North East Coastal Observatory

Royal HaskoningDHV
Enhancing Society Together

Cell 1 Regional Coastal Monitoring Programme Analytical Report 13: 'Full Measures' Survey 2020

South Tyneside Council

South Tyneside Council

October 2020

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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
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). 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.

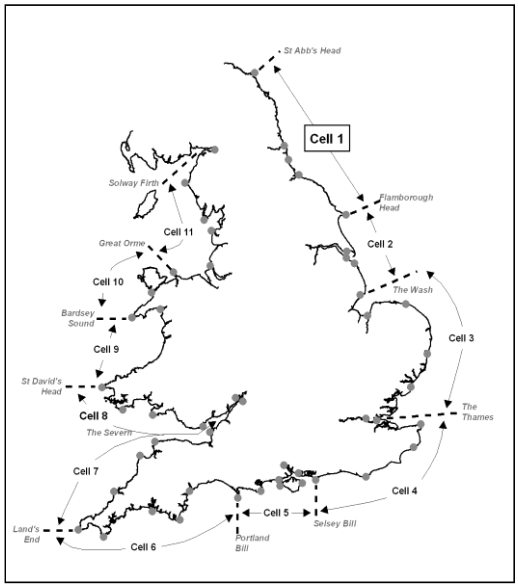


Figure 1 Sediment Cells in England and Wales

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
- LiDAR Surveys
- walk-over and coastal defence asset surveys

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

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

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

To date the following reports have been produced:

Table 1 Analytical, Update and Overview Reports Produced to Date

Year		Full Measures		Partial Measures		Cell 1 Overview Report
		Survey	Analytical Report	Survey	Update Report	
1	2008/09	Sep-Dec 08	May 09	Mar-May 09		-
2	2009/10	Sep-Dec 09	Mar 10	Feb-Mar 10	Jul 10	-
3	2010/11	Aug-Nov 10	Feb 11	Feb-Apr 11	Aug 11	Sep 11
4	2011/12	Oct-Nov 11	Oct 12	Mar - May 12	Feb 13	-
5	2012/13	Nov 12	Mar 13	Mar 13	Jun 13	
6	2013/2014	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	Oct/Nov 16	Feb 17	Mar 17	Jul 17	
10	2017/18	Oct 17	Feb 18	Apr 18	Jun 18	
11	2018/19	Nov 18	Jan 19	Feb 19	May 19	
12	2019/20	Sep 19	Nov 19	May 20	Jun 20	
13	2020/21	Sep 20	Oct 20			

(*) The present report is **Analytical Report 13** and provides an analysis of the 2020 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

Authority	Zone
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, Upgang 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)

In addition to the above, laserscan surveys of the cliffs in Marsden Bay have been undertaken on several occasions. These are reported separately to South Tyneside Council.

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 1st September and 24th September 2020. During this time, the weather and sea state varied greatly, for details of the survey conditions refer to the Academy Geomatics survey report.

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.

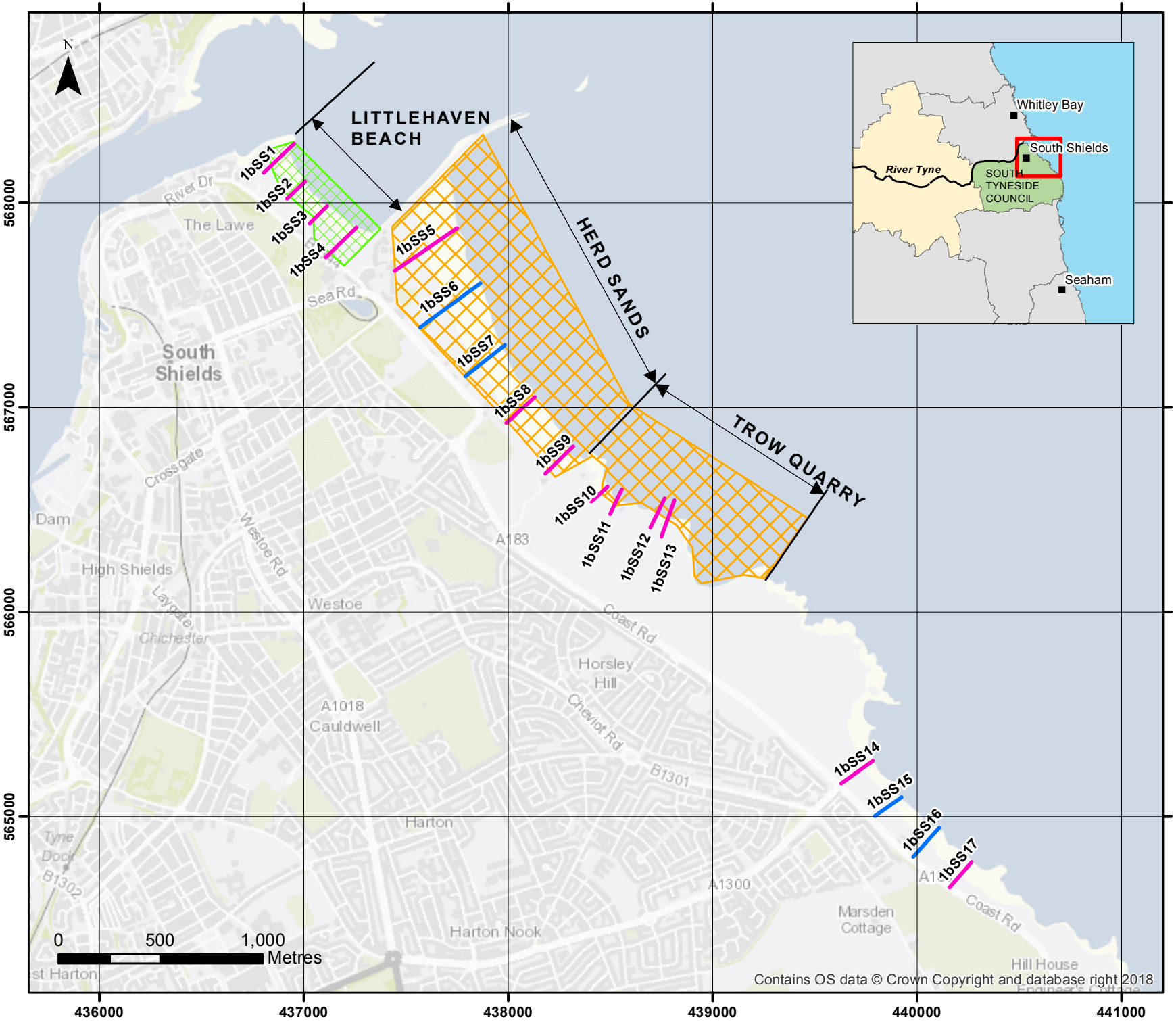
Upon receipt of the data from the survey team, they are quality assured and then uploaded onto the programme's website for storage and availability to others and also input to SANDS and GIS for subsequent analysis.

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.



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Key

SURVEY LOCATIONS

Topographic Profiles

- Annual
- Bi-Annual

Topographic Surveys

- 6 monthly
- yearly
- 5 yearly

(Indicative Survey Extents shown)

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Figure 2 - Map 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
1st – 24th September 2020	**Beach Profiles:** 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 May 2020 and the previous Full Measures survey was undertaken in September 2019. Profiles 1bSS1 and 1bSS3 were last surveyed during the Partial Measures spring survey, 2020. Profiles 1bSS2 and 1bSS4 were last surveyed during the Full Measures autumn survey, 2019. Profile **1bSS1** 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, with small sections of erosion on the back dunes and accretion on the front dunes of less than 0.1m in level. Beach levels on the upper beach (chainages 60m to 93m) have undergone negligible change since the May 2020 survey, with change limited to less than 0.1m. From chainages 93m to 139m there has been accretion of up to 0.2m. The boulder patch seaward of chainage 144m remains exposed with slight changes in position of boulders since the previous survey. The profile is at a high level on the dunes and at a medium level through the upper to lower beach compared to the range recorded from previous surveys. Profiles **1bSS2 to 1bSS4** extend seawards from the new sea wall that was completed since the Full Measures survey in April 2014. At profile **1bSS2**, beach levels have generally accreted by up to 0.3m at the toe of the seawall to chainage 34m, forming a small berm at chainage 28m. There has been erosion by up to 0.2m across the middle beach to chainage 76m, before switching to accretion on the lower beach by up to 0.2m. Overall the profile is at a low-medium level in the upper and middle beach compared to the range recorded from previous surveys, however the lower beach is at a high level compared to the range recorded from previous surveys. At profile **1bSS3**, there has been an accumulation of 0.3m of sediment at the toe of the seawall, which is now covering up the last step. Across the upper beach there has been varying sections of	The beach at Littlehaven has had some time to adjust since construction of the new seawall in April 2014. All of the profiles show limited change since May 2020, with accretion at the toe of the seawall and on the lower beach profile. Generally, the upper and middle beach profiles are at a low-medium level compared to the range recorded from previous surveys, with the lower beach profiles recorded at a high level. **Longer term trends:** 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.

Survey Date	Description of Changes Since Last Survey	Interpretation
	erosion and accretion limited to ±0.1m. A berm has formed at chainage 16m with the accretion of up to 0.5m between chainages 2m and 32m. Between chainages 32m and 50m there has been negligible change in profile, switching to accretion on the lower beach by up to 0.2m.Overall, the upper and middle beach profile is at a medium level, whilst the lower beach is at a high level compared to the range recorded from previous surveys. At profile **1bSS4**, there has been erosion by up to 0.2m from the toe of the seawall to chainage 78m. From chainage 78m to 105m there has been accretion of up to 0.5m, switching to erosion from chainage 105m to chainage 139m by to 0.3m. Seaward of chainage 139m the beach toe has accreted by up to 0.2m. Overall the profile has steepened since the previous survey, with the profile at a low to medium level compared to the range recorded from previous surveys.	
September 2020	**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 (Full Measures, autumn 2020) 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 topographic survey (Partial Measures, spring 2020) and the present survey. The topographic survey shows a continuous band of accretion across the lower beach, and the middle beach from the centre to the south of the bay. Erosion mostly occurs in the middle beach in the northern half of the bay, with small sections on the upper beach in the central bay. North of the seawall the pattern is patchy; with the upper beach showing a mix of erosion and accretion. Change across the whole bay is limited to ±1.0m, with erosion predominantly reaching no greater than 0.5m.	Comparison of the present topographic survey with the previous Partial Measures (spring, 2020) 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.

2.2 Herd Sands

Survey Date	Description of Changes Since Last Survey	Interpretation
1st – 24th September 2020	**Beach Profiles:** 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, 2020. Profiles 1bSS6 and 1bSS7 were last surveyed during the Full Measures autumn survey 2019. Profile **1bSS5** 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 of side of the path. The hollow between the dunes at chainages 87m and 97m has deepened by 0.3m, with accretion on the seaward side of the dune by up to 0.1m. There has been accretion across the beach profile seaward of the dunes, by up to 0.2m on the upper beach, 0.1m on the middle beach and up to 0.4m on the lower beach. The berm at chainage 155m has accreted by 0.1m. Overall, the beach is at a high level compared to the range recorded from previous surveys. At profile **1bSS6**, the dunes have remained stable, with small hollows deepening by 0.1m and dune crests accreting by 0.1m. From the toe of the dunes to chainage 135m, the upper beach has undergone erosion by up to 0.1m. From chainage 135m to 224m there has been an accretion of up to 0.3m at the crest of the berm at chainage 170m. There has been an erosion of the beach profile seaward of chainage 224m by up to 0.3m. Overall the beach is at a medium to high level compared to the range recorded from previous surveys. At profile **1bSS7**, located at the centre of Herd Sands, the entire beach profile has accreted. The upper beach to chainage 65m has accreted by up to 0.3m. The upper beach berm has migrated seaward by 13m and accreted by up to 0.1m. There has been an accretion by up to 0.3m between the berm and chainage 226m, where a lower beach berm has formed at chainage 236m with an accretion of up to 0.6m of sediment. Overall, the beach profile is at a high level compared to the range recorded from previous surveys, particularly between chainages 2-22m and 226-280m which are at their highest level recorded. At profile **1bSS8**, between the toe of the seawall and chainage 49m there has been accretion by up to 0.8m forming a berm on the upper beach at chainage 30m that had previously been removed after	The profiles generally show accretion across the beach profile, except at profile 1bSS6 which generally shows erosion. The upper beach berm accreted across the bay and a lower beach berm formed at profile 1bSS7. Generally, the profiles are at a medium to high level compared to the range recorded from previous surveys. **Longer term trends:** Beach levels generally remain at medium to high levels compared to earlier surveys. The dunes between chainages 2-22m and 226-280m at profile 1bSS7 are at their highest level recorded.

Survey Date	Description of Changes Since Last Survey	Interpretation
	the survey in September 2019. Between chainage 49m and 90m there has been erosion by up to 0.4m, leading to a steeper upper beach profile. Seaward of chainage 90m there has been accretion by up to 0.3m. Overall, the beach is at a medium level on the upper and middle beach, and the lower beach is at a low level compared to the range recorded from previous surveys. Profile **1bSS9** is located at the southern end of Herd Sands. From the toe of the dunes at chainage 25m to 57m chainage, there has been an accretion of up to 0.3m. Between chainages 57-84m there is a small section of erosion of up to 0.2m. Seaward of chainage 84m there has been an accretion of up to 0.6m. Overall the dunes fronting the car park remain at a high level and the upper to lower beach are at a medium level compared to the range recorded from previous surveys.	
September 2020	**Topographic Survey:** Herd Sands is covered by an annual topographic survey between the South Pier and Trow Point, which commenced in November 2008. Data from the most recent topographic survey (Full Measures, autumn 2020) 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 2019) and the present survey. The difference plot shows that change across the dunes is patchy but overall shows more areas of accretion than erosion, particularly on the seaward face of the dunes and at the dune toe. The beach itself generally shows shore parallel bands of erosion and accretion. The upper and middle beach is dominated by accretion, except at the extreme southern end of the bay which has a band of erosion on the upper beach. Erosion is concentrated on the lower beach of the southern part of the bay and some small patches in the central – northern section of the bay.	Comparison of the present topographic survey with the previous Full Measures (autumn, 2019) shows accretion of limited intensity in the dunes and on the seaward dune face. Accretion reaches 1.25-1.75m in the centre of the bay, whilst erosion reaches approximately 0.75-1.0m.

