



Cell 1 Regional Coastal Monitoring Programme Update Report 14: 'Partial Measures' Survey 2022

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Abbreviations and Acronyms

Acronym / Abbreviation	Definition
AONB	Area of Outstanding Natural Beauty
DGM	Digital Ground Model
HAT	Highest Astronomical Tide
LAT	Lowest Astronomical Tide
MHWN	Mean High Water Neap
MHWS	Mean High Water Spring
MLWS	Mean Low Water Neap
MLWS	Mean Low Water Spring
m	Metres
ODN	Ordnance Datum Newlyn

Water Levels Used in Interpretation of Changes

Water Level Parameter	Water Level (m AOD)
	River Tyne to Marsden Bay
HAT	3.1
MHWS	2.4
MHWN	1.3
MLWN	-0.8
MLWS	-1.9

Source: UKHO Admiralty Tide Tables, 2020

Glossary of Terms

Term	Definition
Beach nourishment	Artificial process of replenishing a beach with material from another source.
Berm crest	Ridge of sand or gravel deposited by wave action on the shore just above the normal high water mark.
Breaker zone	Area in the sea where the waves break.
Coastal squeeze	The reduction in habitat area which can arise if the natural landward migration of a habitat under sea level rise is prevented by the fixing of the high water mark, e.g. a sea wall.
Downdrift	Direction of alongshore movement of beach materials.
Ebb-tide	The falling tide, part of the tidal cycle between high water and the next low water.
Fetch	Length of water over which a given wind has blown that determines the size of the waves produced.
Flood-tide	Rising tide, part of the tidal cycle between low water and the next high water.
Foreshore	Zone between the high water and low water marks, also known as the intertidal zone.
Geomorphology	The branch of physical geography/geology which deals with the form of the Earth, the general configuration of its surface, the distribution of the land, water, etc.
Groyne	Shore protection structure built perpendicular to the shore; designed to trap sediment.
Mean High Water (MHW)	The average of all high waters observed over a sufficiently long period.
Mean Low Water (MLW)	The average of all low waters observed over a sufficiently long period.
Mean Sea Level (MSL)	Average height of the sea surface over a 19-year period.
Offshore zone	Extends from the low water mark to a water depth of about 15 m and is permanently covered with water.
Storm surge	A rise in the sea surface on an open coast, resulting from a storm.
Swell	Waves that have travelled out of the area in which they were generated.
Tidal prism	The volume of water within the estuary between the level of high and low tide, typically taken for mean spring tides.
Tide	Periodic rising and falling of large bodies of water resulting from the gravitational attraction of the moon and sun acting on the rotating earth.
Topography	Configuration of a surface including its relief and the position of its natural and man-made features.
Transgression	The landward movement of the shoreline in response to a rise in relative sea level.
Updrift	Direction opposite to the predominant movement of longshore transport.
Wave direction	Direction from which a wave approaches.
Wave refraction	Process by which the direction of approach of a wave changes as it moves into shallow water.

Preamble

The Cell 1 Regional Coastal Monitoring Programme covers approximately 300km of the north east coastline, from the Scottish Border (just south of St. Abb's Head) to Flamborough Head in East Yorkshire. This coastline is often referred to as 'Coastal Sediment Cell 1' in England and Wales (Figure 1). Within this frontage the coastal landforms vary considerably, comprising low-lying tidal flats with fringing salt marshes, hard rock cliffs that are mantled with glacial sediment to varying thicknesses, softer rock cliffs and extensive landslide complexes.

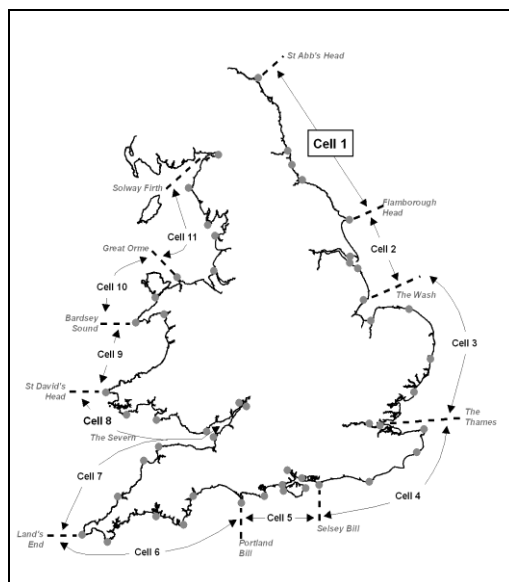


Figure 1 Sediment Cells in England and Wales

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



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

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

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

- beach profile surveys
- topographic surveys
- cliff top recession surveys
- real-time wave data collection
- bathymetric and sea bed characterisation surveys
- aerial photography
- LiDAR Surveys
- walk-over 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	Oct 12	
5	2012/13	Nov 12	Mar 13	Mar 13	Jun 13	
6	2013/14	Nov 13	Feb 14	Apr 14	Jul 14	
7	2014/15	Nov 14	Feb 15	Apr 15	Jul 15	
8	2015/16	Nov 15	Feb 16	Mar 16	Jul 16	Jun 16
9	2016/17	Nov 16	Feb 17	Mar 17	Jul 17	
10	2017/18	Oct 17	Feb 18	Apr 18	Jun 18	
11	2018/19	Nov 18	Jan 19	Feb 19	May 19	
12	2019/20	Sep 19	Nov 19	May 20	Jun 20	
13	2020/21	Sep 20	Oct 20	Apr 21	May 21	Aug 21
14	2021/22	Sep 21	Nov 21	Mar 22	Jul 22(*)	

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

1. Introduction

1.1 Study Area

South Tyneside Council's frontage extends from the mouth of the River Tyne Estuary to the outfall south of Whitburn. For the purposes of this report and for consistency with previous reporting, it has been sub-divided into four areas, namely:

- Littlehaven Beach
- Herd Sands
- Trow Quarry (incl. Frenchman's Bay)
- Marsden Bay

1.2 Methodology

Along South Tyneside Council's frontage, the following surveying is undertaken:

- Full Measures survey annually each autumn comprising:
 - Beach profile surveys along 17 transect lines (commenced 2008)
 - Topographic survey along Littlehaven Beach (commenced 2010)
 - Topographic survey along Herd Sands (commenced 2008)
 - Topographic survey along Trow Quarry (commenced 2008). Note the 2008 surveys at profiles 1bSS11, 1bSS12 and 1bSS13 were undertaken at a different location to subsequent surveys and have therefore been removed from the analysis presented here
- Partial Measures survey annually each spring comprising:
 - Beach profile surveys along 11 transect lines (commenced 2008)
 - Topographic survey along Littlehaven Beach (commenced 2010)
 - Since 2014, Partial Measures survey has also included 2 additional profiles at Littlehaven. These are measured to record the new defence and beach profiles following completion of the sea defence works.
- Cliff top survey bi-annually at:
 - Cliff top survey at Trow Quarry (incl. Frenchman's Bay) (commenced 2008)

For all cliff-top surveys prior to Full Measures 2011, data was reported separately in Trow Quarry Coastal Defence Scheme - Monitoring Plan Year 2 (available from South Tyneside Council). The data was saved in '.kmz' format for plotting and comparison in Google Earth. For the present survey report, this data has been visualised in GIS, which revealed the quality was variable and reliable interpretations of cliff change could not be made. For this reason, the 'kmz' files are not presented or analysed as part of the present report. Therefore, cliff top survey data collected from Full Measures survey (autumn 2011) going forward is presented in this report. The location of these surveys is shown in Figure 2.

The Partial Measures survey was undertaken along this frontage between 30th March 2022 and 31st March 2022. During this time weather conditions were variable; refer to the survey reports for details of the weather conditions over this survey period.

This Update Report presents the following:

- description of the changes observed since the previous survey and an interpretation of the drivers of these changes (Section 2);
- documentation of any problems encountered during surveying or uncertainties inherent in the analysis (Section 3);
- recommendations for 'fine-tuning' the programme to enhance its outputs (Section 4); and
- 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 (Green)
- yearly (Orange)
- 5 yearly (Purple)

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

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

Title: **Figure 2 - Map 1**
LITTLEHAVEN BEACH to MARSDEN BAY
South Tyneside Council Frontage

Report: **Survey Report**

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

Co-ordinate system: British National Grid

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

2. Analysis of Survey Data

2.1 Littlehaven Beach

Survey Date	Description of Changes Since Last Survey	Interpretation
<p>30th – 31st March 2022</p>	<p>Beach Profiles:</p> <p>Littlehaven Beach is covered by four beach profile lines for the Partial Measures surveys, distributed between South Groyne and South Pier (1bSS1, 1bSS2, 1bSS3 and 1bSS4). The previous survey was the Full Measures survey undertaken in September 2021 and the previous Partial Measures survey was undertaken in April 2021. Profiles 1bSS1 and 1bSS3 were last surveyed during the Partial Measures spring survey 2021. Profiles 1bSS2 and 1bSS4 were last surveyed during the Full Measures autumn survey 2021.</p> <p>Profile 1bSS1 is located towards the north of Littlehaven Beach, in the lee of a rocky outcrop and harbour wall. The back dunes have undergone little change, with sections of accretion and erosion limited to ± 0.1m. The lower dune face and toe of the dunes has accreted by up to 0.3m to chainage 65m. Beach levels across the rest of the beach profile have risen by varying amounts, ranging from 0.1m on the middle beach and 0.3m on the lower beach to the exposed rock patch at chainage 150m. Overall, the dunes and beach are at a high level compared to the range recorded from previous surveys, particularly on the lower dune face and upper beach between chainages 56-64m which is at its highest level recorded. The middle and lower beach profile is at a medium-low level compared to the range recorded from previous surveys.</p> <p>Profiles 1bSS2 to 1bSS4 extend seawards from the new sea wall that was completed in 2014.</p> <p>At profile 1bSS2, beach levels at the toe of the seawall have risen by up to 0.3m to chainage 12m. Between chainages 12m and 51m the beach has lowered by up to 0.6m, before switching to accretion across the middle-lower beach by up to 0.4m to chainage 85m. The lower beach seaward of chainage 85m has lowered by up to 0.2m. Overall, the upper and middle beach profile are at a medium level and the lower beach is at a low level compared to the range recorded from previous surveys.</p> <p>At profile 1bSS3 there has been varying sections of accretion and erosion across the upper beach by ± 0.3m. The toe of the seawall has been covered by sediment. Overall, the upper and middle beach profile</p>	<p>Overall, there has been alternating bands of erosion and accretion across Littlehaven beach. Generally, all profiles have risen on the upper beach.</p> <p>Longer term trends: When compared with previous profile surveys, profiles 1bSS1 to 1bSS4 range between a low to high level. The profiles indicate normal seasonal behaviour with no clear trend.</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>is at a medium-high level and the lower beach is at a low level compared with the range recorded from previous surveys.</p> <p>At profile 1bSS4 there has been accretion on the upper beach between the seawall and chainage 70m by up to 0.5m. The middle beach has lowered by up to 0.3m to chainage 116m. The lower beach has accreted by up to 0.2m to the end of the survey at chainage 142m. Overall, the upper and middle beach is at a medium level compared to the range recorded from previous surveys, whilst the lower beach is at a low level.</p>	
<p>March 2022</p>	<p>Topographic Survey:</p> <p>Littlehaven Beach is covered by bi-annual topographic survey between the South Groyne and the South Pier, which commenced in March 2010.</p> <p>Data from the most recent topographic survey (Partial Measures, spring 2021) have been used to create a DGM (Appendix B – Map 1a) using a Geographical Information System (GIS). A difference plot has also been produced using the DGM (Appendix B – Map 1b) produced from the last produced topographic survey (Full Measures, autumn 2021) and the present survey. The survey report notes that 'heavy onshore winds on the 30/03/22 restricted the depth achievable for the topographical survey'.</p> <p>The difference plot shows a clear a pattern of change across the beach, which reflects the beach profile data. The plots show, in general terms, alternating bands of change, which extend from north to south, and comprise: (i) a band of patchy accretion / little change ($\pm 0.1\text{m}$) parallel to the new defences on the upper beach; (ii) a band of erosion on the middle beach which narrows from the south toward the central beach and disappears in the north; and (iii) a band of accretion / little change ($\pm 0.1\text{m}$) on the lower beach which is at its widest from the central beach to the north (except in the south which shows erosion on the lower beach). Change is limited to $\pm 0.5\text{-}0.75\text{m}$. The pattern of alternating bands of erosion and accretion suggests cross-shore movements of sediment. The dunes at the northern end of the bay generally remained stable.</p>	<p>The pattern of beach elevation change observed from the topographic difference plot indicates distinct areas of erosion and accretion, associated with migration of sand bars across the beach face.</p>

2.2 Herd Sands

Survey Date	Description of Changes Since Last Survey	Interpretation
<p>30th – 31st March 2022</p>	<p>Beach Profiles:</p> <p>Herd Sands is covered by three beach profile lines for the Partial Measures survey (Appendix A). The previous survey was the Full Measures survey undertaken in autumn 2021.</p> <p>Profile 1bSS5 is located towards the northern end of Herd Sands, in the lee of the breakwater. Sand fences were constructed on the dunes in 2012 to encourage accretion and stabilisation. Generally, the dunes have accreted since the previous survey by up to 0.2m to chainage 84m. The seaward face of the foredune between chainages 95-105m has eroded by 0.1m. The upper beach between the foredune and chainage 260m has lowered by up to 0.2m. A small section of the middle-lower beach has risen by up to 0.3m between chainage 260-308m. Seaward of this point, the lower beach has lowered by 0.5m. The dunes remain at a high level, particularly between chainages 67-86m which is at its highest level recorded. The rest of the beach profile is at a medium level compared to the range recorded from previous surveys.</p> <p>Profile 1bSS8 is located to the south of Herd Sands. The upper beach has risen by up to 0.9m to chainage 23m, forming a berm at chainage 11m. The upper beach berm at chainage 40m has been removed, with the erosion of up to 1.2m. This has filled in a previous hollow at chainage 90m with the accretion of up to 1.2m to chainage 182m. The beach profile has smoothed since the previous survey and is at a high level compared to the range recorded from previous surveys.</p> <p>Profile 1bSS9 is located to the south of Herd Sands where dunes have accreted by up to 0.1m since the previous survey. The majority of the beach profile has risen by up to 0.2m on the upper beach, 0.1m on the middle beach and 0.6m on the lower beach. There is a small section of erosion between chainages 54-64m which has lowered by up to 0.3m. Overall, the dunes are at their highest level recorded. The rest of the beach profile is at a high level compared to the range recorded from previous surveys.</p>	<p>Since the last survey, the dunes at Herd Sands have, on the whole remained stable, with some small sections of accretion and erosion.</p> <p>Although the dunes have accreted to the north of Herd Sands, the beach is dominated by erosion. To the south of Herd Sands, the profiles are dominated by accretion which has resulted in a smoother profile at 1bSS8.</p> <p>Longer term trends: On the whole, the beach is within the range of levels seen in earlier surveys. The dunes between chainages 67-86m at profile 1bSS5 and 1bSS8 are at their highest level recorded.</p>

