



# **Cell 1 Regional Coastal Monitoring Programme Analytical Report 9: 'Full Measures' Survey 2016**

**South Tyneside Council**



**March 2017**

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## Abbreviations and Acronyms

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

## Water Levels Used in Interpretation of Changes

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

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

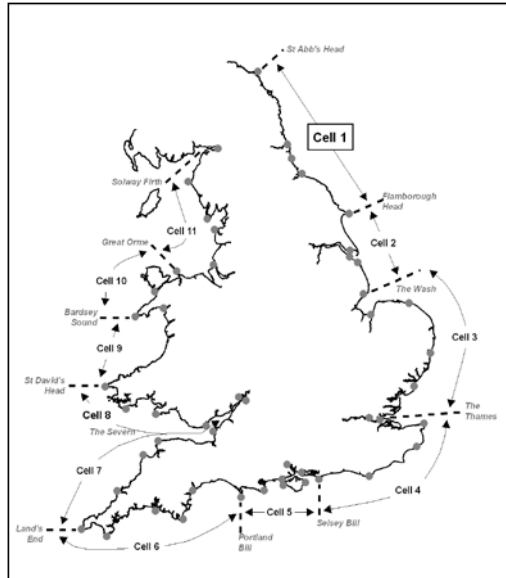


## Glossary of Terms

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). Within this frontage the coastal landforms vary considerably, comprising low-lying tidal flats with fringing salt marshes, hard rock cliffs that are mantled with glacial sediment to varying thicknesses, softer rock cliffs and extensive landslide complexes.



**Figure 1 Sediment Cells in England and Wales**

The work commenced with a three-year monitoring programme in September 2008 that was managed by Scarborough Borough Council on behalf of the North East Coastal Group. This initial phase has been followed by a five-year programme of work, which started in October 2011. The work is funded by the Environment Agency, working in partnership with the following organisations:



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/early winter every year. Some of these surveys are then repeated the following spring as part of a 'Partial Measures' survey.

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

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

To date the following reports have been produced:

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

Year		Full Measures		Partial Measures		Cell 1 Overview Report
		Survey	Analytical Report	Survey	Update Report	
1	2008/09	Sept-Dec 08	May 09	Mar-May 09		-
2	2009/10	Sept-Dec 09	Mar 10	Feb-Mar 10	July 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	Feb 13	-
5	2012/13	Nov 12	Mar 13	Mar 13	June 13	
6	2013/2014	Nov 13	Feb 14	Apr 14	July 14	
7	2014/15	Nov 14	Feb 15	Apr 15	July 15	
8	2015/16	Nov 15	Feb 16	Mar 16	July 16	
9	2016/17	Oct/Nov 16	Feb 17(*)			

(\*) The present report is **Analytical Report 9** and provides an analysis of the 2016 Full Measures survey for South Tyneside Council's frontage.

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

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

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

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

## 1. Introduction

### 1.1 Study Area

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\*)
- Partial Measures survey annually each spring comprising:
  - Beach profile surveys along 11 transect lines (commenced 2008)
  - Topographic survey along Littlehaven Beach (commenced 2010)
- Cliff top survey bi-annually at:
  - Cliff top survey at Trow Quarry (incl. Frenchman's Bay) (commenced 2008)

\*Please note that the 2008 surveys at beach profiles 1bSS11, 1bSS12 and 1bSS13 were found to be undertaken at a different location to all the profiles surveyed since then. For this reason, the 2008 profiles have been excluded from analysis undertaken in this report.

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

The location of these surveys is shown in Figure 2. The Full Measures survey was undertaken along this frontage between 27<sup>th</sup> October and 3<sup>rd</sup> November 2016. During this time, the weather conditions ranged from overcast to sunny but remained dry. Wind speeds ranged from Force 2 to Force 5 and the sea state varied from calm to rough.

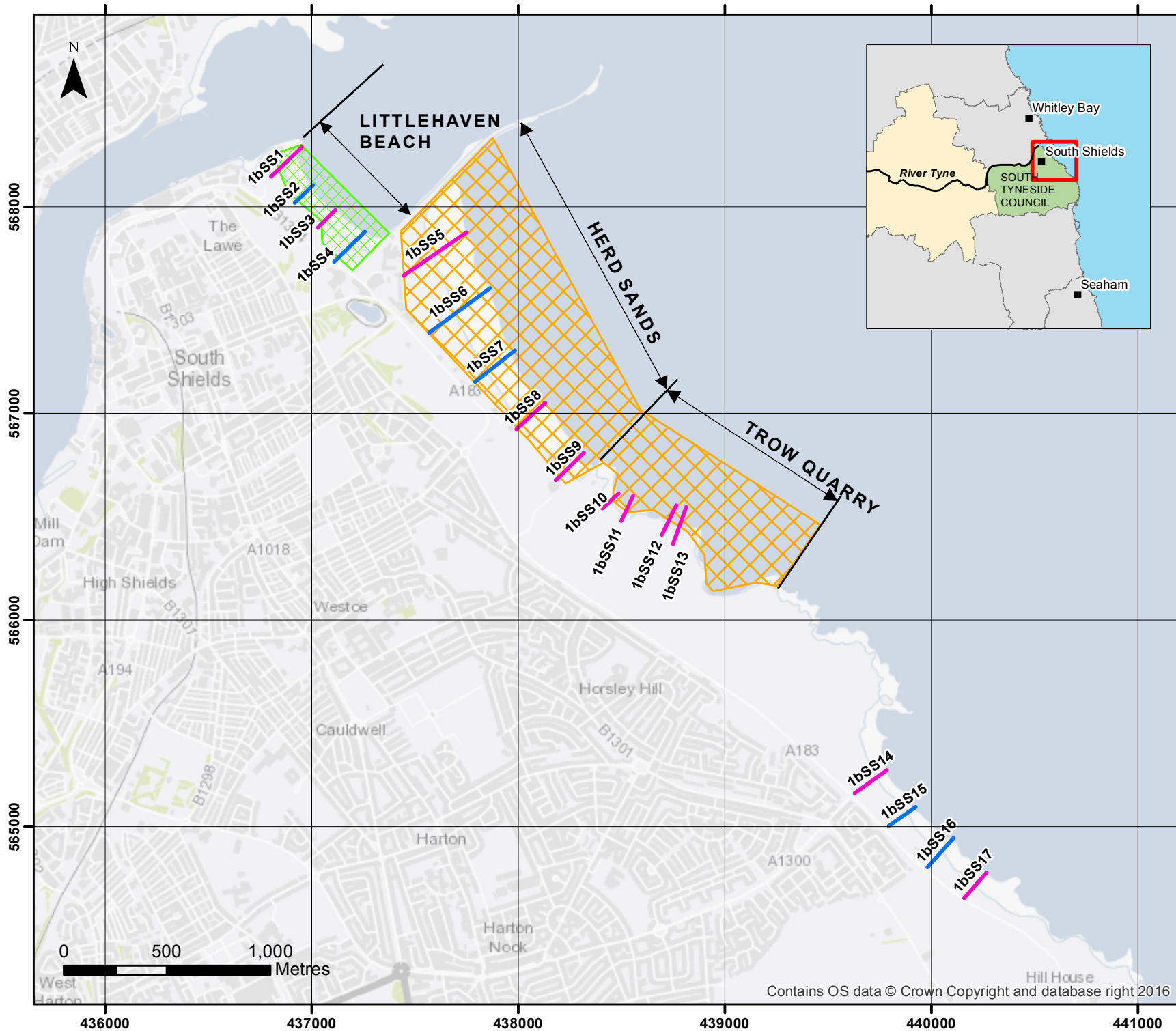
All data have been captured in a manner commensurate with the principles of the Environment Agency's *National Standard Contract and Specification for Surveying Services* and stored in a file format compatible with the software systems being used for the data analysis, namely SANDS and ArcGIS. This data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

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

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

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

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



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

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## 2. Analysis of Survey Data

### 2.1 Littlehaven Beach

Survey Date	Description of Changes Since Last Survey	Interpretation
<p><b>October-November 2016</b></p>	<p><b>Beach Profiles:</b></p> <p>Littlehaven Beach is covered by four beach profile lines for the Full Measures survey, spaced between South Groyne and South Pier (Appendix A). The previous survey was the Partial Measures survey undertaken in March 2016 and the previous Full Measures survey was undertaken in November 2015. Profiles 1bSS1 and 1bSS3 were last surveyed during the Partial Measures spring survey, 2016. Profiles 1bSS2 and 1bSS4 were last surveyed during the Full Measures autumn survey, 2015.</p> <p>Profile <b>1bSS1</b> is located to the north of Littlehaven beach, in the lee of a rocky outcrop and South Groyne. The dunes have remained stable since the last survey. Beach levels have changed very little since the March 2016 survey, with small amounts of accretion &lt;0.2m along the whole beach profile. The profile is at a medium level through the middle and lower beach compared to the range recorded from previous surveys, but at a relatively low level on the upper beach.</p> <p>Profiles <b>1bSS2 to 1bSS4</b> extend seawards from the new sea wall that was completed since the Full Measures survey in April 2014.</p> <p>At profile <b>1bSS2</b>, beach levels have fallen by 0.2m at the toe of the seawall with a corresponding increase of 0.2m between 0 and 15m chainage forming a small berm. There is little change in the profile between 15m and 90m with changes limited to less than ±0.1m. Between 90m and 110m, chainage there has been accretion of up to 0.3m forming a berm on the lower beach. The profile is at a medium-low level through the upper and middle beach compared to the range recorded from previous surveys, but is the highest on record on the lower beach.</p> <p>At profile <b>1bSS3</b>, there has been accretion along the whole beach profile, though it is generally less than 0.2m. The berm crest at 5m chainage has increased slightly by 0.1m. The largest increase is on the lower beach between chainage 60m and 85m of up to 0.3m. Overall, the profile is at a medium level compared to the range recorded from previous surveys, though at its highest recorded level on the</p>	<p>The beach at Littlehaven has had some time to adjust since construction of the new seawall in April 2014. All of the profiles show little change since March 2016, with small amounts of accretion being typical. All of the profiles are generally at medium-low level compared to the range recorded from previous surveys.</p> <p><b>Longer term trends:</b> The beach profiles are at variable positions relative to past levels. In general they are within the boundaries of previous surveys indicating the new seawall has not adversely affected sediment movements. Profile 1bSS1 shows signs of progressive steepening, but is not currently a cause for concern.</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>upper beach above the berm.</p> <p>At profile <b>1bSS4</b>, there has been little change to beach levels, with changes limited to less than <math>\pm 0.2\text{m}</math> across the whole beach profile. The bank of cobble-small boulders present at chainage 80-90m remains exposed. Overall, the beach is at a medium-low level compared to the range recorded from previous surveys, and is particularly low in the upper beach and immediately seaward of the cobble-small boulder bank.</p>	
<p><b>October – November 2016</b></p>	<p><b>Topographic Survey:</b></p> <p>Littlehaven Beach is covered by bi-annual topographic survey between the South Groyne and the South Pier, which commenced in March 2010.</p> <p>Data from the most recent topographic survey (Full Measures, autumn 2016) have been used to create a DGM (Appendix B – Map 1) using GIS. A difference plot has also been produced using the DGM (Appendix B – Map 3) produced from the last produced topographic survey (Partial Measures, spring 2016) and the present survey.</p> <p>The topographic survey is patchy and generally shows little change across the beach. In general the lower foreshore shows accretion with the southern half of the bay also showing some accretion on the upper/mid beach. There are small areas of erosion in the mid beach in the centre of the bay and on the upper beach at the northern end of the bay.</p>	<p>Comparison of the present topographic survey with the previous Partial Measures (spring, 2016) shows that the beach is generally stable with shore-parallel bands of elevation change which reflect seasonal redistributions of material throughout across the beach as bars.</p>

## 2.2 Herd Sands

Survey Date	Description of Changes Since Last Survey	Interpretation
<p><b>October – November 2016</b></p>	<p><b>Beach Profiles:</b></p> <p>Herd Sands is covered by five beach profile lines for the Full Measures survey (Appendix A). Profiles 1bSS5, 1bSS8 to 1bSS9 were last surveyed during the Partial Measures spring survey, 2016. Profiles 1bSS6 and 1bSS7 were last surveyed during the Full Measures autumn survey 2015.</p> <p>Profile <b>1bSS5</b> is located to the north of Herd Sands and is in the lee of the breakwater. Sand fences were constructed on these dunes in 2012 to encourage accretion. The dunes have largely retained a similar form to the previous survey, showing that the defences are helping to stabilise the dunes on the landward side of the path. The dunes between chainage 70m and 85m, and 95m and 105m have increased in height by 0.2m, whilst the hollow between them has eroded into the toe of the more landward dune by c.5m steepening it. The beach seaward of the dunes has increased in level by up to 0.4m between chainage 105m and 125m. The middle beach has undergone up to 0.3m of erosion between chainage 125m and 330m, with the exception of the formation of a small berm at 180m chainage. The lower beach from 330m seawards shows accretion and the formation of a berm between chainage 360m and 380m, resulting in the highest recorded levels for this section of the profile. Overall, the beach is at a medium-high level compared to the range recorded from previous surveys, apart from a short section in the middle beach at chainage 140m which shows the lowest recorded levels.</p> <p>At profile <b>1bSS6</b>, the dunes have largely retained a similar form to the previous survey. The flat surface of the upper beach above HAT between 100m and 140m chainage has eroded slightly (0.2m), but the berm at its seaward edge (chainage 150m) has reformed in elevation by a similar amount, with a secondary berm forming at chainage 170m. The remainder of the profile has undergone erosion of up to 0.6m. Overall, the beach is at a medium-high level compared to the range recorded from previous surveys. .</p> <p>At profile <b>1bSS7</b>, located at the centre of Herd Sands, the two berms present in the previous profile have moved landwards by c.10-15m. From chainage 95m seawards beach levels have dropped by up to 0.5m generally, though at the toe of the beach the erosion is greater c.1m. The upper beach is high compared to the range recorded from previous surveys, whilst the middle beach is at a medium level, and the lower beach is relatively low with the toe of the beach showing its lowest recorded level.</p>	<p>The pattern of change at Herd Sands is complex. There has been accretion on the face of stabilised dunes and on the upper beach, with the formation and movement of berms across the beach.</p> <p><b>Longer term trends:</b> Beach levels generally remain at medium to high levels compared to earlier surveys.</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>At profile <b>1bSS8</b>, there has been variable erosion and accretion across the profile creating a steeper upper beach and flatter lower/mid beach. At the toe of the seawall there has been erosion of 0.5m. Between chainage 10m and 60m there has been accretion of up to 1m forming a berm at chainage 40m. Between 60m and 120m there has been erosion of up to 0.3m, with erosion of up to 0.5m from 120m to 180m chainage. Overall, the beach is at a medium-high level compared to the range recorded from previous surveys, apart from the middle beach around chainage 70m, which is relatively low.</p> <p>Profile <b>1bSS9</b> is located at the southern end of Herd Sands. The dune profile fronting the car park remains unchanged. The beach profile changes follow a very similar pattern to those at profile 1bSS8, with the formation of a berm on the upper beach at chainage 50m. The middle beach between chainage 65m and 150m has dropped in level by up to 0.3m, whilst the lower beach from 150m seawards has accreted by 0.2m except between chainage 180m and 200m where the berm present on the previous survey has disappeared. Overall the beach is at a medium-high level compared to the range recorded from previous surveys, apart from the toe of the beach which shows the lowest recorded level between chainage 190m and 200m.</p>	
Nov 2015	<p><b>Topographic Survey:</b></p> <p>Herd Sands is covered by an annual topographic survey between the South Pier and Trow Point, which commenced in November 2008.</p> <p>Data from the most recent topographic survey (Full Measures, autumn 2016) have been used to create a DGM (Appendix B – Map 1) using GIS. A difference plot has also been produced using the DGM (Appendix B – Map 2) produced from the last topographic survey (Full Measures, autumn 2015) and the present survey.</p> <p>The difference plot shows that change across the dunes is patchy but generally showing accretion. The beach itself is dominated by erosion particularly in the centre and south of Herd Sands, and immediately adjacent to the breakwater. Both the upper and lower beach show narrow strips of accretion in the north and south of the bay but not in the centre. The most intense area of change is in the middle of the beach in the centre of the bay with erosion of up to 2m (where profile 1bSS7 shows the berm has moved landwards).</p>	<p>Comparison of the present topographic survey with the previous Full Measures (autumn, 2015) shows widespread accretion of limited intensity in the dunes and at the dune front, the seaward edge of the upper beach and the lower foreshore. This is mirrored by erosion in the upper and mid foreshore.</p>

## 2.3 Trow Quarry (incl. Frenchman's Bay)

Survey Date	Description of Changes Since Last Survey	Interpretation
<p><b>October – November 2016</b></p>	<p><b>Beach Profiles:</b></p> <p>Trow Quarry is covered by four beach profile lines for the Full Measures survey (Appendix A), two in Graham's Sand and two in Southern Bay. The previous survey was the Partial Measures survey undertaken in March 2016.</p> <p>Profiles <b>1bSS10</b> and <b>1bSS11</b> are located in Graham's Bay.</p> <p>At profile <b>1bSS10</b> the backshore has remained stable. The gravel deposit noted on the March 2016 survey between chainage 24m and 30m has been eroded by up to 1m, although there has been some accretion of gravel between 30m and 50m of up to 0.6m. There has also been erosion of sand between chainage 70m and 85m uncovering c.10m more of rocks. From chainage 85m seawards a broad berm has formed. Overall, the profile is at a relatively low-medium level compared with the range recorded from previous surveys.</p> <p>At profile <b>1bSS11</b>, the profile has remained stable.</p> <p>Profile <b>1bSS12</b> and <b>1bSS13</b> are located in Southern Bay. At both locations the beach profile has remained stable since the previous survey. Apparent changes in the profile likely derive from minor movement of cobbles or differences in the exact placement of survey points.</p>	<p>At both Graham's Bay and Southern Bay, the cliff and rock revetment have remained stable.</p> <p>At Graham's Bay, the northern part of the beach has dropped, with draw-down of material to the lower foreshore, but to the south, the beach has remained fairly stable.</p> <p>At Southern Bay, the rocky foreshore has generally retained the same form and position.</p> <p><b>Longer term trends:</b> Overall, the beach at Graham's Bay and Southern Bay has retained the same form and position since November 2008/March 2009 when surveys began. Movement in the north of Grahams Bay at profile 1bSS10 is within the bounds of previous surveys.</p>
<p><b>October – November 2016</b></p>	<p><b>Topographic Survey:</b></p> <p>Trow Quarry is covered by an annual topographic survey within Graham's Sand, Southern Bay and Frenchman's Bay, which commenced in November 2008.</p> <p>Data from the most recent topographic survey (Full Measures, autumn 2015) have been used to create a DGM (Appendix B – Map 2a) using GIS. A difference plot has also been produced using the DGM (Appendix B – Map 2b) produced from the last topographic survey (Full Measures, autumn 2014) and the present survey.</p> <p>The difference plot shows that up to 1m of change has occurred with the dominant pattern being one of</p>	<p><b>Topographic Survey:</b></p> <p>The difference plot indicates a movement of sediment from the back of the beach to the foreshore, which is most evident at Graham Sands. This is likely a process of drawdown, which moves sediment from the upper beach to form berms or bars on the foreshore.</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
	falls in elevation at the back of the beach and increases on the foreshore.	
<p><b>October – November 2016</b></p>	<p><b>Cliff-top Survey:</b></p> <p>Cliff top survey data collected for baseline survey (autumn, 2011) and bi-annual surveys since then, including the present Full Measures survey (autumn, 2016) is presented in this report.</p> <p>Six ground control points (numbered points 1 to 6) were established along the cliff top at Trow Point in 2008 to monitor cliff erosion at the site of a former landfill. Note: the numbering of ground control points is not intended to correlate with that of the beach profile lines and reference should be made to Appendix C – Map 1 for the location of ground control points.</p> <p>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 <math>\pm 0.1\text{m}</math> due to the technique used.</p> <p>The results from the cliff top survey are presented in Appendix C – Table C1, showing the position from the ground control point to the edge of the cliff top along a defined bearing.</p> <p>Results show erosion greater than the anticipated survey error has been recorded at three points since the last survey, with 0.2m, 0.2m, and 0.4m of recession recorded at survey points 2, 3, and 5 respectively. From September 2011 to present, no survey points have recorded erosion greater than the anticipated survey error.</p>	<p>Results show that since the last survey erosion has occurred at survey points 2, 3, and 5, however previous survey notes record that the cliff has a rounded grass edge and therefore the measurements may be inaccurate. Over the long term, no survey points have recorded recession greater than the survey accuracy. It can be concluded that minimal recession has taken place at the Trow Rocks headland over the survey period.</p>

