North East Coastal Observatory

Royal HaskoningDHV
Enhancing Society Together

Cell 1 Regional Coastal Monitoring Programme Update Report 13: 'Partial Measures' Survey 2021

Northumberland County Council

Northumberland County Council

June 2021

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Authors	
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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)		
	Berwick upon Tweed	Holy Island	North Sunderland
1 in 200 year	3.4	3.4	3.5
HAT	2.8	2.8	2.8
MHWS	2.2	2.4	2.4
MLWS	-1.9	-1.8	-1.7
Water Level Parameter	**Water Level (m AOD)**		
	Amble	**Blyth**	**River Tyne**
1 in 200 year	3.5	3.6	3.7
HAT	3.1	3.1	3.1
MHWS	2.4	2.4	2.4
MLWS	-1.9	-1.8	-1.9

Source: *Scottish Border to River Tyne Shoreline Management Plan 2.* Royal Haskoning, May 2009.

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).

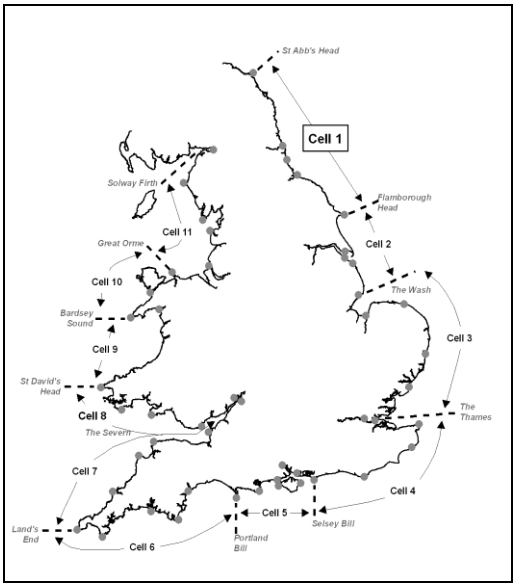


Figure 1 Sediment Cells in England and Wales

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

- beach profile surveys
- topographic surveys
- cliff top recession surveys
- real-time wave data collection
- bathymetric and sea bed characterisation surveys
- aerial photography
- LiDAR Surveys
- walk-over cliff and coastal defence asset surveys

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

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	Sept-Dec 08	May 09	Mar-May 09		-
2	2009/10	Sept-Dec 09	Mar 10	Feb-Mar 10	Jul 10	-
3	2010/11	Aug-Nov 10	Feb 11	Feb-Apr 11	Aug 11	Sept 11
4	2011/12	Oct-Nov 11	Oct 12	Mar-May 12	Feb13	-
5	2012/13	Sept-Nov 12	Mar 13	Mar-Apr 13	Jun 13	-
6	2013/14	Sept-Oct 13	Feb 14	Mar-Apr 14	Jul 14	-
7	2014/15	Sept-Nov 14	Feb 15	Mar-Apr 15	Jul 15	-
8	2015/16	Sept-Dec 15	Feb 16	Mar-May 16	Jul 16	Jun 16
9	2016/17	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(*)	Expected Summer 21

(*) The present report is **Update Report 13** and provides an analysis of the 2021 Partial Measures survey for Northumberland County Council's frontage.

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 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 Newbiggin Bay (commenced 2010)

Cliff top survey (bi-annually) at:

- Cliff top survey at Lynemouth Bay (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)

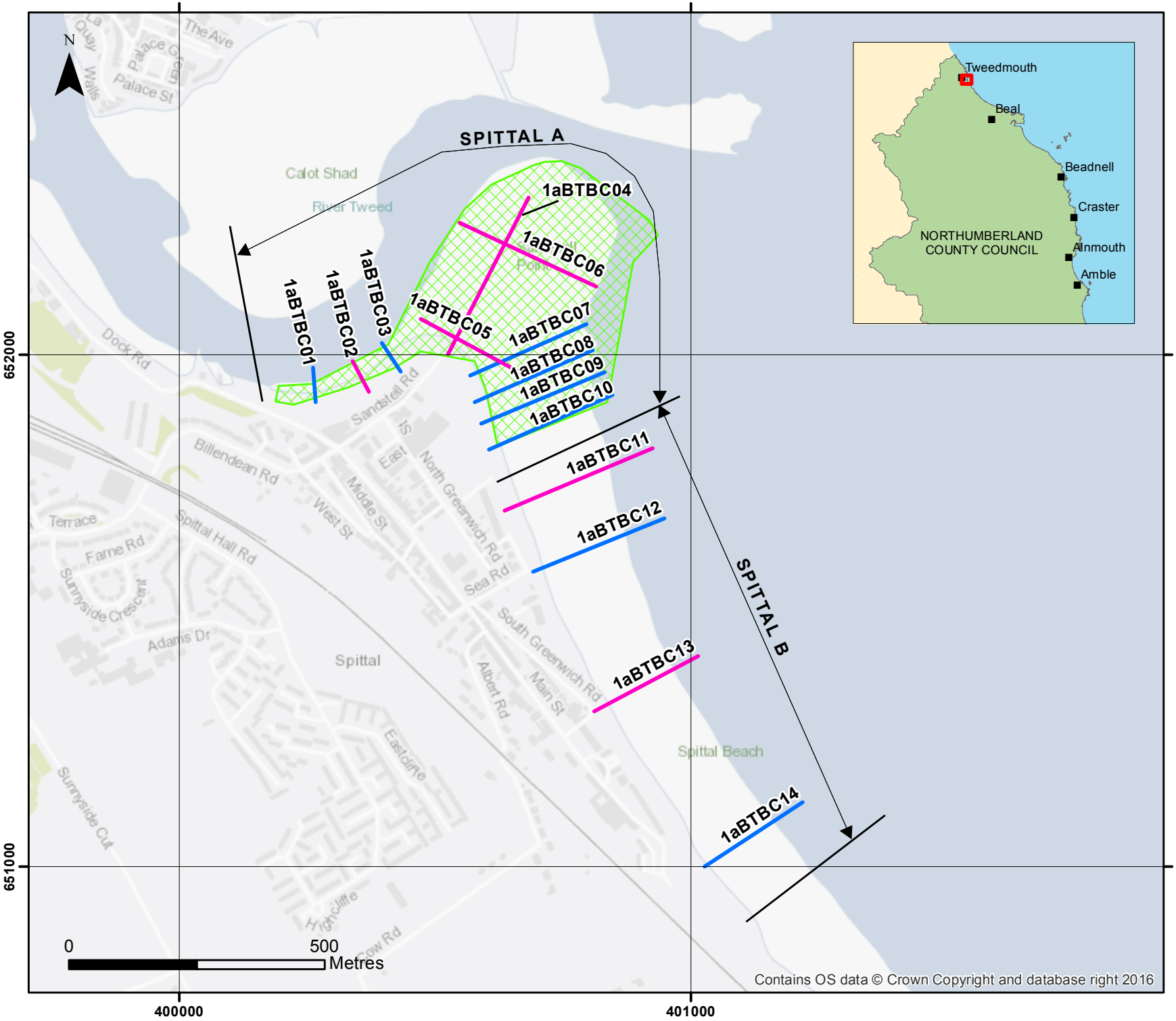
For all cliff-top surveys prior to Full Measures 2011, the data was previously saved in '.kmz' format for plotting and visual comparison in GoogleEarth. This data has been visualised in GIS, which revealed the quality was variable and reliable interpretations of short-term cliff change could not be made. For the present and future surveys, the data will be plotted in GIS and change will 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 Partial Measures survey was undertaken along this frontage between 2nd March 2021 to 18th March 2021. During this time weather conditions varied considerably; refer to the survey reports for details of the weather conditions over this survey period.

The Update Report presents the following:

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

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



Key

SURVEY LOCATIONS

Topographic Profiles

- Annual
- Bi-Annual

Topographic Surveys

- 6 monthly
- yearly
- 5 yearly

(Indicative Survey Extents shown)

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Figure 2 - Map 1

Northumberland County Council Frontage

Analytical Report
Topo Surveys

Drawing Scale at A4 1:10,000

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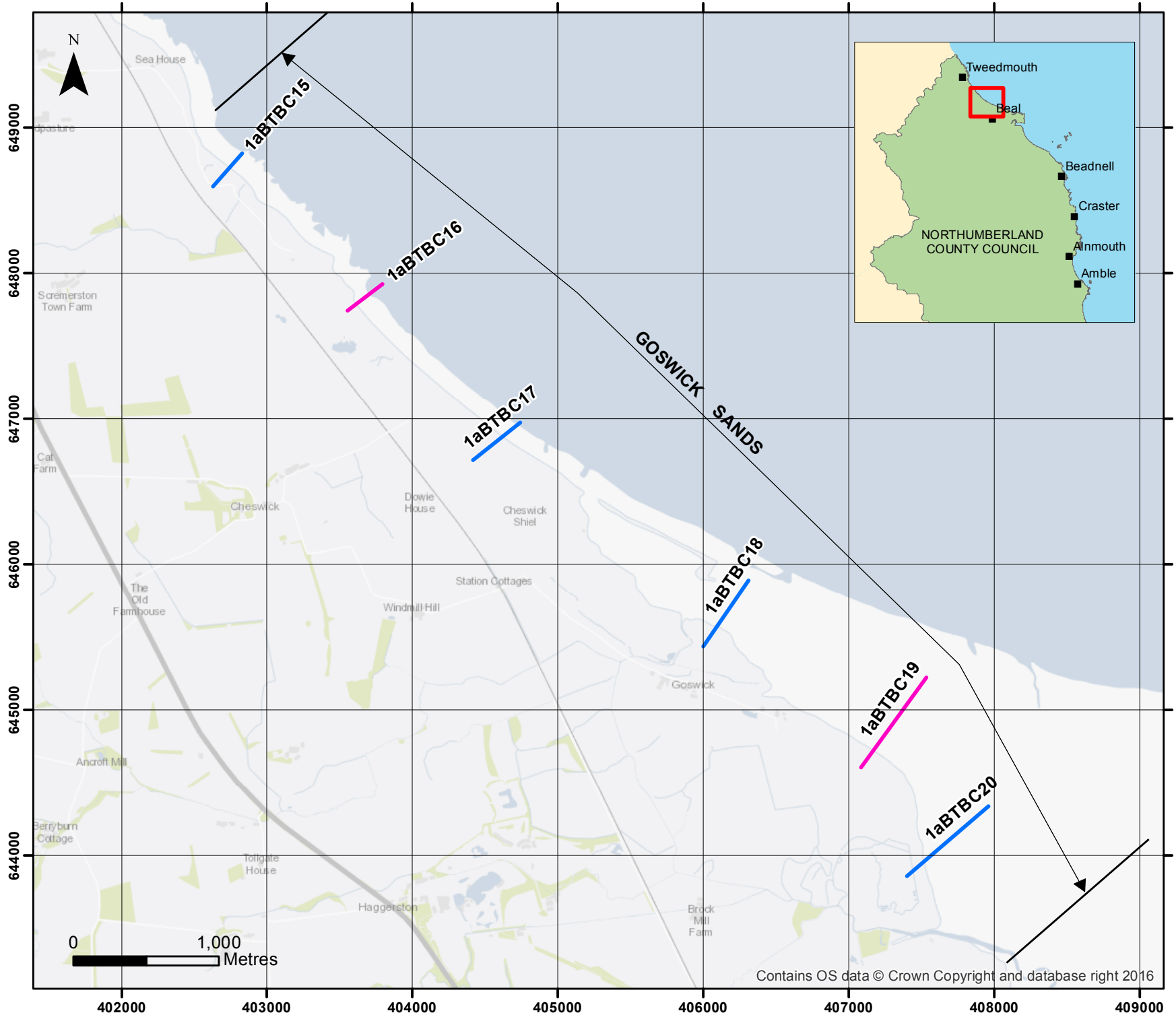

Key

SURVEY LOCATIONS

Topographic Profiles

- Annual
- Bi-Annual

Topographic Surveys

- 6 monthly
- yearly
- 5 yearly

(Indicative Survey Extents shown)

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Figure 2 - Map 2

Northumberland County Council Frontage

Analytical Report
Topo Surveys

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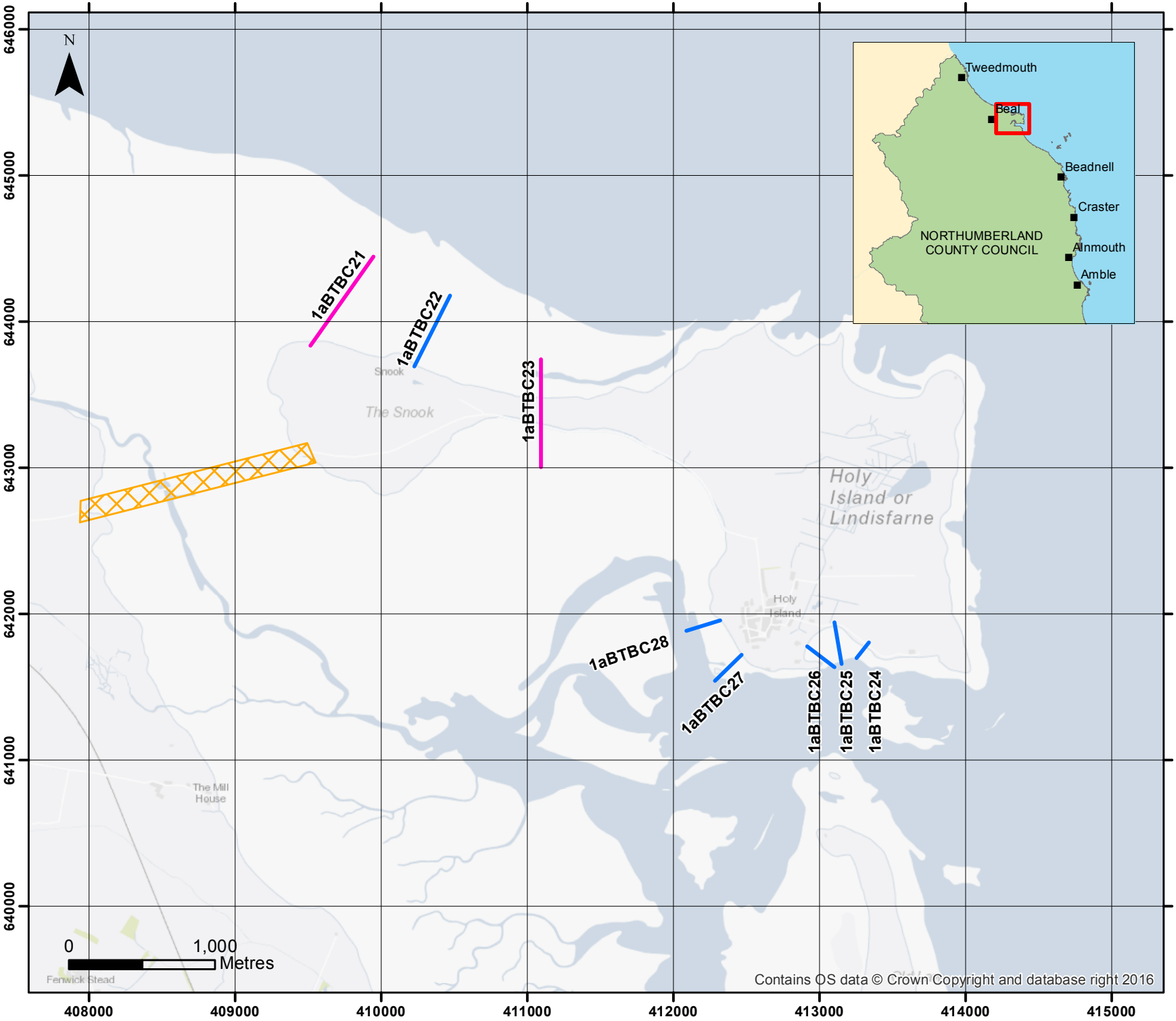

Key

SURVEY LOCATIONS

Topographic Profiles

- Annual
- Bi-Annual

Topographic Surveys

- 6 monthly
- yearly
- 5 yearly

(Indicative Survey Extents shown)

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Figure 2 - Map 3

Northumberland County Council Frontage

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Topo Surveys

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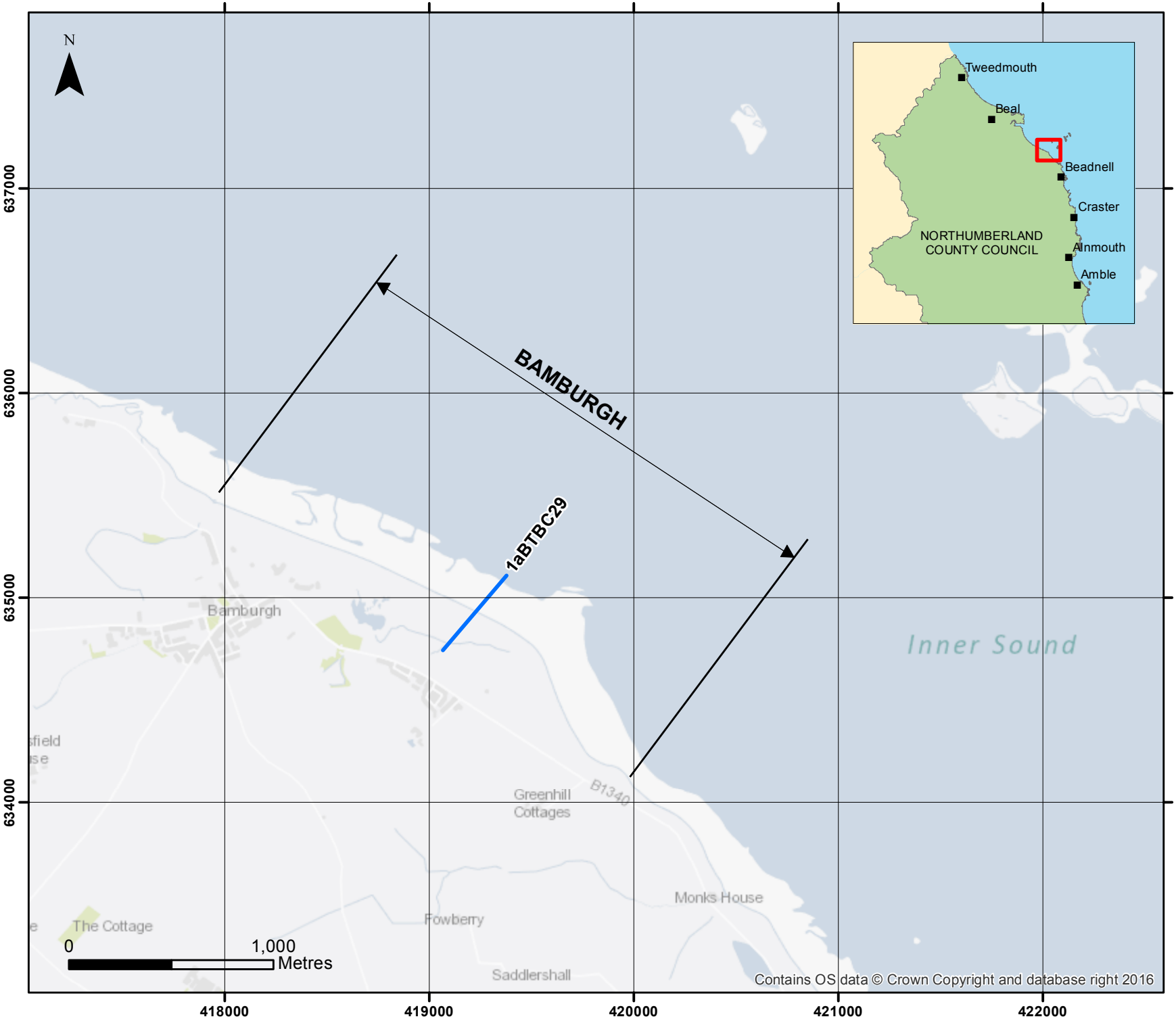

Key

SURVEY LOCATIONS

Topographic Profiles

- Annual
- Bi-Annual

Topographic Surveys

- 6 monthly
- yearly
- 5 yearly

(Indicative Survey Extents shown)

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Figure 2 - Map 4

Northumberland County Council Frontage

Analytical Report
Topo Surveys

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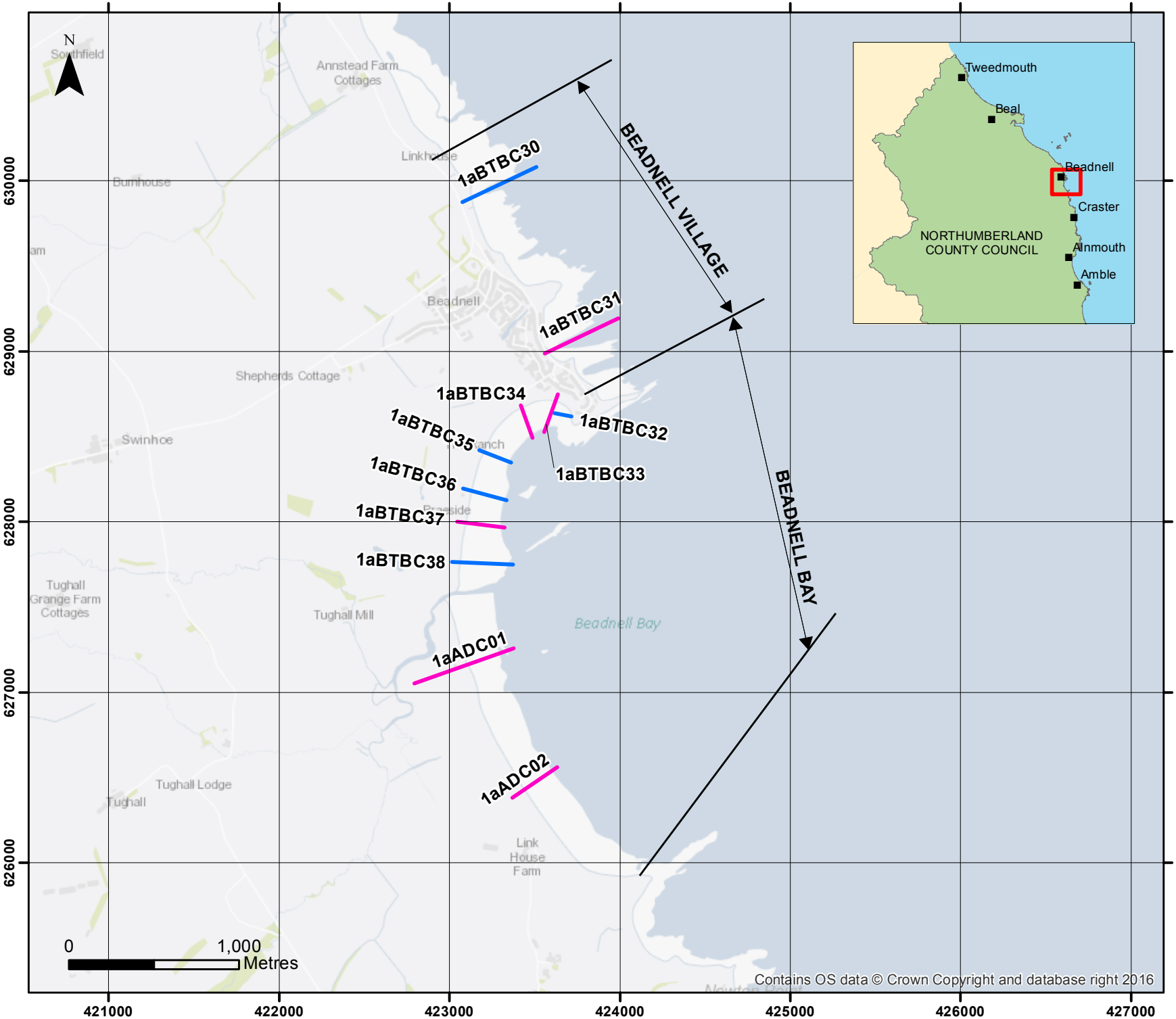

Key

SURVEY LOCATIONS

Topographic Profiles

- Annual
- Bi-Annual

Topographic Surveys

- 6 monthly
- yearly
- 5 yearly

(Indicative Survey Extents shown)

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Figure 2 - Map 5

Northumberland County Council Frontage

Analytical Report
Topo Surveys

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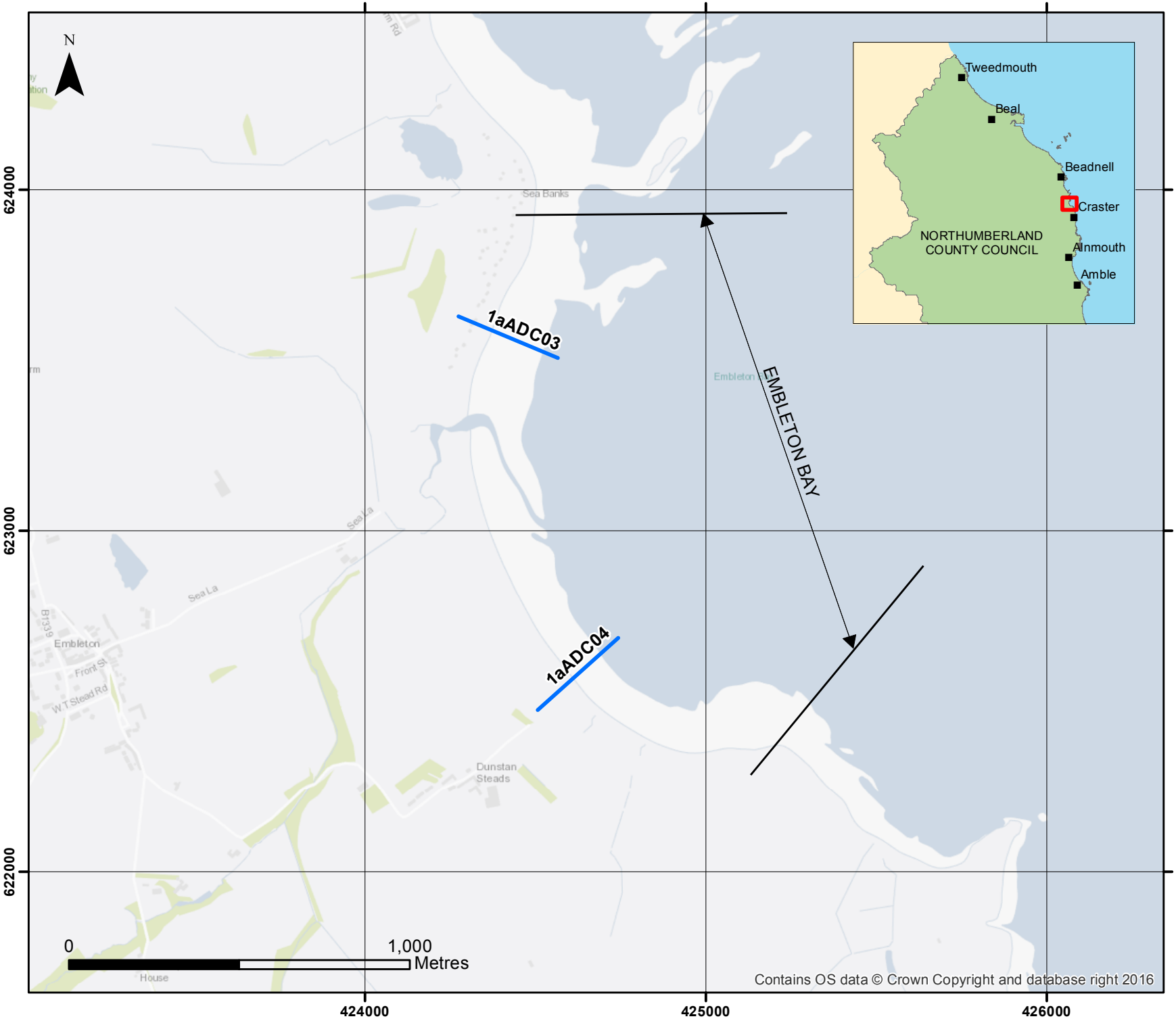

Key

SURVEY LOCATIONS

Topographic Profiles

- Annual
- Bi-Annual

Topographic Surveys

- 6 monthly
- yearly
- 5 yearly

(Indicative Survey Extents shown)

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Figure 2 - Map 6

Northumberland County Council Frontage

Analytical Report
Topo Surveys

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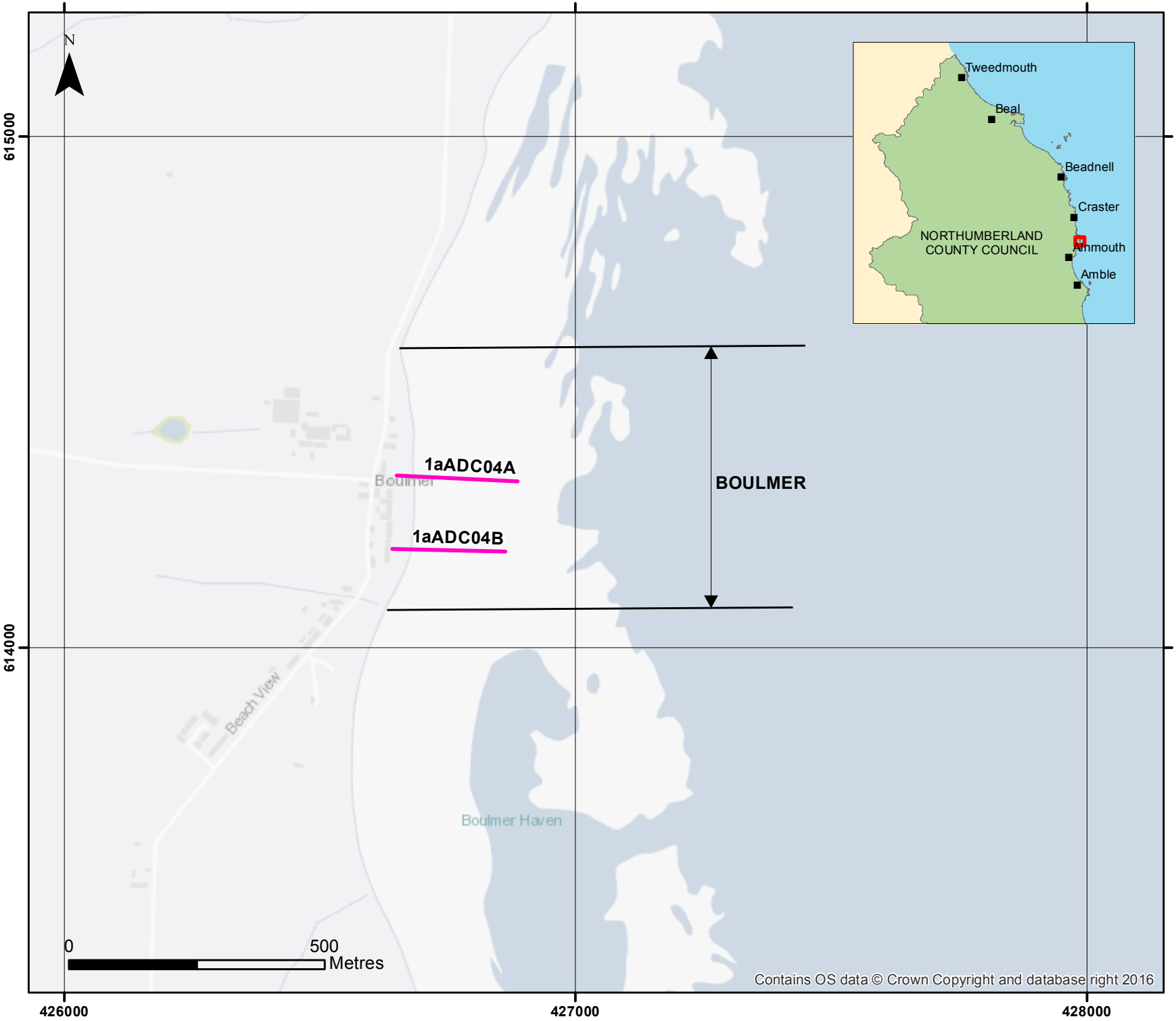

Key

SURVEY LOCATIONS

Topographic Profiles

- Annual
- Bi-Annual

Topographic Surveys

- 6 monthly
- yearly
- 5 yearly

(Indicative Survey Extents shown)

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Figure 2 - Map 7

Northumberland County Council Frontage

Analytical Report
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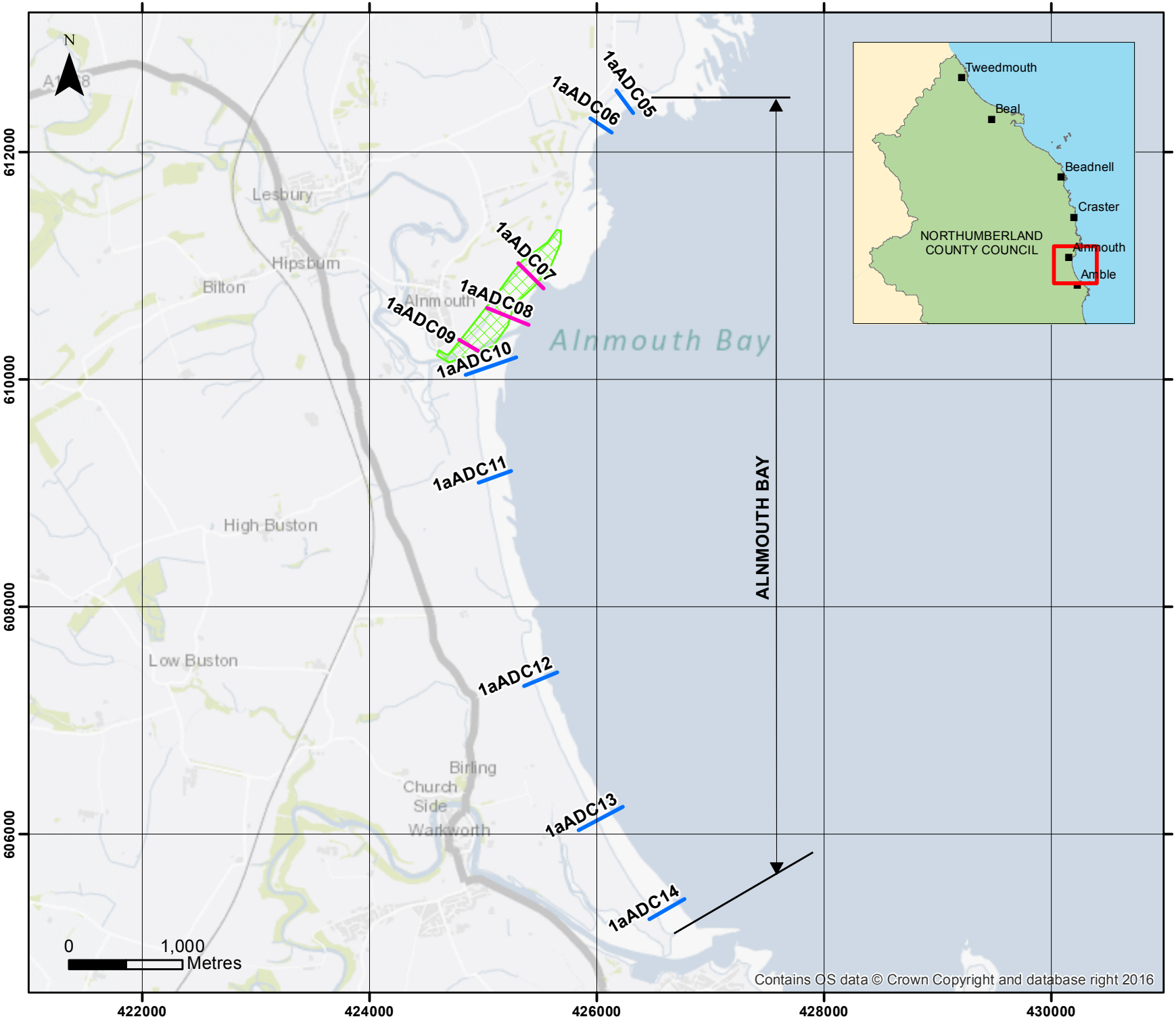

Key

SURVEY LOCATIONS

Topographic Profiles

- Annual
- Bi-Annual

Topographic Surveys

- 6 monthly
- yearly
- 5 yearly

(Indicative Survey Extents shown)

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Figure 2 - Map 8

Northumberland County Council Frontage

Analytical Report
Topo Surveys

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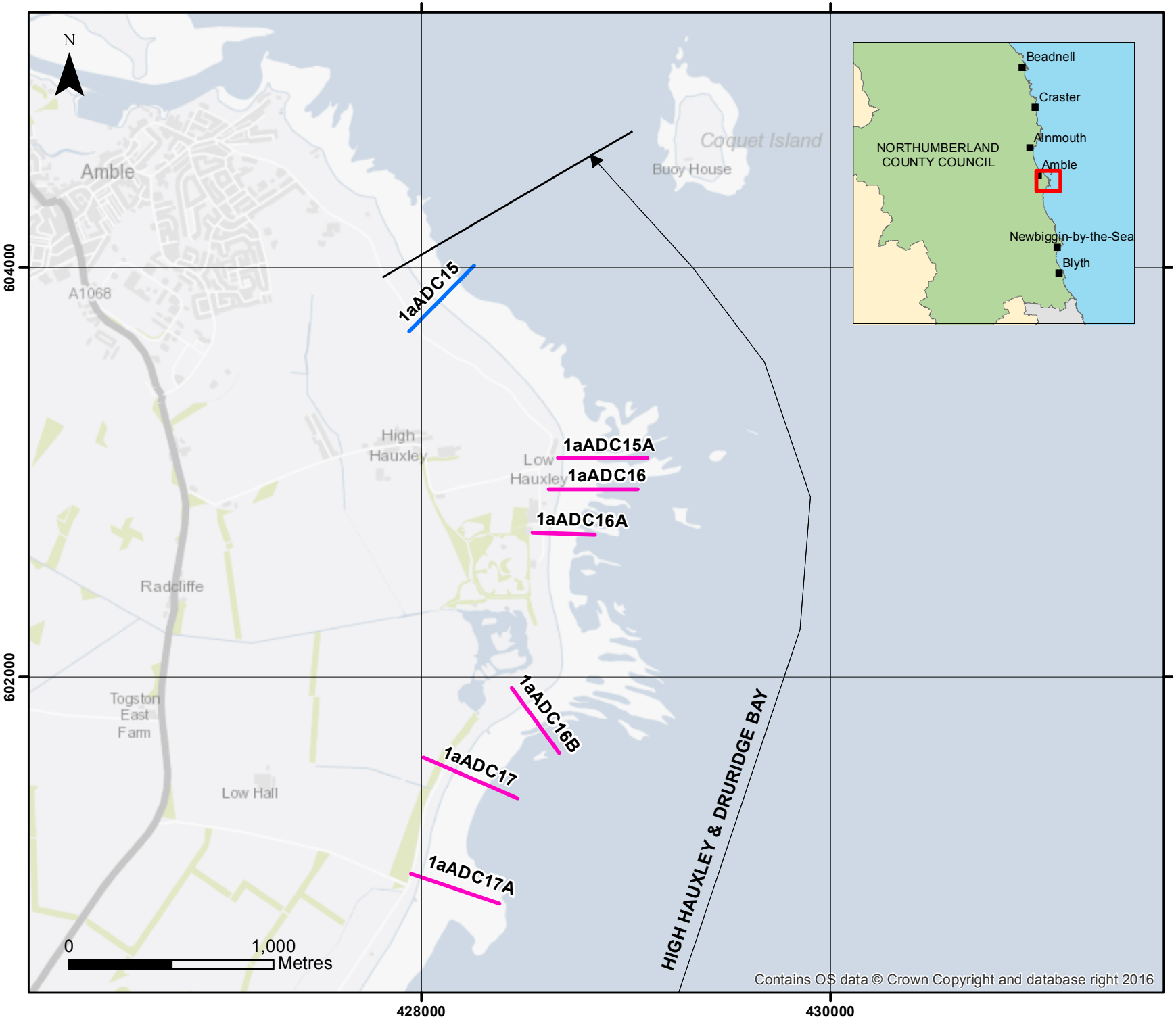

Key

SURVEY LOCATIONS

Topographic Profiles

- Annual
- Bi-Annual

Topographic Surveys

- 6 monthly
- yearly
- 5 yearly

(Indicative Survey Extents shown)

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Figure 2 - Map 9

Northumberland County Council Frontage

Analytical Report
Topo Surveys

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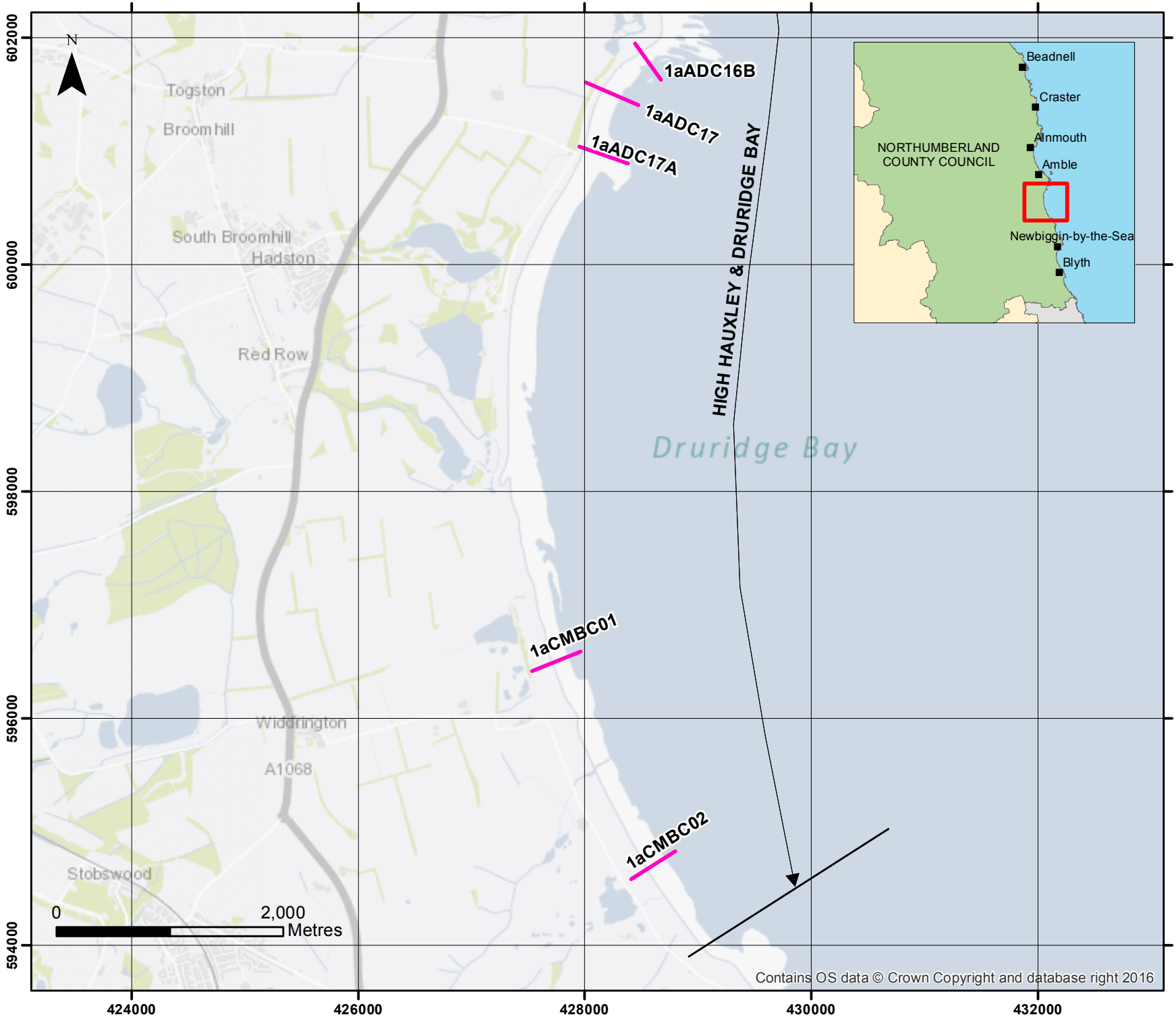

Key

SURVEY LOCATIONS

Topographic Profiles

- Annual
- Bi-Annual

Topographic Surveys

- 6 monthly
- yearly
- 5 yearly

(Indicative Survey Extents shown)

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Figure 2 - Map 10

Northumberland County Council Frontage

Analytical Report
Topo Surveys

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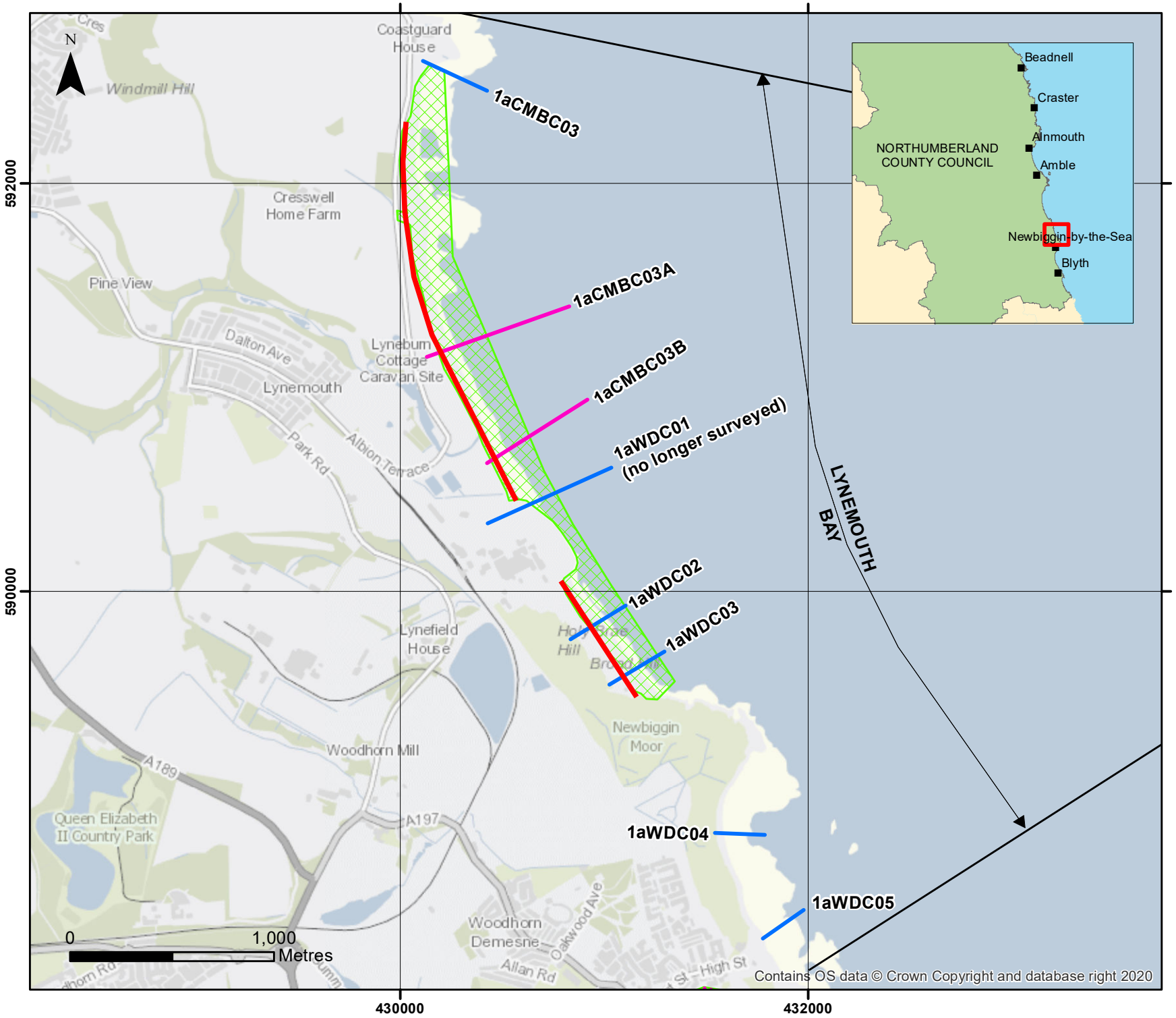

Key

SURVEY LOCATIONS

Topographic Profiles

- Annual
- Bi-Annual

Topographic Surveys

- 6 monthly*
- yearly
- 5 yearly
- Cliff Top Edge Survey*

** First surveyed in Dec 2020*

(Indicative Survey Extents shown)

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Figure 2 - Map 11

Northumberland County Council Frontage

Analytical Report
Topo Surveys

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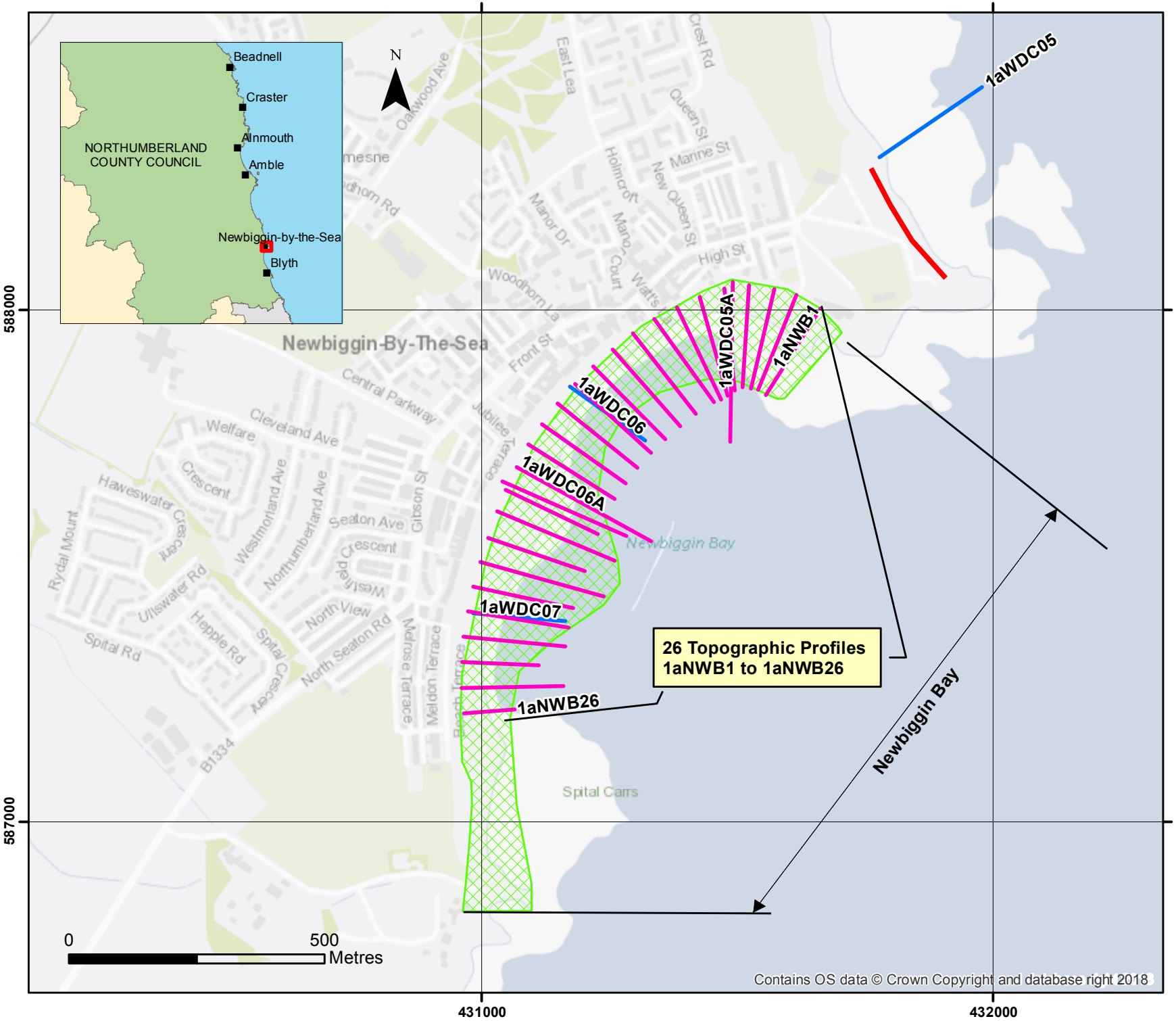

Key

SURVEY LOCATIONS

Topographic Profiles

- Annual
- Bi-Annual

Topographic Surveys

- 6 monthly
- yearly
- 5 yearly
- Cliff Top Edge Survey

(Indicative Survey Extents shown)

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Figure 2 - Map 12

Northumberland County Council Frontage

Analytical Report
Topo Surveys

Drawing Scale at A4 1:10,000

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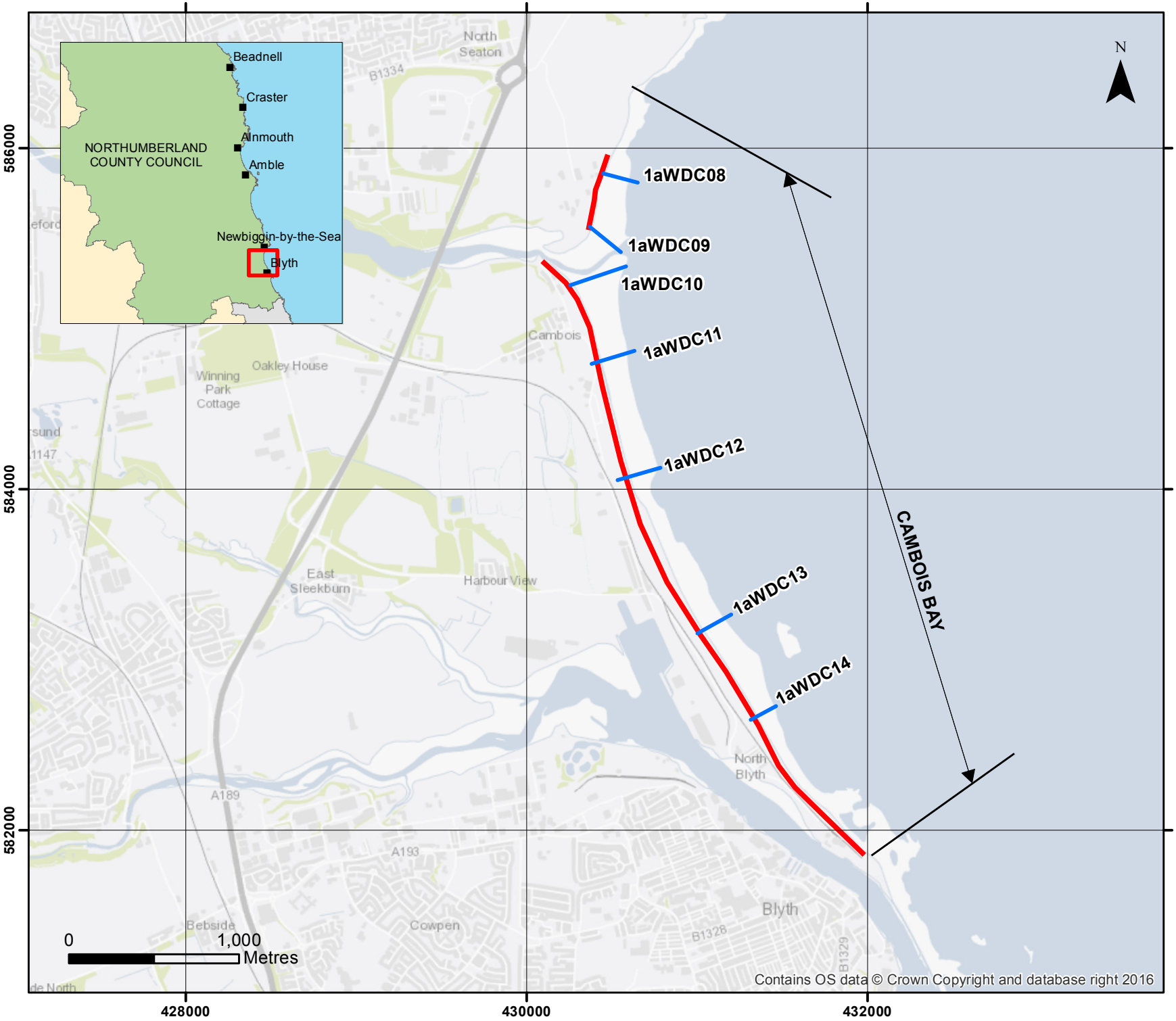

Key

SURVEY LOCATIONS

Topographic Profiles

- Annual
- Bi-Annual
- Cliff Top Edge Survey

Topographic Surveys

- 6 monthly
- yearly
- 5 yearly

(Indicative Survey Extents shown)

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Figure 2 - Map 13

Northumberland County Council Frontage

Analytical Report
Topo Surveys

Drawing Scale at A4 1:30,000

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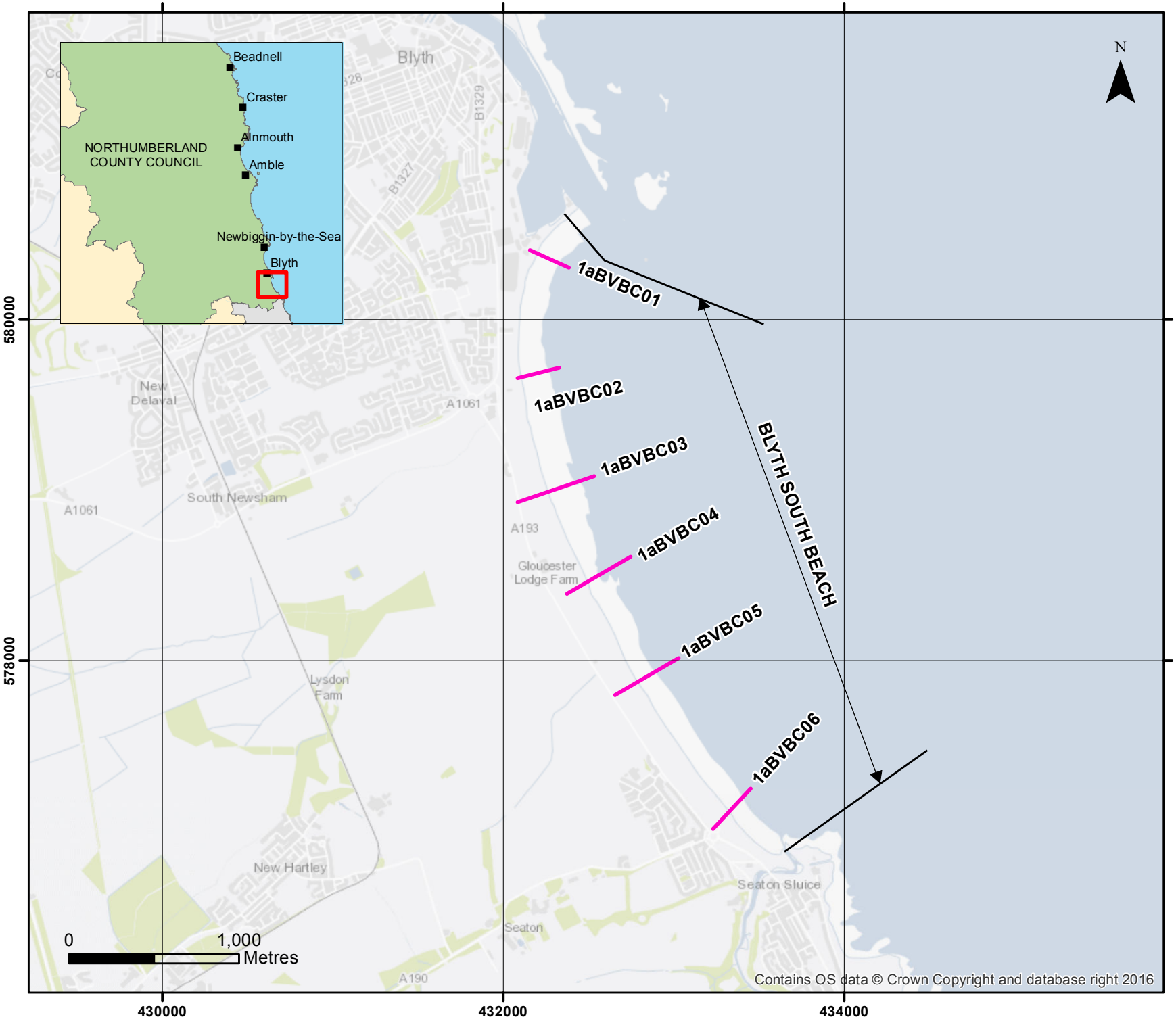

Key

SURVEY LOCATIONS

Topographic Profiles

- Annual
- Bi-Annual
- Cliff Top Edge Survey

Topographic Surveys

- 6 monthly
- yearly
- 5 yearly

(Indicative Survey Extents shown)

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Figure 2 - Map 14

Northumberland County Council Frontage

Analytical Report
Topo Surveys

Drawing Scale at A4 1:30,000

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2. Analysis of Survey Data

2.1 Sandstell Point (Spittal A)

Survey Date	Description of Changes Since Last Survey	Interpretation
18th March 2021	**Beach Profiles:** Sandstell Point is covered by four beach profile lines for the Partial Measures survey (Appendix A). The previous survey was undertaken for the Full Measures survey in autumn 2020. Profile **1aBTBC02** is located on the southern bank of the inner Tweed estuary. From the beginning of the survey to the toe of the dunes at chainage 45m the dunes have accreted by approximately 0.1m. Seaward of this point, the majority of the beach level has lowered by up to 0.1m, except the end of the survey (between chainages 81-83m) which has undergone negligible change. Overall, the dunes remain at a high level and the beach profile is at a medium level compared to the range recorded from previous surveys. Profiles **1aBTBC04** (longitudinal section) and **1aBTBC05** and **1aBTBC06** (both cross-sections) cover the spit at Sandstell Point. Profile **1aBTBC04** shows that the upper beach between chainages 10 – 85m has accreted by 0.2m. The beach between 85-126m has lowered by up to 0.4m. There has been accretion on the middle beach by up to 1.1m to chainage 390m, however from chainage 390m to the end of the survey at chainage 435m the beach has lowered by up to 0.7m. Overall, the spit has increased in elevation and the crest has migrated landward by approximately 65m. The profile is at a relatively medium level compared to the range recorded from previous surveys, with the end of the spit being relatively high. Profiles **1aBTBC05** and **1aBTBC06** are transects across the spit, with the open sea on the left-hand side of the plot and the river channel to the right. At **1aBTBC05**, the seaward side of the spit has accreted by up to 0.6m between the start of the survey and chainage -12m, switching to erosion from chainages -12m to the seaward crest of the spit by up to 0.2m. The top of the spit has accreted by up to 0.2m and widened towards the river. The river side of the spit has undergone little change limited to ±0.1m. Overall the profile has narrowed in profile and is within the middle of its range recorded from previous surveys, both in terms of height and position, except the	Since the last survey, the dunes along the south bank of the River Tweed have remained stable, experiencing accretion of up to 0.1m. The crest of the distal end of the spit has migrated landward by approximately 65m, narrowing in profile since the previous survey. The landward end of the spit has experienced slumping of material down to the seaward side of the spit. **Longer term trends:** The small change in dune profile is within the bounds of previous surveys that indicate they have remained stable over the past 12 years. The beach profiles show that the form of the spit is within the range of past observations. The wide variation in profile forms over time is indicative of this being one of the most dynamic systems on the north east coast.

Survey Date	Description of Changes Since Last Survey	Interpretation
	seaward side of the spit which is at a high level. At **1aBTBC06** the seaward side of the spit has lowered by up to 1.2m to chainage 110m, before switching to accretion on the upper crest of the spit by up to 0.8m and reducing to 0.2m across towards the riverside of the spit. The river-facing side of the spit has migrated seaward by approximately 30m. Overall the spit profile is at a low to medium level in height and position compared to the range recorded from previous surveys. The combination of movement observed at 1aBTBC05 and 1aBTBC06 suggests the spit has remained relatively stable at the landward end of the spit, with an accretion of the crest and slumping of material towards the sea, whilst the seaward end of the spit has narrowed in position and increased in height.	
March 2021	**Topographic Survey:** 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 2011. The previous survey was undertaken for the Full Measures survey in autumn 2020. The survey report notes that "*A temporary station was used as a vehicle was blocking station 4*". Data from the most recent topographic survey (Partial Measures, spring 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 produced topographic survey and the present survey. The difference plot generally shows little change / small scale erosion in the dunes on the south bank of the River Tweed and shore parallel bands of erosion and accretion running south-east to north-west parallel to the coastline, with the highest rates of erosion at the distal end of the spit (upwards of 2.0m). The highest rates of accretion are exhibited on the riverside of the spit approximately 100m from the land	The findings of the topographic survey show similar trends to the profile survey. This appears to show migration of both the river channel and the spit in a clockwise direction around the headland, similar to the trend seen in the previous partial measures survey in 2020.

2.2 Spittal (Spittal B)

Survey Date	Description of Changes Since Last Survey	Interpretation
18th March 2021	**Beach Profiles:** Spittal B is covered by two beach profile lines for the Partial Measures survey (Appendix A). The previous survey was undertaken for the Full Measures survey in autumn 2020. Profile **1aBTBC11** is located to the north of Spittal Beach. The dunes from chainage 0-17m have accreted by up to 0.2m, however the seaward face of the dunes and dune toe have eroded by up to 0.2m. The upper beach from 28-64m has alternated between erosion and accretion limited to ±0.4m, which has filled in a hollow at chainage 54m. The middle beach has lowered by up to 0.7m to chainage 150m, resulting in a steeper upper-middle beach profile. The lower beach seaward of chainage 150m has accreted by up to 1.1m. Overall, the dunes are at a high level, reaching their highest level recorded between chainages 8-14m. The upper beach profile is at a medium level, the middle beach is at a low level, and the lower beach is at a high level compared to the range recorded from previous surveys. Profile **1aBTBC13** is located towards the centre of Spittal Beach. The upper beach to chainage 10m has lowered by up to 0.2m, switching to accretion by up to 0.6m to chainage 40m. The middle beach has lowered by up to 1.0m, leading to a steeper middle beach profile. The lower beach seaward of chainage 130m has accreted by up to 0.2m. Overall, the upper beach profile is at a medium level, the middle beach is at a low level (particularly between chainages 80-101m which is at its lowest level recorded) and the lower beach is at a high level compared to the range recorded from previous surveys.	Since the last survey, the changes in beach level at Spittal have generally shown accretion on the upper and lower beach, with a lowering of the middle beach indicating a redistribution of sediment throughout the profiles. **Longer term trends:** At both profile locations along Spittal Beach, the changes observed from the present survey are generally within the bounds of previous surveys, except at the dunes at profile 1aBTBC11 between chainages 8-14m where the dunes are now at their highest level recorded, and chainages 80-101m at profile 1aBTBC13 which is now at its lowest level recorded.

2.3 Goswick Sands

Survey Date	Description of Changes Since Last Survey	Interpretation
17th March 2021	**Beach Profiles:** Goswick Sands are covered by two beach profile lines for the Partial Measures survey (Appendix A). The previous survey was undertaken for the Full Measures survey in autumn 2019. Profile **1aBTBC16** is located to the north of Goswick Sands, between Far Skerr and Cheswick Black Rocks. The dune has remained stable since the last survey, with little change in profile. Between the dune toe at chainage 46m to 65m, the beach level has risen by up to 0.1m. The middle beach has lowered by up to 0.3m to chainage 117m, whilst the lower beach has accreted by up to 0.5m. Overall the profile is at a high level compared to the range recorded from previous surveys, particularly between chainage 36-56m which is at its highest level recorded. Profile **1aBTBC19** is located to the south of Goswick Sands. The dunes have remained stable since the last survey, with changes generally restricted to ±0.1m. The crest of the foredune has accreted by up to 0.2m and is now at its highest level recorded. The toe of the dunes has lowered by up to 0.3m. Beach levels show very little change to the end of the survey (<0.1m) at chainage 357m.The present survey is c.88m shorter than the previous survey and ends at a drain. Beach levels are at a relatively medium level compared to the range recorded from previous surveys.	Beach levels have undergone very little change since the previous survey. The foredune has continued to accrete since 2009. **Longer term trends:** Both profiles are within the range recorded from previous surveys. However, the range of variation on record is limited compared to beaches elsewhere along the north east coast.

2.4 Holy Island

Survey Date	Description of Changes Since Last Survey	Interpretation
17th March 2021	**Beach Profiles:** Holy Island is covered by two beach profile lines for the Partial Measures surveys (Appendix A). The previous survey was undertaken for the Full Measures survey in autumn 2020. **1aBTBC21** and **1aBTBC23** are located on the north-west side of the island, along The Snook. At profile **1aBTBC21** the dunes have remained stable since the last survey, with small sections of erosion and accretion limited to <0.1m on the dunes and dune face to chainage 38m. The foredune has experienced accretion of up to 0.1m and is now at its highest level recorded, whilst the dune toe has accreted by up to 0.3m across the beach to chainage 130m. The beach level seaward of this point has experienced change limited to 0.1m as far as the end of the survey at chainage 374m. The beach is at a relatively medium level compared to the range recorded from previous surveys. Profile **1aBTBC23** shows that the dunes and beach have remained stable since the last survey. The foredune remains at one of its highest levels recorded. The largest change in beach profile occurs on the northern side of the Snook with a small section of accretion of up to 0.2m between chainages 605m to the end of the survey at chainage 730m. Overall, the beach levels are at a high level compared to the range recorded from previous surveys.	The dunes, sandy foreshore and sand flats around The Snook have remained stable in both form and position since the last survey. The foredune at both profiles is at the highest level recorded. **Longer term trends:** The minor changes observed since the last survey are within the bounds of previous surveys.

2.5 Beadnell Village

Survey Date	Description of Changes Since Last Survey	Interpretation
16th March 2021	**Beach Profiles:** Beadnell Village is covered by one beach profile line for the Partial Measures survey (Appendix A). The previous survey was undertaken for the Full Measures survey in autumn 2020. **1aBTBC31** is in Nacker Hole and extends across the promenade and seawall. There has been up to 0.3m of accretion at the toe of the sea wall to chainage 16m. The rest of the beach profile has alternated between erosion and accretion, limited to ±0.2m. Overall the profile is at a high level on the upper beach, whilst the middle and lower beach are at a medium level compared to the ranges recorded in previous surveys.	The beach to the south of Beadnell Village has remained stable. **Longer term trends:** The changes observed since the last survey are within the bounds of previous surveys.

2.6 Beadnell Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
16th March 2021	**Beach Profiles:** Beadnell Bay is covered by five beach profile lines for the Partial Measures survey (Appendix A). The previous survey was undertaken for the Full Measures survey in autumn 2020. Profiles **1aBTBC33** and **1aBTBC34** are located in Beadnell Harbour to the north of Beadnell Bay. Profile **1aBTBC37** is located further south towards the outfall of Brunton Burn/Long Nanny. At profile **1aBTBC33**,there has been accretion on the dunes by up to 0.3m and on the lower part of the dune face by up to 0.6m. Seaward of dune toe at chainage 55m there has been accretion across the beach profile by up to 0.3m. Overall, the dunes and beach profile are at a high level compared to the range recoded from previous surveys. At profile **1aBTBC34**, the dunes show sections of erosion and accretion of up to 0.3m. Between the dune toe and the rock patch at chainage 102m, there has been a lowering of the beach profile of up to 0.4m. Seaward of the rock patch, the lower beach level has accreted by up to 0.6m. 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 high level. At profile **1aBTBC37**, the dunes have remained mostly stable, with a small section of erosion of 0.4m and accretion of 0.4m on the lower dune face. The majority of the beach profile has lowered by up to 0.1m to chainage 214m. Seaward of chainage 214m the lower beach has accreted by up to 0.4m. Overall the profile is at a high level compared to the range recorded from previous surveys. Profiles **1aADC01** and **1aADC02** are located along the frontage to the south of the outfall of Brunton Burn/Long Nanny. At profile **1aADC01** the dune have lowered in places by up to 0.3m, particularly on the landward side. From the dune toe to chainage 340m there has been accretion of up to 0.3m to chainage 345m. Across the middle beach between chainages 345-495m the middle beach has lowered by 0.3m. Seaward of chainage 345m the lower beach has accreted by up to 0.4m. Overall the profile is at a medium-high level on the upper and middle beach compared to the range recorded from previous surveys, whilst the lower beach is at a medium level.	Along the length of Beadnell Bay, the dunes have remained largely stable since the last survey, with some signs of growth. The profiles along the frontage show variable trends since the previous survey, with no discernible pattern. Beach levels are generally at a high level. **Longer term trends:** Along the length of Beadnell Bay, the dunes are of a similar form to those observed in the past. The changes in beach profile form and position observed since the last survey are within the bounds of previous surveys.

