



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



North Tyneside Council

July 2017

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1. .

Abbreviations and Acronyms

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

Water Levels Used in Interpretation of Changes

| Water Level Parameter | Water Level (m AOD) |
|-----------------------|---------------------|
| | River Tyne |
| 1 in 200 year | 3.7 |
| HAT | 3.1 |
| MHWS | 2.4 |
| MLWS | -1.9 |

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

Glossary of Terms

| Term | Definition |
|-----------------------|---|
| Beach nourishment | Artificial process of replenishing a beach with material from another source. |
| Berm crest | Ridge of sand or gravel deposited by wave action on the shore just above the normal high water mark. |
| Breaker zone | Area in the sea where the waves break. |
| Coastal squeeze | The reduction in habitat area which can arise if the natural landward migration of a habitat under sea level rise is prevented by the fixing of the high water mark, e.g. a sea wall. |
| Downdrift | Direction of alongshore movement of beach materials. |
| Ebb-tide | The falling tide, part of the tidal cycle between high water and the next low water. |
| Fetch | Length of water over which a given wind has blown that determines the size of the waves produced. |
| Flood-tide | Rising tide, part of the tidal cycle between low water and the next high water. |
| Foreshore | Zone between the high water and low water marks, also known as the intertidal zone. |
| Geomorphology | The branch of physical geography/geology which deals with the form of the Earth, the general configuration of its surface, the distribution of the land, water, etc. |
| Groyne | Shore protection structure built perpendicular to the shore; designed to trap sediment. |
| Mean High Water (MHW) | The average of all high waters observed over a sufficiently long period. |
| Mean Low Water (MLW) | The average of all low waters observed over a sufficiently long period. |
| Mean Sea Level (MSL) | Average height of the sea surface over a 19-year period. |
| Offshore zone | Extends from the low water mark to a water depth of about 15 m and is permanently covered with water. |
| Storm surge | A rise in the sea surface on an open coast, resulting from a storm. |
| Swell | Waves that have travelled out of the area in which they were generated. |
| Tidal prism | The volume of water within the estuary between the level of high and low tide, typically taken for mean spring tides. |
| Tide | Periodic rising and falling of large bodies of water resulting from the gravitational attraction of the moon and sun acting on the rotating earth. |
| Topography | Configuration of a surface including its relief and the position of its natural and man-made features. |
| Transgression | The landward movement of the shoreline in response to a rise in relative sea level. |
| Updrift | Direction opposite to the predominant movement of longshore transport. |
| Wave direction | Direction from which a wave approaches. |
| Wave refraction | Process by which the direction of approach of a wave changes as it moves into shallow water. |

Preamble

The Cell 1 Regional Coastal Monitoring Programme covers approximately 300km of the north east coastline, from the Scottish Border (just south of St. Abb's Head) to Flamborough Head in East Yorkshire. This coastline is often referred to as 'Coastal Sediment Cell 1' in England and Wales (Figure 1).

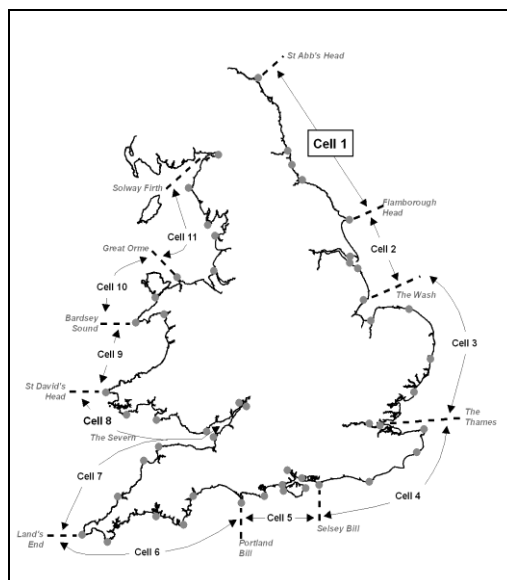


Figure 1 Sediment Cells in England and Wales

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

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

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

To date the following reports have been produced:

Table 1 Analytical, Update and Overview Reports Produced to Date

| Year | | Full Measures | | Partial Measures | | Cell 1 Overview Report |
|------|---------|---------------|-------------------|------------------|---------------|------------------------|
| | | Survey | Analytical Report | Survey | Update Report | |
| 1 | 2008/09 | Sep-Dec 08 | May 09 | Mar-May 09 | Jun 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 | Sep-Oct 12 | Mar 13 | Mar-Apr 13 | Jun 13 | |
| 6 | 2013/14 | Sep-Oct 13 | Feb 14 | Mar-Apr 14 | Jul 14 | |
| 7 | 2014/15 | Oct-Nov 14 | Feb 15 | Mar 15 | Jul 15 | |
| 8 | 2015/16 | Oct-Nov 15 | Feb 16 | Mar 16 | Jul 16 (*) | Jun 16 |
| 9 | 2016/17 | Sep 16 | Feb 17 | Mar 17 | Jul 17 (*) | |

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

1. Introduction

1.1 Study Area

North Tyneside Council's frontage extends from Hartley (just south of Blyth) in the north to River Tyne in the south. For the purposes of this report and for consistency with previous reporting, it has been sub-divided into four areas, namely:

- Whitley Sands
- Cullercoats Bay
- Tynemouth Long Sands
- King Edward's Bay

1.2 Methodology

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

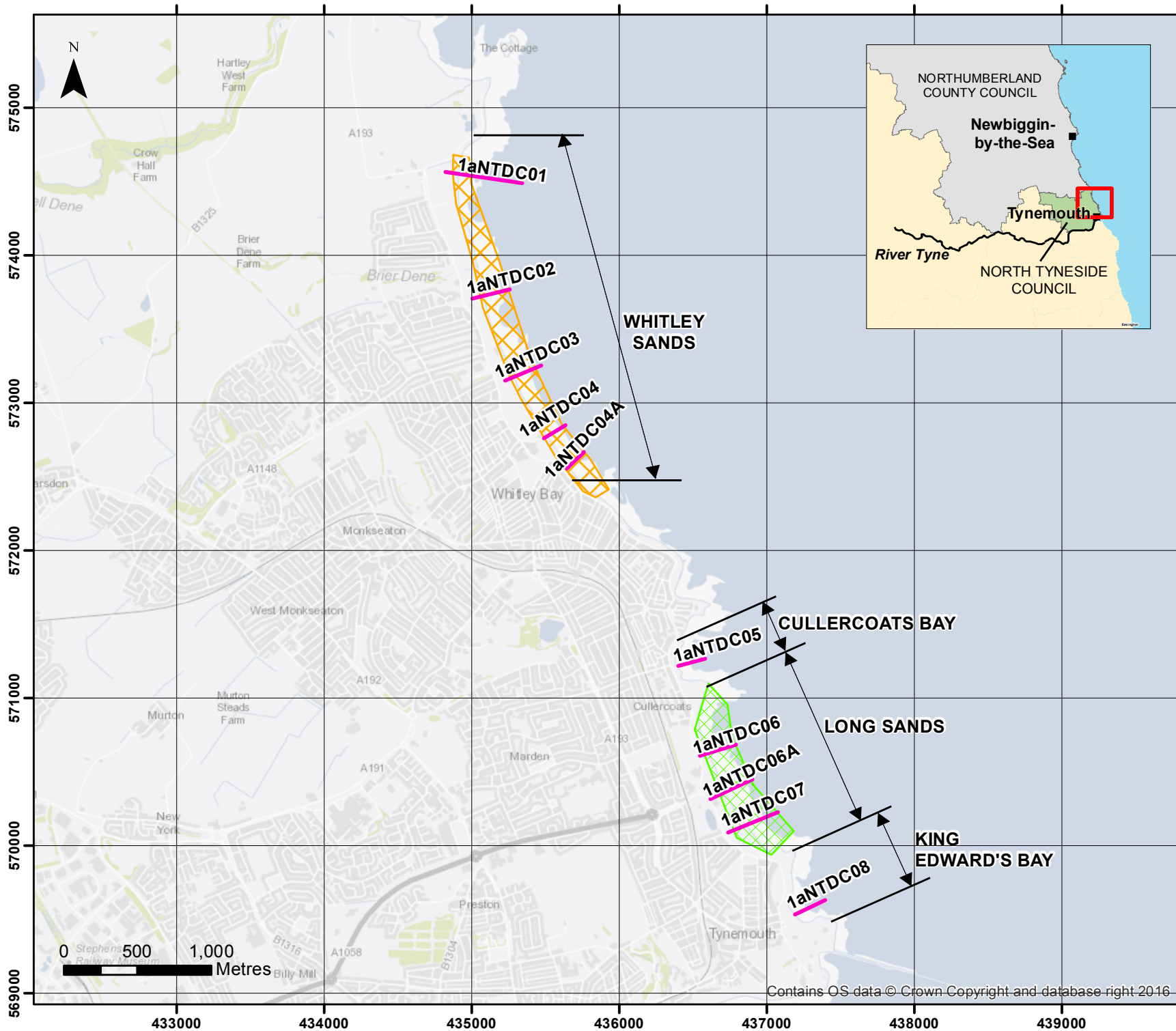
- Full Measures survey annually each autumn comprising:
 - Beach profile surveys along eight transect lines (commenced 2002)
 - Beach profile surveys along an additional two transects (commenced 2010)
 - Topographic survey along Whitley Sands (commenced 2010)
 - Topographic survey along Tynemouth Long Sands (commenced 2011)
- Partial Measures survey annually each spring comprising:
 - Beach profile surveys along all ten transect lines (commenced 2010)

The location of these surveys is shown in Figure 2. The Partial Measures 2017 surveys were undertaken along this frontage on the 1st, 2nd, and 15th March 2017. During this time weather conditions varied; refer to the survey reports for details of the weather conditions over this survey period.

The Update Report presents the following:

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

North Tyneside Council Frontage

Analytical Report
Topo Surveys

Drawing Scale at A4 1:35,000

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2. Analysis of Survey Data

2.1 Whitley Sands

| Survey Date | Description of Changes Since Last Survey | Interpretation |
|--------------------------|---|---|
| <p>March 2017</p> | <p>Beach Profiles:</p> <p>Whitley Sands is covered by five beach profile lines for the Partial Measures survey (Appendix A). Four of these (1aNTDC01 to 1aNTDC04) were initially surveyed in April 2002 and were then re-surveyed annually to 2009 (Full Measures, autumn 2009) after which time they have been surveyed bi-annually. From March 2010 (Partial Measures, spring 2010) onwards, an additional beach profile line (NTDC04A) has been surveyed at the southern end of the frontage for the same time periods listed above. All profiles were last surveyed in autumn 2016 for the Full Measures survey.</p> <p>1aNTDC01 is located in the north of Whitley Sands, along the undefended cliffs immediately south of Trinity Road car park. The profile shows no change in the position of the cliff since the previous survey. Beach levels at the toe of the cliff have fallen by up to 1.7m with the erosion of up to 1.2m continuing to chainage 75m. Between chainage 75m and 130m there has been an increase in beach levels of up to 0.8m. Overall the profile is at a medium level compared to the range recorded from previous surveys.</p> <p>Profile 1aNTDC02 is located towards the north of Whitley Sands. From the sea wall as far as 110m chainage the elevation of the beach has decreased by up to 1.5m compared to the previous survey. From chainage 110m to 165m the beach levels have increased by up to 1.2m, with the formation of a large berm at chainage 117m. The upper beach is at a relatively low level compared to the range recorded from previous surveys, whilst the lower beach is at the highest recorded level.</p> <p>Profile 1aNTDC03 is located at the centre of Whitley Sands. Beach levels have dropped between the sea wall and 65m chainage, with the maximum decrease being 1.0m, this has exposed some small isolated sections of boulders. Between 65m and 125m chainage there has been accretion of up to 0.6m. The effect of these changes has been to flatten the profile of the middle beach, whilst the upper and lower beaches remain at a similar angle as the previous survey. The profile is at a medium to high level on the lower beach compared to the range recorded from previous surveys, but in the upper beach it is relatively low, particularly between chainage 28m and 46m where it is the lowest on record.</p> | <p>Since the last survey, beach levels at Whitley Sands beach levels have varied, with decreases on the upper beach and increases on the lower beach, attributable to redistribution of material through draw down.</p> <p>Longer term trends:</p> <p>The data show that profiles are within the bounds of previous surveys, albeit for the most part at medium to low levels, particularly towards the southern end of the bay.</p> |

| Survey Date | Description of Changes Since Last Survey | Interpretation |
|-------------|---|----------------|
| | <p>Profile 1aNDC04 is located to the south of Whitley Sands. There has been erosion of up to 0.4m on the upper beach from the base of the seawall up to chainage 73m, exposing areas of rock between chainage 55m and 70m. Seawards of chainage 73m the beach levels have increased by 0.4m compared to the previous survey. Overall the profile is at a medium level compared to the range recorded from previous surveys, except between chainage 50m and 75m where the rock has been exposed, this area is relatively low compared to the range recorded.</p> <p>Profile 1aNTDC04a is located to the south of Whitley Sands. Beach levels have fallen by up to 0.4m throughout the profile, exposing the rocky shore platform intermittently between 75m and 95m chainage. Overall the profile is relatively low-medium, but within the range of levels seen in earlier surveys.</p> | |