2.3 Trow Quarry (incl. Frenchman's Bay)

Survey Date	Description of Changes Since Last Survey	Interpretation
1st – 24th September 2020	**Beach Profiles:** 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 May 2020. Profiles **1bSS10** and **1bSS11** are located in Graham's Bay. At profile **1bSS10** the backshore has remained stable. Across the majority of the profile, there has been an accretion of sediment over previously exposed cobbles. Accretion ranges from 0.2m on the upper beach to 0.3m on the lower beach. Overall, the profile is at a relatively medium-low level compared with the range recorded from previous surveys. At profile **1bSS11**, there has been very little change in the beach profile to chainage 21m. Seaward of chainage 21m there has been a movement of rocks, however the profile is generally in the same position as the previous survey in May 2020. Overall the profile is at a low level compared with the range recorded from previous surveys. Profile **1bSS12** and **1bSS13** 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.	At both Graham's Bay and Southern Bay, the cliff and rock revetment have remained stable. At Graham's Bay the beach shows accretion in between rocks and cobbles at profile 1bSS10. There has been very little change across profile 1bSS11. At Southern Bay, the rocky foreshore has generally retained the same form and position. **Longer term trends:** Overall, the beach at Graham's Bay and Southern Bay has generally retained the same form and position since November 2008/March 2009 when surveys began.
September 2020	**Topographic Survey:** Trow Quarry is covered by an annual topographic survey within Graham's Sand, Southern Bay and Frenchman's Bay, which commenced in November 2008. Data from the most recent topographic survey (Full Measures, autumn 2020) 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 2019) and the present survey.	**Topographic Survey:** The difference plot indicates that accretion has been more dominant in the north of the bay, however changes elsewhere display no discernible pattern.

Survey Date	Description of Changes Since Last Survey	Interpretation
	The difference plot shows that there has been patchy change across the beach with no discernible pattern, although accretion is more dominant in the north (corroborating the pattern seen at profile 1bSS10).	
3rd September 2020	**Cliff-top Survey:** Cliff top survey data collected for baseline survey (autumn, 2011) and bi-annual surveys since then, including the present Full Measures survey (autumn, 2020) is presented in this report. 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. 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 ±0.1m 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 the edge of the cliff top along a defined bearing. Results show erosion greater than the anticipated survey error has occurred at two points since the last survey, with 0.3m and 0.15m recession recorded at points 4 and 5, respectively. From September 2011 to the present survey, 2 points have experienced erosion greater than the survey error, with 0.14m and 0.22m recession at points 3 and 4 respectively.	Results show that since the last survey, two points have experienced erosion greater than the anticipated survey error (Points 4 and 5). Over the long term, minimal 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.

2.4 Marsden Sands

Survey Date	Description of Changes Since Last Survey	Interpretation
1st – 24th September 2020	**Beach Profiles:** 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 May 2020 and prior to that the Full Measures survey was completed in September 2019. Profiles 1bSS14 and 1bSS17 were last surveyed during the Partial Measures spring survey, 2020. Profiles 1bSS15 and 1bSS16 were last surveyed during the Full Measures autumn survey, 2019. Profile **1bSS14** is located to the north of the bay and covers the cliff and the former lifeguard station adjacent to the Redwell Steps. The survey report notes that the start of this section was inaccessible due to ongoing works to remove former structures in the area. There has been very little change in the beach profile, with 0.1m erosion across the middle-lower beach profile Overall, the profile is at a medium level compared to the range recorded by previous surveys. At profile **1bSS15,** there has been a 1.0m advance in position of the cliff toe, however this could be a difference in surveying position at the base of the cliff. Across the upper beach profile there has been an erosion of up to 0.3m to chainage 99m. Seaward of chainage 99m the beach profile has accreted by up to 0.8m, covering up a previously exposed boulder patch at chainage 104-124m. Overall, the profile is at a medium to high level compared to the range recorded by previous surveys. At profile **1bSS16,** the cliff top profile has receded by 3m since the previous survey, however this could be a difference in surveying position at the cliff top. The beach profile has eroded by up to 1.0m to the cobbles at chainage 110m. From 110m, apparent changes across the rest of the profile likely derive from minor movement of cobbles or differences in the exact placement of survey points. The profile is at a low level compared with the range recorded from previous surveys. Profile **1bSS17** is located to the south of the bay. There has been erosion of sand at the toe of the cliff by up to 0.4m to chainage 68m. The profile which crosses rocky platform and boulders has been covered by a veneer of sand by up to 0.3m. Overall, the profile is at a low level compared with the range recorded from previous surveys.	The most northerly part of Marsden Bay at profile 1bSS14 appears to have been dominated by erosion across the upper to lower beach. At the centre of the bay, profiles 1bSS15 and 1bSS16 are dominated by erosion across the upper to middle beach and accretion on the lower beach. Changes are minimal further south, where there is less mobile sediment available. **Longer term trends:** The sandier beaches in the north of the bay are at a medium to high level across the profile. 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.

3. Problems Encountered and Uncertainty in Analysis

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 ±0.1m may be considered as being within margin of error of the surveying technique and that any indication of an advancing cliff line is error.

Results from the cliff survey at Trow Quarry show that since the last survey, two points experienced erosion greater than the survey error (Points 4 and 5 with 0.3m and 0.15m of recession respectively). Over the long term (September 2011-2020) it was concluded that minimal recession has taken place at the Trow Rocks headland and there is no cause for concern.

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 are generally within the boundaries of previous surveys, with the upper and middle beach recorded at a low-medium level and the lower beach recorded at a high level compared to previous surveys. Therefore, the beach profiles present no cause 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. At profile 1bSS7, the dunes have progressively prograded and are now at their highest level recorded between chainages 2-22m and 226-280m. The short term difference plot indicates that accretion has been dominant at Herd Sands relative to the previous survey.
- At Trow Quarry, the beach has generally maintained the same form since surveys began in 2009. There has been accretion at profile 1bSS10, creating a smoother profile and very little change has occurred at profile 1bSS11. The recorded profiles show no cause for concern. The cliffs at Trow Point appear to have been stable and the data does not indicate cause for concern.
- At Marsden Bay, profile 1bSS14 shows uniform erosion, whilst the central two profiles 1bSS15 and 1bSS16 show erosion across the upper to middle beach and accretion on the lower beach. The profiles present no causes for concern; with the northern profiles at a medium-high level and the southern profiles at a low level compared to previous surveys.

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

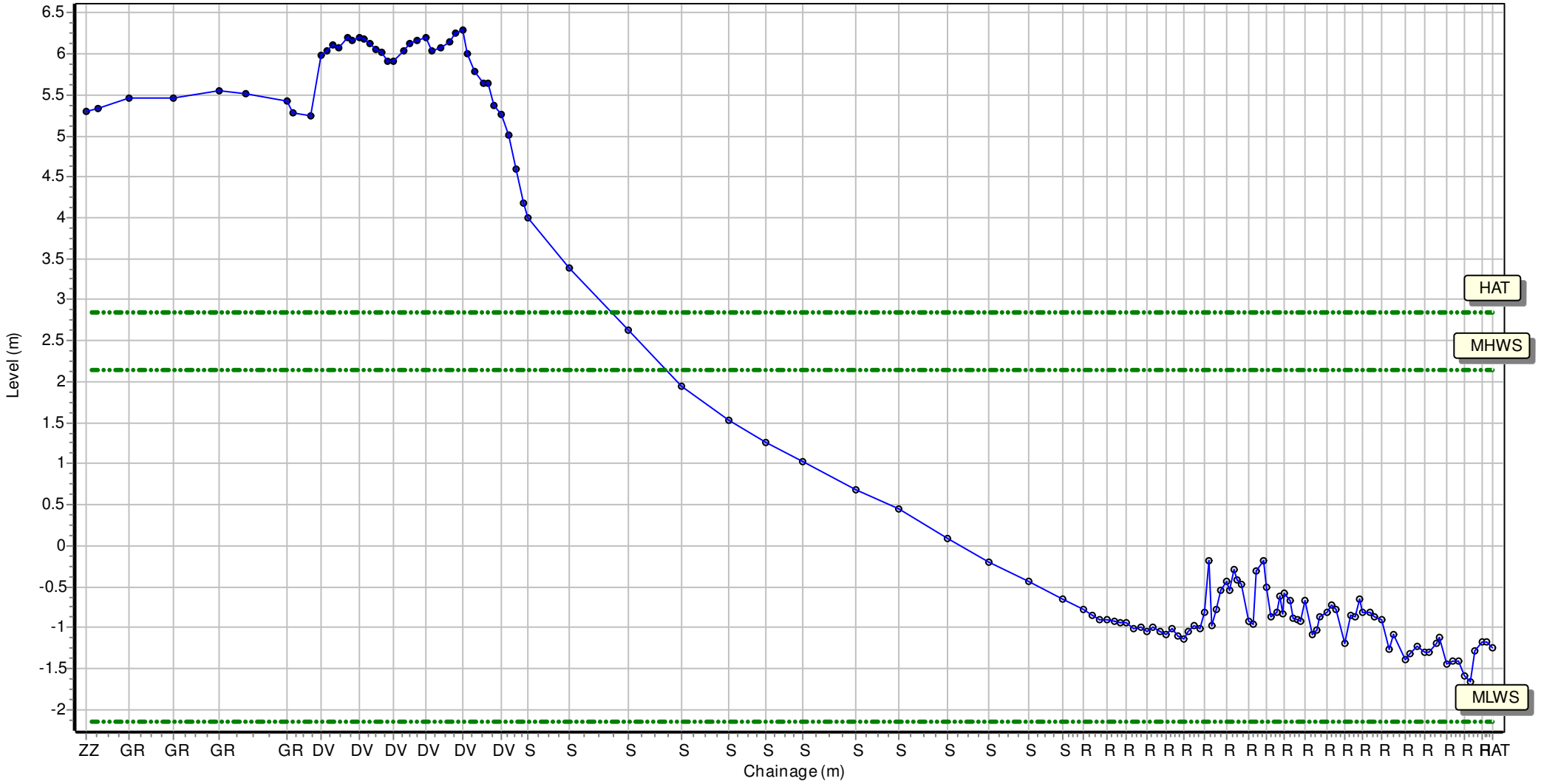
Location: **1bSS1**

Date: 03/09/2020 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2020 Full Measures Topo Survey

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



Beach Profile

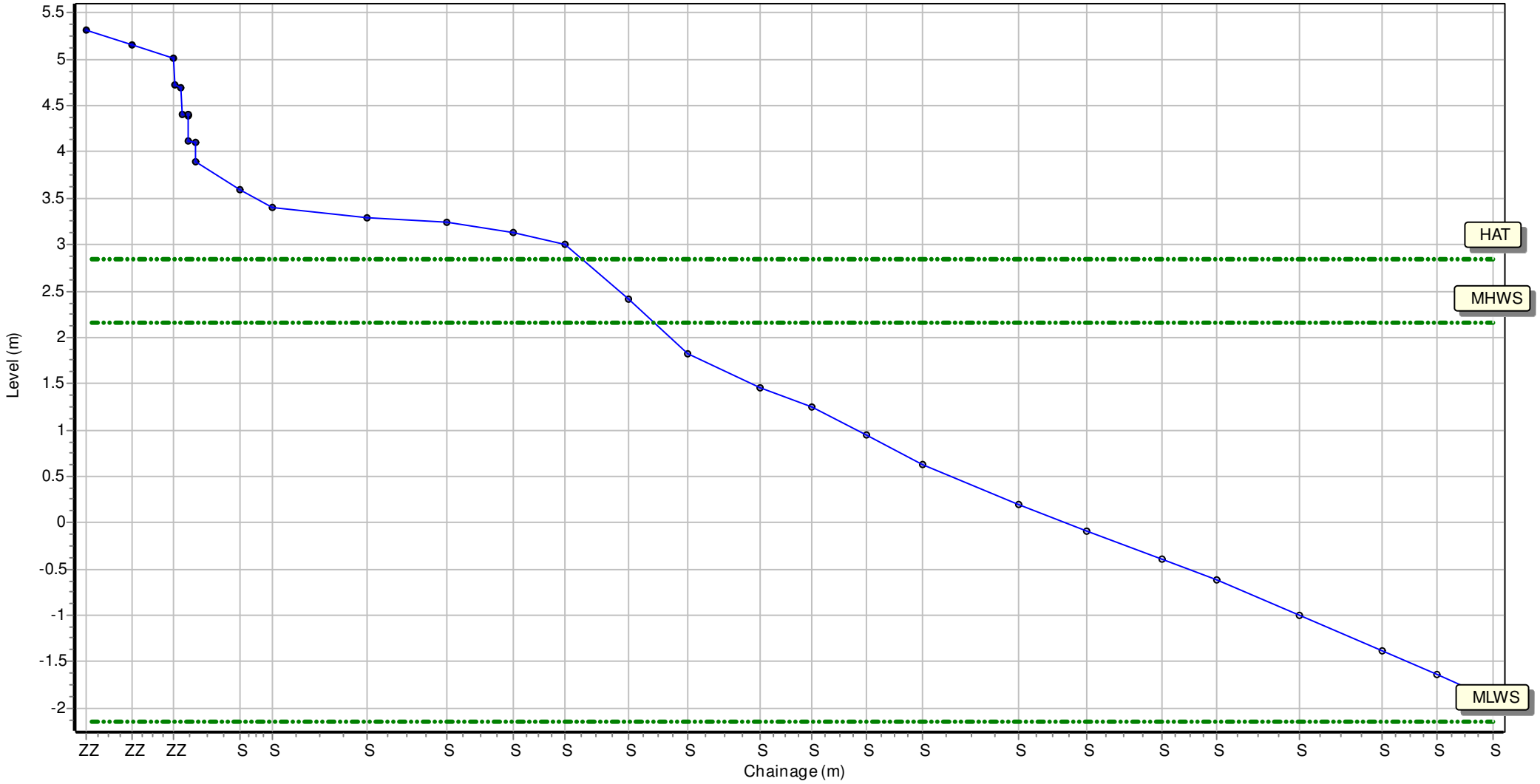
Location: **1bSS2**

Date: 03/09/2020 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2020 Full Measures Topo Survey