Survey Date	Description of Changes Since Last Survey	Interpretation
	At profile **1aADC02** the dunes have not changed since the previous survey, with a minor amount of erosion on the landward side of up to 0.1m. The beach level at the toe of the dunes has lowered by up to 0.8m. The beach profile seaward of chainage 50m has lowered by up to 0.2m on the upper and lower beach and 0.1m on the middle beach. Overall, the dunes are at a high level, whilst the beach profile is at a medium-high level compared to the range recorded from previous surveys.	

2.7 Boulmer

Survey Date	Description of Changes Since Last Survey	Interpretation
15th March 2021	**Beach Profiles:** Boulmer is covered by two beach profile lines for the Partial Measures survey (Appendix A). These were added to the programme in October 2007. The previous survey was undertaken for the Full Measures survey in autumn 2020. At profile **1aADC04A** , there has been accretion from the dune cliff to the exposed rocky outcrop at chainage 76m of up to 0.2m on the upper beach and 0.3m on the middle beach. The rock outcrop has maintained a similar form since the previous survey. Overall, the profile is at a high level compared to the range recorded from previous surveys, particularly between chainages 15-20m and 46-67m which are at their highest level recorded. At profile **1aADC04B** the backshore (now rock armour) has remained stable since the last survey. There has been accretion at the toe of the rock armour of up to 0.4m to chainage 50m. Between chainage 50m and 86m the beach has lowered by up to 0.2m, before switching to accretion between chainage 86m and the rock outcrop at chainage 97m by up to 0.1m. There have been small changes across the rock platform, associated with the movement of rocks. The profile is at a medium-high level compared to the range recorded from previous surveys.	The dune cliff backshore at Boulmer is now fixed in position by the rock armour at both profiles. Beach levels at Boulmer have mostly experienced accretion since the last survey, except the middle beach of profile 1aADC04B which has lowered. **Longer term trends:** The changes in beach profile, form and position observed since the last survey are within the bounds of previous surveys. The rocky shore platform continues to be mainly exposed in the lower foreshore.

2.8 Alnmouth Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
15th March 2021	**Beach Profiles:** Alnmouth Bay is covered by three beach profile lines during the Partial Measures survey (Appendix A). The previous survey was undertaken for the Full Measures survey in autumn 2020. The three profiles are located to the north of Alnmouth Bay between Marden Rocks and the mouth of the River Aln Estuary. At profile **1aADC07** the overall position of the dunes has remained stable since the last survey. The beach level at the toe of the dunes has increased by 0.2m to chainage 16m. The upper beach between chainages 16-89m has lowered by up to 0.6m, switching to accretion on the upper beach by up to 0.5m. The middle-lower beach has lowered by up to 0.4m followed by accretion on the lower beach by up to 0.2m. The beach is at a medium-high level compared to the range recorded from previous surveys, particularly between chainages 10-15m which is at its highest level recorded. At profile **1aADC08** the dunes have remained largely stable since the last survey. From the toe of the dune to chainage 52m there has been accretion of up to 0.3m. Seaward of chainage 52m the middle and lower beach has been lowered by up to 1.1m. The beach profile terminates at the river at chainage 207m due to quicksand. Overall, the profile is at a middle level on the upper and middle beach, and at a low level on the lower beach compared to the range recorded from previous surveys, particularly between chainages 130-180m which is at its lowest level recorded. At profile **1aADC09** the dunes have shown accretion of up to 0.3m on the seaward face of the dune, and up to 1.0m at the dune toe since the last survey. The upper beach has accreted by up to 0.7m to chainage 62m. The middle beach has lowered by up to 0.6m to chainage 125m, switching to accretion on the lower beach by up to 0.1m to the end of the survey which terminates at a river due to quicksand. Overall, the profile is at a relatively medium level compared to the range recorded from previous surveys.	The dunes have remained largely stable since the last survey, showing growth at profile 1aADC08. There has generally been alternating patterns of accretion and erosion across the beach profile. The continued migration of the river channel is the most notable change. **Longer term trends:** The dunes show long-term stability. The changes in beach profile form and position observed since the last survey are within the bounds of previous surveys, although change in the position of the river channel has substantially curtailed profile 1aADC09 and therefore no information is available about beach elevations on the opposite bank of this channel along this profile alignment (this been the case since 2015).

Survey Date	Description of Changes Since Last Survey	Interpretation
March2021	**Topographic Survey:** The northern part of Alnmouth Bay (to the north of the River Aln estuary) is covered by bi-annual topographic survey, which commenced in April 2005. Data from the most recent topographic survey (Partial Measures, spring 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. The difference plot shows a mixed pattern of erosion and accretion. In the northern extent of the survey area, accretion dominates across the middle and lower beach, whilst patchy erosion and accretion occurs at the toe of the dunes. Moving southward, the middle extent of the survey area is characterised by a wide band of erosion on the middle beach and accretion on the lower beach. The upper beach has experienced little change. To the south of the survey area, accretion is dominant in the area fronting the village of Alnmouth itself with a small patch of erosion at the southern-most part of the survey extent closest to the mouth of the River Aln In general, the beach is characterised by alternating bands of accretion and erosion from the upper beach to the lower beach.	The findings of the topographic survey show a mixture of erosion and accretion, some resulting from winter erosion of the upper beach and consequent accretion in the lower beach (draw down), whereas other changes result from migration of the mouth of the River Aln across the beach.

2.9 High Hauxley & Druridge Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
31st March 2021	**Beach Profiles:** High Hauxley to Druridge Bay is covered by eight beach profile lines during the Partial Measures survey (Appendix A). Four of these (with A or B suffixes) were added to the programme in October 2007. The previous survey was undertaken for the Full Measures survey in autumn 2020. **1aADC15A**, **1aADC16** and **1aADC16A** are located around Hauxley Haven. Dunes at these three profiles have remained stable since the last survey. At profile **1aADC15A**, the beach profile has generally accreted by between 0.5m on the upper beach and 0.7m on the lower beach. A small section on the middle beach has lowered by up to 0.1m between chainages 76-114m. The rock outcrop seaward of chainage 194m has remained at a similar position. The beach profile is at a relatively high level compared to the range of previously recorded surveys. At profile **1aADC16** there has been accumulation at the toe of the dunes to chainage 92m by up to 0.3m. Between chainages 92m – 149m, the middle beach has lowered by up to 0.3m. Seaward of chainage 149m the lower beach has accreted by up to 0.9m. Overall, the upper and middle beach is at a low level relative to the range recorded from previous surveys, particularly between chainages 105-145m which is at its lowest level recorded. The lower beach is at a medium level. The survey report notes '*gaps in section due to bushes and no access to resident's garden'* which appear to be in the dune part of the section. Profile **1aADC16A** shows a lowering of the beach profile at the of up to 0.7m from the toe of the sea defences across the upper beach to chainage 134m. Between chainage 134m to the end of the survey at chainage 216m the profile has accreted by up to 0.9m. Overall the upper beach profile is at a low level and the middle and lower beach is at a high level compared to the range recorded from previous surveys. **1aADC16B**, **1aADC17** and **1aADC17A** are located to the north of Druridge Bay, between Bondi Carrs and Hadston Carrs and extend seawards from Togston Links. At profile **1aADC16B** there has been small sections of accretion within the dunes at the cliff top by up to 0.1m. There has been relatively little change across the rock platform which remains wholly exposed,	At Hauxley Haven, the dunes have remained stable since the last survey. Beach levels have generally experienced erosion on the upper-middle beach and accretion on the lower beach. Profiles largely remain within the bounds of previous surveys, except the beach between chainages 105-145m at ADC16 which is at its lowest position recorded. In most of Druridge Bay the dunes and low cliff at their toe, where present, have experienced little change. However, the beaches have varied with erosion tending to dominate on the upper and middle beach, with accretion on the lower beach. Beach profiles range from low to high levels compared to the range recorded from previous surveys. **Longer term trends:** At Hauxley Haven and Druridge Bay, the dunes have demonstrated a long-term trend of stability. The changes in beach profile form and position observed since the last survey are generally within the bounds of previous surveys.

Survey Date	Description of Changes Since Last Survey	Interpretation
	with change generally limited to ±0.1m. A section of the lower beach has lowered by up to 0.4m between chainages 182-218m. Overall the beach remains at a low level relative to the range recorded from previous surveys. At profile **1aADC17** the dunes have remained stable. Between the toe of the dunes at chainage 25m to 153m the upper and middle beach has lowered by up to 0.4m. Seawards of this point until the end of the survey at 297m the lower beach has accreted by up to 0.4m. Overall the profile is at a medium level on the upper beach, a low level on the middle beach, and a high level on the lower beach compared to the range of previously recorded results. At profile **1aADC17A** the dunes have remained stable. From the toe of the dunes to chainage 135m, the upper and middle beach has lowered by up to 0.2m. Seaward of this point the beach profile has accreted by up to 0.5m, covering some of the rock platform seaward of chainage 208m. Overall the beach profile is at a medium-high level compared to the range of previously recorded results. **1aCMBC01** and **1aCMBC02** are located in the southern section of Druridge Bay. At profile **1aCMBC01**, the dunes appear to have remained stable, with minor amounts of accretion and erosion limited to ±0.2m. Between the toe of the dunes at chainage 200m and 240m the upper beach has 0.7m. The middle beach between chainages 240-271m has lowered by up to 0.3m. The lower beach seaward of this point has accreted by up to 0.6m. Overall the beach is at a high level compared to the range of previously recorded surveys. At profile **1aCMBC02**, the dunes have remained stable, whilst the beach level at the toe of the dunes has dropped by up to 0.5m. The upper beach has experienced up to 0.4m of accretion between chainages 203m and chainage 236m. The middle beach between chainages 236-263m has lowered by up to 0.6m, resulting in a steeper upper-middle beach profile. Seaward of this point the lower beach has accreted by up to 0.8m. Overall, the beach profile is at a medium level on the upper beach, low level on the middle beach and high level on the lower beach compared to the range recorded from previous surveys.	

2.10 Lynemouth Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
28th March 2021	**Beach Profiles:** Lynemouth is covered by two beach profile lines during the Partial Measures survey (Appendix A). Profiles 1aCMBC03A and 1aCMBC03B were added to the programme in October 2007. The previous survey was undertaken for the Full Measures survey in autumn 2020. **1aCMBC03A** is located c.450m north of the mouth of the River Lyne and extends across the extensive colliery spoil banks before reaching the foreshore. The profile of the colliery spoil bank has not experienced any significant change since the last survey, with a small accumulation of sediment on the crest of the colliery spoil bank of up to 0.1m. The toe of the colliery spoil bank has eroded landward by approximately 0.2m and lowered by up to 0.3m. The remaining beach profile has lowered by up to 0.6m on the upper beach and up to 1.1m on the lower beach. The entire beach profile seaward of the colliery spoil bank is at its lowest level recorded. **1aCMBC03B** is located to the north of Lynemouth Power Station and extends across the extensive colliery spoil banks before reaching the foreshore. The process of colliery spoil bank erosion has been progressing for some years. Since the last survey, the crest of the colliery spoil bank has shown a 0.9m landward erosion and the toe has moved landward by 1.0m showing a slumping of material. This was recorded in the survey report as "*a small area of cliff fall*". The upper beach seaward of chainage -26m has lowered by up to 0.4m to chainage -21m. Seaward of chainage -21m the beach has accreted by up to 0.3m. Overall the beach profile is low compared to earlier surveys, particularly the upper beach between chainages -26m and -21m which is at its lowest level recorded.	North of the mouth of the River Lyne, the colliery spoil bank has remained stable, whilst the beach has lowered and is at its lowest level recorded. To the north of the power station, the colliery spoil bank has remained mostly stable, however the crest and toe have eroded. The beach has accreted across the majority of its length. **Longer term trends:** Opposite Lynemouth, the colliery spoil has demonstrated a total recession between the first survey in autumn 2007 and the most recent survey in spring 2021 of 34.2m overall. The rate of erosion has increased since the rate up to the last survey (from 2.3m/yr to 2.4m/yr). The backing coastal slopes have remained relatively stable over this time. To the north of the power station, total recession between the first survey in autumn 2007 and the most recent survey in spring 2021 is 56.00m. The average annual rate of erosion is 4.0m/yr which is a slight reduction on the rate seen up to the last survey (4.3m/yr).
May 2021	**Beach Topographic Survey:** Lynemouth Bay is covered by a 6-monthly topographic survey, which was added to the programme in December 2020. Data from the most recent topographic survey (Partial Measures, spring 2021) have been used to create a DGM (Appendix B – Map 3) using a GIS. A difference plot has also been	The highest rates of erosion across Lynemouth Bay are found at the cliff toe in the central survey area north of the River Lyne (up to 2.0m), and on the middle to lower beach immediately south of the rock

Survey Date	Description of Changes Since Last Survey	Interpretation
	produced using the DGM (Appendix B – Map 7) produced from the last topographic survey (Full Measures, autumn 2020) and the present survey. **Figure 7** shows a variable pattern of erosion and accretion across the survey extent. Erosion predominately occurs in three main areas north of the Lynemouth Power Station: on the middle-lower beach in the northern survey extent, across the beach profile in the central survey extent adjacent to Lynemouth and in the middle beach south of the River Lyne. Accretion predominantly occurs on the middle-lower beach immediately north and south of the Headagee outcrop in the north of the bay and across the beach profile immediately north of the River Lyne. The banks of the River Lyne show a patchy distribution of erosion and accretion (albeit quite a large patch of erosion on the northern bank), with generally low rates of change (±0.5m). South of the Lynemouth Power Station, erosion dominates over the middle and lower beach in the north and central survey extent, whilst accretion dominates on the upper beach. This transitions to accretion across the beach toward the south of the survey extent.	revetment (up to 0.75m). **Longer term trends:** The beach in the northern survey extent and in the lee of Headagee has remained relatively stable since the previous survey. The areas where the largest landward retreat has occurred are the areas where historically tipped colliery spoil is eroded on an ongoing basis.
May 2021	**Colliery Spoil / Cliff Edge Survey:** Colliery spoil edge survey data was collected for a baseline survey in December 2020, and again in May 2021. 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 edge has remained stable in this part of the bay since the previous survey, with very little change recorded. In the centre of the bay (immediately north of the power station 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	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. Where the spoil beach is absent (such as in the centre of the bay), the backing colliery spoil cliffs are actively eroding, causing measurable landward recession. **Longer term trends:** Since cliff top surveys began in December 2020, cliff movement has been greatest in the centre of the bay (north of the River Lyne) with up to 18.0m 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. Future repeat cliff top surveys are expected to help

Survey Date	Description of Changes Since Last Survey	Interpretation
	small areas of recession of less than 1.0m. The greatest changes are recorded north of the River Lyne, with several sections retreating by between 1-3m, however, in places this may be due to enabling works undertaken in February 2021 to flatten parts of the cliff top. The largest area of retreat (occurring approximately 116m north of the River Lyne) is a 200m section of cliff which has eroded by up to 18m. This extent of change is beyond the landward of extent of the enabling works and must be deemed at least part erosion. 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. There has been little movement in the colliery spoil edge since the previous survey.	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.

2.11 Newbiggin-by-the-Sea

Survey Date	Description of Changes Since Last Survey	Interpretation
2nd March 2021	**Beach Profiles:** Newbiggin-by-the-Sea is covered by four beach profile lines during the Partial Measures survey (Appendix A). Two of these (with an 'A' suffix) 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. It should be noted that an extended series of profiles and a topographic survey are also recorded via the Cell 1 Regional Coastal Monitoring Programme for purposes of post-project evaluation of this capital scheme. These profiles are not analysed here, however, the findings of the topographic survey are presented below. The previous survey was the Full Measures assessment undertaken in autumn 2020. Profile **1aWDC05A** is in the north of Newbiggin Bay. There has been accretion of up to 0.3m on the landward side of the seawall caused by the wash-over of sediment from the beach. Between the sea wall and chainage 40m the upper beach has experienced very little change, with some small sections experiencing accretion of up to 0.2m. The middle beach has lowered by up to 0.6m between chainages 40-61m, before switching to accretion on the lower beach by up to 0.6m between chainages 61m and the rock platform at chainage 112m. The rock platform remains exposed seaward of chainage 112m. The profile is at a high level across the beach compared to the range recorded from previous surveys. Profile **1aWDC06** is located in the centre of the northern part of Newbiggin Bay, between the two breakwaters. There has been accretion up to 0.1m of material at the base of the seawall to chainage 17m. The upper beach between chainages 17-34m has lowered by up to 0.4m followed by very little change in beach level between chainages 34-51m across the middle beach. The lower beach seaward of chainage 51m has accreted by up to 0.4m. The beach profile is at a relatively medium-high level compared to the range recorded from previous surveys. Profile **1aWDC06A** is located in the centre of Newbiggin Bay, behind the offshore breakwater. There has been accretion of up to 0.2m between the seawall and chainage 78m, followed by a short section of beach lowering by up to 0.7m to chainage 93m. The middle beach between chainages 93-175m has accreted by up to 0.5m. The lower beach seawards of chainage 175m has accreted by up to 0.5m. Overall, the profile is at a high level relative to the range recorded from previous surveys, particularly	Since the last survey, the beach at Newbiggin-by-the-Sea generally shows accretion on the upper beach and lower beach, with erosion on the middle beach. The profiles are generally at a medium-high level, except profile 1aWDC07 which is at a low level. **Longer term trends:** Data collected since the start of monitoring 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. The changes in beach profile form and position observed since the last survey are within the bounds of previous surveys, except profile 1aWDC07 which is continuing to decrease in level.

Survey Date	Description of Changes Since Last Survey	Interpretation
	between chainages 15-35m, 65-77m and 132-170m which are at their highest levels recorded. **1aWDC07** is located towards the south of Newbiggin Bay. There has been accretion across the upper beach by up to 0.1m to chainage 17m, switching to a reduction in beach profile by up to 0.2m to chainage 31m. Seawards of chainage 31m the beach level has risen by up to 0.2m. Overall the profile is at a low level throughout the profile compared to the range recorded from previous surveys.	
March 2021	**Topographic Survey:** Newbiggin-by-the-Sea is covered by bi-annual topographic survey, which commenced in September 2010 to assess the performance of the capital scheme constructed in 2007. Prior to incorporation in the programme, these surveys were undertaken on occasions between 2007 and 2010 as part of the scheme development. The previous survey was the Full Measures assessment undertaken in autumn 2020. Data from the most recent topographic survey (Partial Measures, spring 2020) 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 8) produced from the previous and present surveys. The topographic survey shows shore-parallel bands of accretion and erosion in the north and central areas since the previous survey. The upper beach at the toe of the sea defence shows little change (±0.1m), followed by erosion, accretion and erosion towards the low water mark. The tombolo behind the central breakwater shows accretion on the southern side, with erosion on the north. The south of the bay is dominated by erosion on the middle beach with small patchy areas of accretion on the lower beach. The survey report notes that "*sand was covering most of the revetment rocks at the back of the beach and the concrete steps were exposed for stretches at the back of the beach*".	The topographic survey shows shore parallel bands of erosion and accretion in the north and central bay, whilst the southern end of the bay shows a much patchier distribution of change. Changes are limited to ±0.75m. The topographic survey generally shows a trend of sand bar movement across the beach profile. e
March 2021	**Sand Extent Survey**: Spital Carrs is located to the south of Newbiggin Bay and is covered by a bi-annual sand extent survey, which commenced in 2011. The survey was designed to address concerns that the beach recharge scheme undertaken in Newbiggin Bay may impact on the Spital Carrs SSSI and SPA. The sand extent	Since the last survey, there has been retreat of the edge of the sand across the survey area, except for a few isolated sections in the central survey area. **Longer term trends:** Sand extent surveys for the past

Survey Date	Description of Changes Since Last Survey	Interpretation
	survey therefore identifies the boundary of the sand beach on the rock platform. Data from the most recent sand extent survey (Partial Measures, spring 2021) has been plotted onto aerial imagery (refer to Appendix C – Map 1). In general, the plot shows a landward retreat of the extent of sand between the autumn 2020 and the spring 2021 survey. In the north, there has been up to 8.0m of landward retreat of sand. Erosion of up to 15.0m dominates in the central survey area, however there is one short sections of accretion by up to 7.0m. In the south of the survey extent, erosion has occurred by up to 29m and in many areas is now at its most landward position recorded.	19 surveys shows oscillation of the edge of the beach with no net trend, however the most recent survey is at its most landward position across the majority of the central and southern survey area.

2.12 Cambois Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
March 2021	**Cliff-top Survey:** Cliff top survey data collected for baseline survey (spring, 2009), the previous Full Measures survey (autumn 2020) and the present Partial Measures survey (spring 2021) is presented in this report. 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 from the cliff top monitoring are anticipated to have an accuracy of ±0.2m 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. Overall, the majority of the position of the cliff top at Sandy Bay Caravan Park has remained stable since the previous survey in autumn 2020. However, several short lengths of cliff top have eroded at the northern and southern extent of the caravan park since the previous survey. In the north, two short sections (approximately 5m in length) have eroded by up to 2.0m. In the south, several sections (up to a maximum of 6m in length) have eroded by up to 2.5m since the previous survey. The dunes on the southern bank of the River Wansbeck show very little change since the previous survey in autumn 2020. There has been very little change along the survey length in Cambois Bay, with small isolated sections of retreat of typically less than 0.1m. There is one 48.5m section parallel to West Bridge Street at the mouth of the River Blyth in the southern extent of the survey that retreated by approximately 4.2m.	Since the last survey in autumn 2020, there has been relatively little change except for a few sections of erosion of up to 2.5m along the northern-most and southern-most Sandy Bay Caravan Park survey area. In Cambois Bay the erosion is generally localised small sections, with the most notable section of retreat in the south of the bay of up to 4.2m. **Longer term trends:** 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 2007, whilst the northern part has eroded by c.1-3m. In Cambois Bay, the area of greatest cliff top retreat since the surveys began in 2009 is in the centre of the bay opposite Ridley Terrace, Cambois, where up to 12m of erosion has occurred. The north and south of the bay have more typical retreats of c.3-7m.

2.13 Blyth South Beach

Survey Date	Description of Changes Since Last Survey	Interpretation
3rd March 2021	**Beach Profiles:** Blyth South Beach is covered by six beach profile lines for the Partial Measures survey (Appendix A). The previous survey was the Full Measures assessment undertaken in autumn 2020. Profile **1aBVBC01** is located towards the north of South Beach, in front of the land owned by the Port of Blyth. The dunes have remained stable with some accretion of up to 0.2m on the dune crest and 0.1m on the most seaward dune face. There has been up to 0.2m of erosion from the toe of the dunes at chainage 35m to 41m. The middle beach has lowered by up to 0.6m to chainage 125m. The lower beach has accreted by up to 0.8m to the end of the survey at chainage 212m, filling in a hollow. Overall, the dunes, upper beach and lower beach are at a high level, particularly the dune crest which is at its highest level recorded. The middle beach is at a medium level. At profile **1aBVBC02**, the upper beach at the base of the seawall has lowered by up to 0.6m to chainage 18m switching to a small section of accretion to chainage 30m by up to 0.2m. Between chainages 30m and 101m the middle beach has lowered by up to 0.6m. The lower beach between chainages 101m and 179m has accreted by up to 0.7m. Overall the profile is at a medium level on the upper beach, a low level on the middle beach and a high level on the lower beach compared to the range recorded from previous surveys. At profile **1aBVBC03**, there have been no significant changes to the position and form of the dune crests or the upper part of the dune front since the last survey. The lower part of seaward facing dune has retreated landward by 4m and the toe has lowered by 1.2m. The upper beach berm has eroded by up to 1.1m to chainage 150m. There has been a small section of accretion on the middle beach between chainages 170-205m by up to 0.2m. Seaward of chainage 205m, the lower beach has lowered by up to 1.1m. Overall the profile is at a low level at the dune toe, particularly between chainages 80-89m which is at its lowest level recorded. The upper beach is at a medium level, the middle beach is at a high level and the lower beach is at a low level compared to the range recorded from previous surveys. At profile **1aBVBC04**, up to 0.1m of accretion has taken place on the dune crest and dune face. The	Since the last survey, the dune crests at Blyth South Beach have remained stable, generally retaining the same form and position with some minor advances. There have been variable amounts of erosion and accretion across the profiles, with a general trend of erosion on the upper-middle beach and accretion on the lower beach. Profiles range from a low to high level compared to the range recorded from previous surveys, however the dune crest at 1aBVBC01 is at its highest level recorded and the beach level between chainage 80-89m at profile 1aBVBC03 is at its lowest level recorded. **Longer term trends:** At Blyth South Beach, the dunes have generally demonstrated a long-term trend of stability.

Survey Date	Description of Changes Since Last Survey	Interpretation
	dune toe has lowered by up to 0.8m to chainage 68m. The upper to middle beach has accreted by up to 0.9m between chainages 68-100m. The middle beach has lowered by up to 1.0m to chainage 208m, switching to accretion on the lower beach by up to 0.6m. Overall, the profile is at a medium level compared to the range recorded from previous surveys, whilst the dunes are at a high level. At profile **1aBVBC05**, the dunes have remained stable, with an accumulation of 0.5m between the dune toe and chainage 86m. The middle beach has lowered by up to 0.8m between chainages 86-224m resulting in a stepper middle beach profile. The lower beach has accreted by up to 0.3m. Overall the dunes are at a high level, whilst the rest of the beach profile is at a medium level compared to the range recorded from previous surveys. Profile **1aBVBC06** is located at the southern end of the beach, towards Seaton Sluice. The dunes have remained stable. The upper beach has lowered by up to 0.6m to chainage 140m resulting in a steep upper beach profile. Seaward of chainage 140m the beach level has accreted by up to 0.6m. The dunes are at a high level, whilst the beach is a medium-low level compared to the range recorded from previous surveys.	

3. Problems Encountered and Uncertainty in Analysis

Individual Profiles

- Profiles 1aBTBC19, 1aBTBC21, and 1aBTBC23 all end at drains.
- At profiles 1aADC08 and 1aADC09, the profiles end at the River Aln channel due to quicksand.
- At profile 1aADC16 there are gaps in the section due to bushes, and no access to resident's gardens.
- Profile 1aADC16B now starts at the new fence.
- At profile 1aCMC02 livestock with young prevented access to the start of the section.

Topographic Surveys

- At Newbiggin-by-the Sea, the topographic survey report notes that sand was covering most of the revetment rocks at the back of the beach, and that the concrete steps were exposed for long stretches at the back of the beach.
- At Lynemouth, the River Lyne was too deep to survey bed levels.

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 ±0.2m may be considered as being within the margins of error of the surveying technique, and that any indication of an advancing cliff line is error.

Surveying the cliff top along Cambois Bay is more difficult than the similar surveys at Newbiggin Caravan Park and Sandy Bay Caravan Park because the cliff edge is less distinct and hard to precisely define due to vegetation coverage and its smooth, degraded form.

The surveyors noted the following at Cambois:

- there was very thick dense vegetation at the north end of the cliff top which hindered the survey of the line; and
- A small section of the gabion baskets were displaced.

At Lynemouth, a small area of cliff fall was apparent (see survey report).

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

No changes to the monitoring programme are recommended at this time.

5. Conclusions and Areas of Concern

- At Sandstell Point (Spittal A), the crest of the distal end of the spit has migrated landward by ~65m and has experienced slumping at the landward end. The recorded profiles and topographic survey present no causes for concern.
- At Spittal (Spittal B), there has been a redistribution of sediment throughout the profiles however the recorded profiles present no causes for concern.
- At Goswick Sands, the beach has undergone very little change since the previous survey. The recorded profiles present no causes for concern.
- At Holy Island, the Snook and beach have remained stable since the previous survey. The recorded profiles present no causes for concern.
- At Beadnell Village, the beach is at a medium-high level and the recorded profiles present no causes for concern.

- At Beadnell Bay, the profiles have undergone variable patterns of erosion and accretion, and the dunes have generally remained stable with some signs of growth. The recorded profiles present no causes for concern
- At Boulmer the profiles have generally accreted since the last survey. The recorded profiles present no causes for concern.
- At Alnmouth Bay, there has been alternating patterns of accretion and erosion across the beach profile. The recorded profiles and topographic surveys present no causes for concern.
- At High Hauxley & Druridge Bay, the dunes have remained stable and beach profiles have undergone variable patterns of erosion and accretion. The recorded profiles present no causes for concern.
- At Lynemouth Bay, to the north of the River Lyne (profile 1aCMBC03A) the beach has continued to lower and is now its lowest level recorded. To the north of the Power Station (profile 1aCMBC03B), the crest of the colliery spoil bank has retreated by between 1-3m, which may be a result of battering back of the cliff face as part of the enabling works for the Lynemouth Coastal Landfill Scheme, or coastal erosion. The largest amount of erosion has occurred just south of profile 1aCMBC03A, where a 200m section of colliery spoil cliff has eroded landward by up to 18m (the extent of change is beyond the extent of the enabling works and is therefore deemed at least part erosion).
- At Newbiggin Bay, the beach has remained stable, and the recorded profiles present no cause for concern.
- At Cambois Bay, the cliff top survey shows localised small sections of erosion, with the most notable section of retreat in the south of the bay of up to 4.2m. At the Sandy Bay Caravan Park survey area, there has been relatively little change since the previous survey.
- At Blyth South Beach, there have been variable amounts of erosion and accretion across the profiles, whilst the dunes have generally retained the same form and position since the previous survey.
- Across the Northumberland County Council frontage beaches appears to have recovered from the effects of the March 2018 storm, known as the ‘Beast from the East’.

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

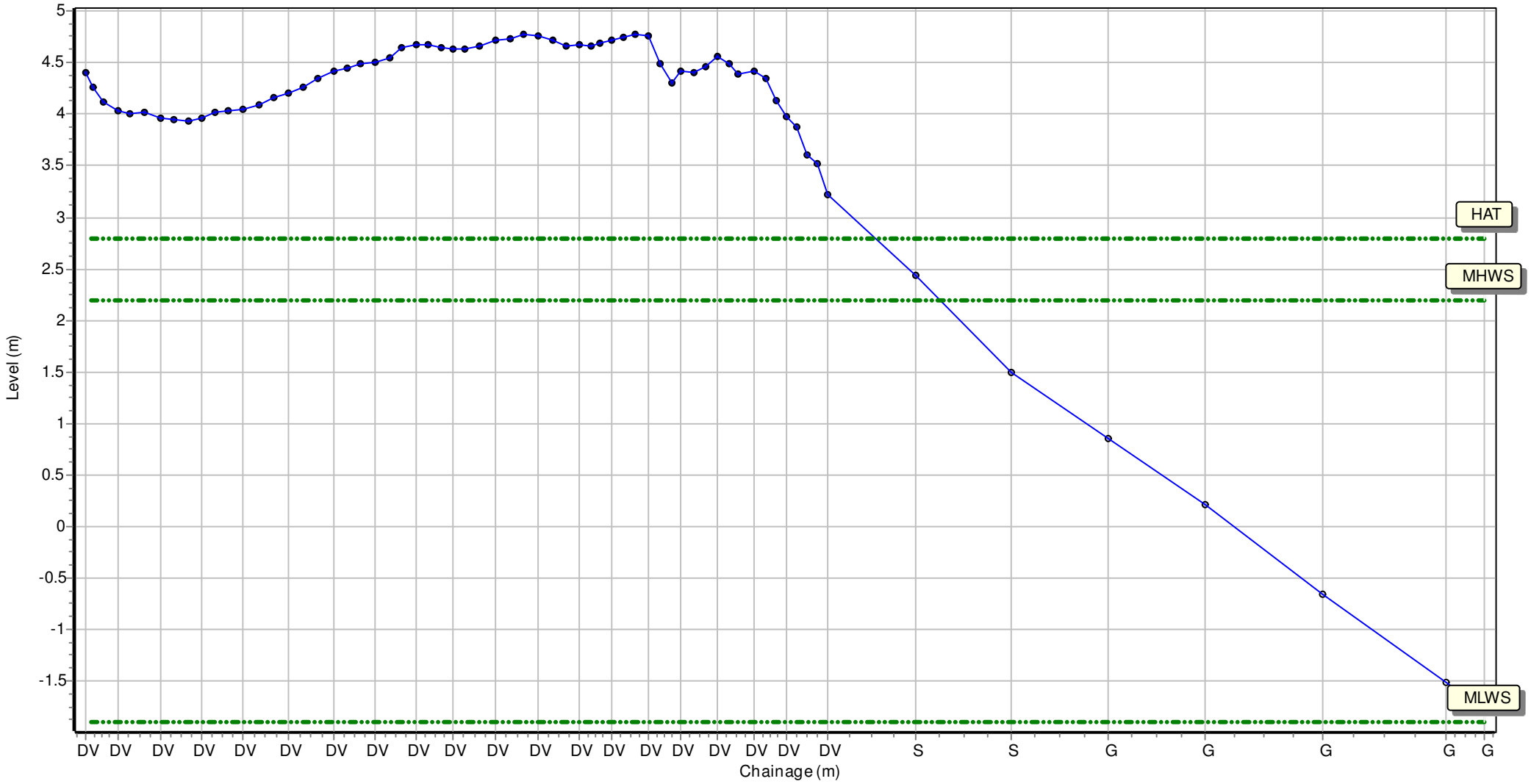
Location: **1aBTBC02**

Date: 18/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

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



Beach Profile

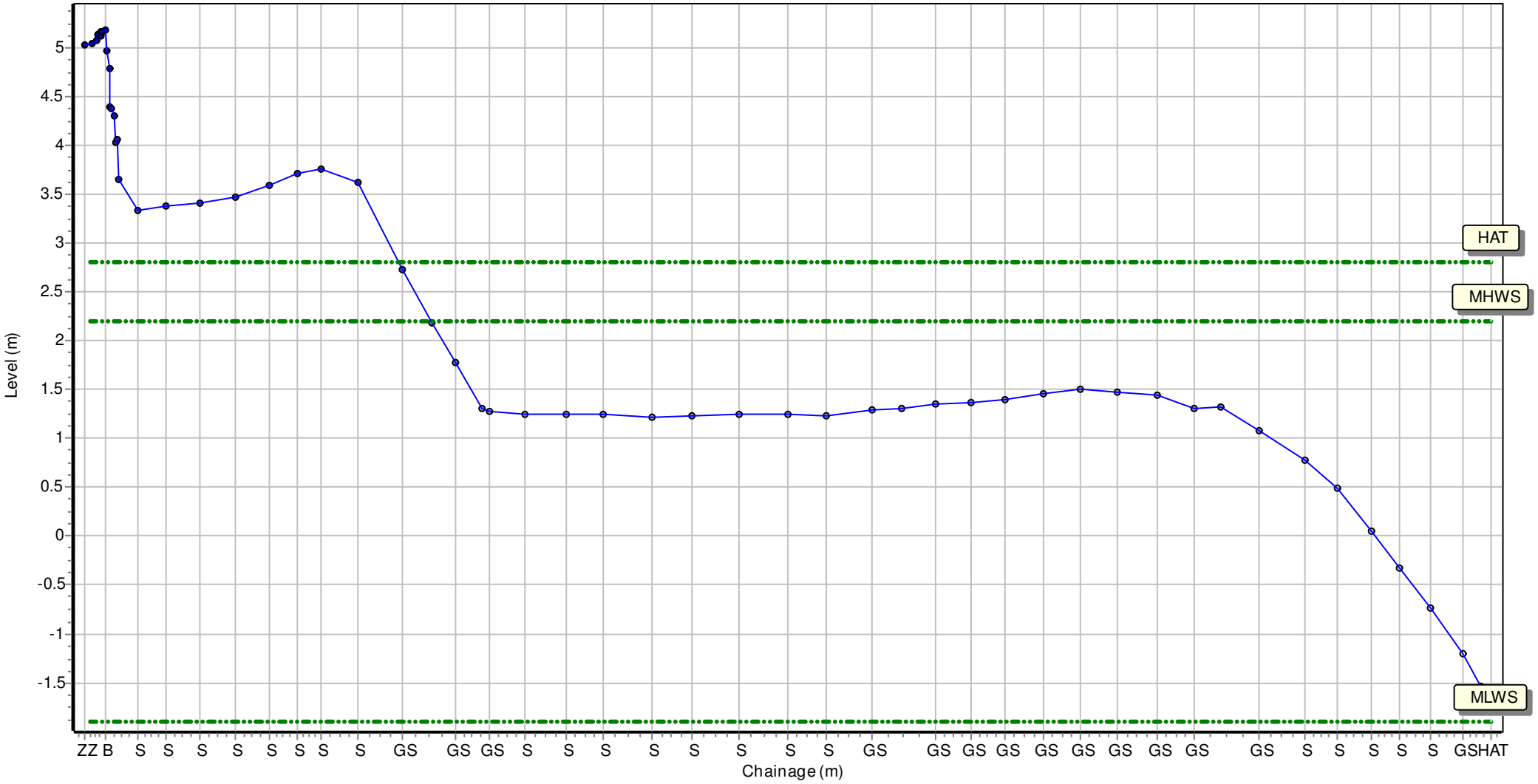
Location: **1aBTBC04**

Date: 18/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

Easting: 400531.615 **Northing:** 652001.966 **Profile Bearing:** 27 ° from North



