



**Cell 1 Regional Coastal Monitoring Programme
Update Report 4: 'Partial Measures' Survey 2012**

**South 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 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).

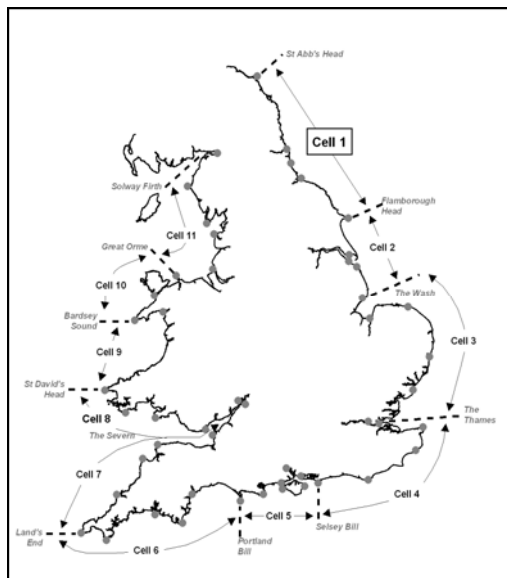


Figure 1 Sediment Cells in England and Wales

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		-
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 South Tyneside Council's frontage.

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:

- Littehaven 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/early winter 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)

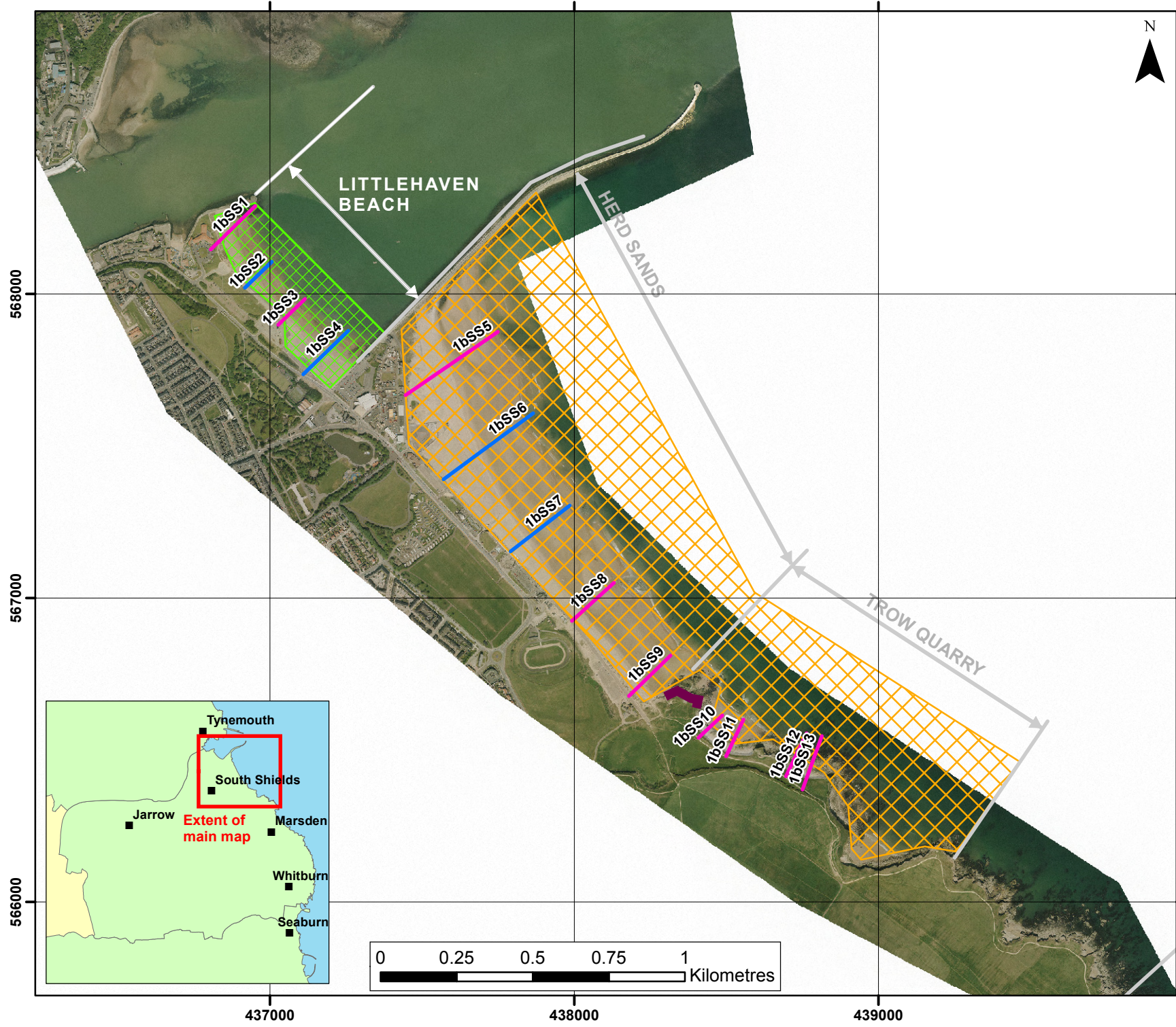
For all cliff-top surveys prior to Full Measures 2011, data was reported separately in Trow Quarry Coastal Defence Scheme - Monitoring Plan Year 2 (available from South Tyneside Council). The data was saved in '.kmz' format for plotting and comparison in GoogleEarth. For the present survey report, this data have 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. Cliff top survey data collected for the full measures survey (winter 2011) and the present partial measures survey (spring, 2012) is presented in this report. Since this is the first time the cliff top data has been presented in this way and the first time that a comparison with a previous survey has been completed, the full measures (winter, 2011) survey is the baseline survey.

The location of these surveys is shown in Figure 2. The Partial Measures survey was undertaken along this frontage between 13th March 2012 and 15th March 2012. During this time weather conditions varied considerably; refer to the survey reports for details of the weather conditions over this survey period.

This 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
 [Green grid] 6 monthly
 [Orange grid] yearly
 [Purple grid] 5 yearly

Cliff Top Monitoring Pegs
 [Purple bar] 50m centres
 [Green bar] 100m centres
 [Red bar] 300m centres
(Indicative Survey Extents shown)

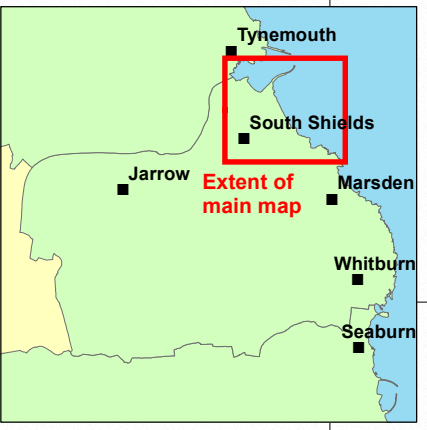
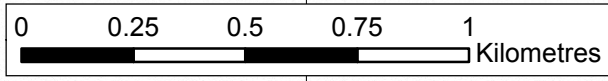
Client: North East Coastal Group
 Project: Cell 1 Regional Coastal Monitoring Programme 2011 to 2016

