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Cell 1 Regional Coastal Monitoring Programme Update Report 3: 'Partial Measures' Survey 2012

North Tyneside Council

North Tyneside Council
Final Report

February 2013

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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
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).

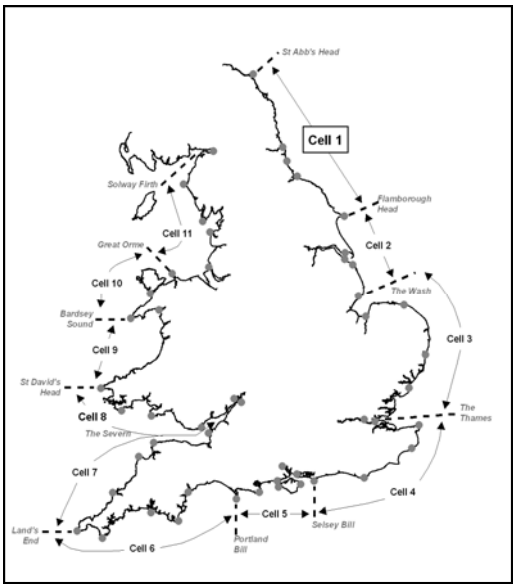


Figure 1 Sediment Cells in England and Wales

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/early winter 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	Sept-Dec 08	May 09	Mar-May 09	June 09	-
2	2009/10	Sept-Dec 09	Mar 10	Feb-Mar 10	Jul 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 (*)	

(*) The present report is **Update Report 4** and provides an analysis of the 2012 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/early winter comprising:
    - Beach profile surveys along 8 transect lines (commenced 2002)
    - Beach profile surveys along an additional 2 transects (commenced 2010)
    - Topographic survey along Whitley Sands (commenced 2010)
    - Topographic survey along Tynemouth Long Sands (commenced 2011)

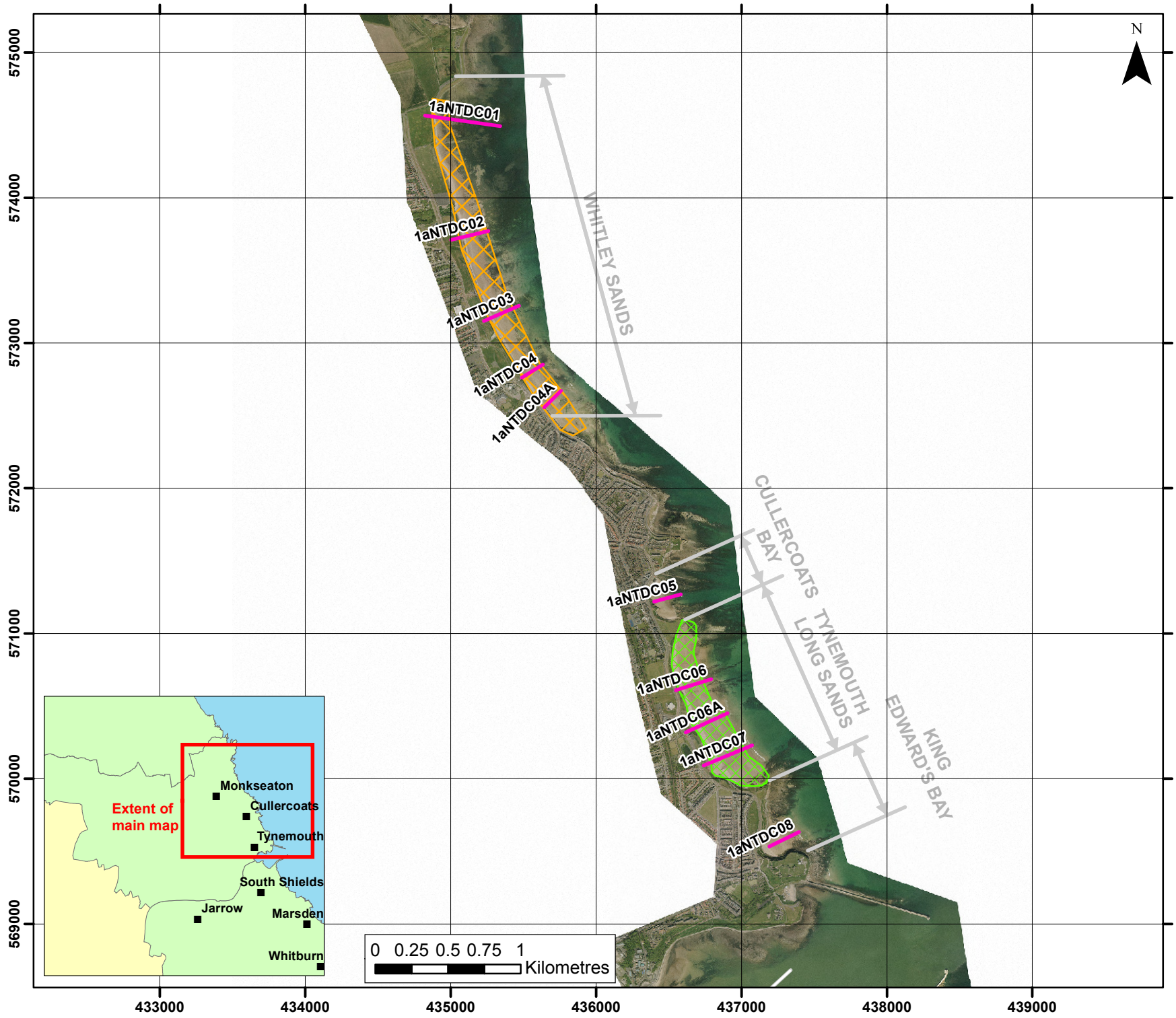
- Partial Measures survey annually each spring comprising:
    - Beach profile surveys along all 10 transect lines (commenced 2010)

The location of these surveys is shown in Figure 2. The baseline Full Measures survey was undertaken along this frontage between 22nd March 2012 and 23rd March 2012, and 25th April 2012 (Tynemouth Long Sands topographic survey). During this time weather conditions varied considerably; 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

Topographic Profiles
- Annual
- 6 monthly

Topographic Surveys
- 6 monthly
- yearly
- 5 yearly

Cliff Top Monitoring Pegs
- 50m centres
- 100m centres
- 300m centres

(Indicative Survey Extents shown)

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme 2011 to 2016

Figure 2 - Map 1
Survey Locations
Whitley Sands to King Edward's Bay
North Tyneside Council

Update Report 4
Partial Measures Survey
Spring 2012

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2. Analysis of Survey Data

2.1 Whitley Sands

Survey Date	Description of Changes Since Last Survey	Interpretation
Mar 2012	**Beach Profiles:** 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 re-surveyed annually to 2009 (full measures, winter 2009). Since then, 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 winter 2011 for the full measures survey. **1aNTDC01** is located in the north of Whitley Sands, along the undefended cliffs immediately south of Trinity Road car park. With the exception of a small length of the profile at a height of 3m (between HAT and MHWS) and between a chainage of 30m and 55m, beach levels across the profile have fallen. Profile **1aNTDC02** is located to the north of Whitley Sands opposite the seawall. Since the last survey, beach levels at the toe of the seawall to a chainage of 100m (level of 0.5m) have increased by up to 1m. Seaward of 100m chainage to the rocky foreshore, beach levels have fallen by 1m. Similar beach levels were last seen on 1st October 2009 (full measures, winter 2009). It is likely that material has been transported across the beach by winter storms. Profile **1aNTDC03** is located at the centre of Whitley Sands. Since the last survey, beach levels at the toe of the seawall to a chainage of 60m (level of 0.8m) have increased by up to 1.5m. Seaward of 60m chainage to the rocky foreshore, beach levels have fallen by up to 1.2m. Similar beach levels were last seen on 1st October 2009 (full measures, winter 2009). It is likely that material has been transported across the beach by winter storms. Profile **1aNDC04** is located to the south of Whitley Sands. Since the last survey, there has been a general increase in elevation along the length of the profile. This increase is greatest around MHWS, when the beach has re-profiled to form a beach berm, as shown by the survey photograph in Plate 1, and on the lower beach where the rocky foreshore has been covered by sand.	At the northern end of Whitley Sands beach levels between the toe of the undefended cliffs and MHWS have increased since the last survey (full measures, winter 2011). Over the same period, beach levels have fallen seaward of MHWS. This suggests sediment has been transferred to the back of the beach. Beach levels in the centre and south of the bay have increased along the upper beach the toe of the seawall. The beach has been re-profiled to form a berm. Beach levels on the middle and lower beach have fallen. As in the northern part of the bay, this trend is likely to represent seasonal cross-shore movement of material in response to winter storms. **Longer term trends:** To the north of Whitley Sands, at the toe of the undefended cliffs, beach levels are the highest observed since October 2008.At other locations, beach levels are within the bounds of previous changes. To the centre of the bay, beach levels are similar to those observed in October 2009, suggesting the beaches have been subject to similar forcing conditions over the winter as those in 2009.