2.3 Trow Quarry (incl. Frenchman’s Bay)

Survey Date	Description of Changes Since Last Survey	Interpretation
<p>30th – 31st March 2022</p>	<p>Beach Profiles:</p> <p>Trow Quarry is covered by four beach profile lines for the Partial Measures survey (Appendix A), two in Graham’s Sand and two in Southern Bay. The previous survey was the Full Measures survey undertaken in autumn 2021.</p> <p>Profiles 1bSS10 and 1bSS11 are located in Graham’s Bay.</p> <p>At profile 1bSS10, there has been varying sections of erosion and accretion between 0-65m by ± 0.5m. The beach profile between chainage 65-112m has risen by up to 1.1m, before switching to erosion at the end of the profile by up to 0.2m. Overall, the upper and middle beach is at a low level compared to the range recorded from previous surveys whilst the lower beach is at a medium level compared to the range recorded from previous surveys.</p> <p>At profile 1bSS11, the beach profile has remained stable since the previous survey.</p> <p>Profiles 1bSS12 and 1bSS13 are located in Southern Bay. At both locations the beach profile has remained stable since the previous survey.</p>	<p>Since the last survey at Graham’s Bay and Southern Bay the cliff, rock revetment and upper boulder/cobble rocky beach have, on the whole, remained stable. There has been an increase in elevation of the lower beach at profile 1bSS10.</p> <p>In Southern Bay, there is no change evident from the profiles, but the presence of cobble-sized beach material in the gaps between rock armour blocks (evident in the survey photographs) indicates sufficient wave energy to move this material.</p> <p>Longer term trends: At both Graham’s Bay and Southern Bay the beach levels are generally within the range of levels seen in previous surveys, indicating changes are within typical seasonal variation.</p>
<p>March 2022</p>	<p>Cliff-top Survey:</p> <p>Cliff top survey data collected for the baseline survey (autumn, 2011), Full Measures survey (autumn, 2021) and the present Partial Measures survey (spring, 2022) is presented in this report.</p> <p>Six ground control points (numbered 1 – 6) were established along the cliff top at Trow Point in 2011 to monitor cliff erosion at the headland adjacent to the site of a former landfill. Note: the numbering of ground control points is not intended to correlate with that of the beach profile lines and reference should be made to Appendix C – Map 1 for the location of ground control points.</p> <p>These cliff top surveys are undertaken bi-annually. Measurements are taken from each ground control point along a fixed bearing to the edge of the cliff top. The results from the cliff top monitoring are anticipated to have an accuracy of ± 0.2m due to the technique used. The results from the cliff top survey are presented in Appendix C – Table C1, showing the position from the ground control point to</p>	<p>Since the last survey, three ground control points have experienced erosion greater than the survey error (Points 1, 4 and 5). Two points have appeared to accrete however this is attributed to differences in cliff top vegetation position.</p> <p>Longer term trends: Very limited change has been detected since surveys began in November 2011.</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>the edge of the cliff top along a defined bearing.</p> <p>Results show that since the last survey in September 2021, three ground control points recorded erosion greater than the survey error (Point 1: 0.49m, Point 4: 0.47m and Point 5: 0.39m). Points 2, and 3 reportedly experienced accretion (however none were greater than the survey error). Given that accretion is highly unlikely in this area, the accretion recorded is most likely changes in recorded cliff top vegetation position. No change greater than the survey error has been recorded over the long term.</p>	

2.4 Marsden Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
30 th – 31 st March 2022	<p>Beach Profiles:</p> <p>Marsden Bay is covered by two beach profile lines for the Partial Measures survey (Appendix A). The previous survey was the Full Measures survey undertaken in autumn 2021.</p> <p>Profile 1bSS14 is located to the north of the bay and covers the cliffs and former lifeguard station adjacent to the Redwell Steps. The survey report notes that '<i>a section of cliff face could not be measured due to ground conditions being unsafe</i>'. The survey between 0-102m cannot be compared to the previous survey as there were access issues during autumn 2021 associated with the removal of structures in the area. The beach seaward of this point has generally risen by up to from chainages 102m to 0.3m, except for a small section on the upper beach which has lowered by up to 0.2m. Overall, the beach profile is at a low level compared to the range recorded from previous surveys.</p> <p>Profile 1bSS17 is located to the south of the bay. There is no change in the position of the cliff top. There has been an apparent seaward movement of the cliff toe, however this is assumed to be due to rock falls immediately below the cliff face. Seaward of 70m chainage, the rocky beach and shore platform has not changed in profile. Overall, the profile is at a low level compared to the range recorded from previous surveys.</p>	<p>At profile 1bSS14 the beach has showed both erosion and accretion across the profile, whilst the beach at profile 1bSS17 shows very little change since the previous survey.</p> <p>Longer term trends: At profile 1bSS14 and 1bSS17 the beach levels are within the bounds of previous changes, indicating fluctuating seasonal or interannual behaviour with no particular trend.</p>

3. Problems Encountered and Uncertainty in Analysis

Individual Profiles / Topographic Survey

- A section of cliff face could not be surveyed at profile 1bSS14 due to ground conditions being unsafe. The original Redwell Steps and adjacent lifeguard station and canoe store were demolished in 2020 due to their deteriorating condition and public health and safety risk. In 2021 a new access was constructed comprising three flights of timber access steps and localised works to the existing concrete ramp landward from the steps. The new Redwell Steps were opened to the public in late 2021.
- Heavy onshore winds on the 30/03/22 restricted the depth achievable for the topographical survey.

Cliff Top Surveys

- Surveying any cliff top is difficult due to the need for a consistent interpretation of the cliff edge in successive surveys, which can be challenging, especially when vegetation is thick. For these reasons, it has been assumed that any changes of $\pm 0.2\text{m}$ may be considered as being within the accuracy of the surveying technique and that any indication of an advancing cliff line is error.

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

- No changes are recommended at the present time.

5. Conclusions and Areas of Concern

- At Littlehaven Beach, the recorded profiles and topographic survey present no causes for concern. Overall, profiles have undergone alternating bands of erosion and accretion, with all profiles dominated by accretion on the upper beach.
- At Herd Sands, the dunes have generally accreted. The beach to the north of Herd Sands is dominated by erosion, whilst the beach to the south is dominated by accretion. The recorded profiles present no causes for concern.
- At Trow Quarry, the recorded profiles present no causes for concern. The cliffs to the north west of Trow Headland appear to have remained stable.
- At Marsden Bay, the recorded profiles present no causes for concern. The beach at 1bSS14 showed both erosion and accretion across the profile.

Appendices

Appendix A
Beach Profiles

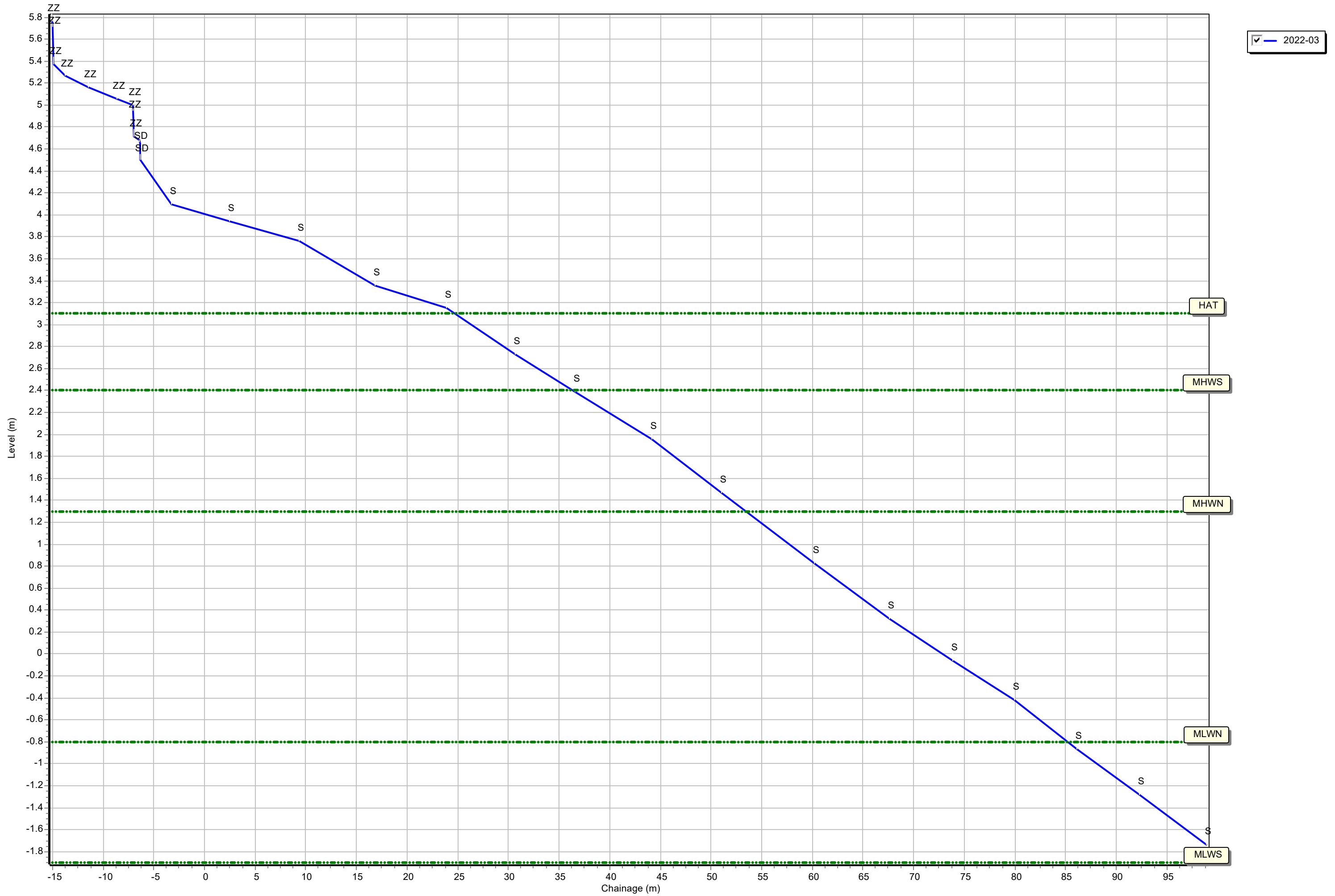
The following sediment feature codes are used on some profile plots:

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

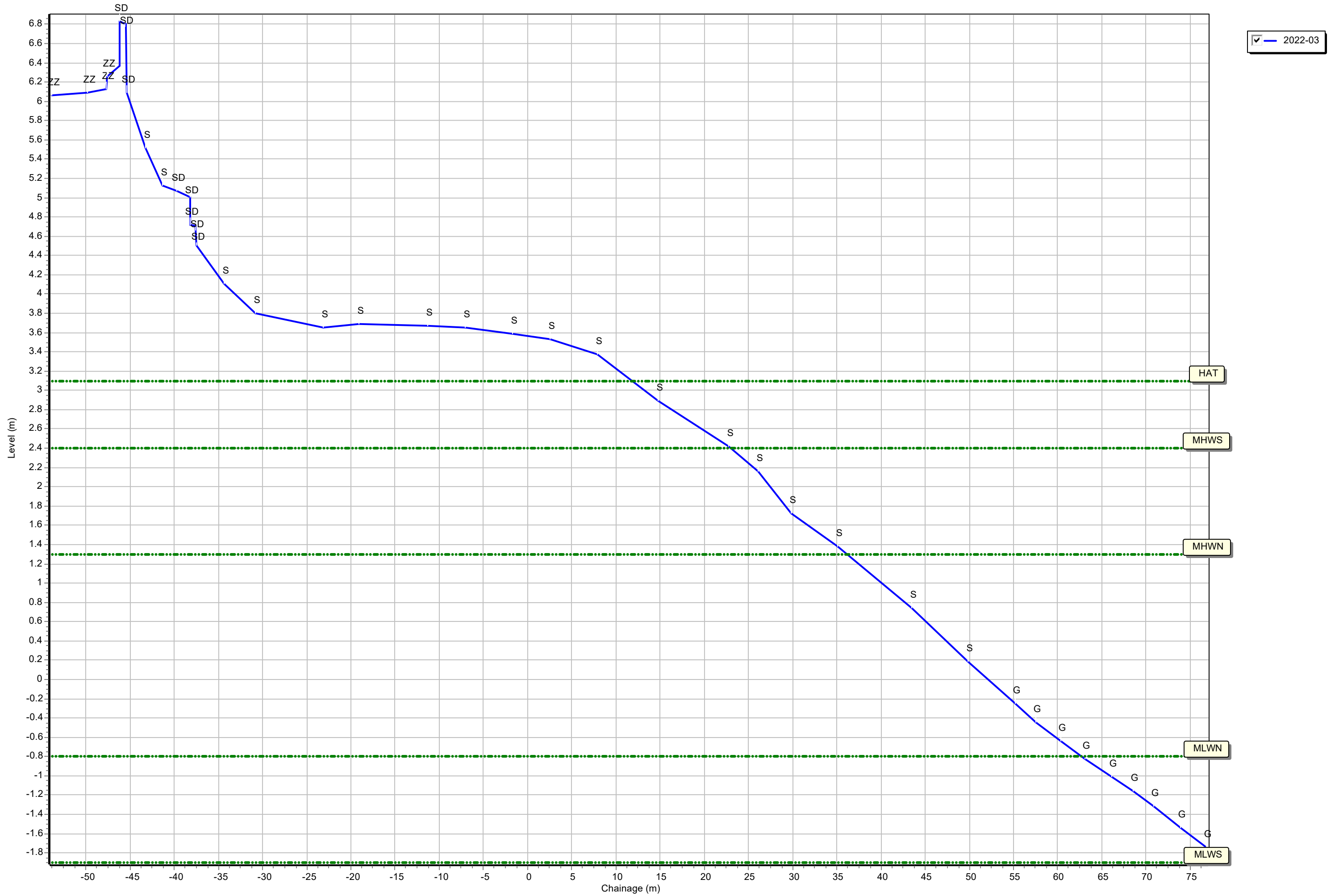
Profiles: 1bSS1



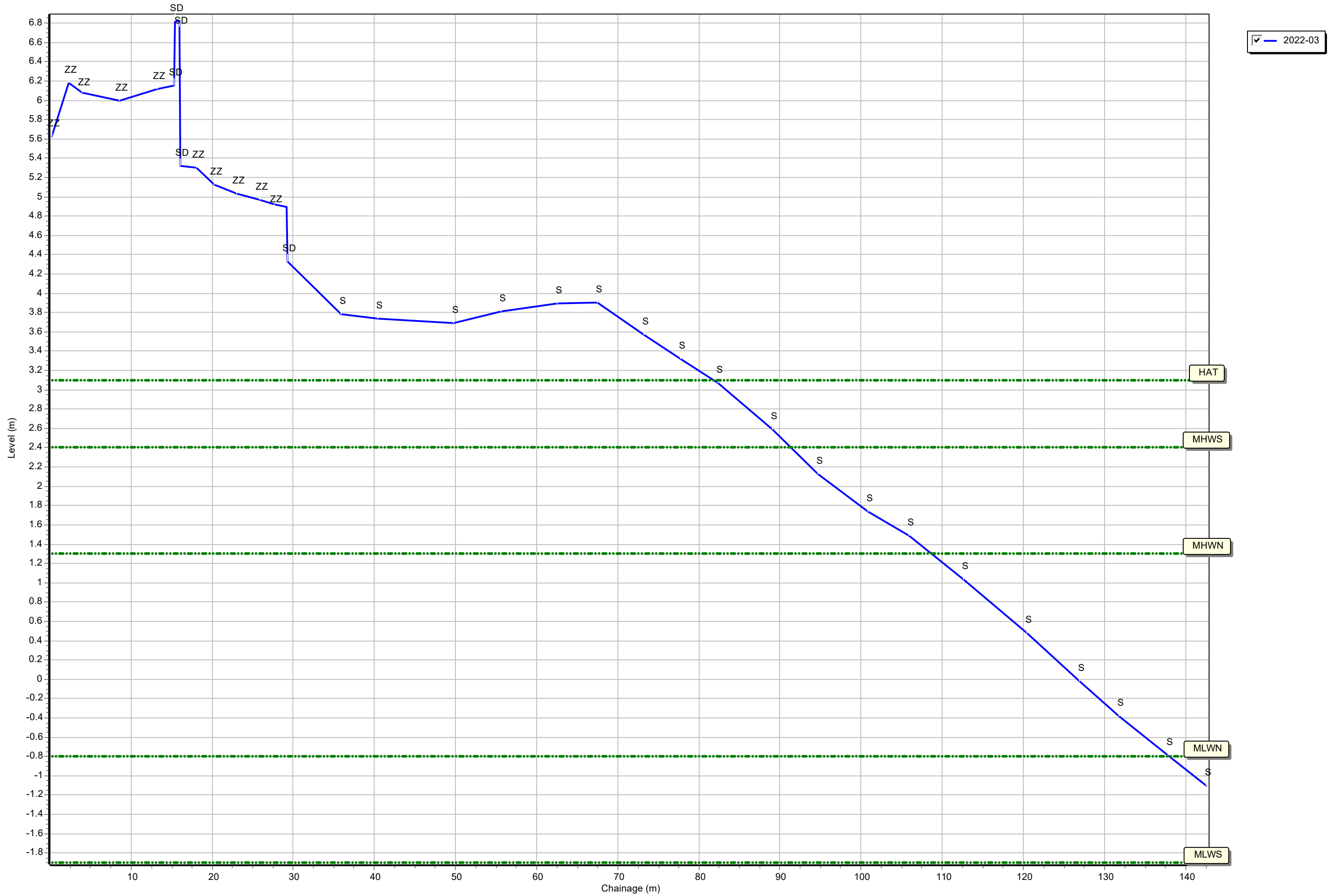
Profiles: 1bSS2



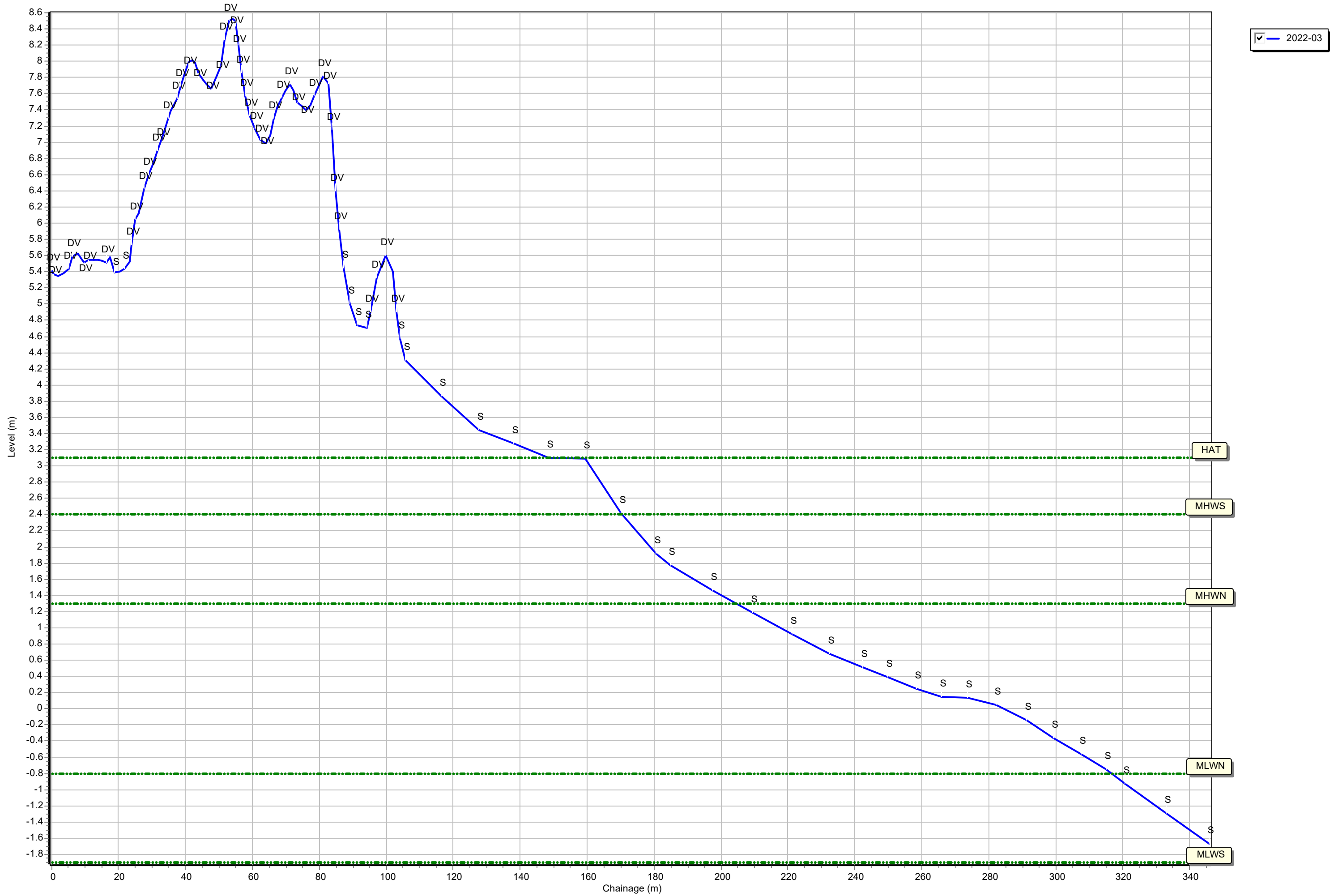
Profiles: 1bSS3



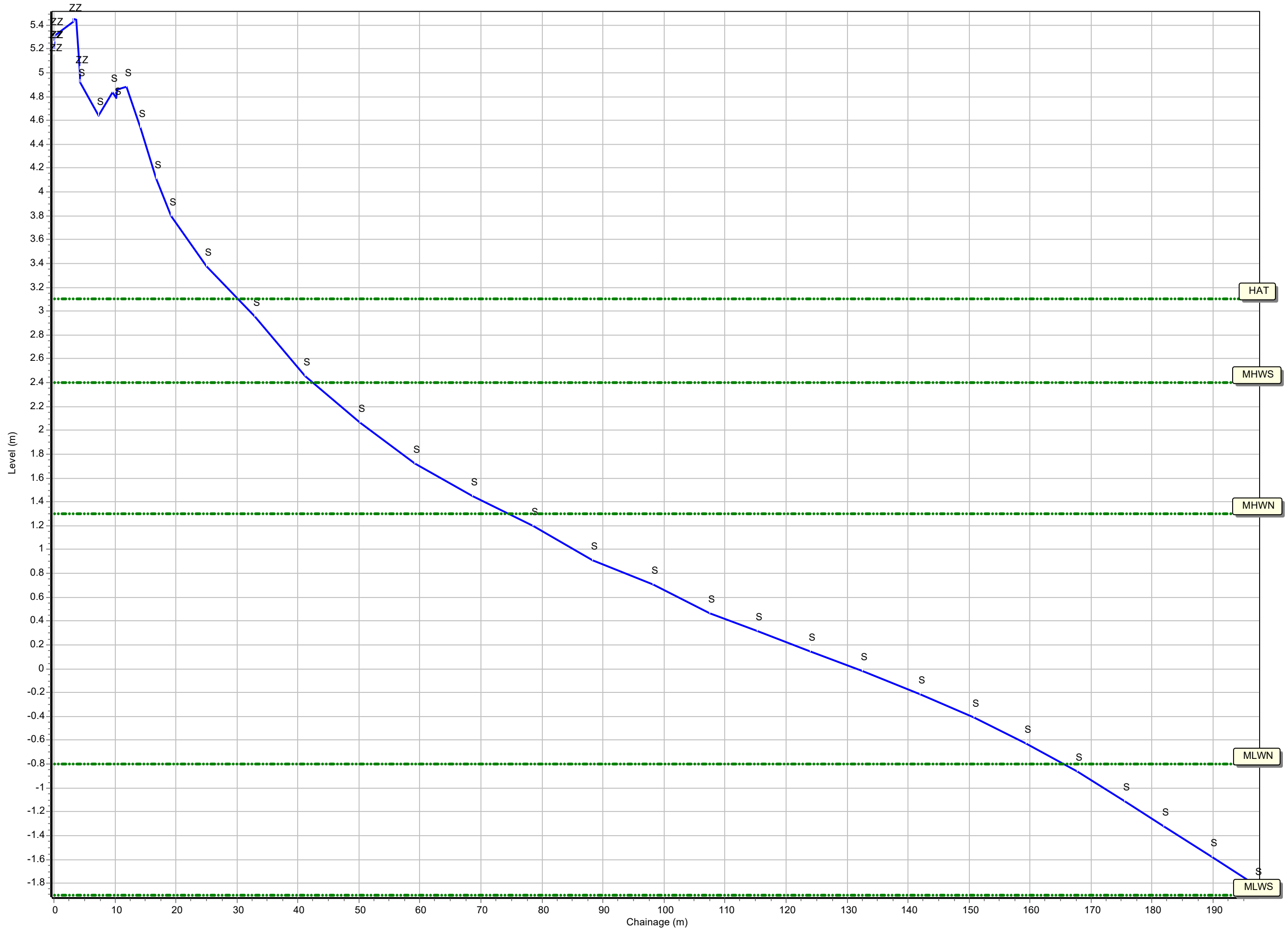
Profiles: 1bSS4



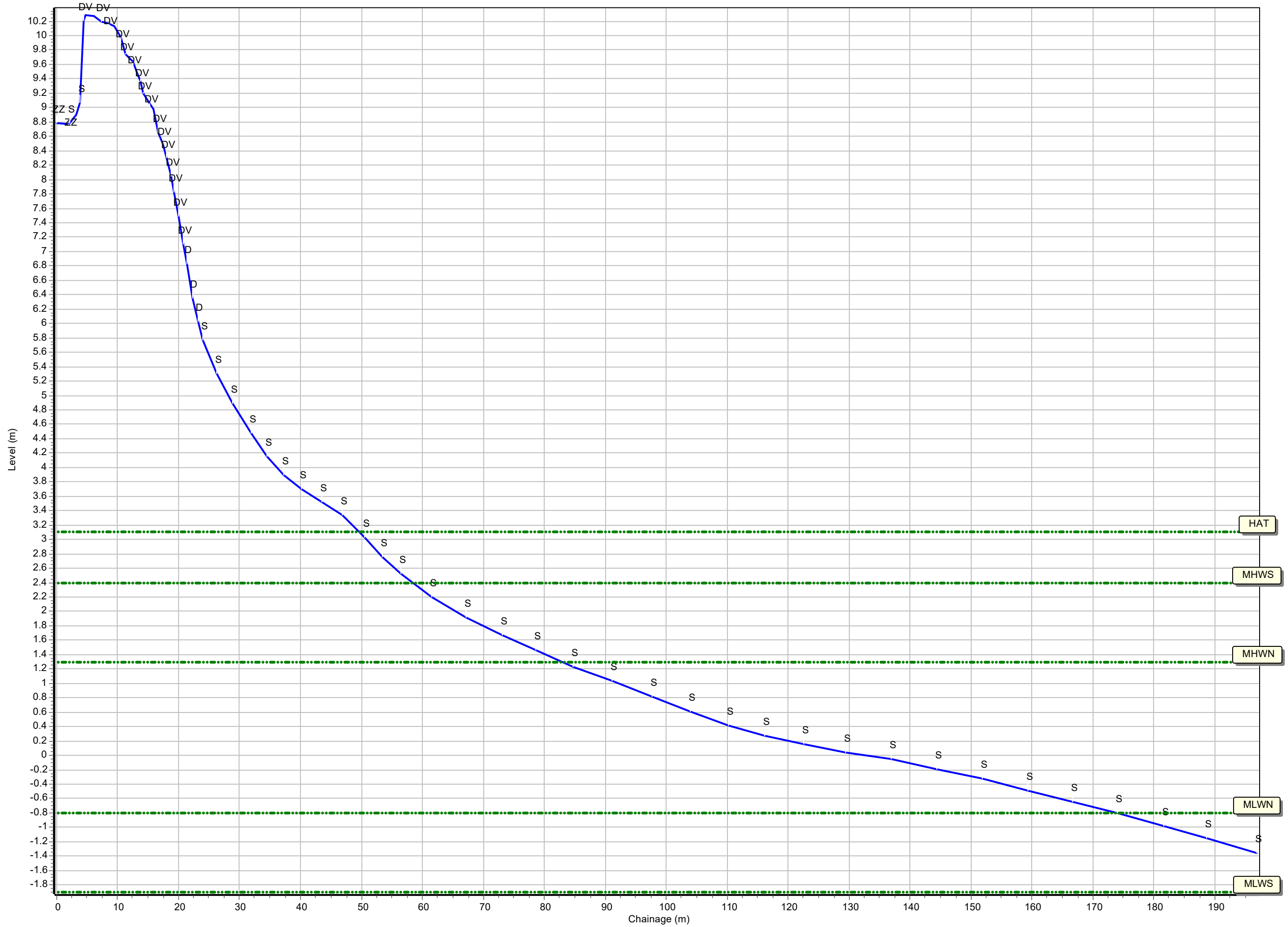
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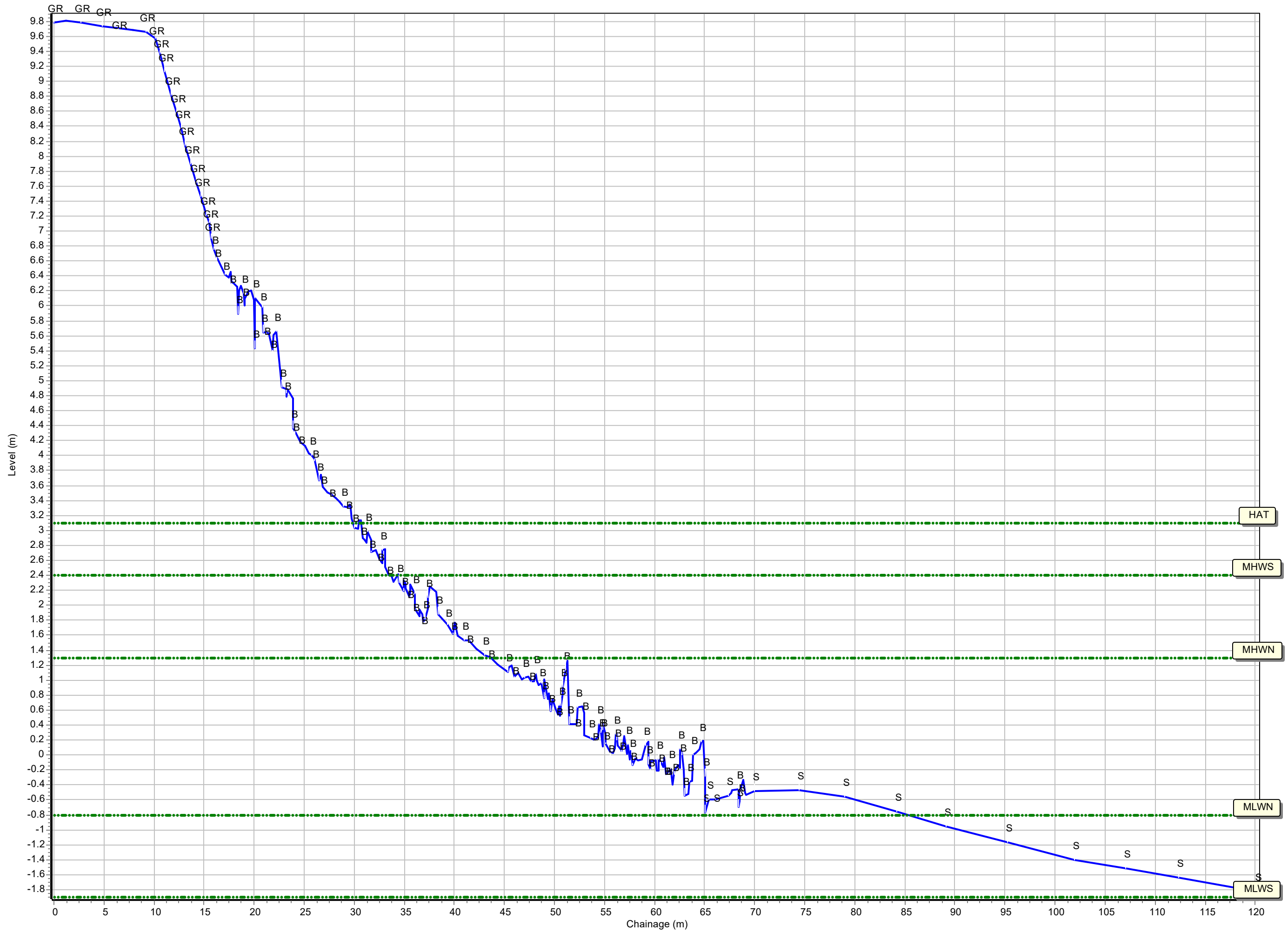