2.2 Cullercoats Bay

| Survey Date | Description of Changes Since Last Survey | Interpretation |
|--------------------------|---|--|
| <p>March 2017</p> | <p>Beach Profiles:</p> <p>Cullercoats Bay is covered by one beach profile line for the Partial Measures survey (Appendix A). This was surveyed annually each autumn between 2002 and 2009. From spring 2010 onwards, it has been surveyed bi-annually. The last survey was the autumn 2016 Full Measures survey.</p> <p>The cliff top position along 1aNTDC05 has remained constant since surveys began in April 2002, but there have been apparent changes on the cliff face. Changes in beach level since the last survey are small, ± 0.1m, between the toe of the cliff and chainage 40m. Between chainage 40m and 75m there has been a slight decrease in beach levels of up to 0.2m. Between chainage 75m and 130m there has been an increase in beach levels of up to 0.5m. Overall the upper beach is high compared to earlier surveys and the beach toe is low.</p> | <p>There has been some winter draw down of material from the upper to lower beach..</p> <p>Longer term trends: The beach levels observed are within the bounds of previous surveys, indicating generic behaviour with no clear trend.</p> |

2.3 Tynemouth Long Sands

| Survey Date | Description of Changes Since Last Survey | Interpretation |
|--------------------------|---|---|
| <p>March 2017</p> | <p>Beach Profiles:</p> <p>Tynemouth Long Sands is covered by three beach profile lines for the Partial Measures survey (Appendix A). Profiles 1aNTDC06 and 1aNTDC07 were initially surveyed annually each autumn between 2002 and 2009. A third profile, 1aNTDC06A, was later added in the centre of the frontage. From spring 2010 (Partial Measures) onwards, they have been surveyed bi-annually. The last survey was the autumn 2016 Full Measures survey.</p> <p>1aNTDC06 is located approximately 150m south of the access road/ramp towards the north of the bay. The profile for the dune-cliff face is limited due to a lack of data points in the profile plot; the survey report for this monitoring period and previous survey reports have noted ‘no access to middle of section 6 due to seed protection fences’. There has been a drop in beach level of up to 0.7m from the toe of the dune-cliff to chainage 125m. Seawards of chainage 125m there has been accretion of up to 0.6m, with a small berm forming at 130m. The upper beach is relatively low compared to the range recorded from previous surveys, whilst the lower beach is at a high-medium level.</p> <p>At profile 1aNTDC06A, the profile for the dune-cliff face is a straight line; a result of a lack of data points in the profile plot; the survey report for this monitoring period and previous survey reports have noted ‘no access to middle of section 6A due to seed protection fences’. There has been a variable amount of erosion and accretion across the beach creating a flatter profile. Minor erosion of up to 0.2m has occurred between chainages 80m and 110m, and 200m and 230m. Accretion of up to 0.5m has occurred between chainages 110m and 200m, and seawards of chainage 230m. Overall the profile is at its highest recorded level compared to previous surveys seawards of chainage 120m, but at a relatively medium level at the toe of the dunes.</p> <p>Profile 1aNTDC07 is located approximately 50m south of the access route through the dunes towards the southern end of the bay. As with the other profiles the dune-cliff face is a straight line; a result of a lack of data points in the profile plot. The survey report for this monitoring period and earlier reports note ‘no access to middle of section 7 due to seed protection fences’. There has been very little change over the majority of the profile, $\pm 0.1\text{m}$, with the exception being at the toe of the beach seawards of chainage 265m where there has been up to 0.5m of erosion. Overall the profile remains at a relatively medium-</p> | <p>At Tynemouth Long Sands, the dune-cliff face was not surveyed due to access constraints, but survey photographs suggest that wind-blown sand continues to accrete in the lee of the defences.</p> <p>Beach profile change has been relatively small over the winter/spring months and generally showing erosion of berms in the upper beach accretion in the mid beach and beach toe.</p> <p>Longer term trends: Overall, the beaches have retained a similar form and are within the bounds of previous surveys.</p> |

| Survey Date | Description of Changes Since Last Survey | Interpretation |
|--------------------------|---|---|
| | high level compared to the range recorded from the previous surveys. | |
| <p>March 2017</p> | <p>Topographic Survey:</p> <p>The first survey for Tynemouth Long Sands was undertaken for the Full Measures survey in October 2010.</p> <p>Data from the current topographic survey have been used to create a digital ground model (DGM) (Appendix B – Map 1a) using a Geographical Information System (GIS). A difference plot has also been produced by comparing the current DGM (Appendix B – Map 1b) with that produced from the last topographic survey.</p> <p>The difference plot shows the northern half of the bay has seen erosion in the upper beach with accretion in the lower beach. Whilst the southern half of the bay shows very little change in the upper beach and erosion at the toe of the beach. These findings correspond well to the beach profile surveys, which show alternating changes in beach levels in a cross-shore direction.</p> | <p>Since the last survey, the beach at Tynemouth Long Sands shows a pattern of cross shore movement of sand, with material being eroded from the upper beach and deposited in the lower beach in the north of the bay. Some sand may also have been drawn down to the nearshore from the beach toe.</p> |

2.4 King Edward's Bay

| Survey Date | Description of Changes Since Last Survey | Interpretation |
|--------------------------|---|---|
| <p>March 2017</p> | <p>Beach Profiles:</p> <p>King Edward's Bay is covered by one beach profile line for the Full Measures survey (Appendix A). This was surveyed annually each autumn between 2002 and 2009. From spring 2010 onwards, it has been surveyed bi-annually. The last survey was the autumn 2016 Full Measures survey.</p> <p>At profile 1aNTDC08 there has been variable amounts of erosion and accretion creating a much smoother profile compared to the previous survey, with berms previously recorded at chainages 35m and 90m being removed. Erosion of up to 0.8m, but more typically 0.2m, has occurred between the seawall and chainage 55m, and chainages 80m to 140m. Between chainages 45m and 80m, and seawards of 140m there has been accretion of up to 0.4m. Overall the profile is at a medium level compared to the range recorded from previous surveys.</p> | <p>Since the last survey, the beach at King Edward's Bay beach has been subject to some notable changes, including the erosion of the berms in the upper and middle beach and accretion at the beach toe.</p> <p>Longer term trends: Although significant changes have occurred since the last survey, they are within the range of historical beach levels.</p> |

3. Problems Encountered and Uncertainty Analysis

Individual Profiles

- At profile 1aNTDC03 there was construction ongoing on the promenade restricting access to the start of the section.
- At profile 1aNTDC05 the cliff was not measured due to dangerous access. Access to this profile is noted to have been dangerous in the previous Partial Measures and Full Measures reports, and it is therefore recommended that the beach profile data should start at the cliff toe and the cliff position should be monitored from aerial survey data.
- At Tynemouth Long Sands (profiles 1aNTDC06, 1aNTDC06A and 1aNTDC07) there was no access to the dunes in the middle of the profile due to seedling protection fences. This means it has not been possible to directly monitor the effectiveness of the dune stabilisation scheme, although observations have been made from the survey photographs.

Topographic Survey

- At Tynemouth Longsands the topographic survey report notes that the beach was being regraded at time of survey.

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

It is recommended that access to the stabilised dunes at Tynemouth Long Sands be attempted in future surveys in order to monitor the effectiveness of the stabilisation fences.

5. Conclusions and Areas of Concern

- At Whitley Sands, beach levels have experienced variable change with increases and decreases throughout individual profiles. For the most part, the beach is at a medium level or lower, tending to be lower at the southern end of the bay. There are no causes for concern.
- At Cullercoats Bay, at profile 1aNTDC05, there has been some drawdown of material from the upper to lower beach but there are no causes for concern.
- At Tynemouth Long Sands, the dune-cliff face was not surveyed due to access constraints, and beach profile change has been relatively small and variable throughout individual profiles, presenting no causes for concern. This is supported by the topographic survey which shows change <1m and clear evidence for expected cross shore movements of sand.
- At King Edward's Bay, the beach has changed notably, in particular the erosion of a berm in the upper and middle beach and accretion at the beach toe. However, changes are within the range of beach levels seen previously and there are no causes for concern.

Appendices

Appendix A
Beach Profiles

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

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

Beach Profile

Location: 1aNTDC01

Date: 02/03/2017

Inspector: AG

Low Tide:

Low Tide Time:

Wind

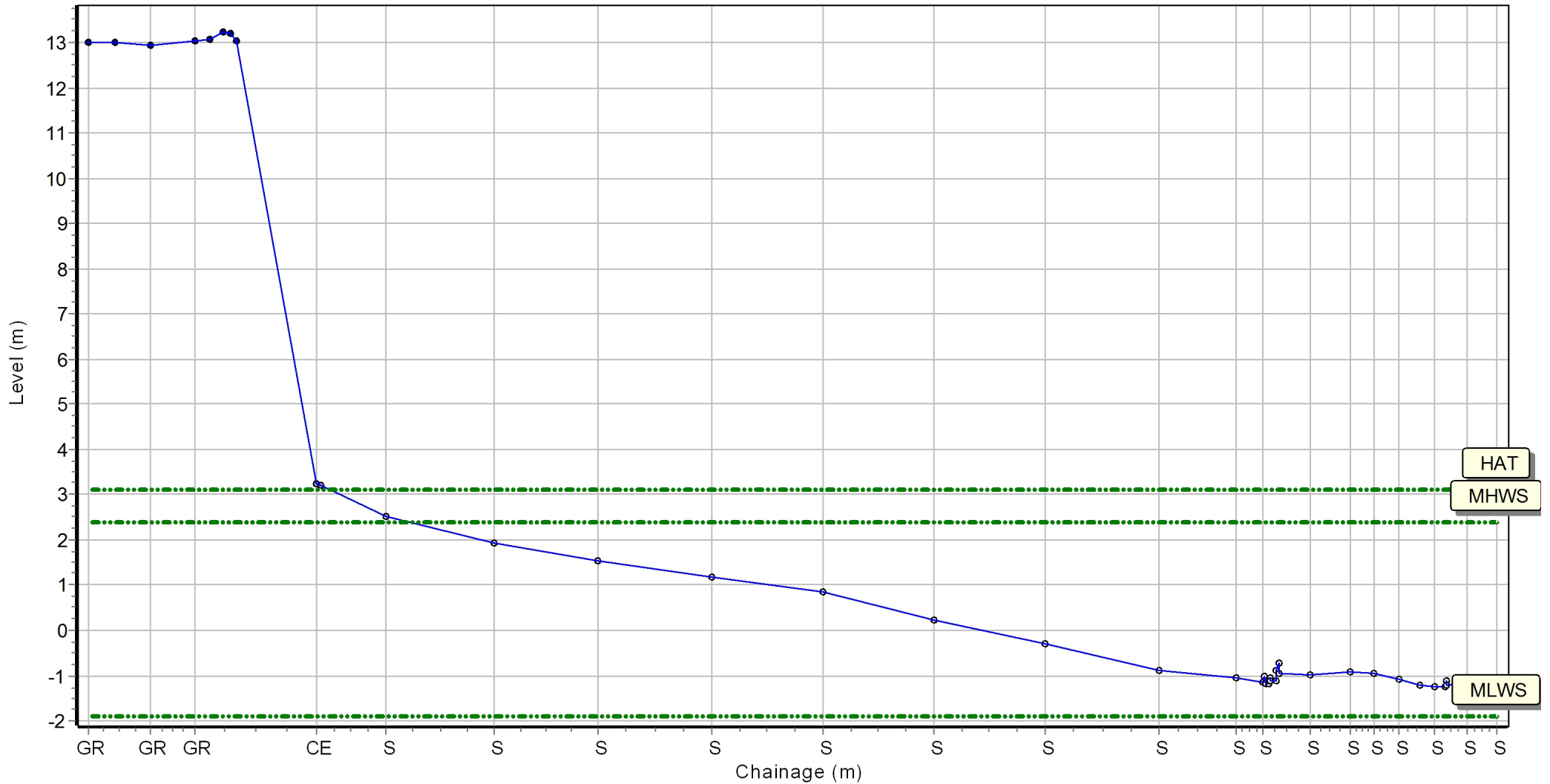
Sea State:

Visibility:

Rain:

Summary: 2017 Partial Measures Topo Survey

Easting: 434851.079 Northing: 574565.379 Profile Bearing: 99 ° from North



Beach Profile

Location: 1aNTDC02

Date: 02/03/2017

Inspector: AG

Low Tide:

Low Tide Time:

Wind

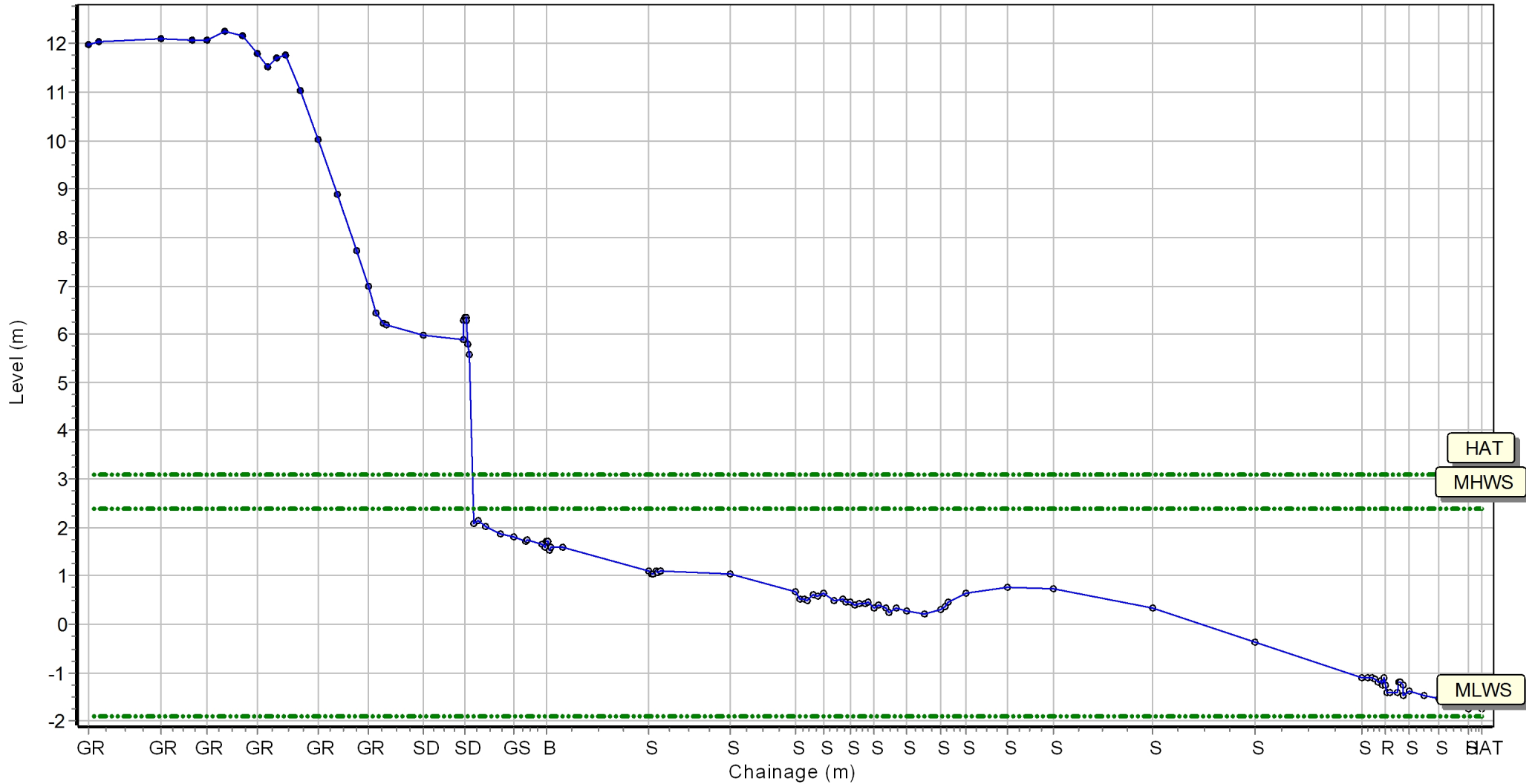
Sea State:

Visibility:

Rain:

Summary: 2017 Partial Measures Topo Survey

Easting: 435030.395 Northing: 573704.317 Profile Bearing: 76 ° from North



Beach Profile

Location: 1aNTDC03

Date: 02/03/2017

Inspector: AG

Low Tide:

Low Tide Time:

Wind

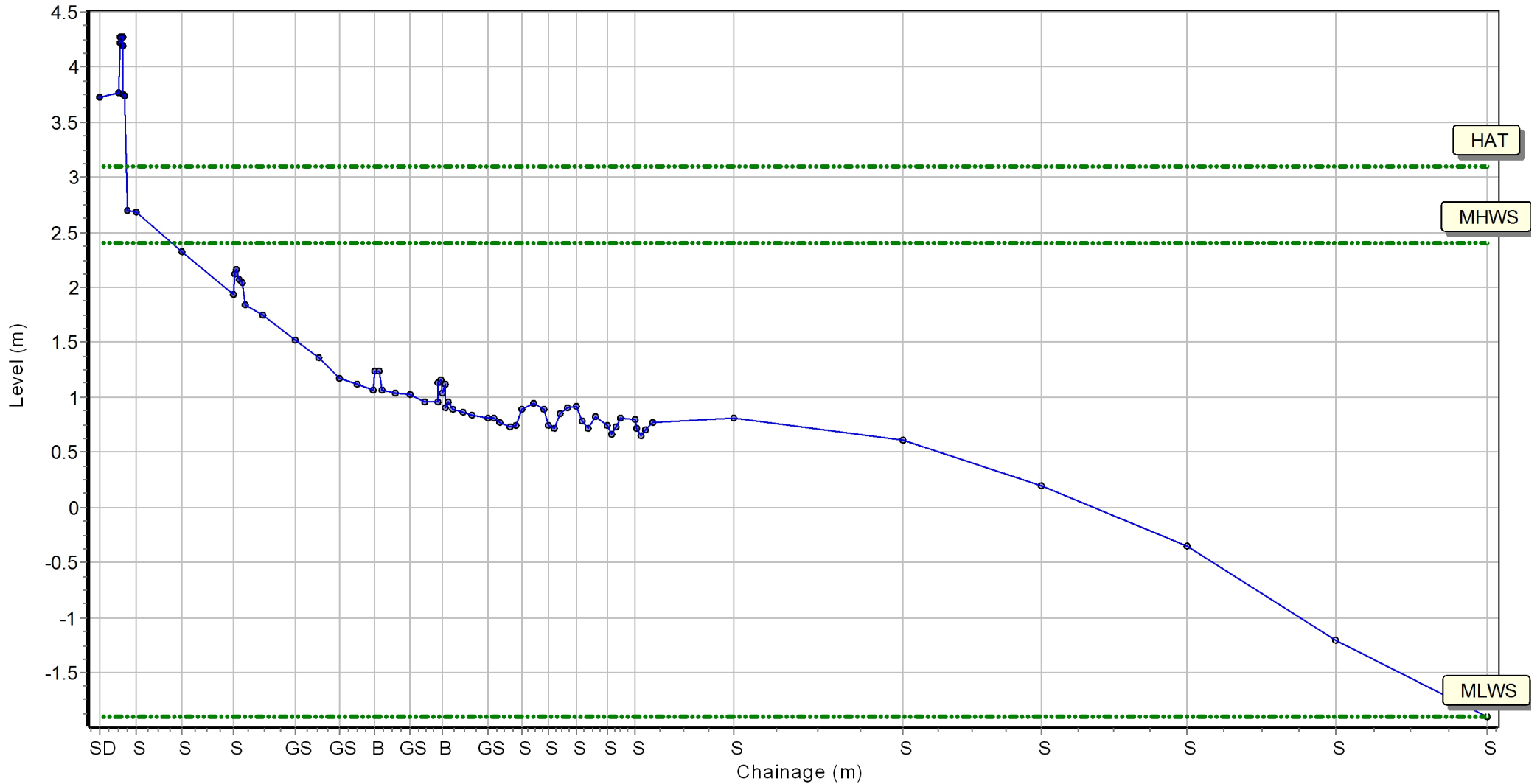
Sea State:

Visibility:

Rain:

Summary: 2017 Partial Measures Topo Survey

Easting: 435270.865 Northing: 573151.795 Profile Bearing: 70 ° from North



Beach Profile

Location: 1aNTDC04

Date: 02/03/2017

Inspector: AG

Low Tide:

Low Tide Time:

Wind

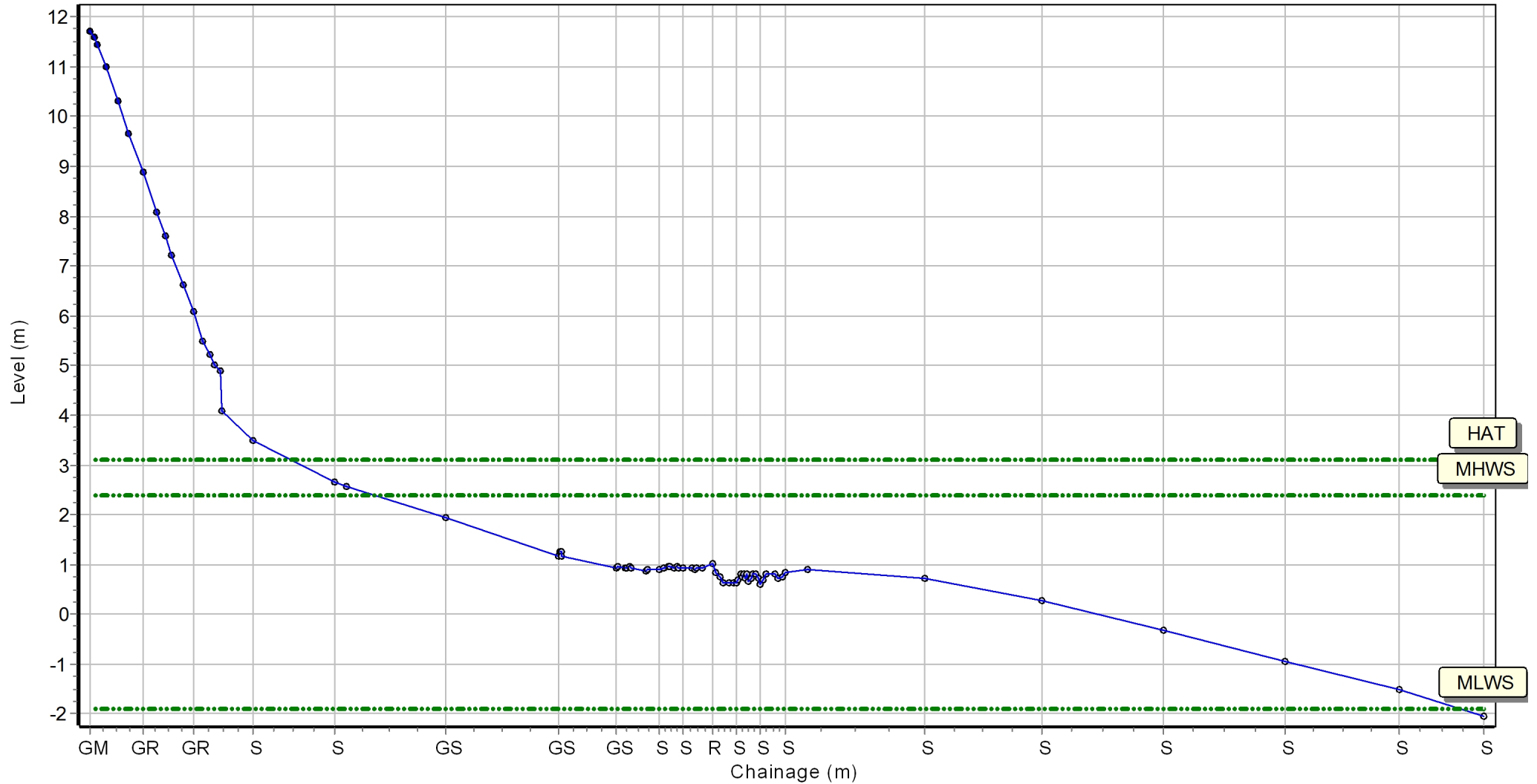
Sea State:

Visibility:

Rain:

Summary: 2017 Partial Measures Topo Survey

Easting: 435490.594 Northing: 572746.234 Profile Bearing: 60 ° from North



Beach Profile

Location: 1aNTDC04A

Date: 02/03/2017 Inspector: AG

Low Tide:

Low Tide Time:

Wind

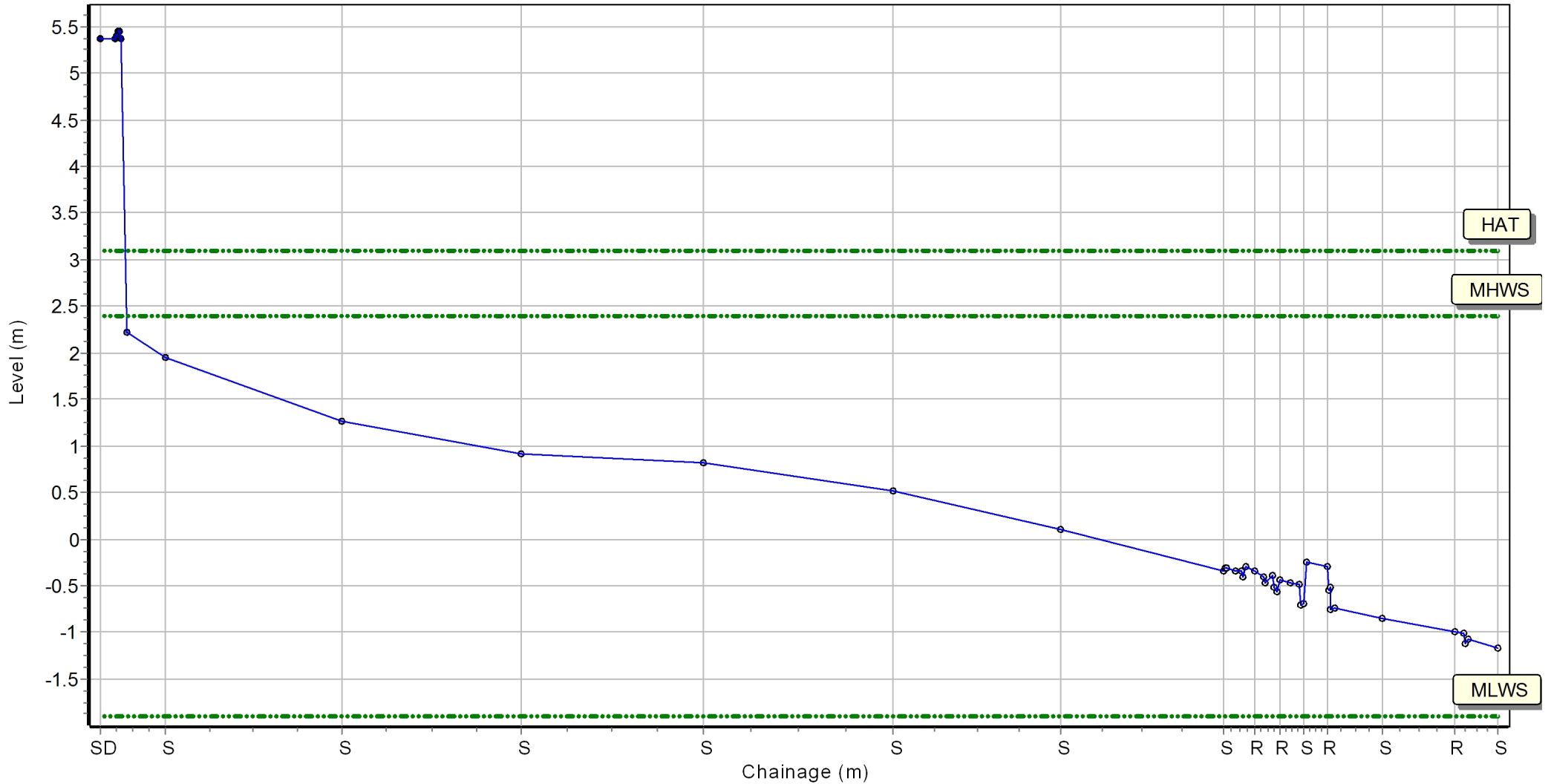
Sea State:

Visibility:

Rain:

Summary: 2017 Partial Measures Topo Survey

Easting: 435645.554 Northing: 572557.615 Profile Bearing: 46 ° from North



Beach Profile

Location: 1aNTDC05

Date: 02/03/2017

Inspector: AG

Low Tide:

Low Tide Time:

Wind

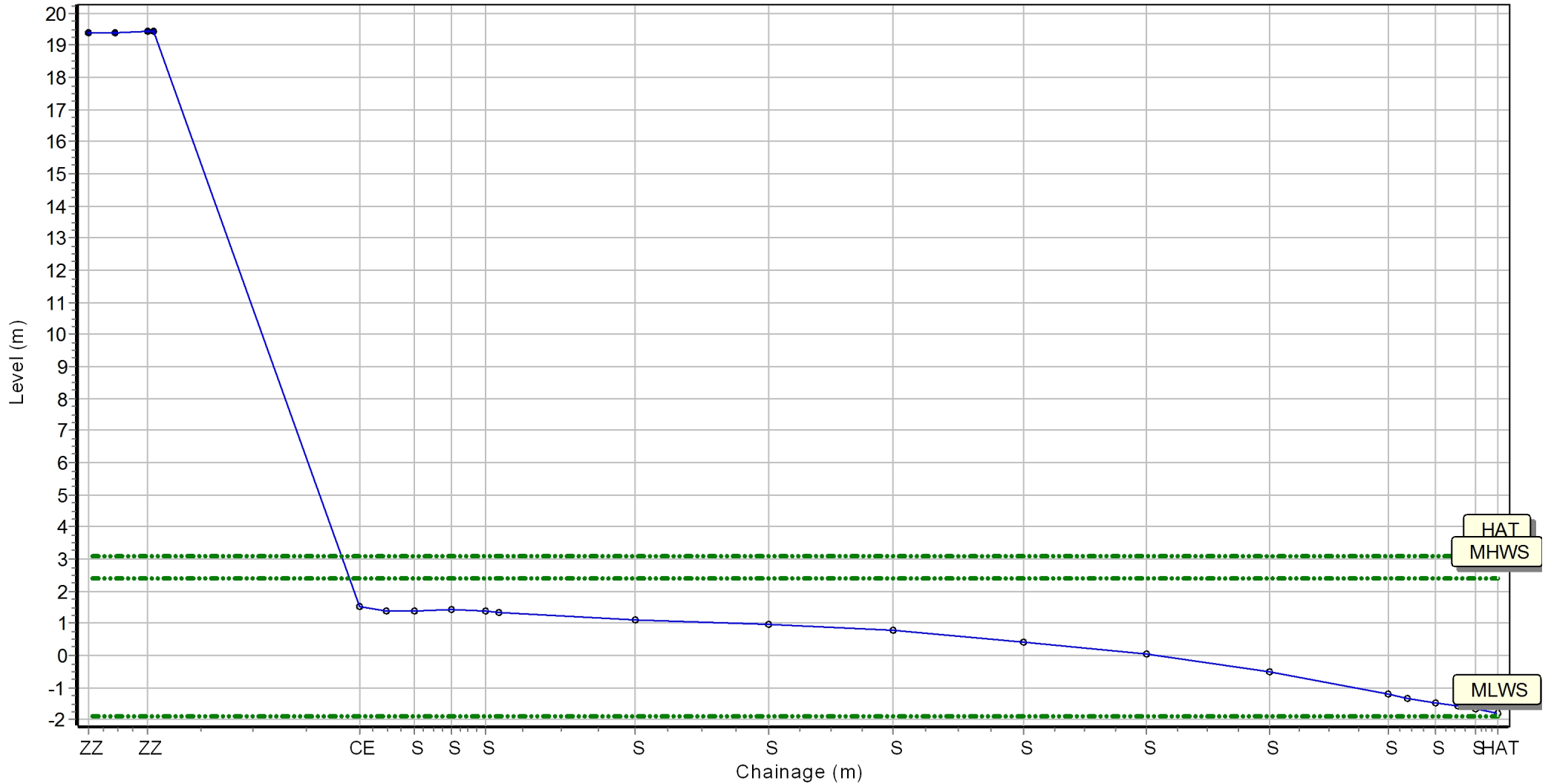
Sea State:

Visibility:

Rain:

Summary: 2017 Partial Measures Topo Survey

Easting: 436365.005 Northing: 571217.518 Profile Bearing: 77 ° from North



Beach Profile

Location: 1aNTDC06

Date: 02/03/2017

Inspector: AG

Low Tide:

Low Tide Time:

Wind

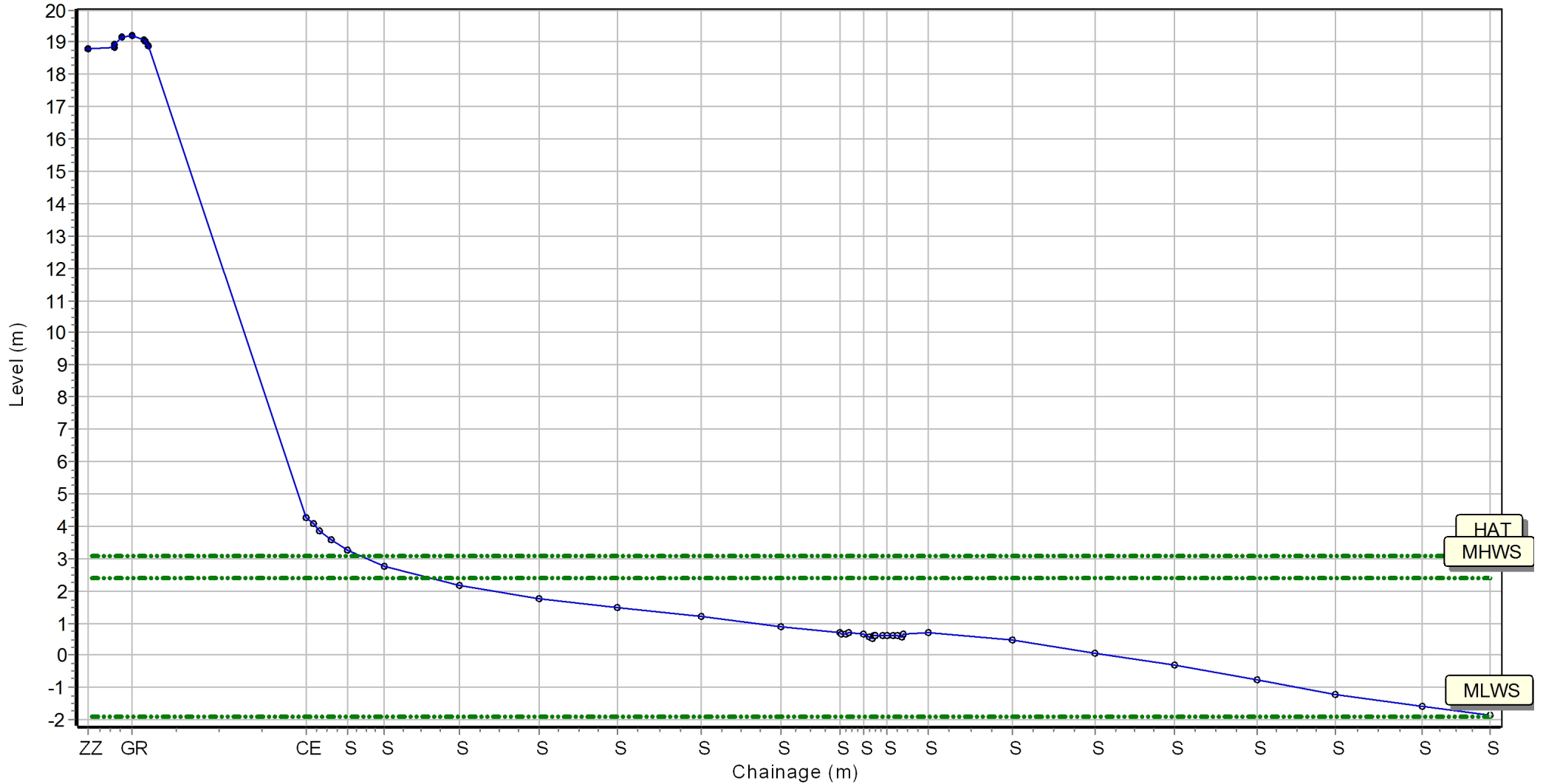
Sea State:

Visibility:

Rain:

Summary: 2017 Partial Measures Topo Survey

Easting: 436550.6 Northing: 570613.529 Profile Bearing: 77 ° from North



Beach Profile

Location: 1aNTDC06A

Date: 02/03/2017 Inspector: AG

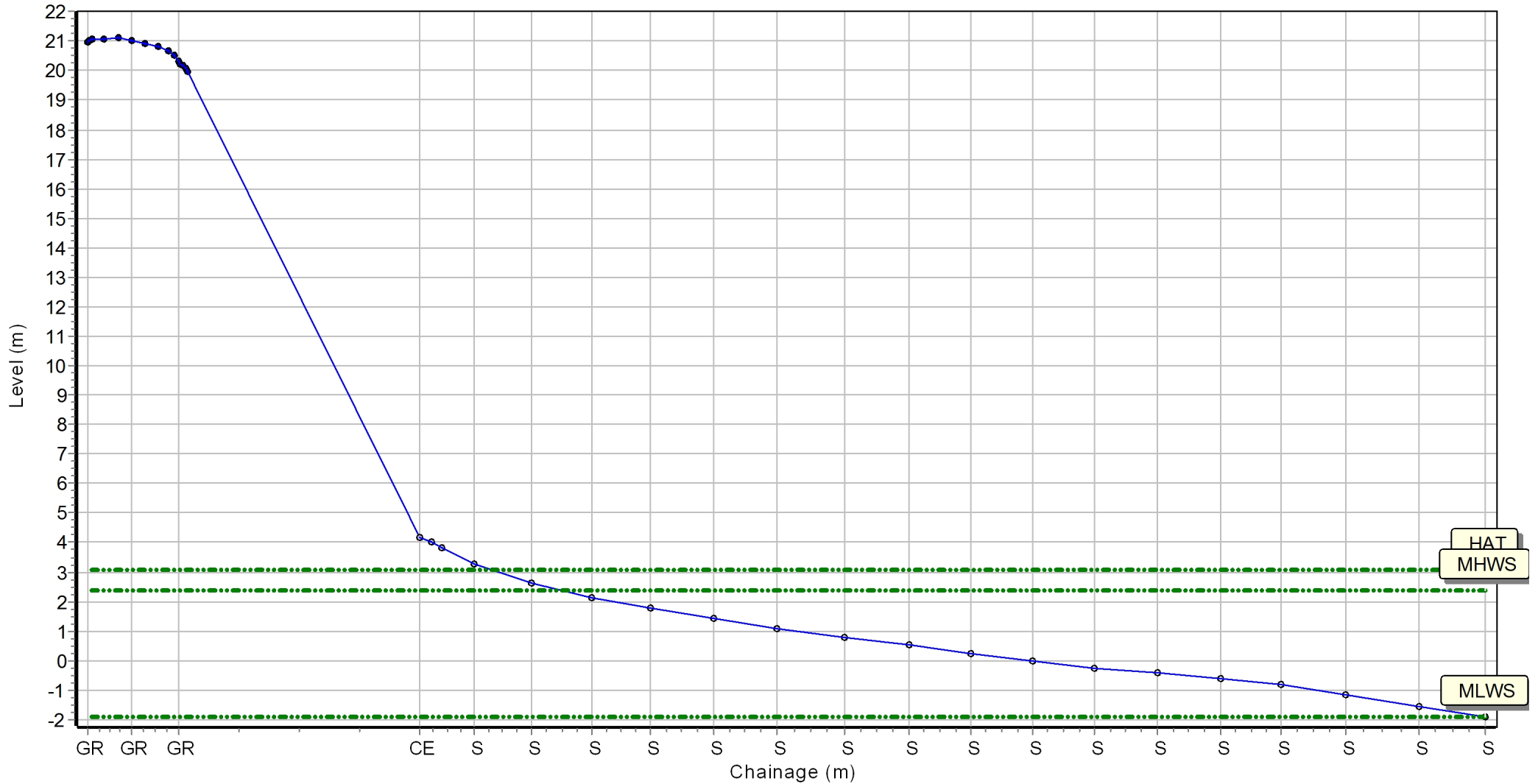
Low Tide: Low Tide Time:

Wind Sea State:

Visibility: Rain:

Summary: 2017 Partial Measures Topo Survey

Easting: 436620.512 Northing: 570317.533 Profile Bearing: 65 ° from North



Beach Profile

Location: 1aNTDC08

Date: 02/03/2017

Inspector: AG

Low Tide:

Low Tide Time:

Wind

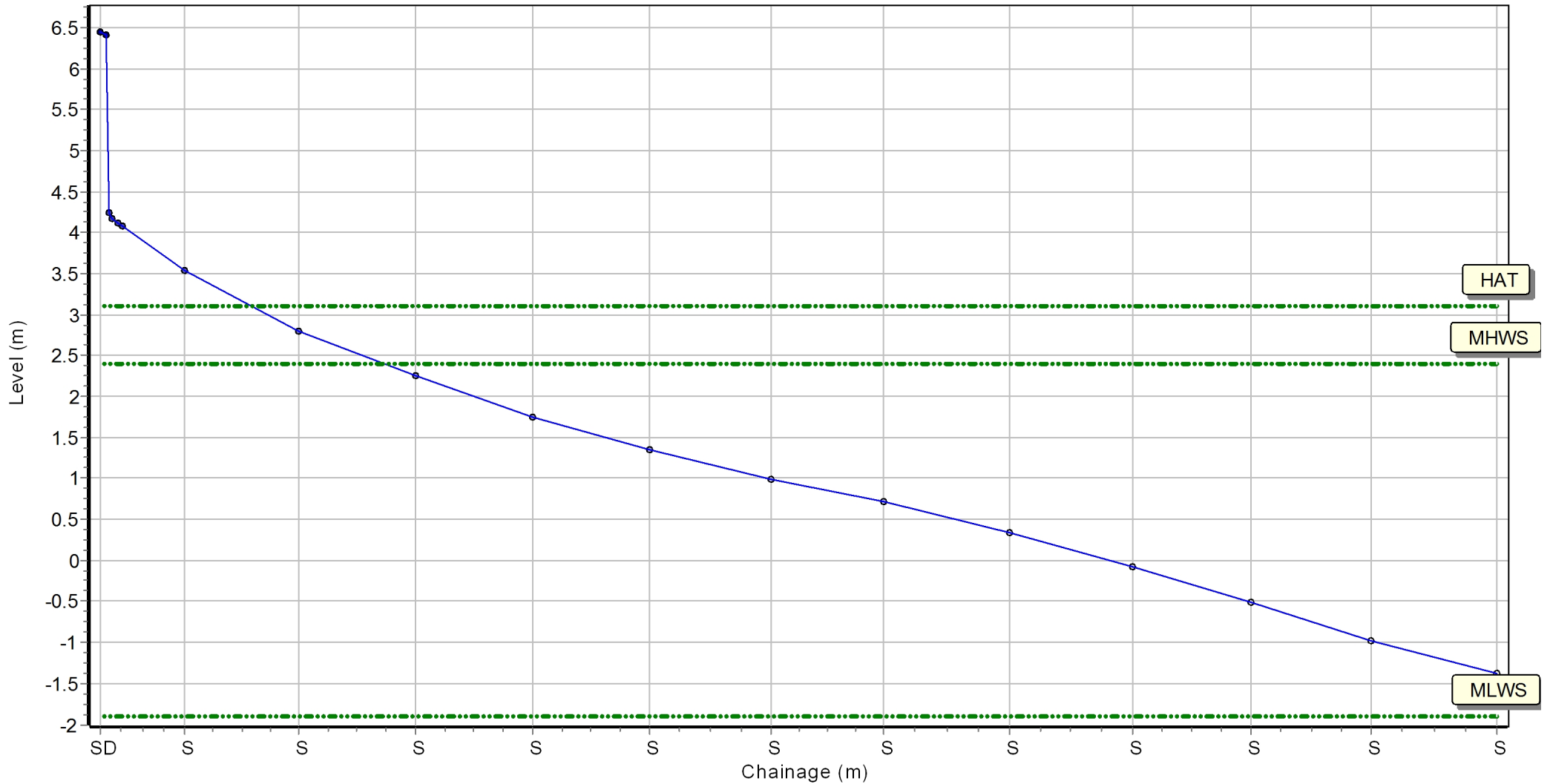
Sea State:

Visibility:

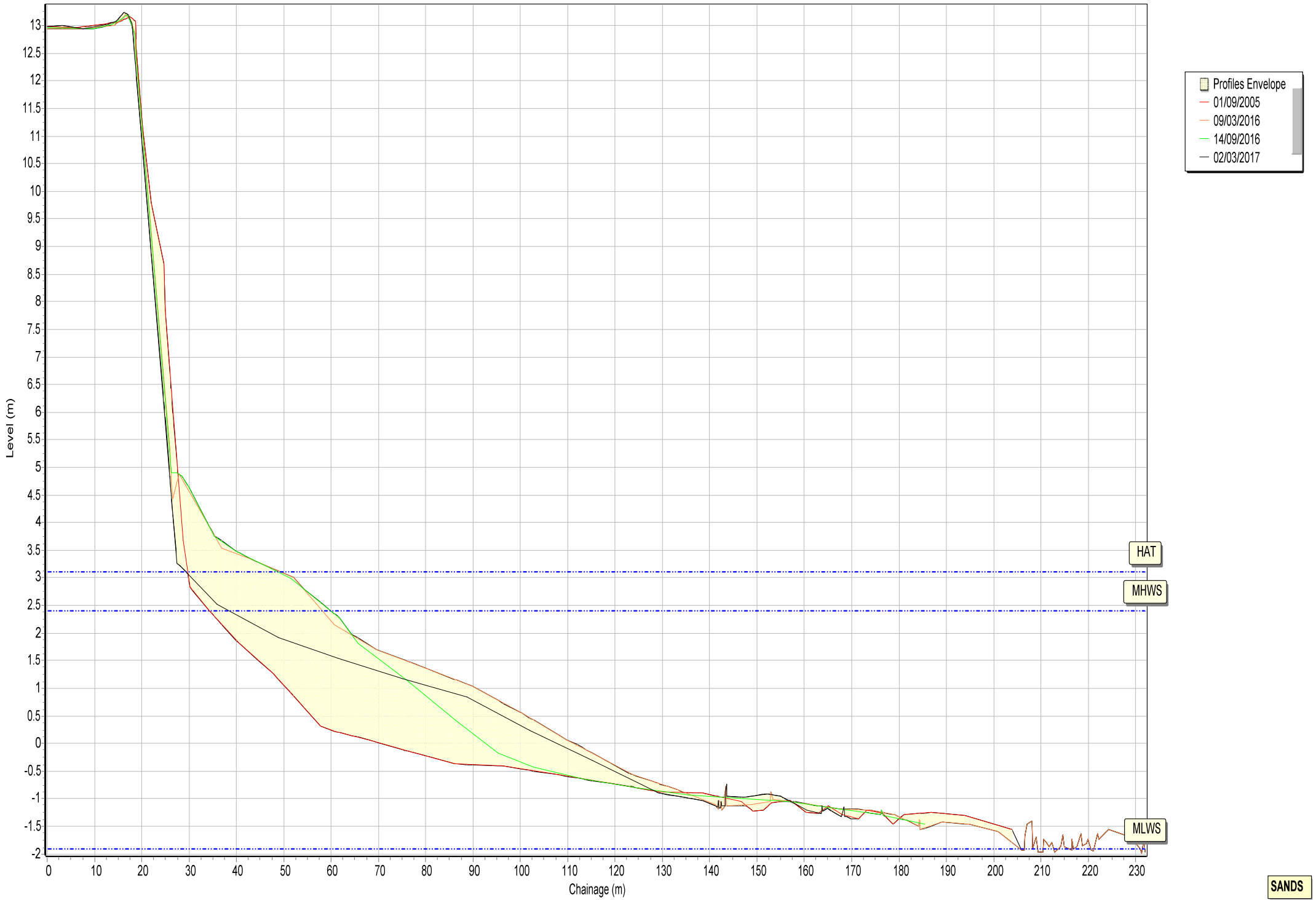
Rain:

Summary: 2017 Partial Measures Topo Survey

Easting: 437142.187 Northing: 569510.828 Profile Bearing: 67 ° from North

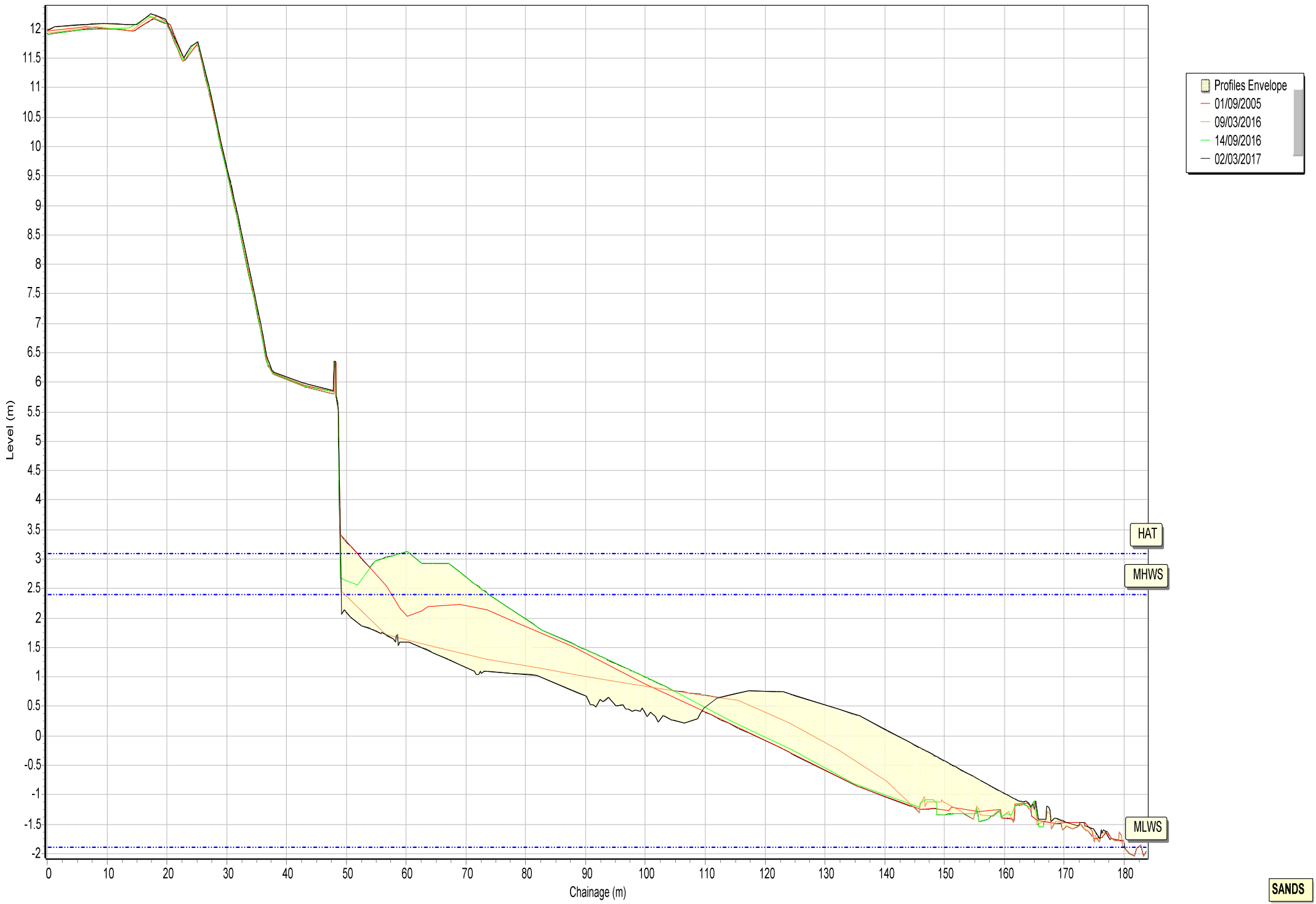


Beach Profiles: 1aNTDC01

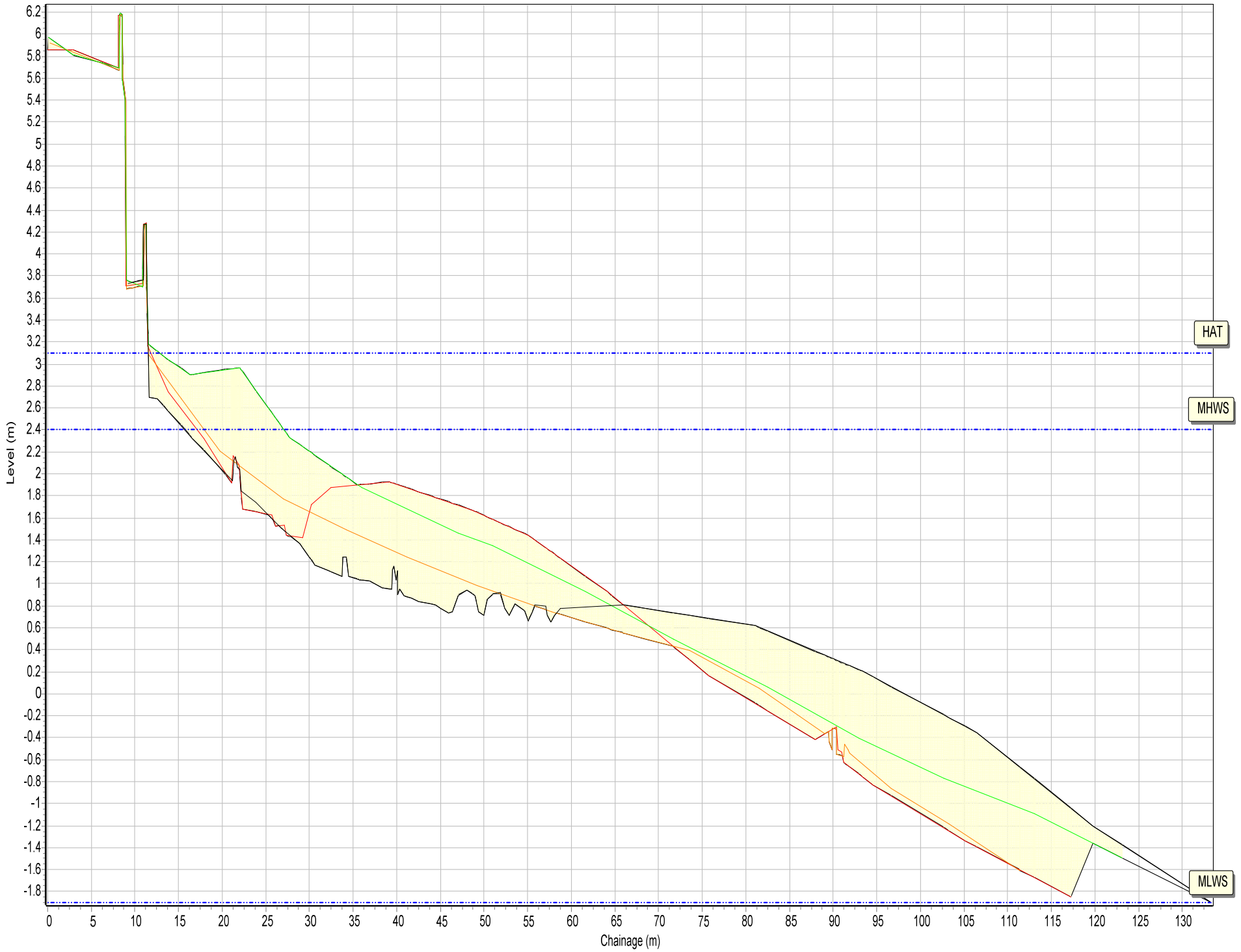


SANDS

Beach Profiles: 1aNTDC02



Beach Profiles: 1aNTDC03



Profiles Envelope

- 01/09/2005
- 09/03/2016
- 14/09/2016
- 02/03/2017

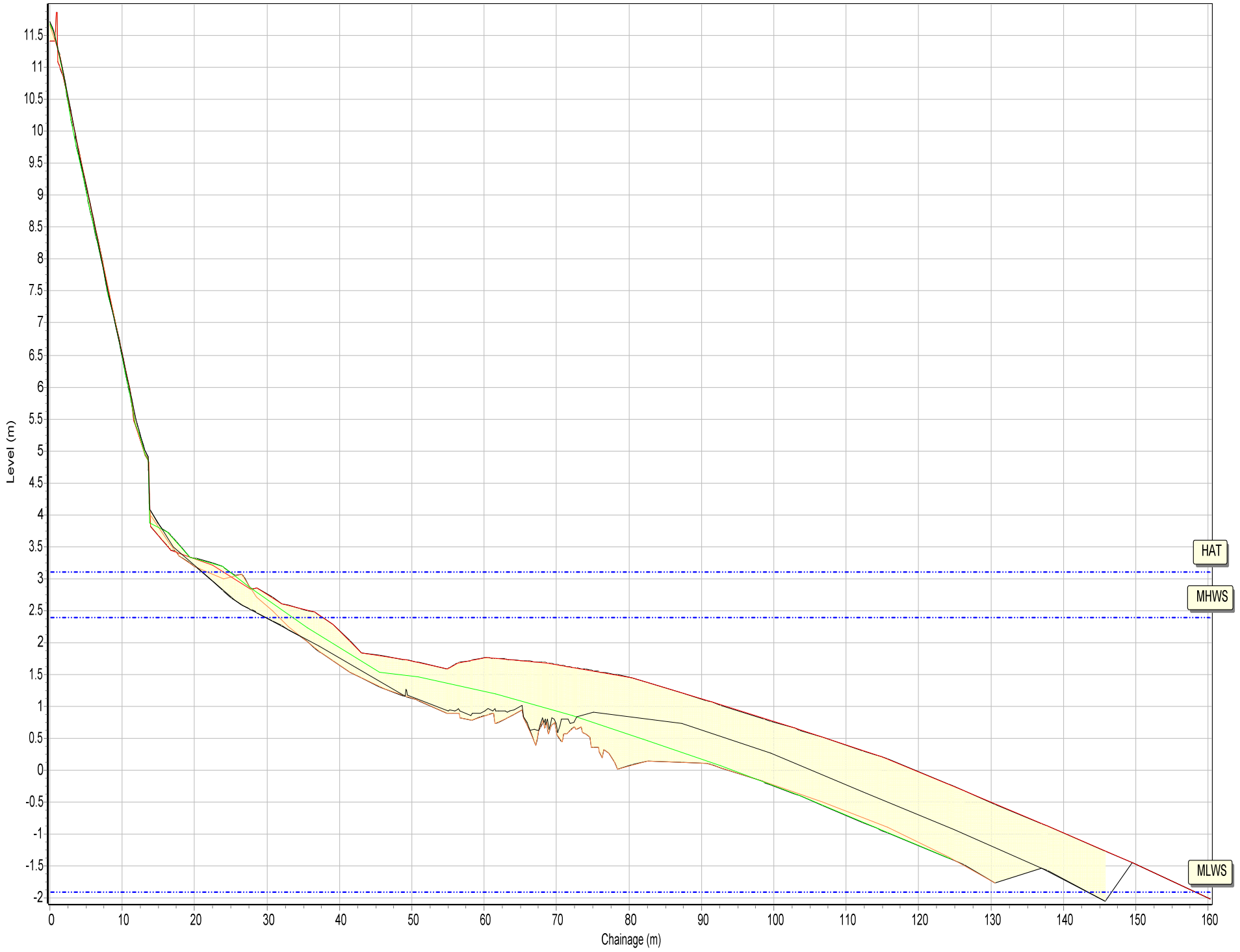
HAT

MHWS

MLWS

SANDS

Beach Profiles: 1aNTDC04



Profiles Envelope
01/09/2005
09/03/2016
14/09/2016
02/03/2017

HAT

MHWS

MLWS

SANDS