Survey Date	Description of Changes Since Last Survey	Interpretation
	Profile **1aNTDC04a** is located to the south of Whitley Sands. Since the last survey, beach levels at the toe of the seawall to a chainage of 40m (level of 1.2m) have increased by up to 1.5m. Seaward of 60m chainage to the rocky foreshore, beach levels have fallen by up to 1.2m.	To the south of Whitley Sand the increases are the largest observed. This suggests particularly significant storms over the winter have transported sediment into the system.

Plate 1 – Survey photograph 1aNTDC04_20120322_N5.JPG

2.2 Cullercoats Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
Mar 2012	**Beach Profiles:** 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 winter 2011 full measures survey. The cliff top position along **1aNTDC05** has remained constant since surveys began in April 2002. Since the last survey the cliff face has retreated by up to 2m towards the top of the cliff. The amount of retreat reduces towards the cliff toe. When compared to other profiles, the cliff was in the same position in September 2010. The survey report notes that '*cliff not measured at section 5 due to dangerous access*'. It is therefore more likely that the changes observed are related to the survey technique used rather than actual change. From the cliff to a chainage of 50m, beach levels have fallen by approximately 0.2m. Seaward of there, with the exception of a length of profile between a chainage of 85m and 105m where beach levels have reduced by 0.1m, beach levels have remained stable since the last survey.	As in the previous survey (full measures, winter 2011), the surveyors report that the cliff has not been surveyed due to dangerous access. It is therefore unclear whether the apparent cut back on the cliff face is actual change or an artefact of the survey point locations. **Longer term trends:** The beach at Cullercoats Bay has remained stable since the last survey. This trend is a continuation of that observed since the full measures survey in February 2010 and as noted in the previous survey report, this is because the beach is well sheltered by the Cullercoats piers.

2.3 Tynemouth Long Sands

Survey Date	Description of Changes Since Last Survey	Interpretation
Mar 2012	**Beach Profiles:** 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, has been added in the centre of the frontage after that. From spring 2010 (partial measures) onwards, they have been surveyed bi-annually. The last survey was the winter 2011 full measures survey. **1aNTDC06** is located approximately 150m south of the access road/ramp towards the north of the bay. Beach levels at the toe of dune-cliff have increased since the last survey to form two small berms at HAT and MHWS. Otherwise, beach levels have oscillated along the profile by approximately 0.3m. At profile **1aNTDC06A**, the dune-cliff face has not changed in form or position. Since the last survey, beach levels have generally increased across the length of the profile. This increase is greatest around HAT and MHWS, where two berms have formed. Profile **1aNTDC07** is located approximately 50m south of the access route through the dunes towards the southern end of the bay. No changes in form or position of the dune-cliff face since the last survey. With the exception of a small increase in beach levels of 0.5m at HAT and MHWS where two small berms have formed beach levels have remained stable.	Since the last survey, the dunes have retained the same form and position. The survey photographs show that the dunes are well vegetated, which indicates stability. In addition, the photographs show the presence of stabilisation fencing. The beaches have generally retained stable, with some fall in levels at discrete locations. Along the length of the coastline, two small berms have formed at HAT and MHWS. This is to be expected over the winter months as the beach responds to storm conditions and sediment is transported landwards. **Longer term trends:** Overall, the beaches have remained stable. This is consistent with the surveys taken since the partial measures survey in spring 2010 that signal a limited pattern of cross-shore transport and redistribution of sediment across the profile.
Apr 2012	**Topographic Survey:** Tynemouth Long Sands is a new survey area. The first survey was undertaken for the full measures survey in October 2011. 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. The topographic changes can be split into those taking place to the north and those taking place to the south of Tynemouth Long Sands. To the north, there is a band of elevation gain along the toe of the	**Longer term trends:** This is the first survey where a comparison to previous data is possible, so longer term trends cannot be deduced. The pattern of change in the 6 months between surveys is an increase in beach elevation along the dune toe, erosion of the middle beach to the north and general stability to the south, as seen with the beach profiles. This pattern of landwards transfer of sediment is consistent with adjacent areas of beach and is typical of winter storms.

Survey Date	Description of Changes Since Last Survey	Interpretation
	dune-cliff. Fronting that is a band of beach elevation decrease along the middle beach, and a band of gain that runs along the lower beach. To the south, the changes are less well defined, with a large proportion of the beach experiencing elevation change of less than 0.1m. There is a band of elevation gain along the toe of the dune-cliff. The beach in the lee of Sharpness Point has reduced in elevation.	

2.4 King Edward's Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
Mar 2012	**Beach Profiles:** 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 winter 2011 full measures survey. At profile **1aNTDC08** beach levels at the toe of the seawall have increased since the last survey to form two berms at HAT and MHWS. Otherwise, beach levels have oscillated along the profile by approximately 0.2m.	The beach at King Edward's Bay has been re-profiled since the last survey to form an undulating profile with berms at HAT and MHWS. This is to be expected over the winter months as the beach responds to storm conditions. **Longer term trends:** The trends along the lower and middle beach are mostly consistent with the last four surveys (i.e. since 15th February 2010, partial measures, spring 2010). The last time that a similar berm was observed in the data series was 1st October 2009. This is comparable with the observations made for Whitely Sands, further suggesting that over the winter the beaches were subject to similar forcing conditions to those during 2009.

3. Problems Encountered and Uncertainty in Analysis

Individual Profiles

At profile 1aNTDC05 the cliff was not measured due to dangerous access. The plot of profiles, which plots straight lines between the survey points suggests that the cliff face may have retreated by up to 2m towards the top of the cliff. The survey report notes that '*cliff not measured at section 5 due to dangerous access'*. When compared to other profiles, the cliff was in the same position in September 2010. It is therefore more likely that the changes observed are related to the survey technique used rather than actual change.

At profile 1aNTDC07, there was no access to the middle of the profile due to seedling protection fences.

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

No changes are recommended at the present time.

5. Conclusions and Areas of Concern

- At Whitley Sands, the recorded profiles present no causes for concern.
- At Cullercoats Bay, the recorded profiles present no causes for concern.
- At Tynemouth Long Sands, the recorded profiles and topographic survey present no causes for concern.
- At King Edward's Bay, the recorded profiles present no causes for concern.

