

**Cell 1 Regional Coastal Monitoring Programme
Update Report 5: 'Partial Measures' Survey 2013**



North Tyneside Council

**North Tyneside Council
Final Report**

June 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).

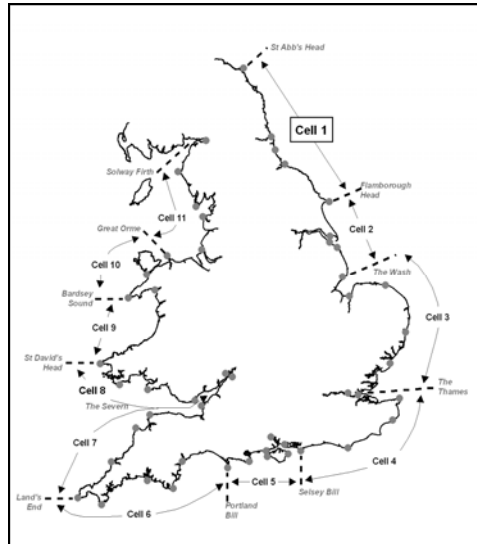


Figure 1 Sediment Cells in England and Wales

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 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	
5	2012/13	Sept-Oct 12	Mar 13	Mar-Apr 13	June 13 (*)	

(*) The present report is **Update Report 5** and provides an analysis of the 2013 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:

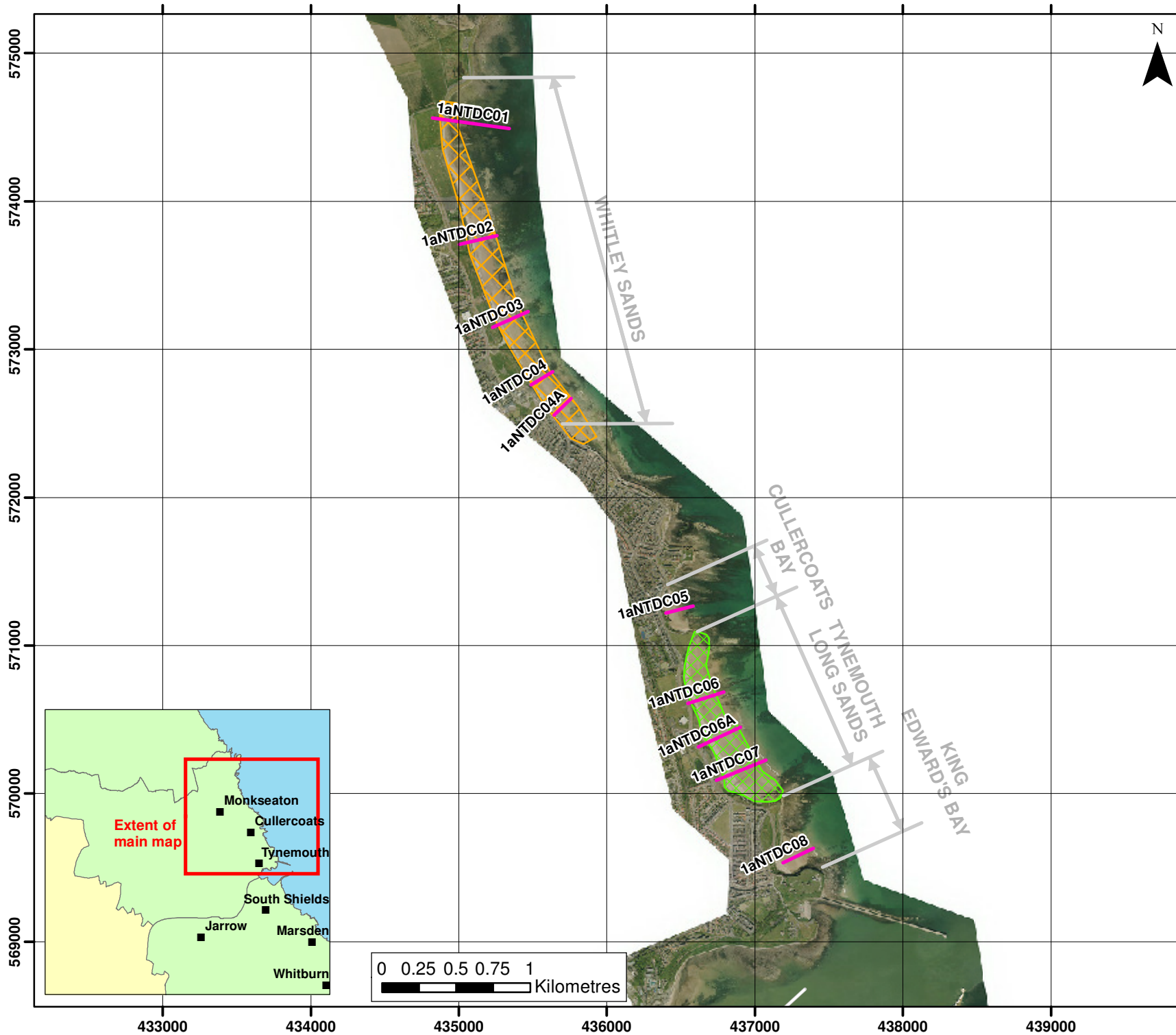
- Full Measures survey annually each autumn comprising:
 - Beach profile surveys along eight transect lines (commenced 2002)
 - Beach profile surveys along an additional two transects (commenced 2010)
 - Topographic survey along Whitley Sands (commenced 2010)
 - Topographic survey along Tynemouth Long 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 2013 surveys were undertaken along this frontage between 12th March 2013 and 23rd April 2013. During this time weather conditions varied to some degree; 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 (blue line)
 — 6 monthly (pink line)

Topographic Surveys
 ▨ 6 monthly (green cross-hatch)
 ▨ yearly (orange cross-hatch)
 ▨ 5 yearly (brown cross-hatch)

Cliff Top Monitoring Pegs
 ■ 50m centres (purple line)
 ■ 100m centres (green line)
 ■ 300m centres (red line)

(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 5
 Partial Measures Survey
 Spring 2013

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2. Analysis of Survey Data

2.1 Whitley Sands

Survey Date	Description of Changes Since Last Survey	Interpretation
Mar 2013	<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 re-surveyed annually to 2009 (Full Measures, autumn 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 autumn 2012 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. From the toe of the cliff to a chainage of 45m (just below MHWS), beach levels have fallen by 0.2m, however, seawards of this beach levels have increased along the length of the profile by up to 1m, so that in places the rocky foreshore is overlain by sand (as shown by the survey photograph in Plate 1).</p> <p>Profile 1aNTDC02 is located to the north of Whitley Sands opposite the seawall. Beach levels from the toe of the seawall to a chainage of 155m have dropped considerably since the last survey. This is by over 2m at the seawall toe, where coarse shingle has been exposed beneath the sand (the difference is shown in the survey photographs in Plates 2 and 3 respectively). Seaward of a chainage of 155m (and a level of -1m), beach levels have increased to form a berm, which may be the material drawn-down from the upper/middle beach during winter storms.</p> <p>Profile 1aNTDC03 is located at the centre of Whitley Sands. Beach levels have generally reduced across the length of this profile by approximately 0.3m, the exception being a short-length of beach between a chainage of 45m and 75m (a level of 0.5m and 1.2m) where beach levels have increased by 0.3m.</p> <p>Profile 1aNTDC04 is located to the south of Whitley Sands. The beach at 1aNTDC04 has behaved similarly to 1aNTDC03, with a general drop in beach levels across the length of this profile by</p>	<p>Since the last survey, along the length of Whitley Sands, beach levels have fallen quite considerably, which is a typical, if extreme, response to winter storms. At profiles 1aNTDC02, 1aNTDC04 and 1aNTDC04A, sand has been eroded to expose the underlying coarse shingle on the foreshore 1aNTDC04A, the rocky foreshore. A berm is present on the lower shore of profile 1aNTDC01. These changes suggest the occurrence of significant storms over the winter months, which have resulted in draw-down of the overlying sand (and a lowering of beach levels) with storage on the lower beach, as observed to the north of the Whitley Sands, or, further offshore as seen on the beaches to the centre and south of Whitley Sands.</p> <p>Longer term trends: At most locations, beach levels are within the bounds of previous changes and beach levels have historically been higher and lower when compared to present levels. The exceptions are 1aNTDC02 and 1aNTDC04A:</p> <ul style="list-style-type: none"> At profile 1aNTDC02, between a chainage of 70m and 105m, beach levels are the lowest observed to date (*April 2002, when monitoring began), and seaward of a chainage of 155m (where the berm has formed), the highest observed to date (*).

Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>approximately 0.3m, the exception being a short-length of beach between a chainage of 60m and 95m (a level of 1m and 0m) where beach levels have increased by 0.3m. There has been a notable change in sediment type on the beach, with a switch from sand to coarse shingle, as shown by the survey photographs in Plates 4 and 5). The survey photograph from the Full Measures 2011 survey (see Plate 6), also shows the presence of the coarse shingle beach. This suggests that this material is likely to have been exposed from beneath the overlying sand rather than the deposition of a new supply of material since the last survey</p> <p>Profile 1aNTDC04a is located to the south of Whitley Sands. Beach levels have fallen considerably, by approximately 1.25m, across the length of the profile. The toe of the revetment steps has been exposed (shown by the survey photographs in Plates 7 and 8) and further seaward, the underlying rocky foreshore around a level of 0m (seaward of a chainage of 50m) has also become exposed.</p>	<ul style="list-style-type: none"> • At profile 1aNTDC04A, beach levels are the lowest observed to date (*March 2010, when monitoring began) by up to 0.8m.



Plate 1 – Survey photograph 1aNTDC01_20130312_N10.JPG



Plate 2 – Survey photograph 1aNTDC01_20130312_N5.jpg



Plate 3 – Survey photograph 1aNTDC02_20120928_N5.jpg



Plate 4 – Survey photograph 1aNTDC04_20130312_N2.jpg



Plate 5 – Survey photograph 1aNTDC02_20120928_N3.jpg



Plate 6 – Survey photograph 1aNTDC04_20111027_N3.jpg



Plate 7 – Survey photograph 1aNTDC04a_20130312_N1.jpg



Plate 8 – Survey photograph 1aNTDC04A_20120928_N1.jpg

2.2 Cullercoats Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
Apr 2013	<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 2012 Full Measures survey.</p> <p>The cliff top position along 1aNTDC05 has remained constant since surveys began in April 2002, but there are apparent changes along the cliff face where the toe has moved seawards by 0.5m to 1m. The survey report notes that '<i>cliff not measured at section 5 due to dangerous access</i>'. It is therefore more likely that the changes observed are related to the survey technique used rather than actual change.</p> <p>From the cliff toe to a chainage of 100m, beach levels have dropped by 0.3m. Seaward of there, beach levels have increased by a similar magnitude. This suggests that material has been drawn-down from the upper/middle beach to the lower beach during winter storms.</p>	<p>As in the previous surveys (Full Measures, autumn 2011, Full Measures, autumn 2012), the surveyors report that the cliff has not been surveyed due to dangerous access. It is therefore unlikely that the apparent seaward movement (accretion) on the cliff toe is actual change and instead related to the survey technique used rather than actual change.</p> <p>The beach has remained relatively stable, with only a small fluctuation in beach levels and no change in form.</p> <p>Longer term trends: Between a chainage of 55m and 95m, beach levels are the lowest observed to date (*2002, when monitoring began), and seaward of a chainage of 110m, the highest observed to date (*).</p>

2.3 Tynemouth Long Sands

Survey Date	Description of Changes Since Last Survey	Interpretation
<p>Apr 2013</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, 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 autumn 2012 Full Measures survey.</p> <p>1aNTDC06 is located approximately 150m south of the access road/ramp towards the north of the bay. The dune-cliff face has not changed in form or position, although the survey report notes '<i>mud slips showing on section 6, sand encroaching up the dunes</i>'. Beach levels have fluctuated along the length of this profile, with a reduction at the toe of the dune-cliff to a chainage of 80m and between a chainage of 115m and 150m. Between a chainage of 80m and seawards of 150m, beach levels have increased. The magnitude of chainage is in the order of. 0.5m across the profile, suggesting a cross-shore movement of material.</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. This is explained by the note in the survey report; which states '<i>no access to middle of section 6A due to seed protection fences</i>'. Review of the survey photographs for the past four surveys (refer to Plates 9, 10, 11 and 12), show how the vegetation cover on the dunes has changed from well-vegetated, to the present survey, where the dune-cliff face is bare and devoid of vegetation. This may be a result of increased aridity, string winds, or human activities. Beach levels have fallen across the profile, with greatest change (1m) occurring at the toe of the dune-cliff face, around MHWS.</p> <p>Profile 1aNTDC07 is located approximately 50m south of the access route through the dunes towards the southern end of the bay. The profile for the dune-cliff face is a straight line; a result of a lack of data points in the profile plot. This is explained by the note in the survey report; which states '<i>no access to middle of section 7 due to seed protection fences</i>'. Beach levels have fallen across the profile, by approximately 0.5m. As with profile 1aNTDC06A, the change is greatest around MHWS, where beach levels have fallen by up to 1m.</p>	<p>At Tynemouth Long Sands, the dune-cliff face has been subject to change, although the profile plots suggest that it has not changed in from or position since the last survey. At profile 1aNTDC06, the survey report notes that mud slips have occurred and are encroaching up the dunes and at profile 1aNTDC06A, the survey photographs for the past four surveys show that the dune-cliff face has changed from well-vegetated to the present survey, where the dune-cliff face is devoid of vegetation. This may be a result of increased aridity, string winds, or human activities. The survey report notes for both 1aNTDC06A and 1aNTDC07 that access to the dunes was not possible due to seed protection fences, which suggests that efforts are being made to help stabilise the dunes.</p> <p>Beach levels along the length of coastline here have fallen between 0.5m and 1m. To the north, at profile 1aNTDC06, the beach is a little more dynamic, with alternating change in beach levels (fall and increase) in a cross-shore direction.</p> <p>Longer term trends: Overall, the beaches have retained a similar form, however, particularly at profiles 1aNTD06A and 1aNTDC0, beach levels are the lowest recorded to date (2010 and 2002 respectively, when monitoring began).</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
Apr 2013	<p>Topographic Survey:</p> <p>Tynemouth Long Sands is a new survey area. The first survey 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>In particular the difference plot shows (i) a general reduction in beach levels to the south of Tynemouth Long Sands between 0m and 1m; and (ii) a dynamic beach to the north, with alternating parallel strips of beach elevation reduction and increase, in the order of 1m, indicating migration of sand bars. These findings correspond well to the each profile surveys, which show alternating changes in beach levels (fall and increase) in a cross-shore direction.</p>	<p>Since the last survey, the beach to the north of Tynemouth Long Sands has been more dynamic, with alternating parallel bars of beach elevation reduction and increase. To the south, beach elevation has generally reduced across the beach in the order of 0m to 1m.</p> <p>Longer term trends: The longer term trends are covered by the long term topographic trends autumn 2010 to autumn 2013 (see next report, Full Measures 2013).</p>



Plate 9 – Survey photograph 1aNTDC06a_20130408_N10.JPG



Plate 10 – Survey photograph 1aNTDC06A_20121002_N6.JPG



Plate 11 – Survey photograph 1aNTDC06A_20120323_N7.JPG



Plate 12 – Survey photograph 1aNTDC06A_20111027_N3.JPG

2.4 King Edward's Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
<p>Apr 2013</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 2012 Full Measures survey.</p> <p>At profile 1aNTDC08 beach levels have reduced considerably (0.6m) across the profile since the last survey. The beach has become slightly steeper and narrower at the toe of the seawall, otherwise, it has retained a similar form.</p>	<p>Since the last survey, the beach at King Edward's Bay beach has become narrower and steeper at the toe of the seawall, but otherwise only lower and retaining a similar form.</p> <p>Longer term trends: Between HAT and a chainage of 80m, beach levels are the lowest observed to date. Otherwise, beach levels are within the bounds of previous changes, and beach levels have historically been both higher and lower when compared to present levels.</p>

3. Problems Encountered and Uncertainty in Analysis

Individual Profiles

At profile 1aNTDC05 the cliff was not measured due to dangerous access. The plot of the Profile therefore shows movement of the cliff toe seawards by 0.5m to 1m, which is misleading. Access to this profile is noted to have been dangerous in the previous partial measures and full measures reports, and therefore consideration should be given to changing the location of this survey.

