Royal HaskoningDHV
Enhancing Society Together

Cell 1 Regional Coastal Monitoring Programme
Update Report 9: 'Partial Measures' Survey 2017

South Tyneside Council

South Tyneside Council
July 2017

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Authors	
Emma Hick	Royal HaskoningDHV
Dr Nick Cooper – Approval	Royal HaskoningDHV

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    1.

Abbreviations and Acronyms

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

Water Levels Used in Interpretation of Changes

Water Level Parameter	Water Level (m AOD)	
	River Tyne to Frenchman's Bay	Frenchman's Bay to Souter Point
HAT	2.85	2.88
MHWS	2.15	2.18
MLWS	-2.15	-2.12

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).

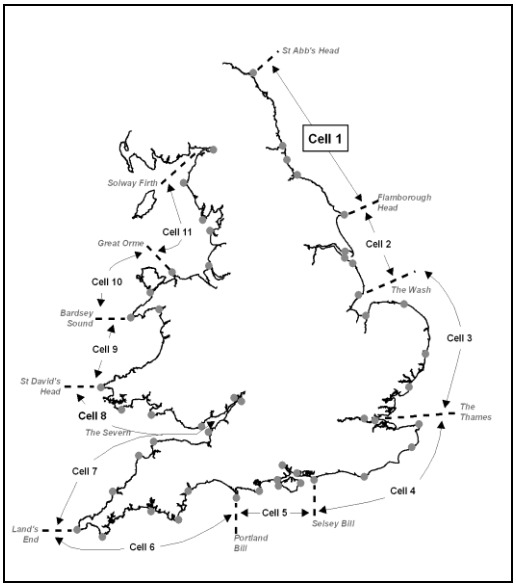


Figure 1 Sediment Cells in England and Wales

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
- walk-over 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	Nov 12	Mar 13	Mar 13	Jun 13	
6	2013/14	Nov 13	Feb 14	Apr 14	Jul 14	
7	2014/15	Nov 14	Feb 15	Apr 15	Jul 15	
8	2015/16	Nov 15	Feb 16	Mar 16	Jul 16	Jun 16
9	2016/17	Nov 16	Feb 17	Mar 17	Jul 2017	

(*) The present report is **Update Report 9** and provides an analysis of the 2017 Partial Measures survey for South Tyneside Council's frontage.

1. Introduction

1.1 Study Area

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

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

1.2 Methodology

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

- Full Measures survey annually each autumn comprising:
    - Beach profile surveys along 17 transect lines (commenced 2008)
    - Topographic survey along Littlehaven Beach (commenced 2010)
    - Topographic survey along Herd Sands (commenced 2008
    - Topographic survey along Trow Quarry (commenced 2008). Note the 2008 surveys at profiles 1bSS11, 1bSS12 and 1bSS13 were undertaken at a different location to subsequent surveys and have therefore been removed from the analysis presented here

- Partial Measures survey annually each spring comprising:
    - Beach profile surveys along 11 transect lines (commenced 2008)
    - Topographic survey along Littlehaven Beach (commenced 2010)
    - Since 2014, Partial Measures survey has also included 2 additional profiles at Littlehaven. These are measured to record the new defence and beach profiles following completion of the sea defence works.

- Cliff top survey bi-annually at:
    - Cliff top survey at Trow Quarry (incl. Frenchman's Bay) (commenced 2008)

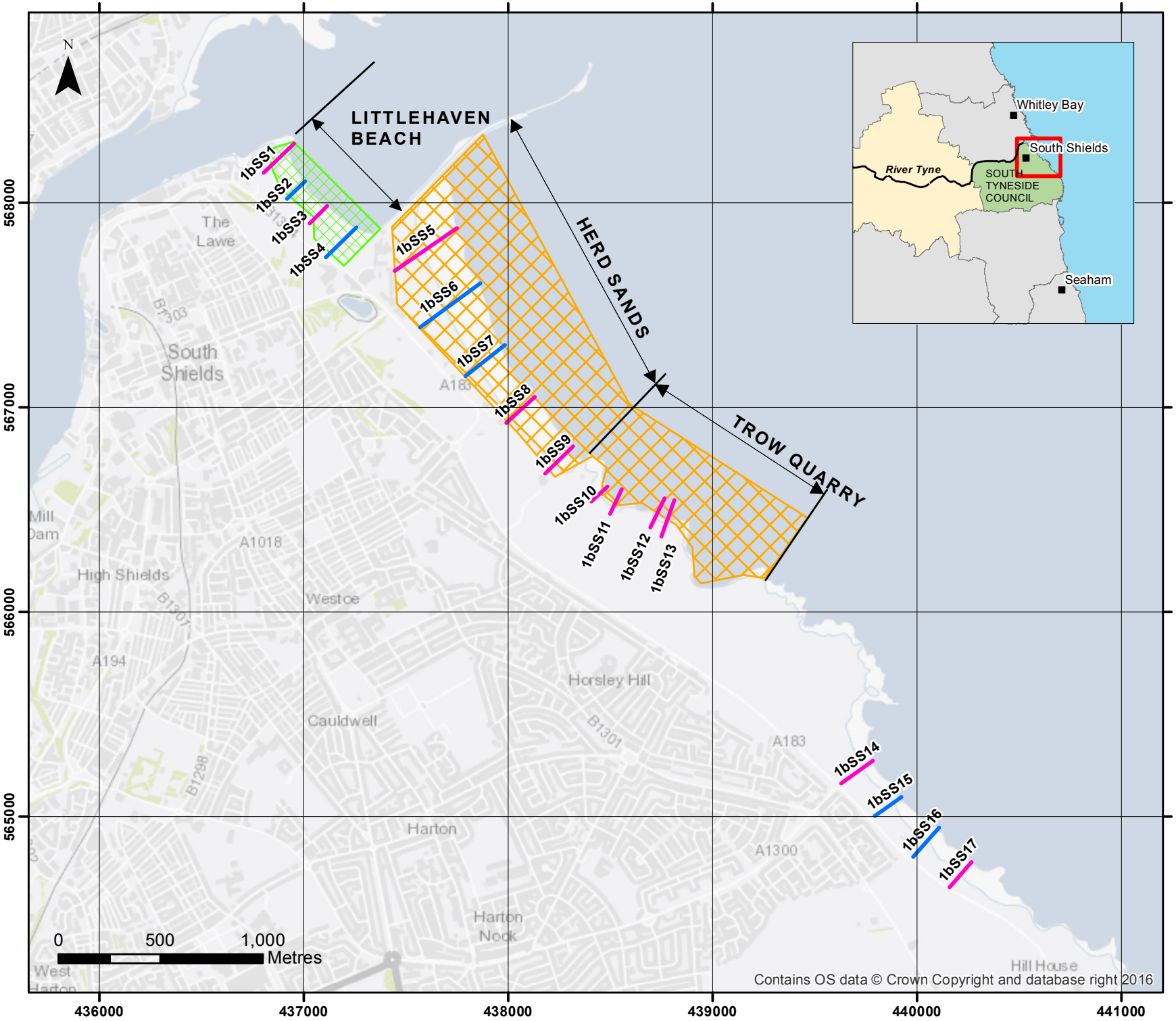
For all cliff-top surveys prior to Full Measures 2011, data was reported separately in Trow Quarry Coastal Defence Scheme - Monitoring Plan Year 2 (available from South Tyneside Council). The data was saved in '.kmz' format for plotting and comparison in GoogleEarth. For the present survey report, this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

The Partial Measures survey was undertaken along this frontage between 12th March 2017 and 14th March 2017. During this time weather conditions were variable; refer to the survey reports for details of the weather conditions over this survey period.

This Update Report presents the following:

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

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



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

South Tyneside Council Frontage

Analytical Report
Topo Surveys

Drawing Scale at A4 1:25,000

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

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2. Analysis of Survey Data

2.1 Littlehaven Beach

Survey Date	Description of Changes Since Last Survey	Interpretation
14th March 2017	**Beach Profiles:** Littlehaven Beach is covered by four beach profile lines for the Partial Measures surveys, distributed between South Groyne and South Pier (1bSS1, 1bSS2, 1bSS3 and 1bSS4).The previous survey was the Full Measures survey undertaken in autumn 2016. Profile **1bSS1** is located towards the north of Littlehaven Beach, in the lee of a rocky outcrop and harbour wall. The dunes have changed little, with <0.1m accretion over the dune crest. There has been erosion between the toe of the dunes and chainage 75m of up to 0.3m, with very little change ±0.1m over the rest of the profile. Overall the dunes are high, the upper beach is low, and the lower beach is medium compared to the range recorded from previous surveys. Profiles **1bSS2 to 1bSS4** extend seawards from the new sea wall that was completed in 2014. At profile **1bSS2** the beach levels at the toe of the seawall have increased by up to 0.6m, up to chainage 3m. Between chainage 3m and 35m there has been erosion of the berm by up to 0.4m, creating a steep upper beach instead of the flat profile of 2016. Between chainage 35m and 65m there has been accretion of up to 0.4m, with erosion of up to 0.3m seawards of between chainage 65m and 108m. Seawards of chainage 108m the profile appears to have accreted slightly. The upper beach between the seawall and chainage 0m, and the toe of beach seawards of 108m have the highest recorded levels compared to the range recorded from previous surveys, however the rest of the profile is relatively low-medium. At profile **1bSS3** there has been accretion of up to 0.4m between the new defences and -8m chainage. The height of the berm crest at 5m chainage has decreased by 0.7m. Between chainage 20m and 55m there has been very little change, ±0.1m. Between chainage 55m and 86m there has been erosion of up to 0.3m, with the toe of the beach seawards of 86m appearing to be accreting. Between the seawall and chainage -8m the profile is at its highest recorded level; however the rest of the profile is at a medium level compared with the range recorded from previous surveys.	Overall the upper beach has eroded except immediately at the toe of the seawall where there has been accretion to the highest beach levels recorded. There has been limited change over the rest of the profiles, though the toe of the beach appears to also show accretion. Longer term trends: When compared with previous profile surveys, profiles **1bSS1** to **1bSS4** are generally within the bounds of previous surveys, indicating normal seasonal behaviour with no clear trend. However the upper beach generally shows its highest recorded levels at the toe of the new sea wall.

Survey Date	Description of Changes Since Last Survey	Interpretation
	At profile **1bSS4** there has been little change to the upper beach between teh seawall and chainage 50m. There has been varying levels of erosion over the rest of the profile, with less than 0.2m change between chainage 87m and the end of the profile. Between chainage50m and 87m, the beach level has reduced by up to 0.4m, with the bank of cobble-small boulders previously present at 80-90m chainage moving landwards by 10m. Overall the beach is at a relatively low level particularly between chainage 45m and 90m with the exception of the cobble-small boulder bank (70-80m chainage).	
March 2017	**Topographic Survey:** Littlehaven Beach is covered by bi-annual topographic survey between the South Groyne and the South Pier, which commenced in March 2010. Data from the most recent topographic survey (Partial Measures, spring 2017) have been used to create a DGM (Appendix B – Map 1a) using a Geographical Information System (GIS). A difference plot has also been produced using the DGM (Appendix B – Map 1b) produced from the last produced topographic survey (Full Measures, autumn 2016) and the present survey. The difference plots shows a clear a pattern of change across the beach, which reflects the beach profile data. The plots show, in general terms, alternating bands of change, which extend from north to south, and comprise: (i) a narrow band of accretion in the upper beach against the new defences; (ii) a wide band of erosion in the upper/middle beach; (iii) a narrow band of accretion/little change in the middle beach; and (iv) a wide band of erosion in the lower beach. The pattern of alternating bands of erosion and accretion suggests cross-shore movements of sediment.	The pattern of beach elevation change observed from the topographic difference plot indicates distinct areas of erosion and accretion, associated with migration of sand bars across the beach face.

2.2 Herd Sands

Survey Date	Description of Changes Since Last Survey	Interpretation
14th March 2017	**Beach Profiles:** Herd Sands is covered by three beach profile lines for the Partial Measures survey (Appendix A). The previous survey was the Full Measures survey undertaken in autumn 2016. Profile **1bSS5** is located towards the northern end of Herd Sands, in the lee of the breakwater. Sand fences were constructed on the dunes in 2012 to encourage accretion and stabilisation. The dunes remain relatively unchanged throughout most of the profile, except between c.85m and 100m chainage where a hollow between two dune crests appears to have been filled in by 0.5m. Seawards of chainage 100m the beach level changes are generally limited to ±0.2m, except for the landward movement of the berm crests previously recorded at chainages 180m and 370m. The result of the changes is a much smoother profile compared to the previous survey. Overall the profile is at a medium-high level compared to the range recorded from previous surveys. Profile **1bSS8** is located to the south of Herd Sands. The beach elevation has increased slightly by up to 0.1m between the seaward edge of the tarmac promenade at 4m chainage and 14m chainage. Between 14m and 60m chainage the level of the beach face has reduced by up to 1.0m. There has been accretion of up to 0.4m between 60m chainage and 130m chainage, with erosion of up to 0.4m between 130m and 190m chainage. Seaward of 190m the beach toe appears to have experienced accretion of up to 0.3m Overall the profile is at a medium level compared to the range recorded from previous surveys. Profile **1bSS9** is located to the south of Herd Sands where dunes have remained stable since the previous survey. There has been very little change over the profile, generally restricted to ±0.1m. The berm crest previously recorded at chainage 45m has dropped by 0.3m and moved seawards down the profile by c5m. Overall the profile is at a medium level compared to the range recorded from previous surveys.	Since the last survey, the dunes at Herd Sands have, on the whole remained stable. Along the length of the Herd Sands there has been variable change in the beach profiles, with the largest changes seen in the centre of the bay **Longer term trends:** On the whole, the beach is within the range of levels seen in earlier surveys.

2.3 Trow Quarry (incl. Frenchman's Bay)

Survey Date	Description of Changes Since Last Survey	Interpretation
14TH March 2017	**Beach Profiles:** Trow Quarry is covered by four beach profile lines for the Partial Measures survey (Appendix A), two in Graham's Sand and two in Southern Bay. The previous survey was the Full Measures survey undertaken in autumn 2016. Profiles **1bSS10** and **1bSS11** are located in Graham's Bay. At profile **1bSS10,** there has been very little change between chainage 25m and 75m. Seaward of 75m chainage there has been a increase in the level of the sandy beach by up to 0.6m, infilling the depression recorded on the previous survey, with the accretion more typically <0.2m from chainage 90m seawards. Overall the profile is at a medium level compared to the range recorded from previous surveys. At profile **1bSS11**, the beach profile has remained stable since the previous survey. Profiles **1bSS12** and **1bSS13** are located in Southern Bay. At both locations the beach profile has remained stable since the previous survey.	Since the last survey at Graham's Bay and Southern Bay the cliff, rock revetment and upper boulder/cobble rocky beach have, on the whole, remained stable. However, there has been an increase in elevation of the sandy beach toe at 1bSS10. In Southern Bay, there is no change evident from the profiles, but the presence of cobble-sized beach material in the gaps between rock armour blocks (evident in the survey photographs) indicates sufficient wave energy to move this material. **Longer term trends:** At both Graham's Bay and Southern Bay the beach levels are within the range of levels seen in previous surveys, indicating changes are within typical seasonal variation.
March 2017	**Cliff-top Survey:** Cliff top survey data collected for the baseline survey (autumn, 2011), Full Measures survey (autumn, 2016) and the present Partial Measures survey (spring, 2017) is presented in this report. Six ground control points (numbered 1-6) were established along the cliff top at Trow Point in 2011 to monitor cliff erosion at the headland adjacent to the site of a former landfill. Note: the numbering of ground control points is not intended to correlate with that of the beach profile lines and reference should be made to Appendix C – Map 1 for the location of ground control points. These cliff top surveys are undertaken bi-annually. Measurements are taken from each ground control point along a fixed bearing to the edge of the cliff top. The results from the cliff top monitoring are anticipated to have an accuracy of ±0.2m due to the technique used. The results from the cliff top survey are presented in Appendix C – Table C1, showing the position from the ground control point to	Since the last survey, no erosion greater than the survey error was recorded. **Longer term trends:** Very limited change has been detected since surveys began in November 2011.