Beach Profile

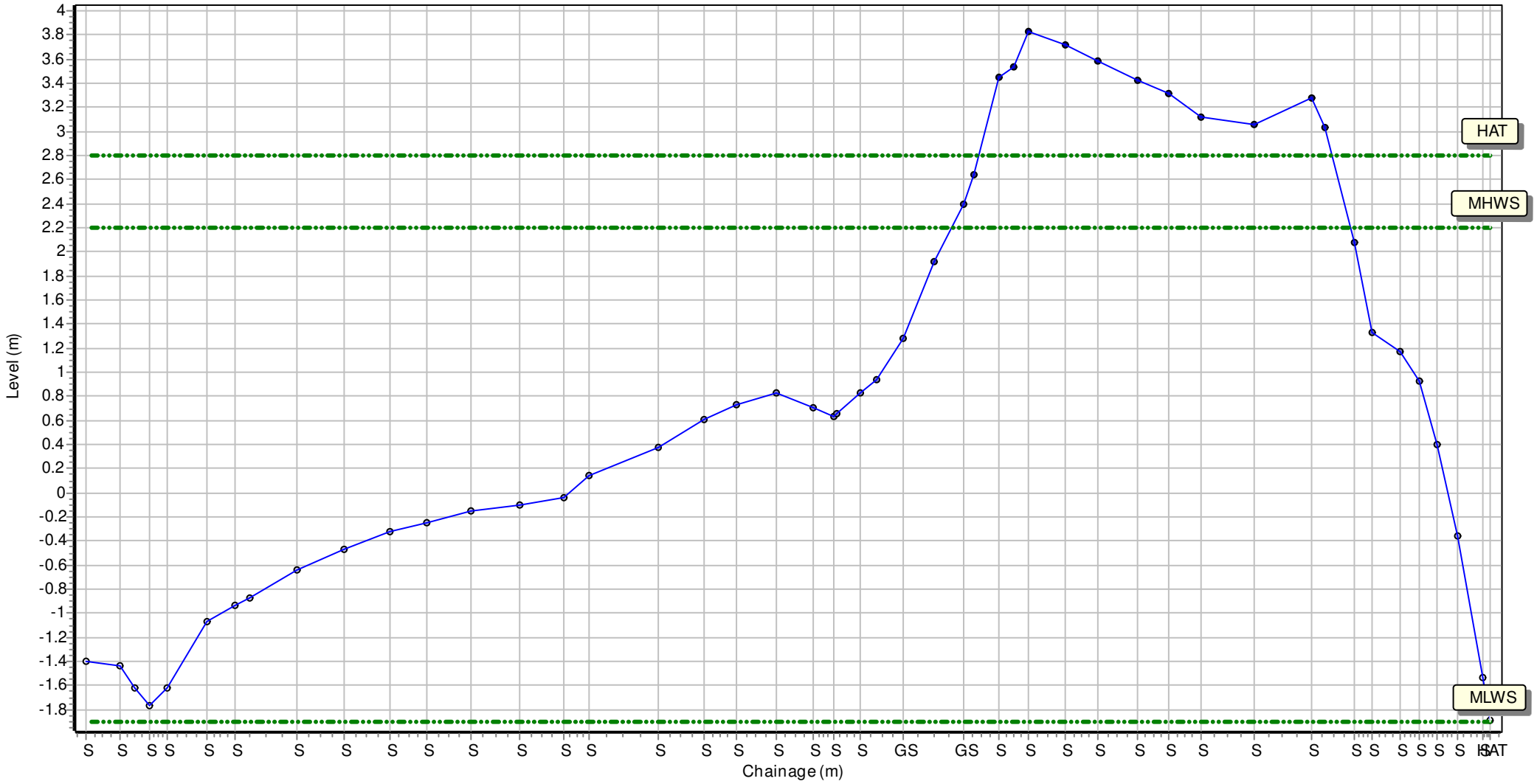
Location: **1aBTBC05**

Date: 18/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

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



Beach Profile

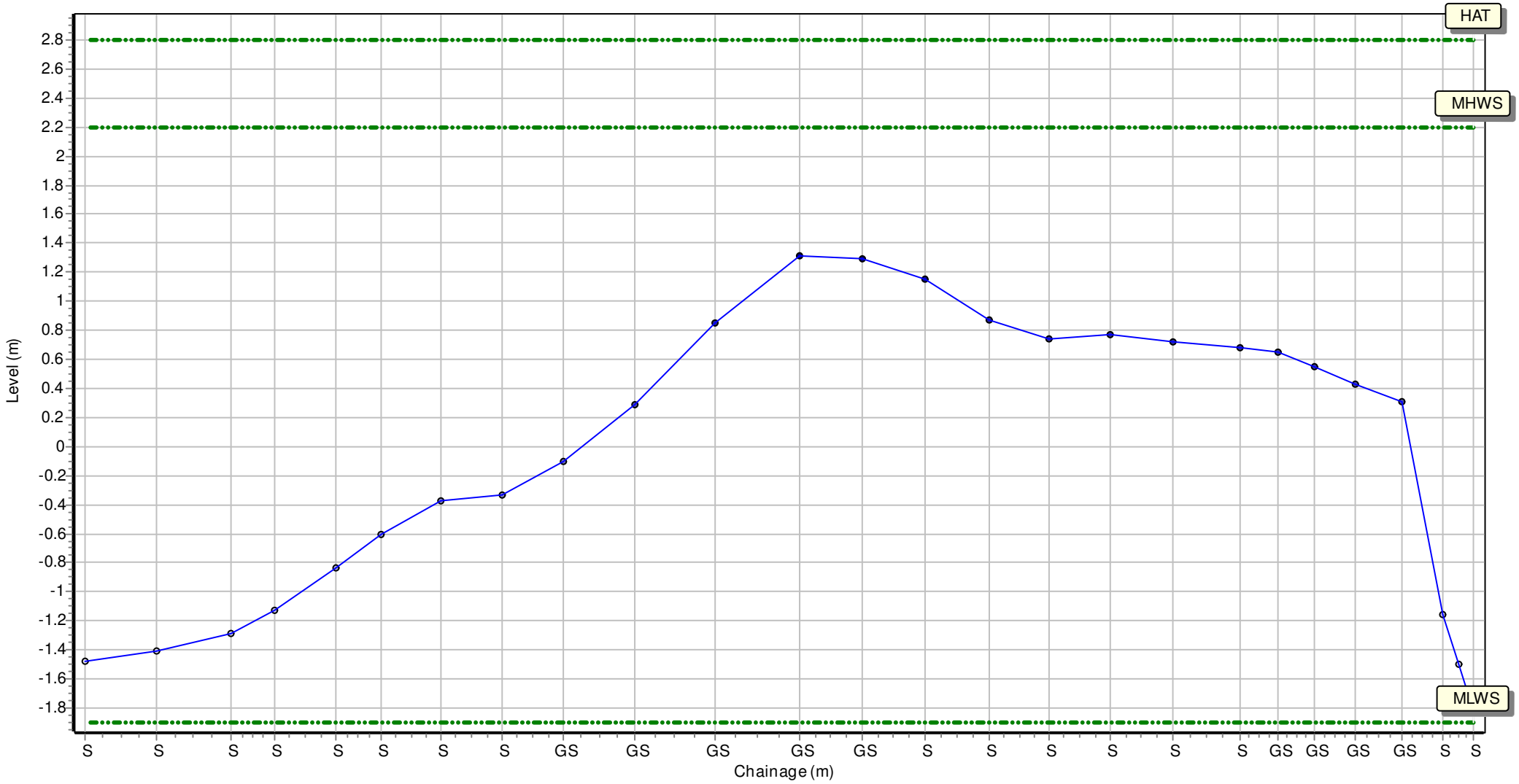
Location: **1aBTBC06**

Date: 18/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

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



Beach Profile

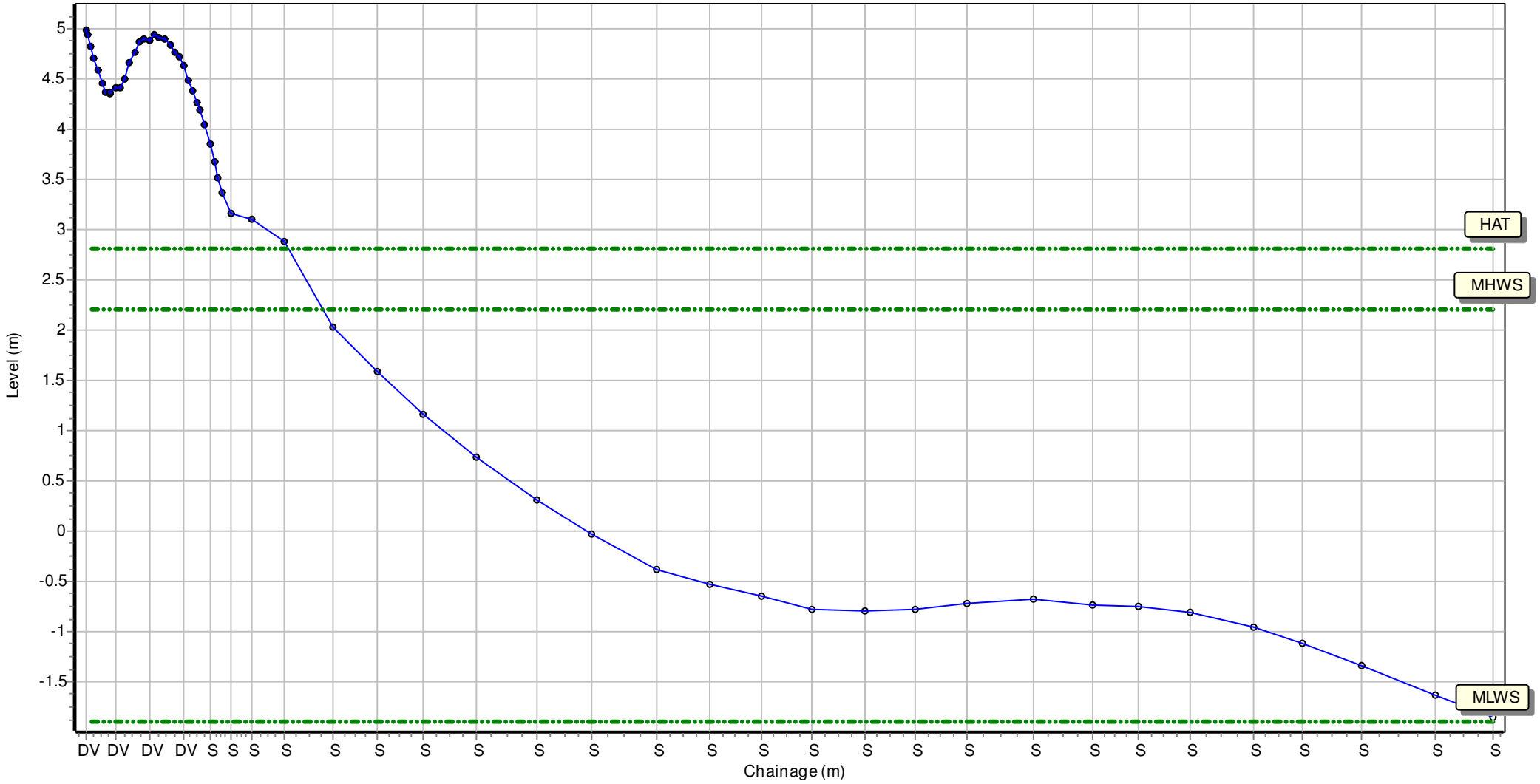
Location: **1aBTBC11**

Date: 18/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

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



Beach Profile

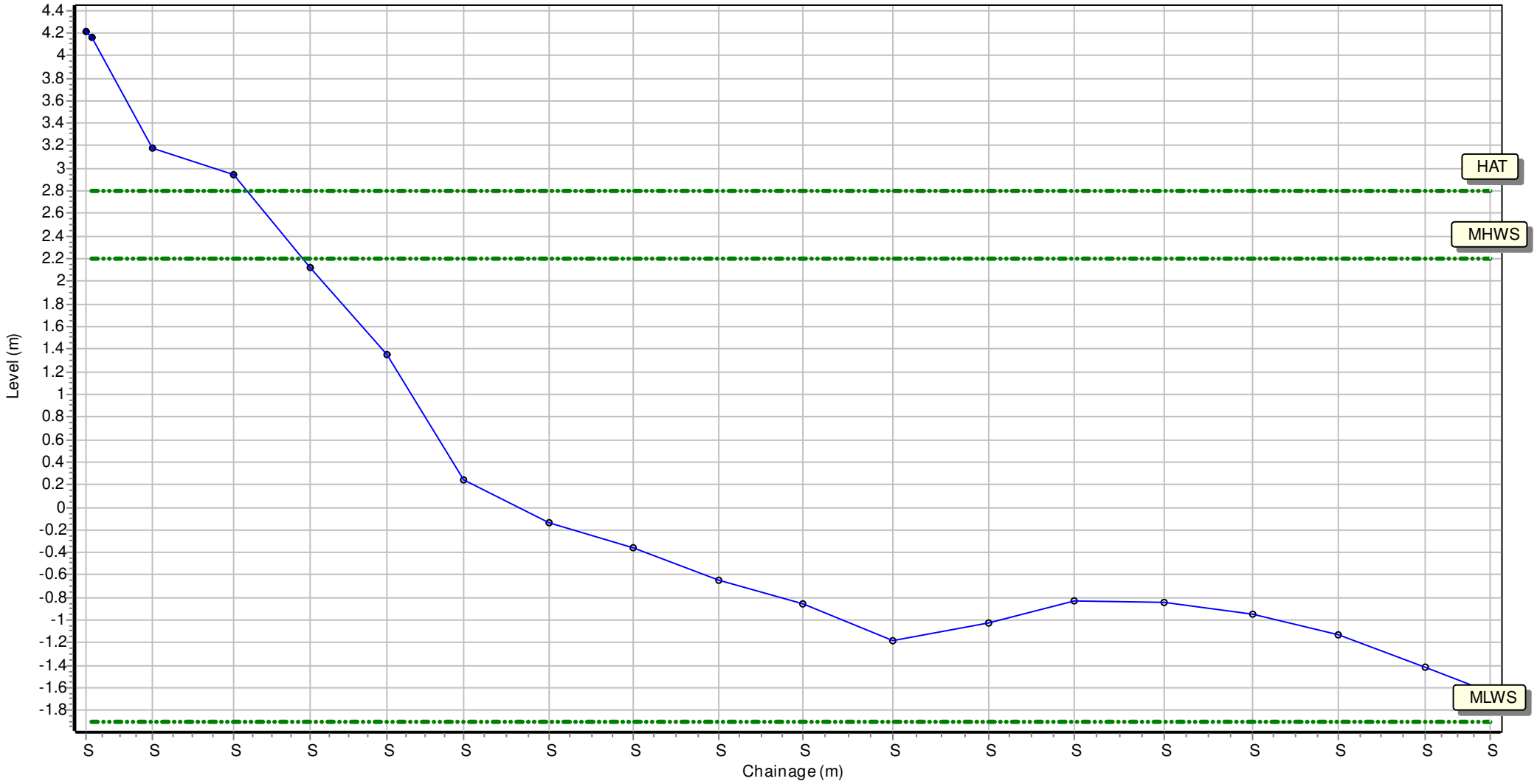
Location: **1aBTBC13**

Date: 18/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

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



Beach Profile

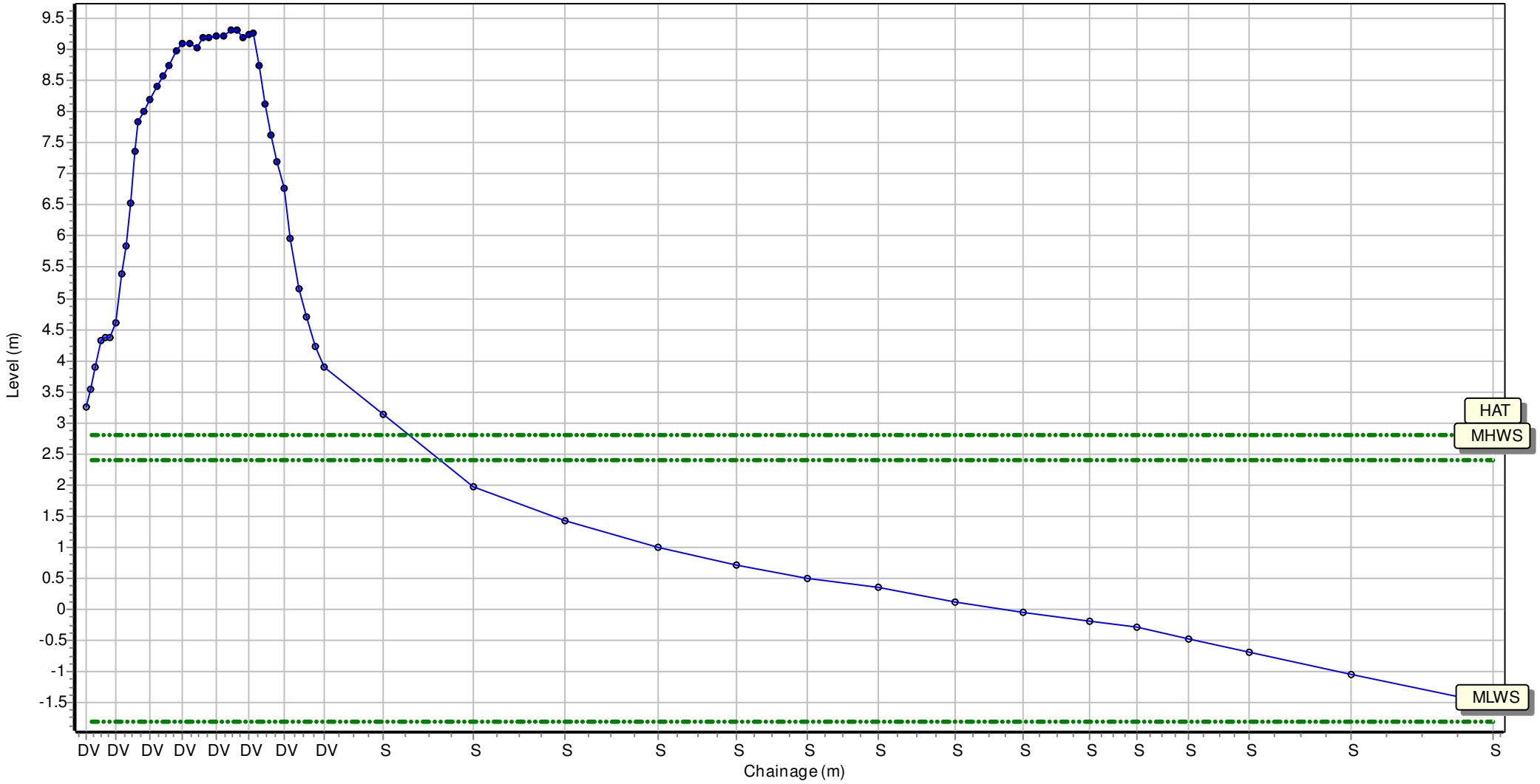
Location: **1aBTBC16**

Date: 17/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

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



Beach Profile

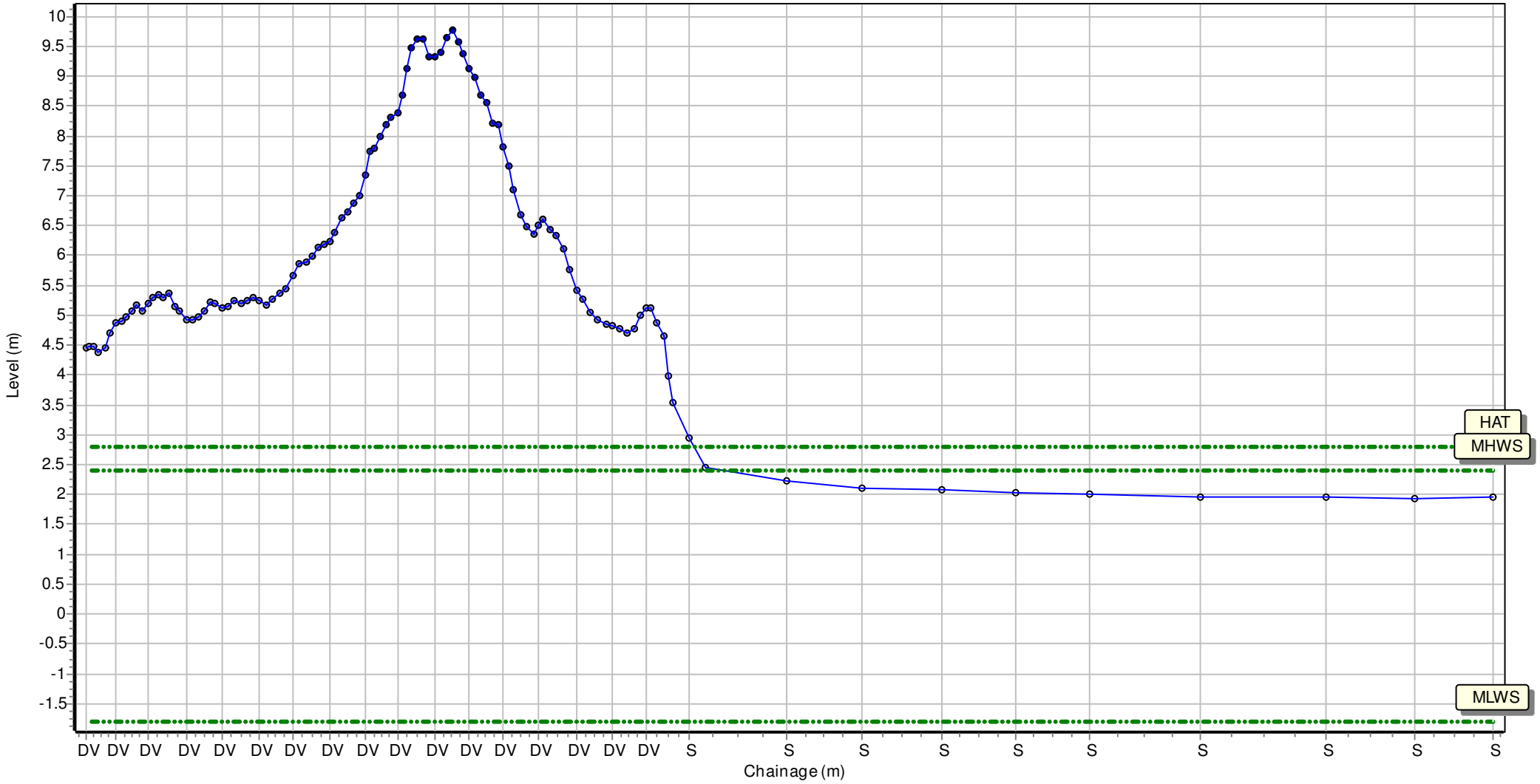
Location: **1aBTBC19**

Date: 17/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

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



Beach Profile

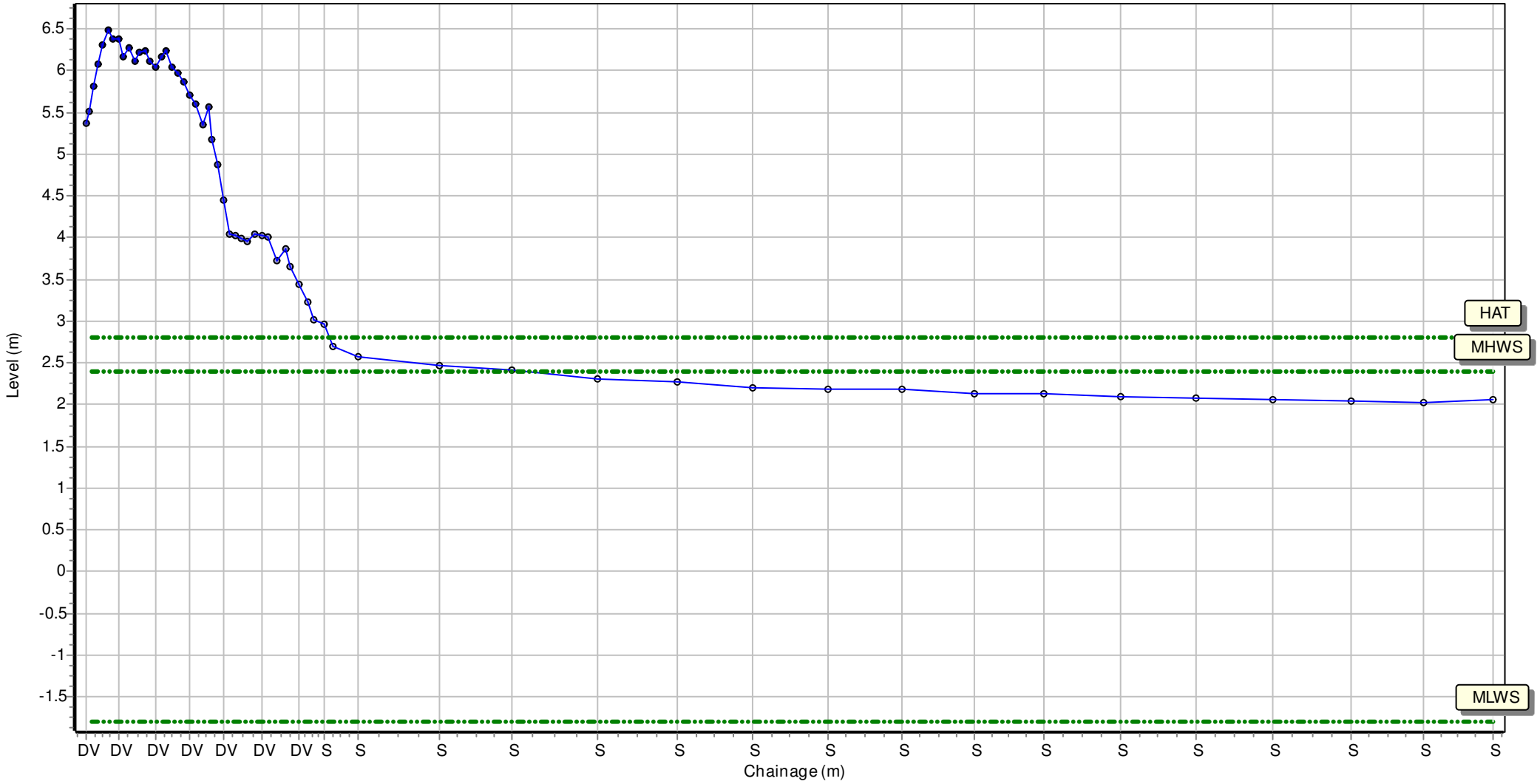
Location: **1aBTBC21**

Date: 17/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

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



Beach Profile

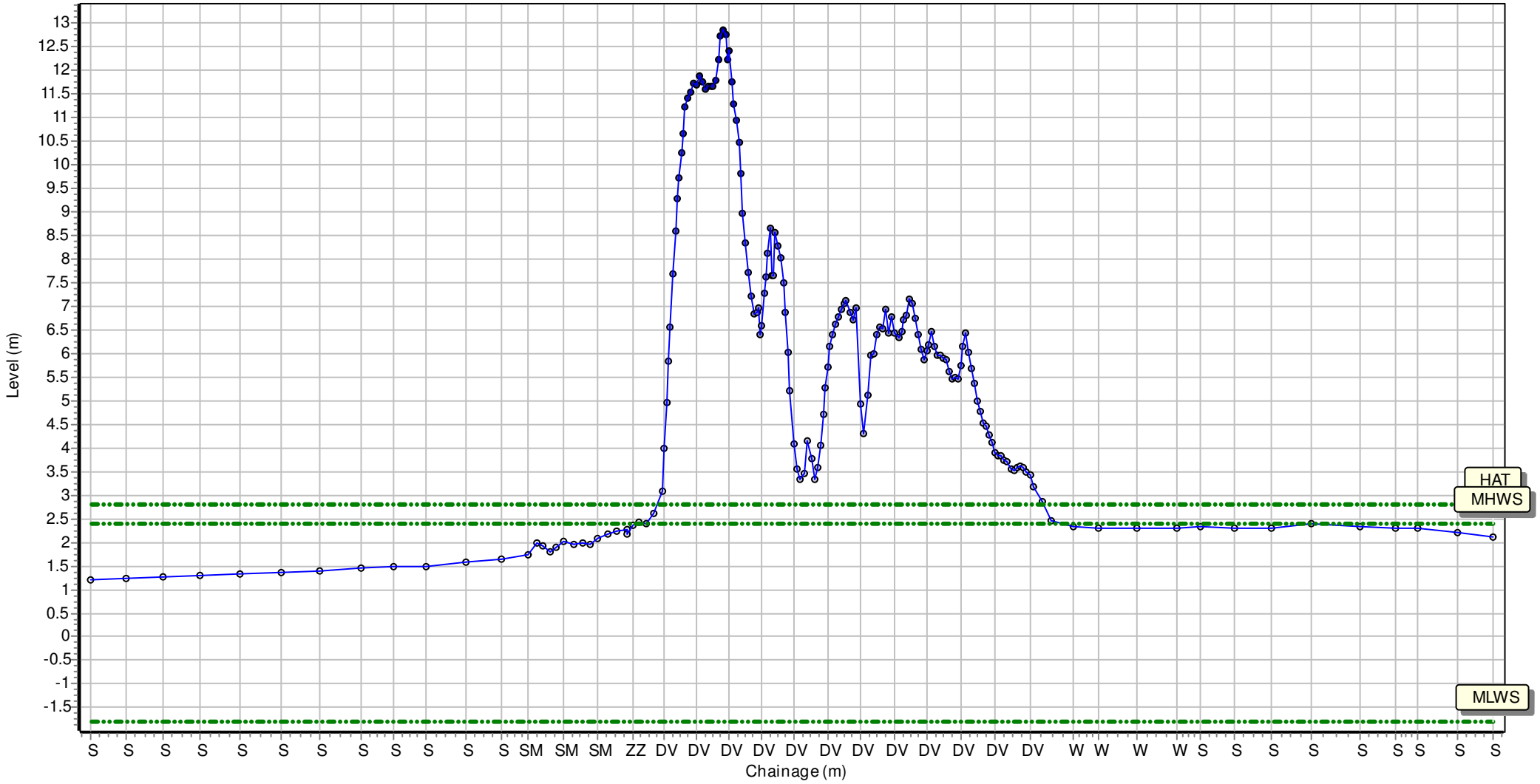
Location: **1aBTBC23**

Date: 17/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

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



Beach Profile

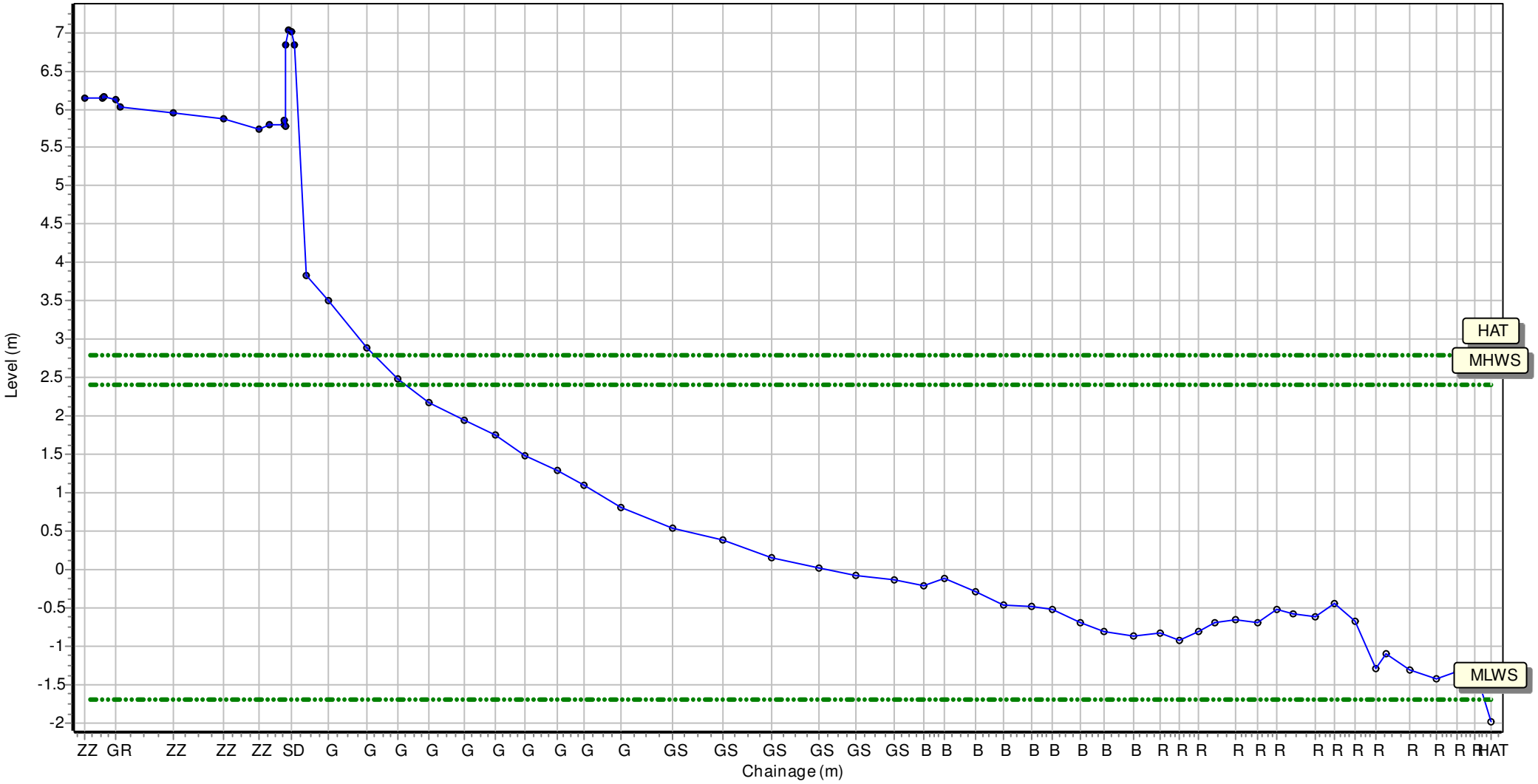
Location: **1aBTBC31**

Date: 16/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

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



Beach Profile

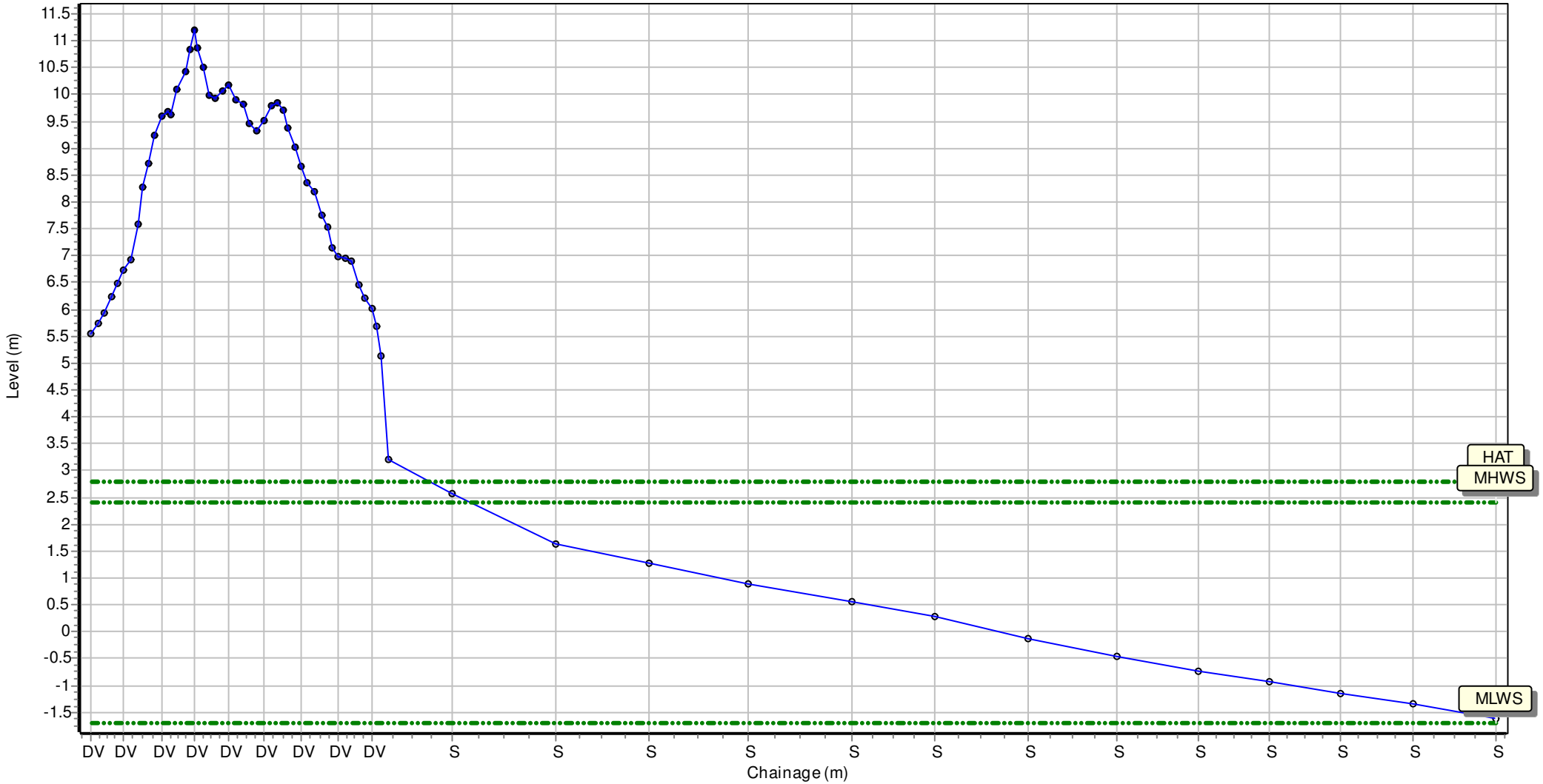
Location: **1aBTBC33**

Date: 16/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

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



Beach Profile

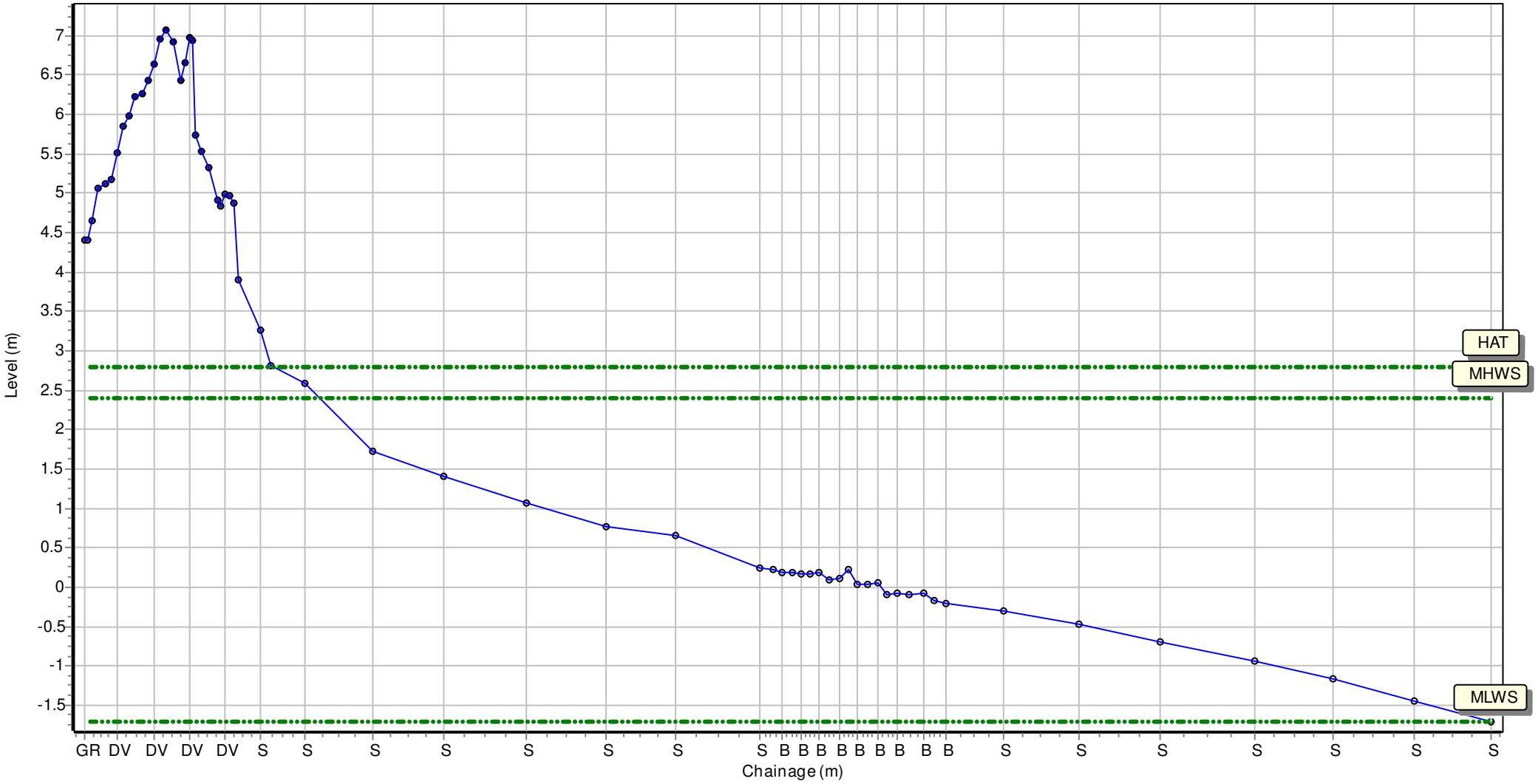
Location: **1aBTBC34**

Date: 16/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

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



Beach Profile

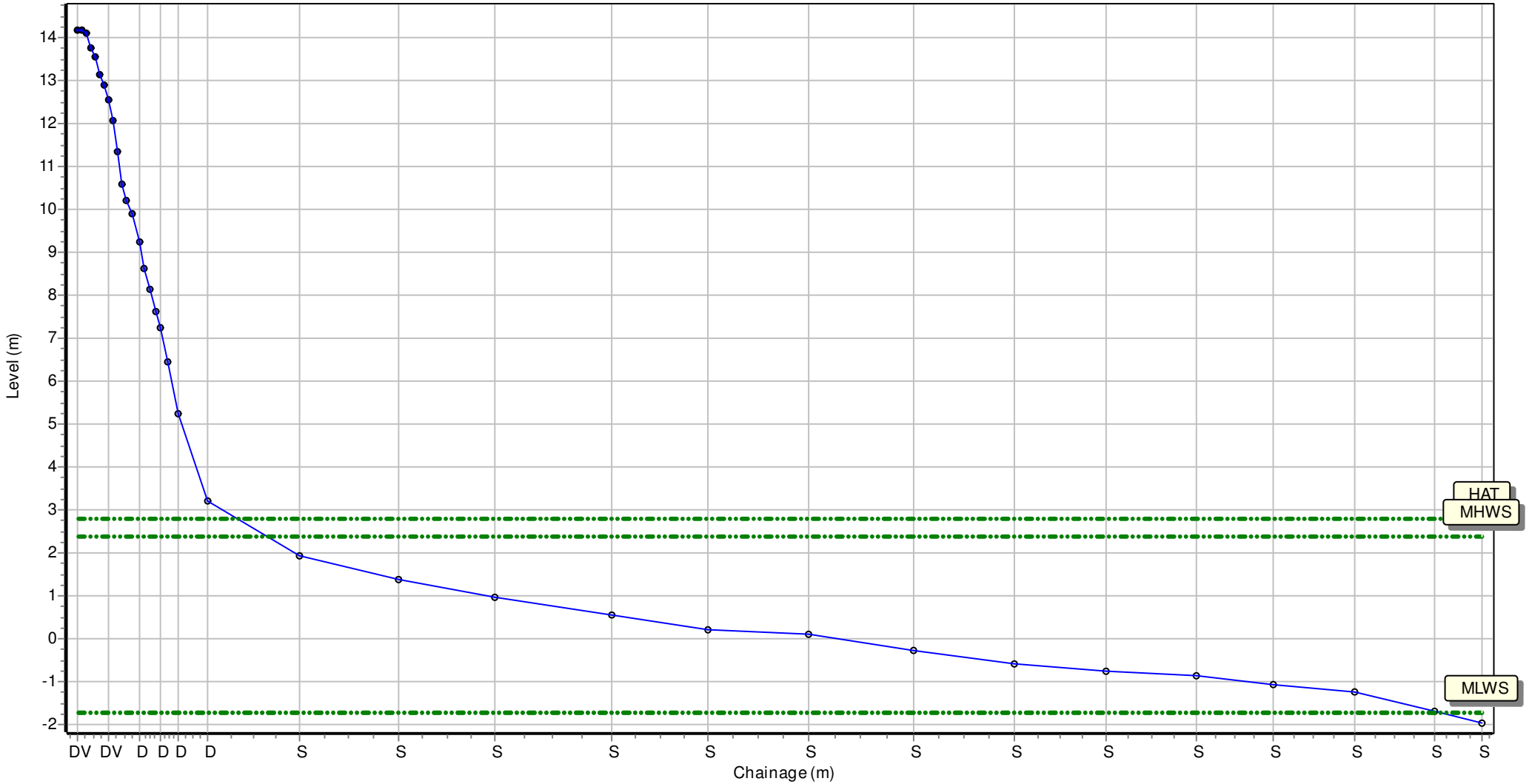
Location: **1aBTBC37**

Date: 16/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

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



Beach Profile

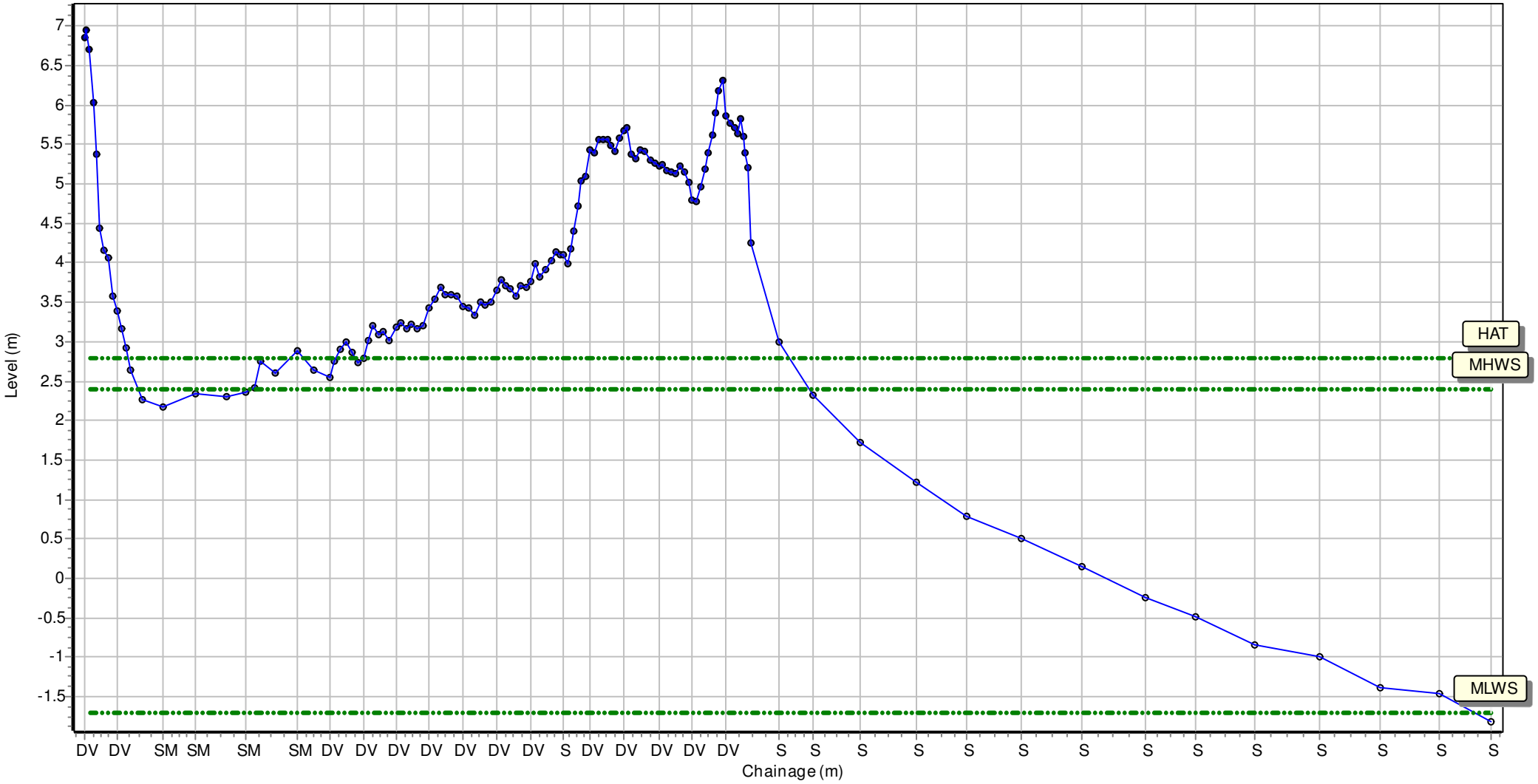
Location: **1aADC01**

Date: 16/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

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



Beach Profile

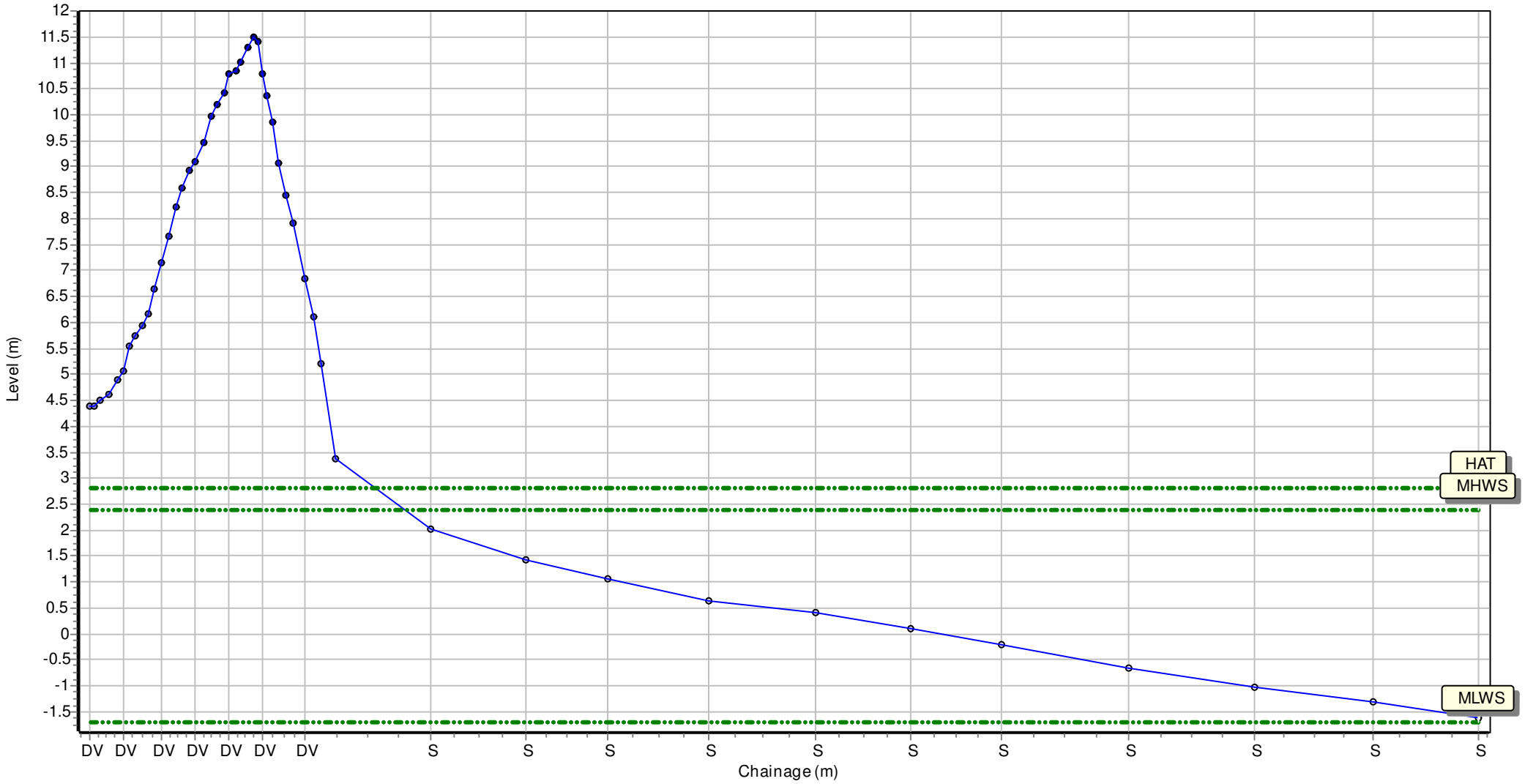
Location: **1aADC02**

Date: 16/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

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



Beach Profile

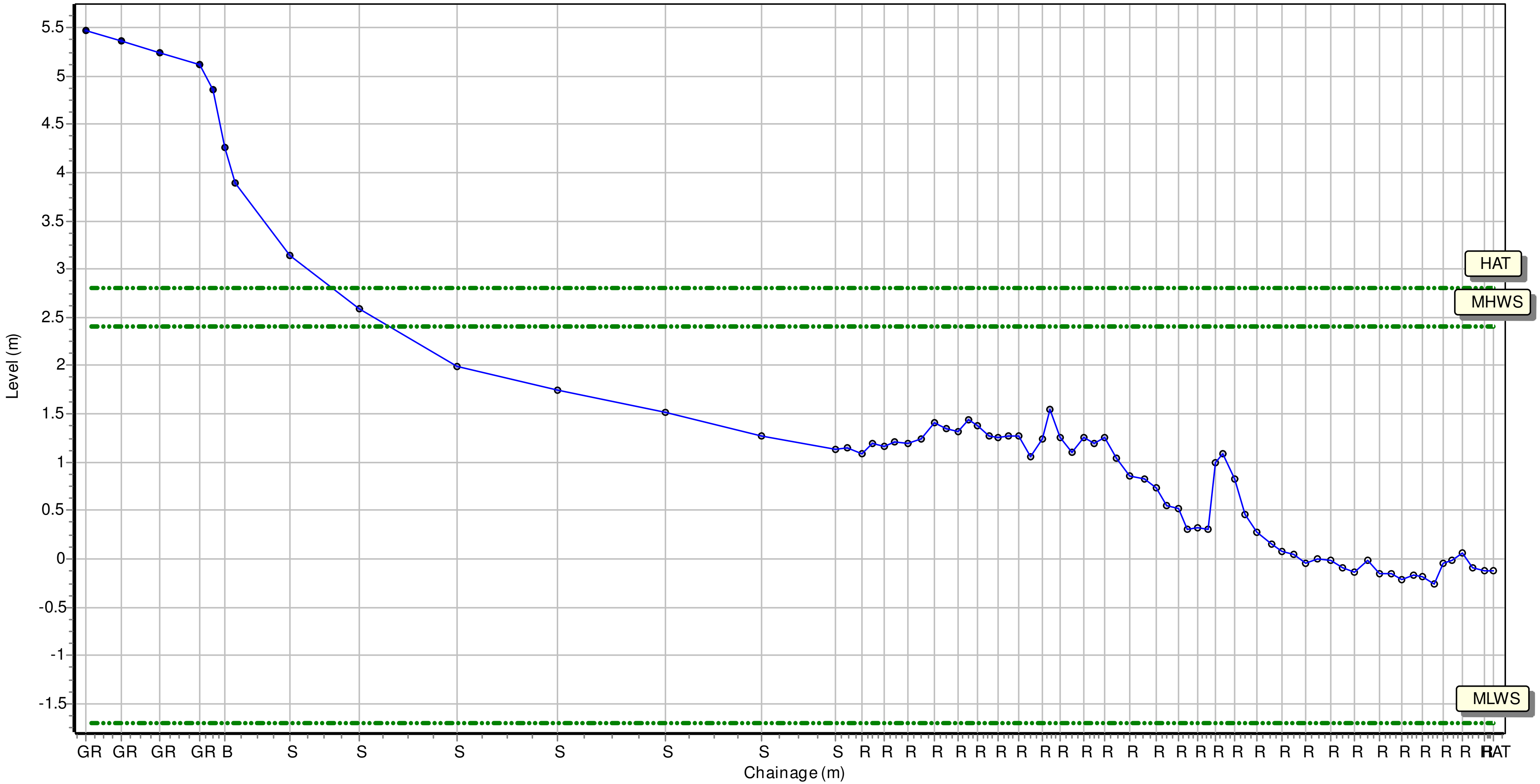
Location: 1aADC04A

Date: 15/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

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



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Beach Profile

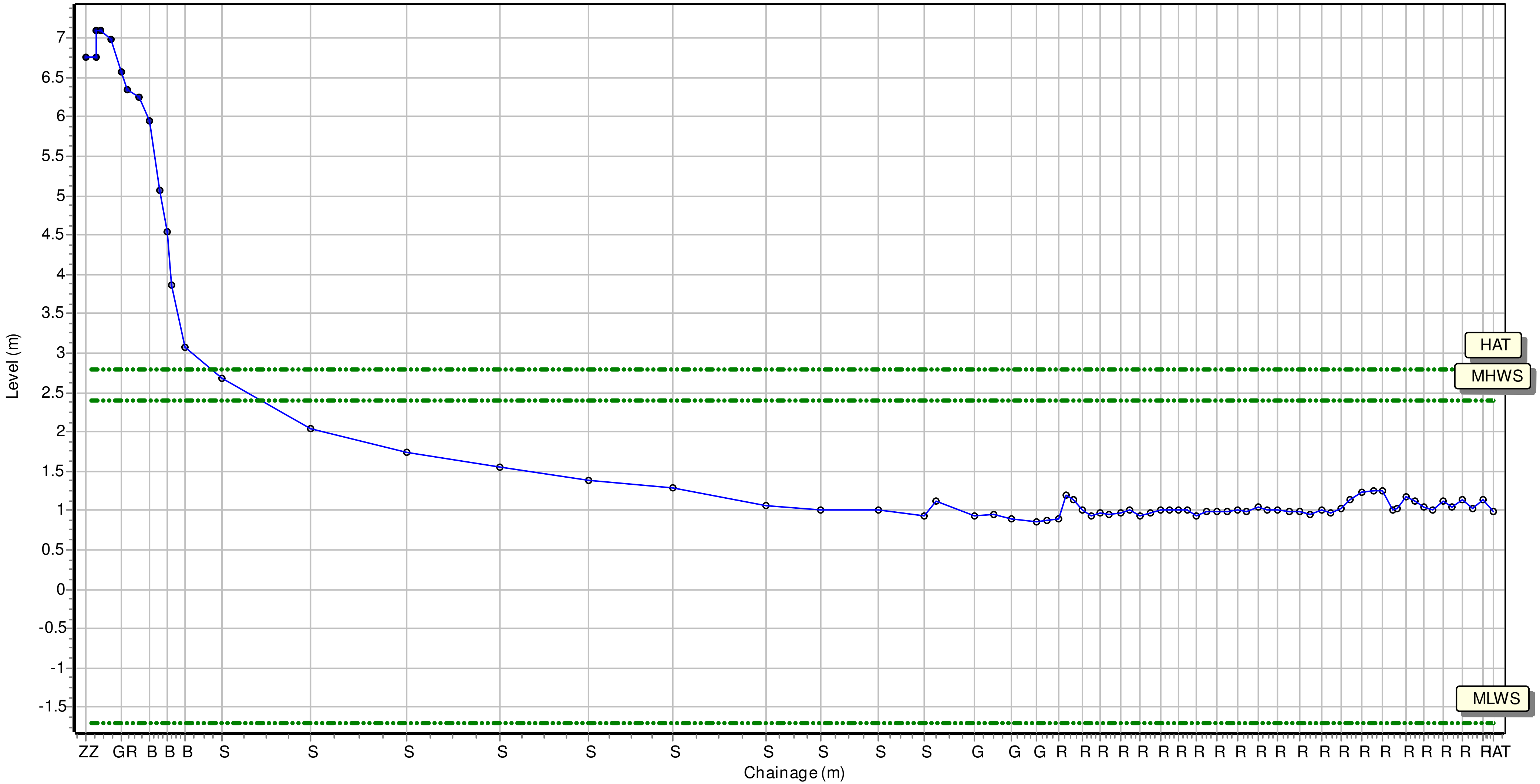
Location: 1aADC04B

Date: 15/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

Easting: 426641.642 **Northing:** 614193.793 **Profile Bearing:** 91 ° from North



Beach Profile

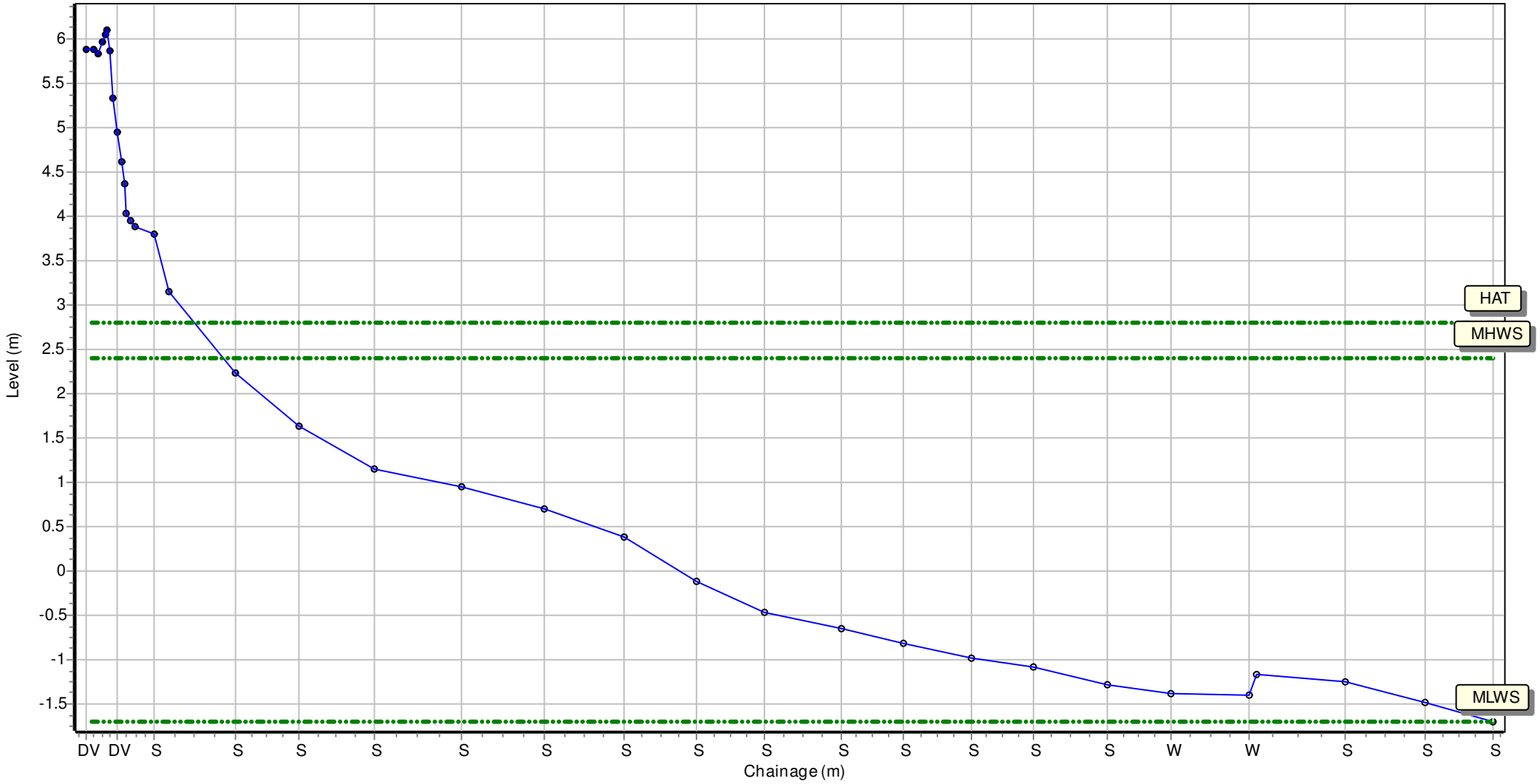
Location: **1aADC07**

Date: 15/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

Easting: 425324.445 **Northing:** 611018.794 **Profile Bearing:** 134 ° from North



Beach Profile

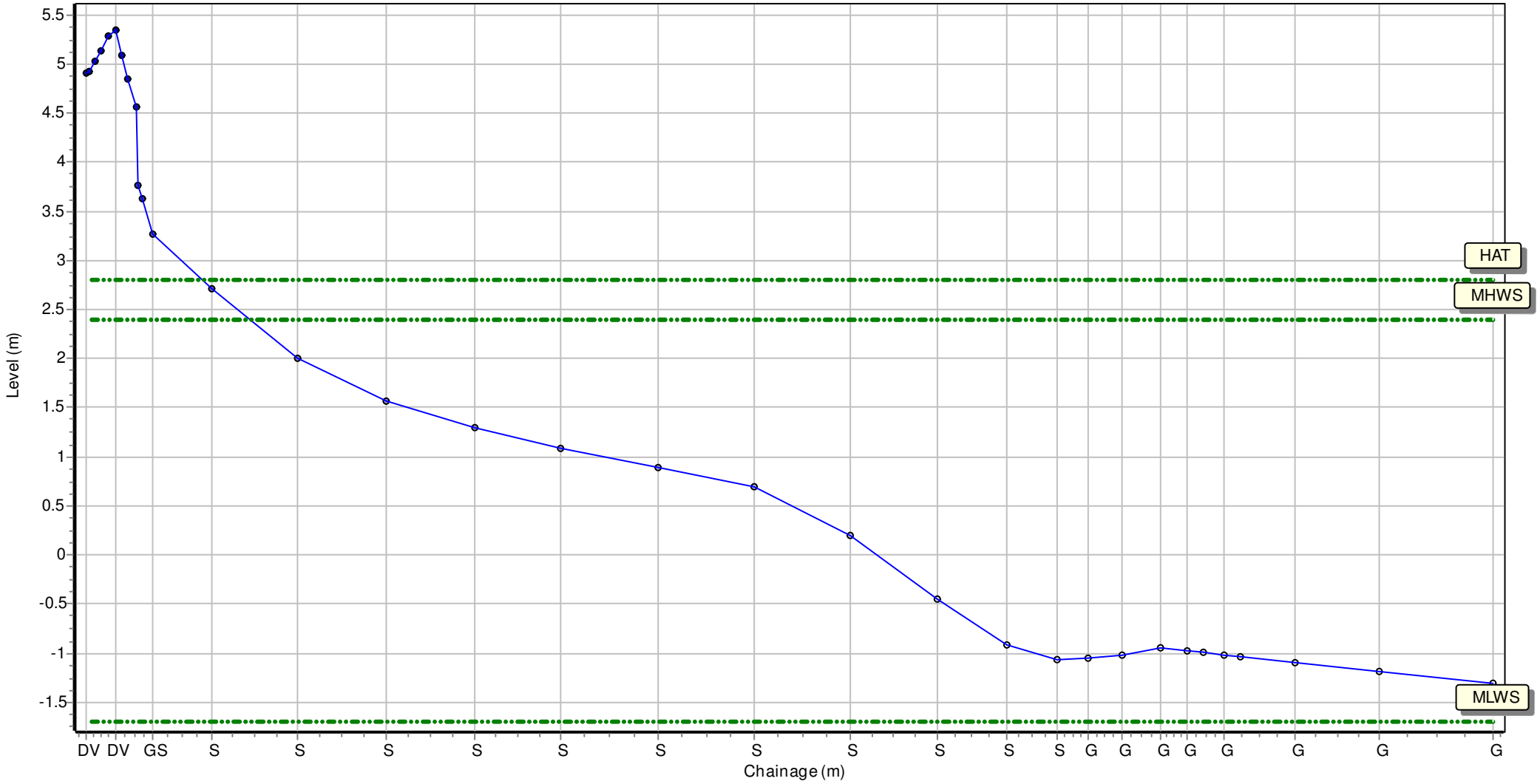
Location: **1aADC08**

Date: 15/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

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



Beach Profile

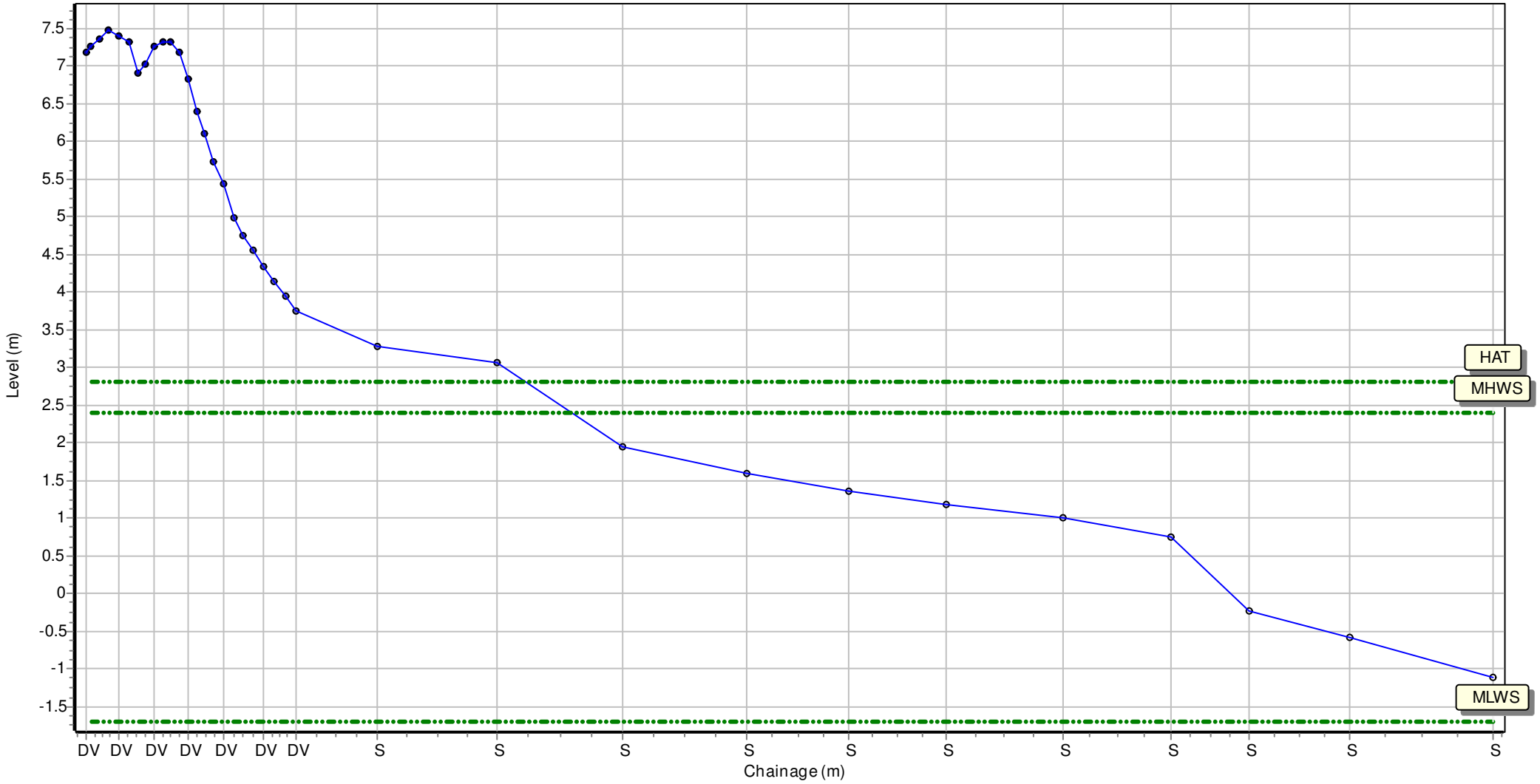
Location: **1aADC09**

Date: 15/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

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



Beach Profile

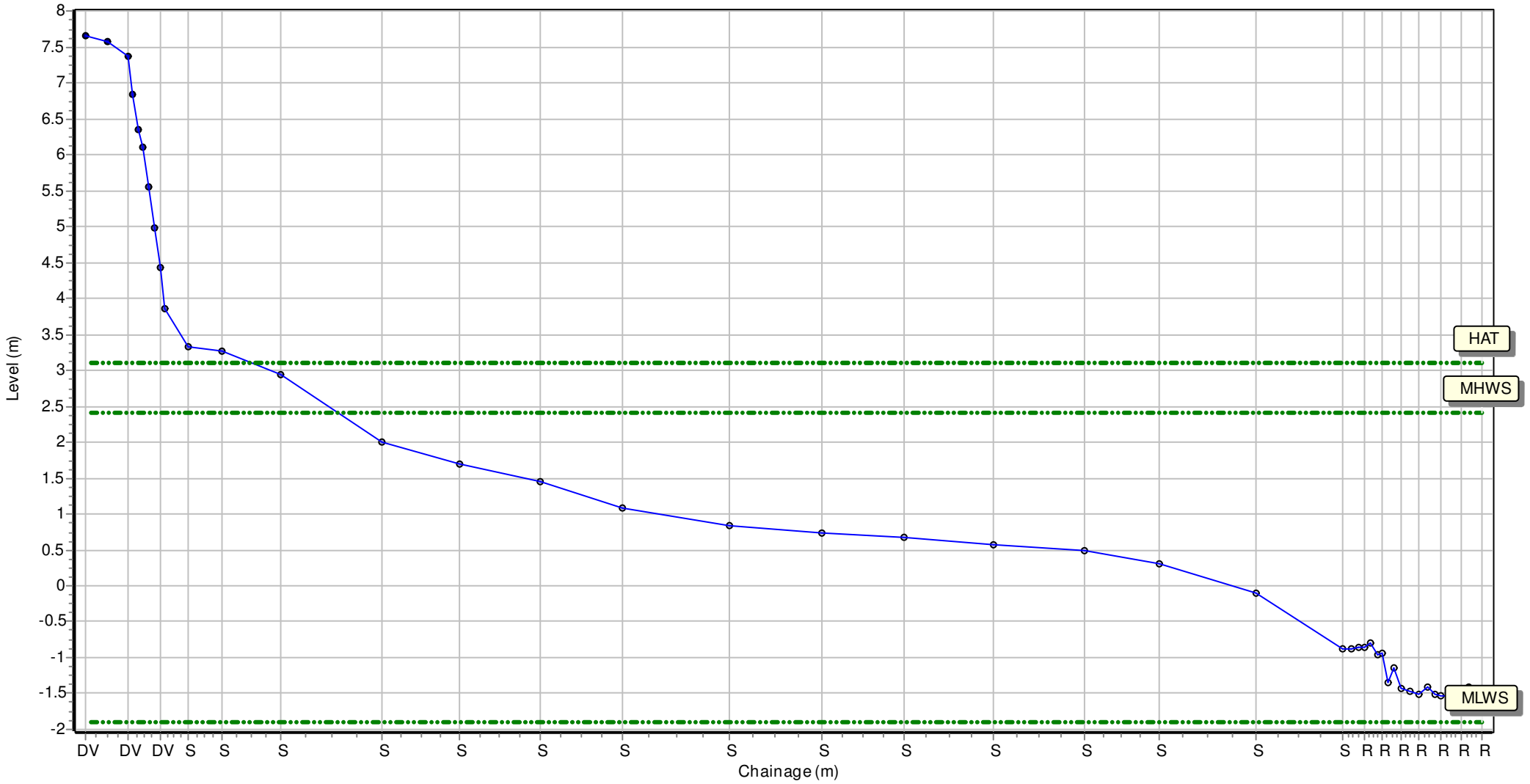
Location: **1aADC15A**

Date: 31/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

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



Beach Profile

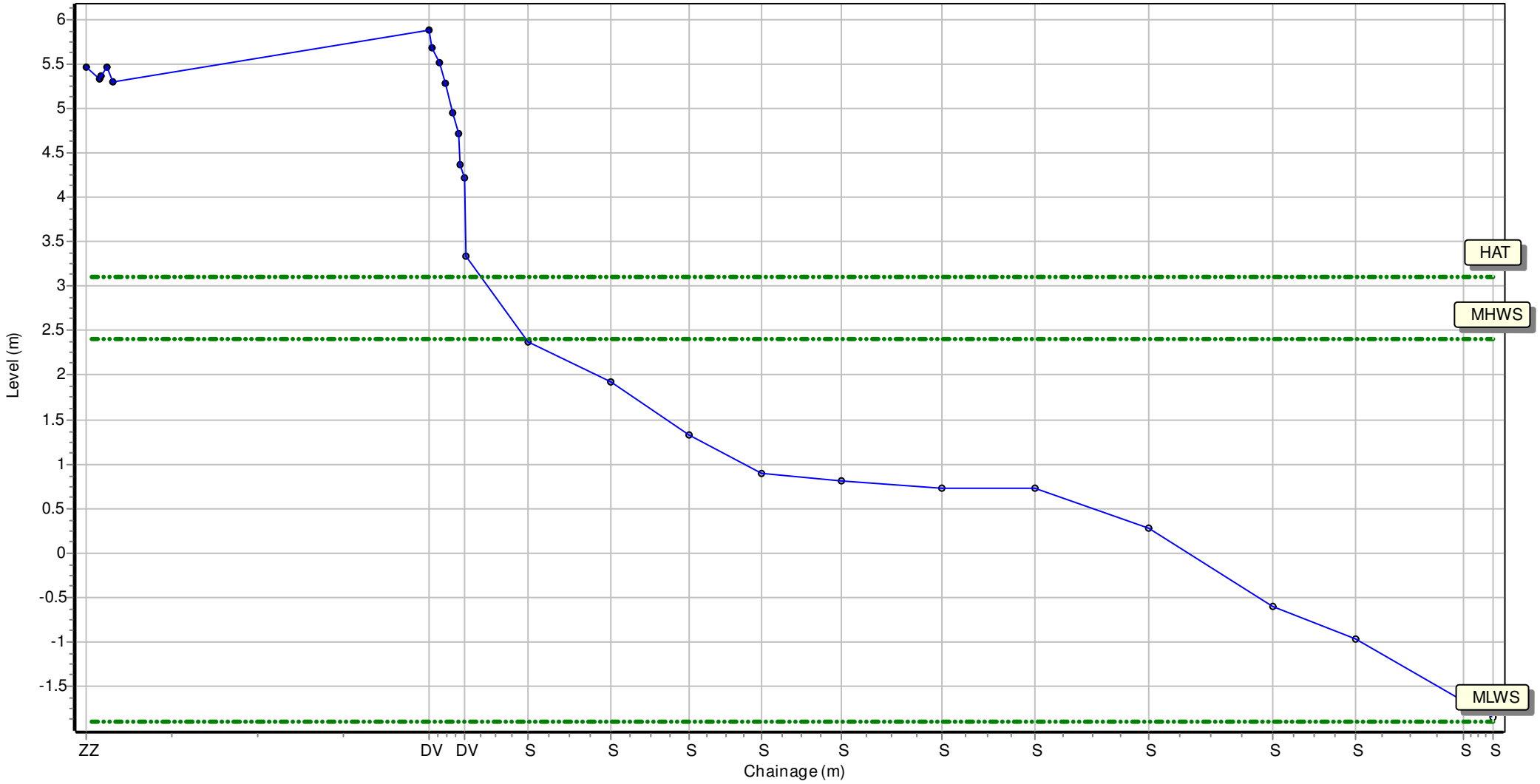
Location: **1aADC16**

Date: 31/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

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



Beach Profile

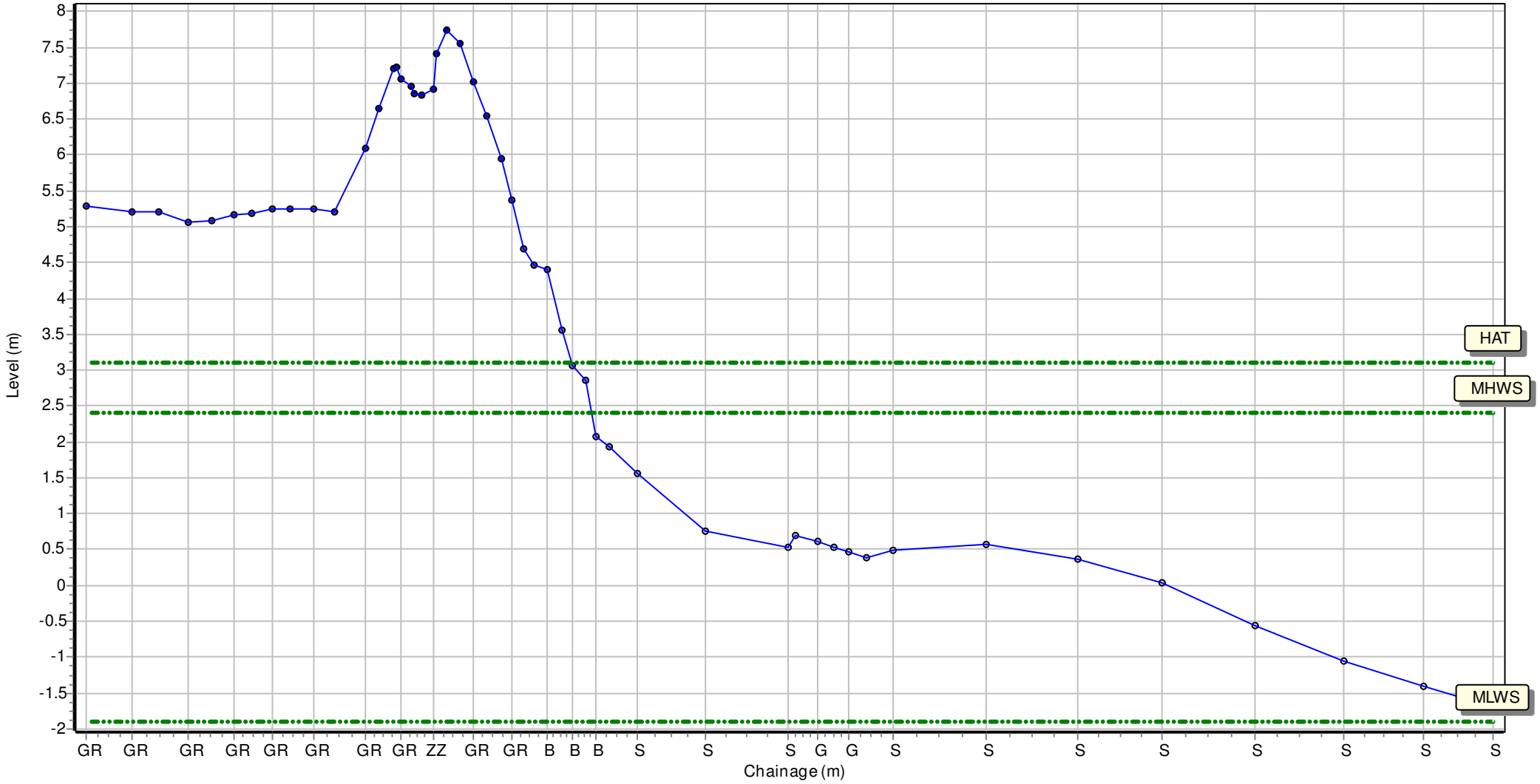
Location: **1aADC16A**

Date: 31/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

Easting: 428543.525 **Northing:** 602704.175 **Profile Bearing:** 92 ° from North



Beach Profile

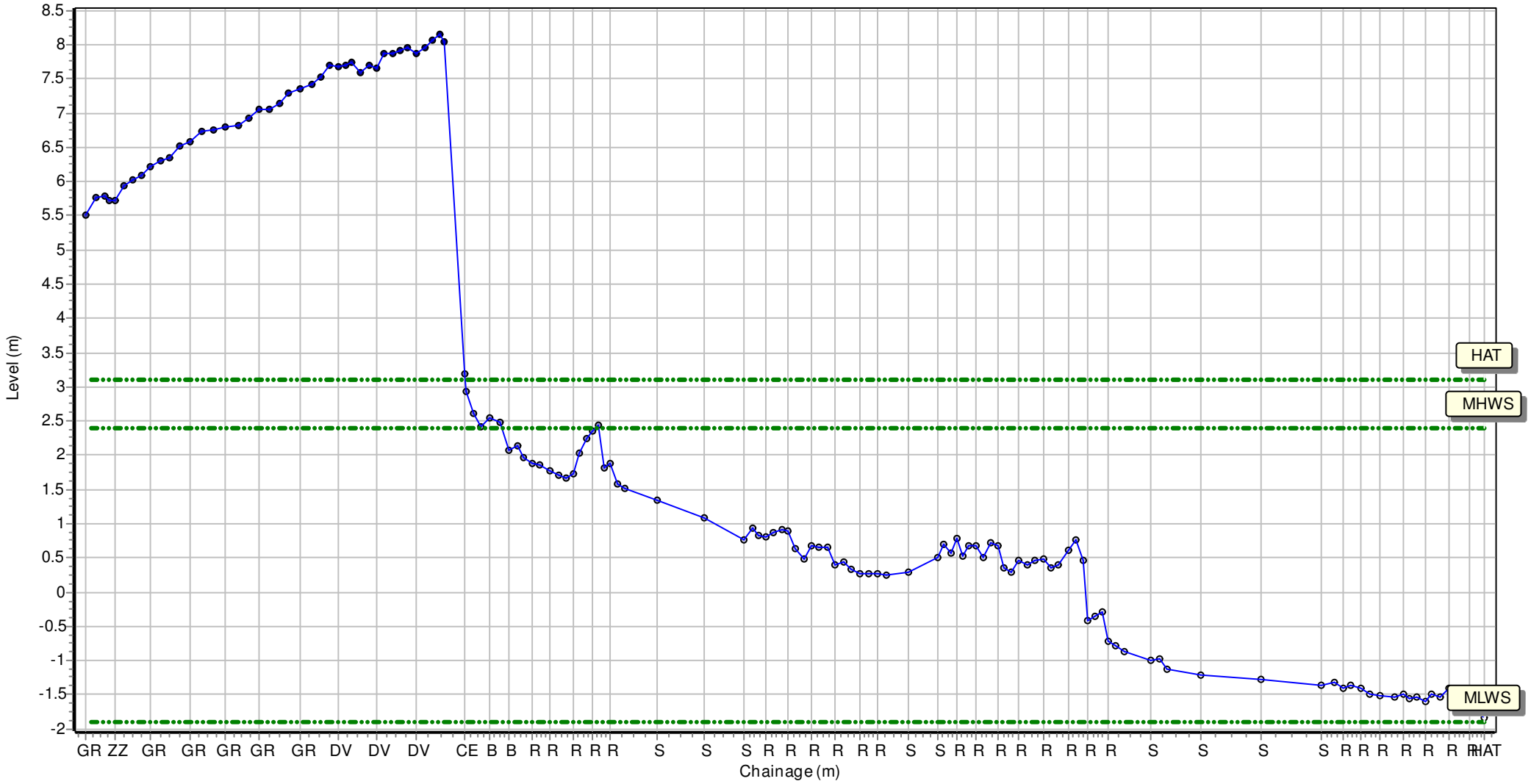
Location: **1aADC16B**

Date: 31/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

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



Beach Profile

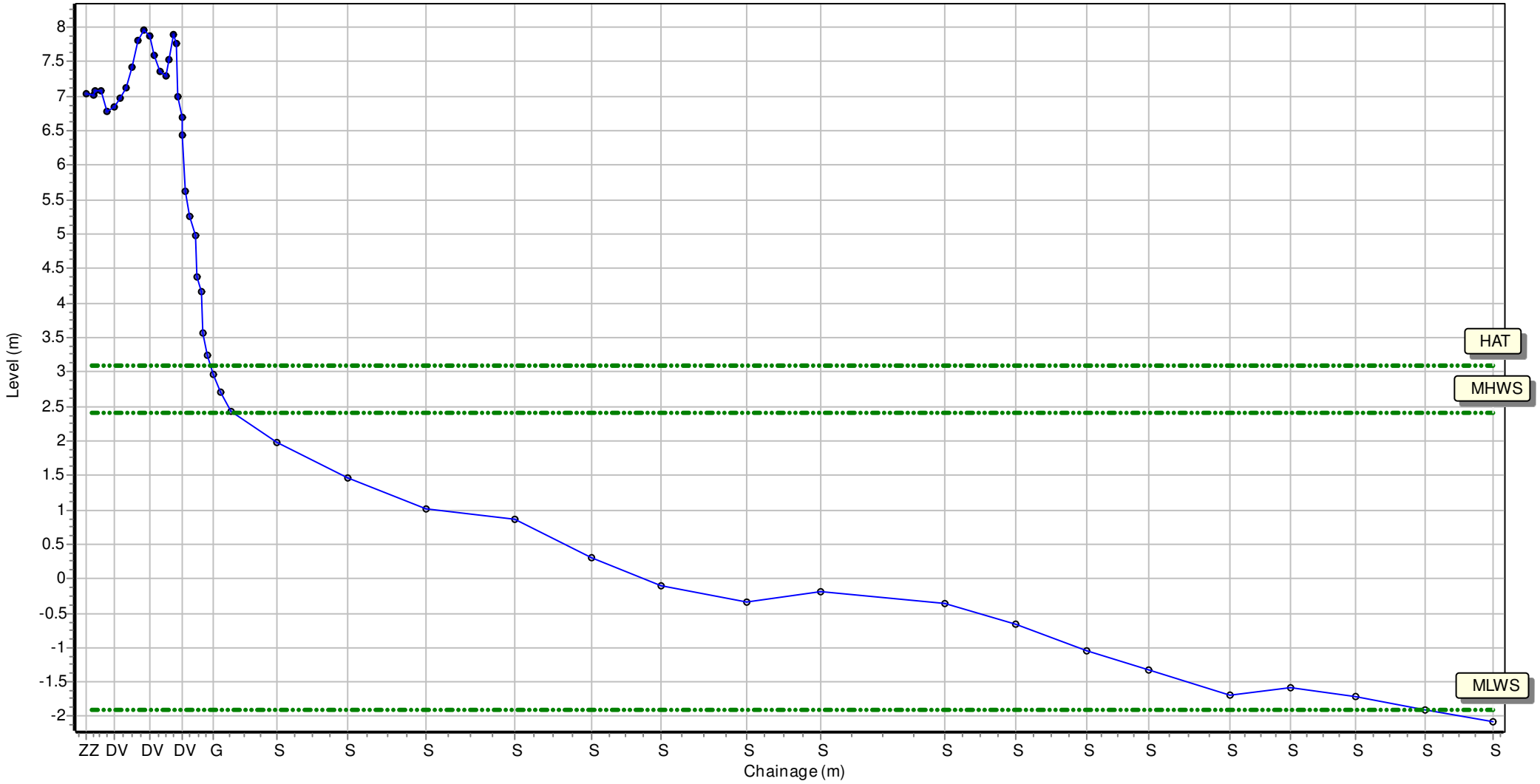
Location: **1aADC17**

Date: 31/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

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



Beach Profile

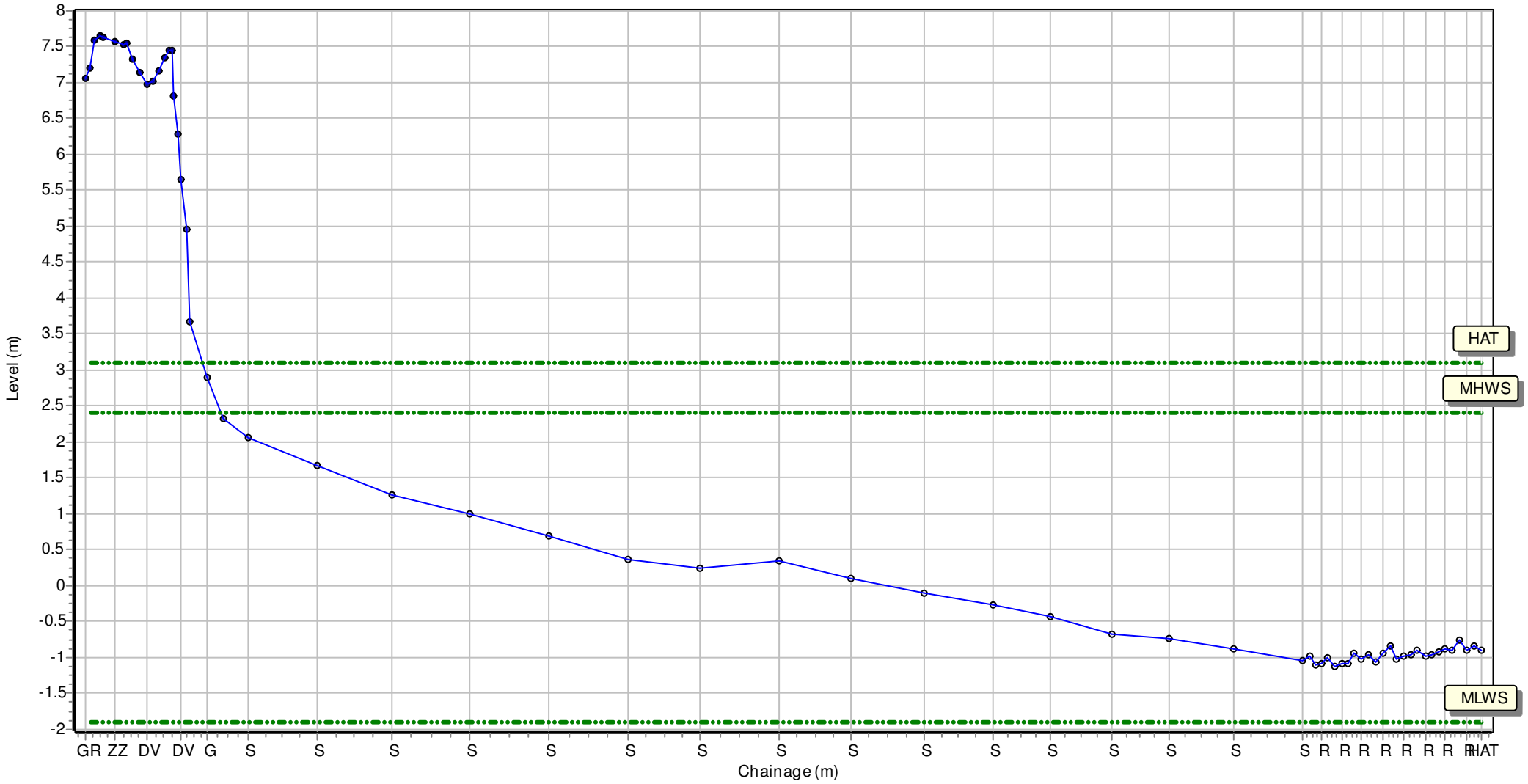
Location: **1aADC17A**

Date: 31/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

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



Beach Profile

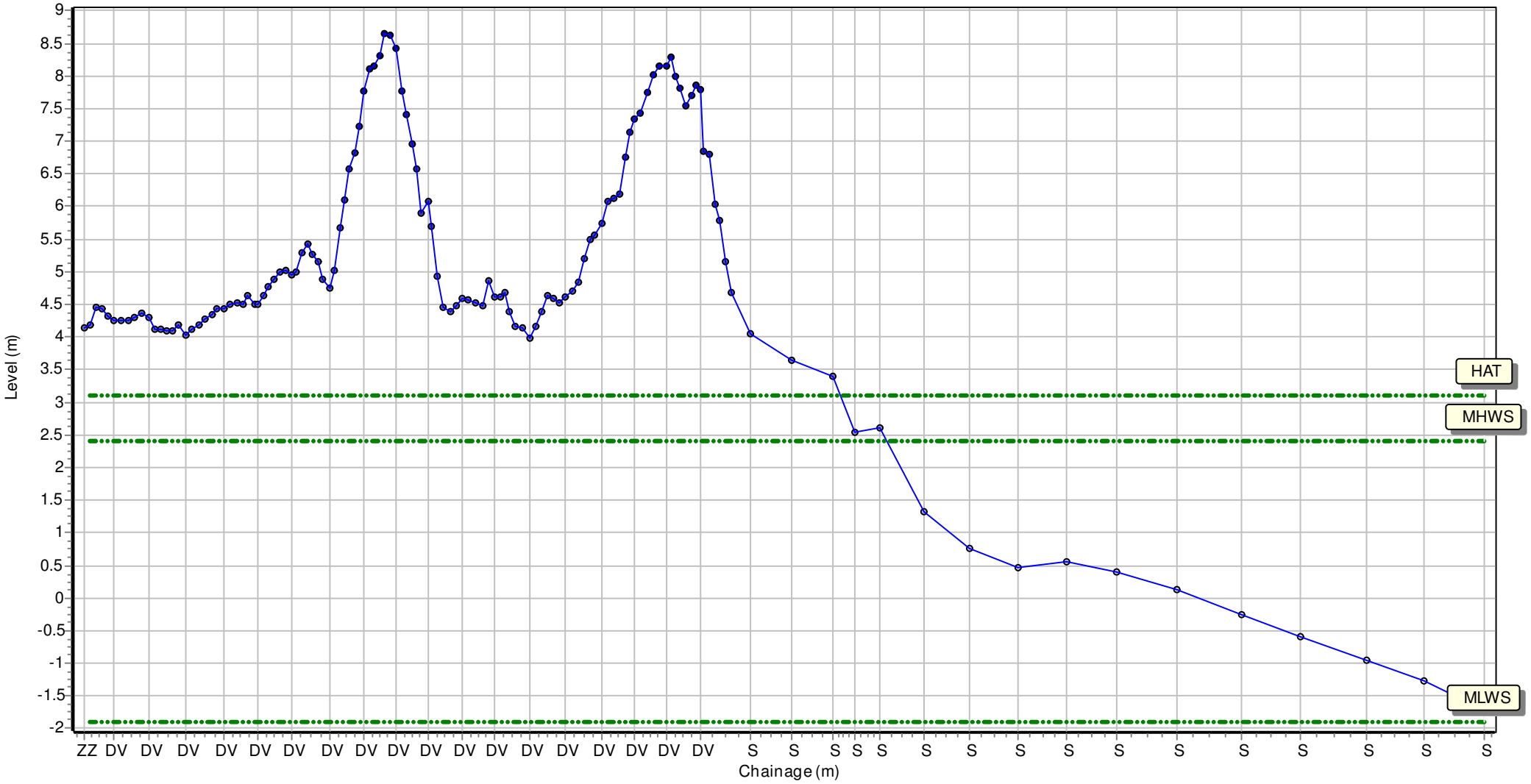
Location: **1aCMBC01**

Date: 28/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

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



Beach Profile

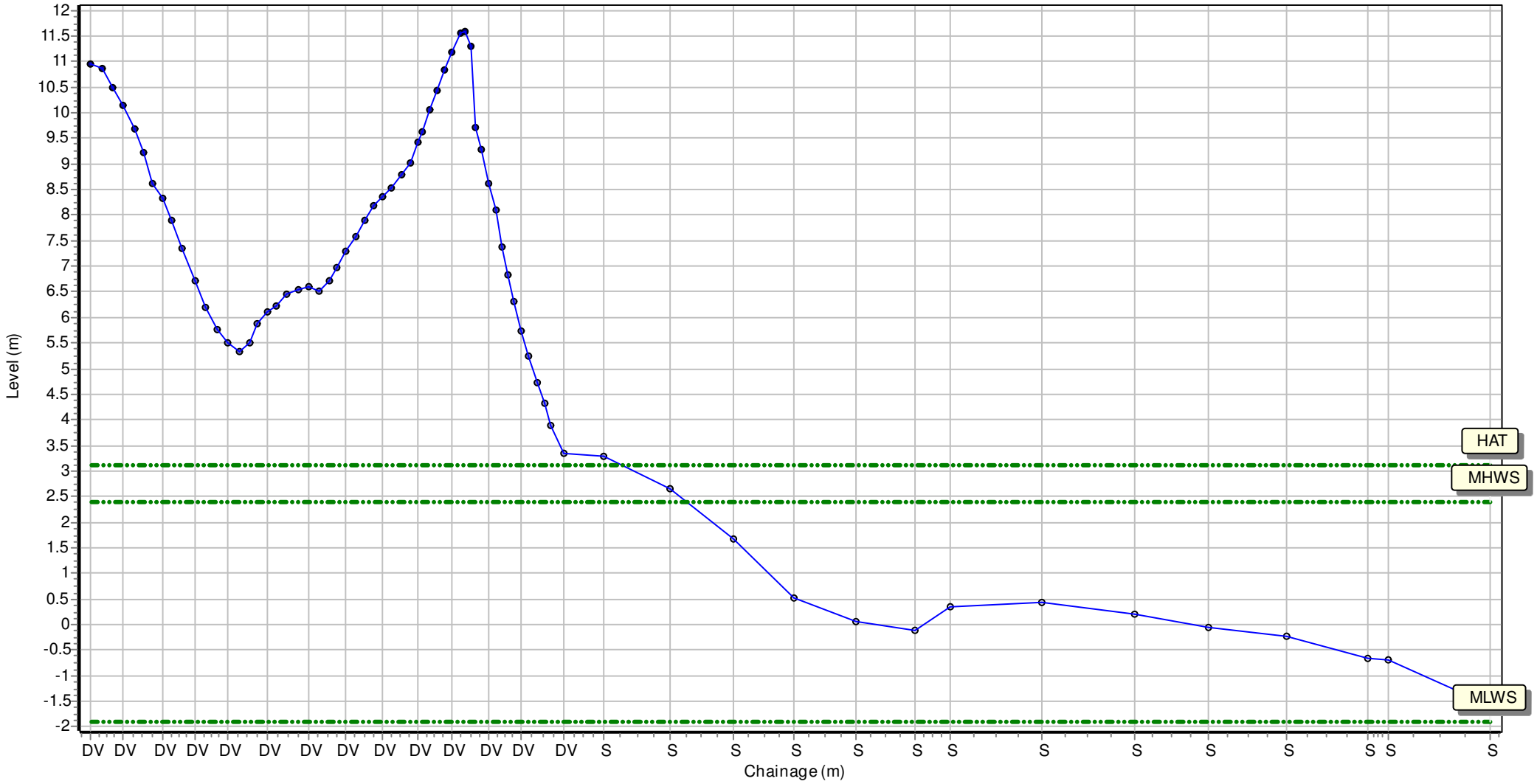
Location: **1aCMBC02**

Date: 28/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

Easting: 428355.916 **Northing:** 594532.141 **Profile Bearing:** 56 ° from North