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



Beach Profile

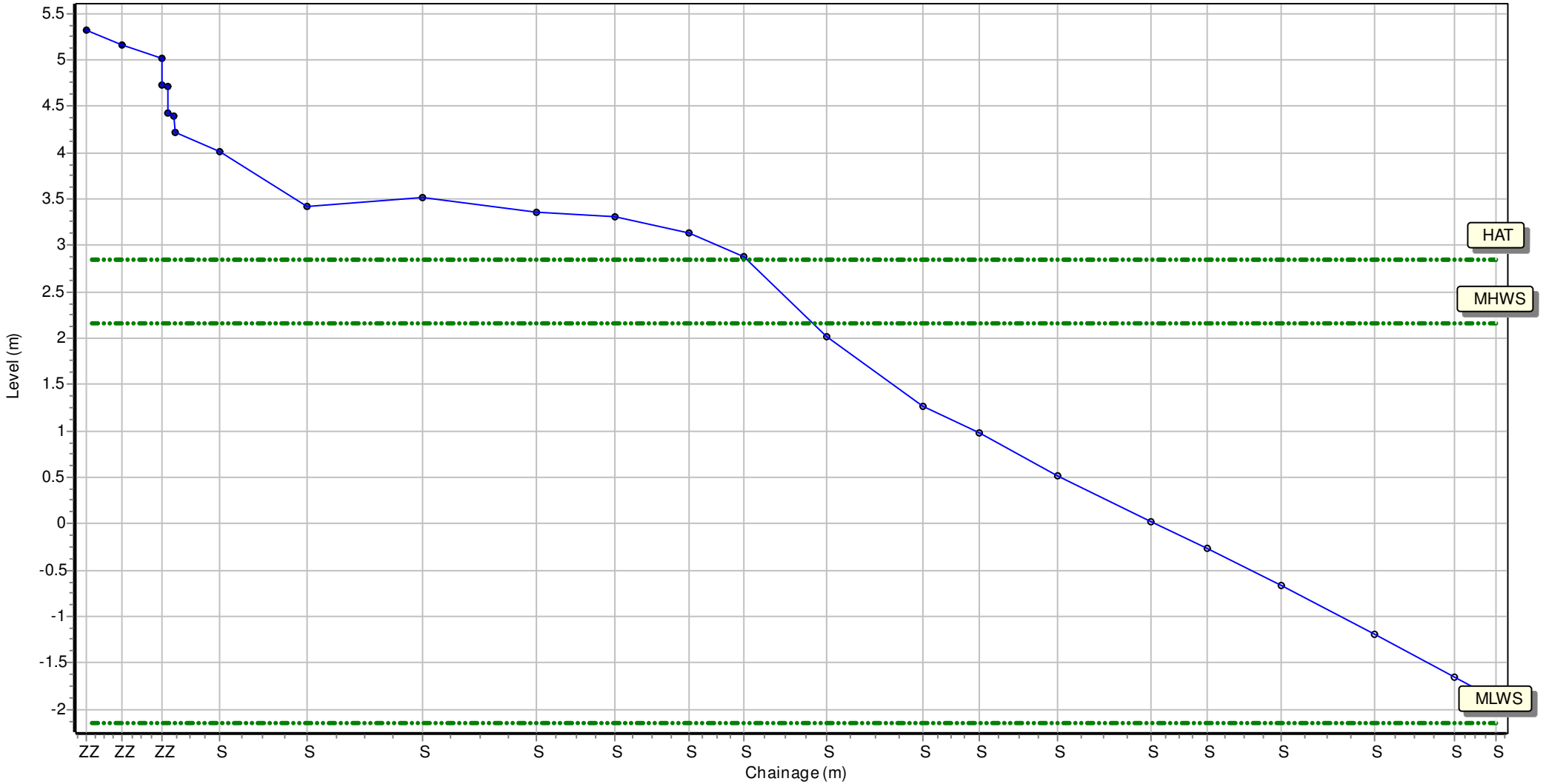
Location: **1bSS3**

Date: 03/09/2020 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2020 Full Measures Topo Survey

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



Beach Profile

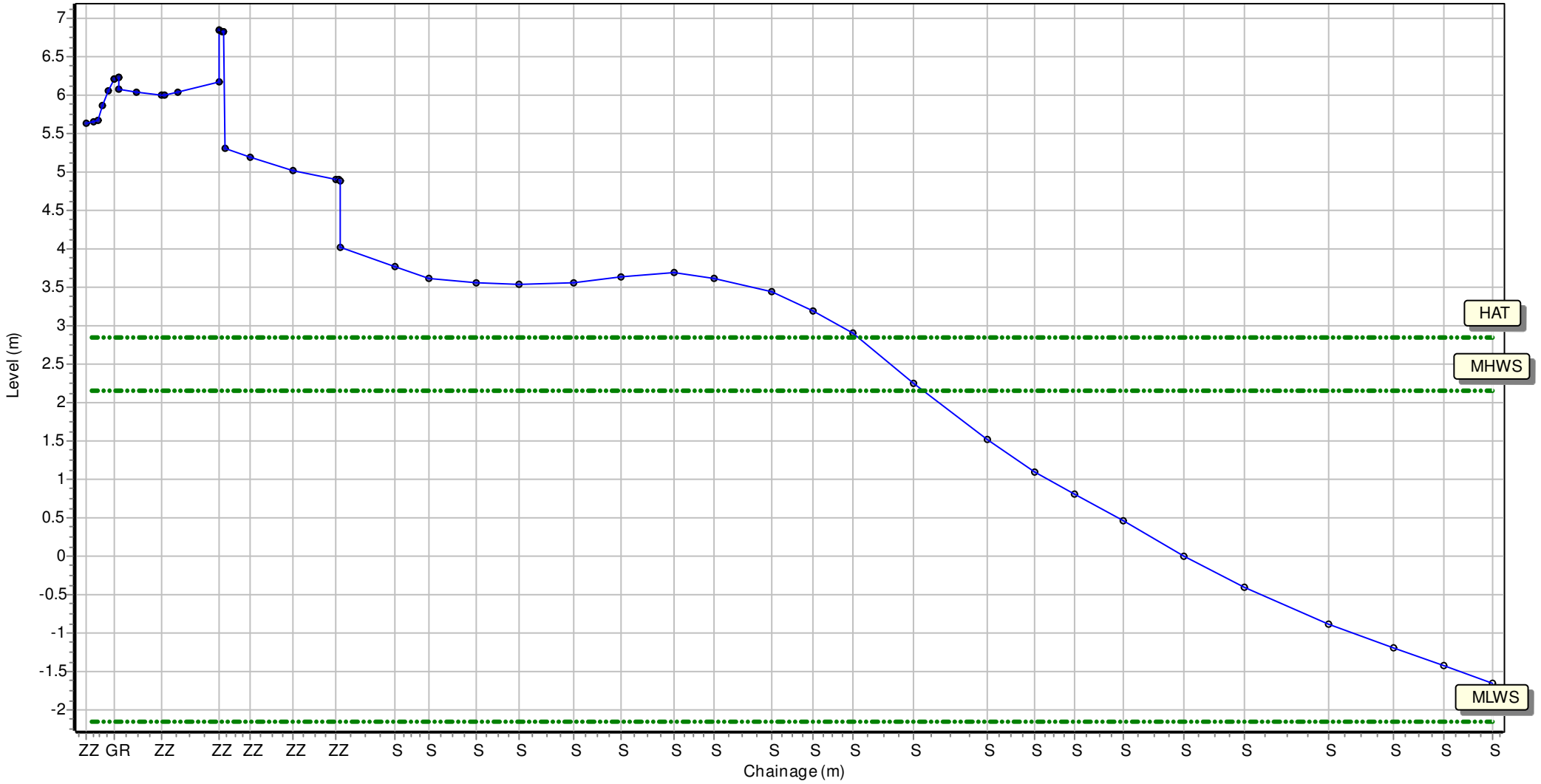
Location: **1bSS4**

Date: 03/09/2020 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2020 Full Measures Topo Survey

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



Beach Profile

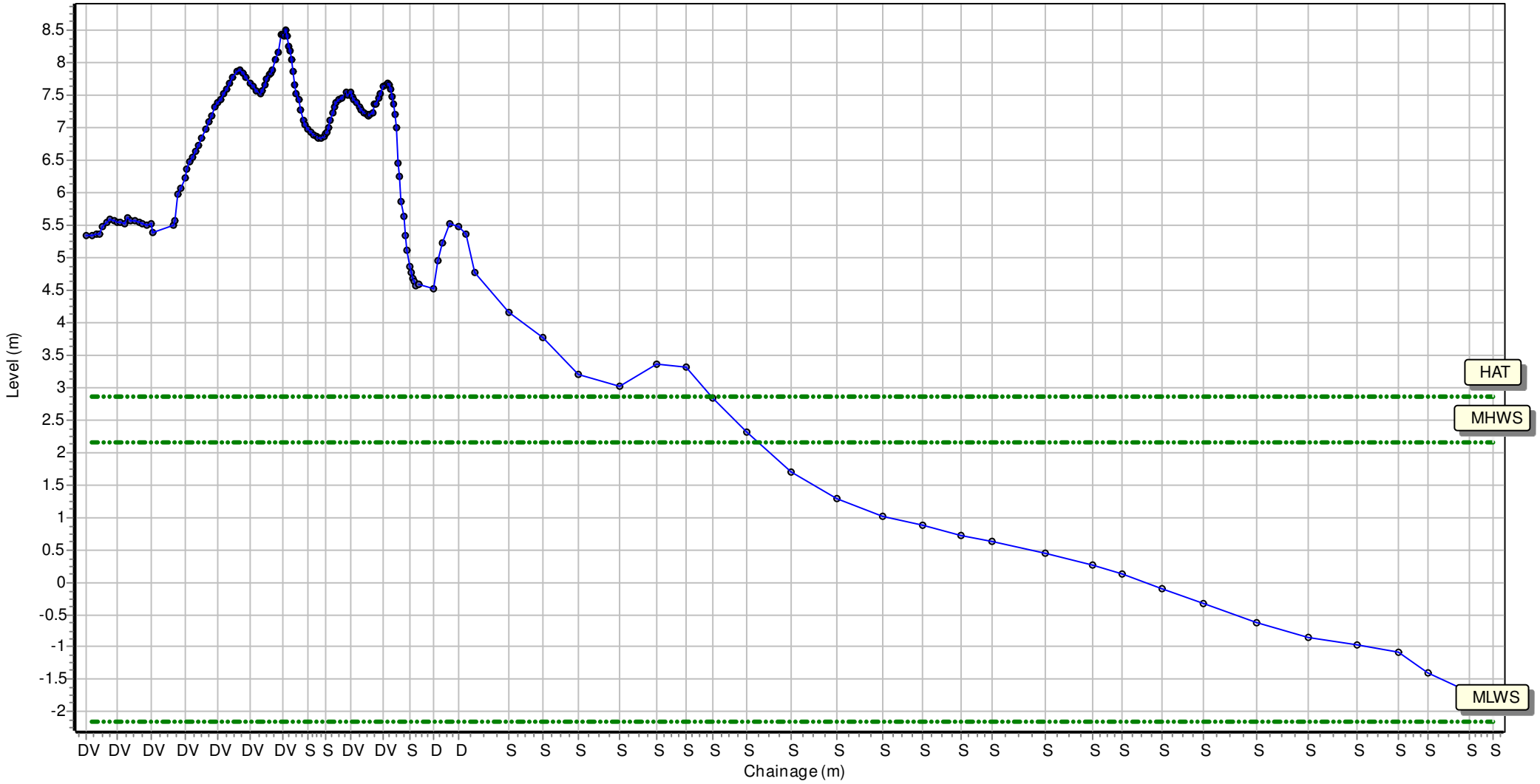
Location: **1bSS5**

Date: 03/09/2020 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2020 Full Measures Topo Survey

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



Beach Profile

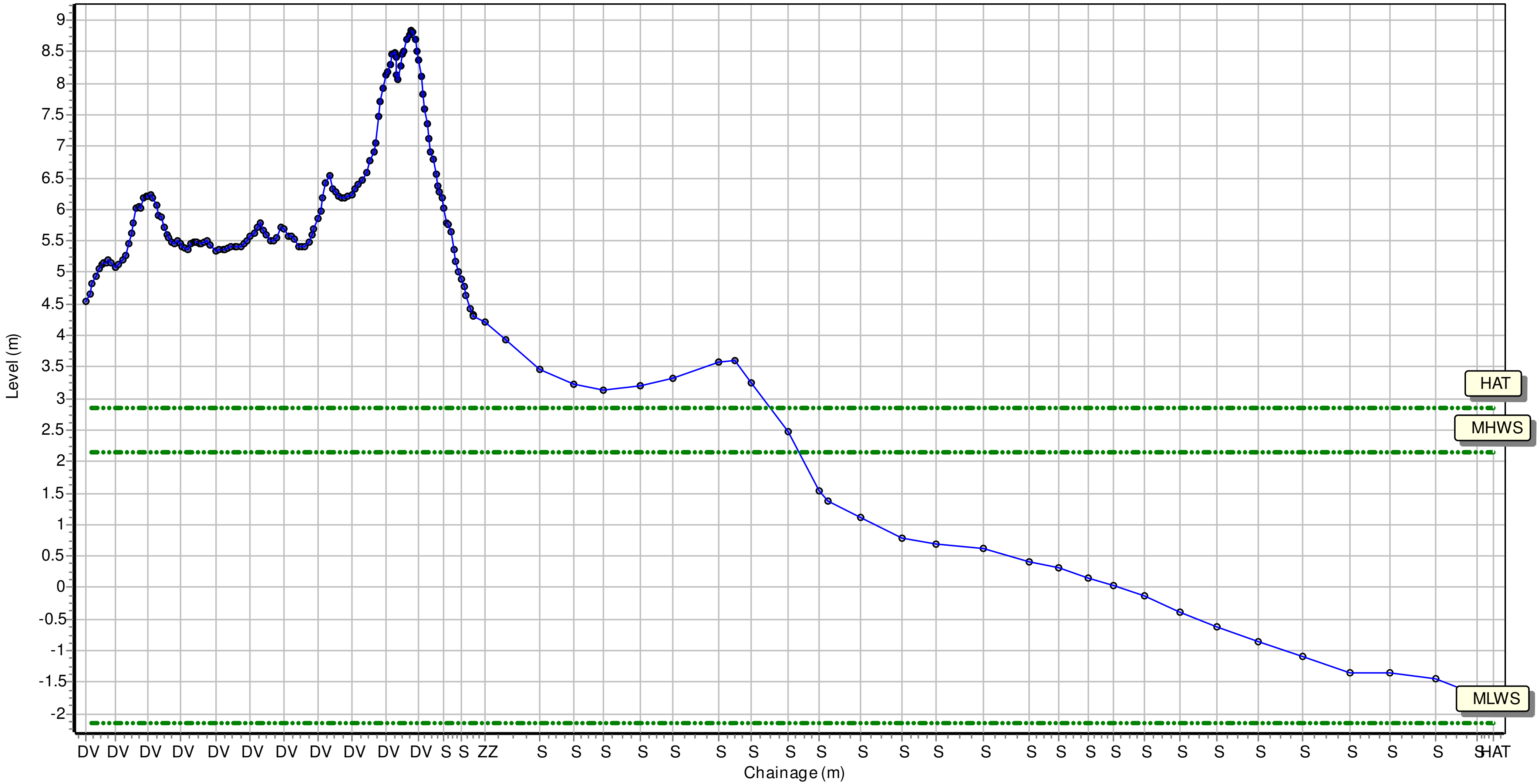
Location: 1bSS6

Date: 03/09/2020 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2020 Full Measures Topo Survey