Survey Date	Description of Changes Since Last Survey	Interpretation
	the edge of the cliff top along a defined bearing. Results show that since the last survey in November 2016, no cliff movement greater than the survey error occurred. No change greater than the survey error has been recorded over the long term.	

2.4 Marsden Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
14th March 2017	**Beach Profiles:** Marsden Bay is covered by two beach profile lines for the Partial Measures survey (Appendix A). The previous survey was the Full Measures survey undertaken in autumn 2016. Profile **1bSS14** is located to the north of the bay and covers the cliffs and former lifeguard station adjacent to the Redwell Steps. There has been no change in the cliff profile since the previous survey. Upper beach levels have risen between the steps and 120m chainage by up to 0.3m. The rest of the profile shows erosion of up to 0.8m, with a berm forming at chainage 162m. The overall effect is a steepening of the profile. Overall the profile is at a medium level compared to the range recorded from previous surveys. Profile **1bSS17** is located to the south of the bay. There has been apparent recession of 1.0m at the cliff toe where the cliff is undercut, although it is possible that this is an artefact of the survey techniques. The upper beach between the cliff toe and 78m chainage has reduced in elevation by up to 0.5m, but more typically <0.2m. Seaward of 78m chainage the rocky beach and shore platform has not changed. Overall the profile is at a medium level compared to the range recorded from previous surveys.	At profiles **1bSS14** the beach has steepened in response to winter/spring storm conditions. The beach at profile **1bSS17** shows 1.0m of recession at the cliff toe. However, this result should be treated with caution as it may relate to redistribution of sediment from the undercut cliff toe as it is accompanied by a lowering of the upper beach level of 0.5m. This change will be in response to winter storms **Longer term trends:** At profile **1bSS14** and **1bSS17** the beach levels are within the bounds of previous changes, indicating fluctuating seasonal or interannual behaviour with no particular trend.

3. Problems Encountered and Uncertainty in Analysis

Individual Profiles / Topographic Survey

- No issues recorded.

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 accuracy of the surveying technique and that any indication of an advancing cliff line is error.

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

No changes are recommended at the present time.

5. Conclusions and Areas of Concern

- At Littlehaven Beach, the recorded profiles and topographic survey present no causes for concern. Overall the upper beach has eroded except immediately at the toe of the seawall where there has been accretion to the highest beach levels recorded.
- At Herd Sands, the recorded profiles present no causes for concern.
- At Trow Quarry, the recorded profiles present no causes for concern. The cliffs to the north west of Trow Headland appear to have been stable and the data does not indicate cause for concern.
- At Marsden Bay, the recorded profiles present no causes for concern.

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

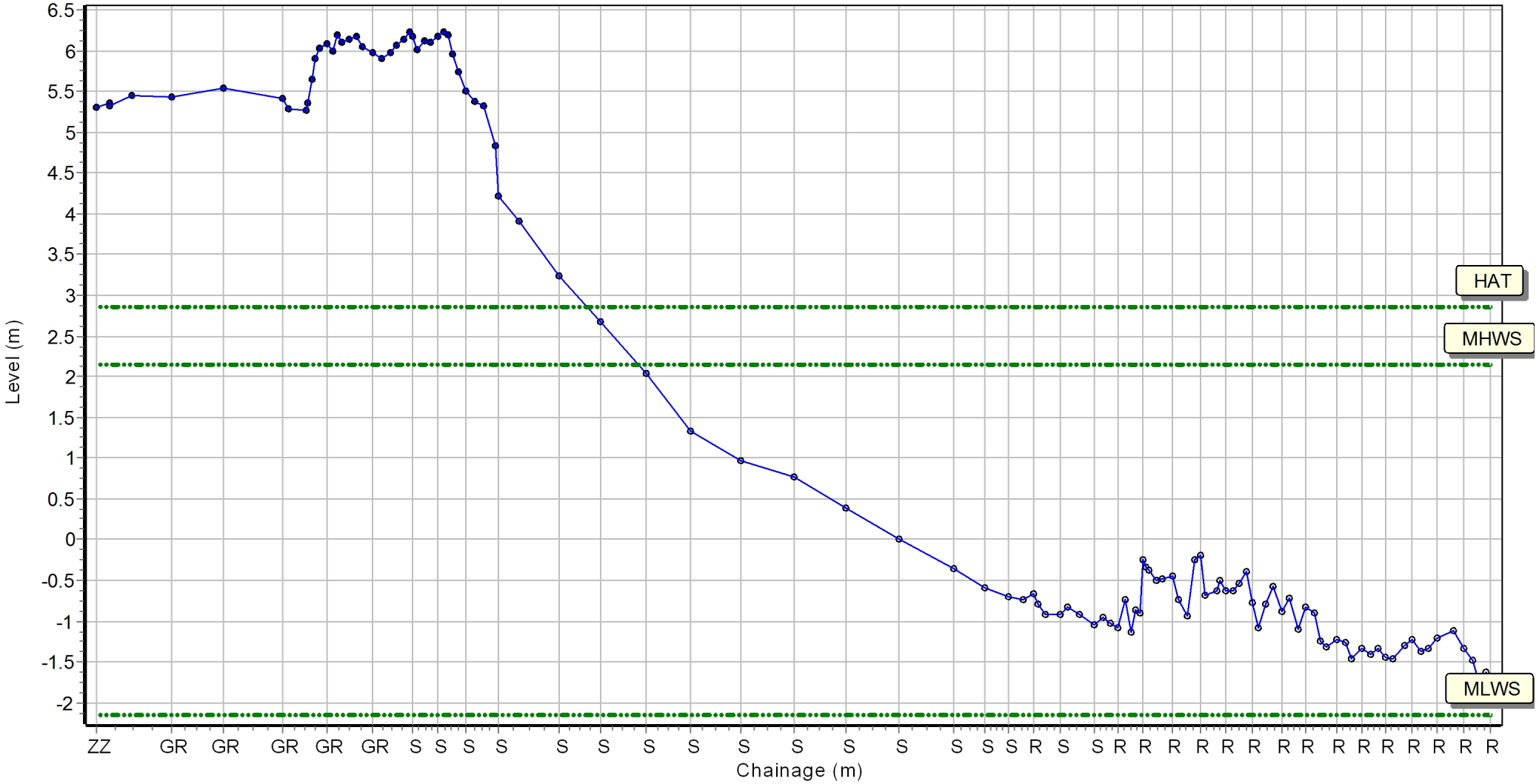
Location: **1bSS1**

Date: 14/03/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 436810.004 **Northing:** 568148.06 **Profile Bearing:** 45 ° from North



Beach Profile

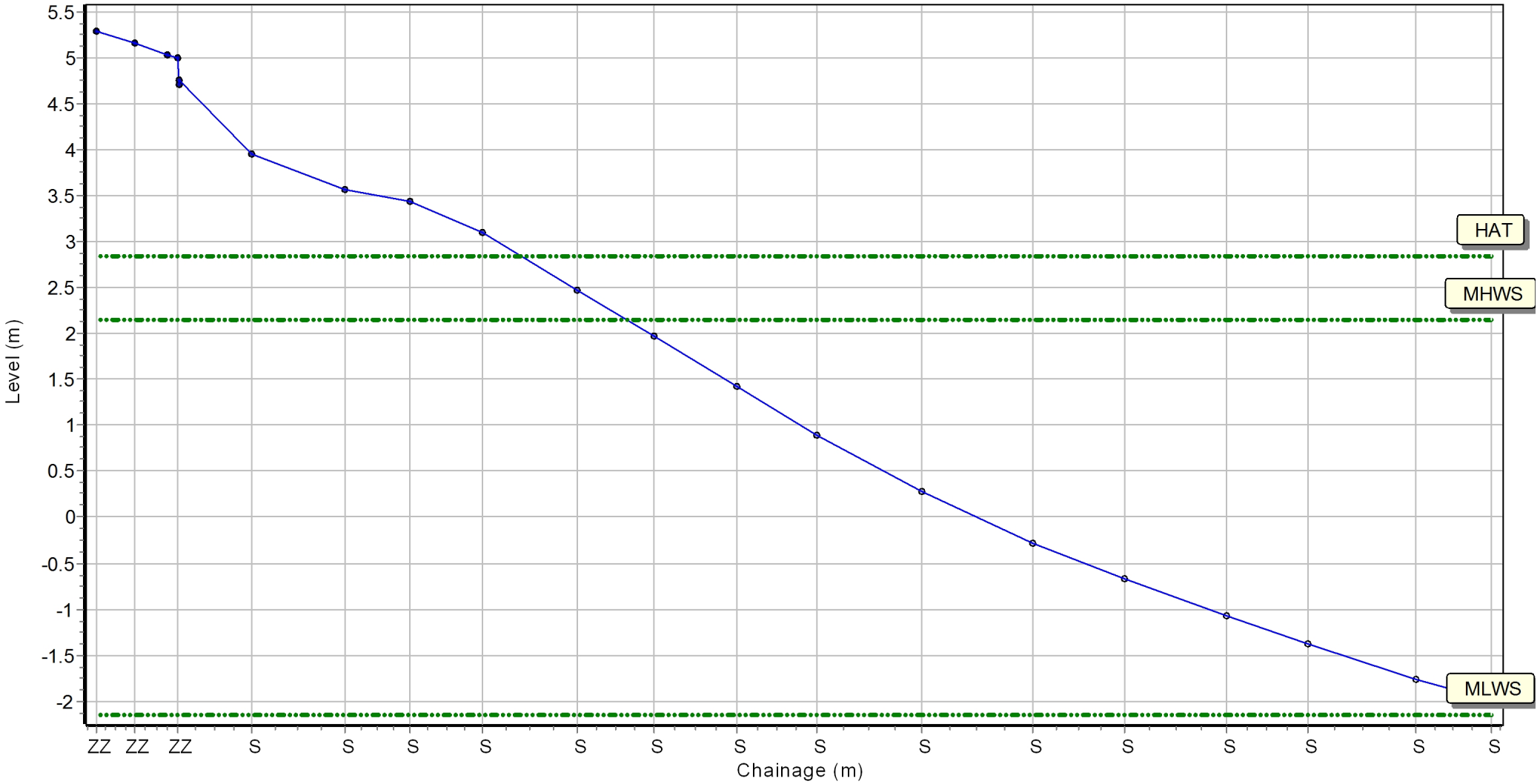
Location: **1bSS2**

Date: 14/03/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 436919.706 **Northing:** 568022.387 **Profile Bearing:** 46 ° from North



Beach Profile

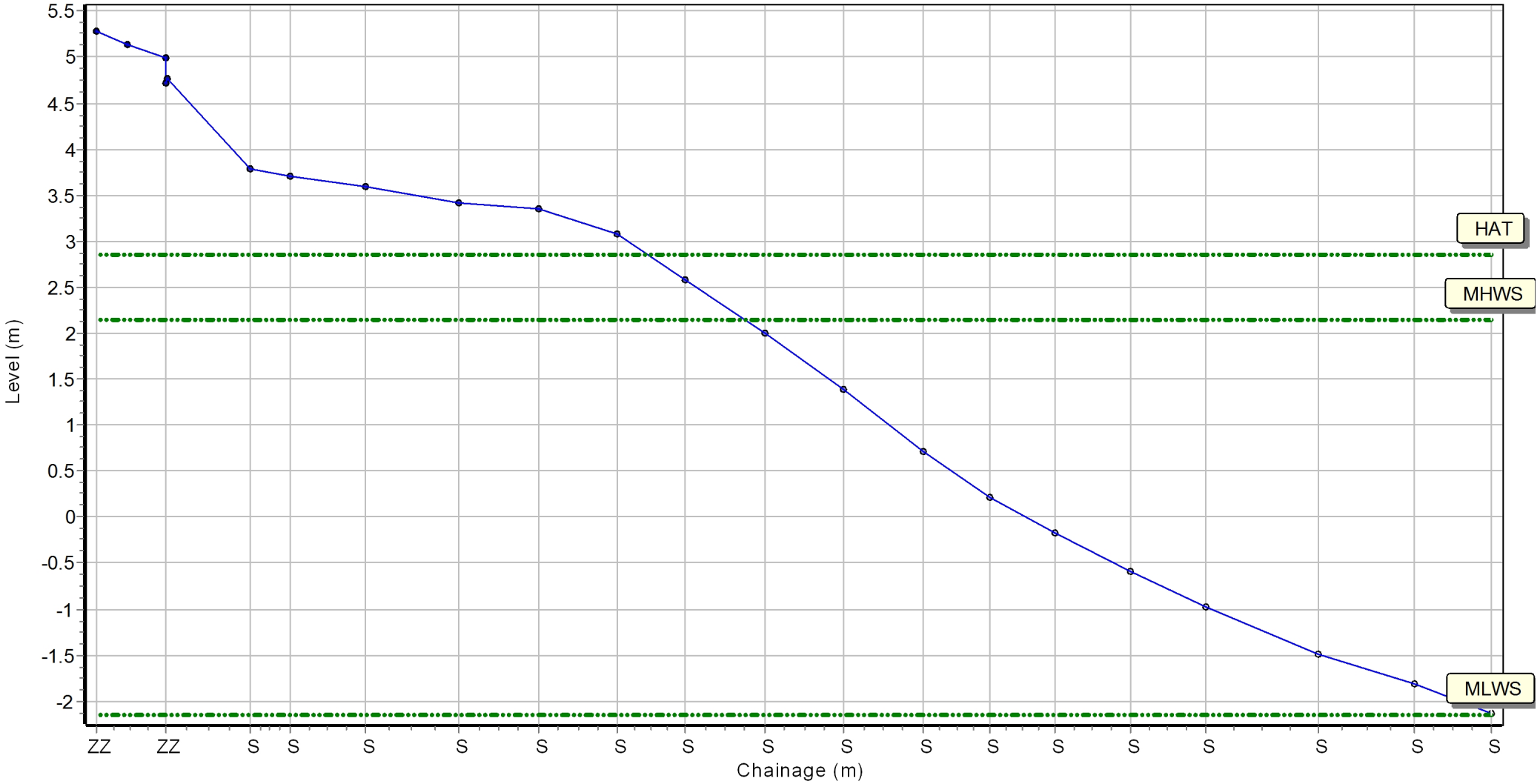
Location: **1bSS3**

Date: 14/03/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 437034.005 **Northing:** 567902.485 **Profile Bearing:** 46 ° from North