Beach Profile

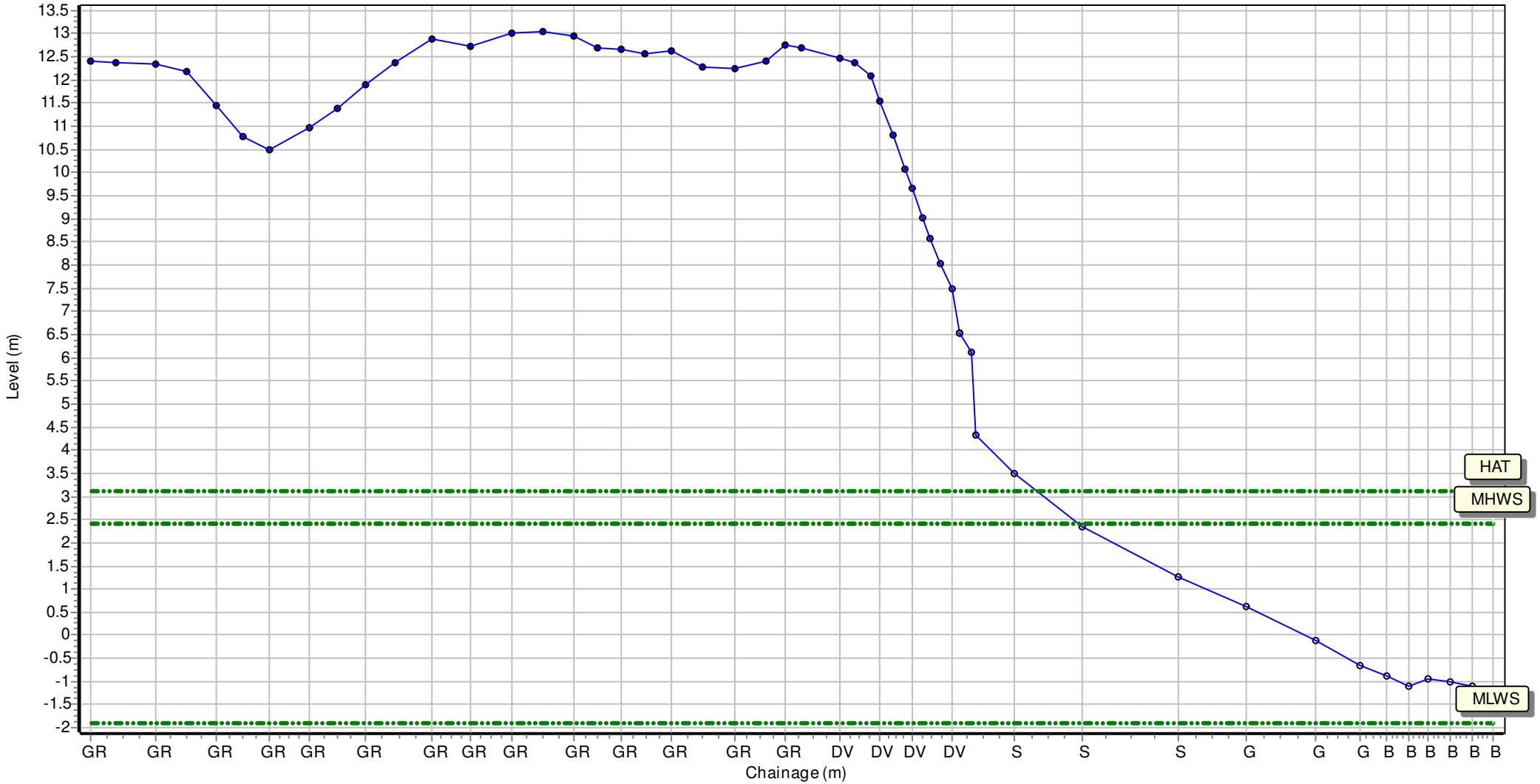
Location: **1aCMBC03A**

Date: 28/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

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



Beach Profile

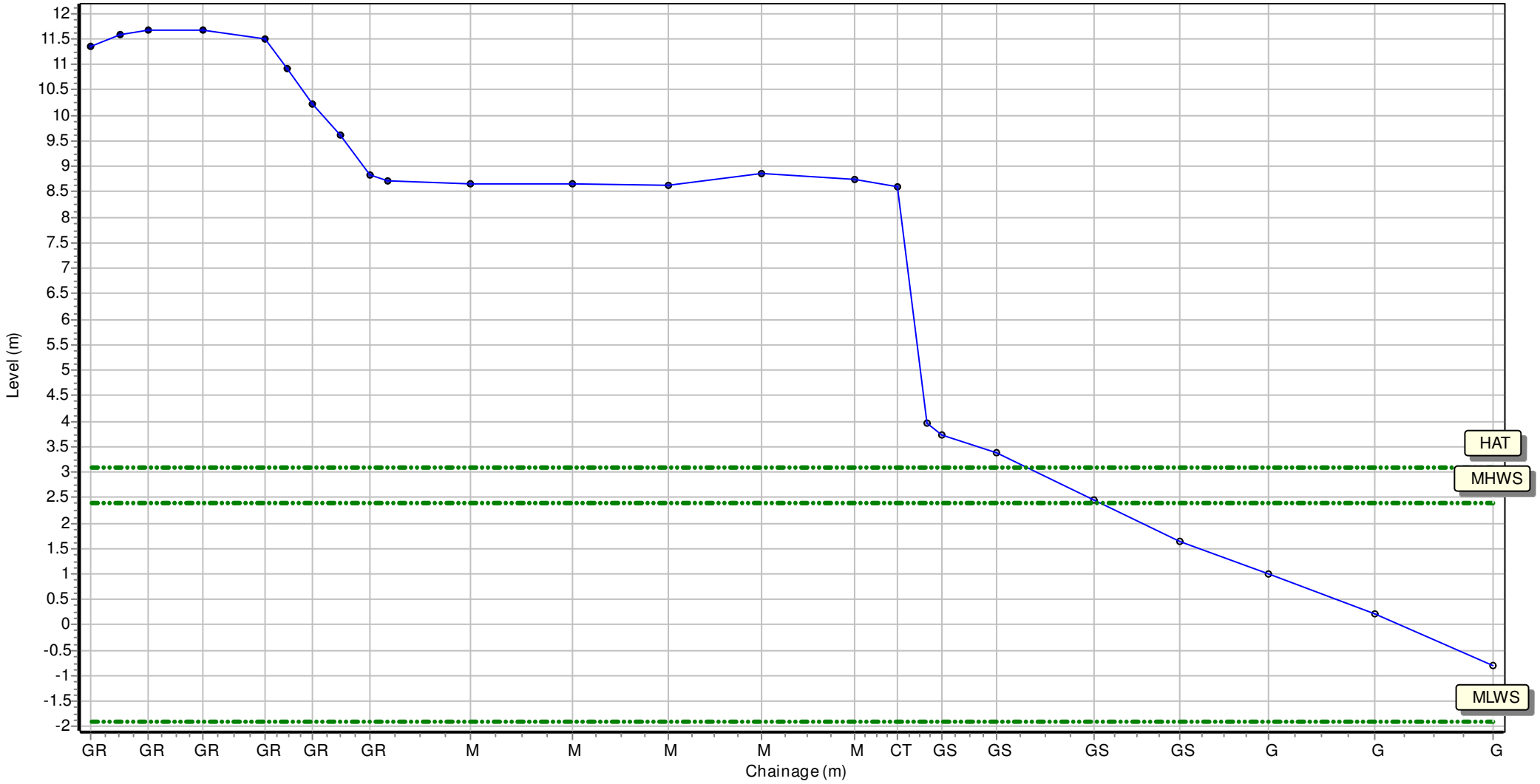
Location: **1aCMBC03B**

Date: 28/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

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



Beach Profile

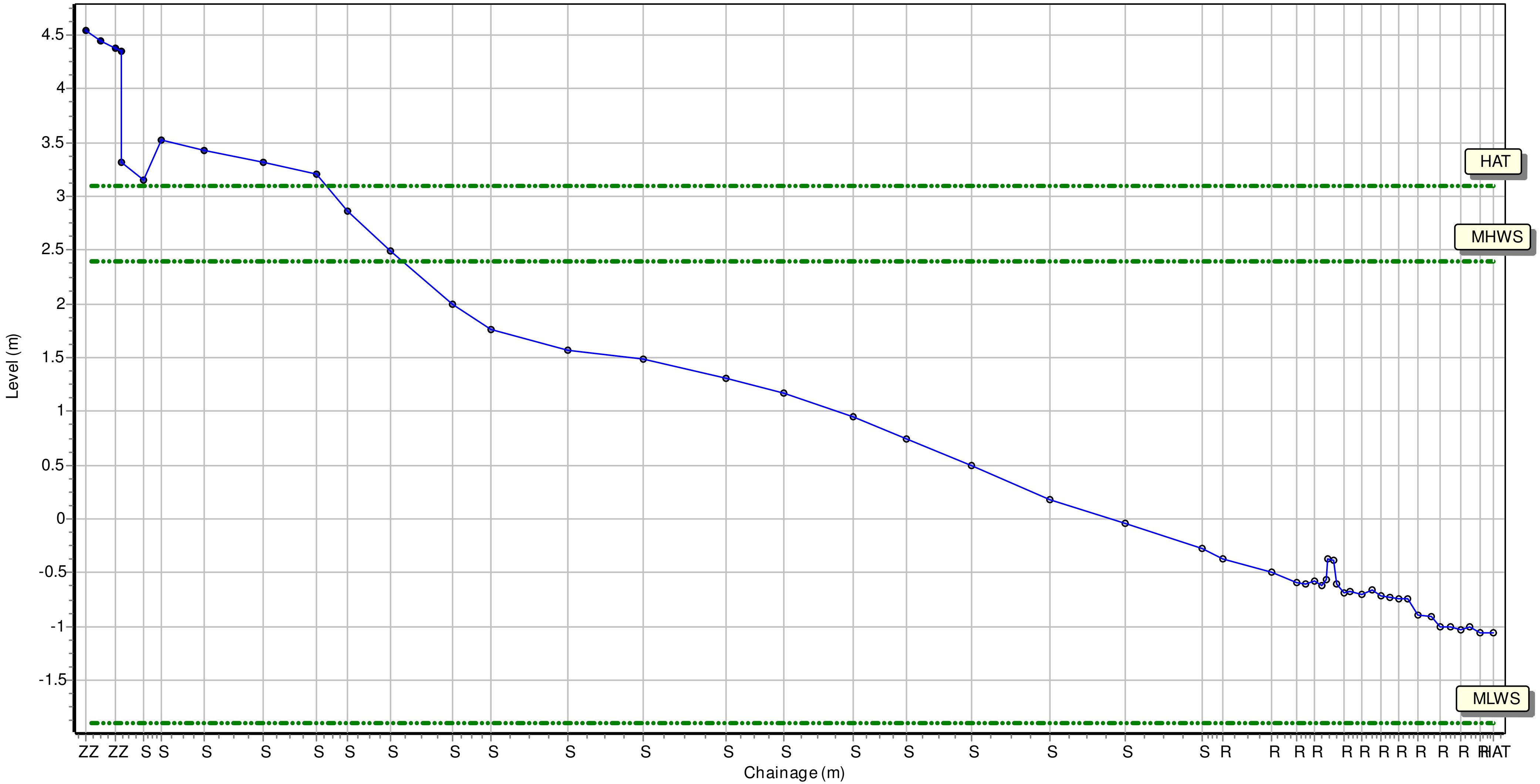
Location: **1aNWB1**

Date: 02/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

Easting: 431665.429 **Northing:** 588007.636 **Profile Bearing:** 212 ° from North



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Beach Profile

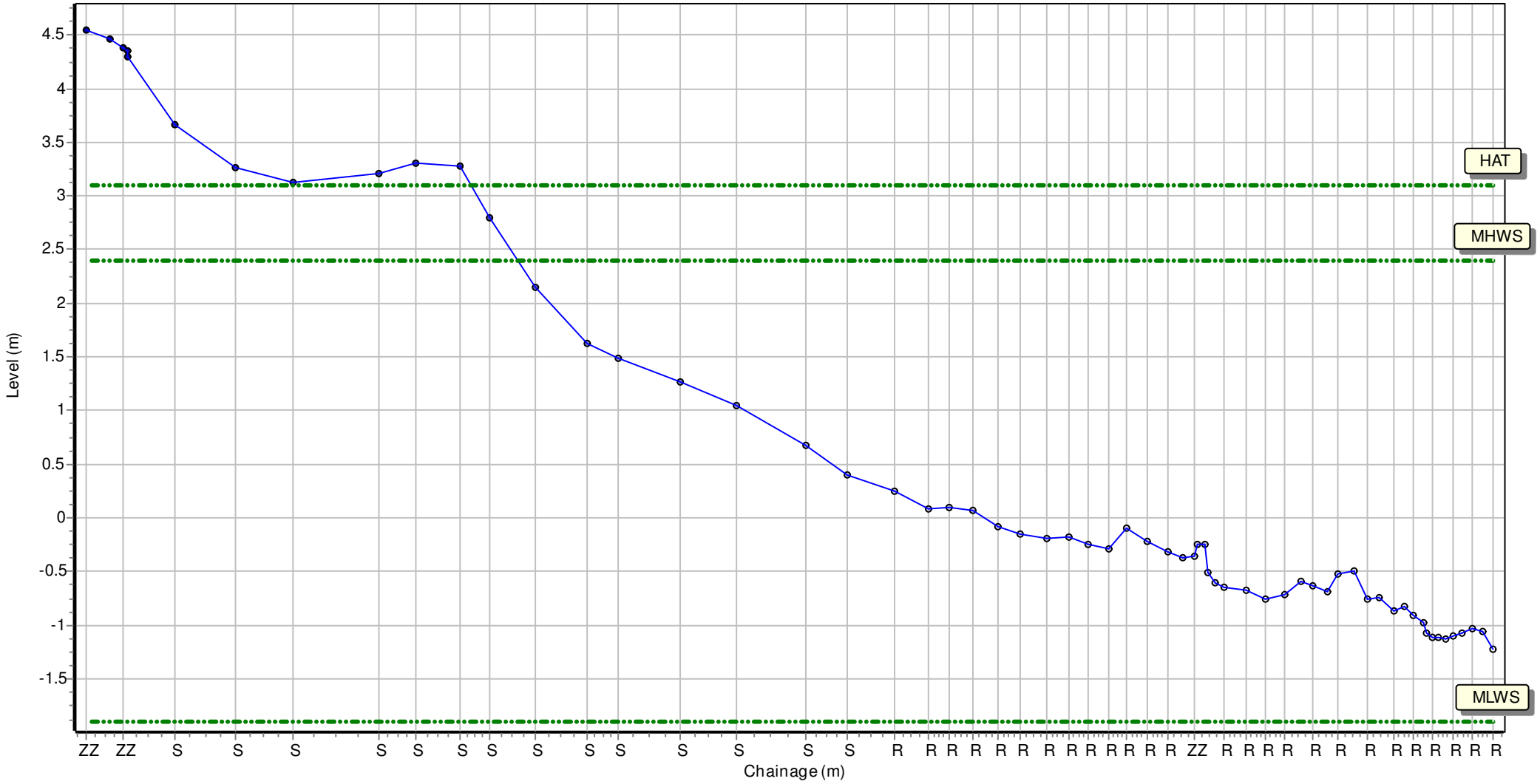
Location: **1aNWB2**

Date: 02/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

Easting: 431618.236 **Northing:** 588035.356 **Profile Bearing:** 202 ° from North



Beach Profile

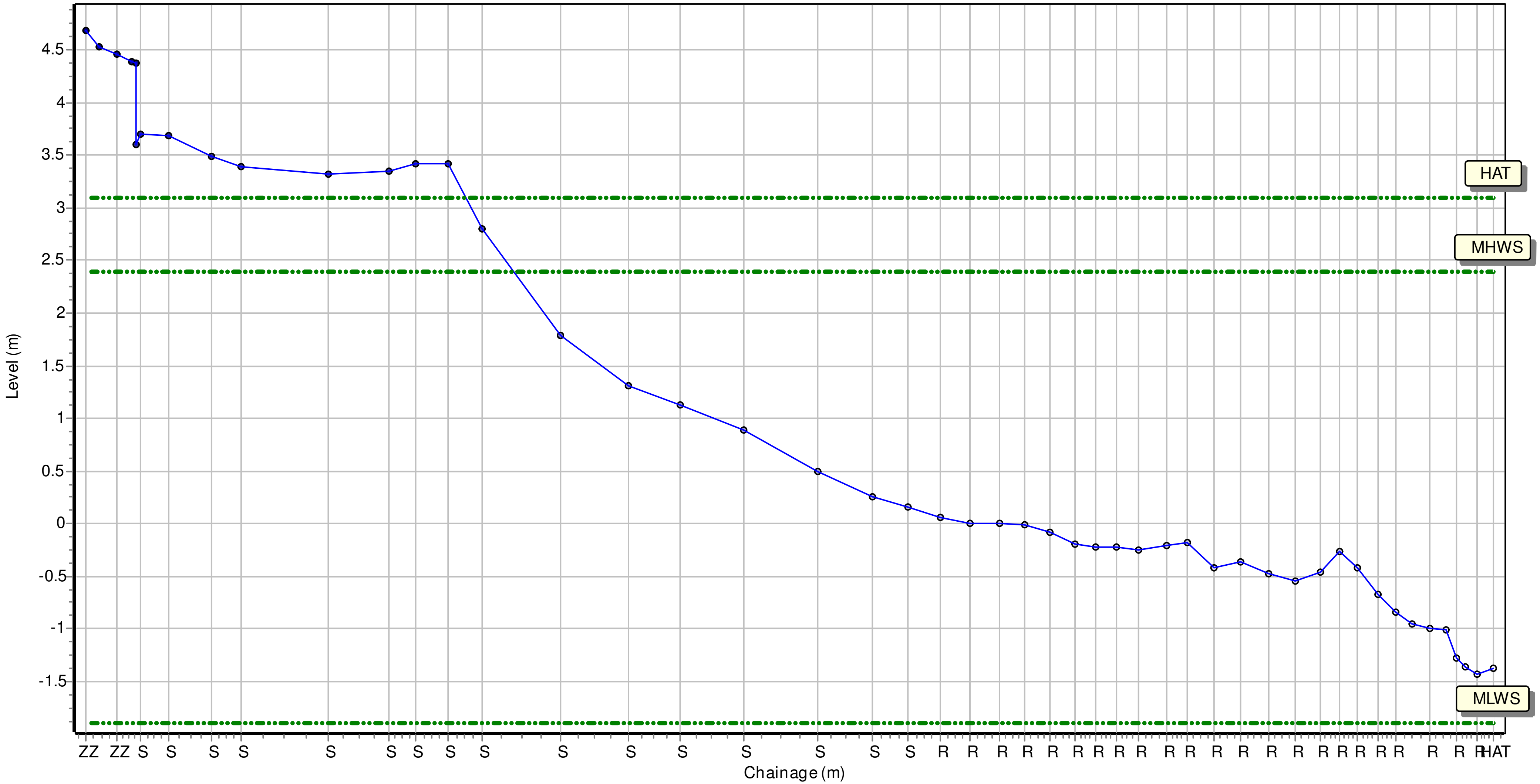
Location: **1aNWB3**

Date: 02/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

Easting: 431573.455 **Northing:** 588049.149 **Profile Bearing:** 193 ° from North