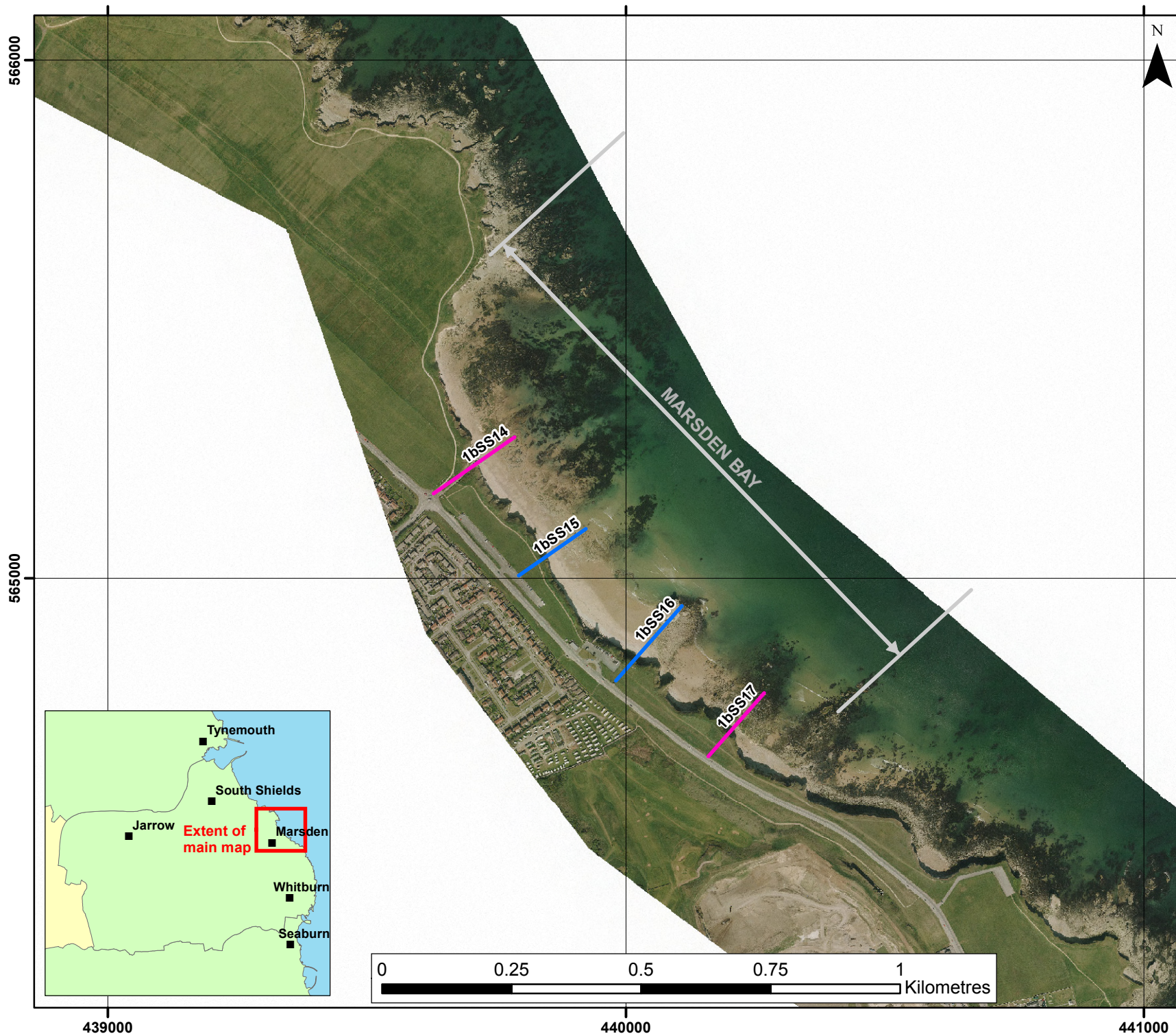
**Figure 2- Map 1
 Survey Locations
 Littlehaven Beach to
 Trow Quarry
 South Tyneside Council**

Update Report 4
 Partial Measures Survey
 Spring 2012

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





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 2
 Survey Locations
 Marsden Bay
 South Tyneside Council**

Update Report 4
 Partial Measures Survey
 Spring 2012

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2. Analysis of Survey Data

2.1 Littehaven Beach

Survey Date	Description of Changes Since Last Survey	Interpretation
Mar 2012	<p>Beach Profiles:</p> <p>Littlehaven Beach is covered by two beach profile lines for the Partial Measures survey, spaced between South Groyne and South Pier (Appendix A). The previous survey was the full measures survey undertaken in winter 2011.</p> <p>Profile 1aSS1 is located to the north of Littlehaven Beach, in the lee of a rocky outcrop. The dunes have been subject to some accretion, with a small increase on the top of the dunes and the dune face. Beach levels have increased by 0.2m at MHWS to form a small berm. Otherwise the beach has retained the same form.</p> <p>Profile 1bSS3 extends seawards from the protruding section of Littlehaven Sea Wall. Compared to the previous survey, the beach has increased along the length of the profile by approximately 0.2m, retaining the same form.</p>	<p>Littlehaven Beach is fairly steeply sloping beach, and with the exception of the beach in the south is mostly of continuous gradient from the dune / seawall out to MLWS.</p> <p>The northern section of the beach has experienced general stability, with some accretion on the dune face and around MHWS.</p> <p>The southern section of the beach has accreted across the length of the profile.</p> <p>Longer term trends: The northern section of Littlehaven Beach has retained the same form and general position since the survey in November 2008.</p> <p>The southern section is known to be volatile in front of the wall. However, the data collected on 15th March 2012 showed the highest levels recorded since November 2008, with levels at the wall toe over 1m higher than the lowest levels recorded in March 2010.</p>
Mar 2012	<p>Topographic Survey:</p> <p>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, winter 2011) have been used to create a DGM (Appendix B – Map 1a) using a Geographical Information System (GIS). A difference plot has also been produced using the DGM (Appendix B – Map 1b) produced from the last produced topographic survey (partial measures, spring 2011) and the present</p>	<p>Similarly to the previous survey, generally beach elevation changes are in the region of 0 to +/-0.5m. There has been some accretion along the backshore in small pockets. There has been a slight decrease in beach elevation to the north on the upper beach and to the south on the middle beach. Otherwise the beach has generally remained stable.</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>survey.</p> <p>In particular, the difference plot shows: (i) a general pattern of change of less than 0.1m, with some small gain in the region of 0.1 to 0.25m; (ii) beach elevation loss to the north on the upper beach and to the south on the middle beach; and (ii) pockets of beach elevation gain along the backshore.</p>	

