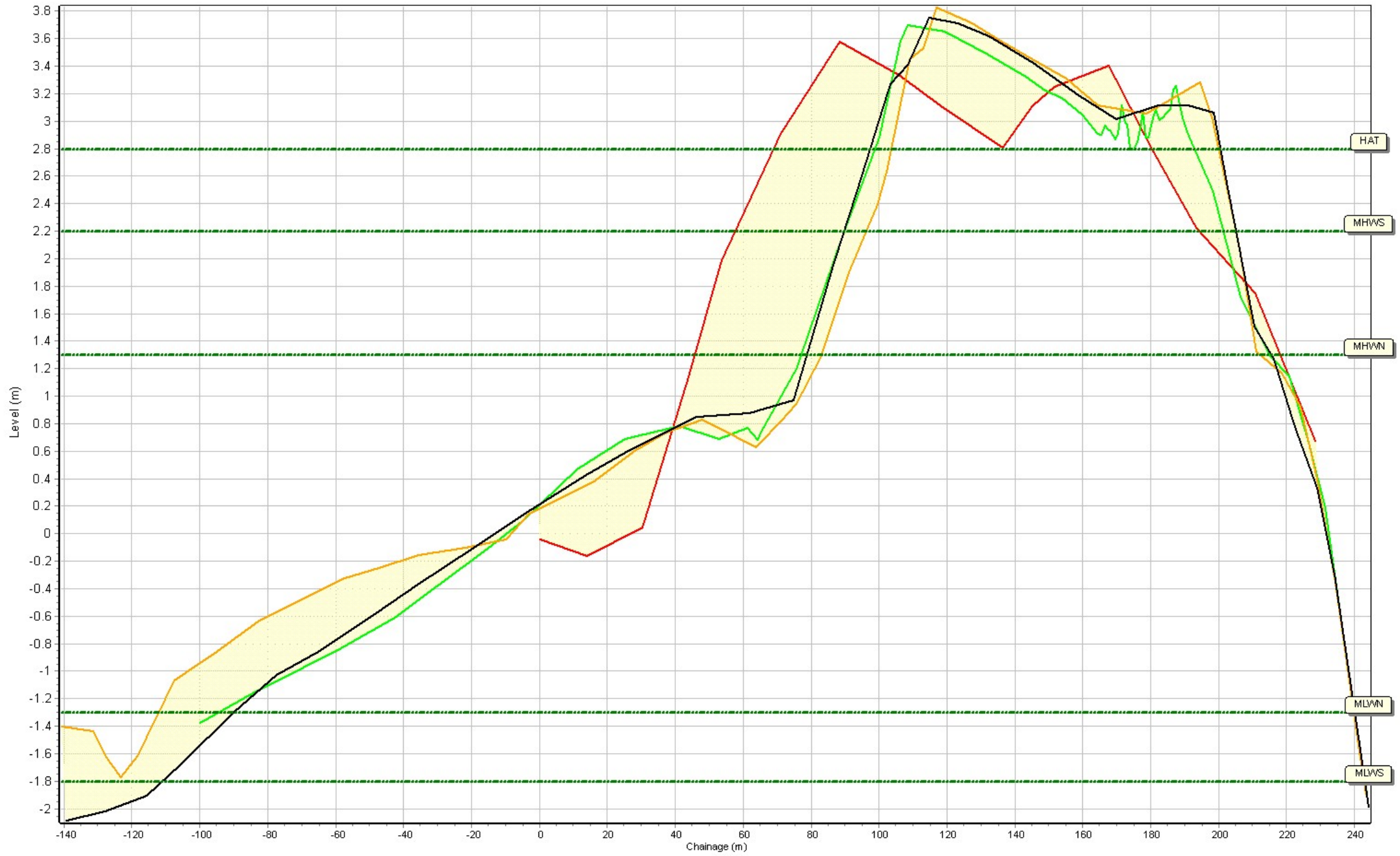


Profiles: 1aBTC04



Profile Envelope  2002-04  2020-08  2021-03  2021-08

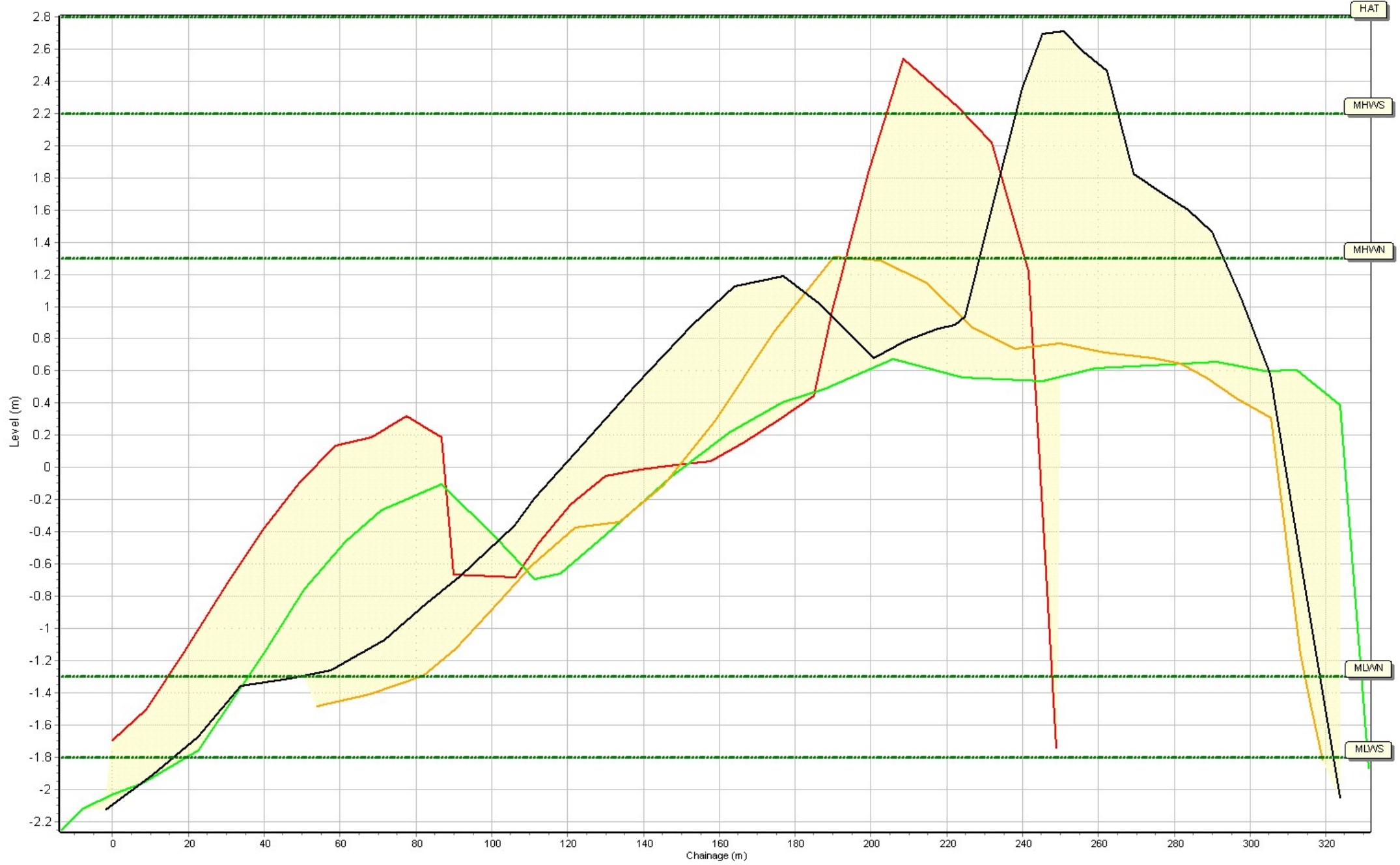
Profiles: 1aBTC05



Profile Envelope  2002-04  2020-08  2021-03  2021-08



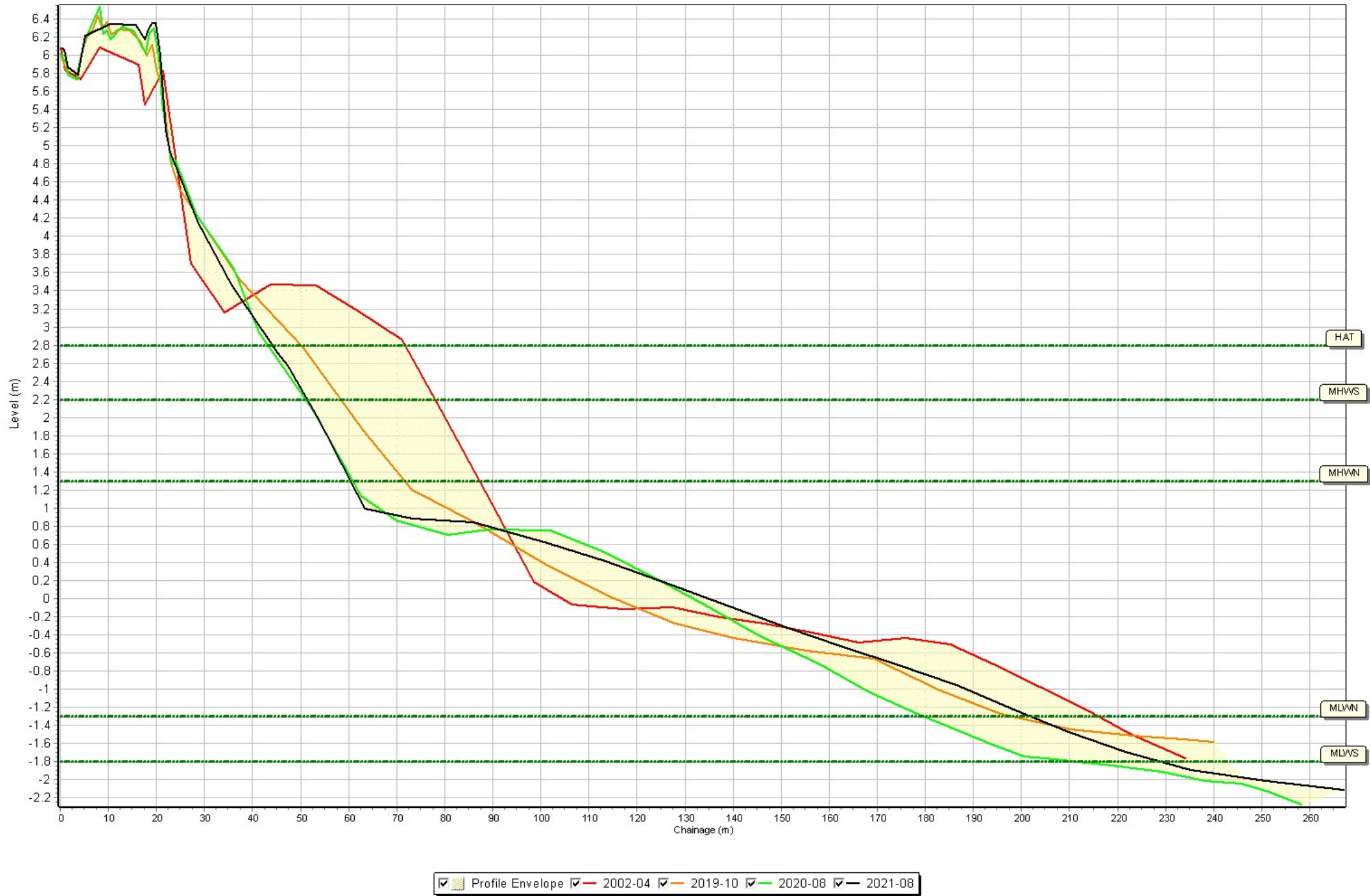
Profiles: 1aBTBC06



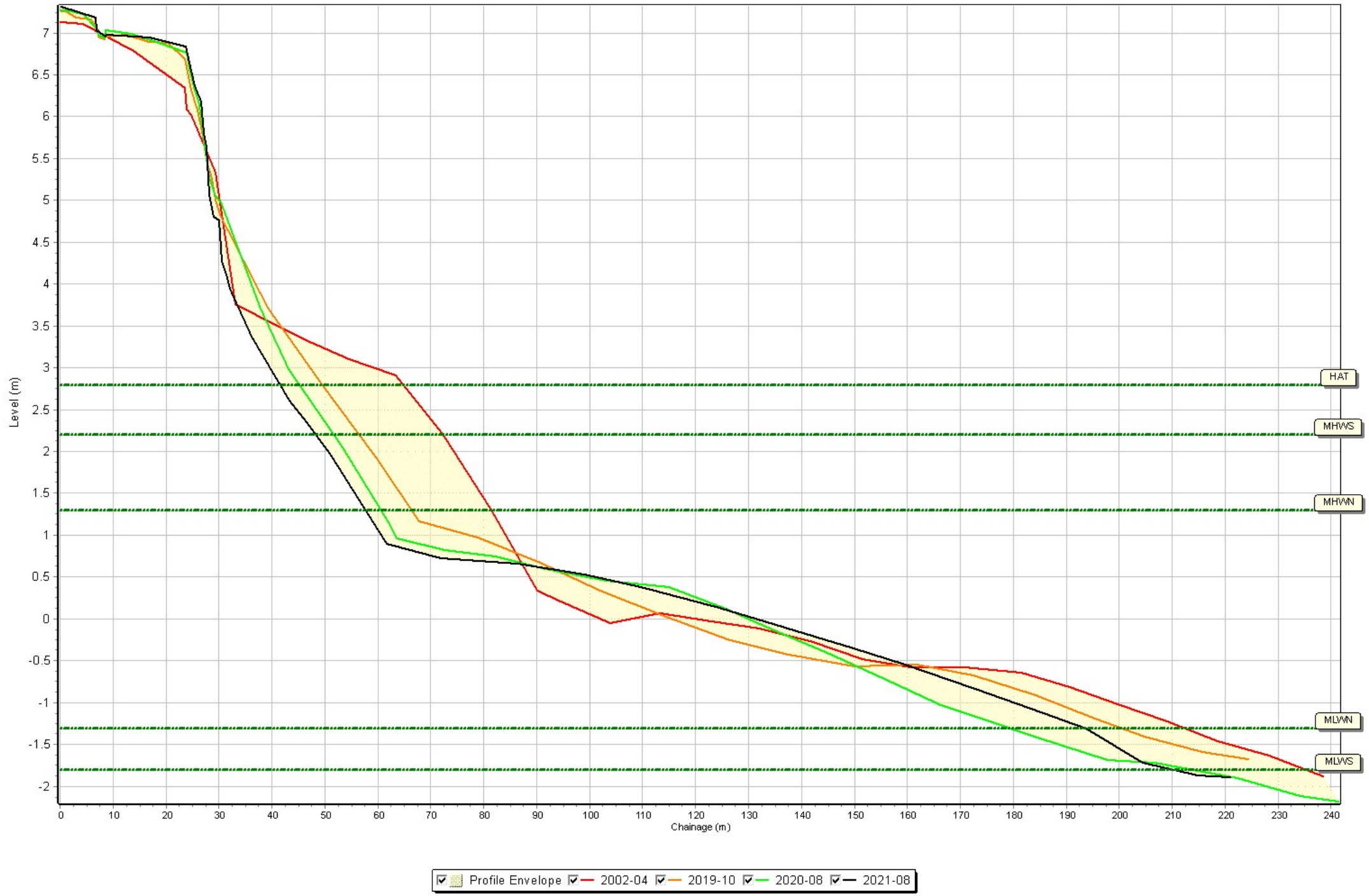
Profile Envelope  2002-04  2020-08  2021-03  2021-08



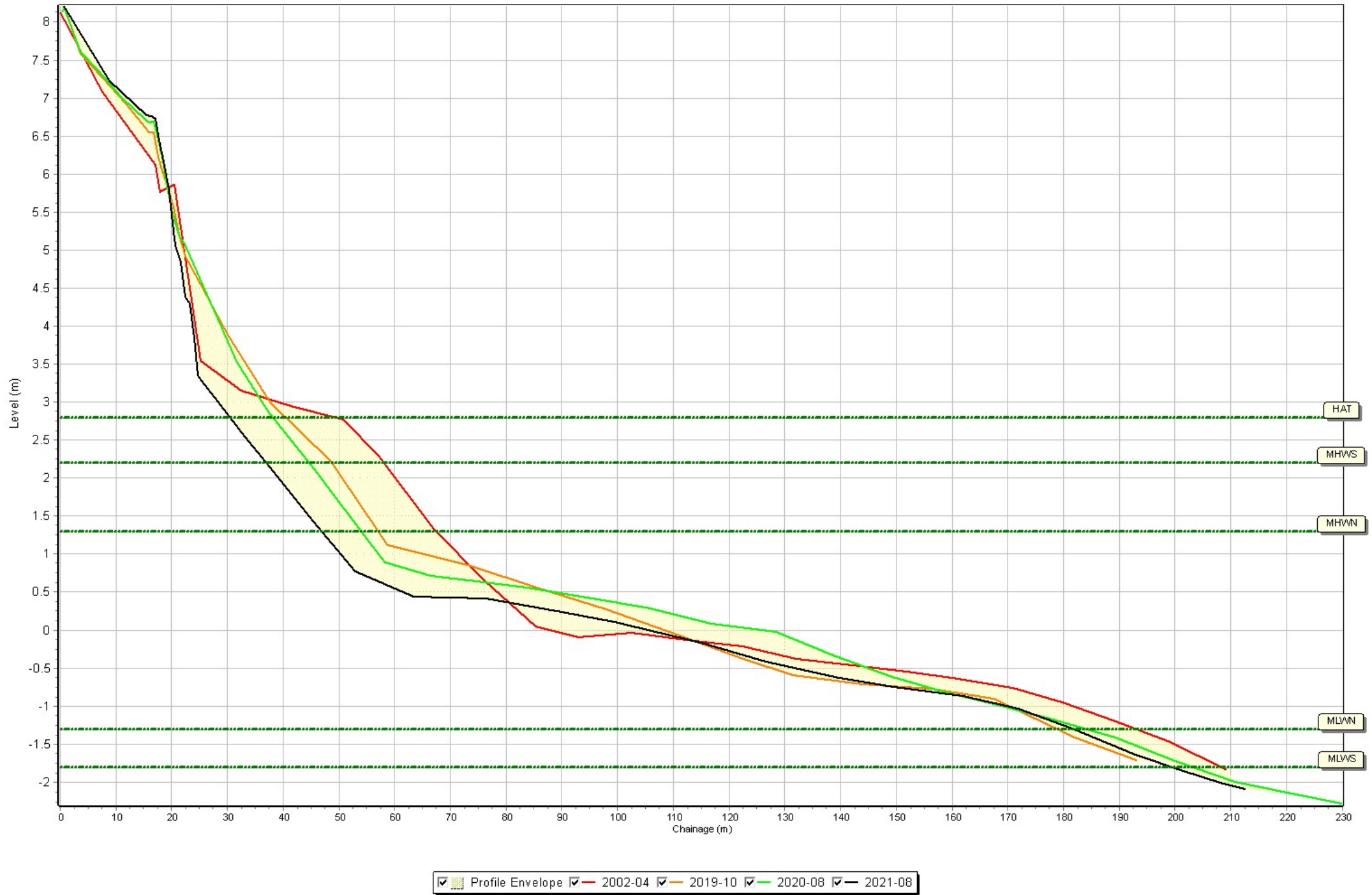
Profiles: 1aBTC07



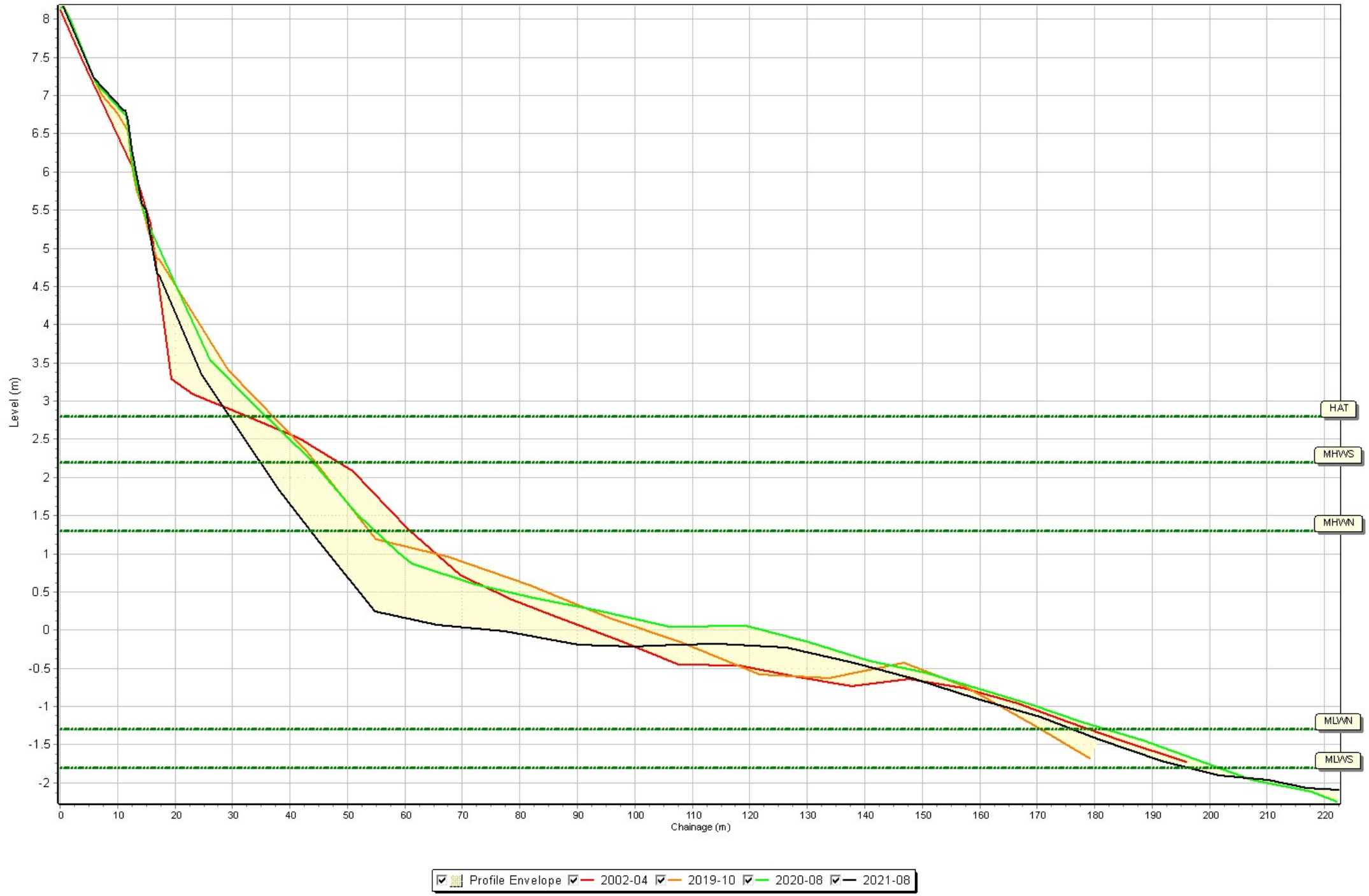
Profiles: 1aBTBC08



Profiles: 1aBTBC09

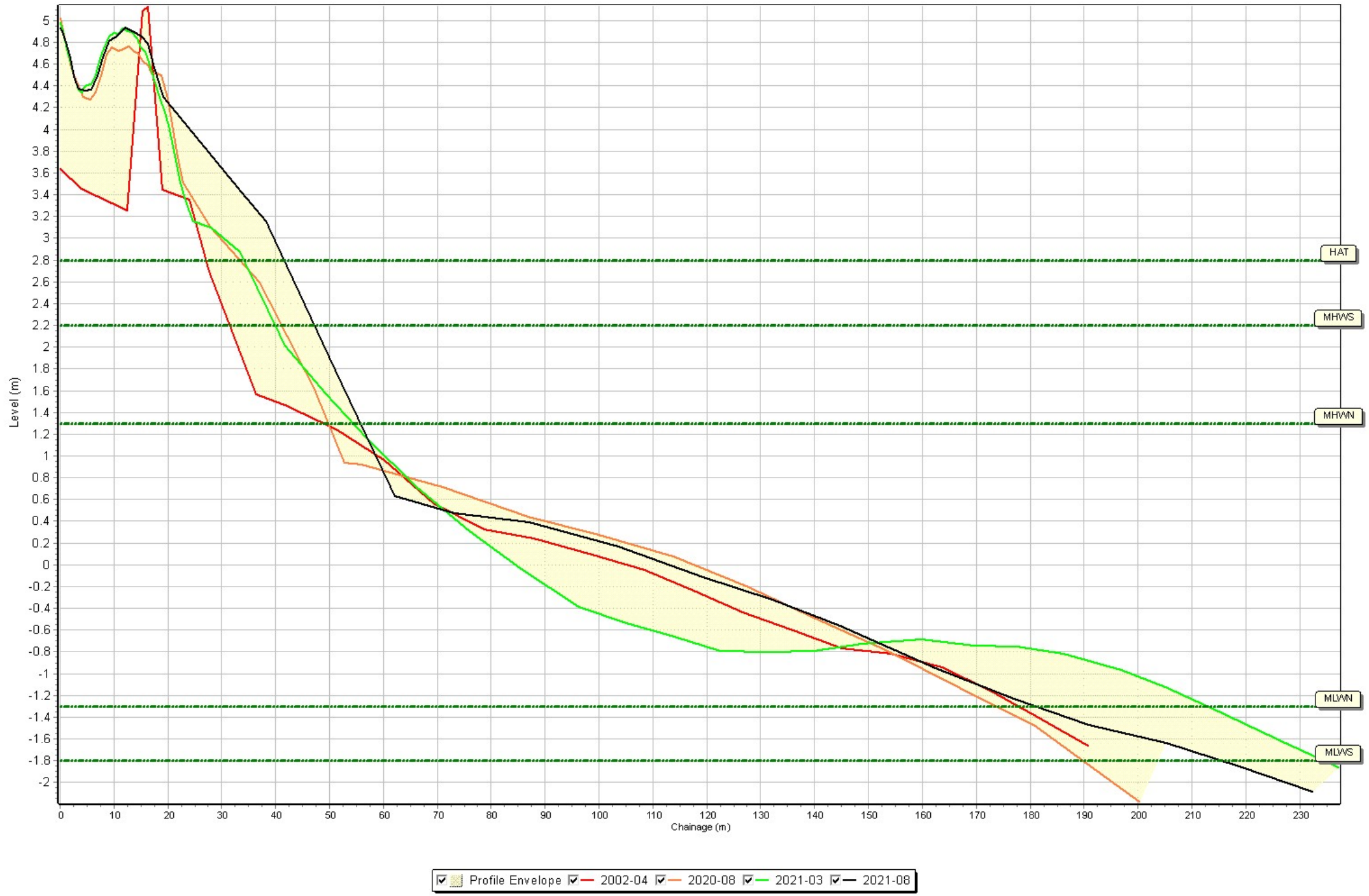


Profiles: 1aBTBC10

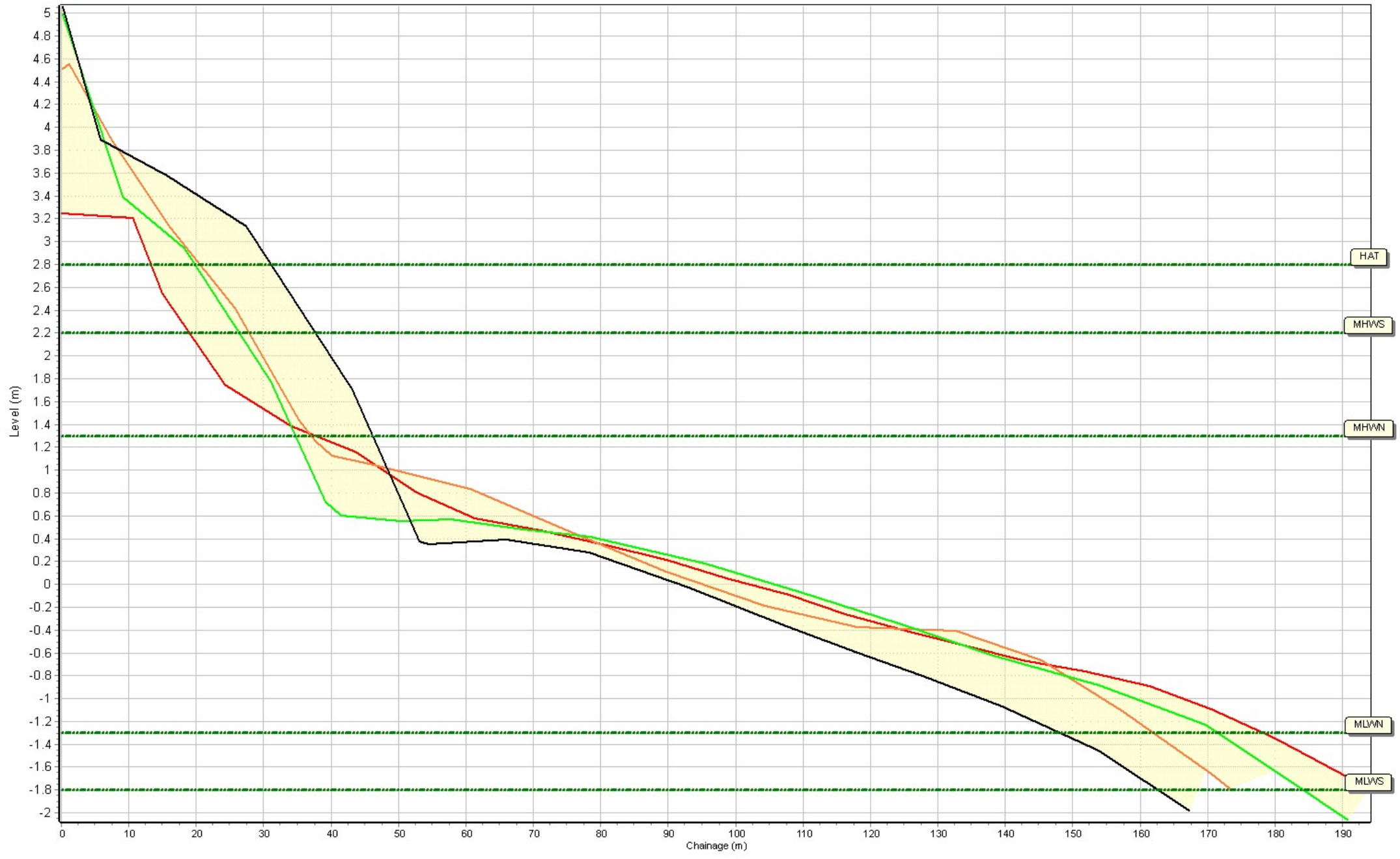




Profiles: 1aBTBC11

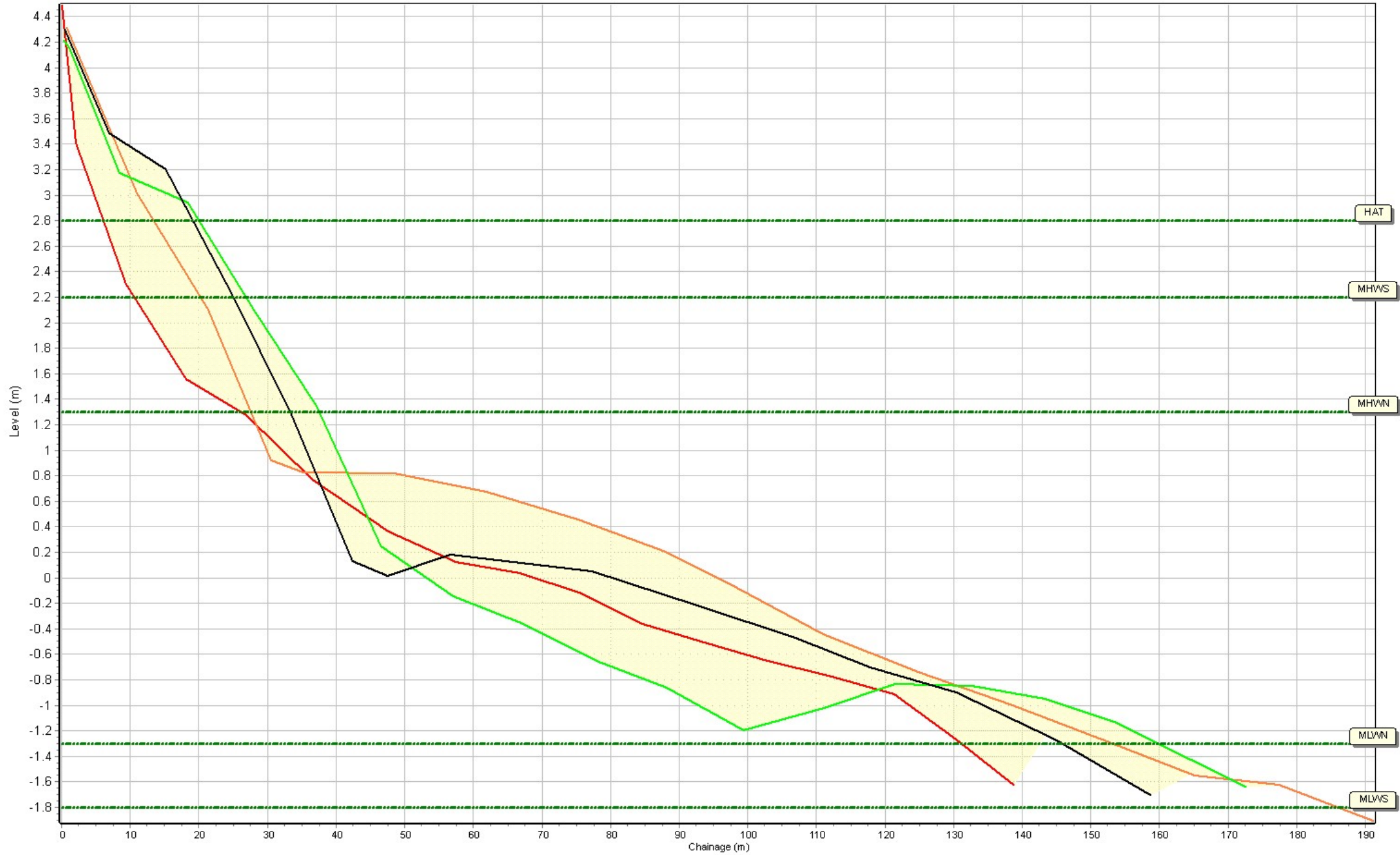


Profiles: 1aBTBC12



Profile Envelope  2002-04  2019-10  2020-08  2021-08

Profiles: 1aBTBC13



Profile Envelope  2002-04  2020-08  2021-03  2021-08

Profiles: 1aBTBC14



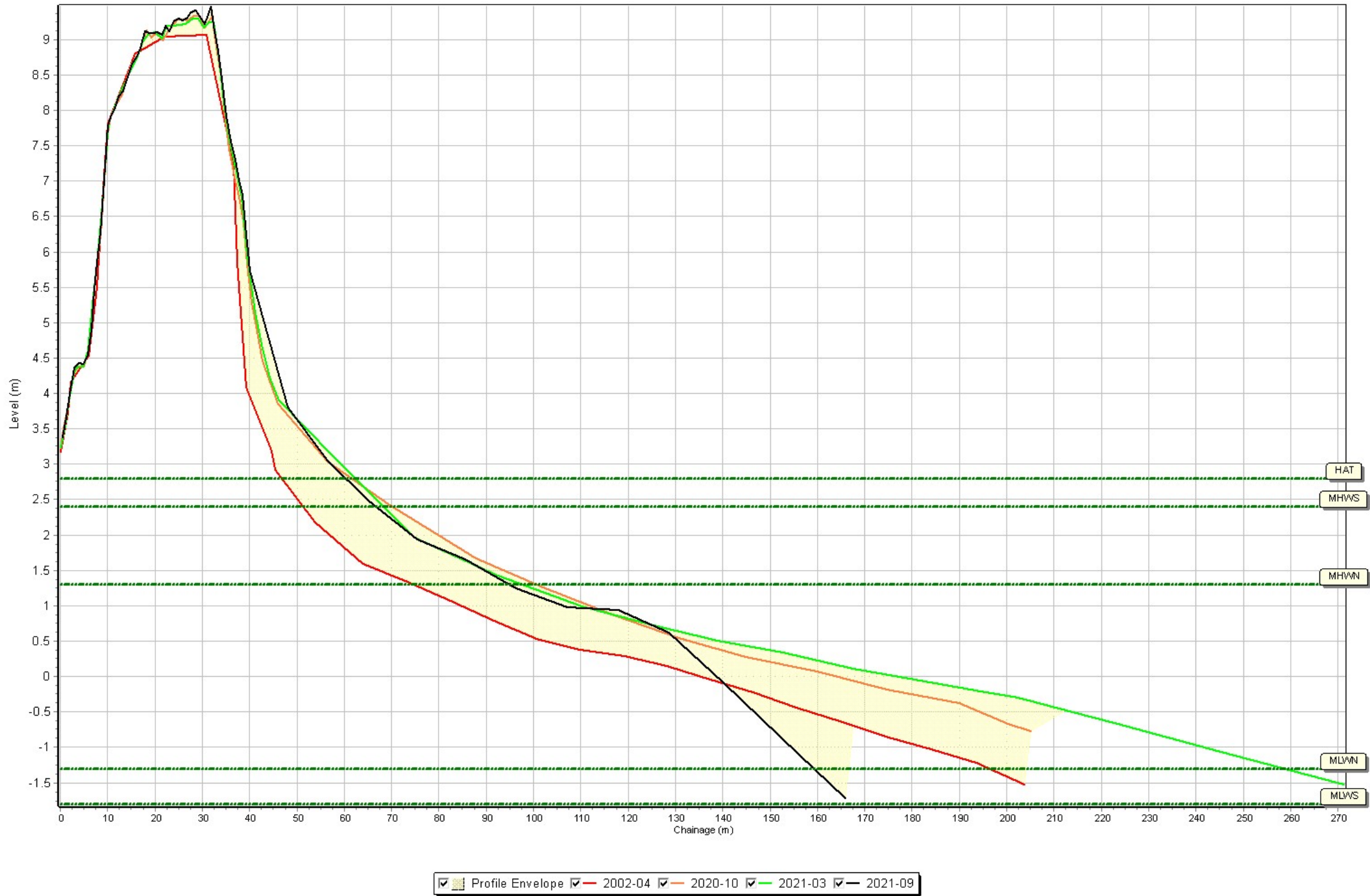
Profile Envelope  2002-04  2019-10  2020-08  2021-08