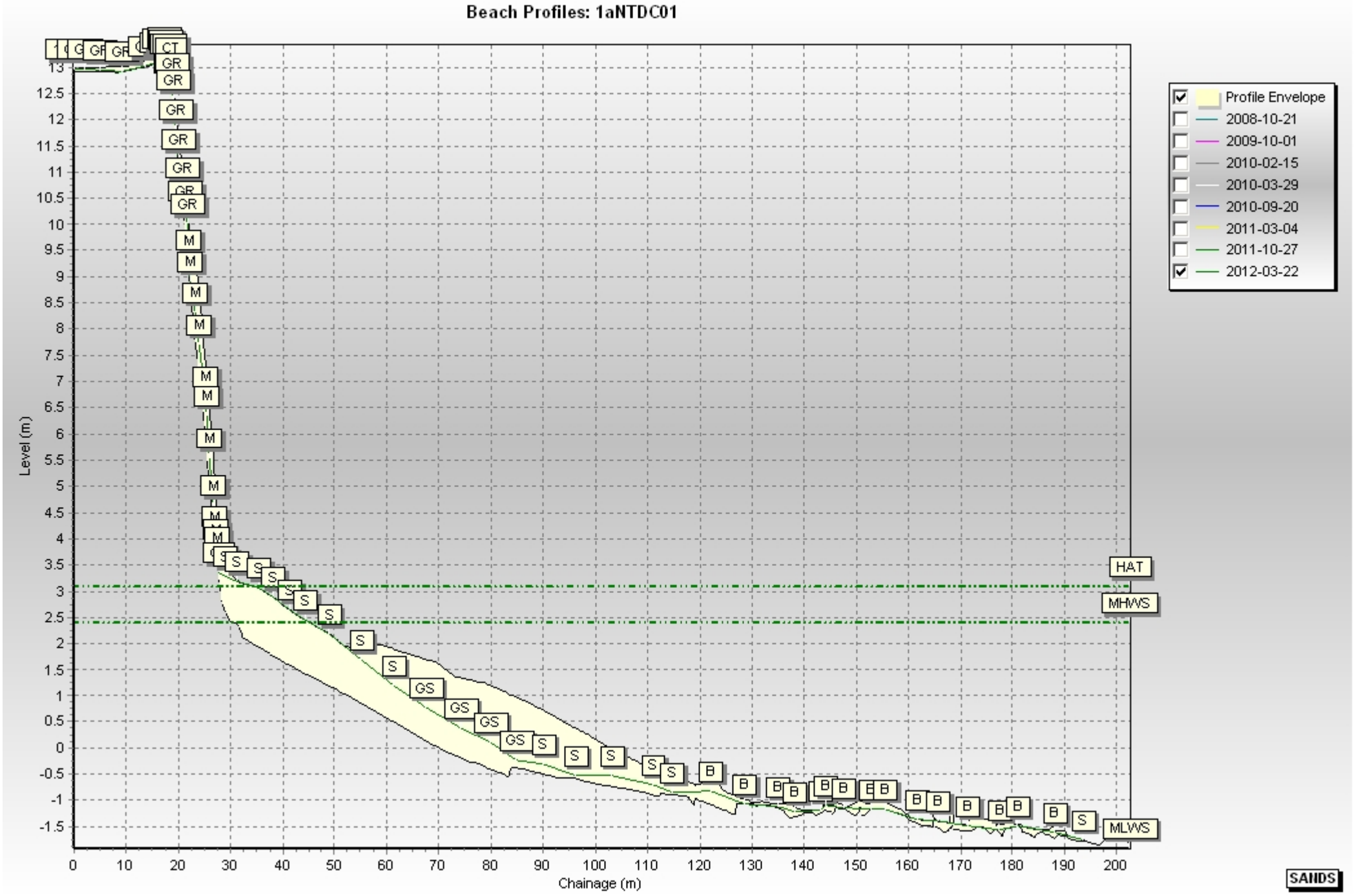
Appendices

Appendix A

Beach Profiles

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

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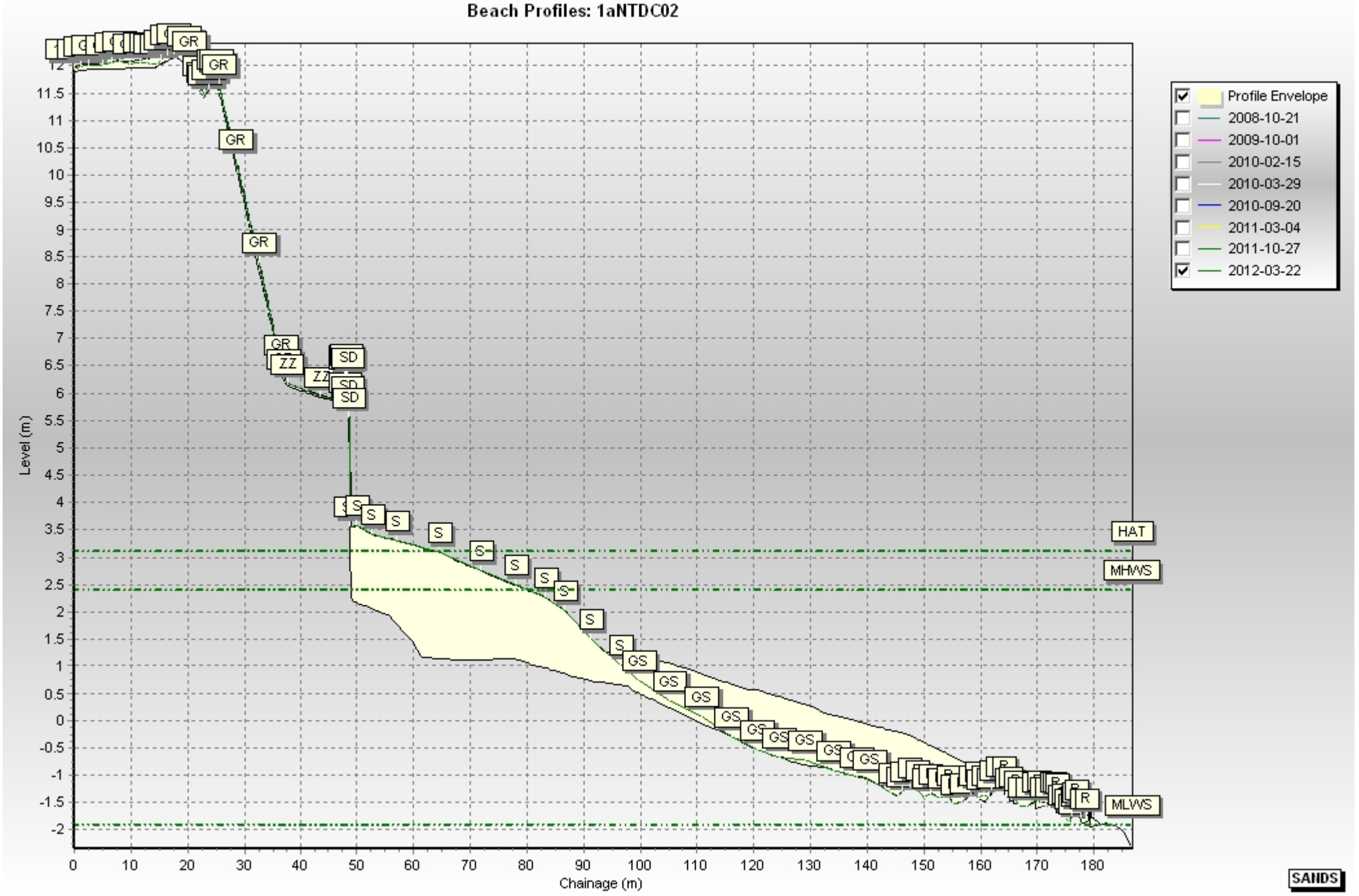