2.2 Herd Sands

Survey Date	Description of Changes Since Last Survey	Interpretation
Mar 2012	<p>Beach Profiles:</p> <p>Herd Sands is covered by three beach profile lines for the Partial Measures survey (Appendix A). The previous survey was the full measures survey undertaken in winter 2011.</p> <p>Profile 1bSS5 is located to the north of Herd Sands and is located in the lee of the breakwater. The dunes have largely retained a similar form since the last survey. Between a chainage of 130m and 180m, around a height 3.4m, the dunes have eroded, however, on the dune face and across the beach profile, levels have increased by approximately 0.2m.</p> <p>Profile 1bSS8 is located to south of Herd Sands. Since the last survey, beach levels above HAT have increased by up to 0.5m. From MHWS to the end of the profile, beach levels have oscillated, with an increase in the order of 0.2m between 65m and 110m chainage and a fall of the same magnitude seaward of 110m chainage.</p> <p>Profile 1bSS9 is located to south of Herd Sands. The dune face has retained the same form and position since the last survey. Beach levels have generally increased across the length of the profile, particularly at the toe of the dunes, between a chainage of 25m and 60m and 75m and 155m. The profile was last at this level in September 2009. The beach berm remains present, however seaward of there, the profile has flattened.</p>	<p>Since the last survey, the beach at Herd Sands has shown an accretionary trend. To the south, in particular, beach levels have increased above HAT and a level of 1m and -1m. As described in the previous survey report, this accretion is probably related to the transport of material across the beach by wind and wave activity.</p> <p>Longer term trends: Generally the changes observed since the last survey are within the bounds of previous surveys. To the north at 1bSS5, the berm at HAT is the highest observed since November 2008 (full measures, winter 2008) To the south, the changes observed are within the bounds of previous surveys.</p>

2.3 Trow Quarry (incl. Frenchman's Bay)

Survey Date	Description of Changes Since Last Survey	Interpretation
Mar 2012	<p>Beach Profiles:</p> <p>Trow Quarry is covered by four beach profile lines for the Partial Measures survey (Appendix A), two in Graham's Sand and two in Southern Bay. The previous survey was the full measures survey undertaken in winter 2011.</p> <p>Profiles 1bSS10 and 1bSS11 are located in Graham's Bay. At profile 1bSS10, the back shore has remained stable. With the exception of a length of profile between 35m and 50m beach levels have increased by up to 0.5m across the profile. Comparison with previous surveys, shows that the present profile is very similar to the profile for the previous partial measures survey (spring 2011). At profile 1bSS11 the back shore has remained stable. Beach levels have increased by up to 0.3m across the length of the profile. As with 1bSS10, comparison with previous surveys shows that the present profile is very similar to the previous partial measures survey (spring 2011).</p> <p>Profiles 1bSS12 and 1bSS13 are located in Southern Bay. At both locations, the back shore has remained stable. The beach is predominantly comprised of boulder and rock and the changes observed at this profile are more likely to relate to the movement of boulder / rock / cobbles rather than an increase or decrease in beach levels. The survey photographs in Plates 1 and 2 show the beach from a similar angle during the present survey and the previous full measures survey (winter, 2011). The photograph for the present survey shows that the sediment on the beach is comprised of a larger portion of smaller cobbles and pebbles than the previous survey.</p>	<p>At both Graham's Bay and Southern Bay, the cliff and rock revetment have remained stable.</p> <p>At Graham's Bay, the beach profile has accreted, however, comparison with previous surveys shows the profile has returned to a similar profile observed in the previous partial measures survey in spring 2011.</p> <p>At Southern Bay, the rocky foreshore has generally retained the same form and position with some movement of boulders, rocks and a redistribution of finer material across the profile.</p> <p>Longer term trends: Overall the beach has retained the same form and position since November 2008.</p>
Mar 2012	<p>Cliff-top Survey:</p> <p>Cliff top survey data collected for the full measures survey (winter 2011) and the present partial measures survey (spring, 2012) is presented in this report. Since this is the first time the cliff top data has been presented in this way and the first time that a comparison with a previous survey has been completed, the full measures (winter, 2011) survey is the baseline survey.</p> <p>6 ground control points (numbered 1-6) were established along the cliff top at Trow Point in 2008 to monitor cliff erosion at the headland adjacent to 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</p>	<p>This is the second year that the cliff top survey data has been included within the survey report and the data presented in a table, so it is the first time that a comparison with previous data has been completed.</p> <p>Longer term trends: The limited data set does not allow long term trends to be established yet. From the data available the cliffs around Trow Headland have shown minimal change. There is a small degree of erosion around the north-west side. The survey data</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>should be made to Appendix C – Map 1 for the location of ground control points.</p> <p>These cliff top surveys are undertaken bi-annually. 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 $\pm 0.2\text{m}$ due to the technique used.</p> <p>The results from the cliff top survey are presented in Appendix C – Table C1, showing the position from the ground control point to the edge of the cliff top along a defined bearing. Also shown is the change in measurement since the baseline (winter 2011) and current (spring 2012) cliff top surveys.</p> <p>Results show that erosion or an amount greater than the survey error has occurred 3 ground control points since the baseline survey in winter 2011. Other locations have not changed, or erosion is within the error band.</p> <p>Point 1, which is located on the north-west side of the headland, has eroded by up to 0.3m.</p> <p>Points 5 and 6, which are located on south-west side of the headland in Graham's Bay, have accreted up to 0.4m and 0.6m respectively. A beach profile has not been surveyed at this location so it is not possible to compare this to another dataset. The indicated cliff advance may result from survey of cliff fall debris, but is more likely to represent error in the survey, either due to misidentification of the cliff line, or error in the survey data. Review and analysis of the 2012 aerial photography will allow the nature of change to be better understood.</p>	<p>suggests that the south-west side is accreting, however, this is likely to represent survey error.</p>



Plate 1 – Survey photograph 1bSS13_20120315_N5.JPG (PM 2012)



Plate 2 – Survey photograph 1bSS13_20110916_N5.JPG (FM 2011)

2.4 Marsden Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
Mar 2012	<p>Beach Profiles:</p> <p>Marsden Bay is covered by two beach profile lines for the Partial Measures survey (Appendix A). The previous survey was the full measures survey undertaken in winter 2011.</p> <p>Profile 1bSS14 is located to the north of the bay and covers the cliffs and former lifeguard station adjacent to the Redwell Steps. The cliff has retained the same form and position since the last survey. Beach levels seaward of HAT have increased by approximately 0.2m across the profile.</p> <p>Profile 1bSS17 is located to the south of the bay. Since the last survey, the cliff has retained the same form and position. Beach levels at the toe of the cliff to a chainage of 70m have remained stable since the last survey. From 75m to 95m chainage, beach levels have lowered by approximately 0.2m and between 95m and 115m, beach levels have increased by approximately 0.2m. This is likely to represent cross-shore transport of material and draw-down during winter storms.</p>	<p>The cliffs in Marsden Bay have retained the same form and position since the last survey (full measures, winter 2011).</p> <p>To the north of the Marsden Bay there has been a small level of beach accretion.</p> <p>To the south, the beach fronting the cliffs has remained stable with no change in form or position. Beach lowering on the middle beach has occurred alongside beach level increase on the lower beach suggesting draw-down of sediment during winter storms.</p> <p>Longer term trends: Although beach movements are observed since the last survey, the overall change is within the bounds of changes observed since the first survey in November 2008. The beach to the south of Marsden Bay is particularly stable with movements within a range of 0.3m since November 2008.</p>

3. Problems Encountered and Uncertainty in Analysis

Individual Profiles

At profile 1bSS5, numerous sand fences have been installed in the dunes at start of the section. The next full measures survey (winter, 2012) should show the impact that they have had on sediment retention on the beach.

Cliff Top Surveys

Surveying any cliff top is difficult due to: (i) the Health and Safety risks posed to surveyors, especially during adverse weather; and (ii) the 'apparent' changes that can arise due to surveyors interpreting different points as the cliff edge on successive surveys.

For these reasons, it has been assumed that any changes of $\pm 0.2\text{m}$ may be considered as being within the accuracy of the surveying technique.