## 2.4 Marsden Sands

Survey Date	Description of Changes Since Last Survey	Interpretation
<p><b>October – November 2016</b></p>	<p><b>Beach Profiles:</b></p> <p>Marsden Sands is covered by four beach profile lines for the Full Measures survey (Appendix A). The previous survey was the Partial Measures survey in March 2016 and prior to that the Full Measures survey was completed in November 2015. Profiles 1bSS14 and 1bSS17 were last surveyed during the Partial Measures spring survey, 2016. Profiles 1bSS15 and 1bSS16 were last surveyed during the Full Measures autumn survey, 2015.</p> <p>Profile <b>1bSS14</b> is located to the north of the bay and covers the cliff and the former lifeguard station adjacent to the Redwell Steps. The cliff has retained the same form and position since the last survey. The upper beach has eroded by up to 0.6m between the steps and chainage 135m. From 135m seawards there has been accretion of up to 0.8m. This has resulted in a flattening of the profile. The upper part of the profile is at a medium level compared to the range recorded from previous surveys but the lower part of the profile from chainage 135m is the highest on record.</p> <p>At profile <b>1bSS15</b>, the profile suggests that the cliff has retreated by c.2m but there is no evidence for this in the survey report. The veneer of sand reported in the last survey has mostly been eroded by up to 0.6m, revealing the gravel in the upper beach and boulders in the mid beach. From chainage 115m, the sand remains however, showing accretion of 0.1m from chainage 130m seawards. Overall, the profile is at a low-medium level compared to the range recorded by previous surveys except for the lower beach from chainage 125m, which is relatively high.</p> <p>At Profile <b>1bSS16</b>, the cliff has retained the same form and position since the last survey The beach profile has remained stable since the previous survey. Apparent changes in the profile likely derive from minor movement of cobbles or differences in the exact placement of survey points. Overall, the beach is at its lowest level on record.</p> <p>Profile <b>1bSS17</b> is located to the south of the bay. There has been an increase in beach level of up to 1m in the upper beach. The survey data indicates that this is a gravel deposit which has accumulated at the back of the beach. Otherwise, the profile which crosses rocky platform and boulders with small</p>	<p>The more northerly part of Marsden Bay appears to have experienced erosion throughout most of the profile, whereas changes are minimal further south, where there is less mobile sediment available.</p> <p><b>Longer term trends:</b> The sandier beaches in the north of the bay are medium-low compared to earlier surveys. Further south, there is little sand and therefore the underlying coarser sediment and the shore platform is exposed, indicating a general trend of movement of sediment towards the north.</p>



<b>Survey Date</b>	<b>Description of Changes Since Last Survey</b>	<b>Interpretation</b>
	pockets of sand remains relatively unchanged, with some increase in levels of <0.2m. Overall, the profile is at a medium-high level compared with the range recorded from previous surveys.	

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

##### **Individual Profiles**

The survey report notes that the start of section 5 was currently blocked by a construction site fence and access was not possible. The section was started at the first available position.

##### **Topographic Survey**

The surveyors noted that the beach had previously been groomed.

##### **Cliff Top Surveys**

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

No cliff recession has been recorded at Trow Quarry since records began, but visual inspection indicates that small rock falls have occurred. The data reflects the episodic nature of rock falls through time and the uneven distribution of events along the cliff.

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

No changes are recommended at the present time.

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

- At Littlehaven Beach, the recorded profiles and topographic survey present no causes for concern. The short term picture indicates seasonal redistribution of sand within the bay, and the long term picture a general movement of sediment northwards.
- At Herd Sands the recorded profiles present no causes for concern, and beach profiles remain at medium to high levels. The short term difference plot indicates that erosion has been dominant at Herd Sands relative to the previous survey.
- At Trow Quarry, the recorded profiles show no causes for concern. The cliffs at Trow Point appear to have been stable and the data does not indicate cause for concern.
- At most of Marsden Bay, the recorded profiles present no causes for concern; although they are all medium to low they are within the bounds of previous surveys.

## **Appendices**

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

# Beach Profile

Location: 1bSS1

Date: 03/11/2016

Inspector: AG

Low Tide:

Low Tide Time:

Wind

Sea State:

Visibility:

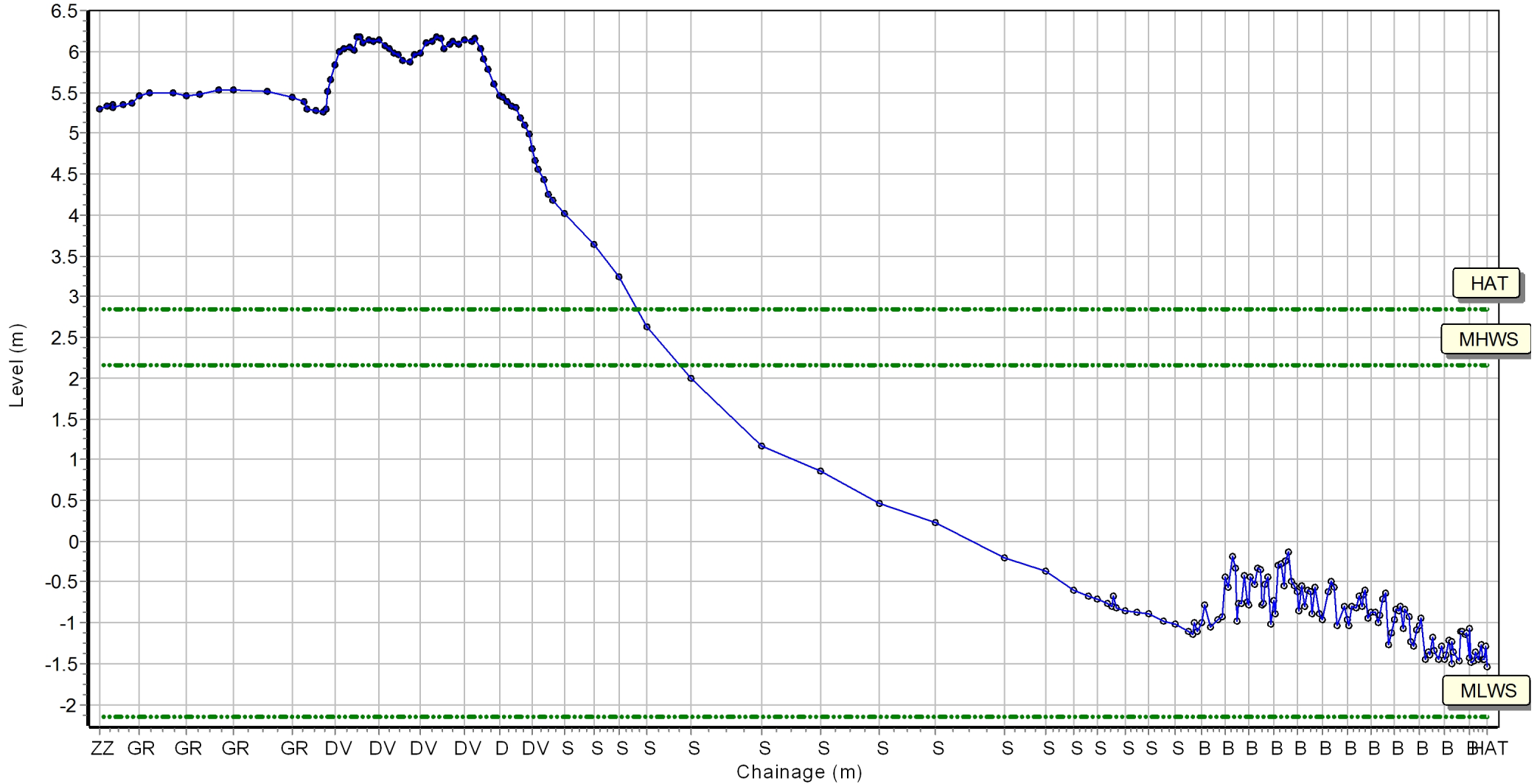
Rain:

Summary: 2016 Full Measures Topo Survey

Easting: 436810.004

Northing: 568148.06

Profile Bearing: 45 ° from North



# Beach Profile

Location: 1bSS2

Date: 03/11/2016

Inspector: AG

Low Tide:

Low Tide Time:

Wind

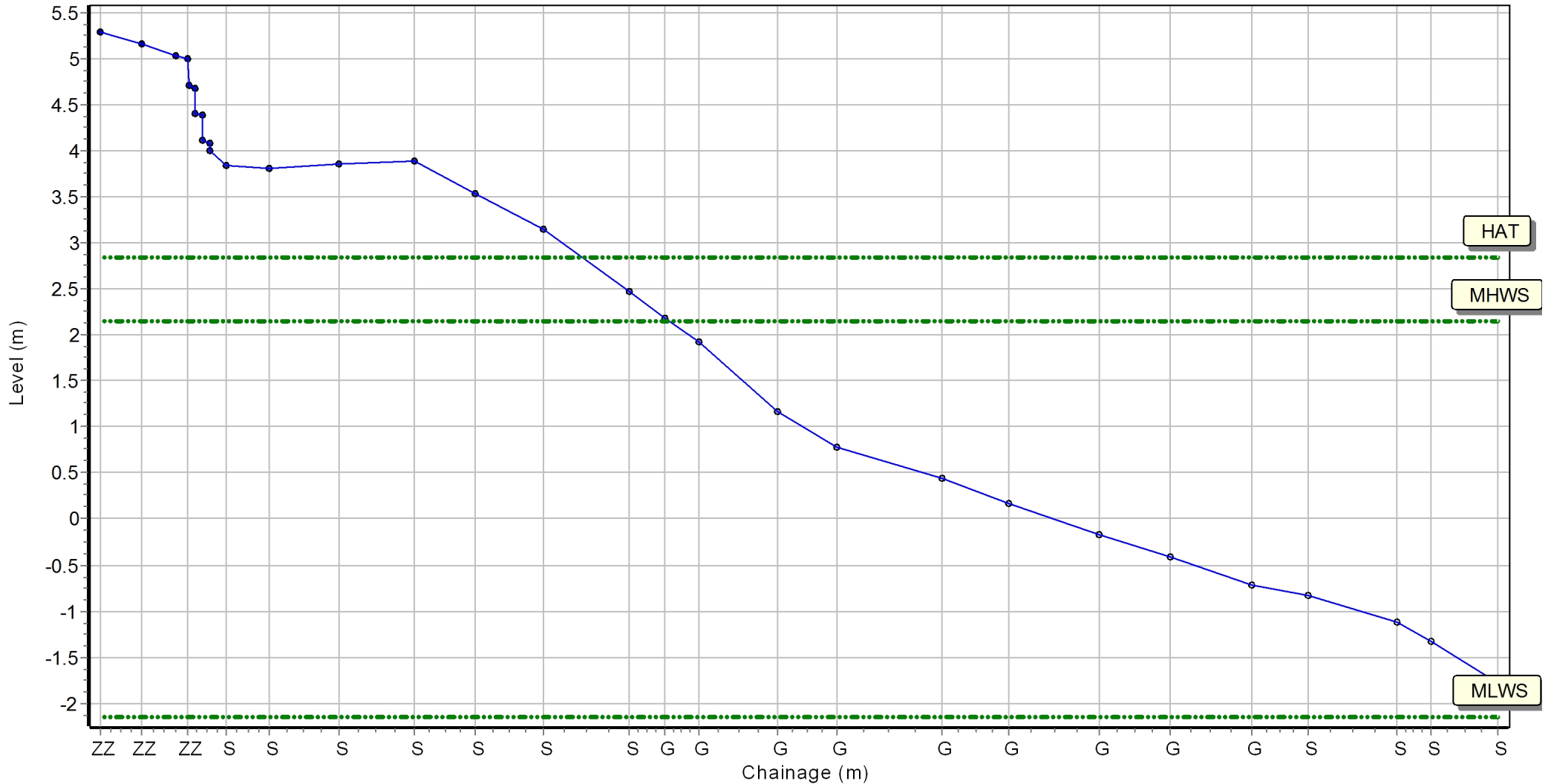
Sea State:

Visibility:

Rain:

Summary: 2016 Full Measures Topo Survey

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



# Beach Profile

Location: 1bSS3

Date: 03/11/2016

Inspector: AG

Low Tide:

Low Tide Time:

Wind

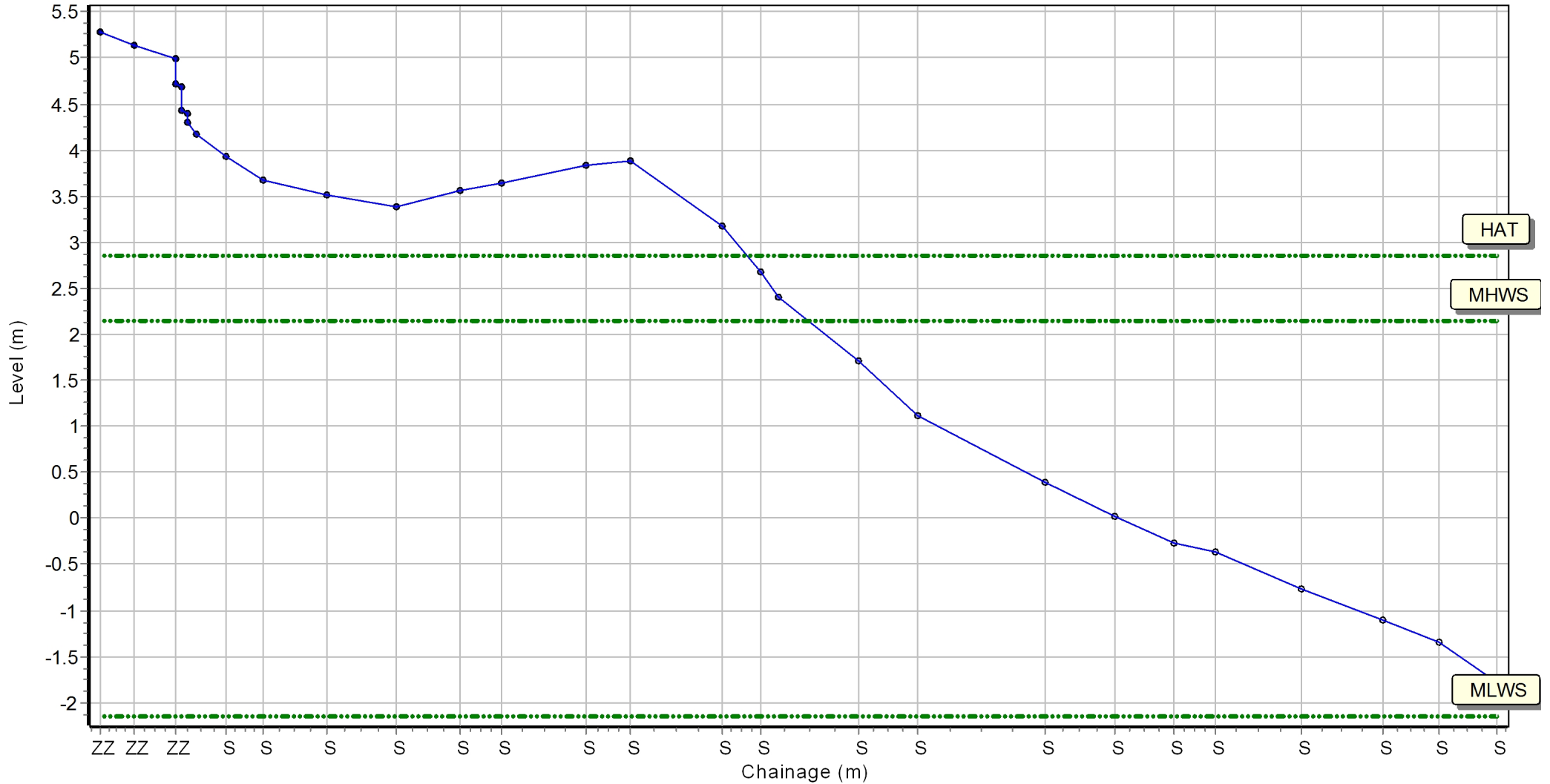
Sea State:

Visibility:

Rain:

Summary: 2016 Full Measures Topo Survey

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





# Beach Profile

Location: 1bSS4

Date: 03/11/2016

Inspector: AG

Low Tide:

Low Tide Time:

Wind

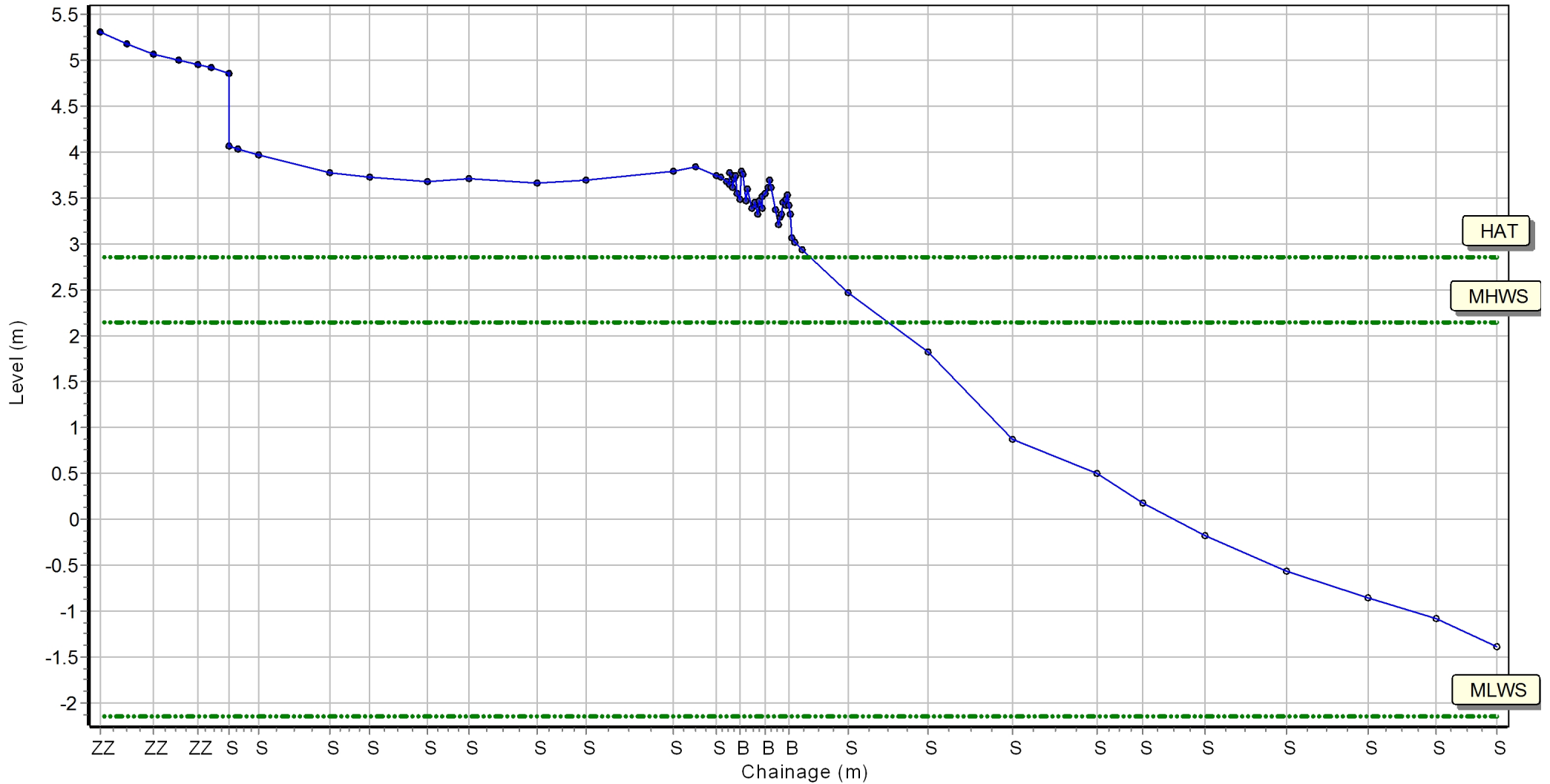
Sea State:

