



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

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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)
	Souter Point to Chourdon Point
HAT	3.18
MHWS	2.48
MLWS	-1.92

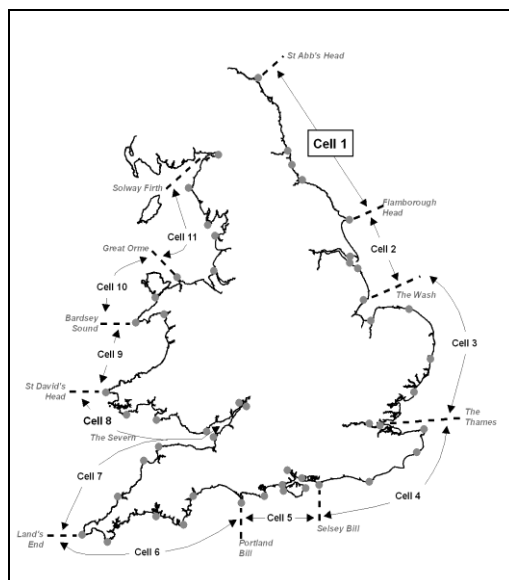
**Source:** *River Tyne to Flamborough Head Shoreline Management Plan 2.*  
Royal Haskoning, February 2007.

## 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	Sep-Dec 08	May 09	Mar-May 09		
2	2009/10	Sep-Dec 09	Mar 10	Feb-Mar 10	Jul 10	
3	2010/11	Aug-Nov 10	Feb 11	Feb-Apr 11	Aug 11	Sep 11
4	2011/12	Oct-Nov 11	Oct 12	Mar-May 12	Oct 12	
5	2012/13	Sep-Oct 12	Mar 13	Mar 13	Jun 13	
6	2013/14	Sep-Oct 13	Feb 14	Mar 14	Jul 14	
7	2014/15	Sep-Nov 14	Feb 15	Mar-Apr 15	Jul 15	
8	2015/16	Sep-Nov 15	Feb 16	Mar 16	Jul 16	Jun 16
9	2016/17	Sep-Nov 16	Feb 17	Apr 17	Jul 17	
10	2017/18	Oct-Nov 17	Mar 18	Mar 18	May 18	Nov 18
11	2018/19	Oct-Nov 18	Feb 19	Feb-Mar 19	May 19	
12	2019/20	Sep-Nov 19	Jan 20	Mar 20	Apr 20	
13	2020/21	Sep-Oct 20	Jan 21	Mar-Apr 21	May 21 (*)	Expected Summer 21

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

## **1. Introduction**

### **1.1 Study Area**

Sunderland City Council's frontage extends from The Bents to Ryhope. For the purposes of this report and for consistency with previous reporting, it has been sub-divided into three areas, namely:

- Whitburn Bay
- Sunderland Harbour and Docks
- Hendon to Ryhope (including Halliwell Banks)

### **1.2 Methodology**

Along Sunderland City Council's frontage, the following surveying is undertaken:

- Full Measures survey annually each autumn comprising:
  - Beach profile surveys along 58 transect lines (commenced 2009)
  - Topographic survey at Whitburn Bay (commenced 2009)
  - Topographic survey at Hendon to Ryhope (including Halliwell Banks) (commenced 2009)
- Partial Measures survey annually each spring comprising:
  - Beach profile surveys along 16 transect lines (commenced 2009)
- Cliff top survey bi-annually at:
  - Hendon to Ryhope (including Halliwell Banks) (commenced 2009)

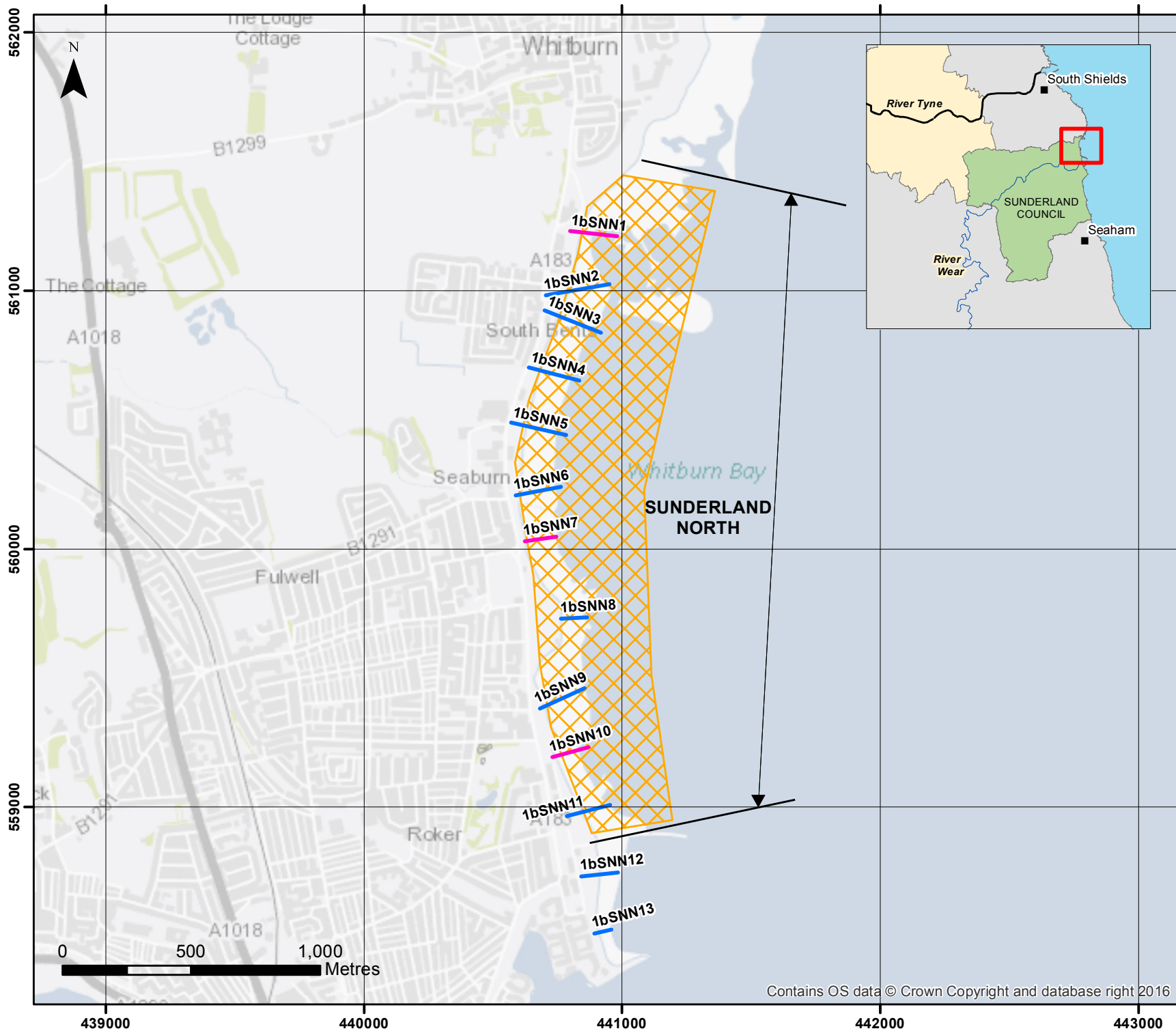
The location of these surveys is shown in Figure 2. The Partial Measures survey was undertaken along this frontage on 4<sup>th</sup> March 2021 (Whitburn Bay), and between 15<sup>th</sup> and 16<sup>th</sup> April 2021 (Hendon to Ryhope, including Halliwell Bank). During this time weather conditions varied, see surveyors reports for details.

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
- providing key conclusions and highlighting any areas of concern (Section 5).

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





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**

**Sunderland Council Frontage**

Analytical Report  
Topo Surveys

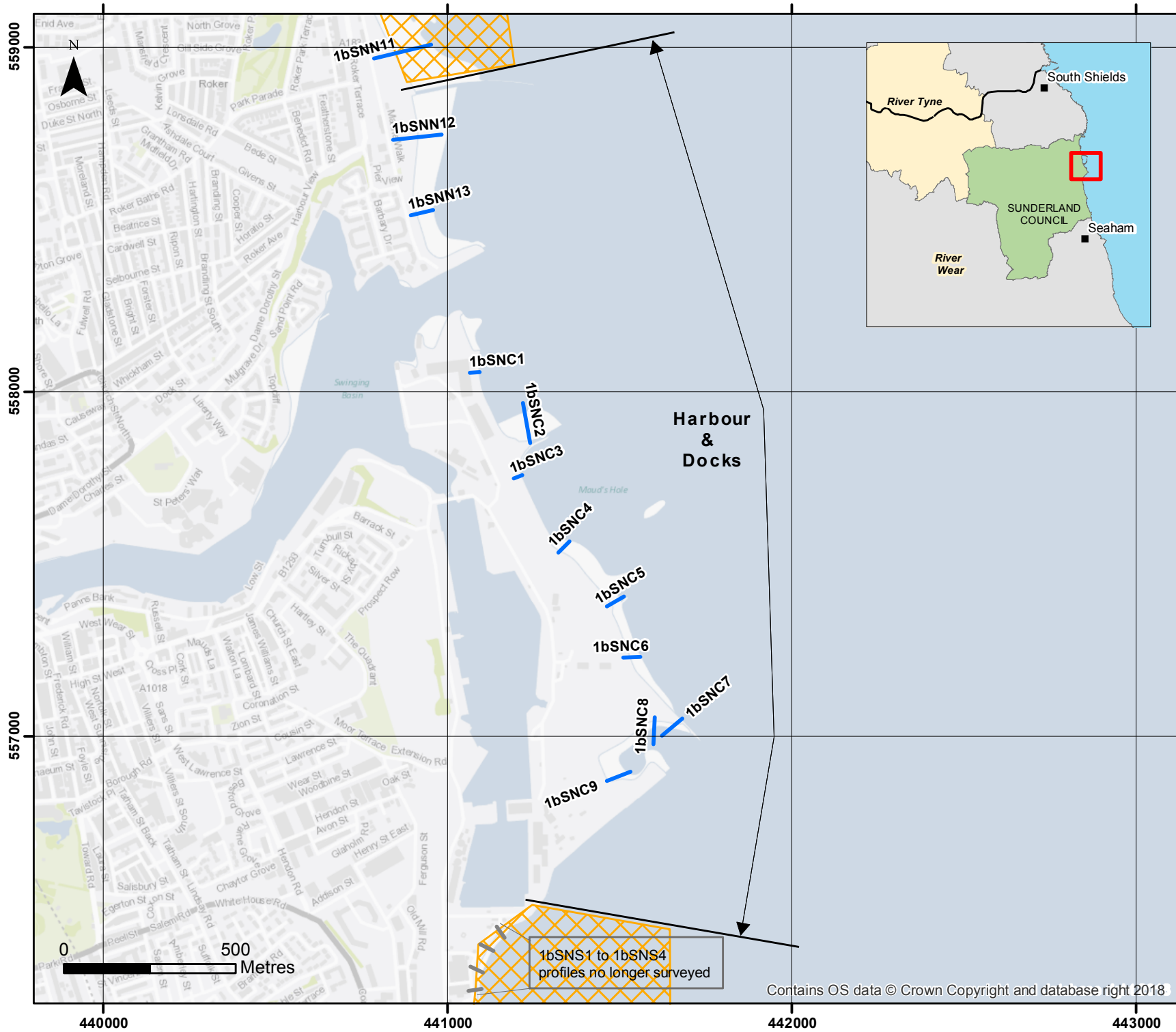
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**Key**

**SURVEY LOCATIONS**

**Topographic Profiles**

- Annual
- Bi-Annual
- Discontinued

**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  
 Sunderland Council  
 Frontage**

Analytical Report  
 Topo Surveys

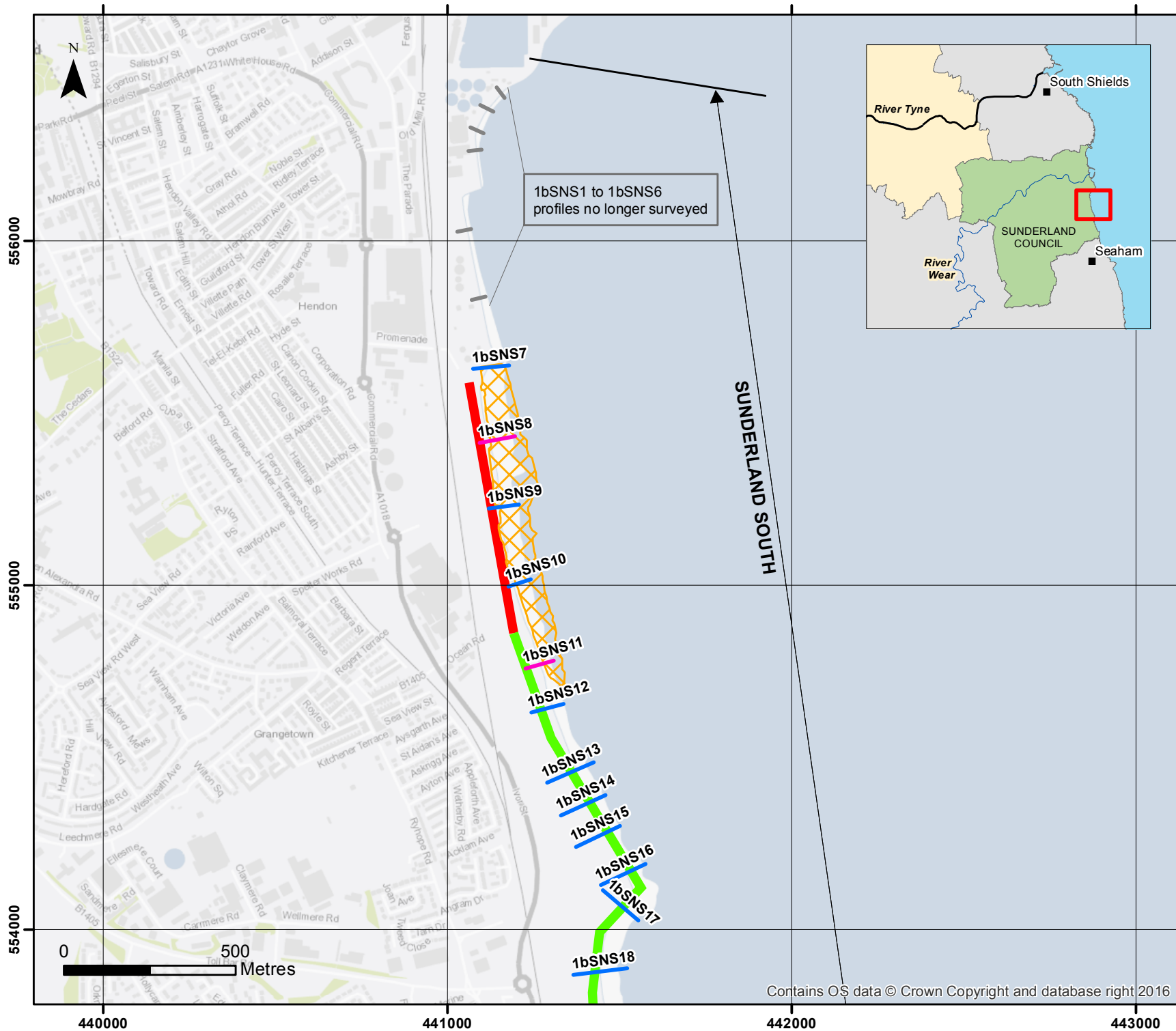
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**Key**

**SURVEY LOCATIONS**

**Topographic Profiles**

- Annual
- Bi-Annual
- Discontinued

**Topographic Surveys**

- 6 monthly
- yearly
- 5 yearly

**Cliff Top Monitoring Pegs**

- @ 100
- @ 300

*(Indicative Survey Extents shown)*

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

**Figure 2 - Map 3**

**Sunderland Council Frontage**

Analytical Report  
Topo Surveys

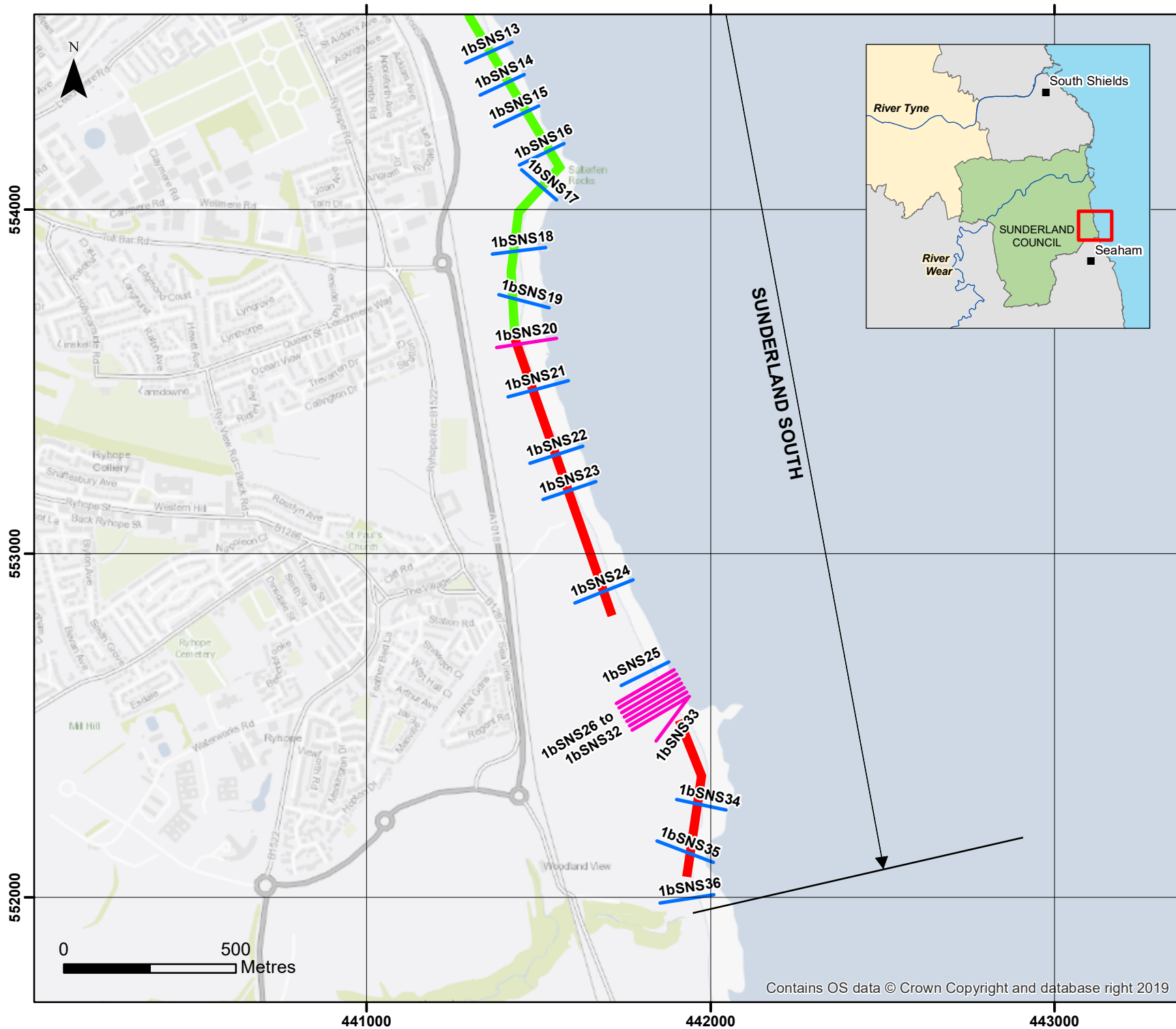
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Key