Beach Profile

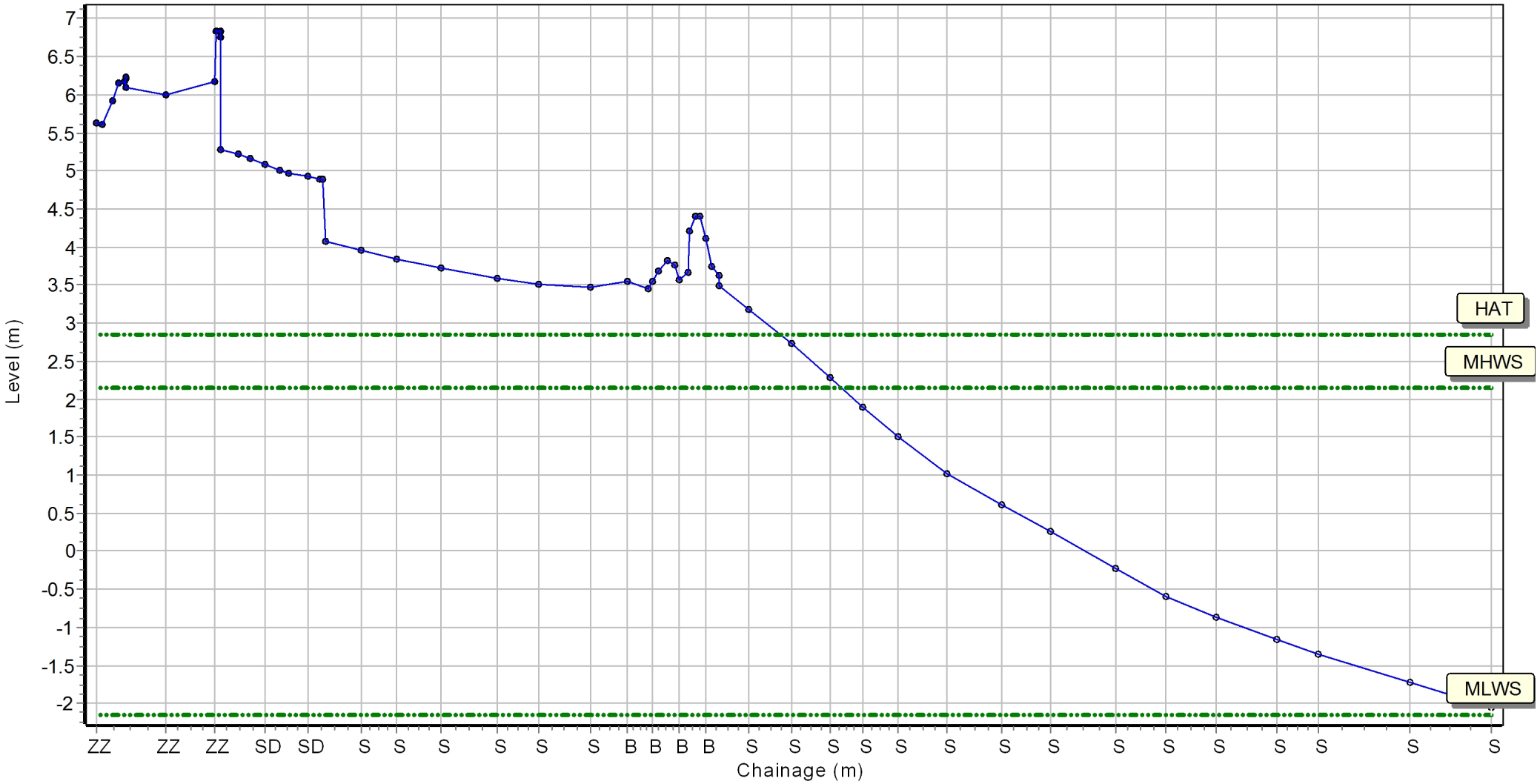
Location: **1bSS4**

Date: 14/03/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 437113.944 **Northing:** 567736.452 **Profile Bearing:** 46 ° from North



Beach Profile

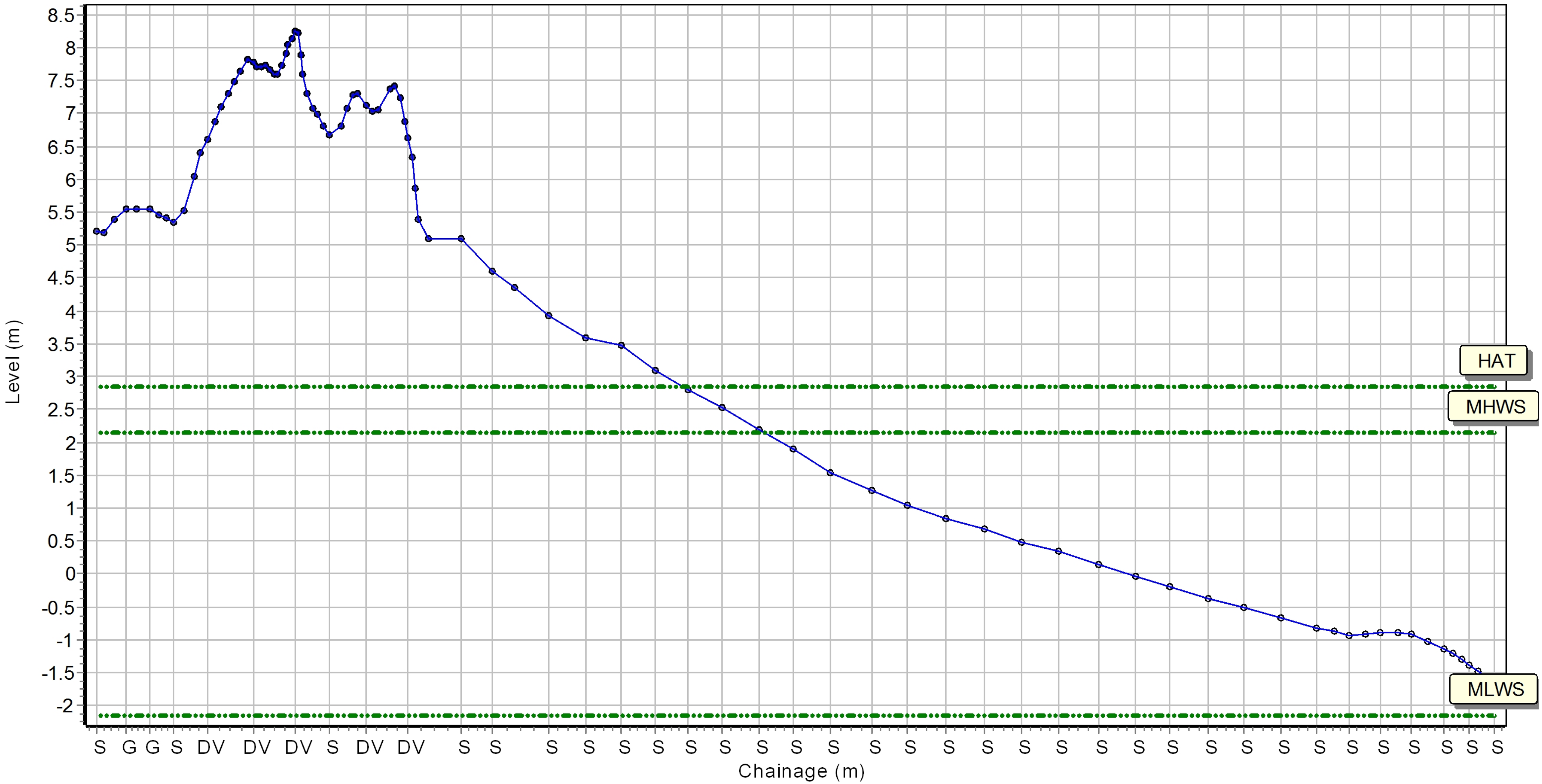
Location: 1bSS5

Date: 14/03/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 437448.703 **Northing:** 567669.997 **Profile Bearing:** 55 ° from North



Beach Profile

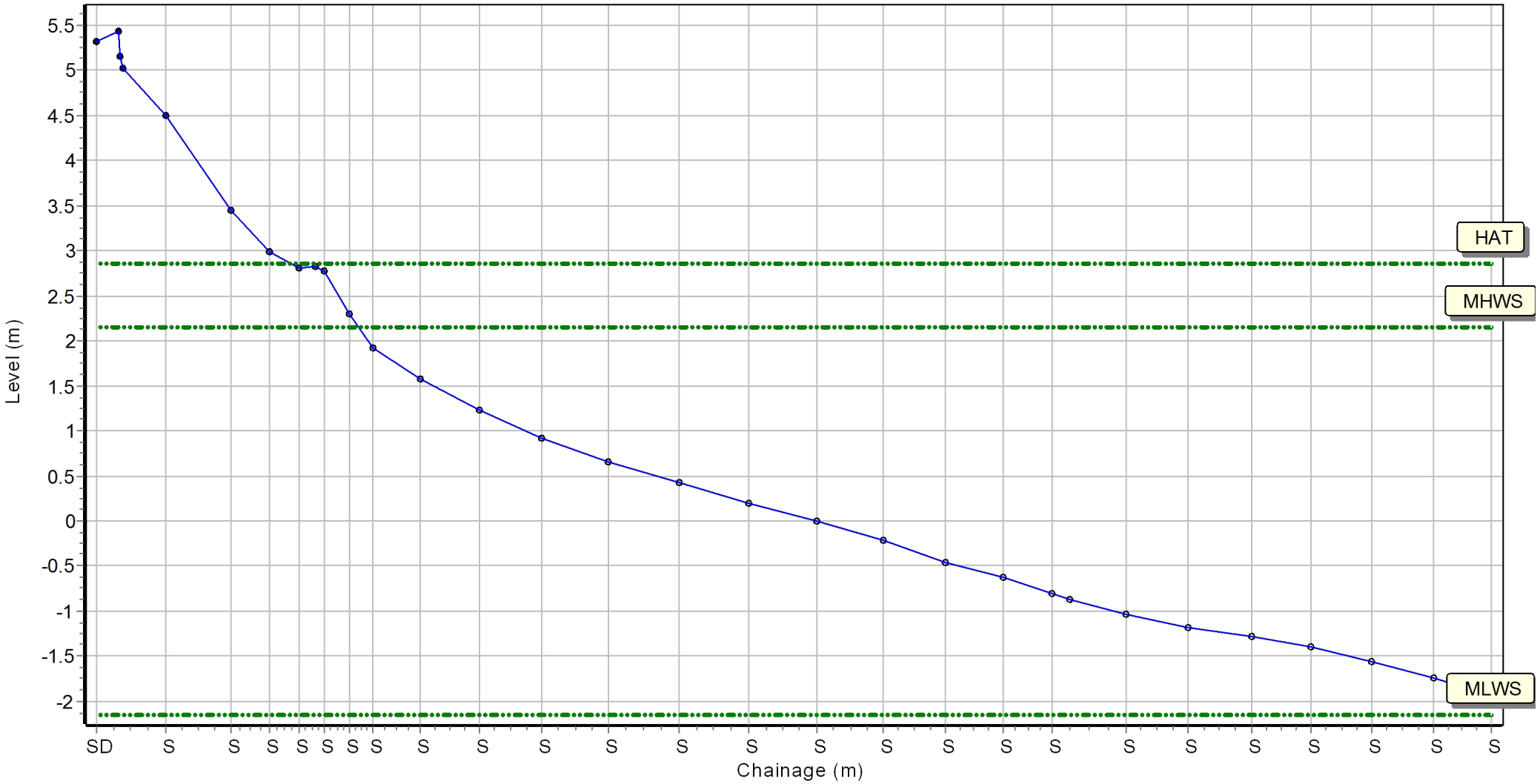
Location: **1bSS8**

Date: 14/03/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 437996.548 **Northing:** 566926.497 **Profile Bearing:** 48 ° from North



Beach Profile

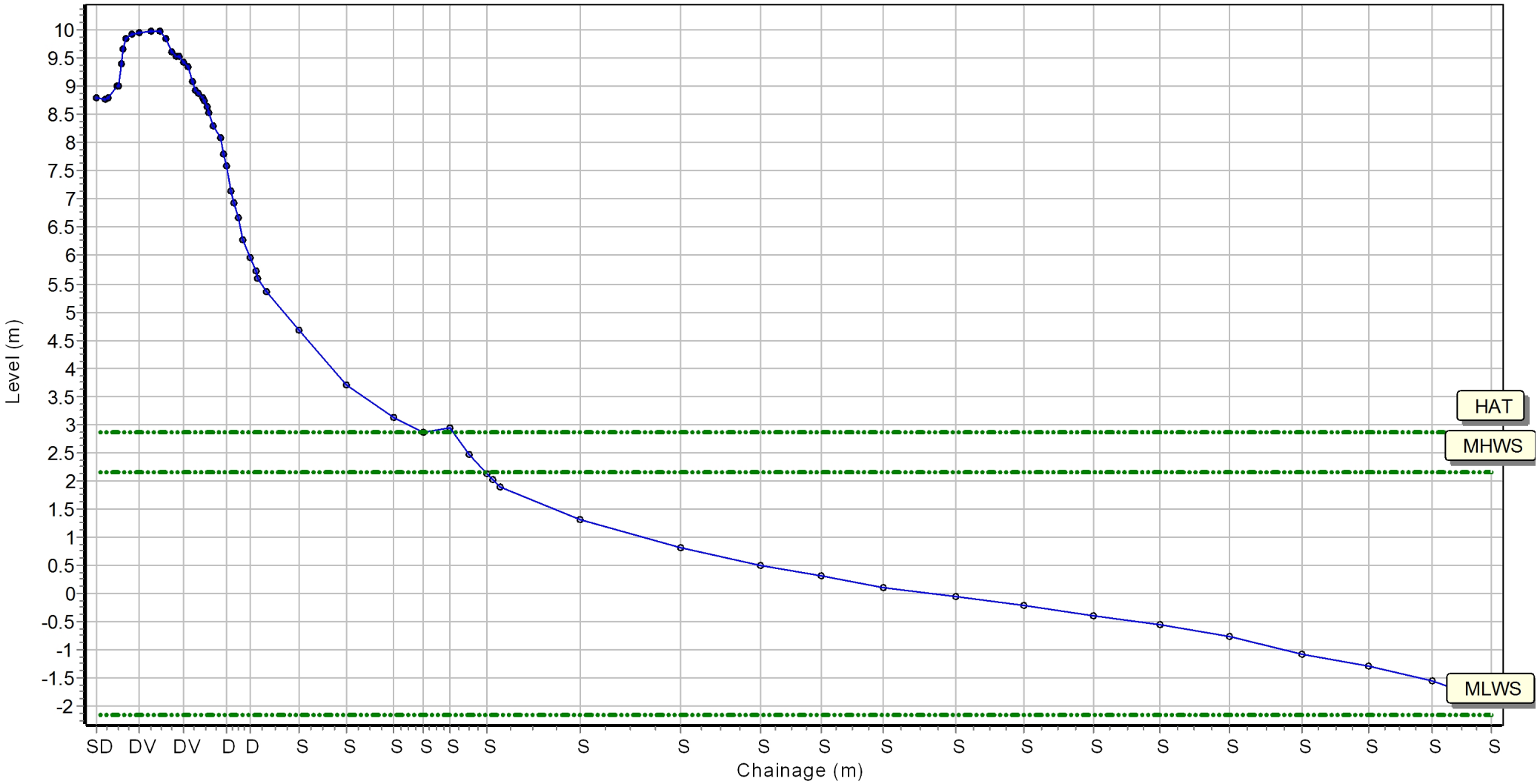
Location: **1bSS9**

Date: 14/03/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 438183.431 **Northing:** 566678.818 **Profile Bearing:** 46 ° from North