Visibility:

Rain:

Summary: 2016 Full Measures Topo Survey

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



# Beach Profile

Location: 1bSS5

Date: 03/11/2016

Inspector: AG

Low Tide:

Low Tide Time:

Wind

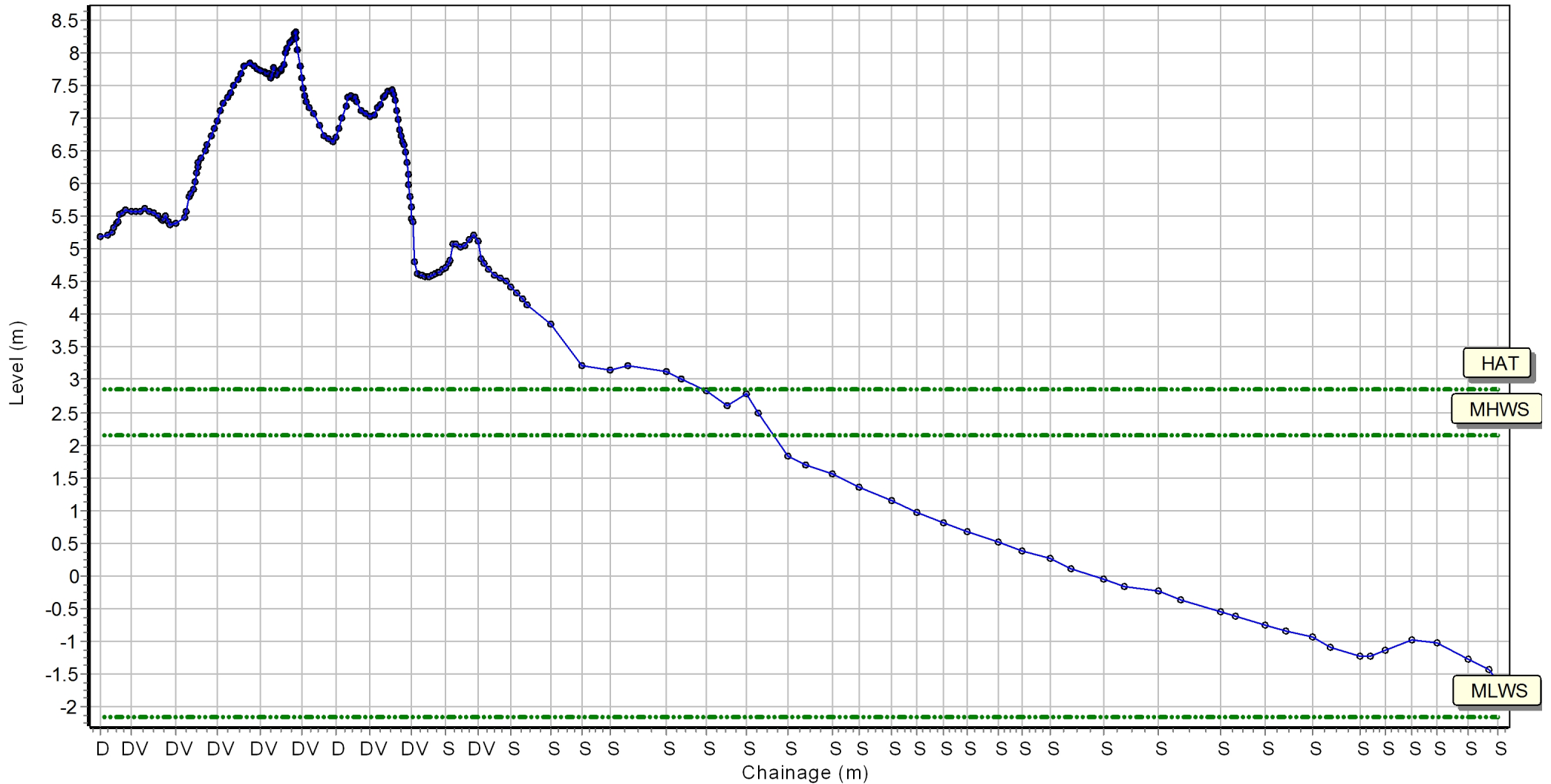
Sea State:

Visibility:

Rain:

Summary: 2016 Full Measures Topo Survey

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



# Beach Profile

Location: 1bSS6

Date: 03/11/2016 Inspector: AG

Low Tide:

Low Tide Time:

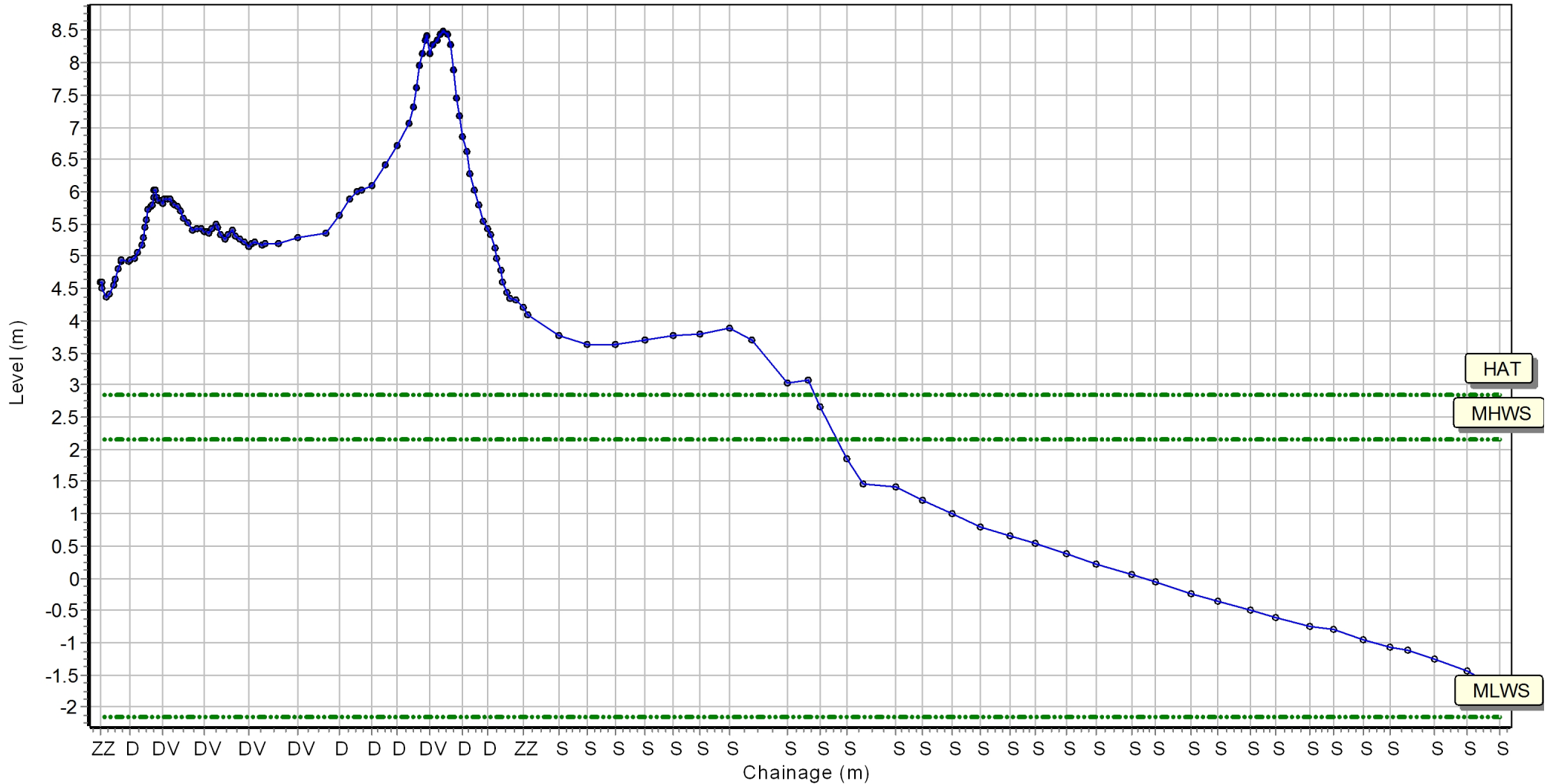
Wind Sea State:

Visibility:

Rain:

Summary: 2016 Full Measures Topo Survey

Easting: 437573.882 Northing: 567388.817 Profile Bearing: 53 ° from North



# Beach Profile

Location: 1bSS7

Date: 03/11/2016

Inspector: AG

Low Tide:

Low Tide Time:

Wind

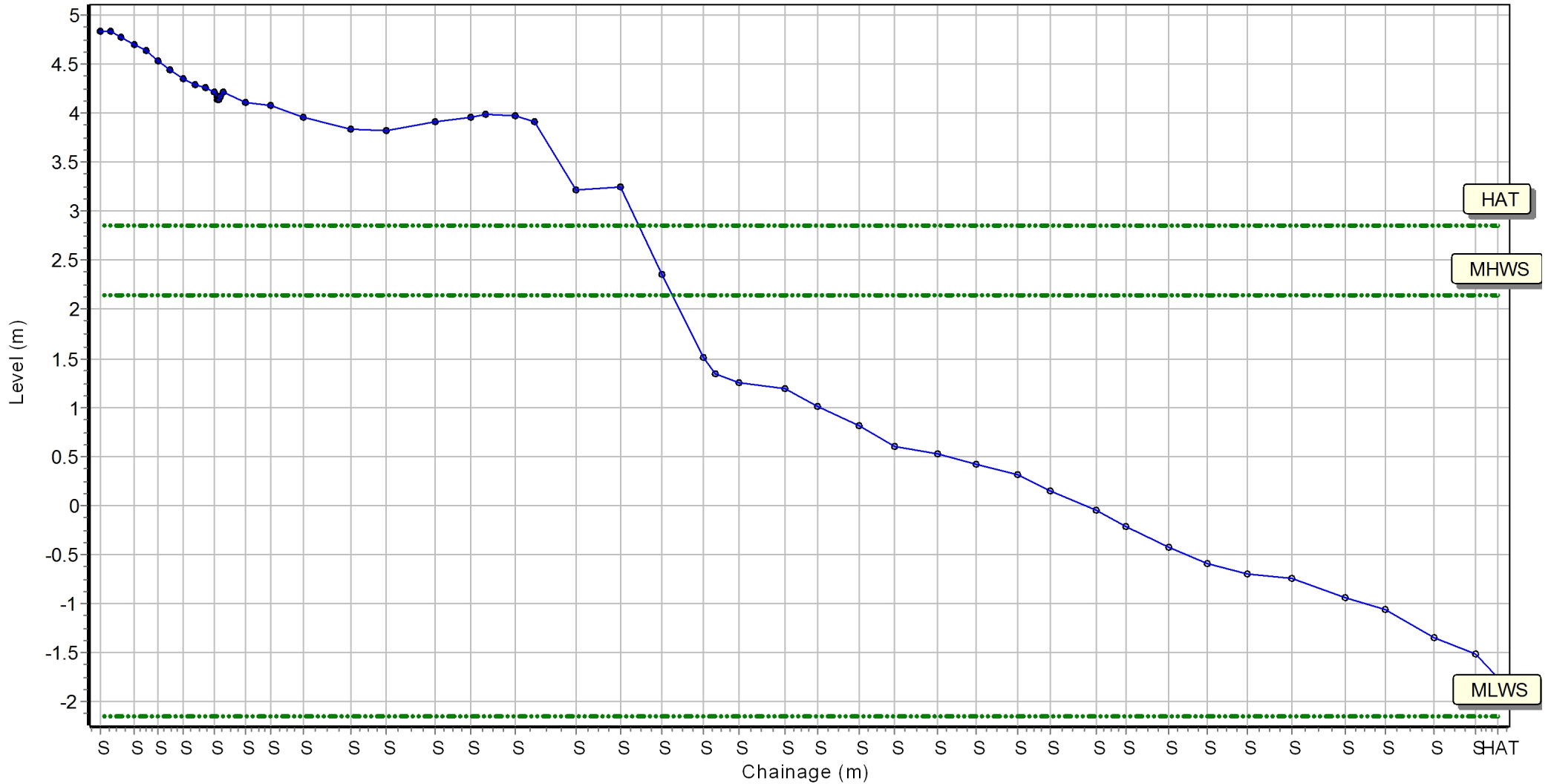
Sea State:

Visibility:

Rain:

Summary: 2016 Full Measures Topo Survey

Easting: 437793.069 Northing: 567153.712 Profile Bearing: 52 ° from North



# Beach Profile

Location: 1bSS8

Date: 03/11/2016

Inspector: AG

Low Tide:

Low Tide Time:

Wind

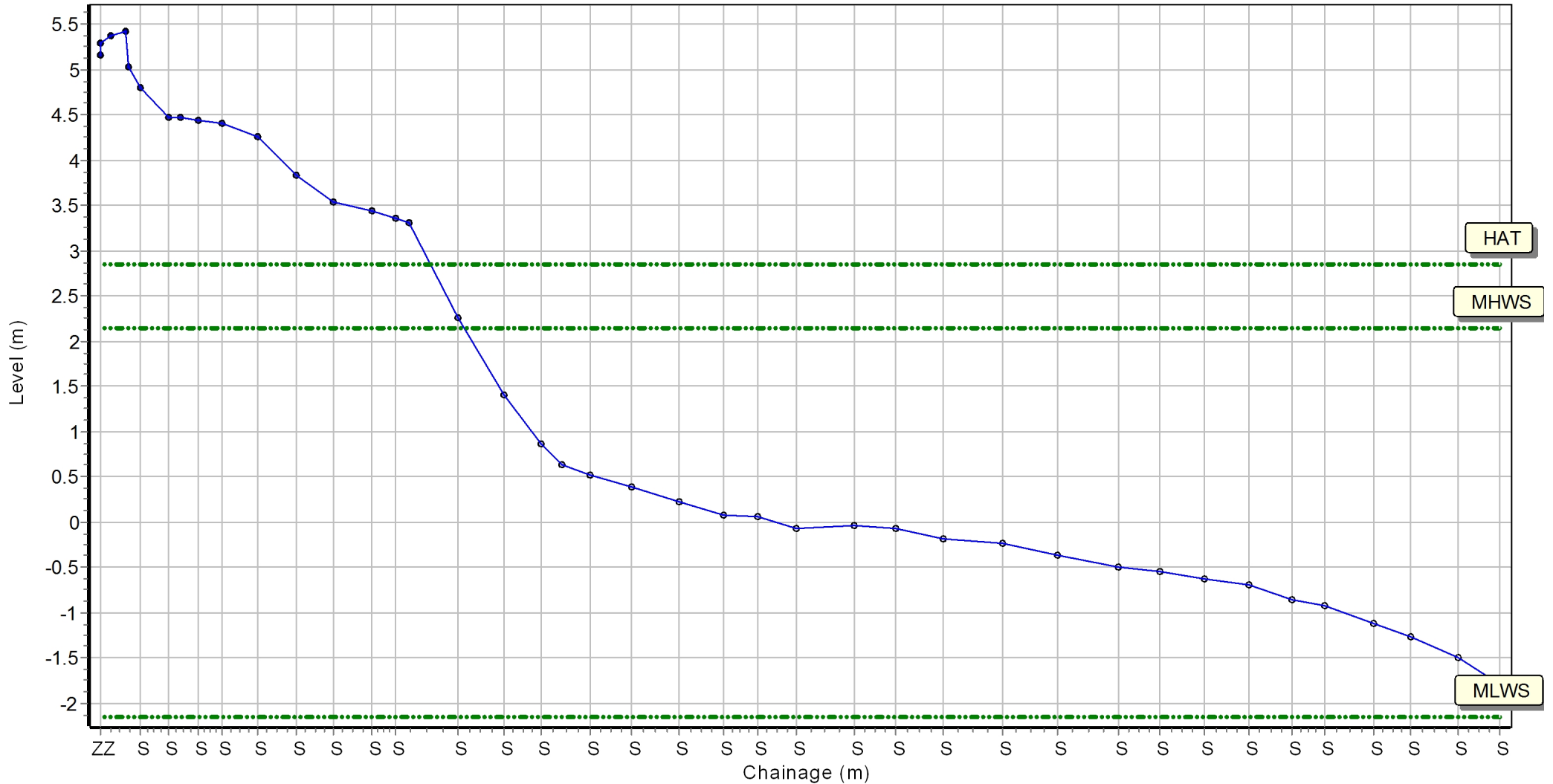
Sea State:

Visibility:

Rain:

Summary: 2016 Full Measures Topo Survey

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



# Beach Profile

Location: 1bSS9

Date: 03/11/2016

Inspector: AG

Low Tide:

Low Tide Time:

Wind

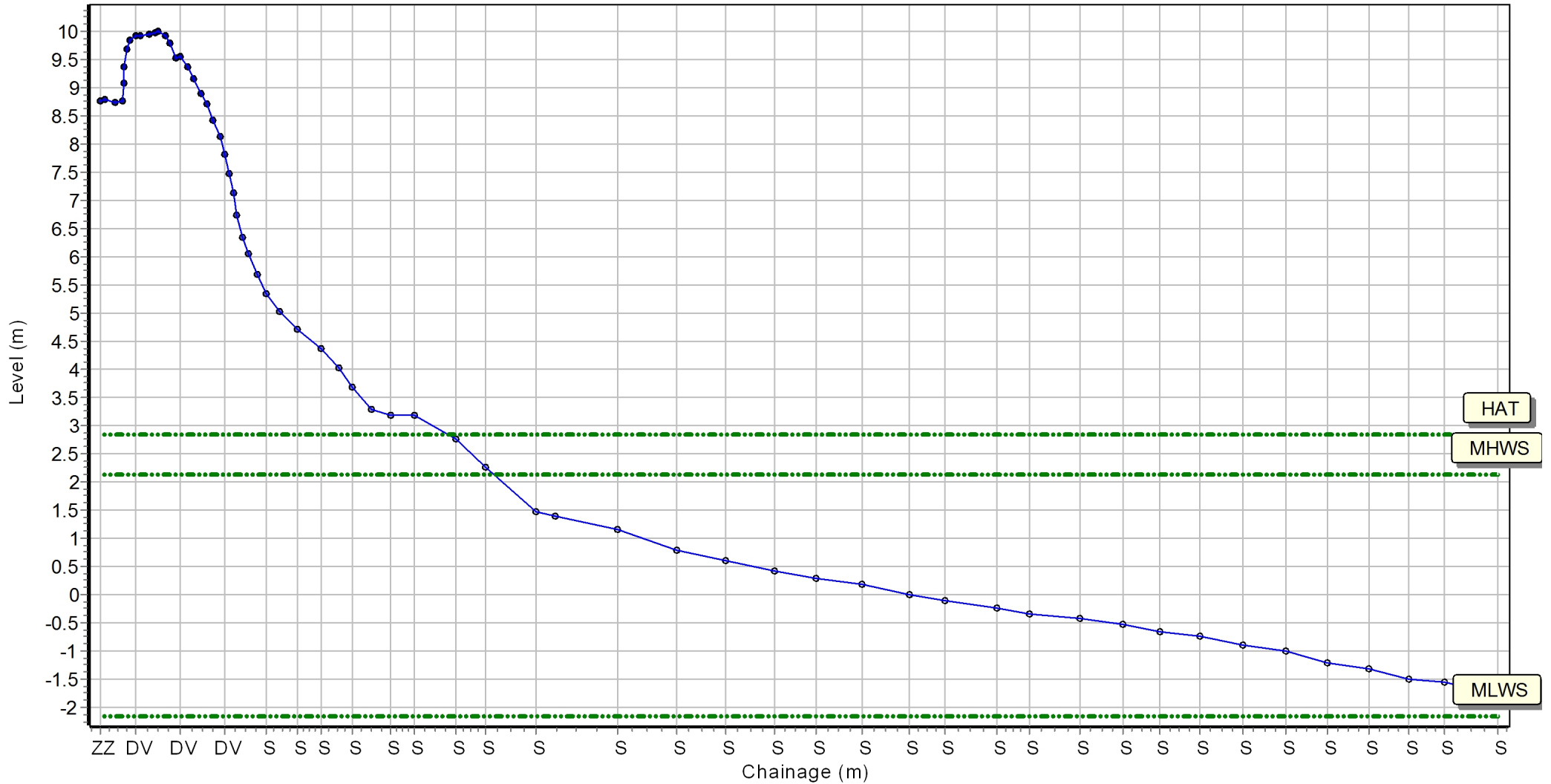
Sea State:

Visibility:

Rain:

Summary: 2016 Full Measures Topo Survey

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



# Beach Profile

Location: 1bSS10

Date: 03/11/2016

Inspector: AG

Low Tide:

Low Tide Time:

Wind

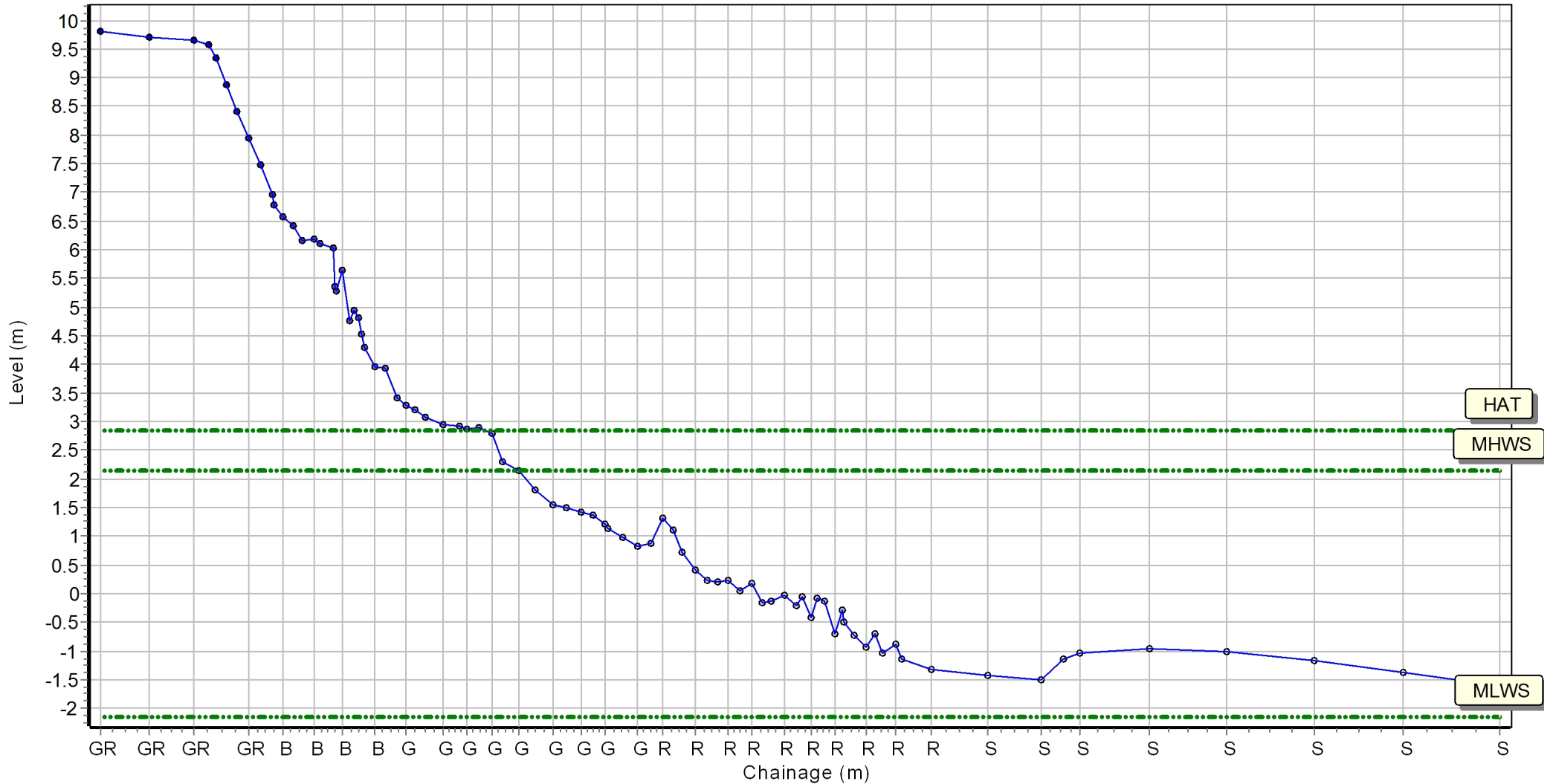
Sea State:

Visibility:

Rain:

Summary: 2016 Full Measures Topo Survey

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







# Beach Profile

Location: 1bSS12

Date: 03/11/2016

Inspector: AG

Low Tide:

Low Tide Time:

Wind

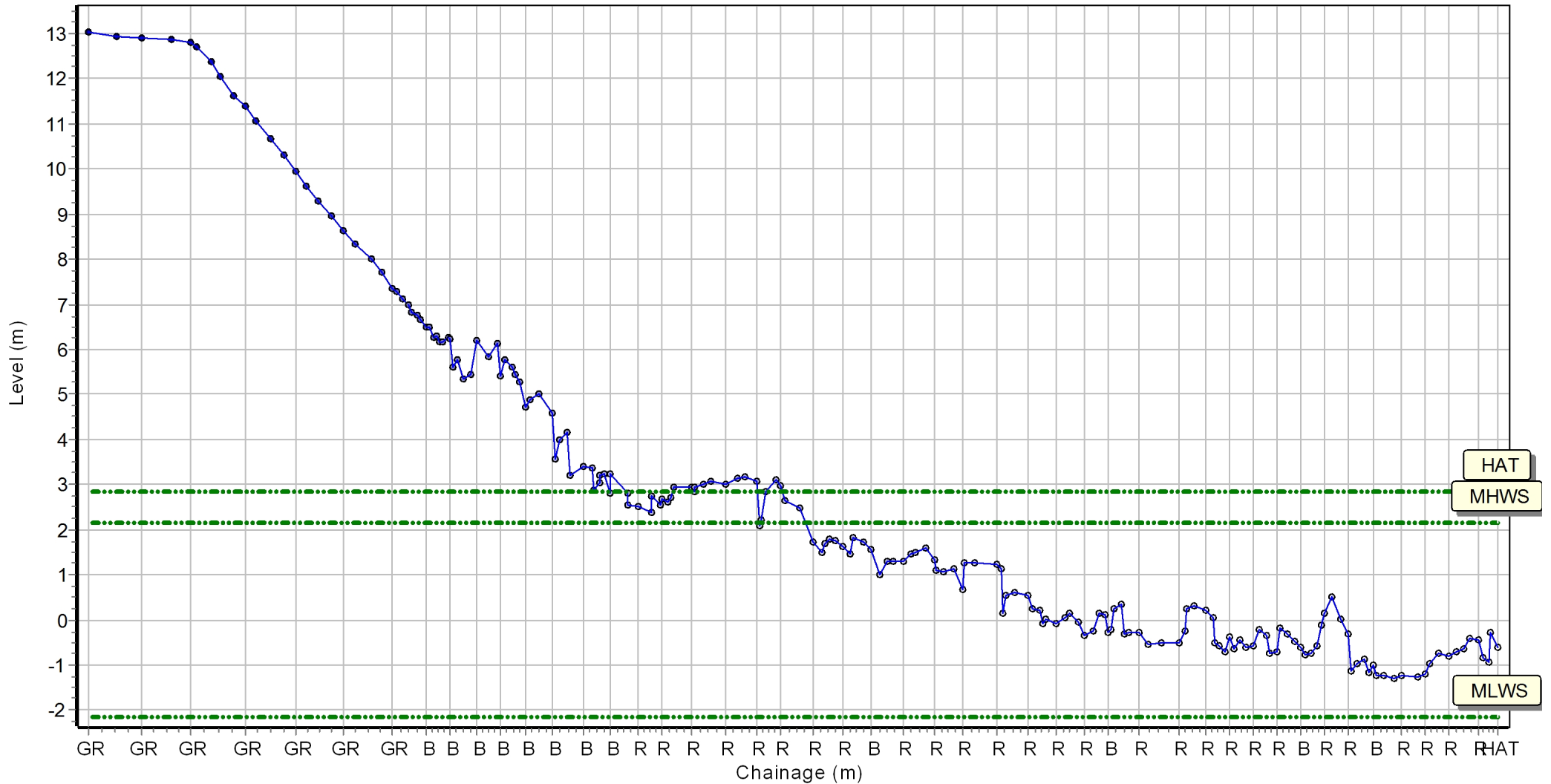
Sea State:

Visibility:

Rain:

Summary: 2016 Full Measures Topo Survey

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



# Beach Profile

Location: 1bSS13

Date: 03/11/2016

Inspector: AG

Low Tide:

Low Tide Time:

Wind

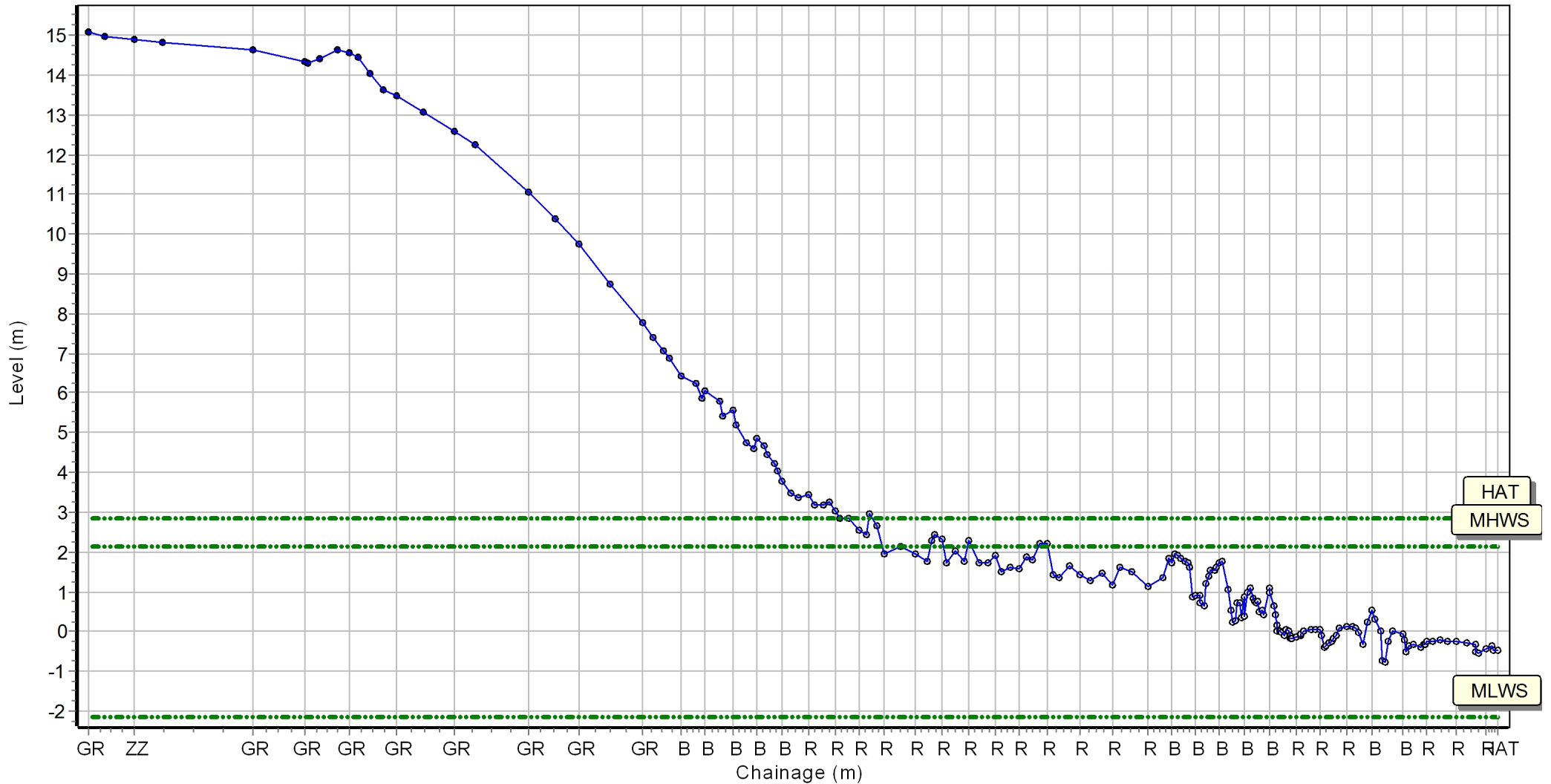
Sea State:

Visibility:

Rain:

Summary: 2016 Full Measures Topo Survey

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



# Beach Profile

Location: 1bSS14

Date: 03/11/2016

Inspector: AG

Low Tide:

Low Tide Time:

Wind

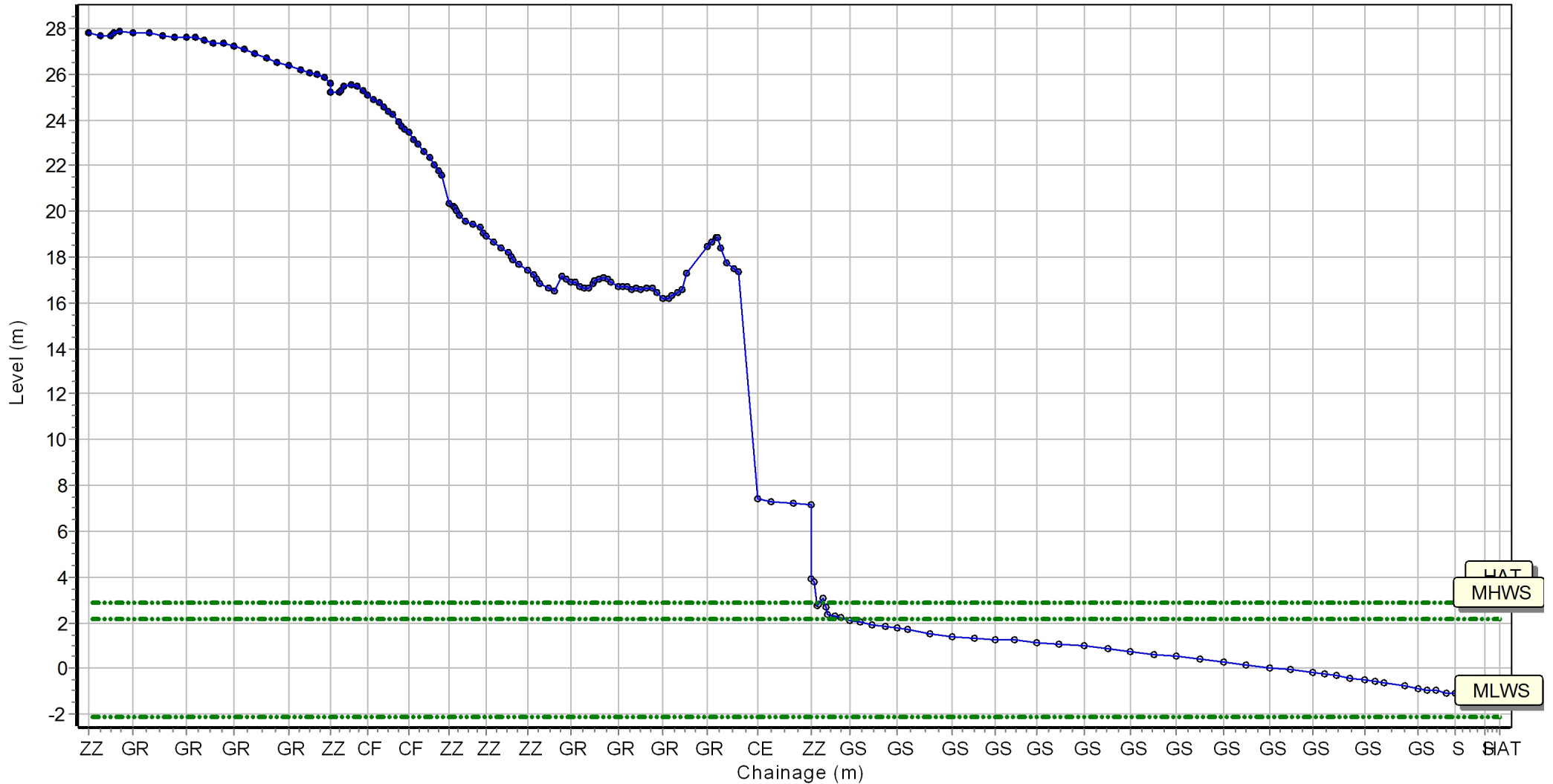
Sea State:

Visibility:

Rain:

Summary: 2016 Full Measures Topo Survey

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



# Beach Profile

Location: 1bSS15

Date: 03/11/2016

Inspector: AG

Low Tide:

Low Tide Time:

Wind

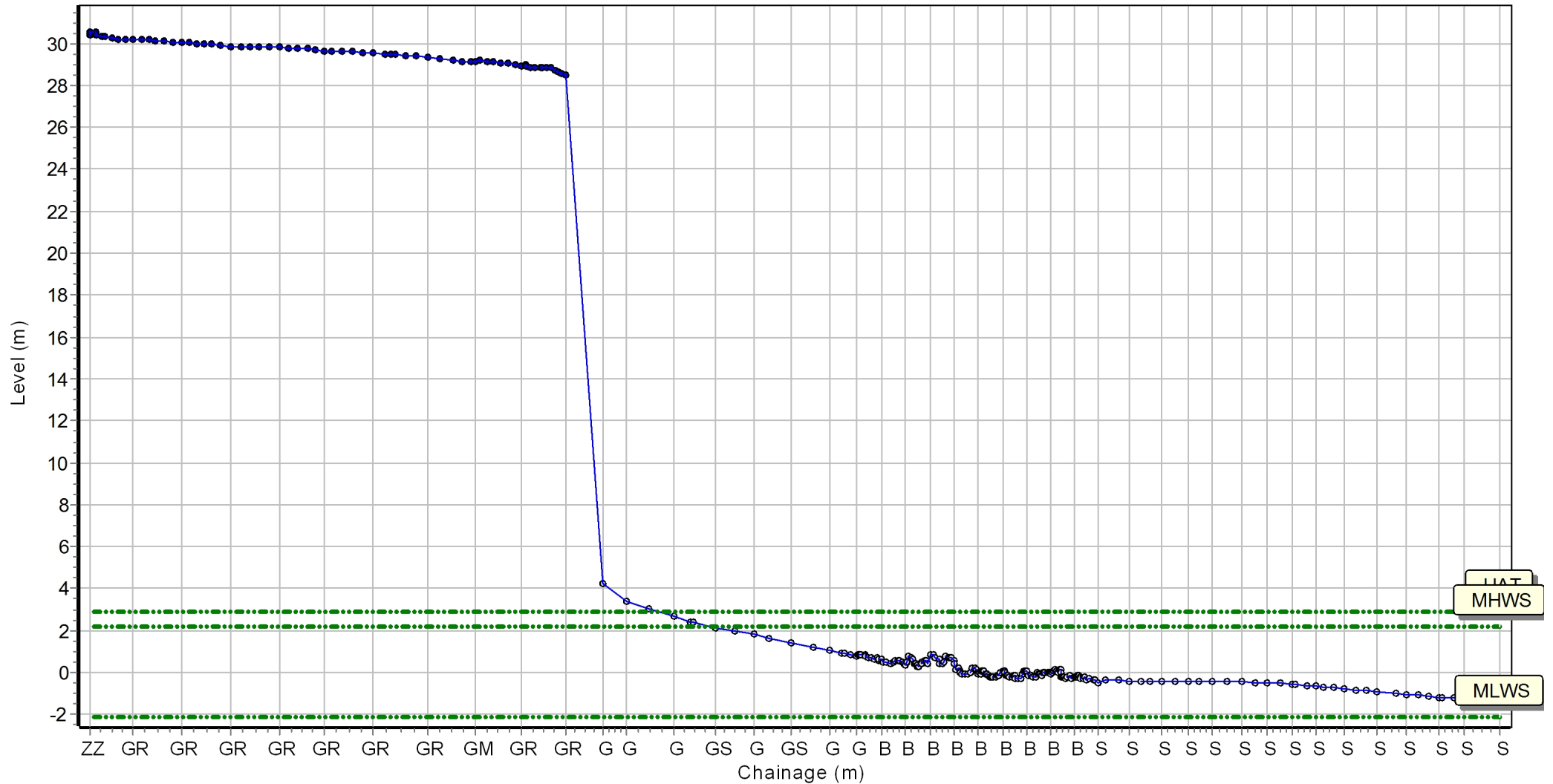
Sea State:

Visibility:

Rain:

Summary: 2016 Full Measures Topo Survey

Easting: 439795.292 Northing: 565005.895 Profile Bearing: 55 ° from North





# Beach Profile

Location: 1bSS17

Date: 03/11/2016

Inspector: AG

Low Tide:

Low Tide Time:

Wind

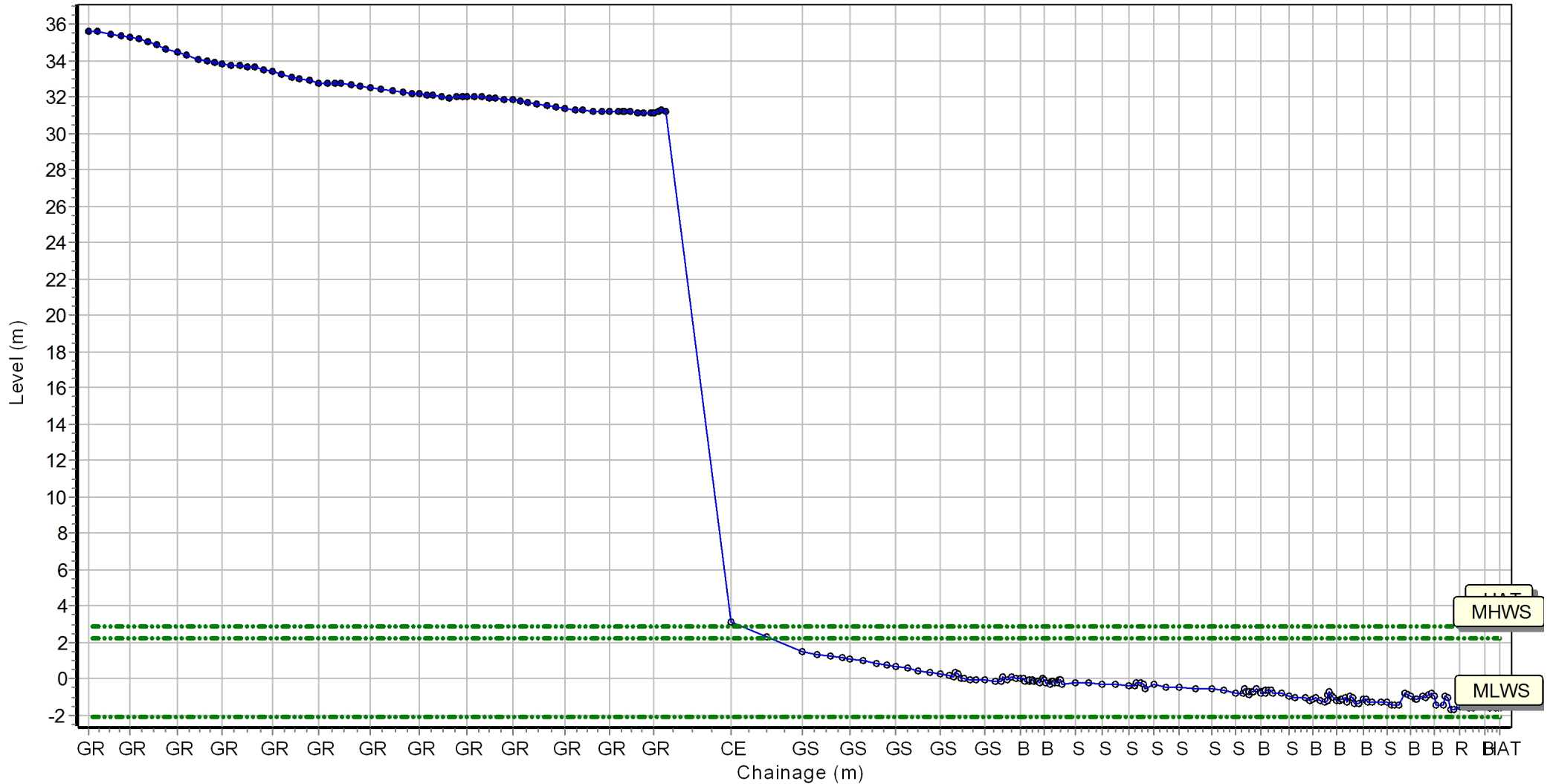
Sea State:

Visibility:

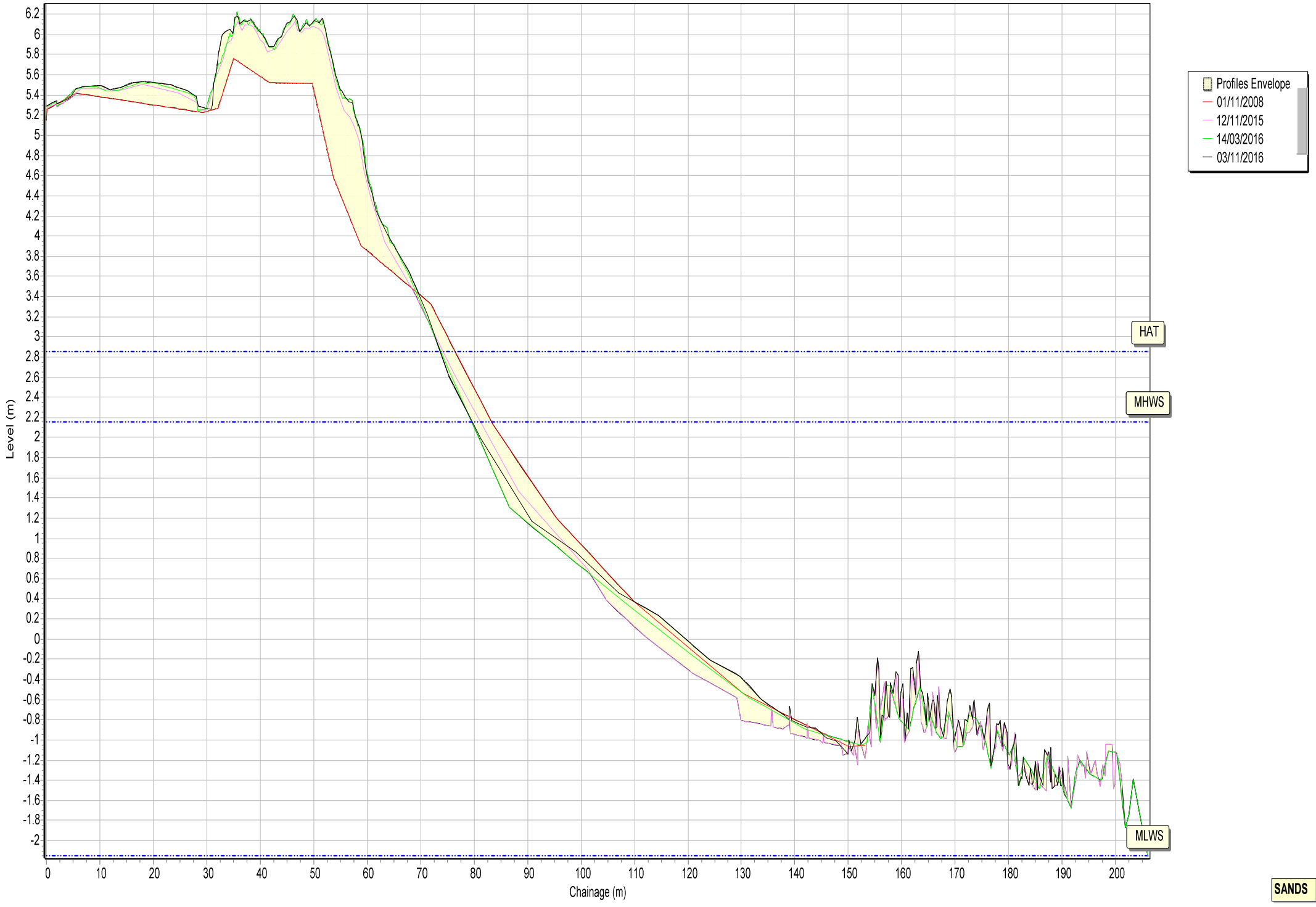
Rain:

Summary: 2016 Full Measures Topo Survey

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



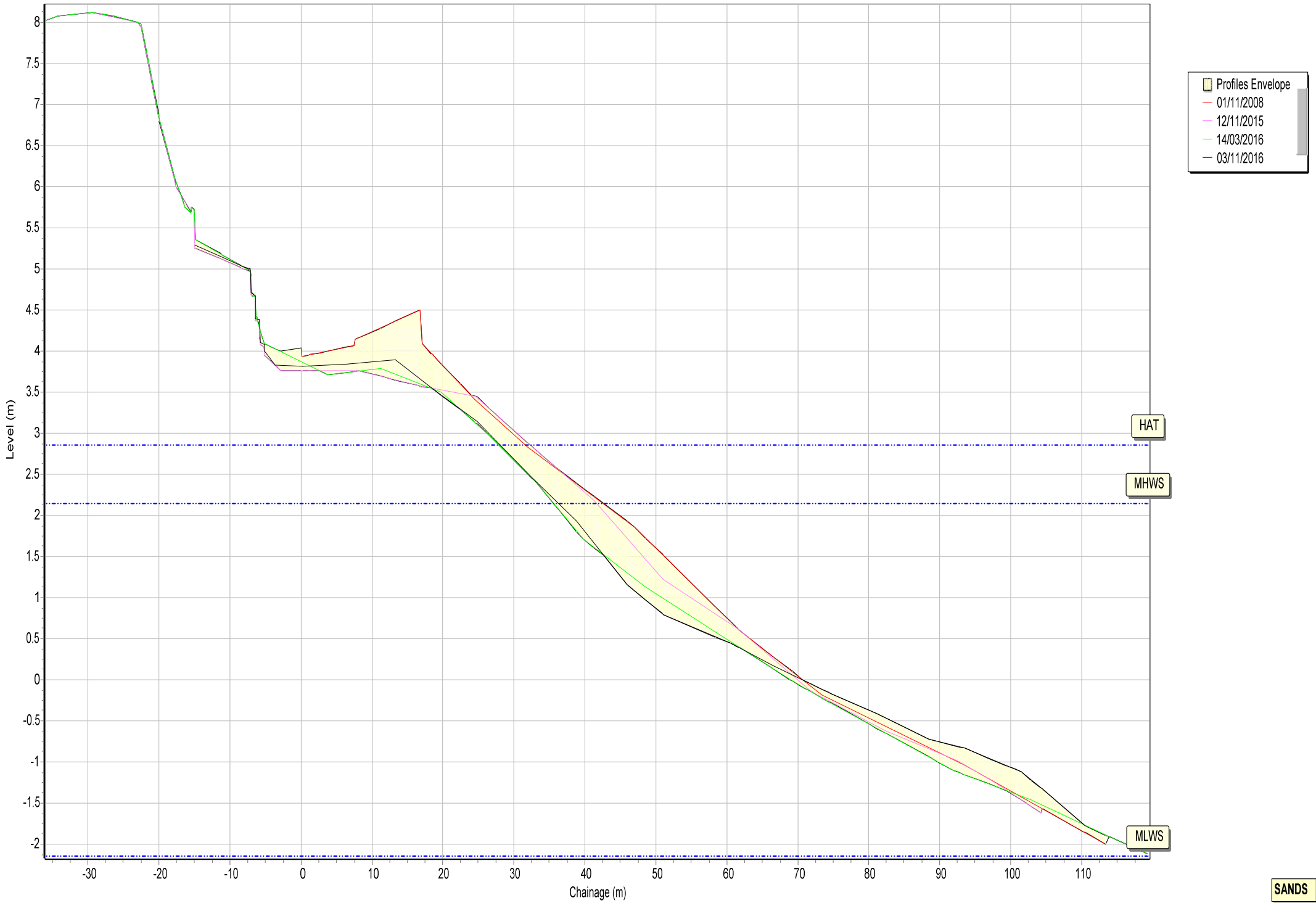
Beach Profiles: 1bSS1



SANDS

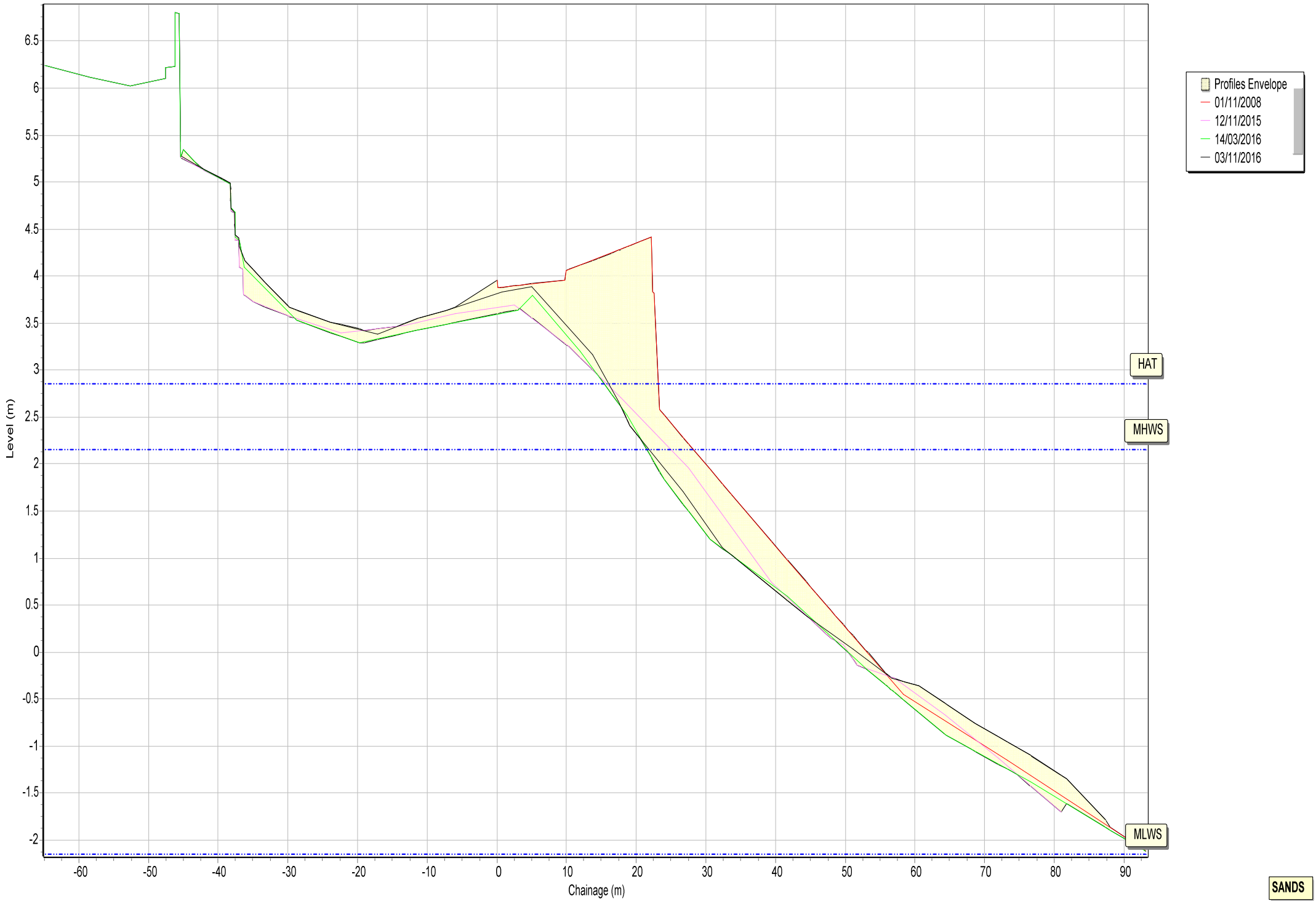


Beach Profiles: 1bSS2

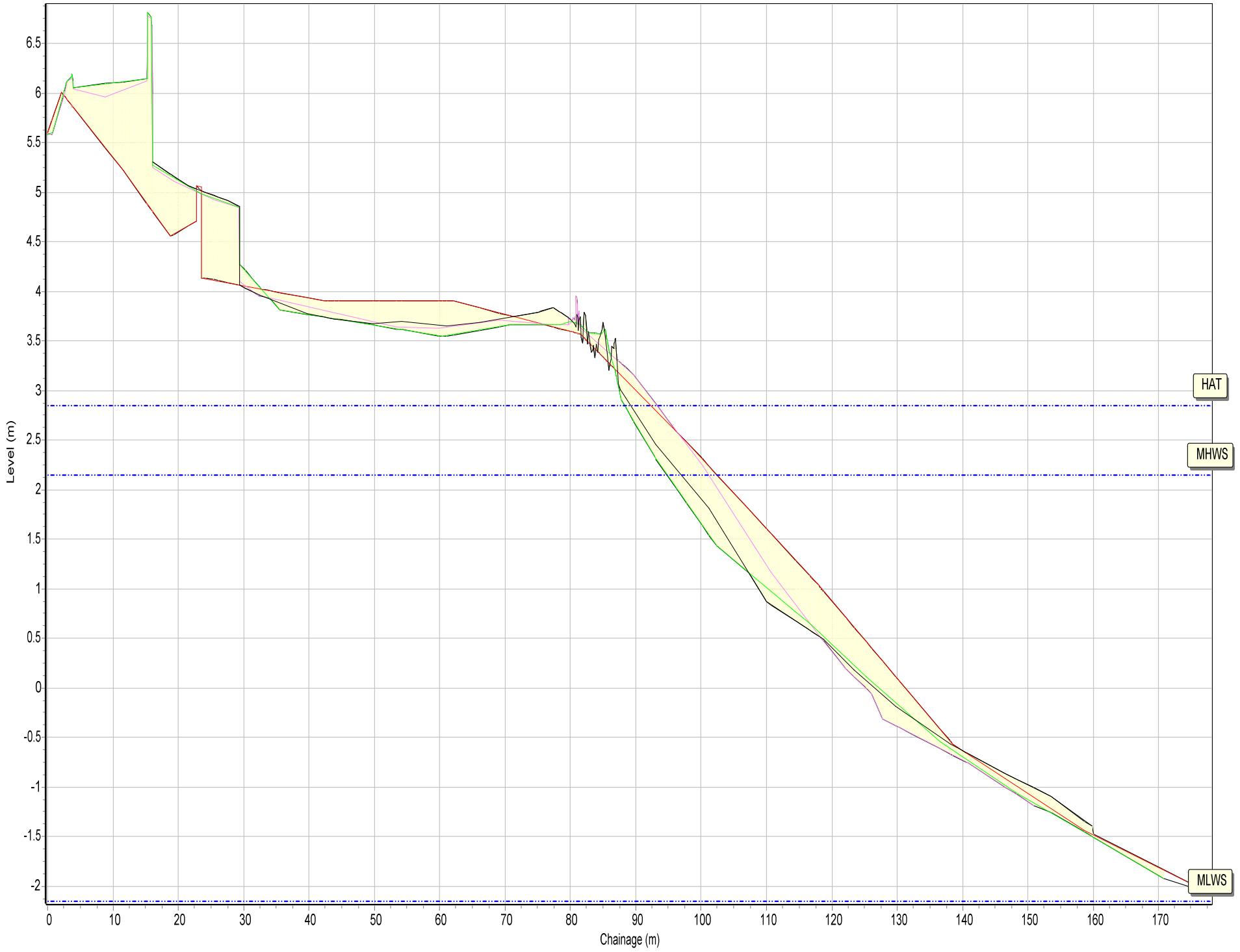


SANDS

Beach Profiles: 1bSS3



Beach Profiles: 1bSS4



Profiles Envelope

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- 12/11/2015
- 14/03/2016
- 03/11/2016