MHWS
MLWS
Level (m)
Chainage (m)
SANDS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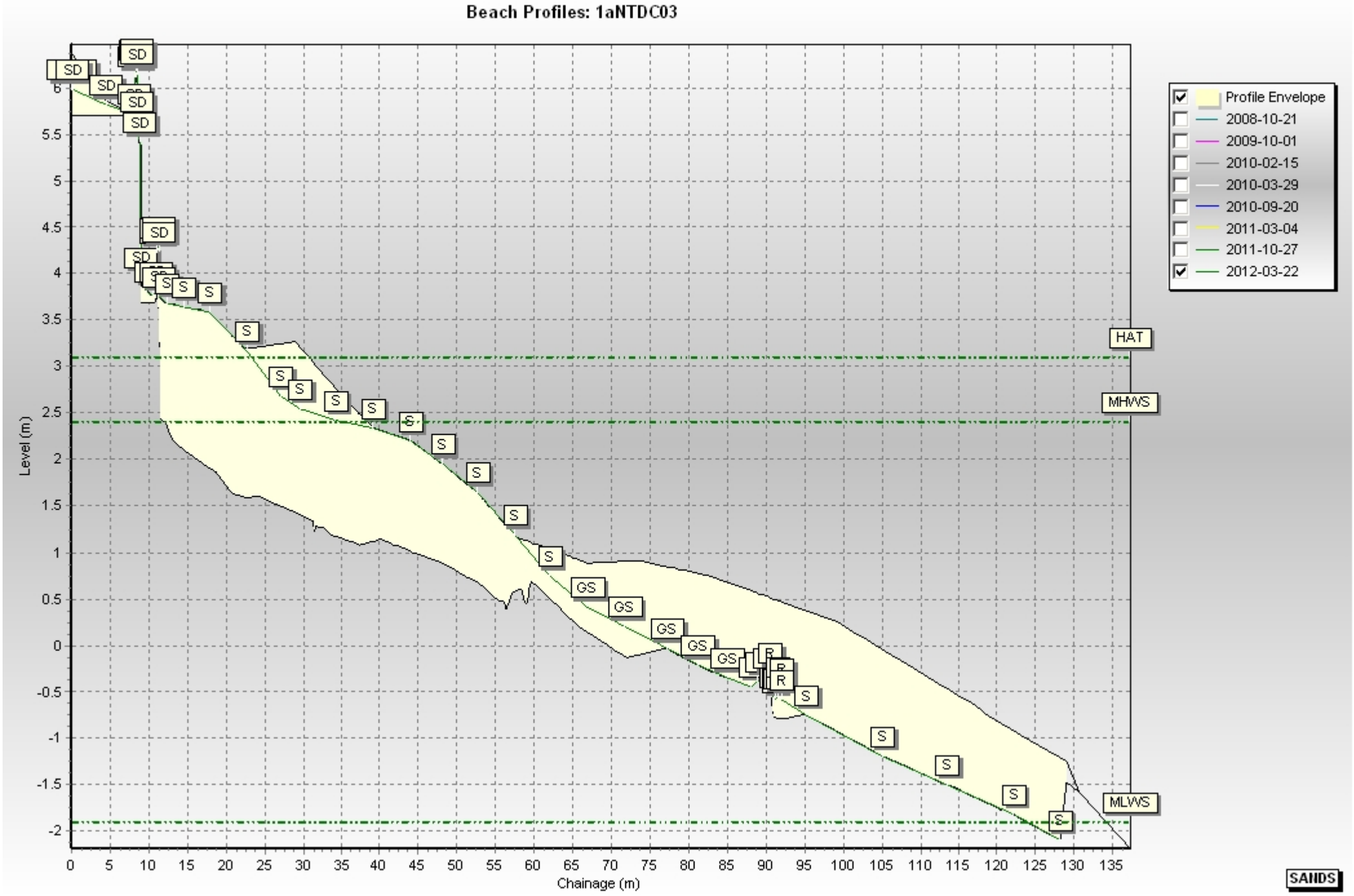
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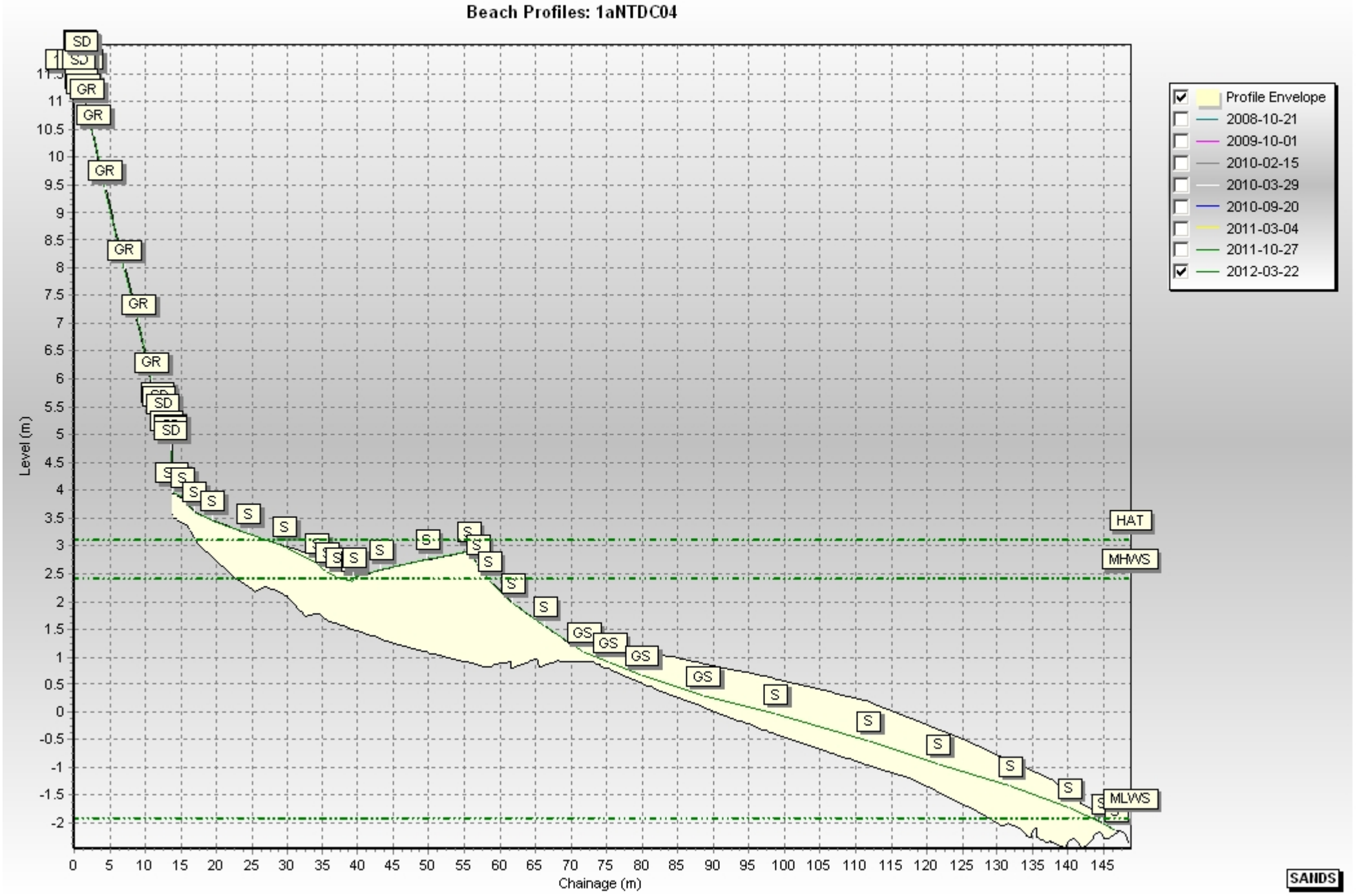