Profiles: 1aBTBC15



Profiles: 1aBTBC16



Profiles: 1aBTBC17



Profile Envelope  2002-04  2019-10  2020-10  2021-09

HAT  
MHWS  
MHWN  
MLWN  
MLWS

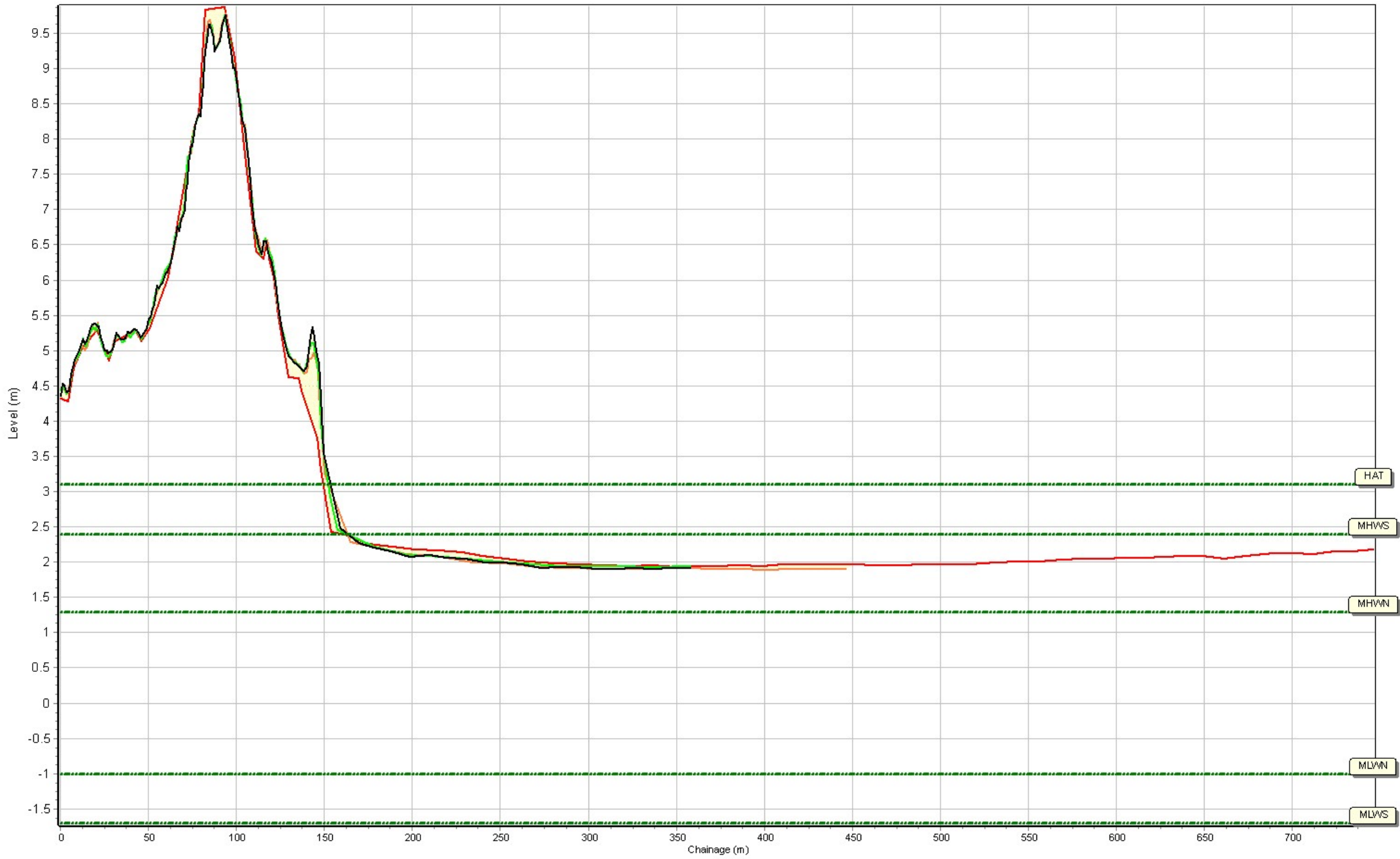
Profiles: 1aBTBC18



Profile Envelope  2002-04  2019-10  2020-10  2021-09

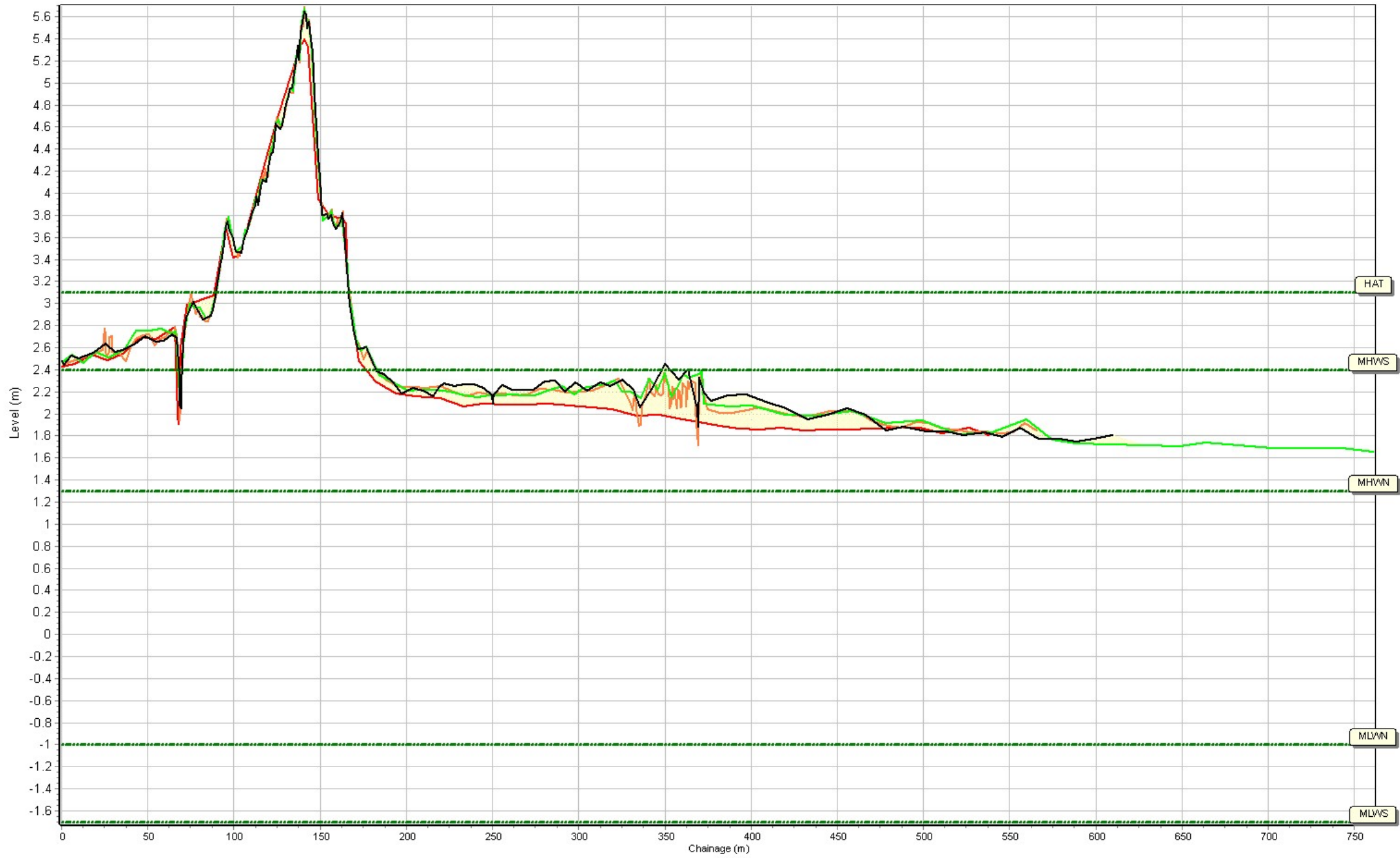


Profiles: 1aBTC19



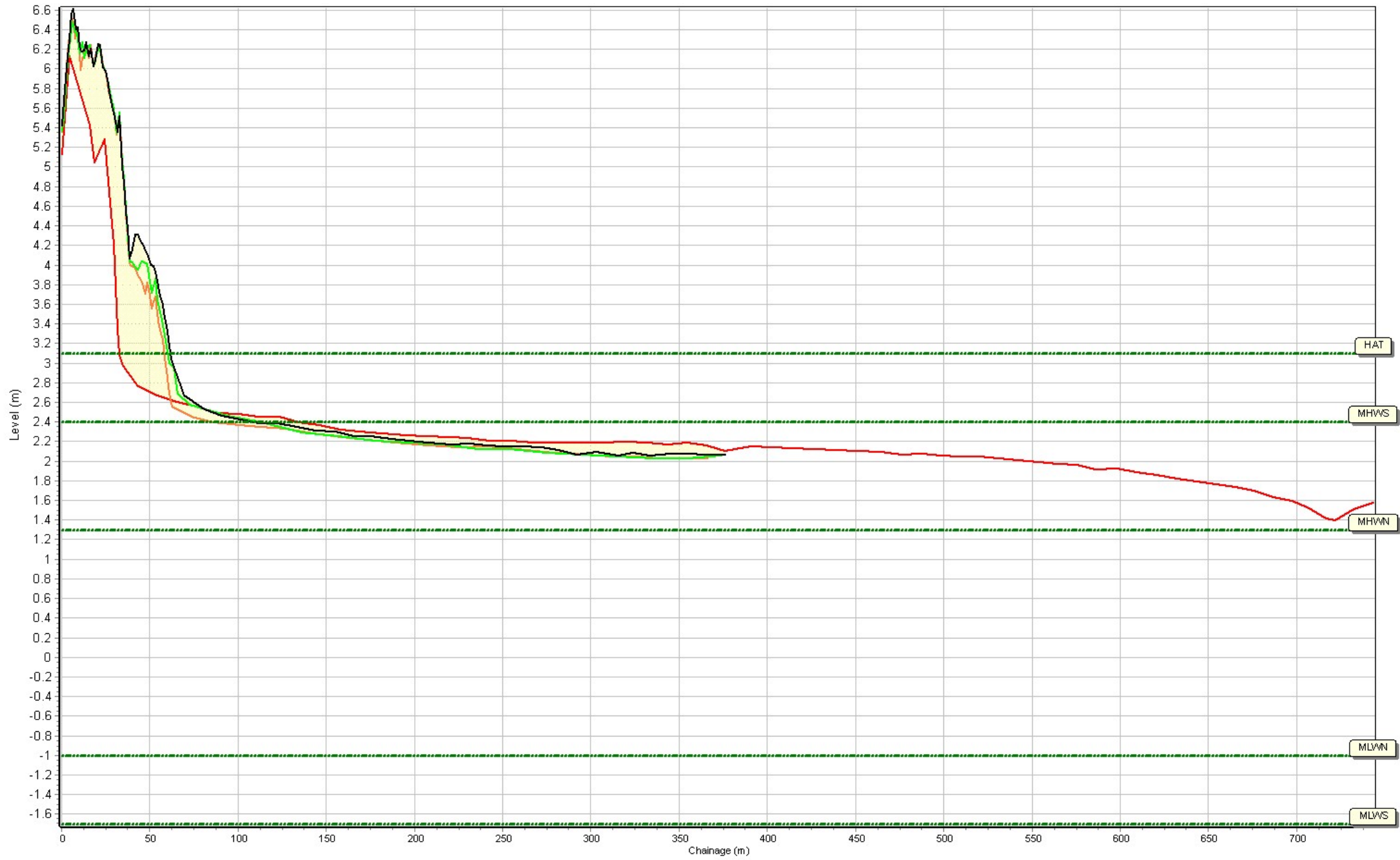
Profile Envelope  2002-04  2020-10  2021-03  2021-09

Profiles: 1aBTC20



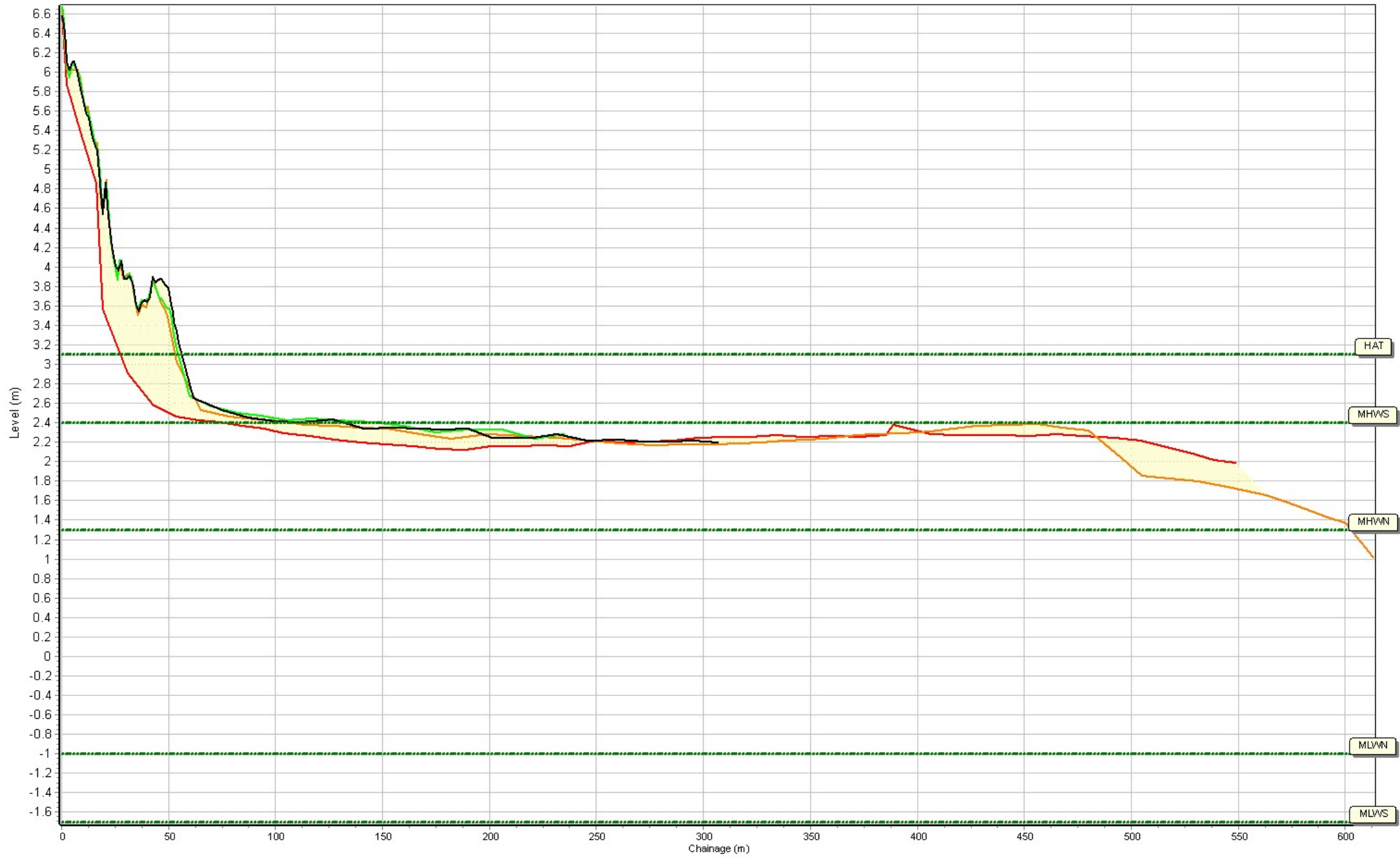
Profile Envelope  2002-04  2019-10  2020-10  2021-09

Profiles: 1aBTBC21



Profile Envelope  2002-04  2020-08  2021-03  2021-09

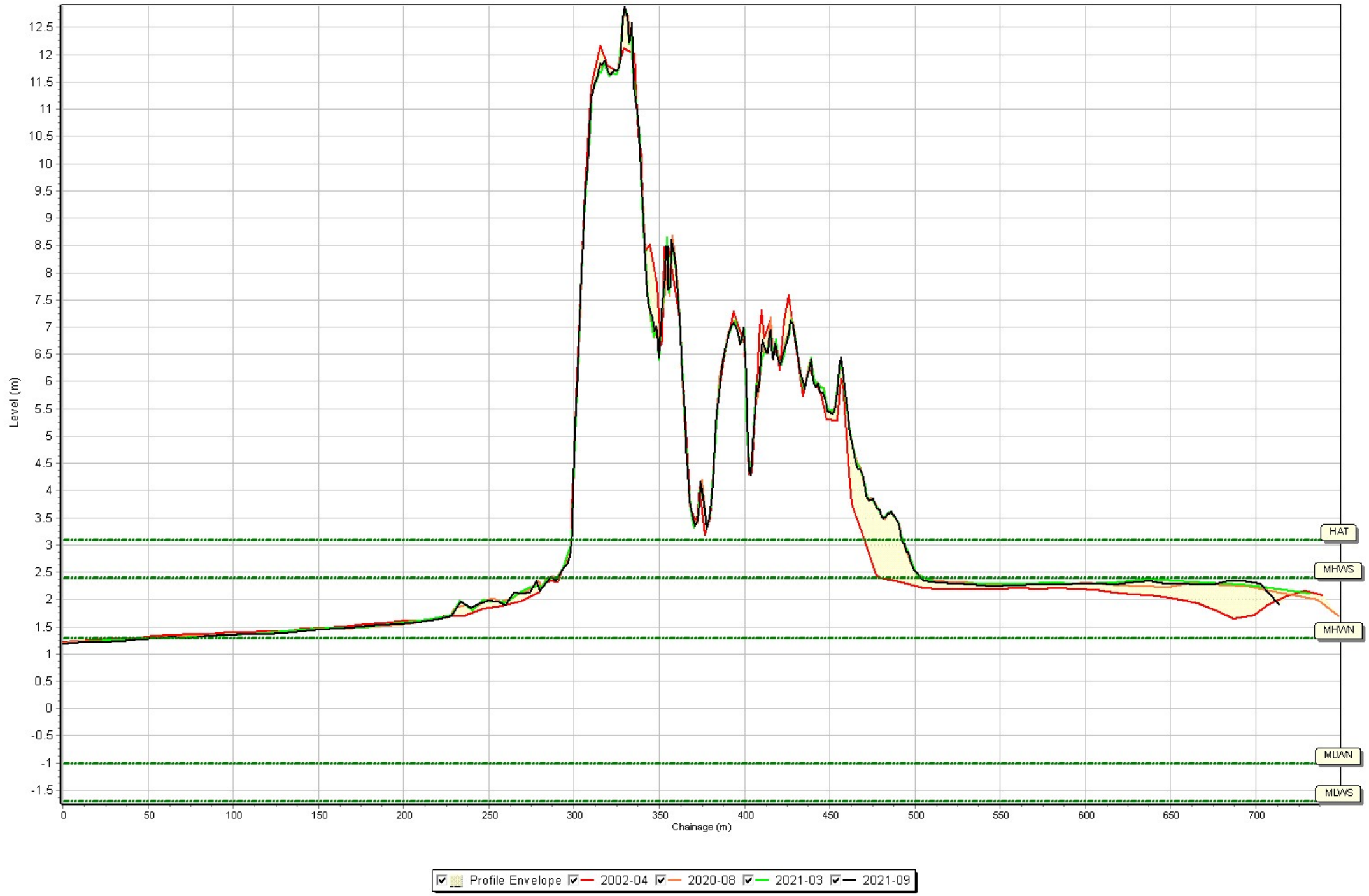
Profiles: 1aBTBC22



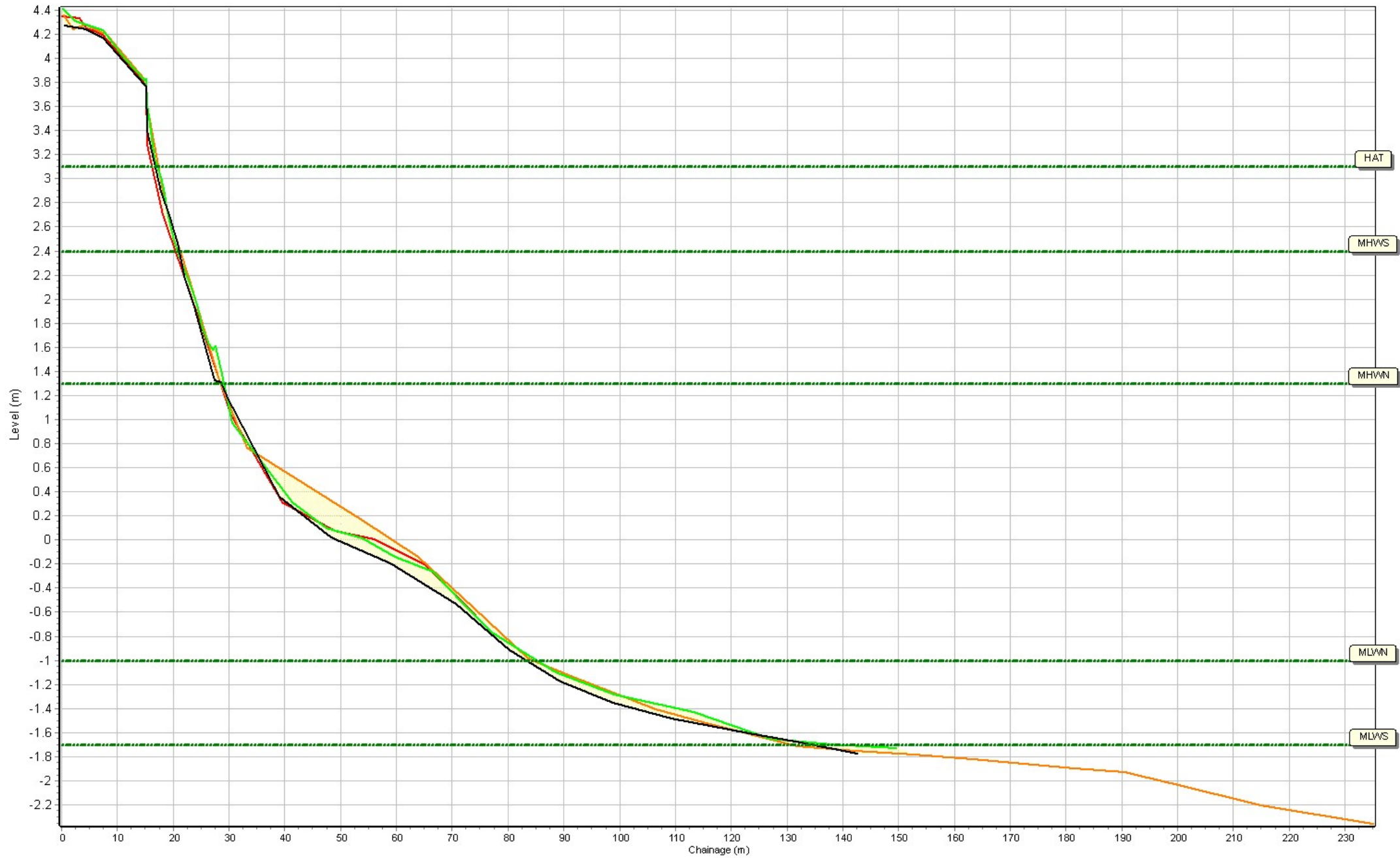
Profile Envelope  2002-04  2019-09  2020-08  2021-09