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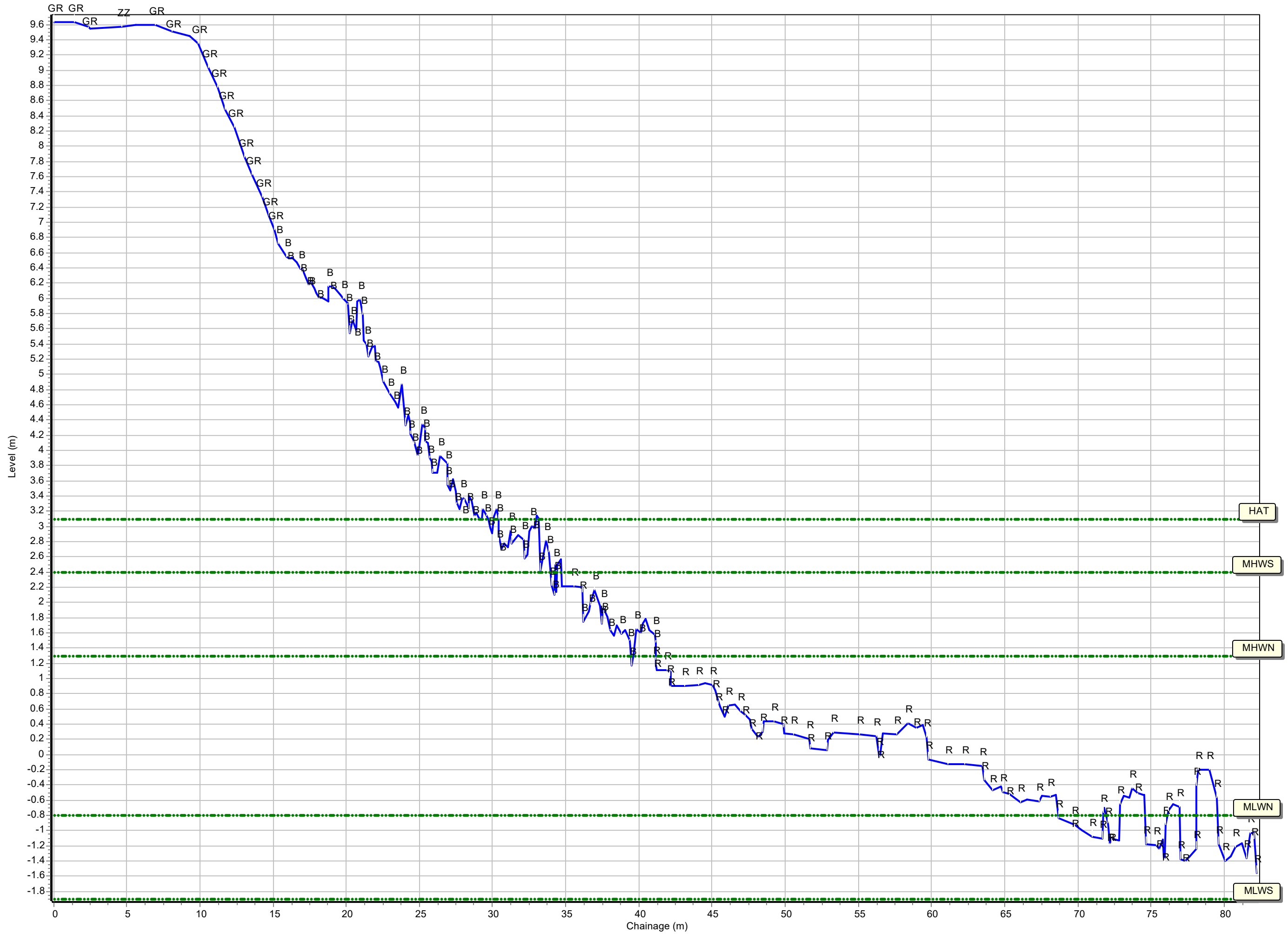
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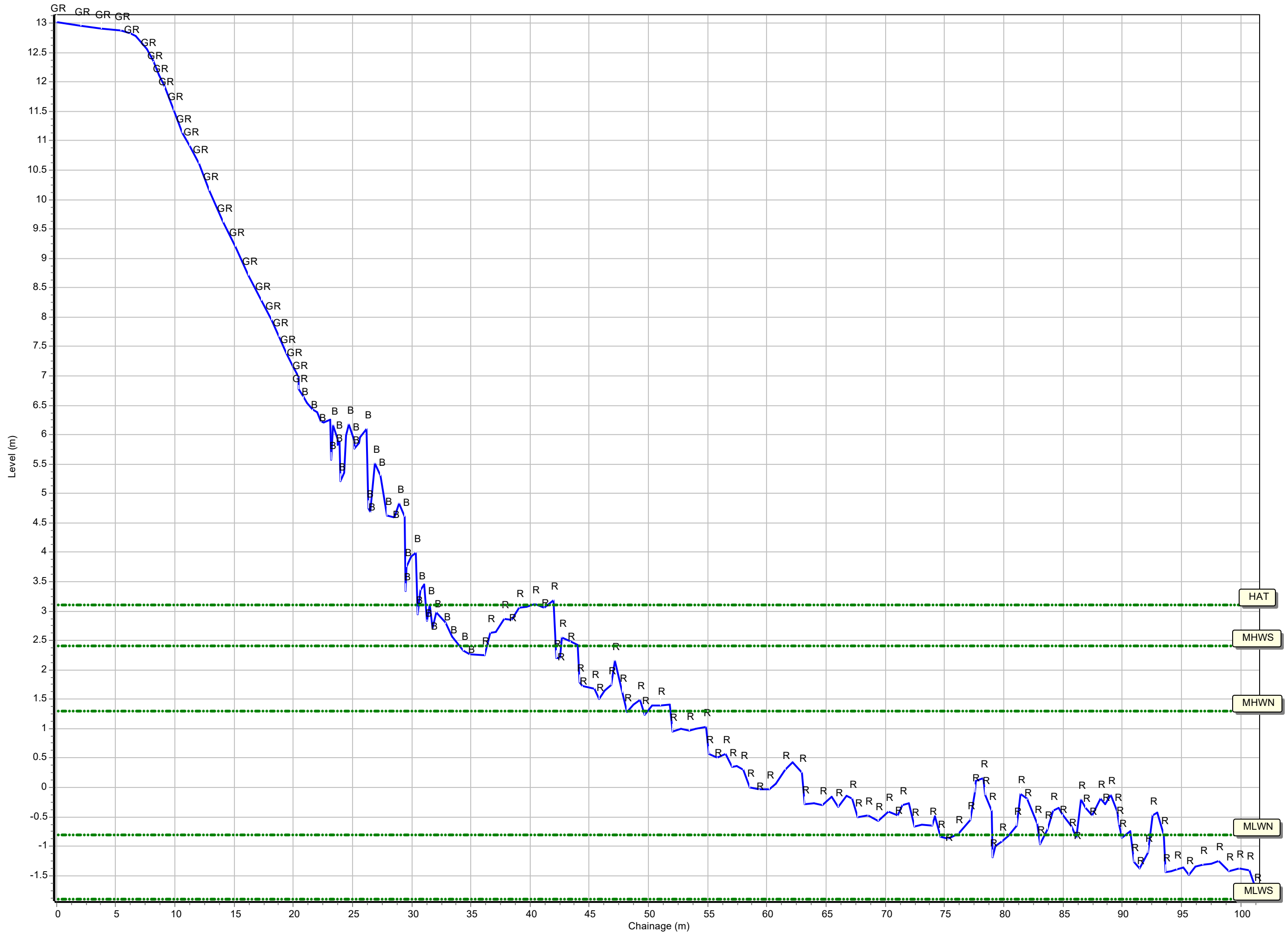
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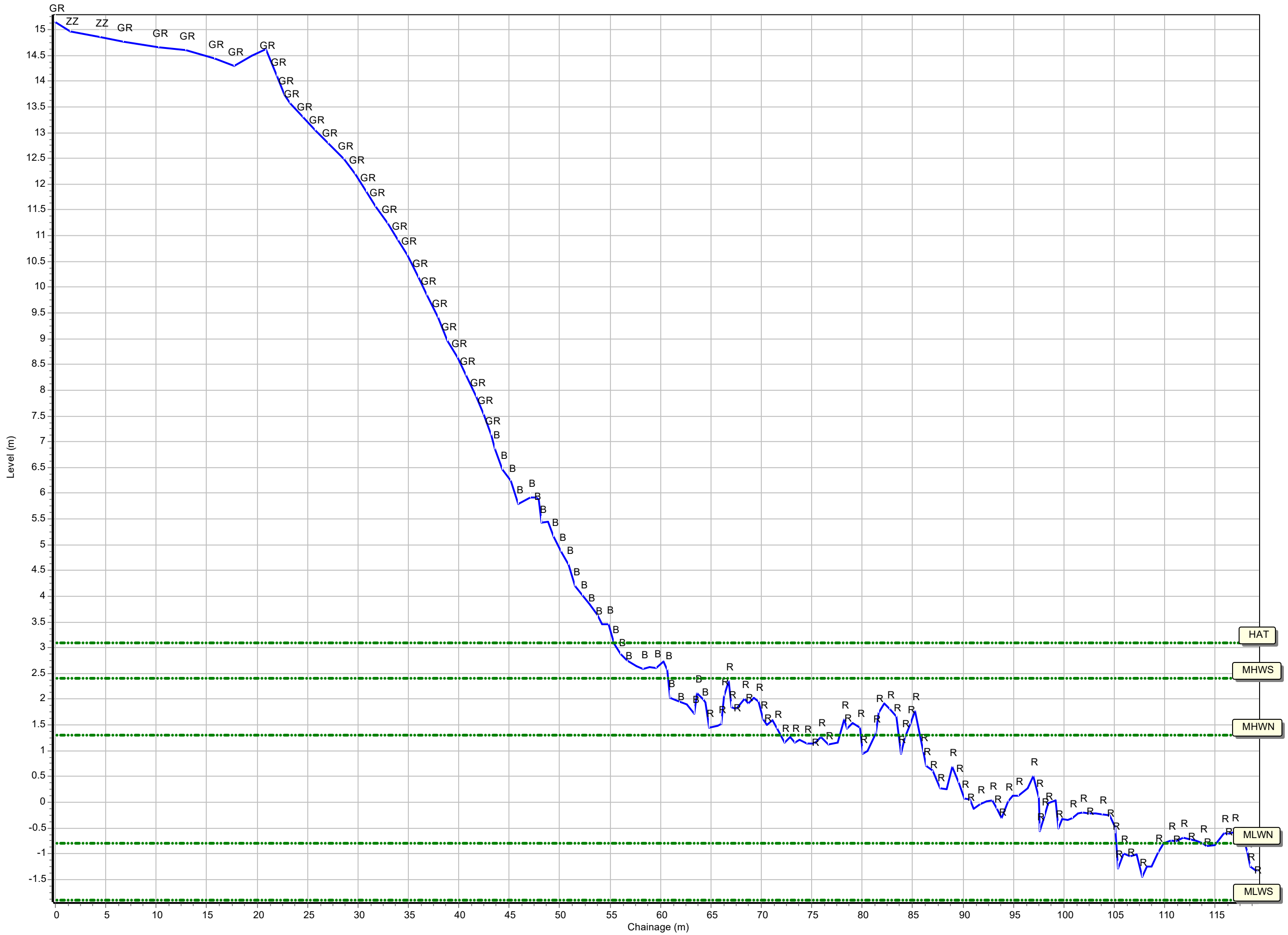
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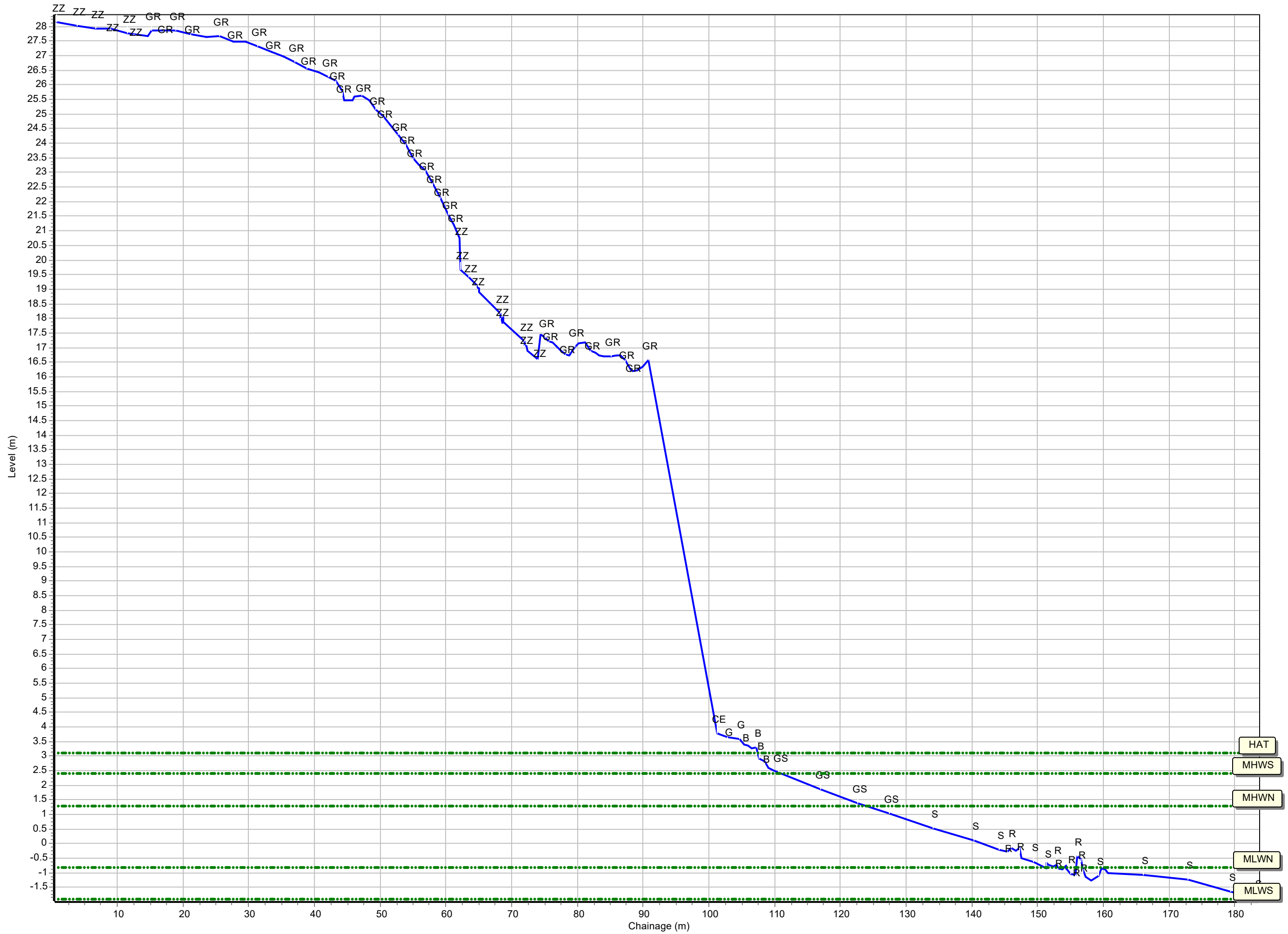