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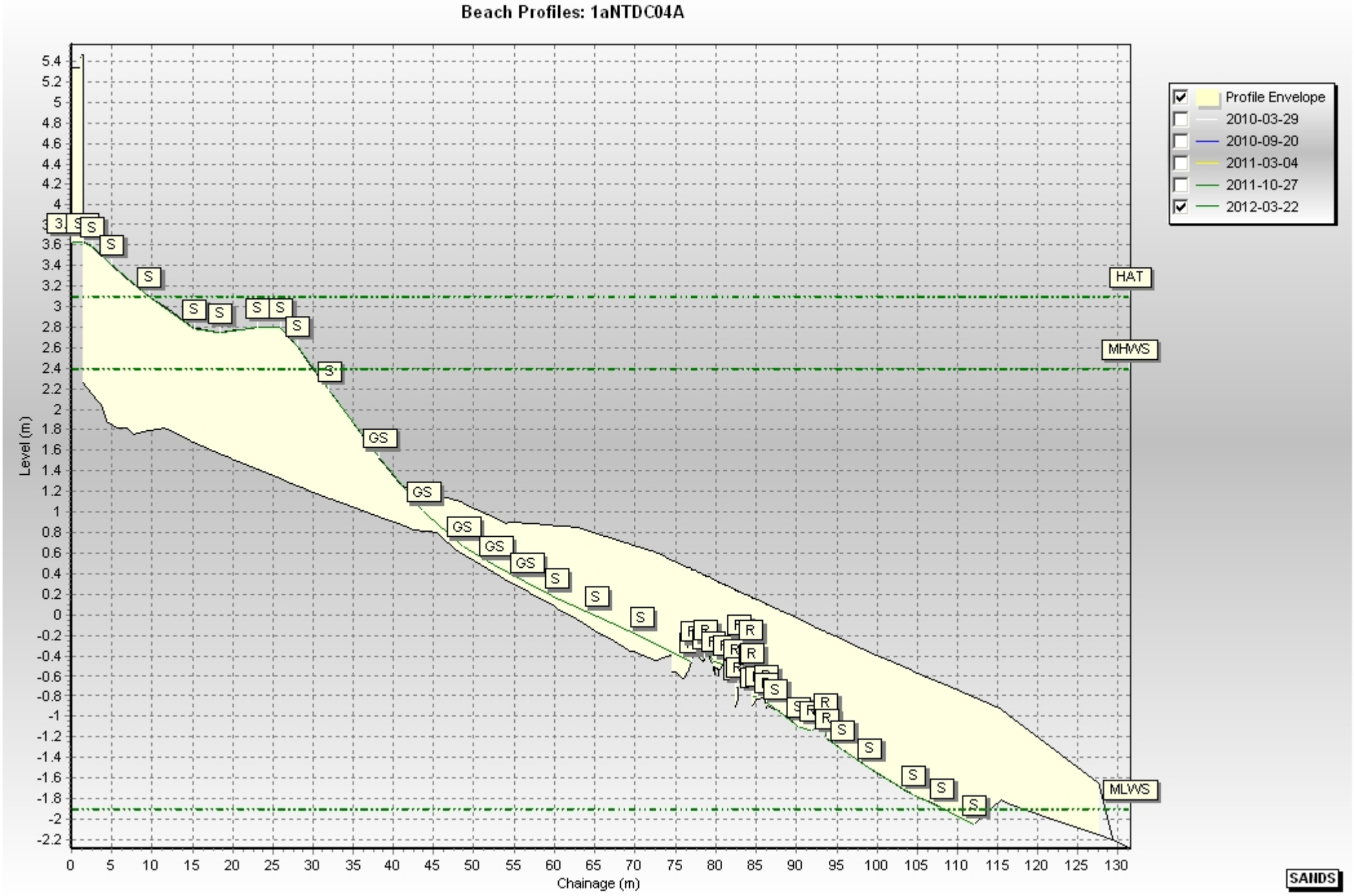
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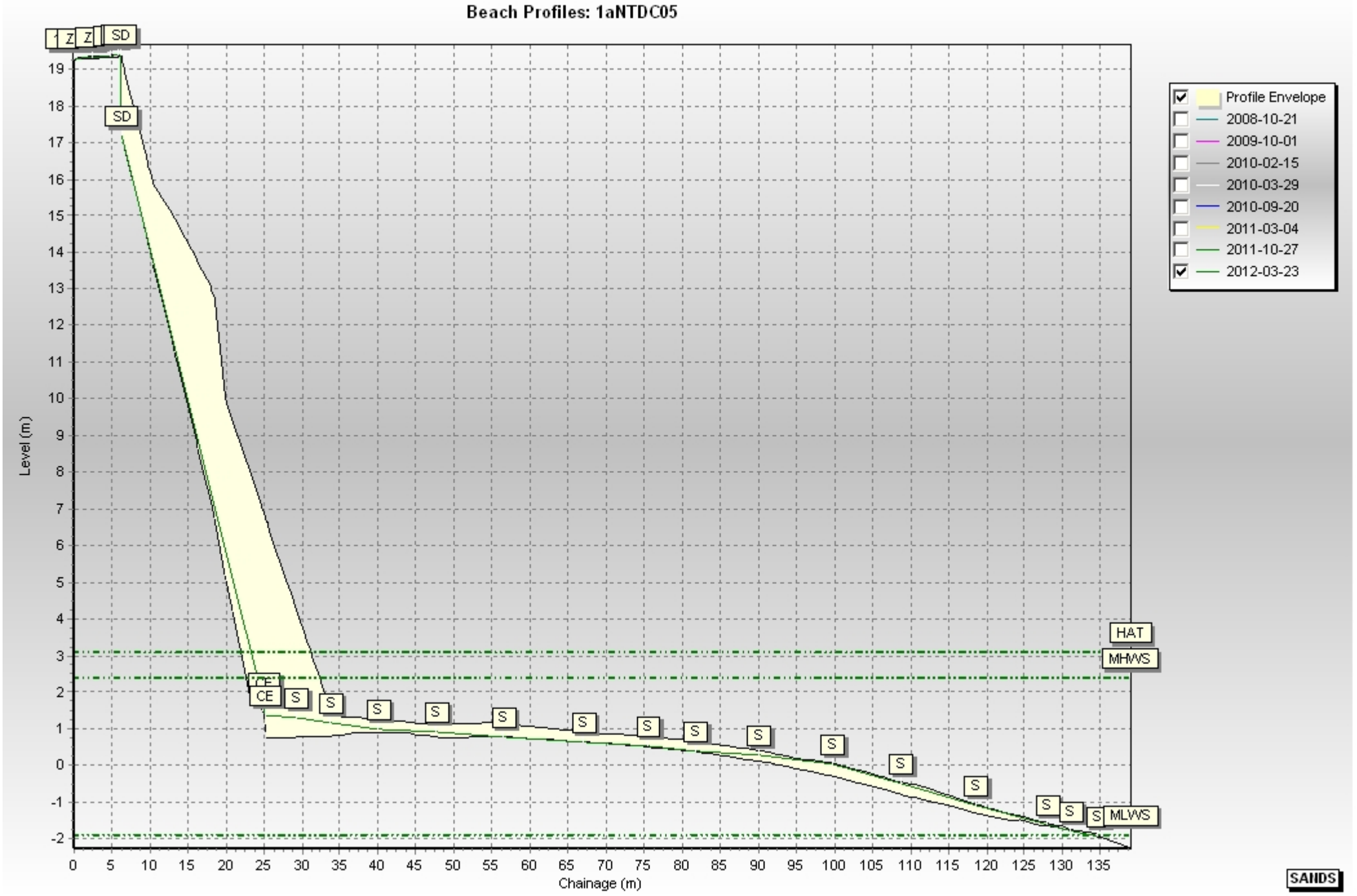
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