In addition, the cliff top measurements to the south-west of Trow Point appear to indicate accretion. This is more likely to be error resulting from mis-identification of the cliff top or error in the survey data. Further surveys will provide a longer data-set over which to make comparisons, and therefore provide more clarity to observed trends.

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

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). Although cliff top data is available for surveys prior to the Full Measures 2011, the accuracy of the data is such that no reliable interpretation can be made. For this reason, the 'kmz' files are not presented or analysed as part of the present report. Cliff top surveying needs to be undertaken with careful identification of the 'cliff top' to make the data useful in long-term assessment of erosion.

However, in the short term, more reliable assessments of cliff recession will be derived from analysis of time-series remote sensing data. A high quality baseline survey, comprising LiDAR and aerial photography, was collected in 2010, a repeat survey was completed in Sept/Oct 2012 and a second repeat survey is planned for 2014. These data will be analysed to give more accurate information on the behaviour of the cliffs in a separate report.

5. Conclusions and Areas of Concern

- At Little Haven Beach, the recorded profiles and topographic survey present no causes for concern.
- At Herd Sands, the recorded profiles present no causes for concern.
- At Trow Quarry, the recorded profiles present no causes for concern. The cliffs to the north-west of Trow Headland are eroding, but the magnitude of change is presently small and presents no cause for concern.
- At Marsden Bay, the recorded profiles present no causes for concern.

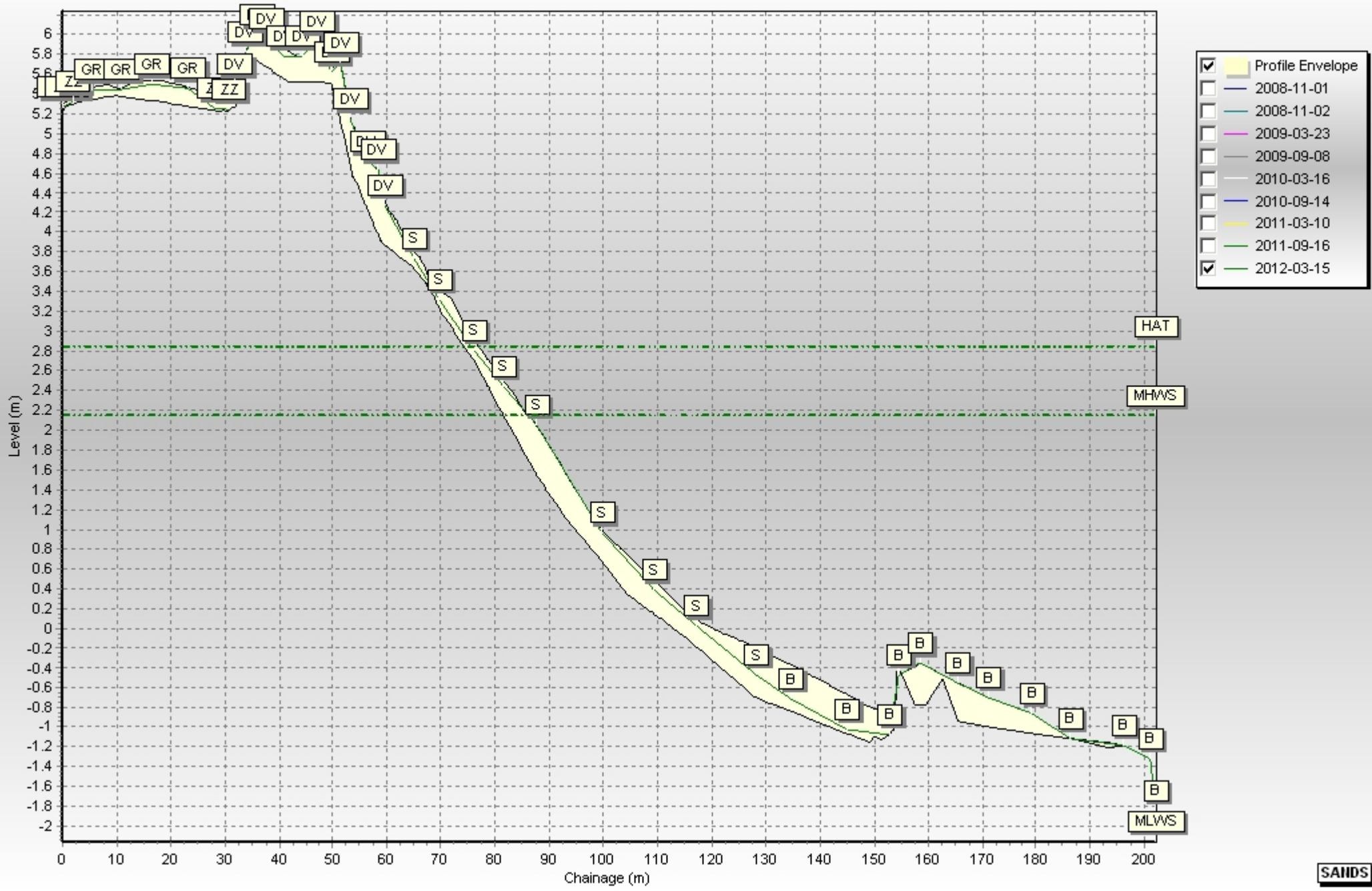
Appendices

Appendix A
Beach Profiles

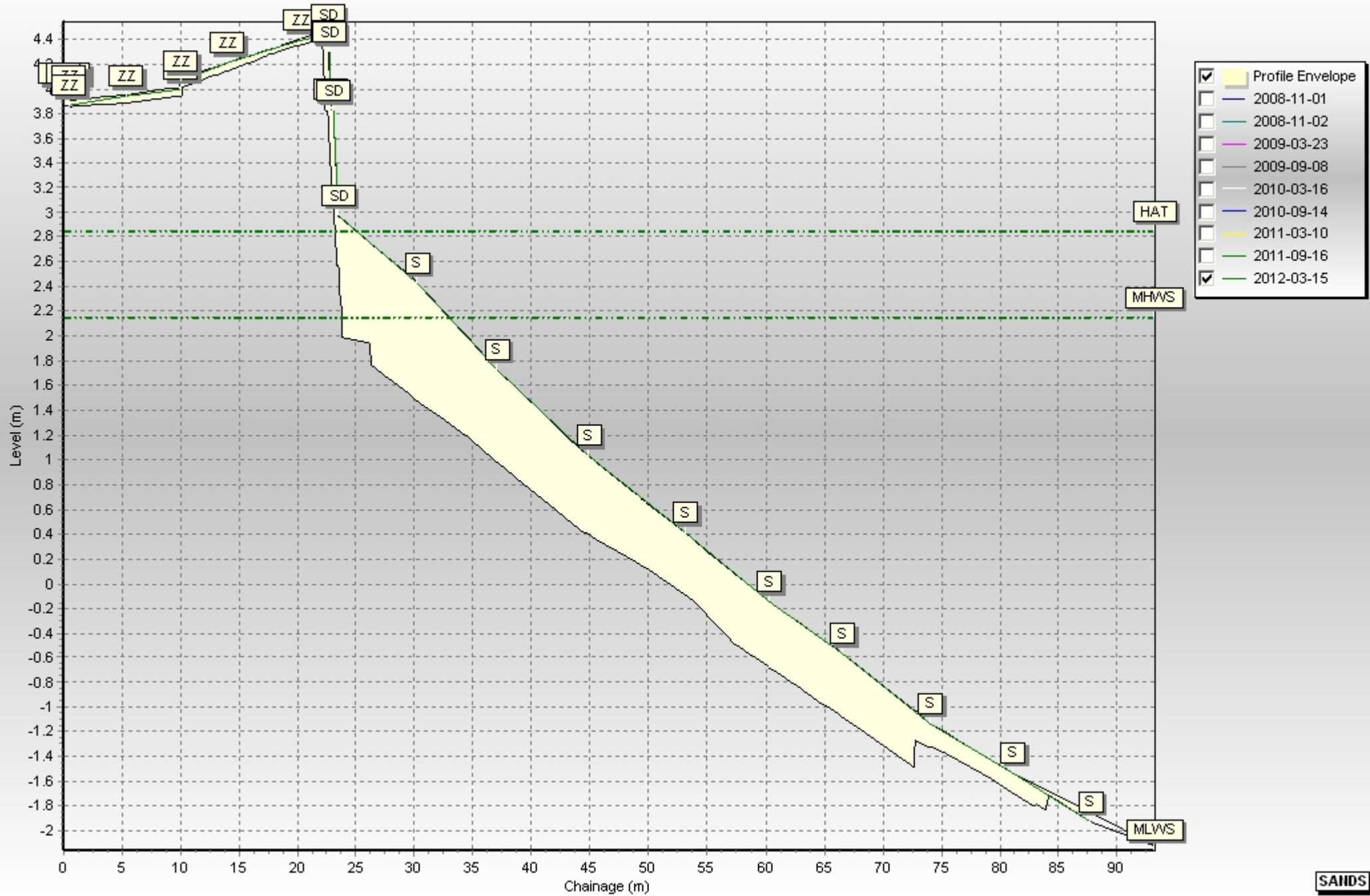
The following sediment feature codes are used on some profile plots:

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

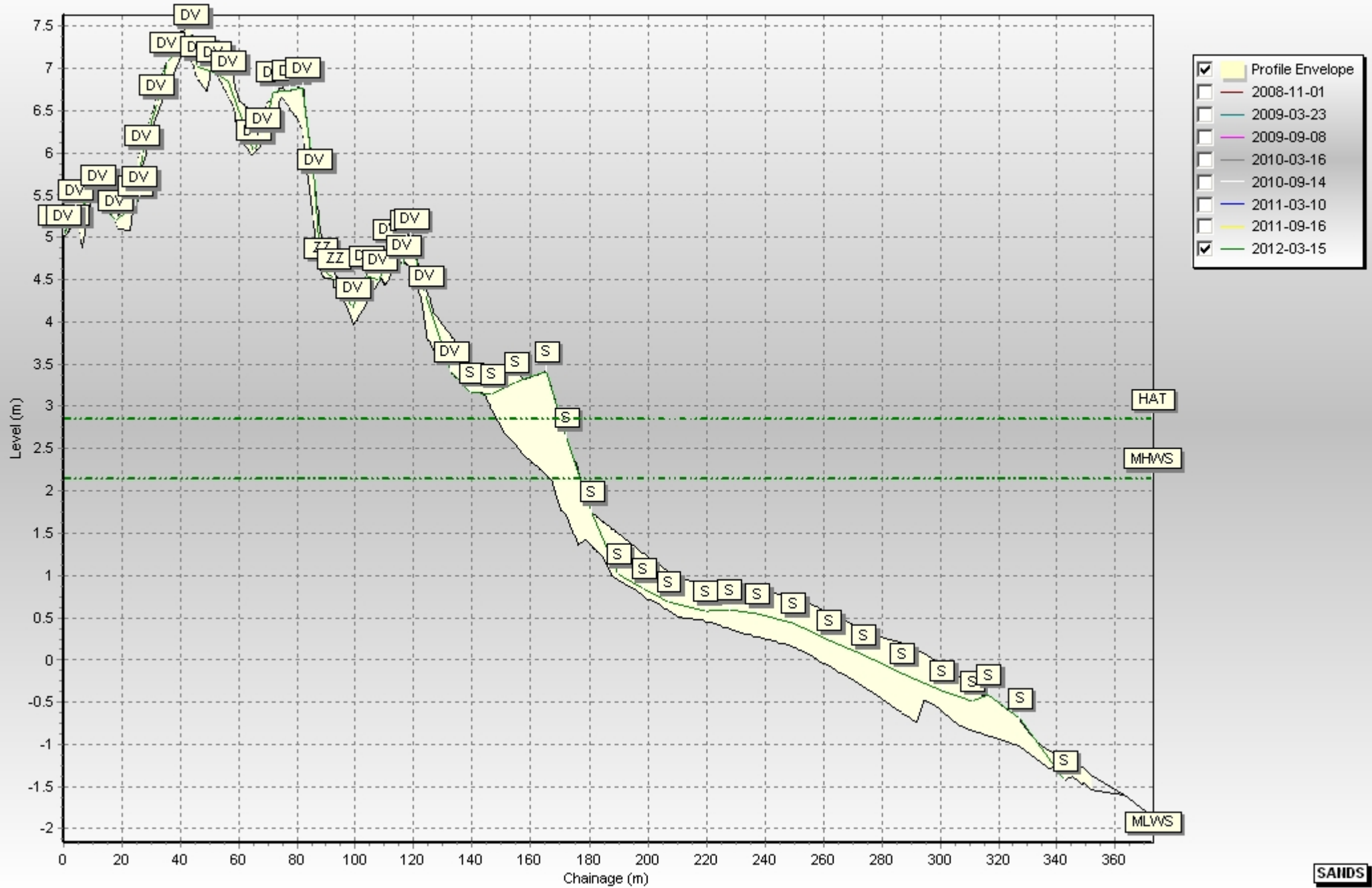
Beach Profiles: 1bSS1



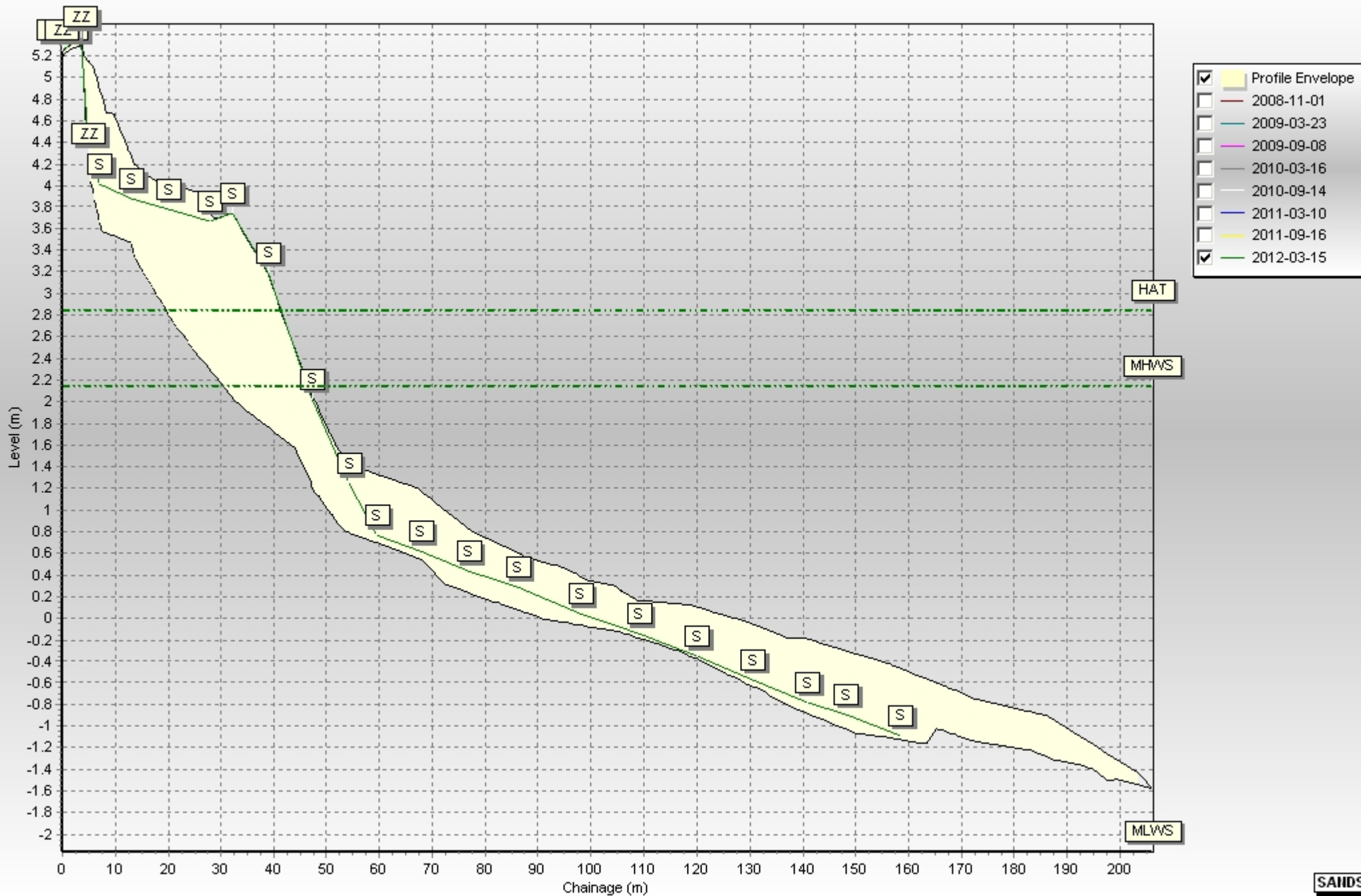