**SURVEY LOCATIONS**

**Topographic Profiles**

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

**Cliff Top Monitoring Pegs**

- @ 100 (Green line)
- @ 300 (Red line)

(Indicative Survey Extents shown)

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

**Figure 2 - Map 4**

**Sunderland Council Frontage**

Analytical Report  
Topo Surveys

Drawing Scale at A4 1:15,000

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## 2. Analysis of Survey Data

### 2.1 Whitburn Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
4 <sup>th</sup> March 2021	<p><b>Beach Profiles:</b></p> <p>Whitburn Bay is covered by three beach profile lines for the Partial Measures survey (Appendix A). The last survey was Full Measures, undertaken in Autumn 2020.</p> <p><b>1bSNN1</b> is just to the south of Sunderland City Council's northern boundary. Since the last survey, the backshore above HAT has changed little, with small sections of accretion of up to 0.1m. From chainage 45m to 121m, an upper beach berm has been removed and the beach has lowered by up to 1.4m. Between chainages 121-180m beach levels have risen by 1.0m, forming a prominent lower beach berm. The beach toe has lowered by up to 0.5m. The upper and lower beach are at a relatively high level compared to the range recorded from previous surveys, particularly between chainages 140m and 175m which is at its highest level recorded. The middle beach is at a medium level. The beach toe is at one of its lowest levels recorded, in line with Spring 2019 and Spring 2020 levels.</p> <p><b>1bSNN7</b> is at Seaburn, north of Parson's Rock. Beach levels have lowered evenly across the beach profile seaward of the seawall by up to 0.5m to the end of the survey at chainage 174m. Overall, the entire beach profile is at a medium level compared to the range recorded from previous surveys.</p> <p><b>1bSNN10</b> is located mid-way between Parson's Rock and Roker Pier. Similar to profile 1bSNN7, the beach profile seaward of the seawall has lowered evenly by up to 0.4m on the upper beach and up to 0.2m on the middle and lower beach. The profile across the upper, middle and lower beach is at a medium level compared to the range recorded from previous surveys.</p>	<p>Beach levels in the centre and south of Whitburn Bay have lowered evenly by up to 0.5m. The northern beach profile has experienced draw down of sediment from the upper beach to the lower beach.</p> <p><b>Longer term trends:</b> Profiles in Whitburn Bay are generally within the bounds of previous surveys, however beach levels between chainages 140-175m at profile 1bSNN1 is now at its highest level recorded, whilst the beach toe is at one of its lowest levels recorded.</p>

## 2.2 Hendon to Ryhope (incl. Halliwell Banks)

Survey Date	Description of Changes Since Last Survey	Interpretation
<p>15<sup>th</sup>-16<sup>th</sup> April 2021</p>	<p><b>Beach Profiles:</b></p> <p>Hendon to Ryhope is covered by twelve beach profile lines for the Partial Measures survey (Appendix A). The last survey was Full Measures, undertaken in Autumn 2020.</p> <p>Profile <b>1bSNS8</b> extends across the seawall, rock revetment, and sandy beach. Beach levels have generally lowered across the beach profile by up to 0.3m on the upper beach and 0.7m on the middle and lower beach exposing rocks between chainages 48-76m. Accretion has occurred at the toe of the seawall at chainage 22m to chainage 25m by up to 0.7m, and between chainages 38-45m by up to 0.3m. The upper beach profile is at a high level compared to the range recorded from previous surveys, whilst the middle to lower beach profile is at a low level, particularly between chainages 44m and 76m which is at its lowest level recorded.</p> <p>Profile <b>1bSNS11</b> starts at the coastal slope backing the sea wall and extends over the rock armour and beach. Beach levels have decreased from the toe of the rock armour to chainage 50m by up to 0.2m, switching to accretion between chainages 50-58m by up to 0.2m. Beach levels across the middle beach have remained stable, whilst the lower beach has lowered by up to 0.6m. Overall the beach profile is at a medium-high level compared to the range recorded from previous surveys, particularly between chainages 50-55m which is at its highest level recorded, however the beach toe is at a low level.</p> <p>Profile <b>1bSNS20</b> is located at Shirley Banks. The cliff face has receded landward by approximately 1.0m. There has been accretion on the upper beach by up to 0.4m to chainage 63m. There appears to have been movement of some of the rocks between chainage 63-85m since the previous survey. Seaward of this point there is little change to the previously exposed rock patch. The entire beach profile is at a low level compared to the range recorded from previous surveys, particularly between chainages 66-82m which is at its lowest level recorded.</p> <p>Profile <b>1bSNS25</b> is located at Halliwell Banks. The cliff top has receded by approximately 1.0m since the last survey. The rest of the beach profile has accreted by up to 0.2m from the cliff toe to the exposed rock patch at chainage 85m. The beach profile is at a medium level compared to the range recorded from previous surveys.</p>	<p>At South Hendon (1bSNS8 to 1bSNS20), there has generally been a lowering of beach profiles, with small sections of accretion generally on the upper or middle beach. Profile 1bSNS25 has experienced an increase in beach levels since the previous survey. The cliff top at 1bSNS20 and 1bSNS25 has retreated by up to 1.0m.</p> <p>At the landfill site (profiles 1bSSN26 to 1bSSN33) the cliff has experienced erosion of the cliff top and toe across the majority of profiles. Generally, the northern-most profiles (1bSNS26-1bSNS28) are dominated by a lowering of the upper and lower beach, with some low levels of accretion across the middle beach, whilst the southern-most profiles (1bSNS29-1bSNS33) have experienced a lowering across the entire beach profile.</p> <p><b>Longer term trends:</b> In general, the profile change along the Hendon to Ryhope frontage is within the bounds of previous surveys.</p> <p>At the landfill site, several profiles continue to show recession of the cliff top and toe. Overall, beach levels are at a medium-low level, with the section between 93-120m at profile 1bSNS33 now at its lowest level recorded.</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>Profiles <b>1bSNS26</b> to <b>1bSNS33</b> are located on Halliwell Banks to assess erosion of a former land fill site. Cliff tops are between 26m and 27mOD.</p> <p>At profiles <b>1bSNS26</b>, the cliff top has receded by approximately 1.0m, which is now at its most landward position recorded. The beach level at the cliff toe has lowered by 0.2m to chainage 96m. The beach profile has risen between chainages 96m to the exposed rock path at chainage 130m by up to 0.4m. Overall the profile is at a relatively medium level compared to the range recorded from previous surveys.</p> <p>At <b>1bSNS27</b> there has been no change in the position of the top of the cliff or cliff face, however the toe of the cliff has receded landward by approximately 1.0m. The upper beach has lowered by up to 0.4m to chainage 105m, before switching to accretion by up to 0.2m to the end of the survey at chainage 130m. The lower cliff face is at one of its most landward positions recorded. The beach profile is at a medium level compared to the range recorded from previous surveys.</p> <p>At <b>1bSNS28</b>, beach levels at the toe of the cliff have risen by 0.3m. The upper beach between chainages 94m -114m have lowered by up to 0.4m, resulting in a steeper upper beach. There is a small section of accretion on the middle beach between chainages 114m to 125m by 0.2m until the exposed rock patch. Seaward of the rock patch at chainage 137m there has been a lowering of the lower beach by up to 0.2m. Overall the beach profile is at a medium-low level compared to the range recorded from previous surveys.</p> <p>At profile <b>1bSNS29</b>, the cliff top and entire cliff face has retreated by approximately 1.0m and is now at its most landward position recorded. The rest of the beach profile has lowered by up to 0.7m on the upper beach, up to 0.2m on the middle beach and 0.4m on the lower beach. Overall, the beach is at a low level compared to the range recorded from previous surveys.</p> <p>At profile <b>1bSNS30</b>, there has been an apparent retreat of the lower cliff face by up to 3.0m. The beach profile has lowered by up to 0.5m on the upper beach, 0.6m on the middle beach, and 0.4m on the lower beach. Overall, the beach profile is at a low level compared to the range recorded from previous surveys.</p> <p>Profile <b>1bSNS31</b> shows an apparent retreat of the cliff face and toe by c.3.0m and is now at its most landward position recorded. Similar to previous profiles, the beach has lowered across the profile by up to 0.4m on the upper beach, 0.2m on the middle beach and 0.4m on the lower beach. Overall, the profile is at a low level compared to the range recorded from previous surveys.</p>	

Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>At profile <b>1BSNS32</b>, the cliff shows apparent recession of 1.2m at the toe, which is now at its most landward position recorded. The beach profile has lowered by up to 1.4m on the upper beach, 0.2m on the middle beach, and 0.4m on the lower beach. The rock patch seaward of chainage 130m is now exposed. Overall the beach profile is at a low level compared to the range recorded from previous surveys.</p> <p>At profile <b>1bSNS33</b>, the cliff shows apparent recession of approximately 1.0m at the cliff toe, which is now at its most landward position recorded. Overall the beach profile is at a low level compared to the range recorded from previous surveys, particularly between chainages 93-120m which is at its lowest level recorded.</p>	
<p><b>8<sup>th</sup>-11<sup>th</sup> March 2020</b></p>	<p><b>Cliff-top Survey:</b></p> <p>32 ground control points (numbered 1-32) were established along the cliff top between Hendon and Ryhope in March 2009, with a further three (28A, 28B and 28C) added in September 2009 (Figure 3). Note: the numbering of ground control points is not intended to correlate with that of the beach profile lines.</p> <p>Measurements are taken from each ground control point along a fixed bearing to the edge of the cliff top. These cliff top surveys are undertaken bi-annually and are intended to inform on erosion rates of the sea cliffs extending from the defended industrial areas at Hendon southwards along the undefended cliffs to Ryhope Dene.</p> <p>The results from the cliff top monitoring are anticipated to have an accuracy of <math>\pm 0.2\text{m}</math> due to the technique used. These cliff top surveys are undertaken bi-annually and are intended to inform on erosion rates of the sea cliffs extending from the defended industrial areas at Hendon southwards along the undefended cliffs to Ryhope Dene. Appendix B – Table B1 provides results from the March 2009 cliff top survey, showing the position from the ground control point to the edge of the cliff top along a defined bearing. Also shown is the change in measurement since the original (March 2009) and previous (October 2020) cliff top surveys.</p> <p>Results show that since the last survey, fourteen locations have shown erosion greater than the anticipated survey error; Point 3 by 0.21m, Point 5 by 3.41m, Point 11 by 0.59m, Point 13 by 0.44m, Point 16 by 0.24m, Point 23 by 1.16m, Point 24 by 0.69m, Point 25 by 1.31m, Point 26 by 0.22m, Point</p>	<p>Since the last survey, the cliffs at Points 3, 5, 11, 13, 16, 23-28, 28B, 29 and 30 have eroded, with very little change elsewhere. Point 5 shows the greatest amount of erosion of 3.41m.</p> <p><b>Longer term trends:</b> Since 2009, the majority of the points south of the sea defences have eroded. The greatest erosion has occurred at points 10, 25, 26, 27, 28A and 31 where between 7.48m and 12.26m have been lost.</p>



Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>27 by 0.51m, Point 28 by 1.61m, Point 28B by 0.81m, Point 29 by 0.5m and Point 30 by 0.59m.</p> <p>Since surveys began in March 2009 (or September 2009 for 28A, 28B, and 28C) erosion greater than the survey error has occurred at around 80% of the ground control points, where total losses are 12.26m (at Point 25) at their greatest, and more typically less than 5m. The long-term erosion rates are up to 1.02m/yr and 0.97m/yr (Point 25 and Point 27, respectively), with up to 0.5m/yr being more typical.</p>	

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

#### **Individual Profiles**

- No problems were encountered.

#### **Cliff Top Surveys**

- The largest cliff erosion encountered since the previous survey was located at VMP's 5, 23, 25 and 28 where cliff top recession of between 1.16m and 3.41m was recorded.

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

- No changes are recommended at the present time.

### **5. Conclusions and Areas of Concern**

- At Whitburn Bay, the recorded profiles are generally within the bounds of previous surveys and present no causes for concern. The only exception is at profile 1bSNN1 where the beach level between chainages 140-175m is at its highest level recorded, and the beach toe is at one of its lowest levels recorded.
- At Hendon to Ryhope (incl. Halliwell Banks), cliff top erosion at the landfill site in Halliwell Banks is ongoing, with several points recording erosion greater than the survey error. Points 5, 23, 25 and 28 showed between 1.16m and 3.41m of erosion since the previous survey (see Table B1 in Appendix B). The greatest amount of erosion recorded to have taken place between March 2009 and April 2021 was 12.26m at Point 25 which is along the border of the landfill site.
- Elsewhere at Hendon to Ryhope, the recorded profiles and cliff top surveys show no cause for concern. Profiles in the north have generally lowered, with small sections of accretion on the upper or middle beach. Profile SNS25 has accreted across the beach profile. The profiles at the landfill sites have mostly eroded, with a landward retreat of the cliff top and toe at the majority of profiles. Beach levels are at a medium-low levels compared to the range recorded from previous surveys.

## **Appendices**

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

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

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

# Beach Profile

Location: 1bSNN1

Date: 04/03/2021

Inspector: AG

Low Tide:

Low Tide Time:

Wind

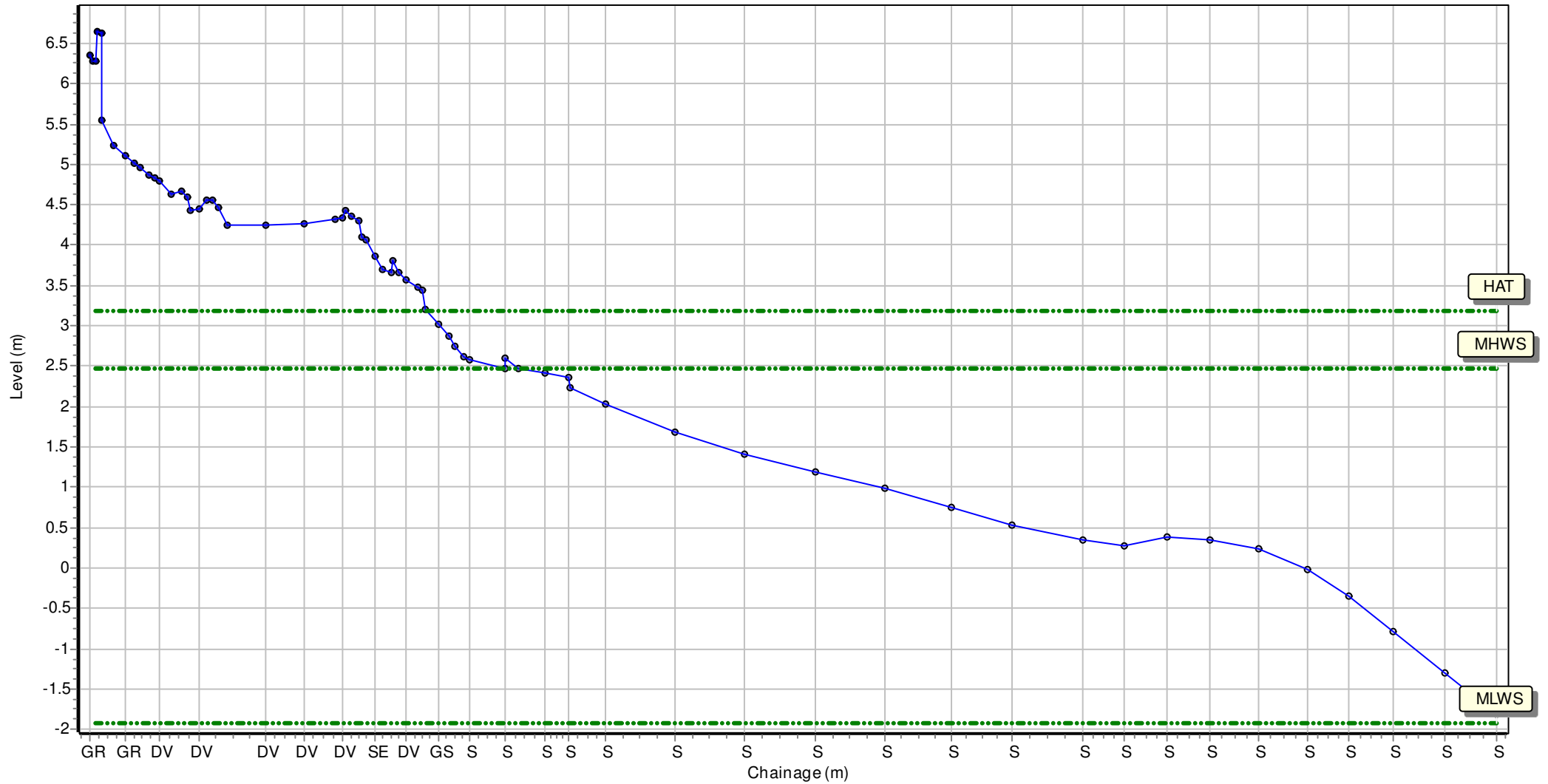
Sea State:

Visibility:

Rain:

Summary: 2021 Partial Measures Topo Survey

Easting: 440797.428 Northing: 561231.249 Profile Bearing: 97 ° from North



# Beach Profile

Location: 1bSNN7

Date: 04/03/2021

Inspector: AG

Low Tide:

Low Tide Time:

Wind

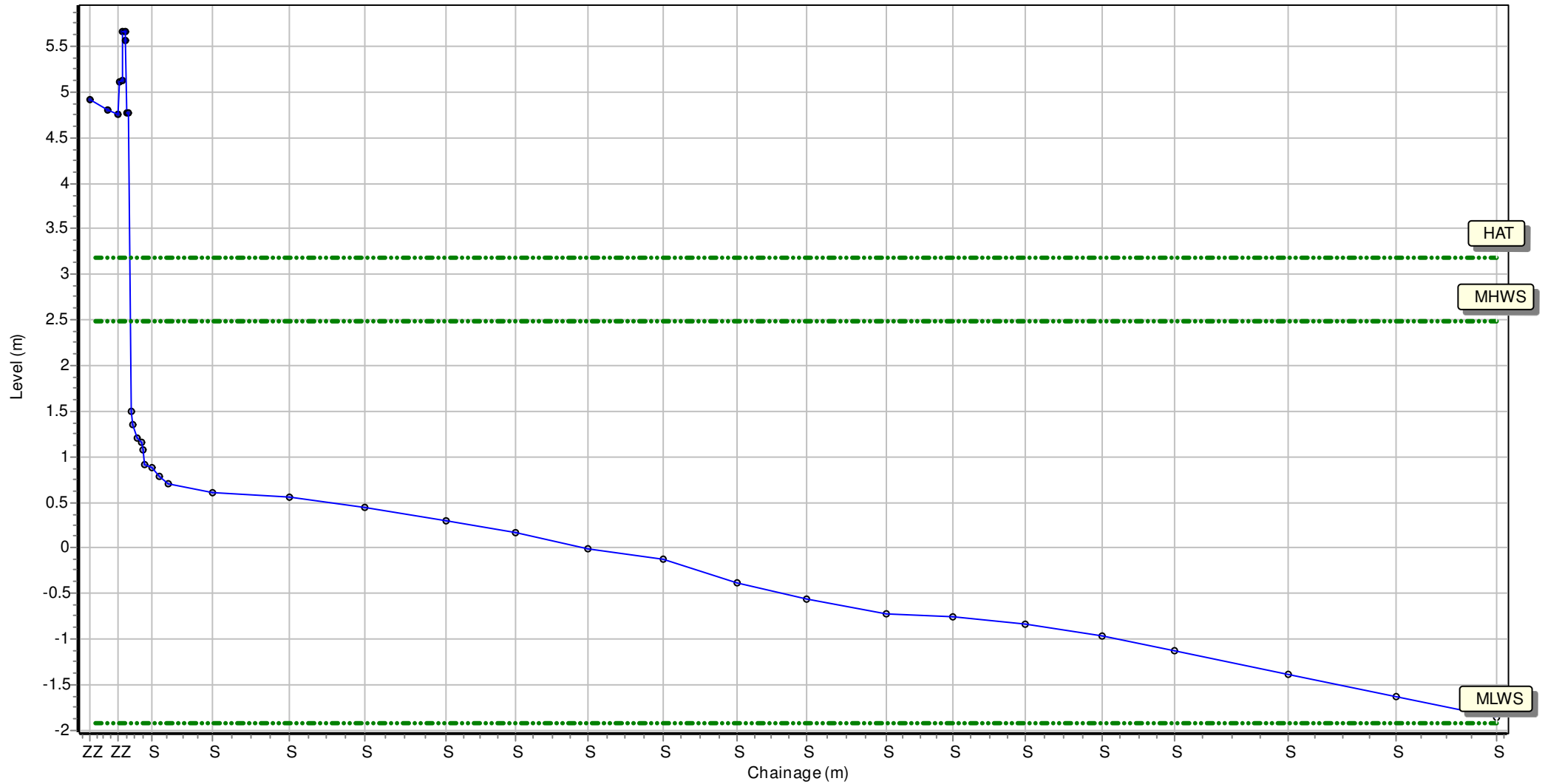
Sea State:

Visibility:

Rain:

Summary: 2021 Partial Measures Topo Survey

Easting: 440623.795 Northing: 560029.932 Profile Bearing: 81 ° from North



# Beach Profile

Location: 1bSNN10

Date: 04/03/2021

Inspector: AG

Low Tide:

Low Tide Time:

Wind

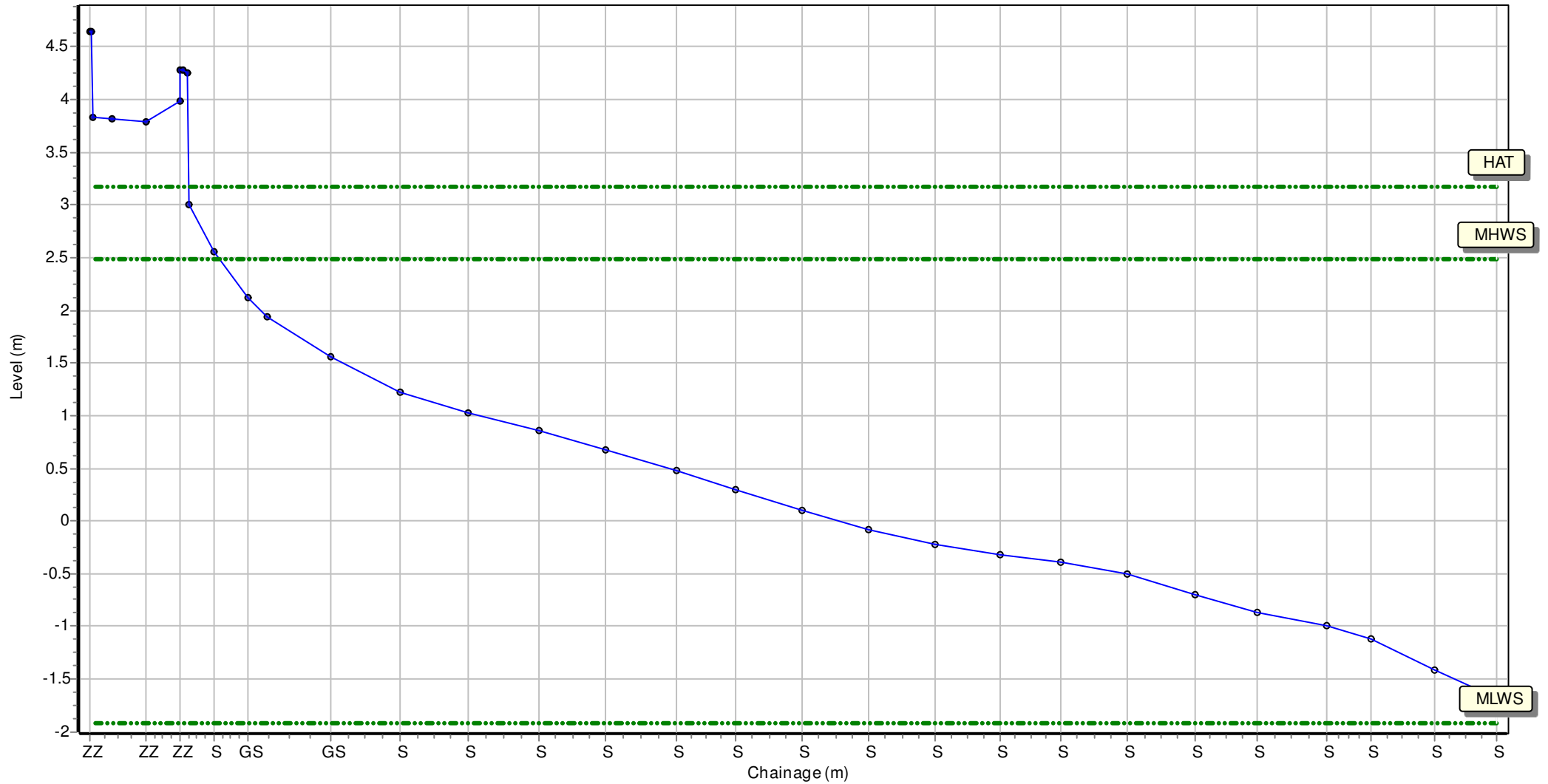
Sea State:

Visibility:

Rain:

Summary: 2021 Partial Measures Topo Survey

Easting: 440728.714 Northing: 559193.372 Profile Bearing: 74 ° from North





# Beach Profile

Location: 1bSNS8

Date: 16/04/2021

Inspector: AG

Low Tide:

Low Tide Time:

Wind

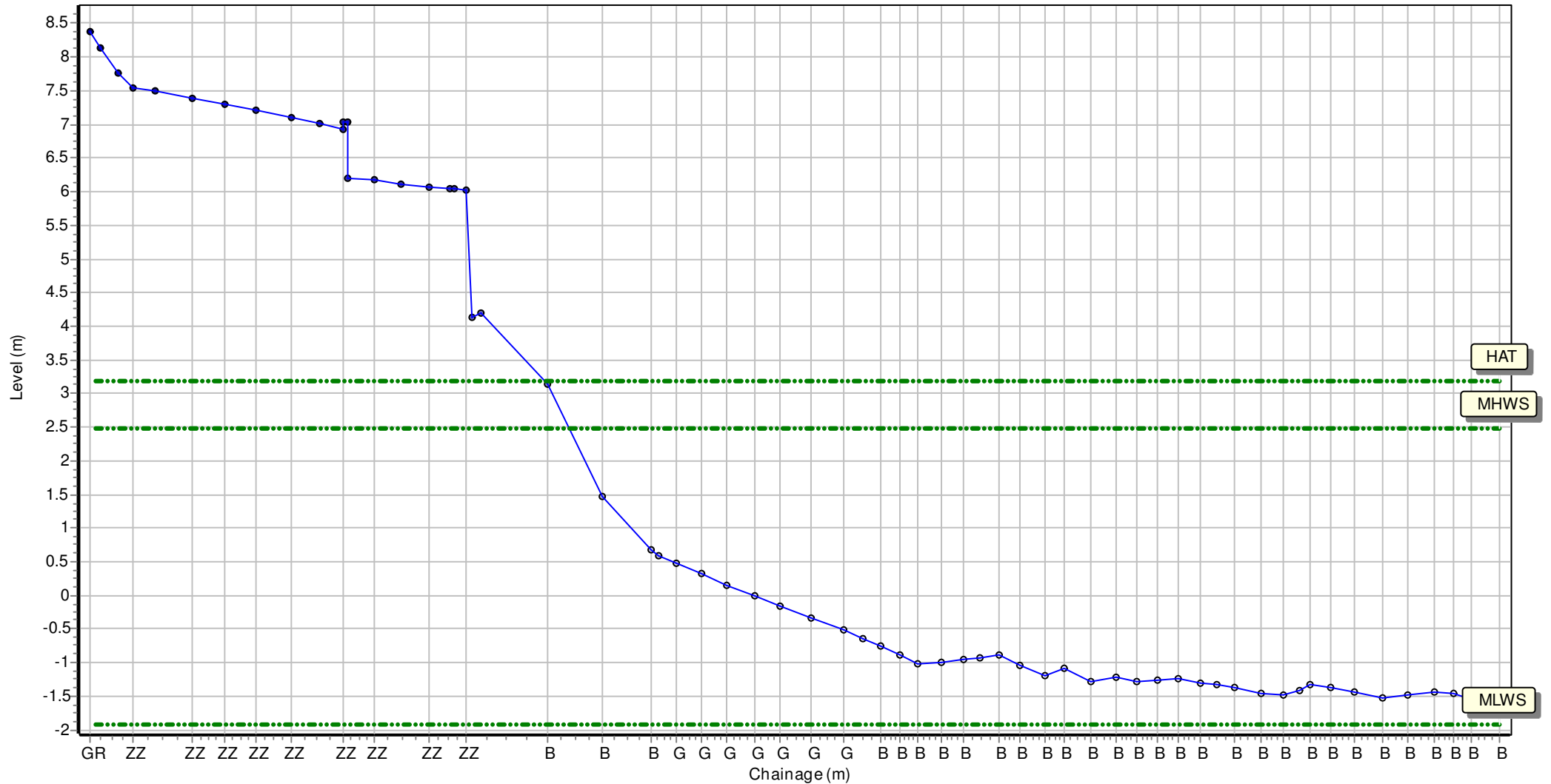
Sea State:

Visibility:

Rain:

Summary: 2021 Partial Measures Topo Survey

Easting: 441092.263 Northing: 555414.414 Profile Bearing: 80 ° from North



# Beach Profile

Location: 1bSNS11

Date: 16/04/2021 Inspector: AG

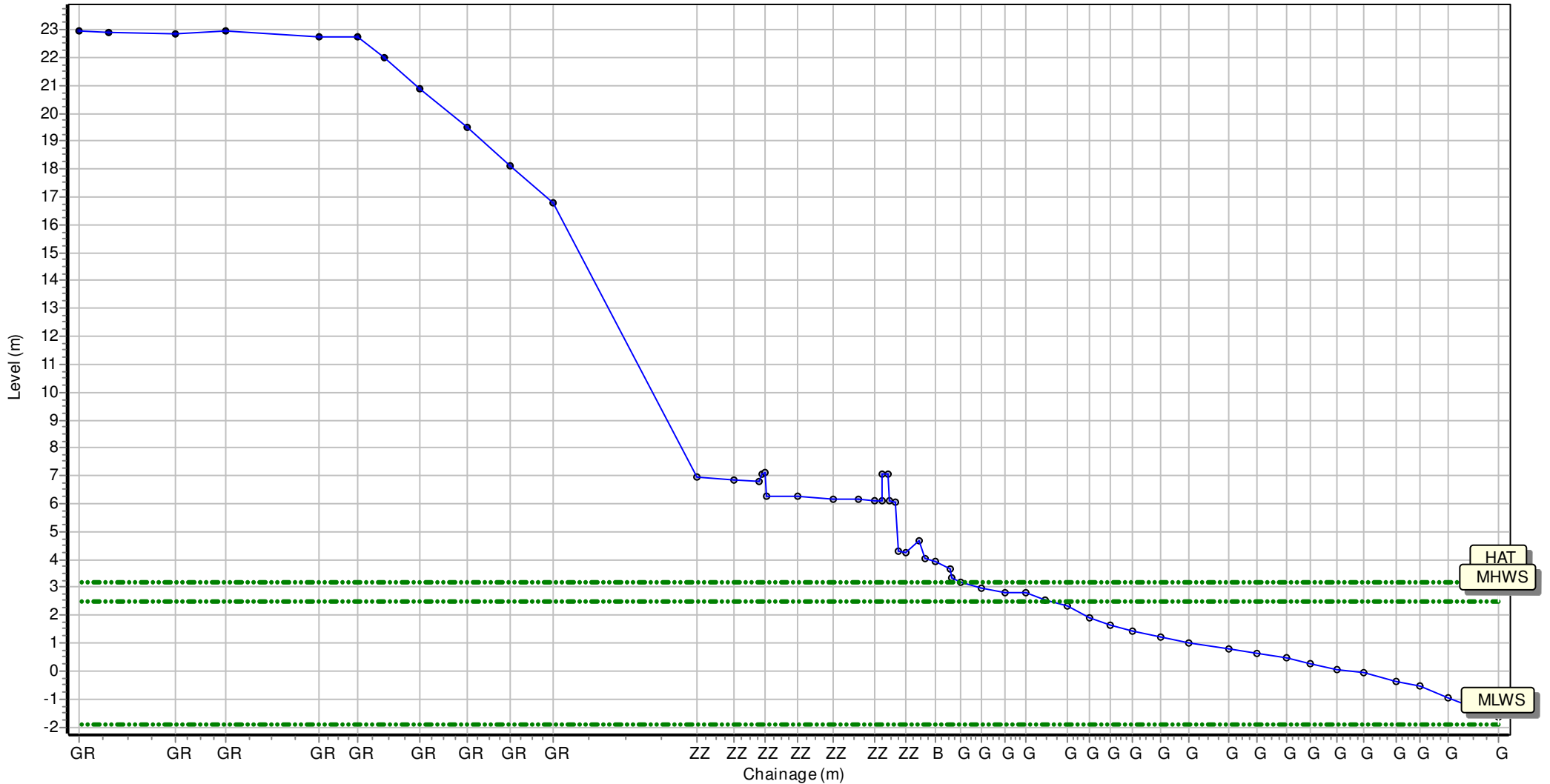
Low Tide: Low Tide Time:

Wind Sea State:

Visibility: Rain:

Summary: 2021 Partial Measures Topo Survey

Easting: 441225.182 Northing: 554759.021 Profile Bearing: 75 ° from North



# Beach Profile

Location: 1bSNS20

Date: 16/04/2021 Inspector: AG

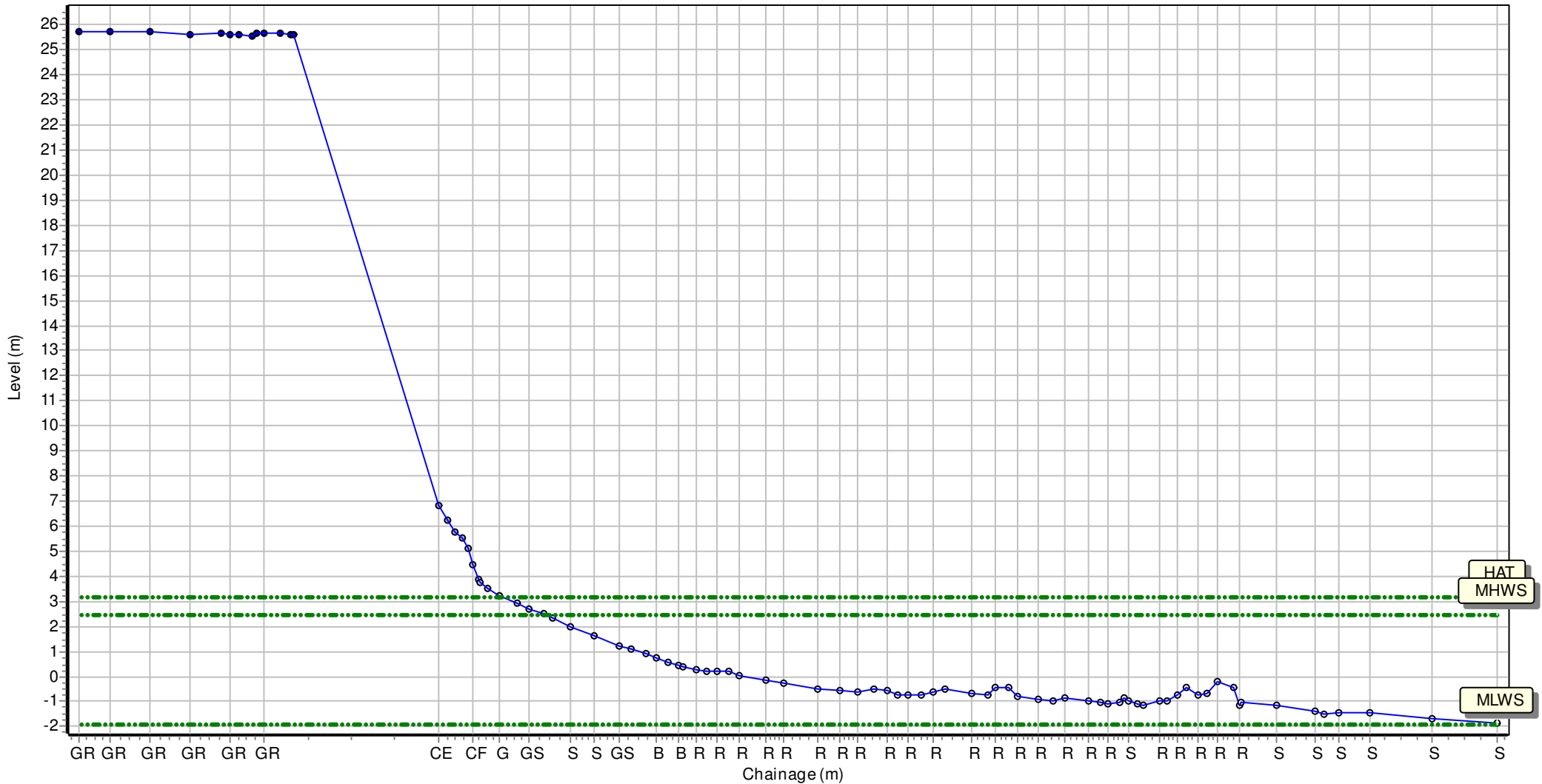
Low Tide: Low Tide Time:

Wind Sea State:

Visibility: Rain:

Summary: 2021 Partial Measures Topo Survey

Easting: 441378.054 Northing: 553599.123 Profile Bearing: 81 ° from North



# Beach Profile

Location: 1bSNS25

Date: 16/04/2021

Inspector: AG

Low Tide:

Low Tide Time:

Wind

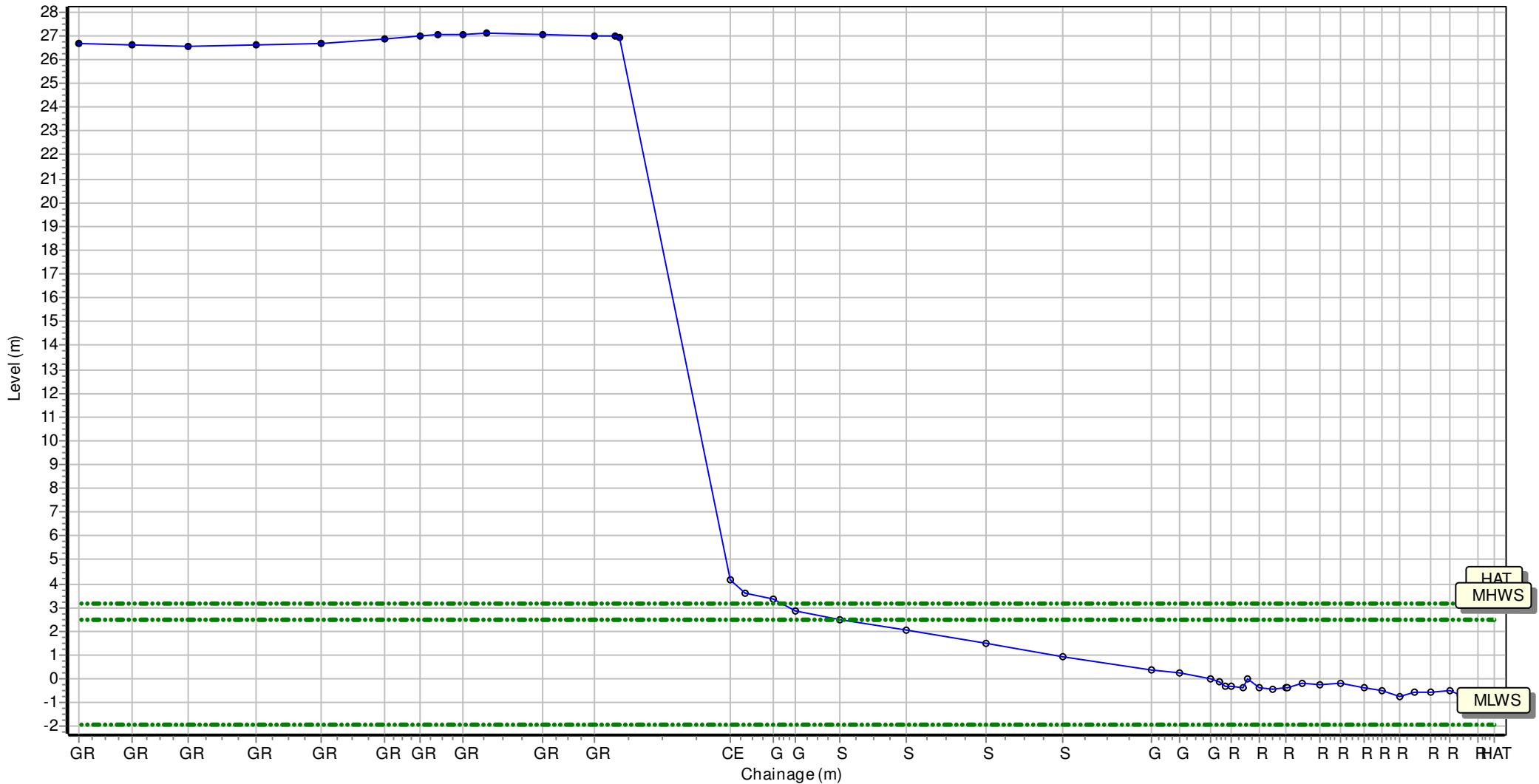
Sea State:

Visibility:

Rain:

Summary: 2021 Partial Measures Topo Survey

Easting: 441740.614 Northing: 552616.135 Profile Bearing: 64 ° from North



# Beach Profile

Location: 1bSNS26

Date: 16/04/2021

Inspector: AG

Low Tide:

Low Tide Time:

Wind

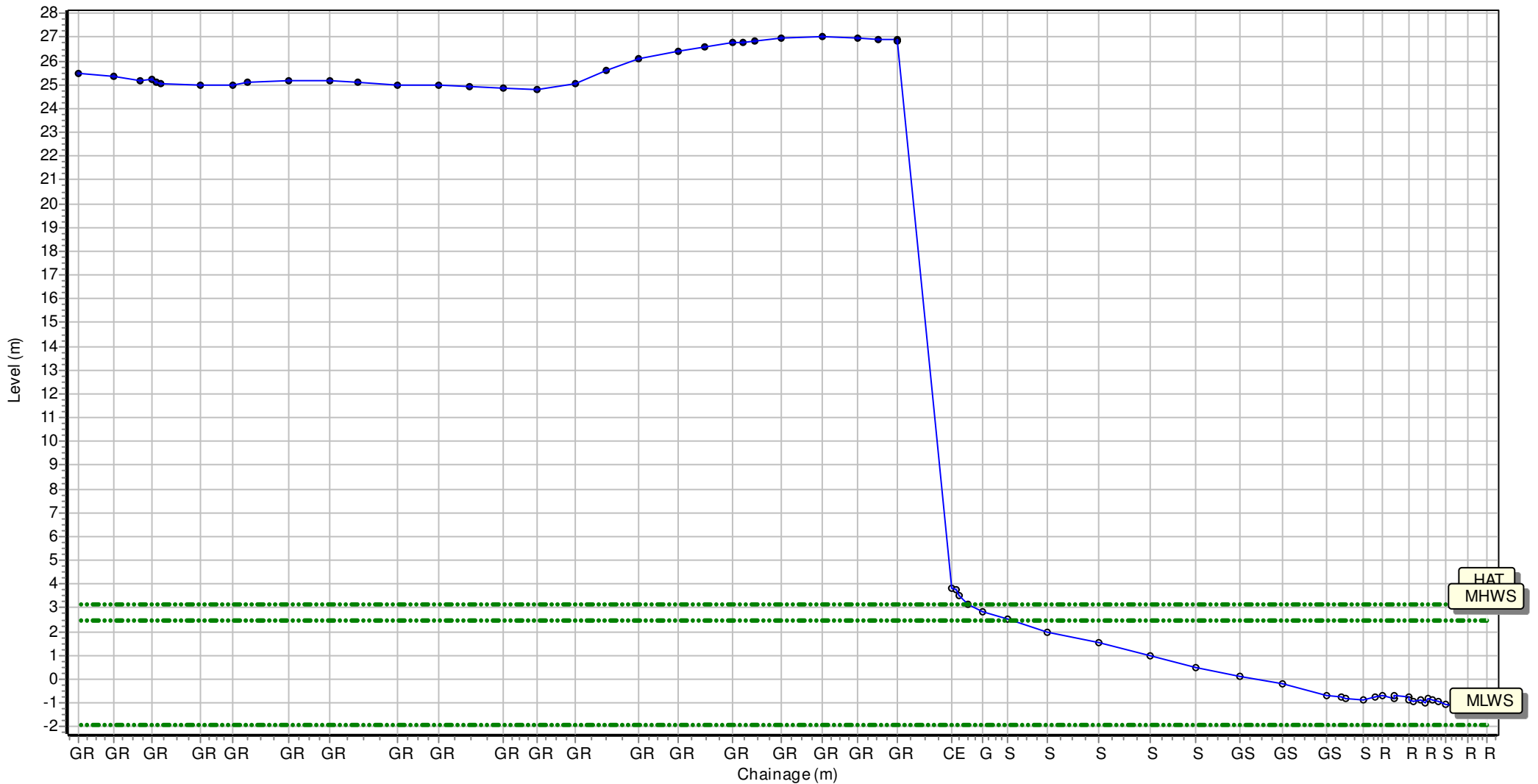
Sea State:

Visibility:

Rain:

Summary: 2021 Partial Measures Topo Survey

Easting: 441726.053 Northing: 552563.41 Profile Bearing: 60 ° from North



# Beach Profile

Location: 1bSNS27

Date: 16/04/2021

Inspector: AG

Low Tide:

Low Tide Time:

Wind

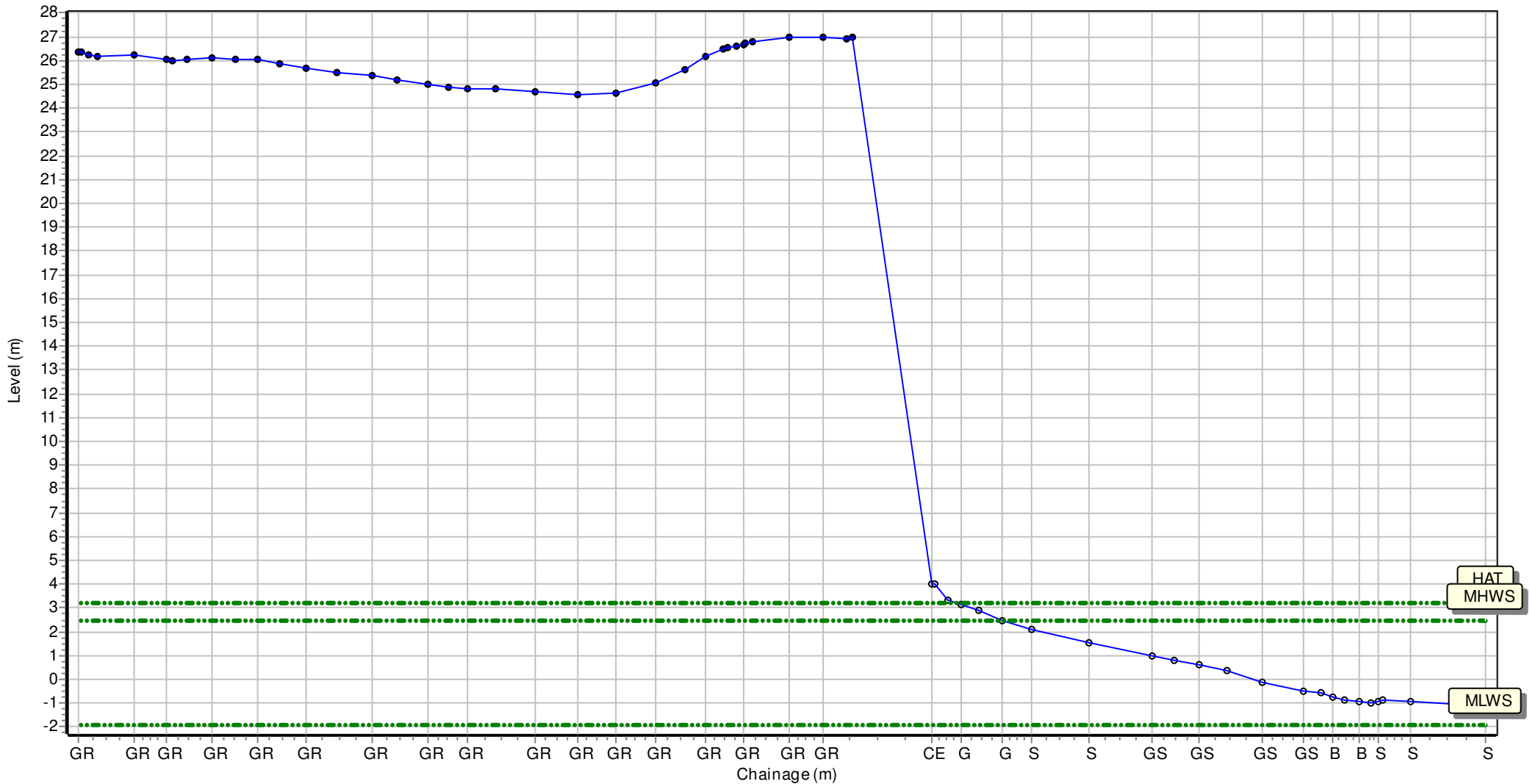
Sea State:

Visibility:

Rain:

Summary: 2021 Partial Measures Topo Survey

Easting: 441733.63    Northing: 552550.463    Profile Bearing: 60 ° from North



# Beach Profile

Location: 1bSNS28

Date: 16/04/2021

Inspector: AG

Low Tide:

Low Tide Time:

Wind

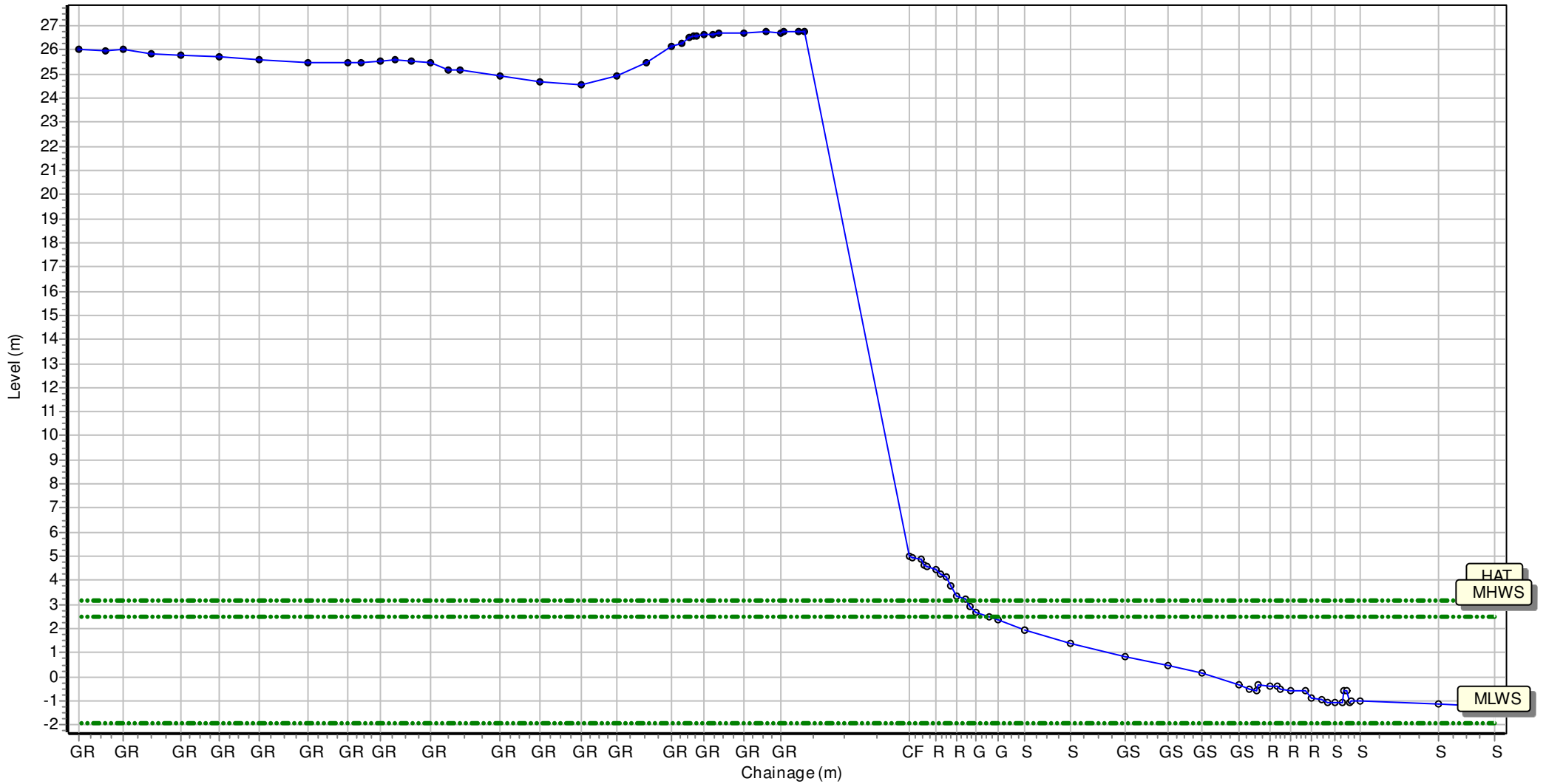
Sea State:

Visibility:

Rain:

Summary: 2021 Partial Measures Topo Survey

Easting: 441741.207 Northing: 552537.517 Profile Bearing: 60 ° from North



# Beach Profile

Location: 1bSNS29

Date: 16/04/2021 Inspector: AG

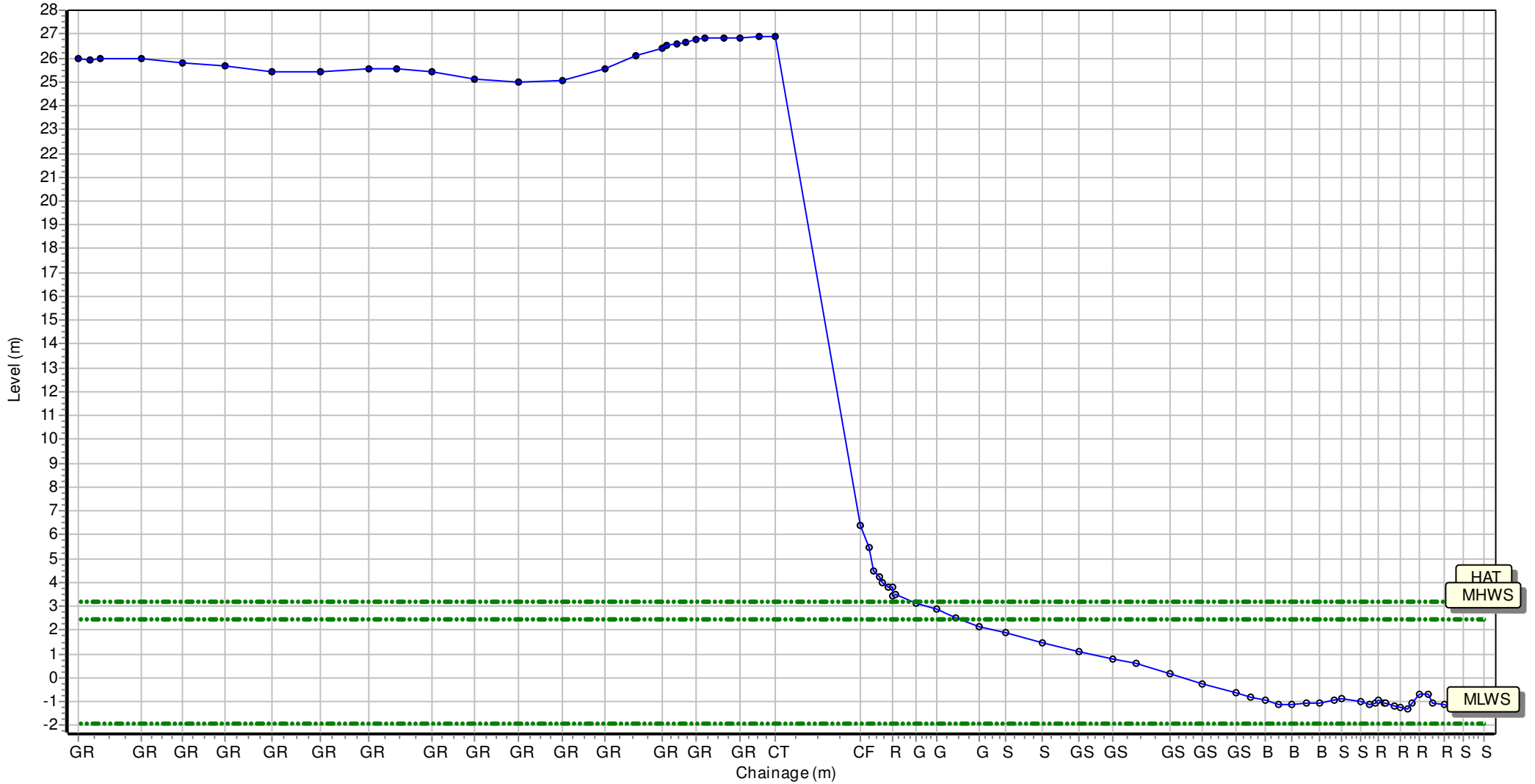
Low Tide: Low Tide Time:

Wind Sea State:

Visibility: Rain:

Summary: 2021 Partial Measures Topo Survey

Easting: 441748.776 Northing: 552524.571 Profile Bearing: 60 ° from North





# Beach Profile

**Location:** 1bSNS30

**Date:** 16/04/2021   **Inspector:** AG

**Low Tide:**

**Low Tide Time:**

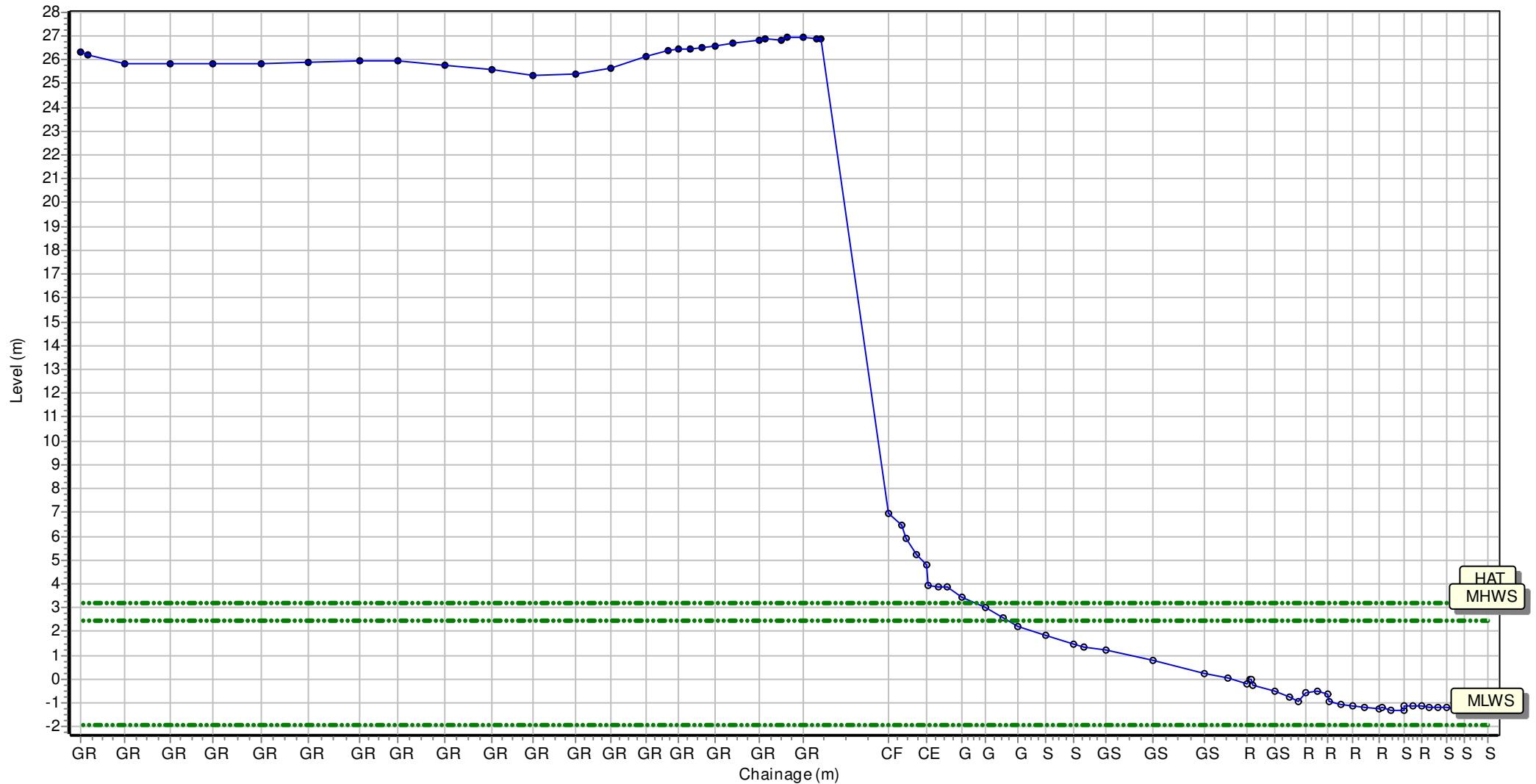
**Wind:**   **Sea State:**

**Visibility:**

**Rain:**

**Summary:** 2021 Partial Measures Topo Survey

**Easting:** 441756.353   **Northing:** 552511.624   **Profile Bearing:** 60 ° from North



# Beach Profile

Location: 1bSNS31

Date: 16/04/2021

Inspector: AG

Low Tide:

Low Tide Time:

Wind

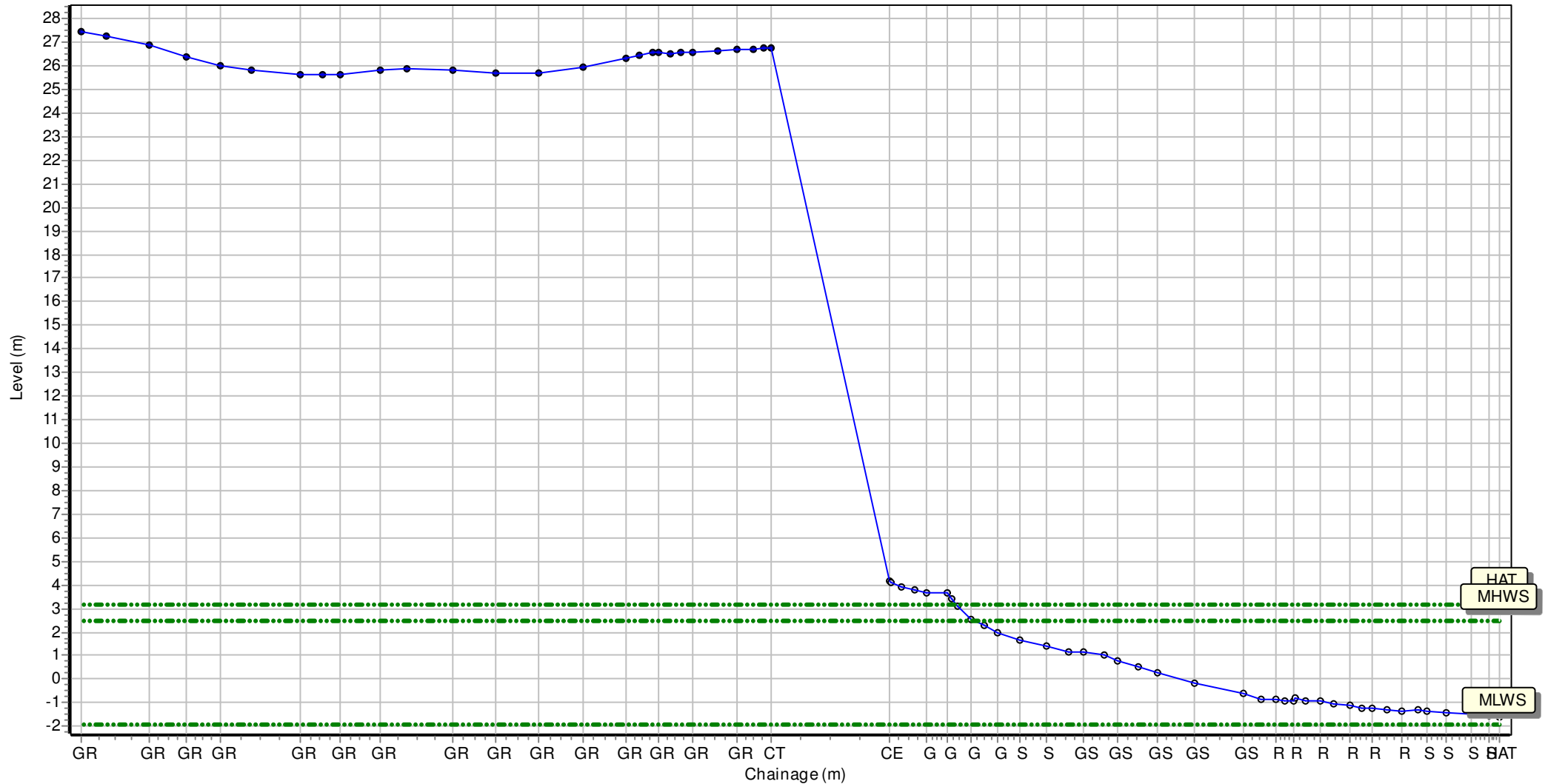
Sea State:

Visibility:

Rain:

Summary: 2021 Partial Measures Topo Survey

Easting: 441763.931 Northing: 552498.678 Profile Bearing: 60 ° from North



# Beach Profile

Location: 1bSNS32

Date: 16/04/2021 Inspector: AG

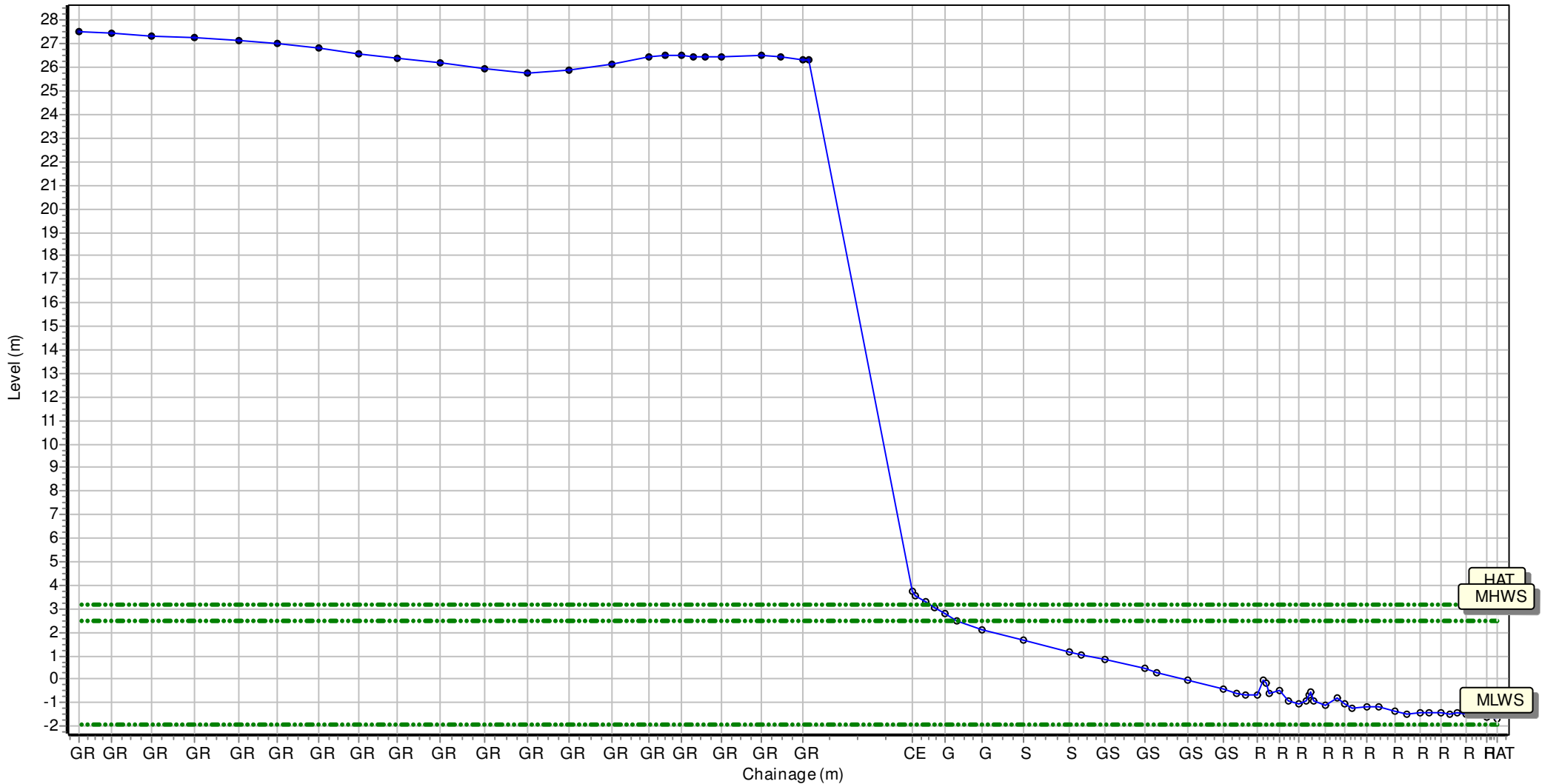
Low Tide: Low Tide Time:

Wind Sea State:

Visibility: Rain:

Summary: 2021 Partial Measures Topo Survey

Easting: 441771.5 Northing: 552485.732 Profile Bearing: 60 ° from North



# Beach Profile

Location: 1bSNS33

Date: 16/04/2021

Inspector: AG

Low Tide:

Low Tide Time:

Wind

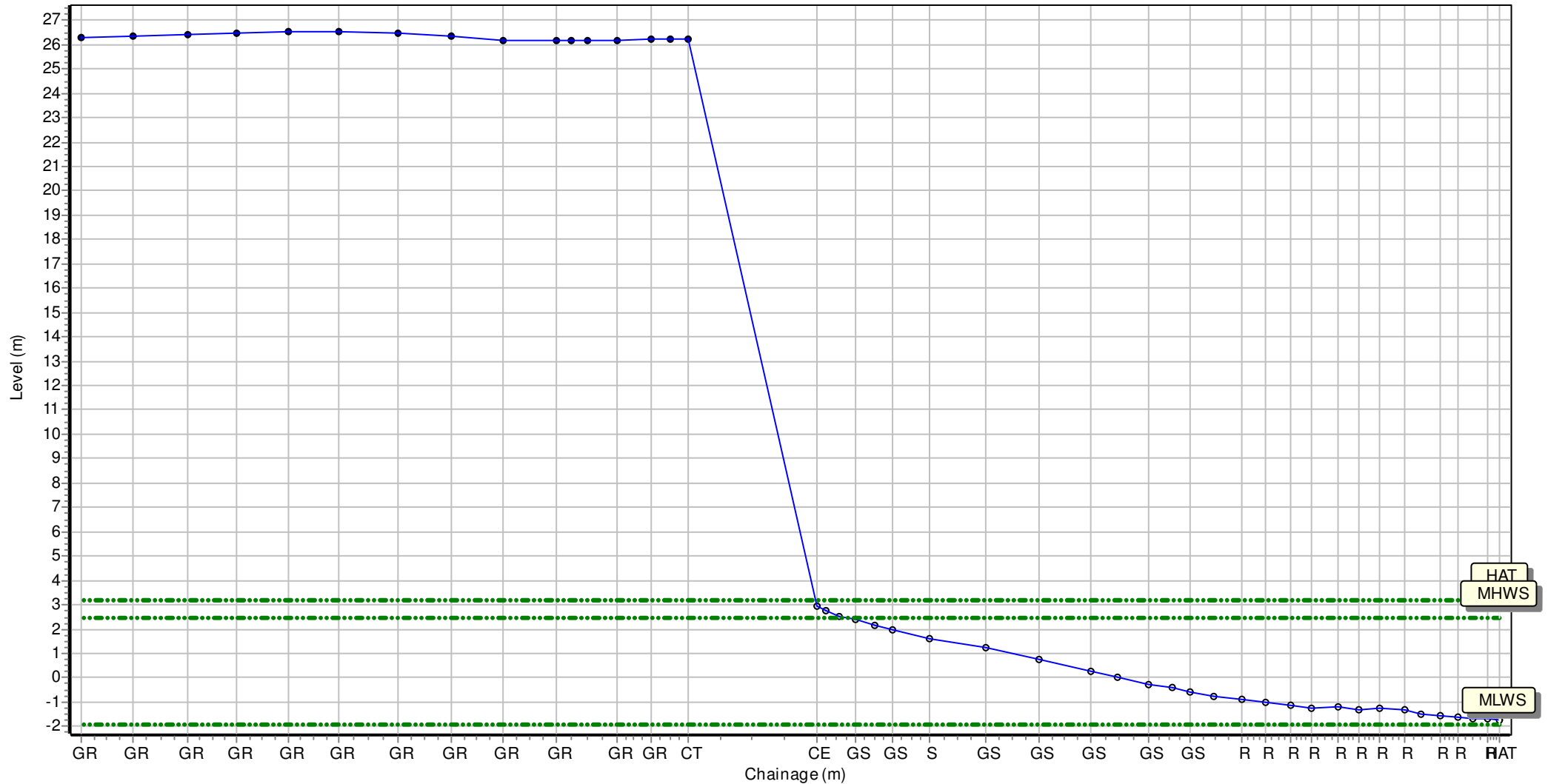
Sea State:

Visibility:

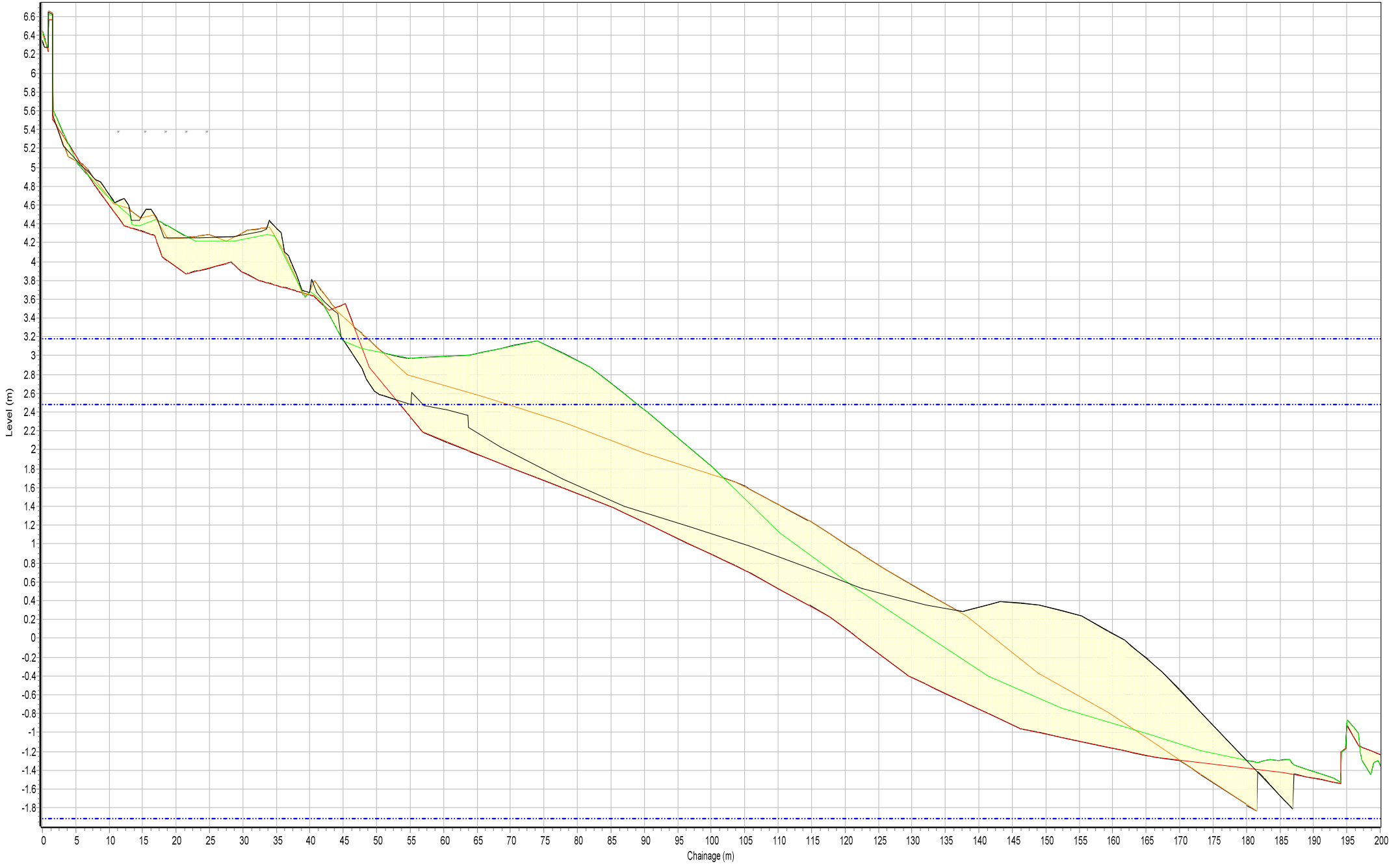
Rain:

Summary: 2021 Partial Measures Topo Survey

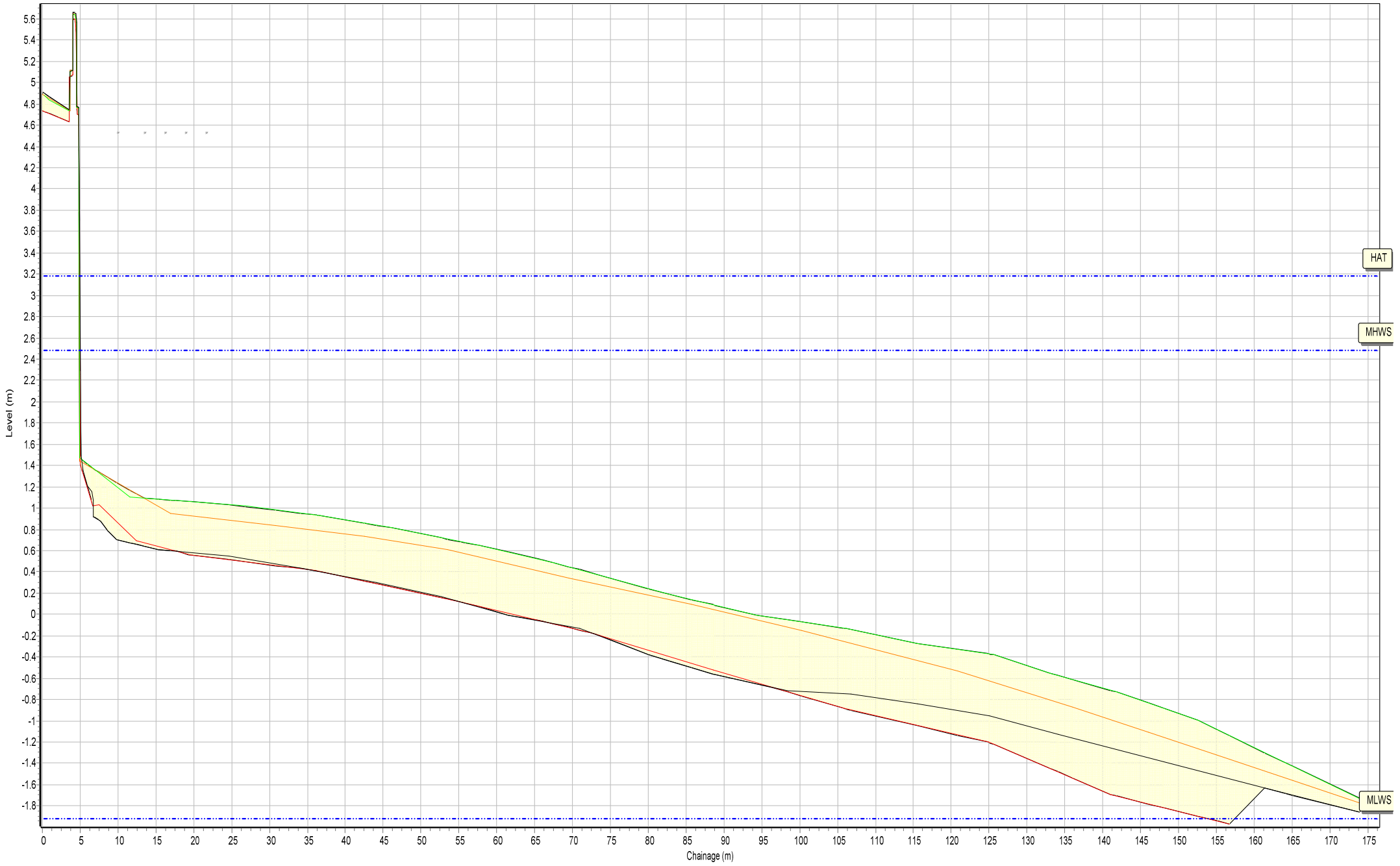
Easting: 441841.104 Northing: 552454.571 Profile Bearing: 37 ° from North