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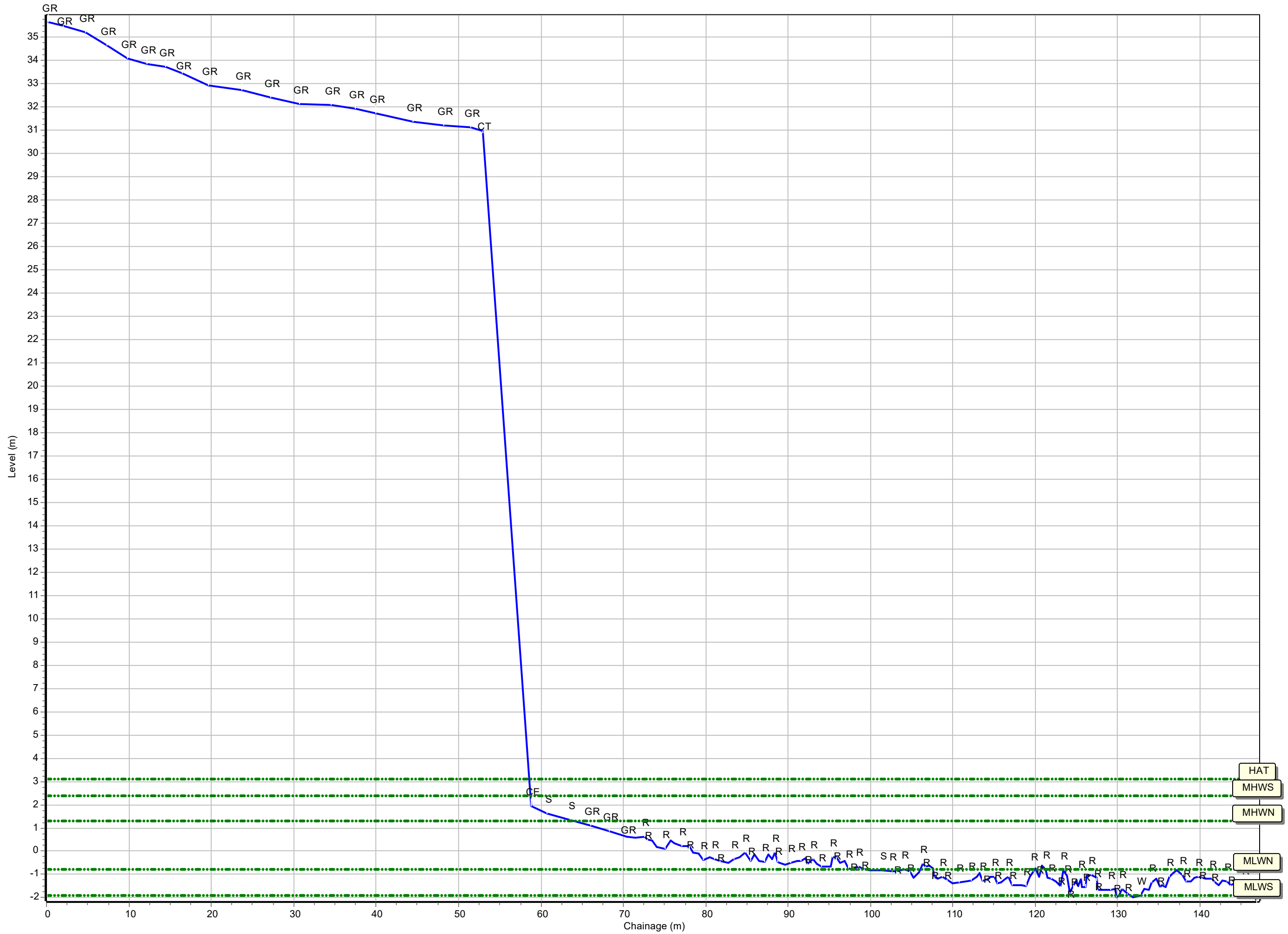
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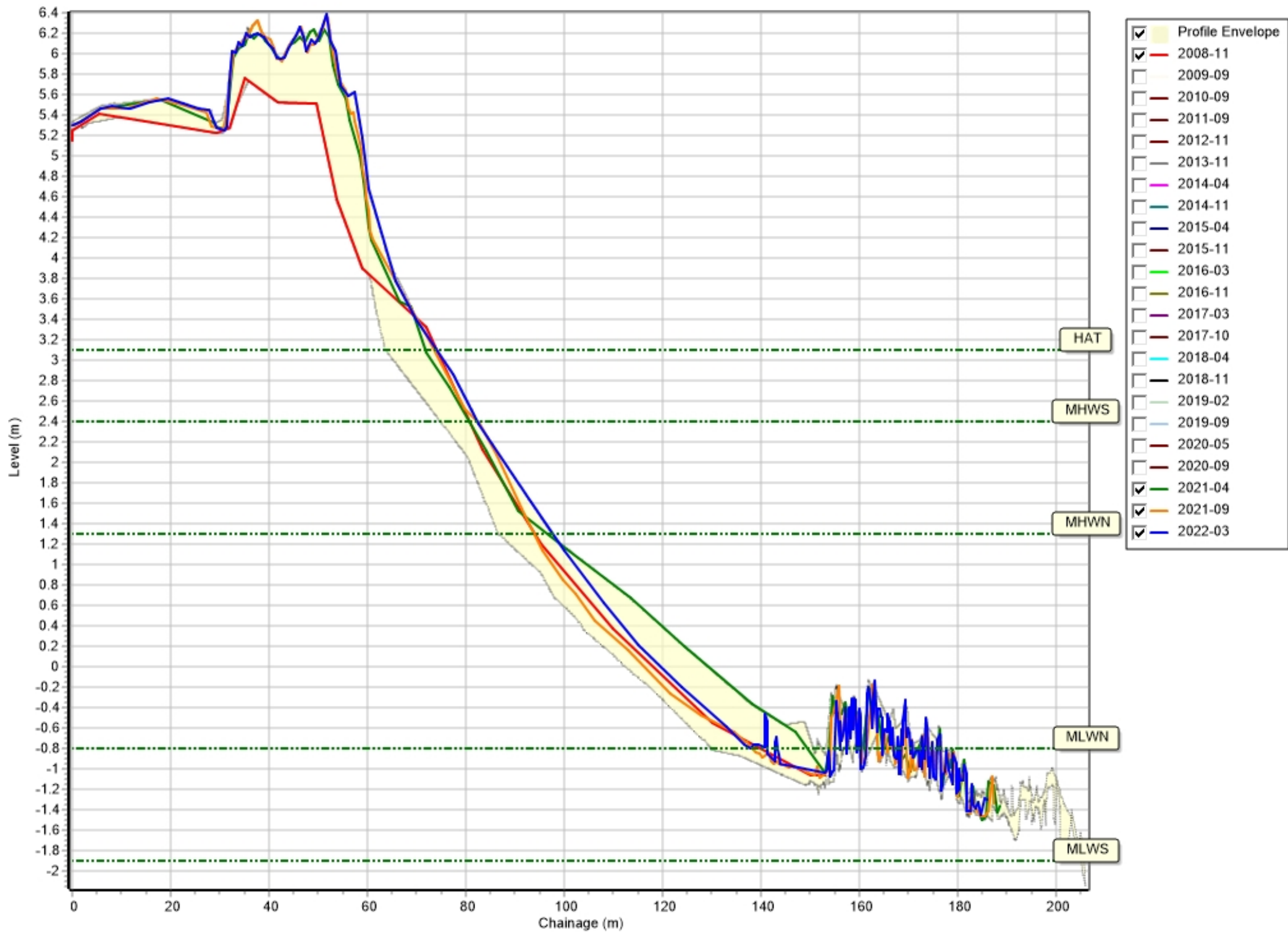
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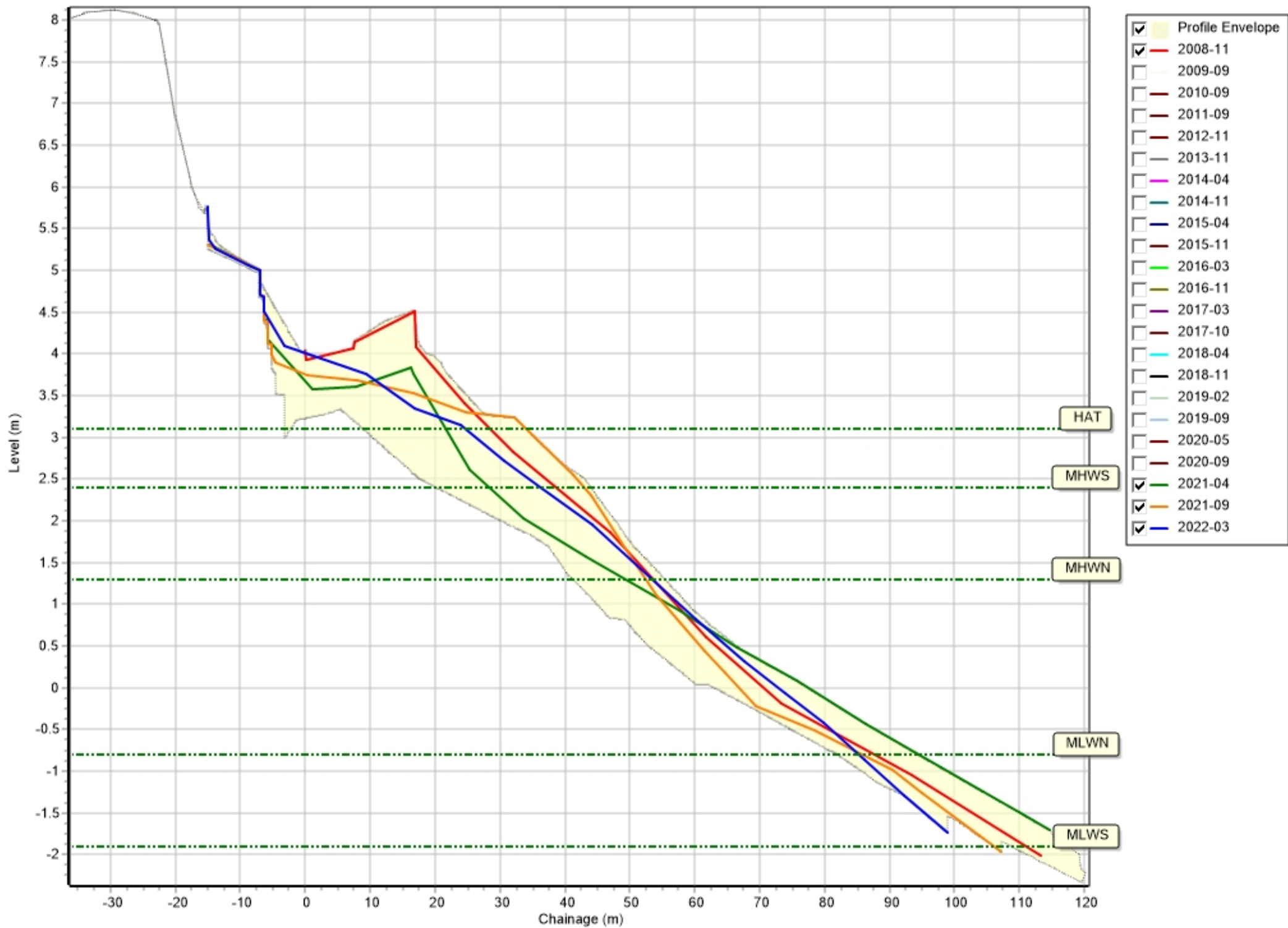
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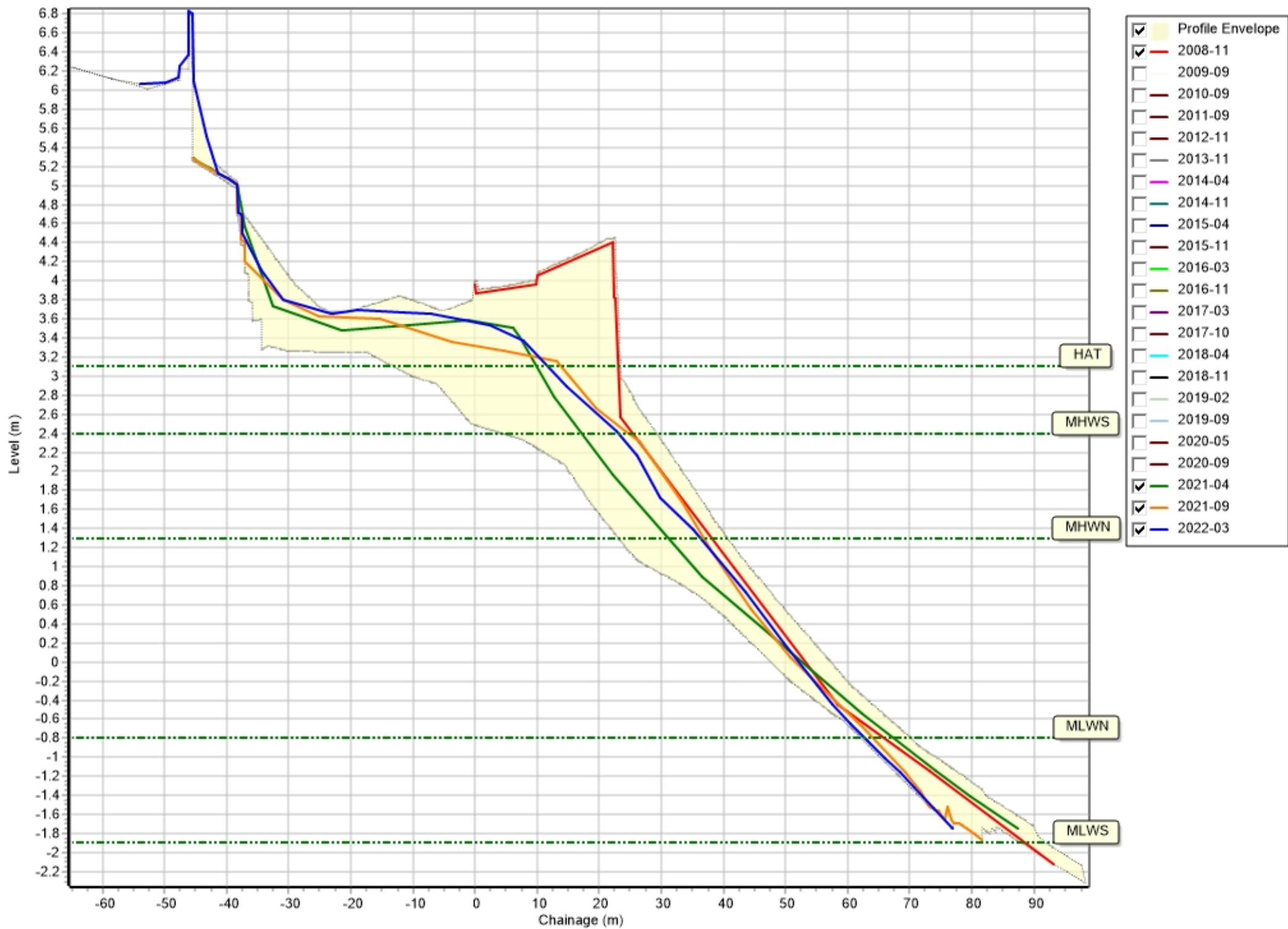