Profiles: 1aBTC23

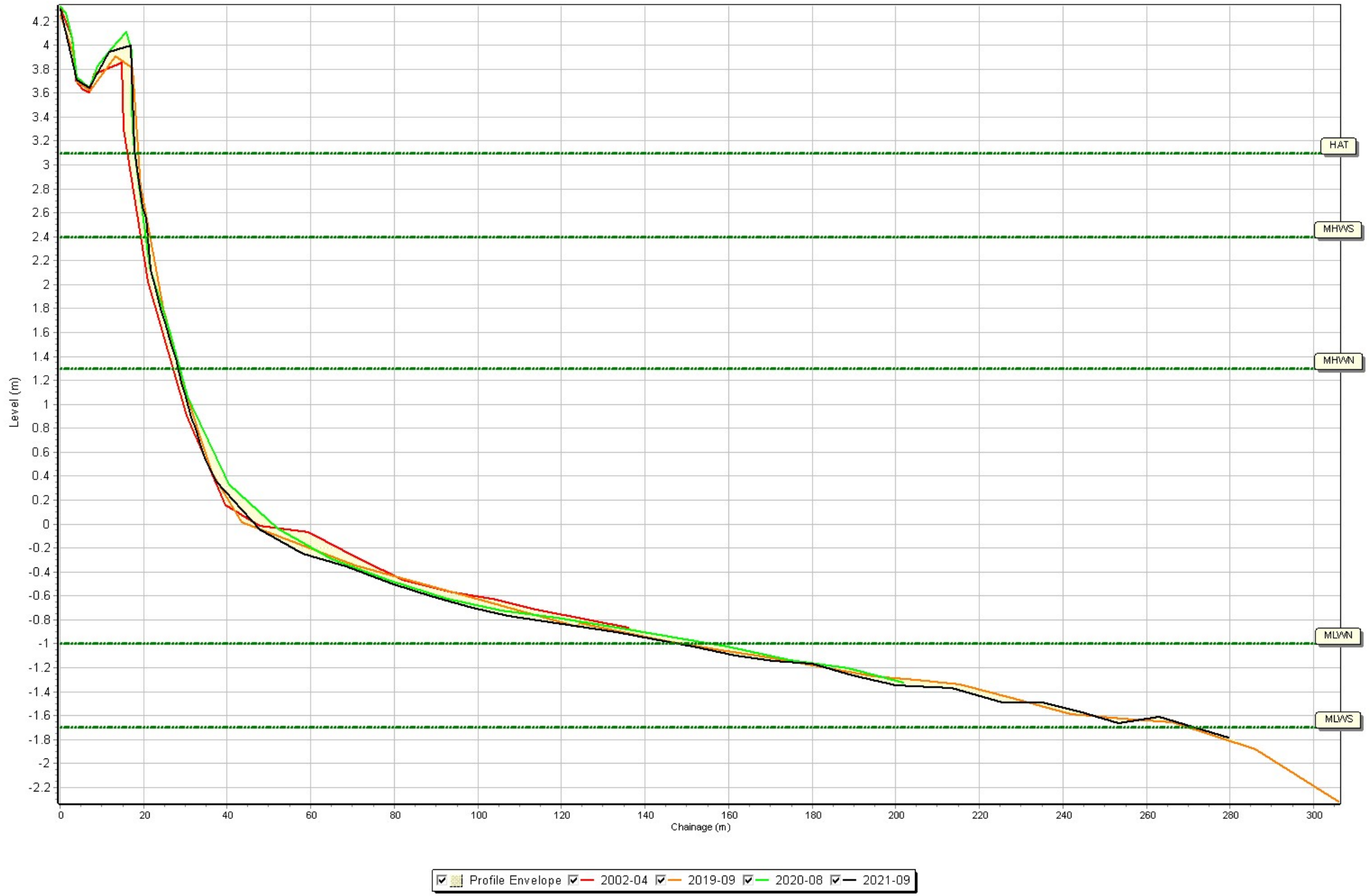


Profiles: 1aBTC24

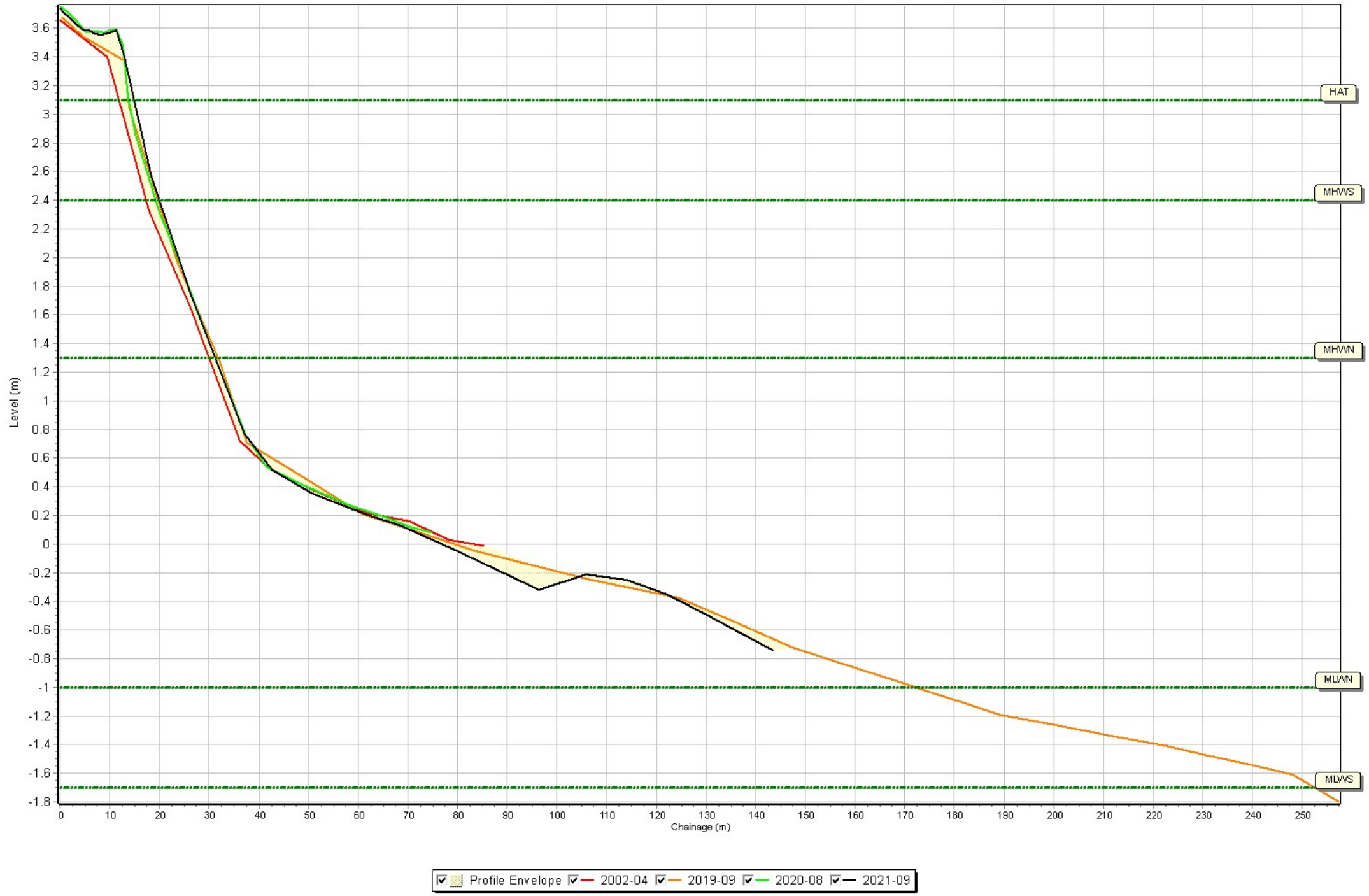


Profile Envelope  2002-04  2019-09  2020-08  2021-09

Profiles: 1aBTBC25

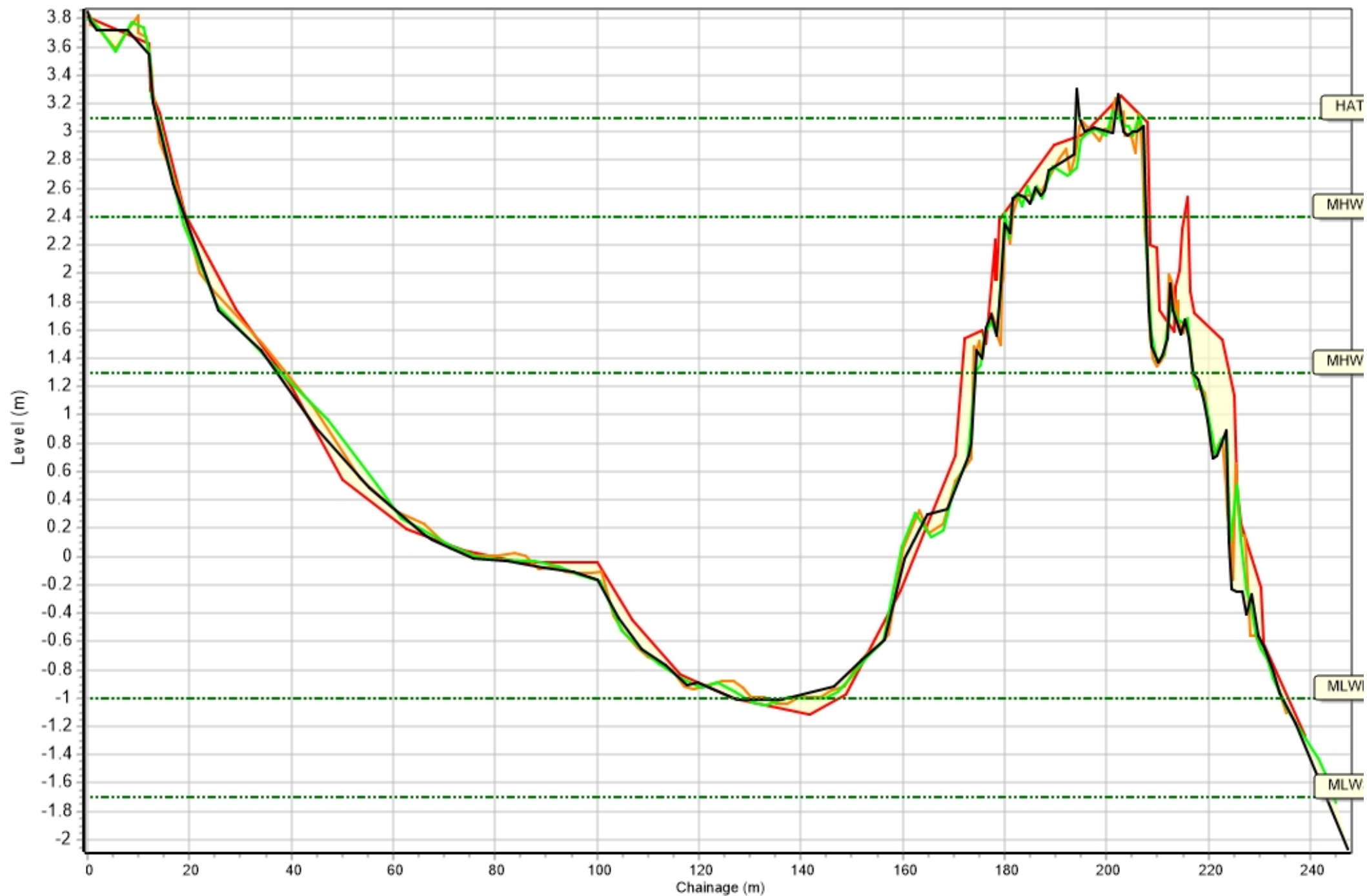


Profiles: 1aBTBC26



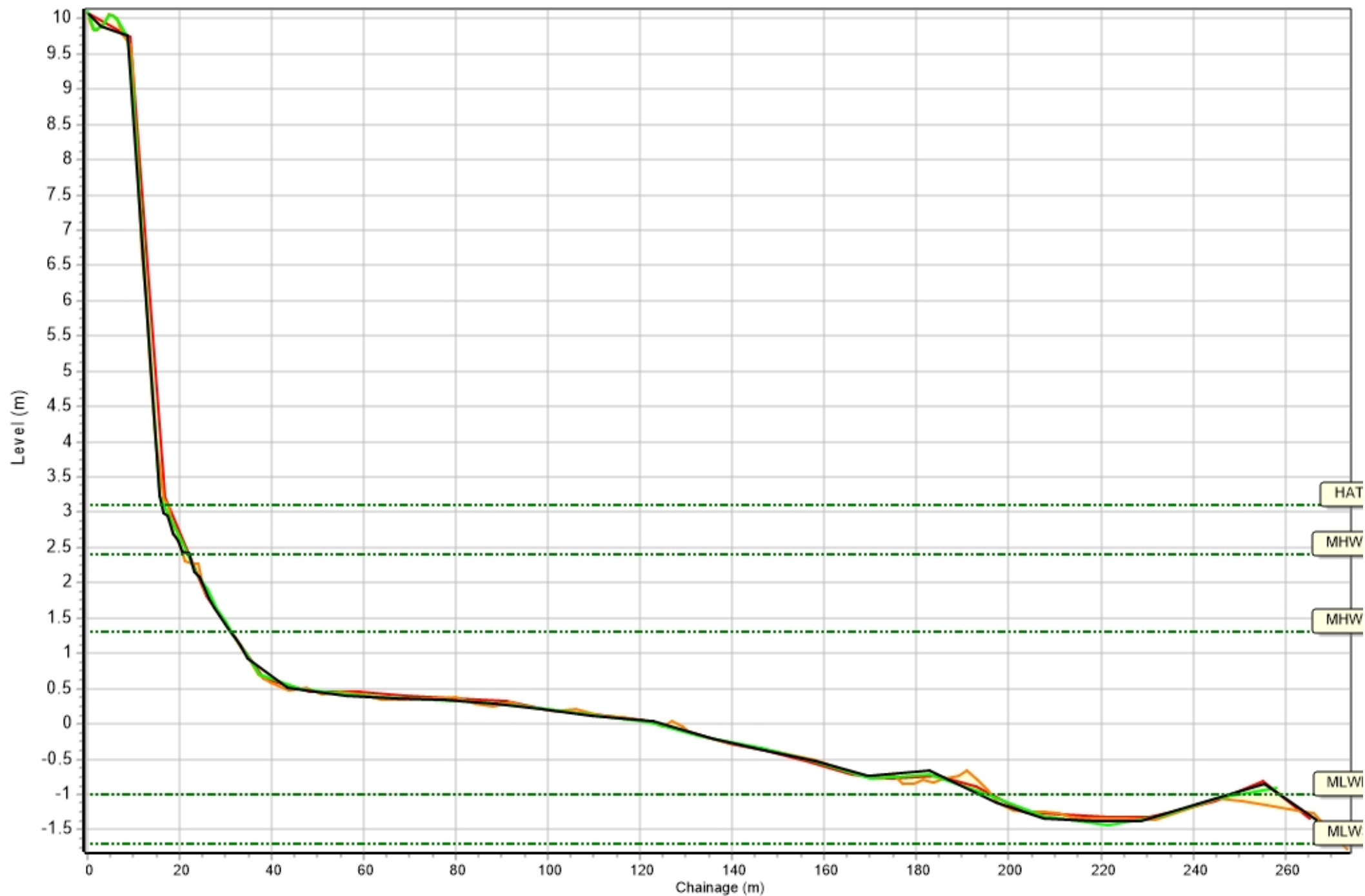


Profiles: 1aBTBC27



Profile Envelope
  2002-04
  2019-10
  2020-08
  2021-09

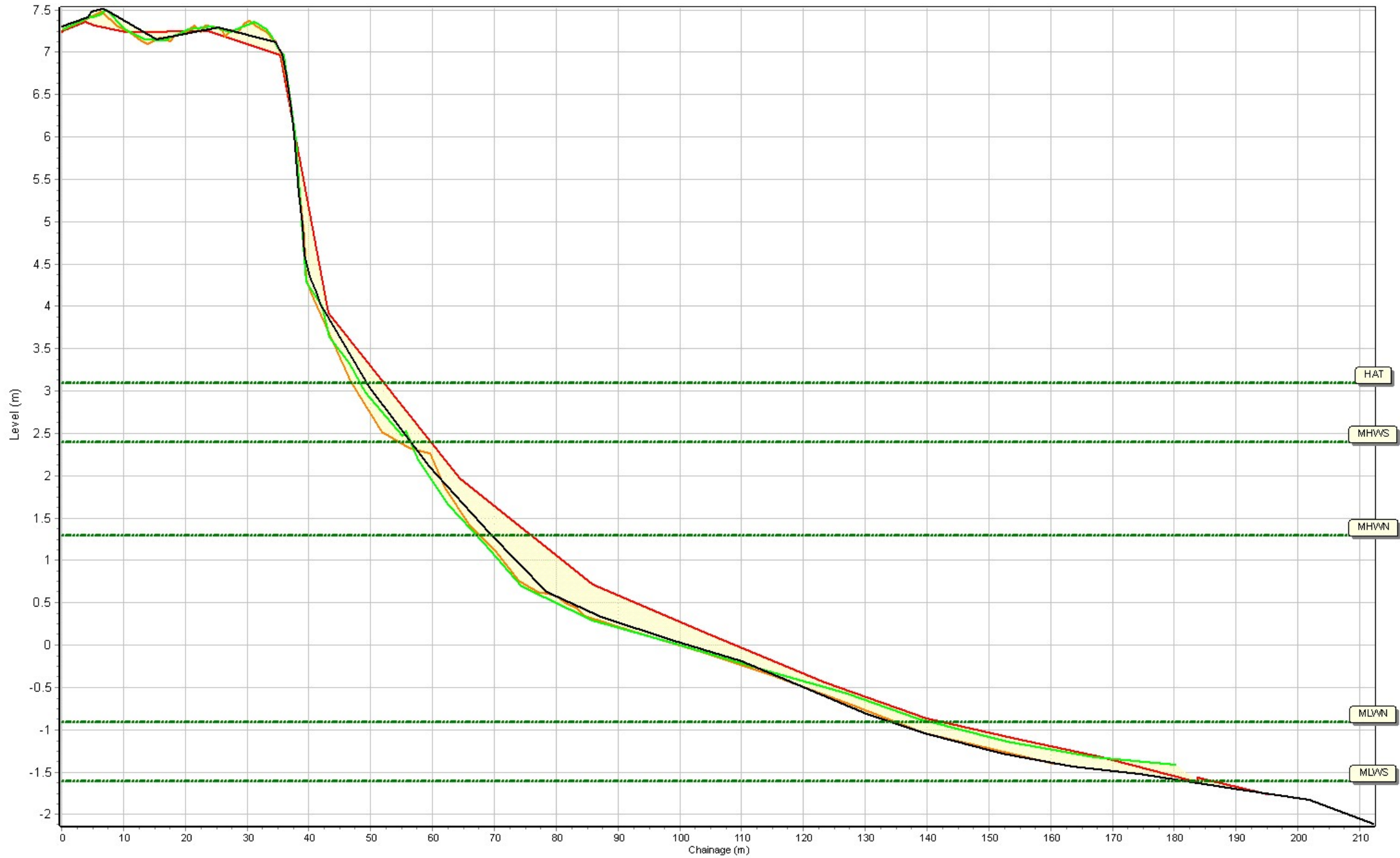
Profiles: 1aBTBC28



Profile Envelope  2002-04  2019-10  2020-08  2021-09



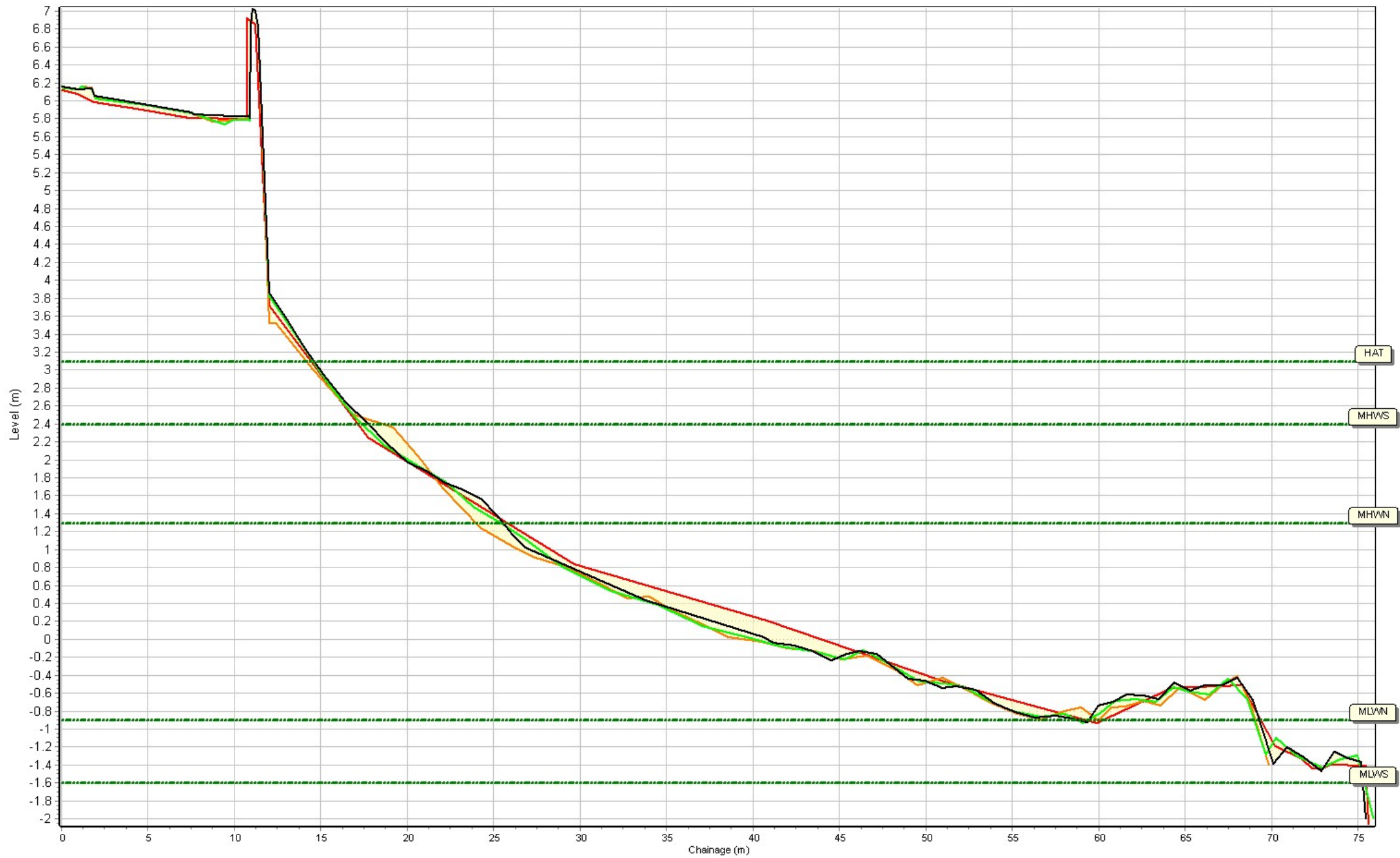
Profiles: 1aBTBC30



Profile Envelope  2002-04  2019-10  2020-10  2021-09



Profiles: 1aBTBC31



Profile Envelope  2002-04  2020-10  2021-03  2021-09

Profiles: 1aBTBC32



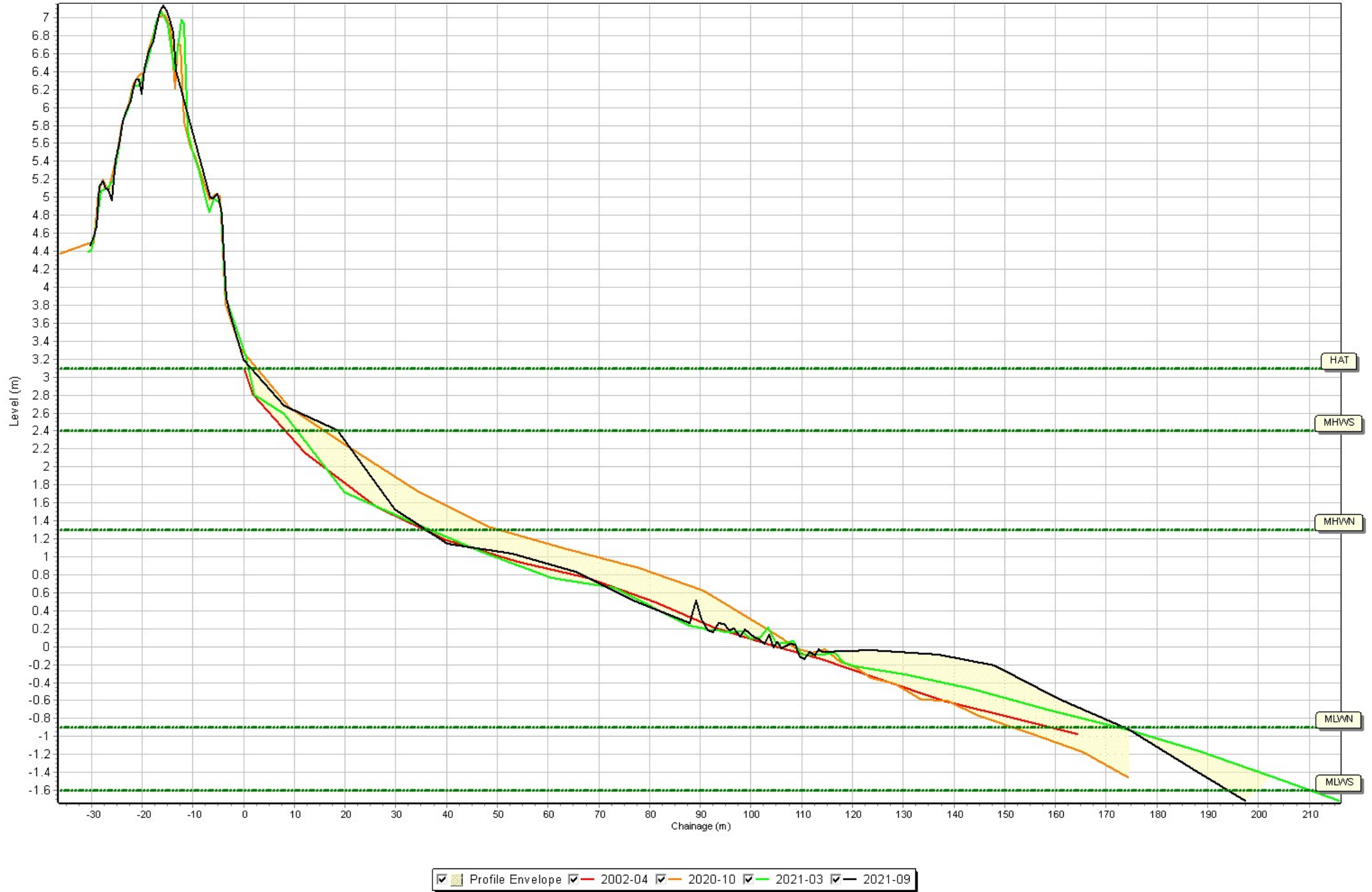
Profile Envelope  2002-04  2019-10  2020-10  2021-09

Profiles: 1aBTBC33



Profile Envelope  2002-04  2020-10  2021-03  2021-09

Profiles: 1aBTBC34

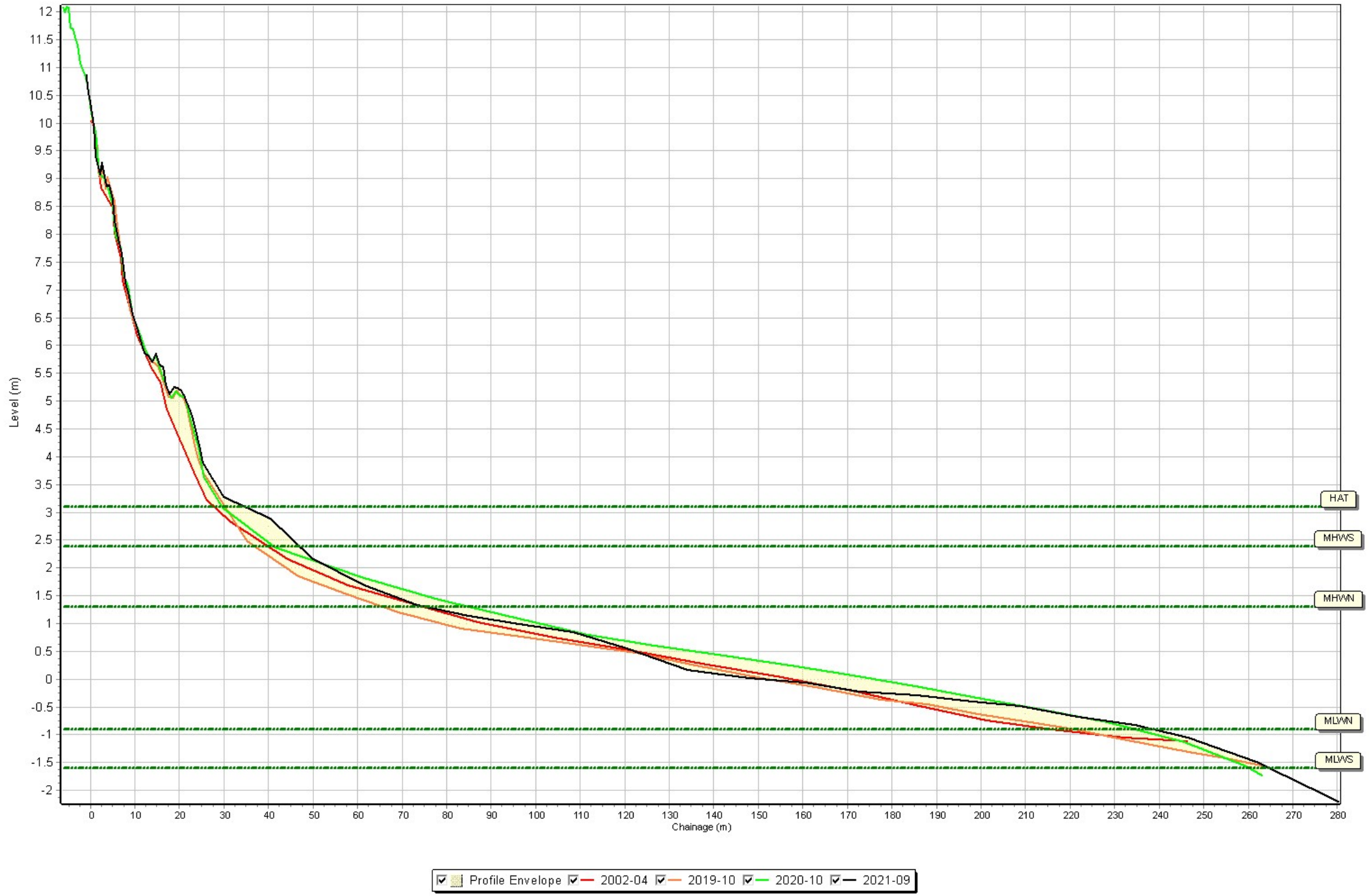




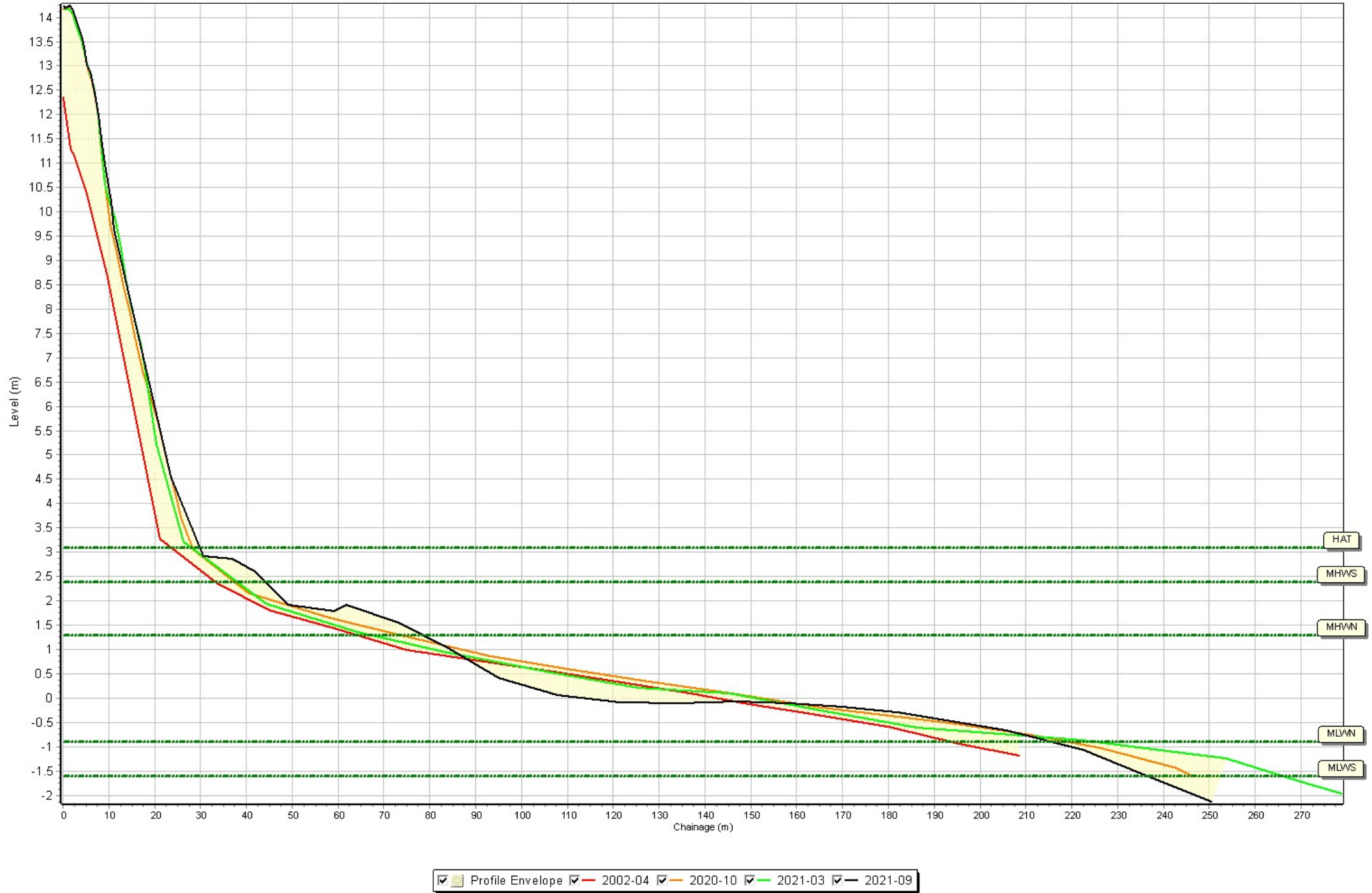
Profiles: 1aBTBC35



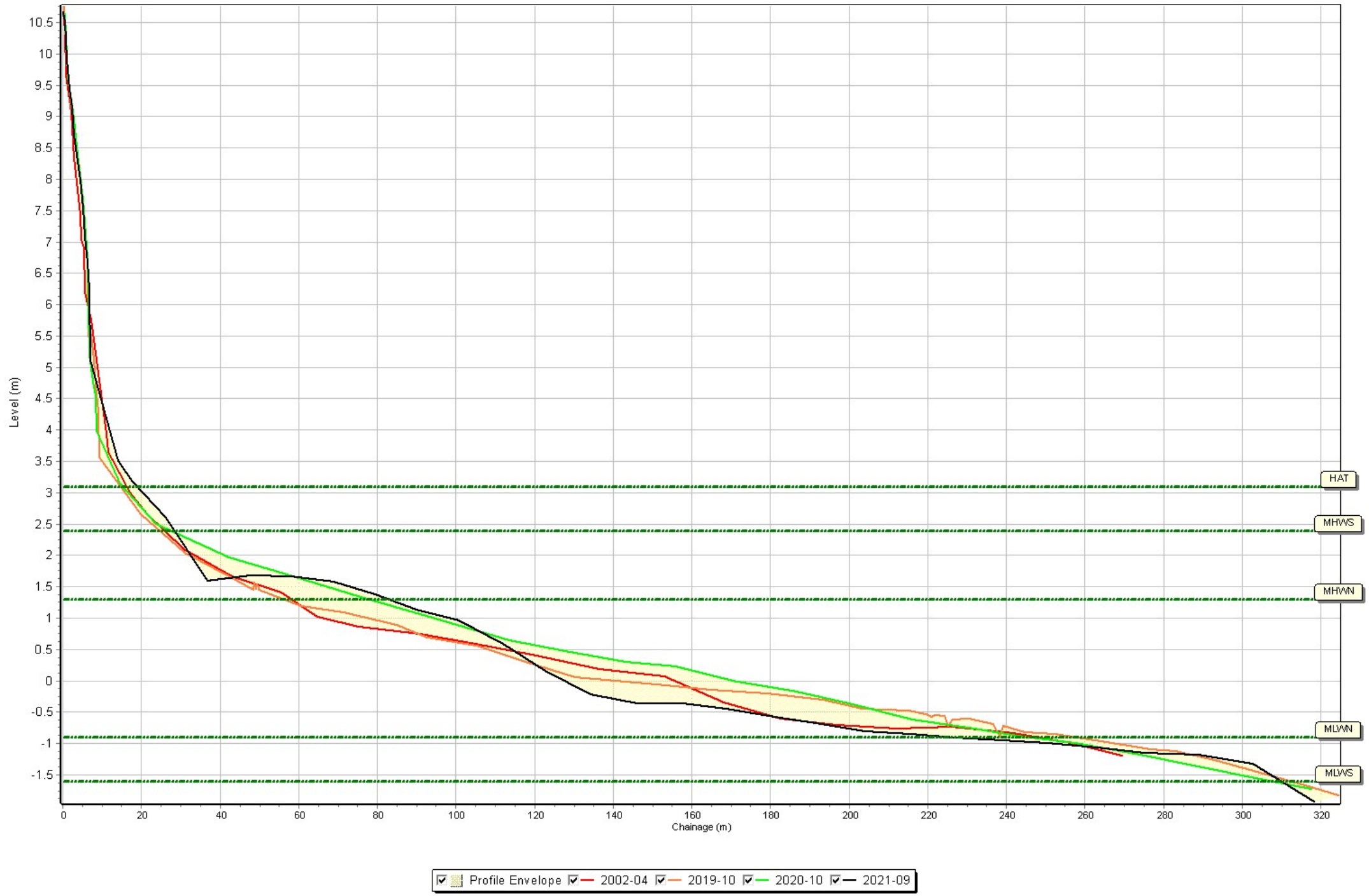
Profiles: 1aBTBC36



Profiles: 1aBTBC37



Profiles: 1aBTBC38

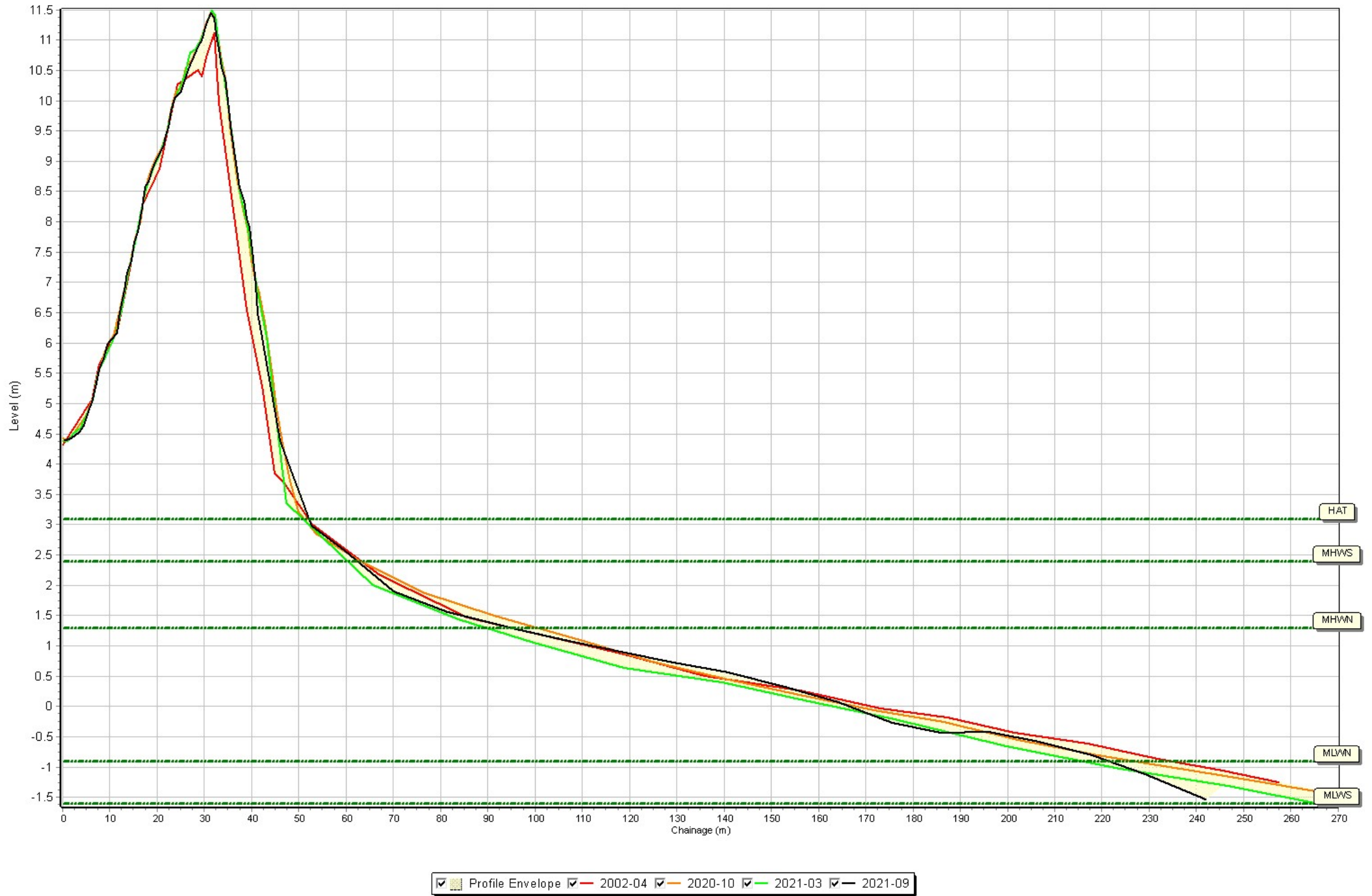




Profiles: 1aADC01



Profiles: 1aADC02

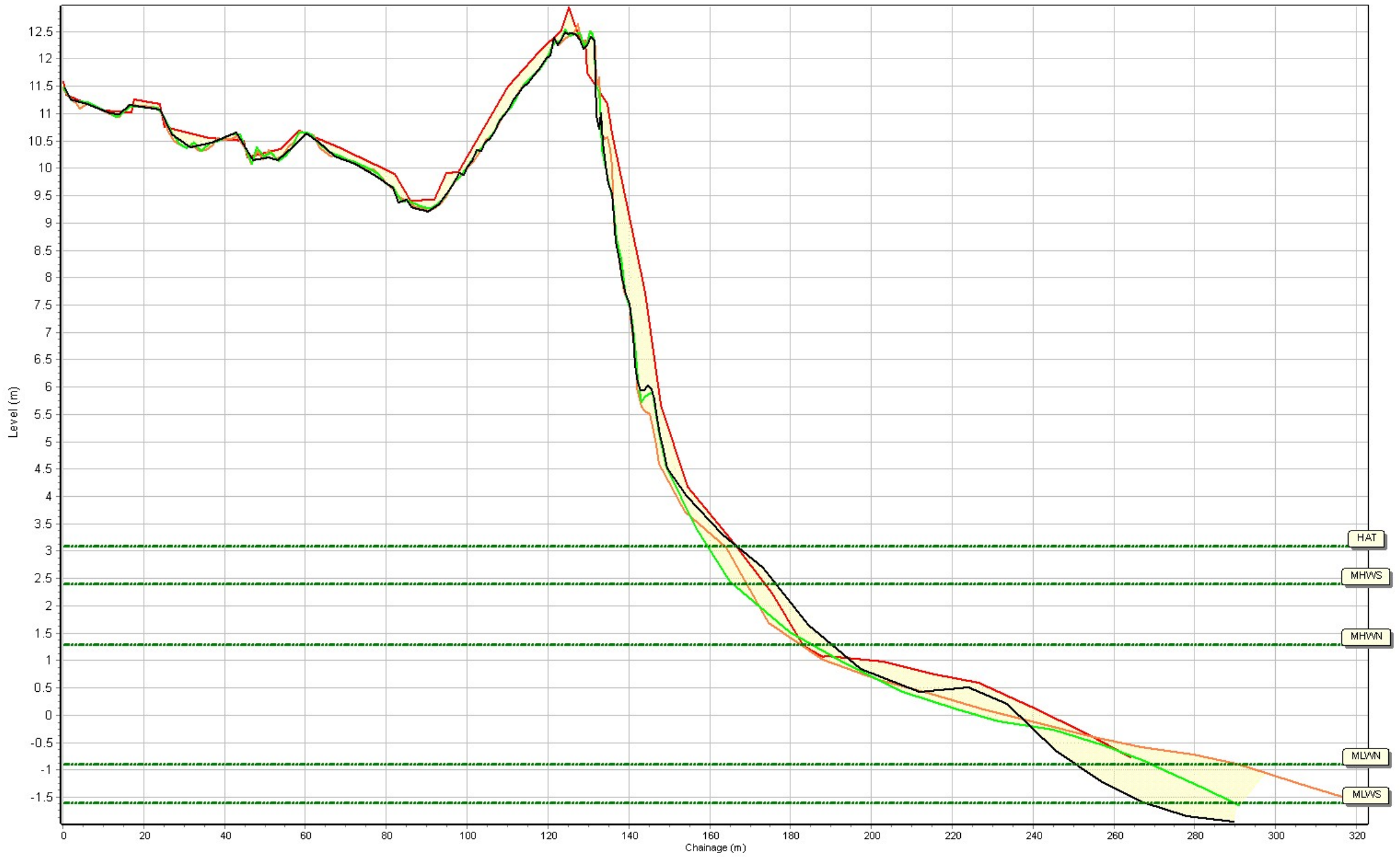


Profiles: 1aADC03



Profile Envelope  2002-04  2019-10  2020-10  2021-09

Profiles: 1aADC04



Profile Envelope  2002-04  2019-10  2020-10  2021-09



Profiles: 1aADC04A



Profile Envelope  2007-10  2020-09  2021-03  2021-09

Profiles: 1aADC04B

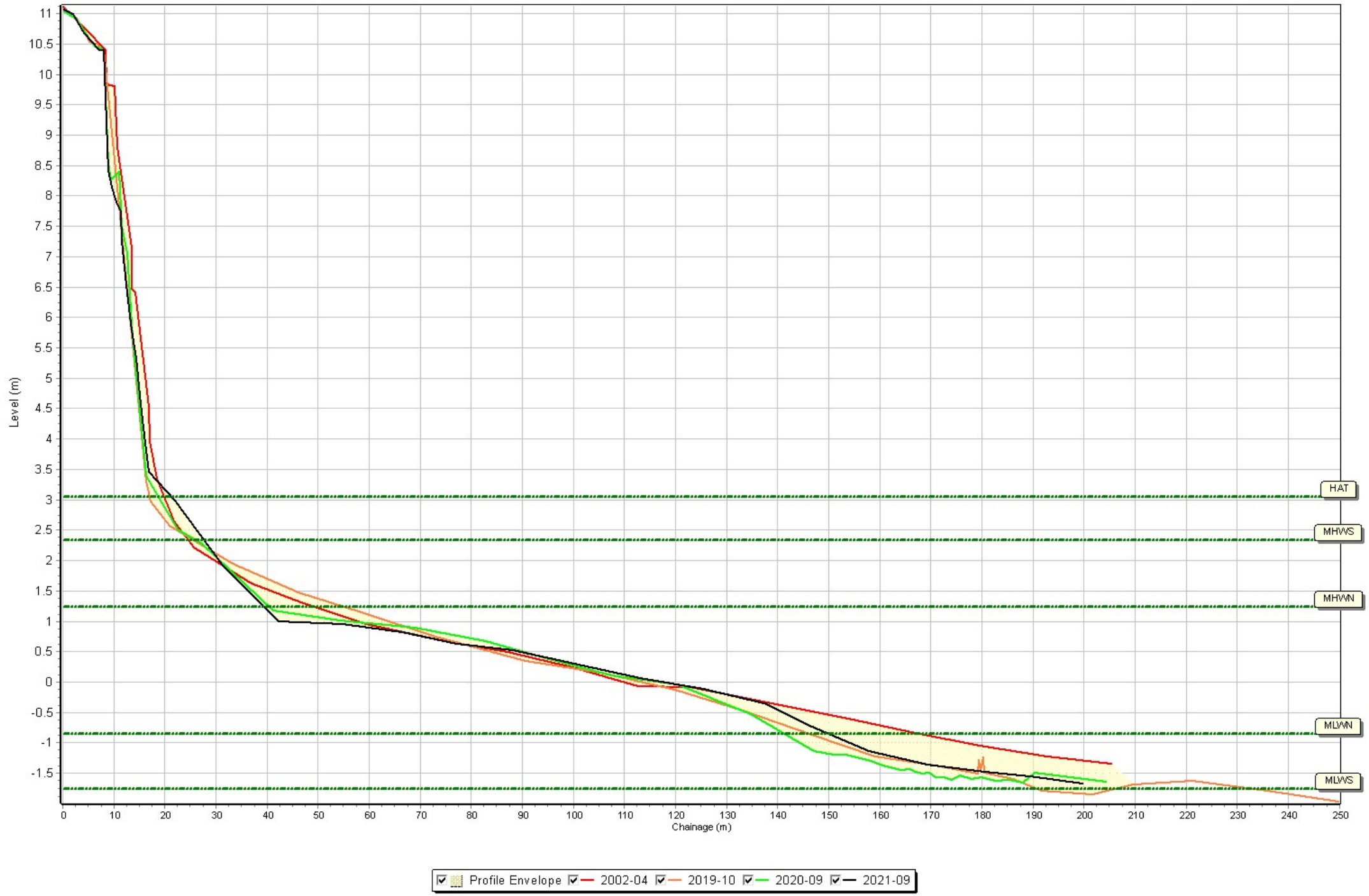


Profiles: 1aADC05



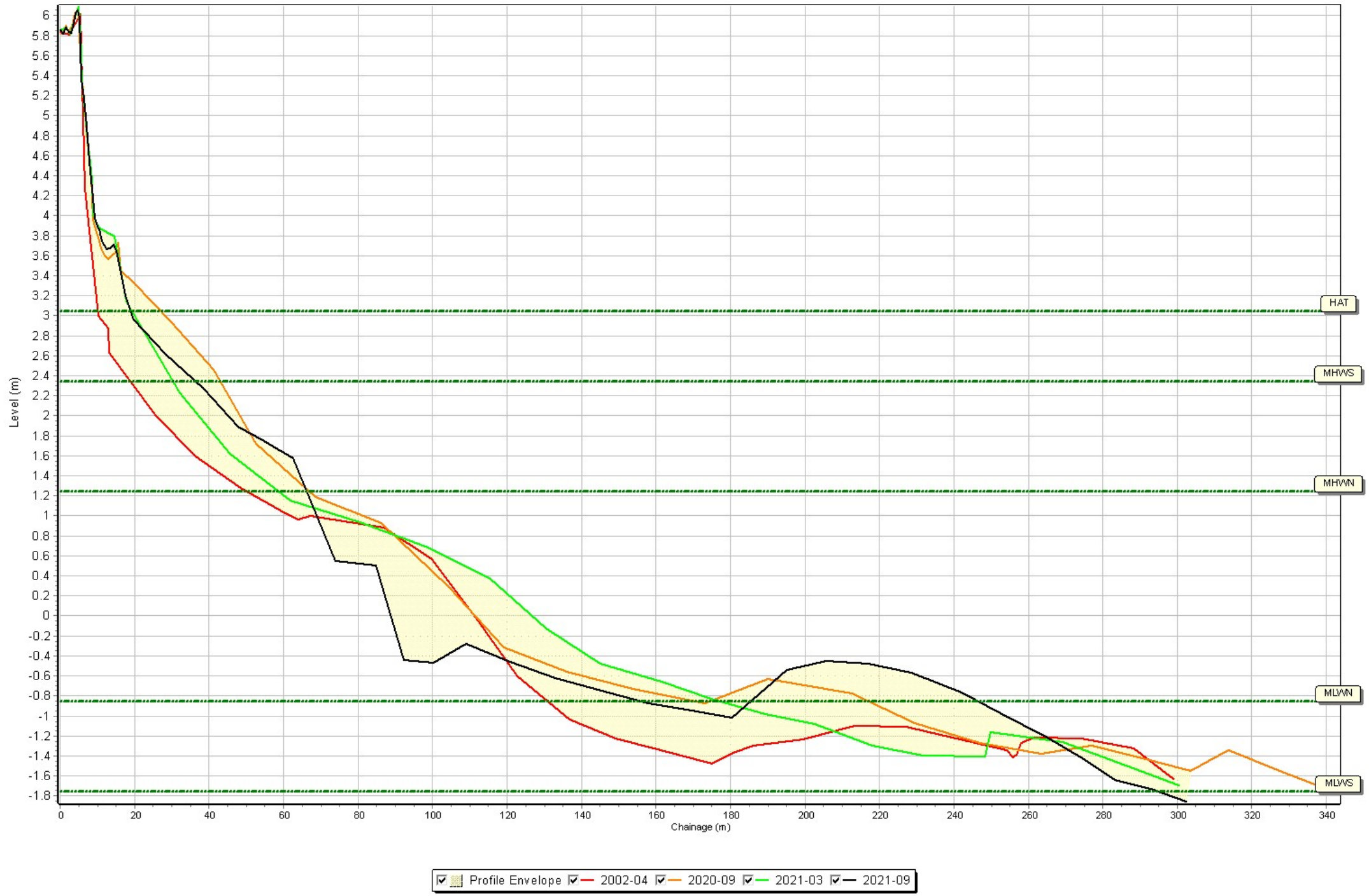
Profile Envelope  2002-04  2019-10  2020-09  2021-09