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



http://www.sandsuser.com

SANDS

Beach Profile

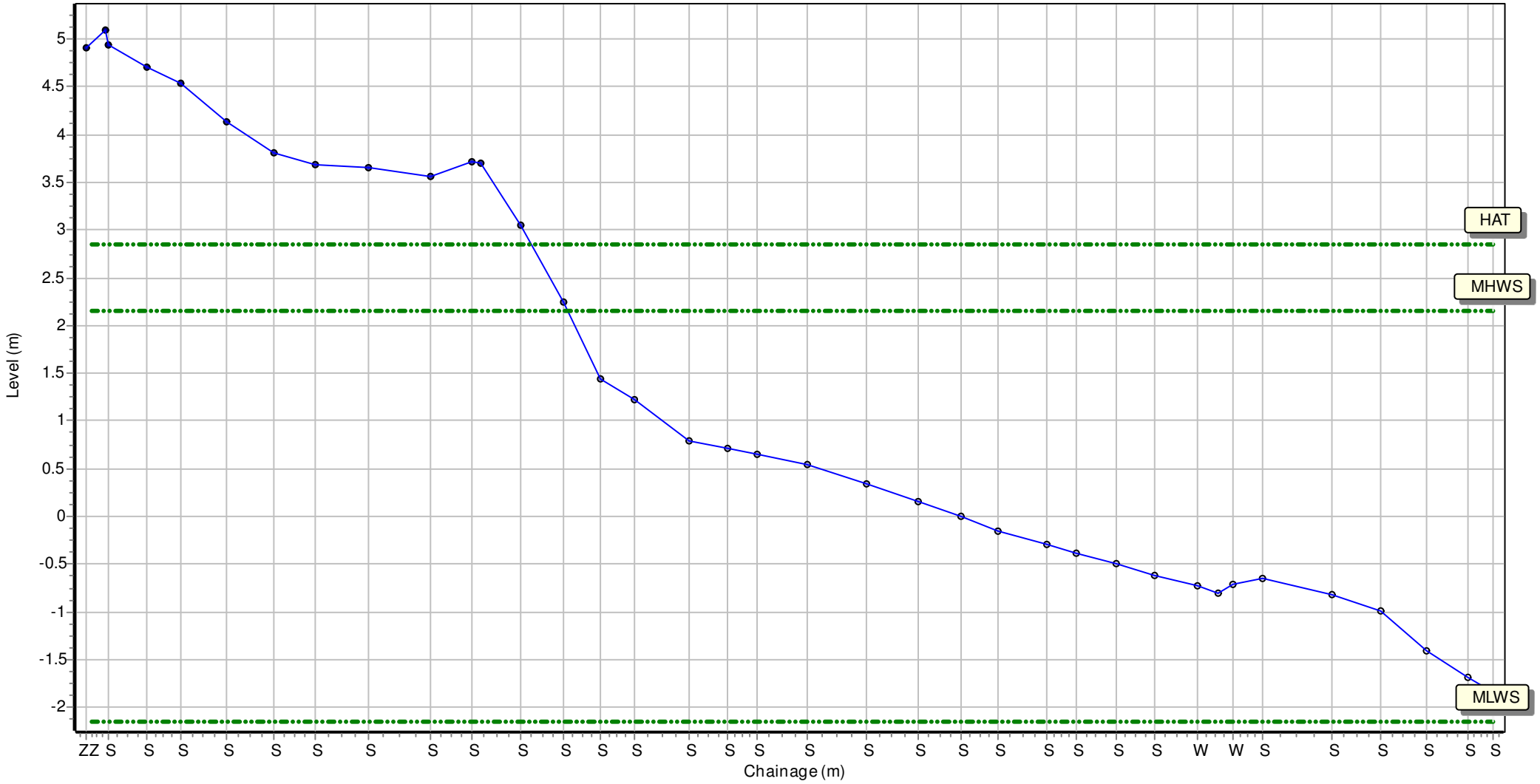
Location: **1bSS7**

Date: 03/09/2020 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2020 Full Measures Topo Survey

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



Beach Profile

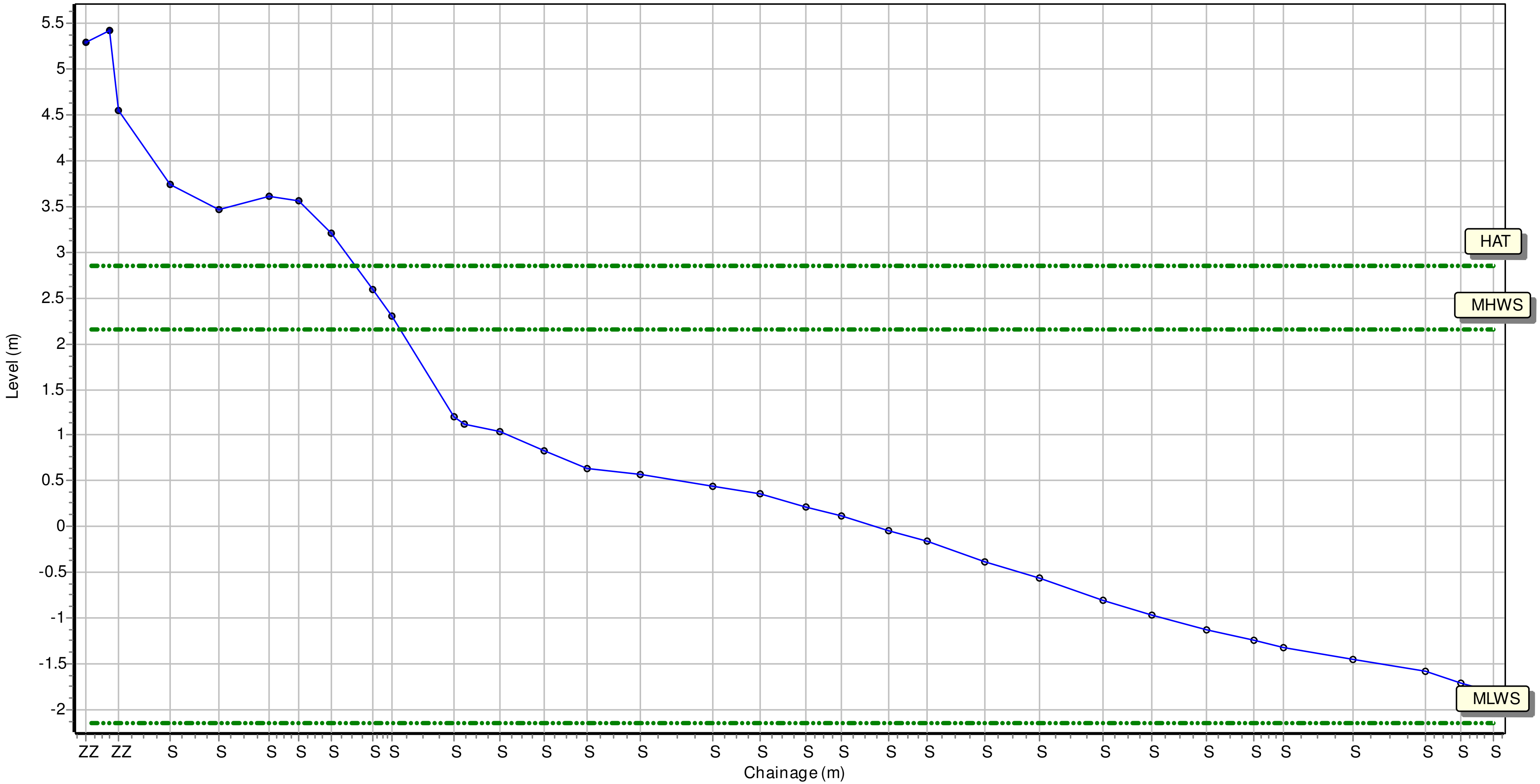
Location: 1bSS8

Date: 03/09/2020 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2020 Full Measures Topo Survey

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



http://www.sandsuser.com

SANDS

Beach Profile

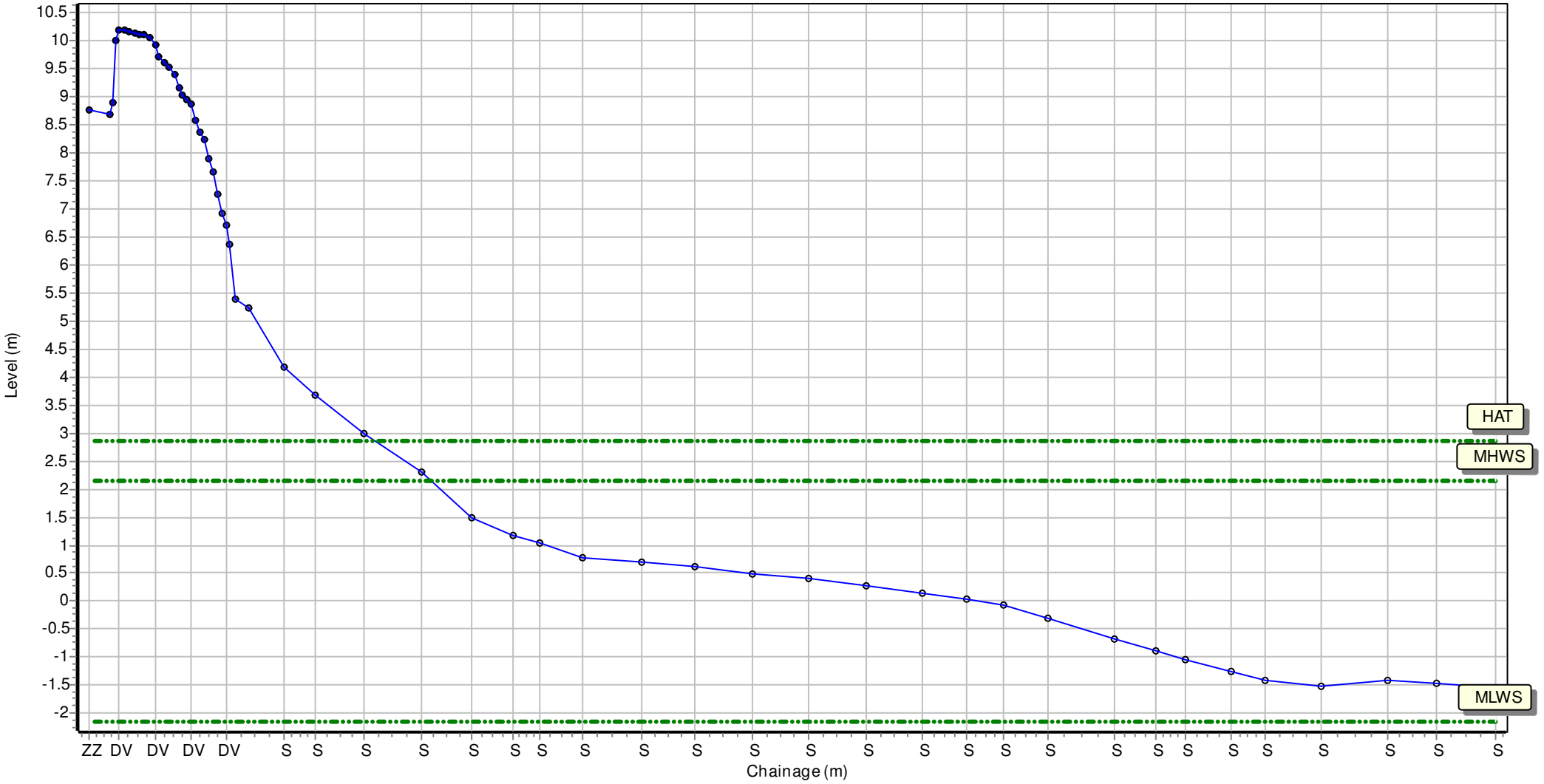
Location: **1bSS9**

Date: 03/09/2020 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2020 Full Measures Topo Survey

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



Beach Profile

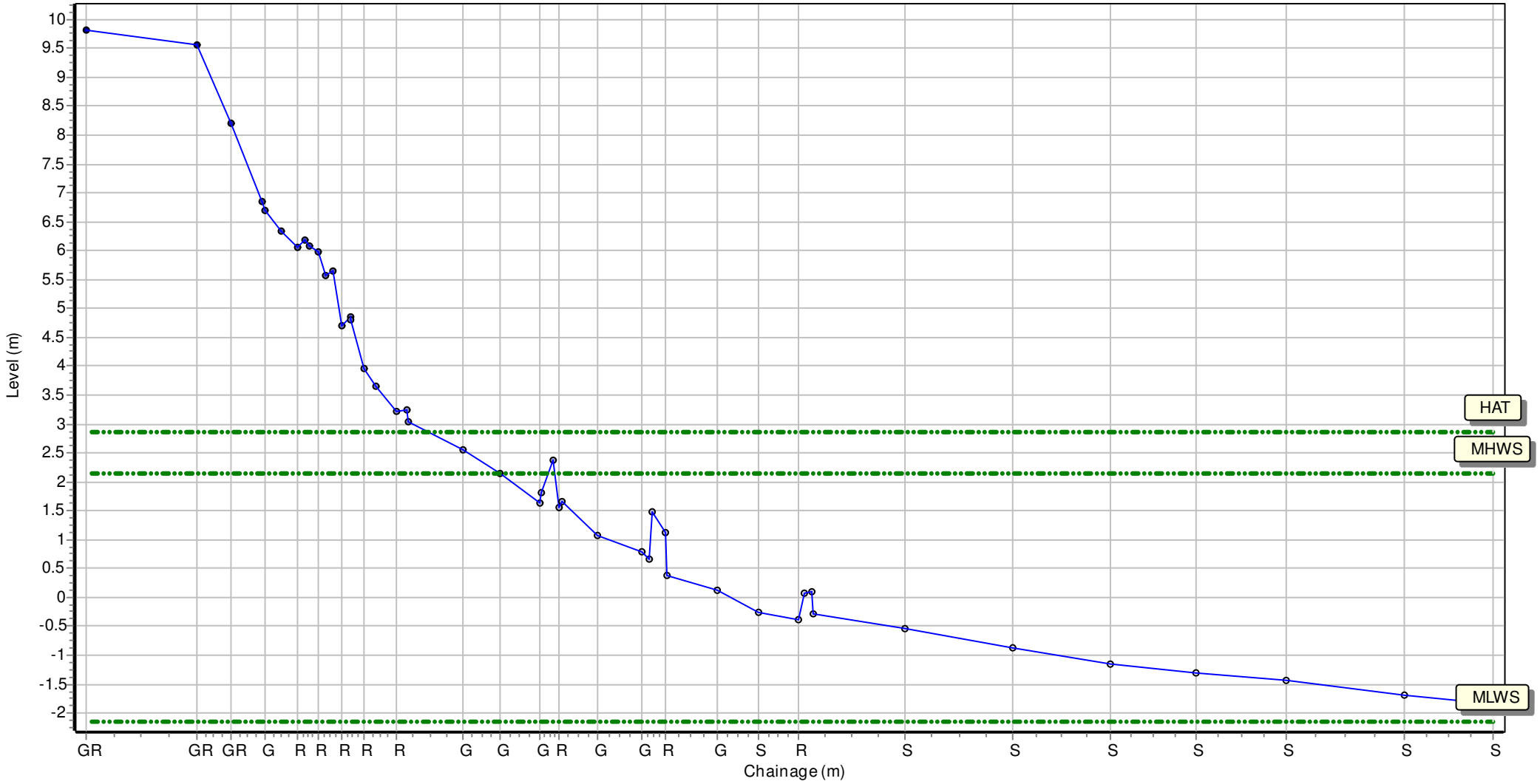
Location: **1bSS10**

Date: 03/09/2020 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2020 Full Measures Topo Survey