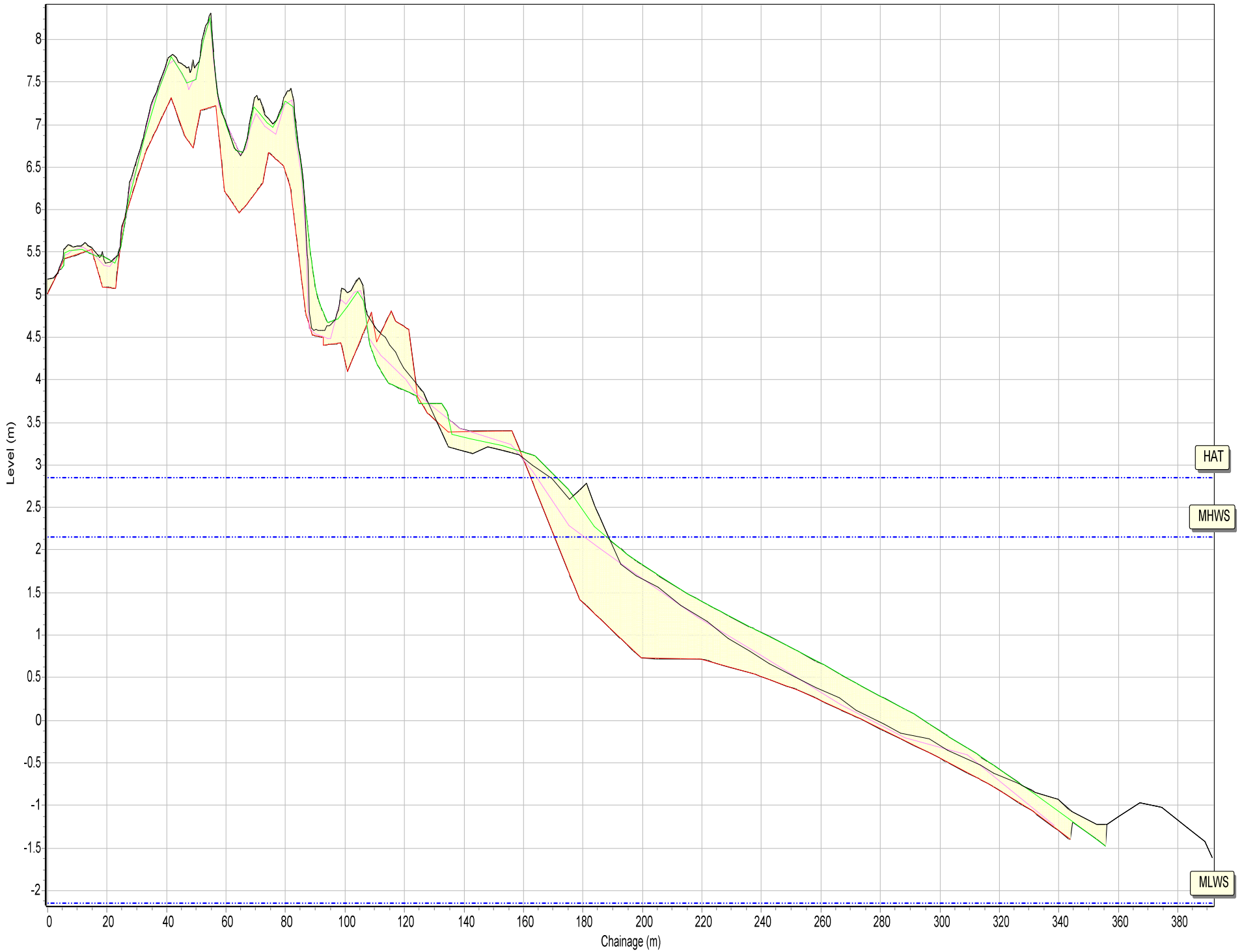
HAT

MHWS

MLWS

SANDS

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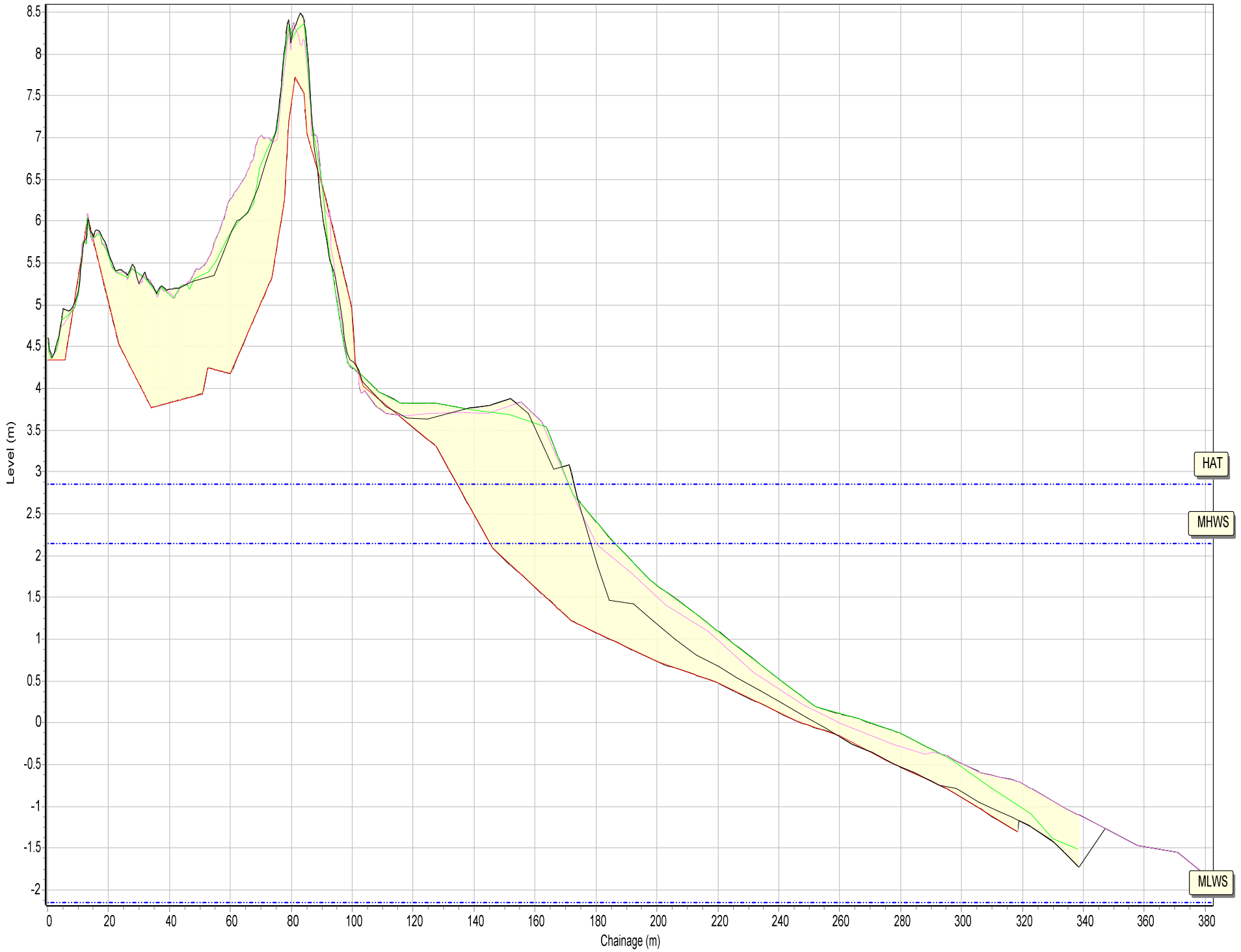
HAT

MHWS

MLWS

SANDS

Beach Profiles: 1bSS6



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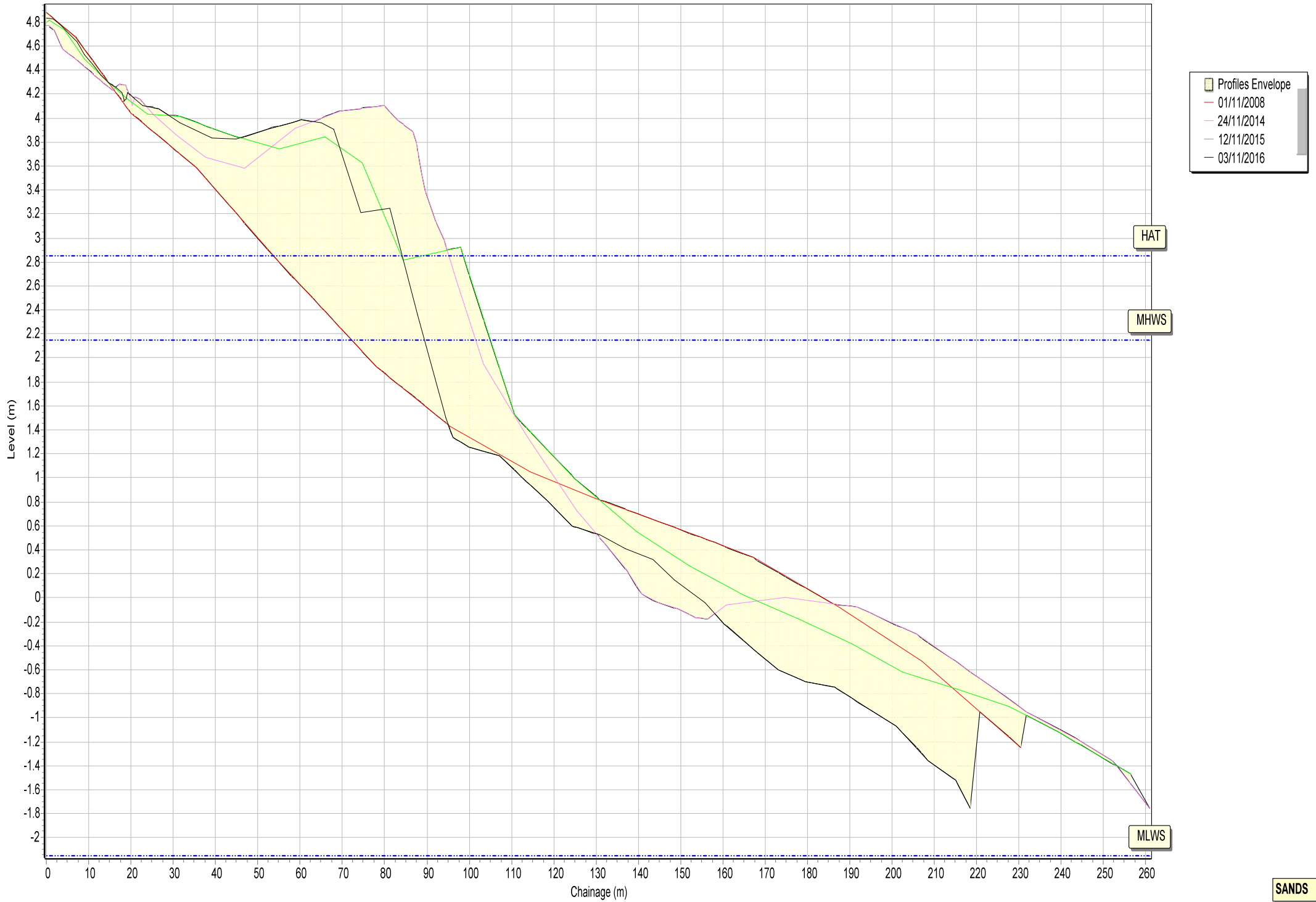
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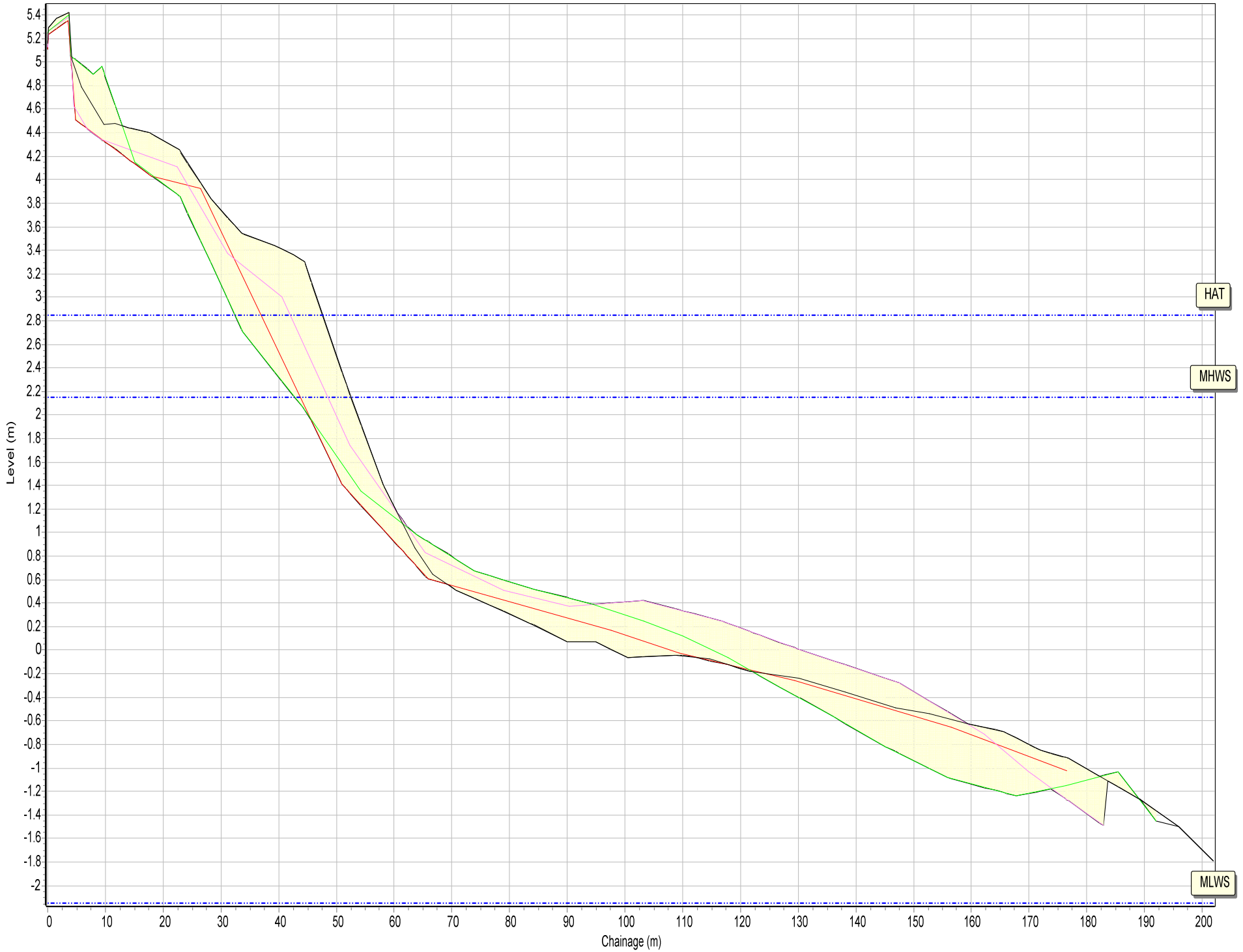
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Beach Profiles: 1bSS7



SANDS

Beach Profiles: 1bSS8



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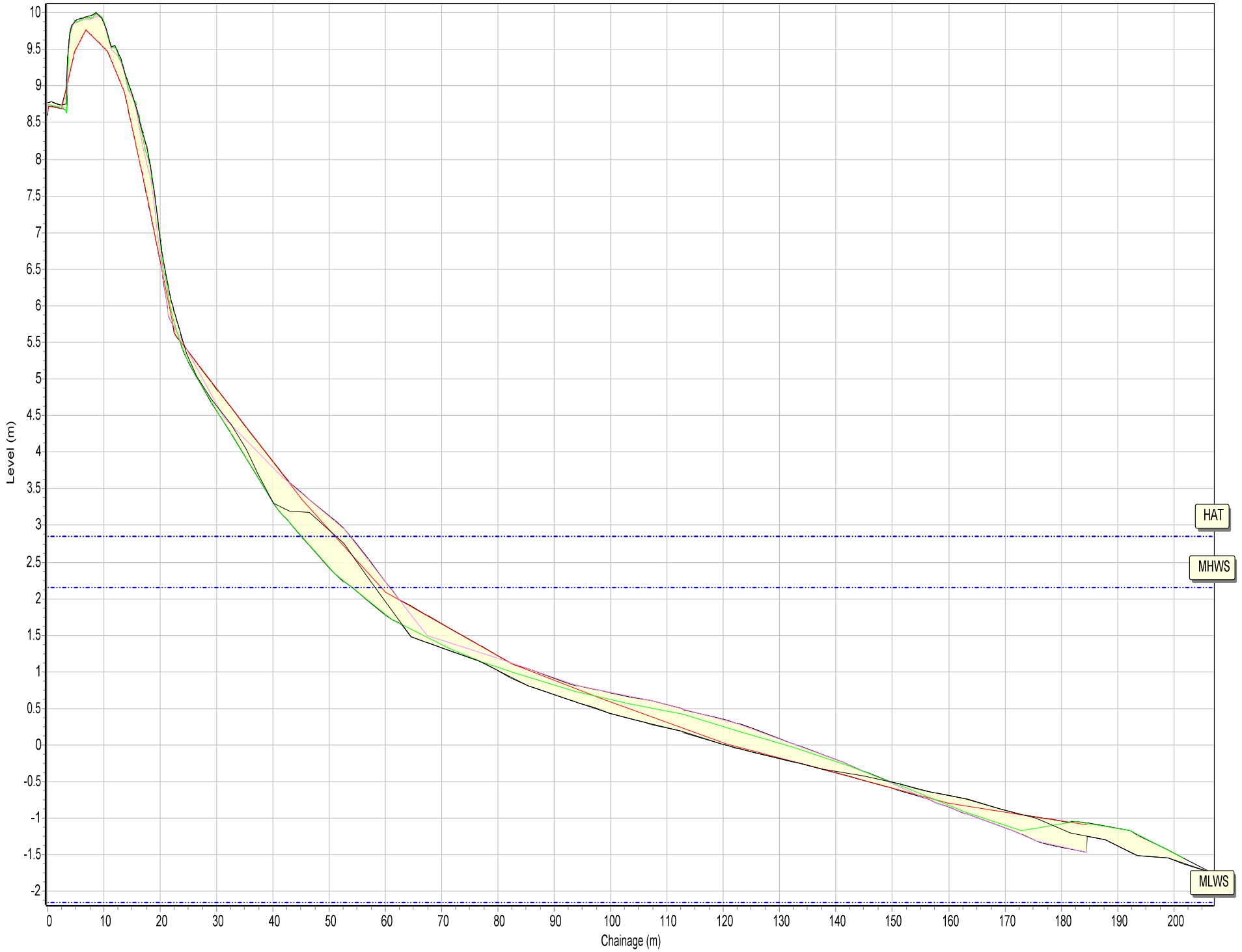
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MHWS