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Beach Profile

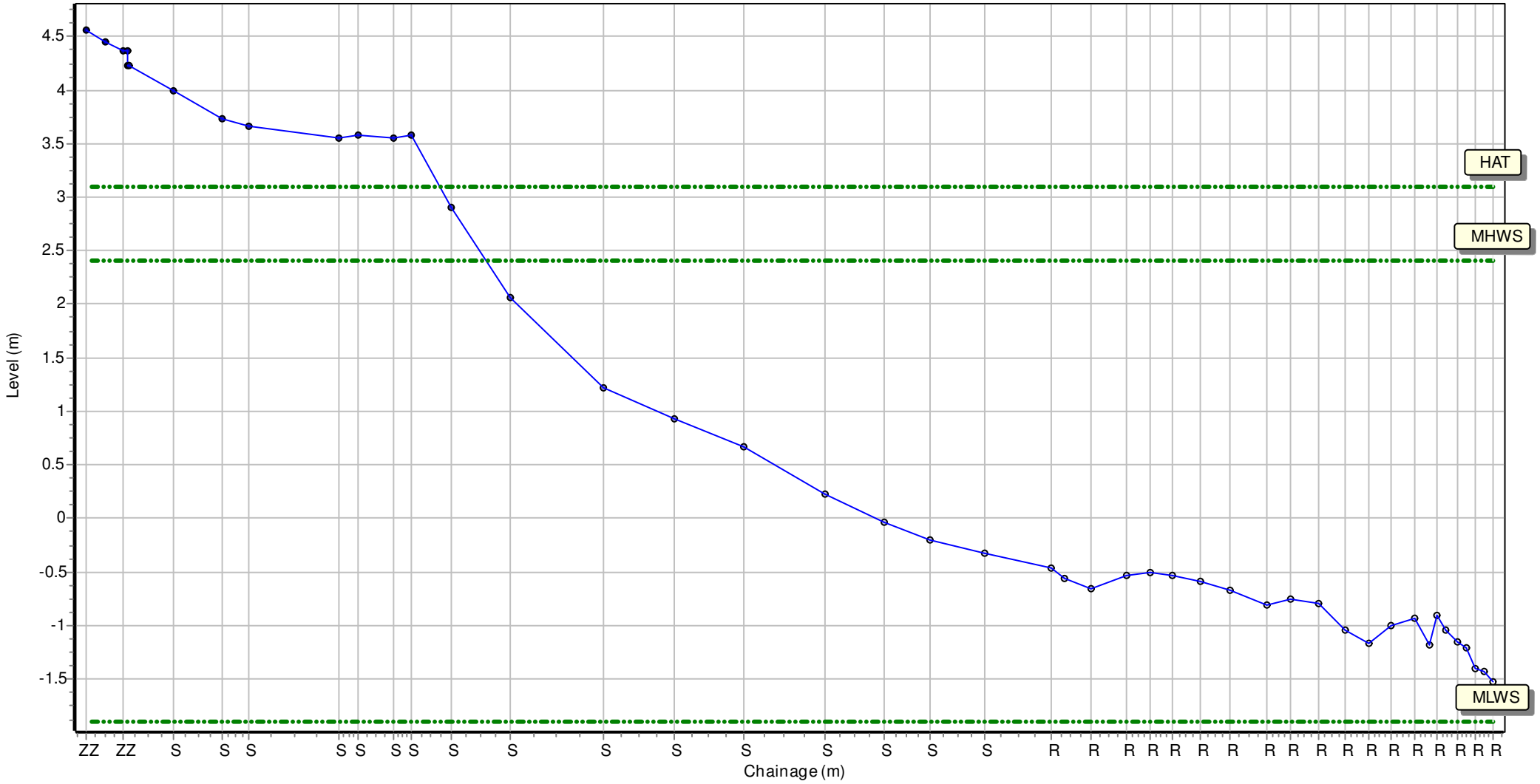
Location: **1aNWB4**

Date: 02/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

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



Beach Profile

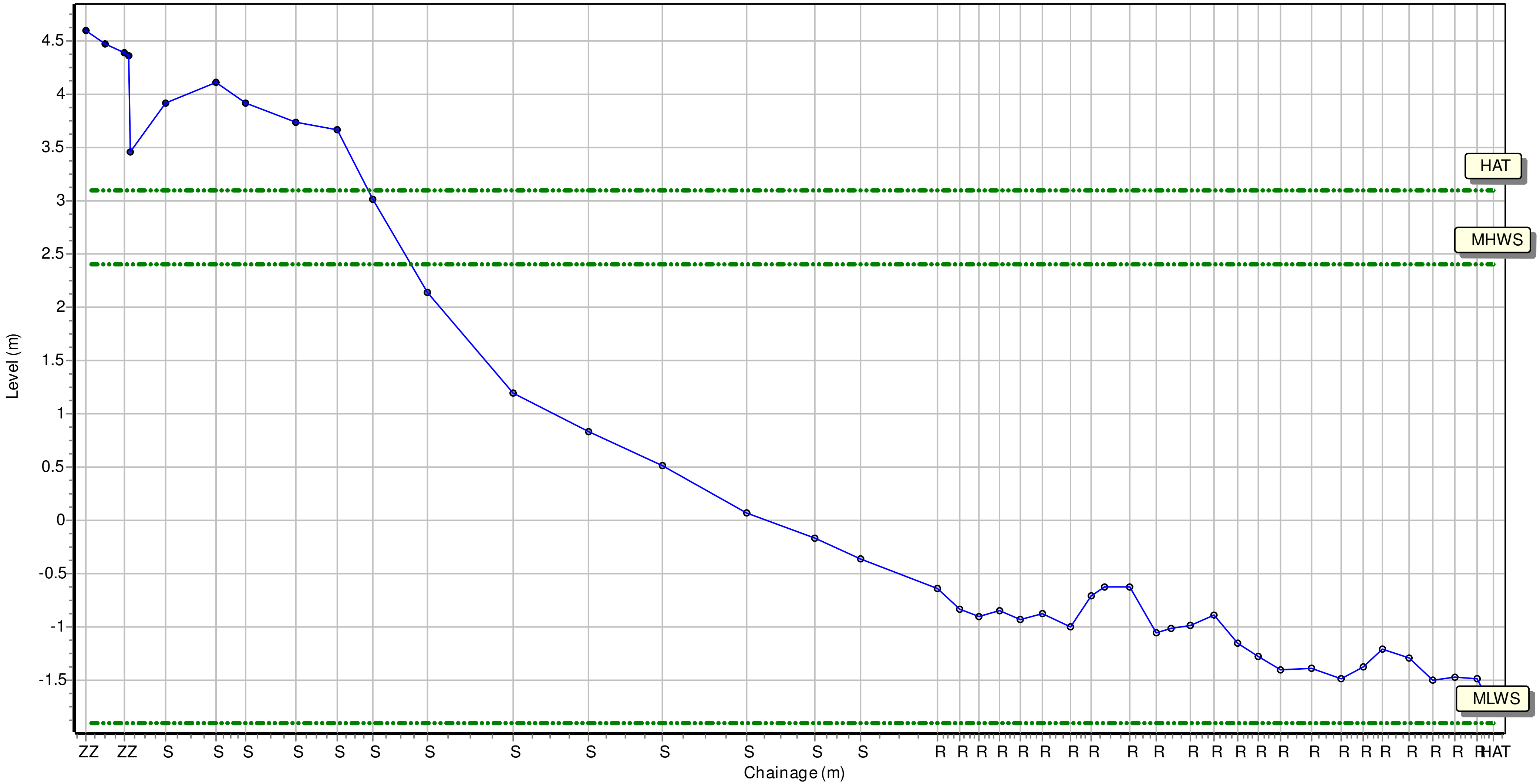
Location: 1aNWB5

Date: 02/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

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



Beach Profile

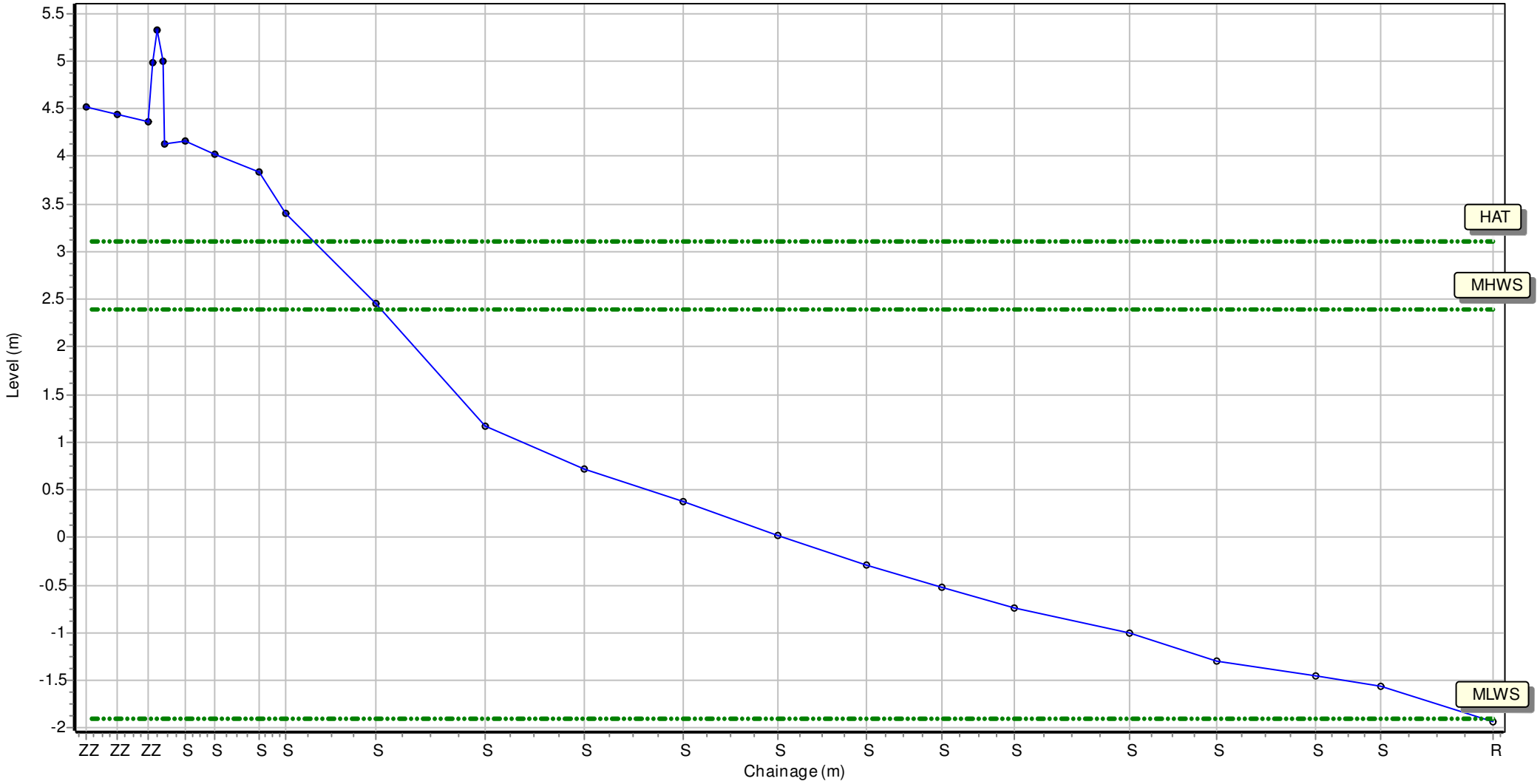
Location: **1aNWB6**

Date: 02/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

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



Beach Profile

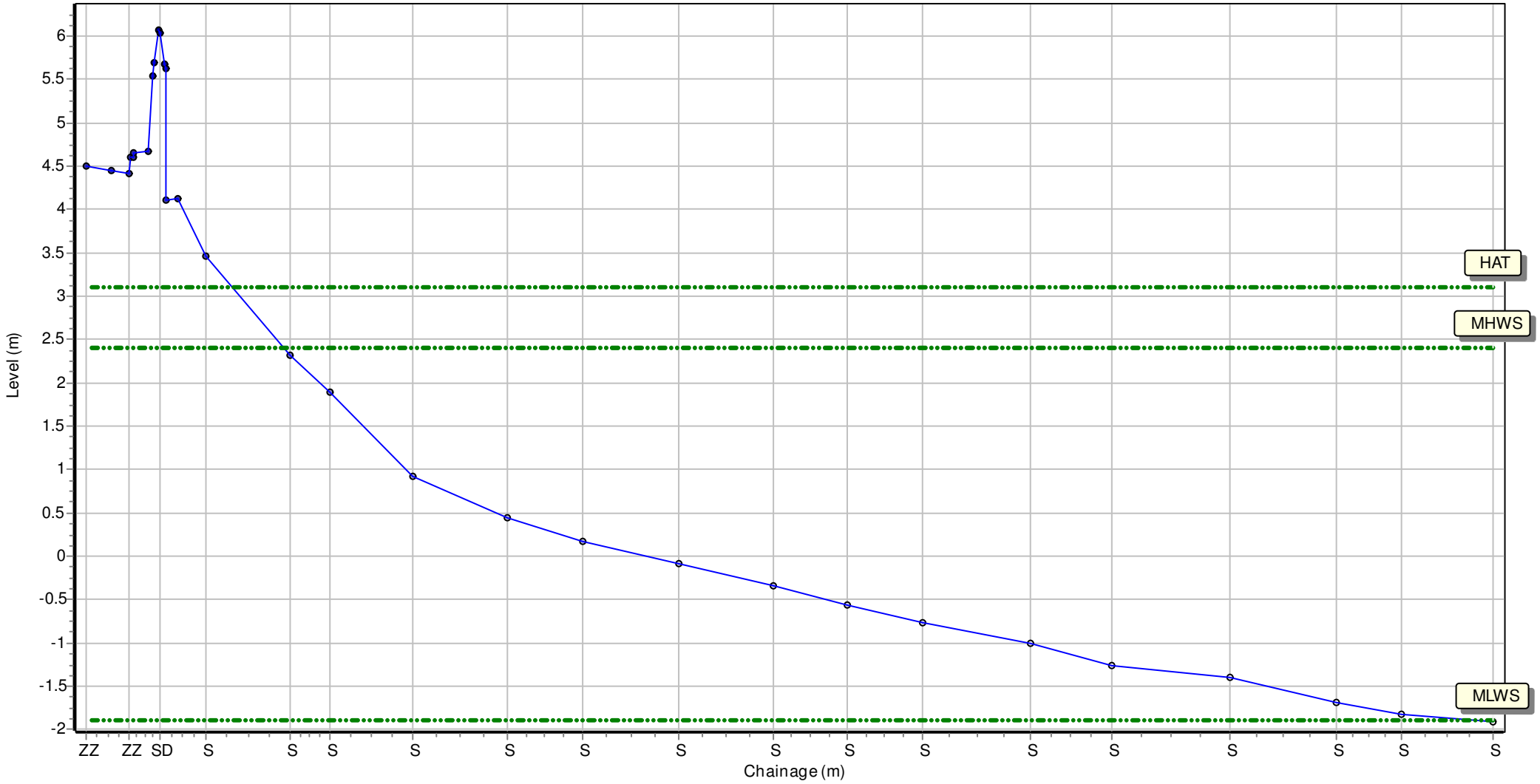
Location: **1aNWB7**

Date: 02/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

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



Beach Profile

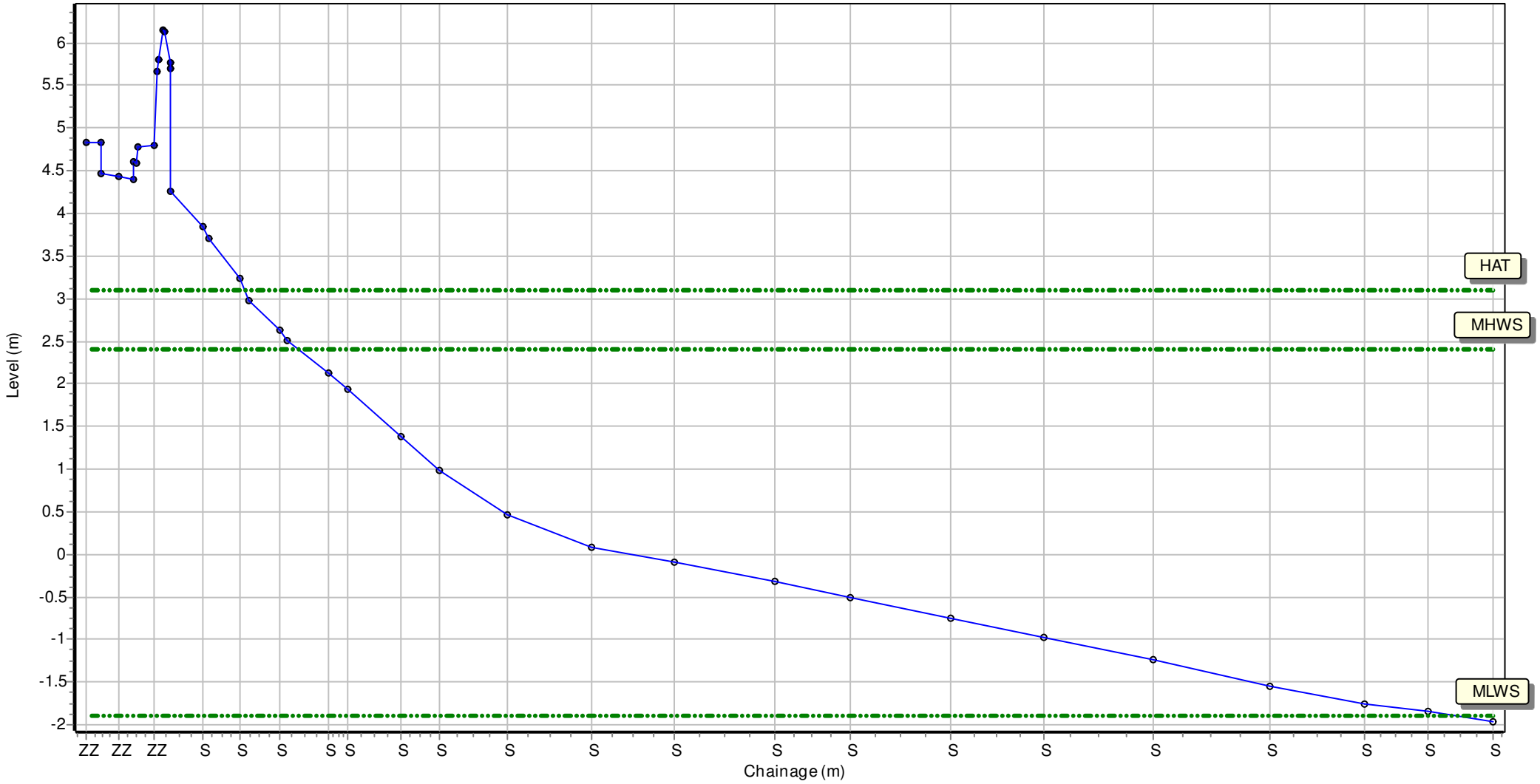
Location: **1aNWB8**

Date: 02/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

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



Beach Profile

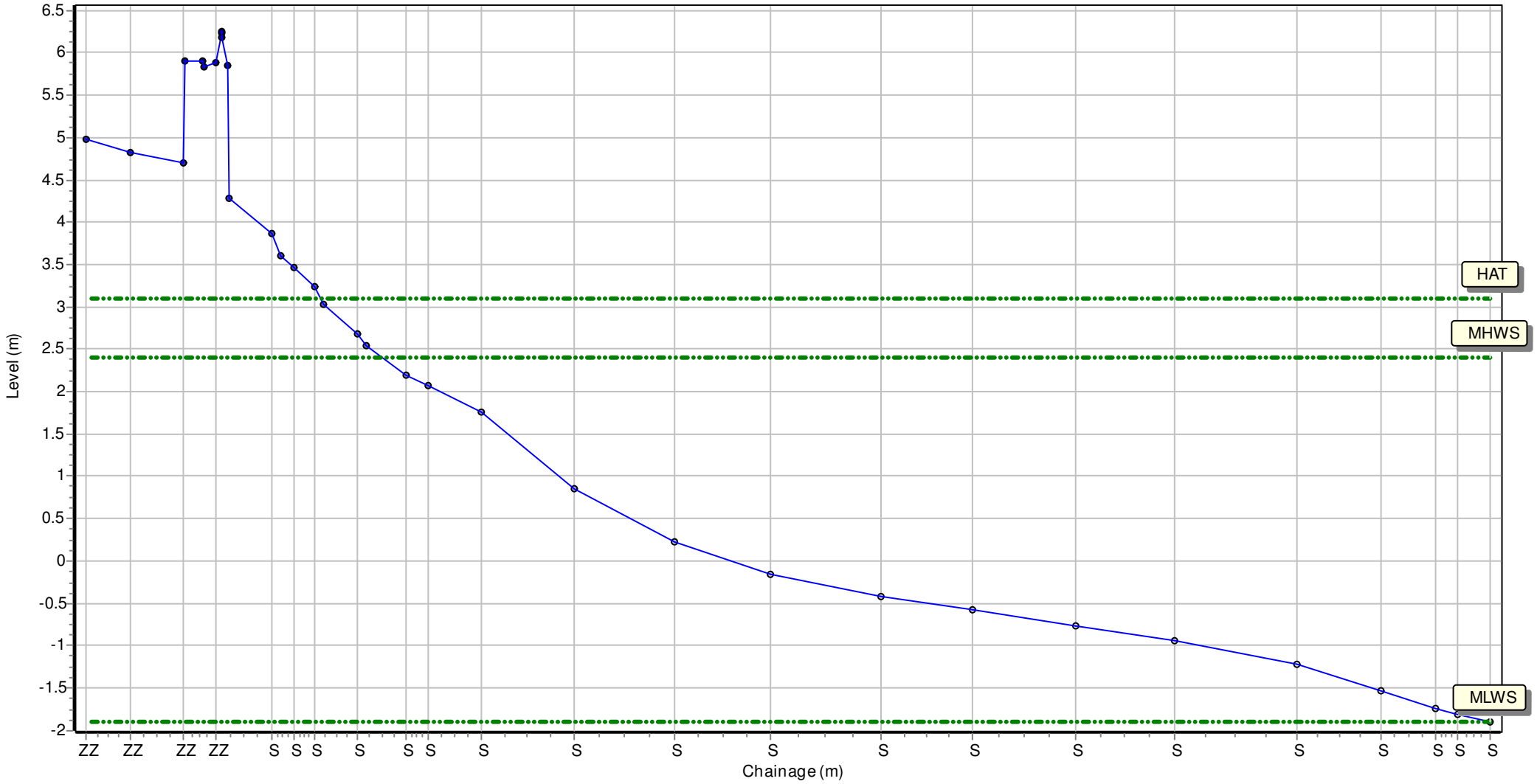
Location: **1aNWB9**

Date: 02/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

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



Beach Profile

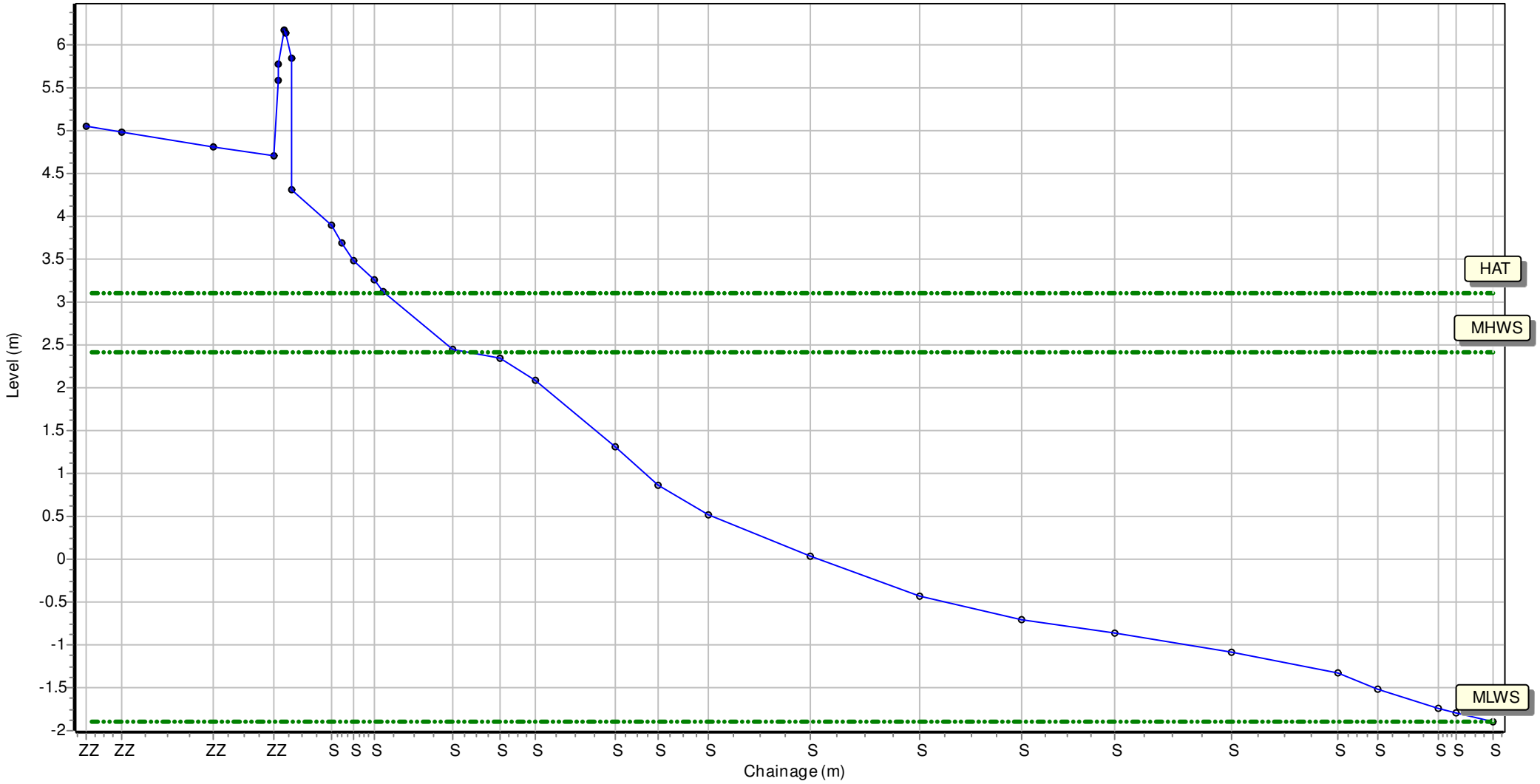
Location: **1aNWB10**

Date: 02/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

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



Beach Profile

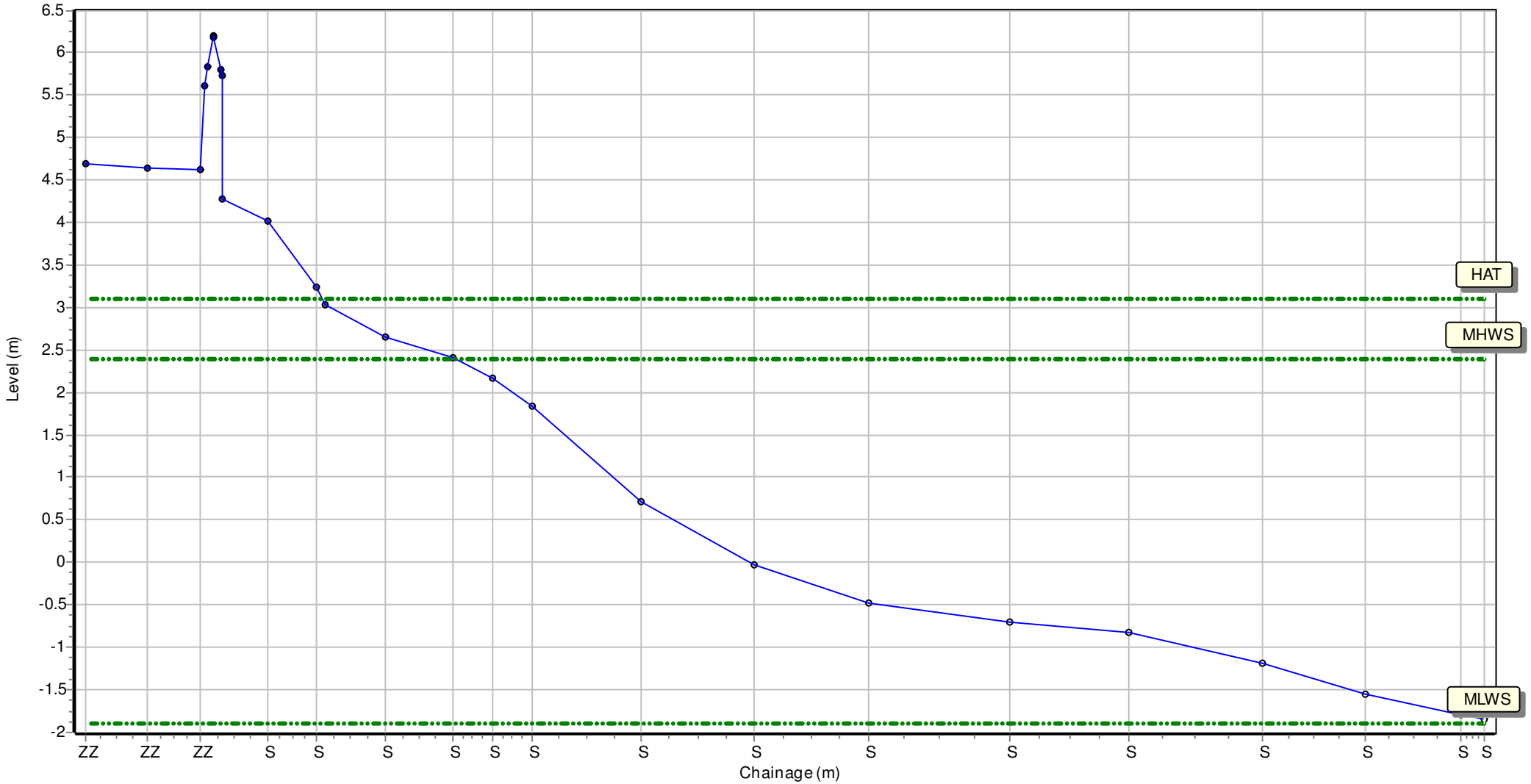
Location: **1aNWB11**

Date: 02/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

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



Beach Profile

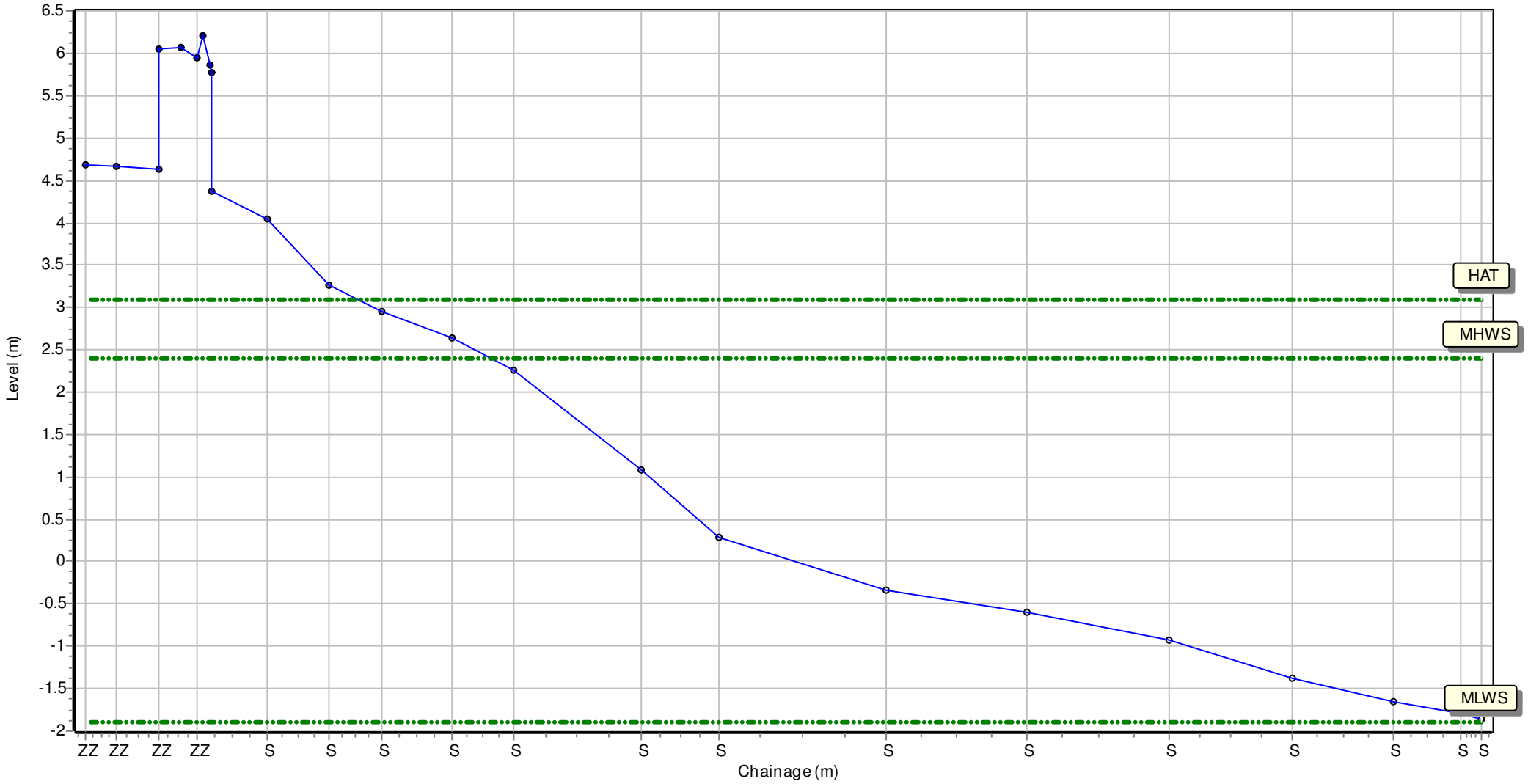
Location: **1aNWB12**

Date: 02/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

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



Beach Profile

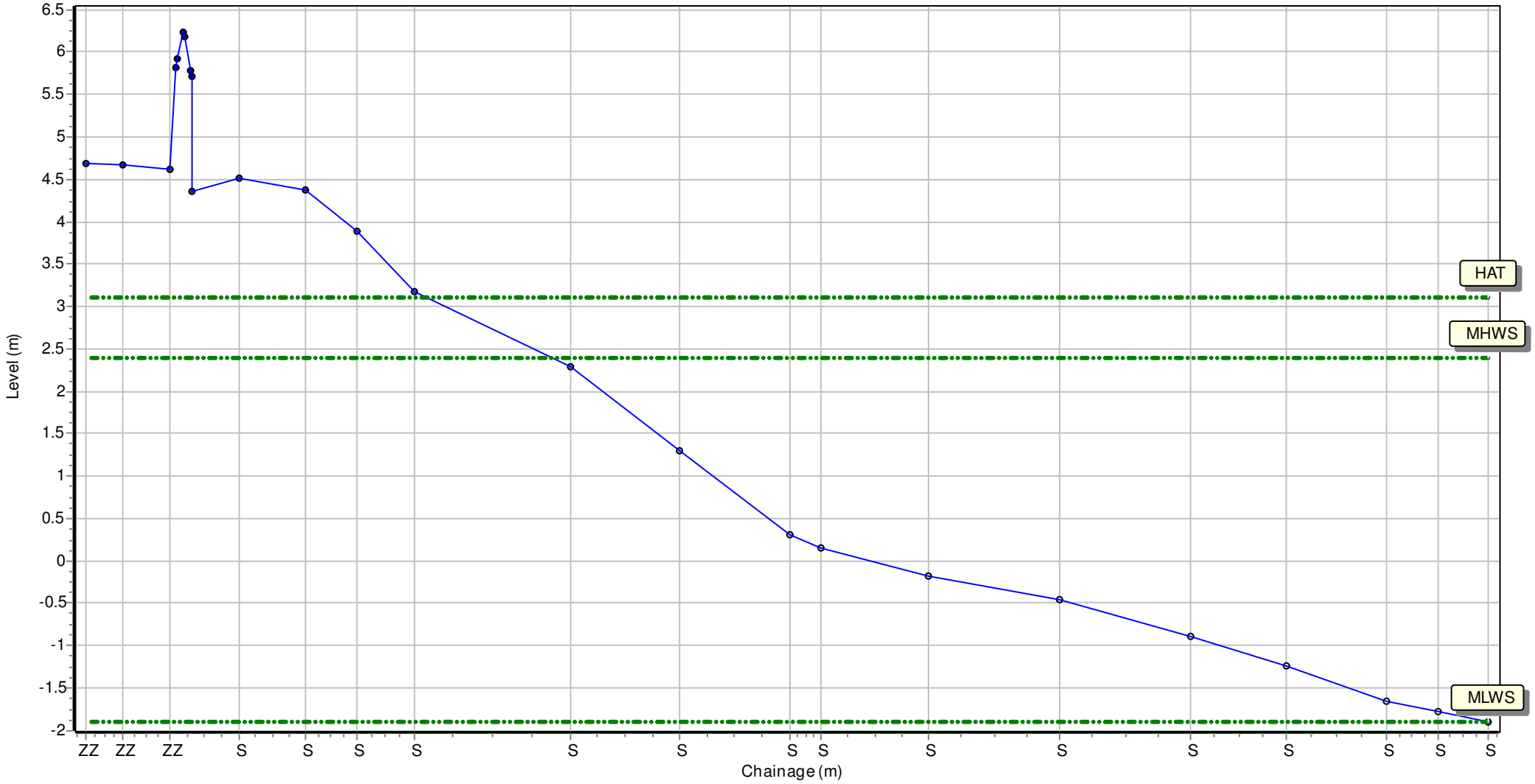
Location: **1aNWB13**

Date: 02/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

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



Beach Profile

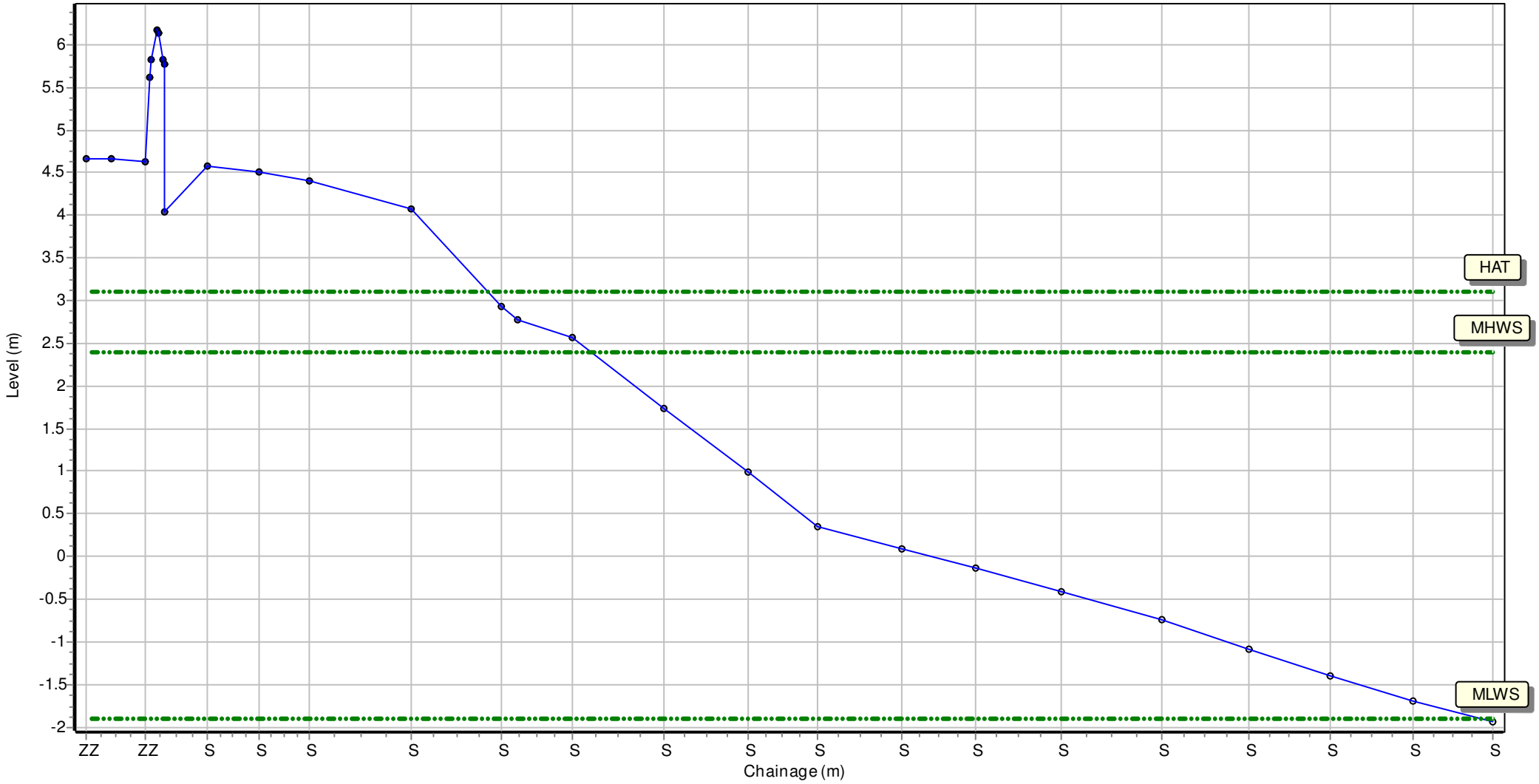
Location: **1aNWB14**

Date: 02/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

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



Beach Profile

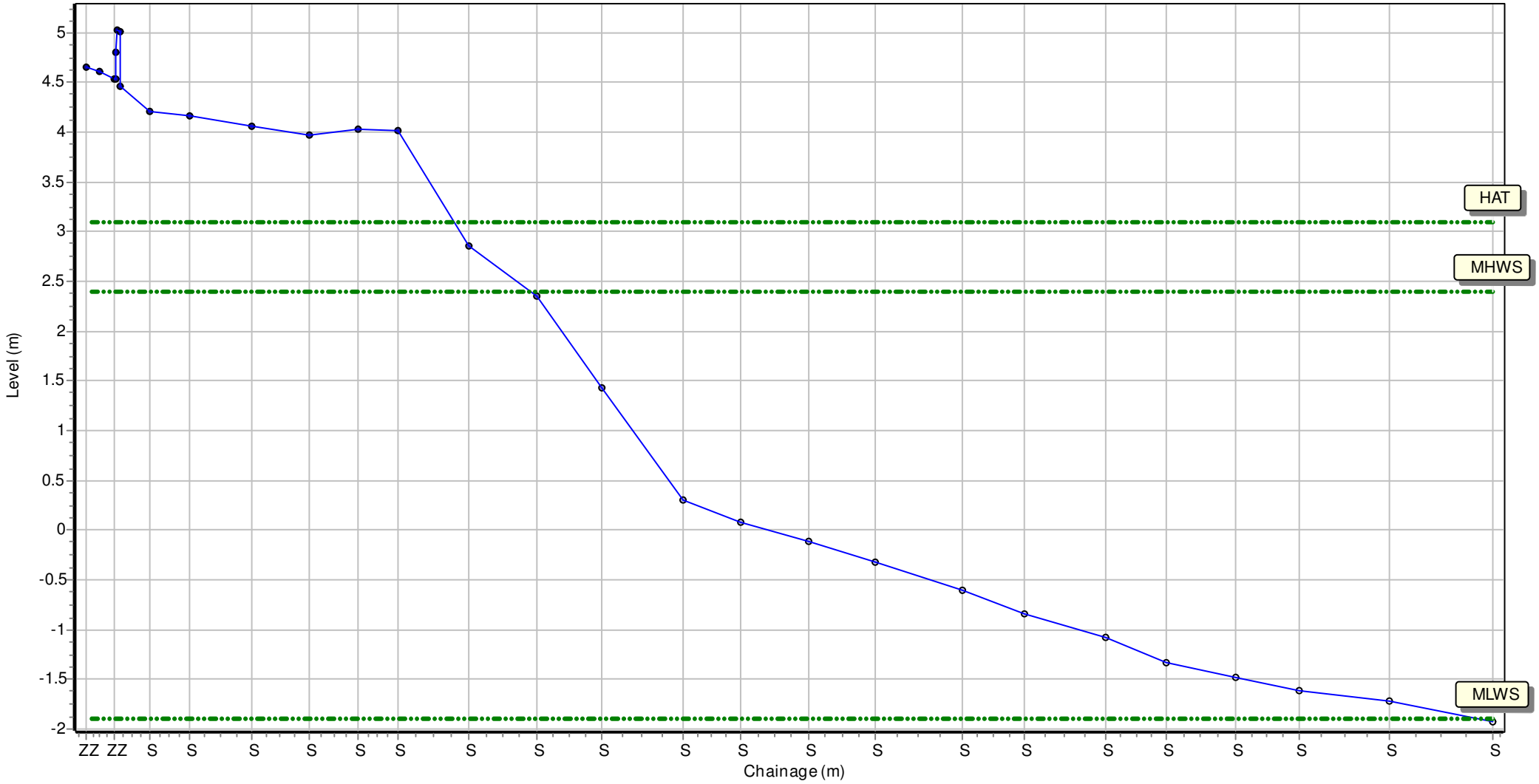
Location: **1aNWB15**

Date: 02/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

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



Beach Profile

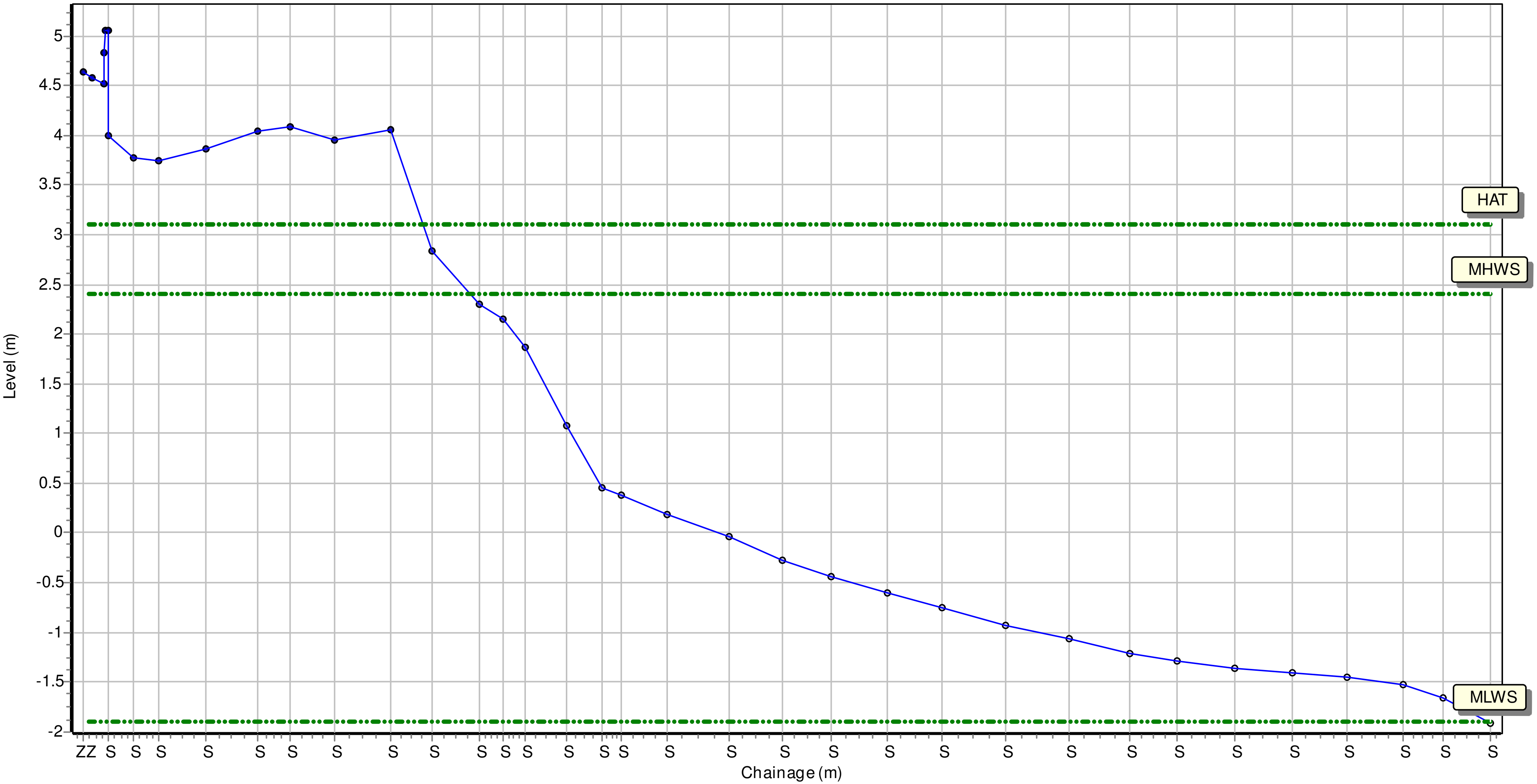
Location: **1aNWB16**

Date: 02/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

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



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Beach Profile

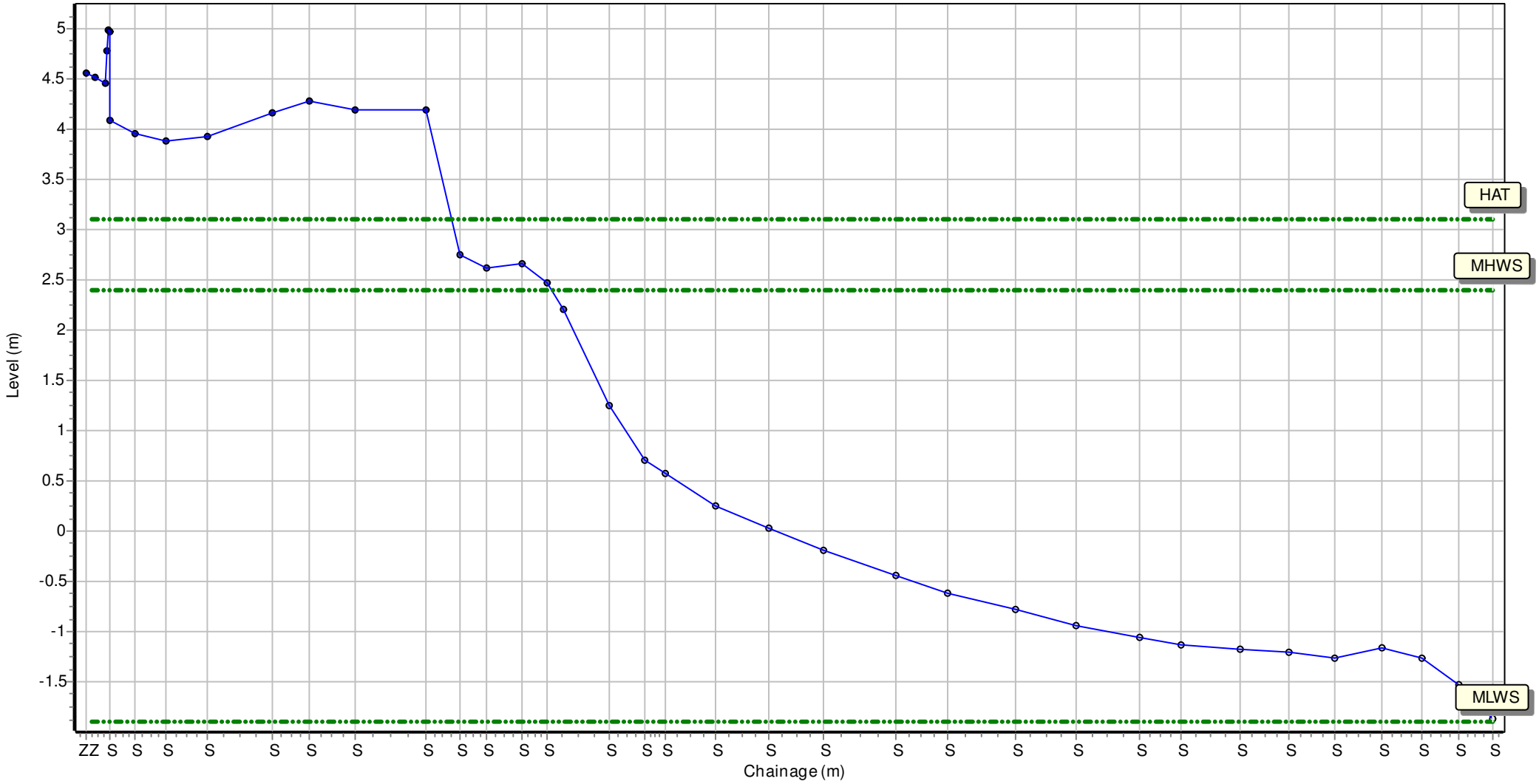
Location: **1aNWB17**

Date: 02/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

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



Beach Profile

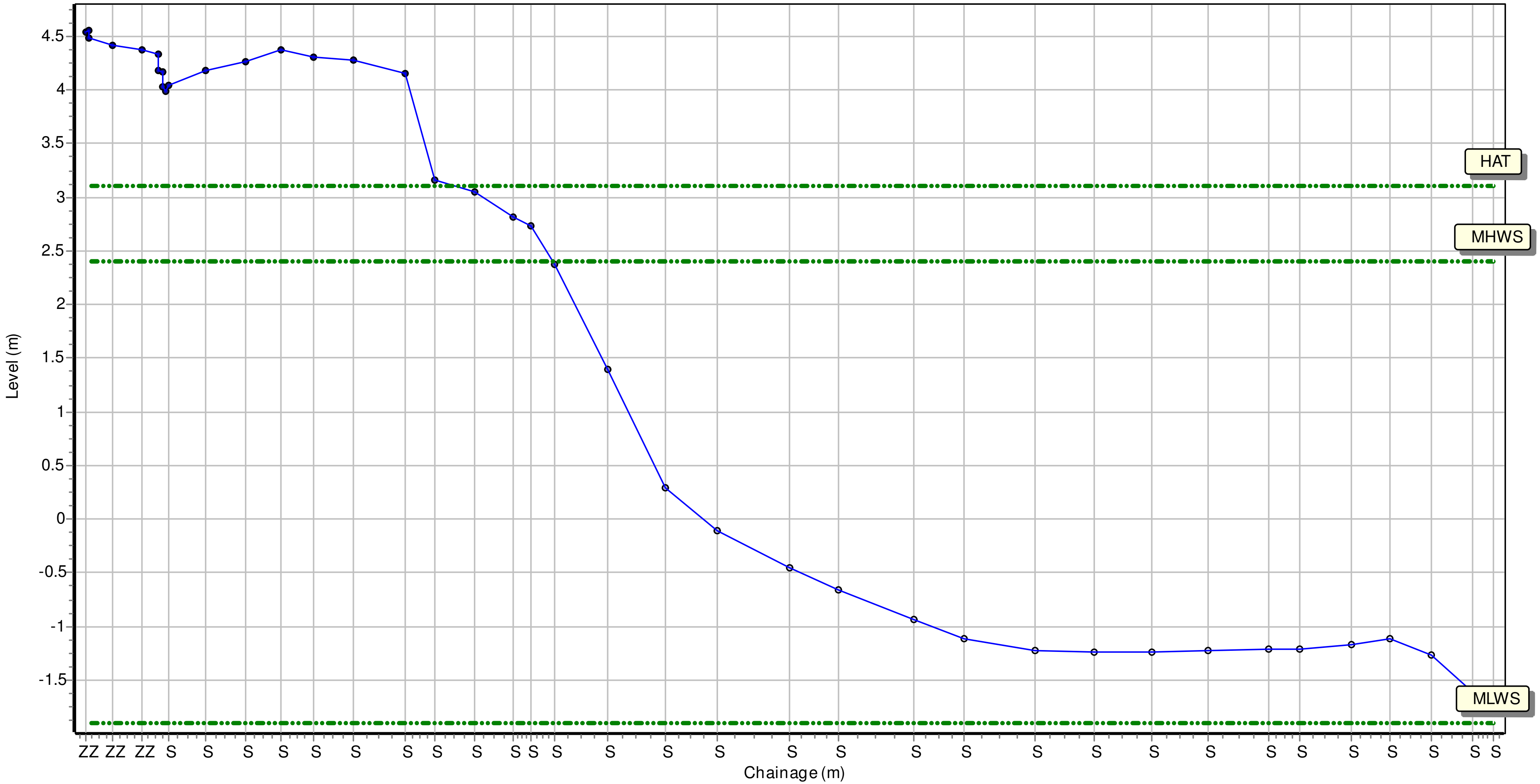
Location: **1aNWB18**

Date: 02/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

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



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Beach Profile

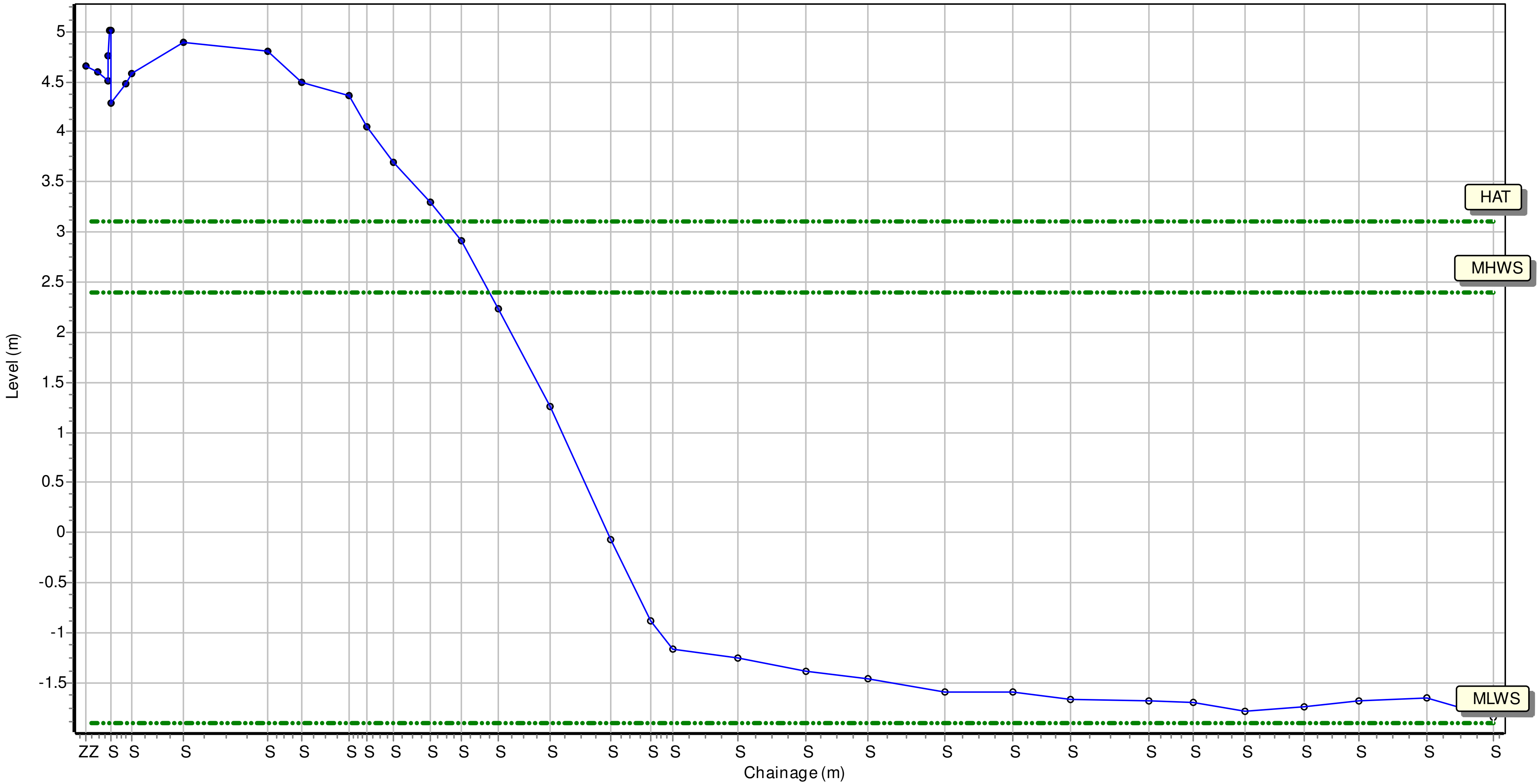
Location: **1aNWB19**

Date: 02/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

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



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Beach Profile

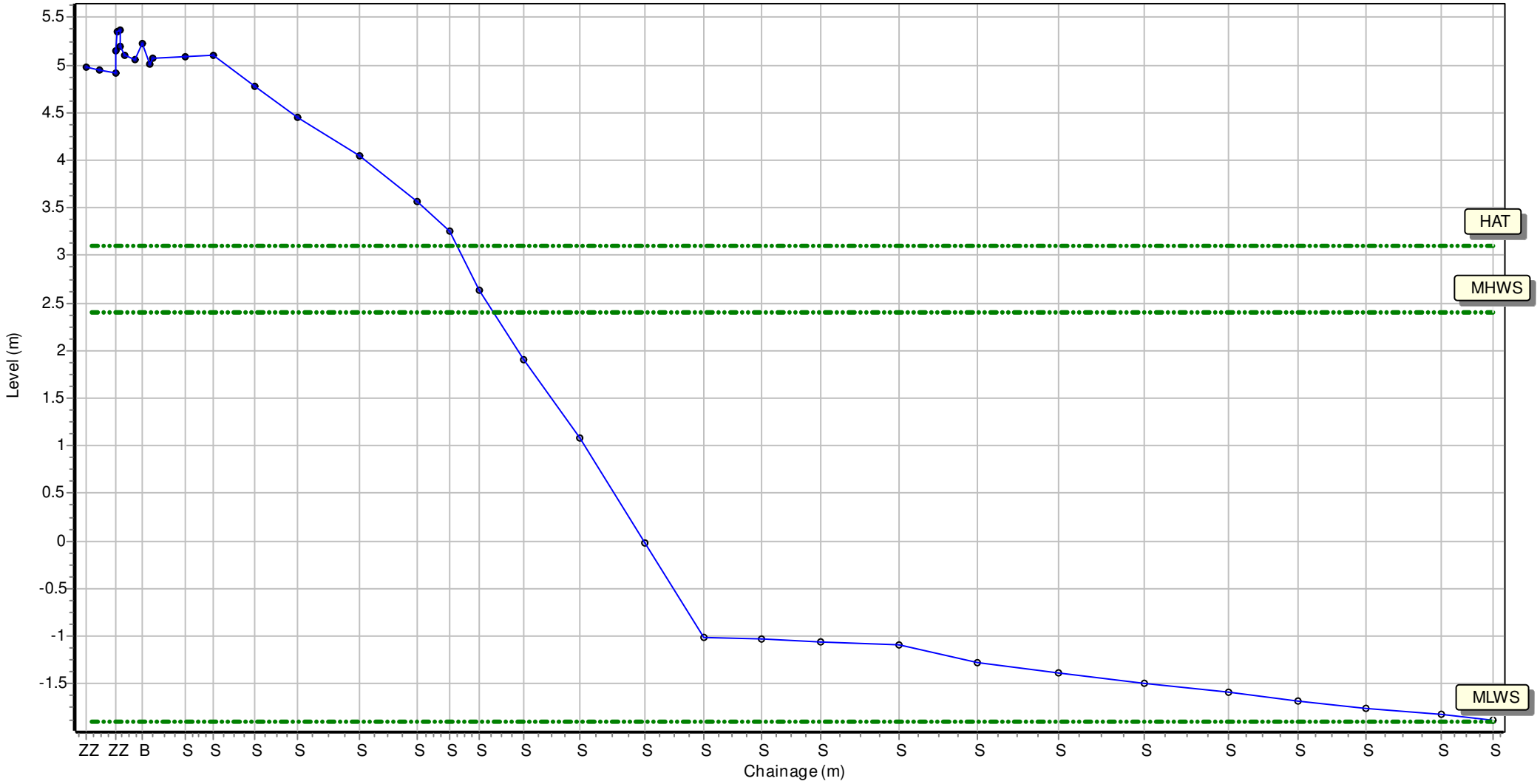
Location: **1aNWB20**

Date: 02/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

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



Beach Profile

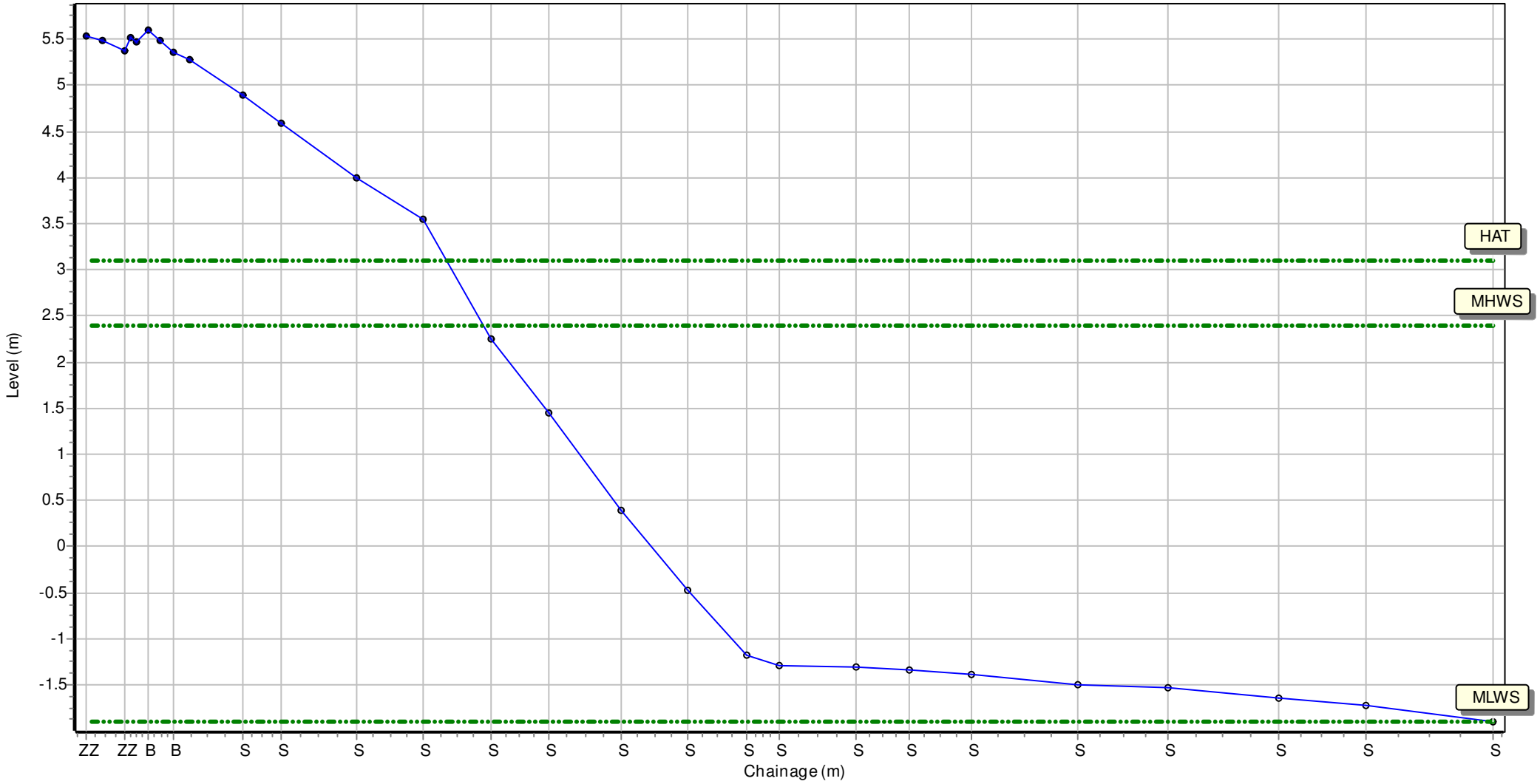
Location: **1aNWB21**

Date: 02/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

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



Beach Profile

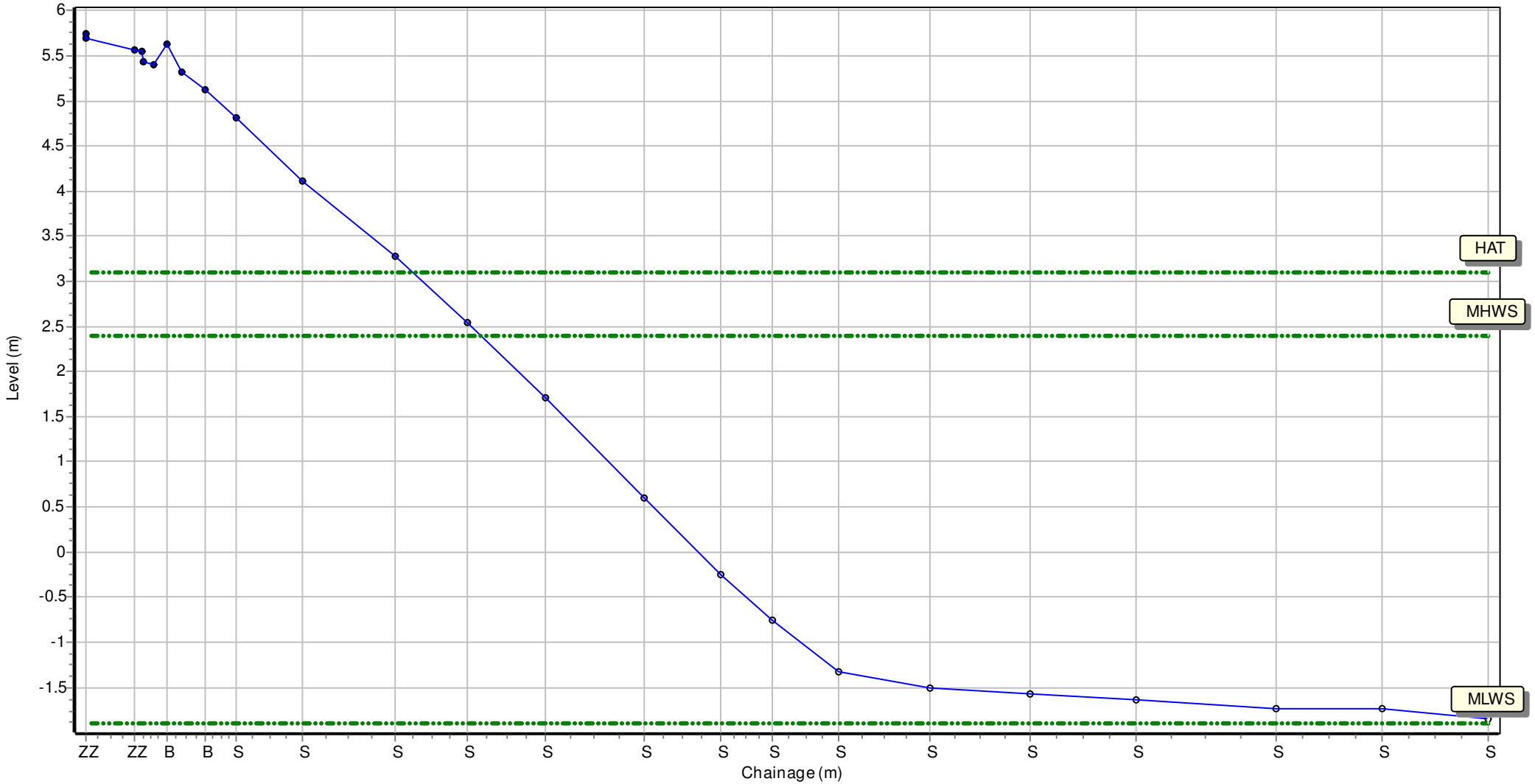
Location: **1aNWB22**

Date: 02/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

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



Beach Profile

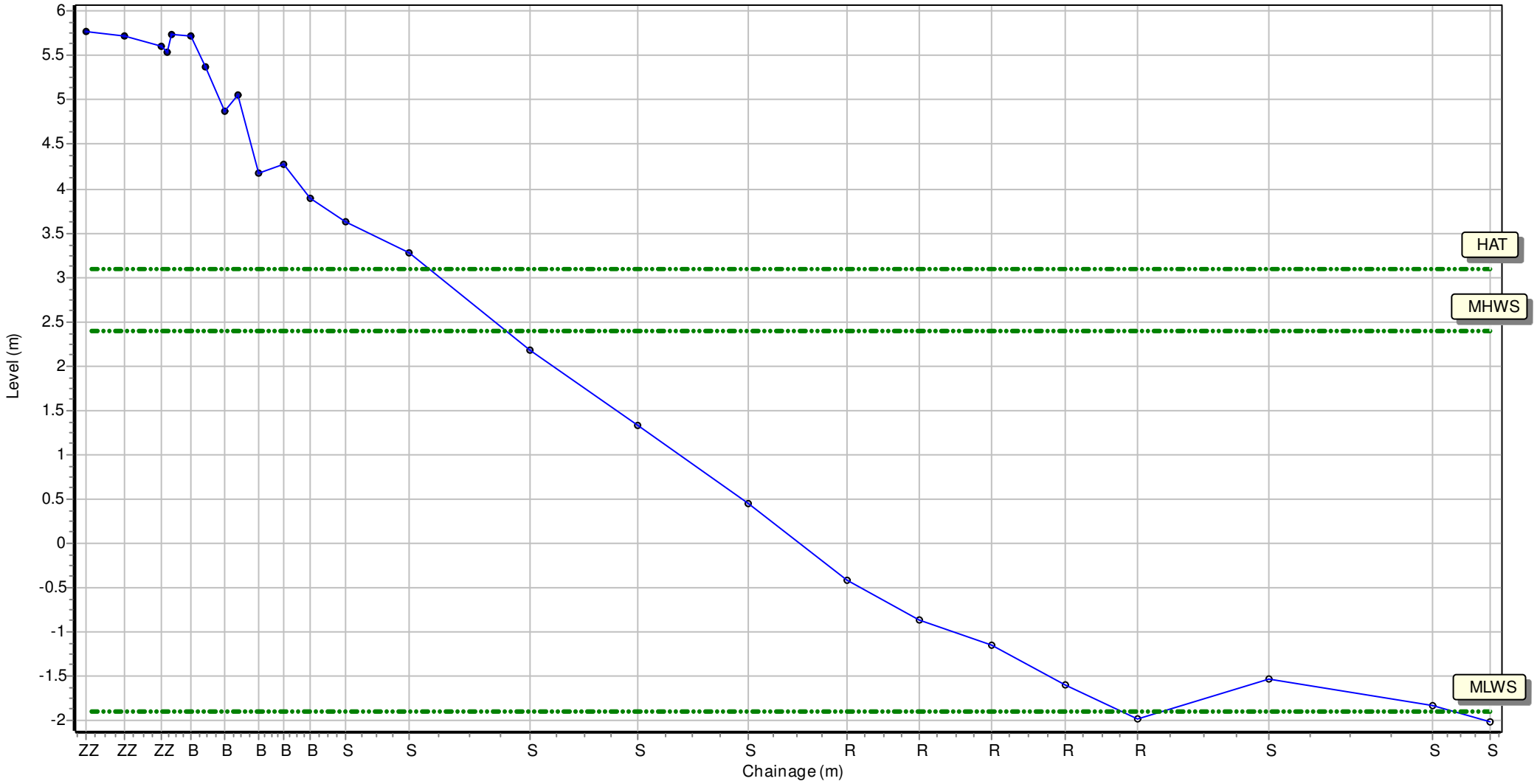
Location: **1aNWB23**

Date: 02/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

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



Beach Profile

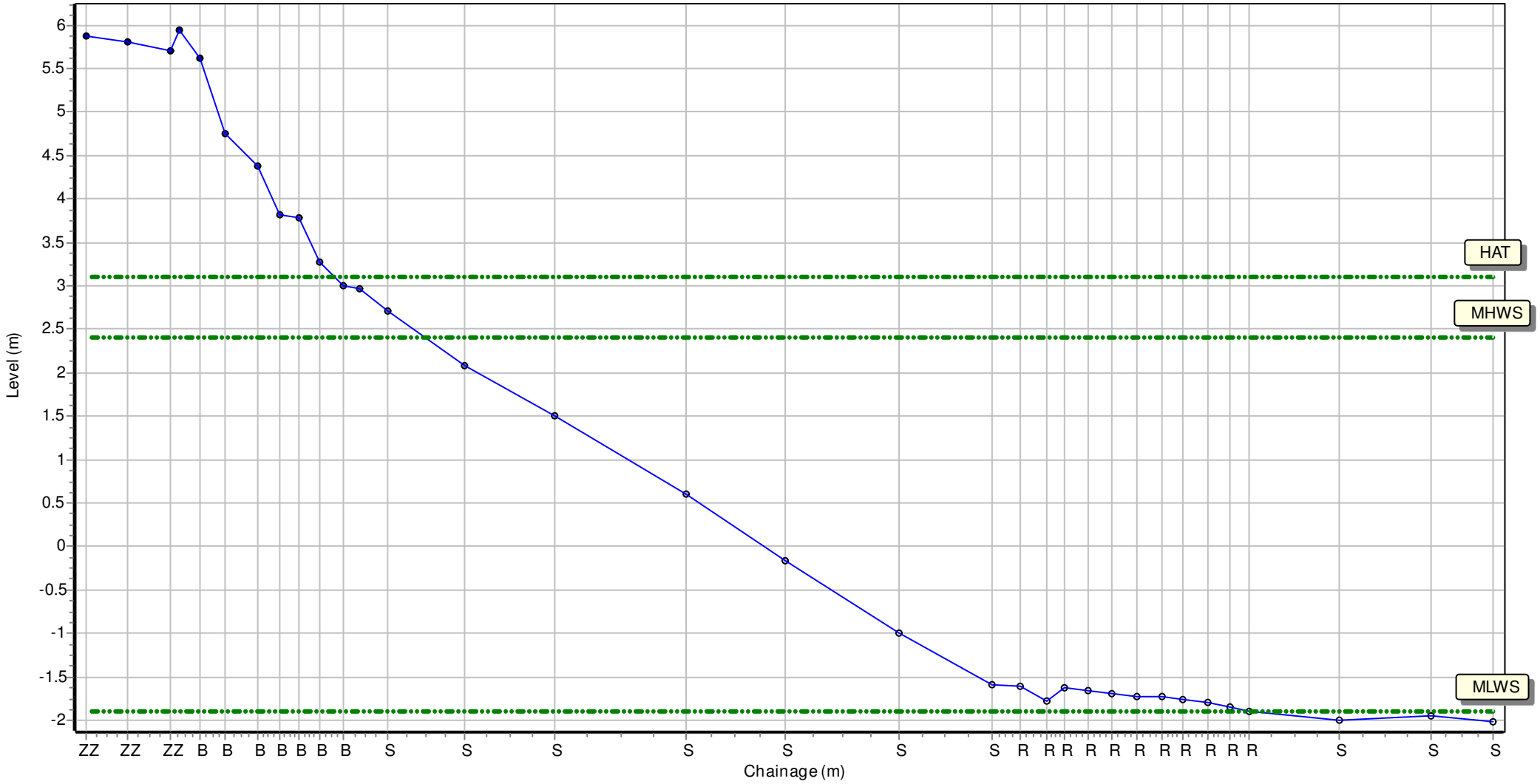
Location: **1aNWB24**

Date: 02/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

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



Beach Profile

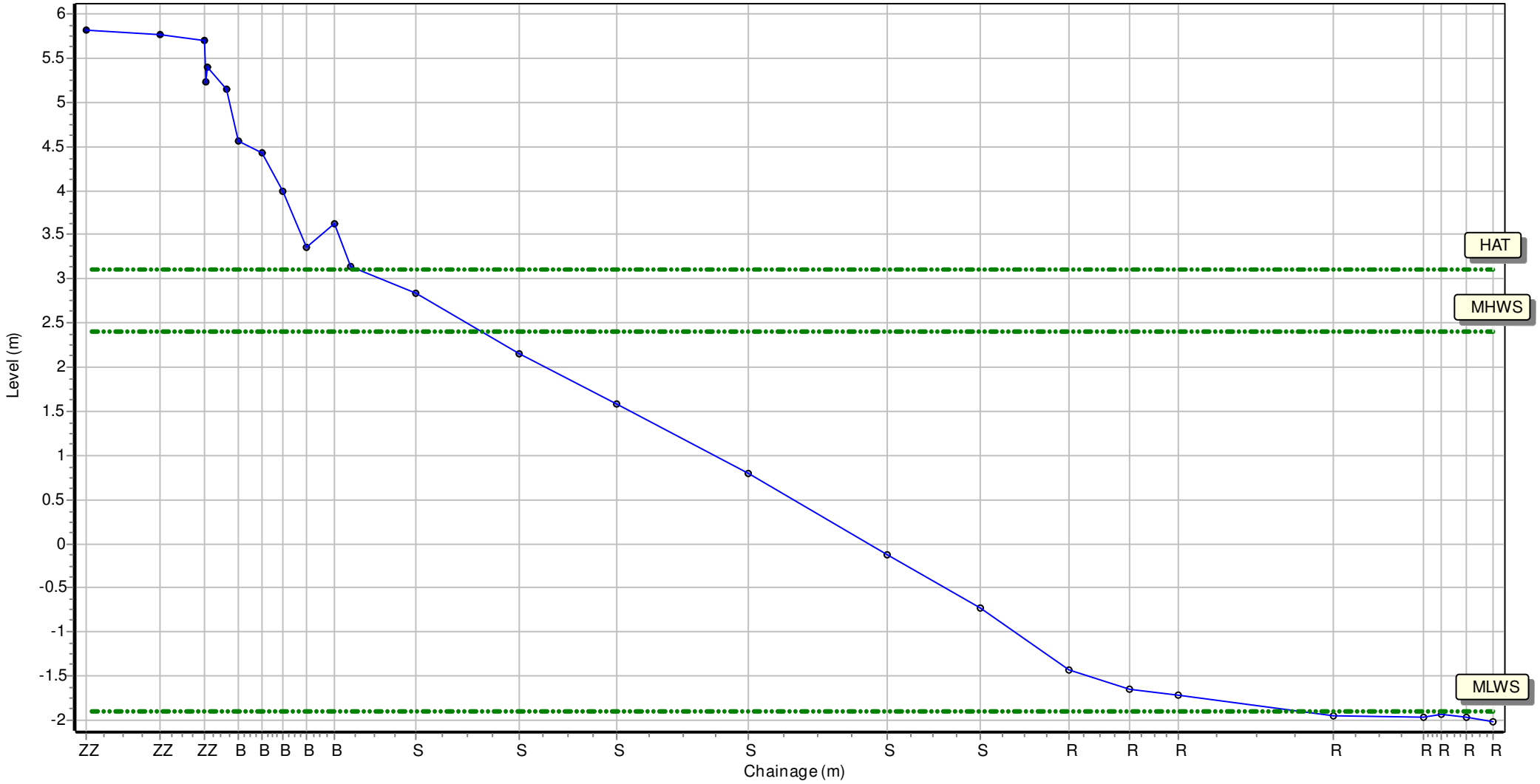
Location: **1aNWB25**

Date: 02/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

Easting: 430953.984 **Northing:** 587261.982 **Profile Bearing:** 89 ° from North



Beach Profile

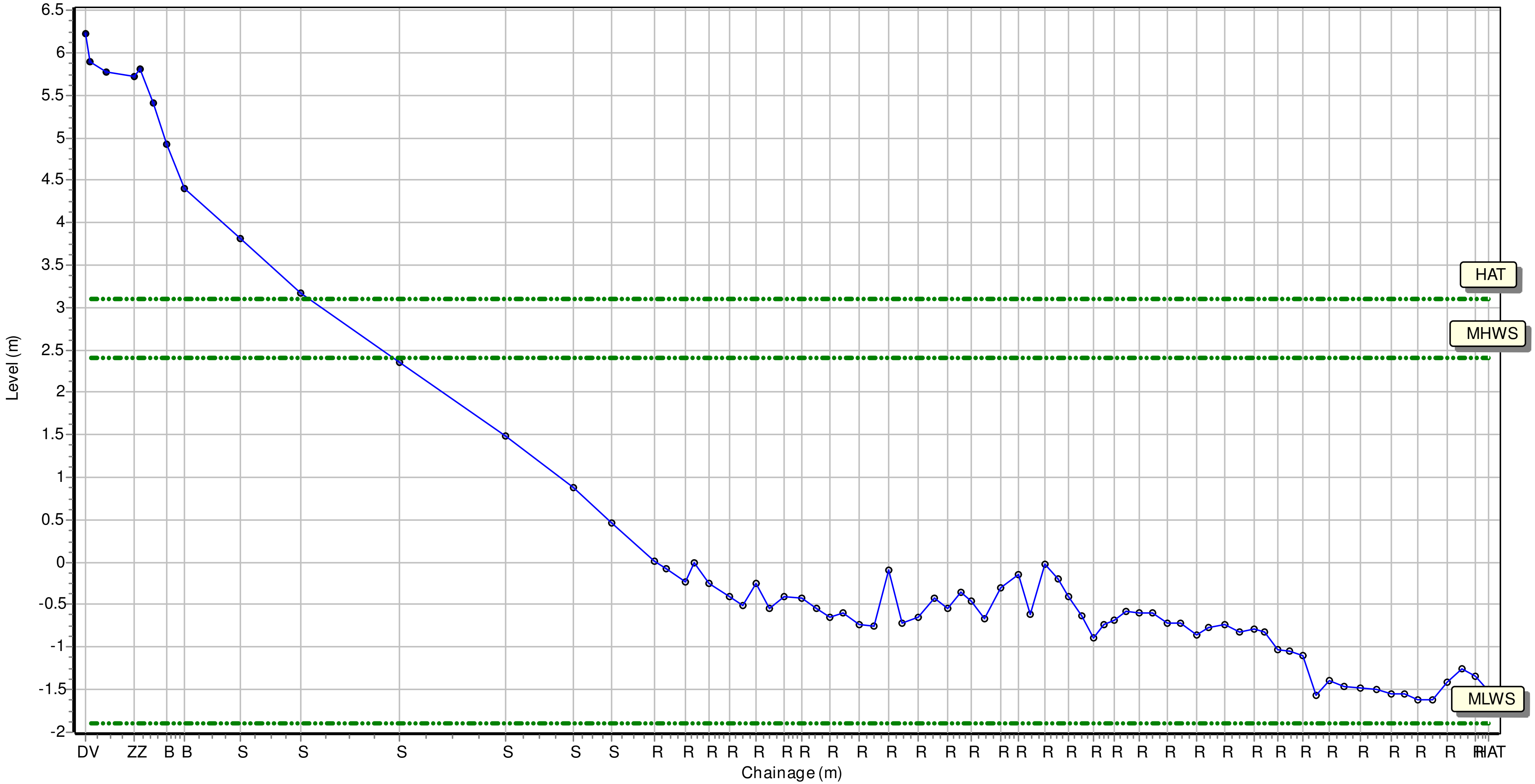
Location: **1aNWB26**

Date: 02/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

Easting: 430960.828 **Northing:** 587212.152 **Profile Bearing:** 86 ° from North



Beach Profile

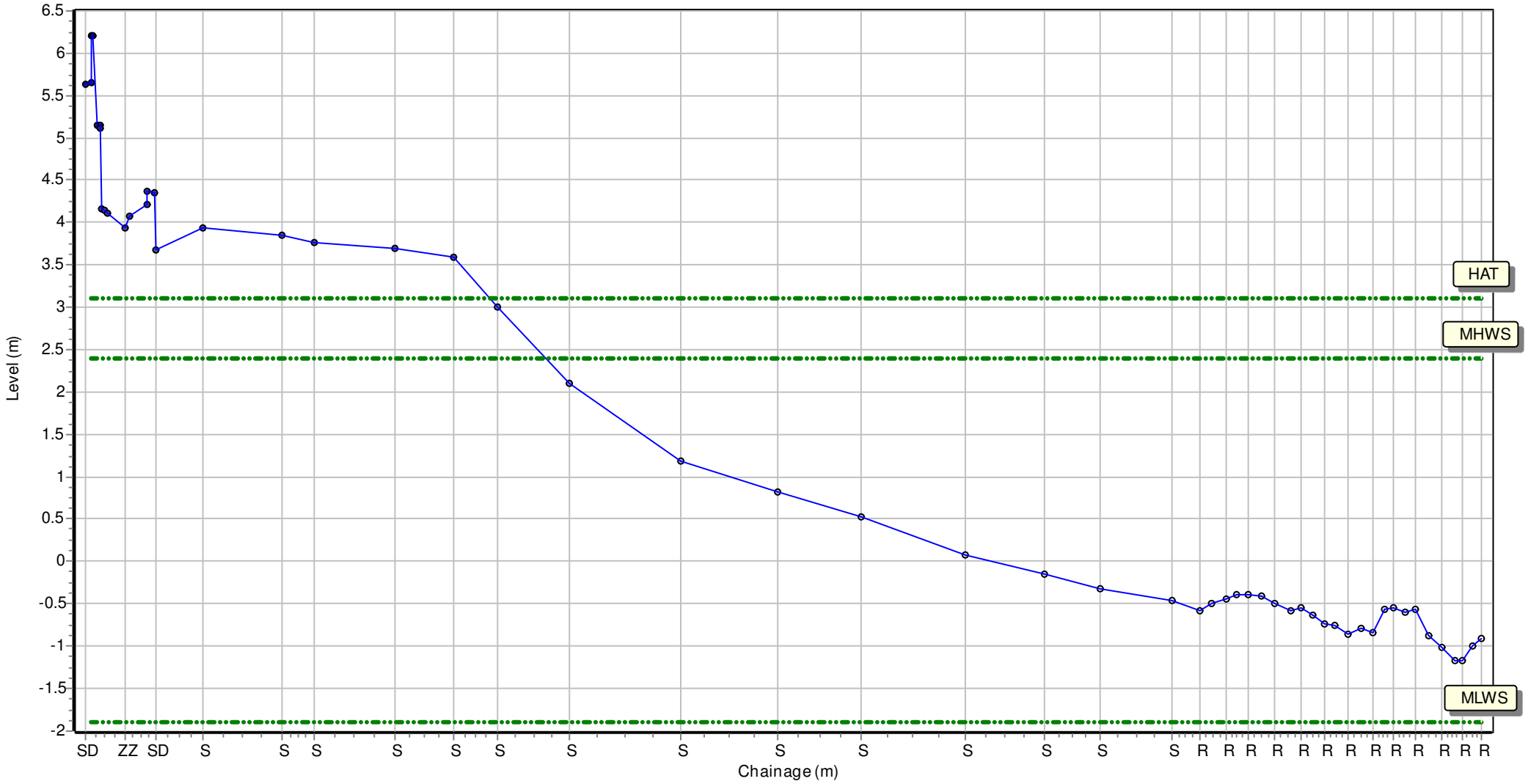
Location: **1aWDC05A**

Date: 02/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

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



Beach Profile

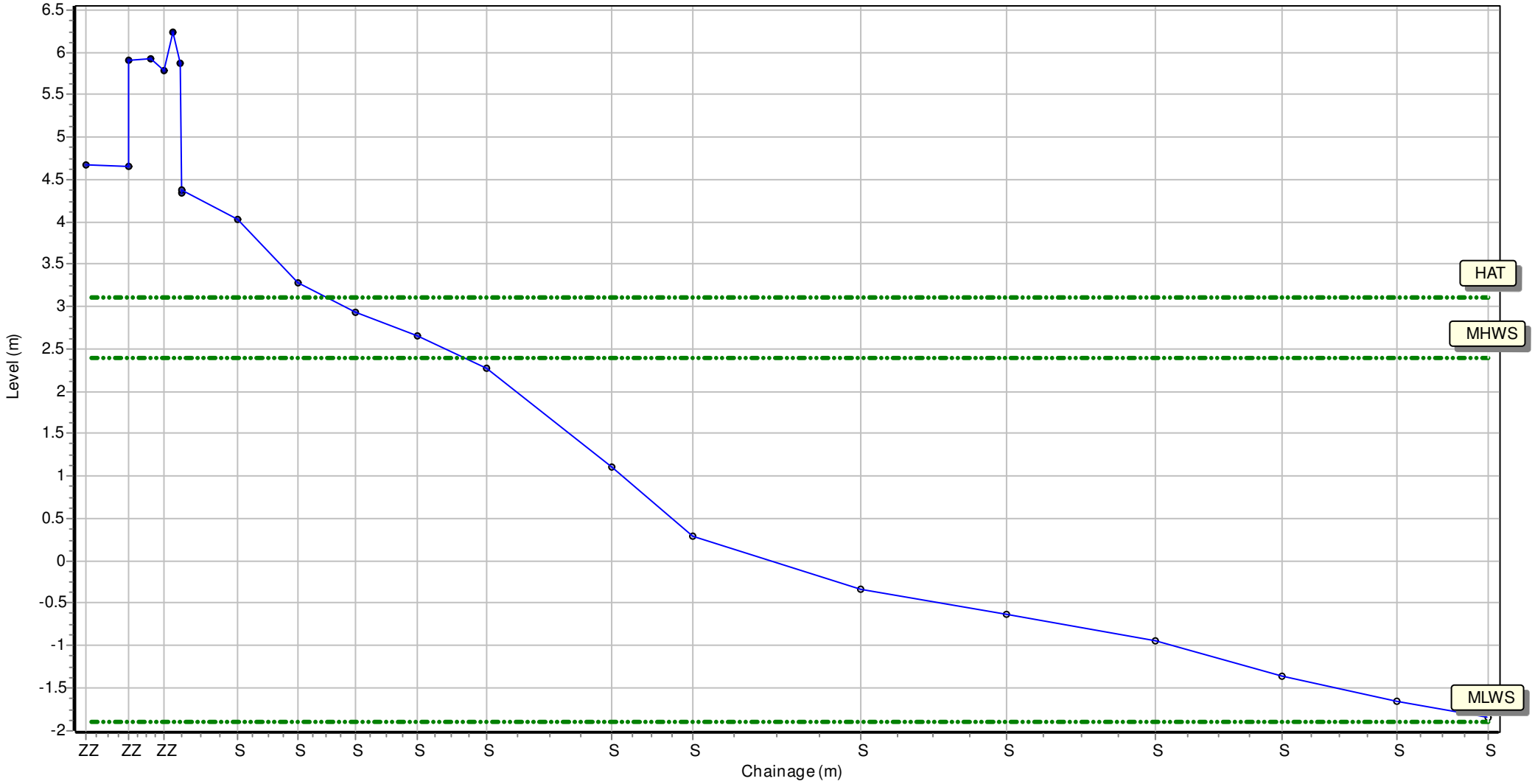
Location: **1aWDC06**

Date: 02/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

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



Beach Profile

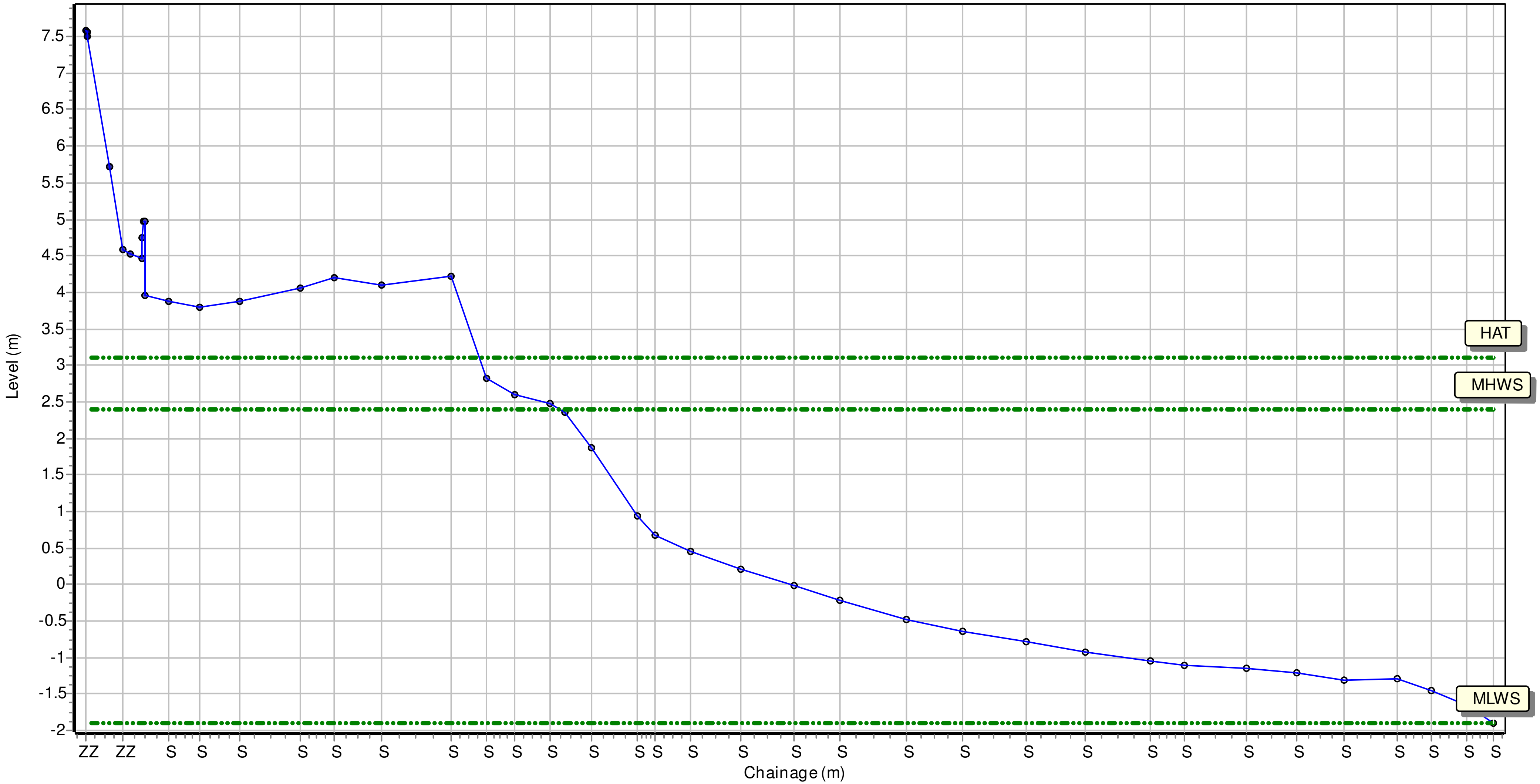
Location: **1aWDC06A**

Date: 02/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

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



Beach Profile

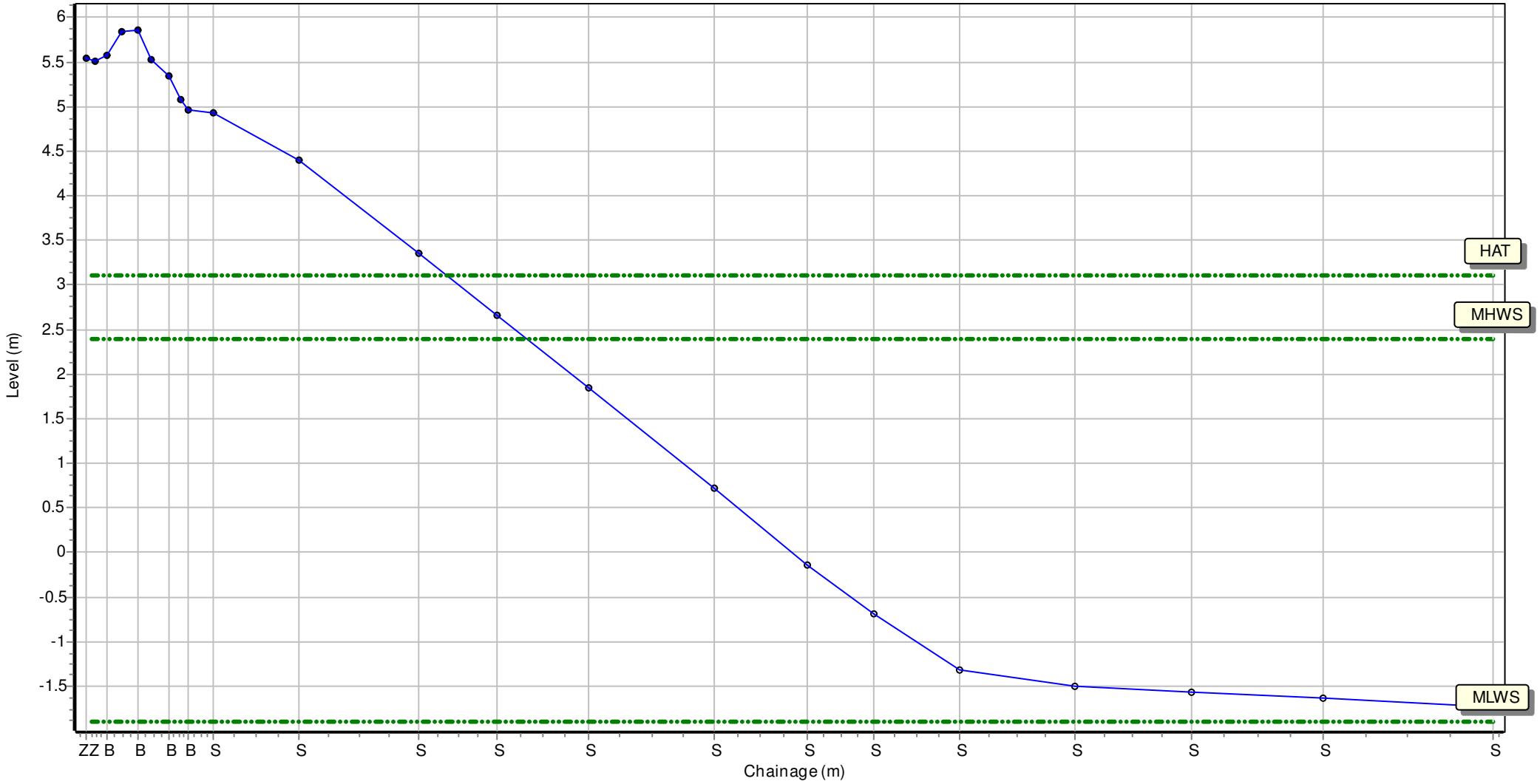
Location: **1aWDC07**

Date: 02/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

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



Beach Profile

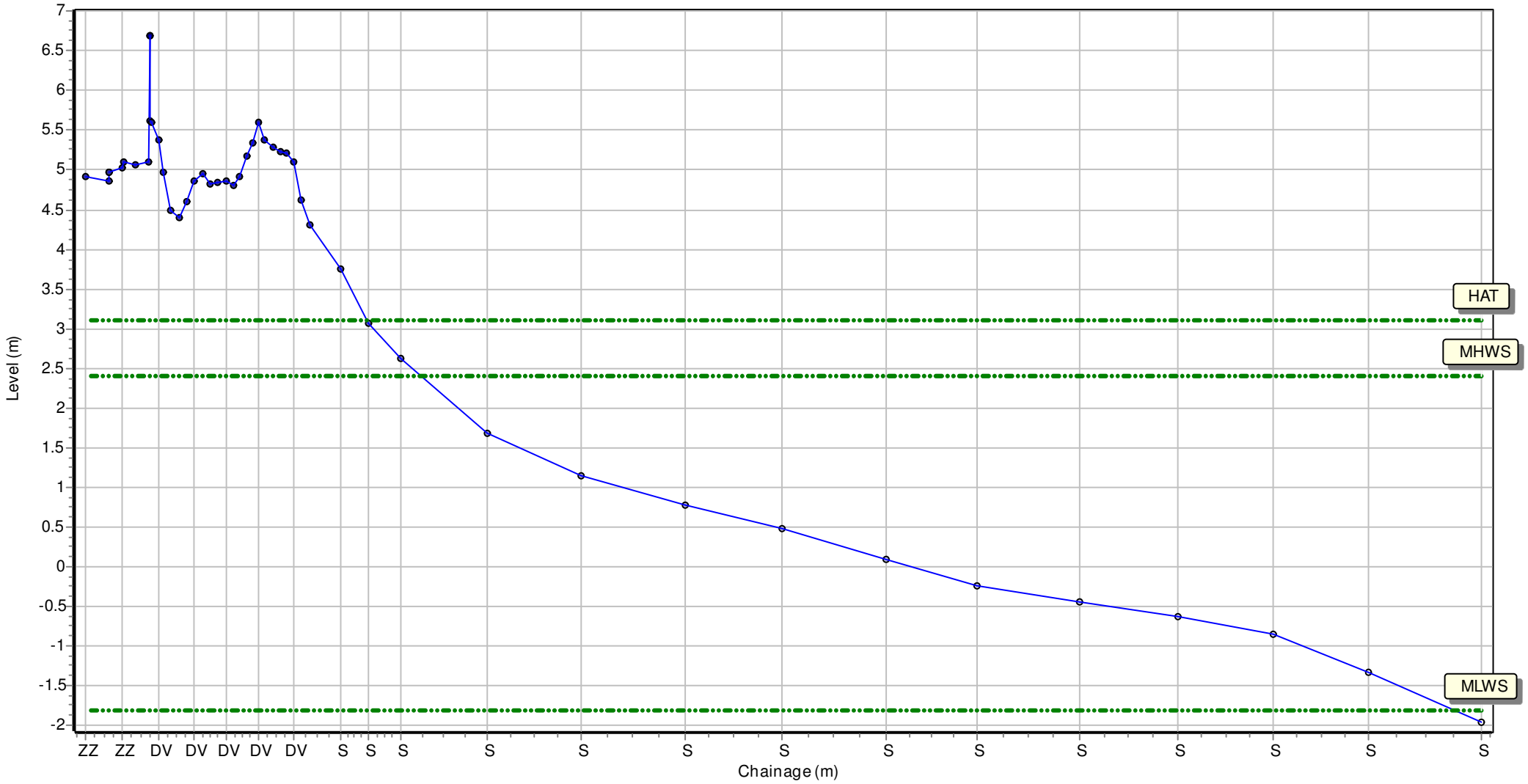
Location: **1aBVBC01**

Date: 03/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

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



Beach Profile

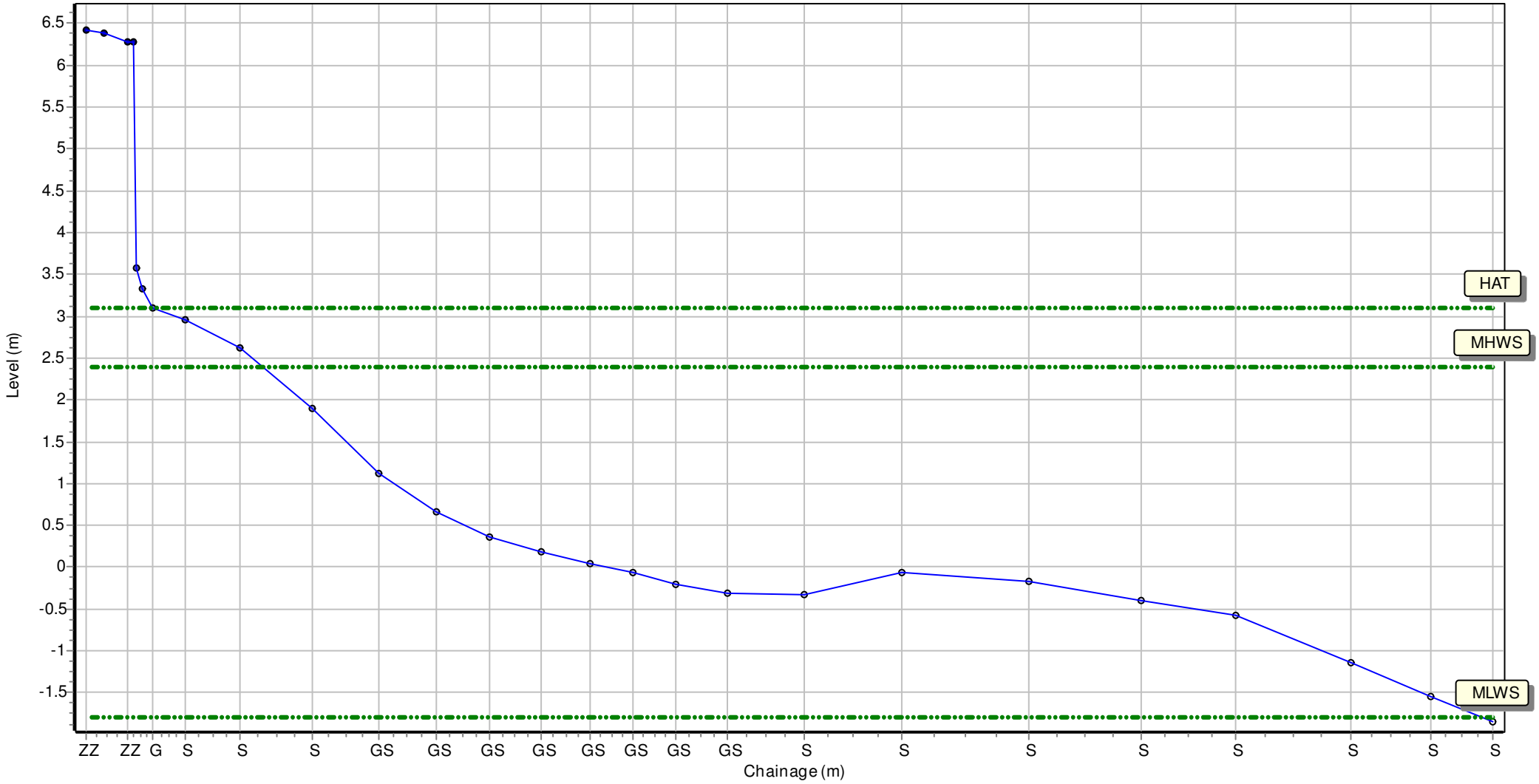
Location: **1aBVBC02**

Date: 03/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

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



Beach Profile

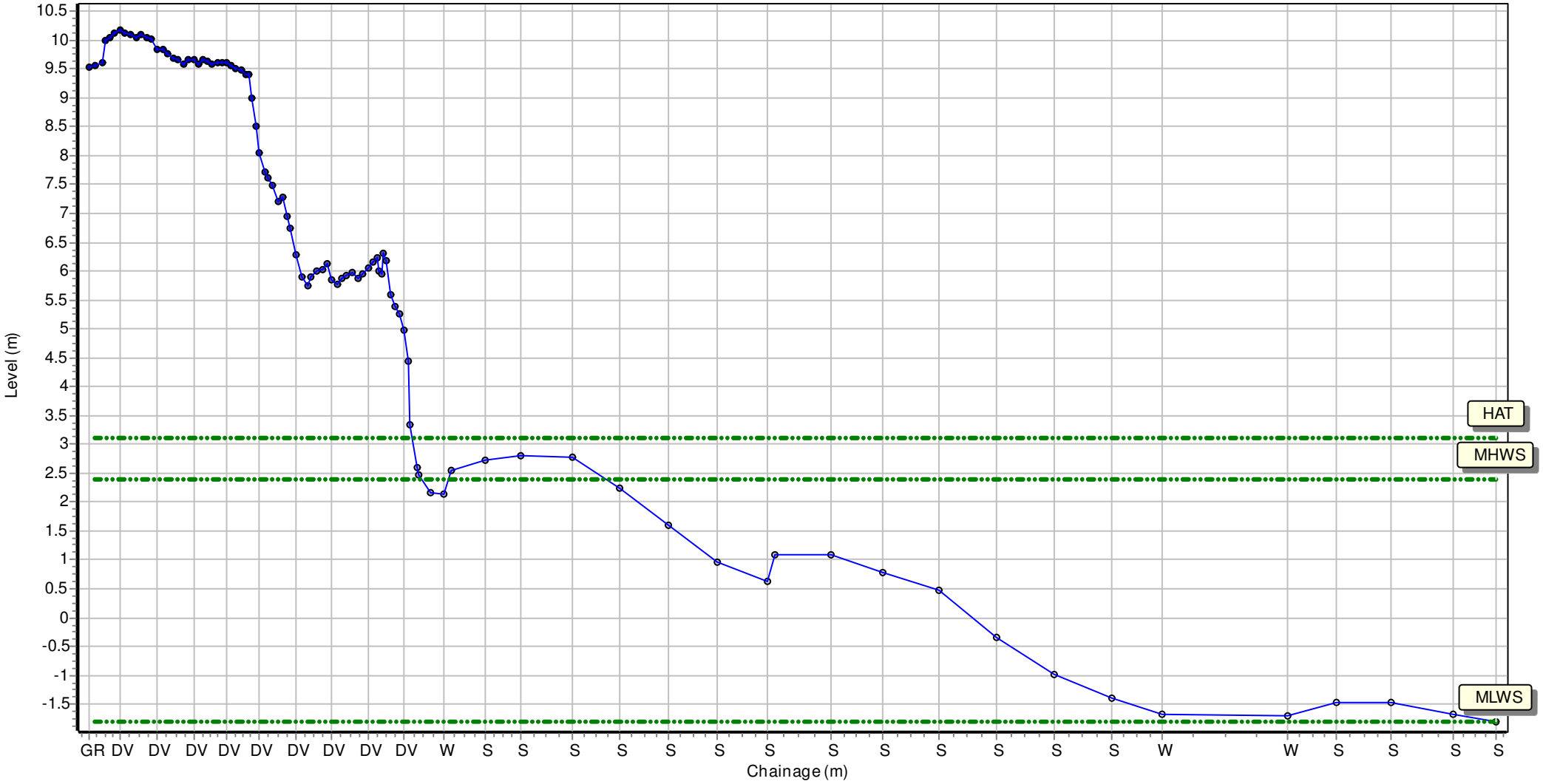
Location: **1aBVBC03**

Date: 03/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

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



Beach Profile

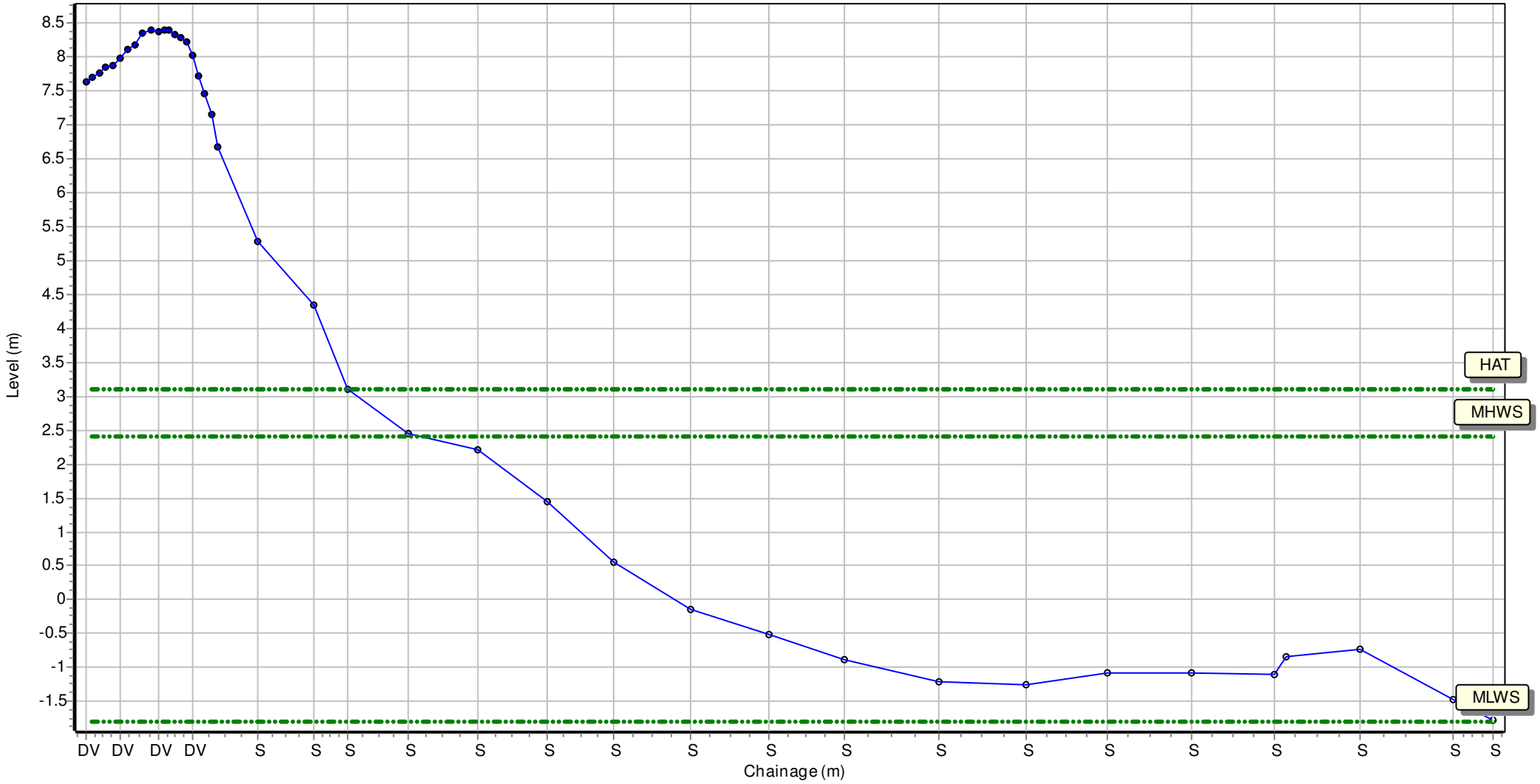
Location: **1aBVBC04**

Date: 03/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

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



Beach Profile

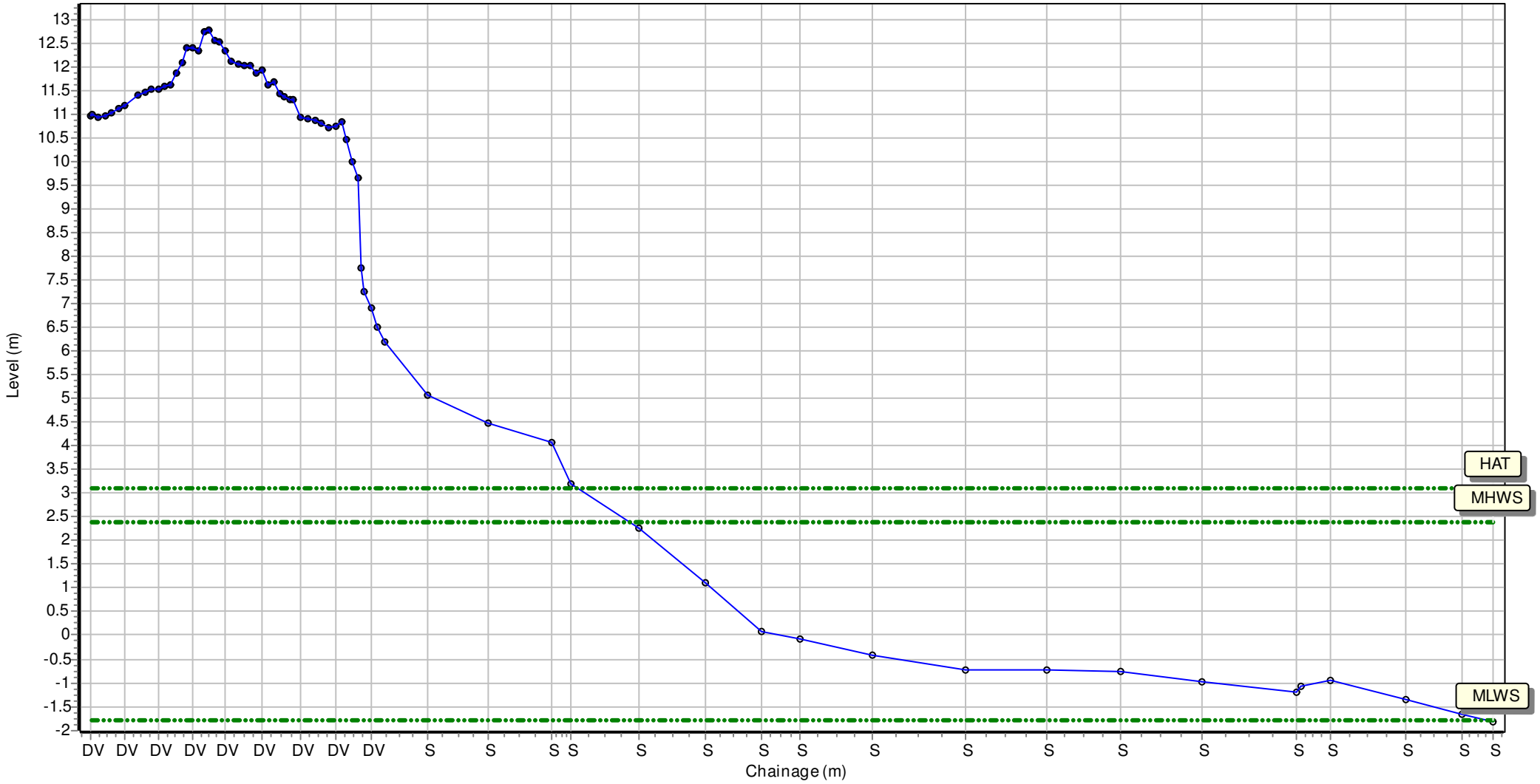
Location: **1aBVBC05**

Date: 03/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

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



Beach Profile

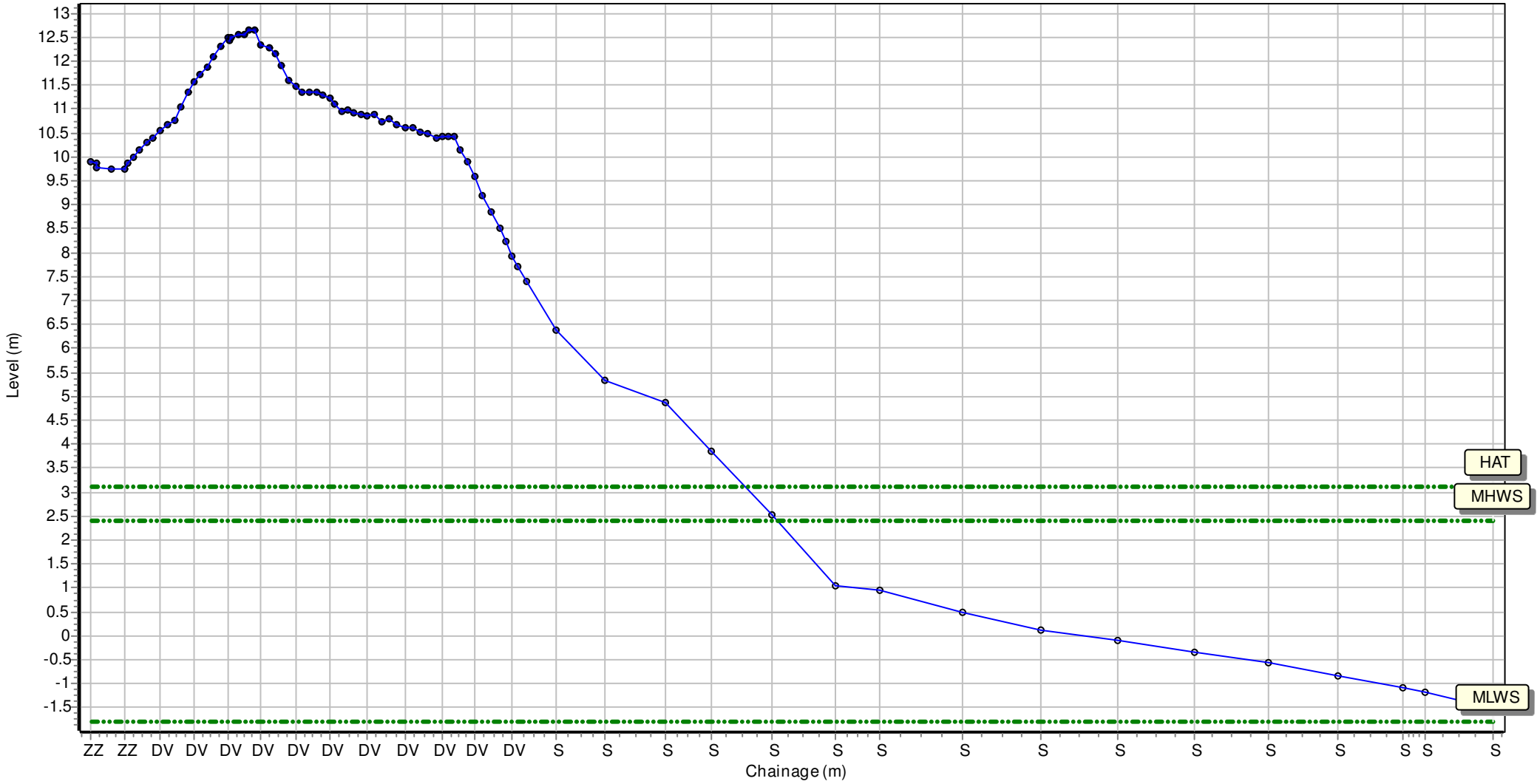
Location: **1aBVBC06**

Date: 03/03/2021 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2021 Partial Measures Topo Survey

Easting: 433247.516 **Northing:** 577032.054 **Profile Bearing:** 53 ° from North




Beach Profiles: 1aBTBC02
Level (m)
Chainage (m)
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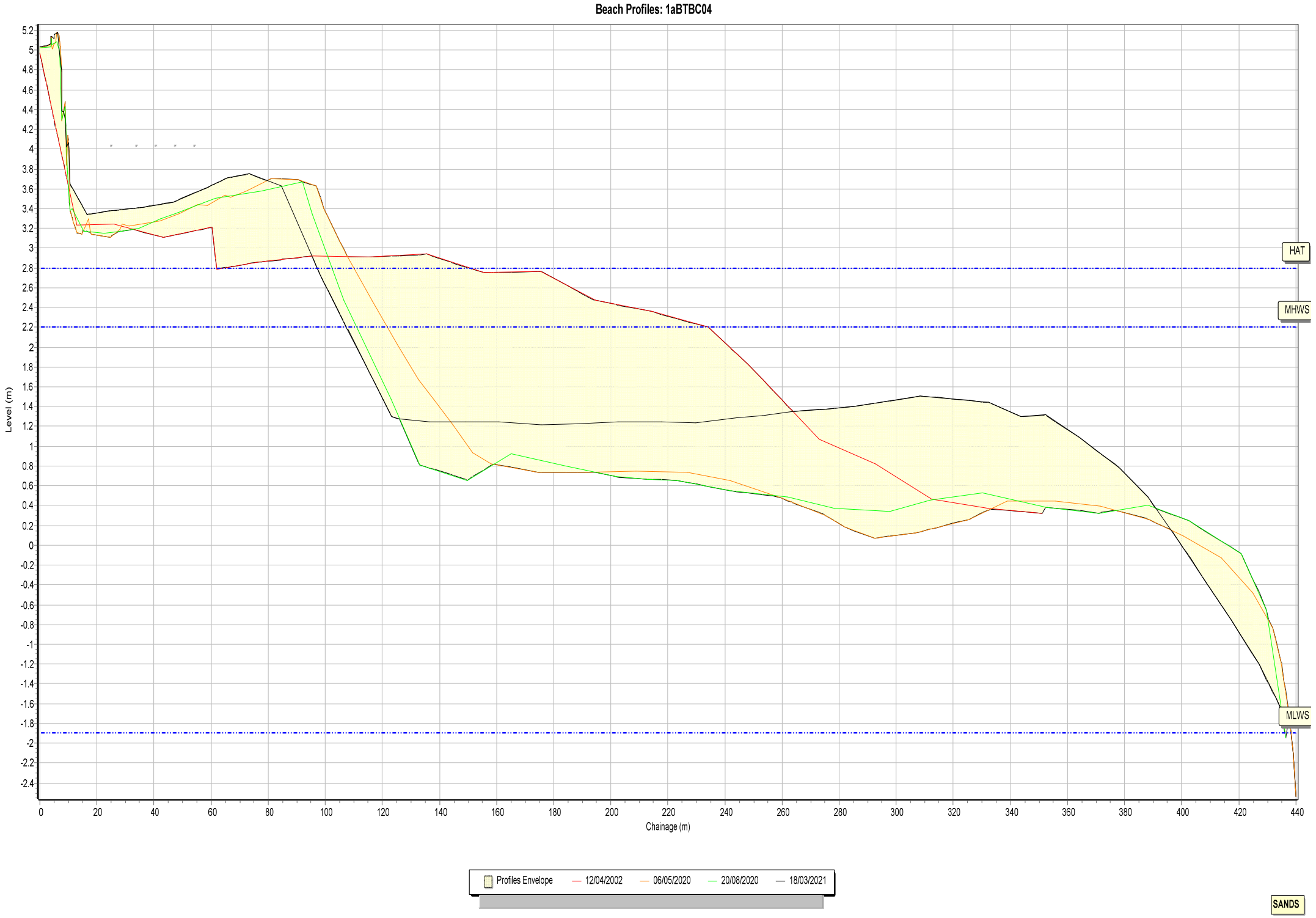
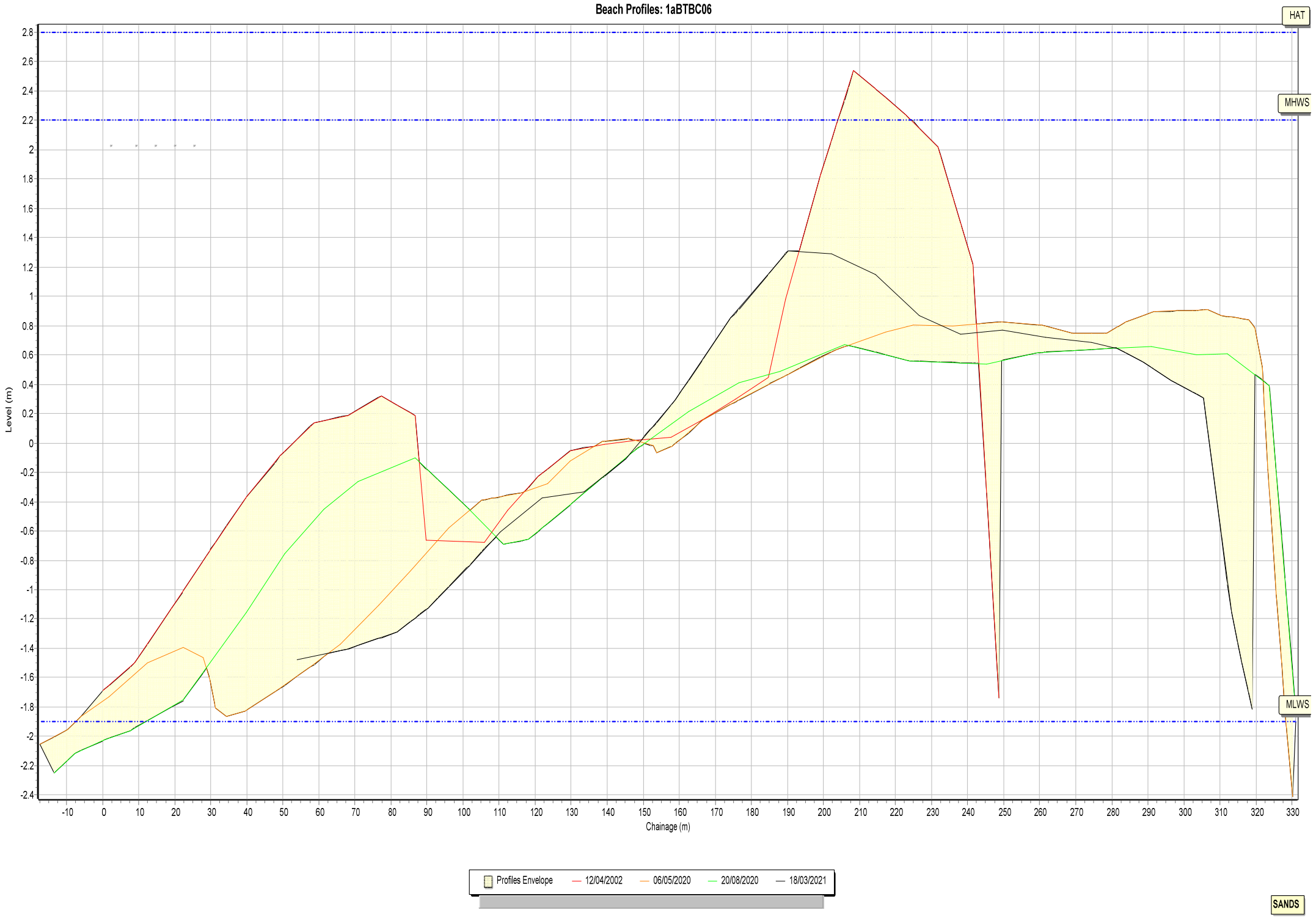
MHWS
MLWS
Profiles Envelope
12/04/2002
06/05/2020
20/08/2020
18/03/2021
SANDS