Profiles: 1aADC06





Profiles: 1aADC07

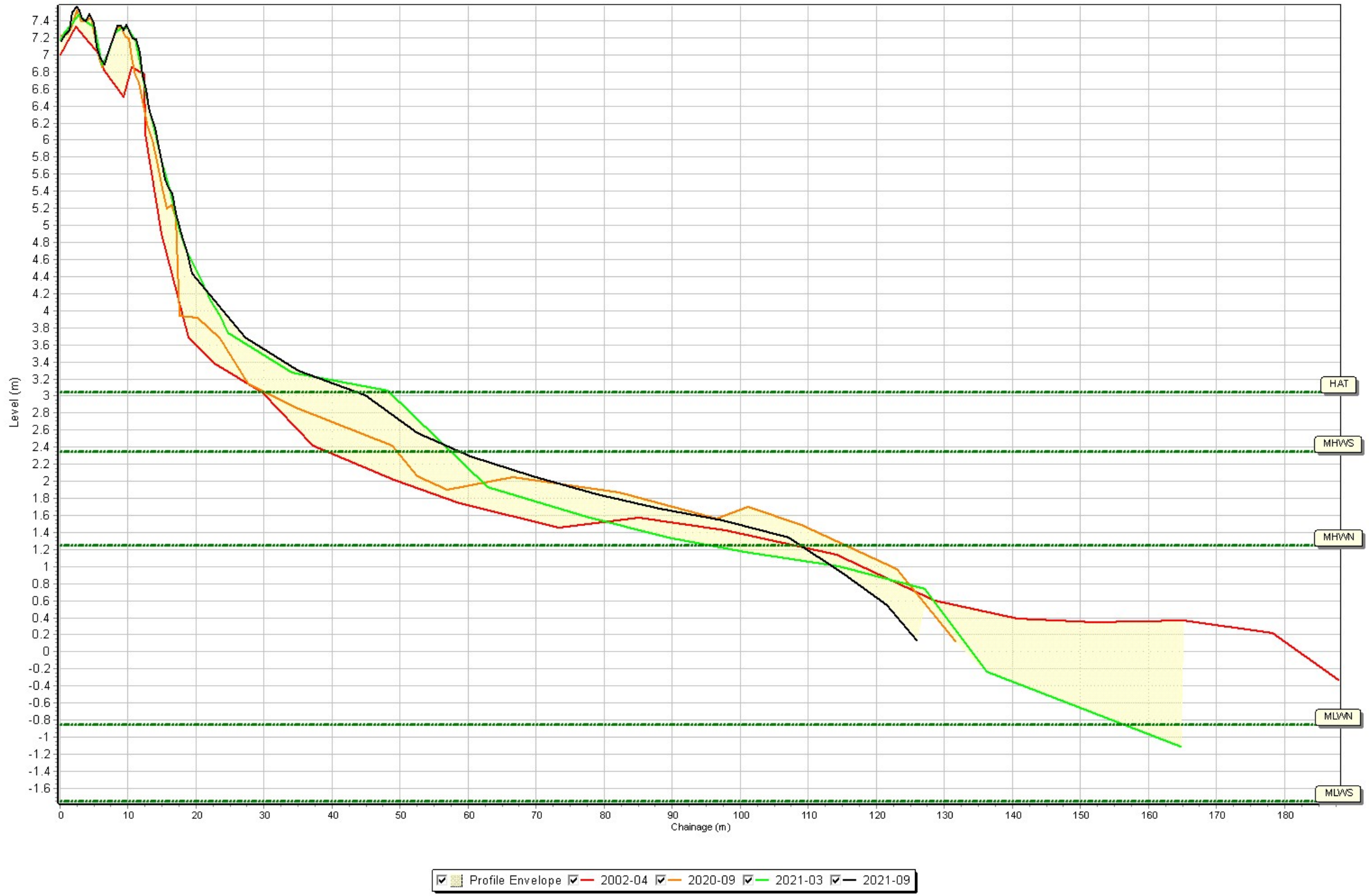


Profiles: 1aADC08



Profile Envelope  2002-04  2020-09  2021-03  2021-09

Profiles: 1aADC09

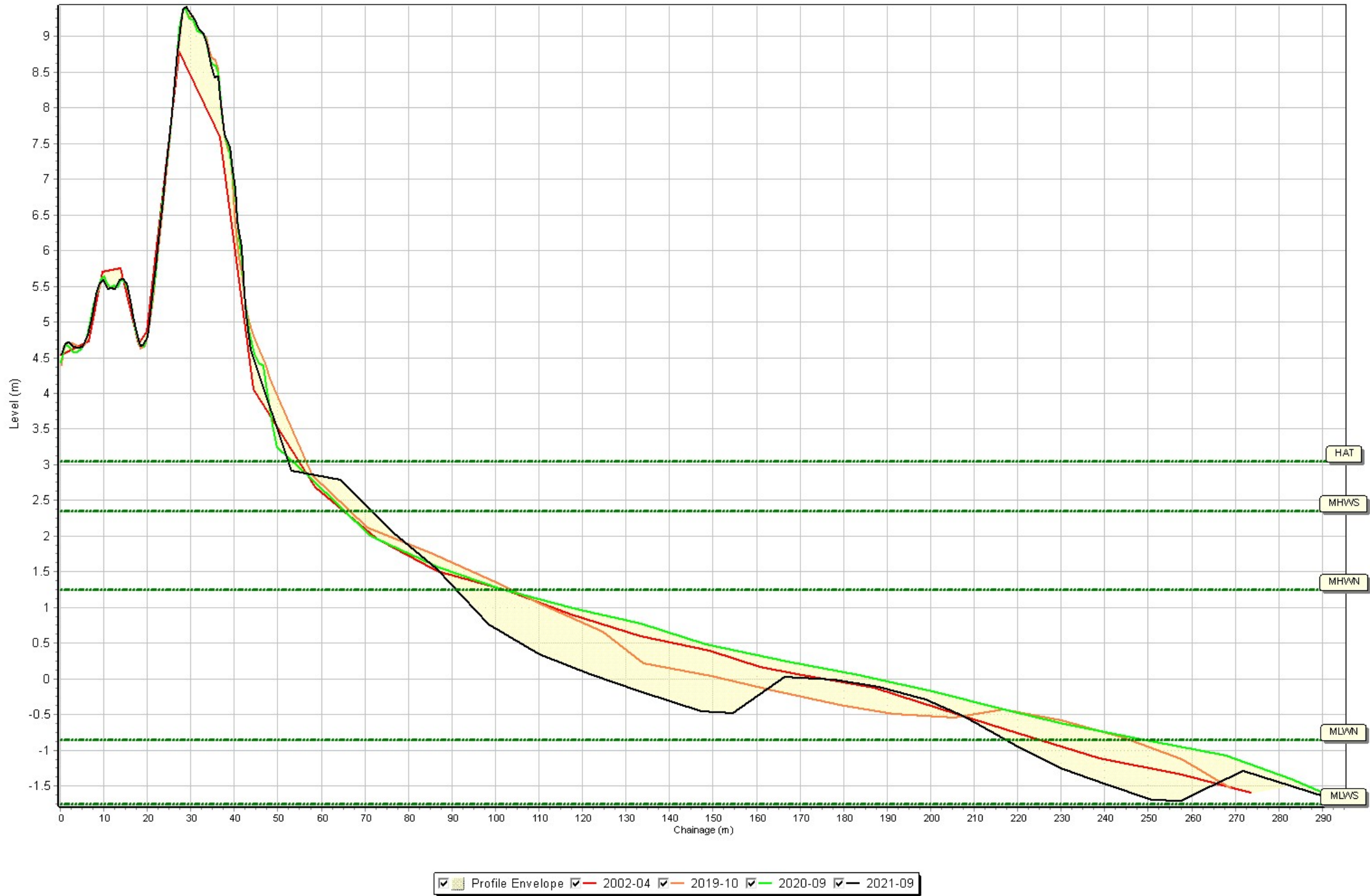


Profiles: 1aADC10

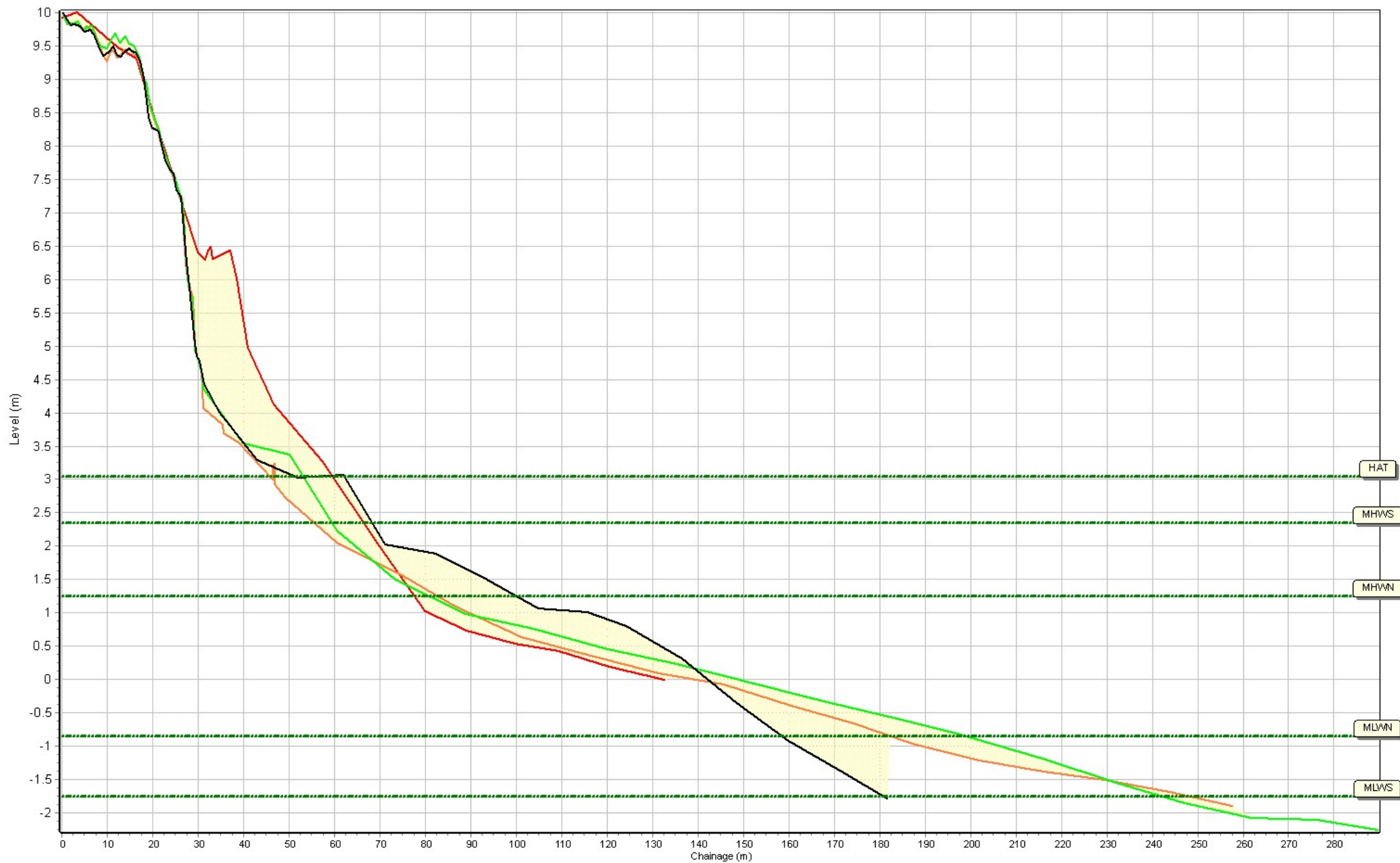




Profiles: 1aADC11



Profiles: 1aADC12



Profile Envelope  2002-04  2019-10  2020-09  2021-09

Profiles: 1aADC13



Profiles: 1aADC14

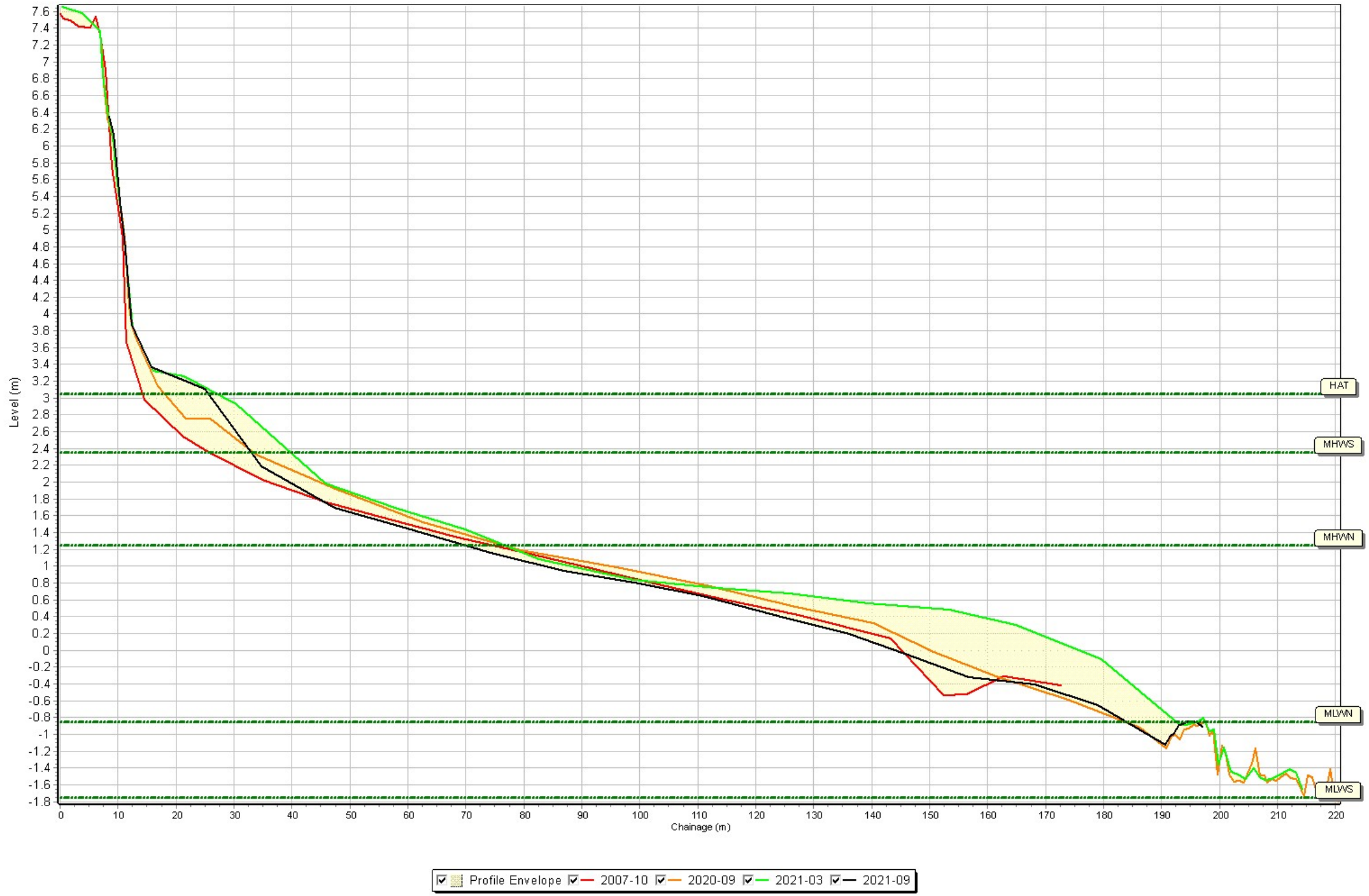




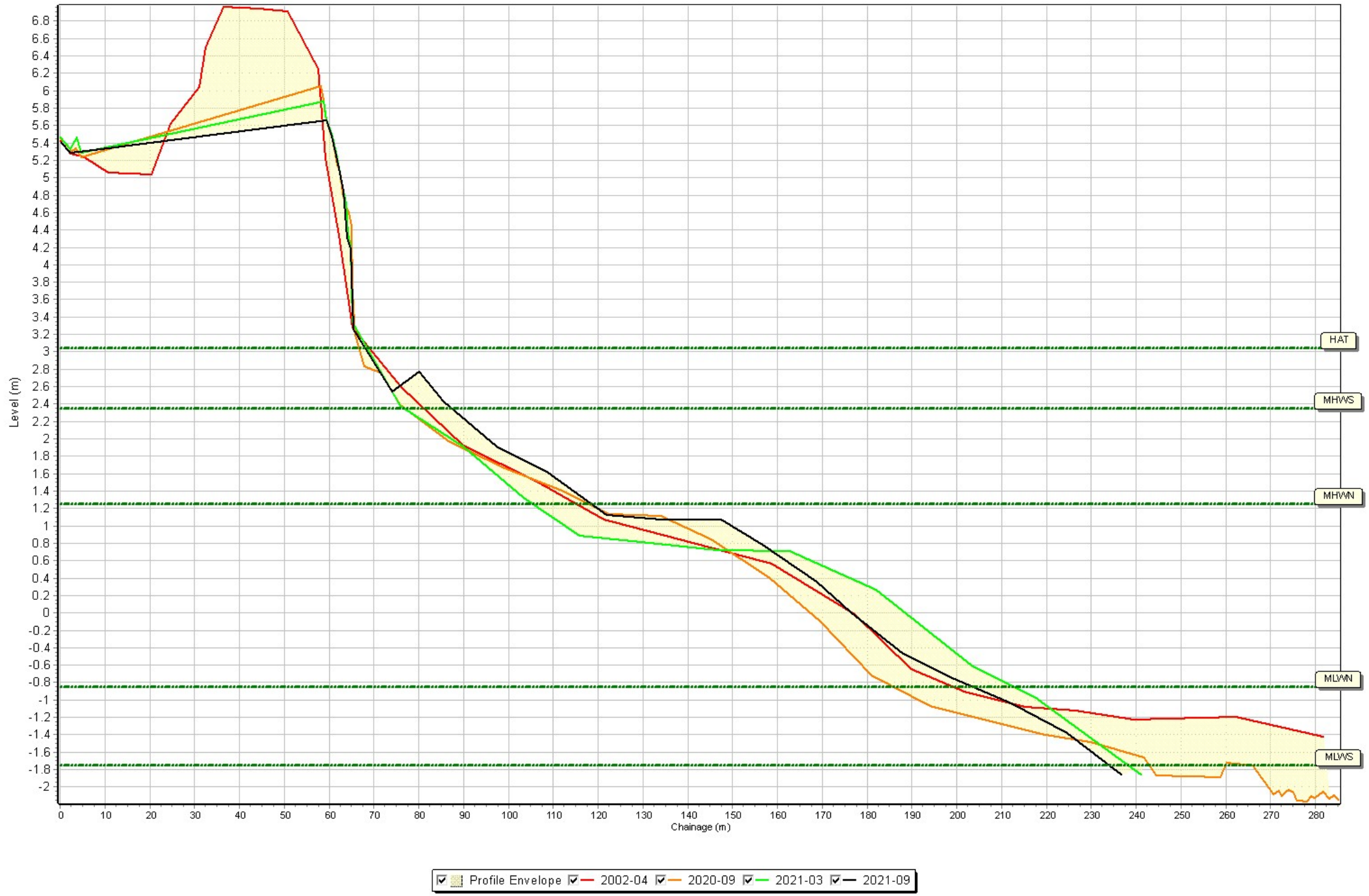
Profiles: 1aADC15



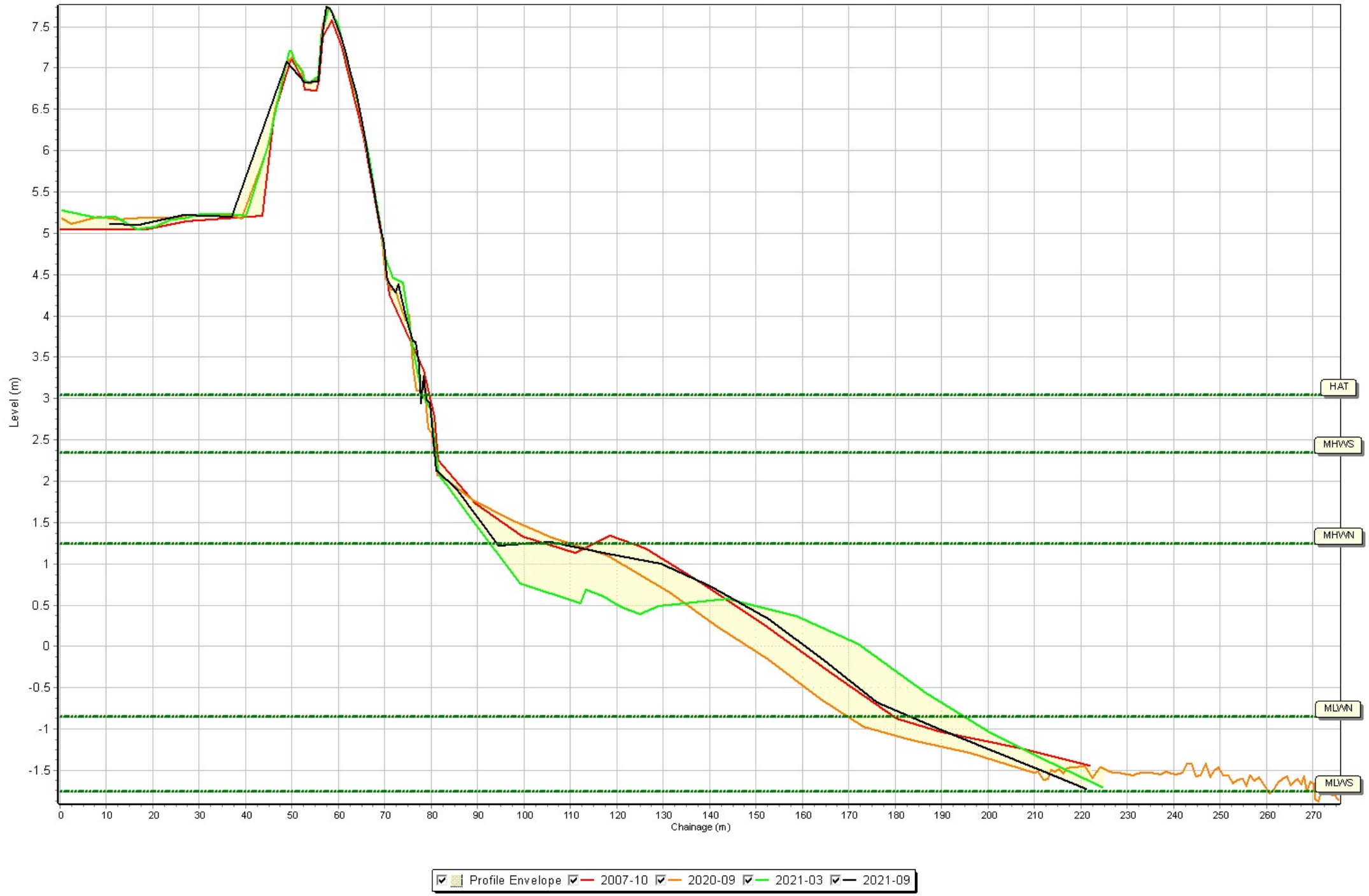
Profiles: 1aADC15A



Profiles: 1aADC16

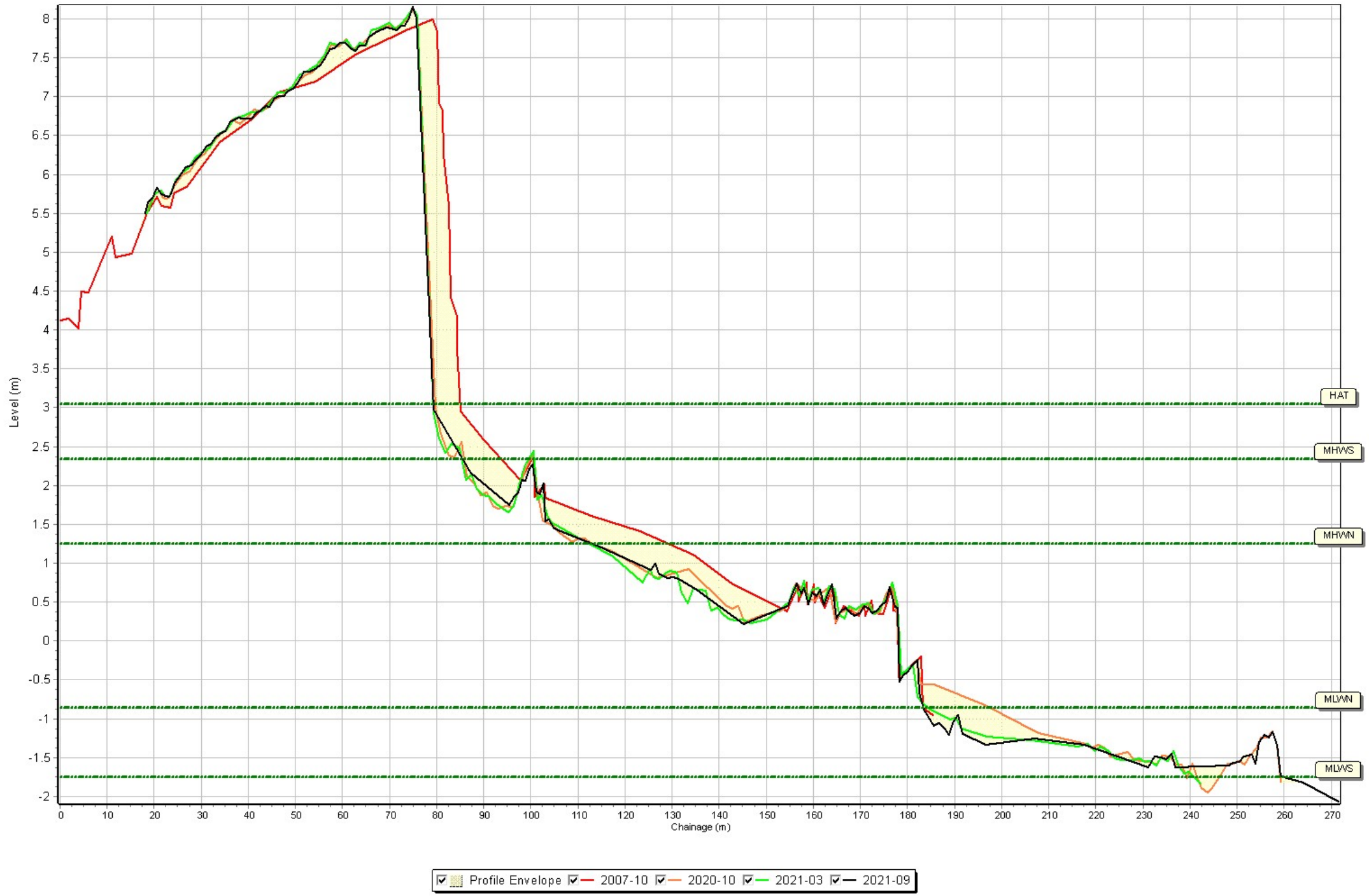


Profiles: 1aADC16A





Profiles: 1aADC16B



Profiles: 1aADC17



Profiles: 1aADC17A

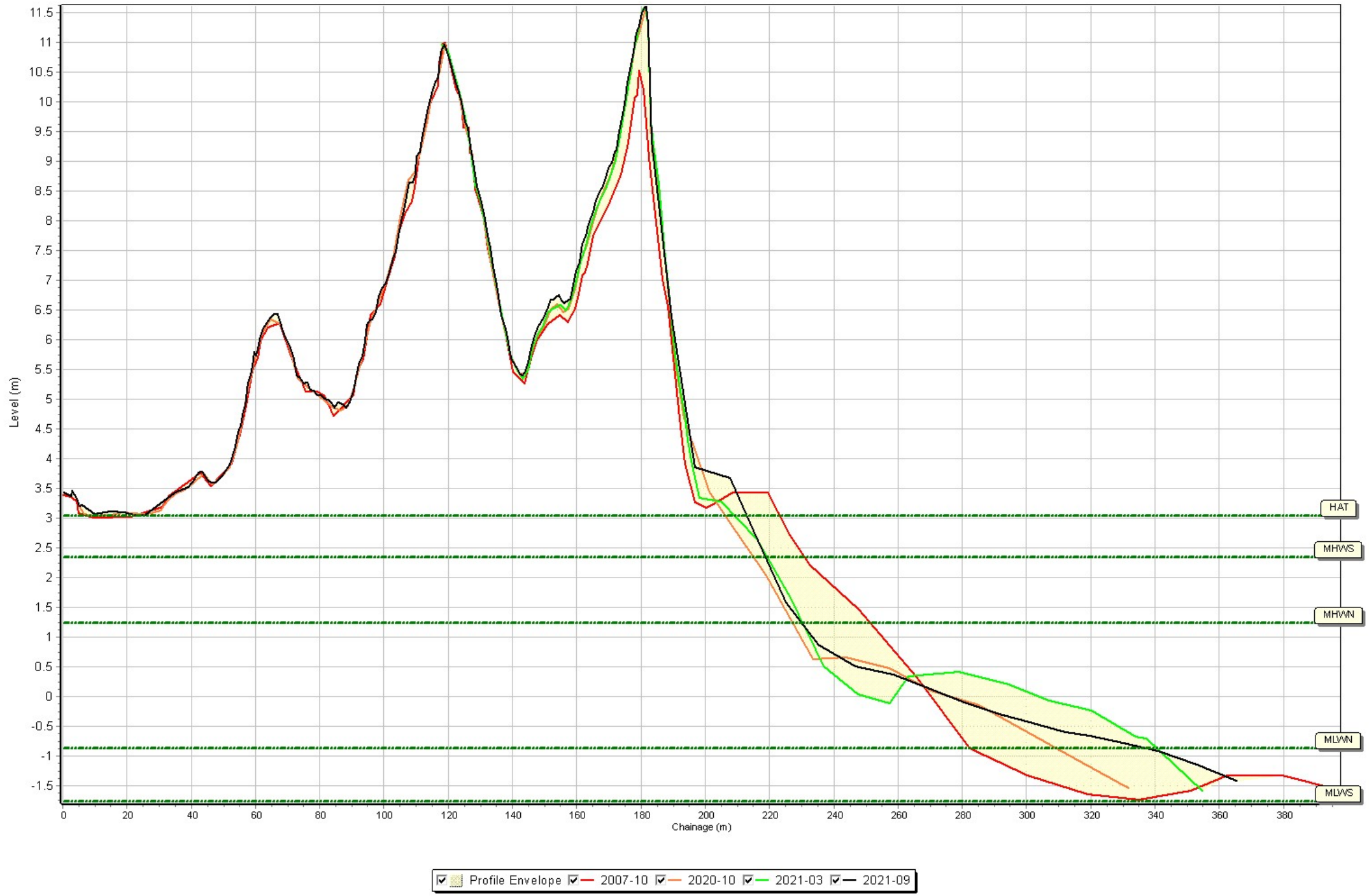


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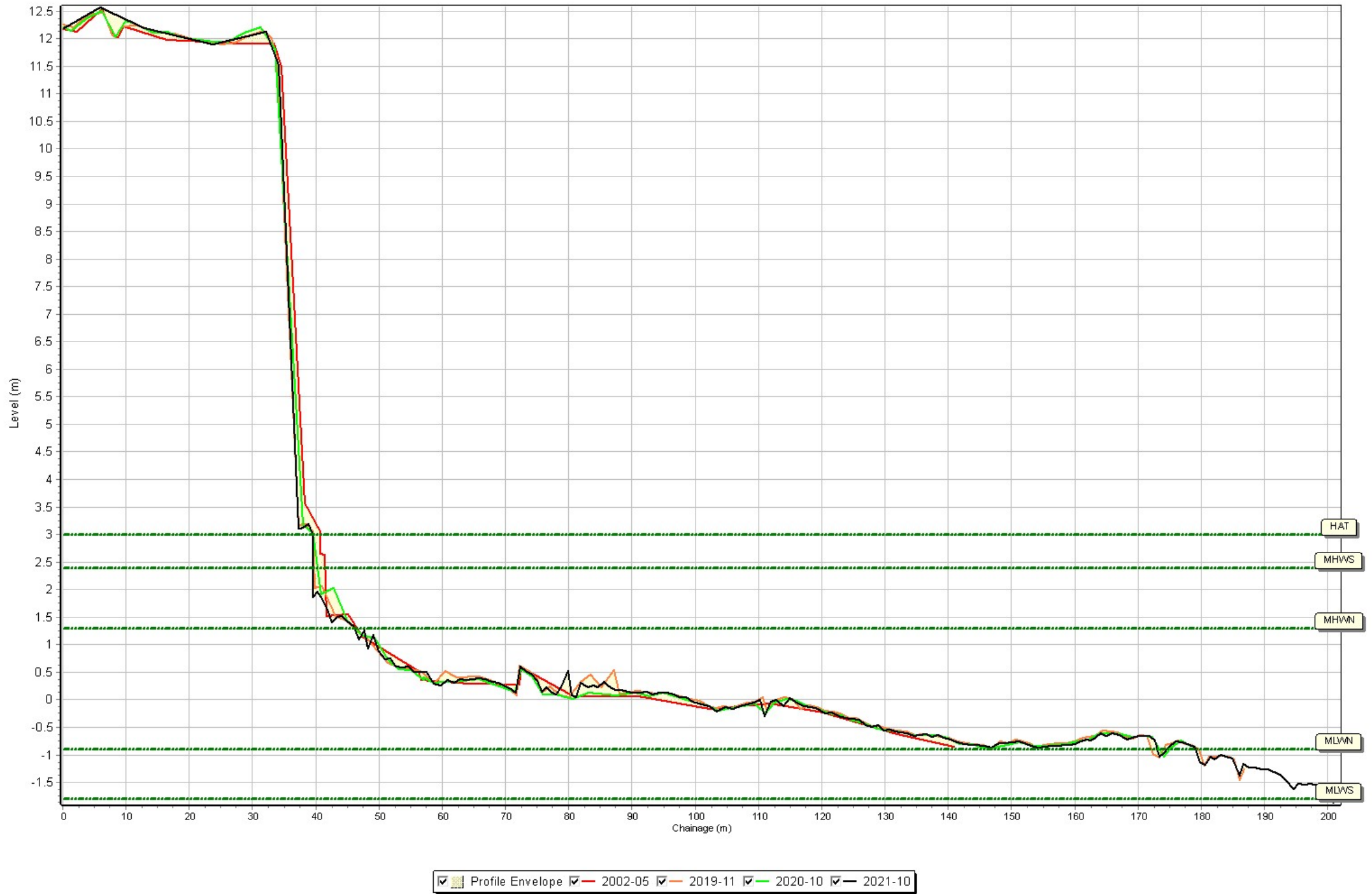
Profile Envelope  2007-10  2020-10  2021-03  2021-09

Profiles: 1aCMB02

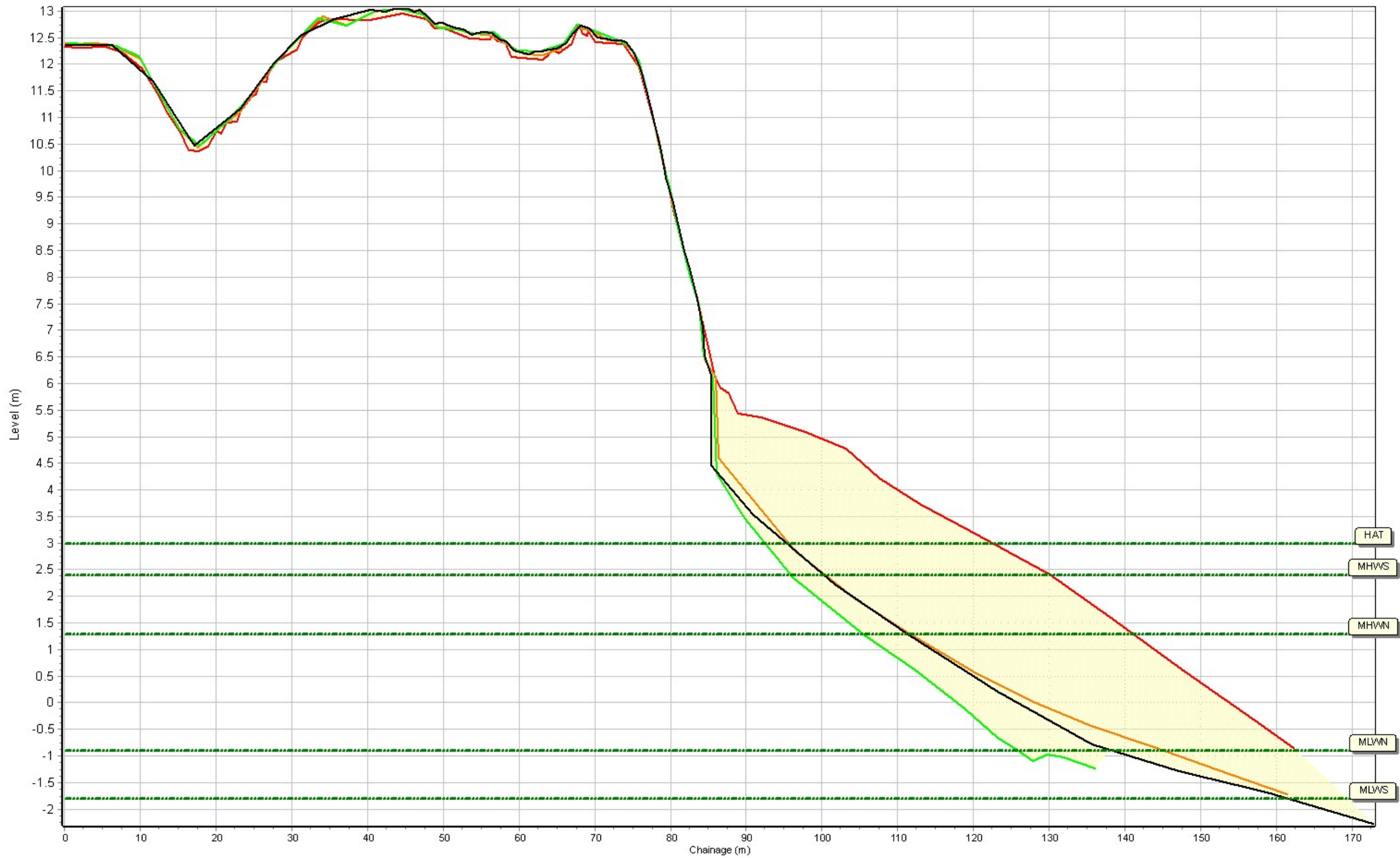




Profiles: 1aCMB03

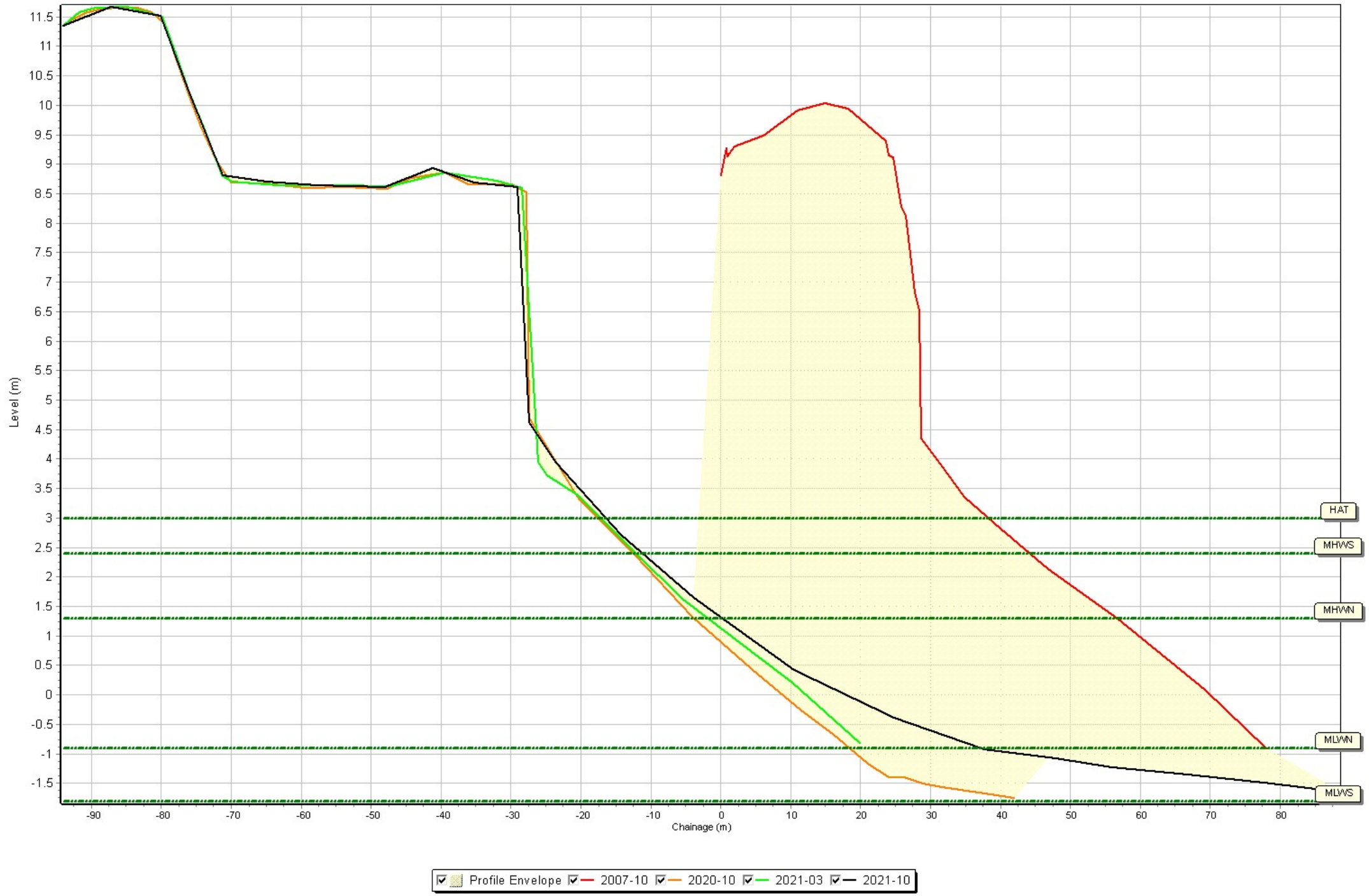


Profiles: 1aCMB03A

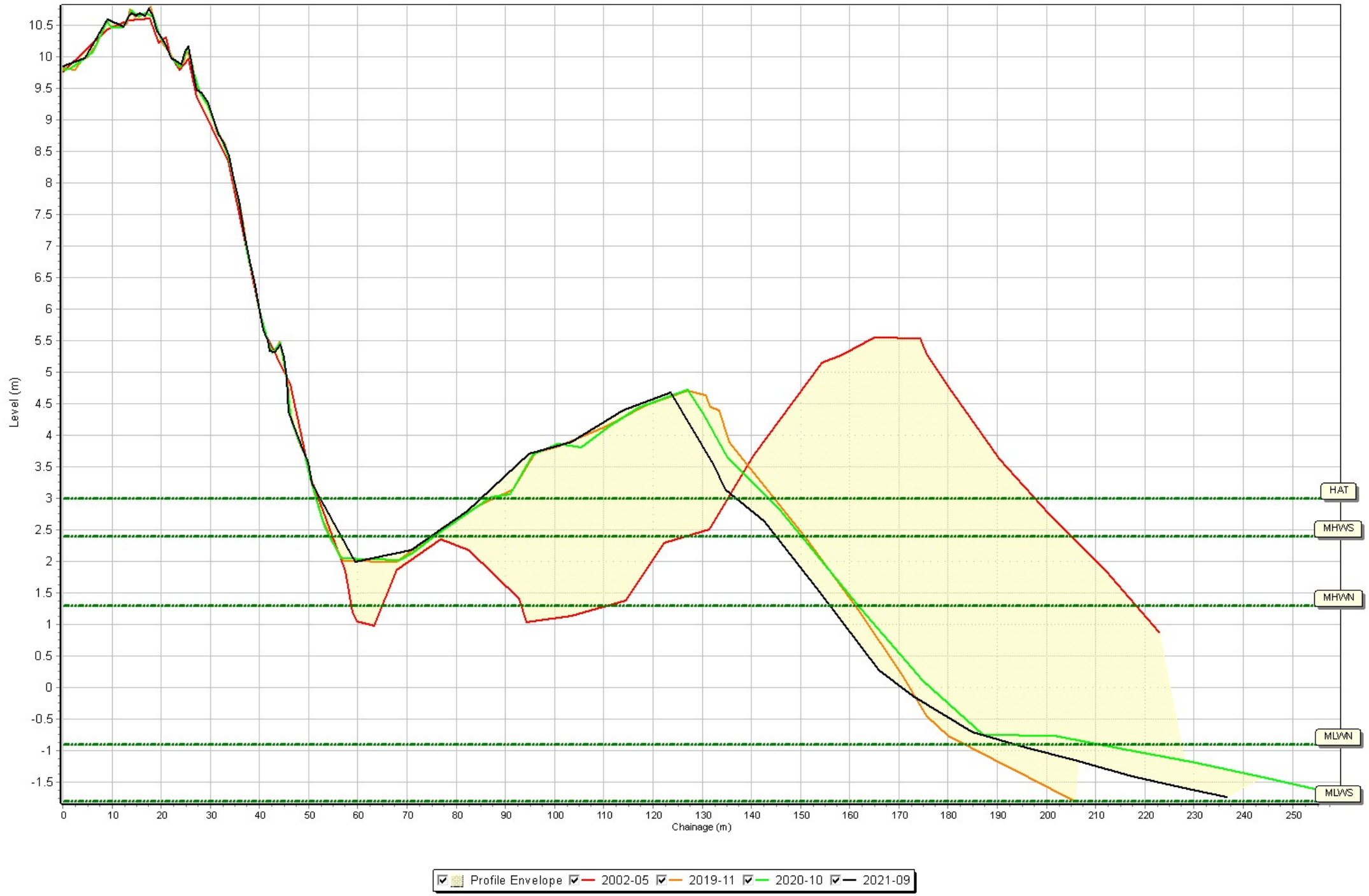


Profile Envelope  2007-10  2020-10  2021-03  2021-10

Profiles: 1aCMB03B



Profiles: 1aWDC02





Profiles: 1aWDC03



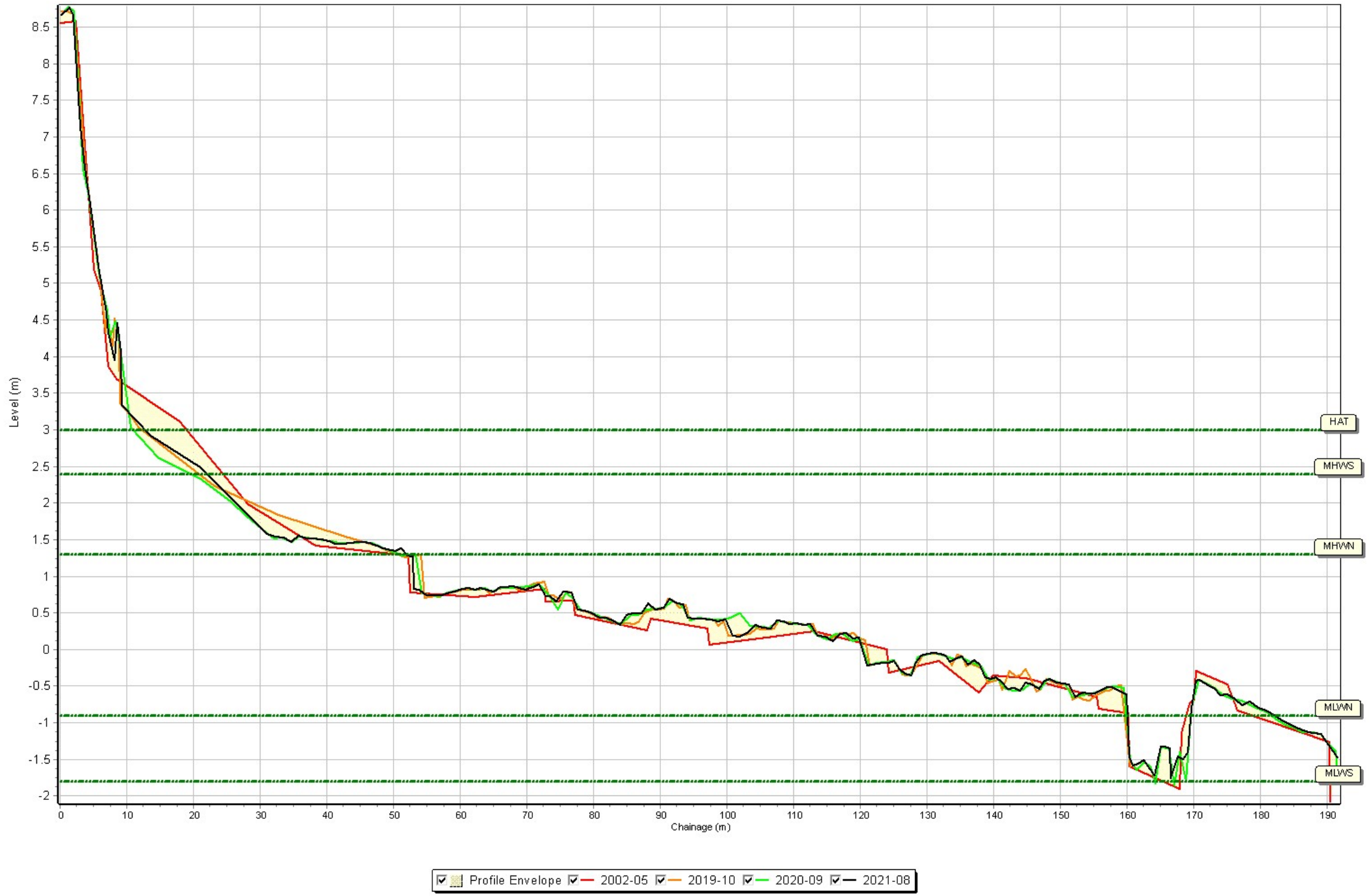
Profile Envelope  2002-05  2019-11  2020-10  2021-09