MLWS

SANDS

Beach Profiles: 1bSS9



Profiles Envelope

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- 03/11/2016

HAT

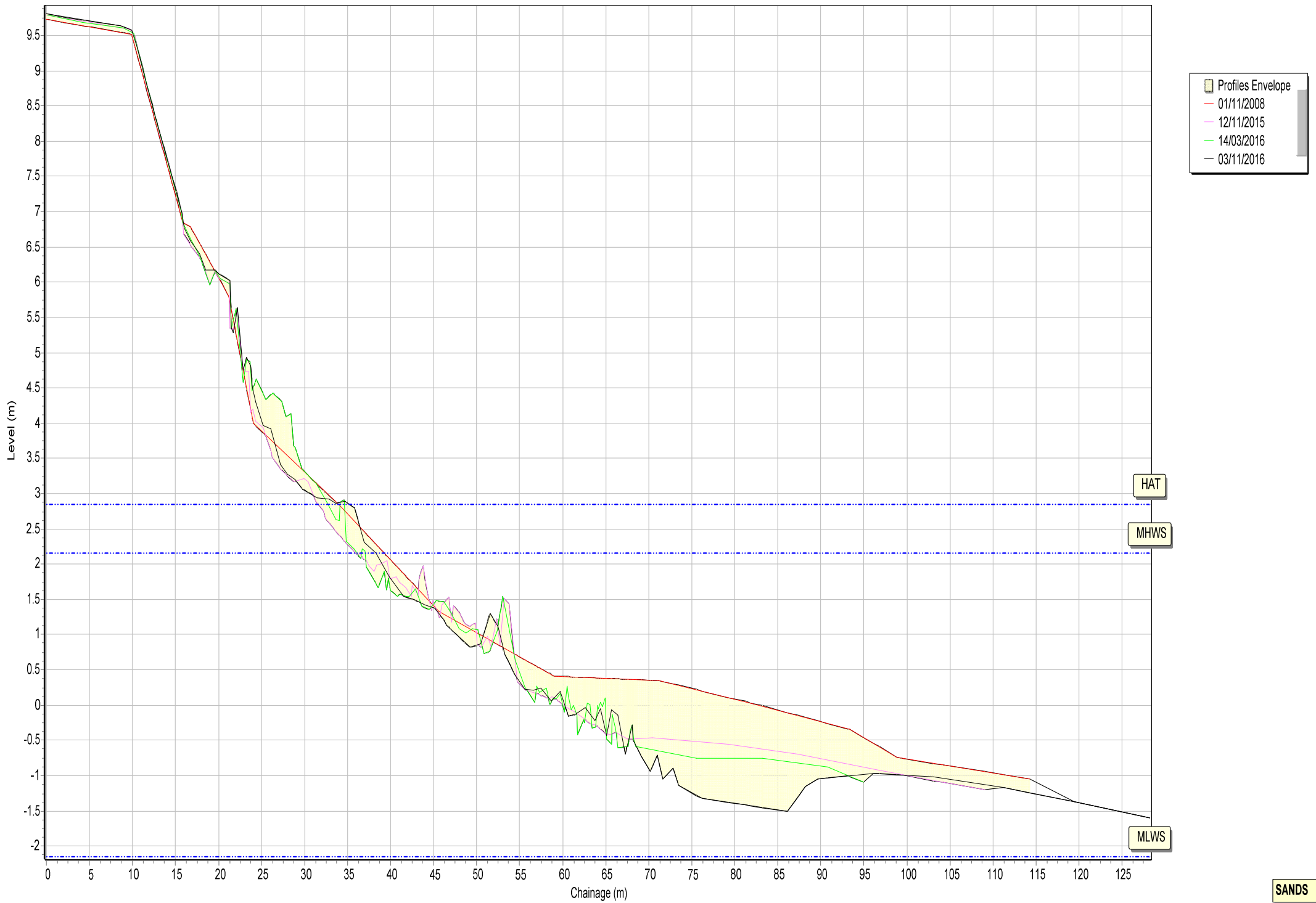
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MLWS

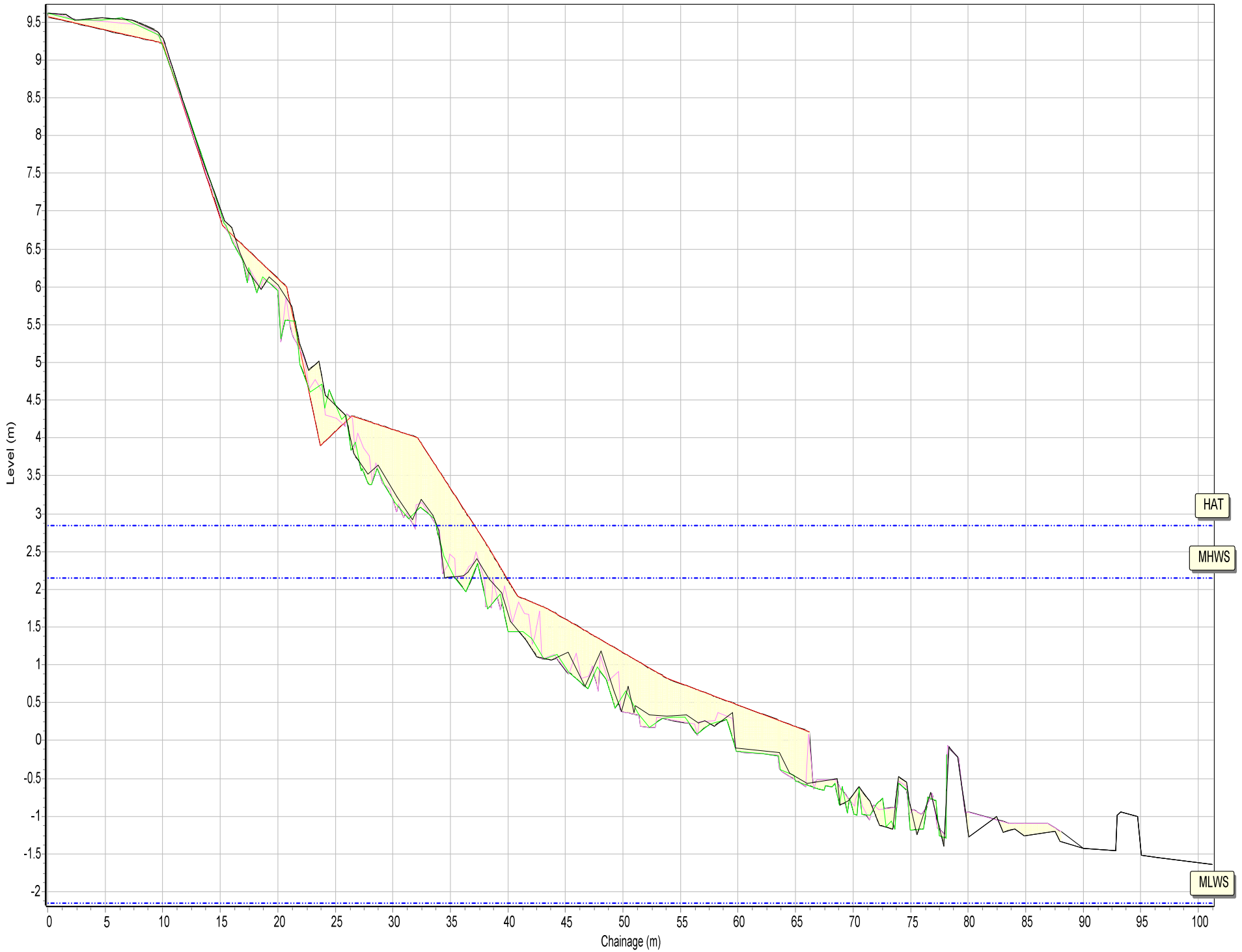
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Beach Profiles: 1bSS10



Beach Profiles: 1bSS11



Profiles Envelope  
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03/11/2016

HAT

MLWS

MLWS

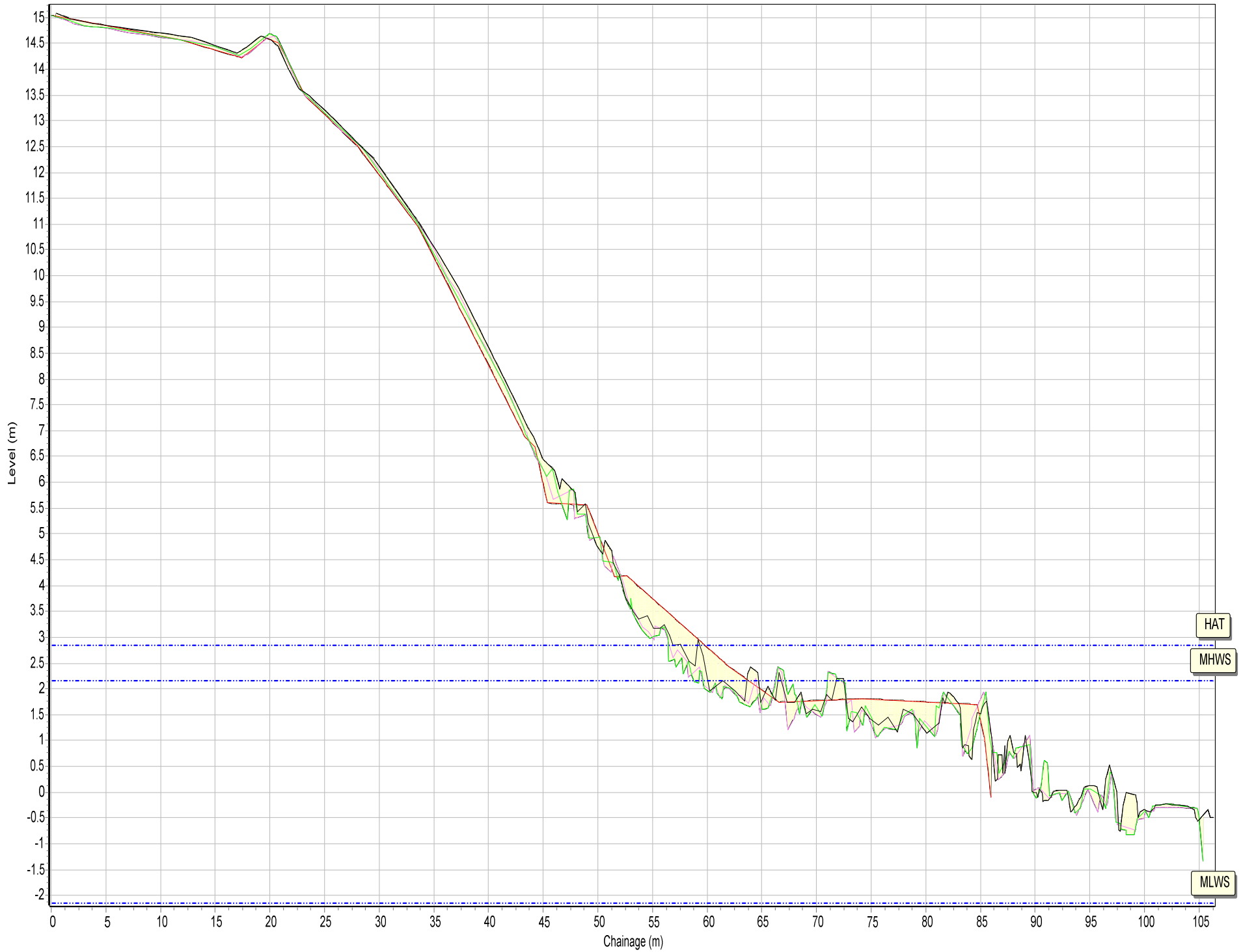
SANDS

Beach Profiles: 1bSS12



SANDS

Beach Profiles: 1bSS13



Profiles Envelope  
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14/03/2016  
03/11/2016

HAT

MHWS

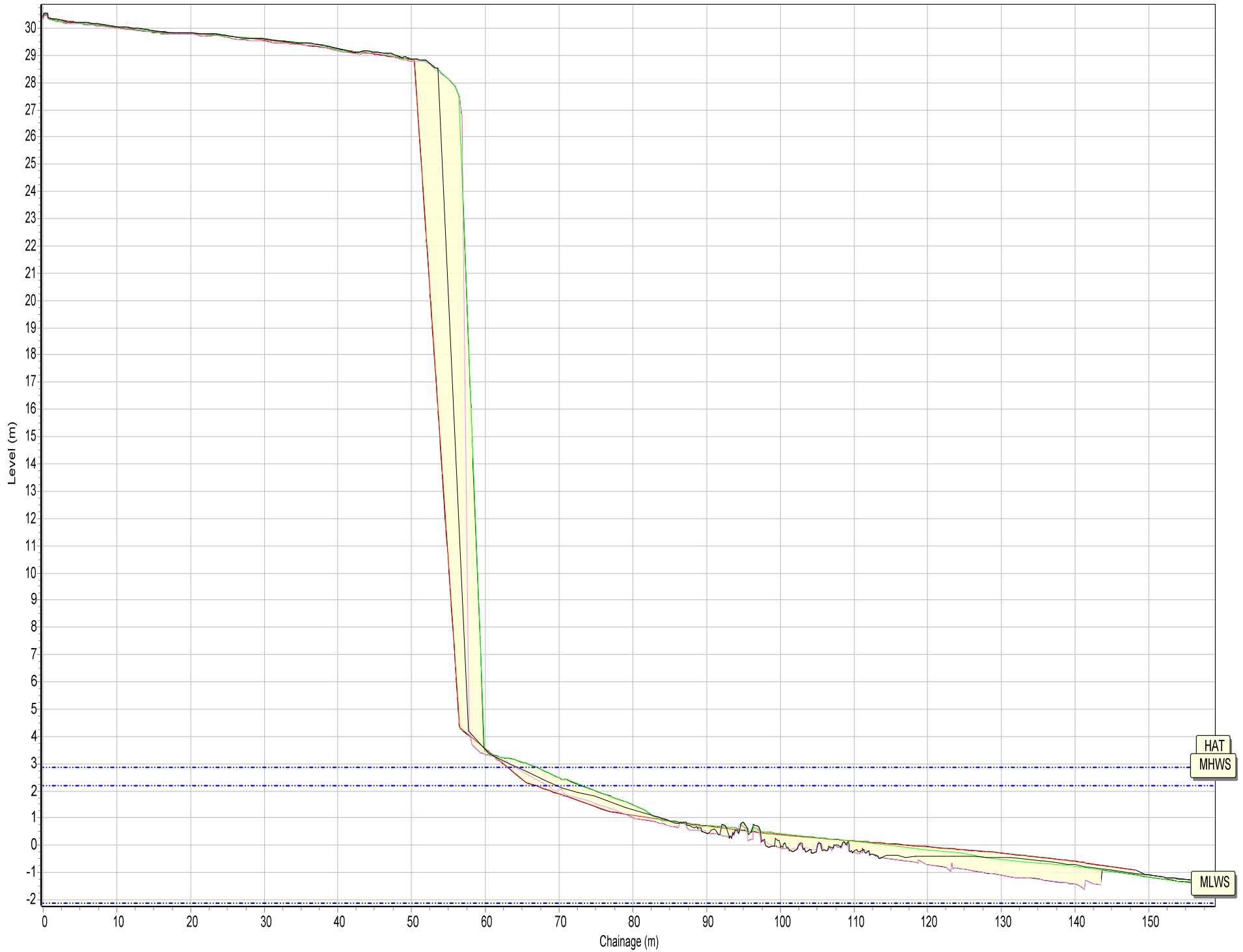
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SANDS

Beach Profiles: 1bSS14



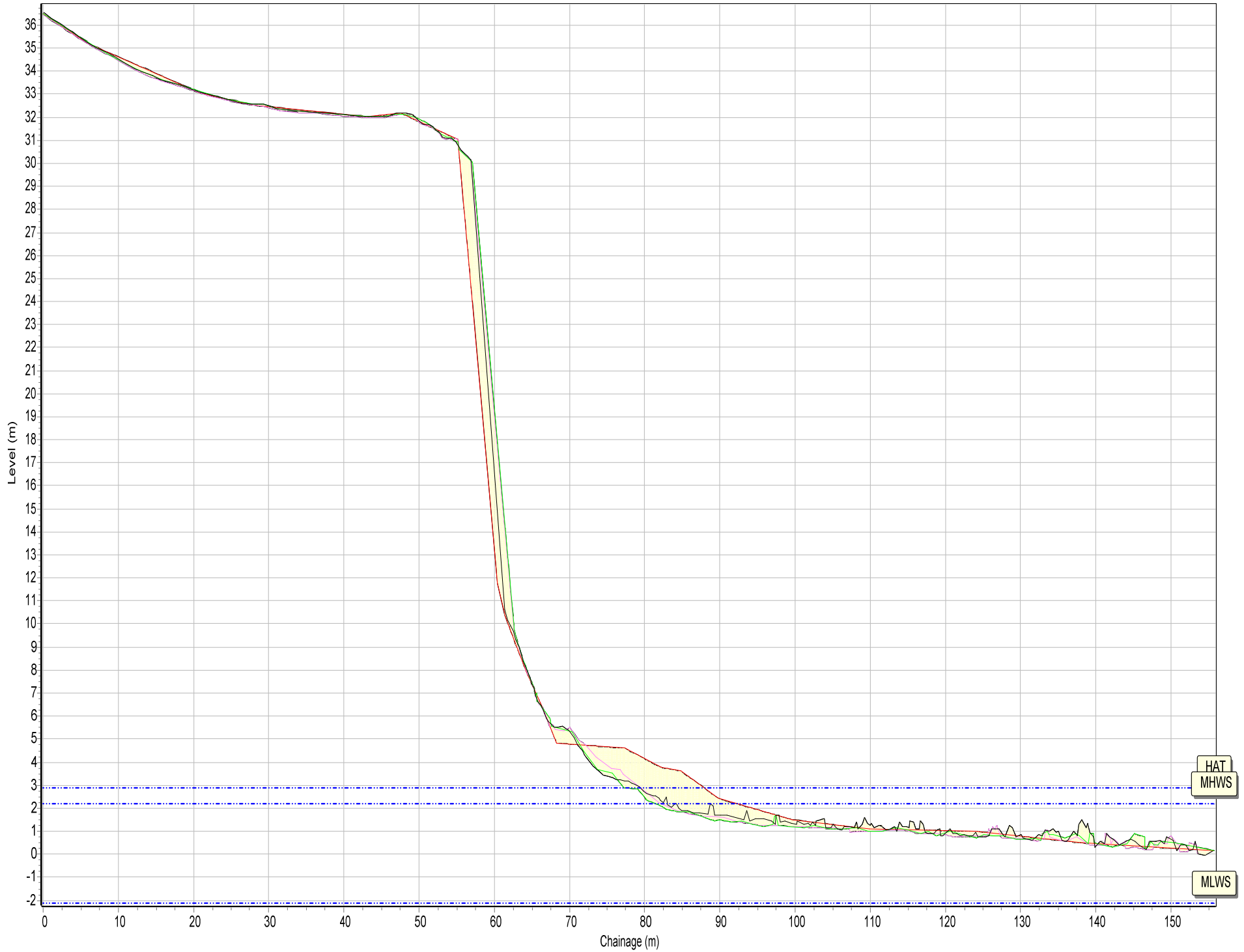
Beach Profiles: 1bSS15



Profiles Envelope  
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27/11/2014  
12/11/2015  
03/11/2016