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



Beach Profile

Location: 1bSS11

Date: 03/09/2020 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2020 Full Measures Topo Survey

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

http://www.sandsuser.com

SANDS

Beach Profile

Location: 1bSS12

Date: 03/09/2020 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2020 Full Measures Topo Survey

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

http://www.sandsuser.com

SANDS

Beach Profile

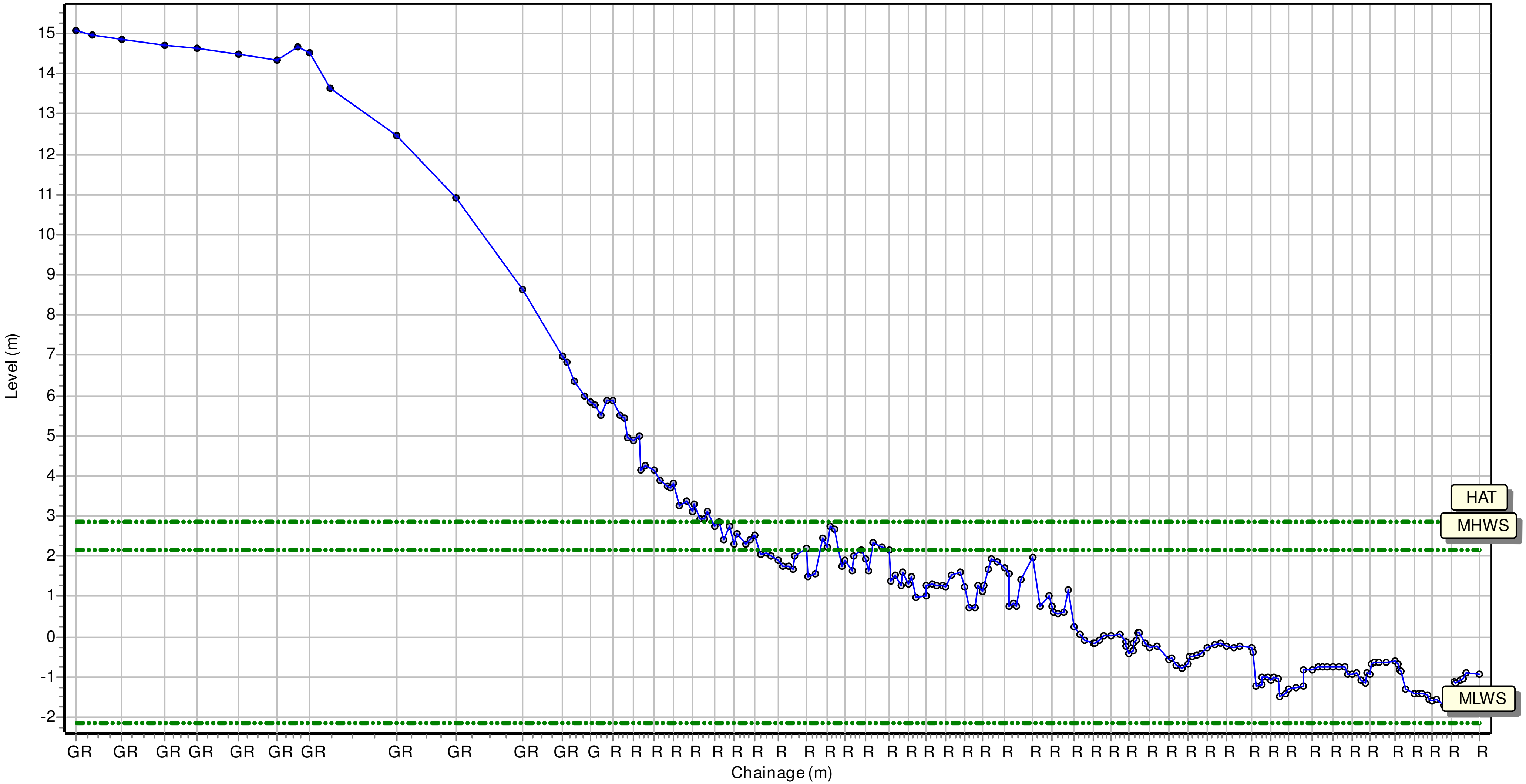
Location: 1bSS13

Date: 03/09/2020 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2020 Full Measures Topo Survey

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



http://www.sandsuser.com

SANDS

Beach Profile

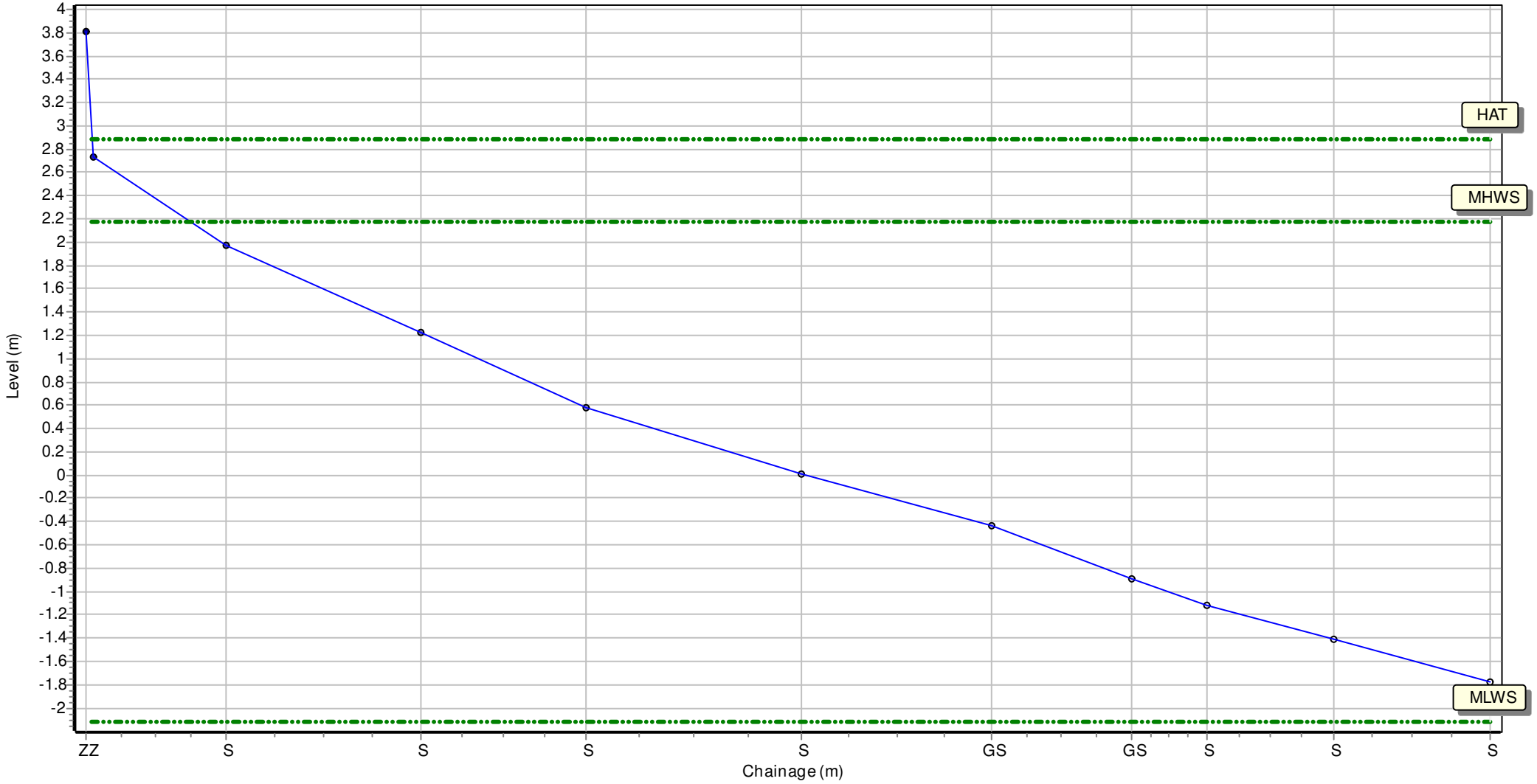
Location: **1bSS14**

Date: 03/09/2020 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2020 Full Measures Topo Survey

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



Beach Profile

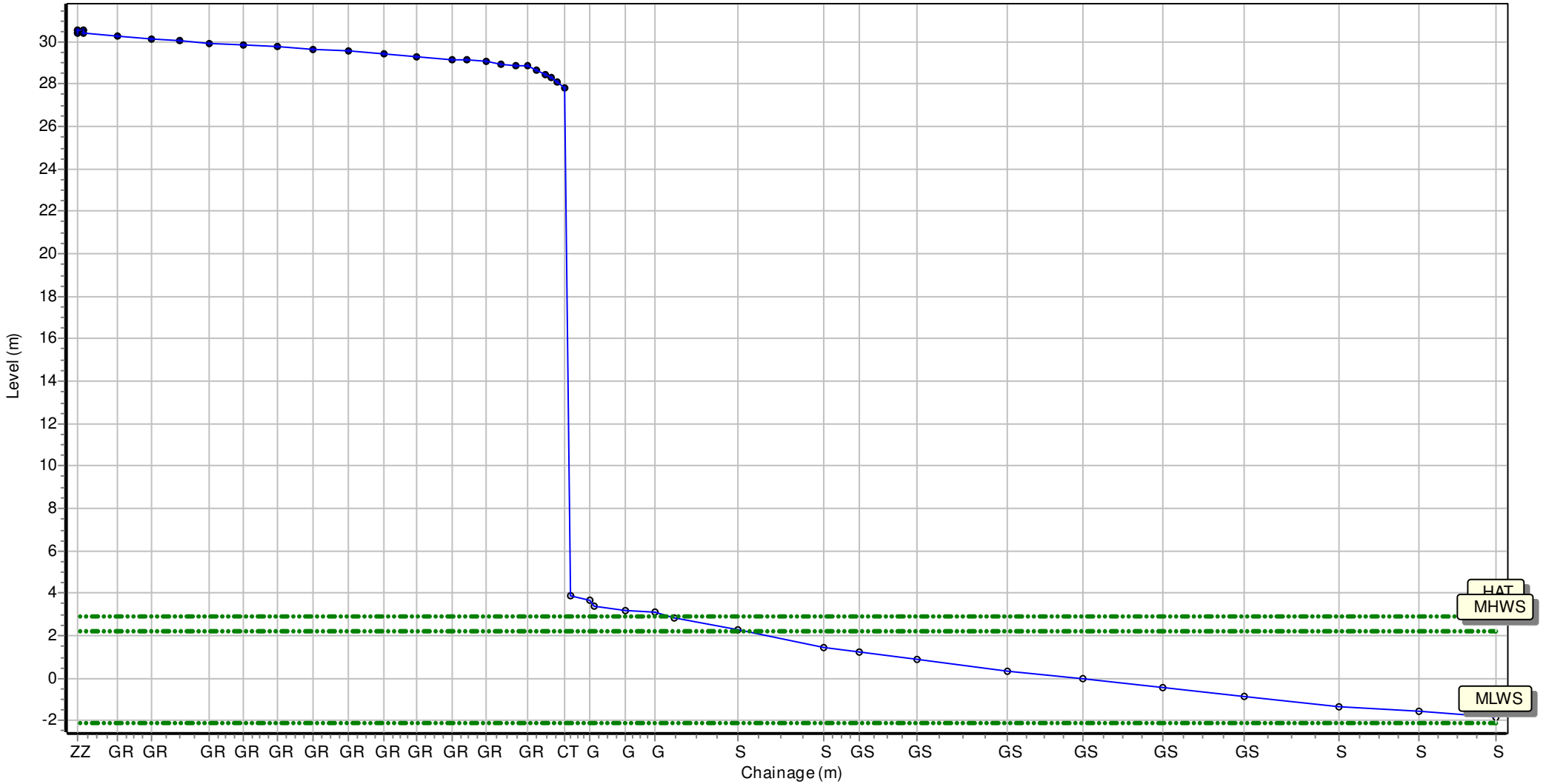
Location: **1bSS15**

Date: 03/09/2020 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2020 Full Measures Topo Survey