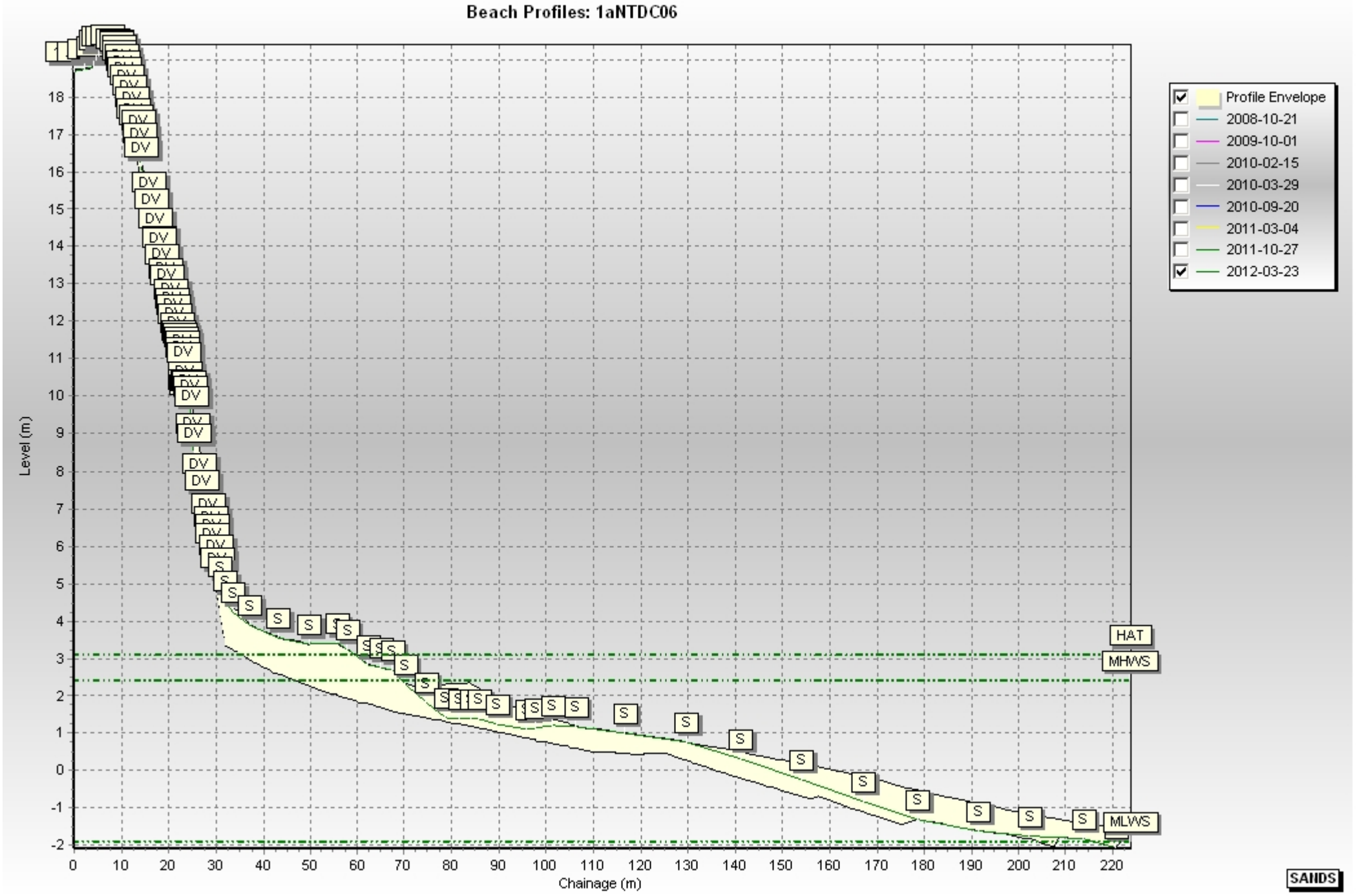
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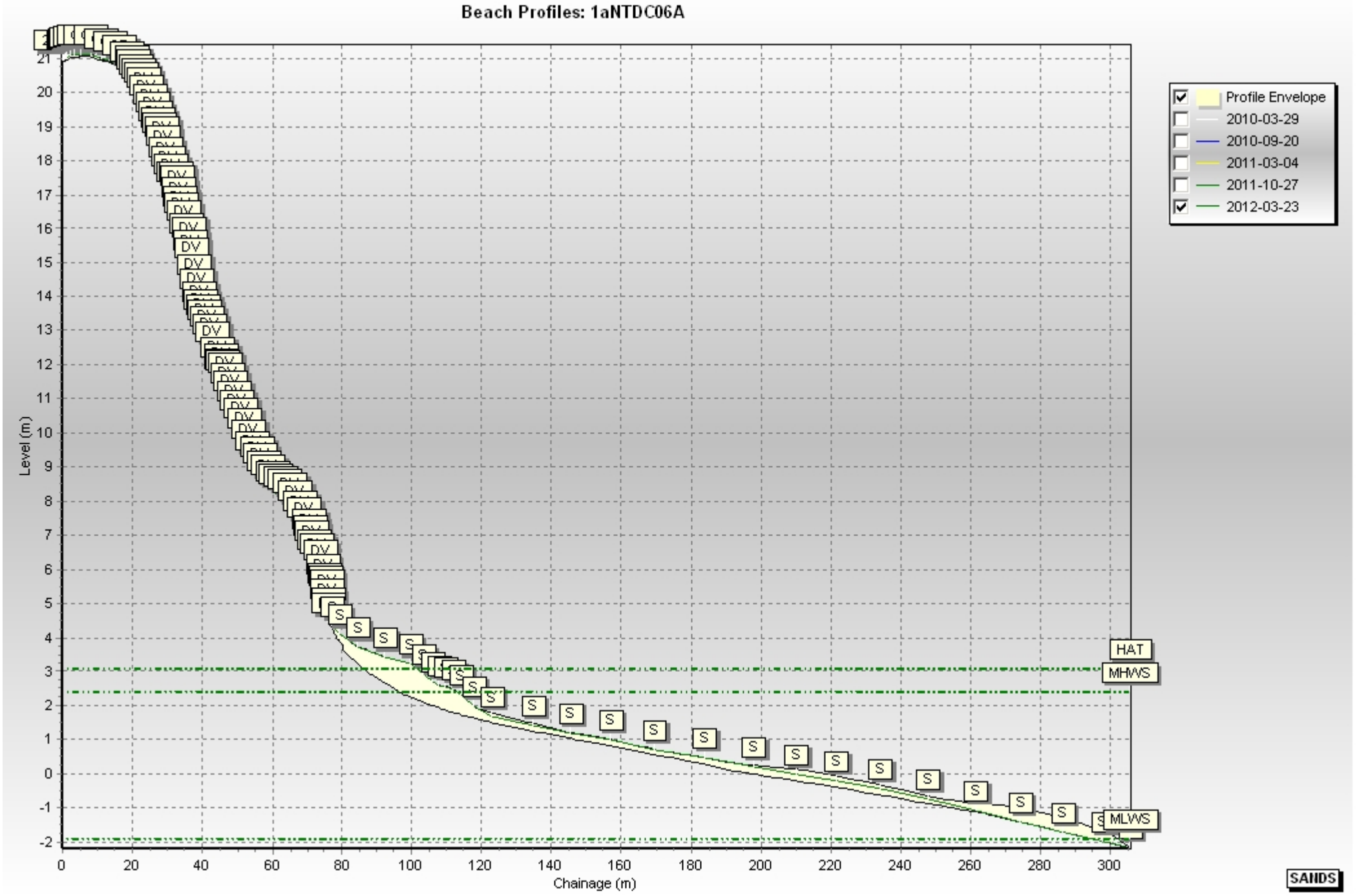
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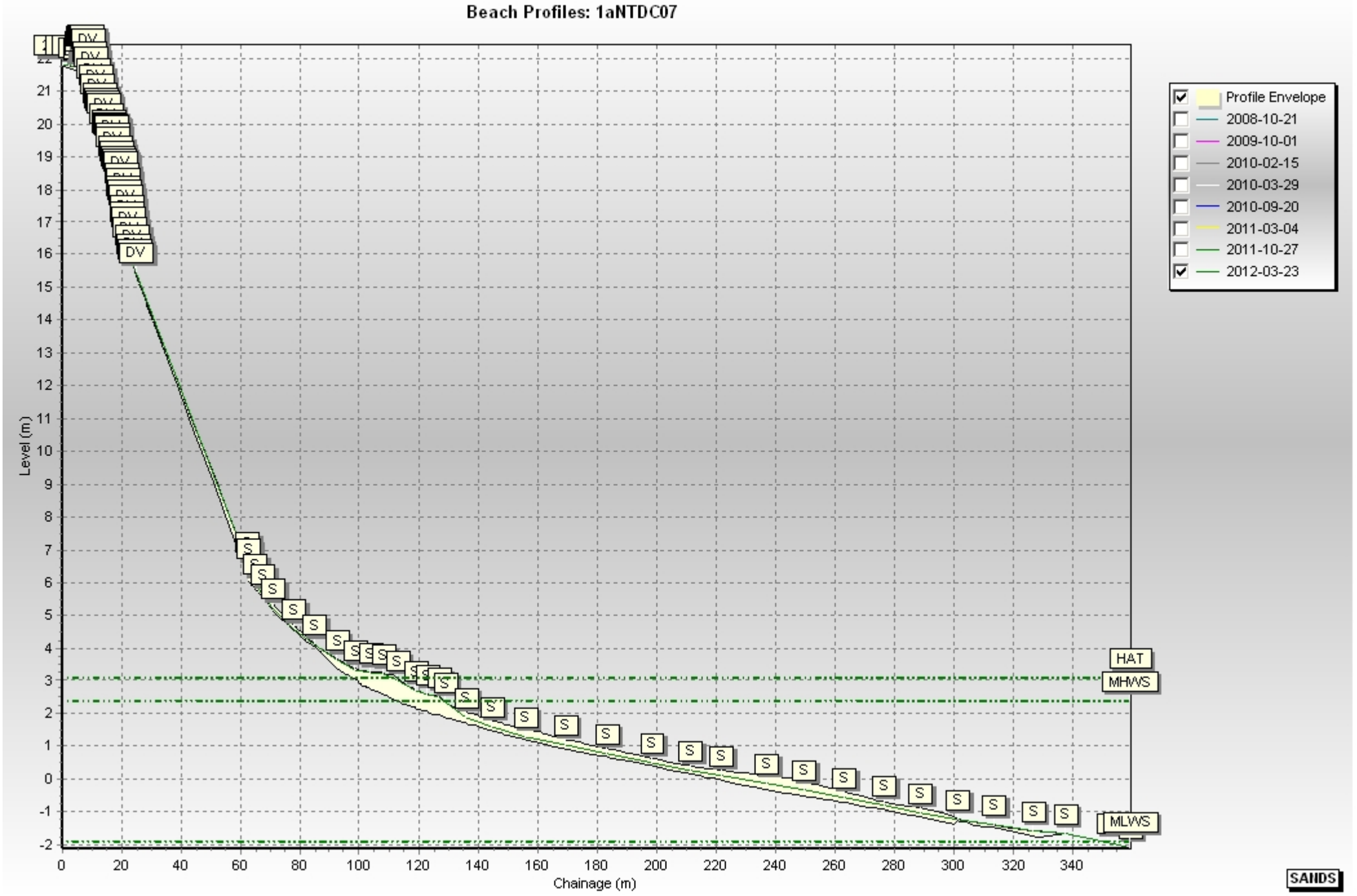