Beach Profiles: 1aNTDC04A



Profiles Envelope
29/03/2010
09/03/2016
14/09/2016
02/03/2017

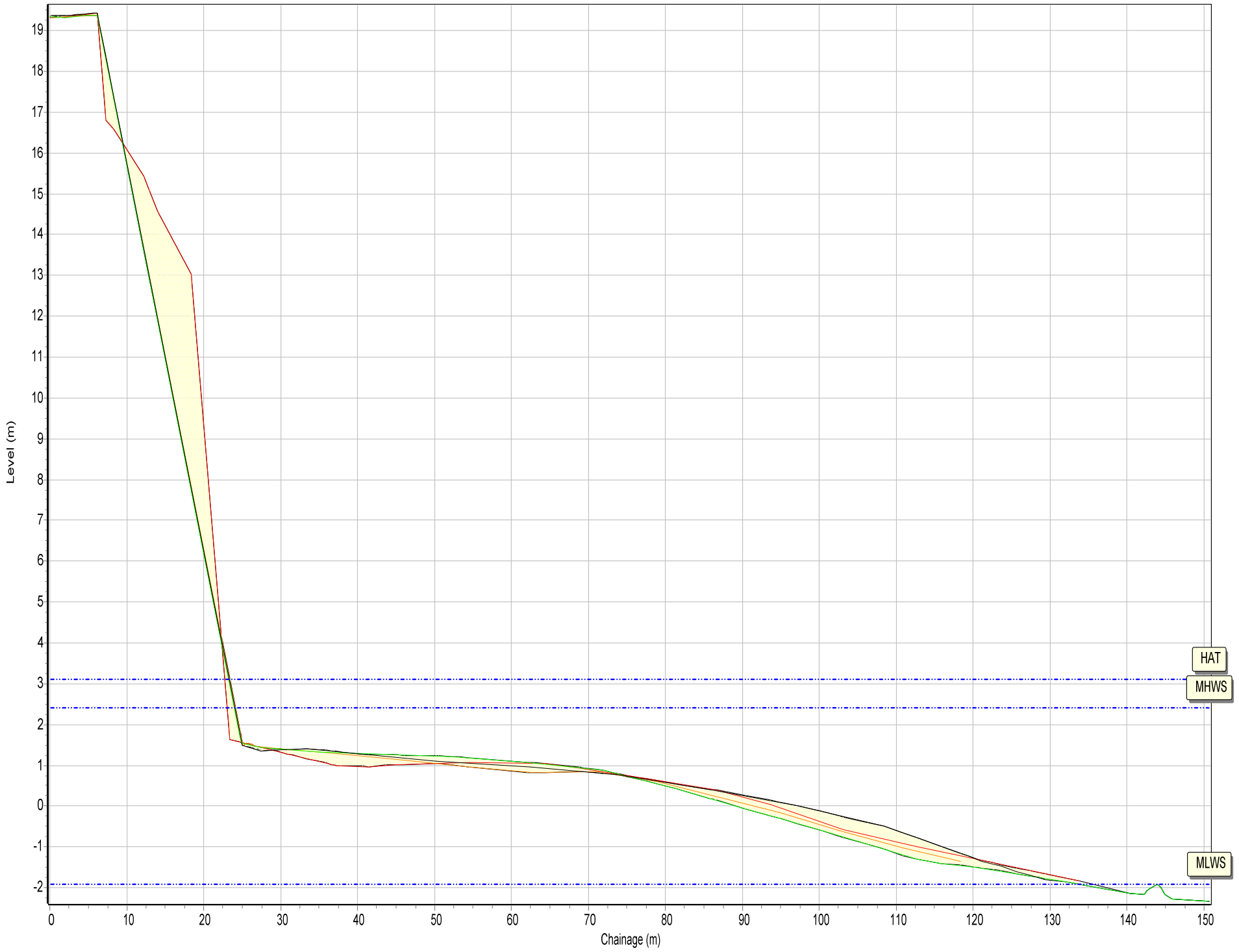
HAT

MHWS

MLWS

SANDS

Beach Profiles: 1aNTDC05



Profiles Envelope
01/09/2005
10/03/2016
20/09/2016
02/03/2017

HAT
MHWS

MLWS

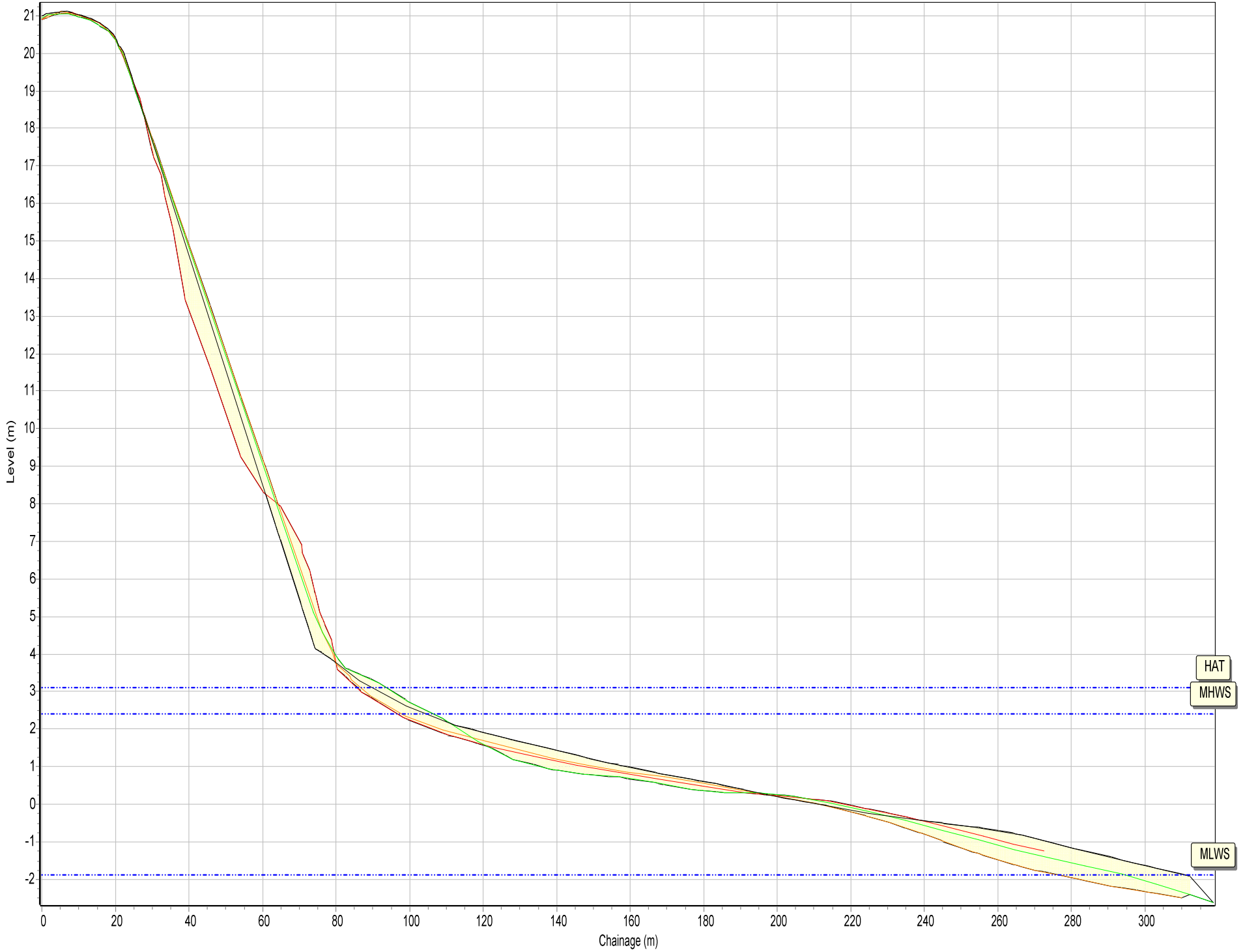
SANDS

Beach Profiles: 1aNTDC06



SANDS

Beach Profiles: 1aNTDC06A



Profiles Envelope

- 29/03/2010
- 10/03/2016
- 20/09/2016
- 02/03/2017

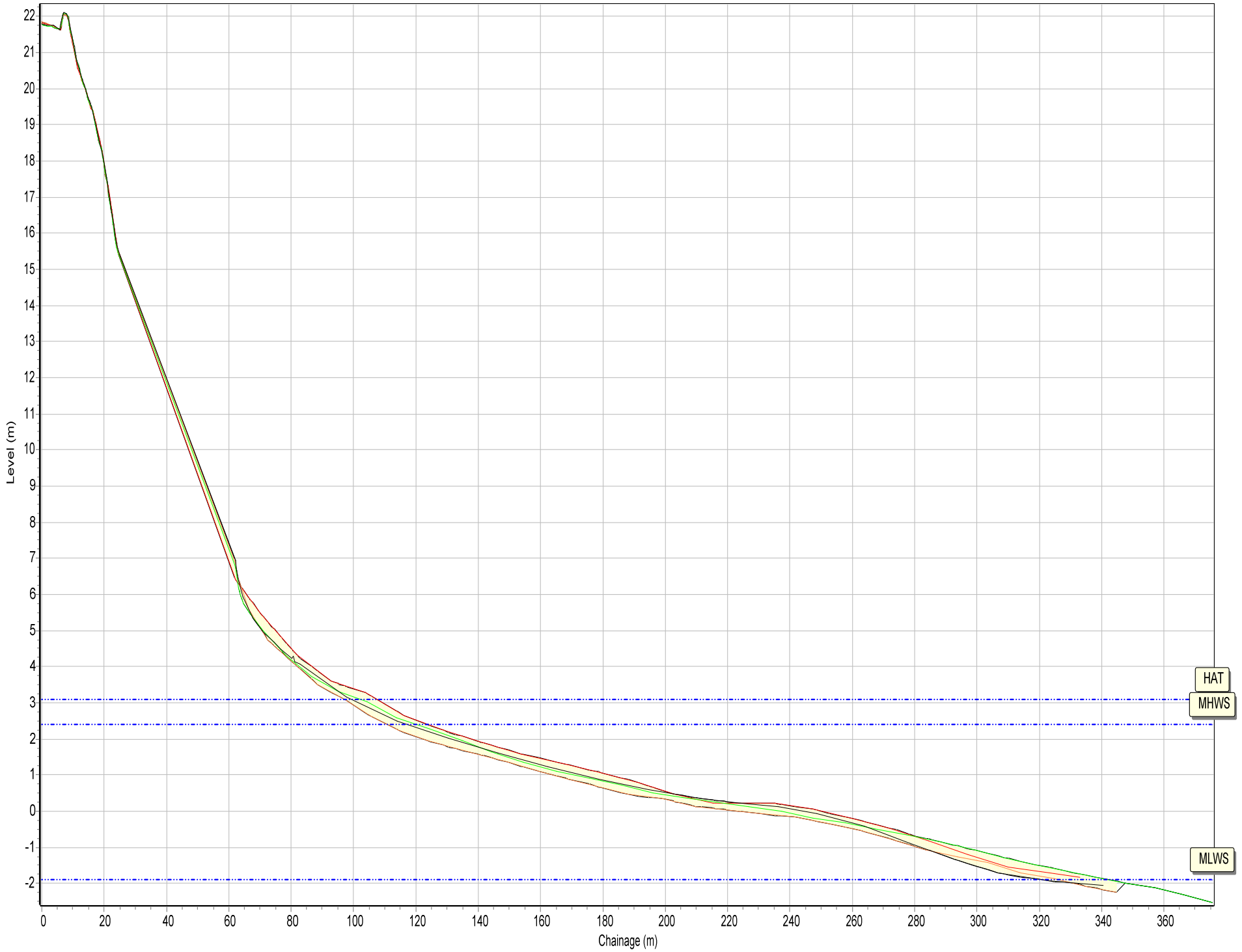
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MHWS