Beach Profiles: 1aBTBC04
Level (m)
Chainage (m)
HAT
MHWS
MLWS
Profiles Envelope
12/04/2002
06/05/2020
20/08/2020
18/03/2021
SANDS


Beach Profiles: 1aBTBC05
Level (m)
Chainage (m)
HAT
MHWS
MLWS
Profiles Envelope
12/04/2002
06/05/2020
20/08/2020
18/03/2021
SANDS


Beach Profiles: 1aBTBC06
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MHWS
MLWS
SANDS
Level (m)
Chainage (m)
Profiles Envelope
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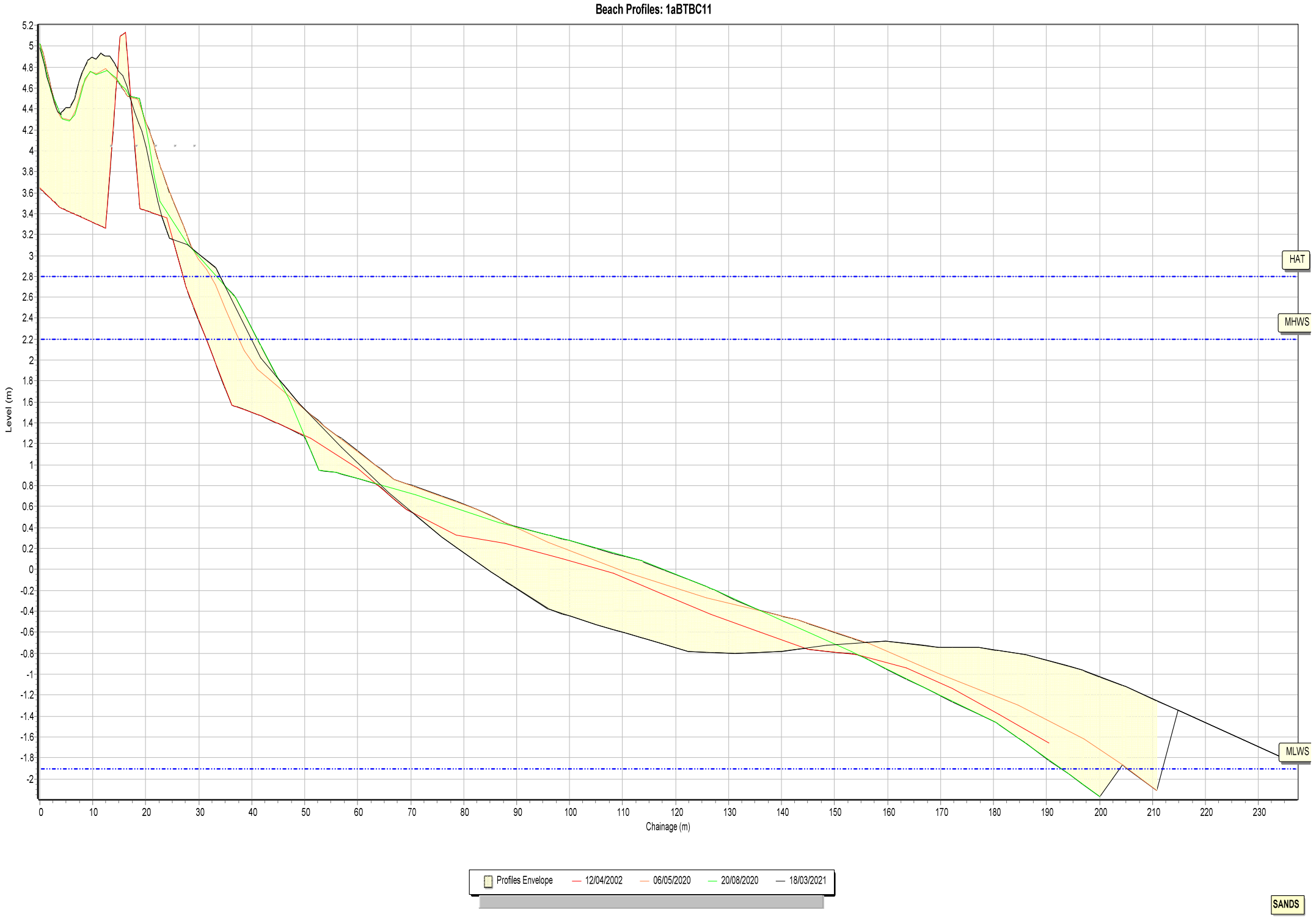
06/05/2020
20/08/2020
18/03/2021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Level (m)
Chainage (m)
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MHWS
MLWS
Profiles Envelope
12/04/2002
06/05/2020
20/08/2020
18/03/2021
SANDS


Beach Profiles: 1aBTBC13
Level (m)
Chainage (m)
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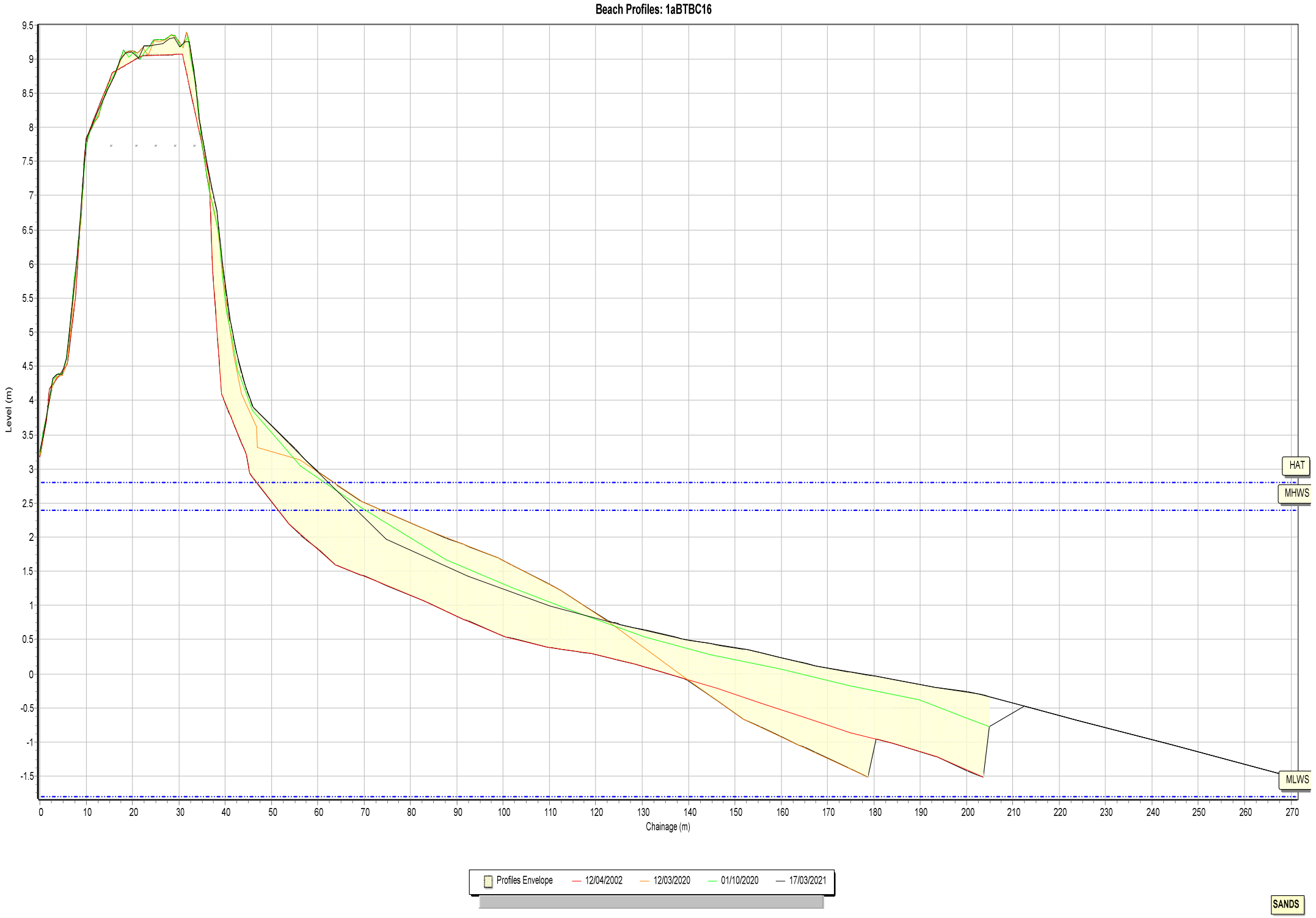
MHWS
MLWS
Profiles Envelope
12/04/2002
06/05/2020
20/08/2020
18/03/2021
SANDS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Level (m)
Chainage (m)
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MHWS
MLWS
Profiles Envelope
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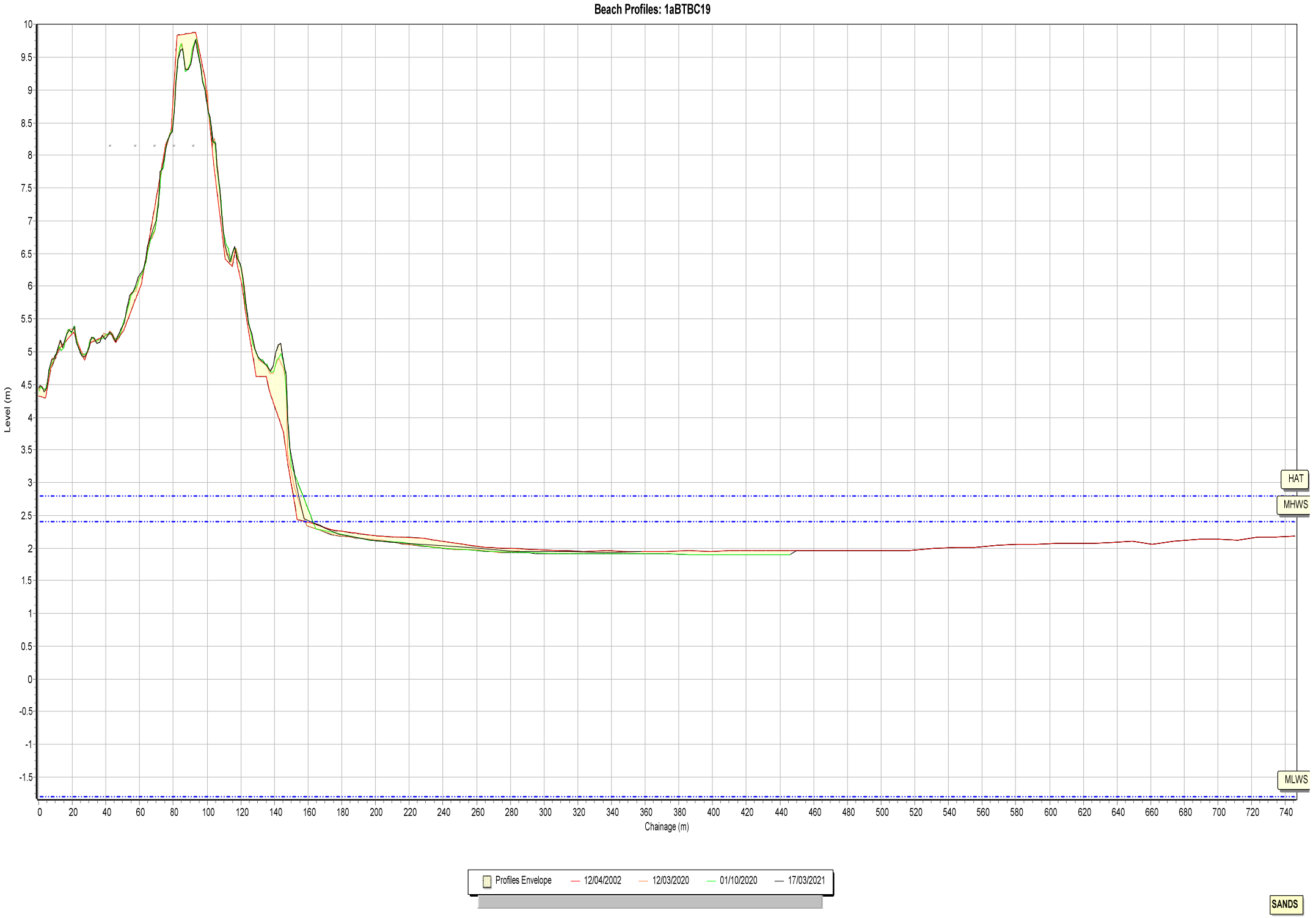
12/03/2020
01/10/2020
17/03/2021
SANDS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Level (m)
Chainage (m)
HAT
MHWS
MLWS
Profiles Envelope
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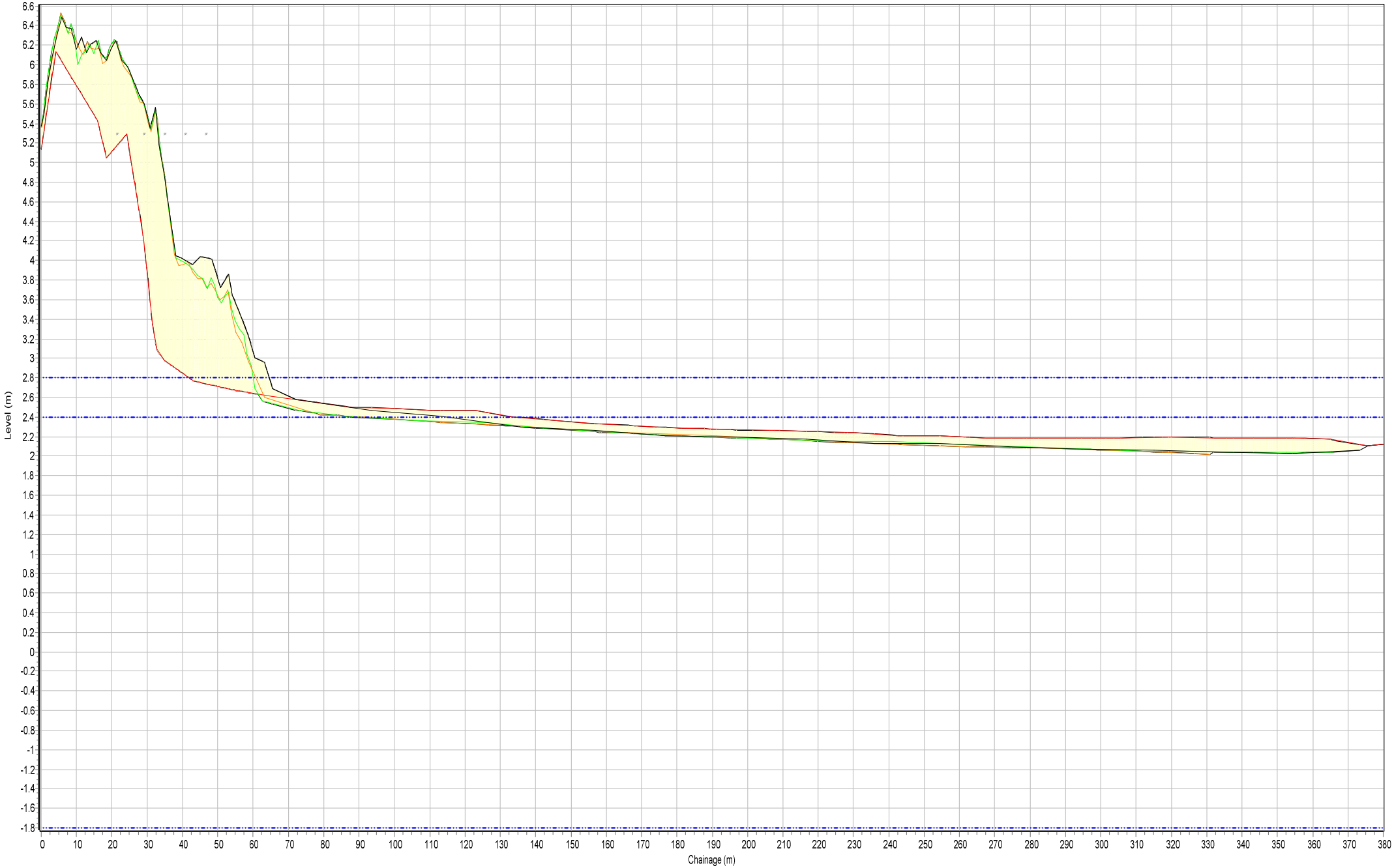
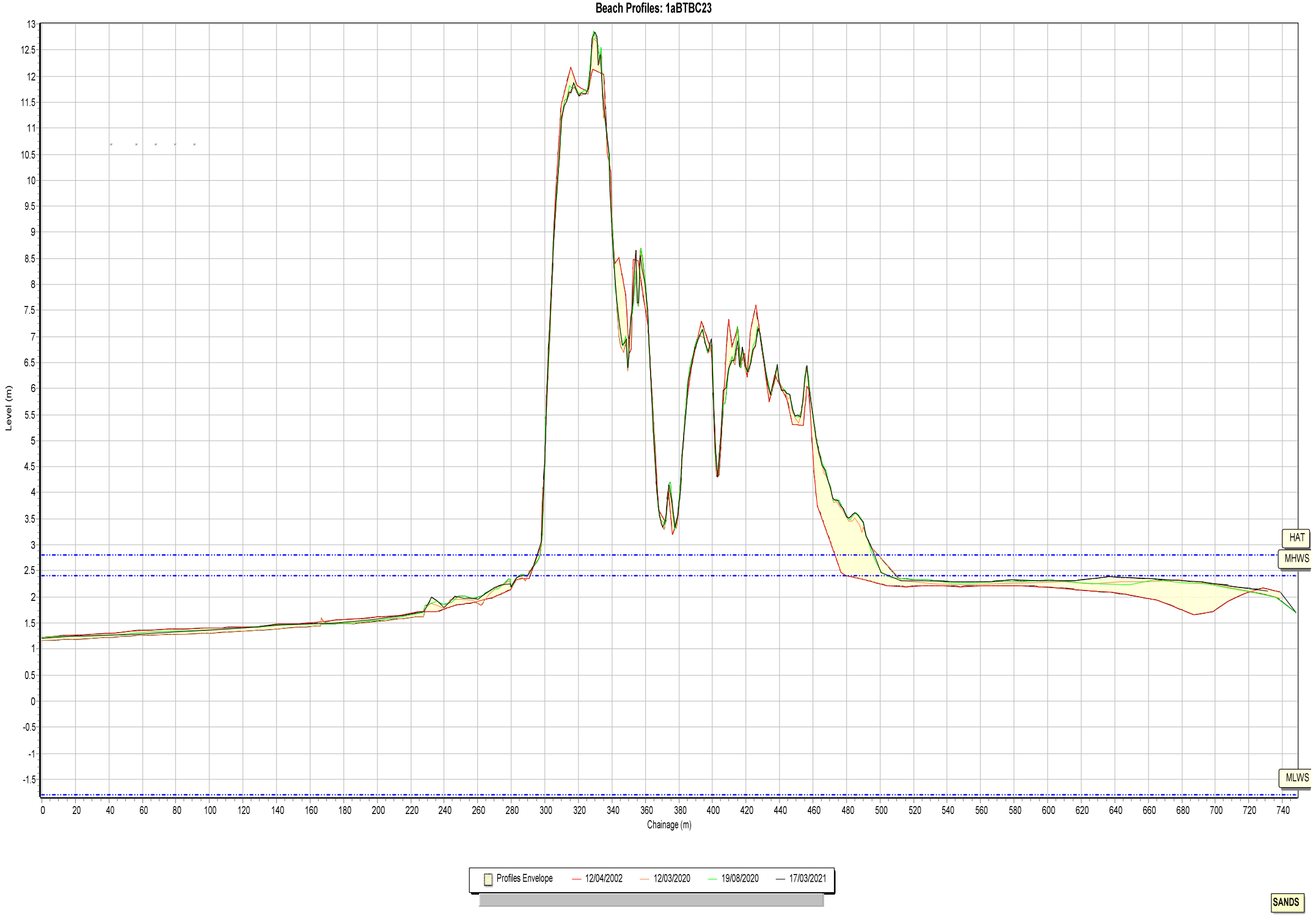
12/03/2020
01/10/2020
17/03/2021
SANDS

Beach Profiles: 1aBTBC21




Beach Profiles: 1aBTBC23
Level (m)
Chainage (m)
HAT
MHWS
MLWS
Profiles Envelope
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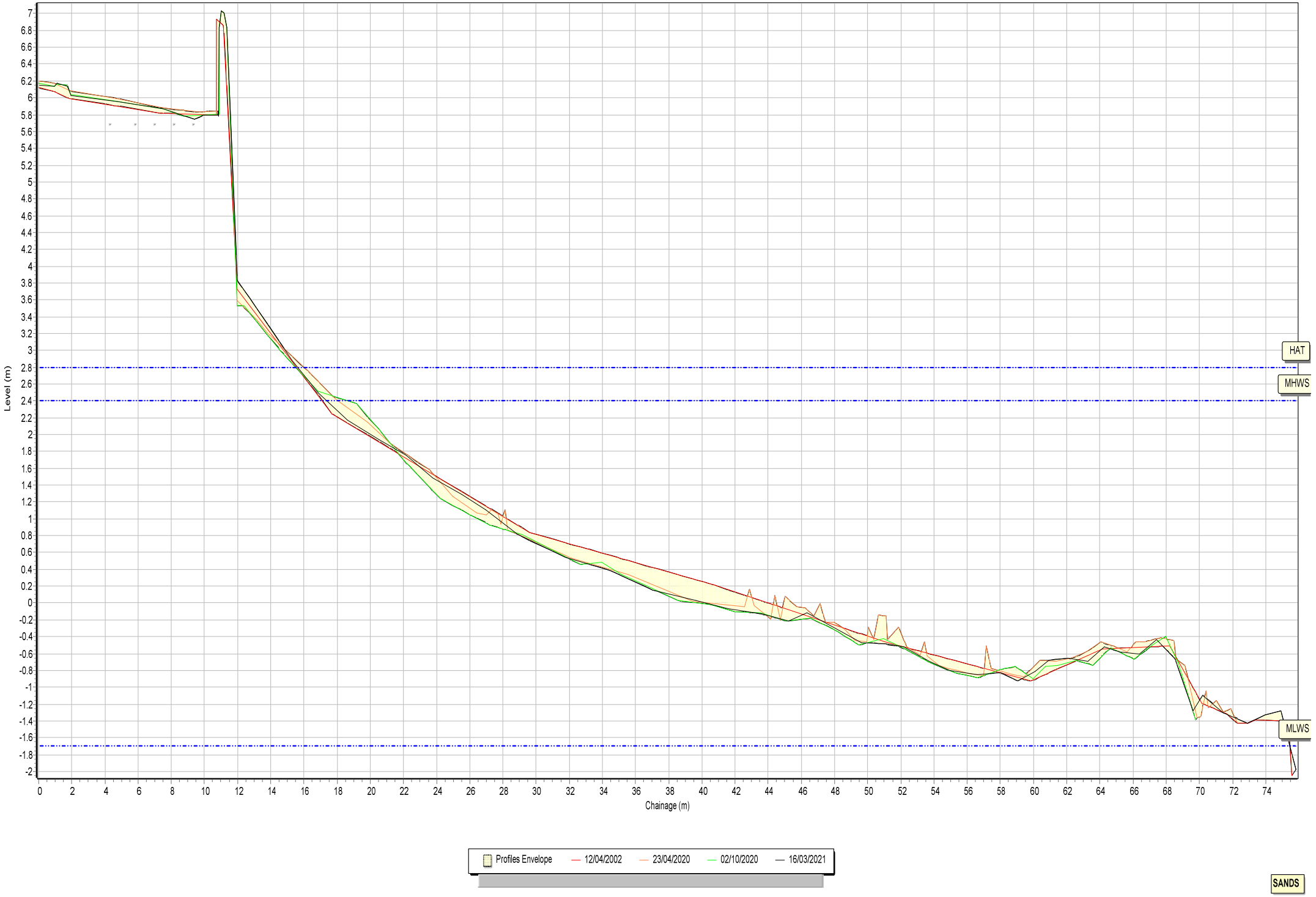
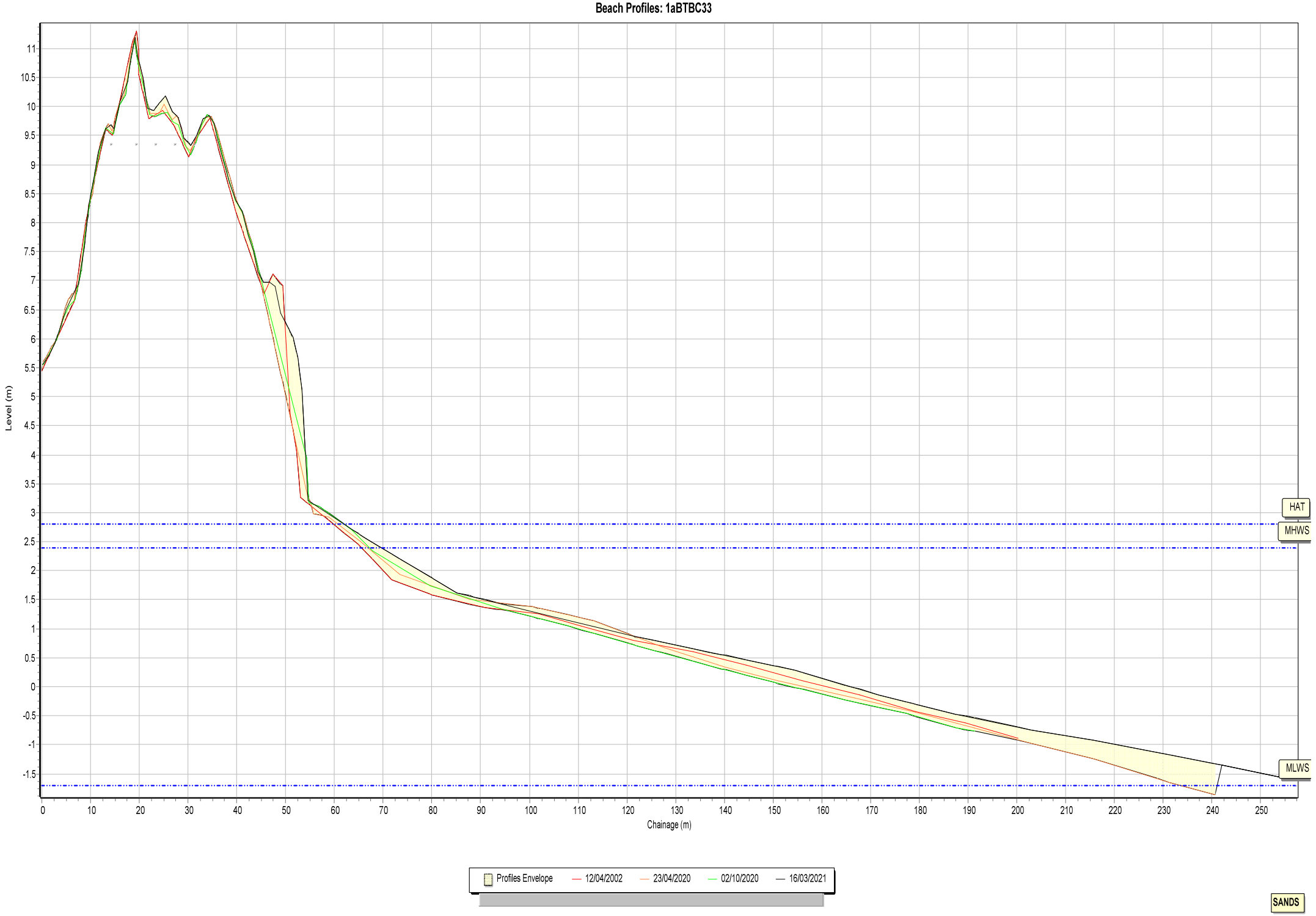
12/03/2020
19/08/2020
17/03/2021
SANDS

Beach Profiles: 1aBTBC31

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Level (m)
Chainage (m)
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MHWS
MLWS
Profiles Envelope
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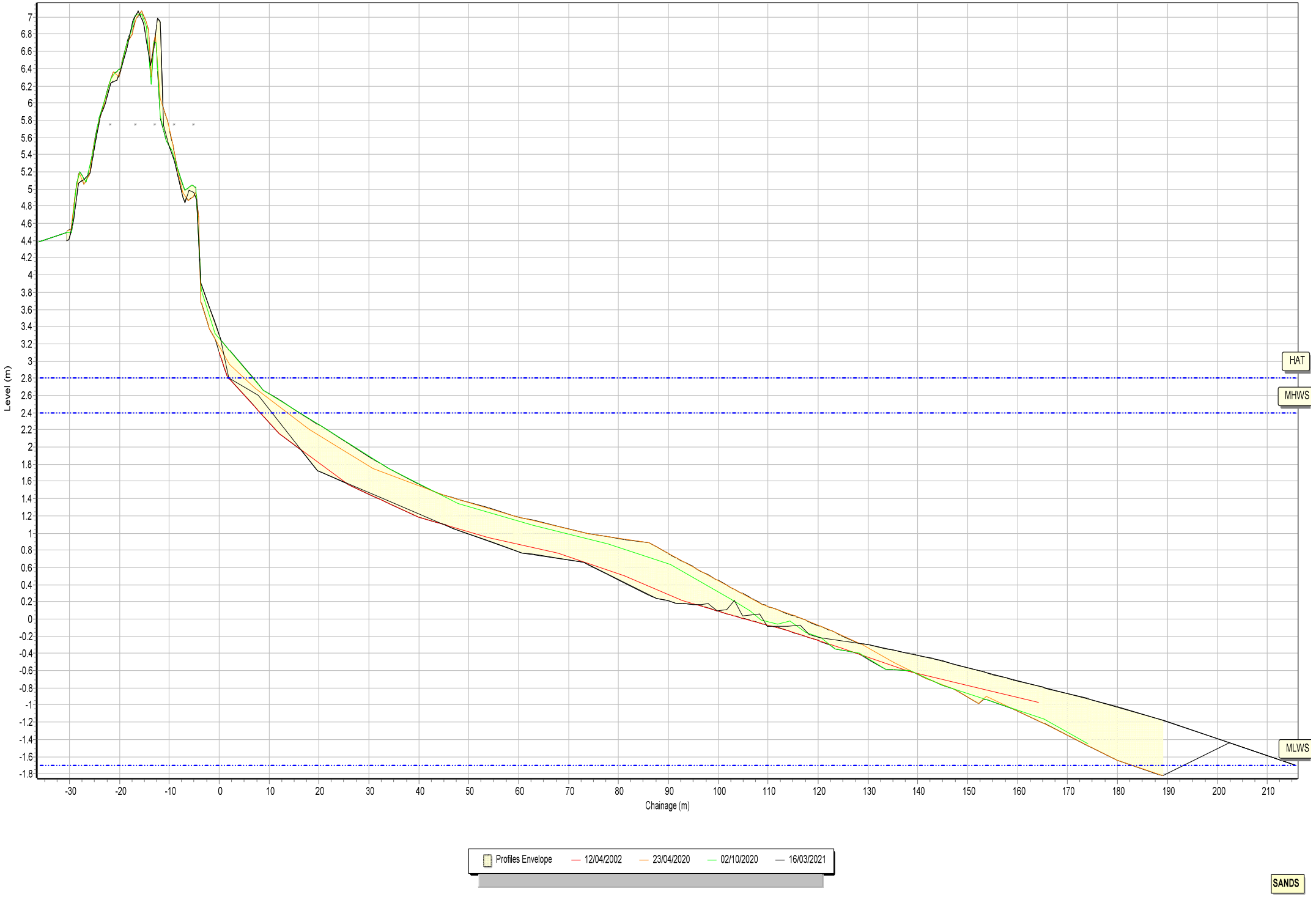
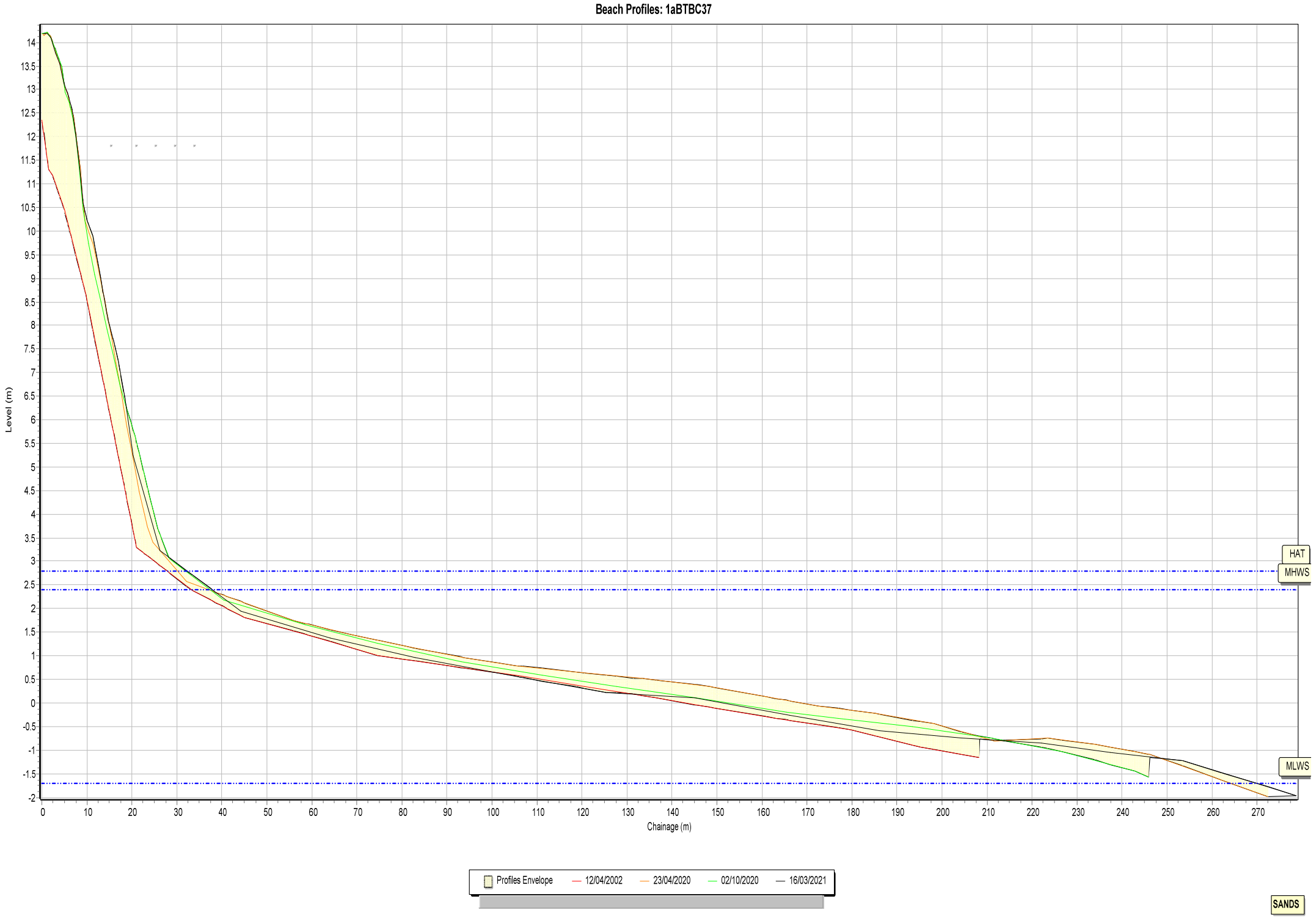
23/04/2020
02/10/2020
16/03/2021
SANDS

Beach Profiles: 1aBTBC34

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Level (m)
Chainage (m)
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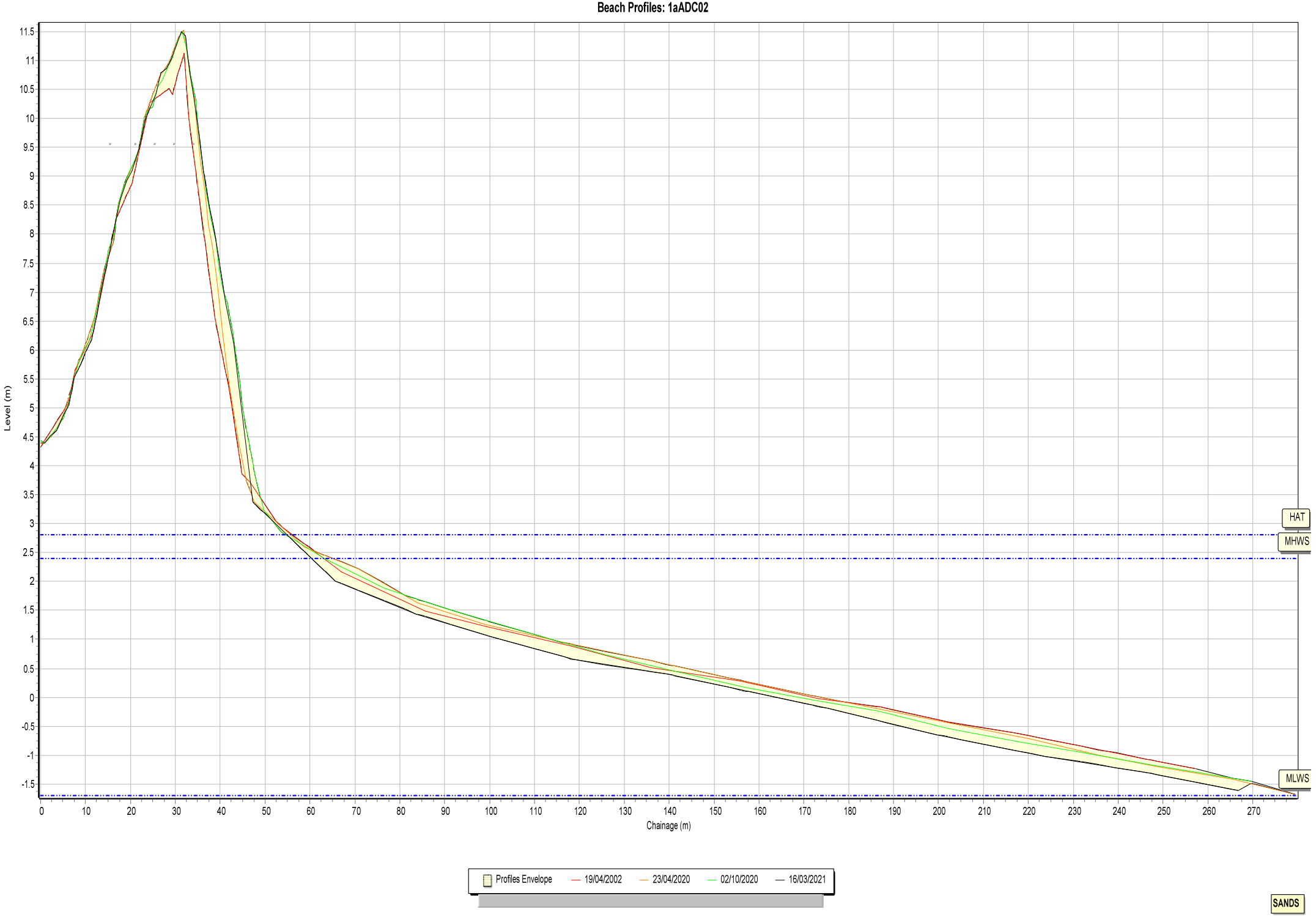
MHWS
MLWS
Profiles Envelope
12/04/2002
23/04/2020
02/10/2020
16/03/2021
SANDS

Beach Profiles: 1aADC01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Chainage (m)
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Profiles Envelope
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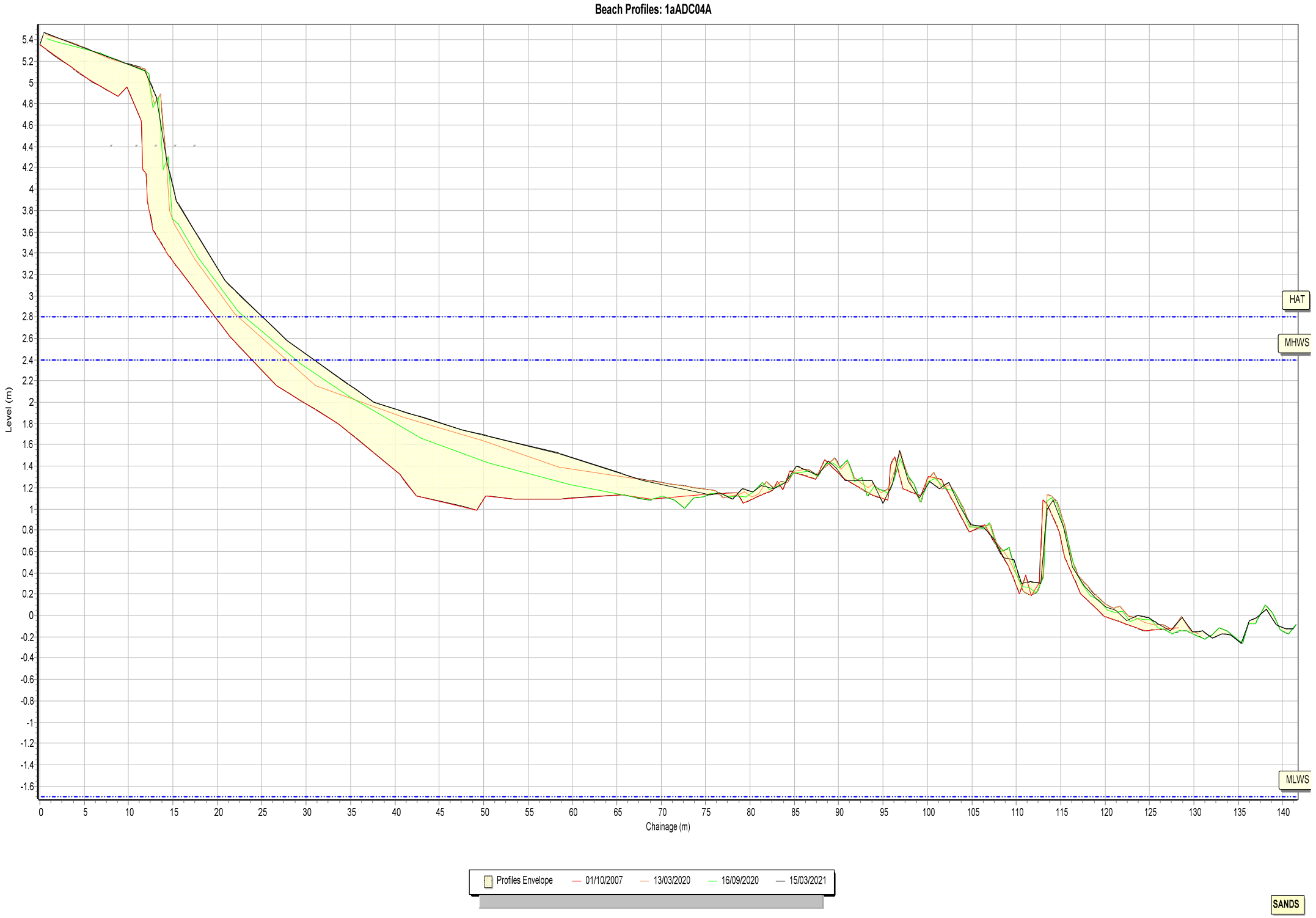
23/04/2020
02/10/2020
16/03/2021
SANDS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Chainage (m)
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MLWS
Profiles Envelope
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16/09/2020
15/03/2021
SANDS


Beach Profiles: 1aADC04B
Level (m)
Chainage (m)
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MHWS
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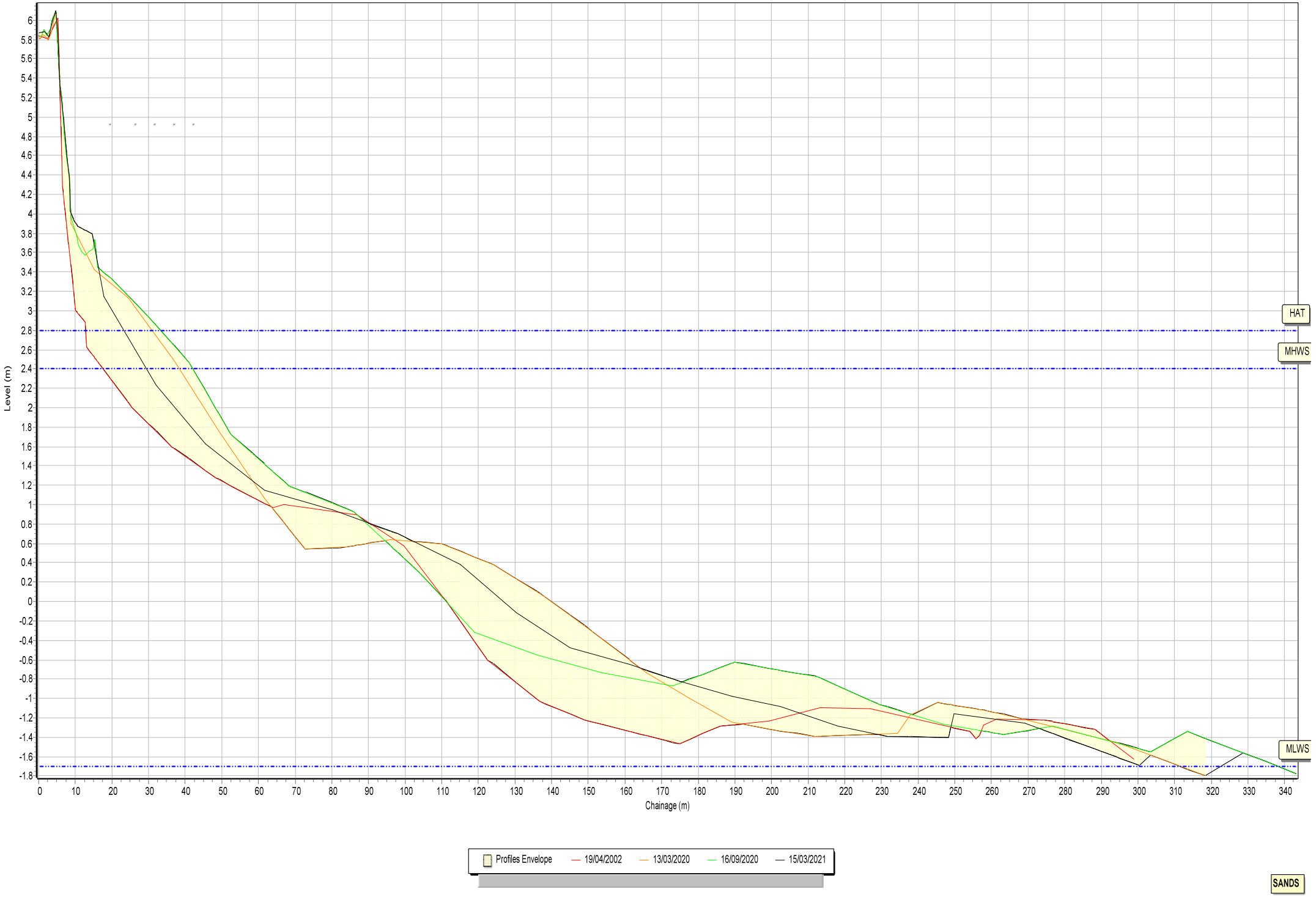
13/03/2020
16/09/2020
15/03/2021
SANDS

Beach Profiles: 1aADC07




Beach Profiles: 1aADC08
Level (m)
Chainage (m)
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Profiles Envelope
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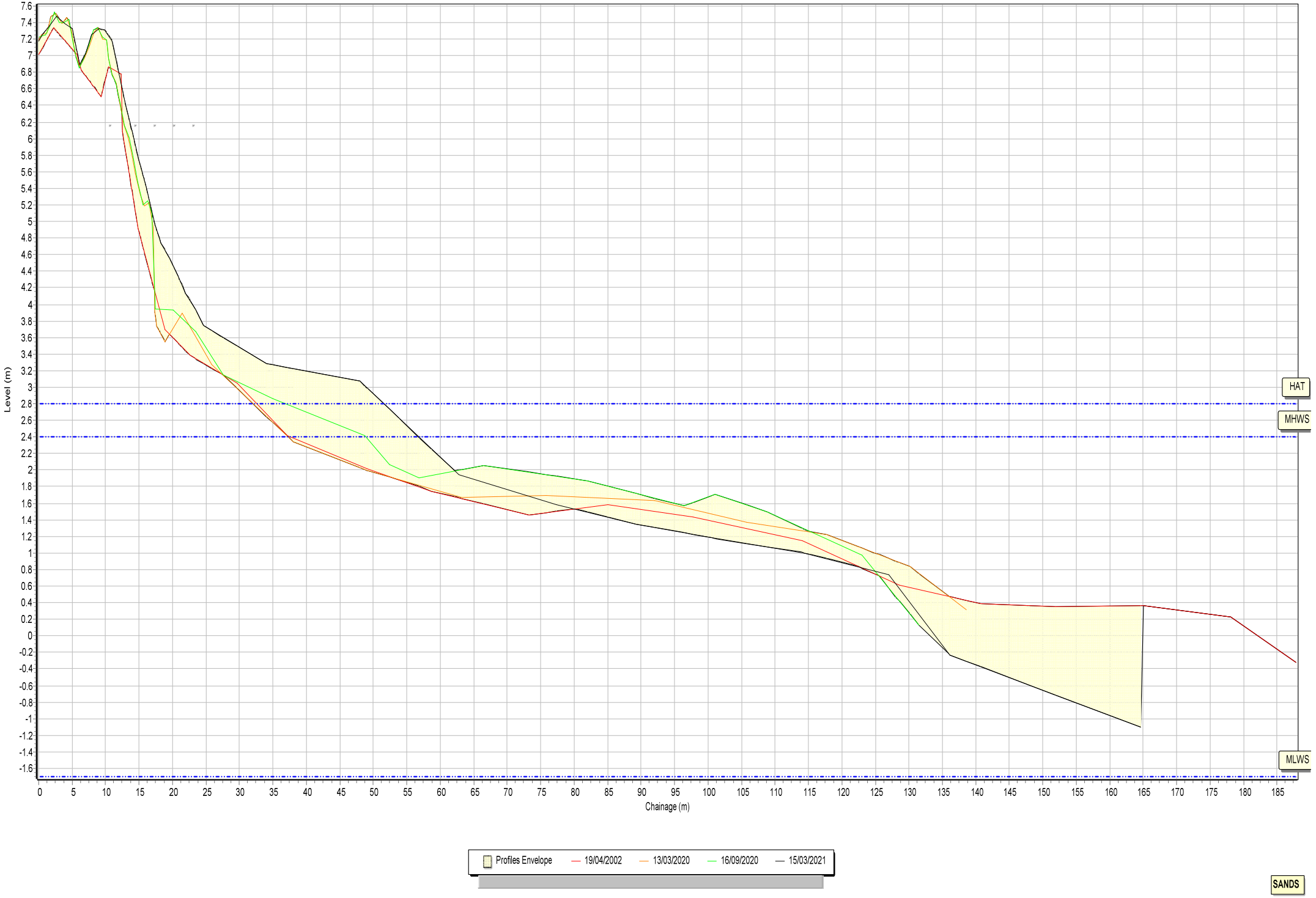
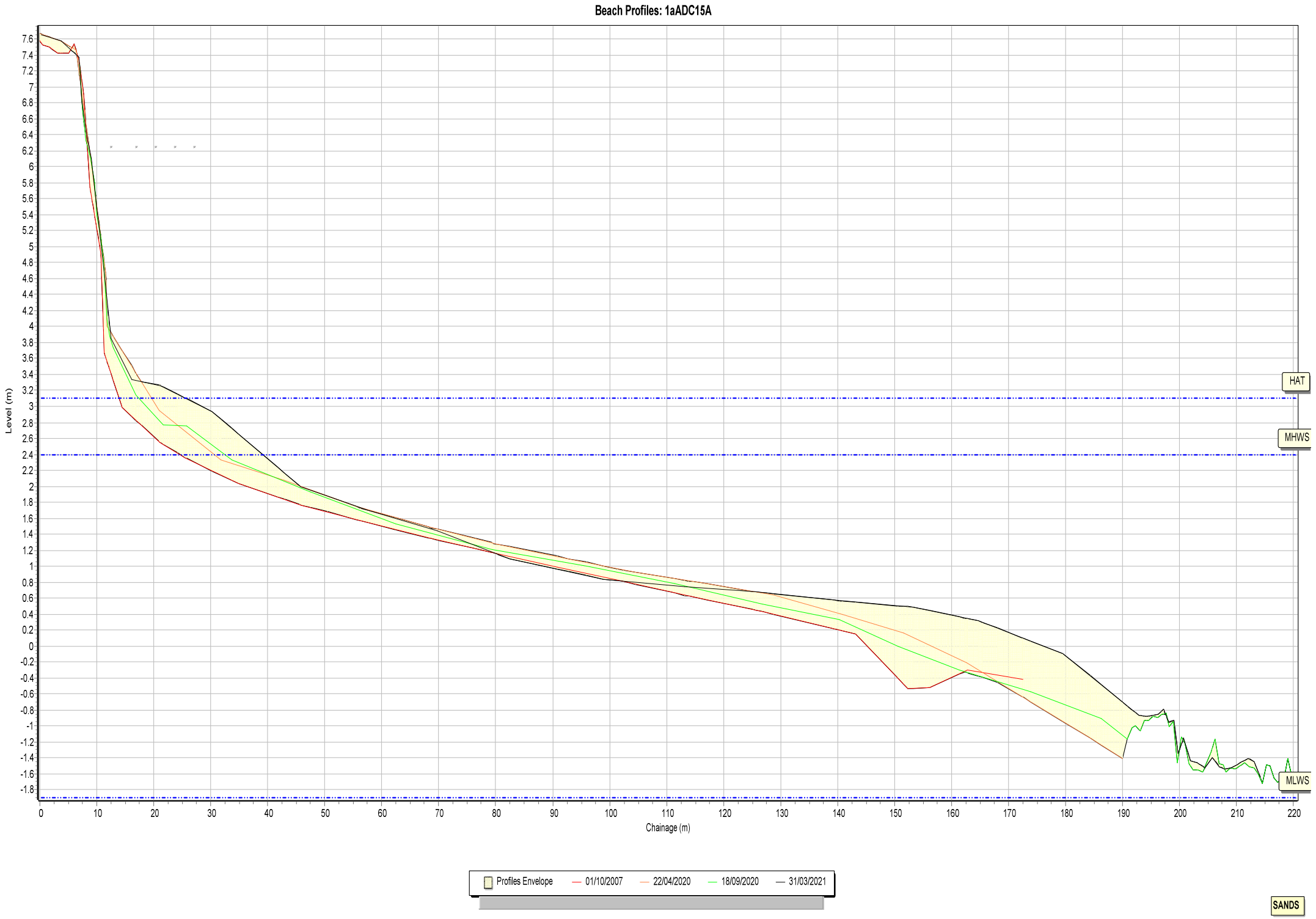
16/09/2020
15/03/2021
SANDS

Beach Profiles: 1aADC09

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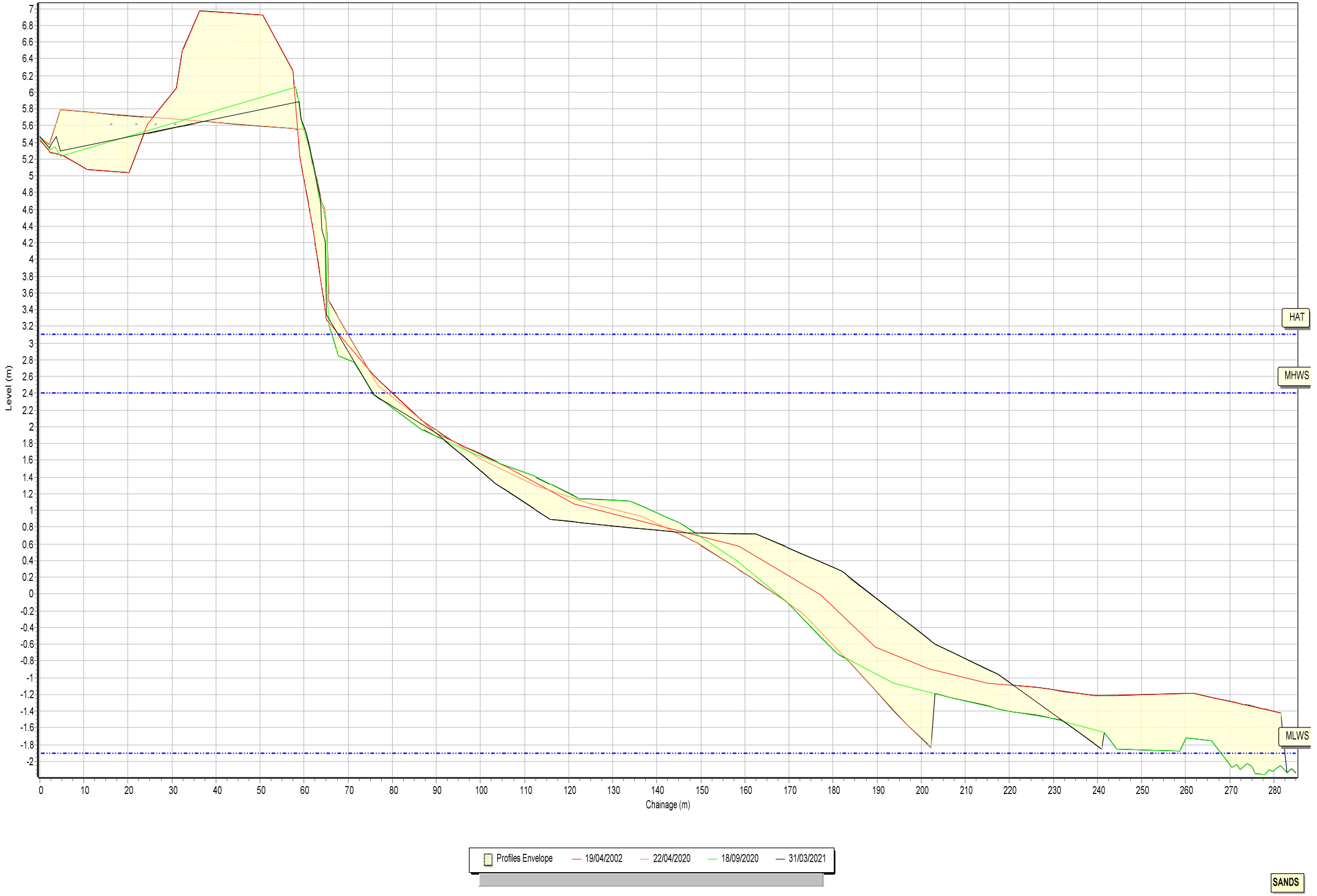
31/03/2021
SANDS

Beach Profiles: 1aADC16



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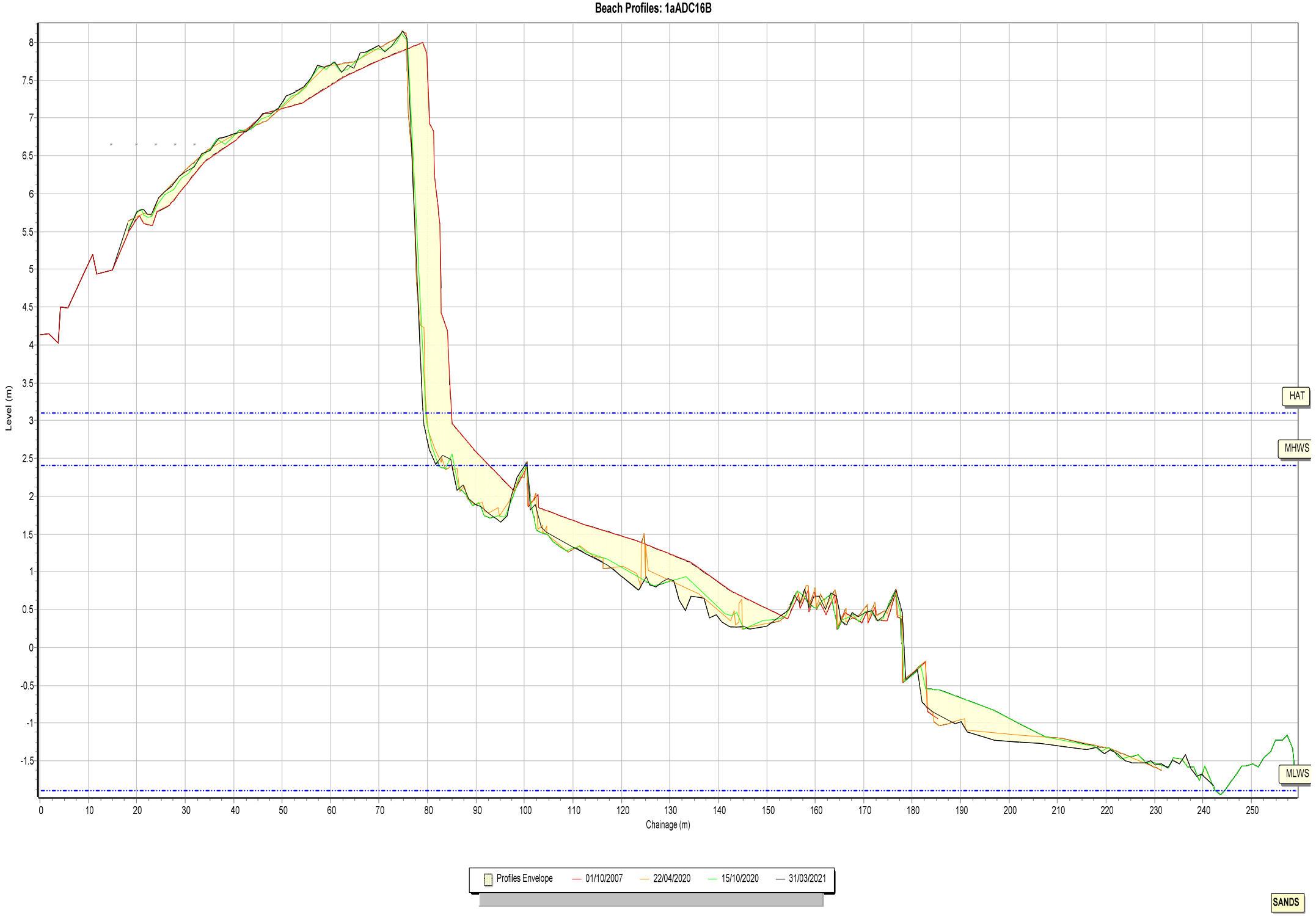
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Profiles Envelope
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22/04/2020
15/10/2020
31/03/2021
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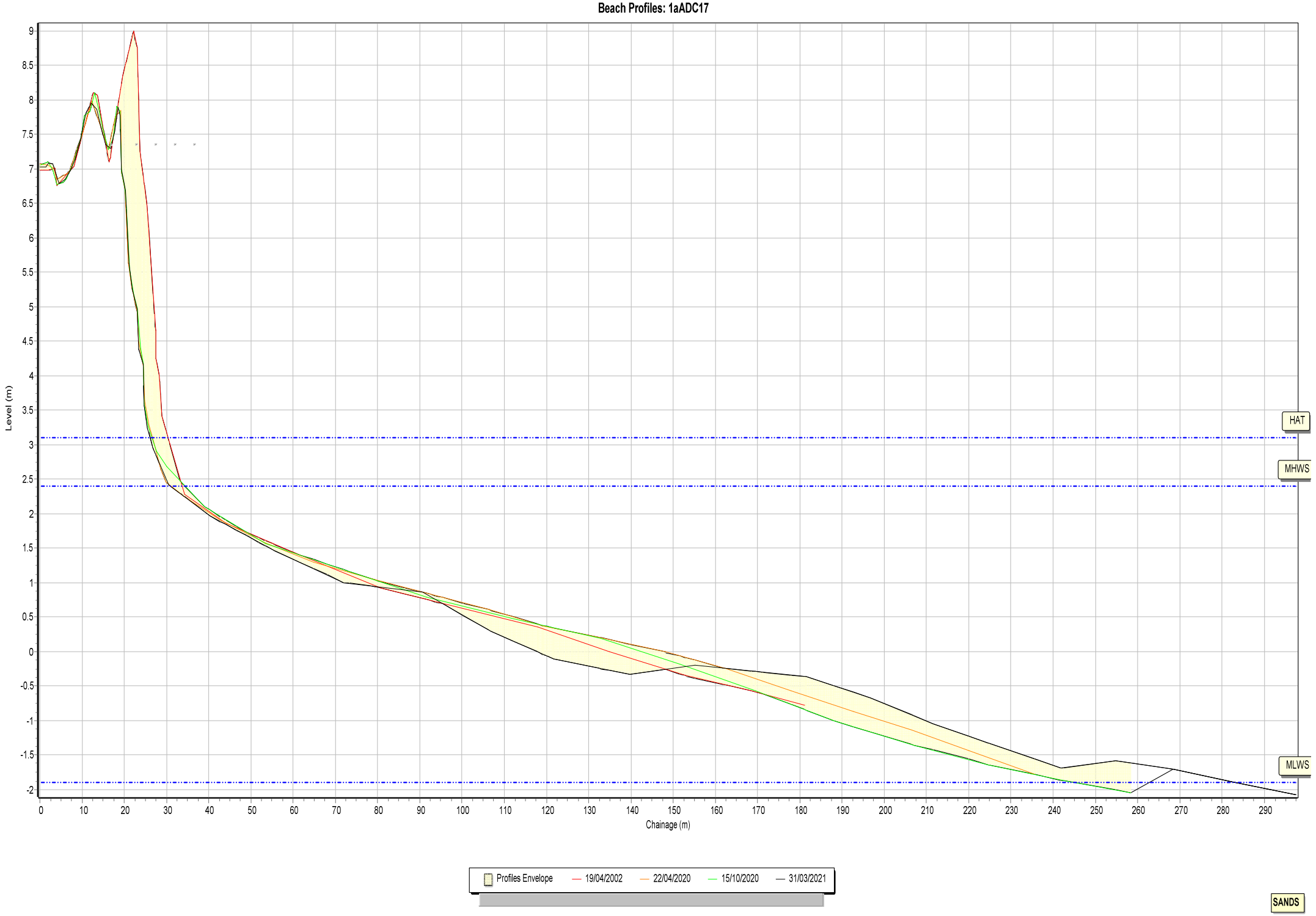
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Chainage (m)
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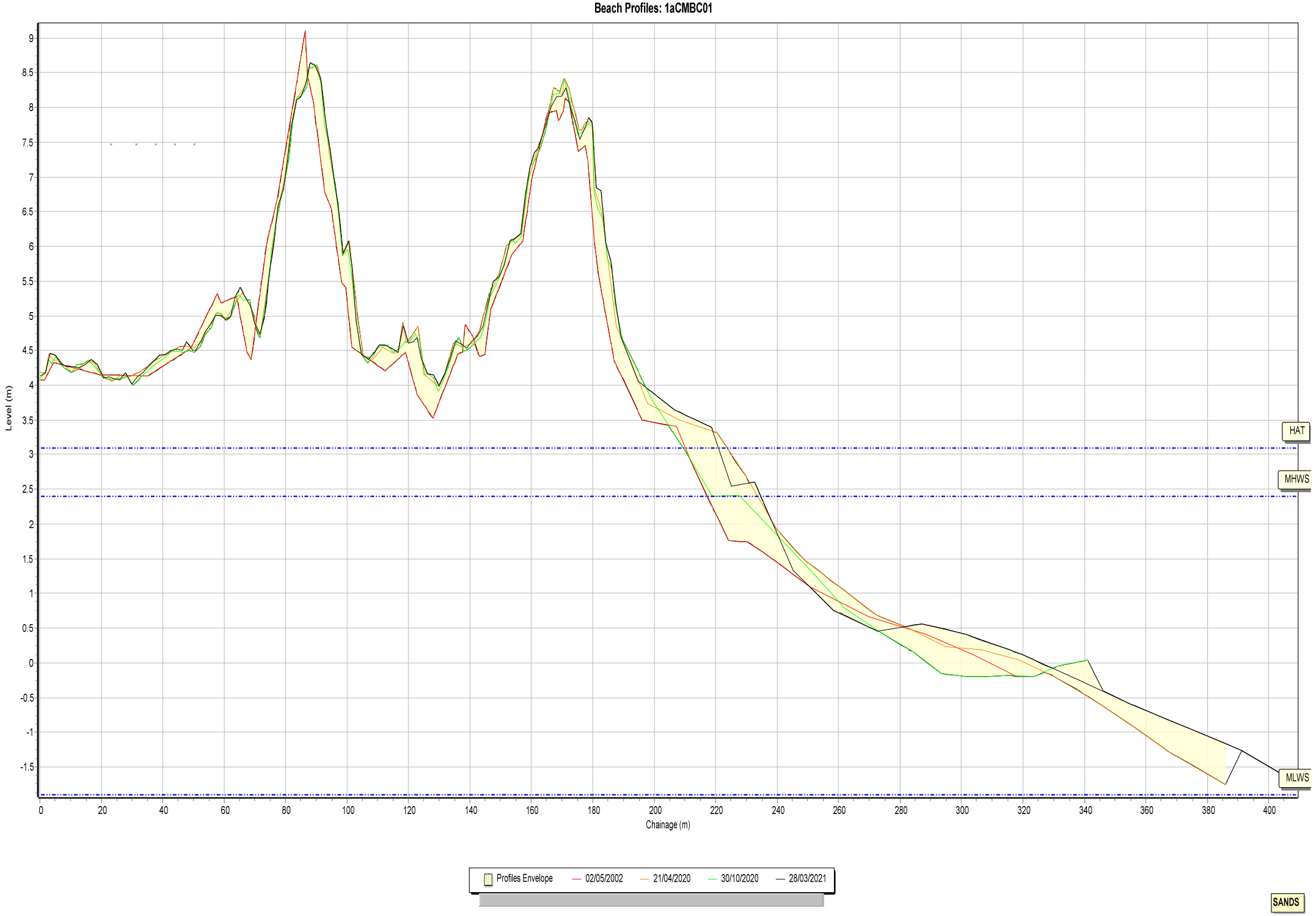
31/03/2021
SANDS