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



Beach Profile

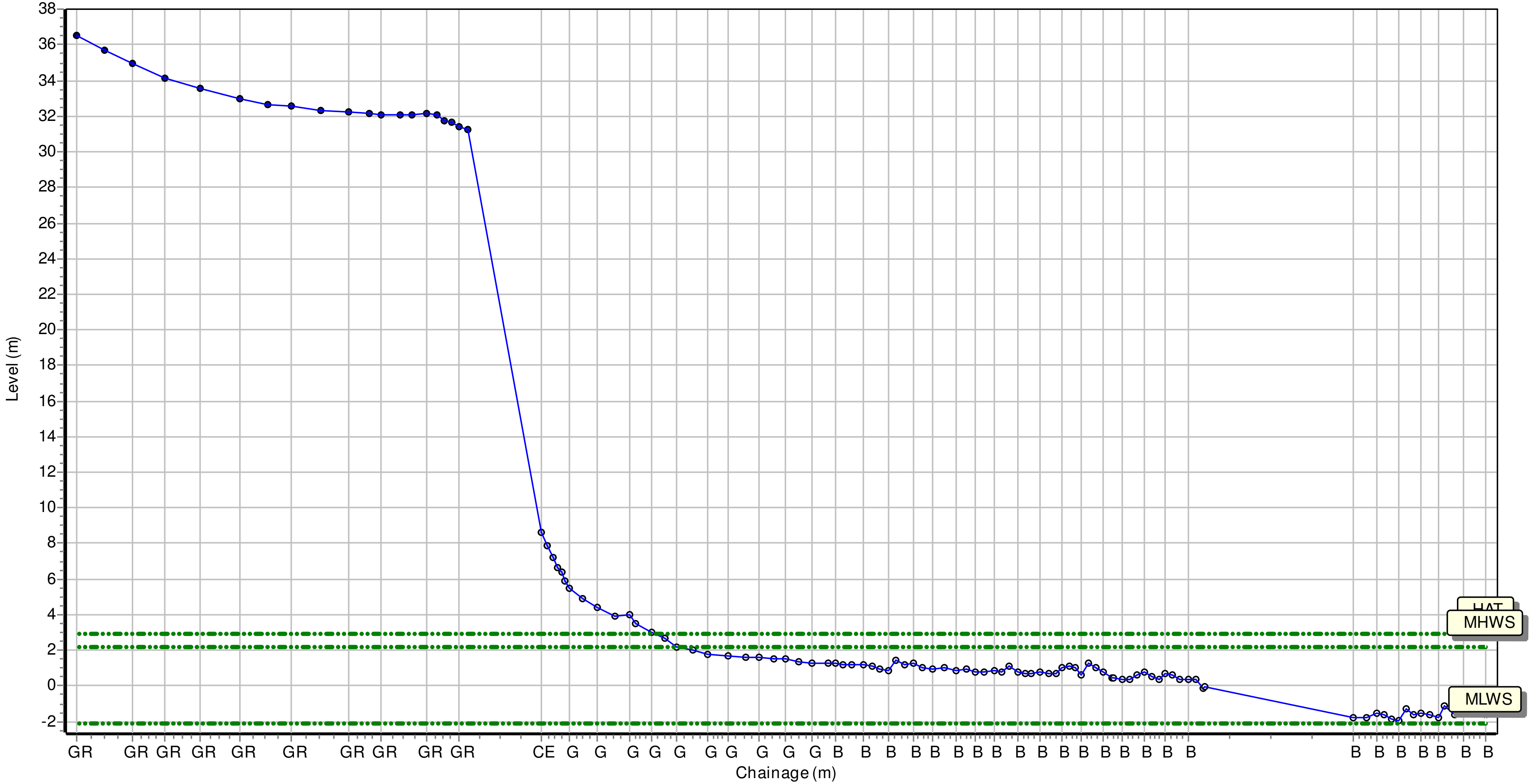
Location: **1bSS16**

Date: 03/09/2020 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2020 Full Measures Topo Survey

Easting: 439981.413 **Northing:** 564802.714 **Profile Bearing:** 42 ° from North



Beach Profile

Location: **1bSS17**

Date: 03/09/2020 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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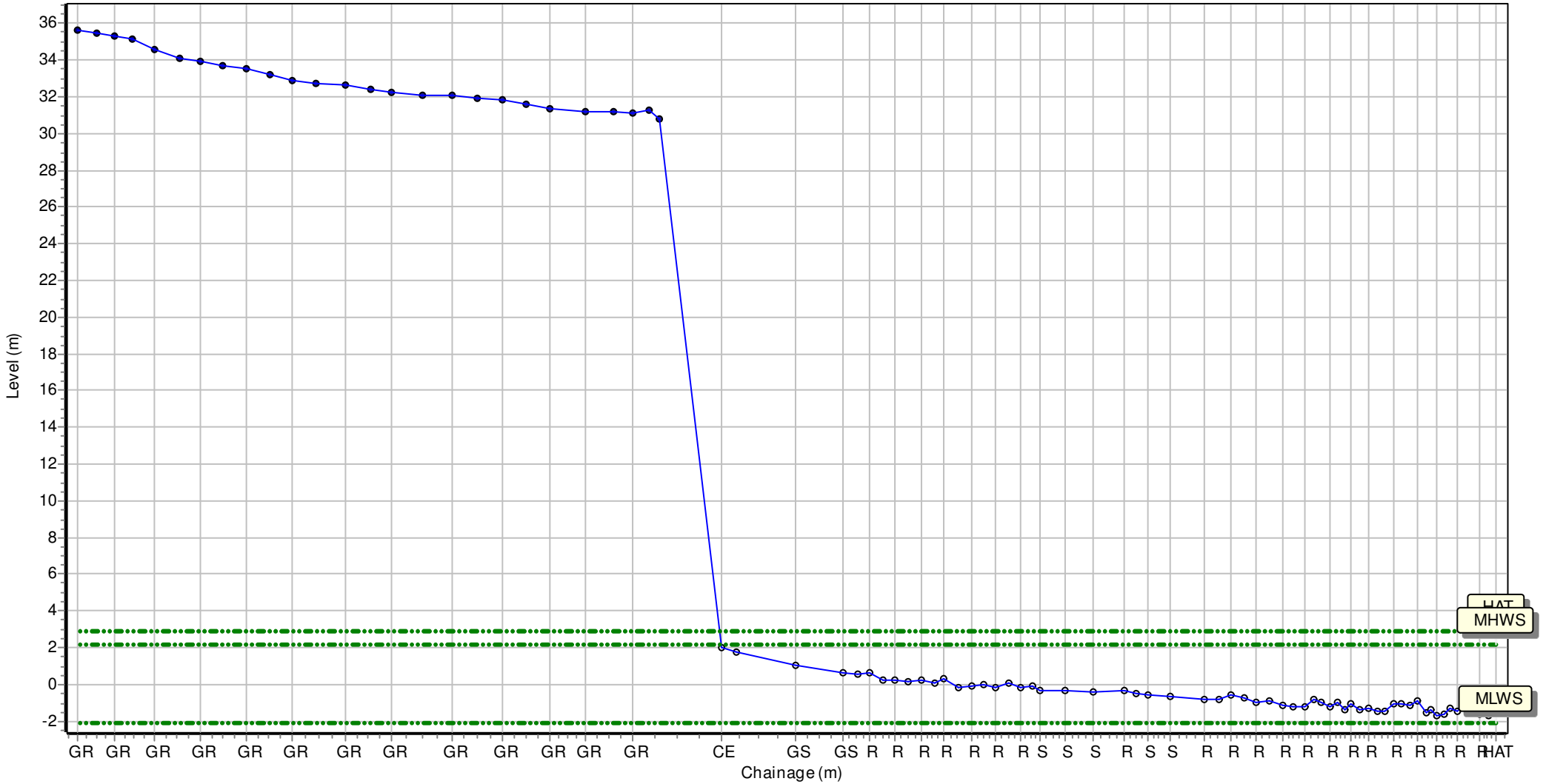
Summary: 2020 Full Measures Topo Survey

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

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Level (m)
Chainage (m)
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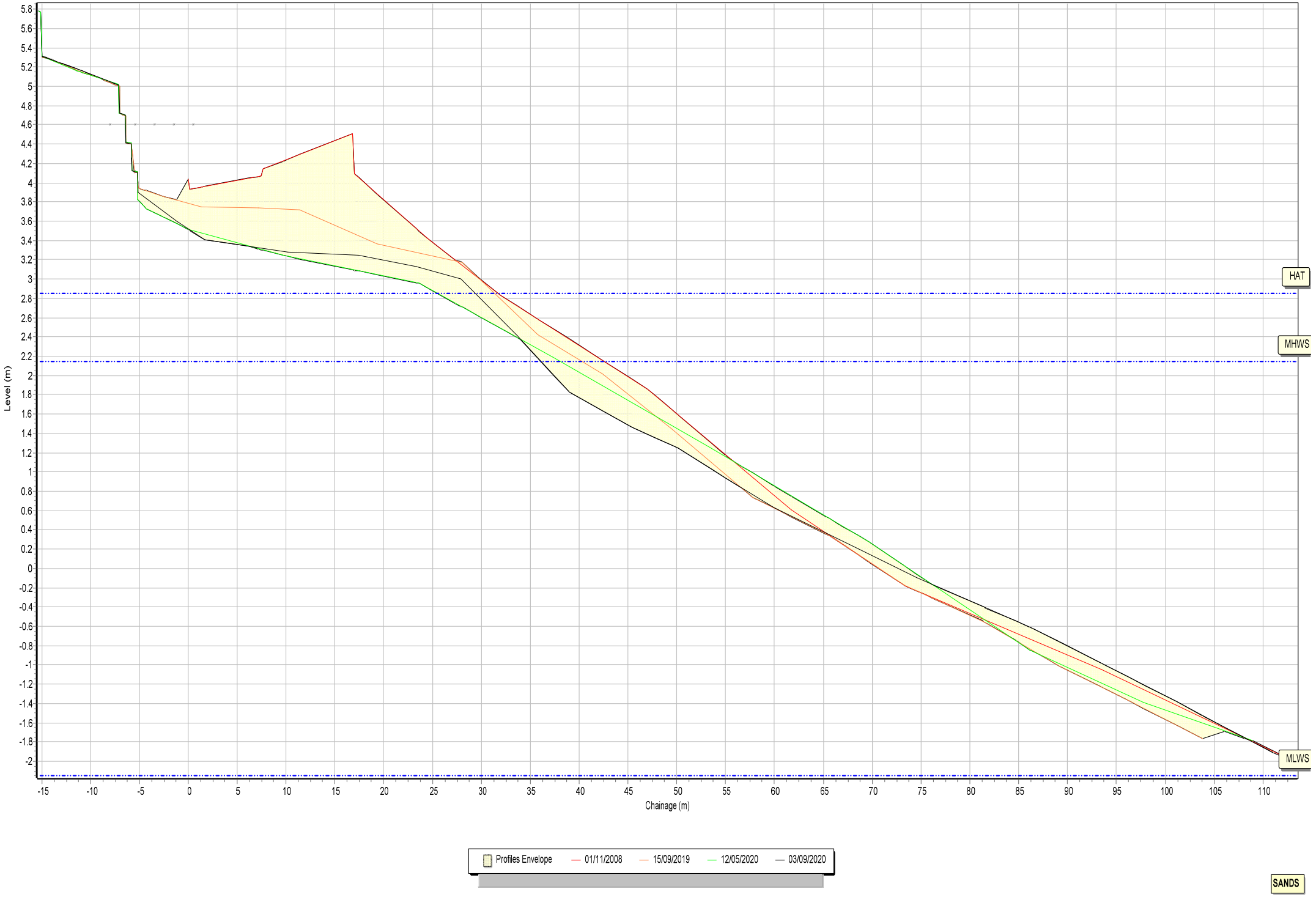
MHWS
MLWS
Profiles Envelope
01/11/2008
15/09/2019
12/05/2020
03/09/2020
SANDS

Beach Profiles: 1bSS2




Beach Profiles: 1bSS3
Level (m)
Chainage (m)
HAT
MHWS
MLWS
Profiles Envelope
01/11/2008
15/09/2019
12/05/2020
03/09/2020
SANDS

Beach Profiles: 1bSS4


Beach Profiles: 1bSS5
Level (m)
Chainage (m)
HAT
MHWS
MLWS
Profiles Envelope
01/11/2008
15/09/2019
12/05/2020
03/09/2020
SANDS


Beach Profiles: 1bSS6
Level (m)
8.5
8
7.5
7
6.5
6
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
HAT
MHWS
MLWS
0
10
20
30
40
50
60
70
80
90
100
110
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270
280
290
300
310
320
330
340
350
360
Chainage (m)
Profiles Envelope
01/11/2008
12/11/2018
15/09/2019
03/09/2020
SANDS