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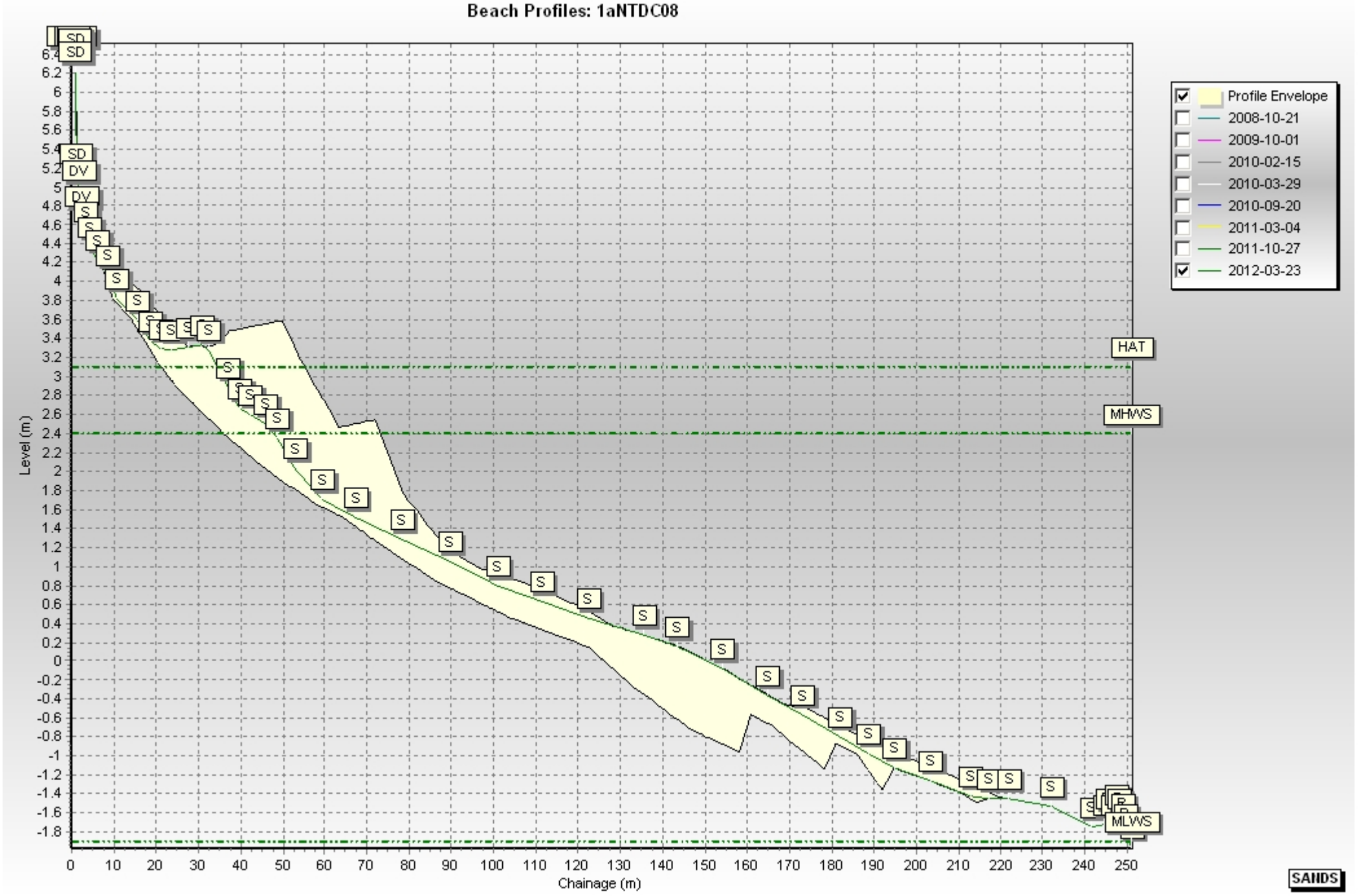
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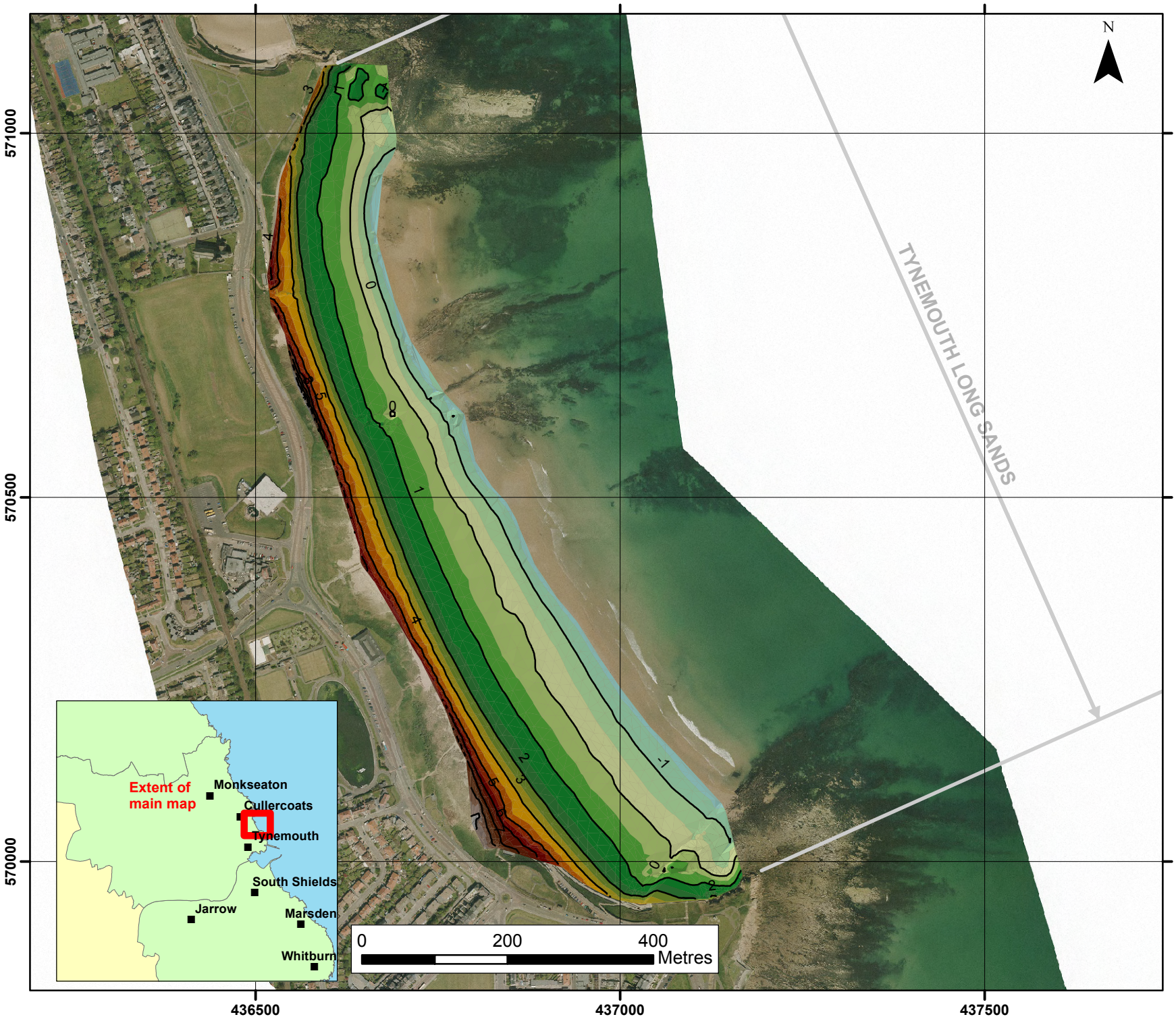
MLWS
Level (m)
Chainage (m)
SANDS