HAT  
MHWS  
MLWS

Beach Profiles: 1bSS16

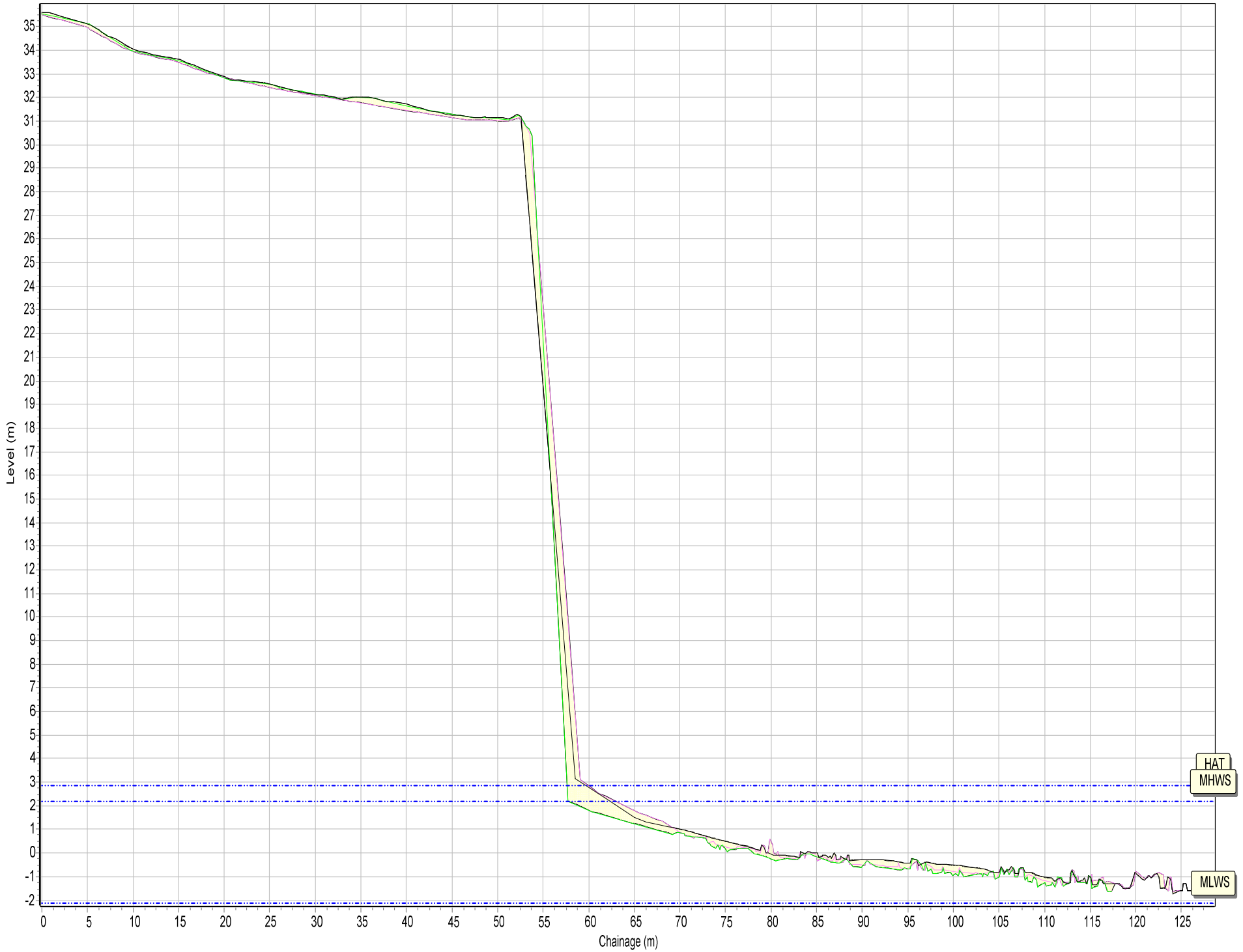


Profiles Envelope  
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12/11/2015  
03/11/2016

HAT  
MHWS  
MLWS

SANDS

Beach Profiles: 1bSS17



Profiles Envelope

- 23/03/2009
- 12/11/2015
- 14/03/2016
- 03/11/2016

HAT  
MHWS

MLWS

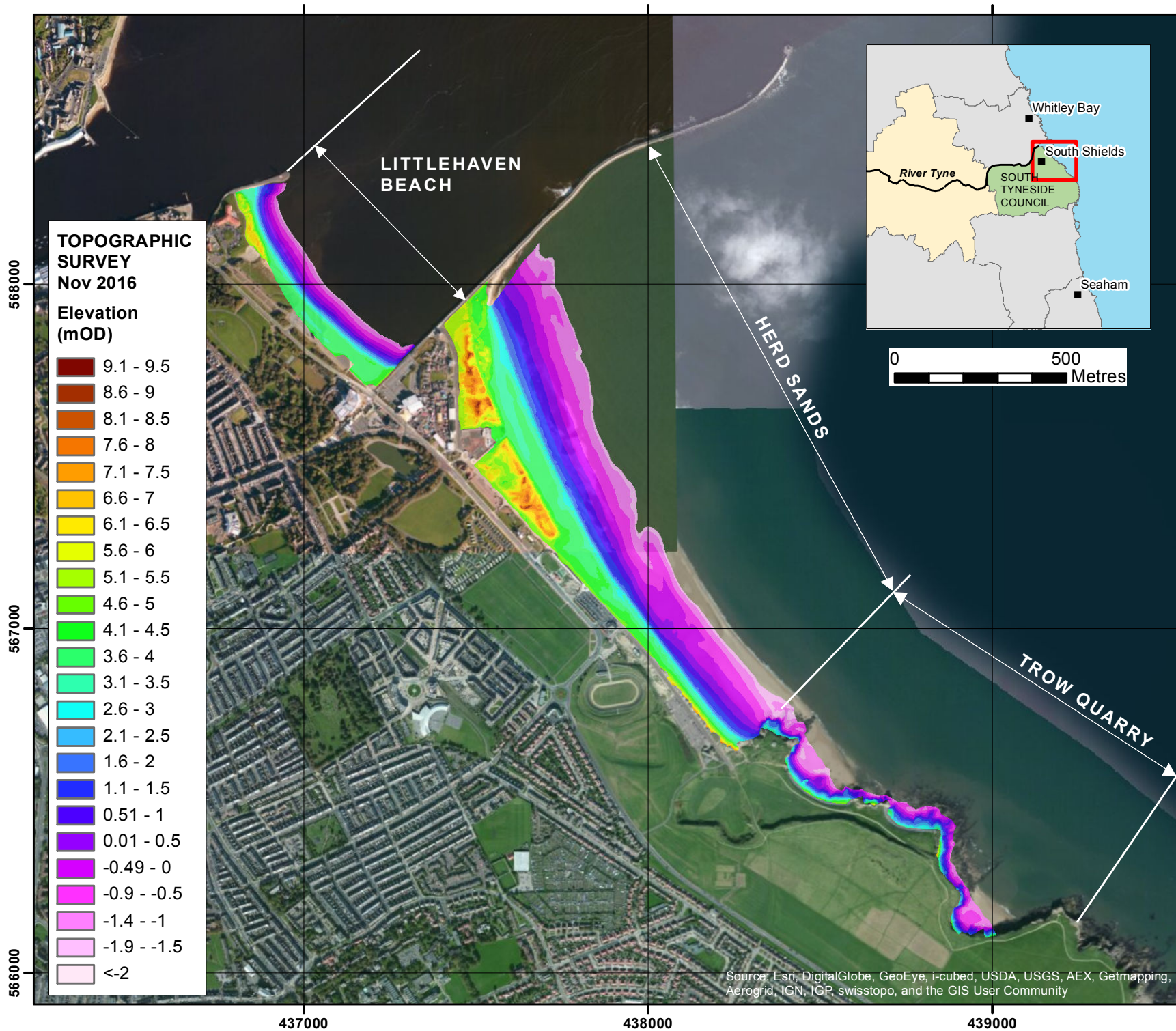
SANDS



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

**Appendix B**  
**Topographic Survey**



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

**Appendix B - Map 1**  
**LITTLEHAVEN BEACH,**  
**HERD SANDS,**  
**TROW QUARRY**  
**North Tyneside**  
**Council Frontage**  
 Analytical Report  
 'Full Measures' Survey 2016

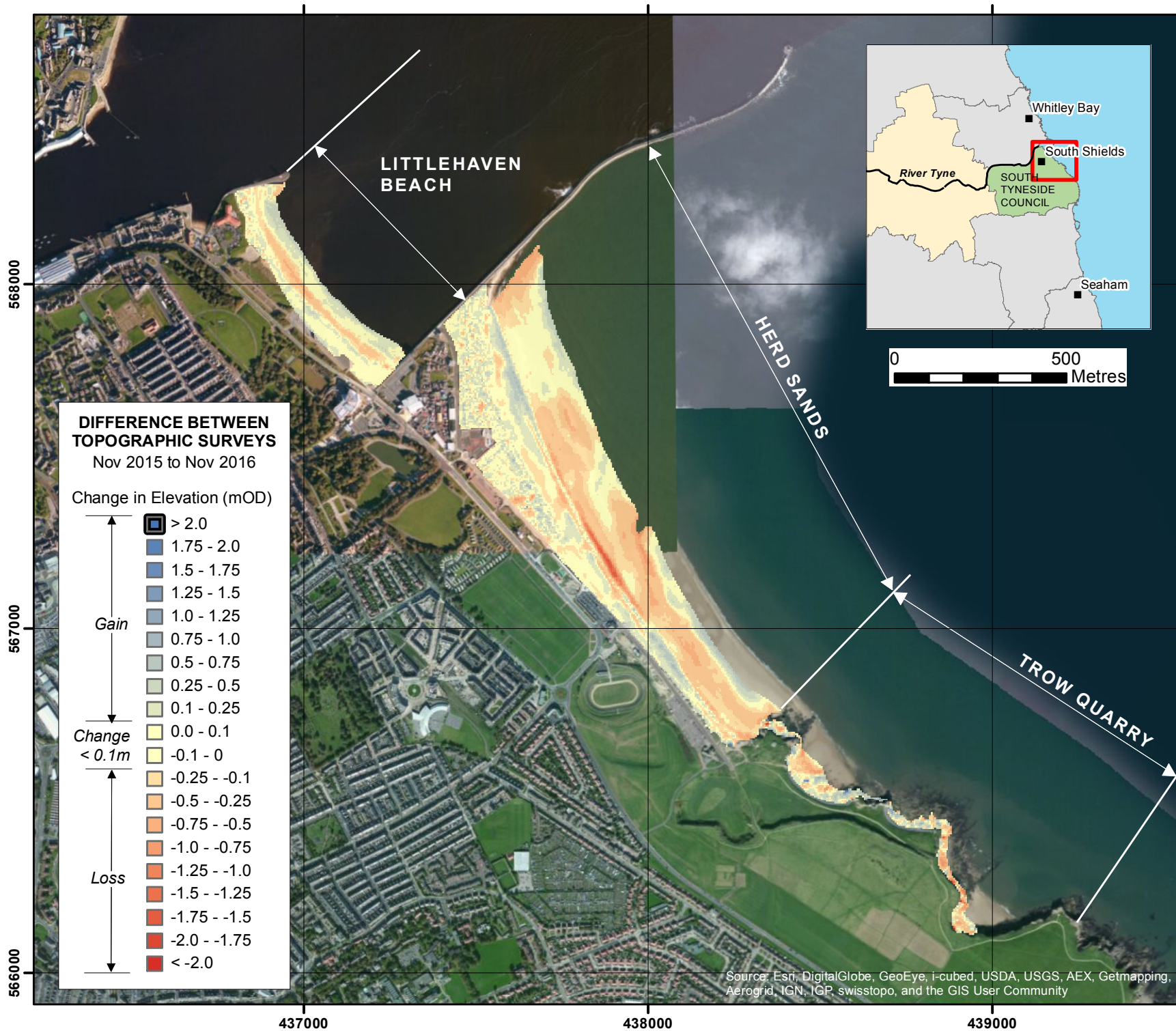
Drawing Scale at A4 1:15,000

**WATER**  
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 www.royalhaskoningdhv.com







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

**Appendix B - Map 2**  
**LITTLEHAVEN BEACH, HERD SANDS, TROW QUARRY**  
**North Tyneside Council Frontage**  
Analytical Report  
'Full Measures' Survey 2016

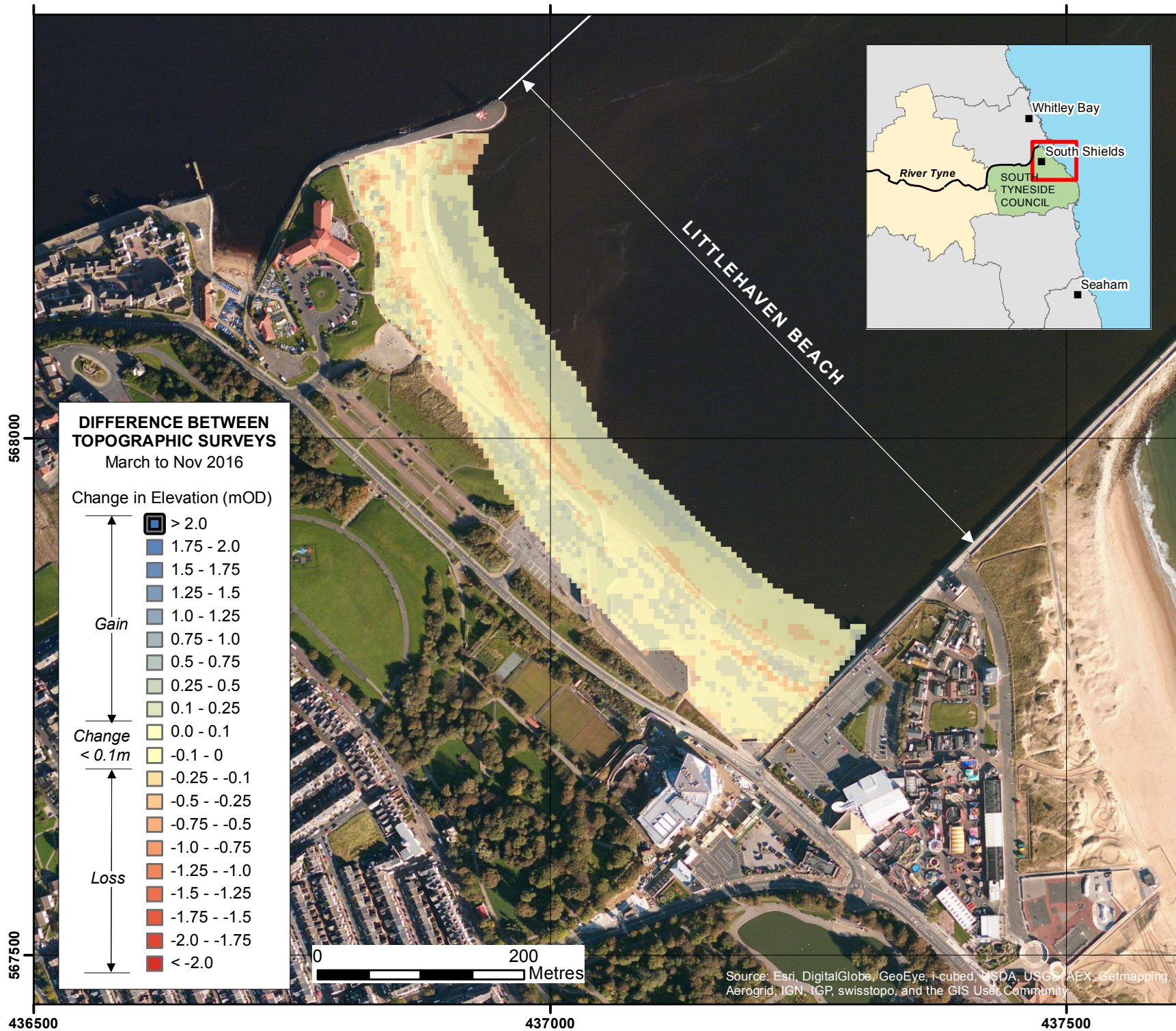
Drawing Scale at A4 1:15,000

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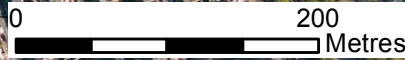
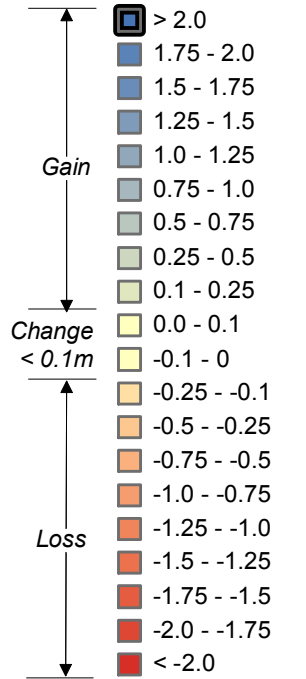




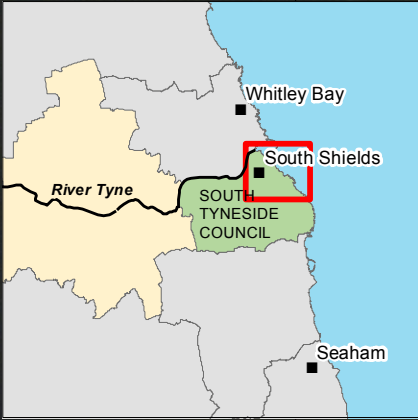


**DIFFERENCE BETWEEN TOPOGRAPHIC SURVEYS**  
March to Nov 2016

Change in Elevation (mOD)



Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



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

**Appendix B - Map 3**  
**LITTLEHAVEN BEACH, HERD SANDS, TROW QUARRY**  
**North Tyneside Council Frontage**  
Analytical Report  
'Full Measures' Survey 2016

Drawing Scale at A4 1:5,000

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436500 437000 437500 567500 568000

**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	Mar 2016	Nov 2016	Sep 2011 - Nov 2016	Mar 2016 - Nov 2016	Sep 2011 - Nov 2016
1	438300.3	566674.7	309	7	6.9	6.92	0.08	-0.02	0.02
2	438338.8	566694.3	312	9.4	9.5	9.31	0.09	0.19	0.02
3	438384.7	566669	33	7	7.1	6.92	0.08	0.18	0.02
4	438408.1	566664.8	71	10.5	10.5	10.45	0.05	0.05	0.01
5	438401.1	566638	120	7	7.6	7.23	-0.23	0.37	0.00
6	438392.8	566604.2	110	10.2	10.1	10.07	0.13	0.03	0.03