Beach Profiles: 1aADC17A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9
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6.5
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5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
HAT
MHWS
MLWS
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20
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80
100
120
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200
220
240
260
280
300
320
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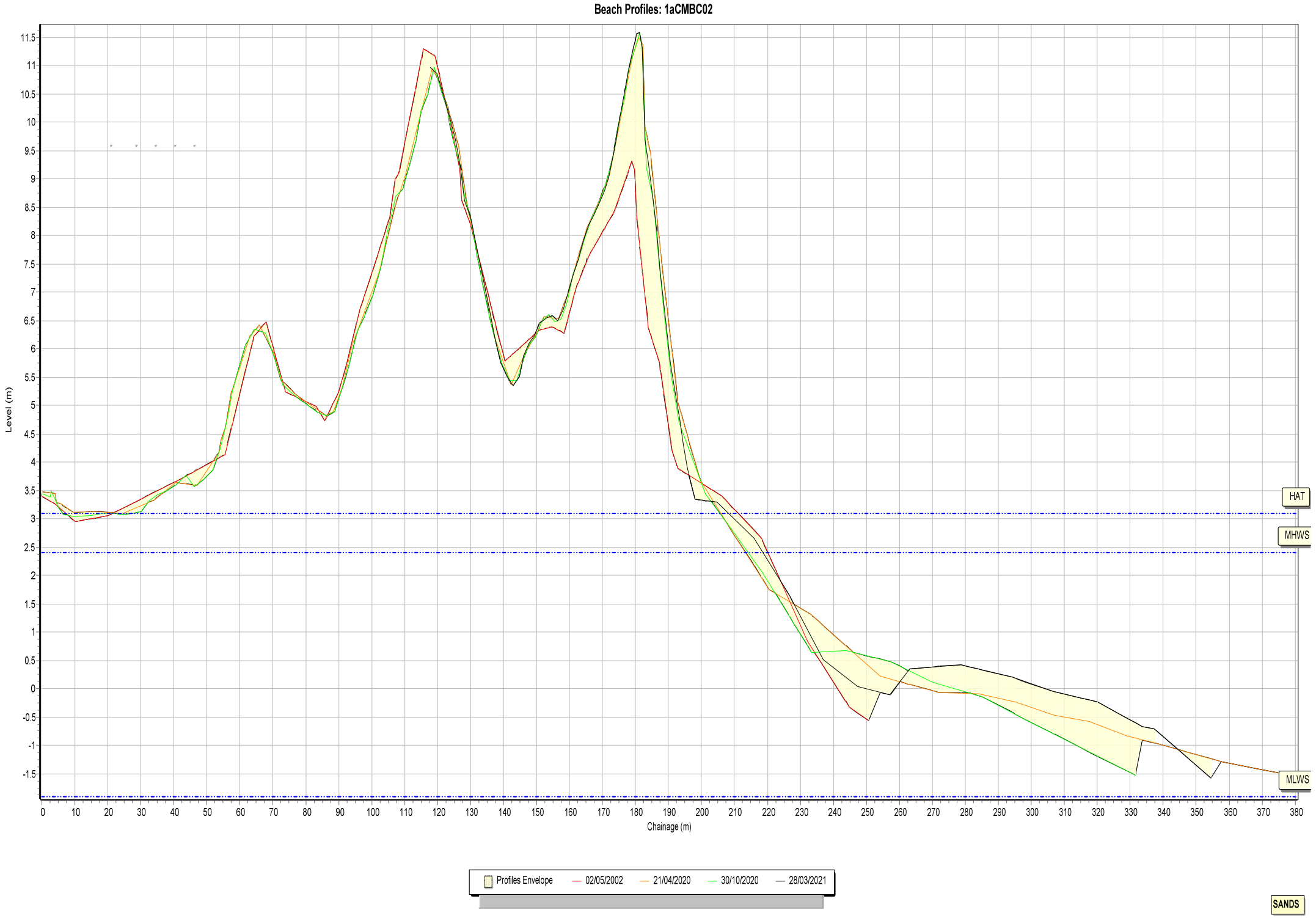
360
380
400
Chainage (m)
Profiles Envelope
02/05/2002
21/04/2020
30/10/2020
28/03/2021
SANDS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MLWS
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02/05/2002
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30/10/2020
28/03/2021
SANDS


Beach Profiles: 1aCMBC03A
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Chainage (m)
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MHWS
MLWS
Profiles Envelope
01/10/2007
21/04/2020
30/10/2020
28/03/2021
SANDS


Beach Profiles: 1aCMBC03B
Level (m)
Chainage (m)
HAT
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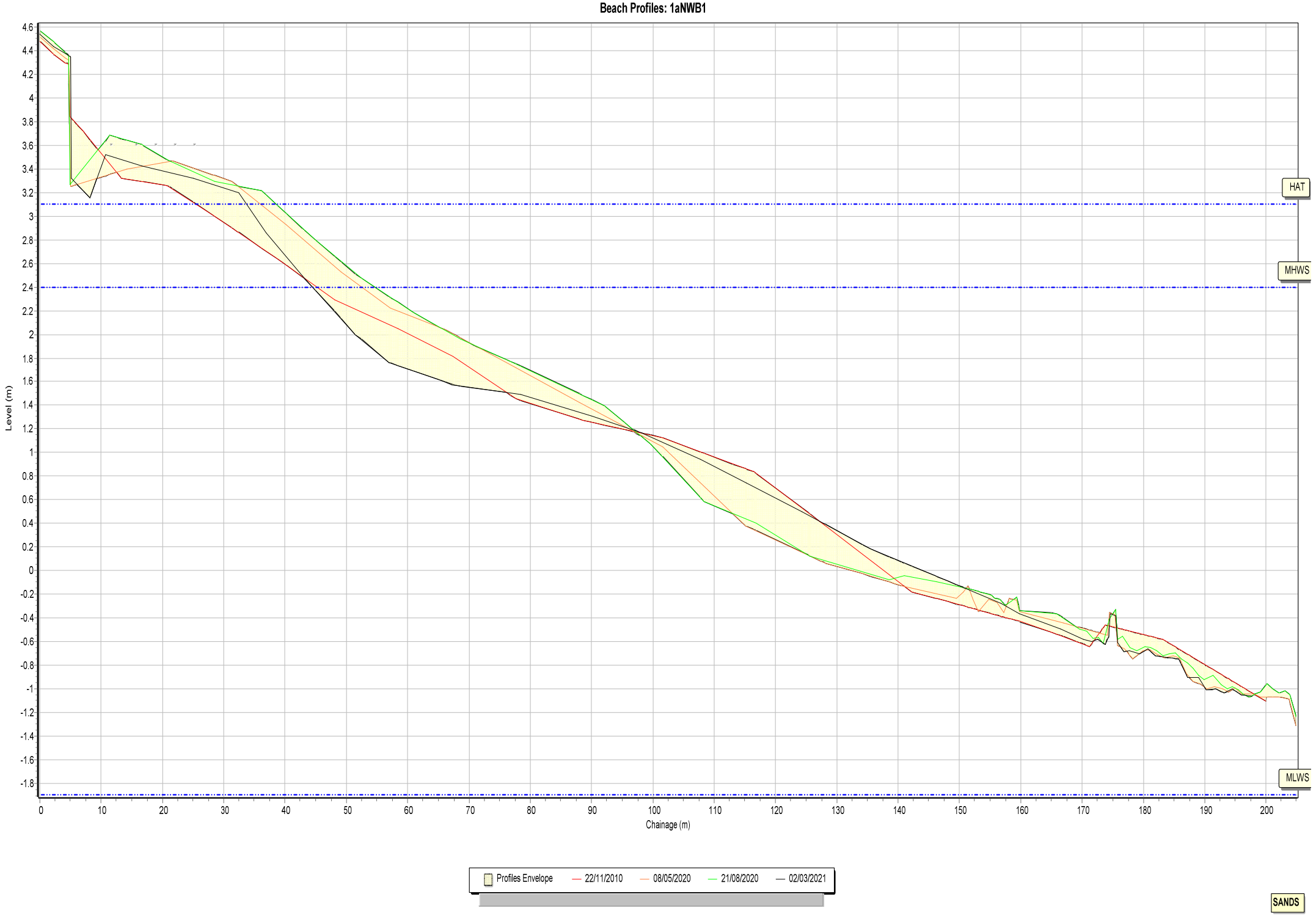
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02/03/2021
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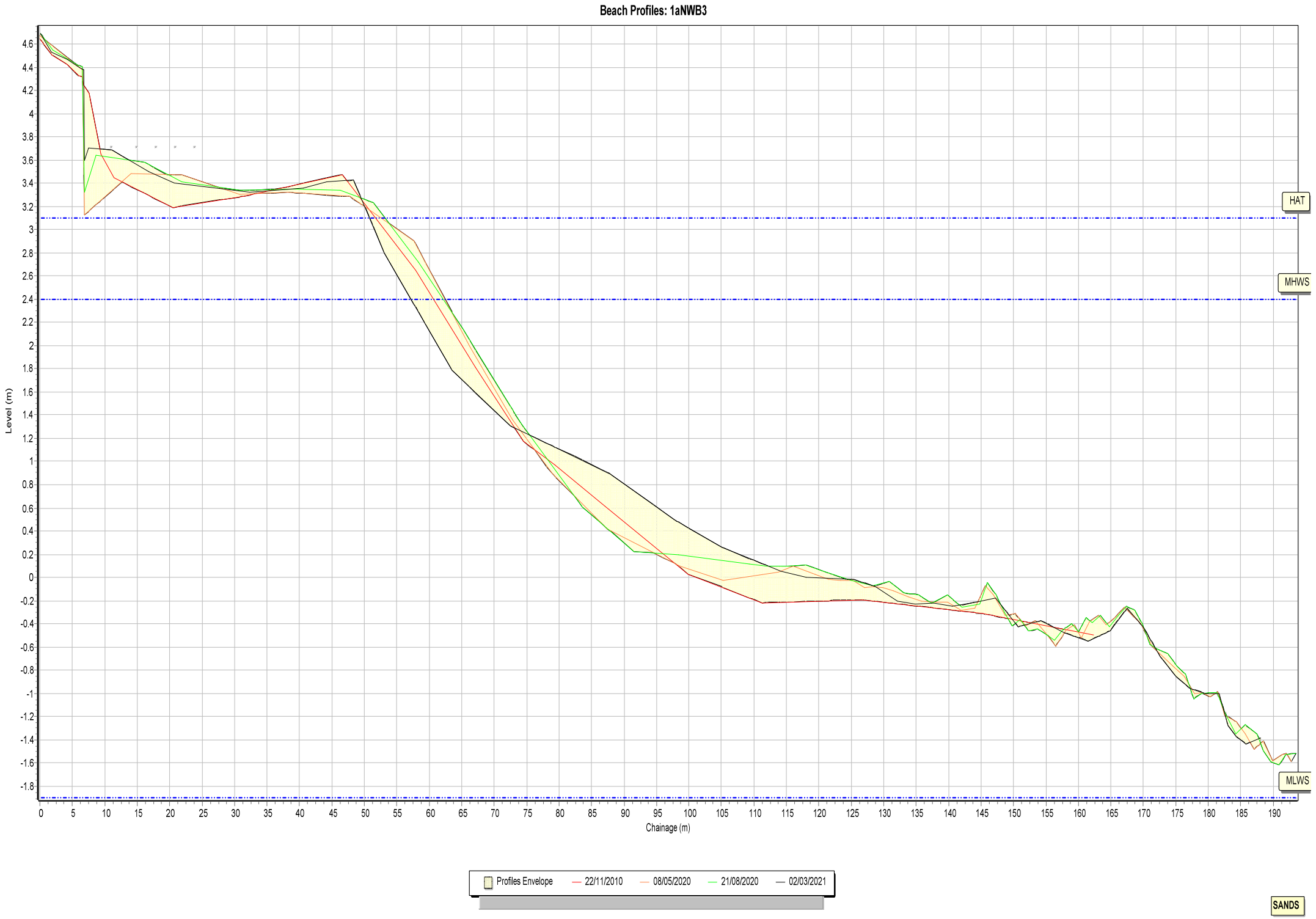
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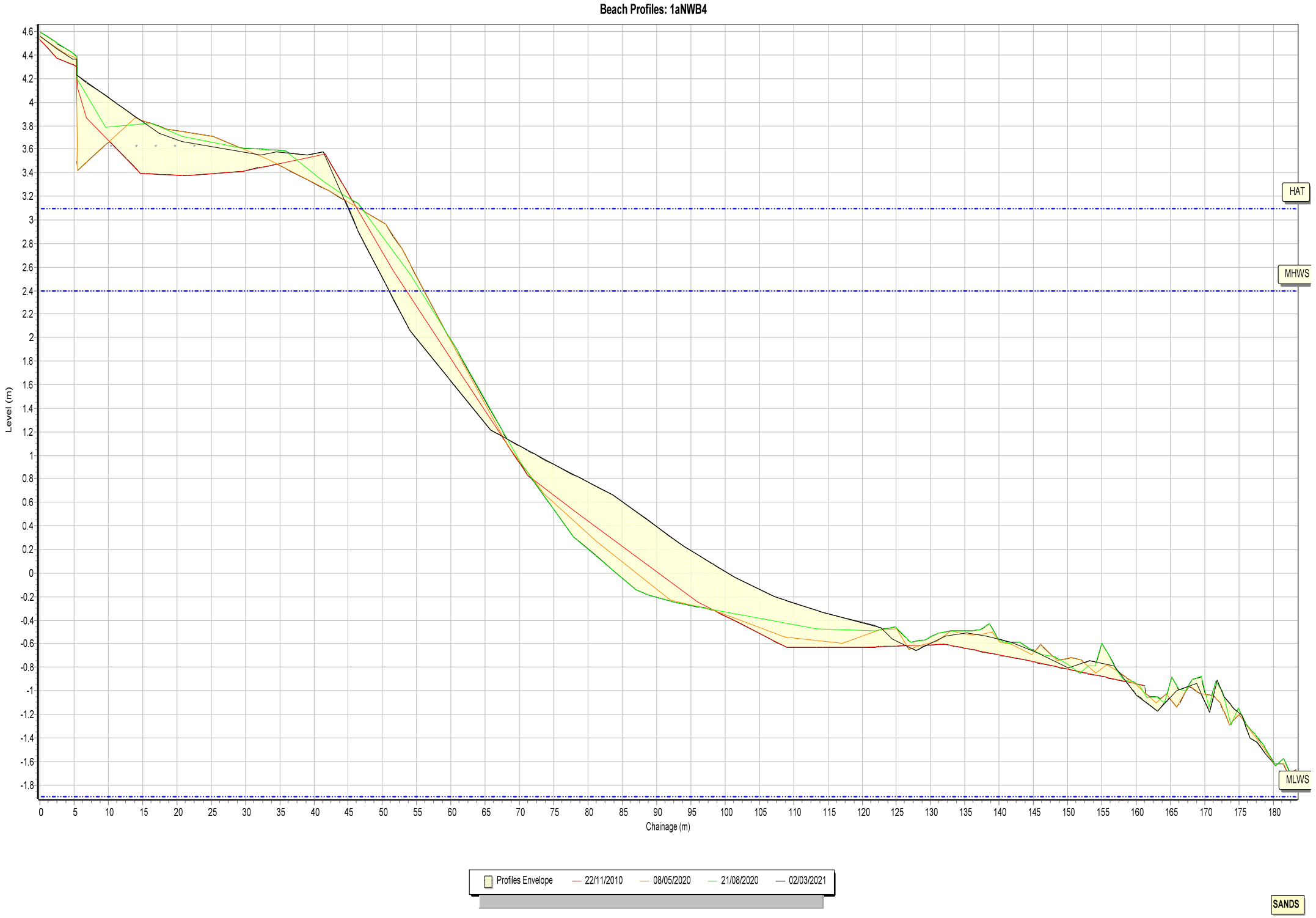
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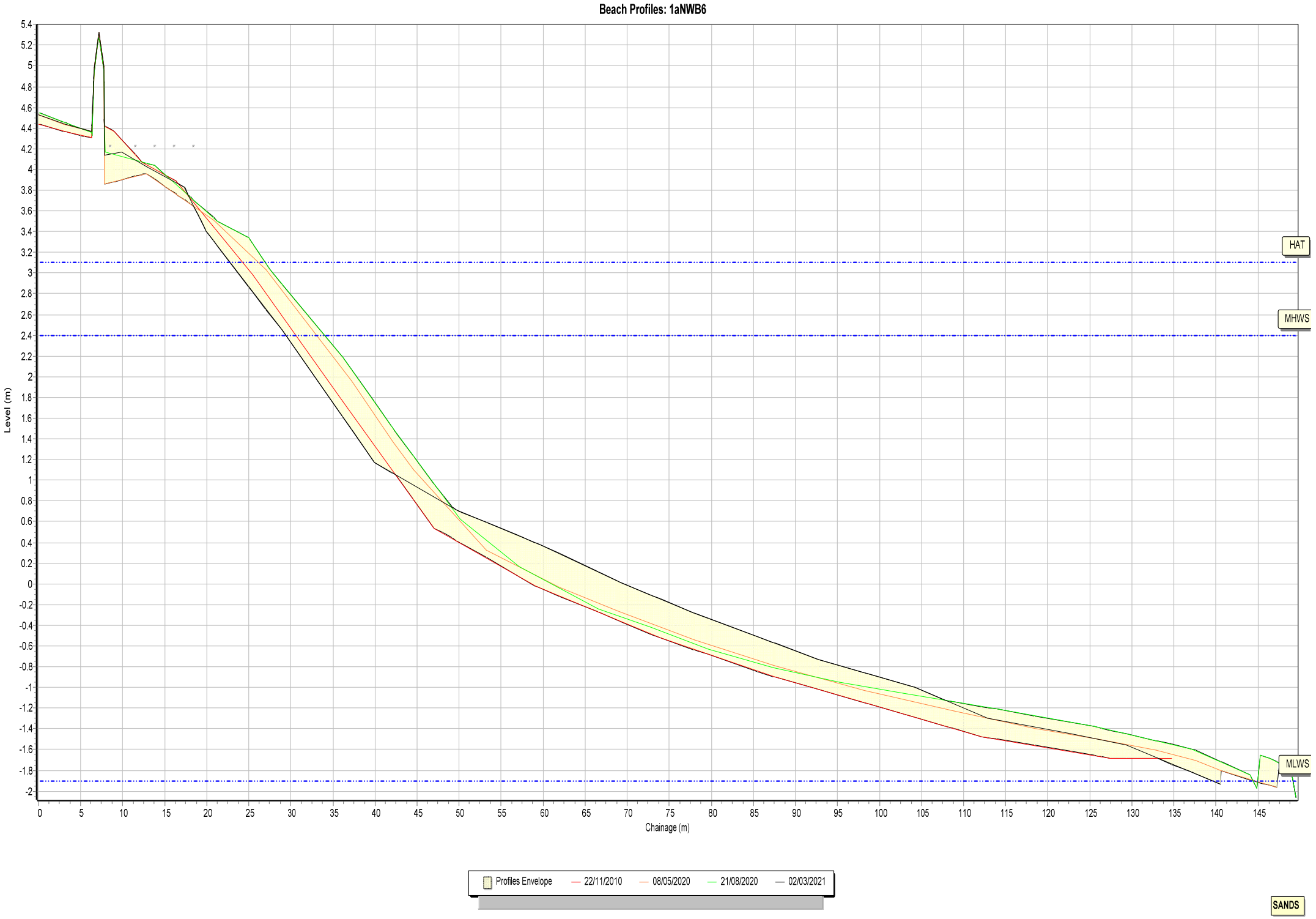
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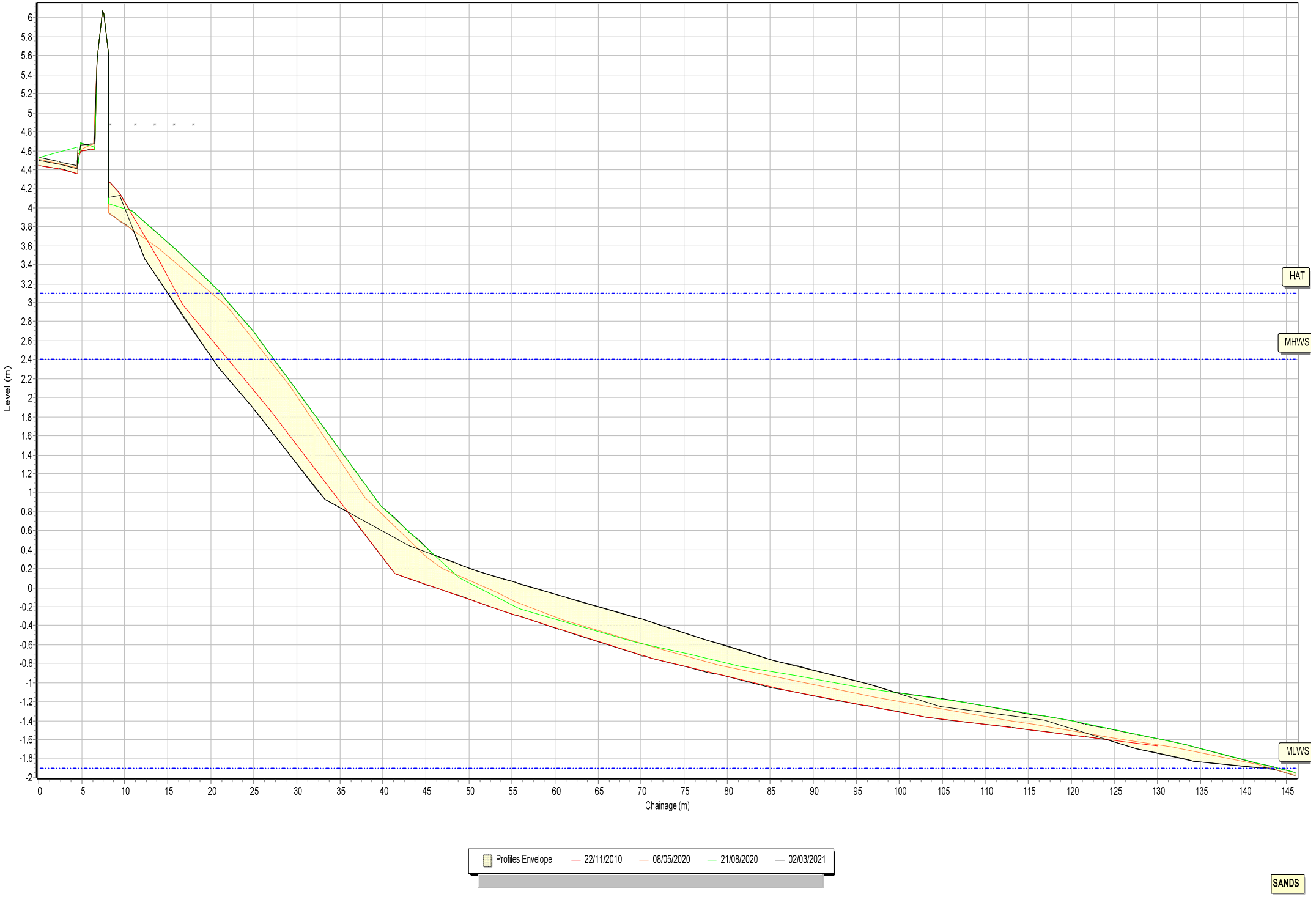

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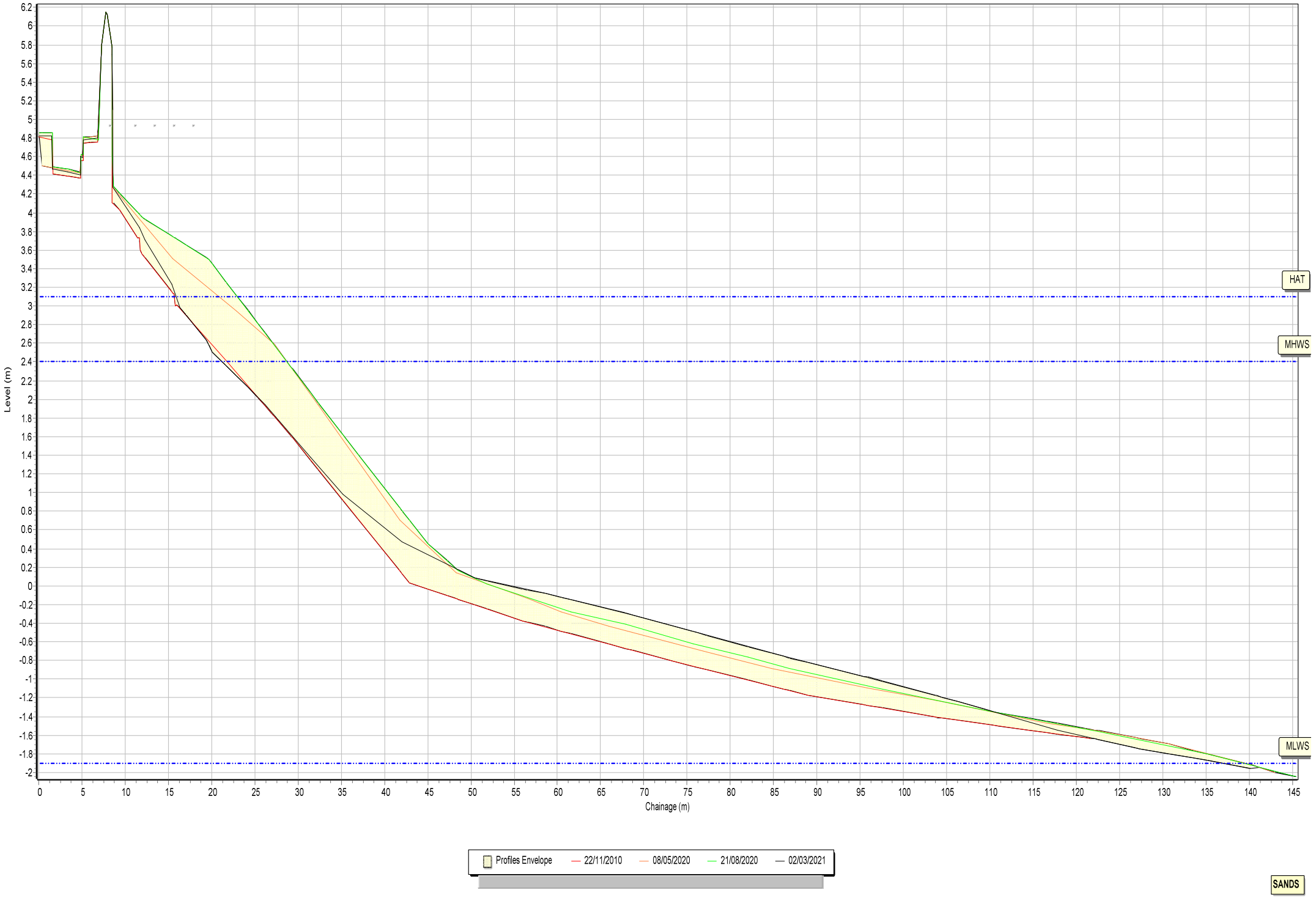

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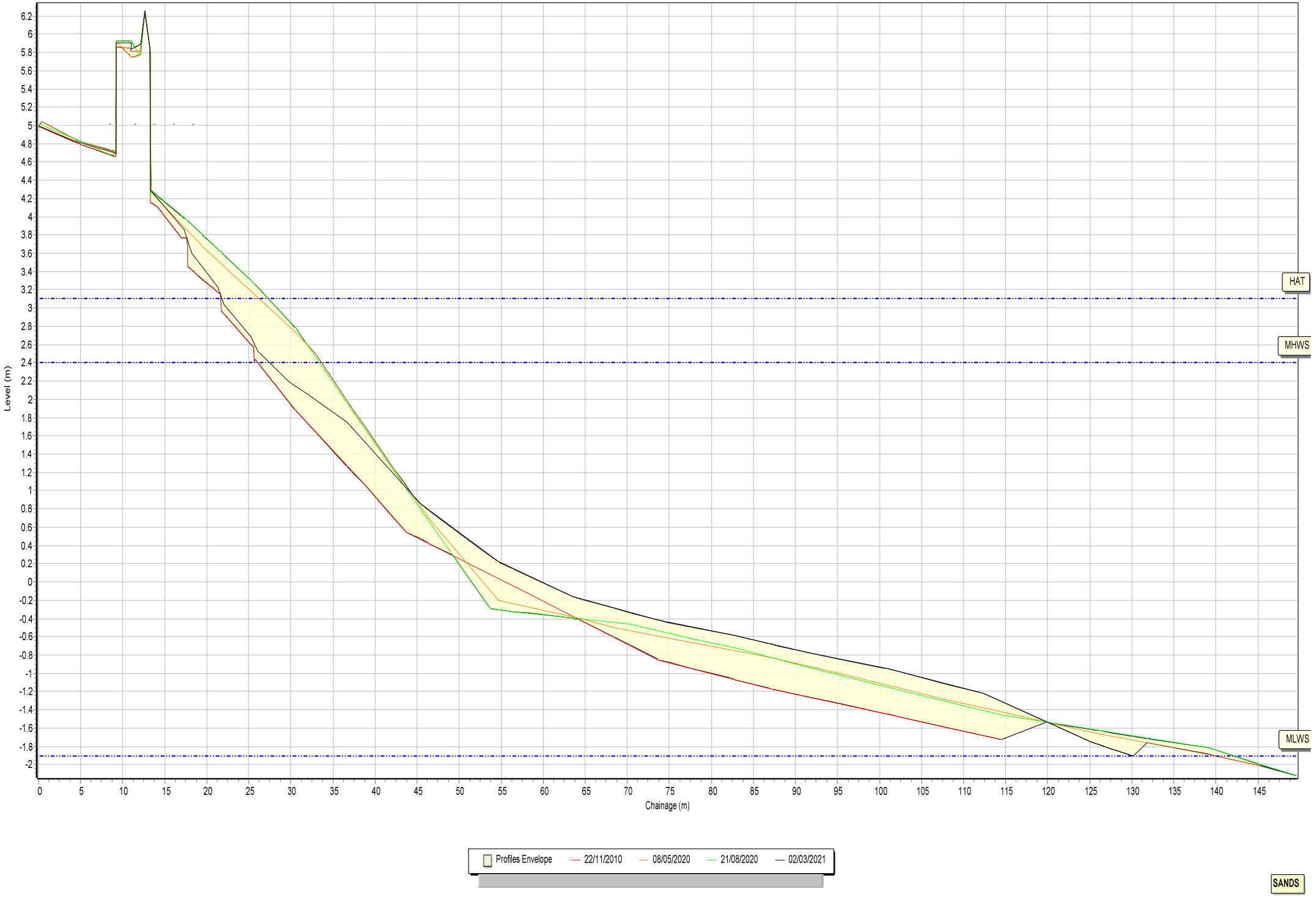

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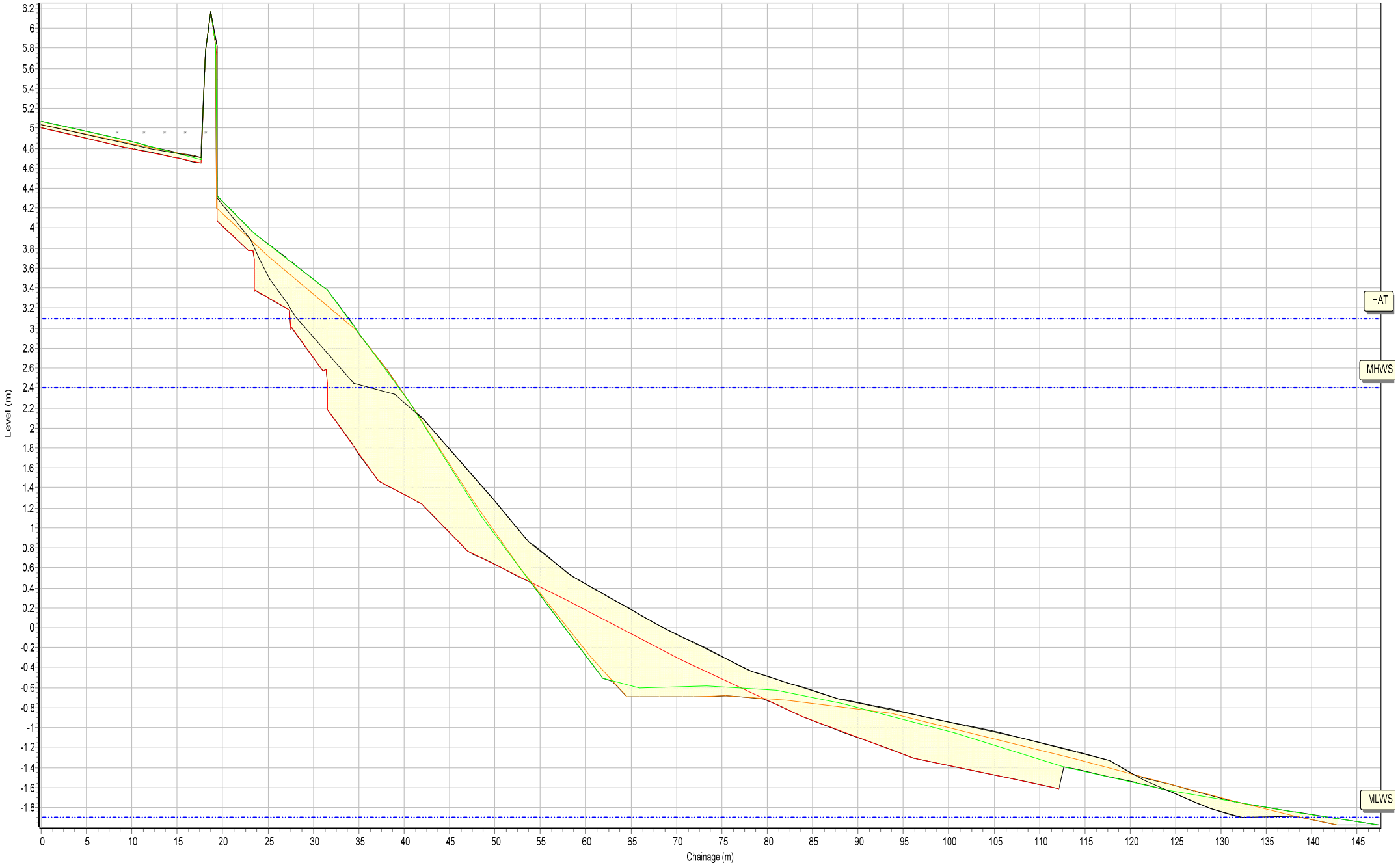

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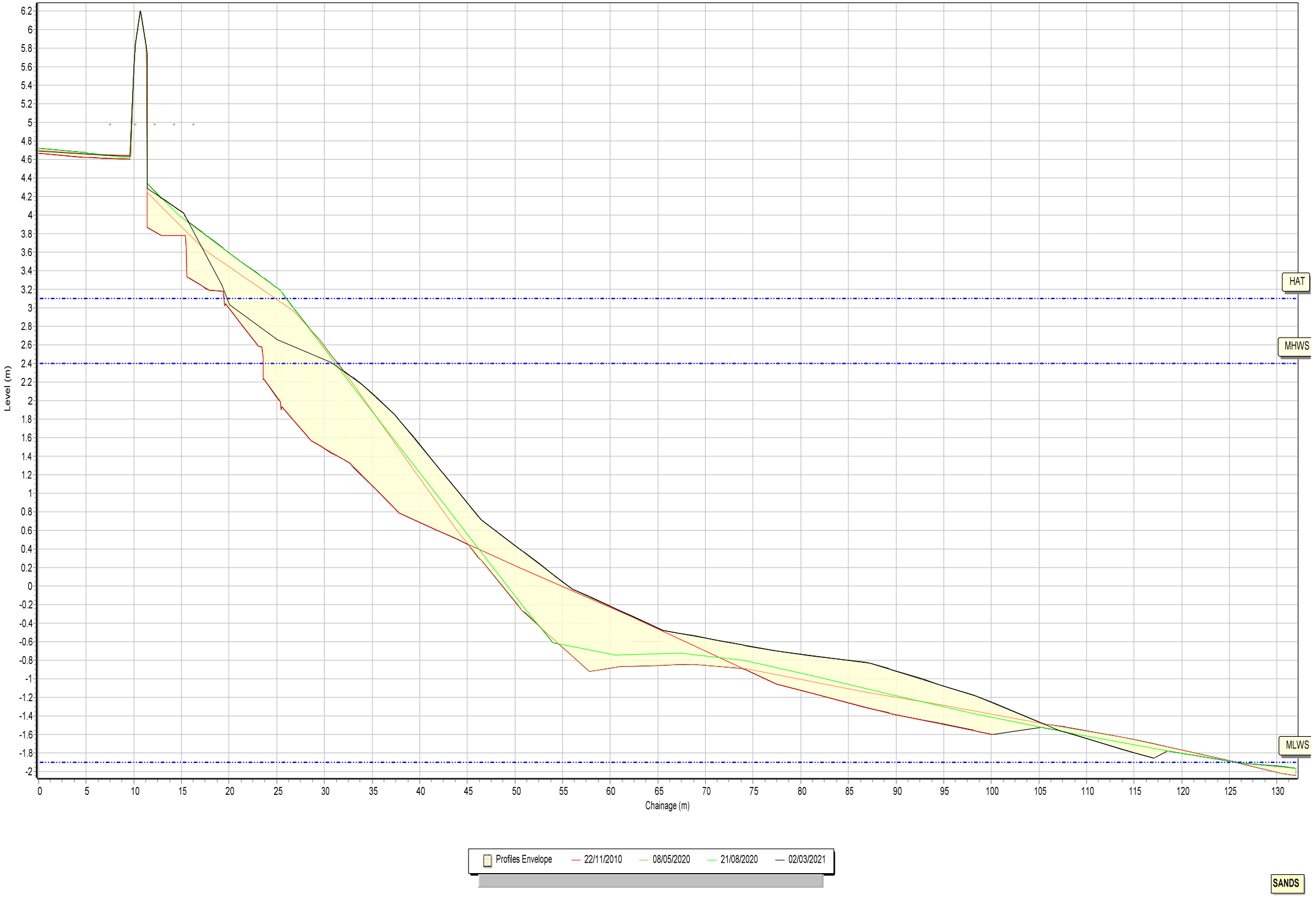

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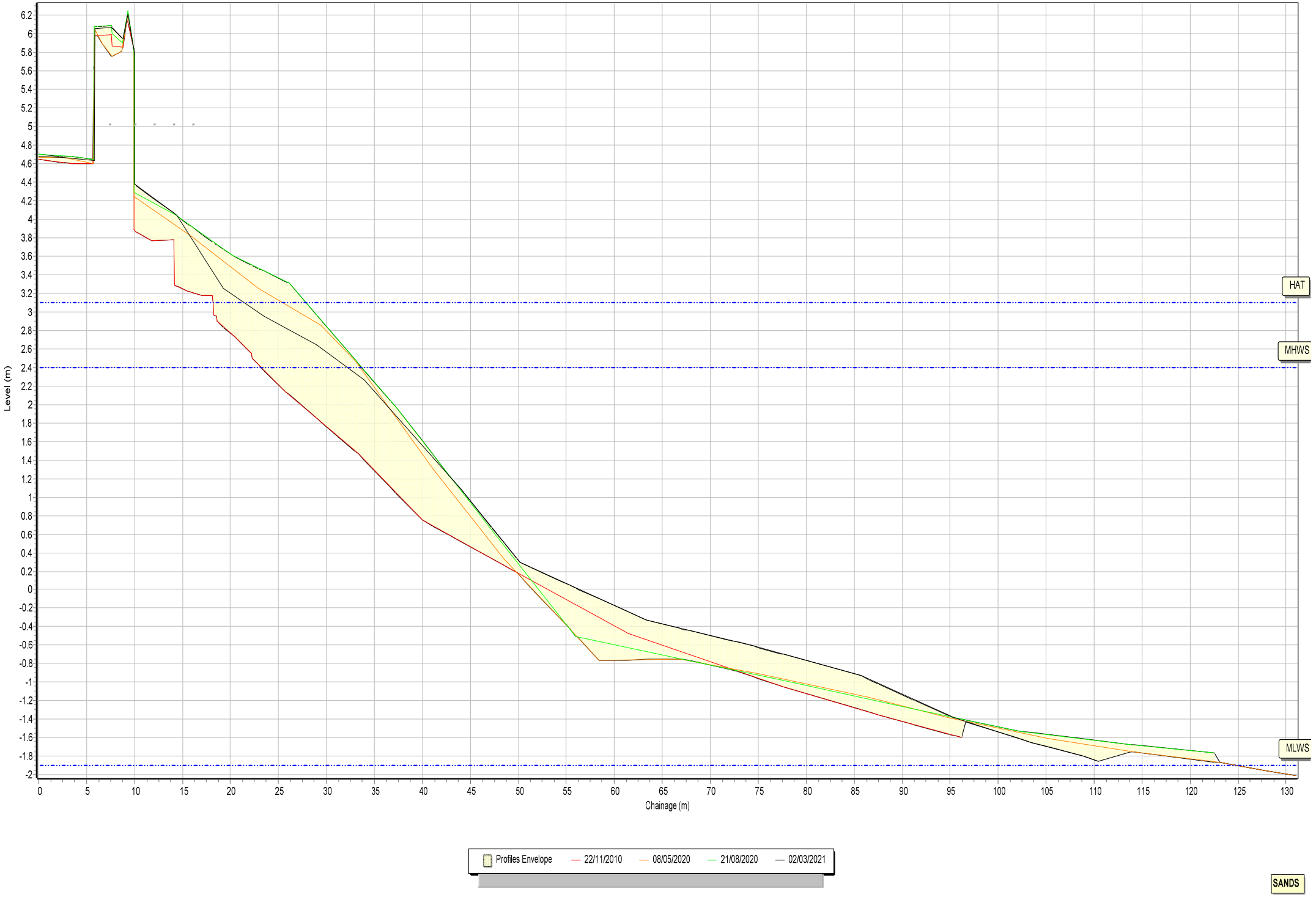

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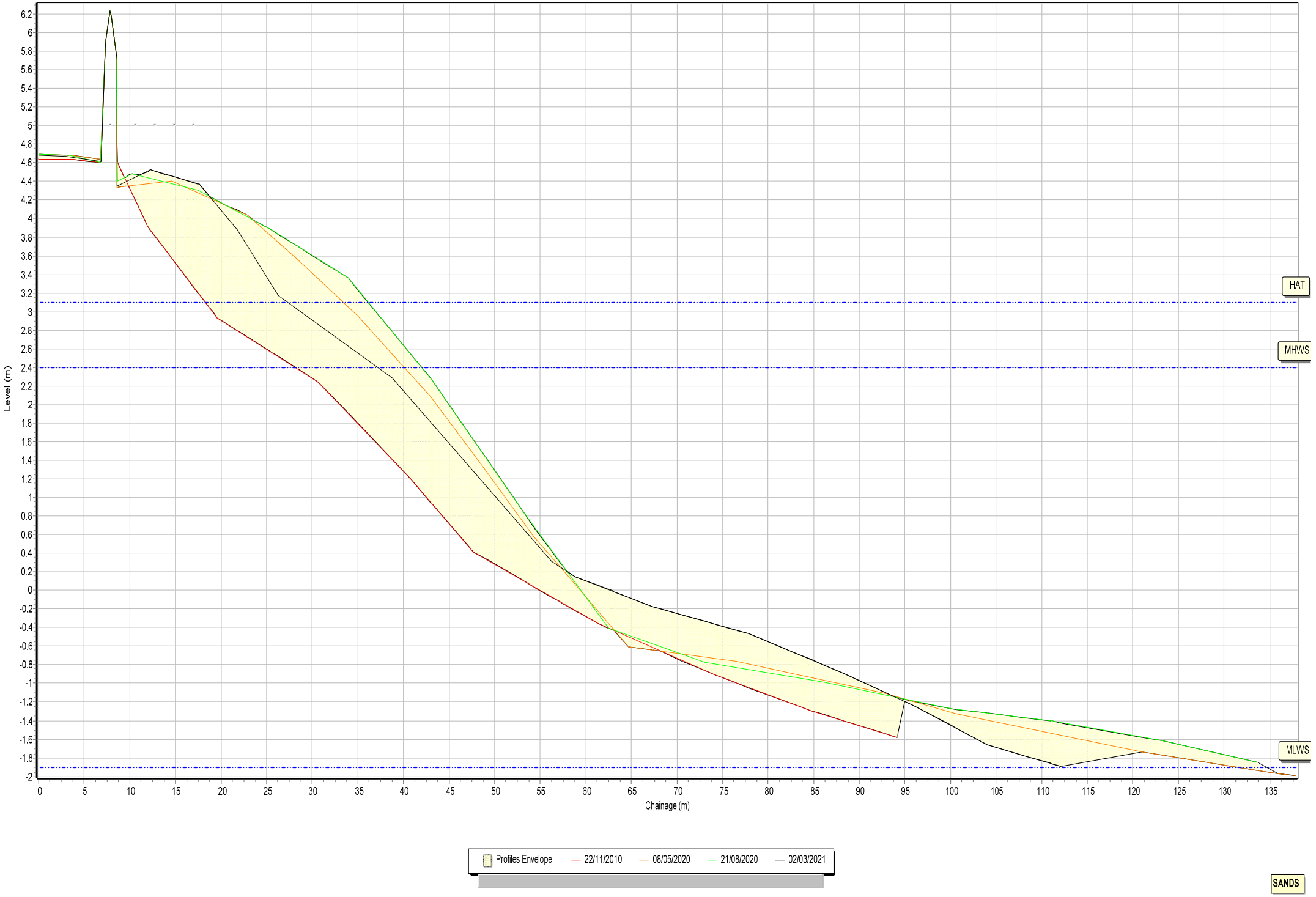

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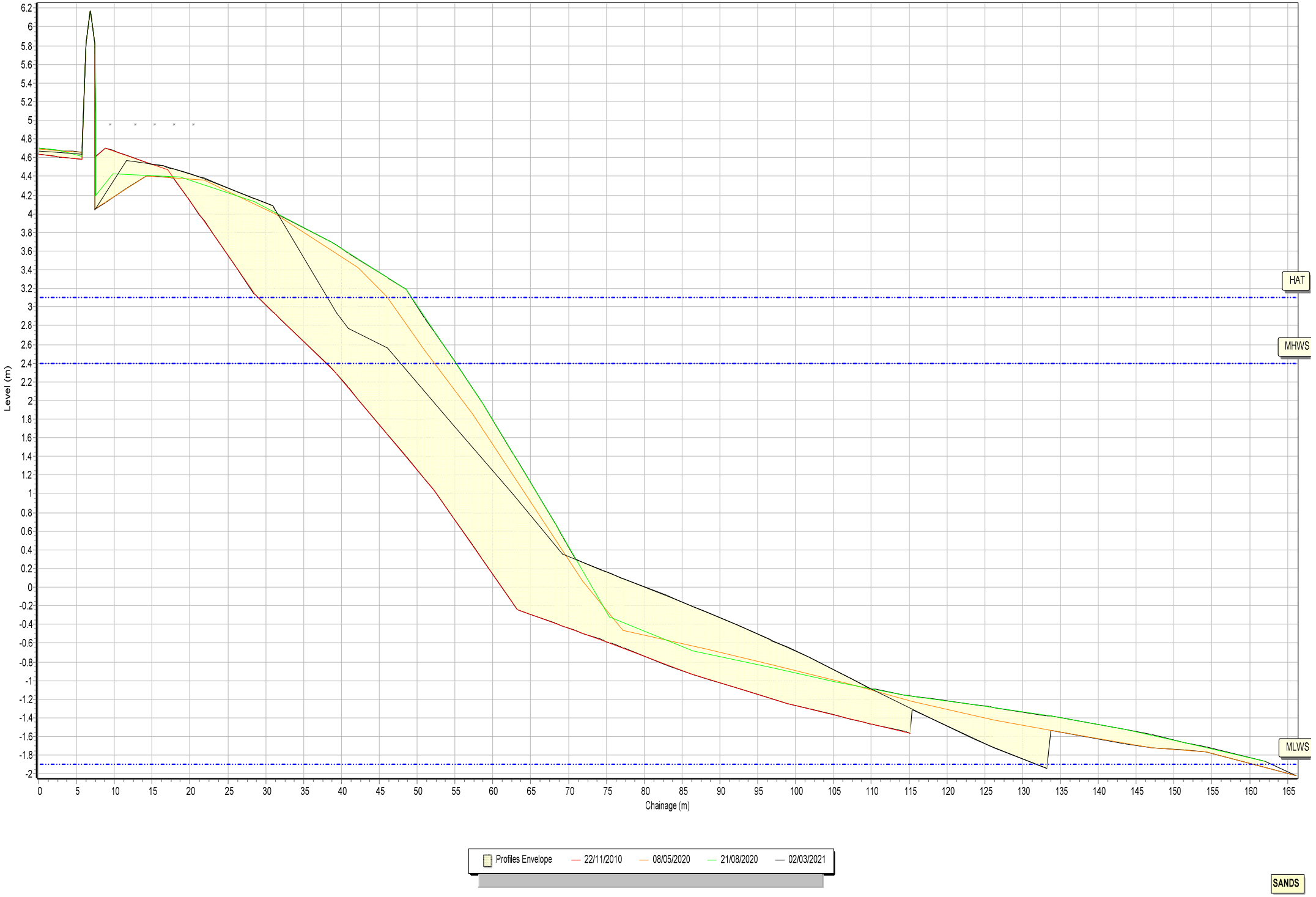

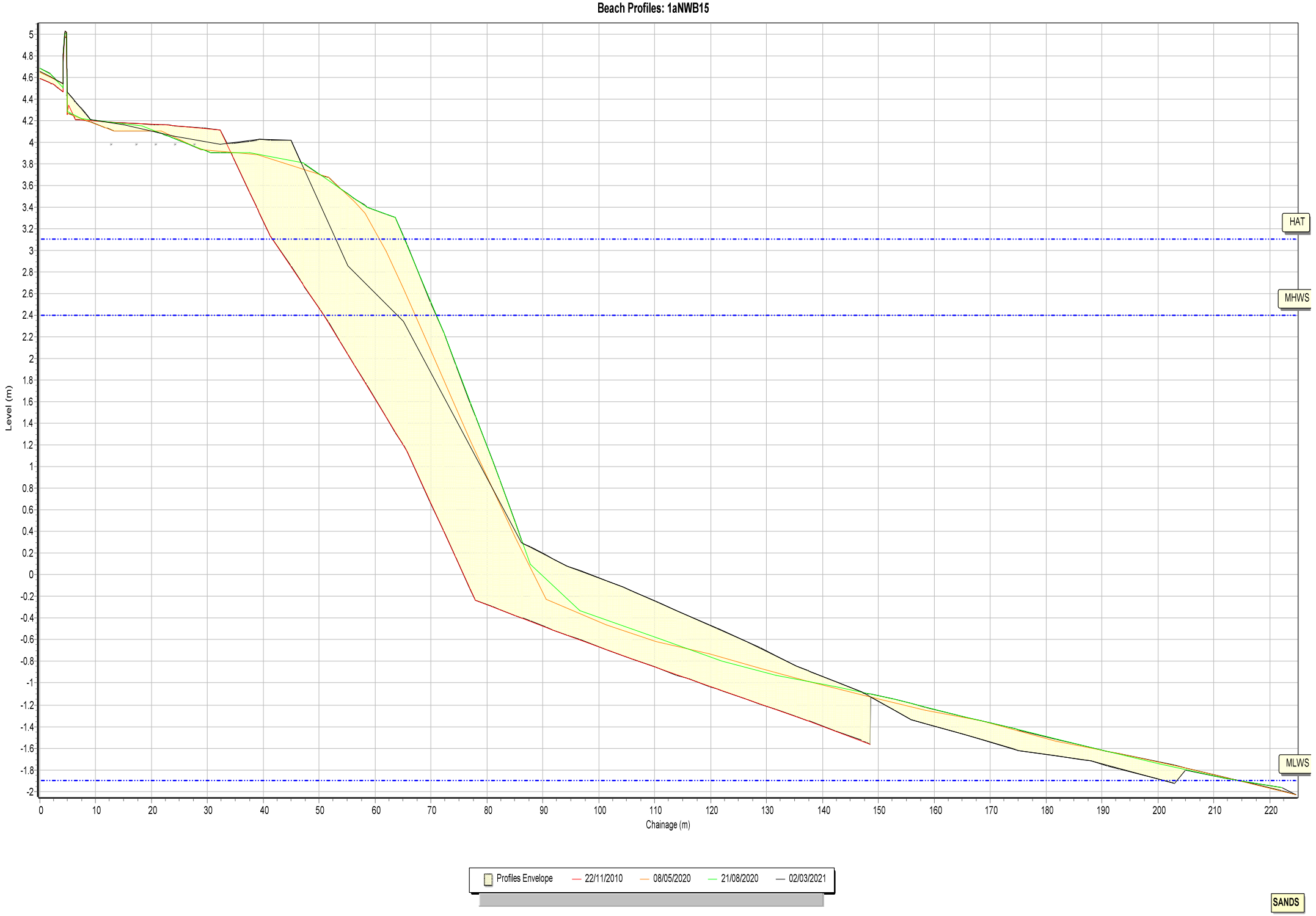
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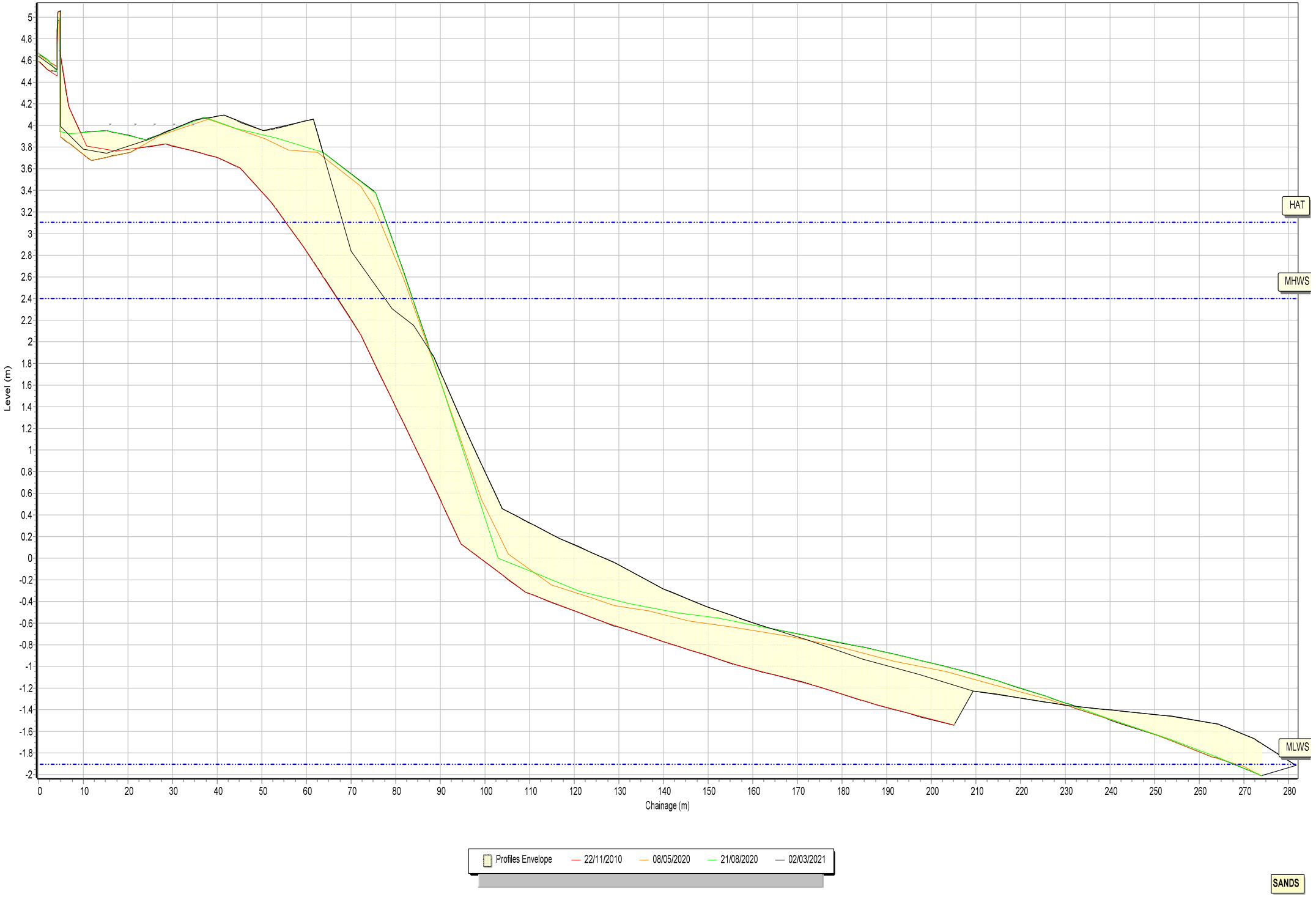

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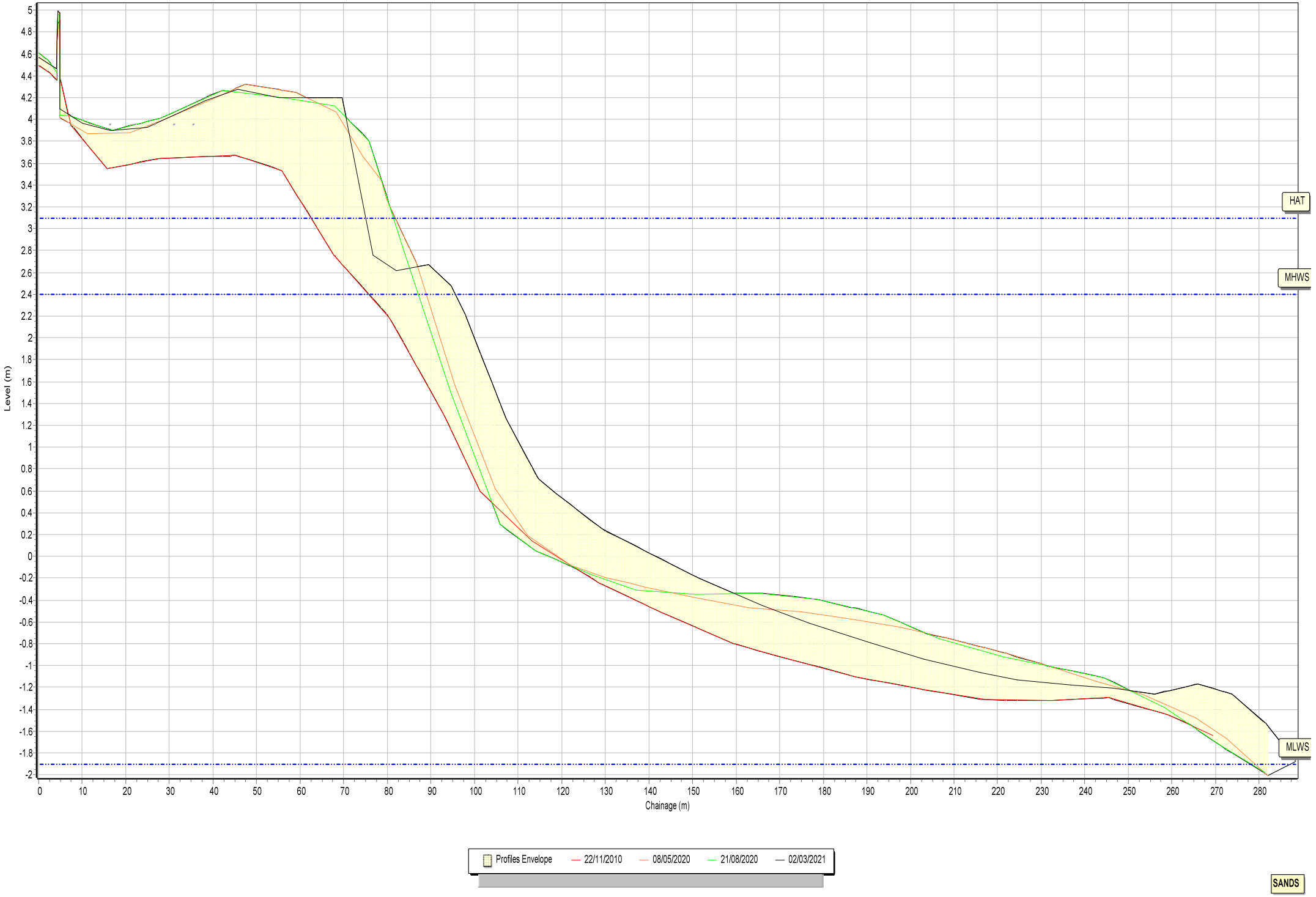


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02/03/2021
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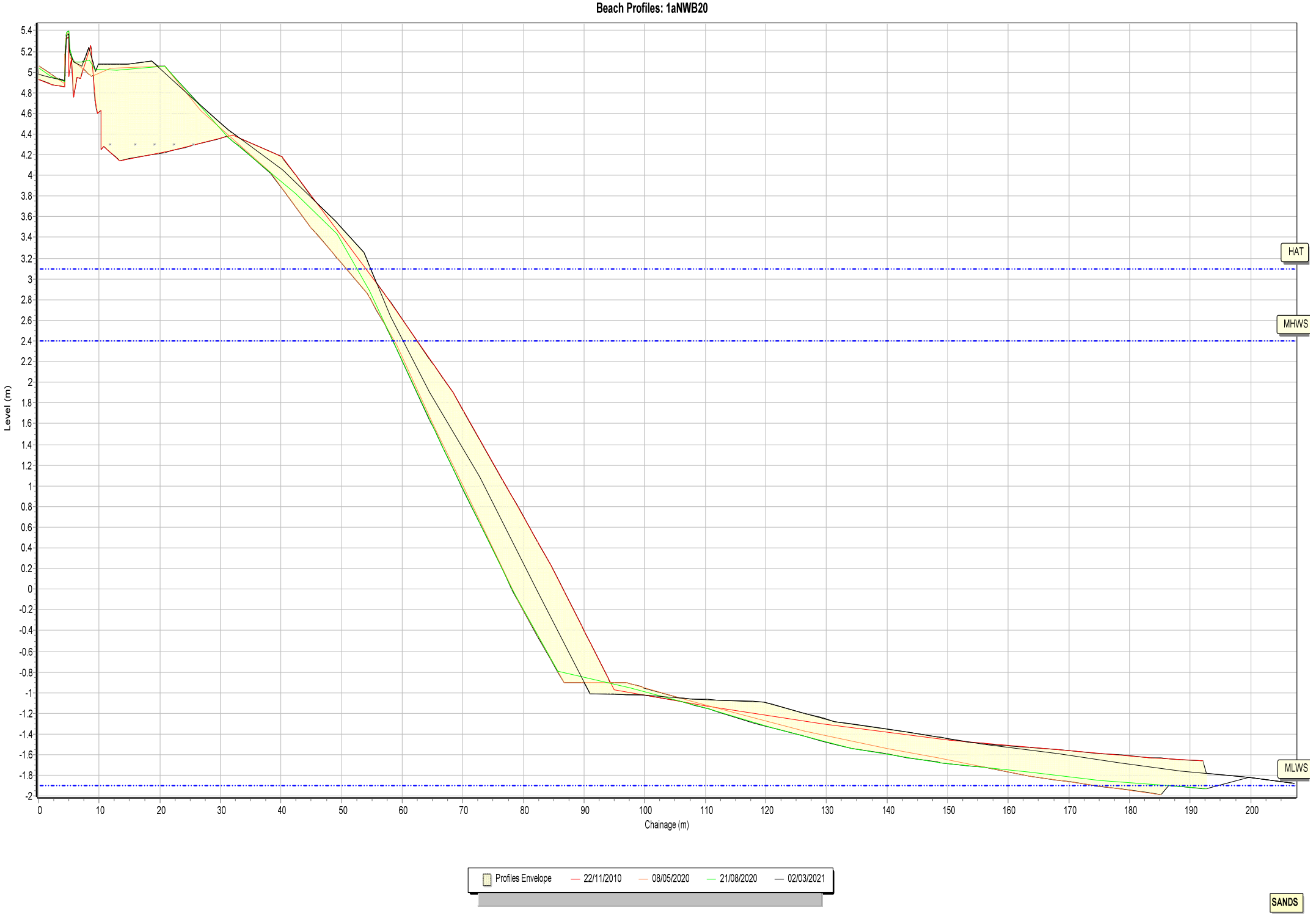
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02/03/2021
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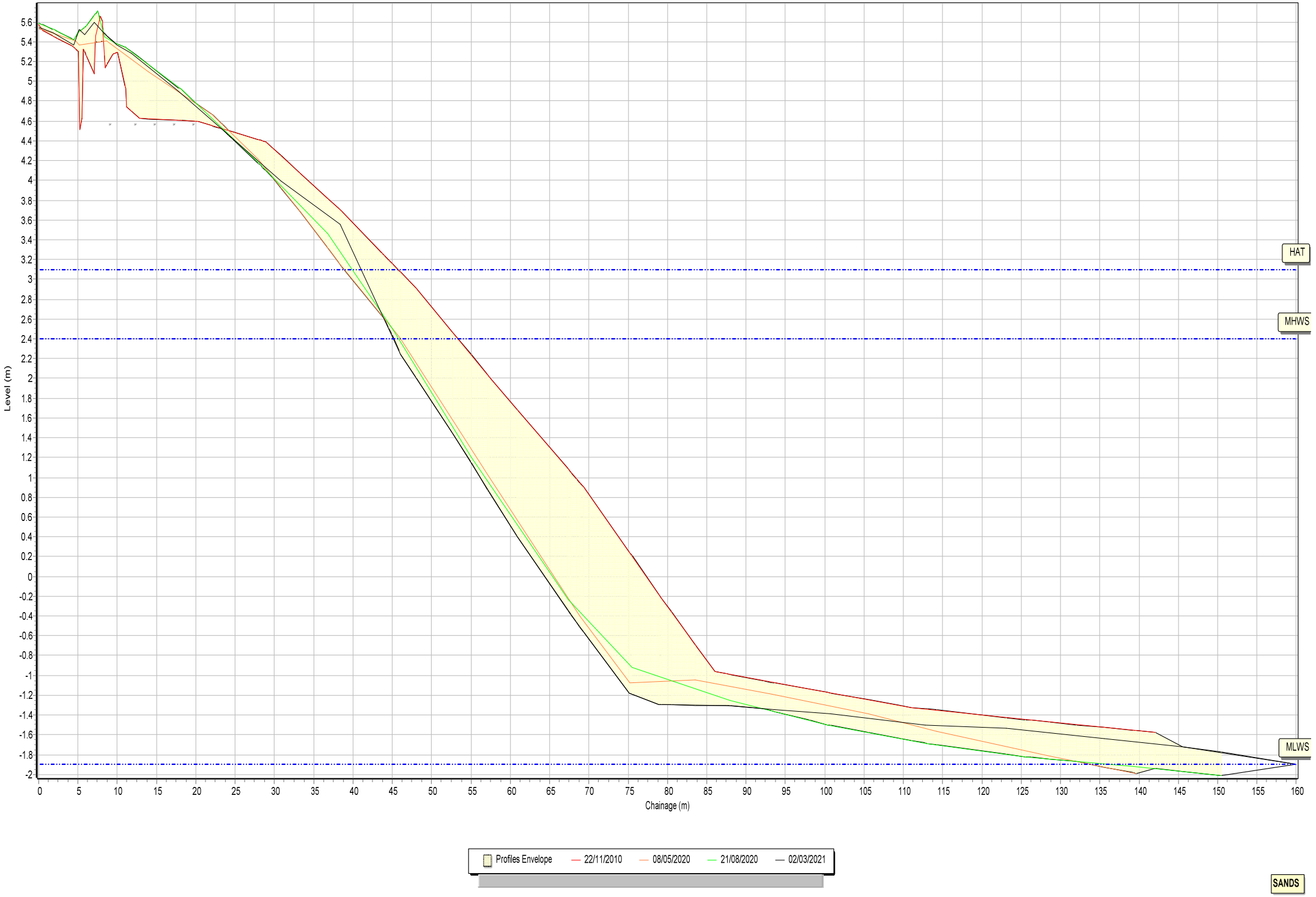

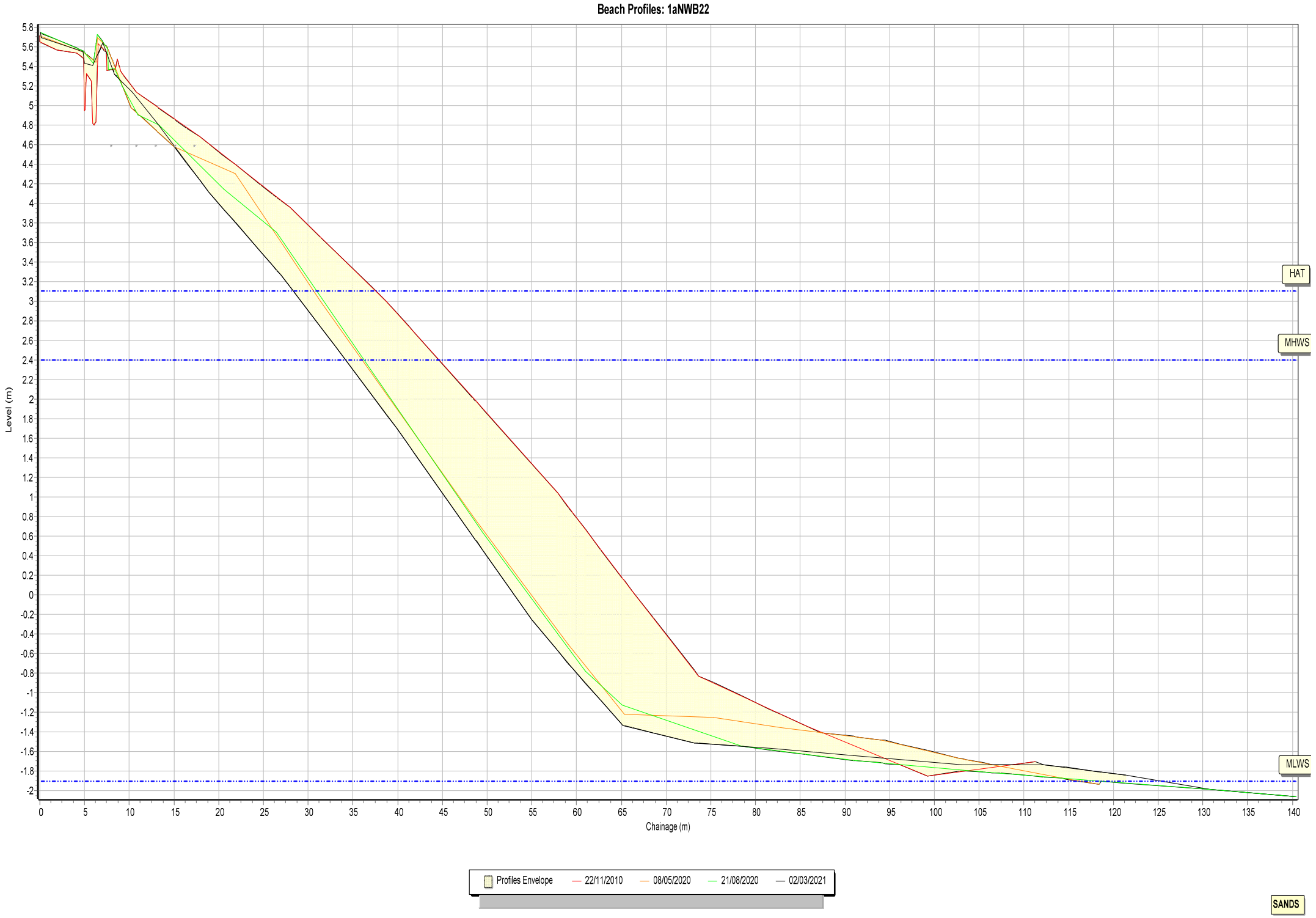
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02/03/2021
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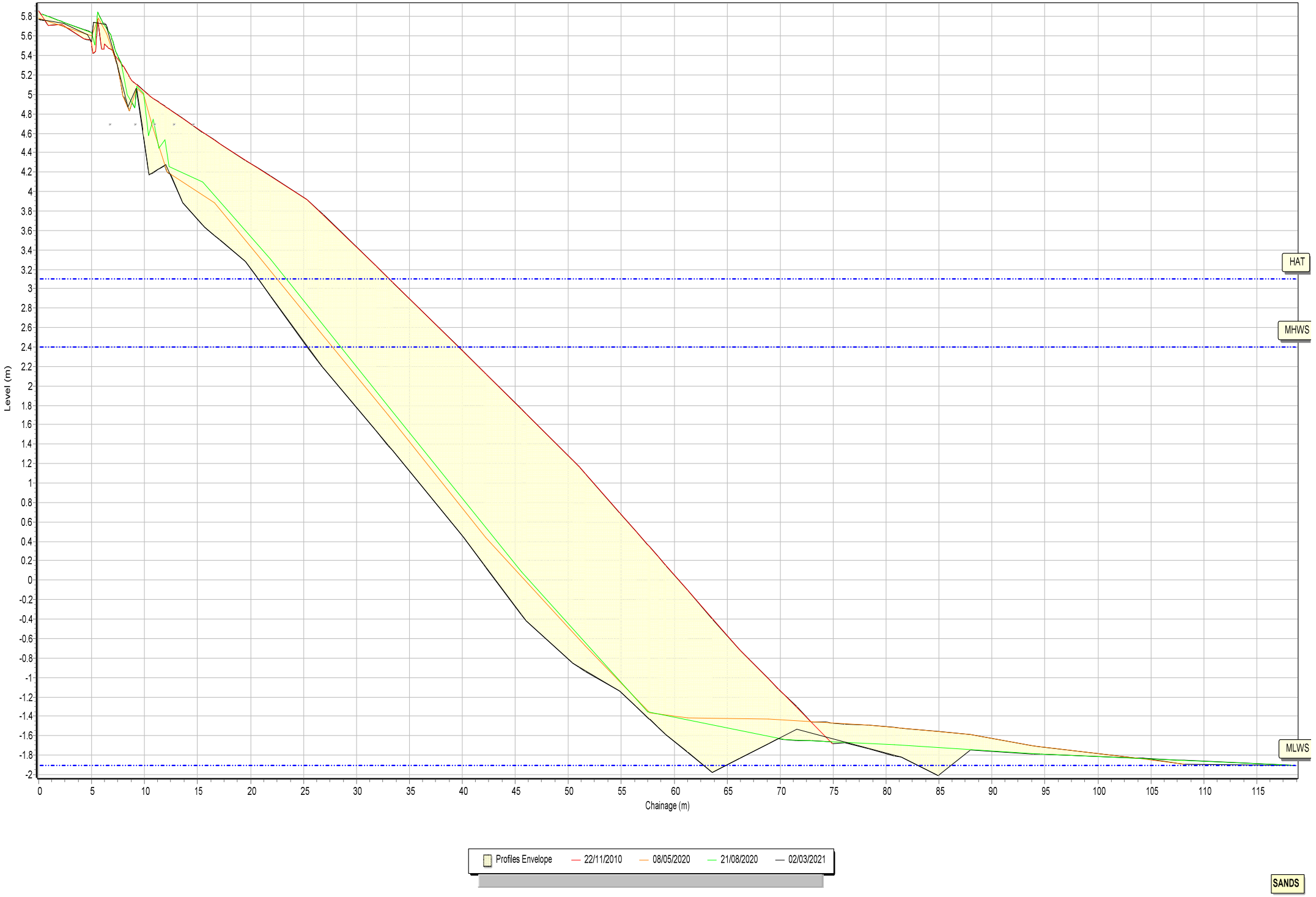