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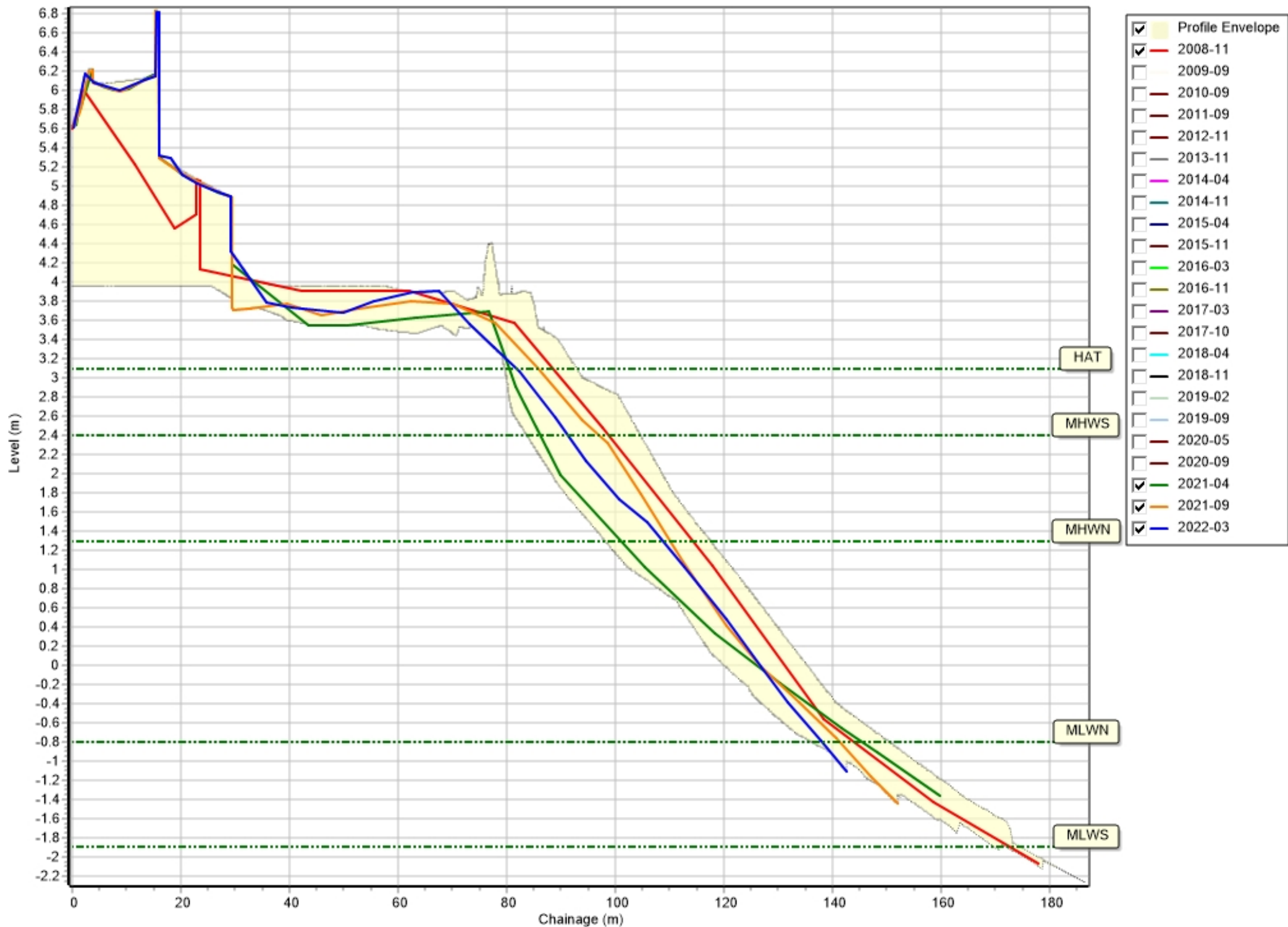
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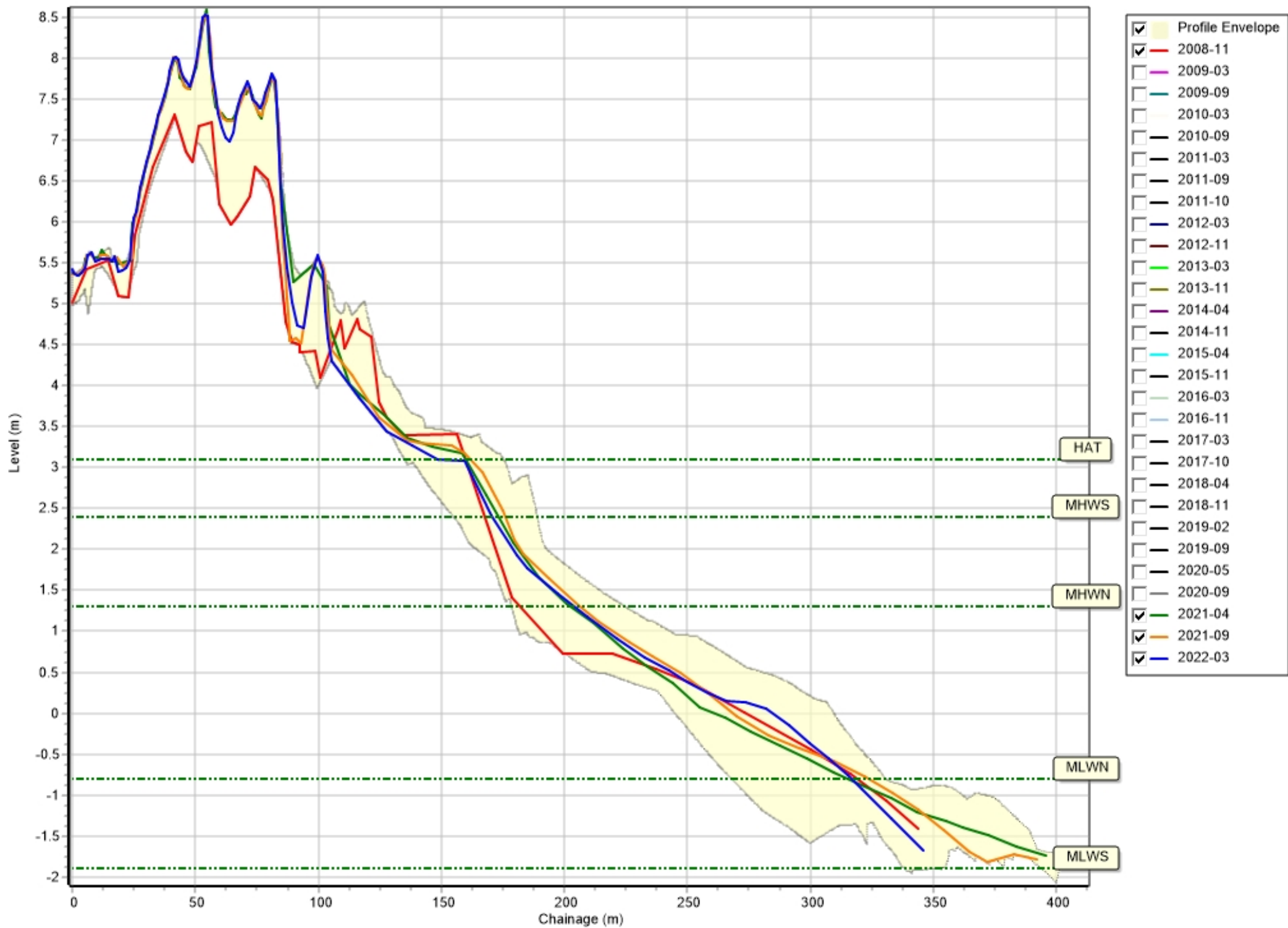
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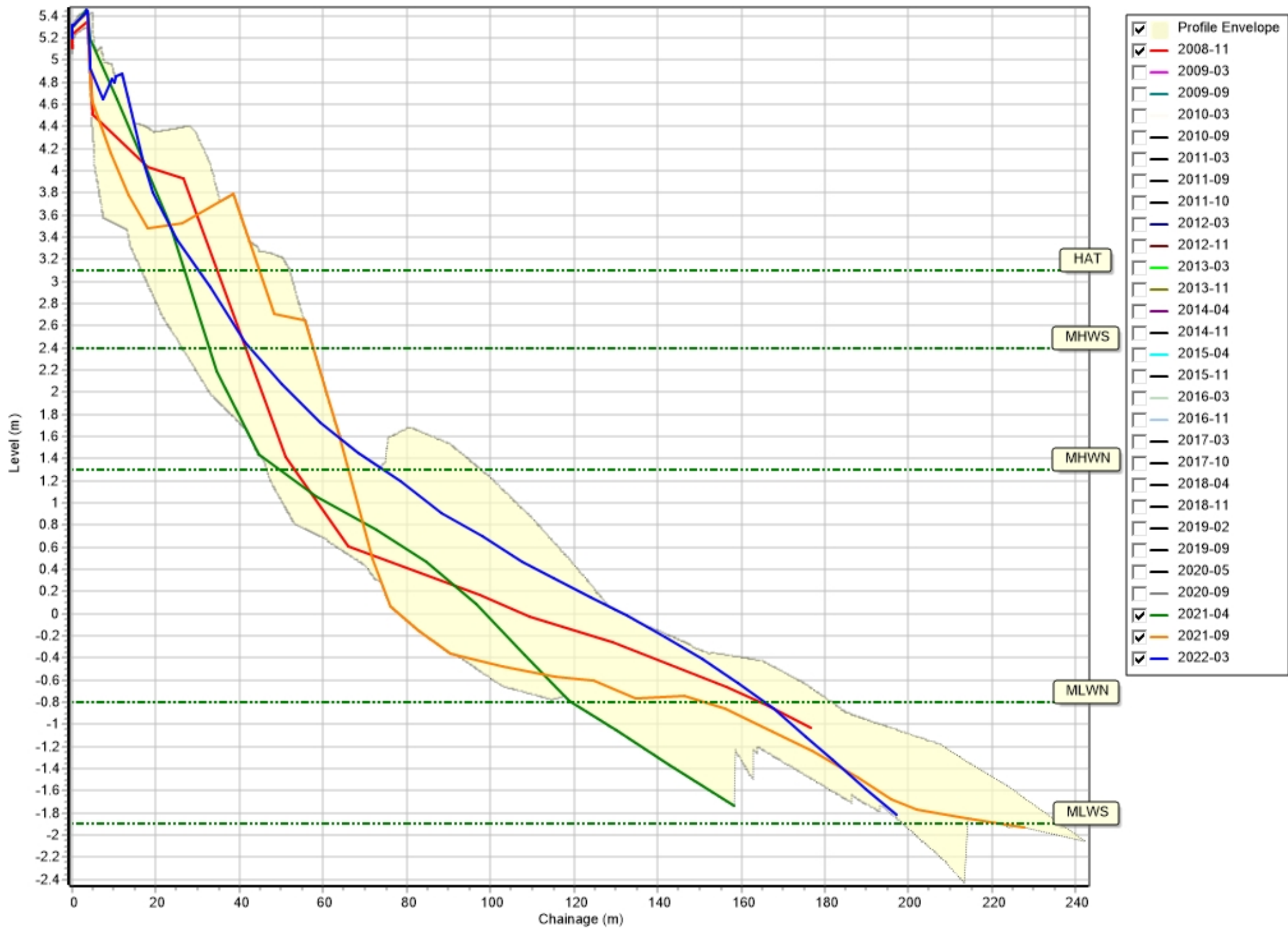
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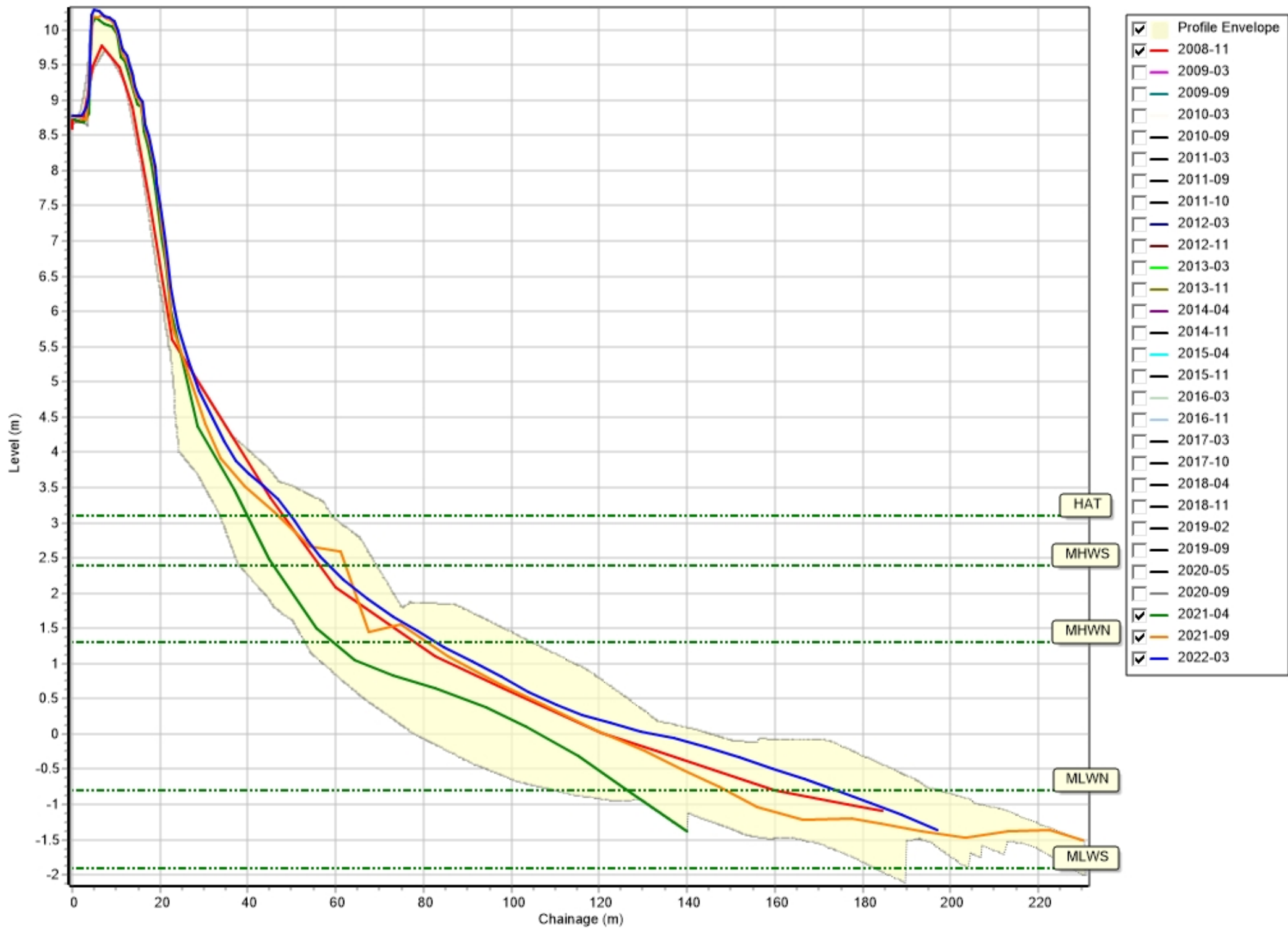
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Profiles: 1bSS9