Beach Profiles: 1bSS7
Level (m)
Chainage (m)
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MHWS
MLWS
Profiles Envelope
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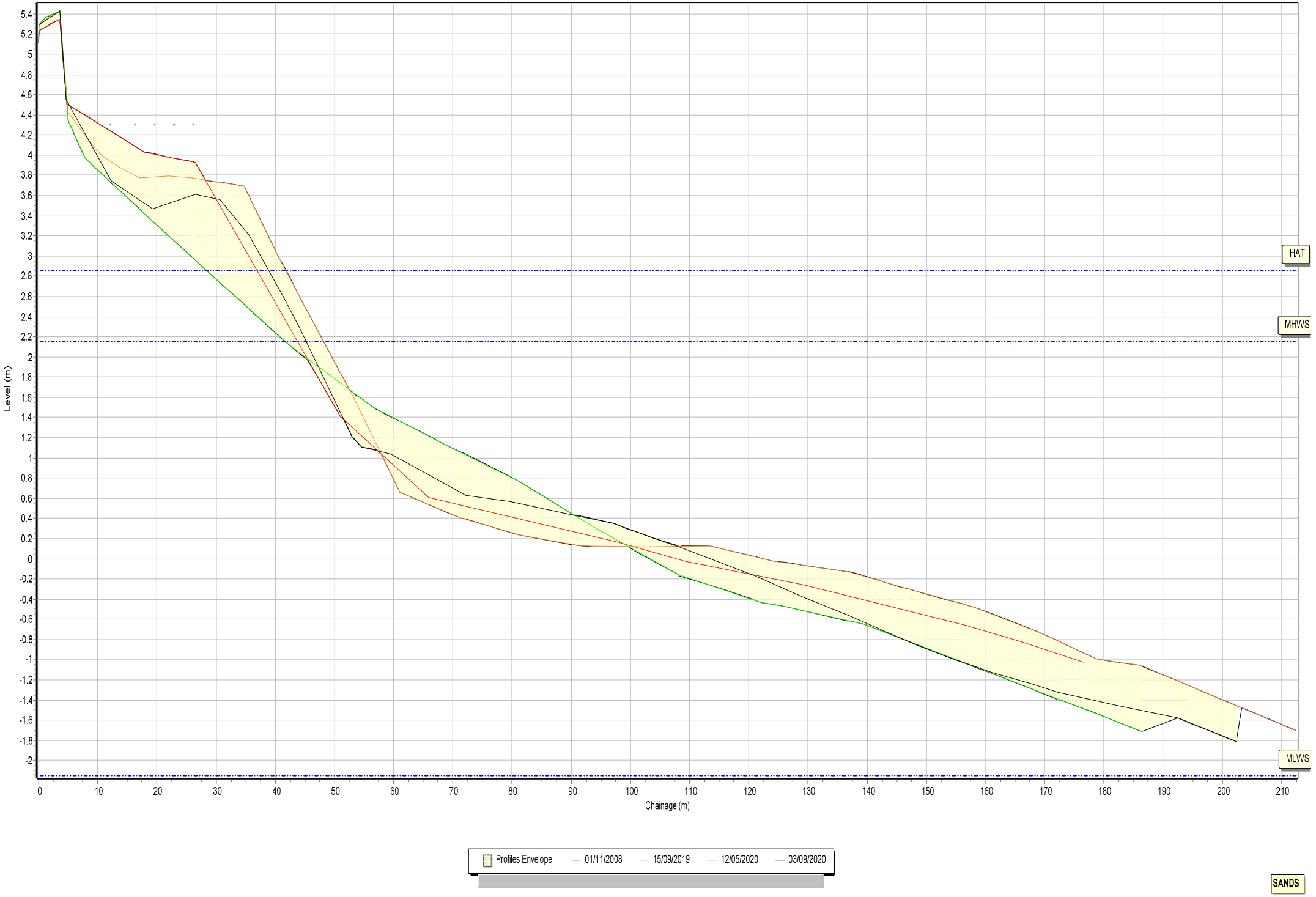
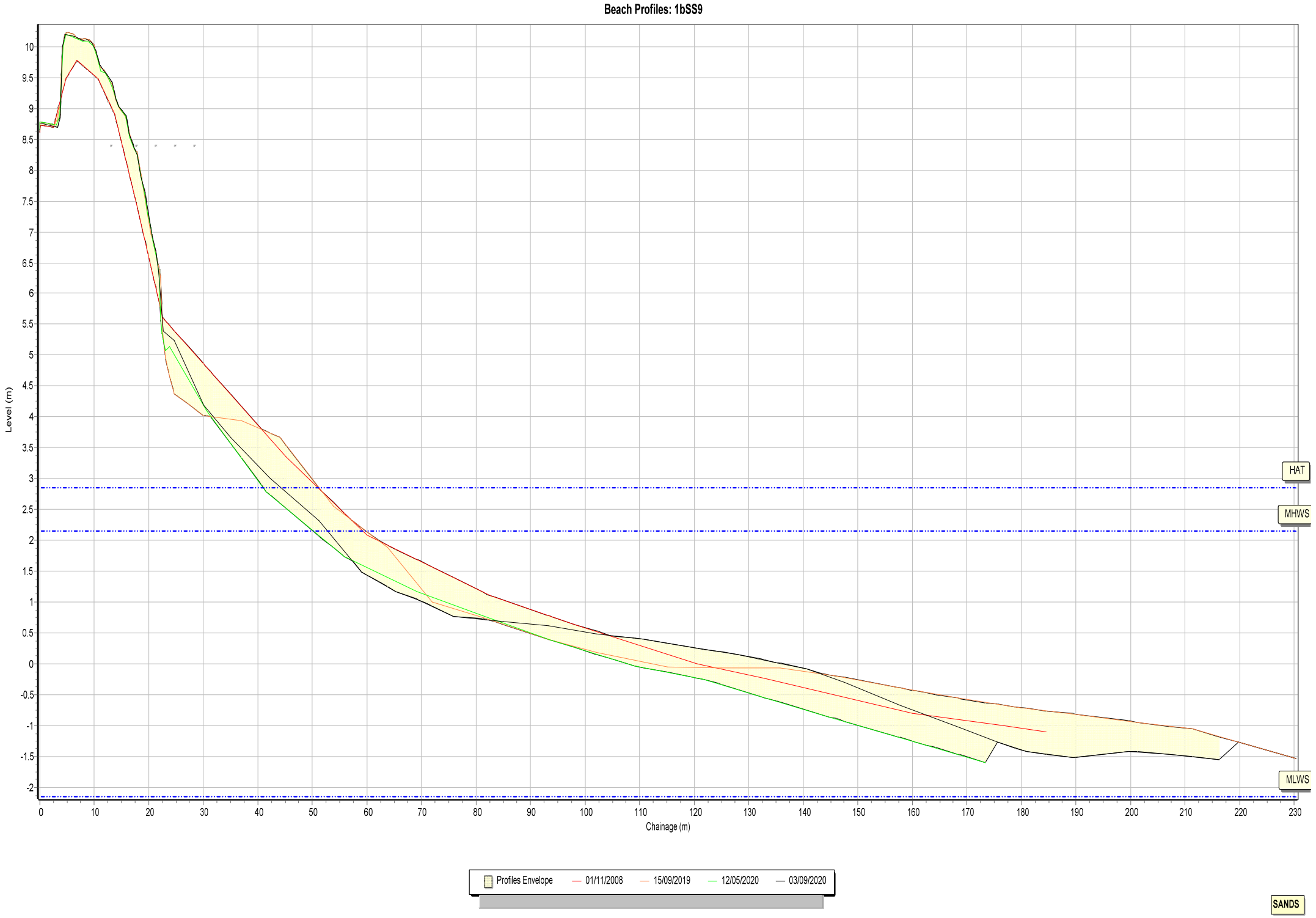
12/11/2018
15/09/2019
03/09/2020
SANDS

Beach Profiles: 1bSS8

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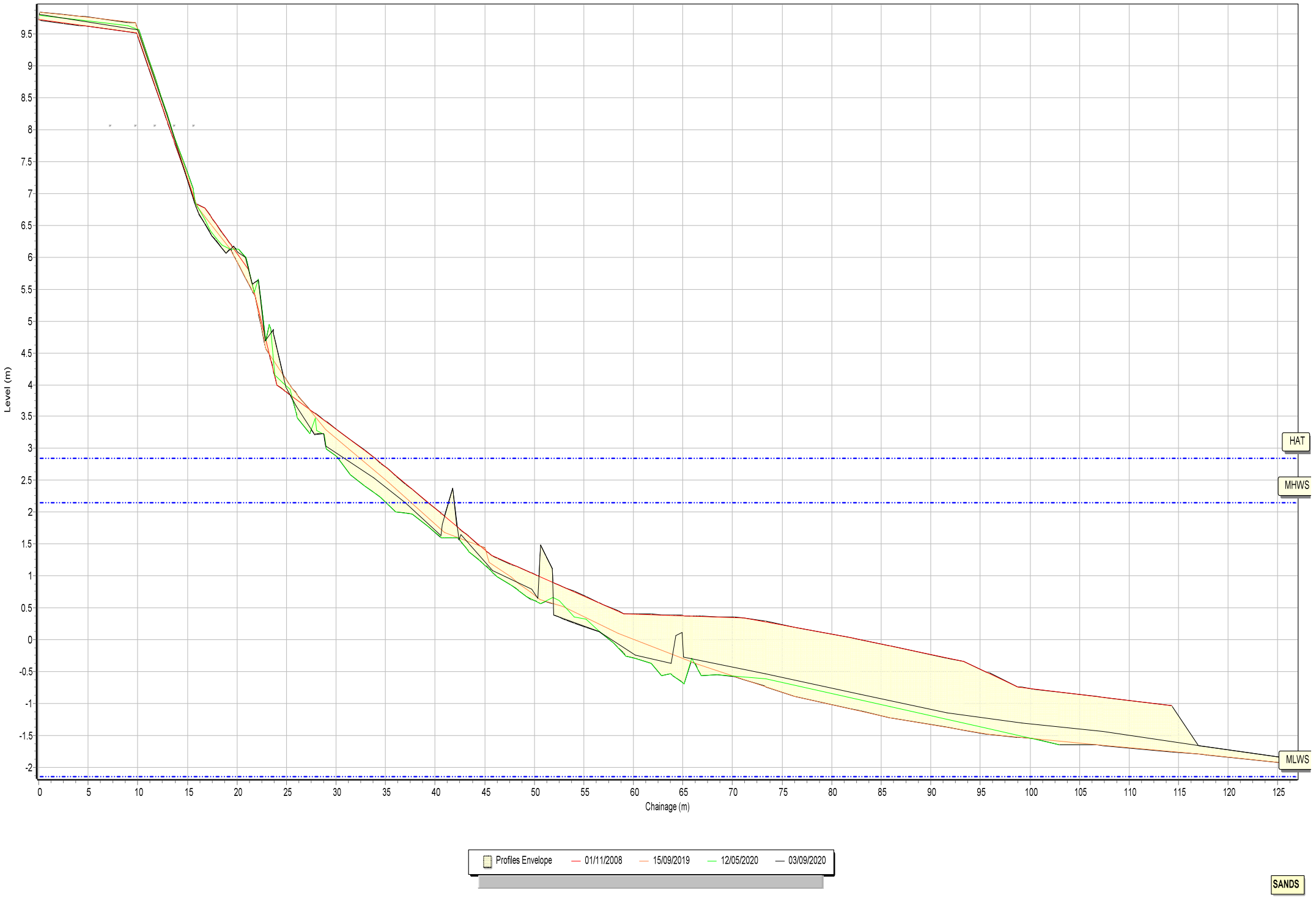
Level (m)
Chainage (m)
HAT
MHWS
MLWS
Profiles Envelope
01/11/2008
15/09/2019
12/05/2020
03/09/2020
SANDS

Beach Profiles: 1bSS10




Beach Profiles: 1bSS11
Level (m)
Chainage (m)
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Profiles Envelope
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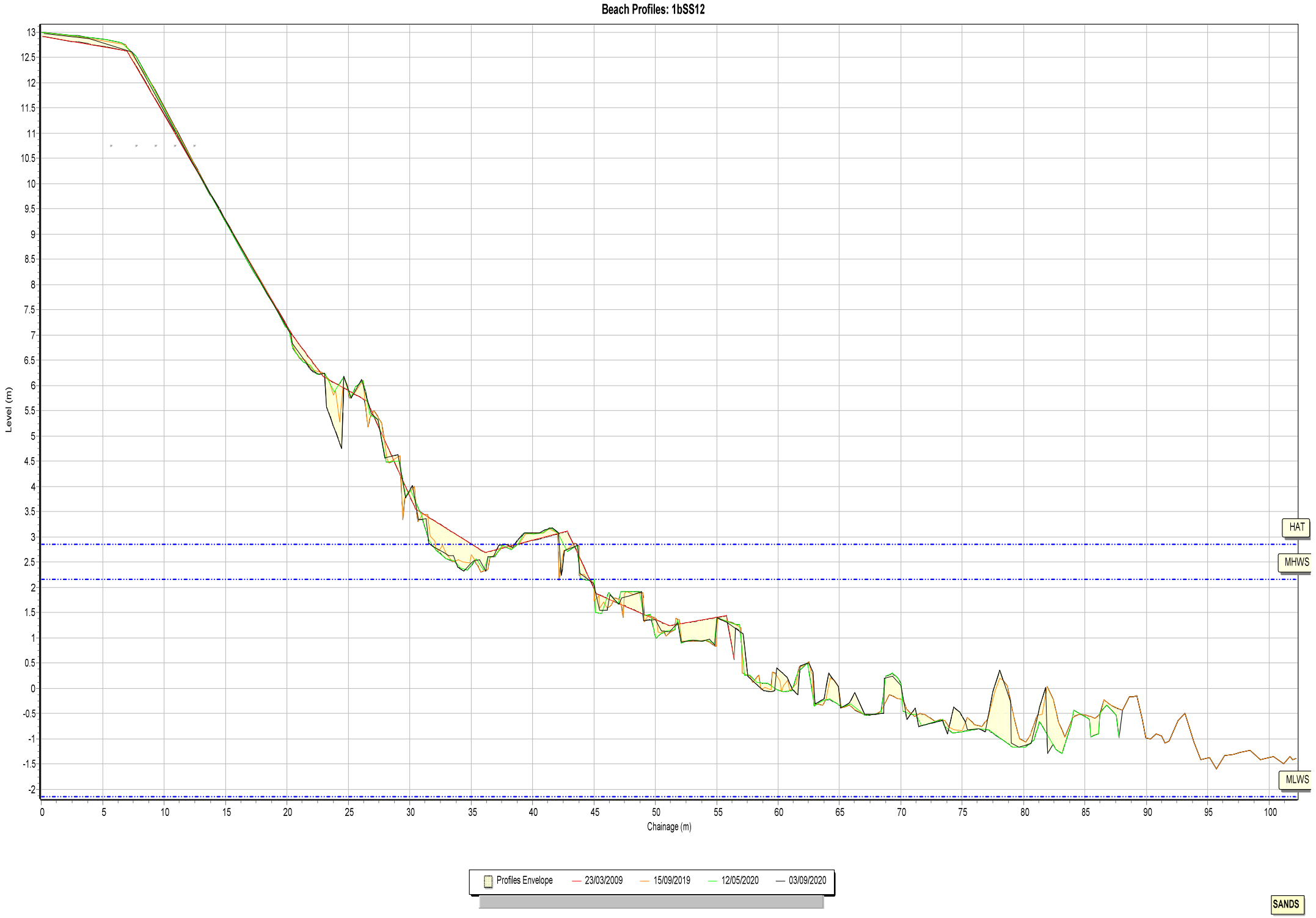
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MLWS
Profiles Envelope
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15/09/2019
12/05/2020
03/09/2020
SANDS


Beach Profiles: 1bSS13
Level (m)
Chainage (m)
HAT
MHWS
MLWS
Profiles Envelope
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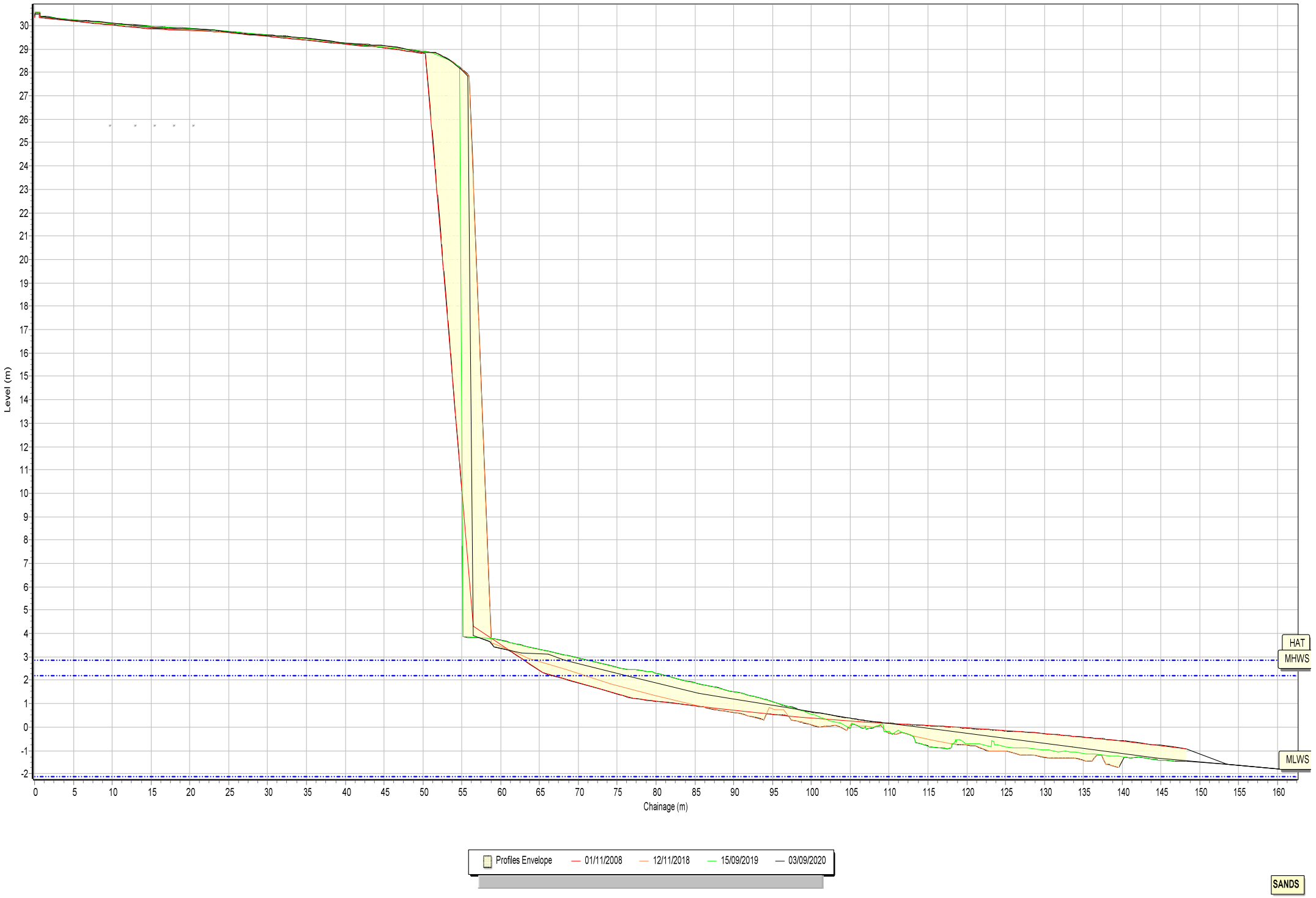
15/09/2019
12/05/2020
03/09/2020
SANDS