Beach Profile

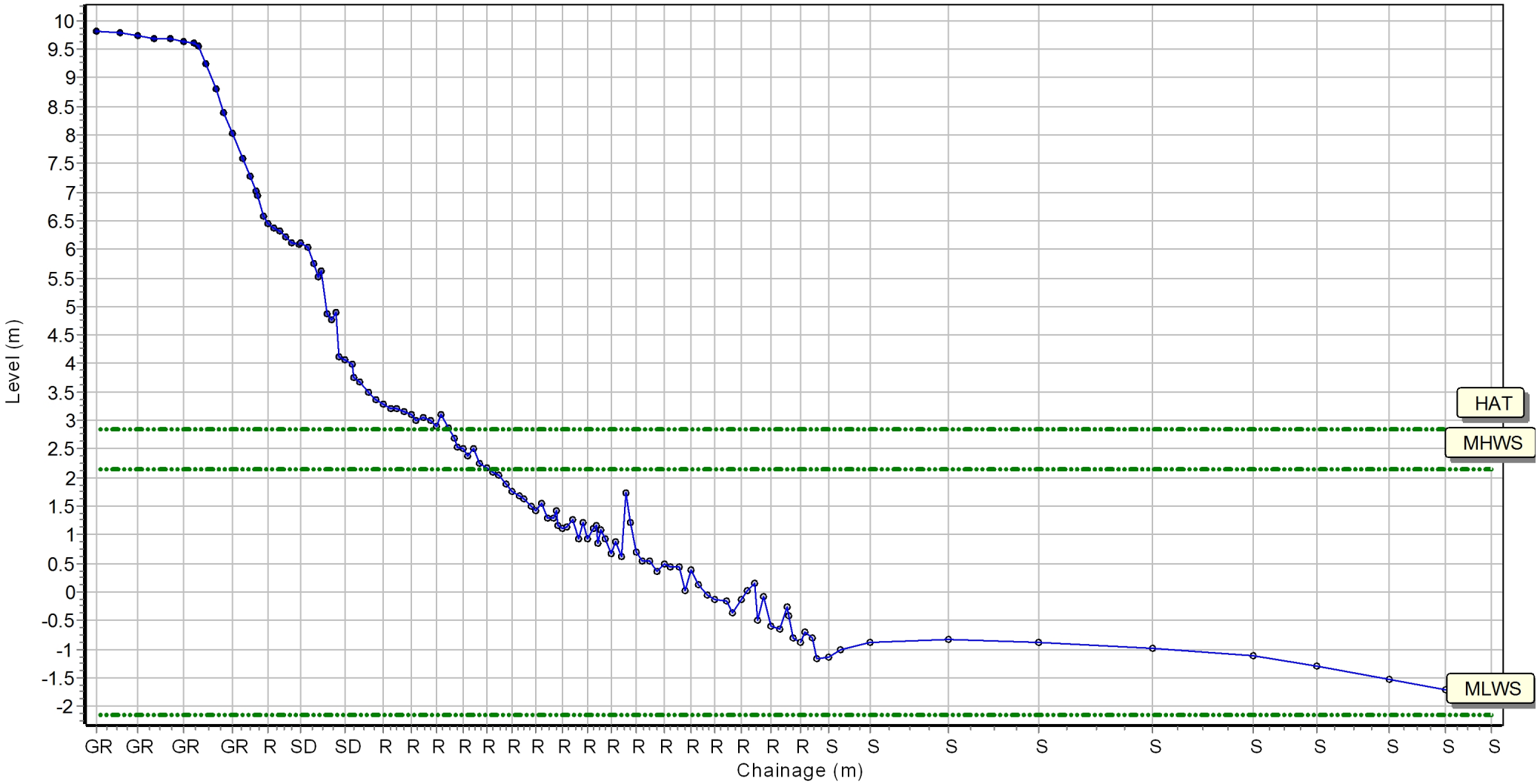
Location: **1bSS10**

Date: 14/03/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 438408.755 **Northing:** 566539.727 **Profile Bearing:** 47 ° from North



Beach Profile

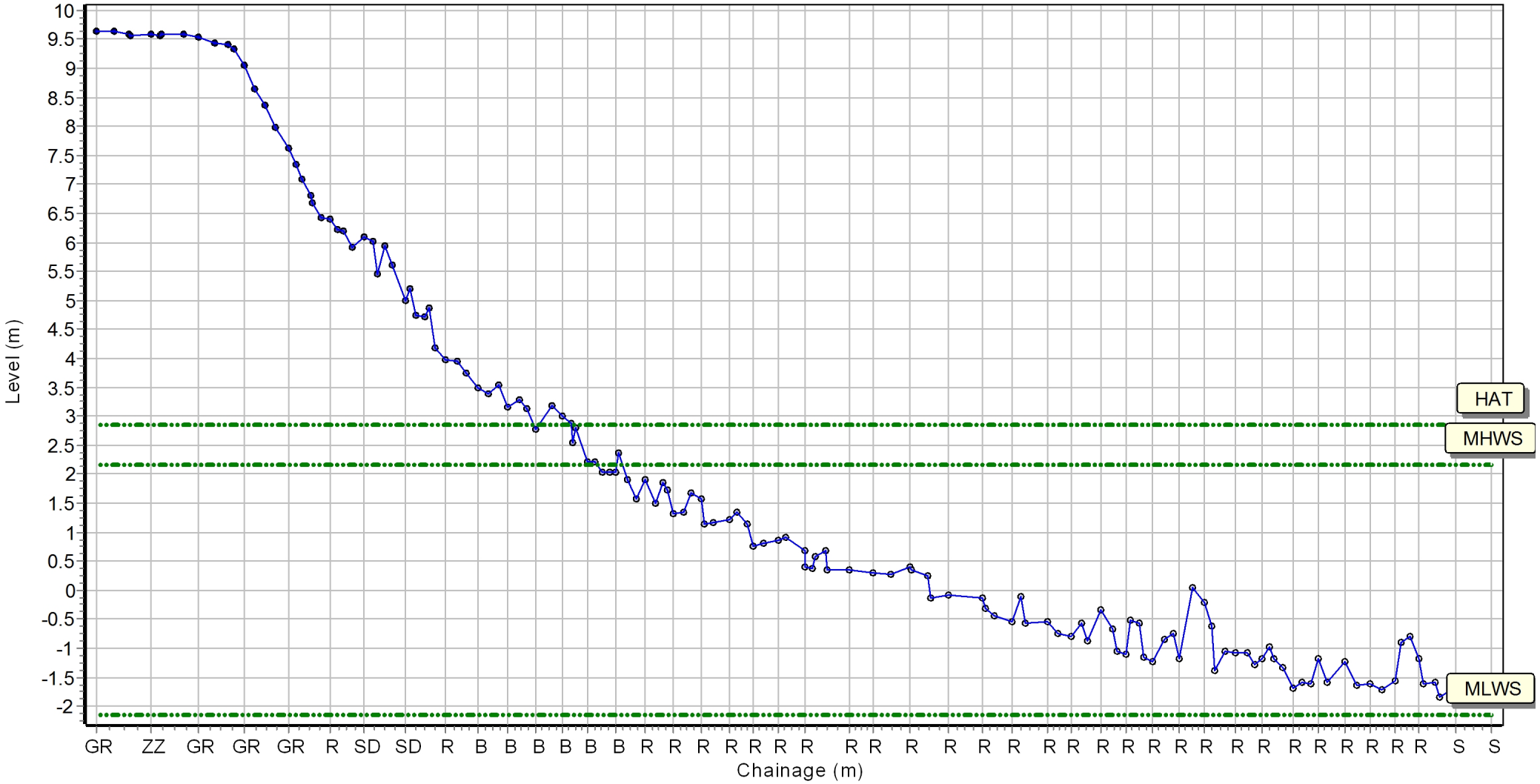
Location: **1bSS11**

Date: 14/03/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 438498.97 **Northing:** 566479.034 **Profile Bearing:** 26 ° from North



Beach Profile

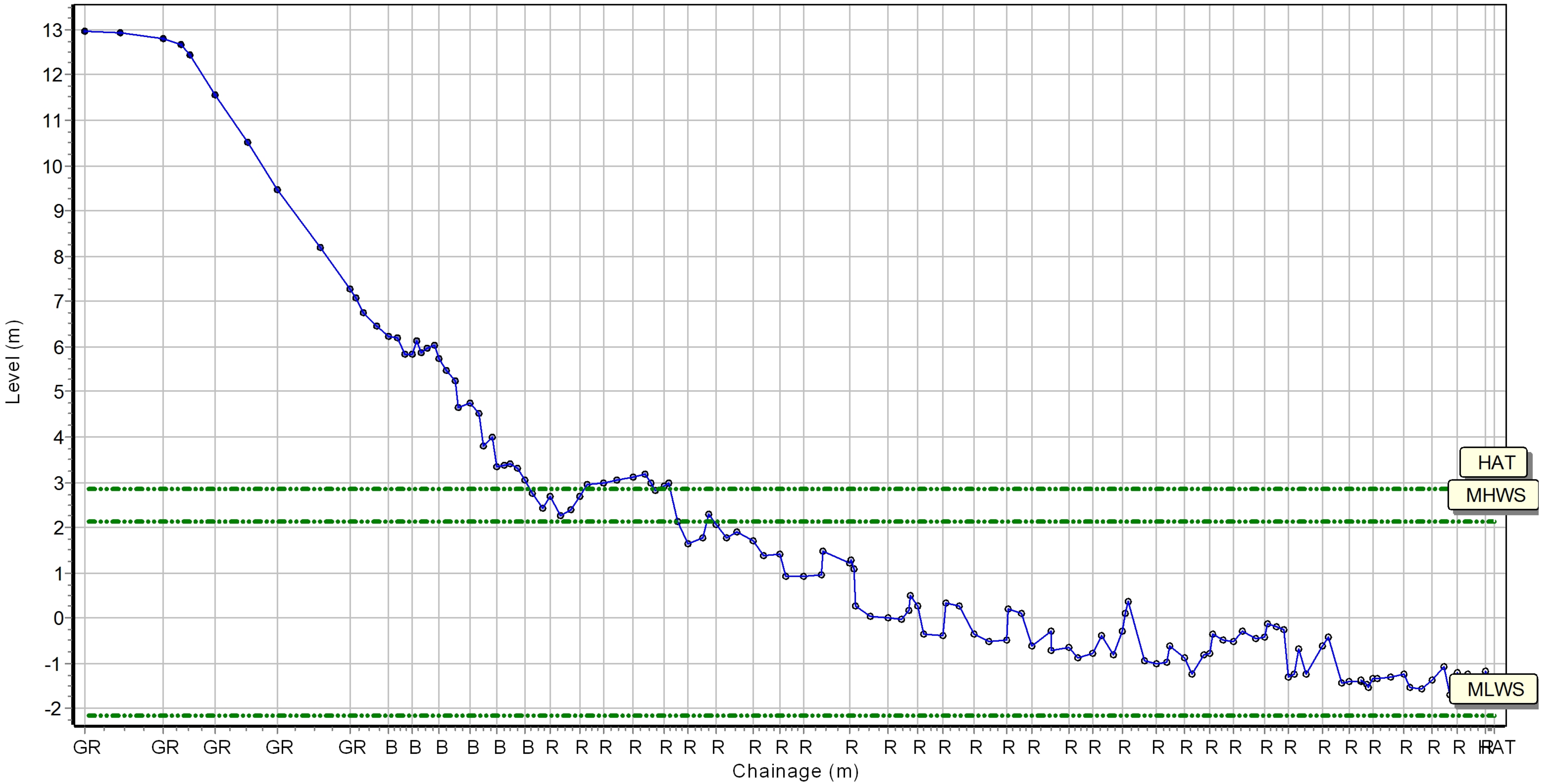
Location: 1bSS12

Date: 14/03/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 438696.305 **Northing:** 566412.949 **Profile Bearing:** 26 ° from North



Beach Profile

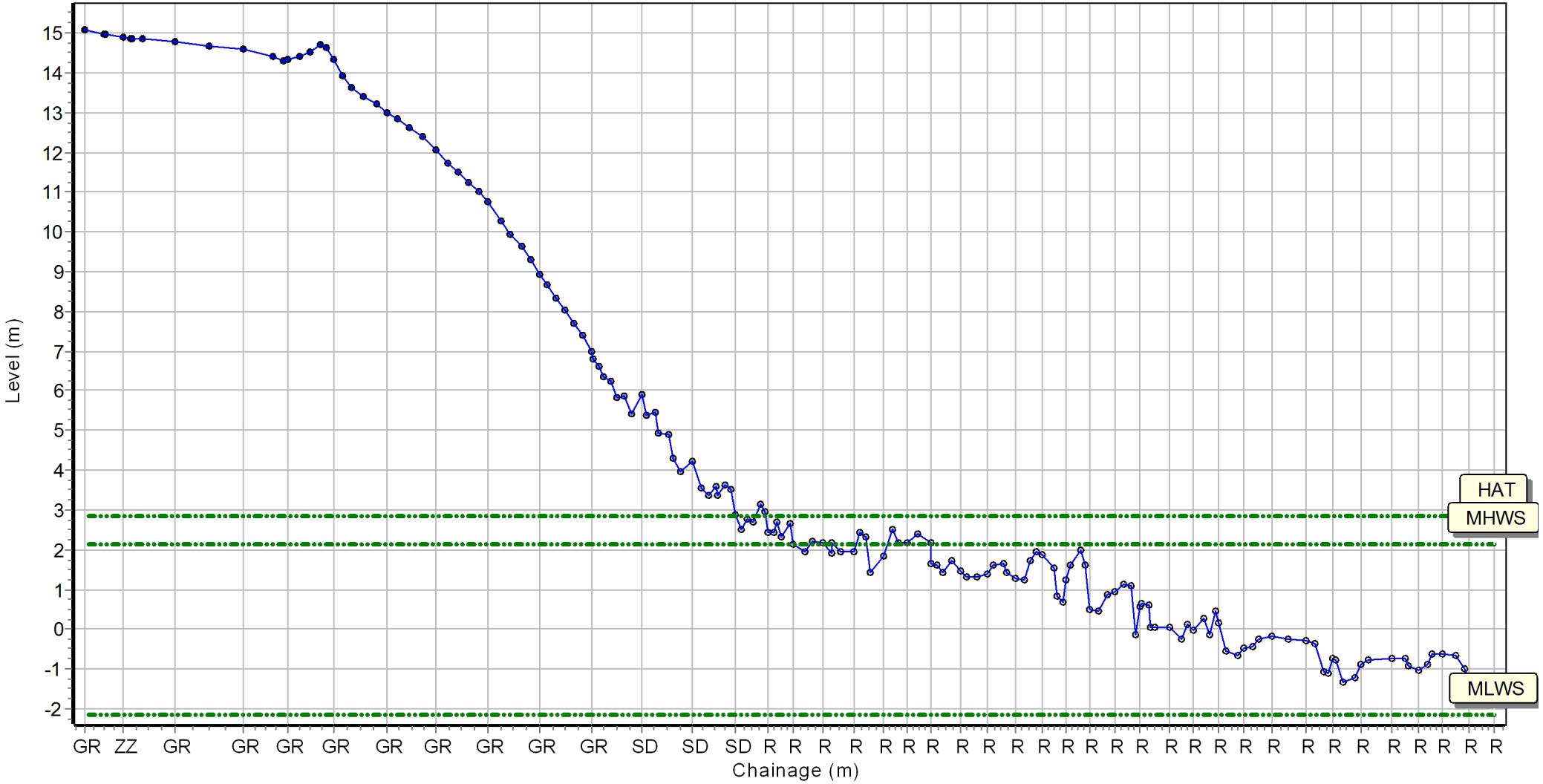
Location: **1bSS13**

Date: 14/03/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 438750.749 **Northing:** 566369.415 **Profile Bearing:** 20 ° from North