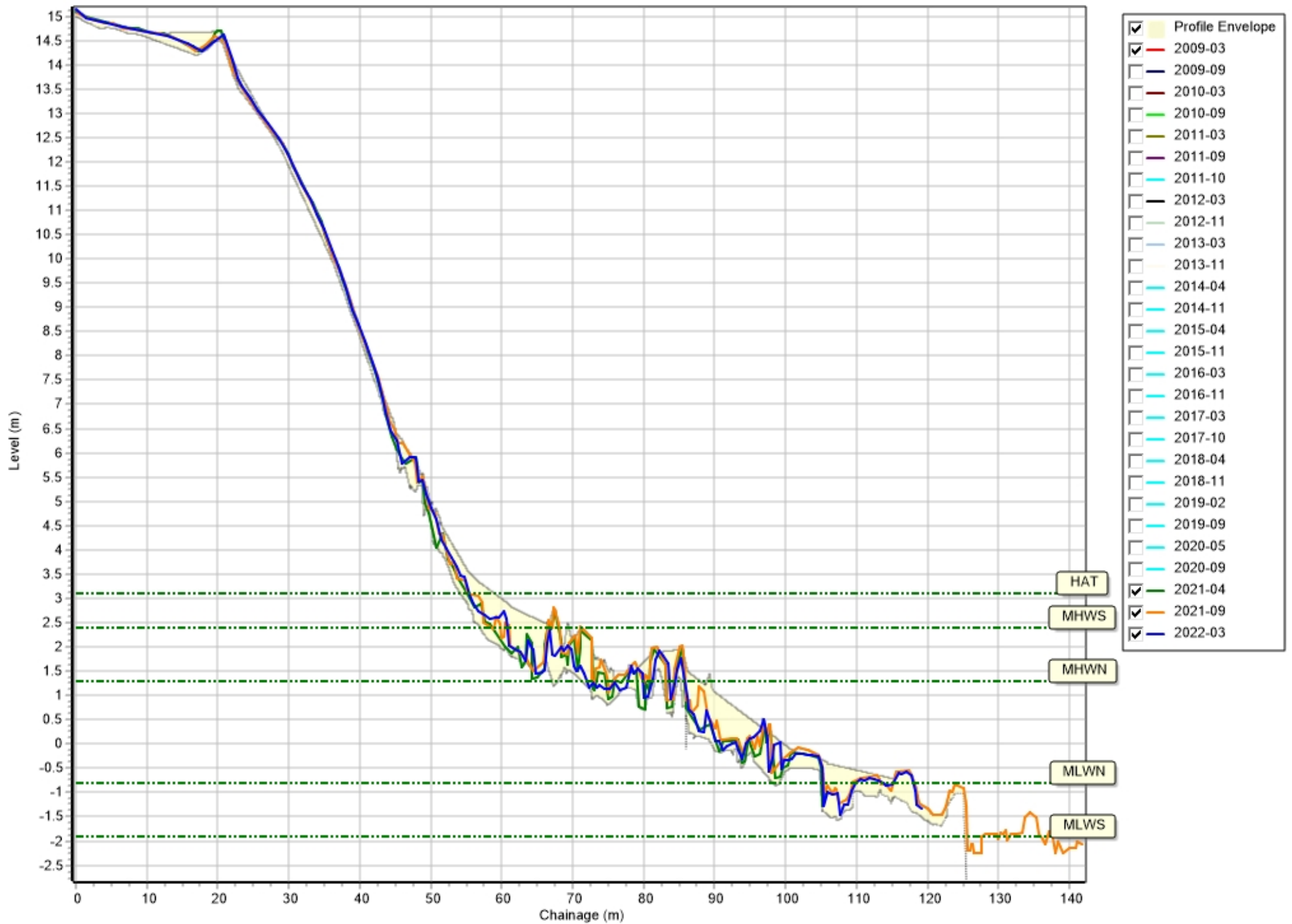
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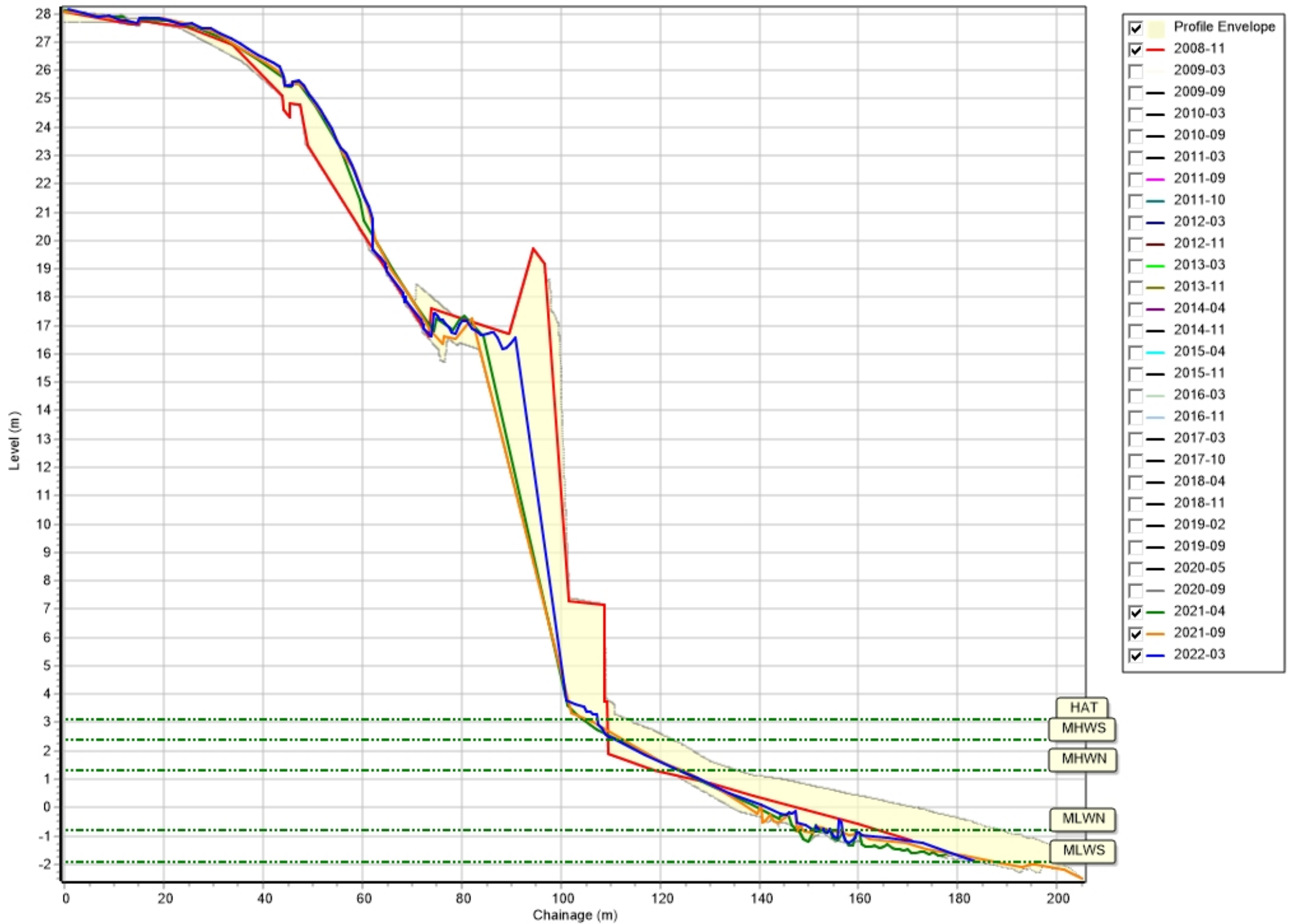
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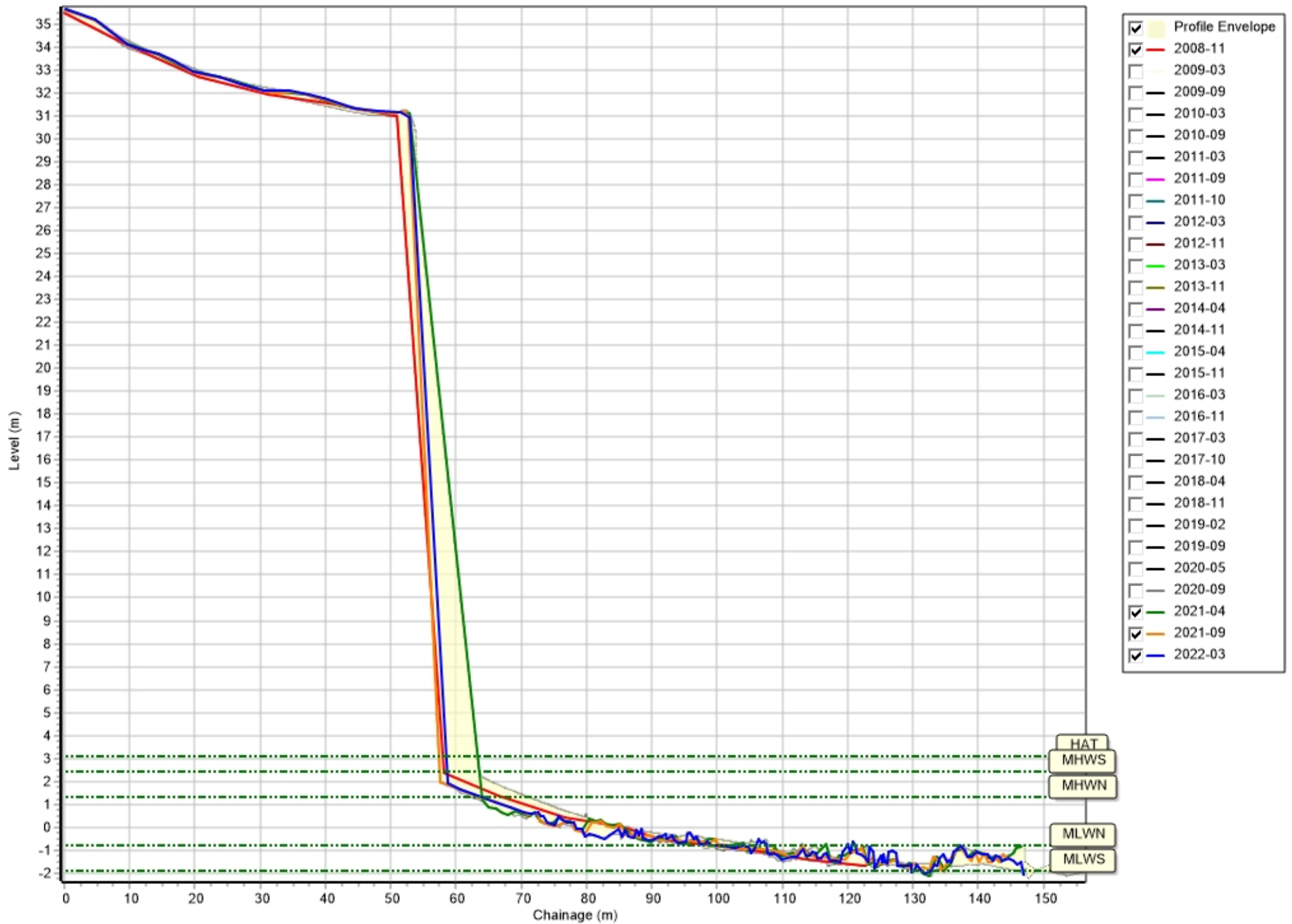
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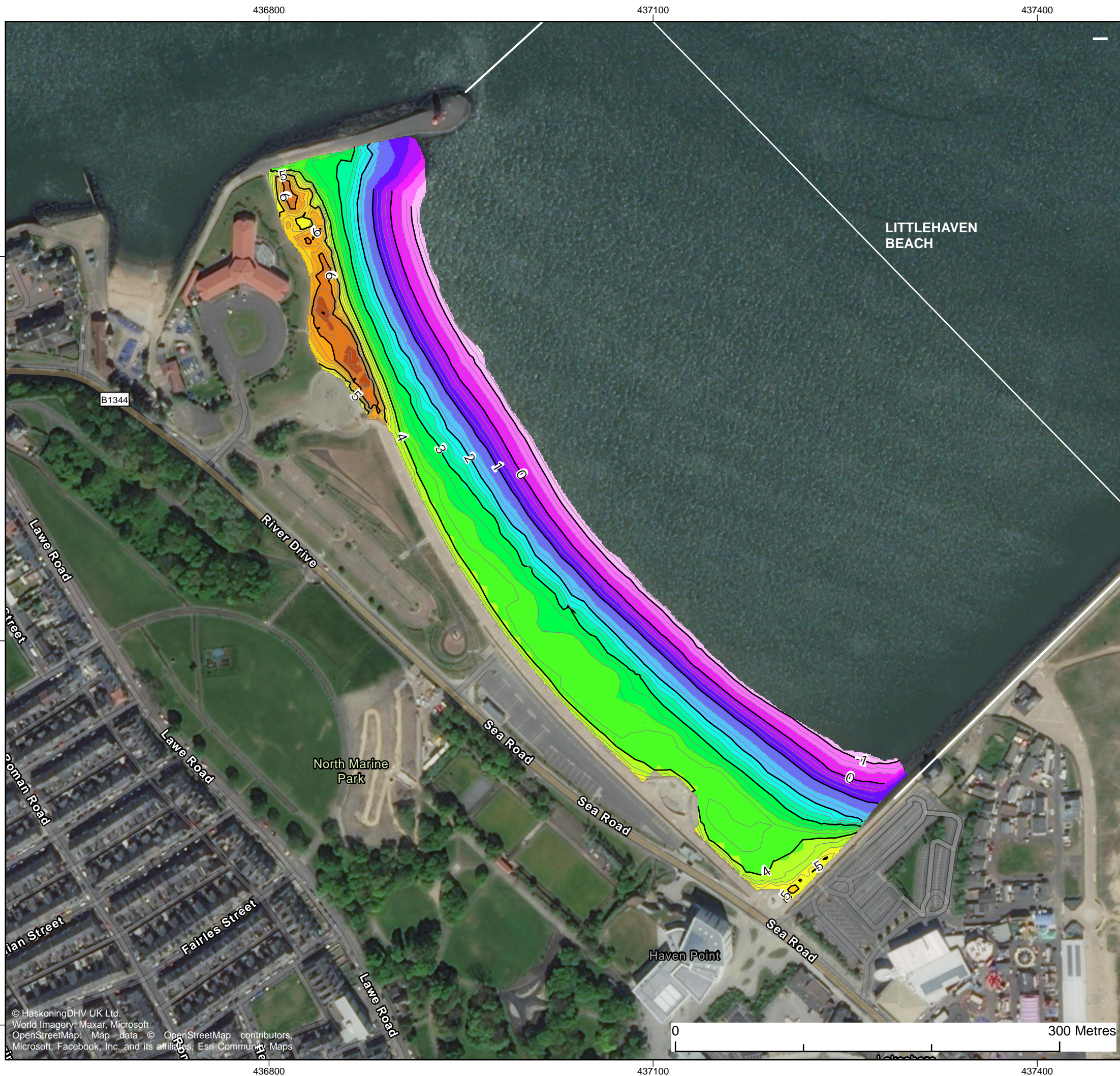
Profiles: 1bSS14