Profiles: 1aWDC04



Profiles: 1aWDC05



Profiles: 1aWDC05A



Profiles: 1aWDC06



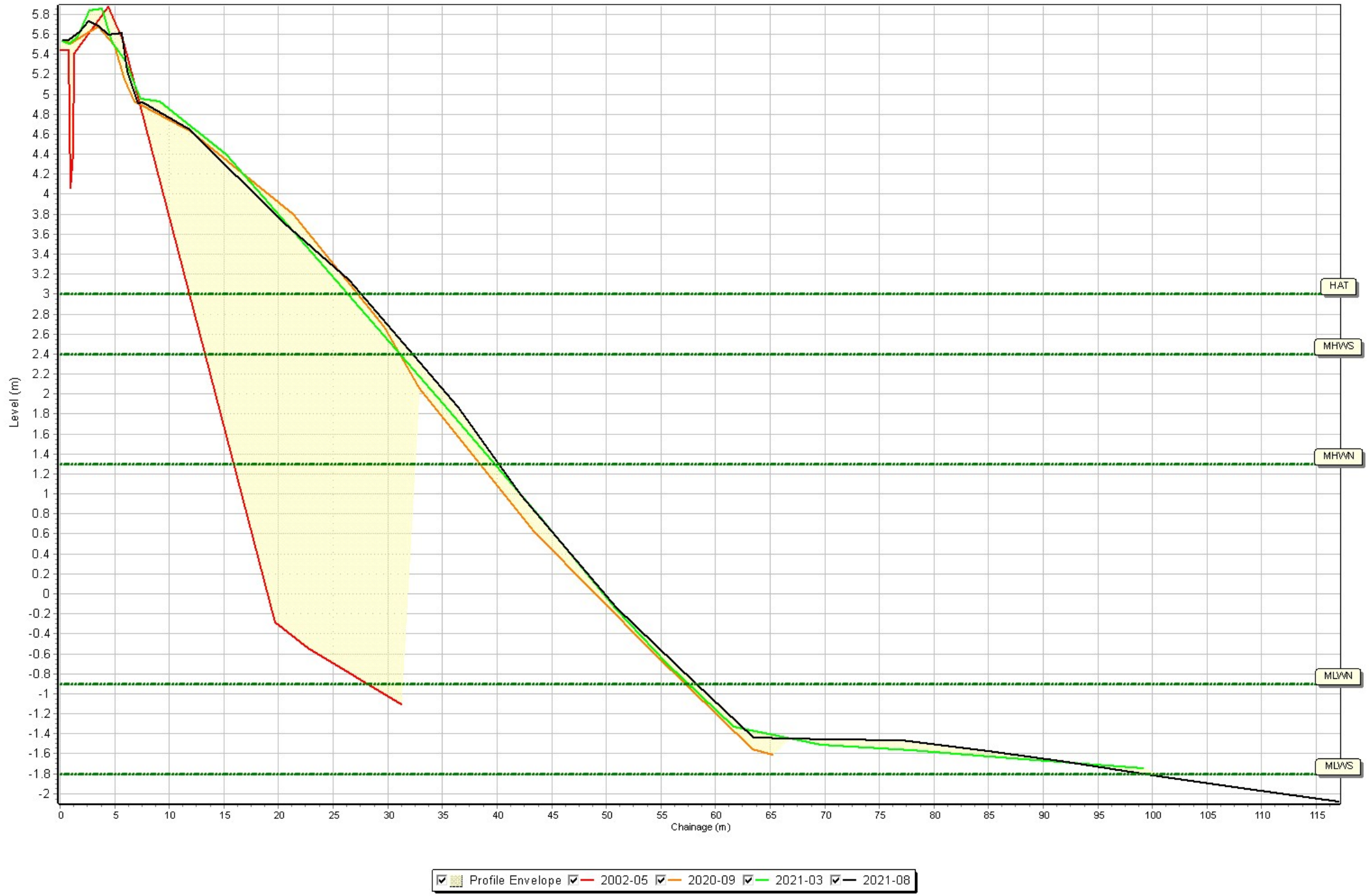
Profile Envelope  2002-05  2020-09  2021-03  2021-08



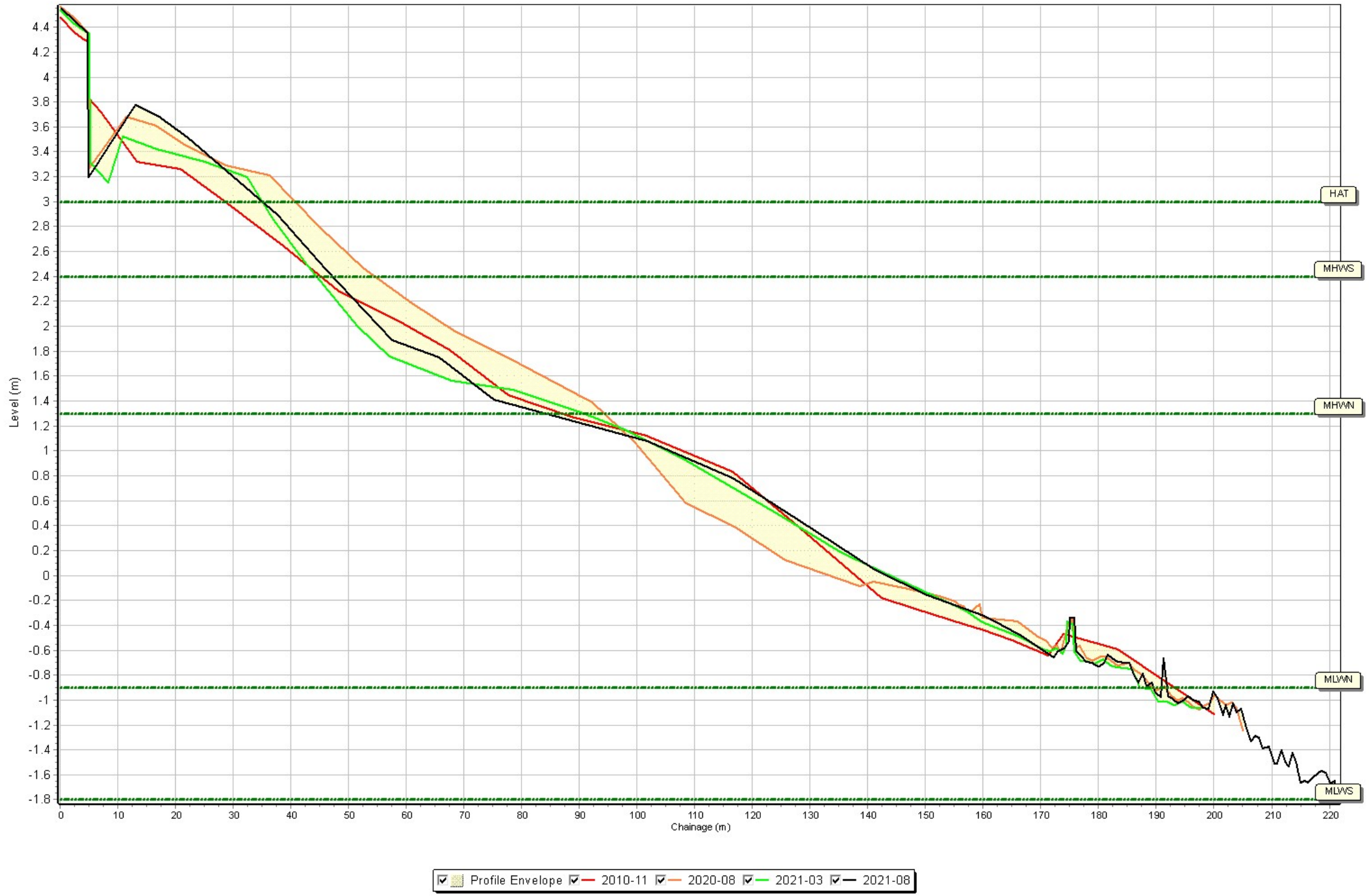
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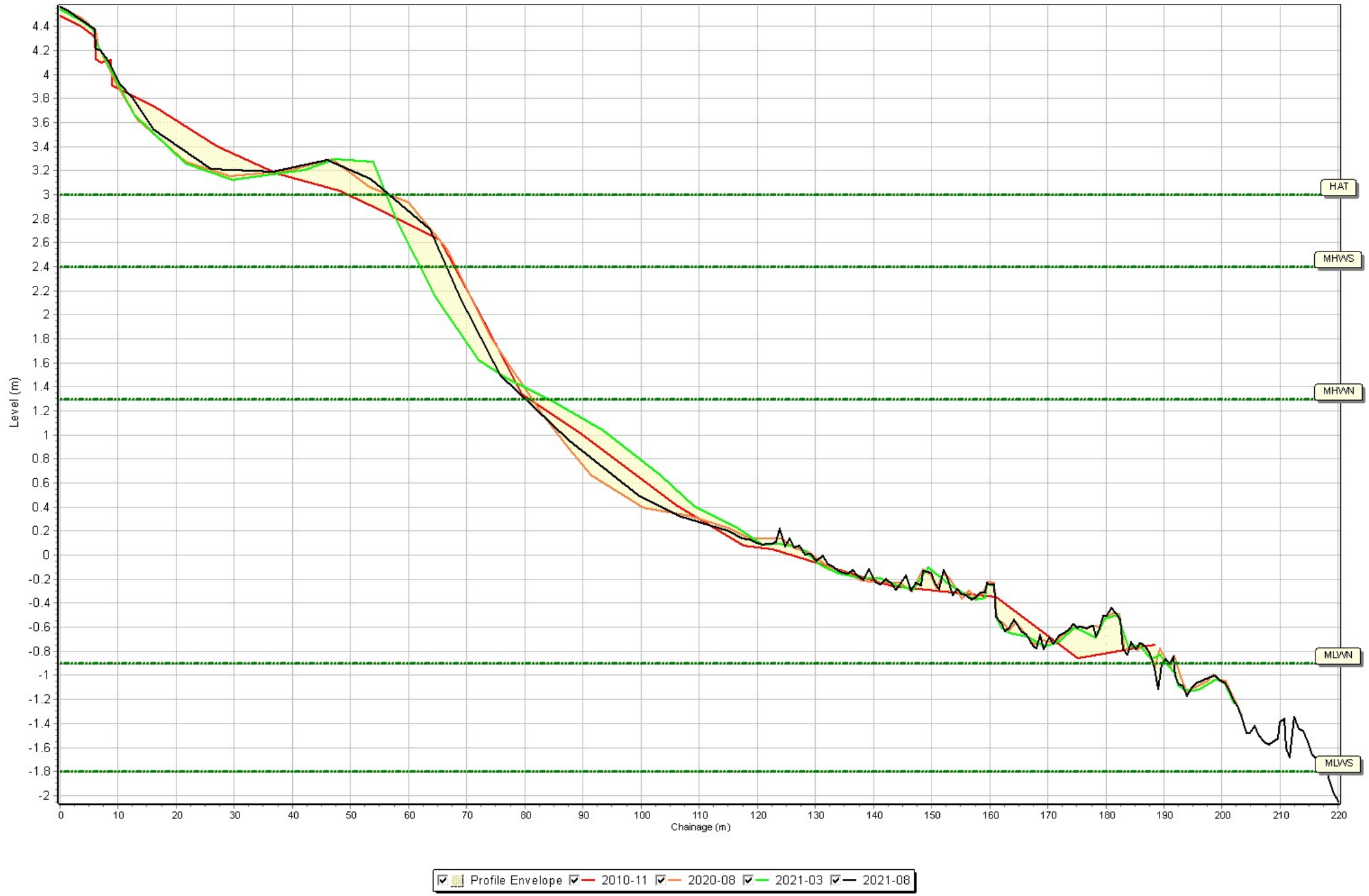
Profiles: 1aWDC07



Profiles: 1aNWB1



Profiles: 1aNWB2



Profiles: 1aNWB3

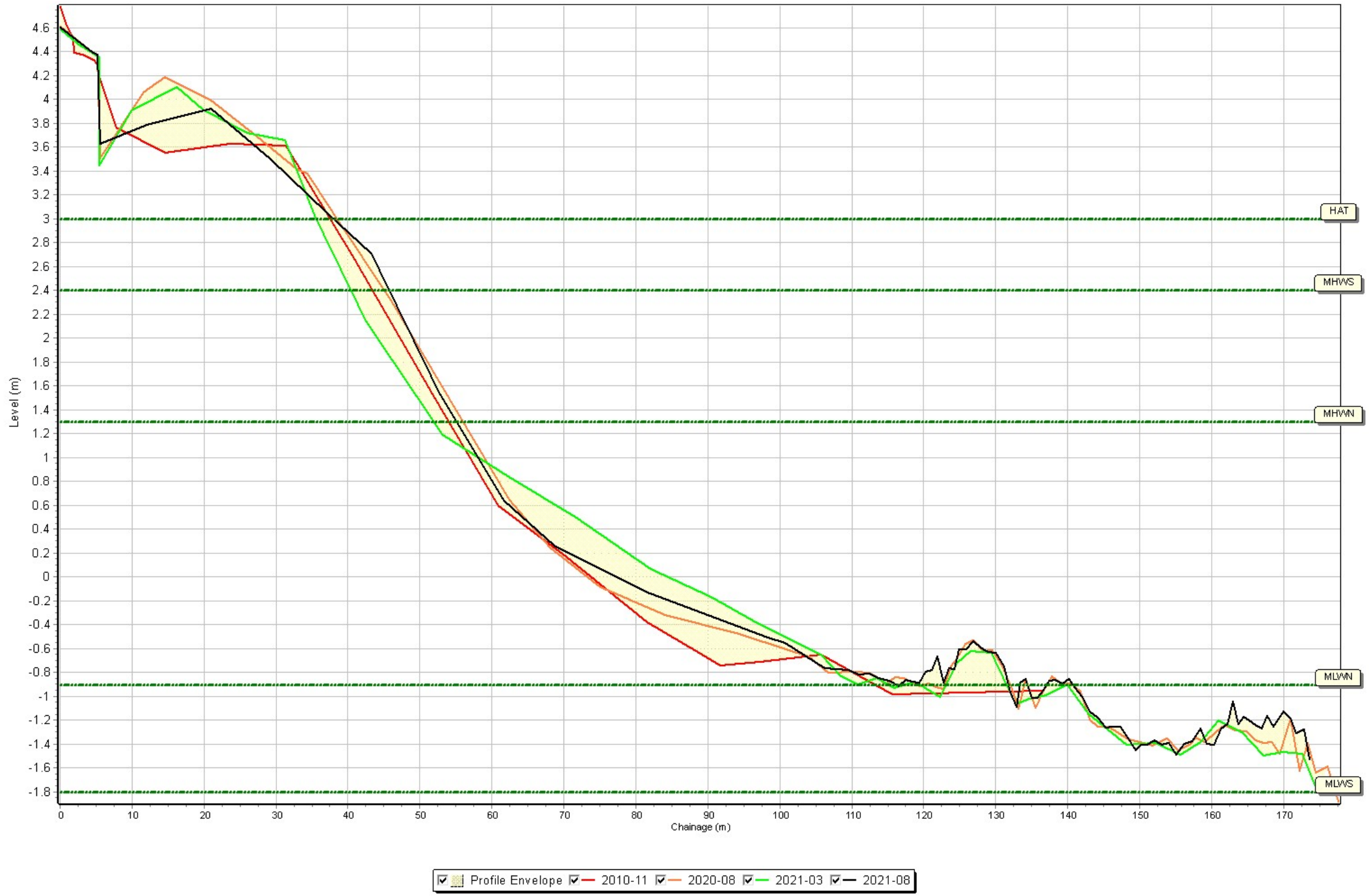




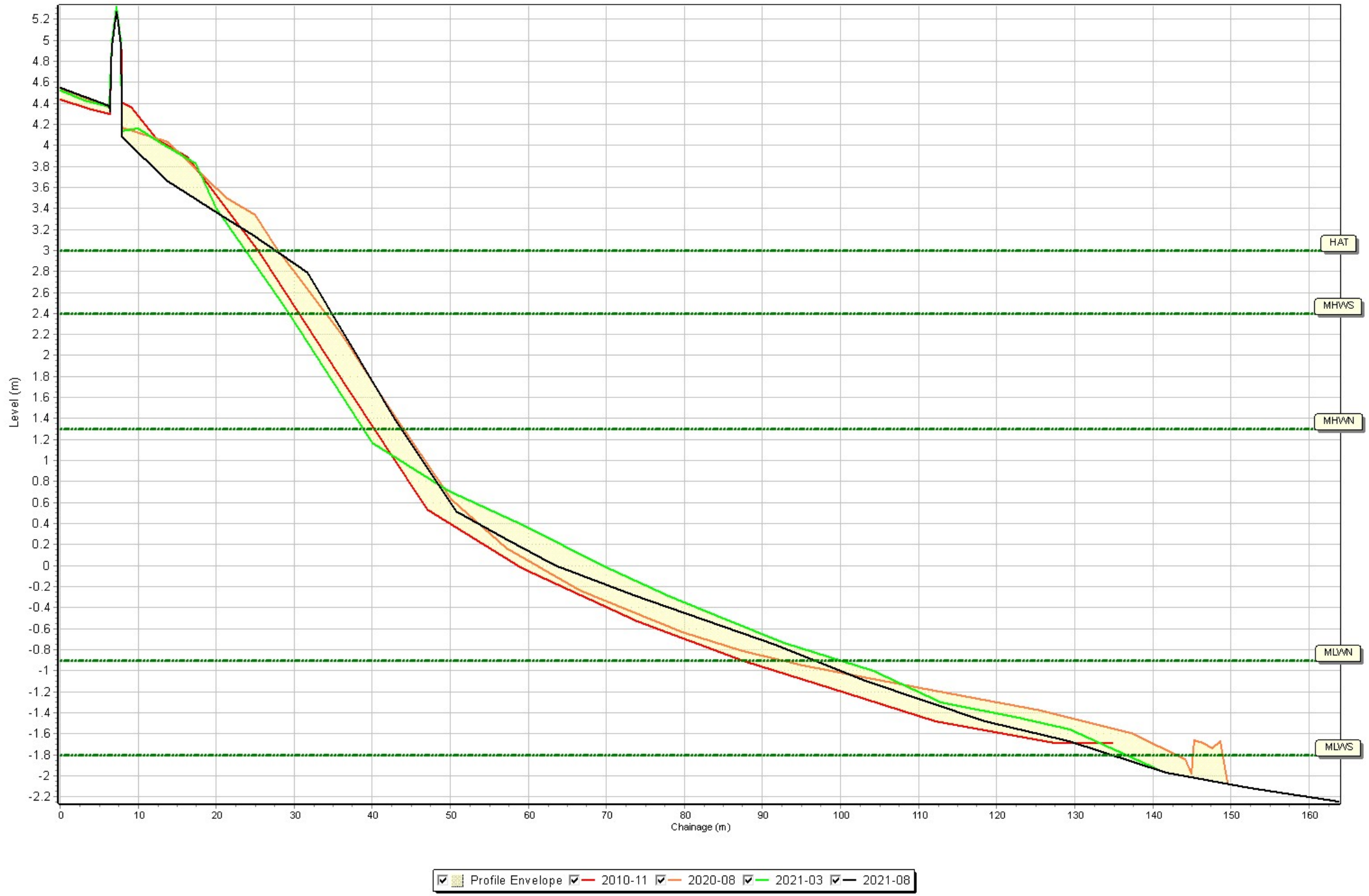
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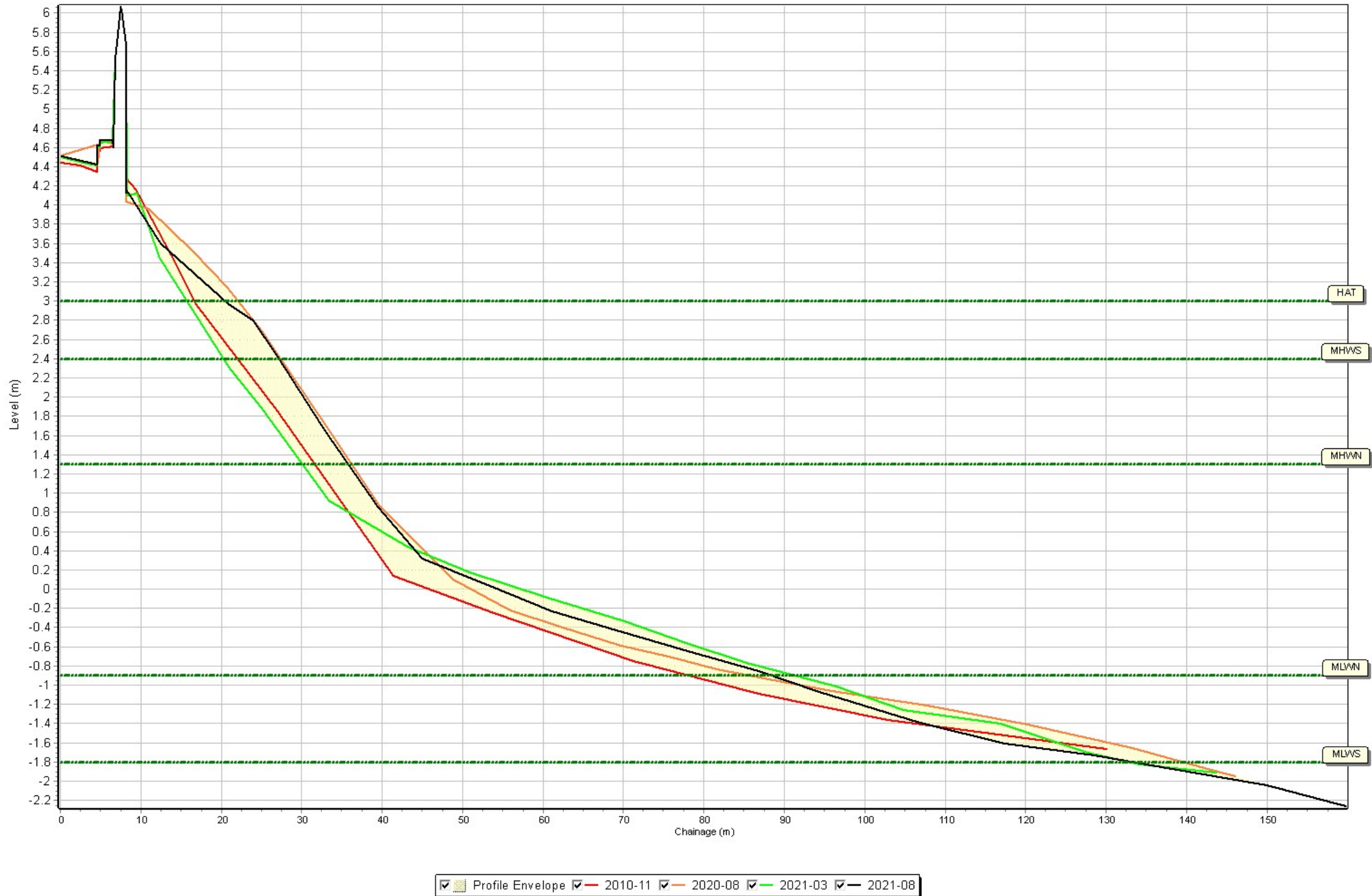
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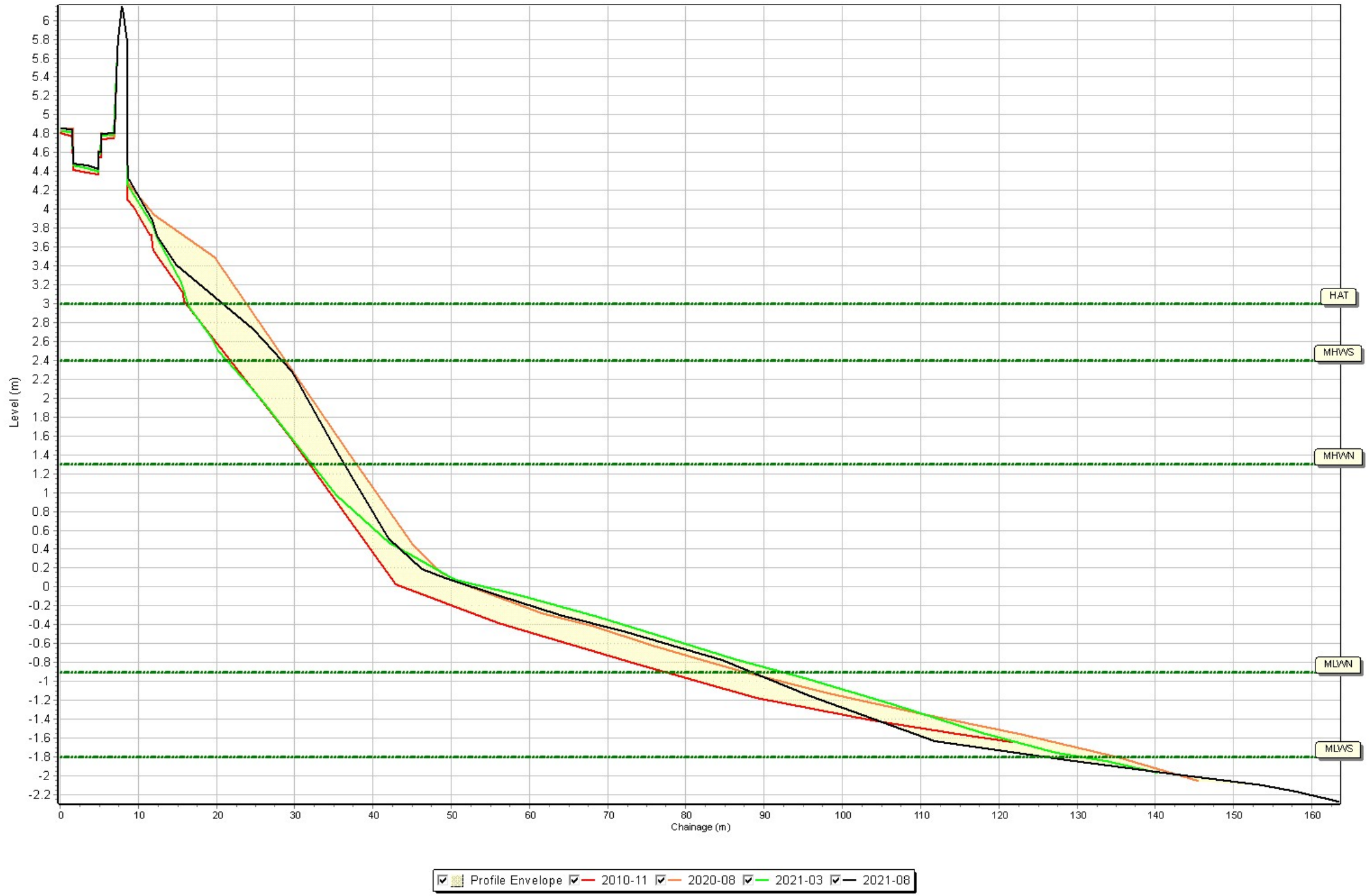
Profiles: 1aNWB6



Profiles: 1aNWB7

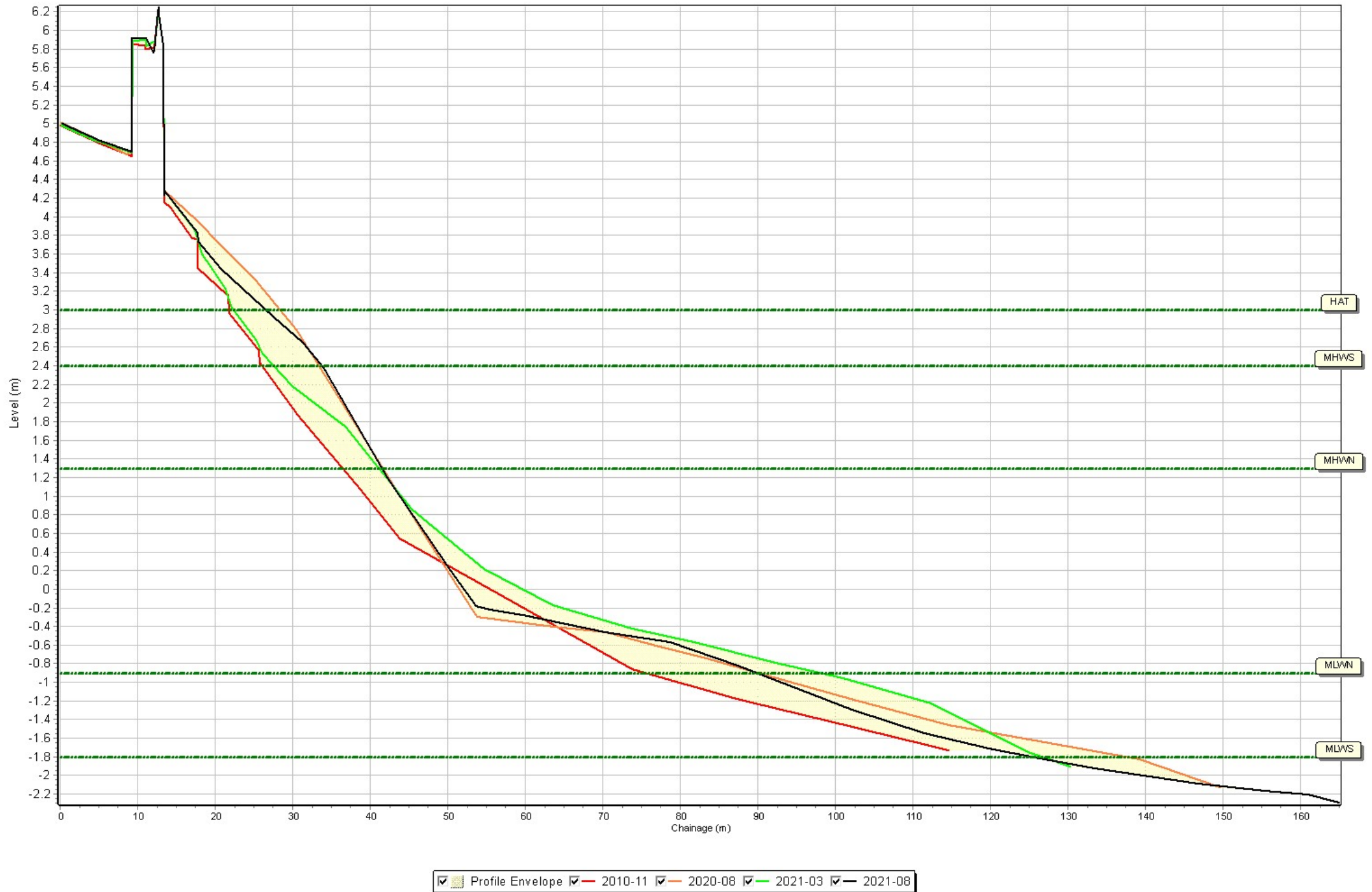


Profiles: 1aNWB8

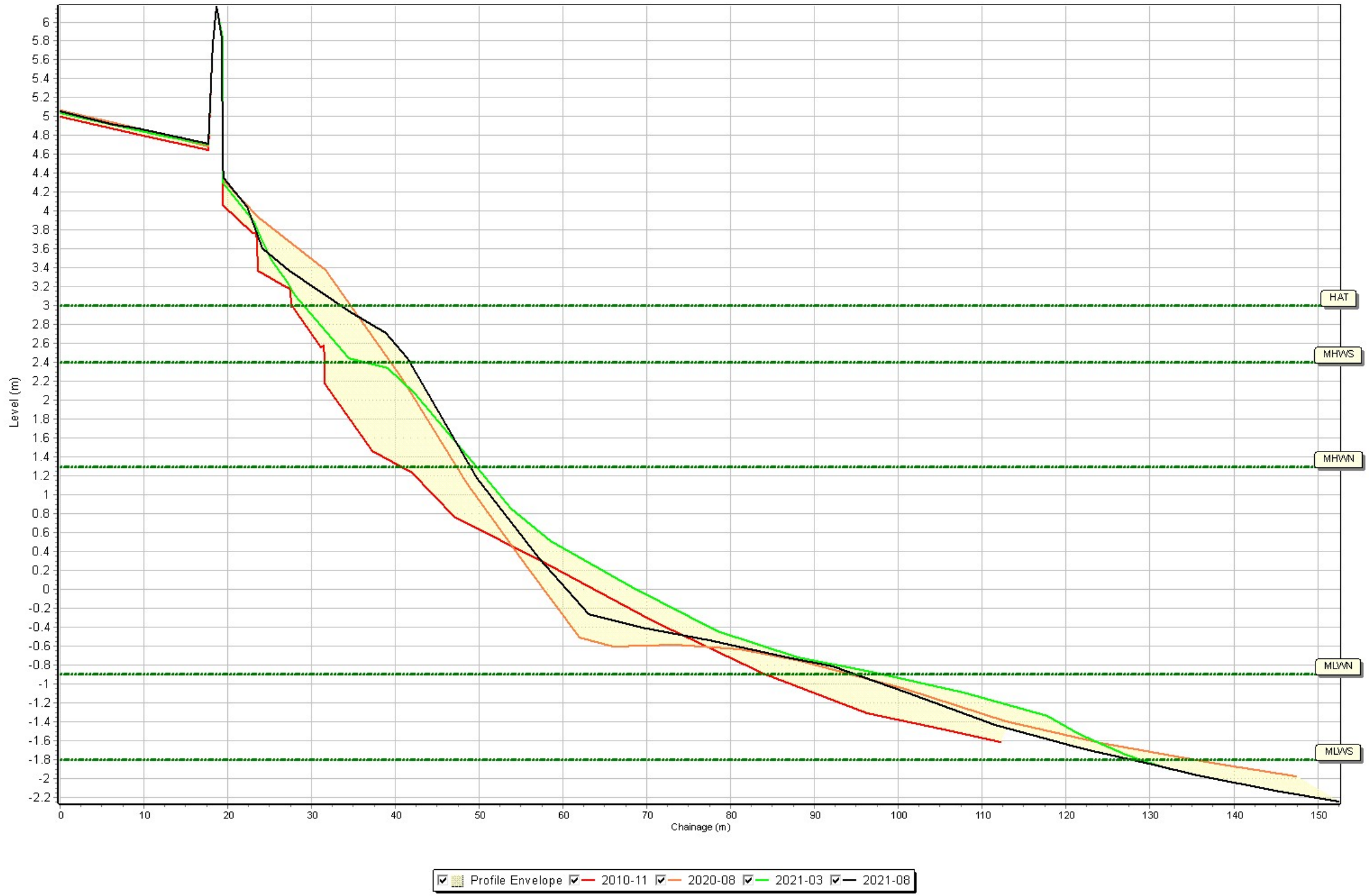




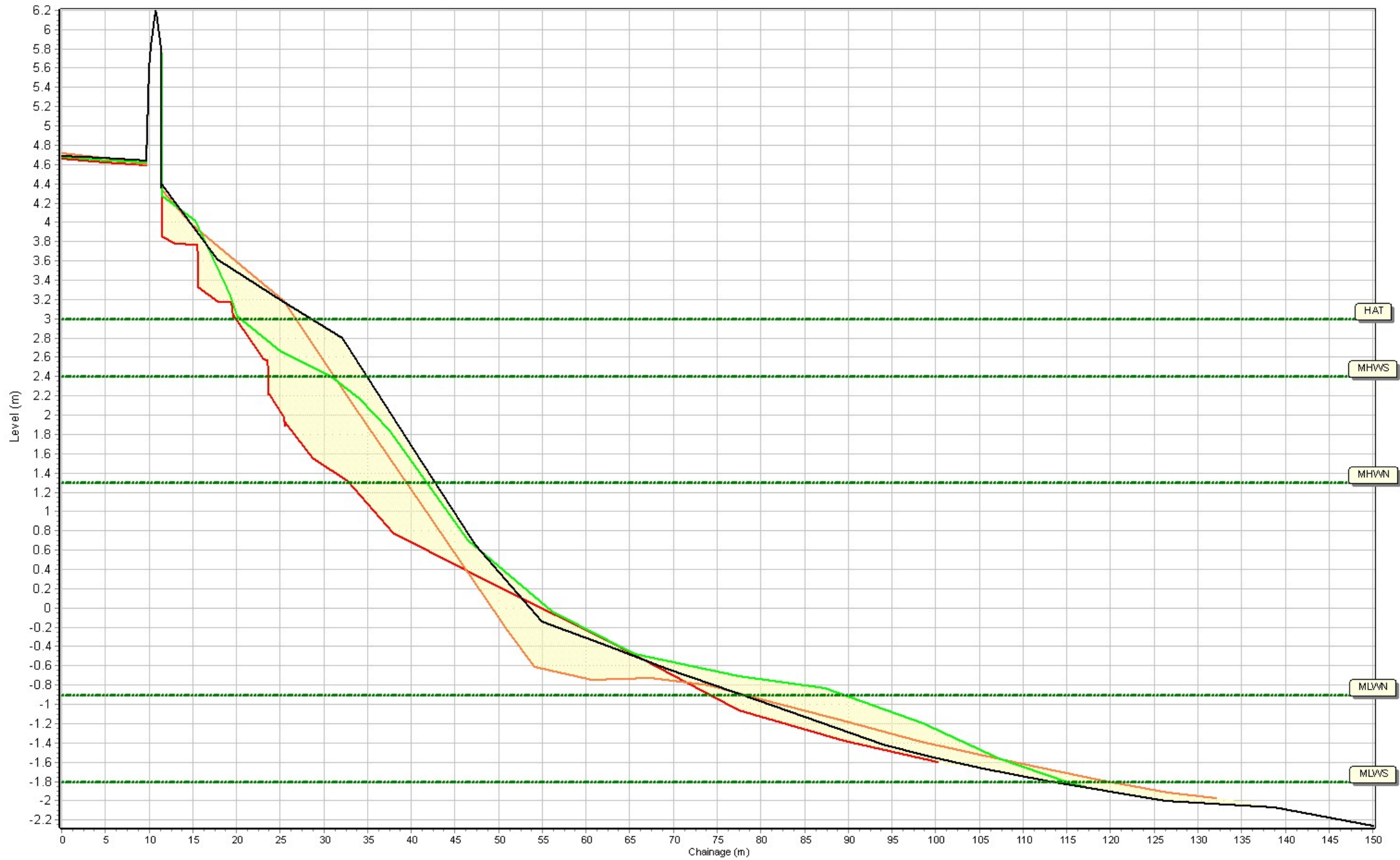
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Profiles: 1aNWB10