Beach Profile

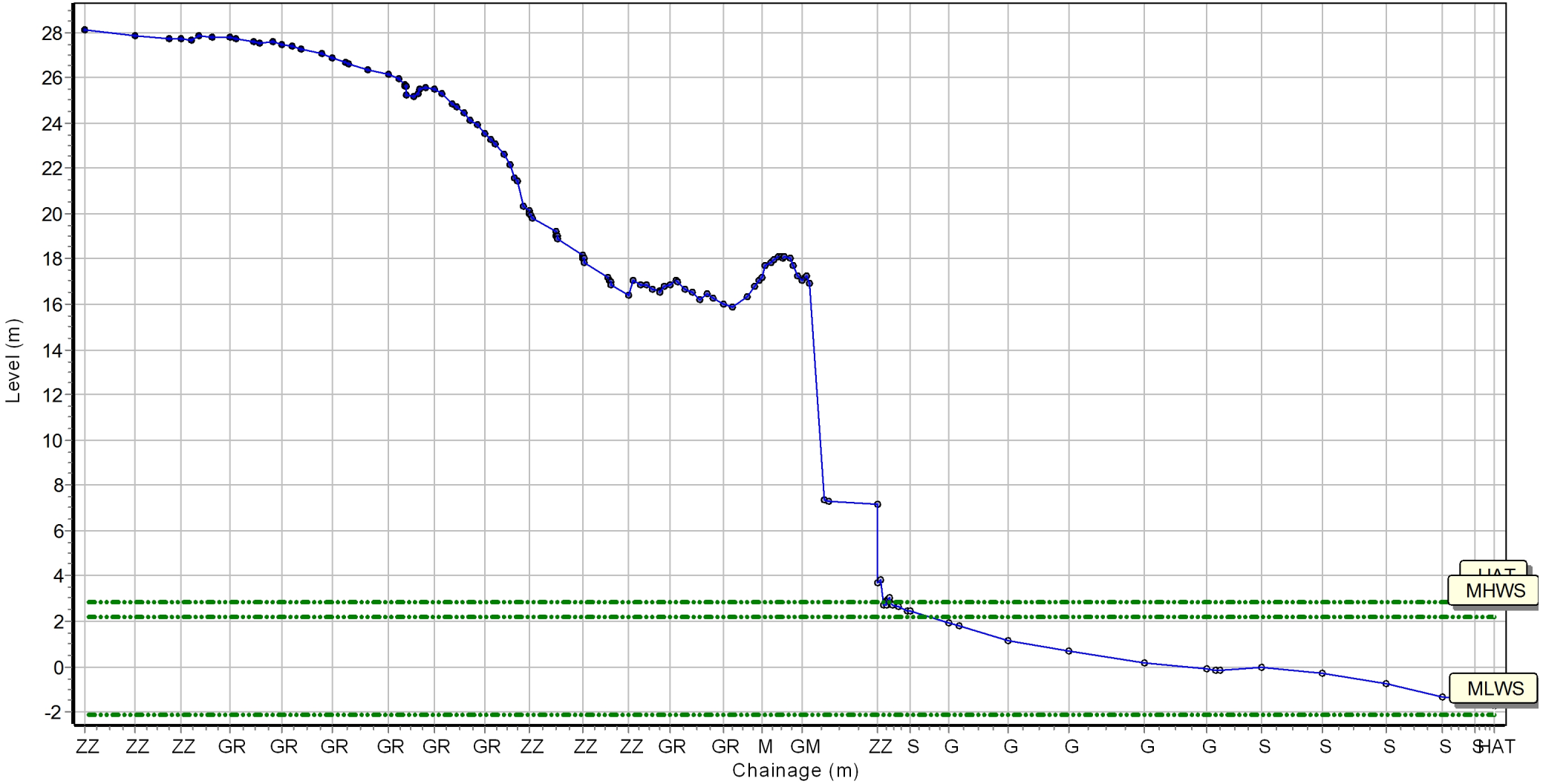
Location: **1bSS14**

Date: 14/03/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 439630.452 **Northing:** 565163.521 **Profile Bearing:** 55 ° from North



Beach Profile

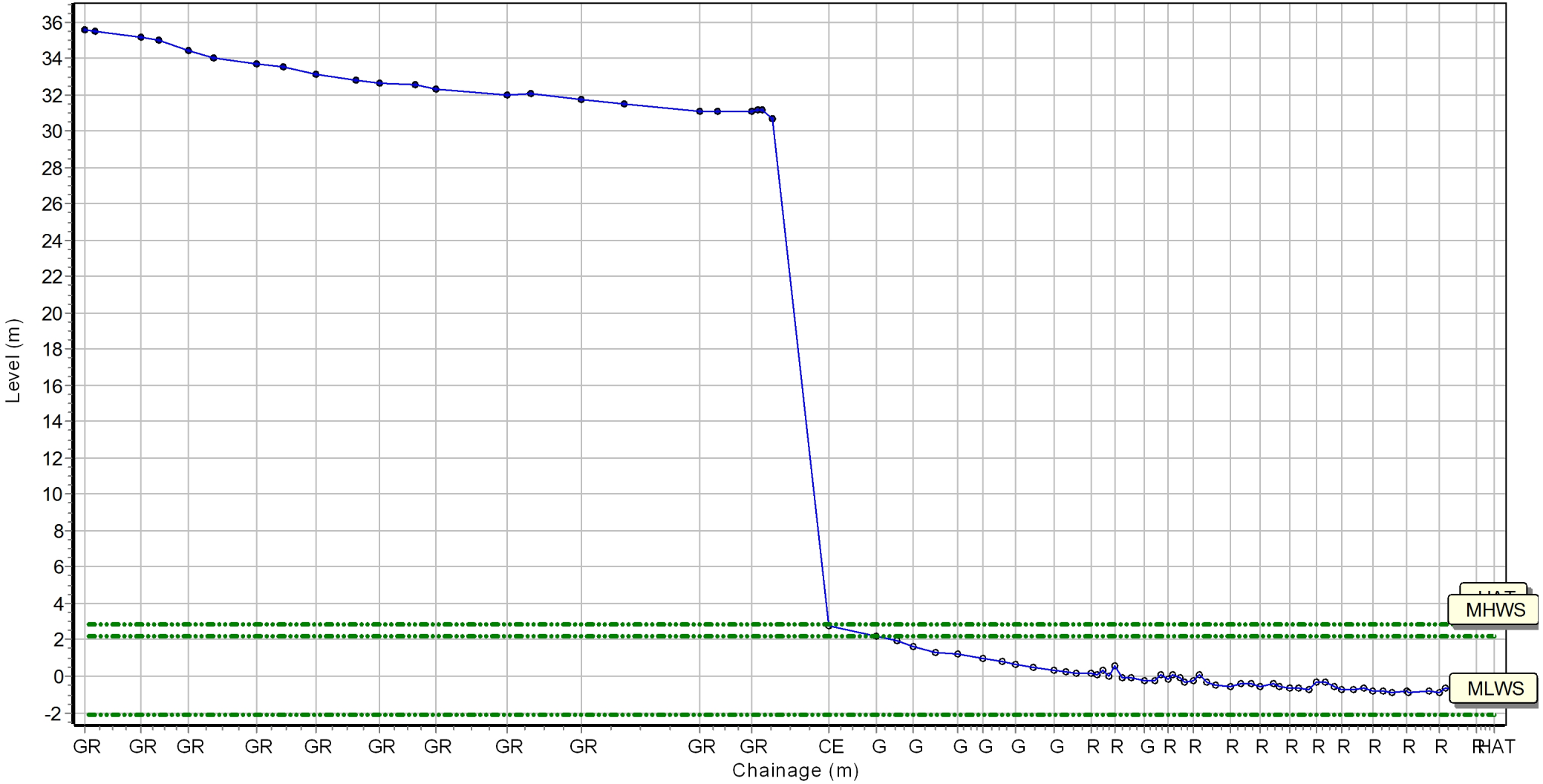
Location: **1bSS17**

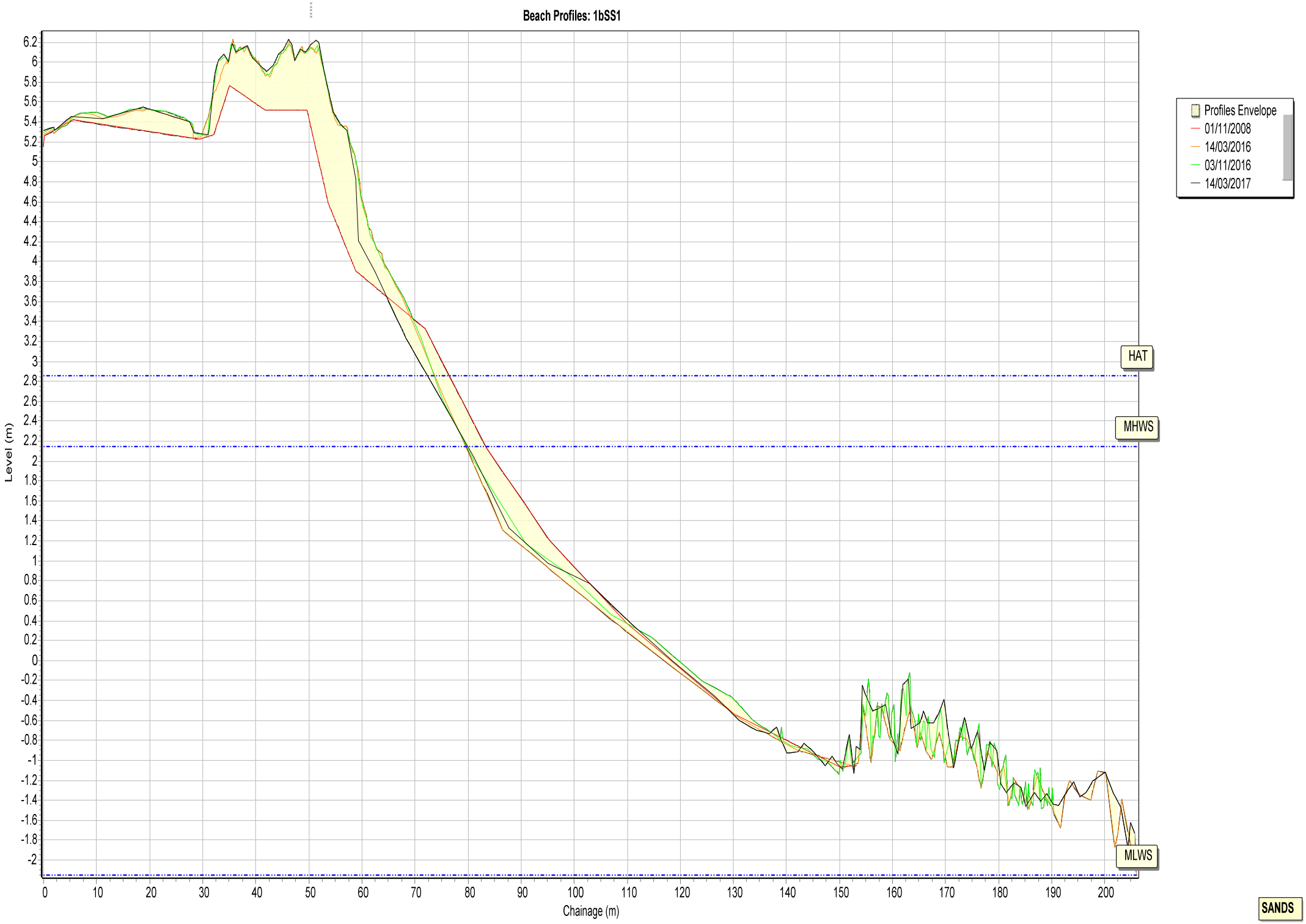
Date: 14/03/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 440161.831 **Northing:** 564656.791 **Profile Bearing:** 41 ° from North