Beach Profiles: 1bSNN1



# Beach Profiles: 1bSNN7



Beach Profiles: 1bSNN10



Profiles Envelope 27/04/2009 08/03/2020 16/09/2020 04/03/2021

HAT

MHWS

MLWS

SANDS

# Beach Profiles: 1bSNS8



HAT

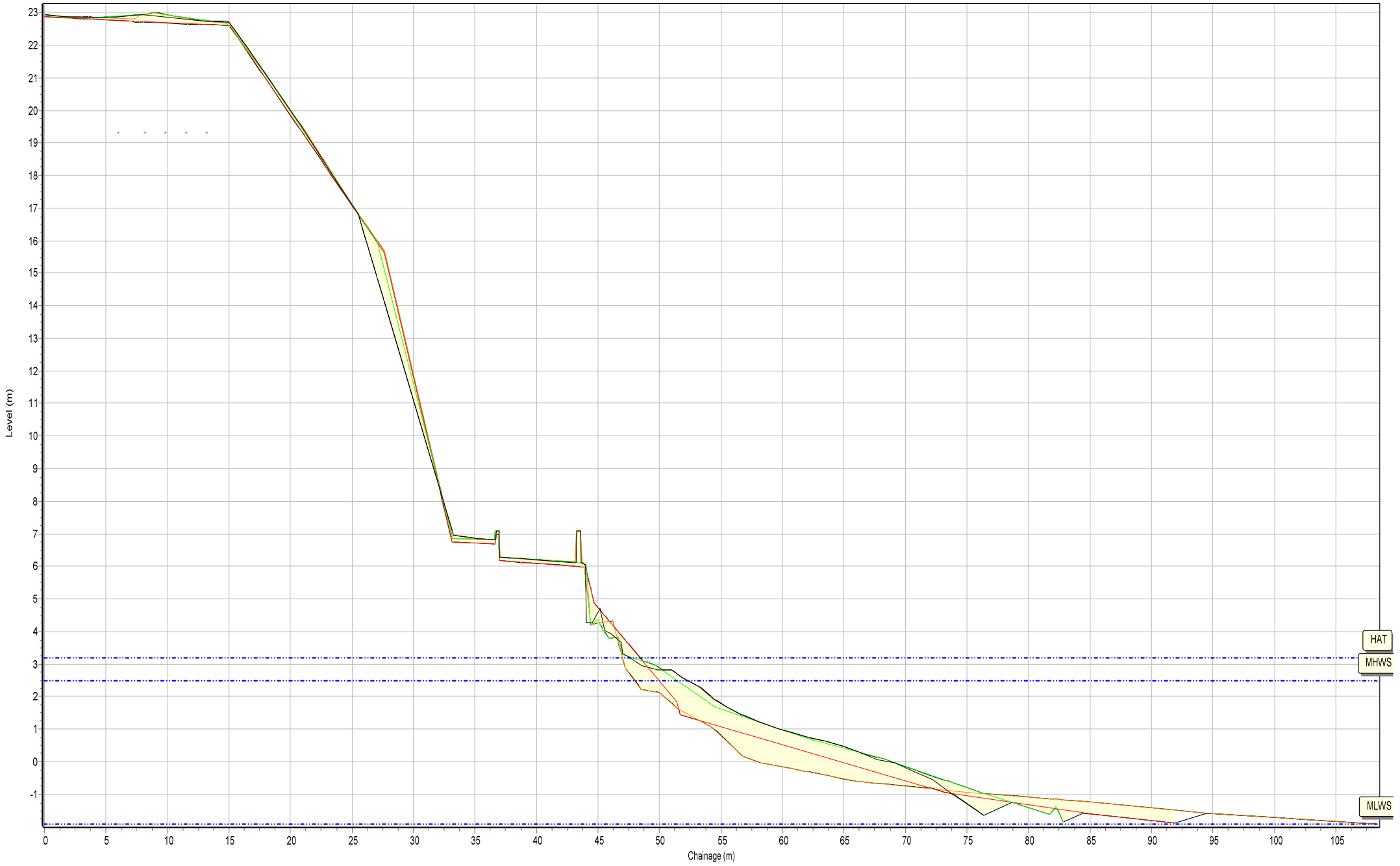
MHWs

MLWS

SANDS



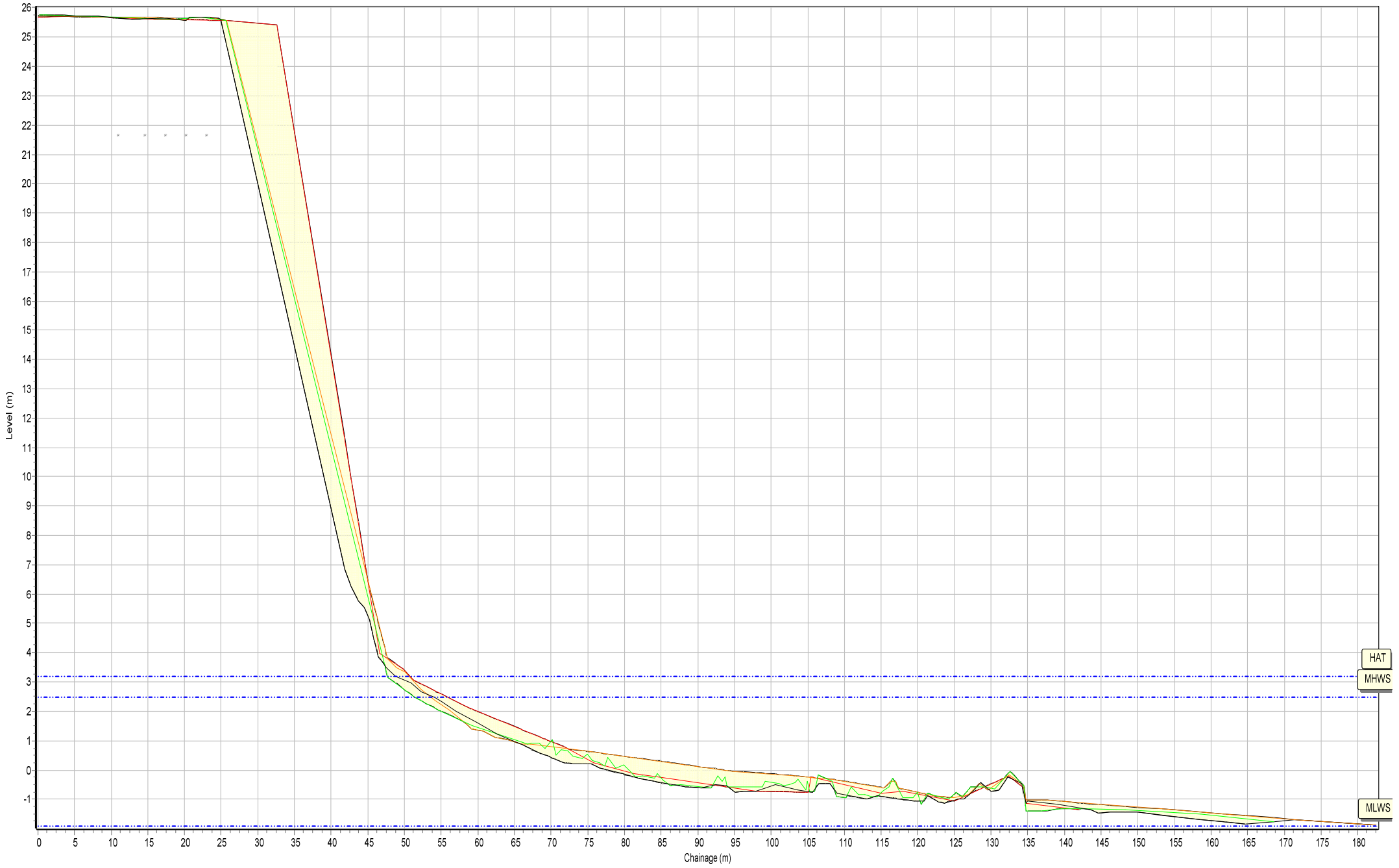
Beach Profiles: 1bSNS11



HAT  
MHWS  
MLWS

SANDS

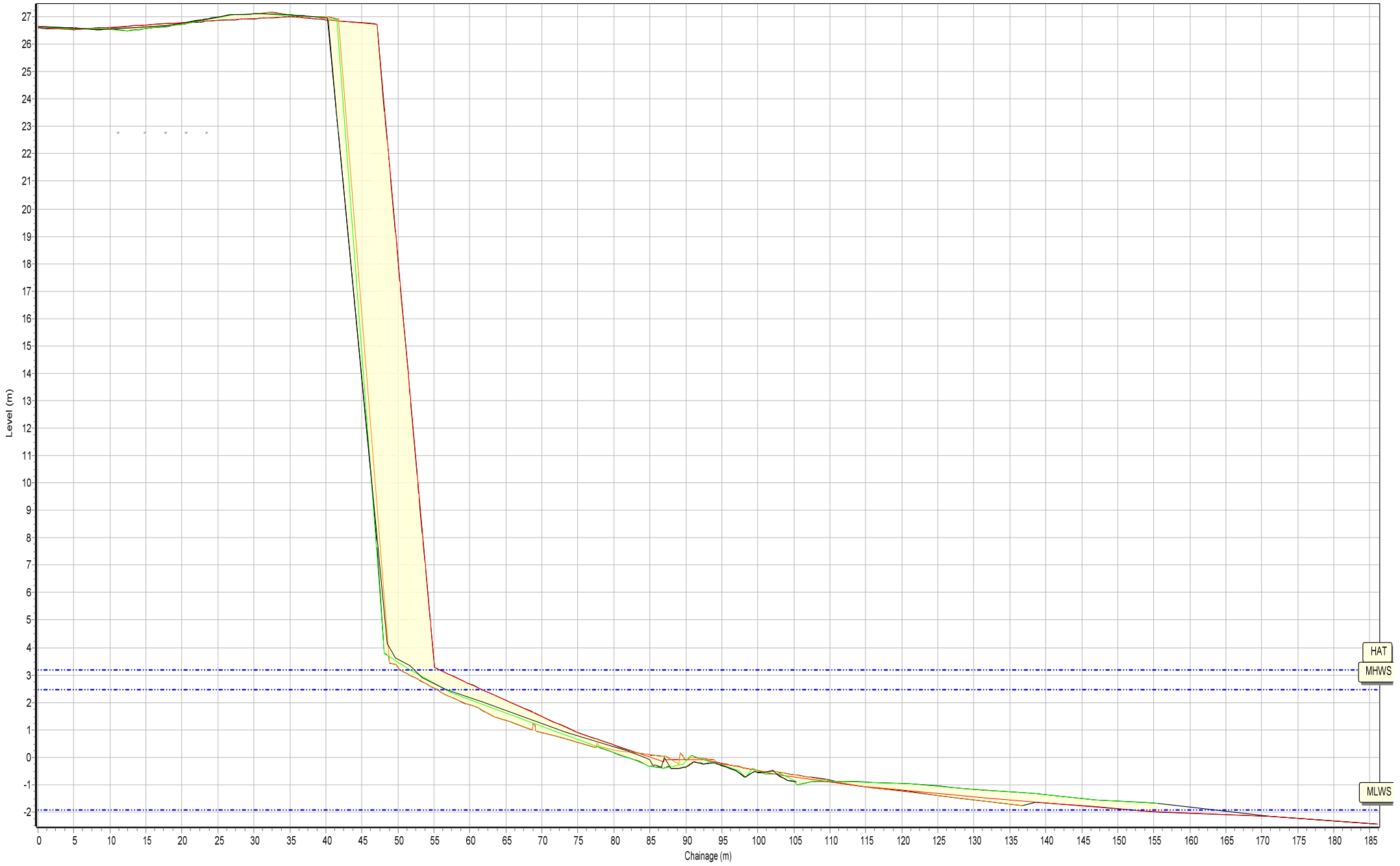
Beach Profiles: 1bSNS20



HAT  
MHWS  
MLWS

SANDS

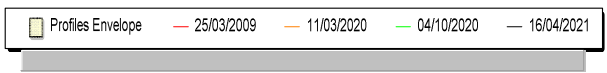
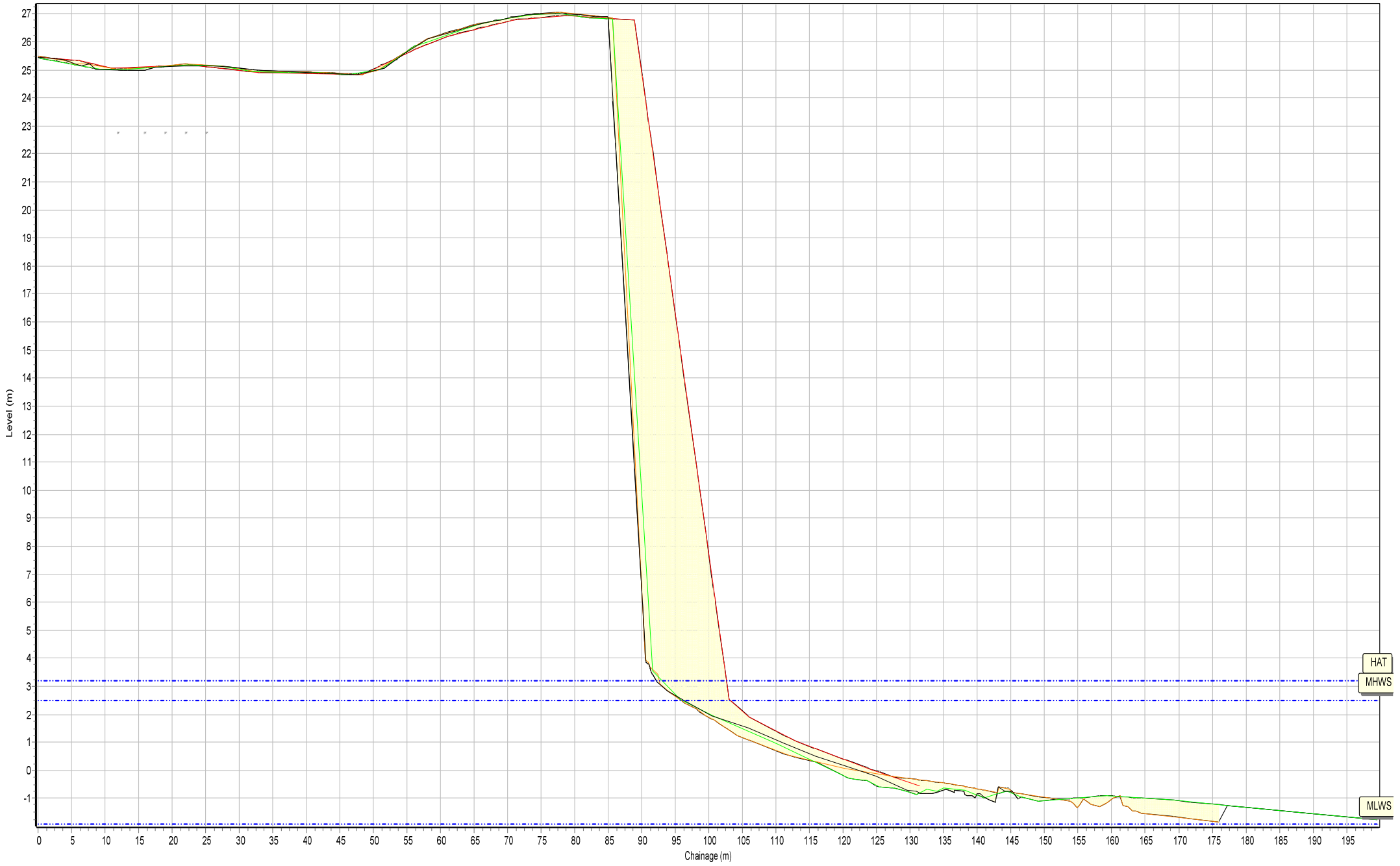
Beach Profiles: 1bSNS25



Profiles Envelope 16/09/2009 11/03/2020 04/10/2020 16/04/2021

HAT  
MHWs  
MLWS

Beach Profiles: 1bSNS26

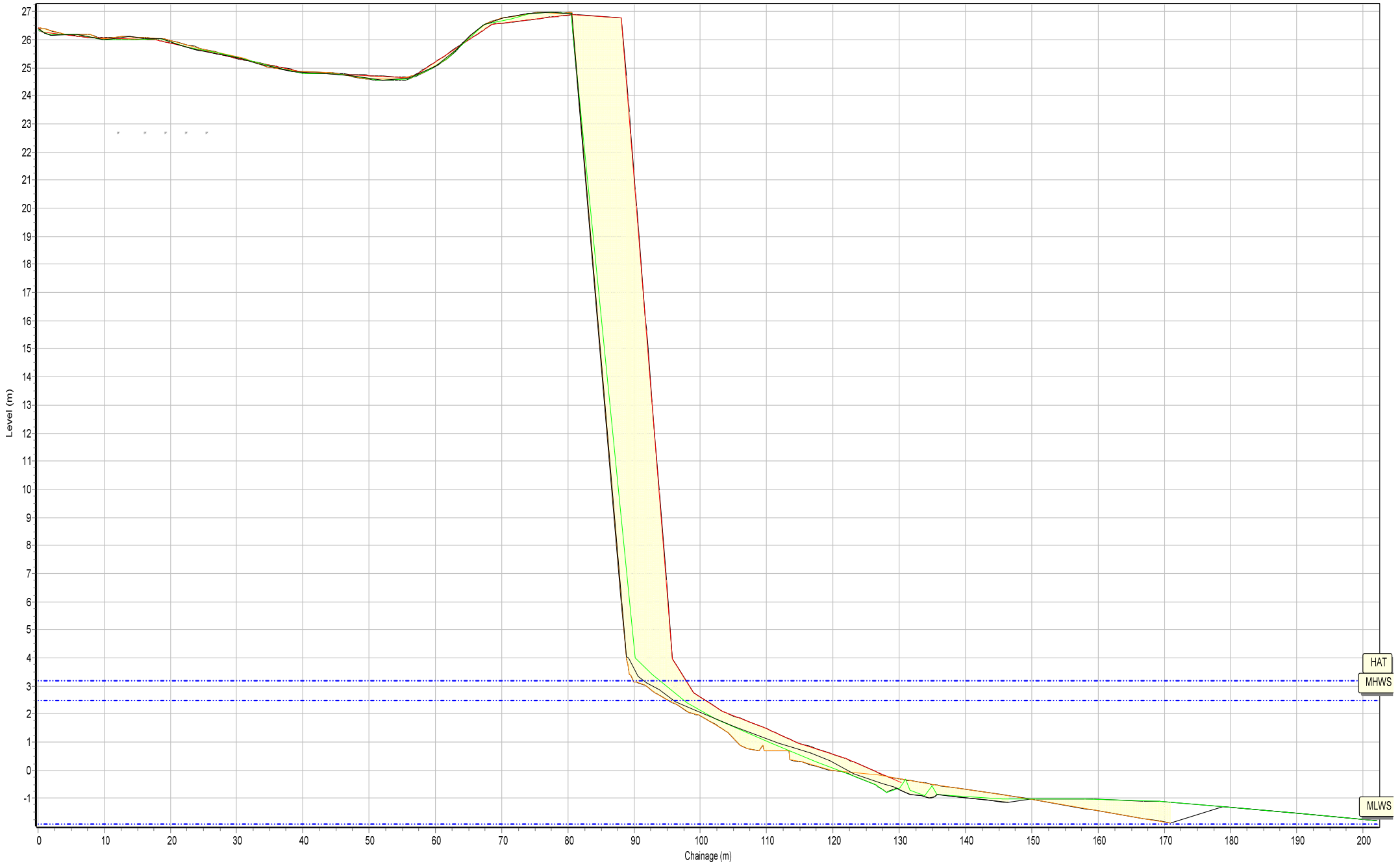


HAT  
MHWS

MLWS

SANDS

Beach Profiles: 1bSNS27

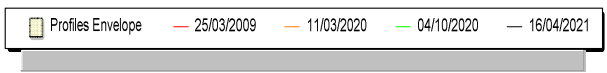
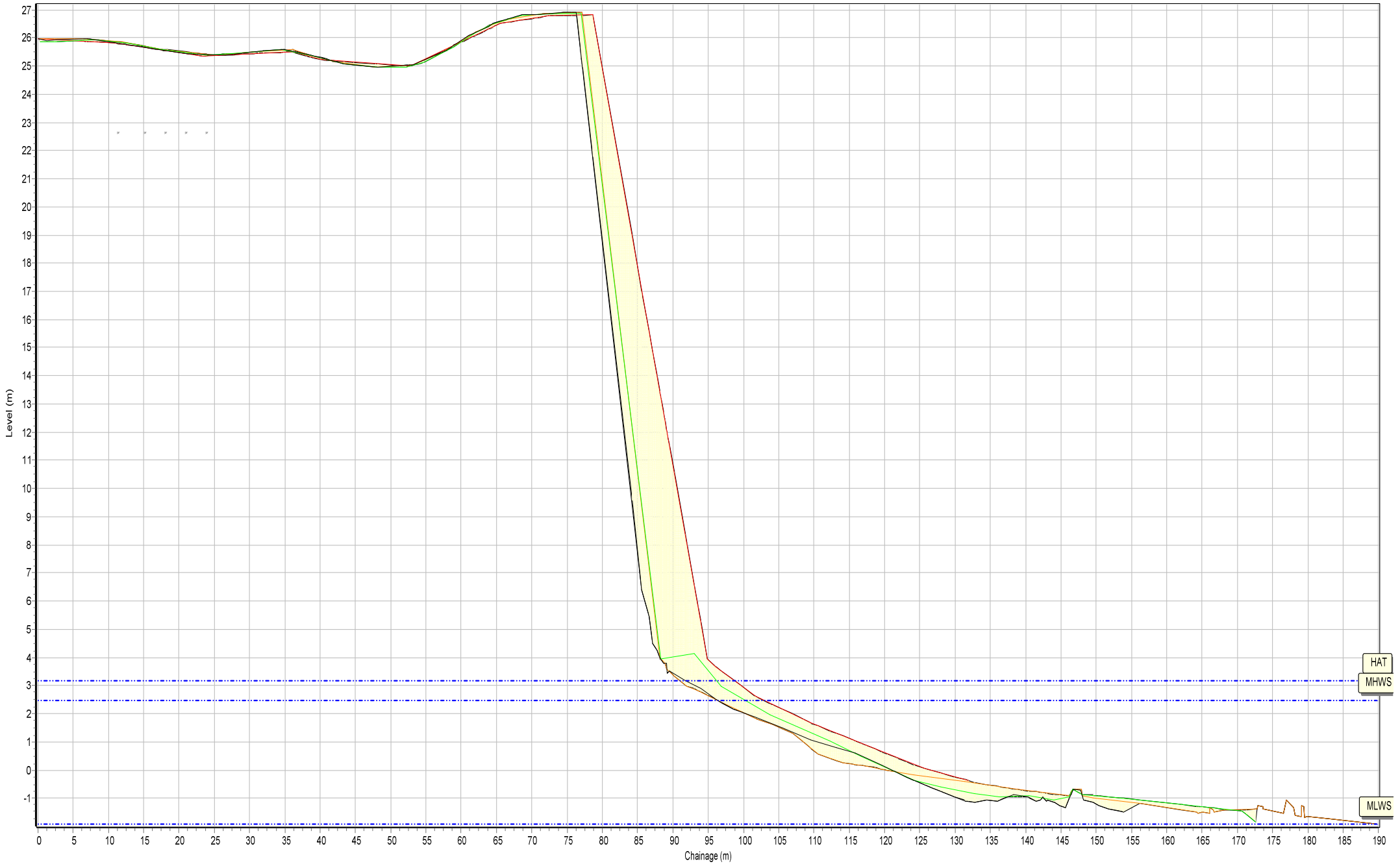