Profiles: 1bSS17



Appendix B
Topographic Survey



TOPOGRAPHIC SURVEY (March 2022)

Elevation (mOD)

- 7.1 - 7.5
- 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

Contours (mOD)*

- 1.0m interval
- 0.25m interval

* Contours only cover sandy beach areas.

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

Title:

Appendix B - Map 1

LITTLEHAVEN BEACH

South Tyneside Council Frontage

Report:

Update Report
'Partial Measures' Survey 2022

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	23/05/2022	TC	NJC	A3	1:3,000

Co-ordinate system: British National Grid

Royal HaskoningDHV
Enhancing Society Together

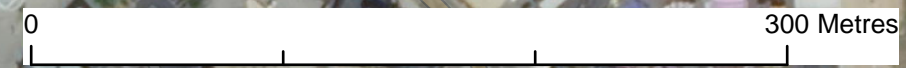
North East Coastal Observatory

568200
567900
567600

436800 437100 437400

436800 437100 437400

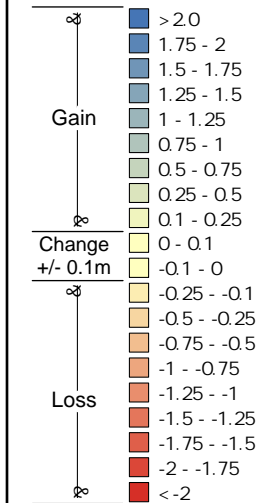
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Difference between topographic surveys
(Sept 2021 to March 2022)

Change in Elevation (mOD)



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

Title:

Appendix B - Map 2

LITTLEHAVEN BEACH

South Tyneside Council Frontage

Report:

Update Report
'Partial Measures' Survey 2022

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	23/05/2022	TC	NJC	A3	1:3,000

Co-ordinate system: British National Grid



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Appendix C
Cliff Top Survey



SURVEY LOCATIONS
 ● Cliff Top Survey Points

© HaskoningDHV UK Ltd.
 Aerial photography 2019 courtesy of North East Coastal Observatory.
 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:
Figure 3 - Map 1
TROW QUARRY
South Tyneside Council Frontage

Report:
 Survey Report

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	n/a	TC	NJC	A4	1:1,500

Co-ordinate system: British National Grid



Cliff Top Survey

Trow Quarry

Six ground control points have been established at Trow Quarry (Figure C1). The maximum separation between any two points varies along the coast, reflecting the degree of risk from the erosion.

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

Table C1 provides baseline information about these ground control points and results from the 2011 (baseline) survey showing the position from the ground control point to the edge of the cliff top along the defined bearing. Future reports will show results from subsequent surveys and provide a means of assessing erosion since the baseline survey.

Table C1 – Cliff Top Surveys at Trow Quarry

Ground Control Points				Distance to Cliff Top (m)			Total Erosion (m)		Erosion Rate (m/year)
Ref	Easting	Northing	Bearing	Baseline Survey	Previous Survey	Present Survey	Baseline to Present	Previous to Present	Baseline to Present
			(°)	Sep 2011	Sep 2021	Mar 2022	Sep 2011 - Mar 2022	Sep 2021 – Mar 2022	Sep 2011 - Mar 2022
1	438300.3	566674.7	309	7.00	7.01	6.52	-0.48	-0.49	-0.044
2	438338.8	566694.3	312	9.40	9.33	9.39	-0.01	0.06	-0.001
3	438384.7	566669	33	7.00	6.82	7	0	0.18	0.000
4	438408.1	566664.8	71	10.50	11.47	11	0.5	-0.47	0.045
5	438401.1	566638	120	7.00	7.5	7.11	0.11	-0.39	0.010
6	438392.8	566604.2	110	10.20	10.03	9.88	-0.32	-0.15	-0.029