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14/03/2017
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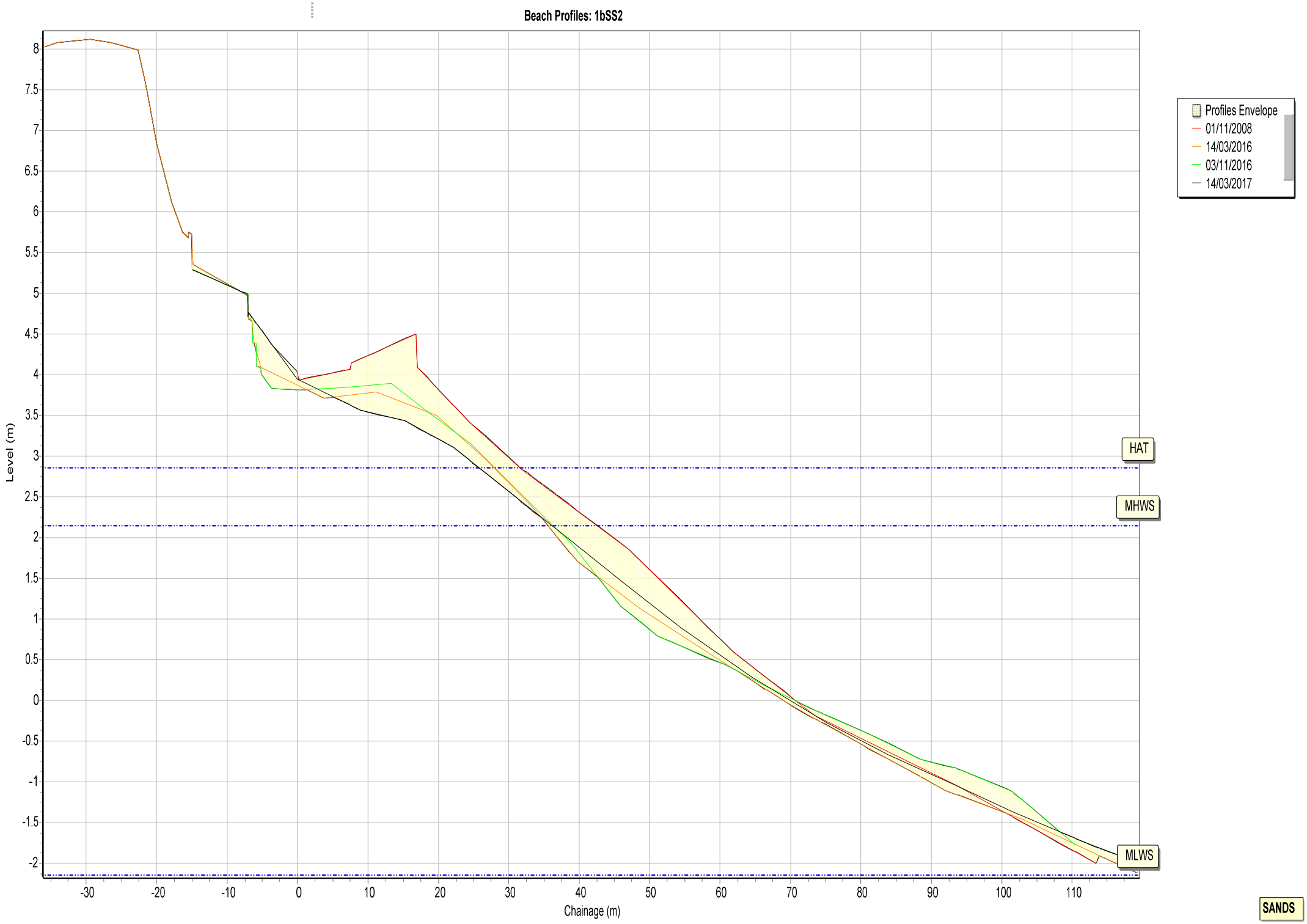
Level (m)
Chainage (m)
SANDS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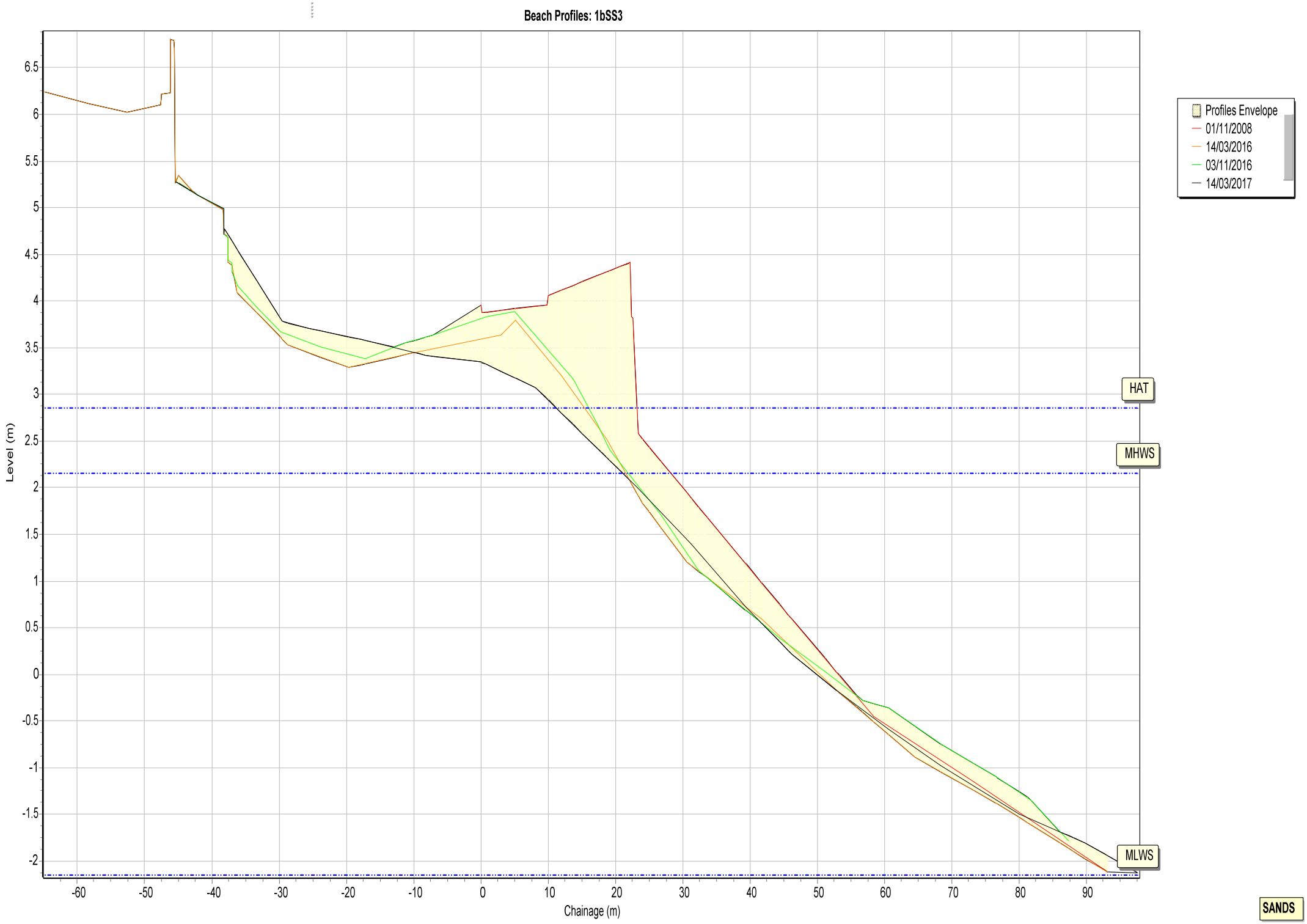
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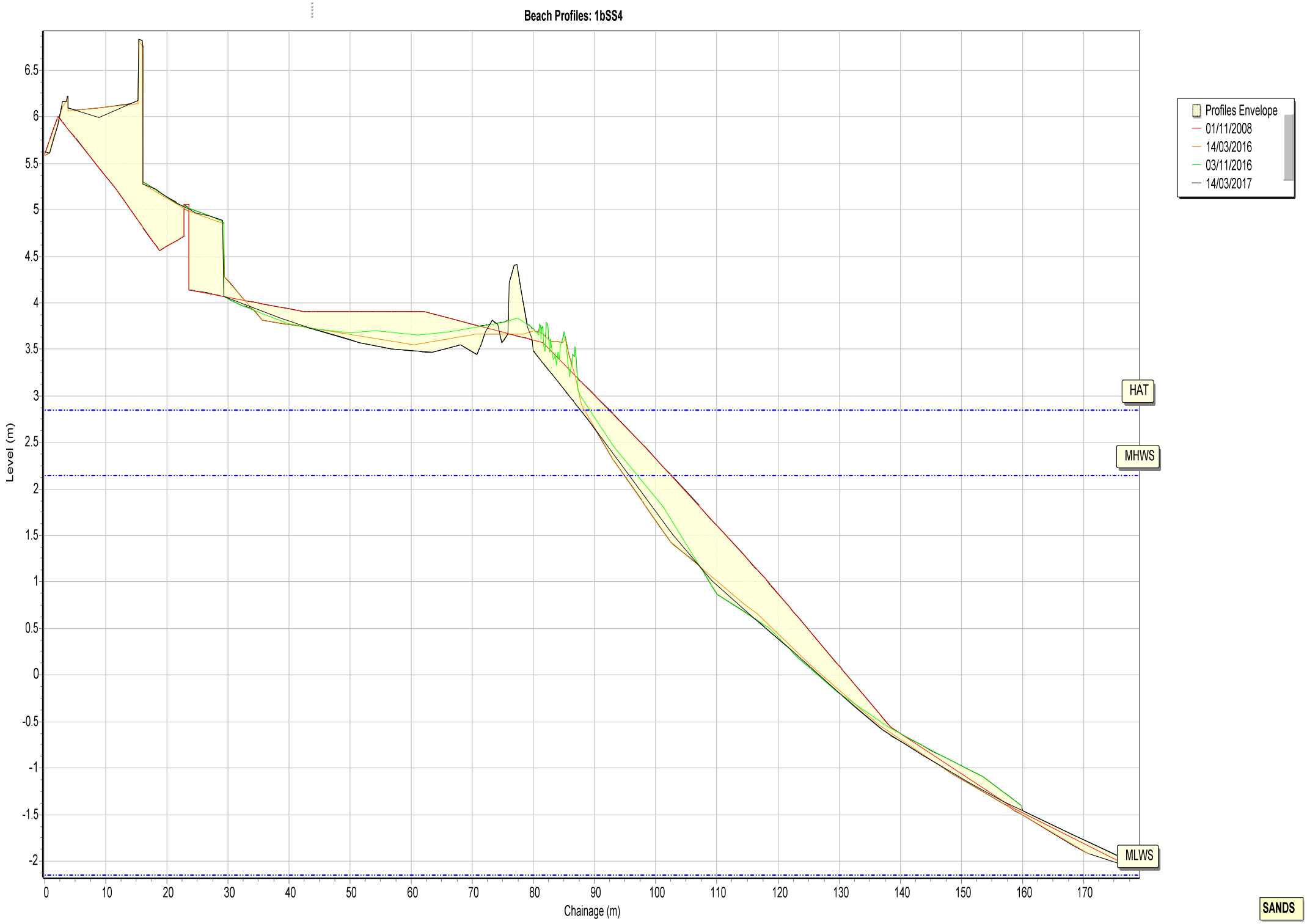
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170
SANDS