Beach Profiles: 1bSNS28



Profiles Envelope 25/03/2009 11/03/2020 04/10/2020 16/04/2021

Beach Profiles: 1bSNS29

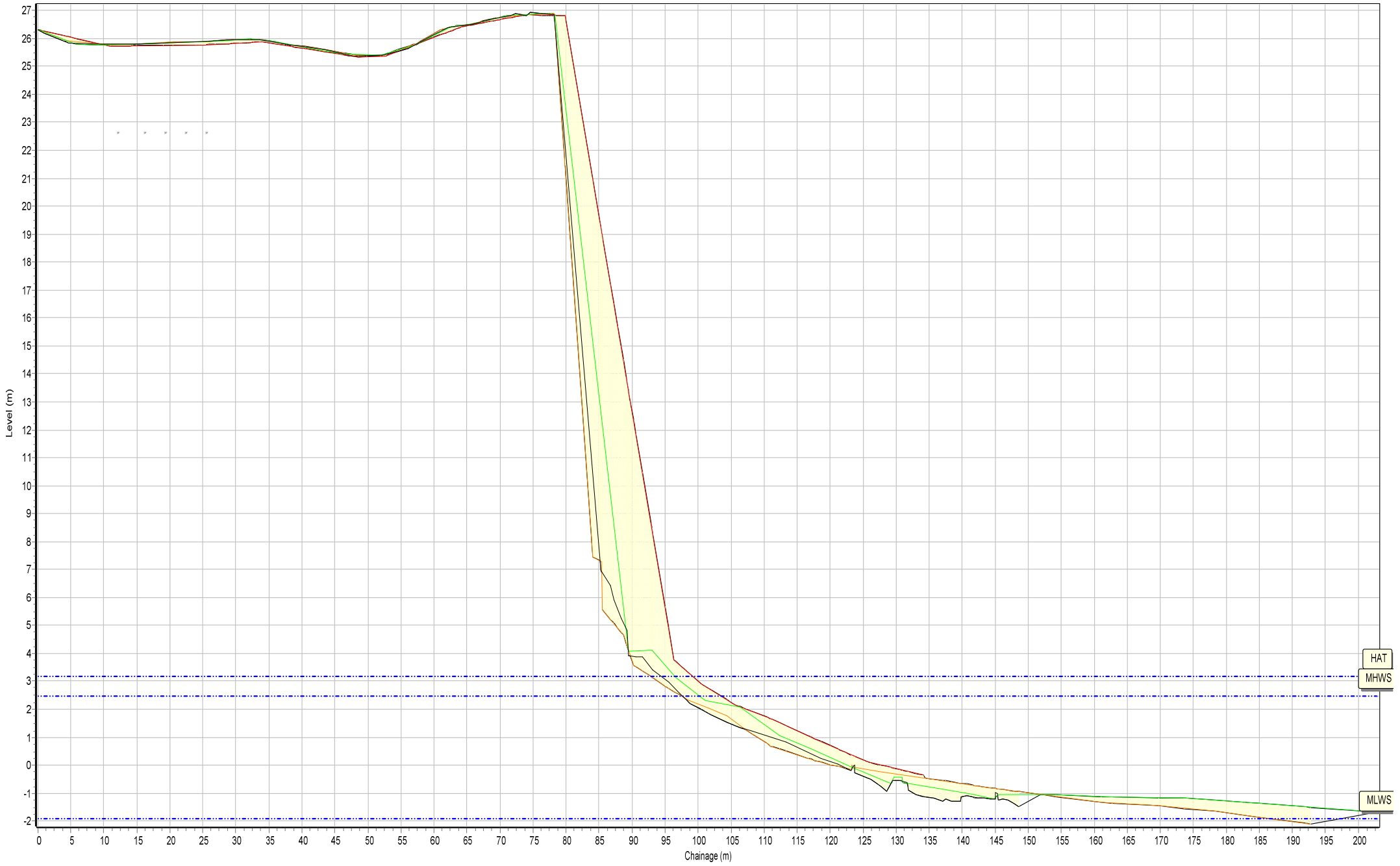


HAT  
MHWS

MLWS

SANDS

Beach Profiles: 1bSNS30



Profiles Envelope 25/03/2009 11/03/2020 04/10/2020 16/04/2021

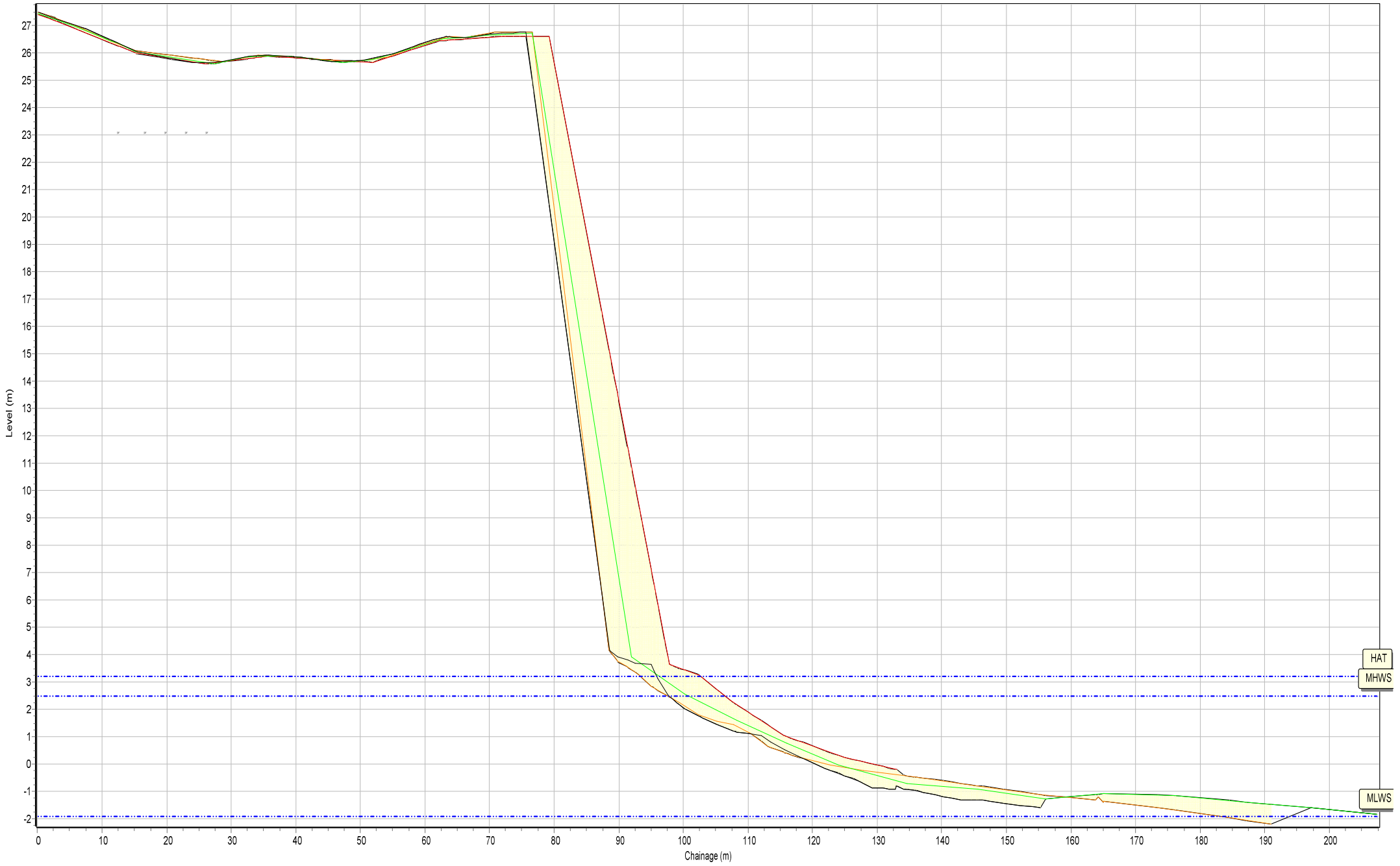
HAT  
MHWS

MLWS

SANDS



Beach Profiles: 1bSNS31



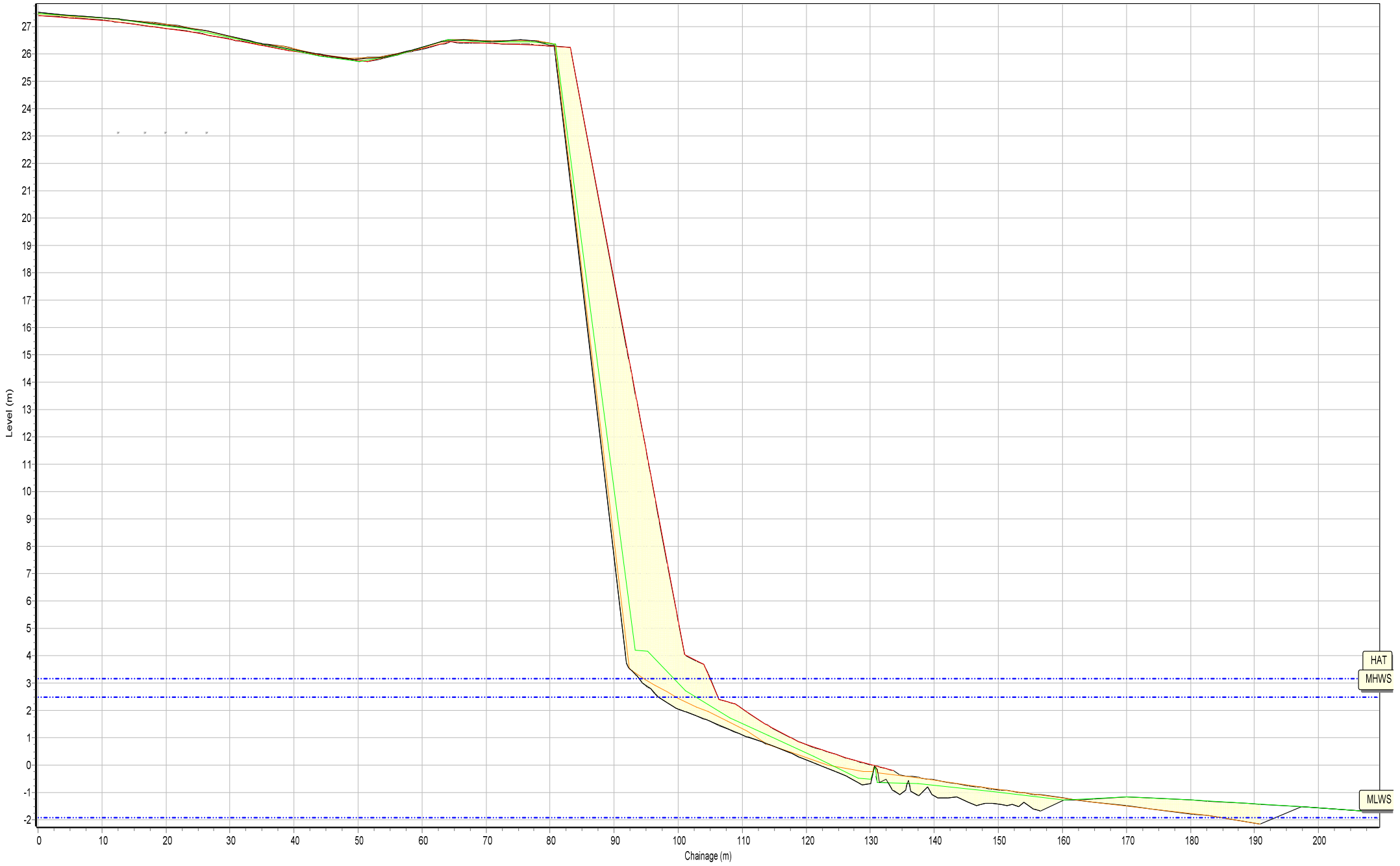
Profiles Envelope 25/03/2009 11/03/2020 04/10/2020 16/04/2021

HAT  
MHWS

MLWS

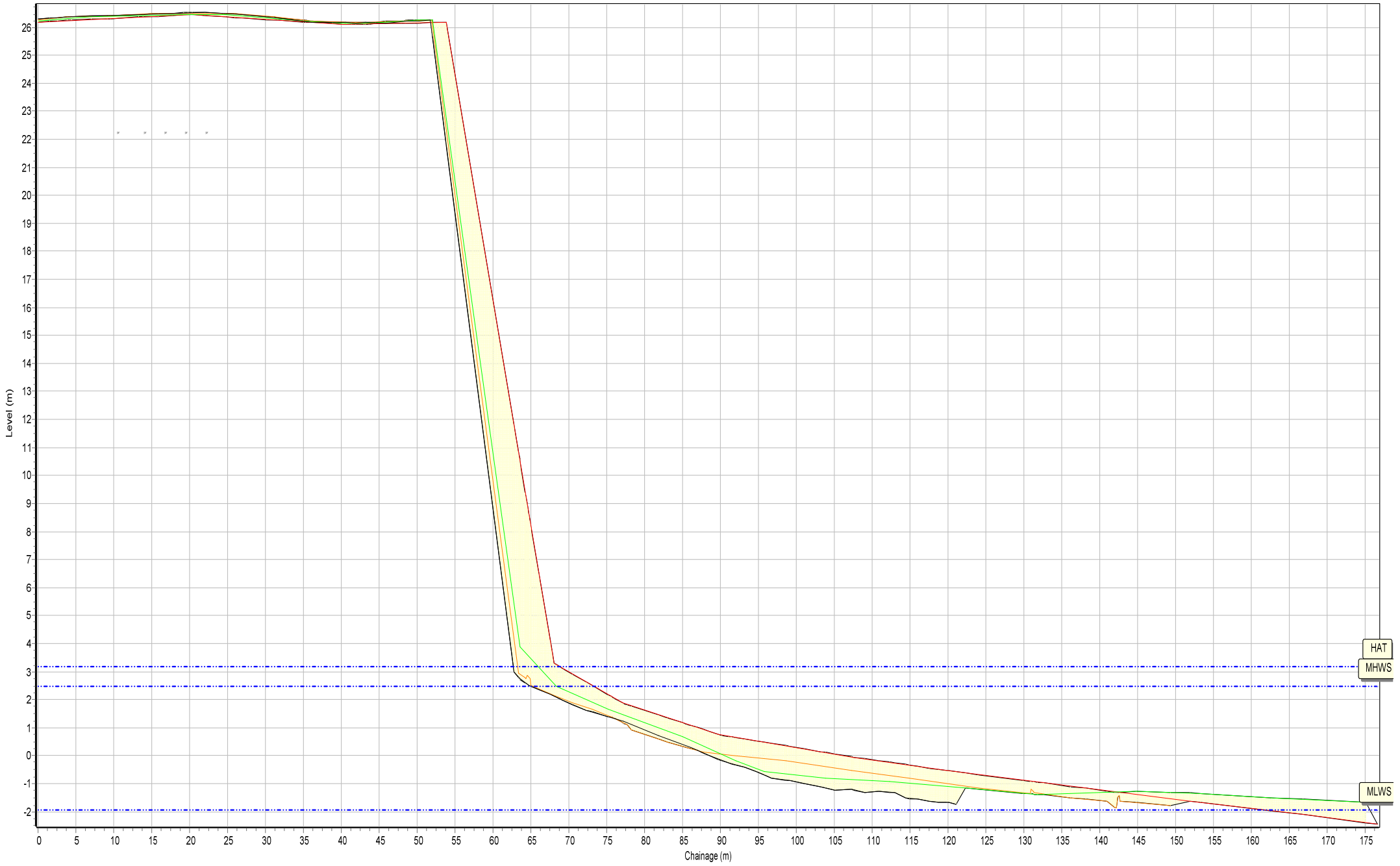
SANDS

Beach Profiles: 1bSNS32



Profiles Envelope 25/03/2009 11/03/2020 04/10/2020 16/04/2021

Beach Profiles: 1bSNS33



Profiles Envelope 16/09/2009 11/03/2020 04/10/2020 16/04/2021

HAT  
MHWS

MLWS

SANDS

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



**Key**  
 ● Cliff Top Survey Locations

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

**Figure 3 - Map 1**  
**HENDON TO RYHOPE SOUTH**  
**Sunderland City Council**  
**Council Frontage**  
 Cliff Top Survey Locations

Drawing Scale at A4 1:10,000

**WATER**  
 Royal HaskoningDHV  
 Marlborough House  
 Marlborough Crescent  
 Newcastle upon Tyne  
 NE1 4EE

Tel: +44 (0)191 211 1300  
 Fax: +44 (0)191 211 1313  
 www.royalhaskoningdhv.com



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

## Cliff Top Survey

### Hendon and Ryhope

Thirty-two ground control points have been established between Hendon and Ryhope. The maximum separation between any two points varies along the coast, reflecting the degree of risk from the erosion.

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

Table B1 provides baseline information about these ground control points and results from the 2009 (baseline) survey showing the position from the ground control point to the edge of the cliff top along the defined bearing. Future reports will show results from subsequent surveys and provide a means of assessing erosion since the baseline survey.

**Table B1 – Cliff Top Surveys between Hendon and Ryhope**

Ground Control Points				Distance to Cliff Top (m)			Total Erosion (m)		Erosion Rate (m/year)
Ref	Easting	Northing	Bearing	Baseline Survey	Previous Survey	Present Survey	Baseline to Present	Previous to Present	Baseline to Present
			(°)	Mar 2009	Oct 2020	Apr 2021	Mar 2009 - Apr 2021	Oct 2020- Apr 2021	Mar 2009 - Apr 2021
1	441025.7	555571.1	75	8.16	8.21	8.43	0.27	0.22	0.02
2	441064.4	555355.1	85	7.09	5.08	6.06	-1.03	0.98	-0.09
3	441098	555124	82	10.01	10.3	10.09	0.08	-0.21	0.01
4	441174	554938.7	65	10.3	10.48	10.53	0.23	0.05	0.02
5	441199.1	554861.1	65	7.71	10.95	7.54	-0.17	-3.41	-0.01
6	441224.5	554774.2	71	10.83	10.96	10.79	-0.04	-0.17	0.00
7	441248.4	554690.3	74	10.18	10.34	10.34	0.16	0	0.01
8	441259.3	554596.6	101	10.08	9.48	9.51	-0.57	0.03	-0.05
9	441275.8	554513.4	66	10.52	5.7	5.69	-4.83	-0.01	-0.40
10	441309.4	554421.3	58	8.77	1.15	1.16	-7.61	0.01	-0.63
11	441354	554346.5	68	8.2	2.76	2.17	-6.03	-0.59	-0.50
12	441400.2	554248.2	56	6.17	5.59	5.69	-0.48	0.1	-0.04
13	441452.3	554174.7	63	11.61	6.32	5.88	-5.73	-0.44	-0.48

Ground Control Points				Distance to Cliff Top (m)			Total Erosion (m)		Erosion Rate (m/year)
14	441472.3	554080.5	127	7.33	5.9	5.79	-1.54	-0.11	-0.13
15	441413	554005.1	122	7.84	7.85	7.73	-0.11	-0.12	-0.01
16	441384.8	553913.3	90	9.89	7.26	7.02	-2.87	-0.24	-0.24
17	441404.1	553815.5	93	6.32	5.47	5.66	-0.66	0.19	-0.06
18	441404.1	553723.6	119	8.1	3.12	3.02	-5.08	-0.1	-0.42
19	441398.5	553632.8	78	8.23	3.88	3.88	-4.35	0	-0.36
20	441438.3	553452.9	71	10.09	5.5	5.35	-4.74	-0.15	-0.40
21	441506.1	553256.1	62	8.57	-2.49	3.56	-5.01	6.05	-0.42
22	441550.1	553158.7	103	6.57	3.13	3.08	-3.49	-0.05	-0.29
23	441585.2	553076.5	64	8.11	4.7	3.54	-4.57	-1.16	-0.38
24	441624.4	552870.7	69	7.53	3.03	2.34	-5.19	-0.69	-0.43
25	441689.1	552758	70	14.58	3.63	2.32	-12.26	-1.31	-1.02
26	441715	552713.3	54	12.87	2.8	2.58	-10.29	-0.22	-0.86
27	441749.2	552674.4	62	14.56	3.4	2.89	-11.67	-0.51	-0.97
28	441776.6	552629.9	57	8.62	4.17	2.56	-6.06	-1.61	-0.51
28A	441798.6	552586.3	56	13.63	6.09	6.15	-7.48	0.06	-0.62
28B	441817.4	552542.4	64	12.3	9.3	8.49	-3.81	-0.81	-0.32
28C	441852.2	552502.6	52	13.11	12.33	12.31	-0.8	-0.02	-0.07
29	441880.1	552471.6	83	15.46	15.07	14.57	-0.89	-0.5	-0.07
30	441921.4	552269	97	8.55	4.86	4.27	-4.28	-0.59	-0.36
31	441853.1	552094	75	11.2	2.31	2.15	-9.05	-0.16	-0.75
32	441883.3	551988.5	96	9.82	2.65	2.62	-7.2	-0.03	-0.60

\*Note that 28a-c baseline is September 2009.