MLWS

SANDS

Beach Profiles: 1aNTDC07



Profiles Envelope

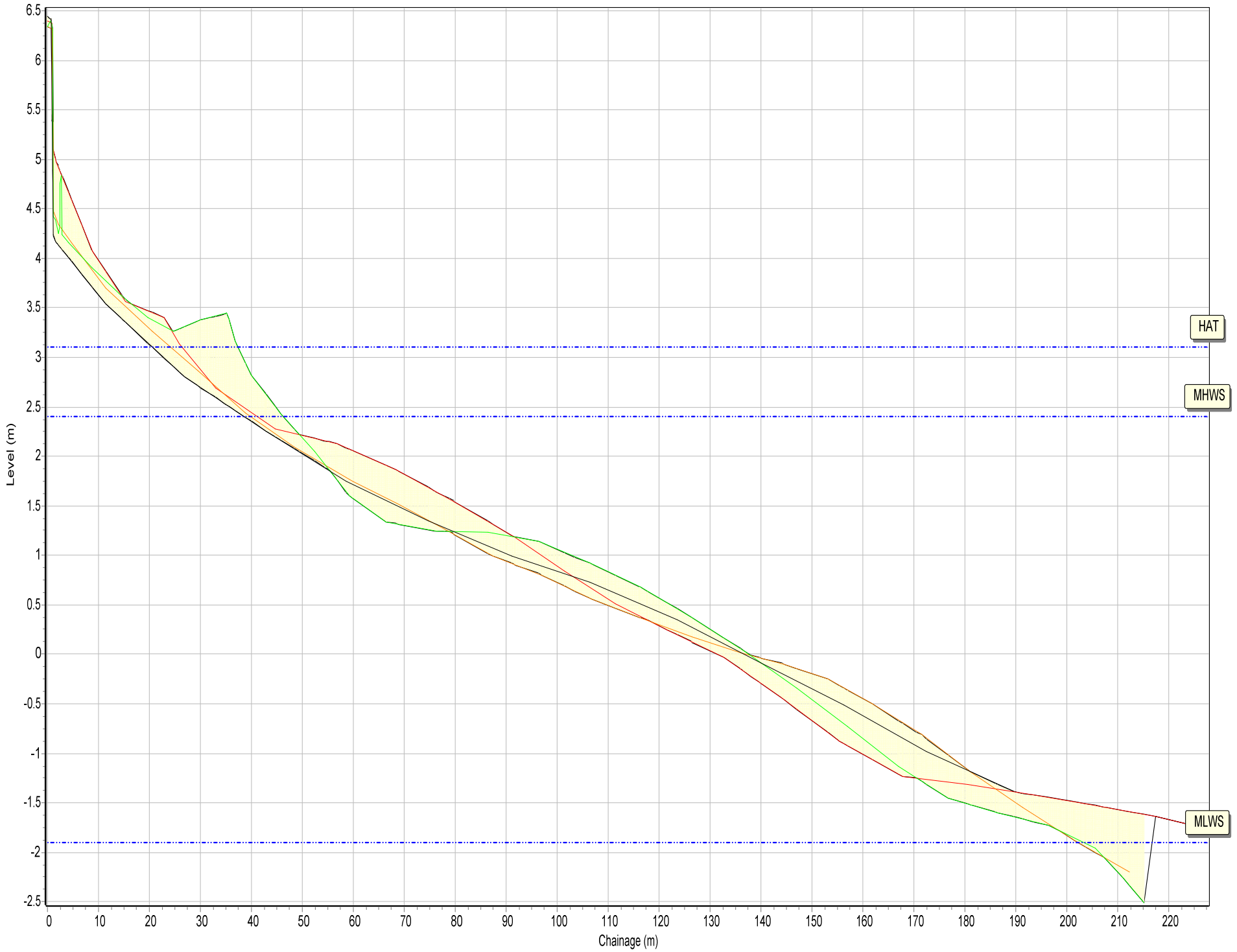
- 01/09/2005
- 10/03/2016
- 20/09/2016
- 02/03/2017

HAT
MHWS

MLWS

SANDS

Beach Profiles: 1aNTDC08



Profiles Envelope
01/09/2005
10/03/2016
20/09/2016
02/03/2017

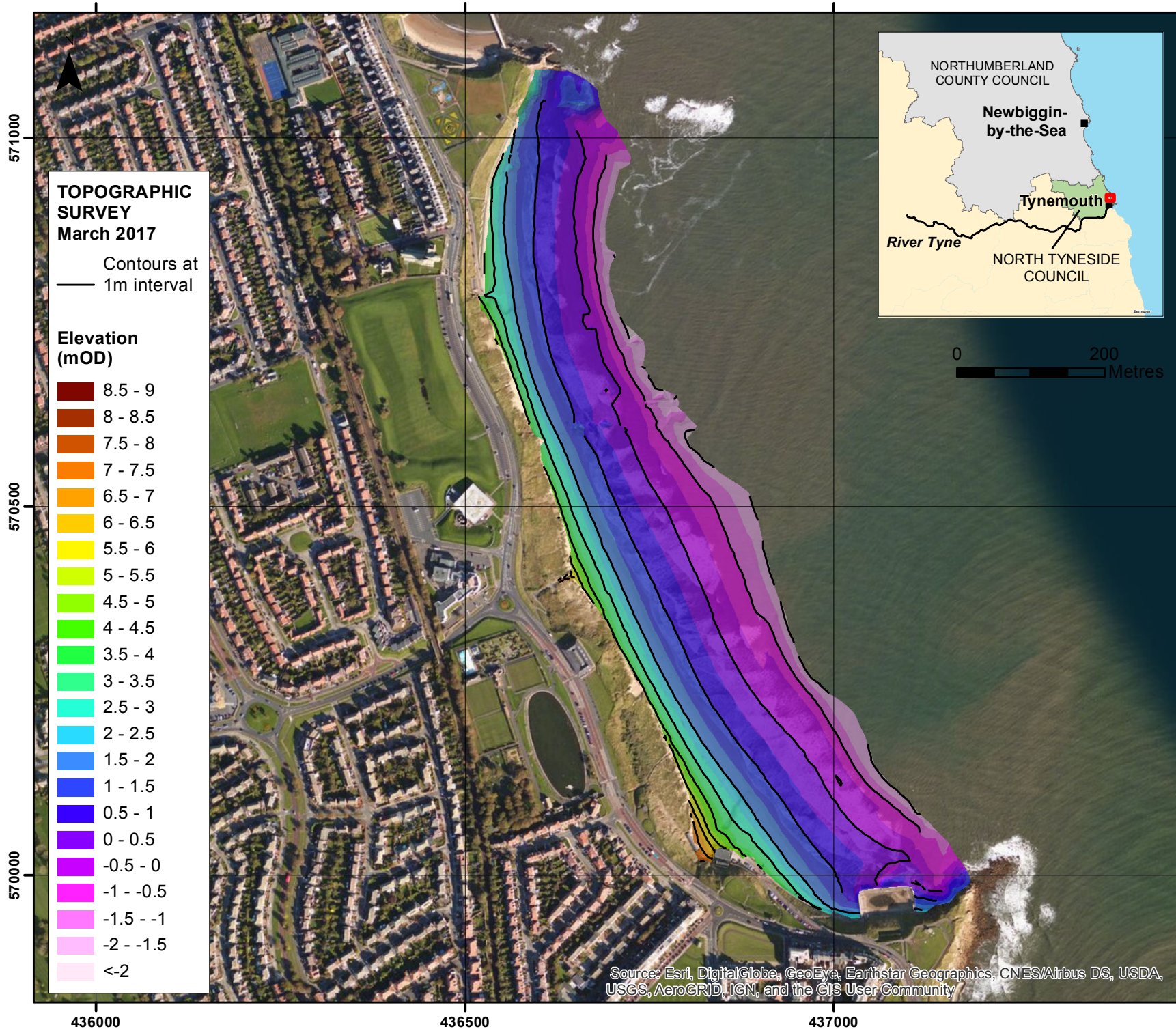
HAT

MHWS

MLWS

SANDS

Appendix B
Topographic Survey



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

Appendix B - Map 1

LONGSANDS

North Tyneside Council Frontage

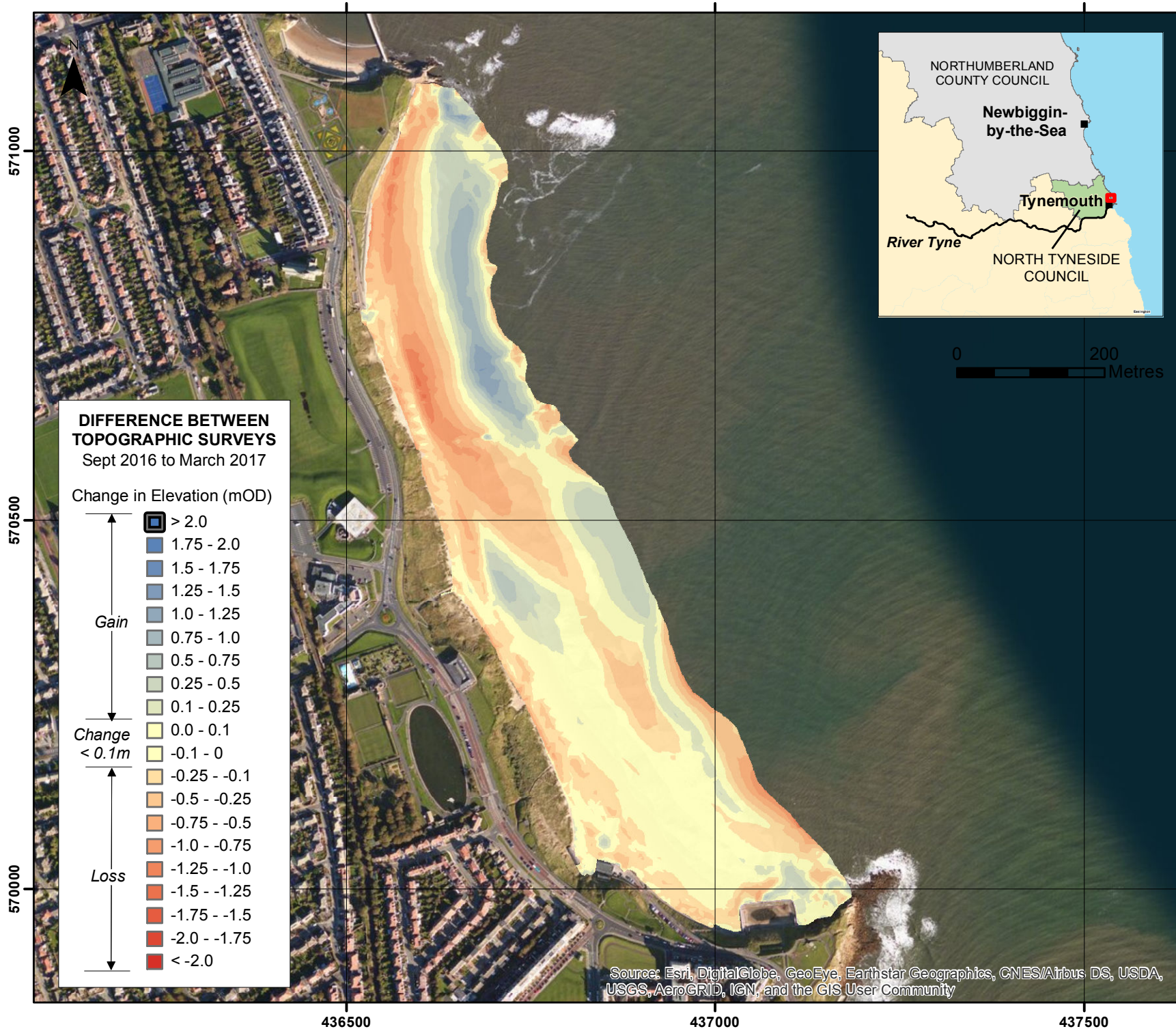
Update Report
 'Partial Measures' Survey 2017

Drawing Scale at A4 1:7,000

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Royal HaskoningDHV
 Enhancing Society Together



DIFFERENCE BETWEEN TOPOGRAPHIC SURVEYS
Sept 2016 to March 2017

Change in Elevation (mOD)

| | |
|---------------|--------------|
| Gain | > 2.0 |
| | 1.75 - 2.0 |
| | 1.5 - 1.75 |
| | 1.25 - 1.5 |
| | 1.0 - 1.25 |
| | 0.75 - 1.0 |
| | 0.5 - 0.75 |
| | 0.25 - 0.5 |
| | 0.1 - 0.25 |
| | 0.0 - 0.1 |
| Change < 0.1m | -0.1 - 0 |
| | -0.25 - -0.1 |
| | -0.5 - -0.25 |
| | -0.75 - -0.5 |
| | -1.0 - -0.75 |
| | -1.25 - -1.0 |
| | -1.5 - -1.25 |
| | -1.75 - -1.5 |
| | -2.0 - -1.75 |
| | < -2.0 |
| Loss | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |



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

Appendix B - Map 2
LONGSANDS
North Tyneside Council Frontage
Update Report
'Partial Measures' Survey 2017

Drawing Scale at A4 1:7,000

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