At profile 1aNTDC06, mud slips were observed and sand was encroaching up the dunes.

At profile 1aNTDC06A, there was no access to the middle of the profile due to seedling protection fences.

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

Topographic Survey

At Tynemouth Long Sands, the topographic survey report notes:

- 'slips evident on face of dunes'.
- 'spring at south end of beach in deep channel'.

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, 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 therefore consideration should be given to changing the location of this survey.
- At Tynemouth Long Sands, at profile 1aNTDC06A, survey photographs show a reduction in vegetation cover on the dunes, which may be due to increased aridity, strong winds, drying of sand or human activities. Protection fences have been installed and their effectiveness in stabilising the dunes can be monitored by future surveys.
- Elsewhere along 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.

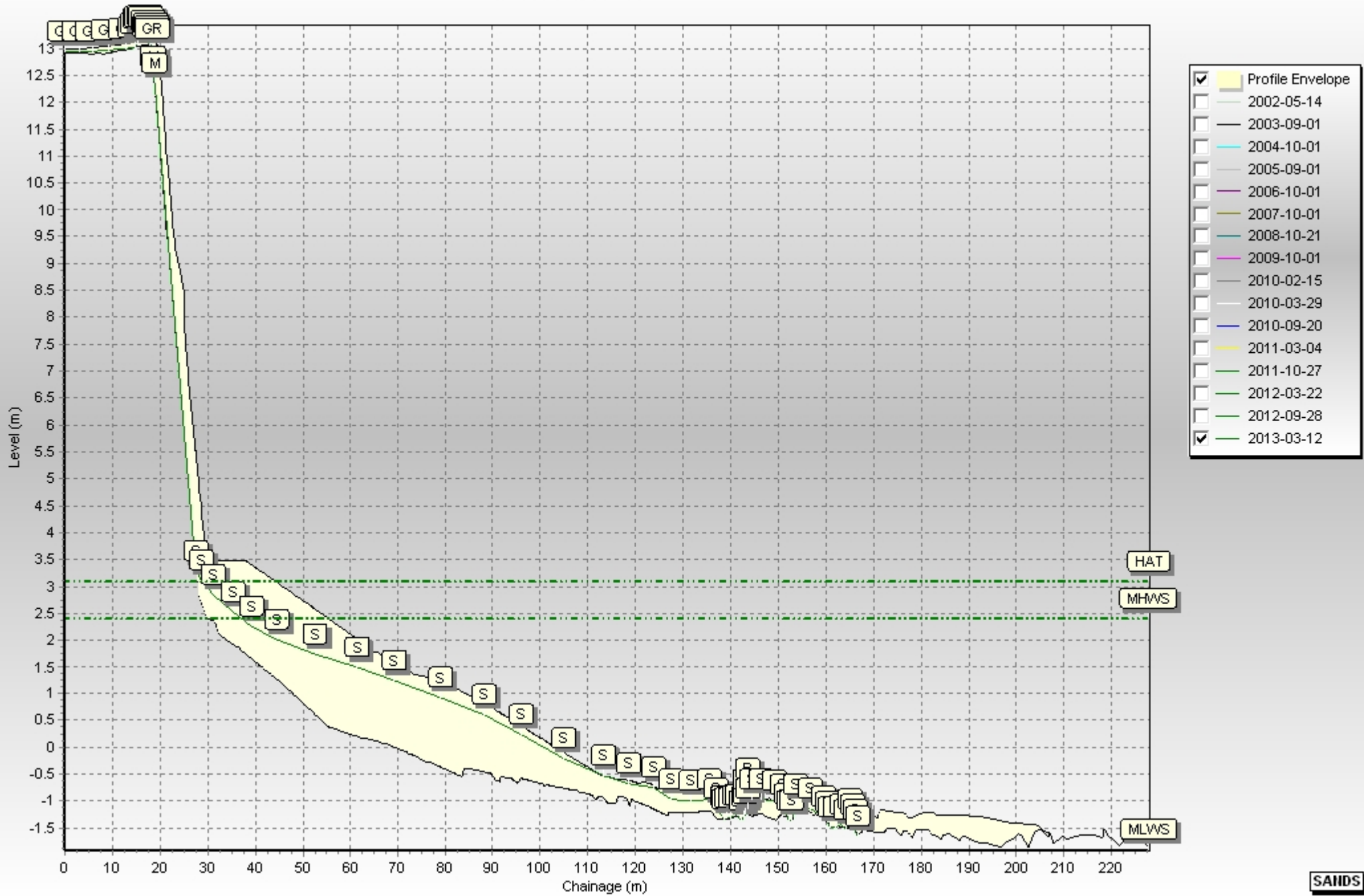
Appendices

Appendix A
Beach Profiles

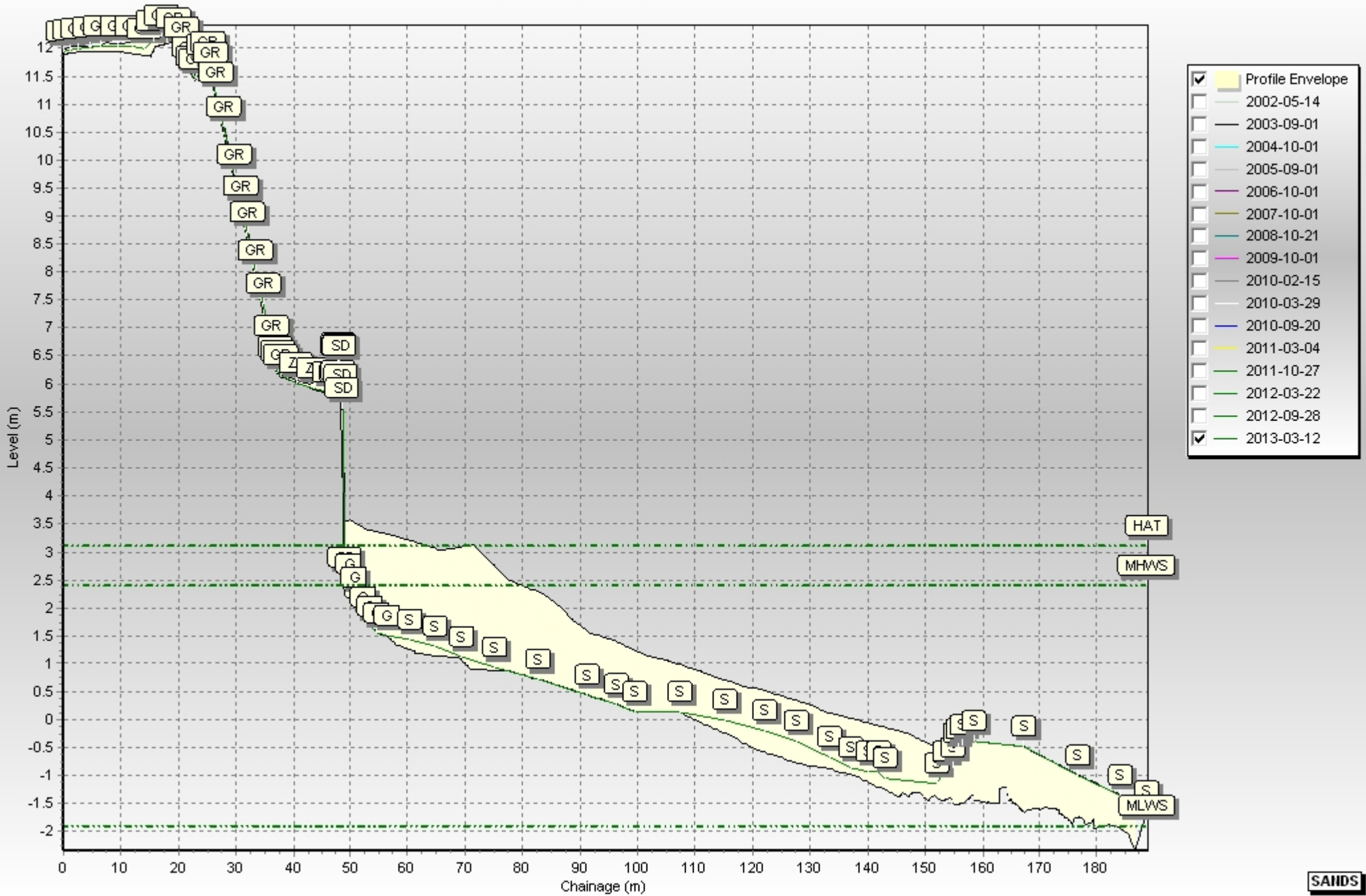
The following sediment feature codes are used on some profile plots:

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

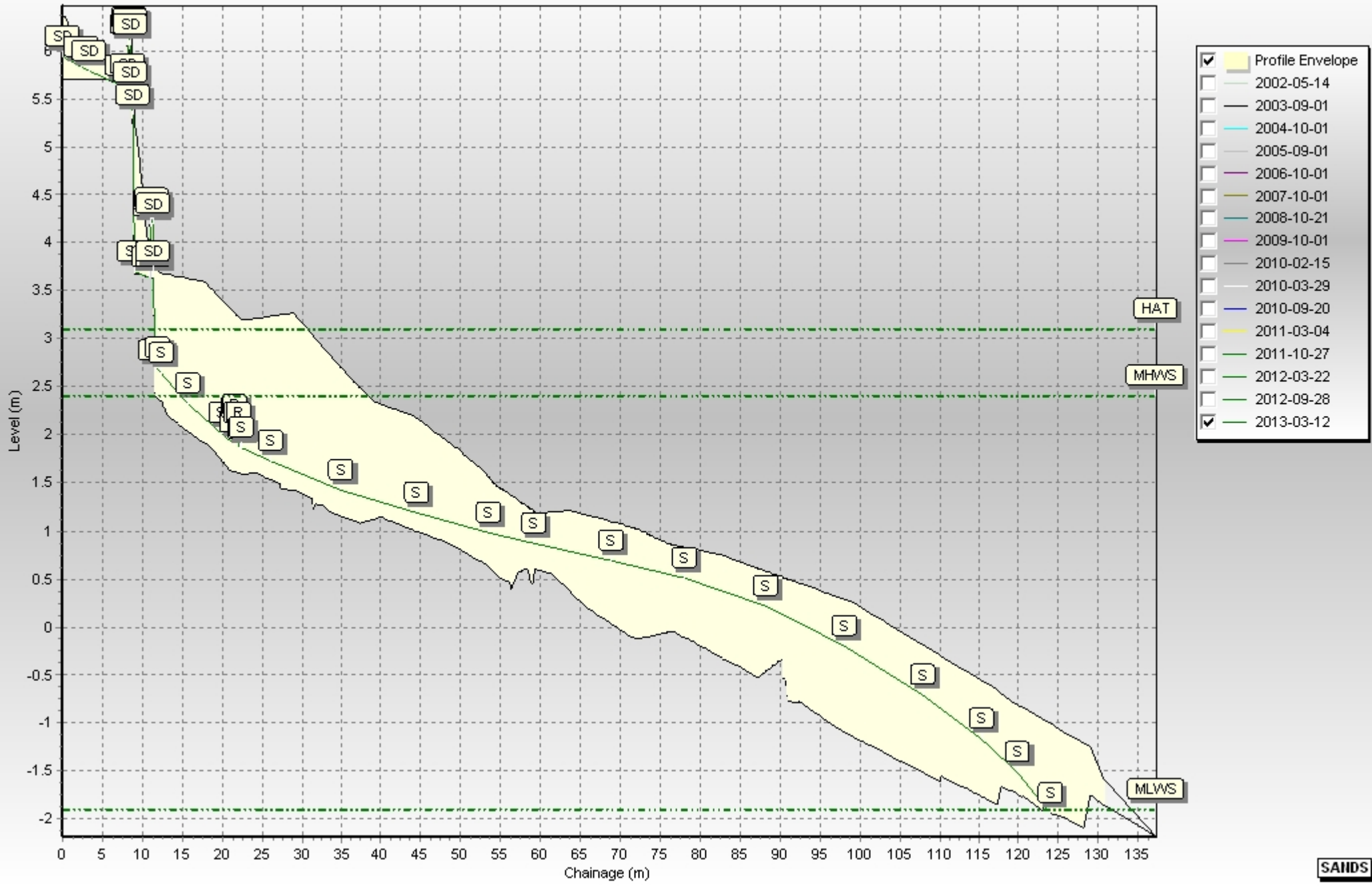
Profiles: 1aNTDC01



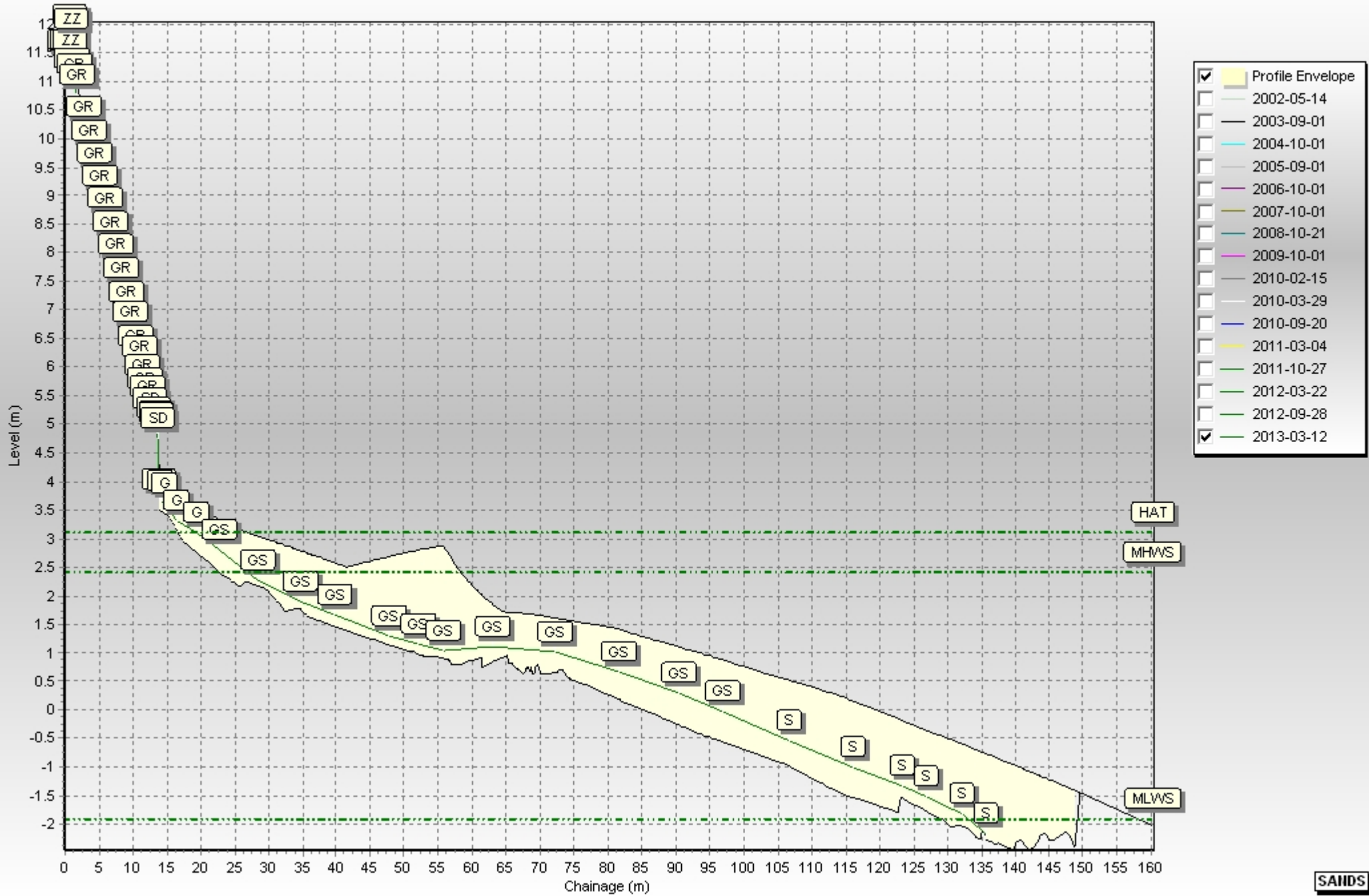
Profiles: 1aNTDC02



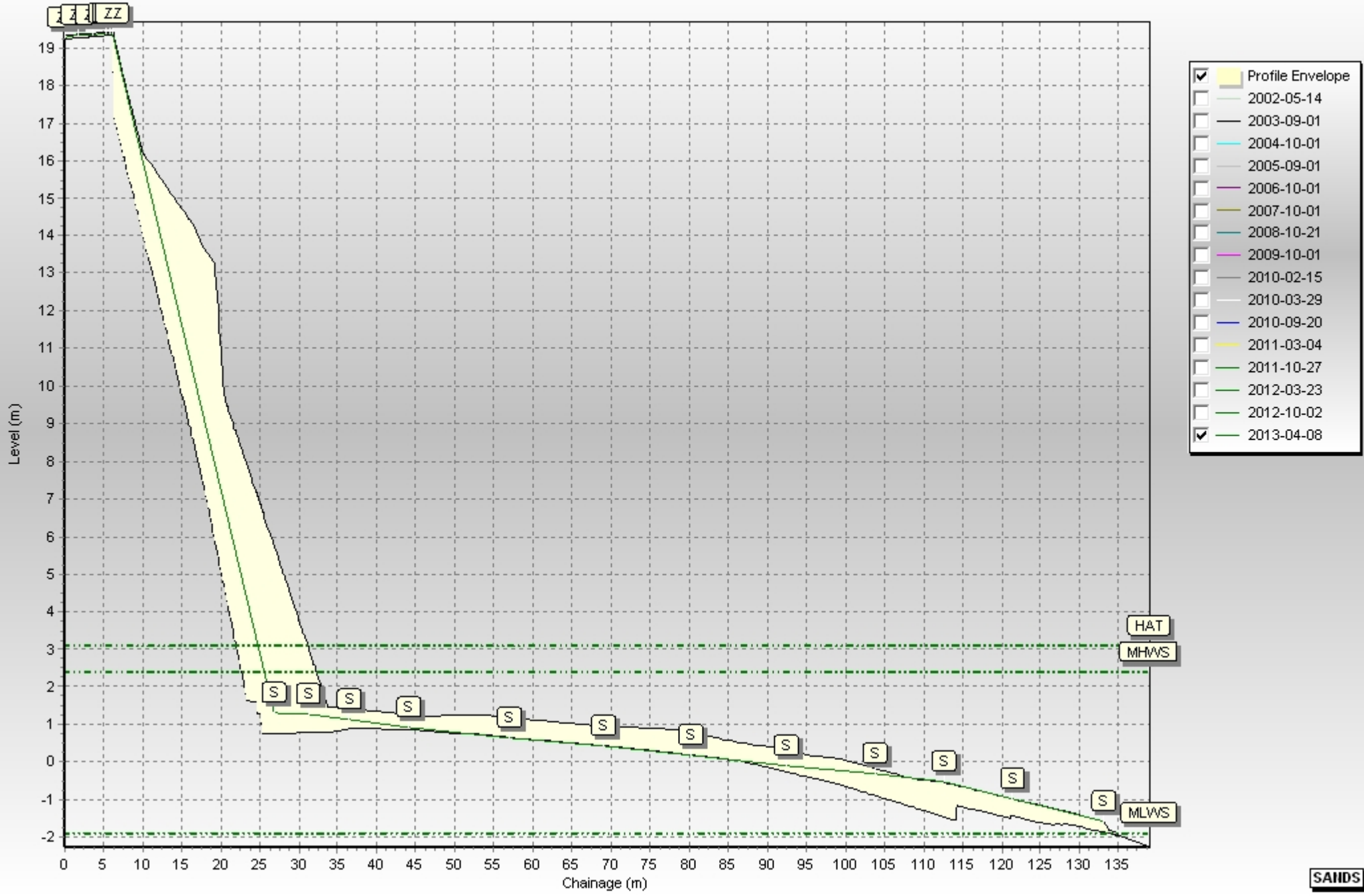
Profiles: 1aNTDC03



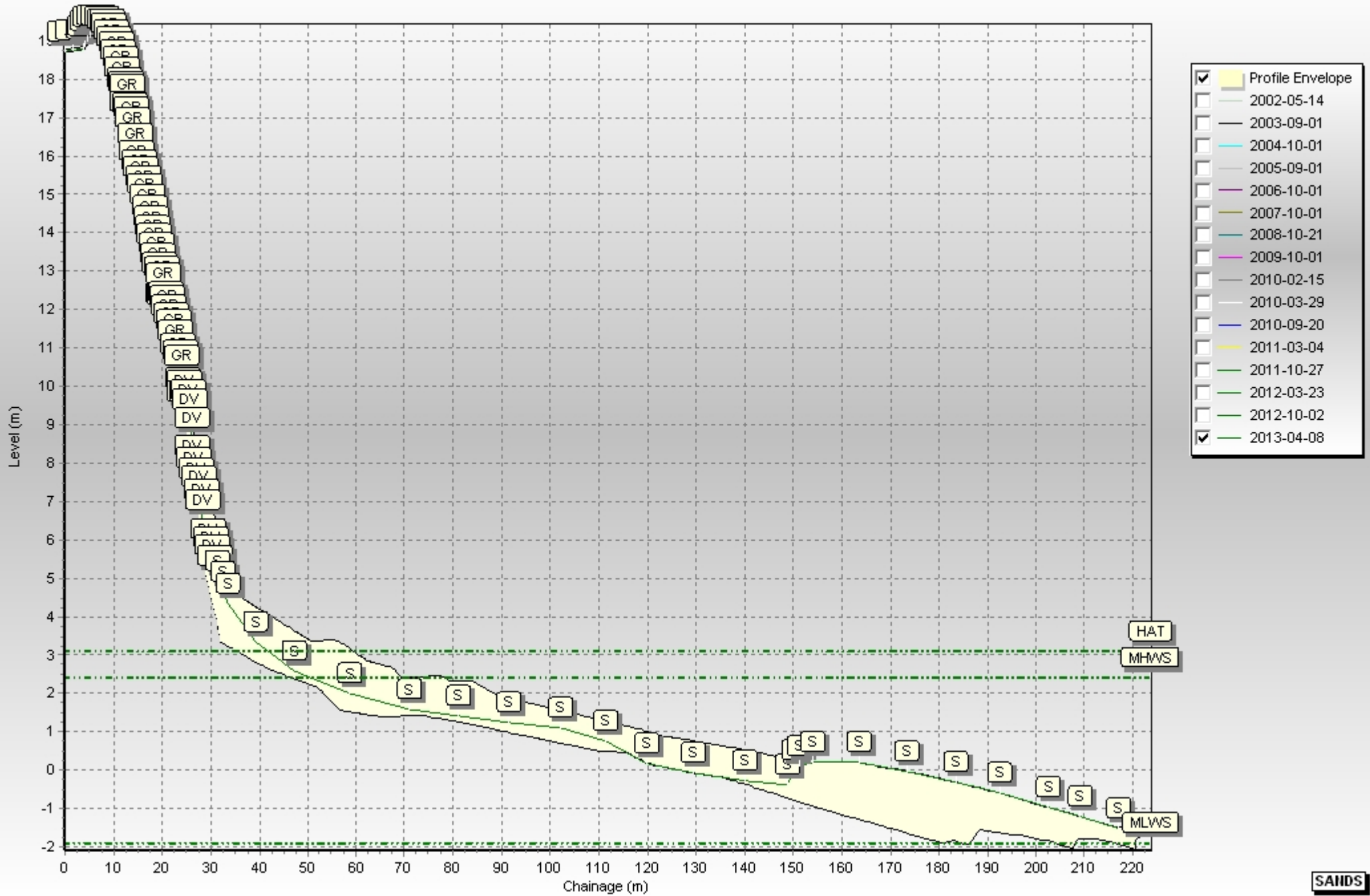
Profiles: 1aNTDC04