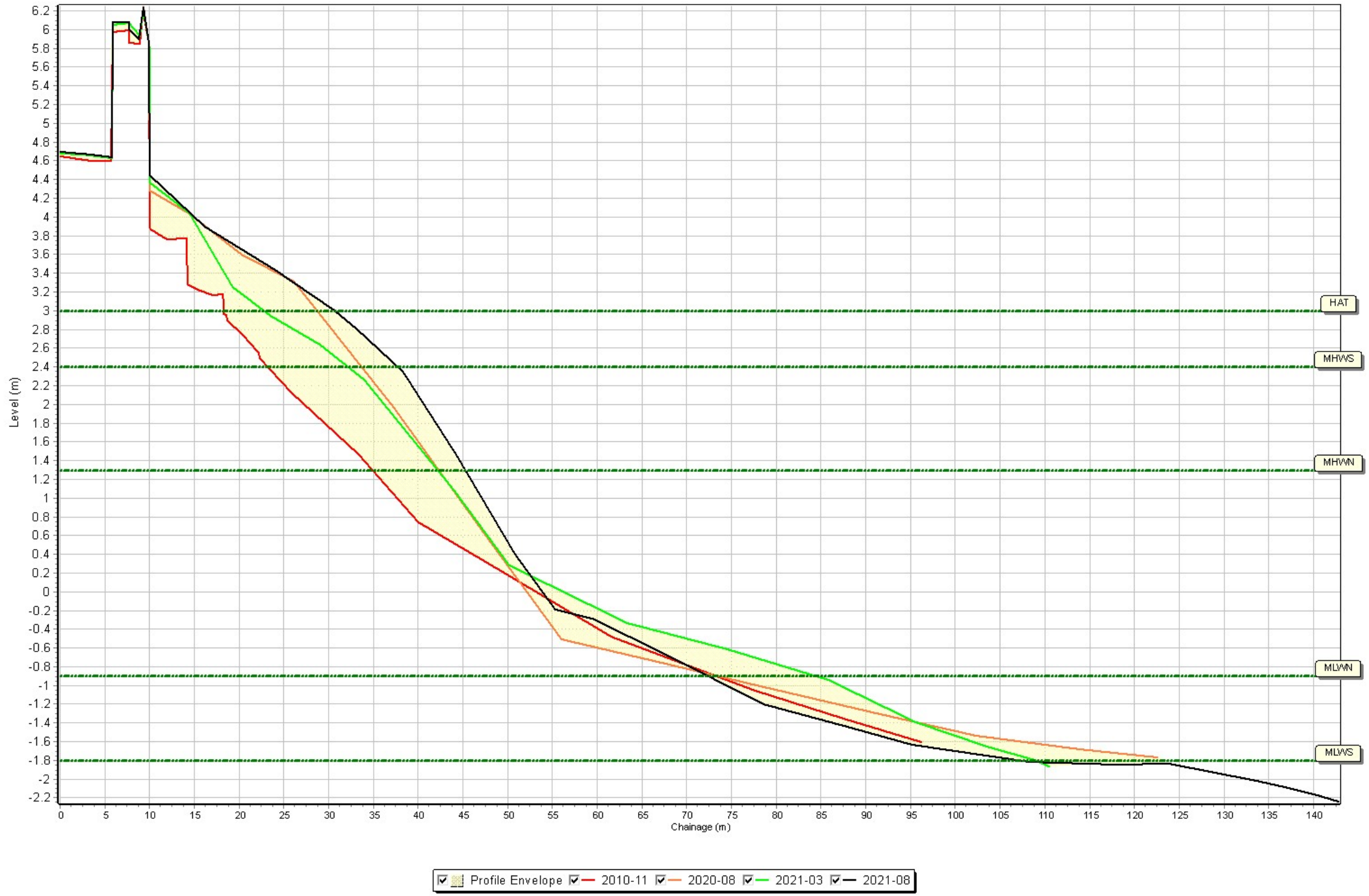


Profiles: 1aNWB11



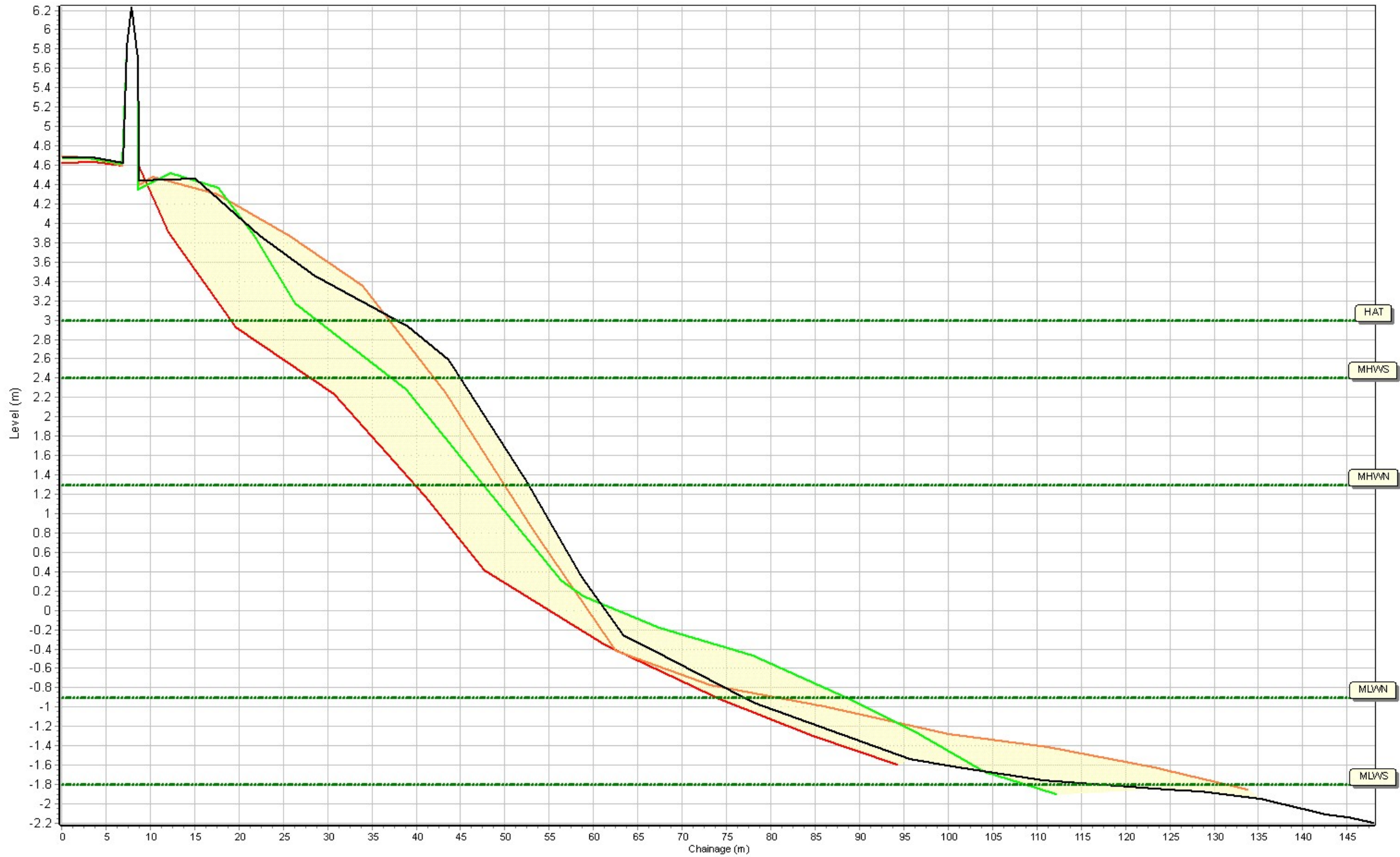
Profile Envelope  2010-11  2020-08  2021-03  2021-08

Profiles: 1aNWB12





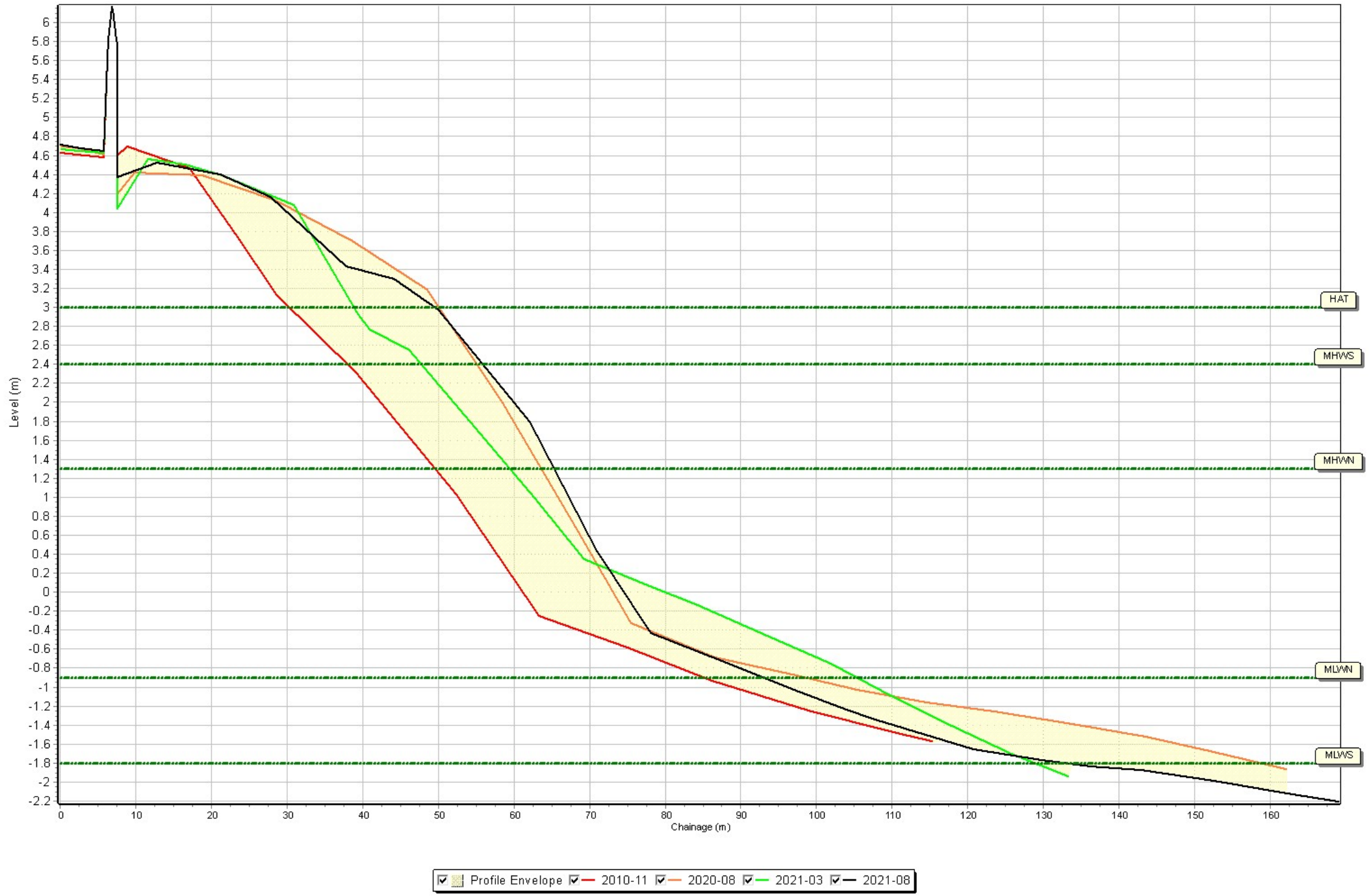
Profiles: 1aNWB13



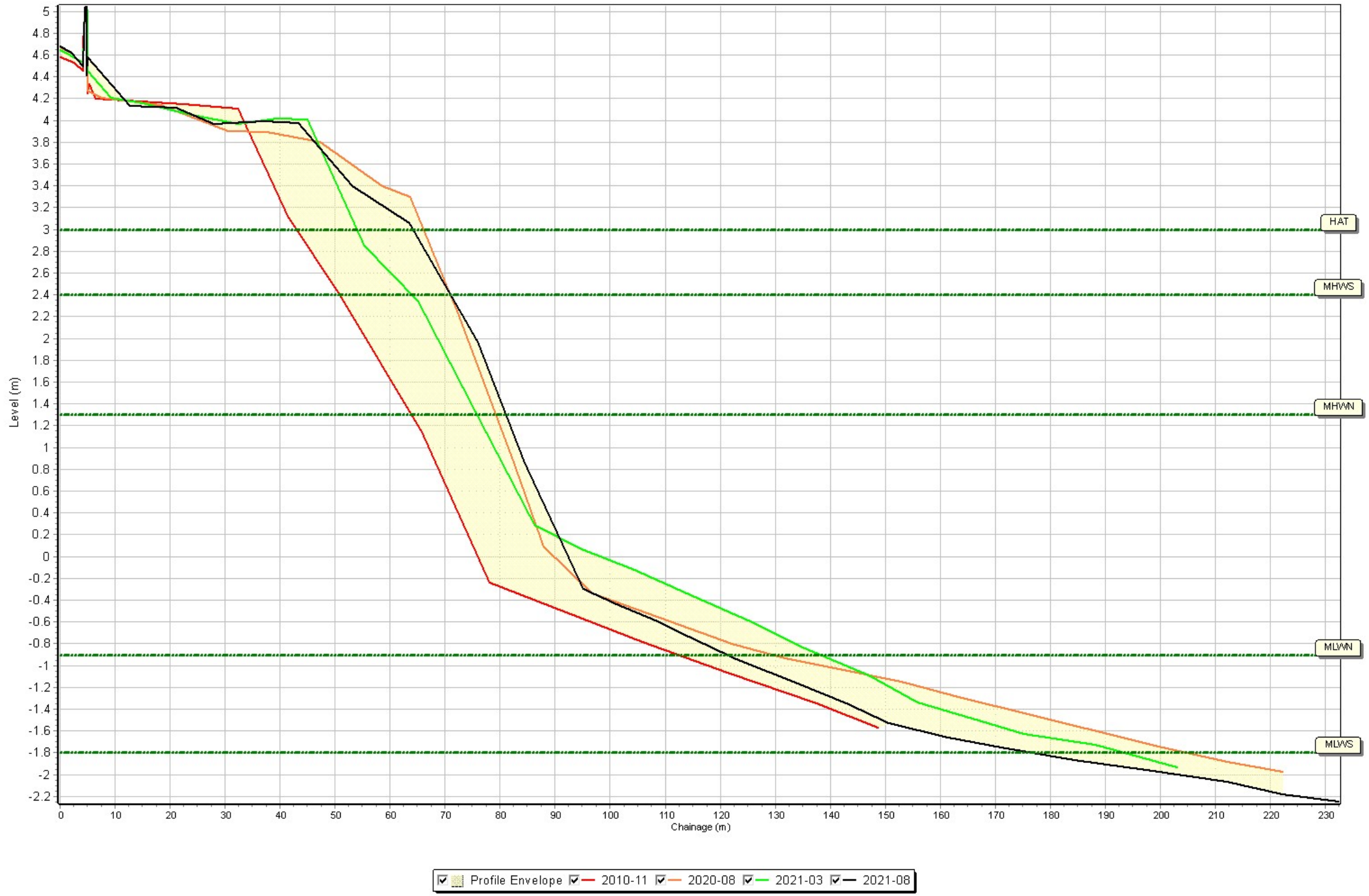
Profile Envelope  2010-11  2020-08  2021-03  2021-08