Beach Profiles: 1bSS3



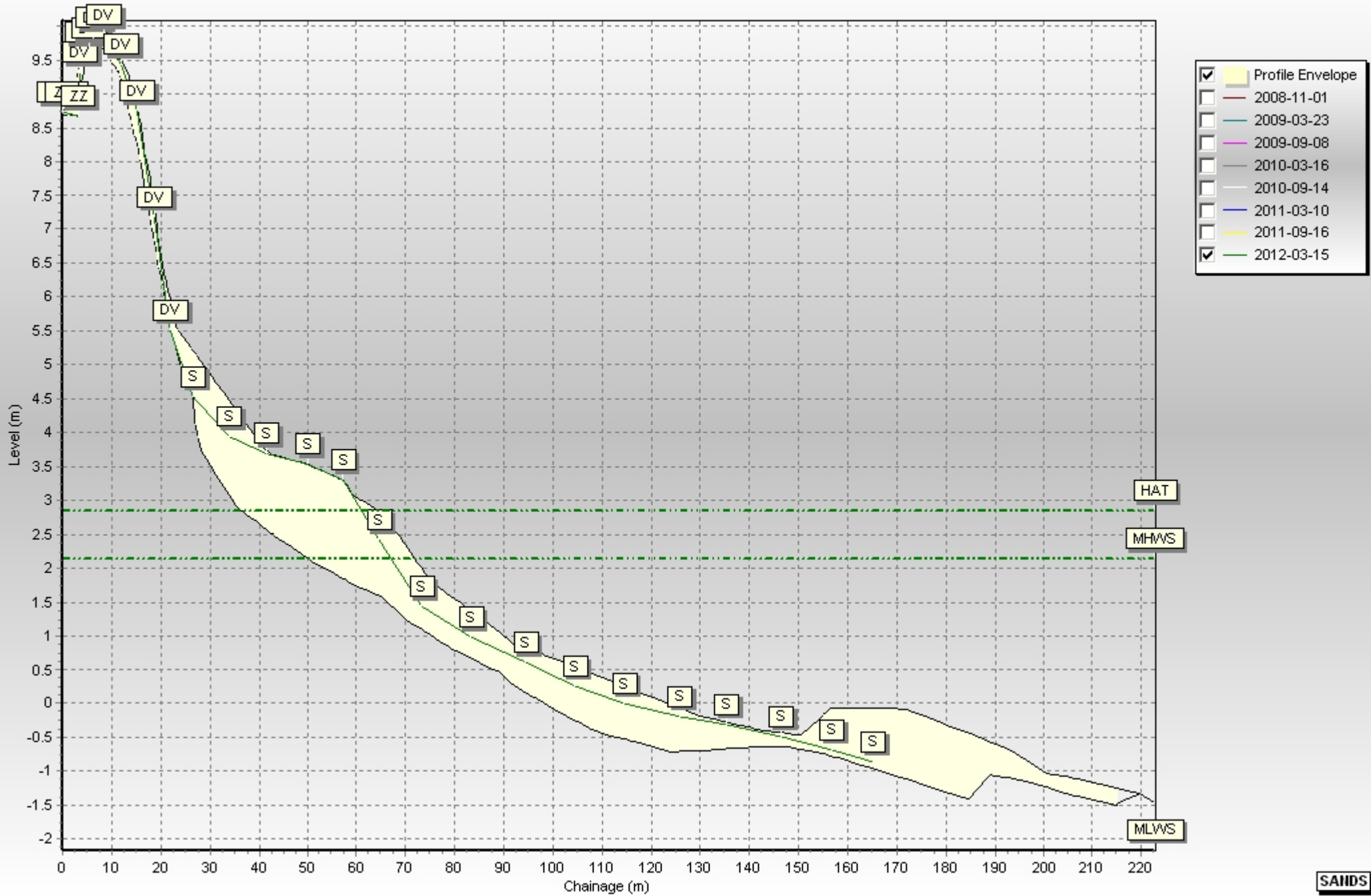
Beach Profiles: 1bSS5



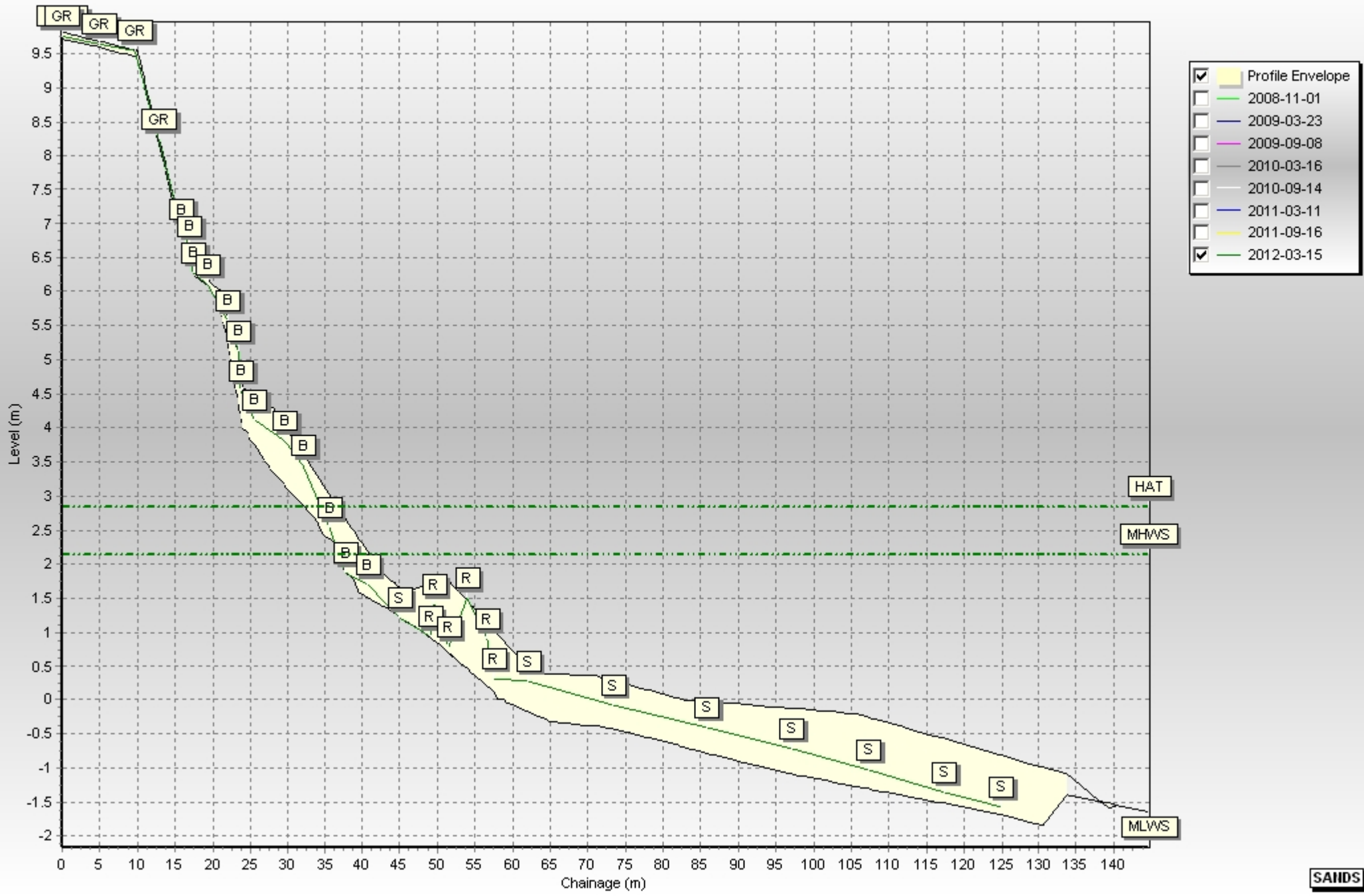