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03/11/2016
14/03/2017
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SANDS
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Chainage (m)
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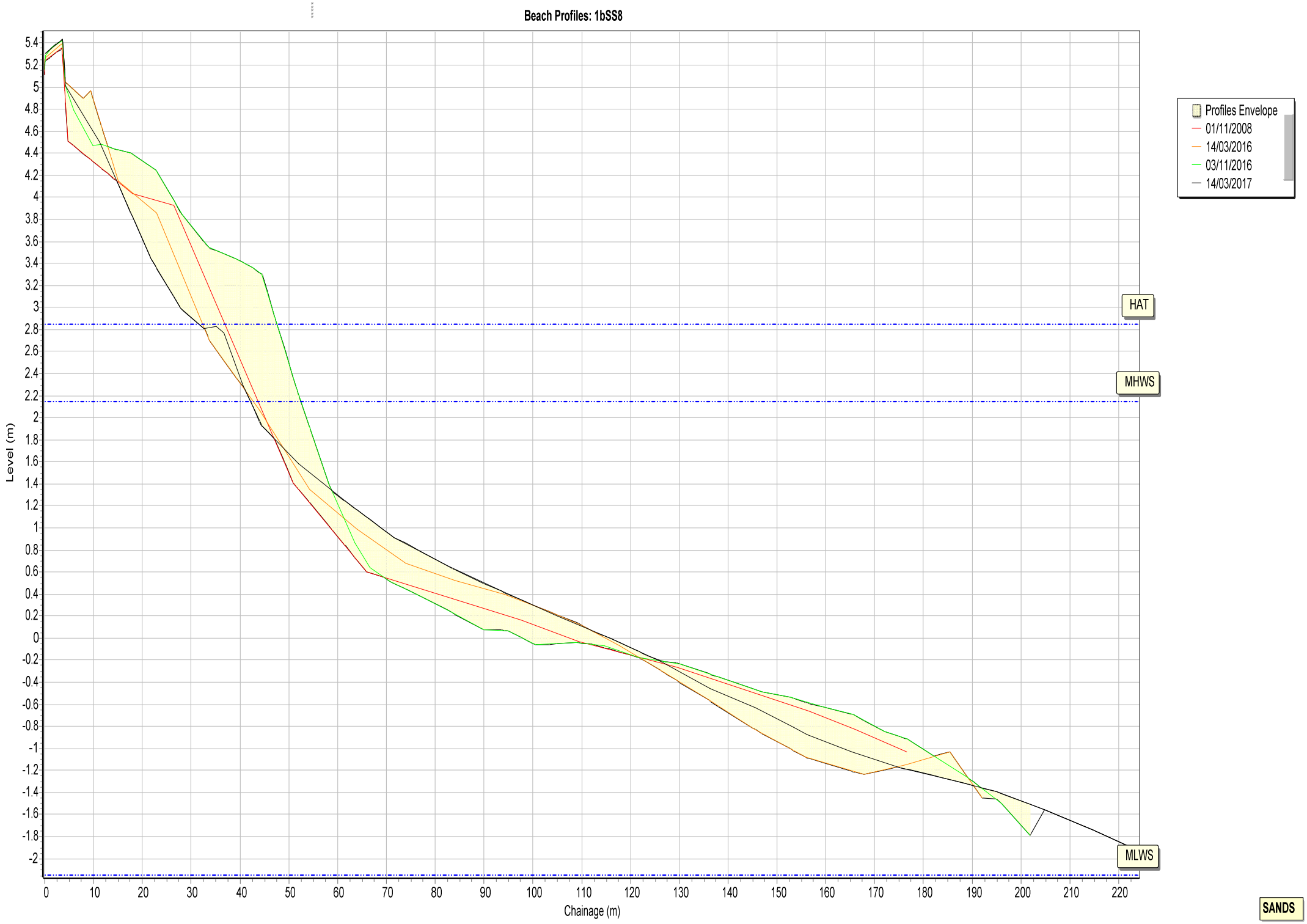
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Chainage (m)
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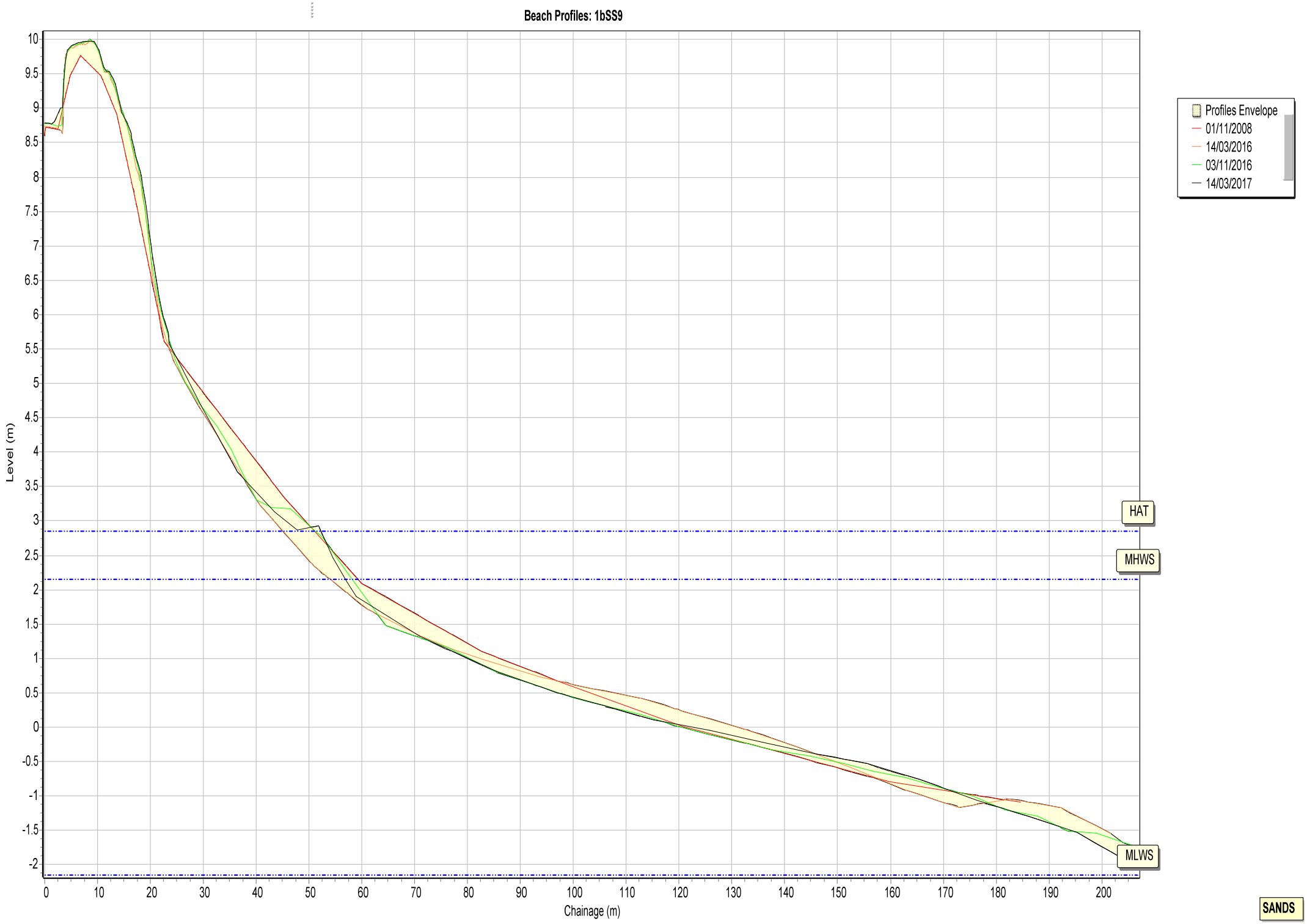
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03/11/2016
14/03/2017
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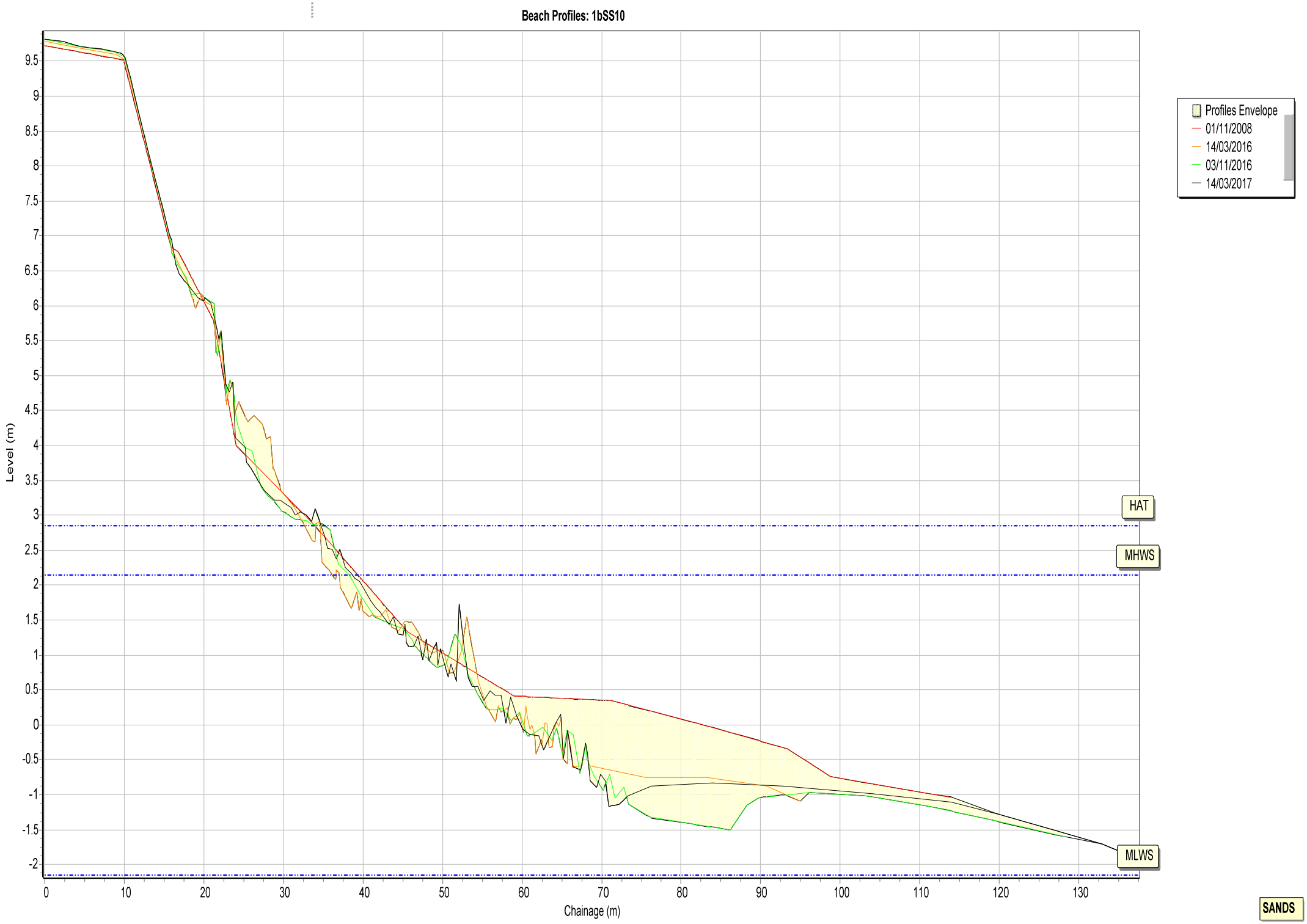
Chainage (m)
SANDS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14/03/2017
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Chainage (m)
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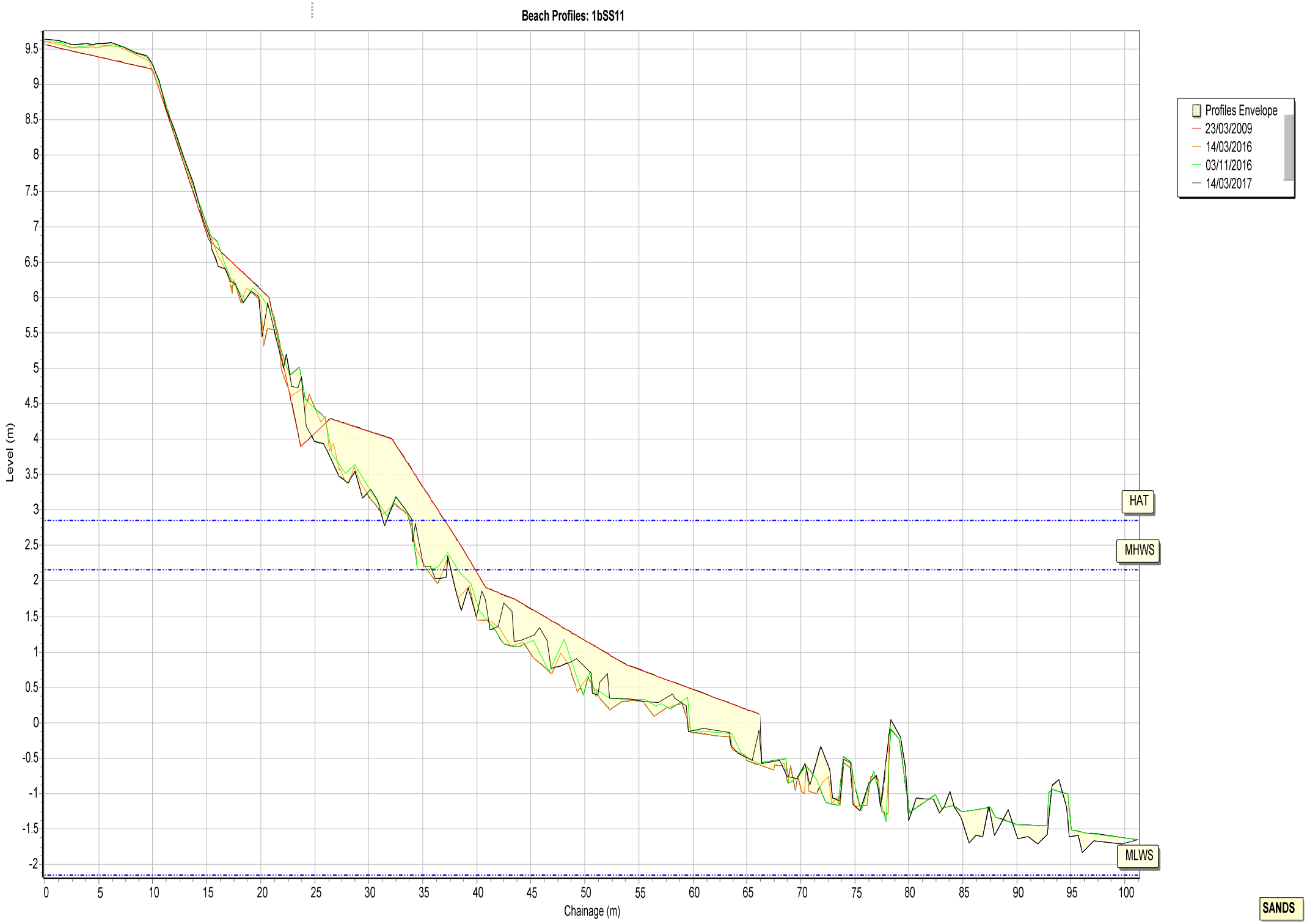
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Profiles Envelope
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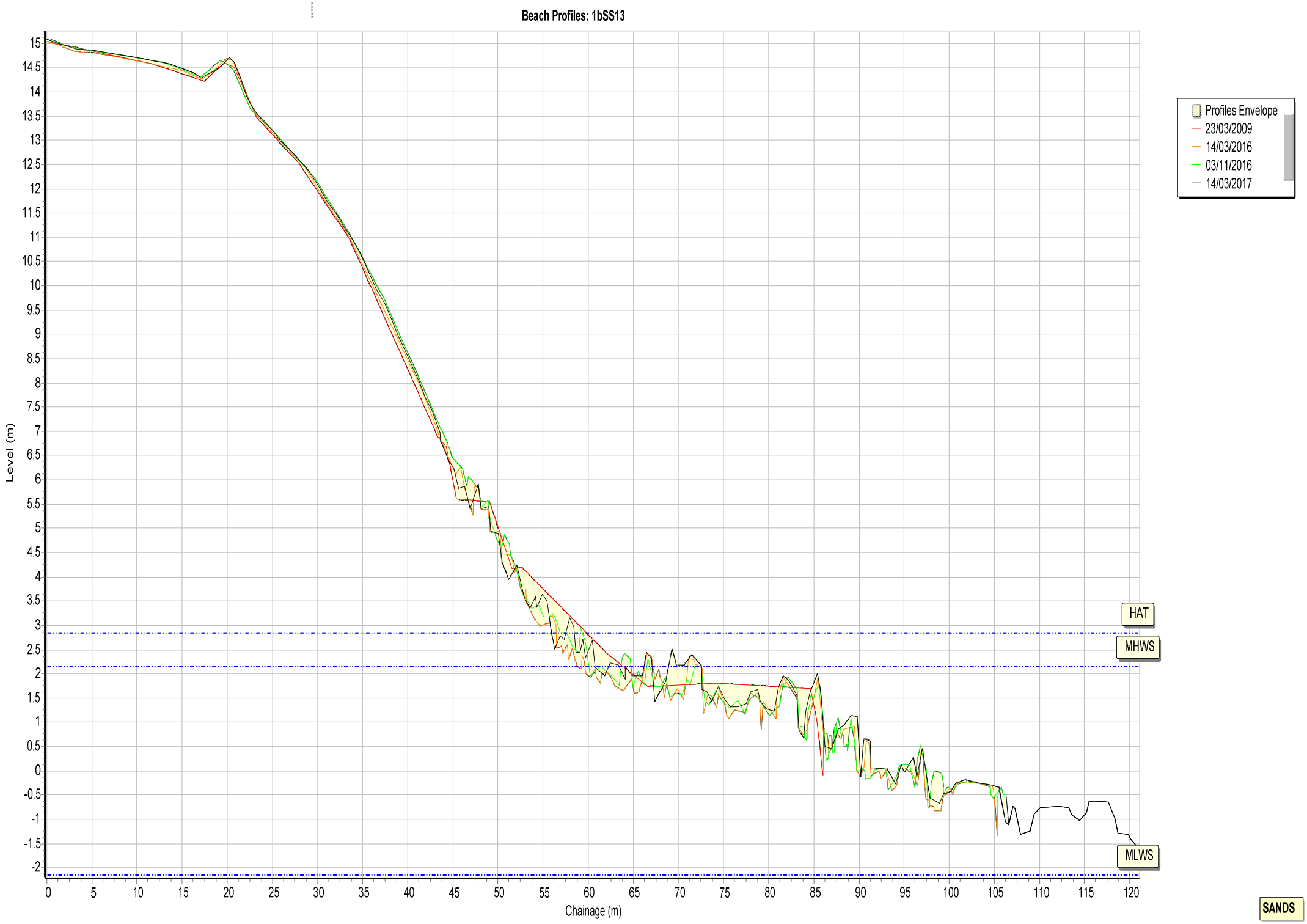
Level (m)
Chainage (m)
SANDS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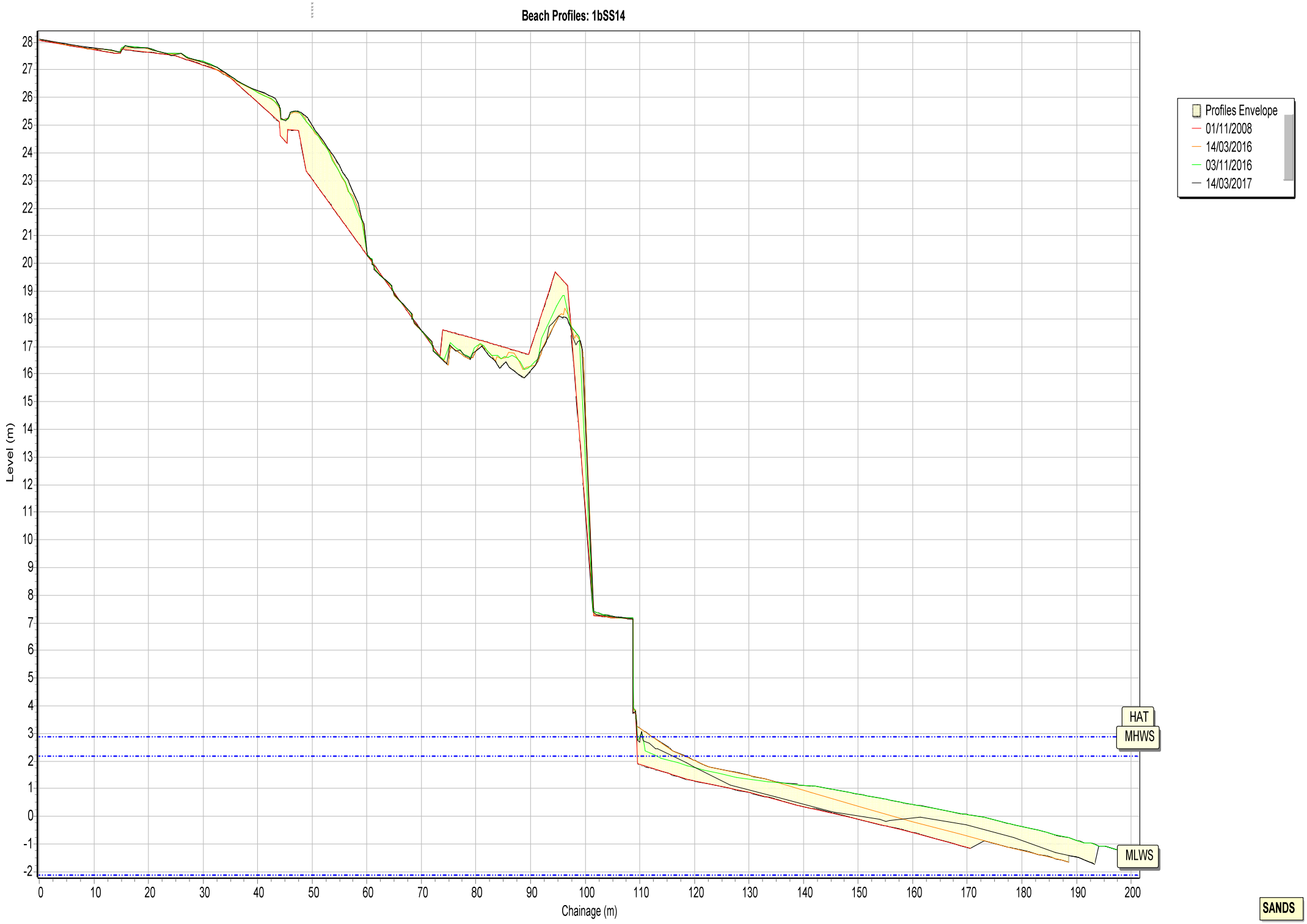
Chainage (m)
SANDS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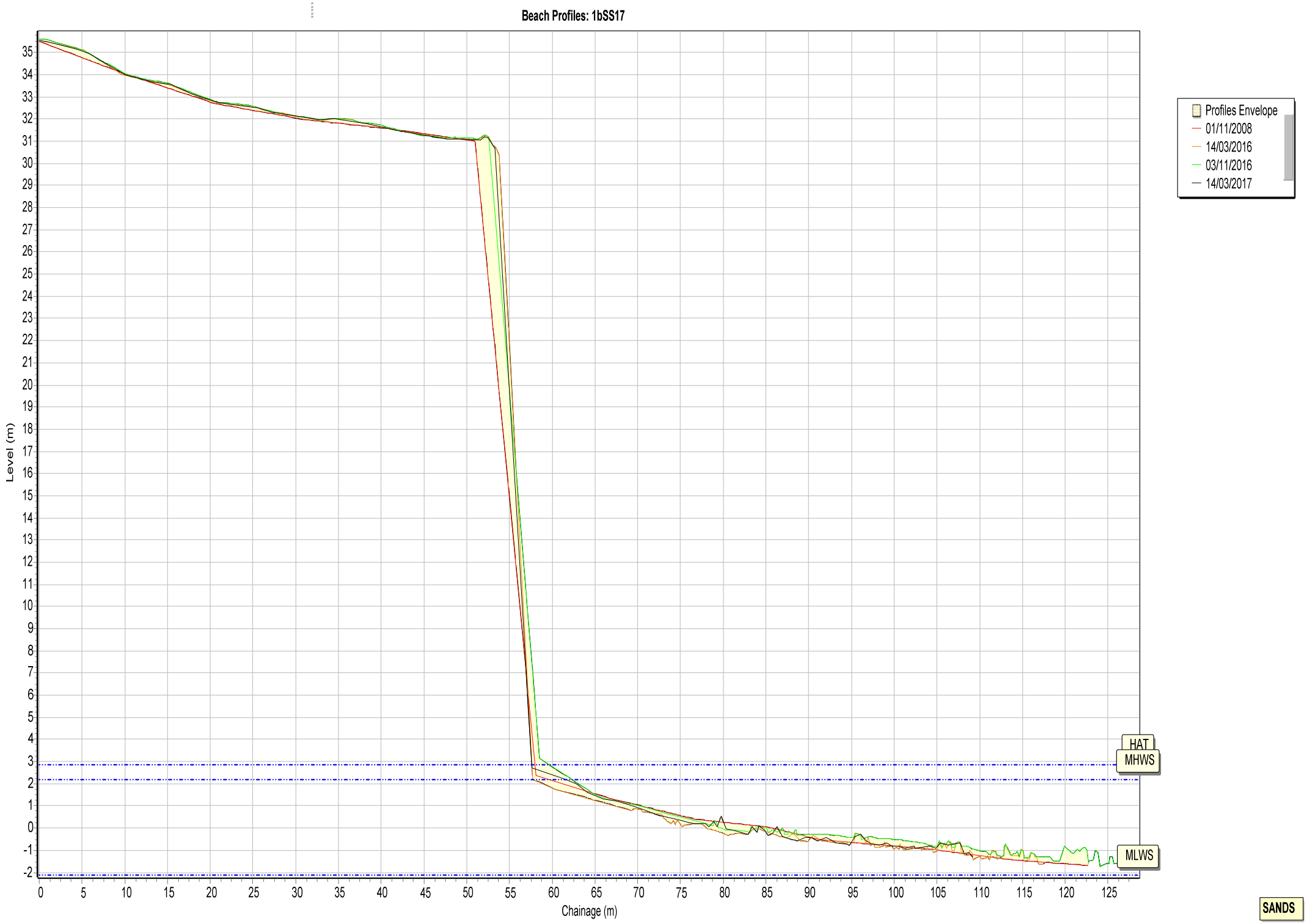
Chainage (m)
SANDS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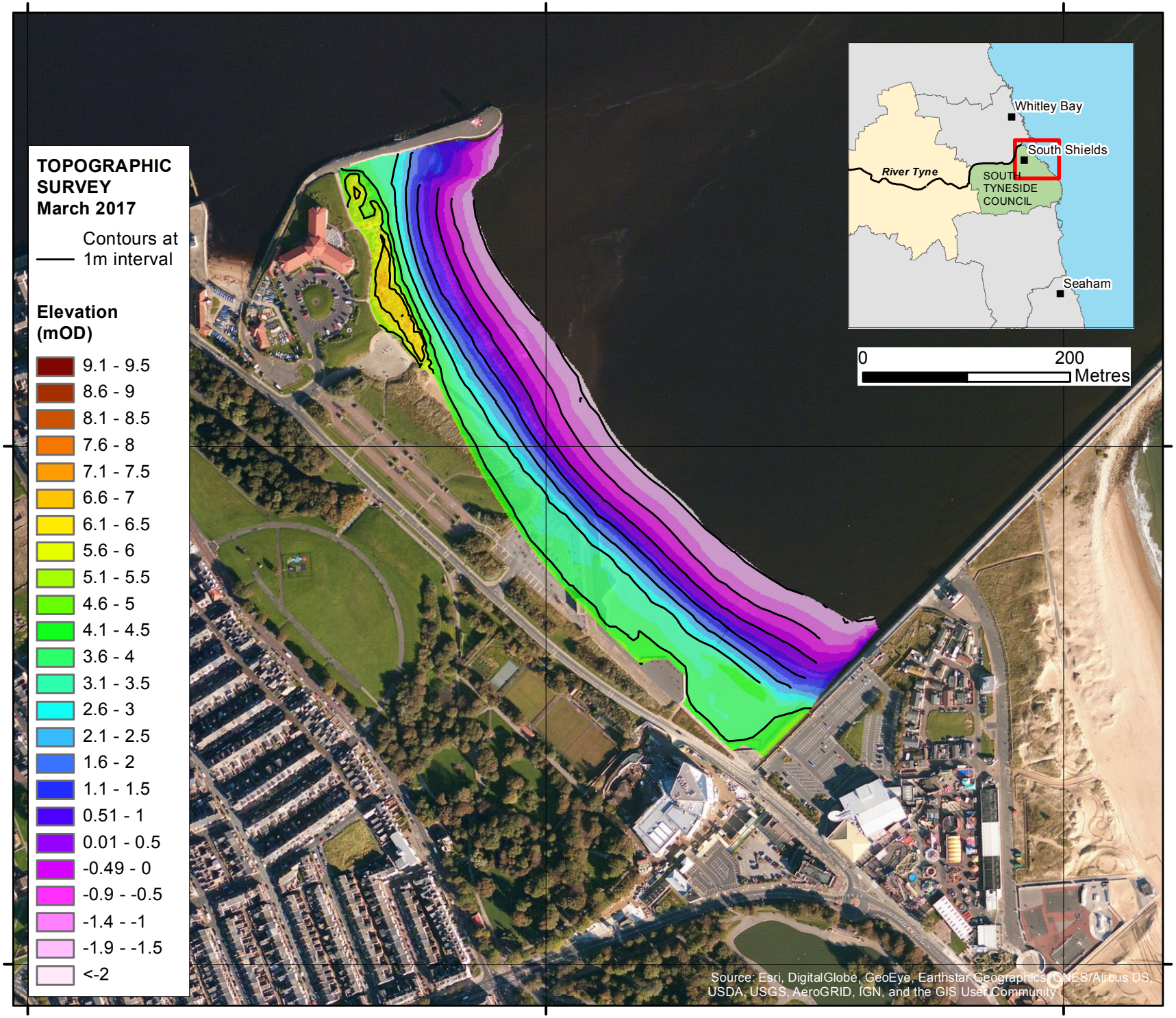
03/11/2016
14/03/2017
Level (m)
Chainage (m)
HAT
MHWS
MLWS
SANDS