Profiles: 1aNBW14



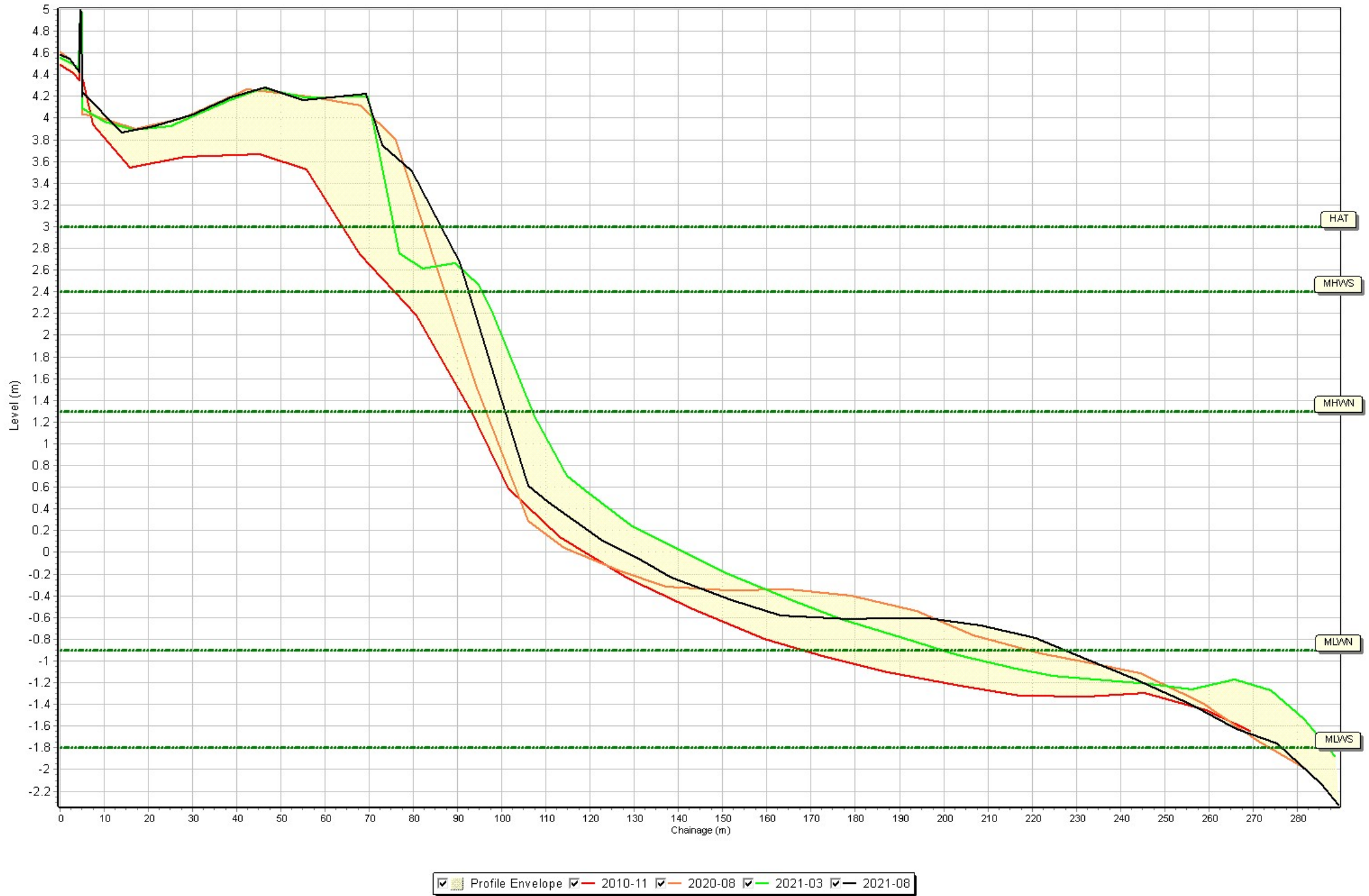
Profiles: 1aNWB15



Profiles: 1aNWB16



Profiles: 1aNBW17





Profiles: 1aNWB18

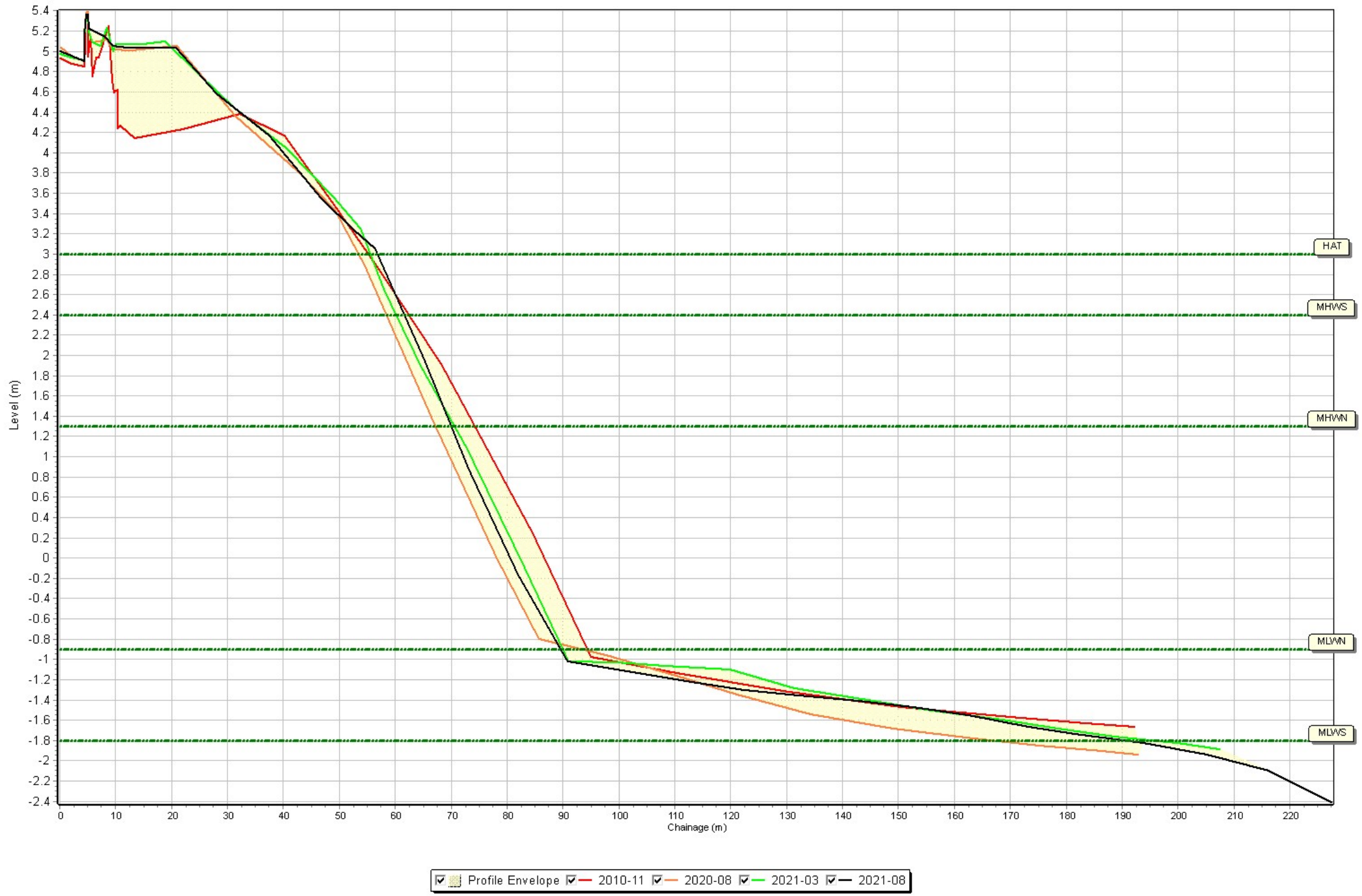




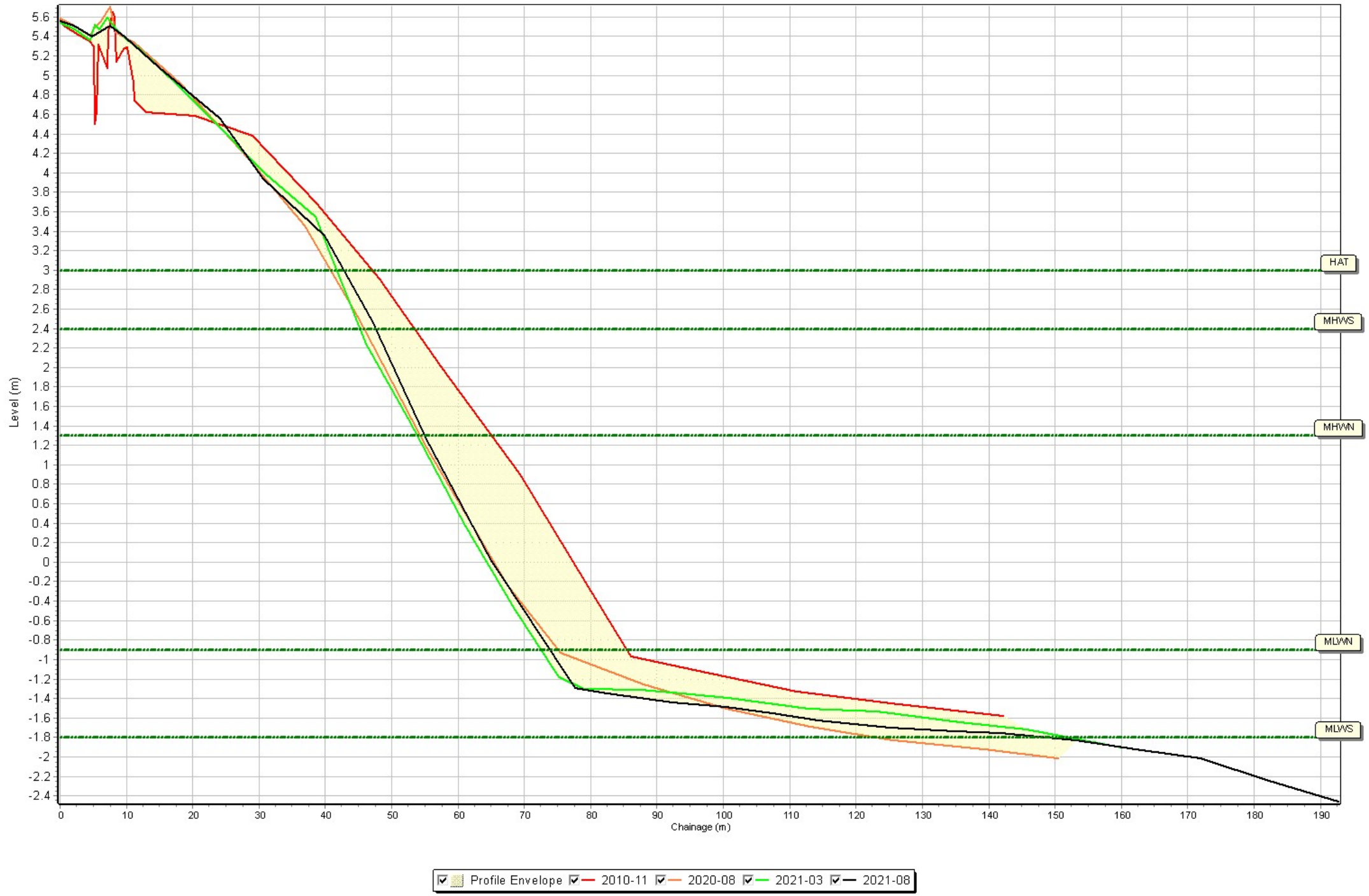
Profiles: 1aNWB19



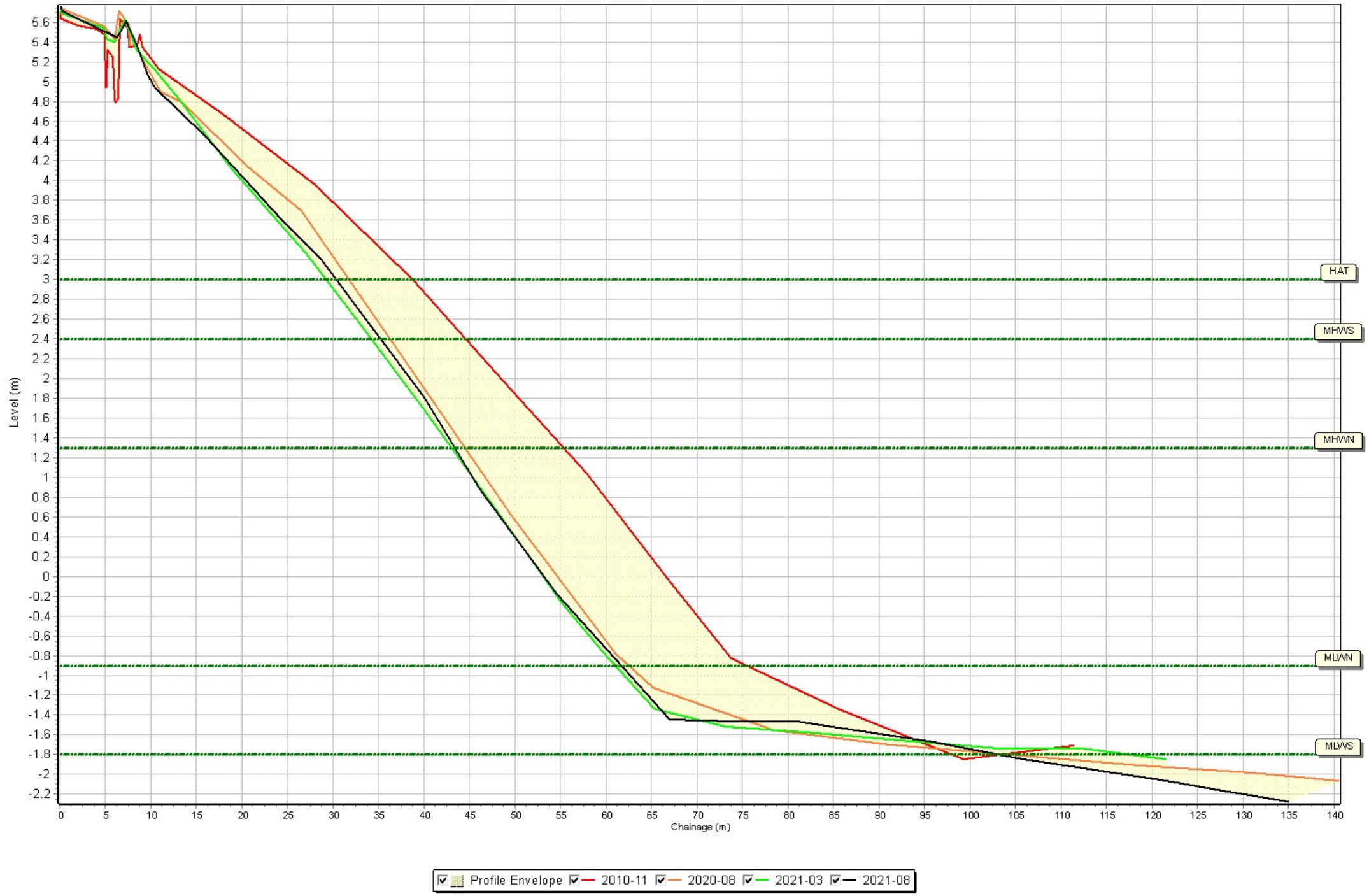
Profiles: 1aNBW20



Profiles: 1aNWB21

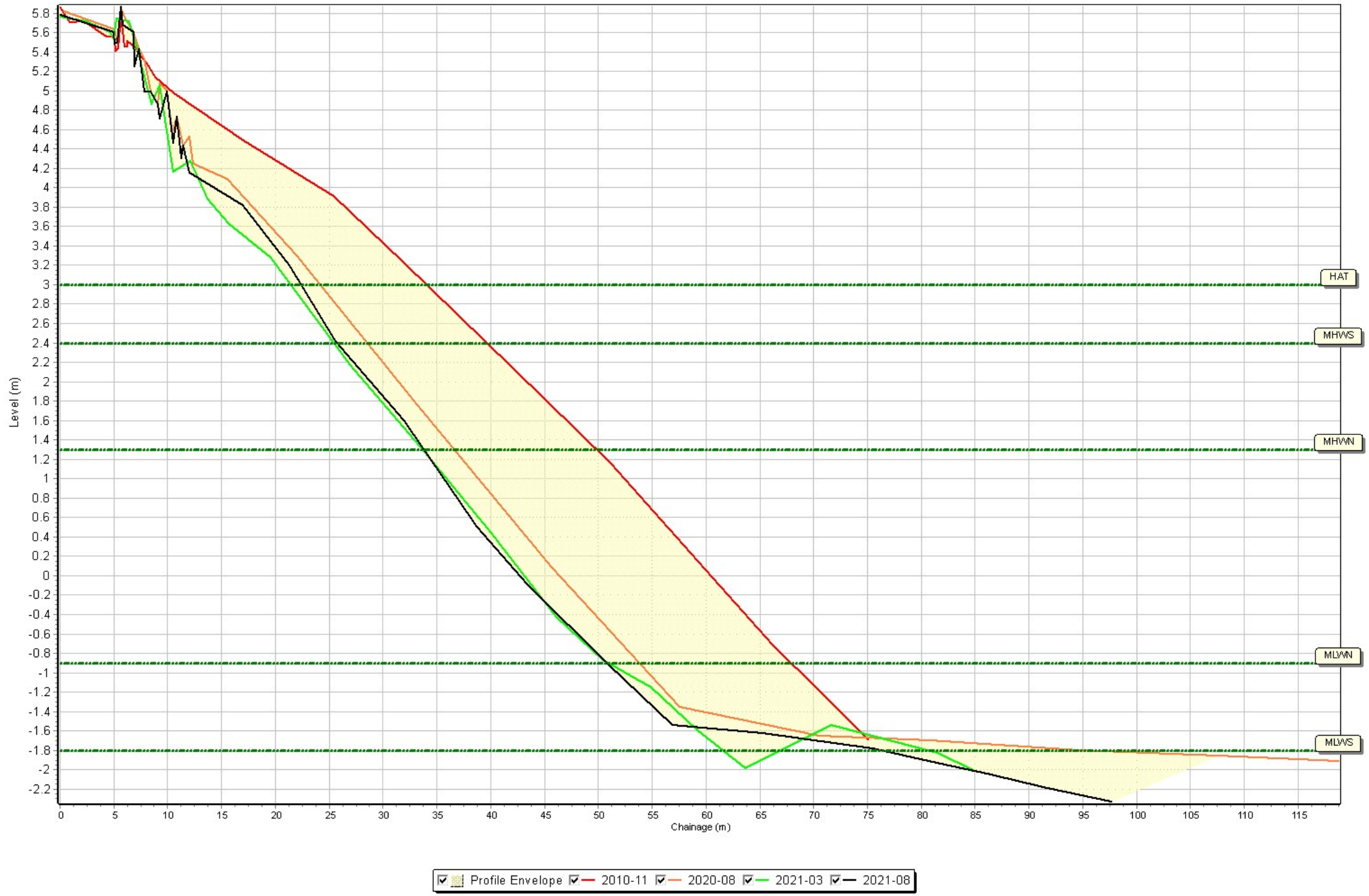


Profiles: 1aNBW22

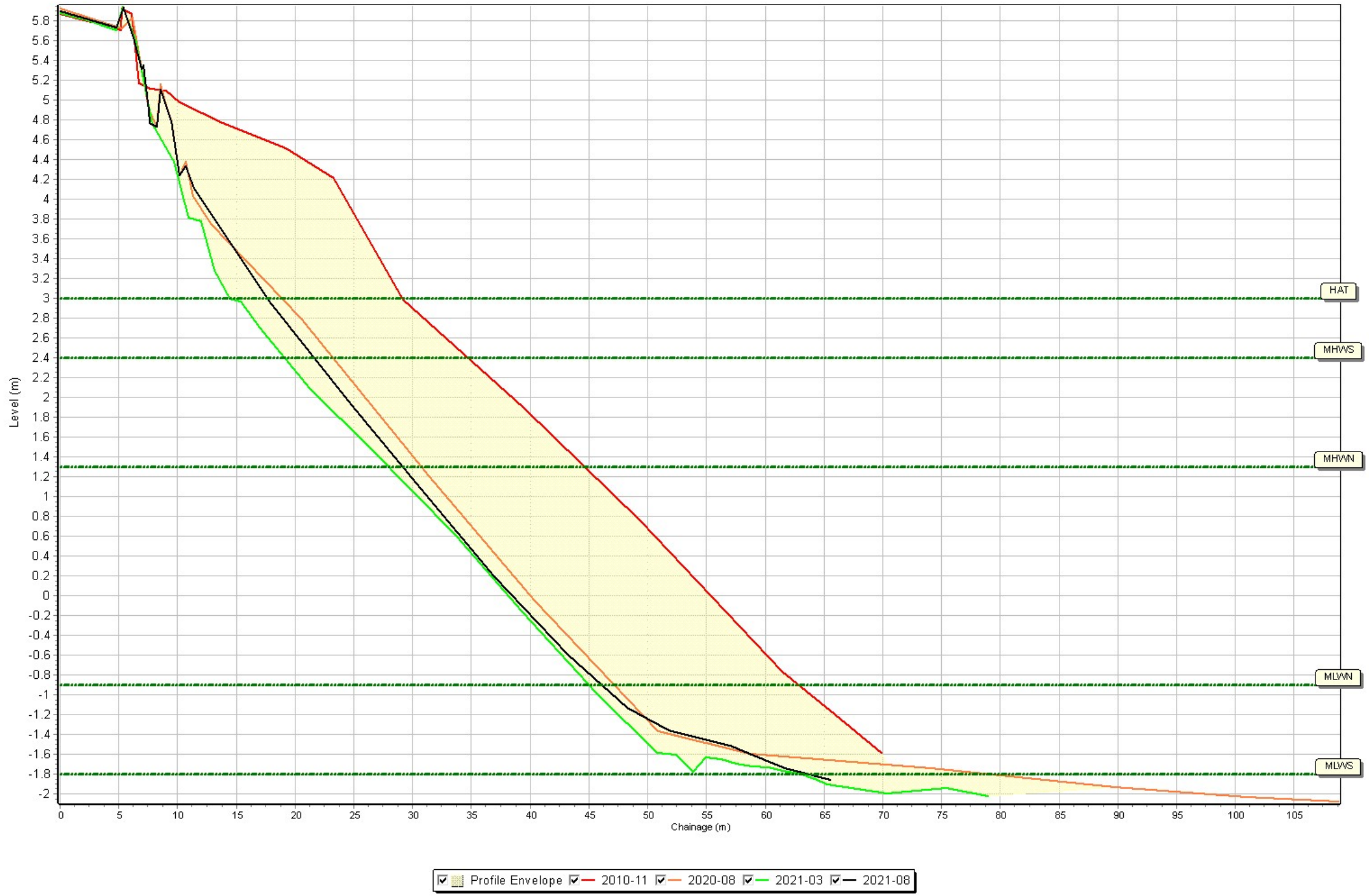




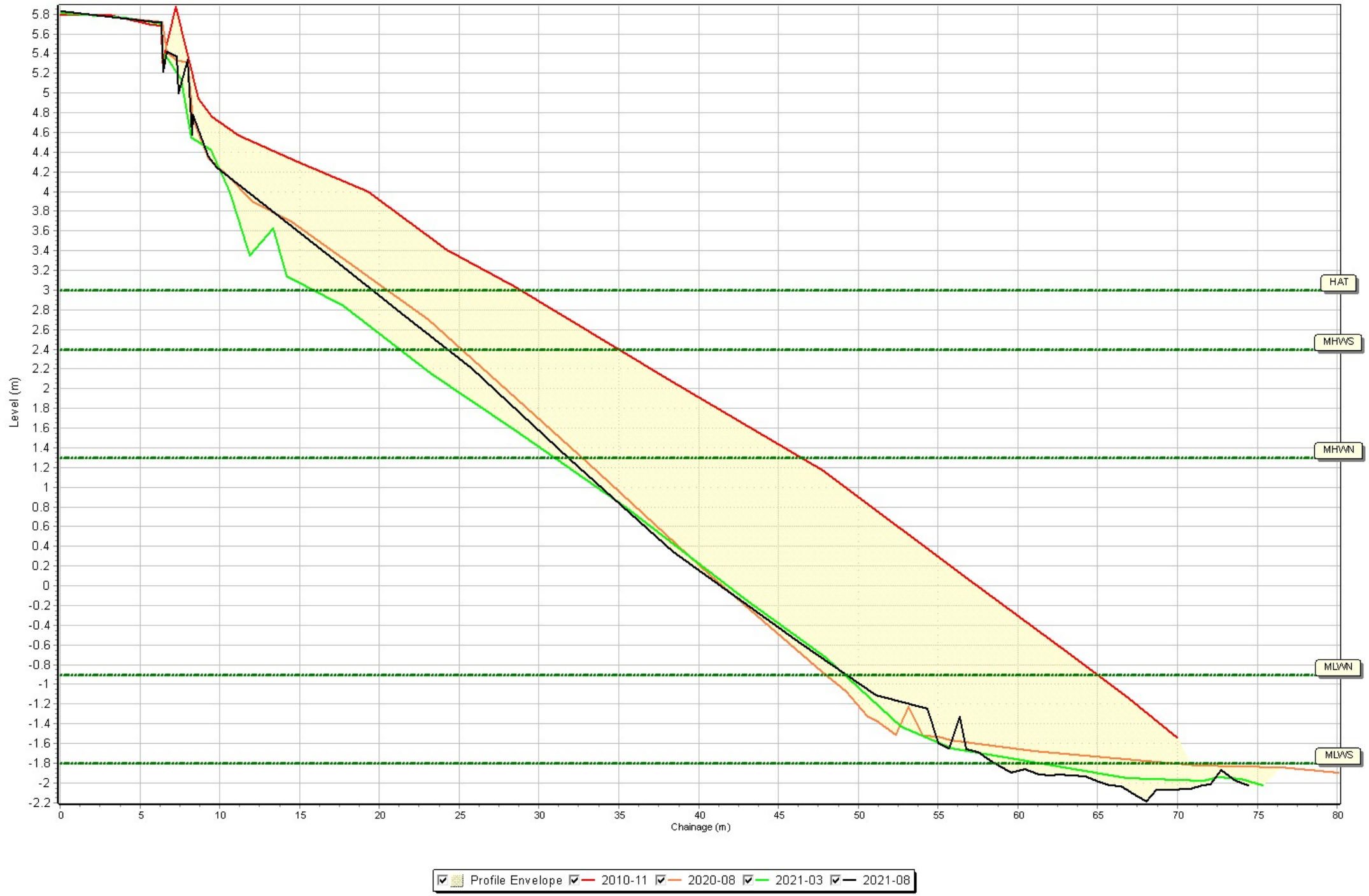
Profiles: 1aNWB23



Profiles: 1aNBW24



Profiles: 1aNBW25



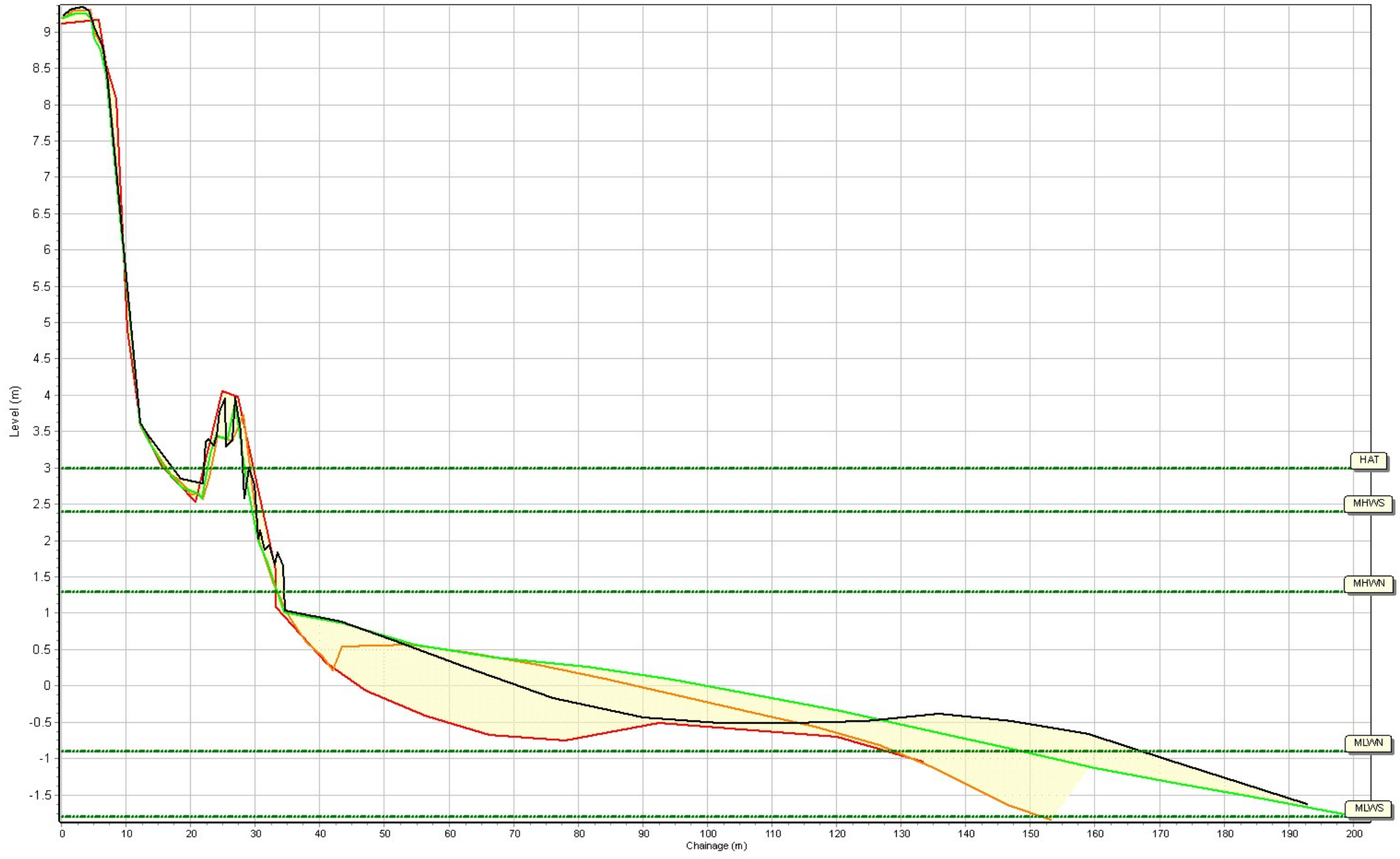


Profiles: 1aNBW26



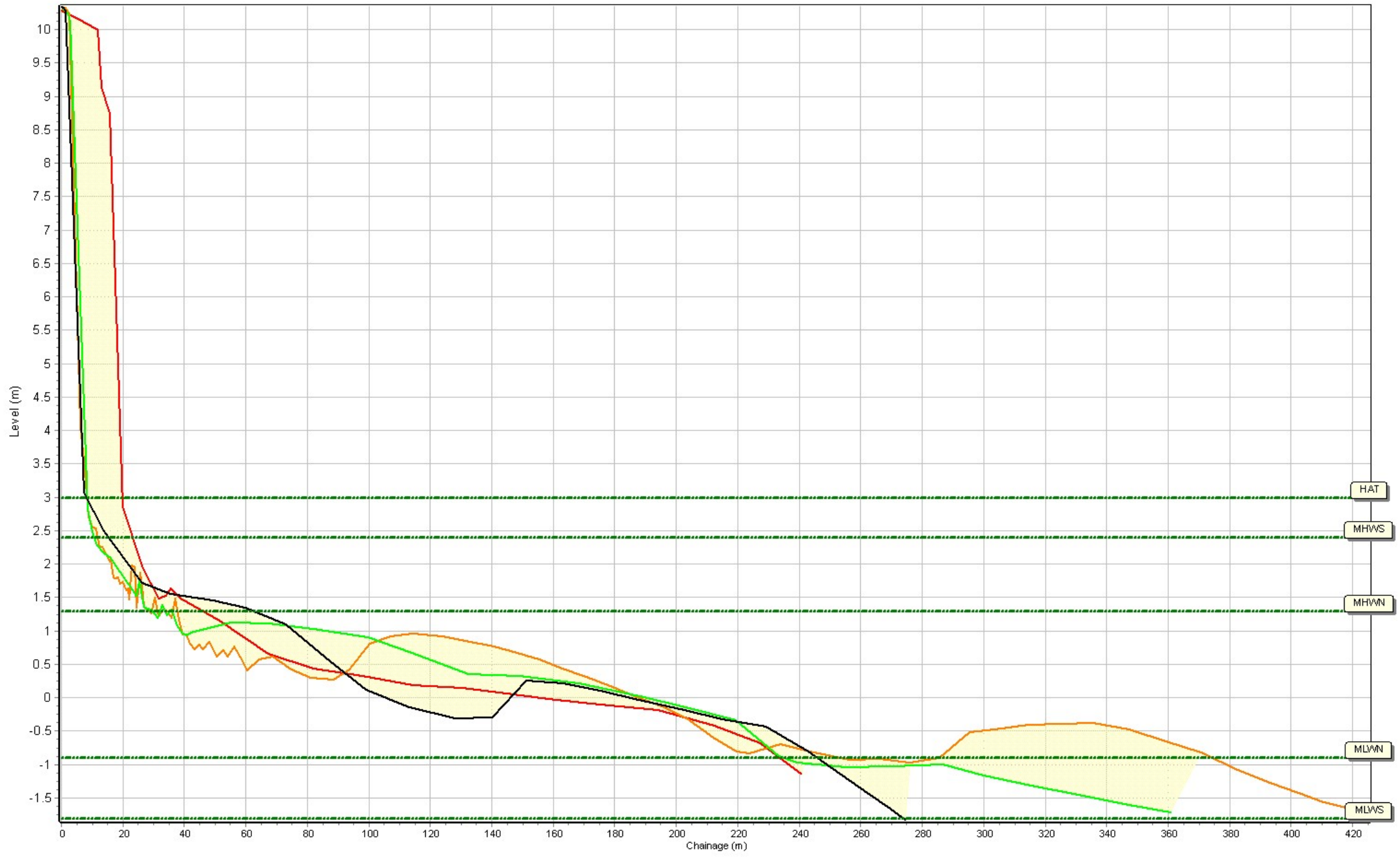


Profiles: 1aWDC08



Profile Envelope  2002-05  2019-10  2020-09  2021-09

Profiles: 1aWDC09

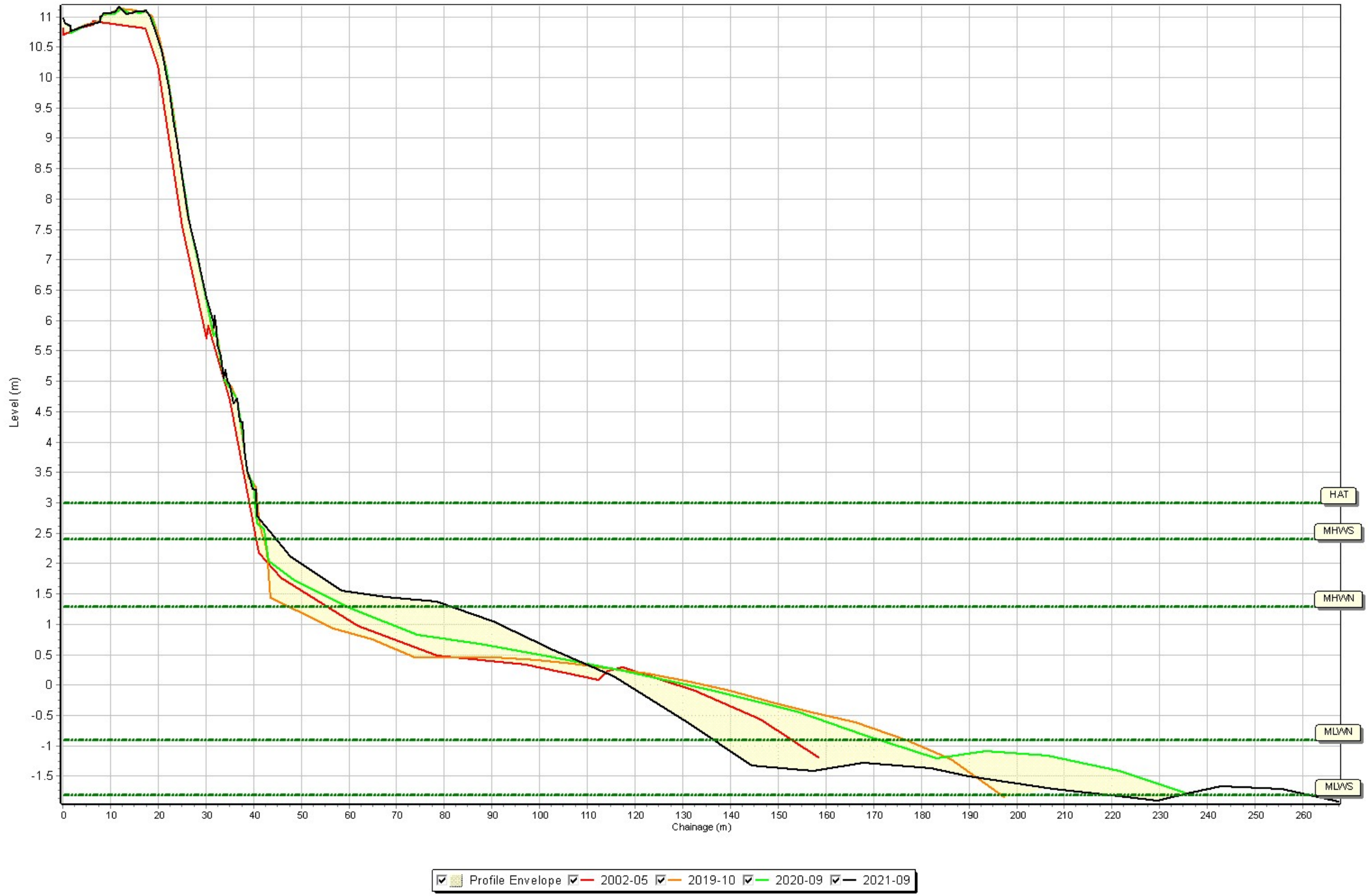


Profile Envelope  2002-05  2019-10  2020-09  2021-09

Profiles: 1aWDC10

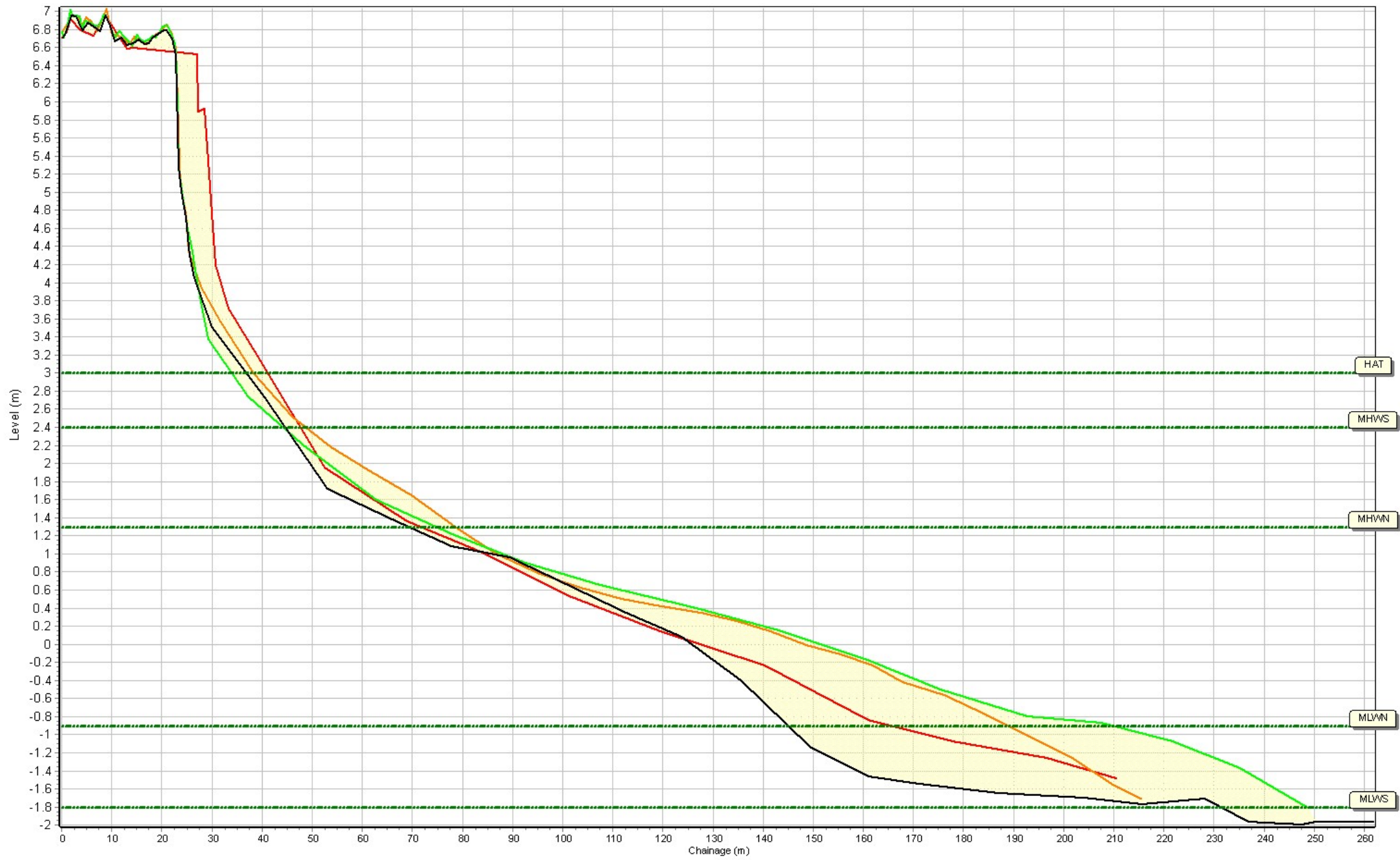


Profiles: 1aWDC11



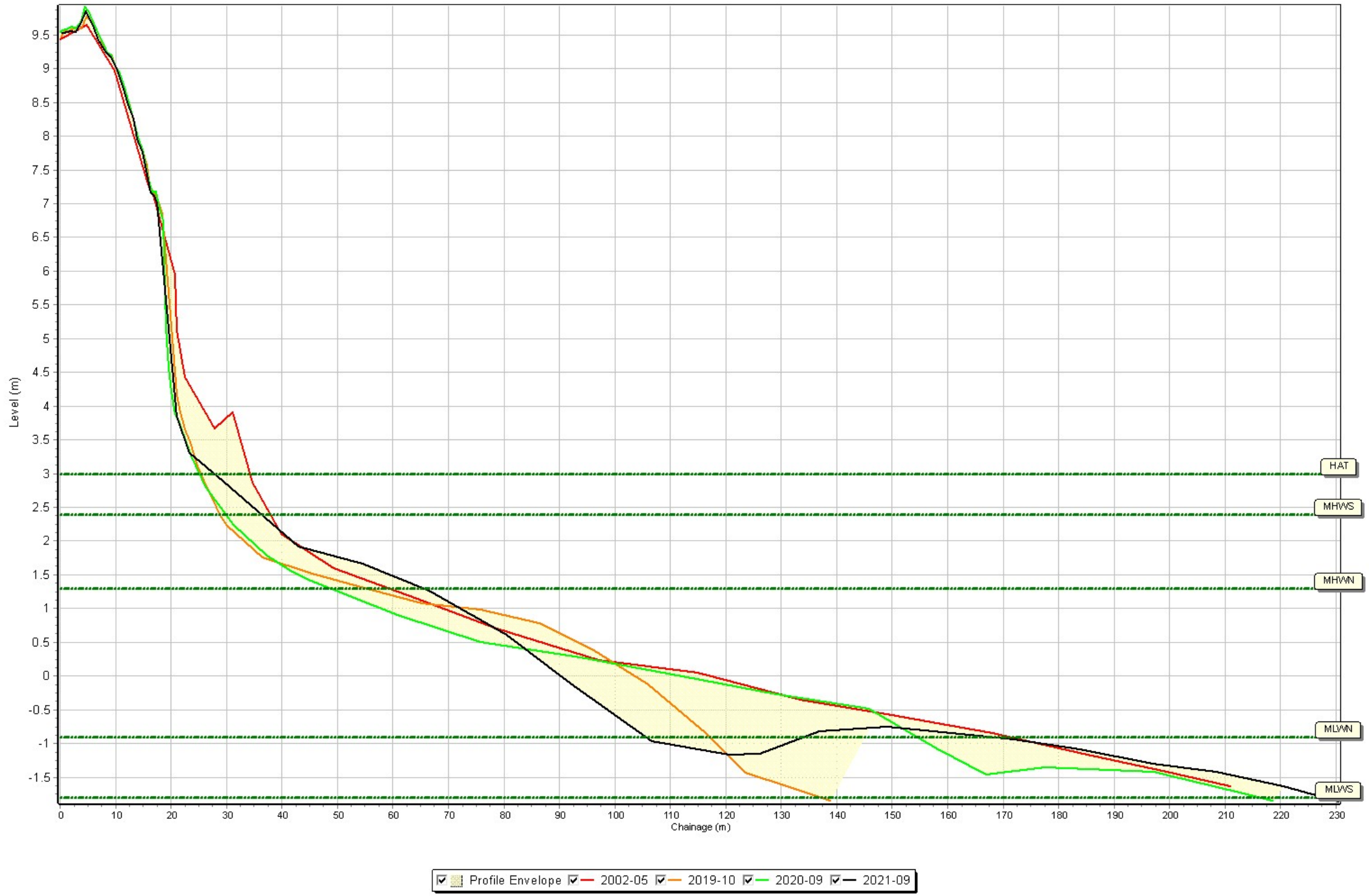


Profiles: 1aWDC12

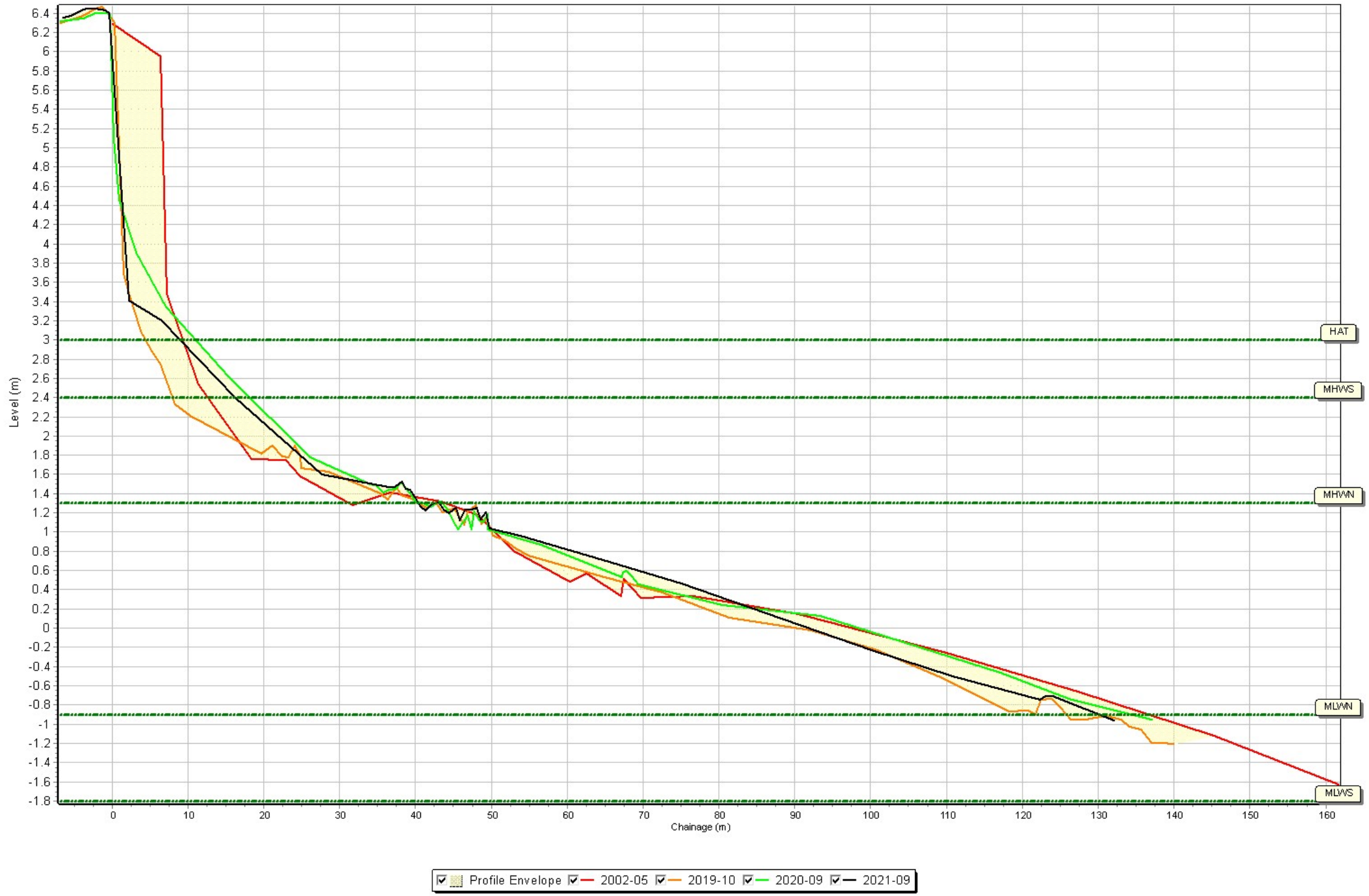


Profile Envelope  2002-05  2019-10  2020-09  2021-09

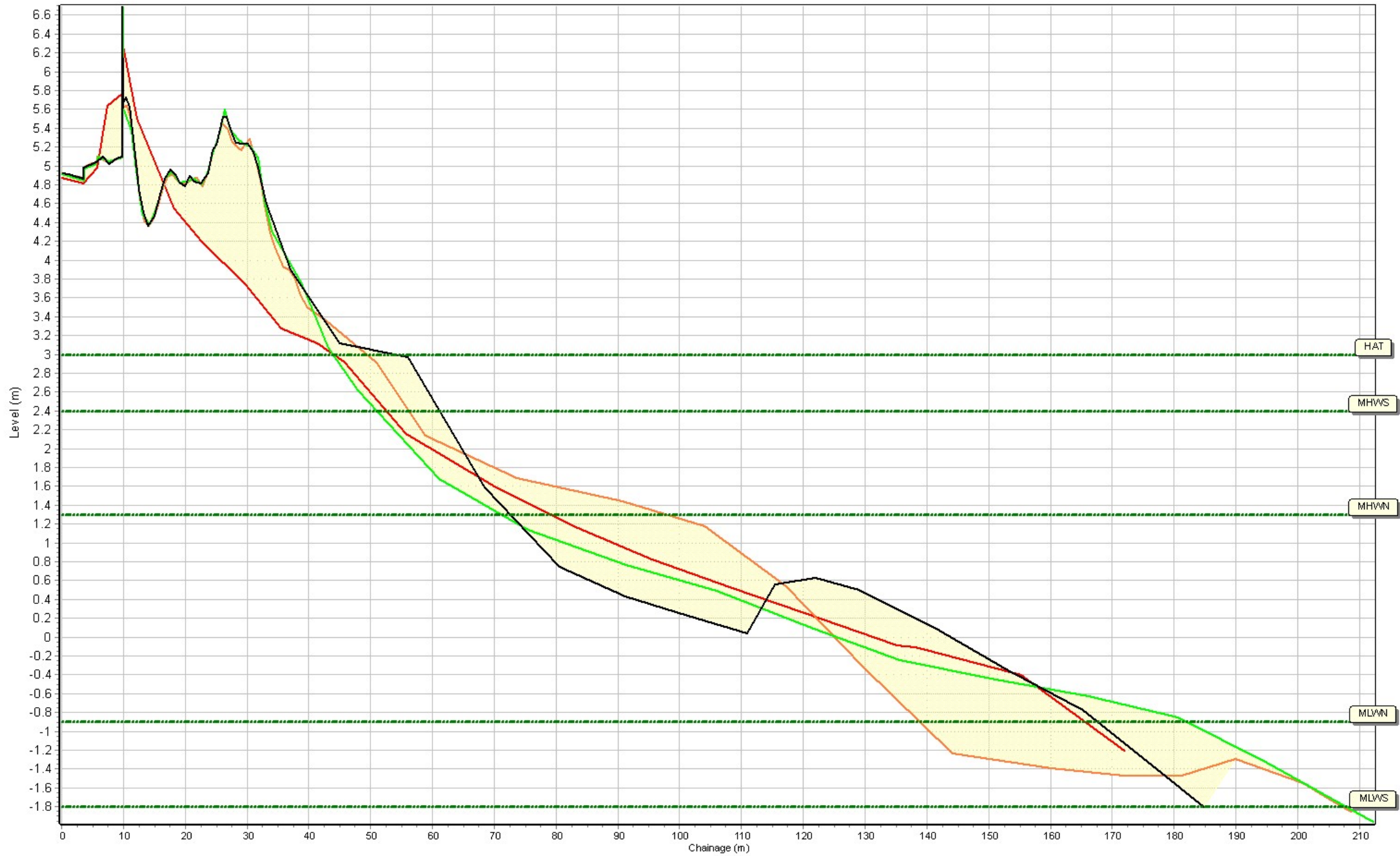
Profiles: 1aWDC13



Profiles: 1aWDC14



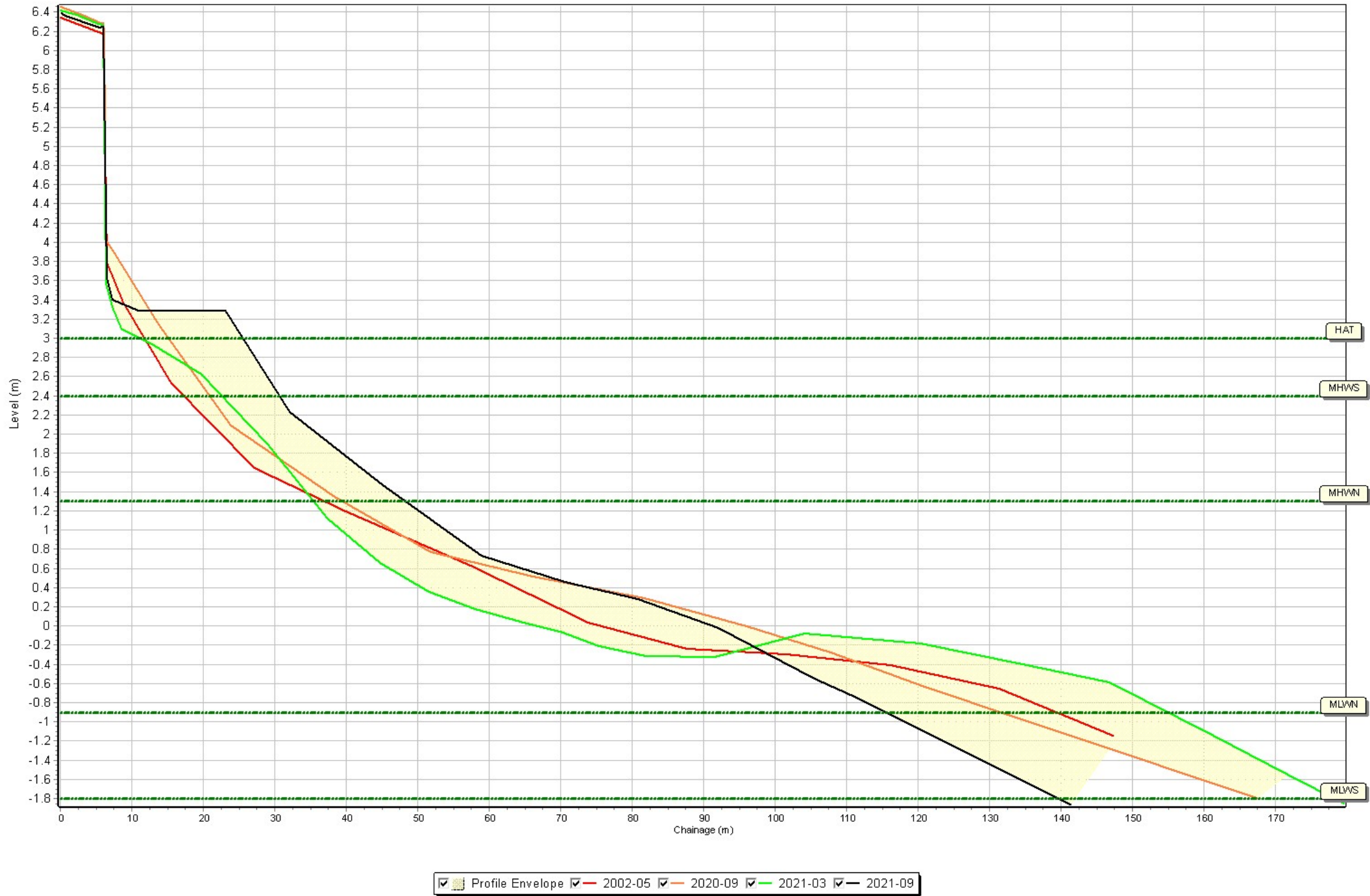
Profiles: 1aBVC01



Profile Envelope  2002-05  2020-09  2021-03  2021-09



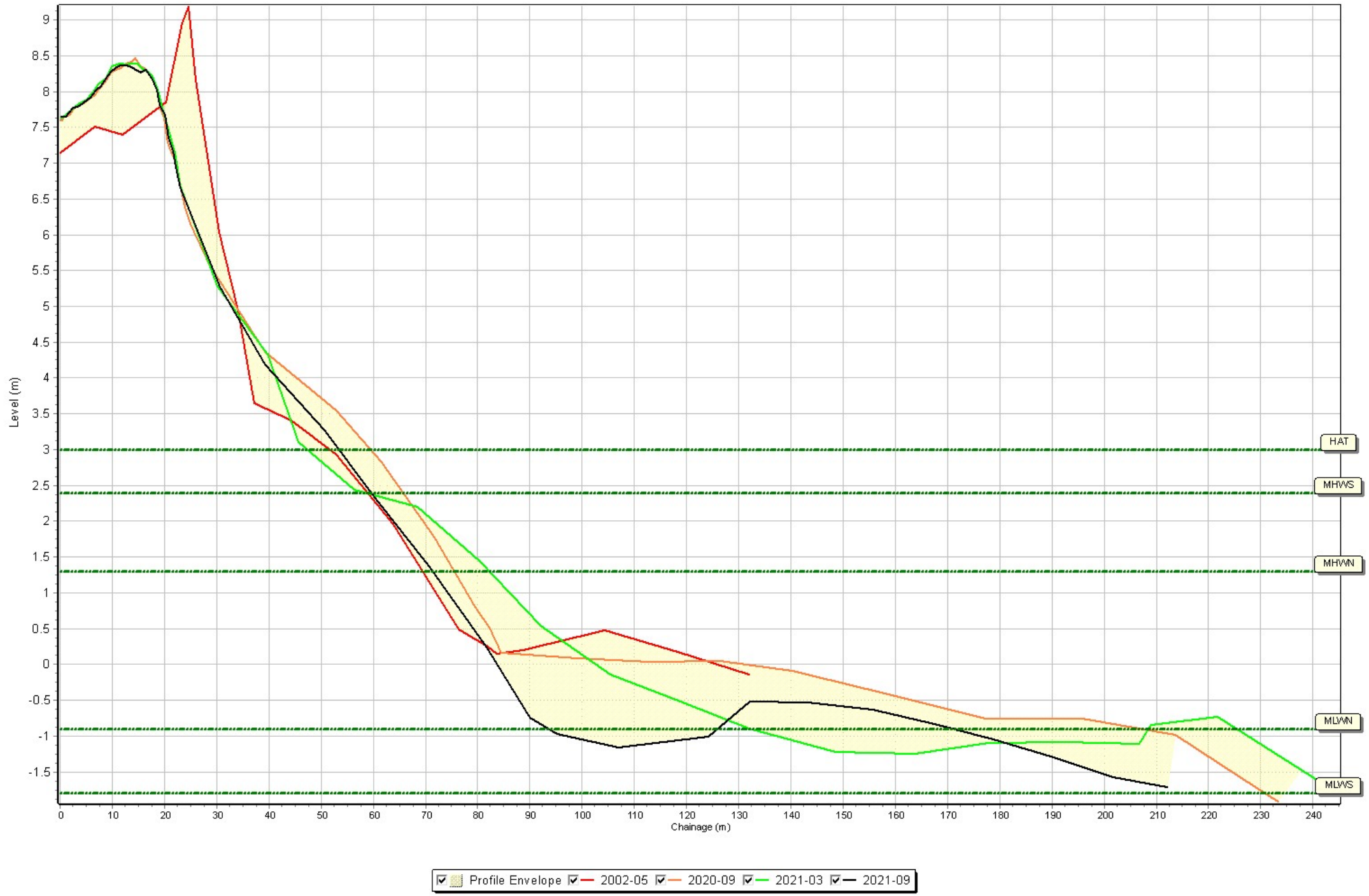
Profiles: 1aBVC02



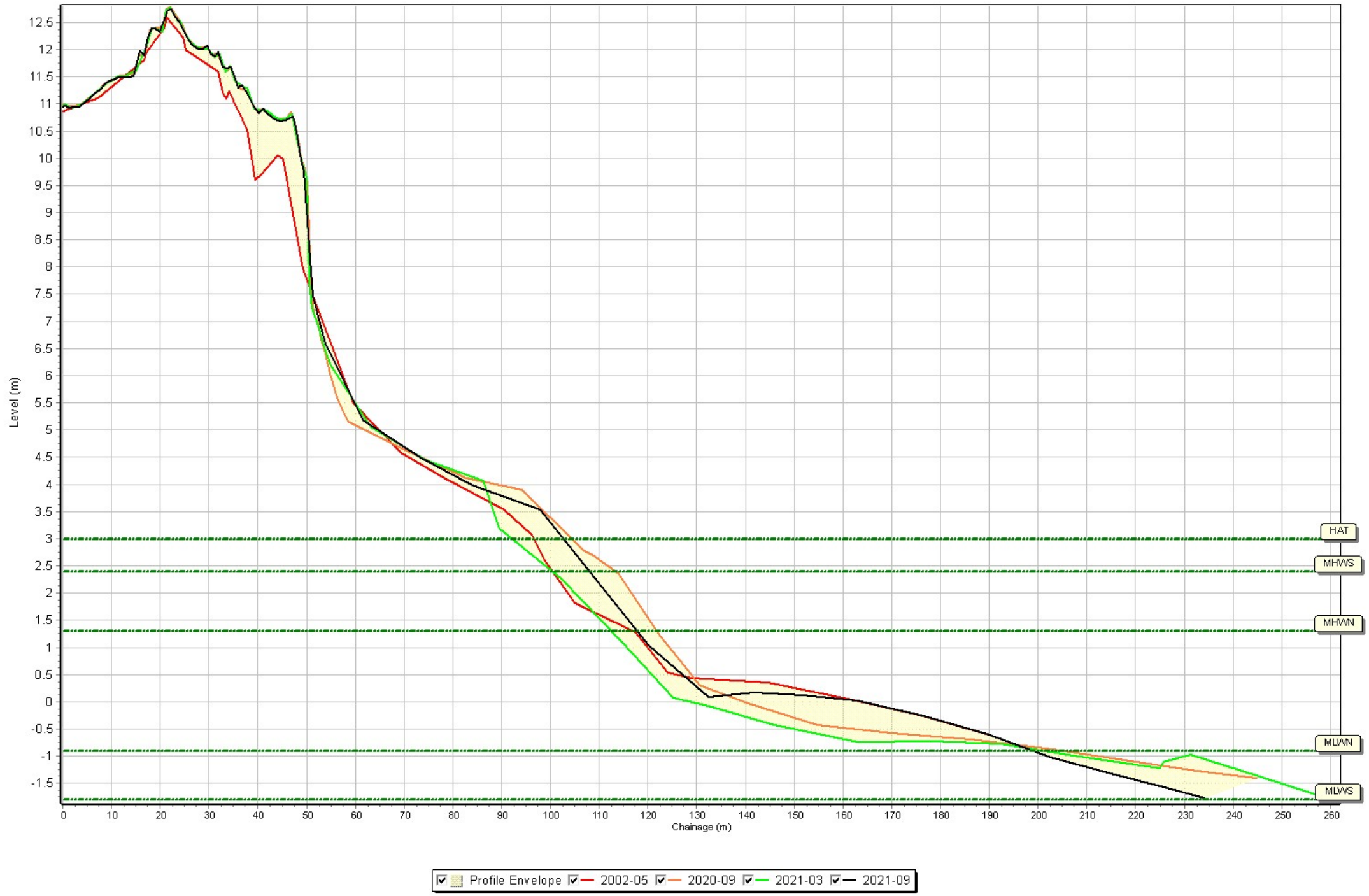
Profiles: 1aBVC03



Profiles: 1aBVC04

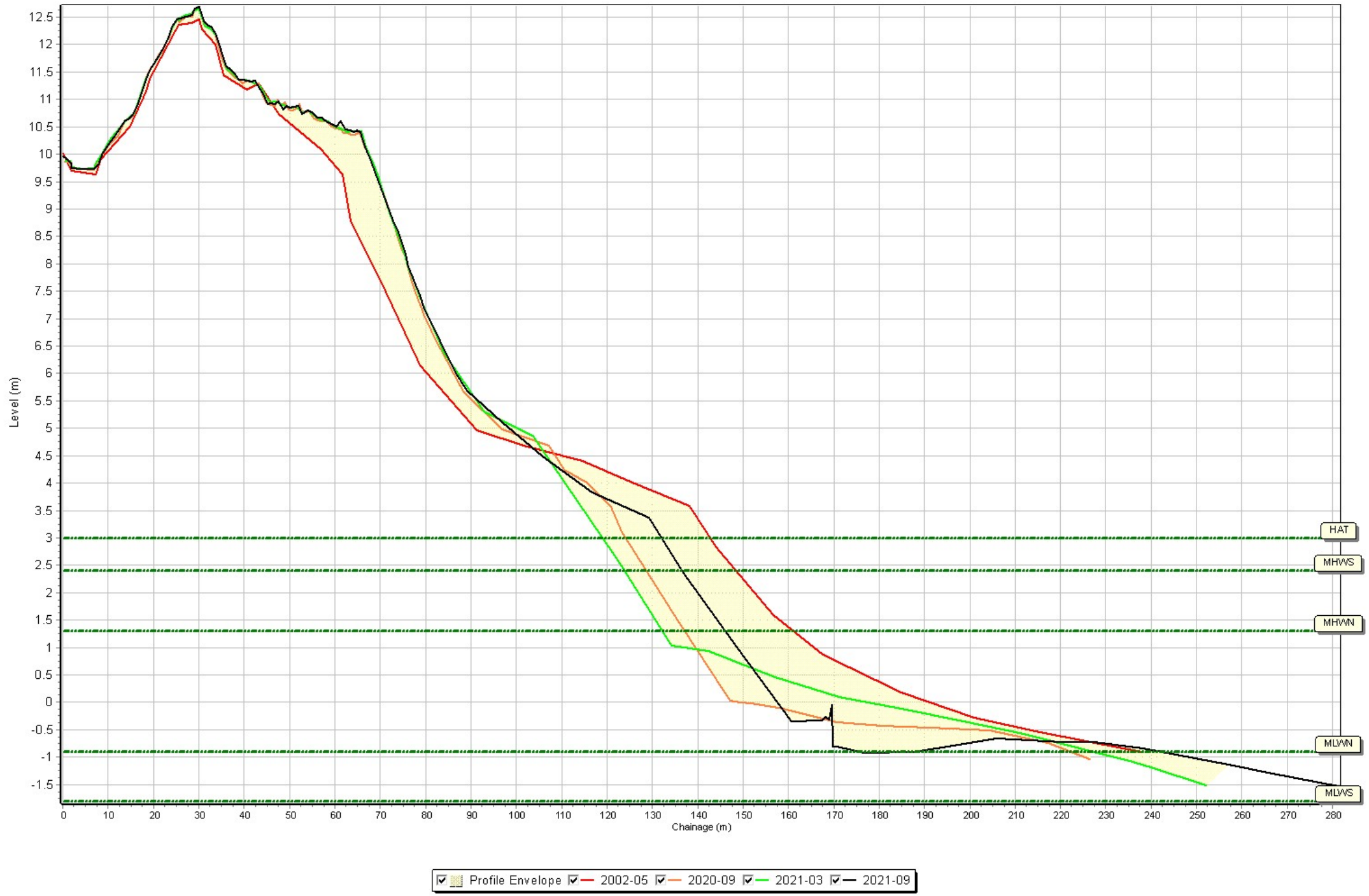


Profiles: 1aBVC05





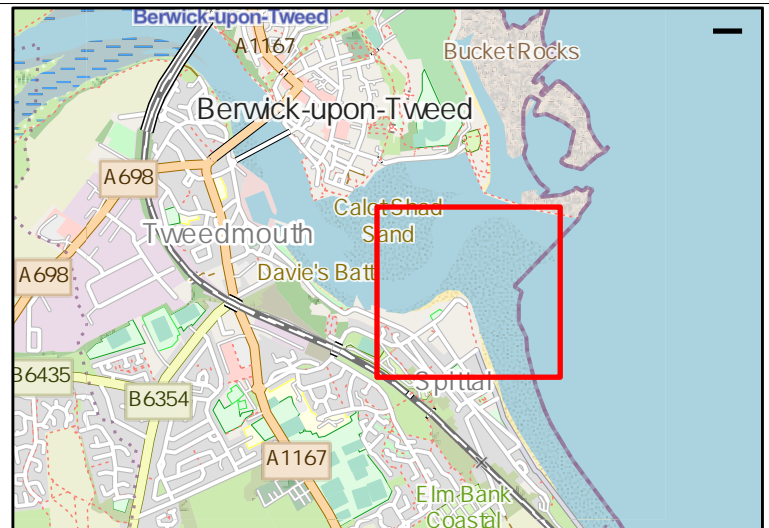
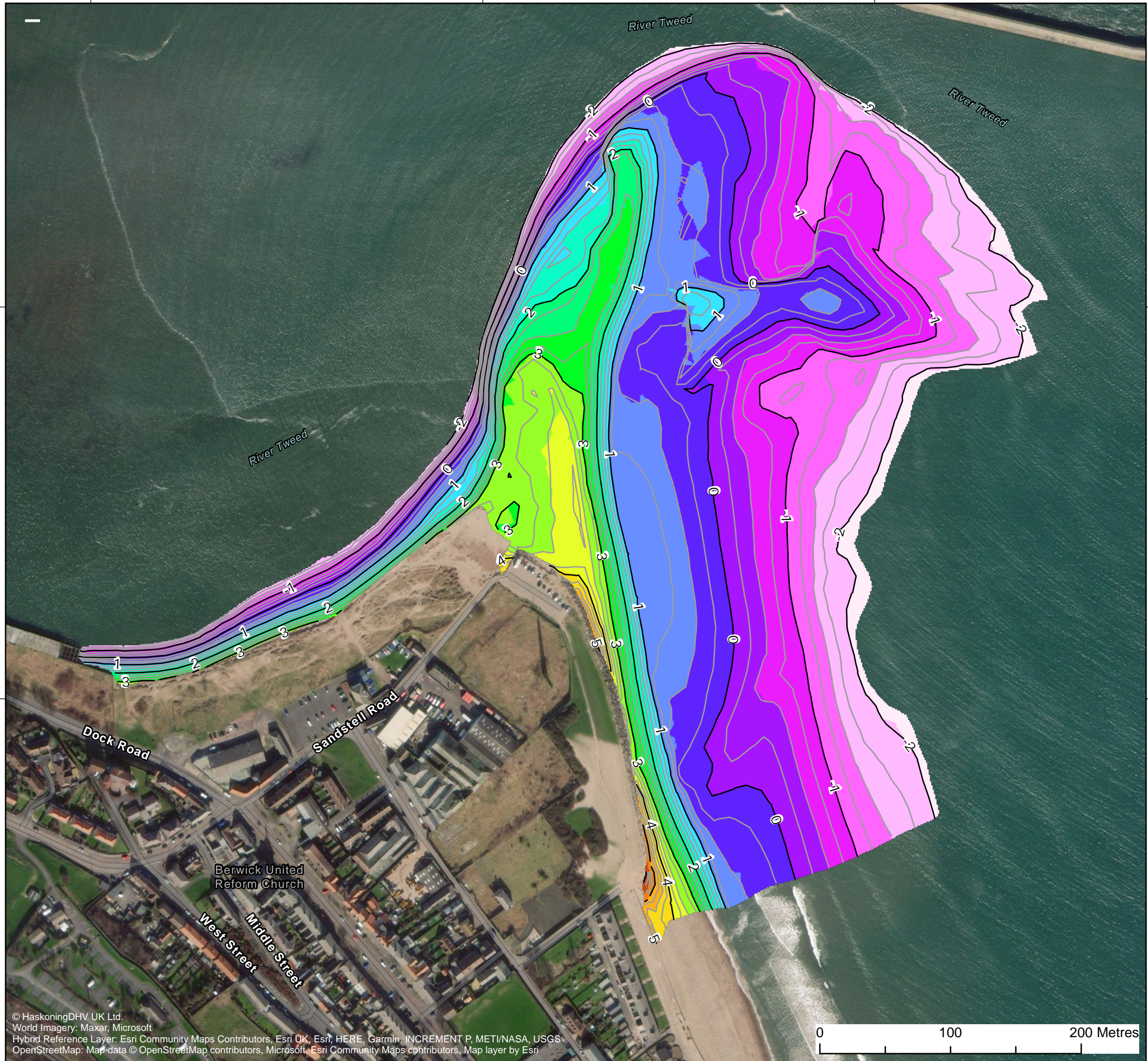
Profiles: 1aBVC06



## **Appendix B**

# **Topographic Survey**





**TOPOGRAPHIC SURVEY (August 2021)**

Elevation (mOD)	Contours (mOD)*
6.1 - 6.5	— 1.0m interval
5.6 - 6	— 0.25m interval
5.1 - 5.5	
4.6 - 5	
4.1 - 4.5	
3.6 - 4	
3.1 - 3.5	
2.6 - 3	
2.1 - 2.5	
1.6 - 2	
1.1 - 1.5	
0.6 - 1	
0.1 - 0.5	
-0.4 - 0	
-0.9 - -0.5	
-1.4 - -1	
-1.9 - -1.5	
-2.1 - -2	

\* Contours only cover sandy beach areas.