Beach Profiles: 1bSS8



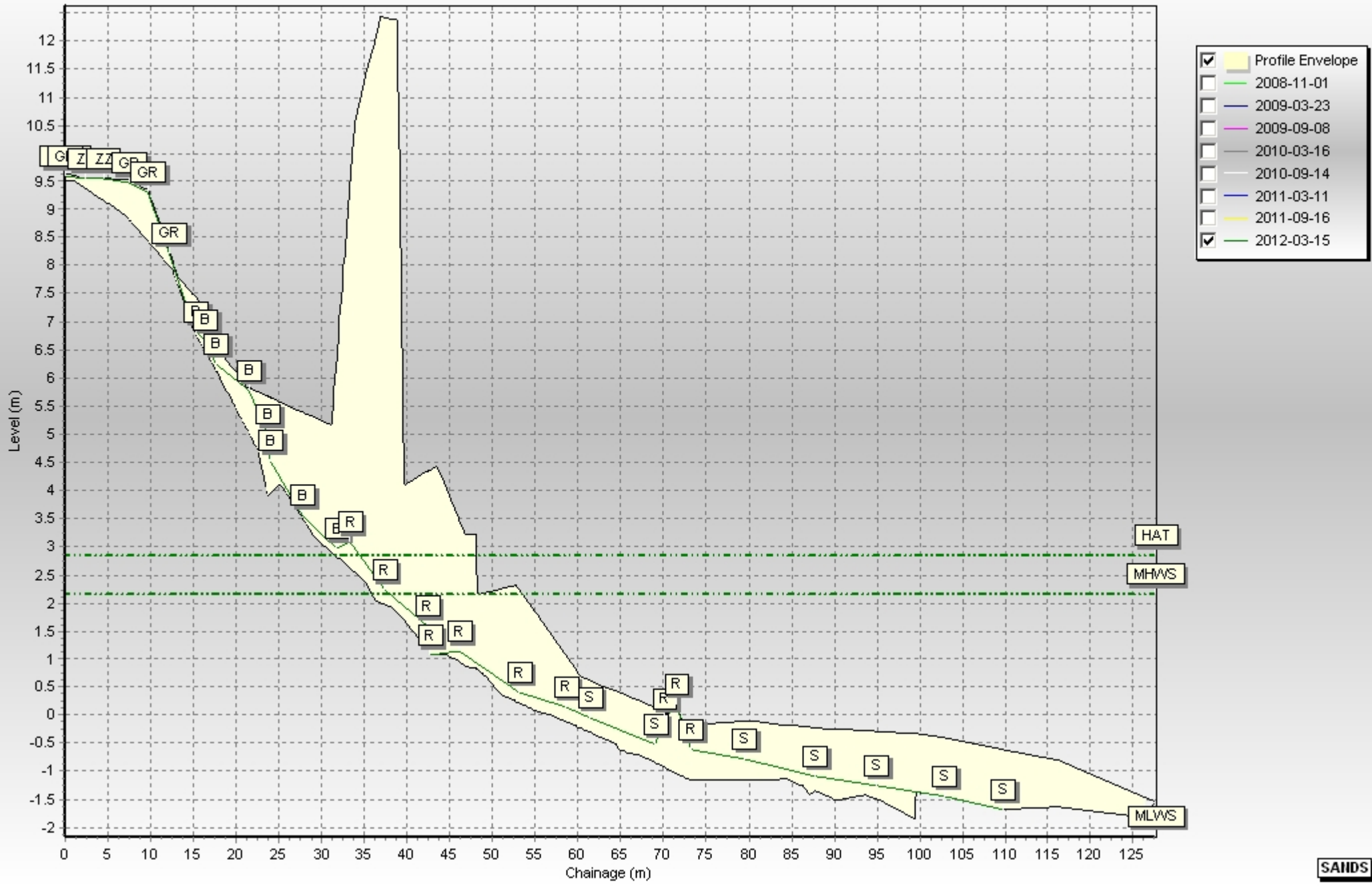
Beach Profiles: 1bSS9



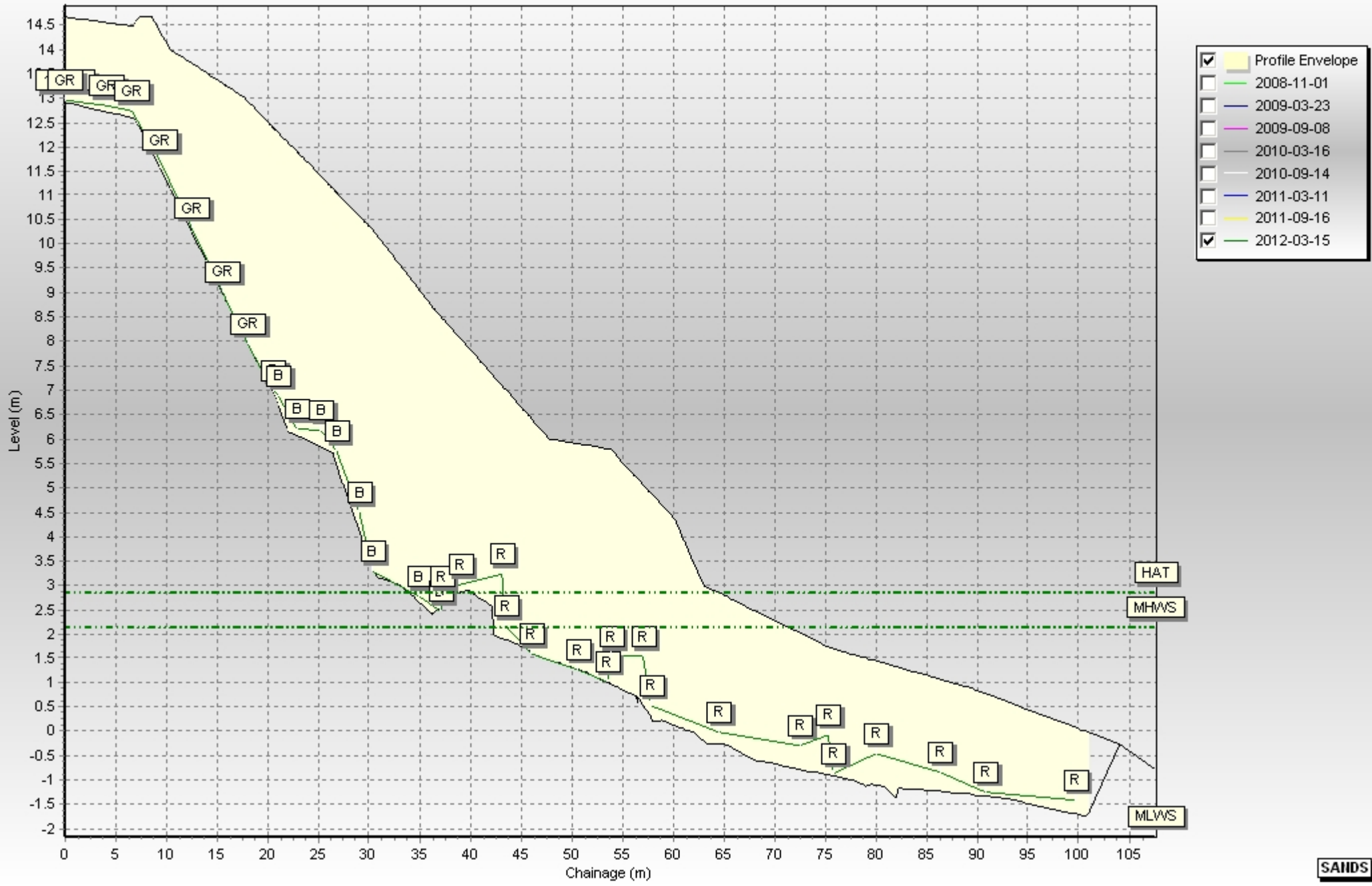