Appendix B

Topographic Survey



KEY

Elevation (m OD)	
9.5 - 10	3 - 3.5
9 - 9.5	2.5 - 3
8.5 - 9	2 - 2.5
8 - 8.5	1.5 - 2
7.5 - 8	1 - 1.5
7 - 7.5	0.5 - 1
6.5 - 7	0 - 0.5
6 - 6.5	-0.5 - 0
5.5 - 6	-1 - -0.5
5 - 5.5	-1.5 - -1
4.5 - 5	-2 - -1.5
4 - 4.5	1m contour
3.5 - 4	

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme 2011 to 2016

Appendix B - Map 1a
Topographic Survey
Tynemouth Long Sands
North Tyneside Council

Update Report 4
Partial Measures Survey
Spring 2012

Halcrow
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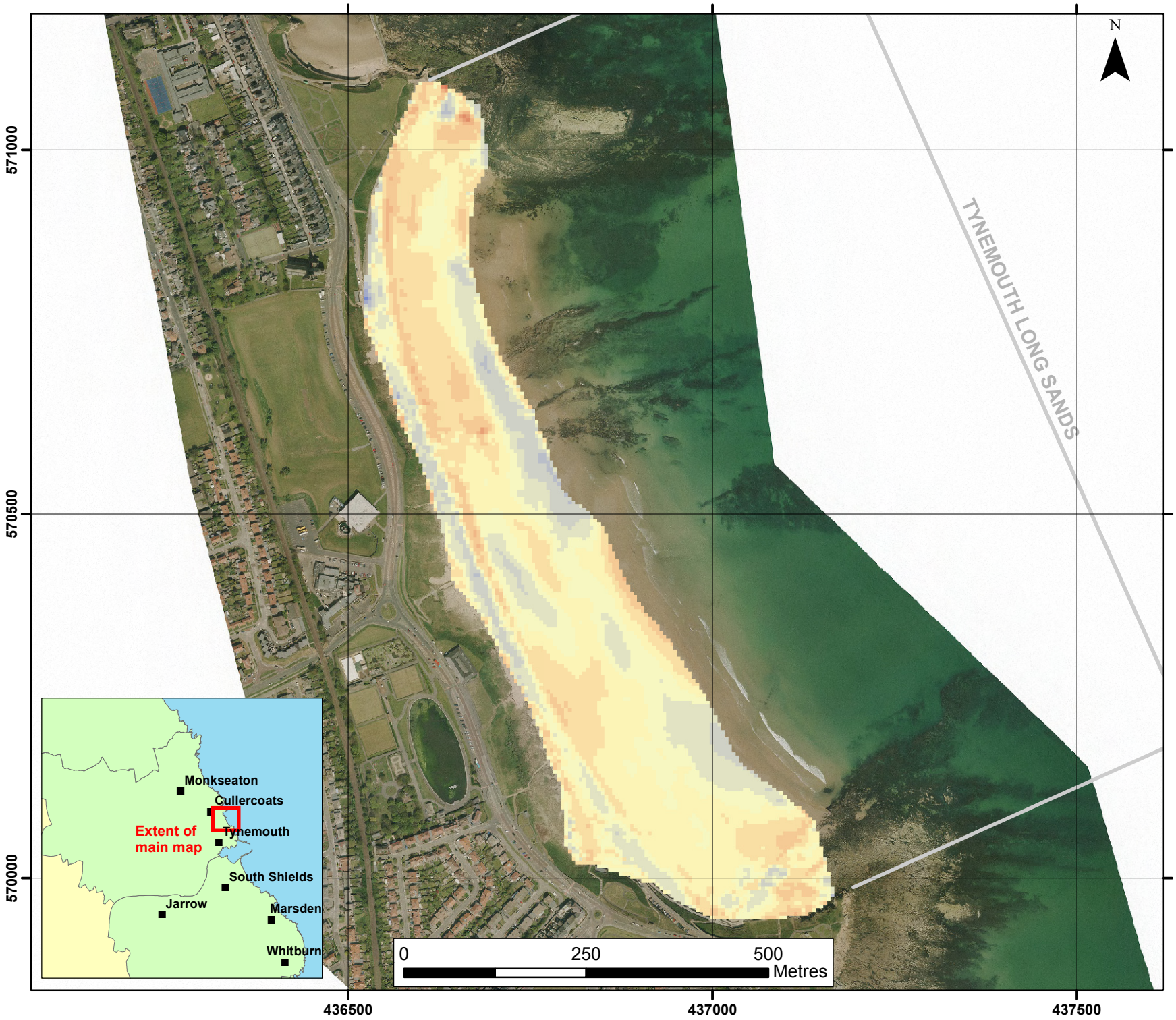
Photography courtesy of North East Coastal Observatory
www.northeastcoastalobservatory.org.uk



KEY Winter 2011 to Spring 2012
Change in elevation (m OD)

<-2	Loss
-2 - -1.75	
-1.75 - -1.5	
-1.5- -1.25	
-1.25 - -1	
-1 - -0.75	
-0.75 - -0.5	
-0.5 - -0.25	
-0.25 - -0.1	
-0.1 - 0	Change < 0.1 m
0 - 0.1	
0.1 - 0.25	Gain
0.25 - 0.5	
0.5 - 0.75	
0.75 - 1	
1 - 1.25	
1.25 - 1.5	
1.5 - 1.75	
1.75 - 2	
>2	

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme 2011 to 2016

Appendix B - Map 1b
Topographic Difference
Tynemouth Long Sands
North Tyneside Council

Update Report 4
Partial Measures Survey
Spring 2012

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