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

Title:

**Appendix B - Map 1**

**Spittal A and B**

**Northumberland County Council Frontage**

Report:

Analytical Report  
'Full Measures' Survey 2021

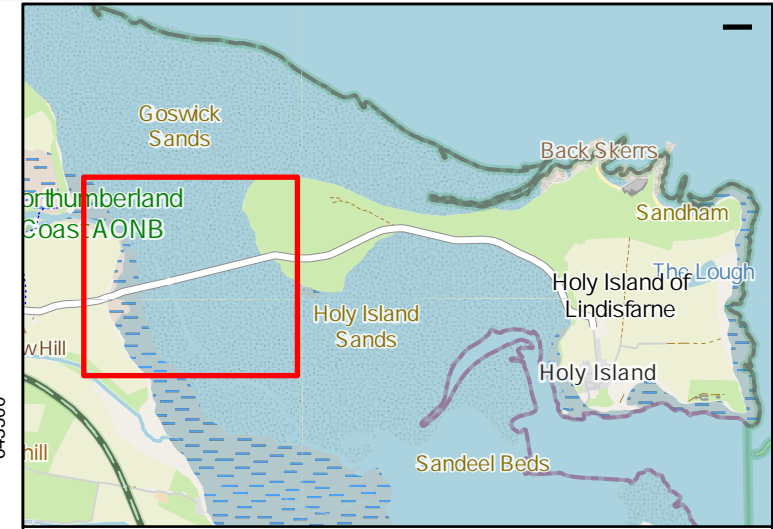
Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	02/12/2021	TC	NJC	A3	1:3,000

Co-ordinate system: British National Grid

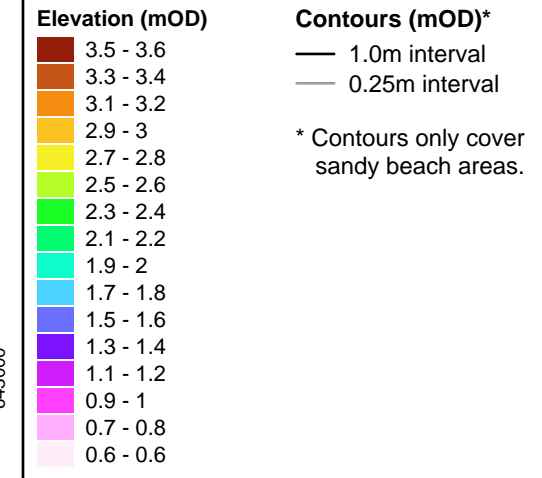
© HaskoningDHV UK Ltd.  
 World Imagery: Maxar, Microsoft  
 Hybrid Reference Layer: Esri Community Maps Contributors, Esri UK, Esri, HERE, Garmin, INCREMENT P, METI/NASA, USGS  
 OpenStreetMap: Map data © OpenStreetMap contributors, Microsoft, Esri Community Maps contributors, Map layer by Esri







**TOPOGRAPHIC SURVEY (September 2021)**



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

Title:

**Appendix B - Map 2**

**Holy Island**

**Northumberland County Council Frontage**

Report:

Analytical Report  
'Full Measures' Survey 2021

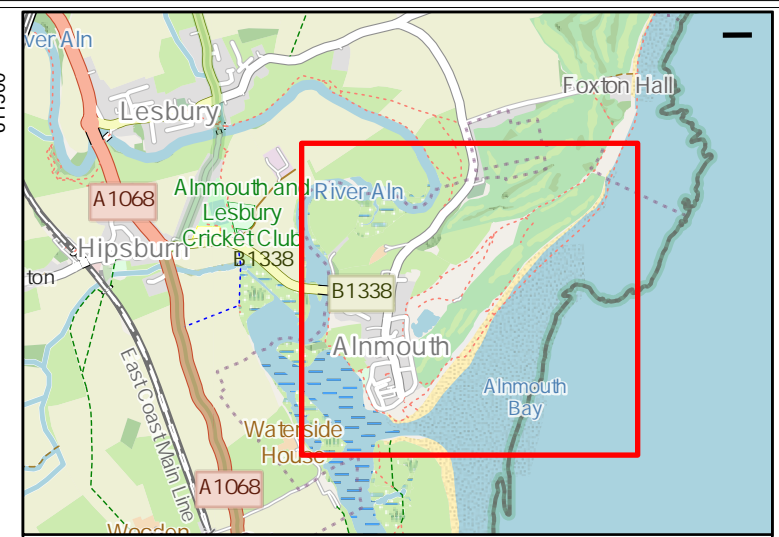
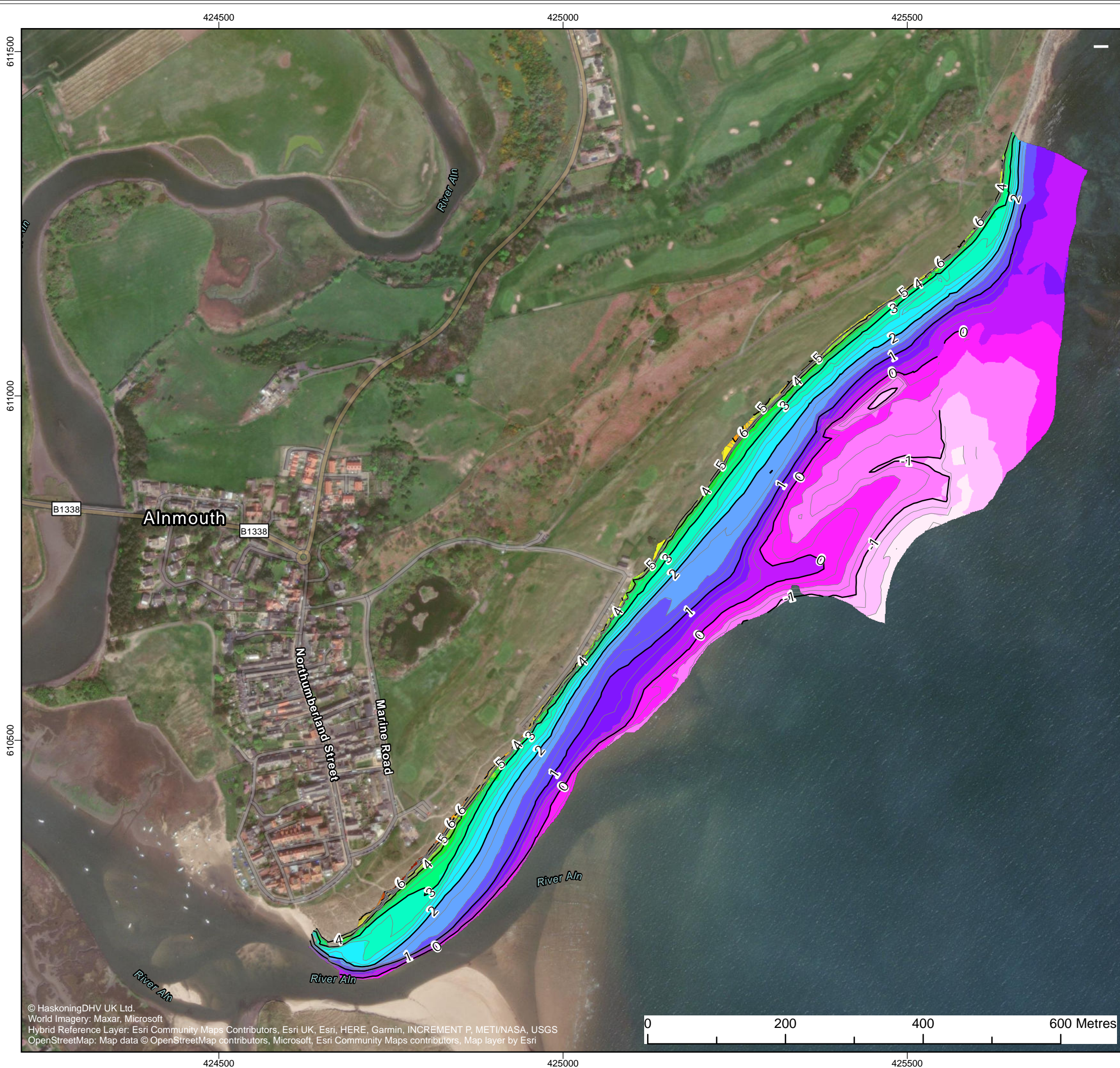
Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	02/12/2021	TC	NJC	A3	1:7,000

Co-ordinate system: British National Grid

© HaskoningDHV UK Ltd.  
World Imagery: Maxar, Microsoft  
Hybrid Reference Layer: Esri Community Maps Contributors, Esri UK, Esri, HERE, Garmin, INCREMENT P, METI/NASA, USGS  
OpenStreetMap: Map data © OpenStreetMap contributors, Microsoft, Esri Community Maps contributors, Map layer by Esri







**TOPOGRAPHIC SURVEY (September 2021)**

<b>Elevation (mOD)</b>	<b>Contours (mOD)*</b>
7.6 - 8	— 1.0m interval
7.1 - 7.5	— 0.25m interval
6.6 - 7	
6.1 - 6.5	
5.6 - 6	
5.1 - 5.5	
4.6 - 5	
4.1 - 4.5	
3.6 - 4	
3.1 - 3.5	
2.6 - 3	
2.1 - 2.5	
1.6 - 2	
1.1 - 1.5	
0.6 - 1	
0.1 - 0.5	
-0.4 - 0	
-0.9 - -0.5	
-1.4 - -1	
-1.8 - -1.5	

\* Contours only cover sandy beach areas.

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

Title:  
**Appendix B - Map 3**  
**Alnmouth Bay**  
**Northumberland County Council Frontage**

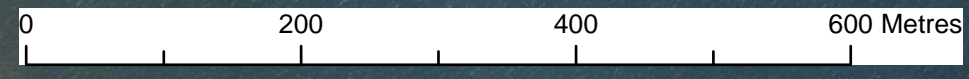
Report:  
 Analytical Report  
 'Full Measures' Survey 2021

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	02/12/2021	TC	NJC	A3	1:5,500

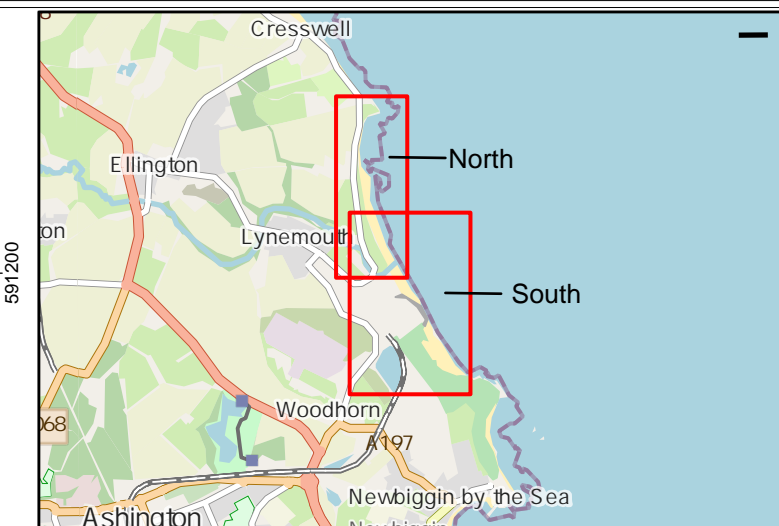
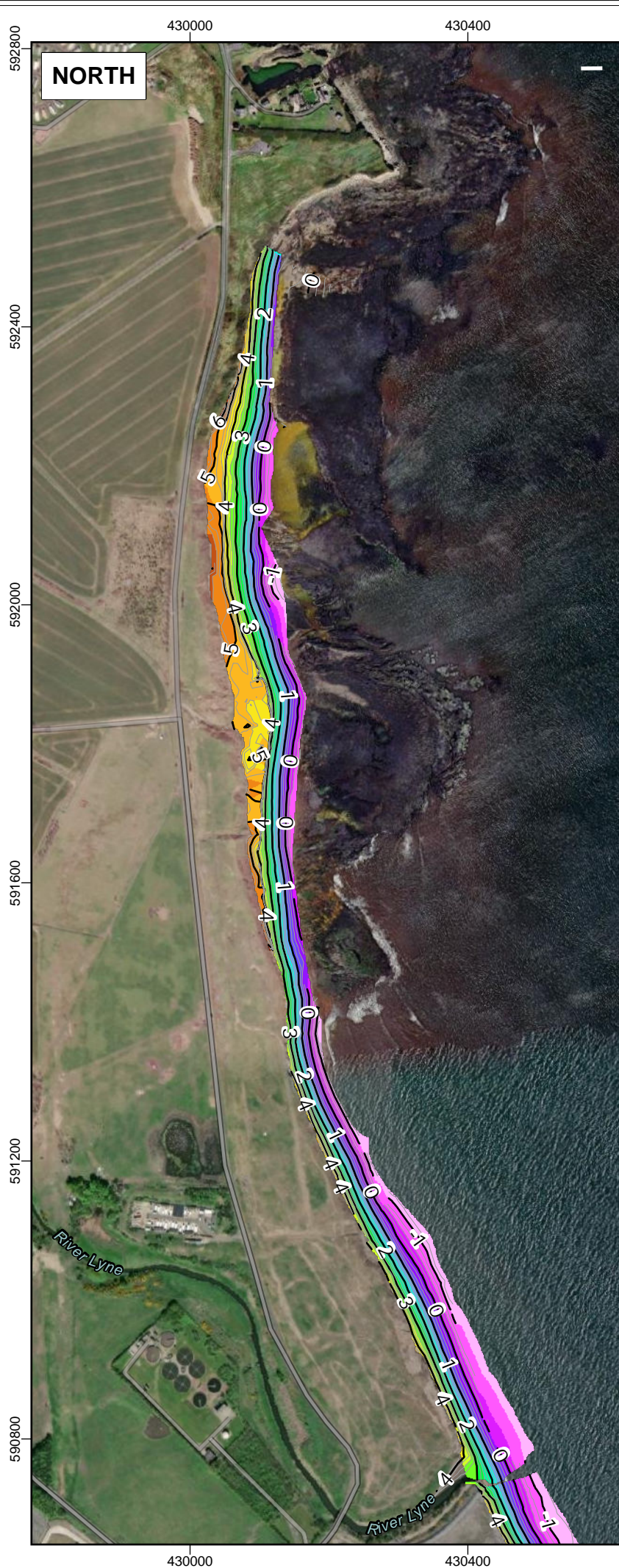
Co-ordinate system: British National Grid

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 Enhancing Society Together

North East Coastal Observatory







**TOPOGRAPHIC SURVEY (October 2021)**

**Elevation (mOD)**

6.01 - 6.5
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
0.51 - 1
0.01 - 0.5
-0.49 - 0
-0.99 - -0.5
-1.49 - -1
-1.74 - -1.5

**Contours (mOD)\***

- 1.0m interval
- 0.5m interval

\* Contours only cover sandy beach areas.

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

Title:

**Appendix B - Map 4**

**LYNEMOUTH**

**Northumberland County Council Frontage**

Report:

Analytical Report  
'Full Measures' Survey 2021

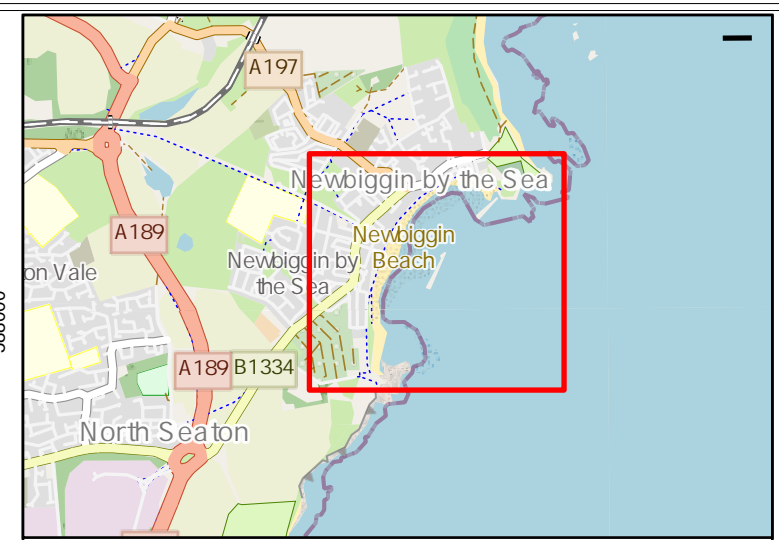
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0	02/12/2021	TC	NJC	A3	1:8,000

Co-ordinate system: British National Grid

Royal HaskoningDHV  
Enhancing Society Together

North East Coastal Observatory





**TOPOGRAPHIC SURVEY (August 2021)**

Elevation (mOD)	Contours (mOD)*
6.1 - 6.5	— 1.0m interval
5.6 - 6	— 0.25m interval
5.1 - 5.5	
4.6 - 5	
4.1 - 4.5	
3.6 - 4	
3.1 - 3.5	
2.6 - 3	
2.1 - 2.5	
1.6 - 2	
1.1 - 1.5	
0.6 - 1	
0.1 - 0.5	
-0.4 - 0	
-0.9 - -0.5	
-1.4 - -1	
-1.9 - -1.5	
-2.4 - -2	

\* Contours only cover sandy beach areas.

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

Title:

**Appendix B - Map 5**

**Newbiggin Bay**

**Northumberland County Council Frontage**

Report:

Analytical Report  
'Full Measures' Survey 2021

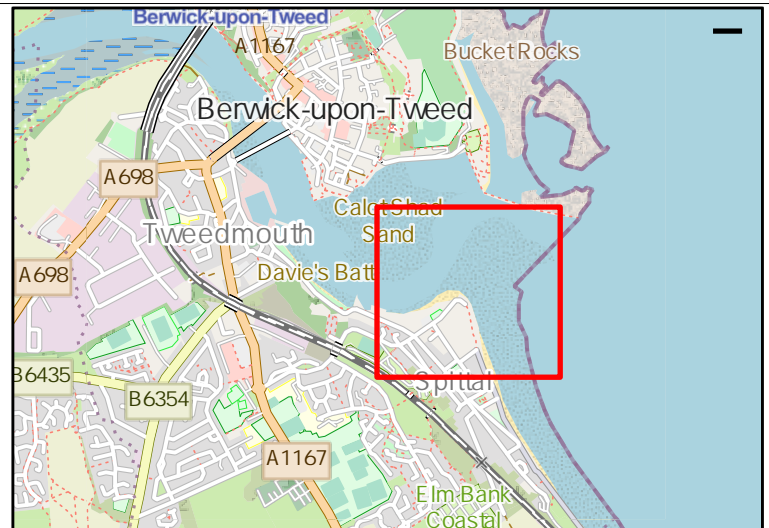
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0	02/12/2021	TC	NJC	A3	1:5,000

Co-ordinate system: British National Grid



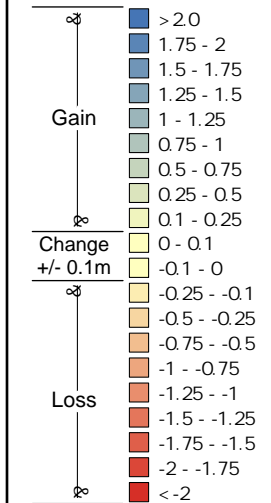
© HaskoningDHV UK Ltd.  
 World Imagery: Maxar, Microsoft  
 Hybrid Reference Layer: Esri Community Maps Contributors, Esri UK, Esri, HERE, Garmin, INCREMENT P, METI/NASA, USGS  
 OpenStreetMap: Map data © OpenStreetMap contributors, Microsoft, Esri Community Maps contributors, Map layer by Esri





**Difference between topographic surveys**  
(Mar 2021 to Aug 2021)

**Change in Elevation (mOD)**



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

Title:

**Appendix B - Map 6**

**Spittal A and B**

**Northumberland County Council Frontage**

Report:

Analytical Report  
'Full Measures' Survey 2021

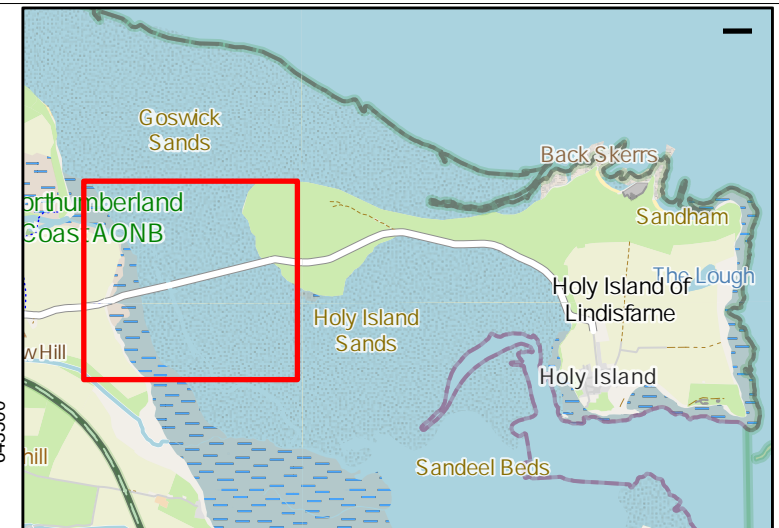
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0	02/12/2021	TC	NJC	A3	1:3,000

Co-ordinate system: British National Grid



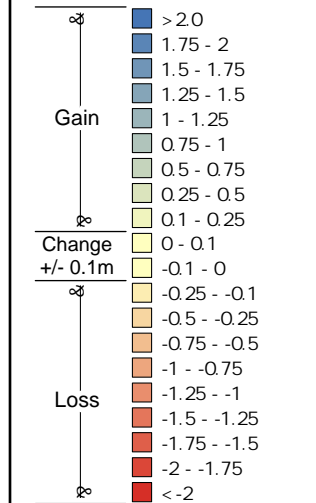
© HaskoningDHV UK Ltd.  
World Imagery: Maxar, Microsoft  
Hybrid Reference Layer: Esri Community Maps Contributors, Esri UK, Esri, HERE, Garmin, INCREMENT P, METI/NASA, USGS  
OpenStreetMap: Map data © OpenStreetMap contributors, Microsoft, Esri Community Maps contributors, Map layer by Esri





**Difference between topographic surveys**  
(Aug 2020 to Sept 2021)

**Change in Elevation (mOD)**



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

Title:

**Appendix B - Map 7**

**Holy Island**

**Northumberland County Council Frontage**

Report:

Analytical Report  
'Full Measures' Survey 2021

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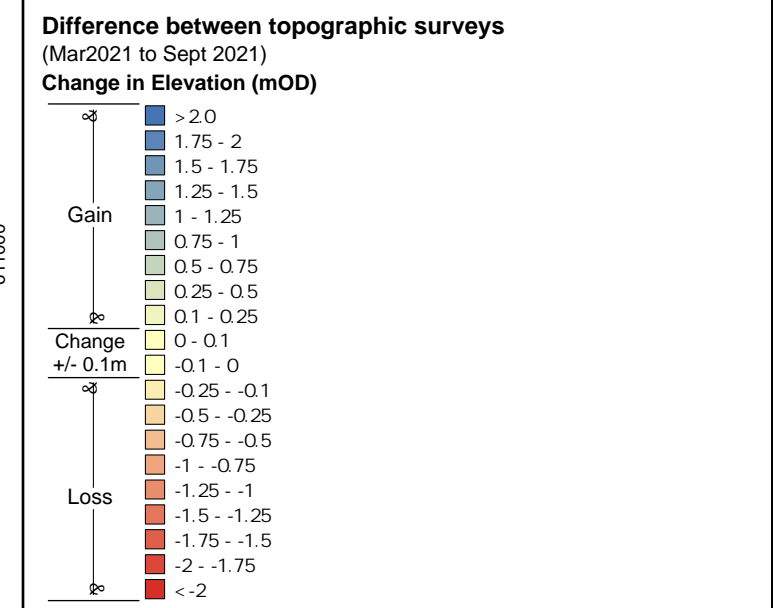
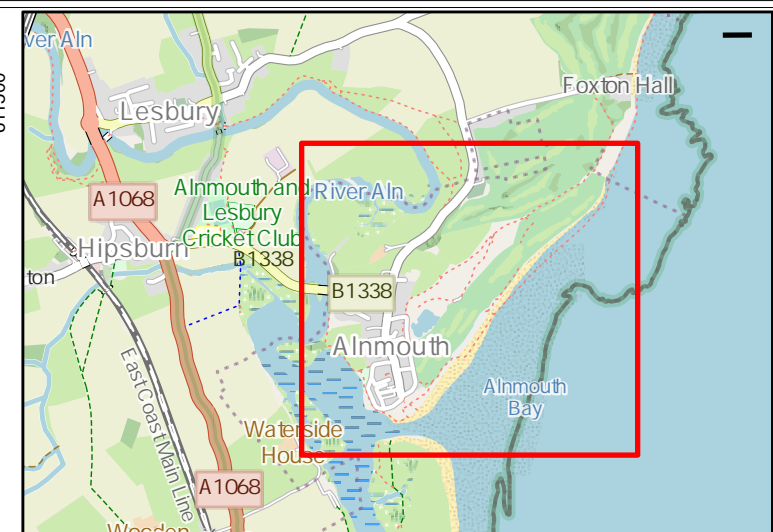
Co-ordinate system: British National Grid



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World Imagery: Maxar, Microsoft  
Hybrid Reference Layer: Esri Community Maps Contributors, Esri UK, Esri, HERE, Garmin, INCREMENT P, METI/NASA, USGS  
OpenStreetMap: Map data © OpenStreetMap contributors, Microsoft, Esri Community Maps contributors, Map layer by Esri







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

Title:

**Appendix B - Map 8**

**Alnmouth Bay**

**Northumberland County Council Frontage**

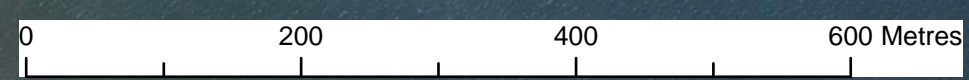
Report:

Analytical Report  
'Full Measures' Survey 2021

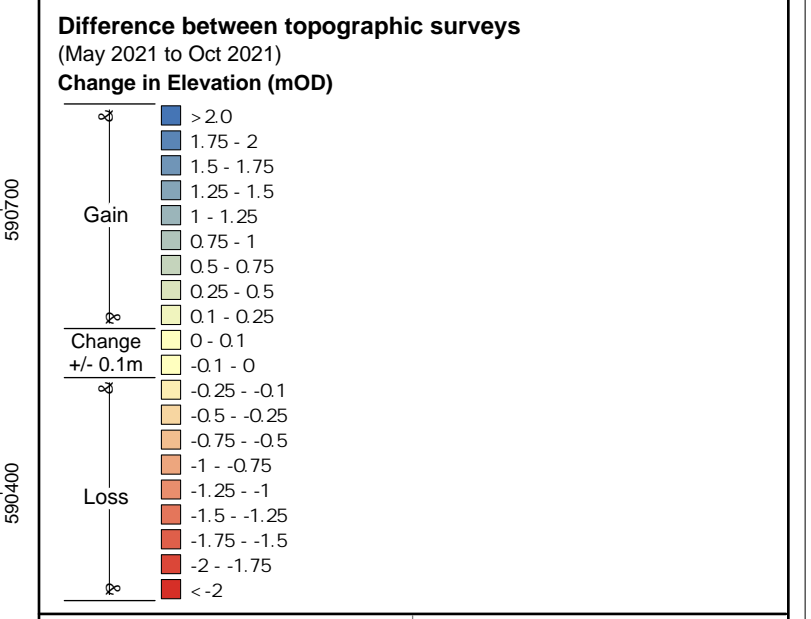
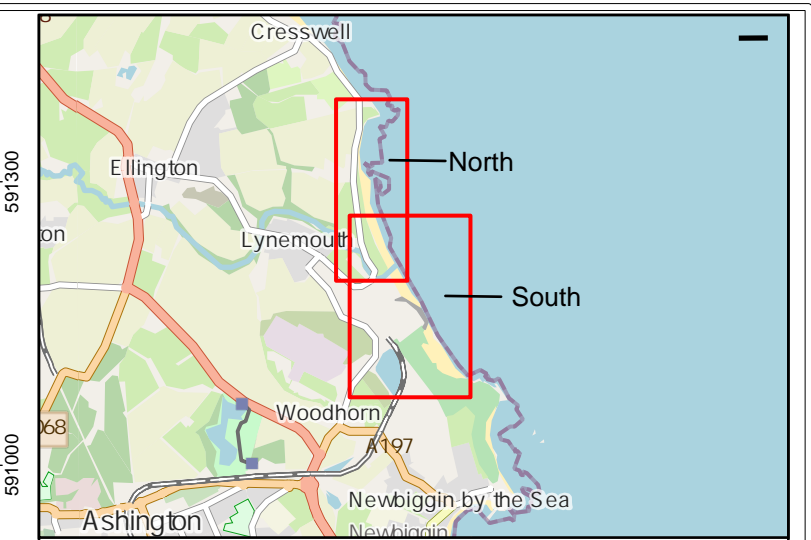
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Co-ordinate system: British National Grid

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World Imagery: Maxar, Microsoft  
Hybrid Reference Layer: Esri Community Maps Contributors, Esri UK, Esri, HERE, Garmin, INCREMENT P, METI/NASA, USGS  
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Client:	Project:
North East Coastal Group	Cell 1 Regional Coastal Monitoring Programme

Title:

**Appendix B - Map 9**

**LYNEMOUTH**

**Northumberland County Council Frontage**

Report:

Analytical Report  
'Full Measures' Survey 2021

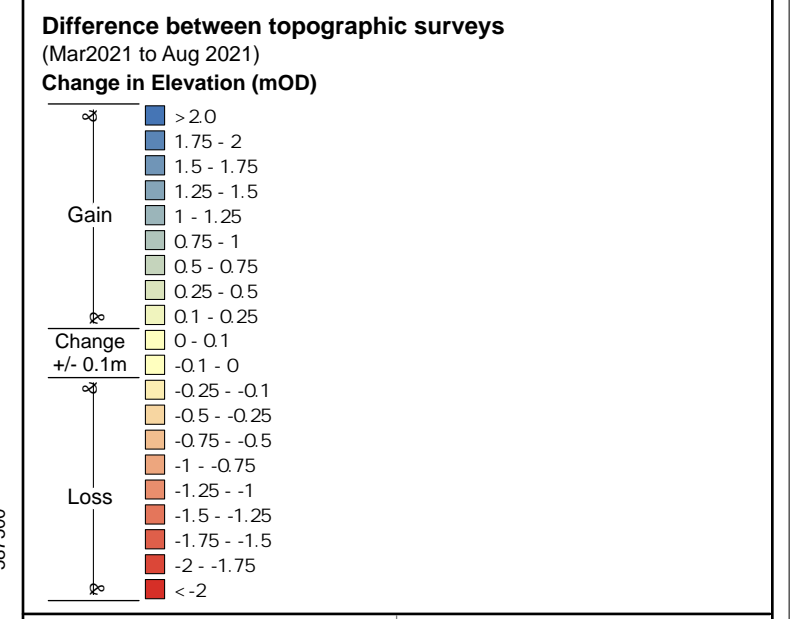
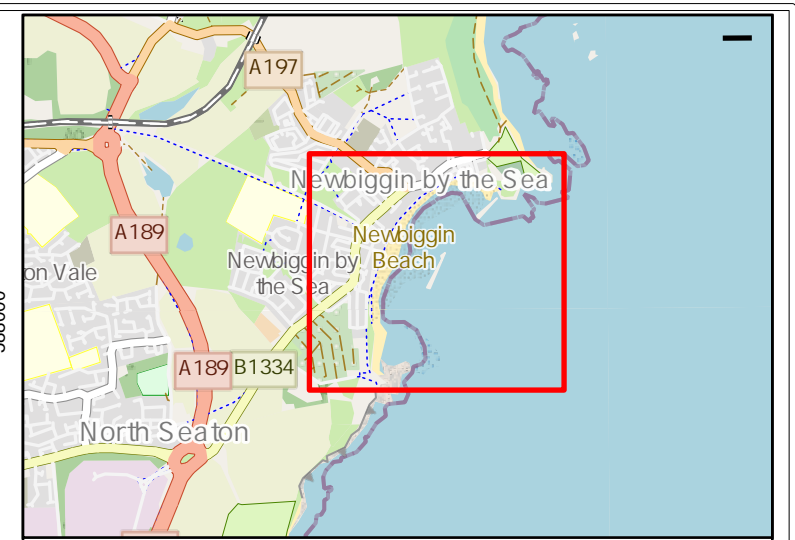
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Co-ordinate system: British National Grid



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

Title:

**Appendix B - Map 10**

**Newbiggin Bay**

**Northumberland County Council Frontage**

Report:

Analytical Report  
'Full Measures' Survey 2021

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	02/12/2021	TC	NJC	A3	1:5,000

Co-ordinate system: British National Grid

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**North East Coastal Observatory**

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OpenStreetMap: Map data © OpenStreetMap contributors, Microsoft, Esri Community Maps contributors, Map layer by Esri

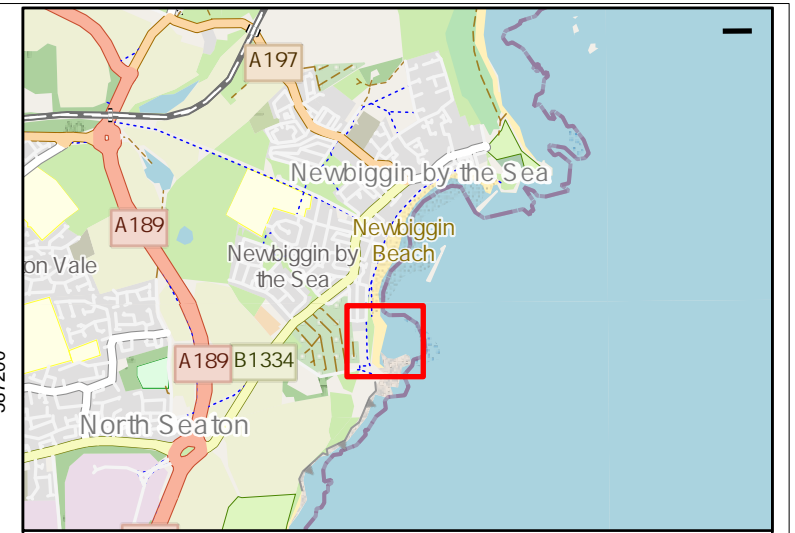




## **Appendix C**

# **Sand Extent Survey**





**SAND EXTENT**

— Autumn 2021	— Spring 2016
— Spring 2021	— Autumn 2015
— Autumn 2020	— Spring 2015
— Spring 2020	— Autumn 2014
— Autumn 2019	— Spring 2014
- - - Spring 2019	— Autumn 2013
- - - Autumn 2018	— Spring 2013
- - - Spring 2018	— Autumn 2012
- - - Autumn 2017	— Spring 2012
- - - Spring 2017	— Autumn 2011
- - - Autumn 2016	

▨ Site of Special Scientific Interest (SSSI)

Client: North East Coastal Group	Project: Cell 1 Regional Coastal Monitoring Programme
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Title:  
**Appendix C - Map 1**  
**Newbiggin-by-the-Sea**  
**Sand Extent**  
**Northumberland County Council Frontage**

Report:  
Analytical Report  
'Full Measures' Survey 2021

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	06/12/2021	TC	NJC	A3	1:1,500

Co-ordinate system: British National Grid

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