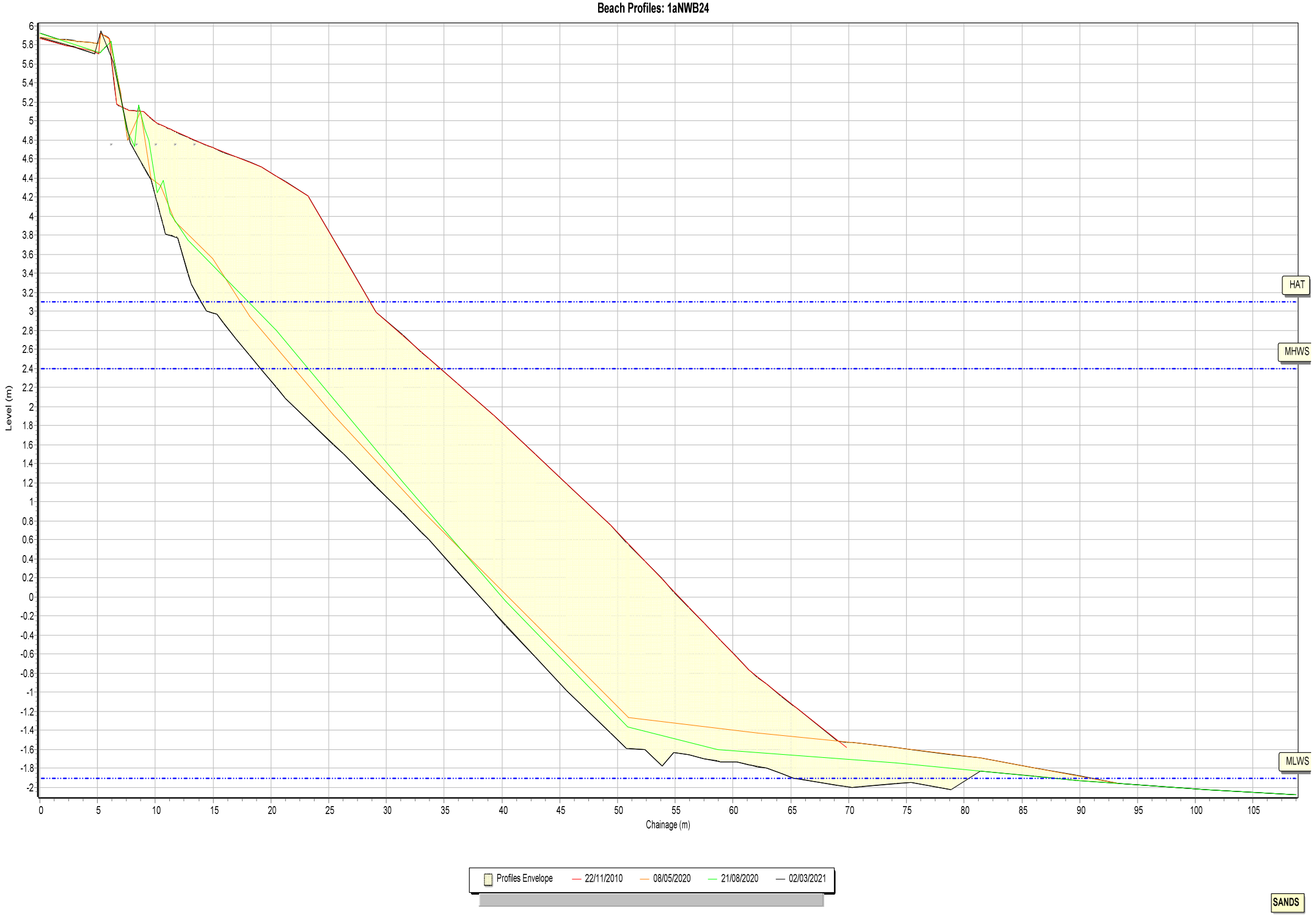
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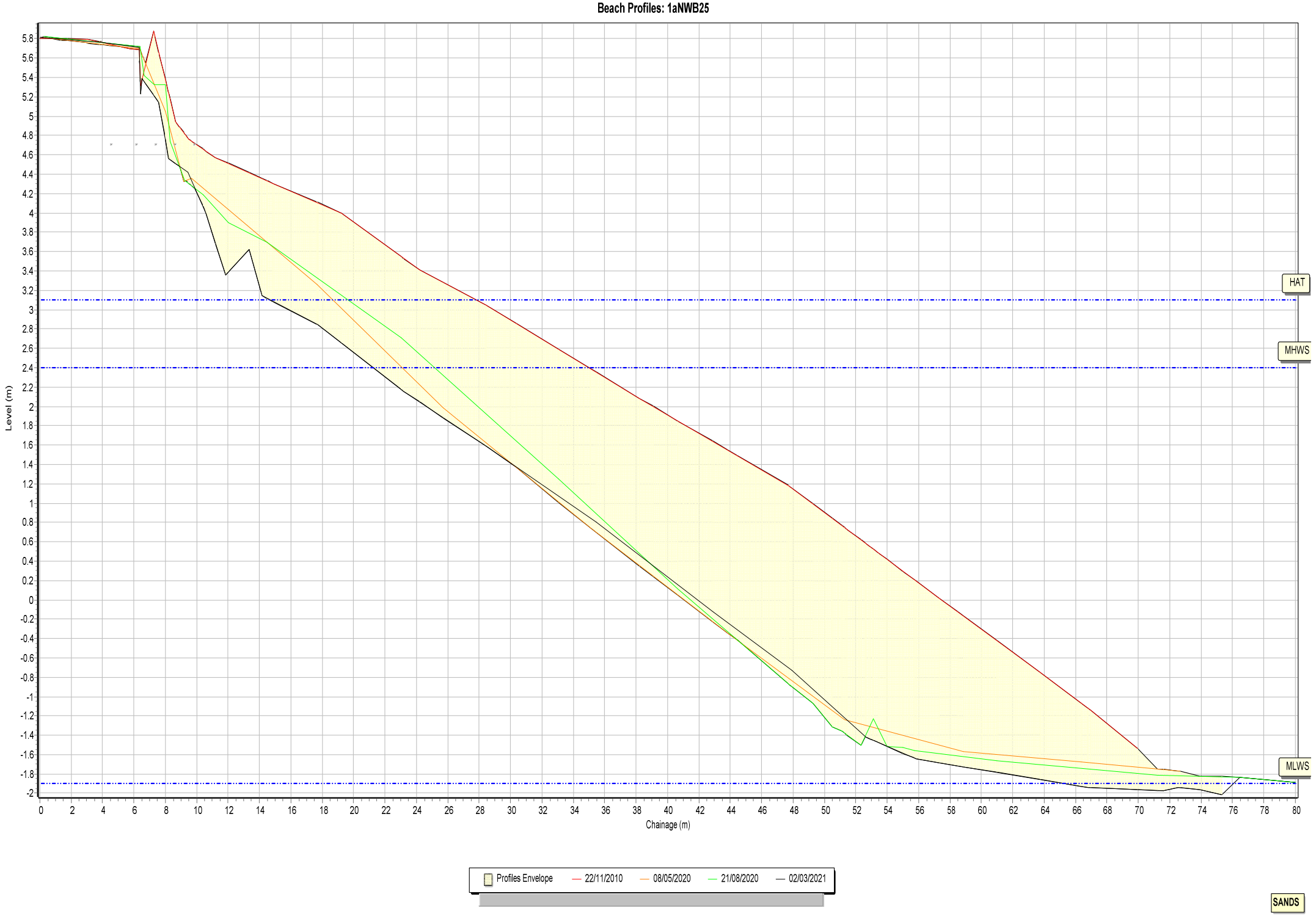
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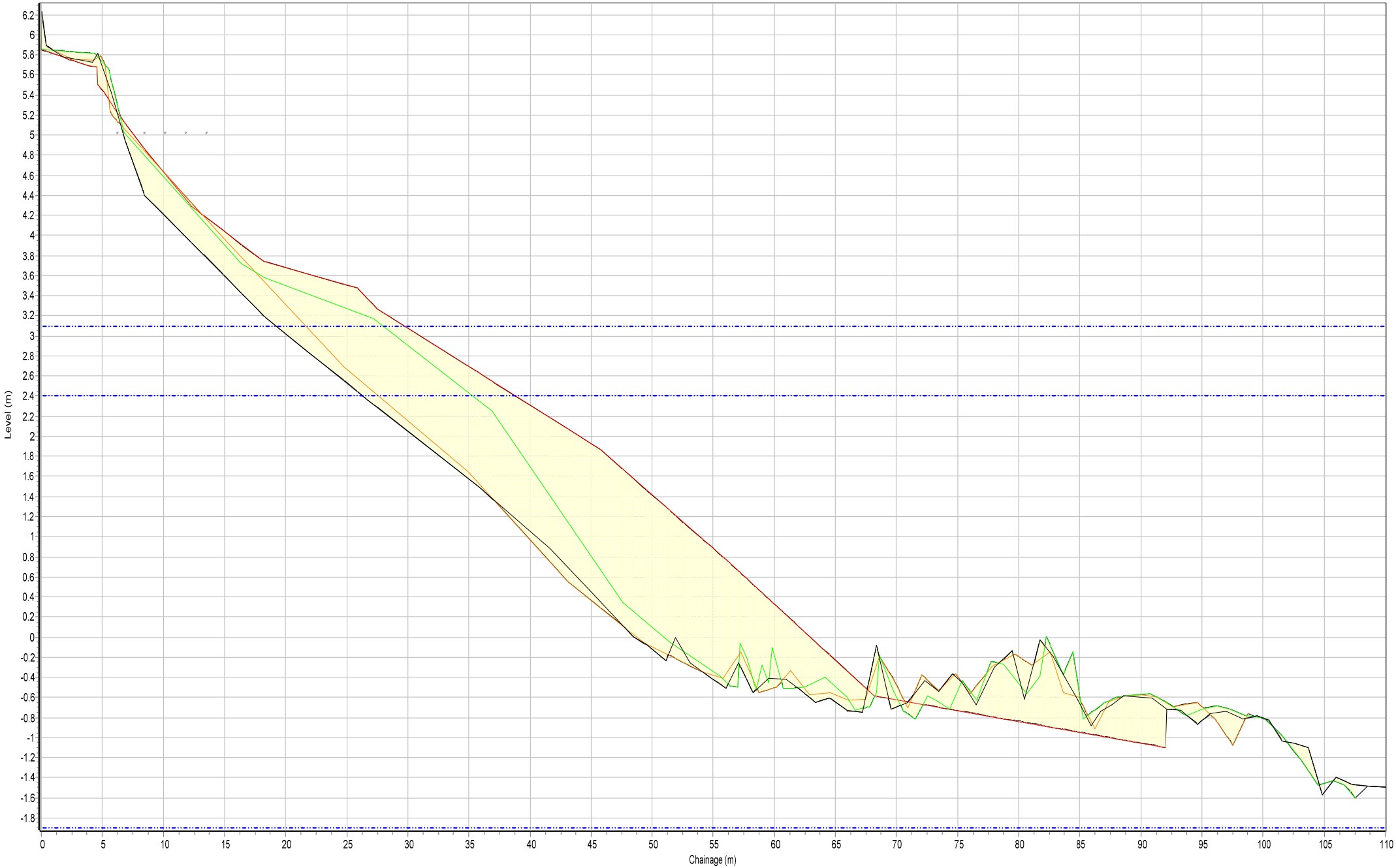


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02/03/2021
SANDS

Beach Profiles: 1aWDC06


Beach Profiles: 1aWDC06A
Level (m)
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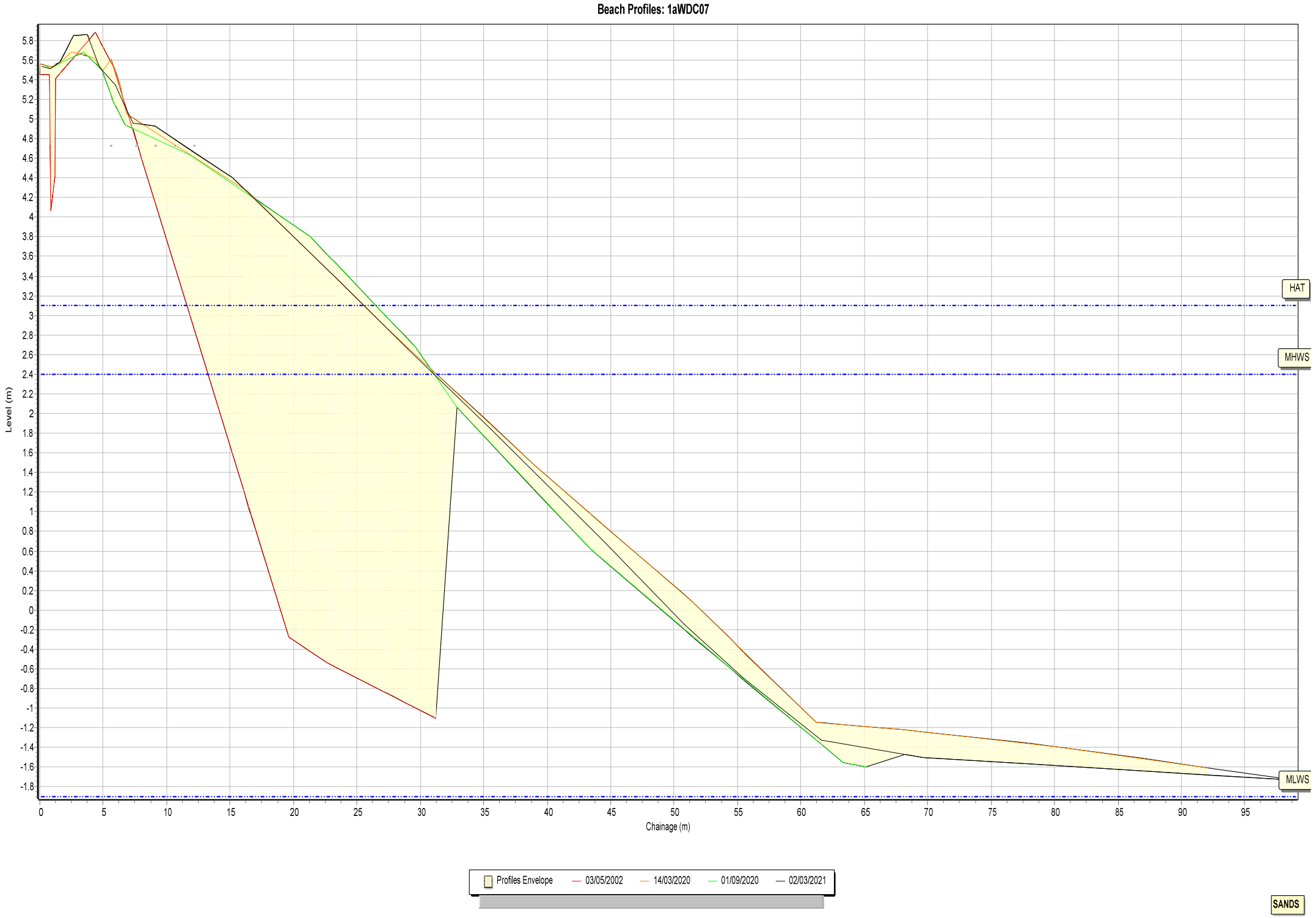
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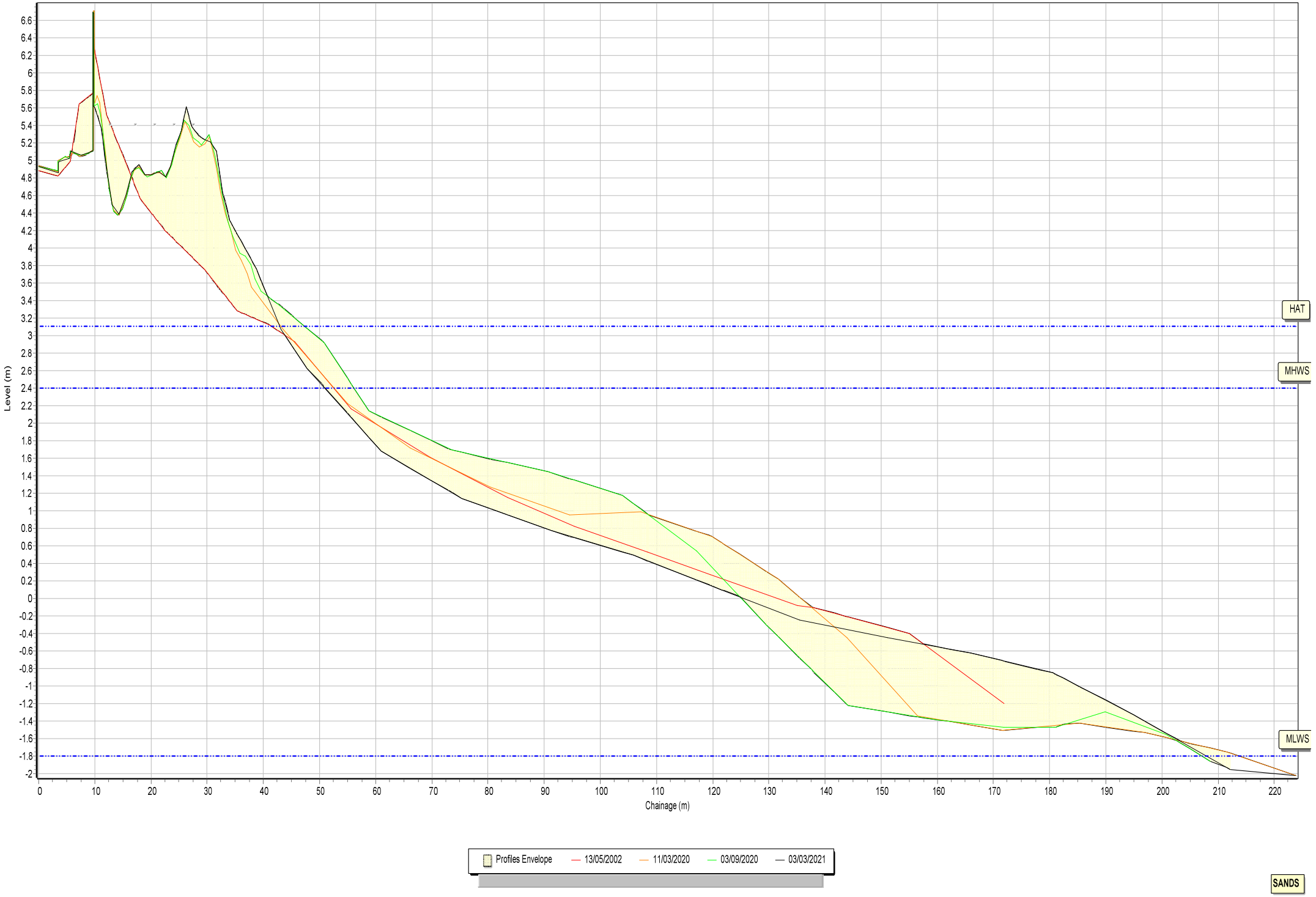

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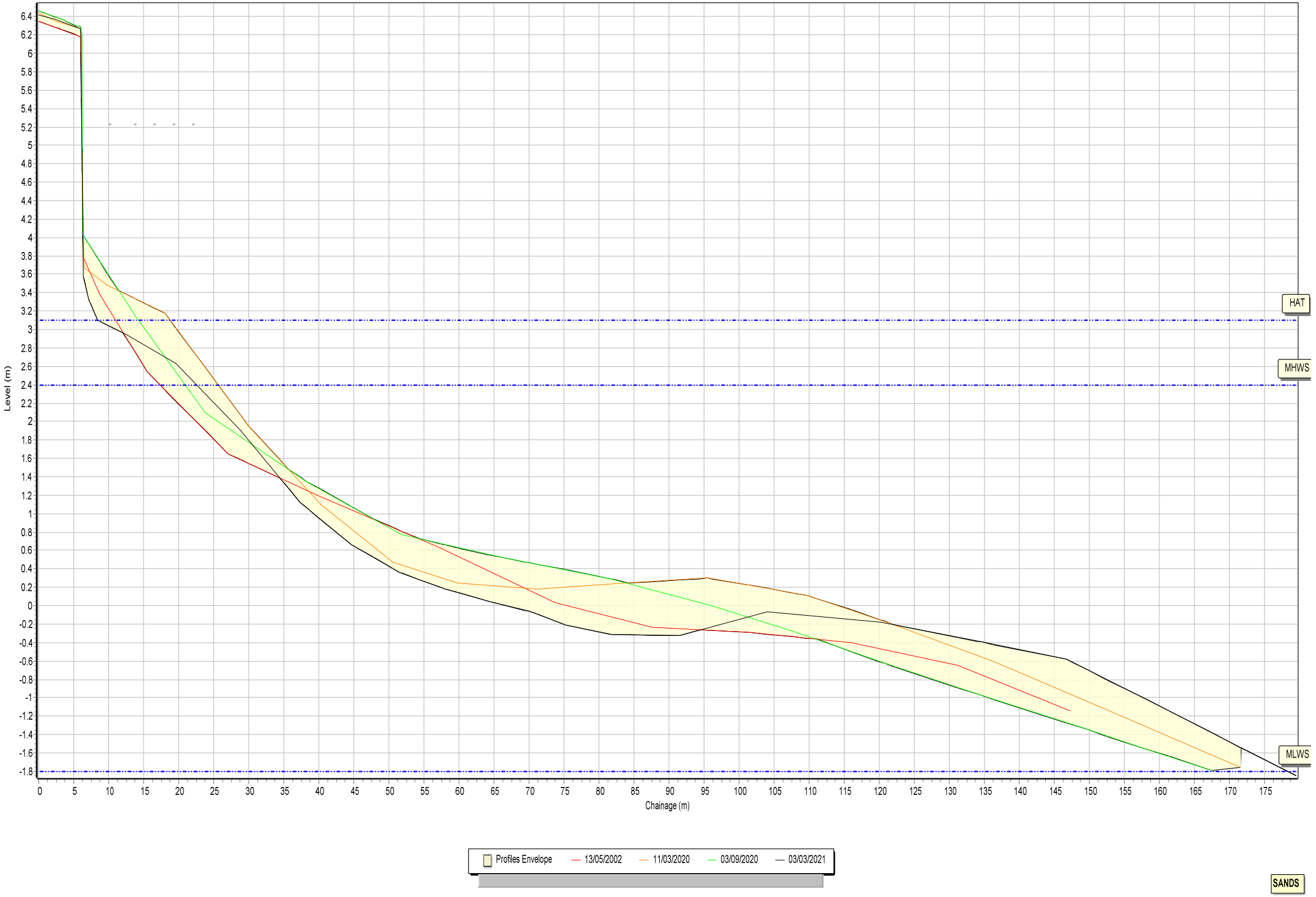


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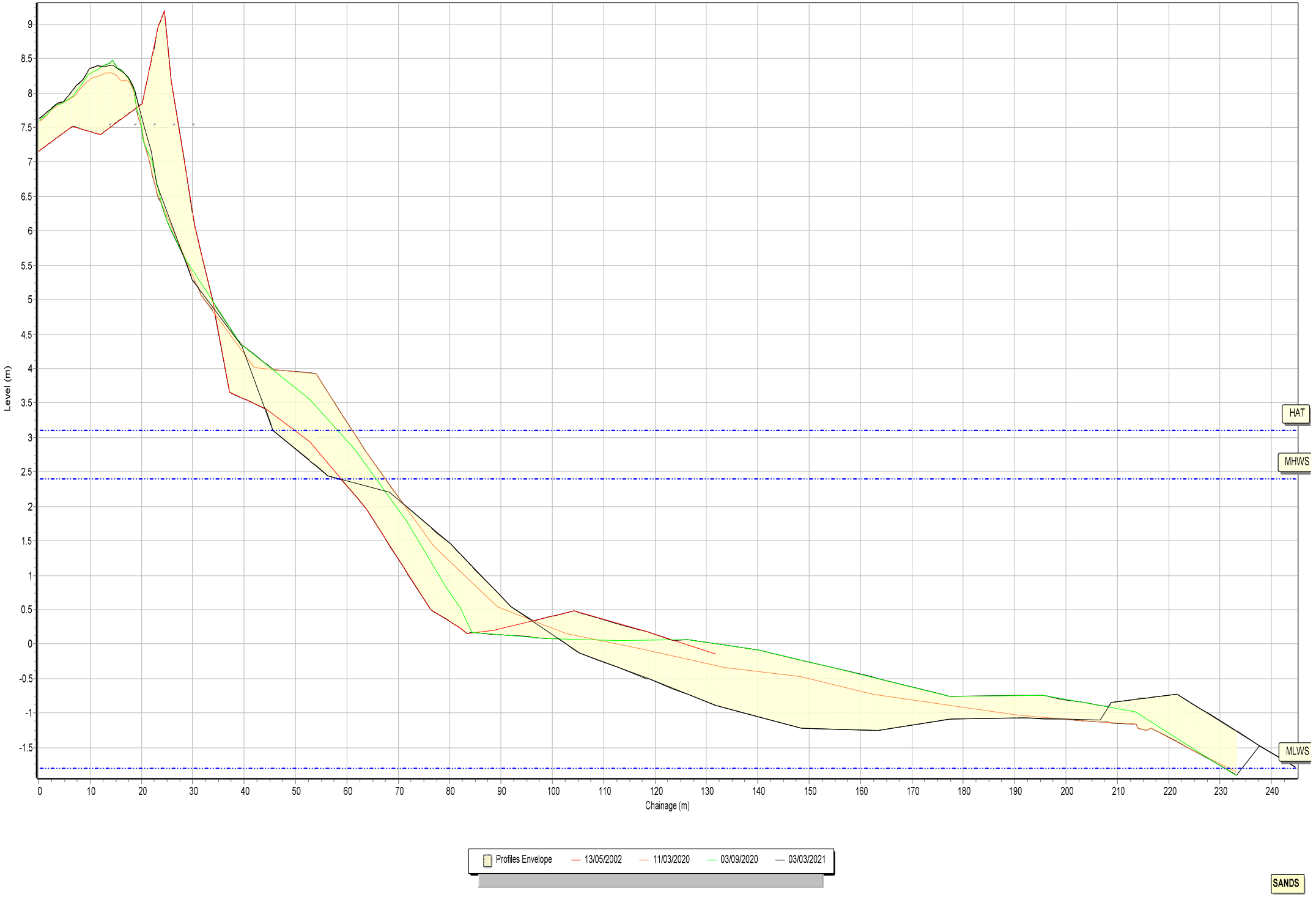

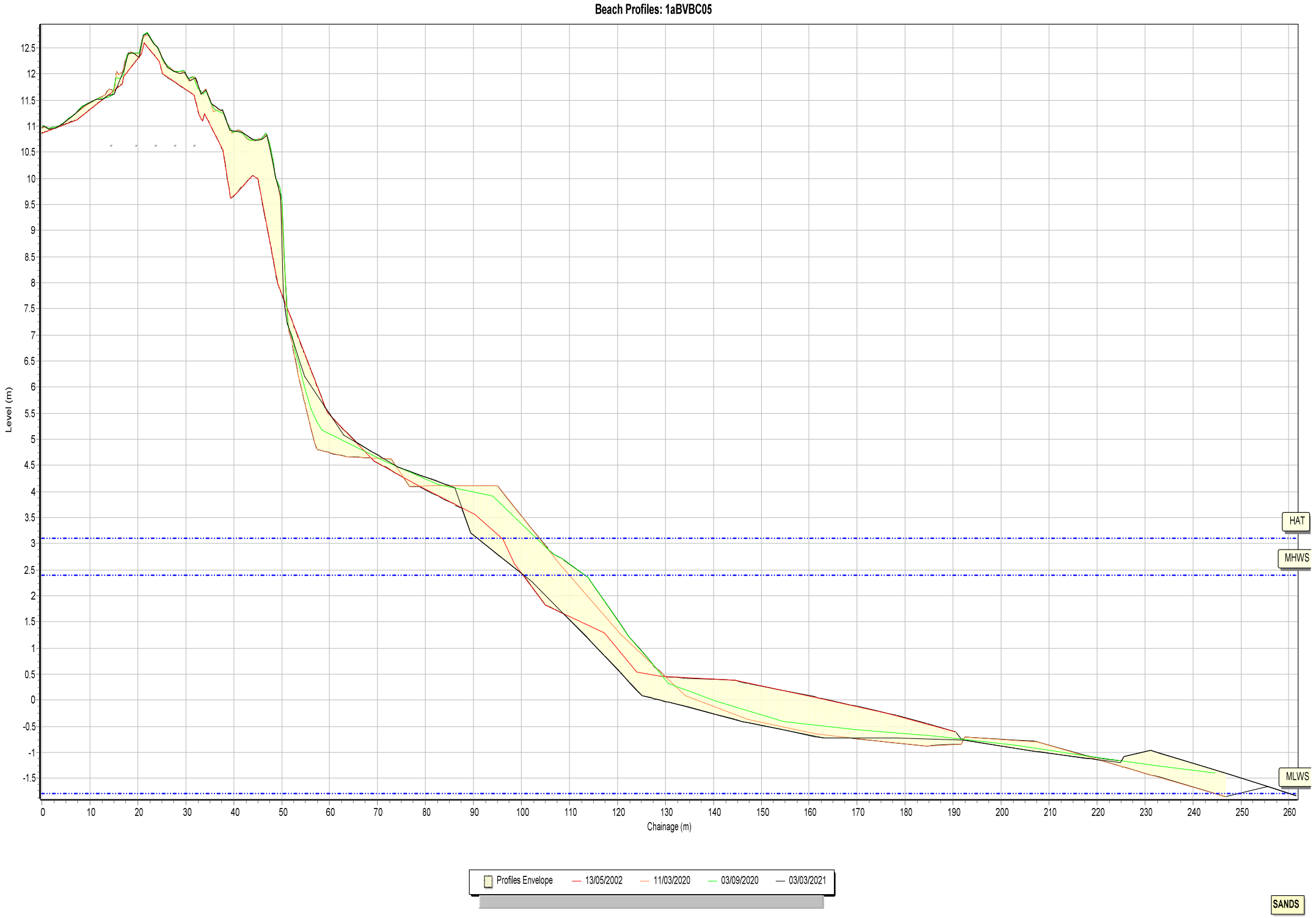
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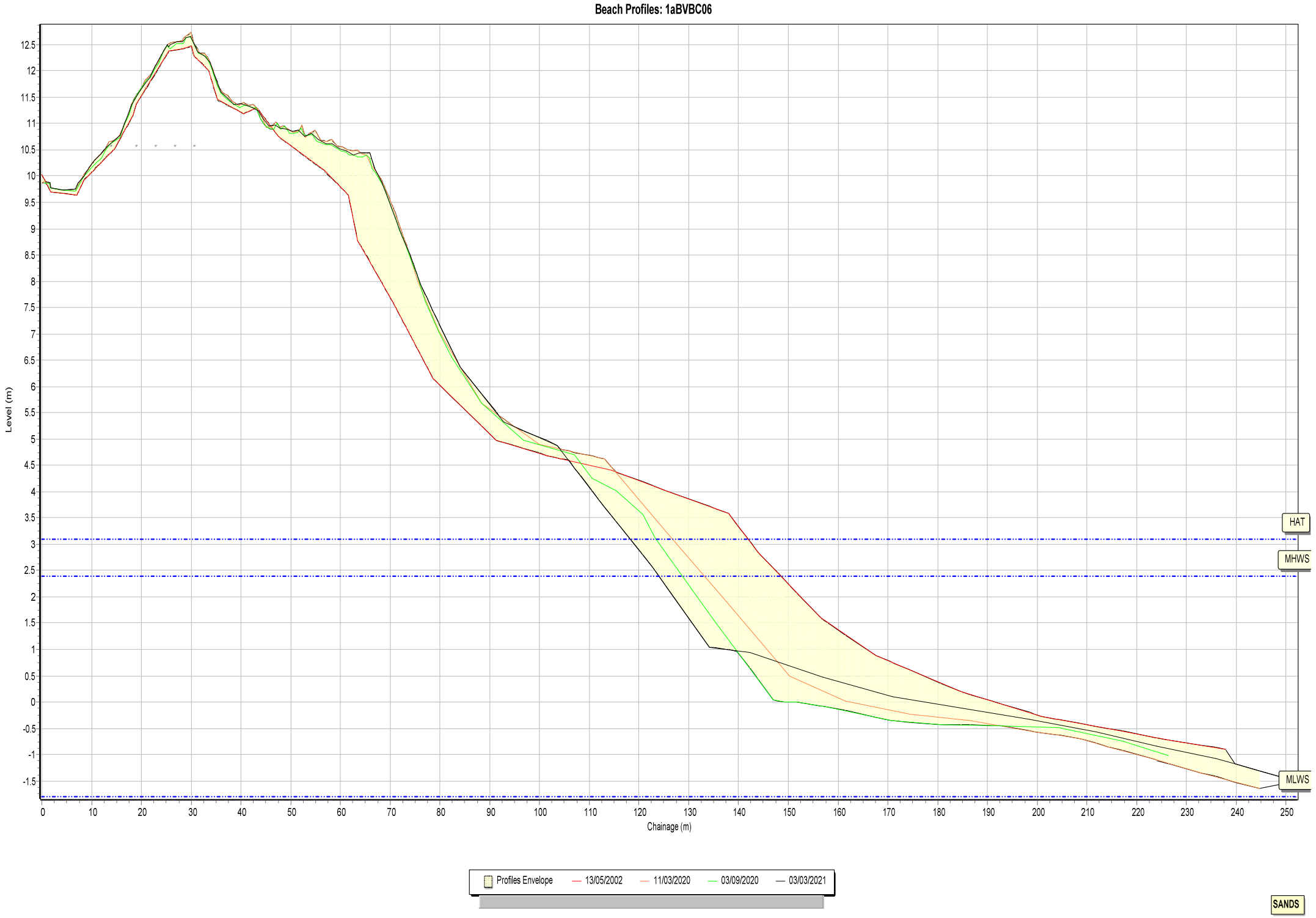
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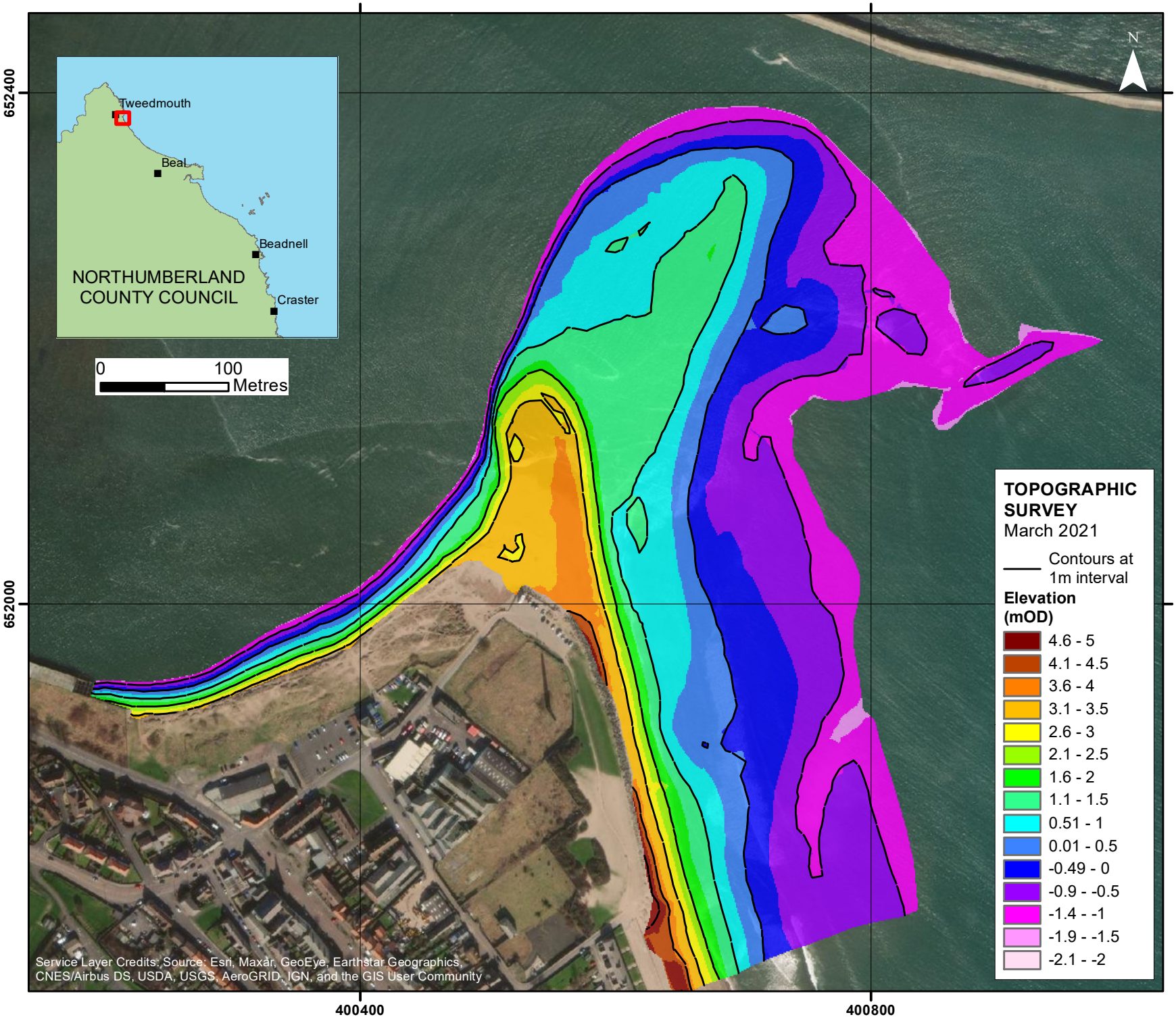
Appendix B

Topographic Survey



Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Appendix B - Map 1

BERWICK

Northumberland County Council Frontage

Update Report
'Partial Measures' Survey 2021

Drawing Scale at A4 1:4,000

WATER
Royal HaskoningDHV
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Fax: +44 (0)191 211 1313
www.royalhaskoningdhv.com

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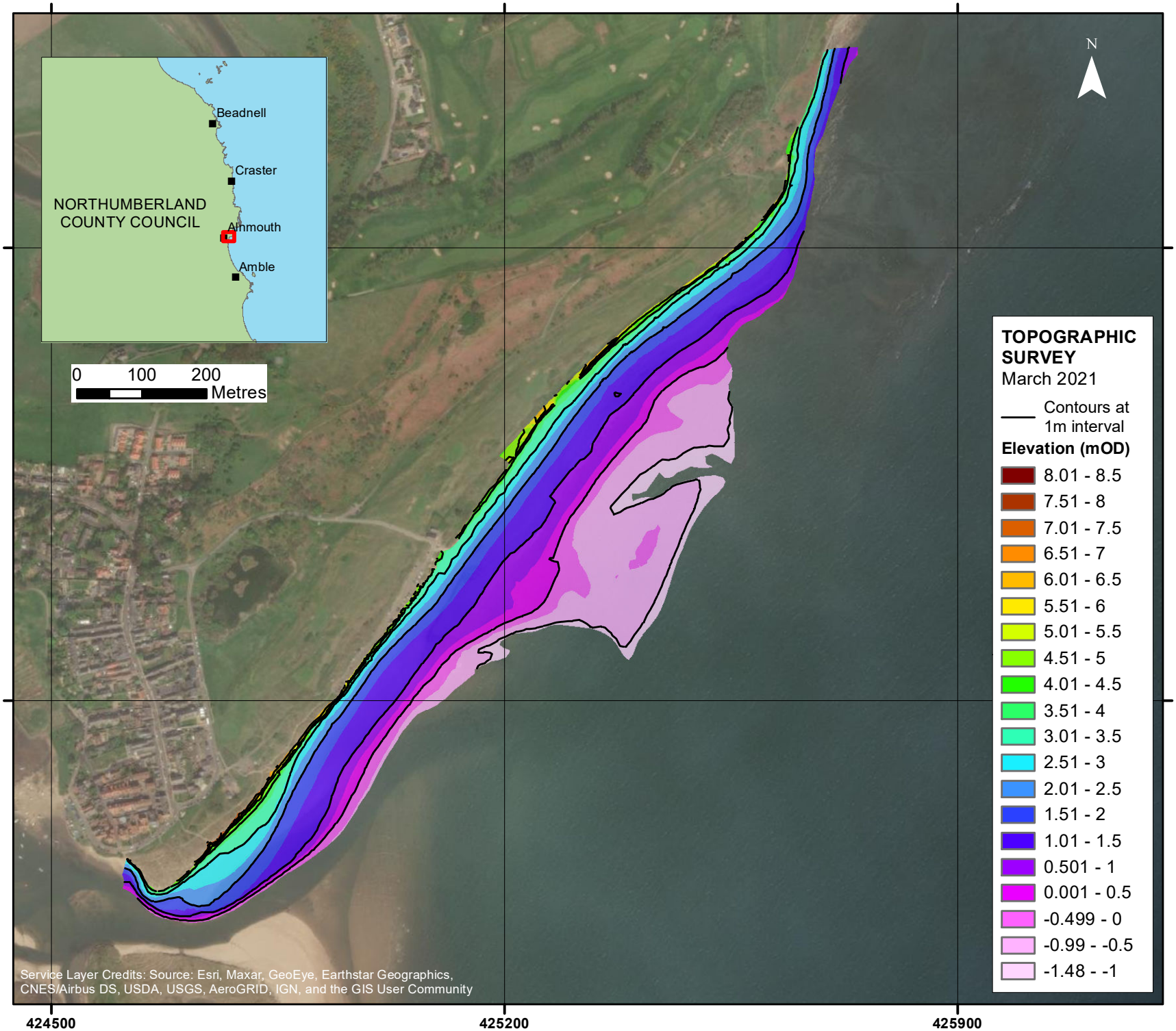

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Appendix B - Map 2

ALNMOUTH

Northumberland County Council Frontage

Update Report
'Partial Measures' Survey 2021

Drawing Scale at A4 1:8,000

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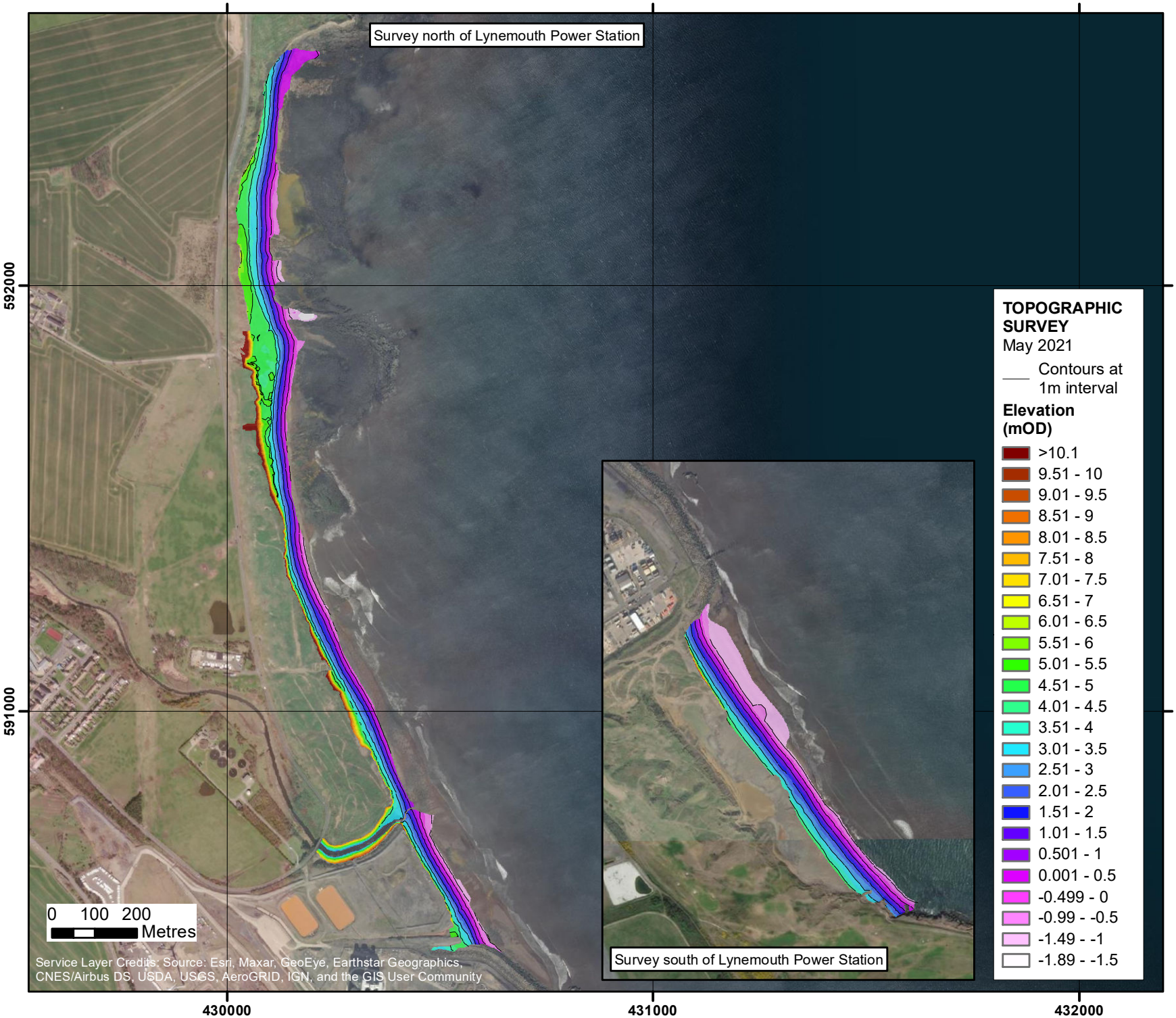

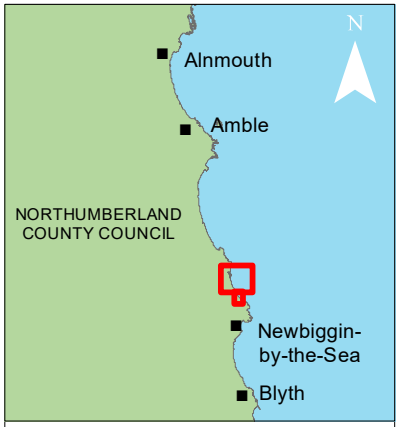

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Appendix B - Map 3

LYNEMOUTH

Northumberland County Council Frontage

Update Report
'Partial Measures' Survey 2021

Drawing Scale at A4 1:12,000

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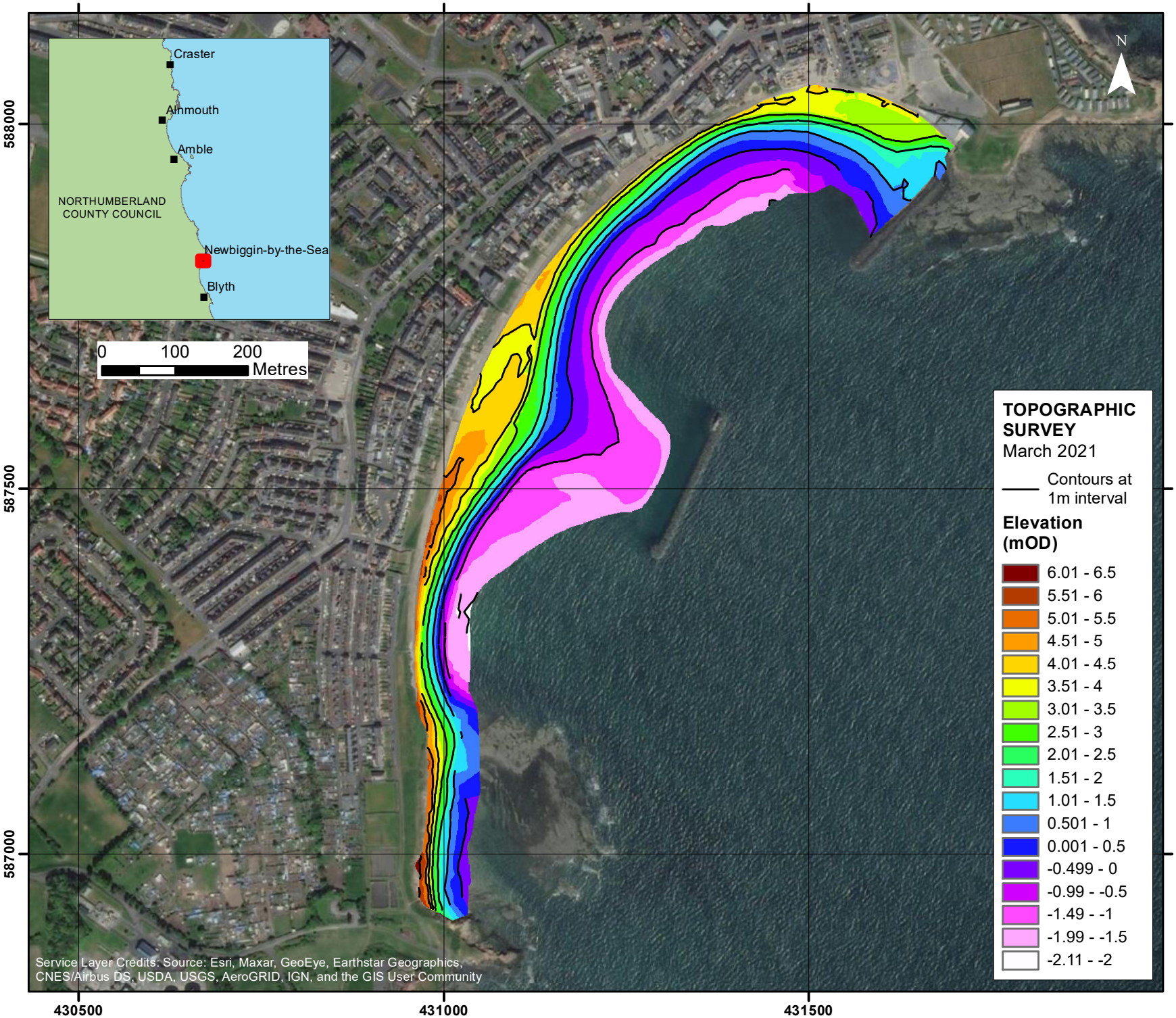

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Appendix B - Map 4

NEWBIGGIN-BY-THE-SEA

Northumberland County Council Frontage

Update Report
'Partial Measures' Survey 2021

Drawing Scale at A4 1:7,000

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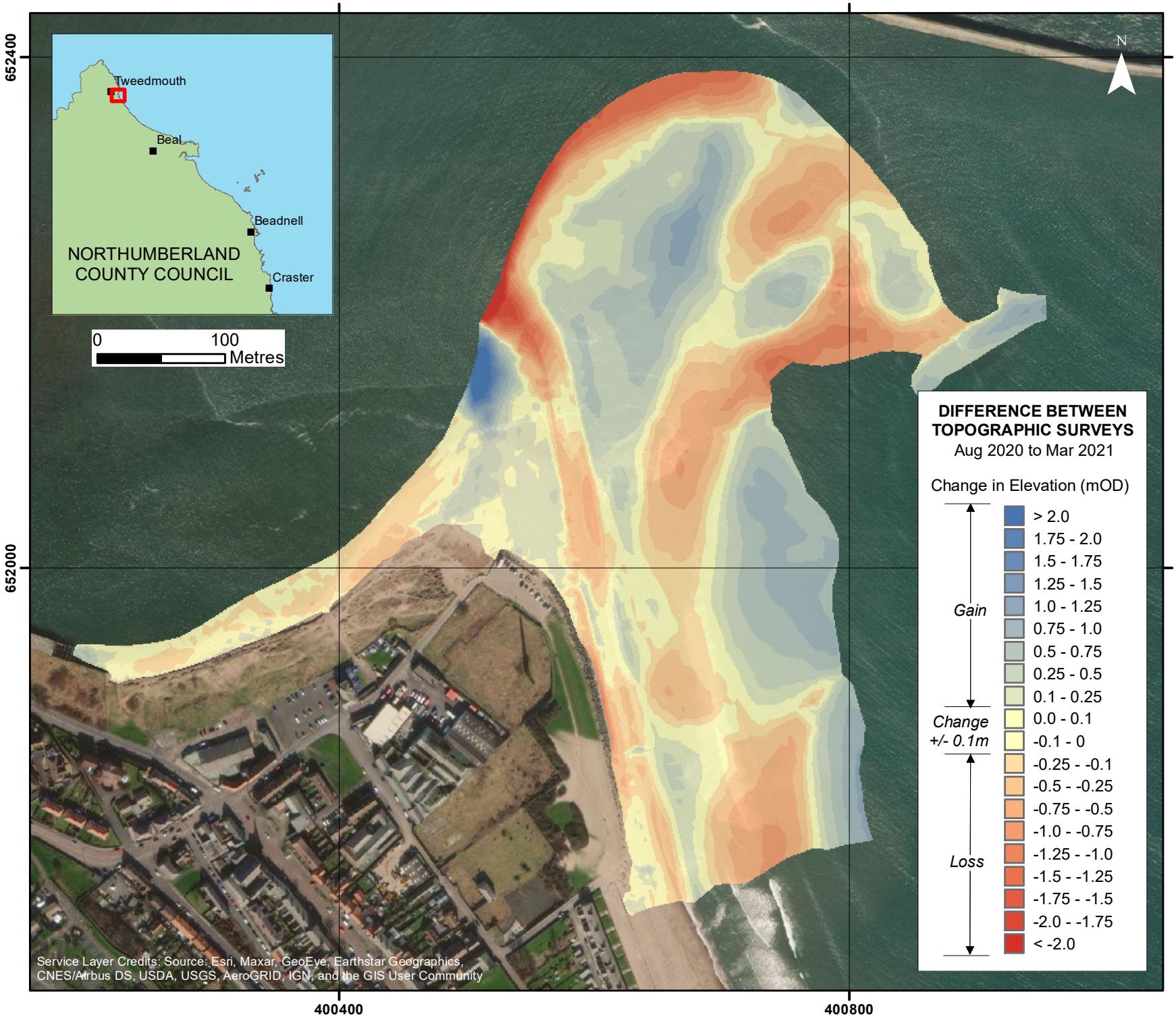

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Appendix B - Map 5

BERWICK

Northumberland County Council Frontage

Update Report
'Partial Measures' Survey 2021

Drawing Scale at A4 1:4,000

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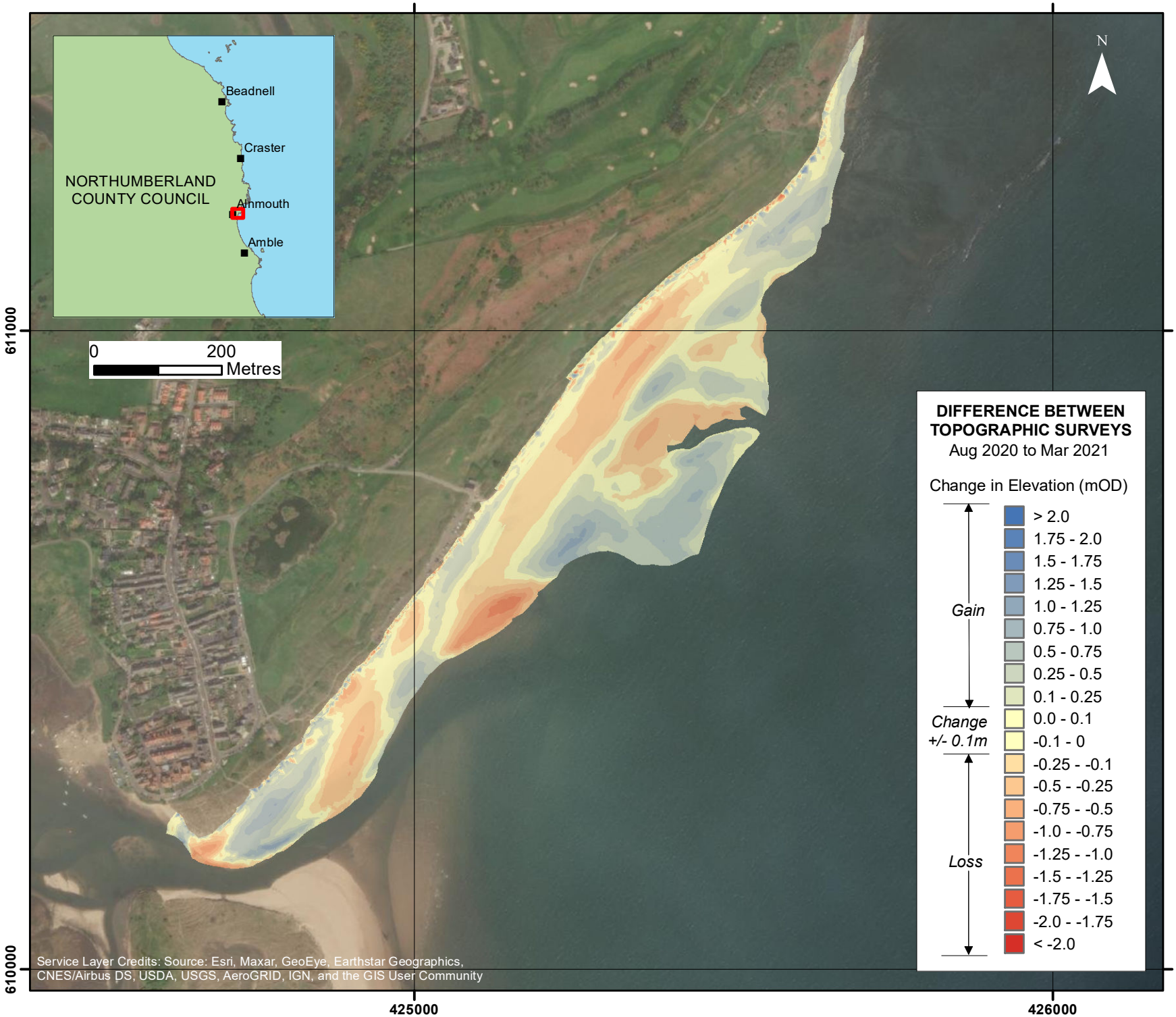

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Appendix B - Map 6

ALNMOUTH

Northumberland County Council Frontage

Update Report
'Partial Measures' Survey 2021

Drawing Scale at A4 1:8,000

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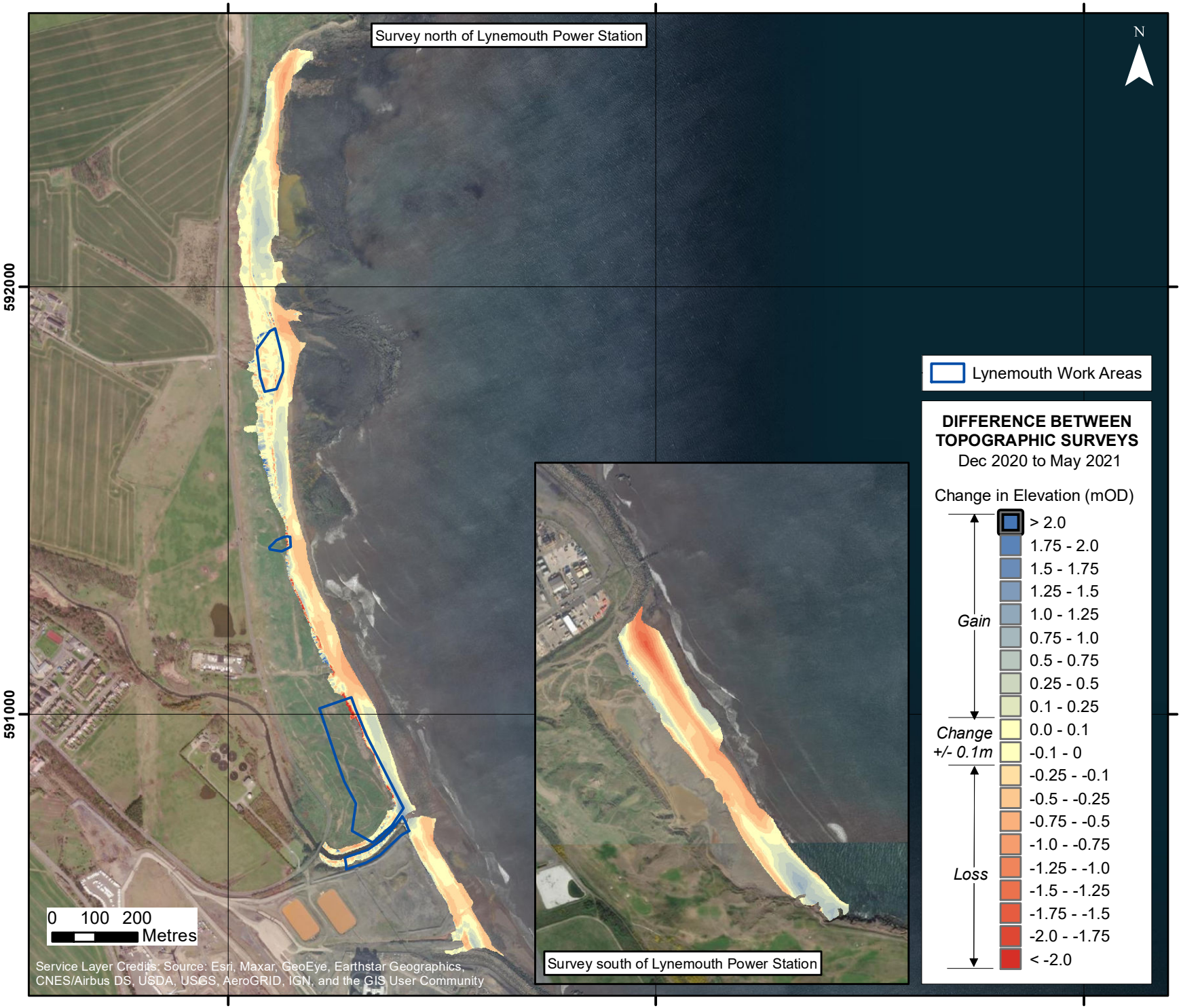

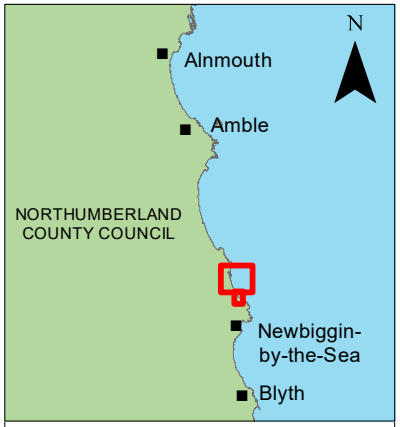

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Appendix B - Map 7

LYNEMOUTH

Northumberland County Council Frontage

Update Report
'Partial Measures' Survey 2021

Drawing Scale at A4 1:12,000

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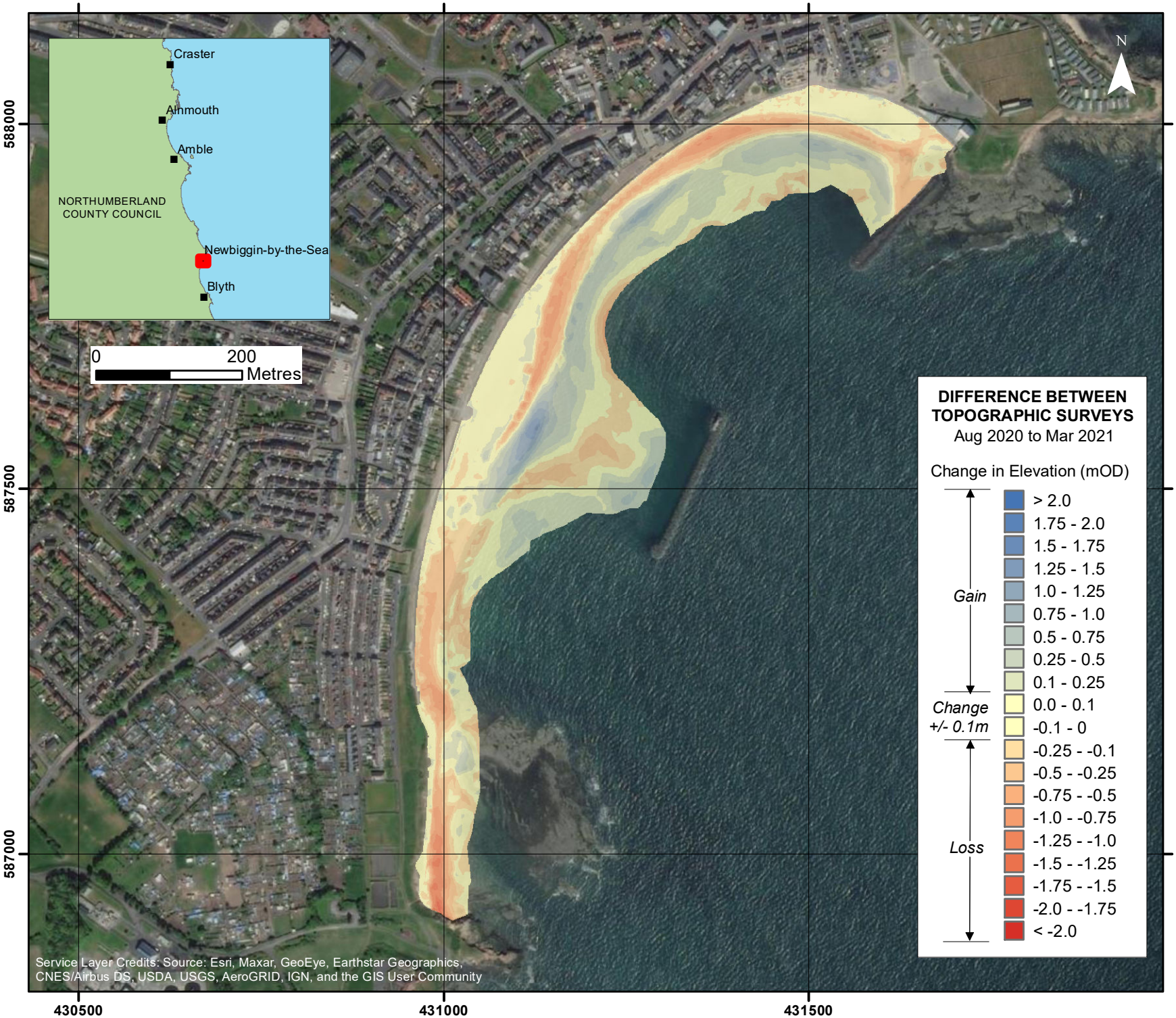

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Appendix B - Map 8

NEWBIGGIN-BY-THE-SEA

Northumberland County Council Frontage

Update Report
'Partial Measures' Survey 2021

Drawing Scale at A4 1:7,000

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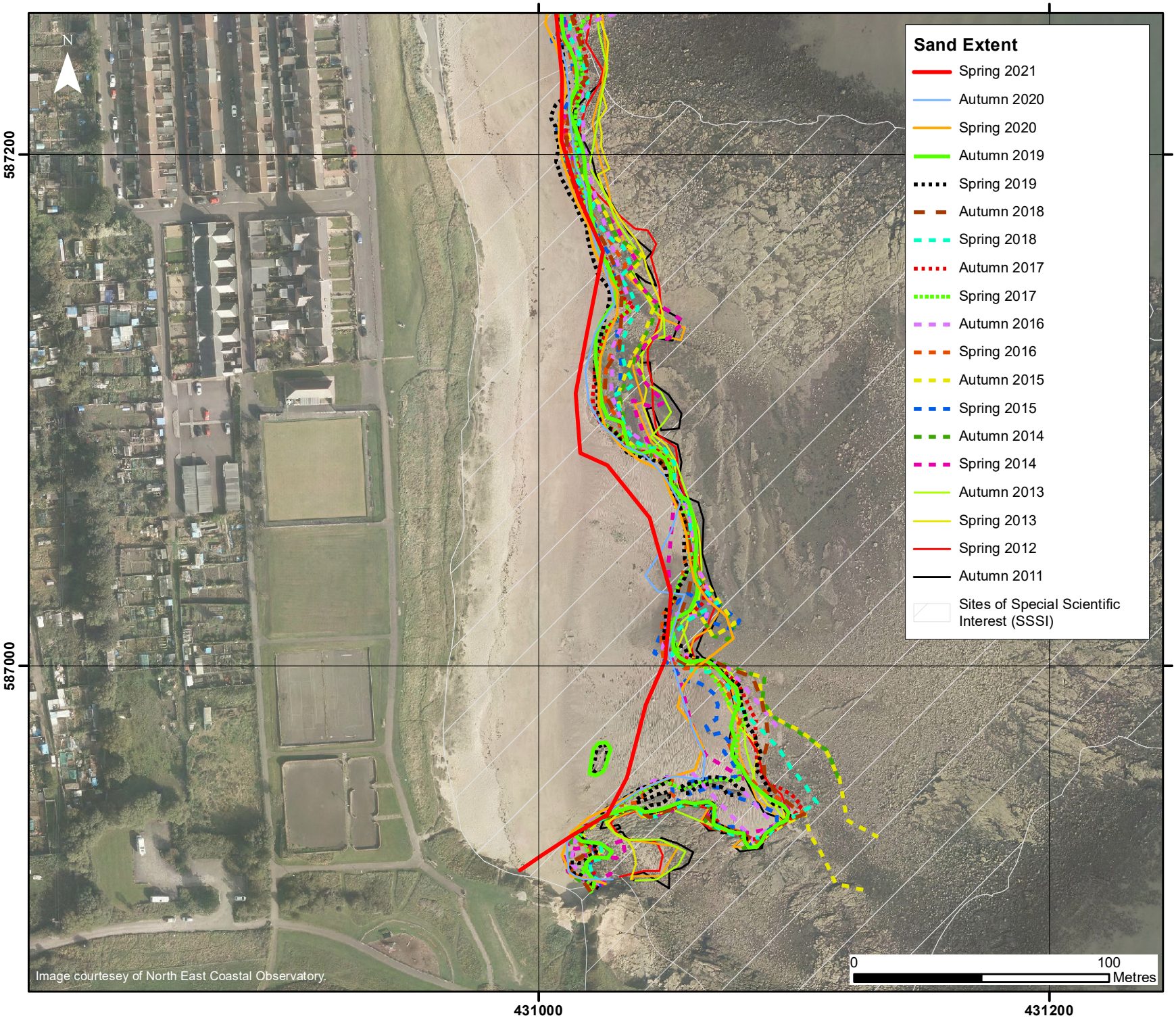
Appendix C

Sand Extent Survey



Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

NEWBIGGIN-BY-THE-SEA SAND EXTENT

Northumberland County Council Frontage

Update Report
'Partial Measures' Survey 2021

Drawing Scale at A4 1:2,000

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