Beach Profiles: 1bSS14

Beach Profiles: 1bSS15

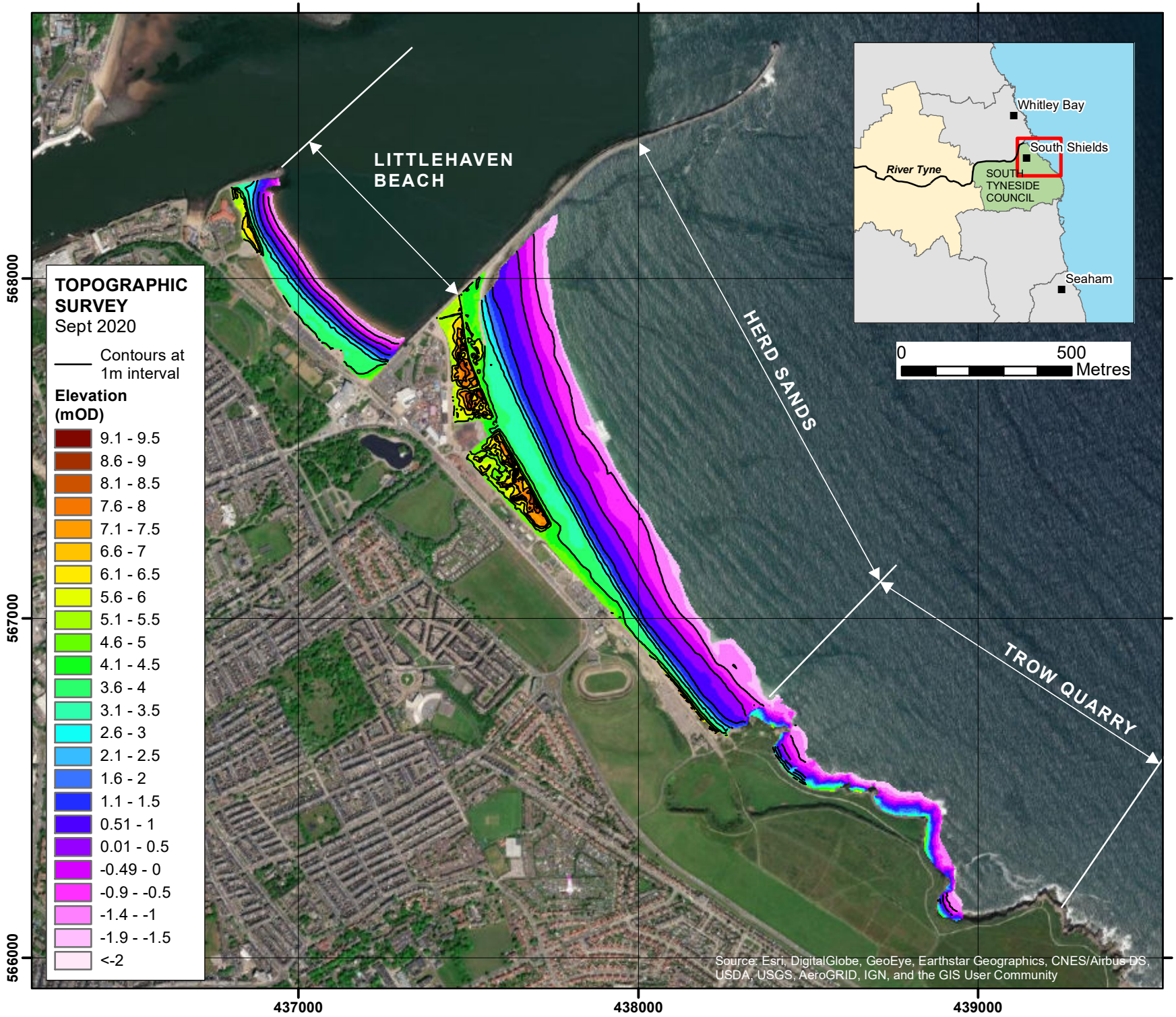


Beach Profiles: 1bSS16

Beach Profiles: 1bSS17

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 2020

Drawing Scale at A4 1:15,000

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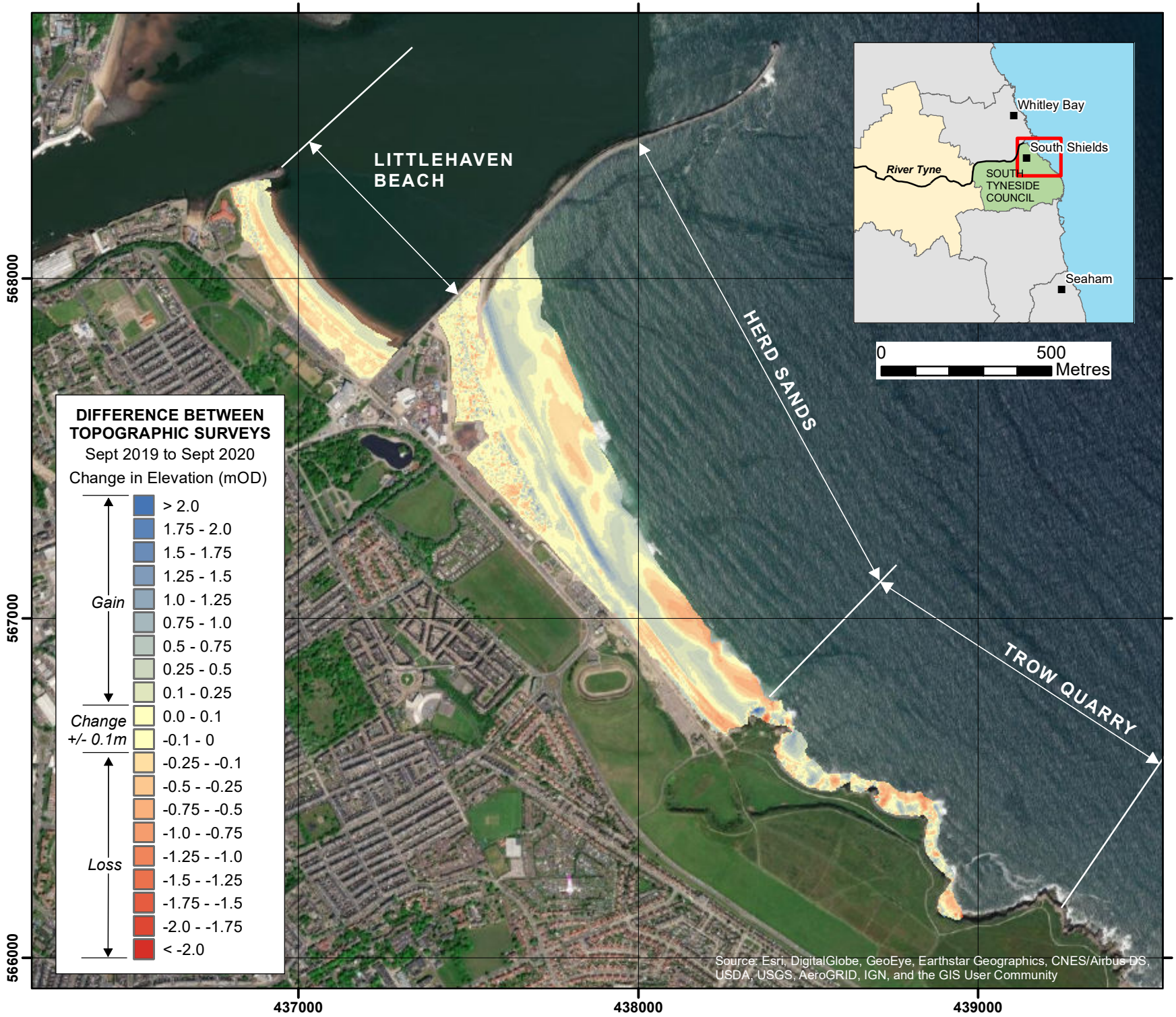

Client: North East Coastal Group

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 2020

Drawing Scale at A4 1:15,000

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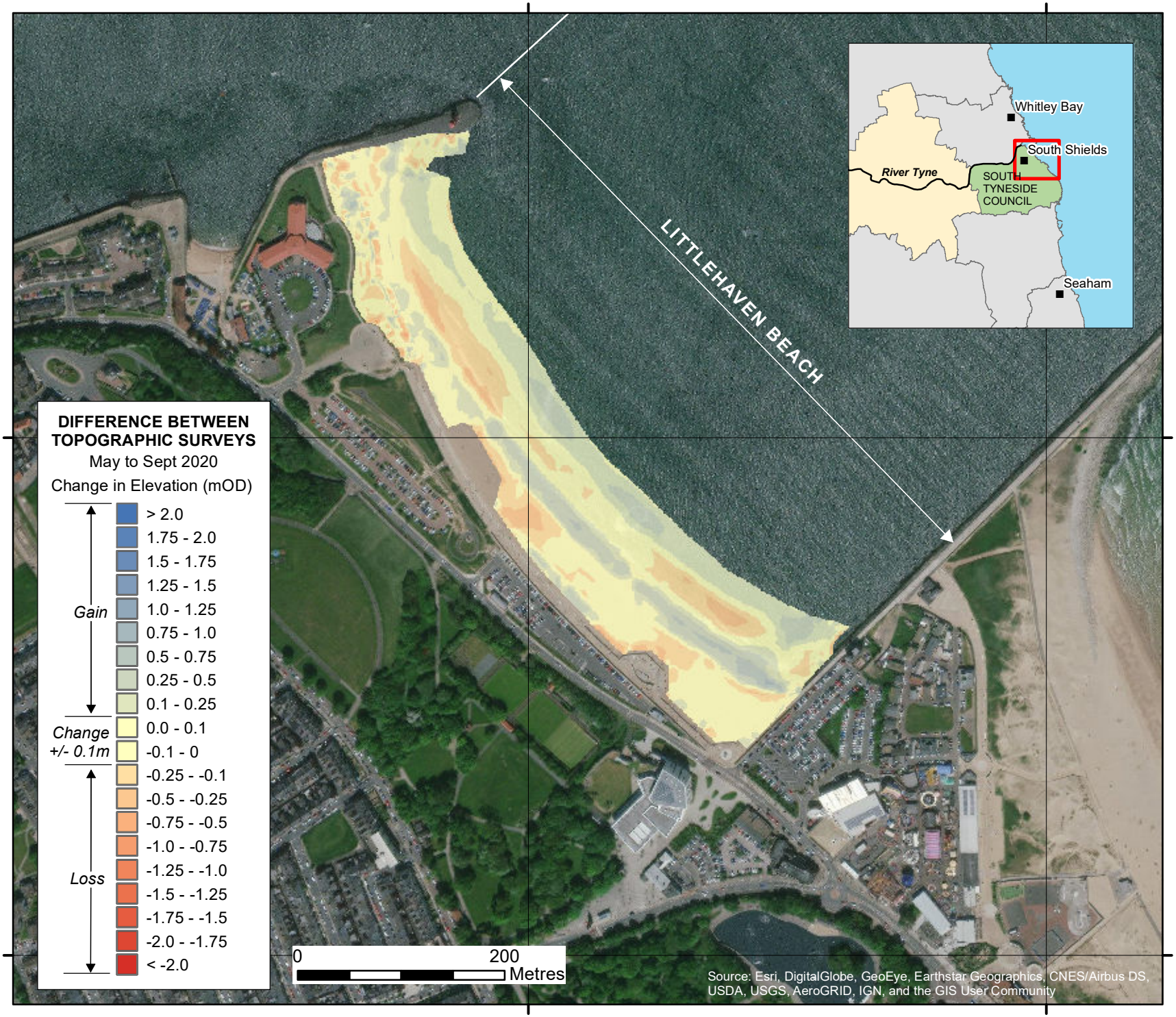

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Appendix B - Map 3

LITTLEHAVEN BEACH

North Tyneside Council Frontage

Analytical Report
'Full Measures' Survey 2020

Drawing Scale at A4 1:5,000

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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 3 – Map 1). 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	May 2020	Sep 2020	Sep 2011 - Sep 2020	May 2020 – Sep 2020	Sep 2011 - Sep 2020
1	438300.3	566674.7	309	7.00	7.01	7.04	0.04	0.03	0.00
2	438338.8	566694.3	312	9.40	9.35	9.34	-0.06	-0.01	-0.01
3	438384.7	566669	33	7.00	6.89	6.86	-0.14	-0.03	-0.02
4	438408.1	566664.8	71	10.50	10.58	10.28	-0.22	-0.3	-0.02
5	438401.1	566638	120	7.00	7.25	7.1	0.1	-0.15	0.01
6	438392.8	566604.2	110	10.20	10.03	10	-0.2	-0.03	-0.02

Key

- Cliff Top Survey Locations

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Figure 3 - Map 1

TROW QUARRY

South Tyneside Council Frontage

Cliff Top Survey Locations

Drawing Scale at A4 1:1,500

WATER
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