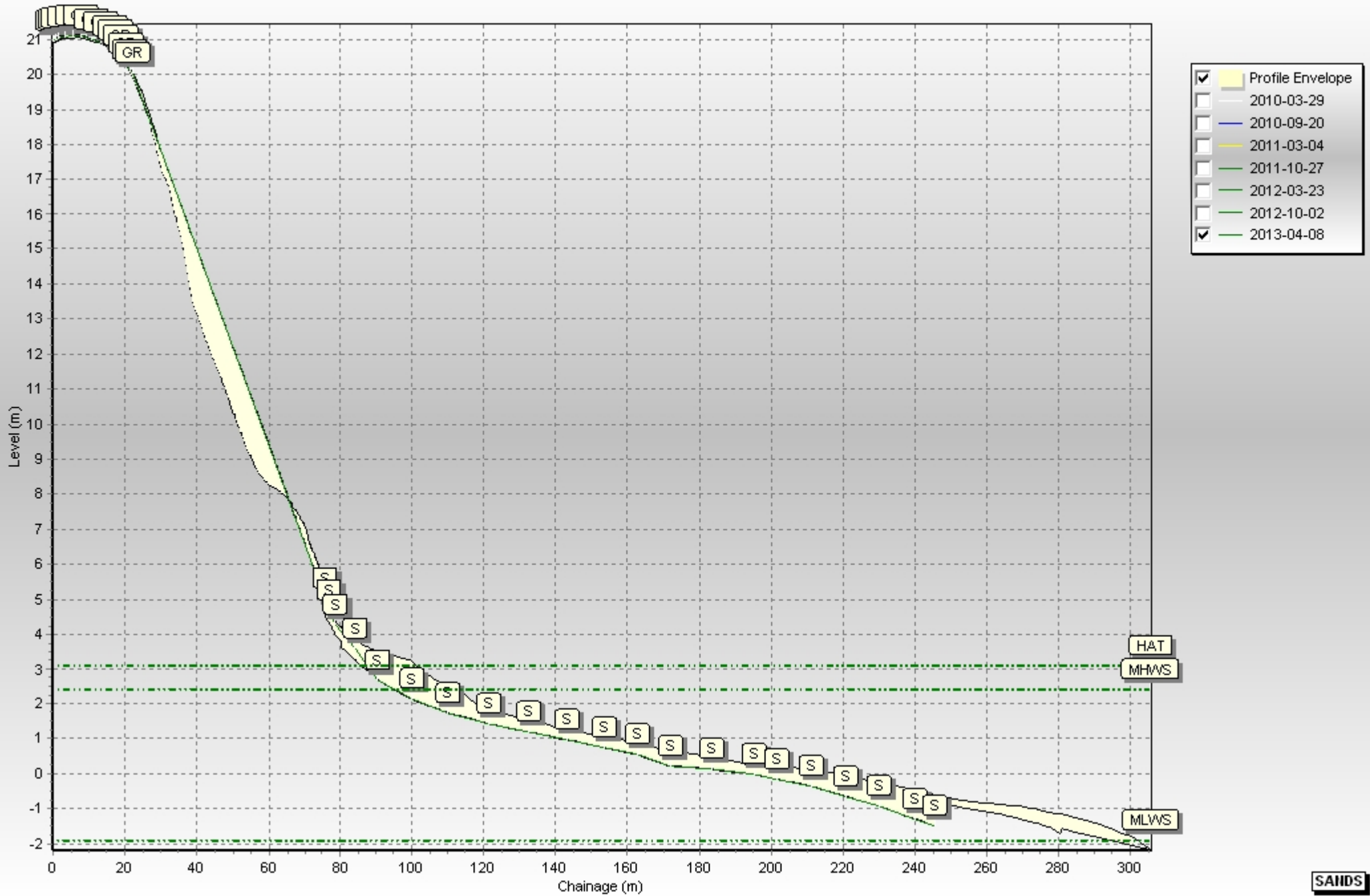
Profiles: 1aNTDC05



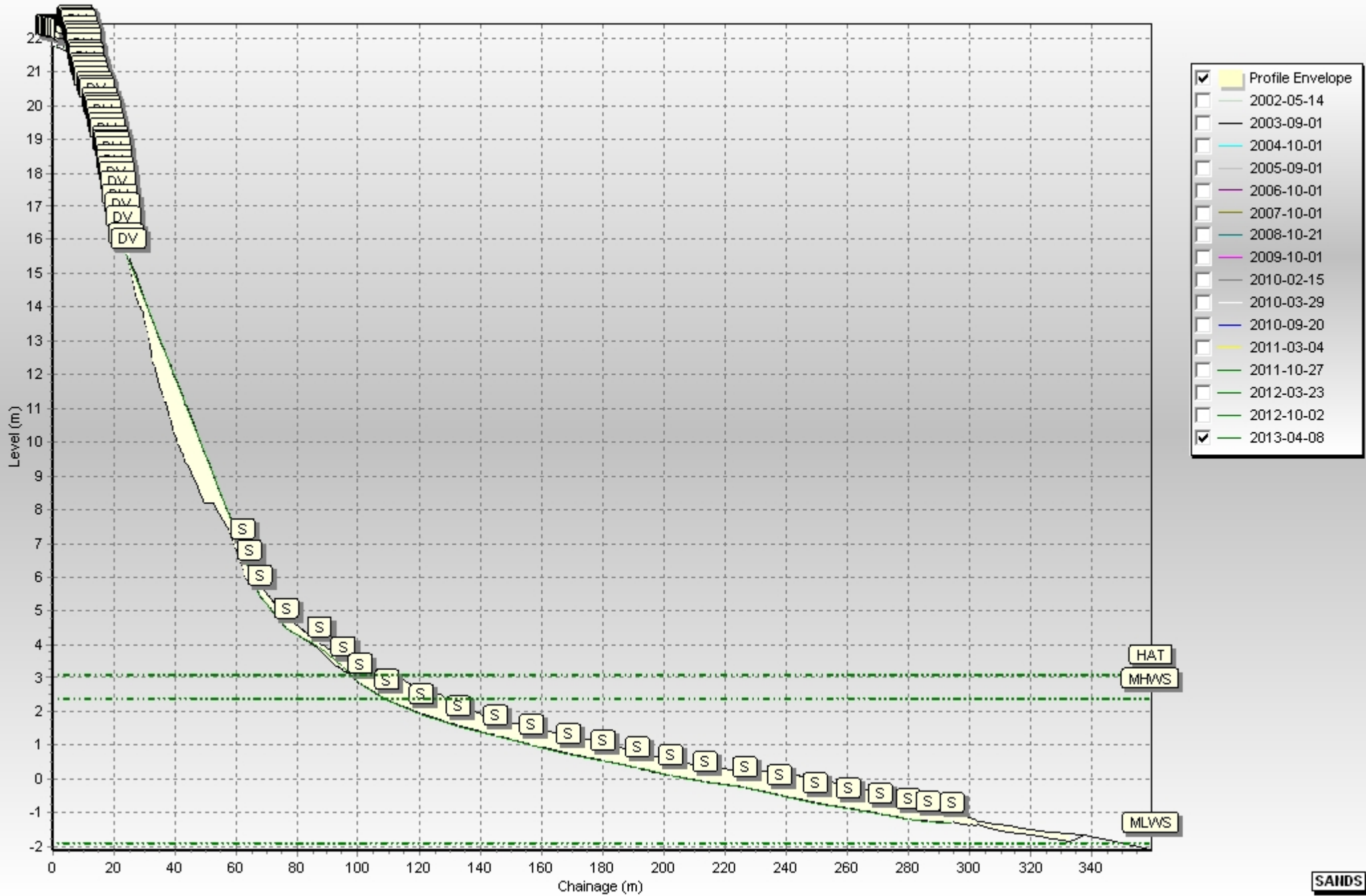
Profiles: 1aNTDC06



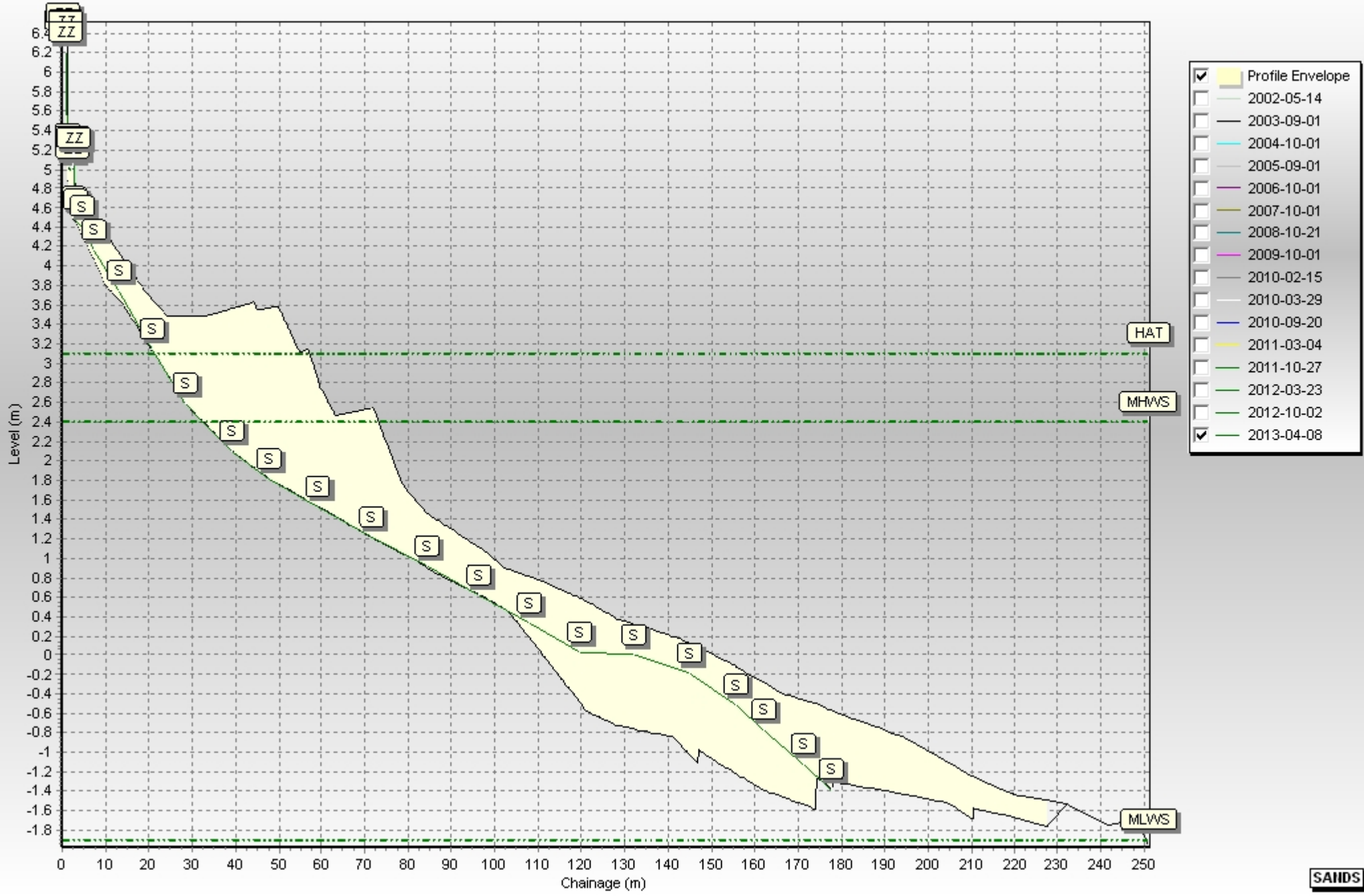
Profiles: 1aNTDC06A



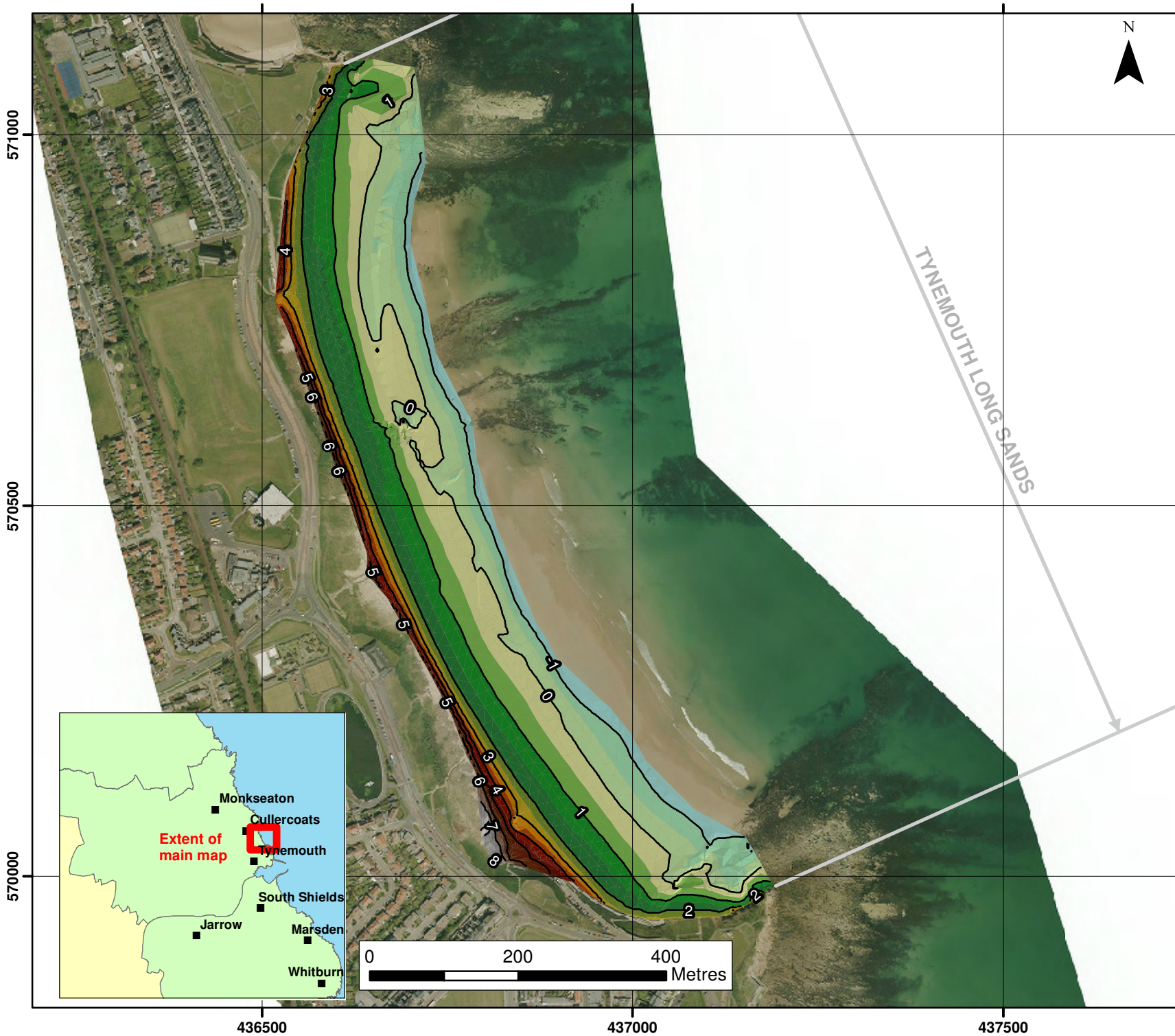
Profiles: 1aNTDC07



Profiles: 1aNTDC08



Appendix B
Topographic Survey