Appendix B

Topographic Survey



Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Appendix B - Map 1

LITTLEHAVEN BEACH

North Tyneside Council Frontage

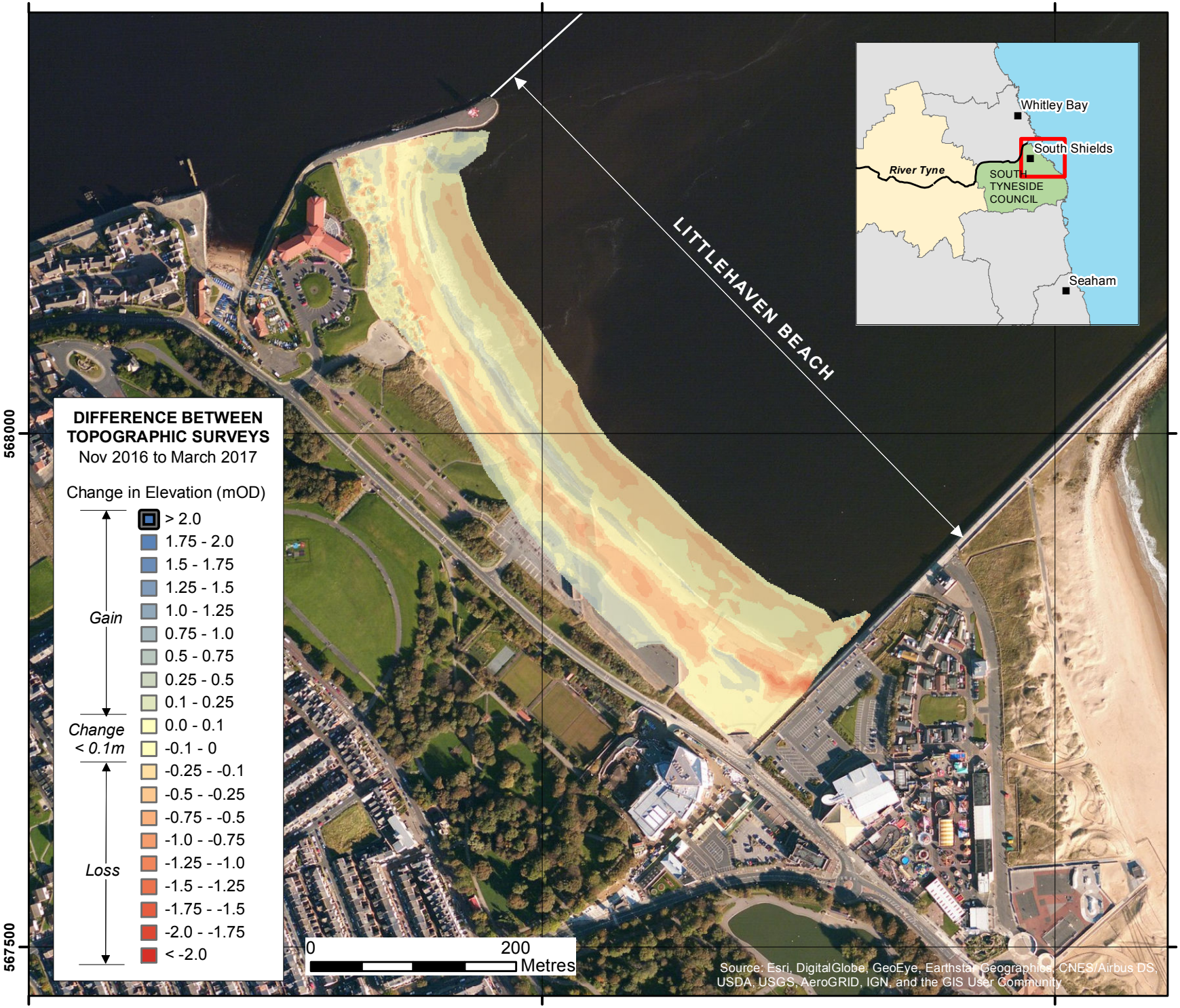
Update Report
'Partial Measures' Survey 2017

Drawing Scale at A4 1:5,000

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

Royal HaskoningDHV
Enhancing Society Together



Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Appendix B - Map 2

LITTLEHAVEN BEACH

North Tyneside Council Frontage

Update Report
'Partial Measures' Survey 2017

Drawing Scale at A4 1:5,000

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

Royal HaskoningDHV
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Appendix C

Cliff Top Survey

Cliff Top Survey

Trow Quarry

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

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

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

Table C1 – Cliff Top Surveys at Trow Quarry

Ground Control Points				Distance to Cliff Top (m)			Total Erosion (m)		Erosion Rate (m/year)
Ref	Easting	Northing	Bearing	Baseline Survey	Previous Survey	Present Survey	Baseline to Present	Previous to Present	Baseline to Present
			(°)	Sep 2011	Nov 2016	Mar 2017	Sep 2011 - Mar 2017	Nov 2016 - Mar 2017	Sep 2011 - Mar 2017
1	438300.3	566674.7	309	7	6.92	6.99	0.01	-0.07	0.00
2	438338.8	566694.3	312	9.4	9.31	9.33	0.07	-0.02	0.01
3	438384.7	566669	33	7	6.92	6.87	0.13	0.05	0.03
4	438408.1	566664.8	71	10.5	10.45	10.47	0.03	-0.02	0.01
5	438401.1	566638	120	7	7.23	7.34	-0.34	-0.11	0.00
6	438392.8	566604.2	110	10.2	10.07	10.01	0.19	0.06	0.04