KEY

Elevation (m OD)

8.5 - 9
8 - 8.5
7.5 - 8
7 - 7.5
6.5 - 7
6 - 6.5
5.5 - 6
5 - 5.5
4.5 - 5
4 - 4.5
3.5 - 4
3 - 3.5
2.5 - 3
2 - 2.5
1.5 - 2
1 - 1.5
0.5 - 1
0 - 0.5
-0.5 - 0
-1 - -0.5
-1.5 - -1
— Contour 1m

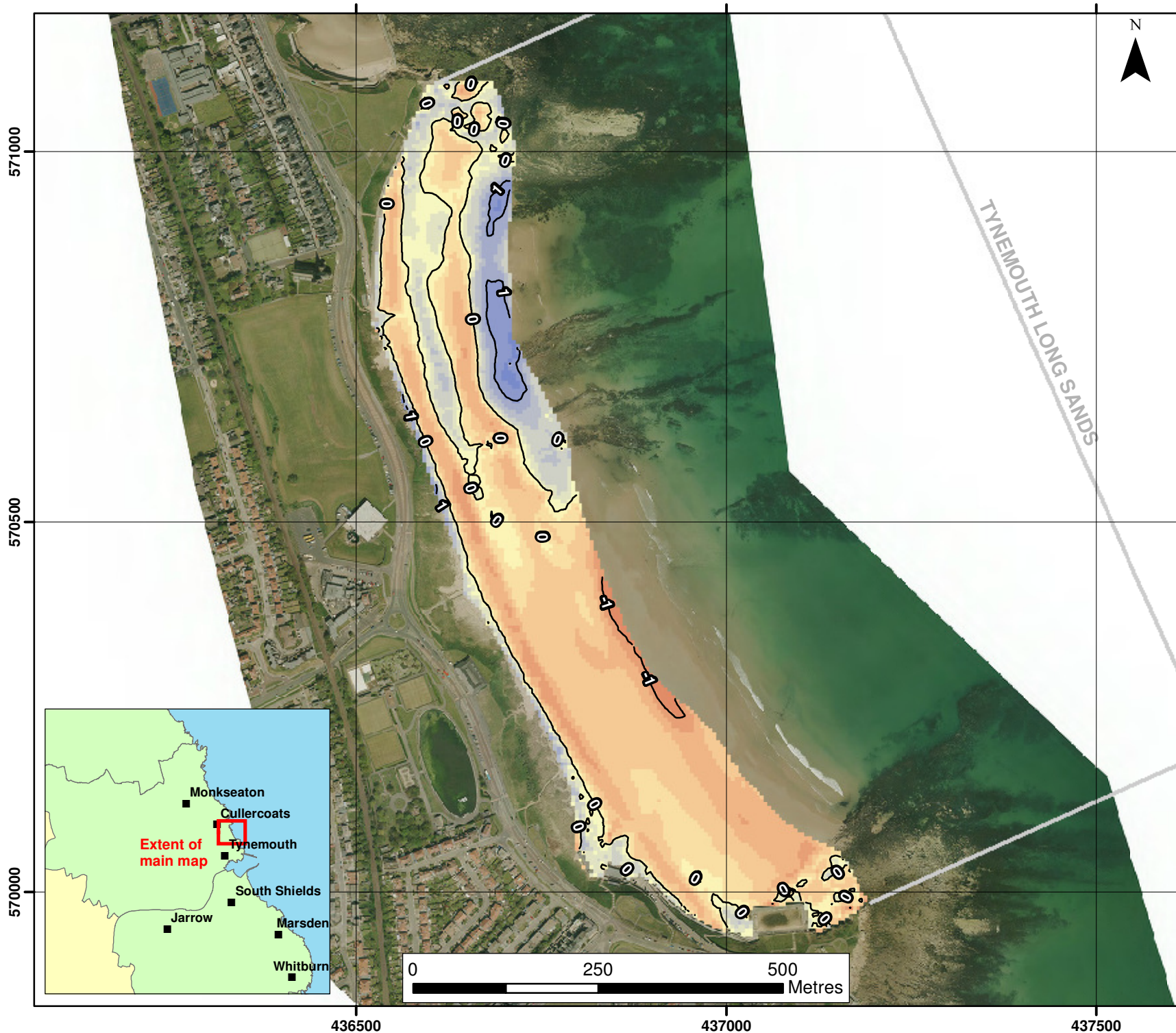
Client: North East Coastal Group
 Project: Cell 1 Regional Coastal Monitoring Programme 2011 to 2016

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

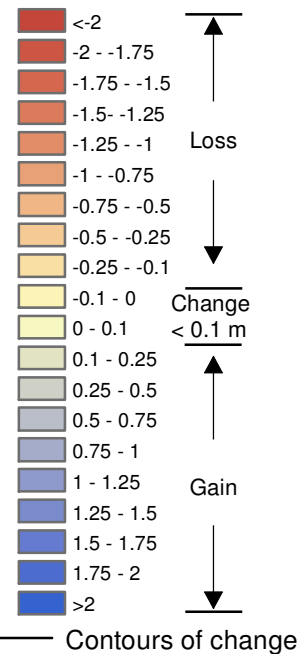
Update Report 5
 Partial Measures Survey
 Spring 2013

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



KEY Autumn 2012 and Spring 2013
Change in elevation (m)



Client: North East Coastal Group
Project: Cell 1 Regional Coastal
Monitoring Programme 2011 to 2016

Appendix B - Map1b
Short-term
Elevation Change
Tynemouth Long Sands
North Tyneside Council

Update Report 5
Partial Measures Survey
Spring 2013

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