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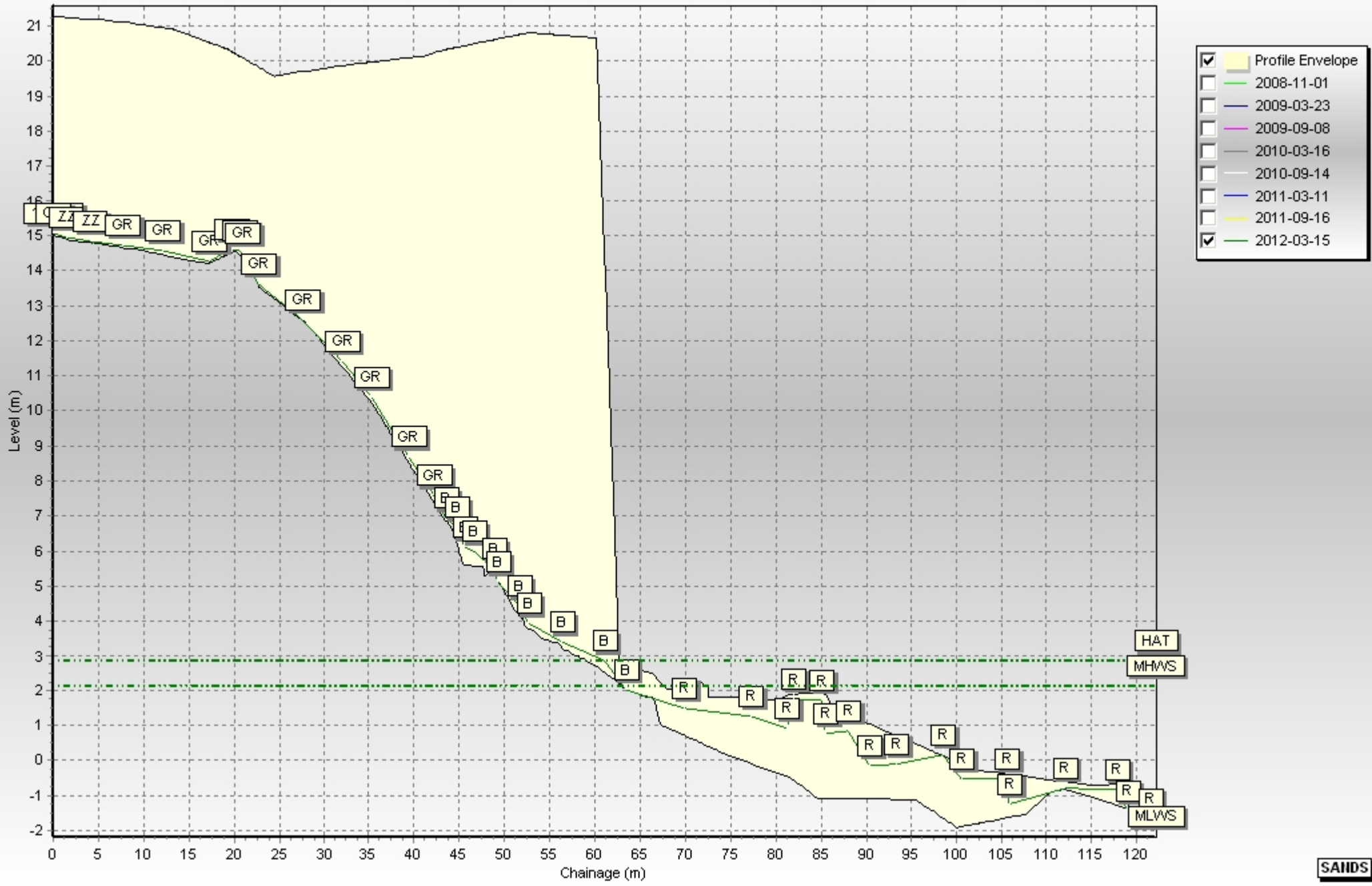
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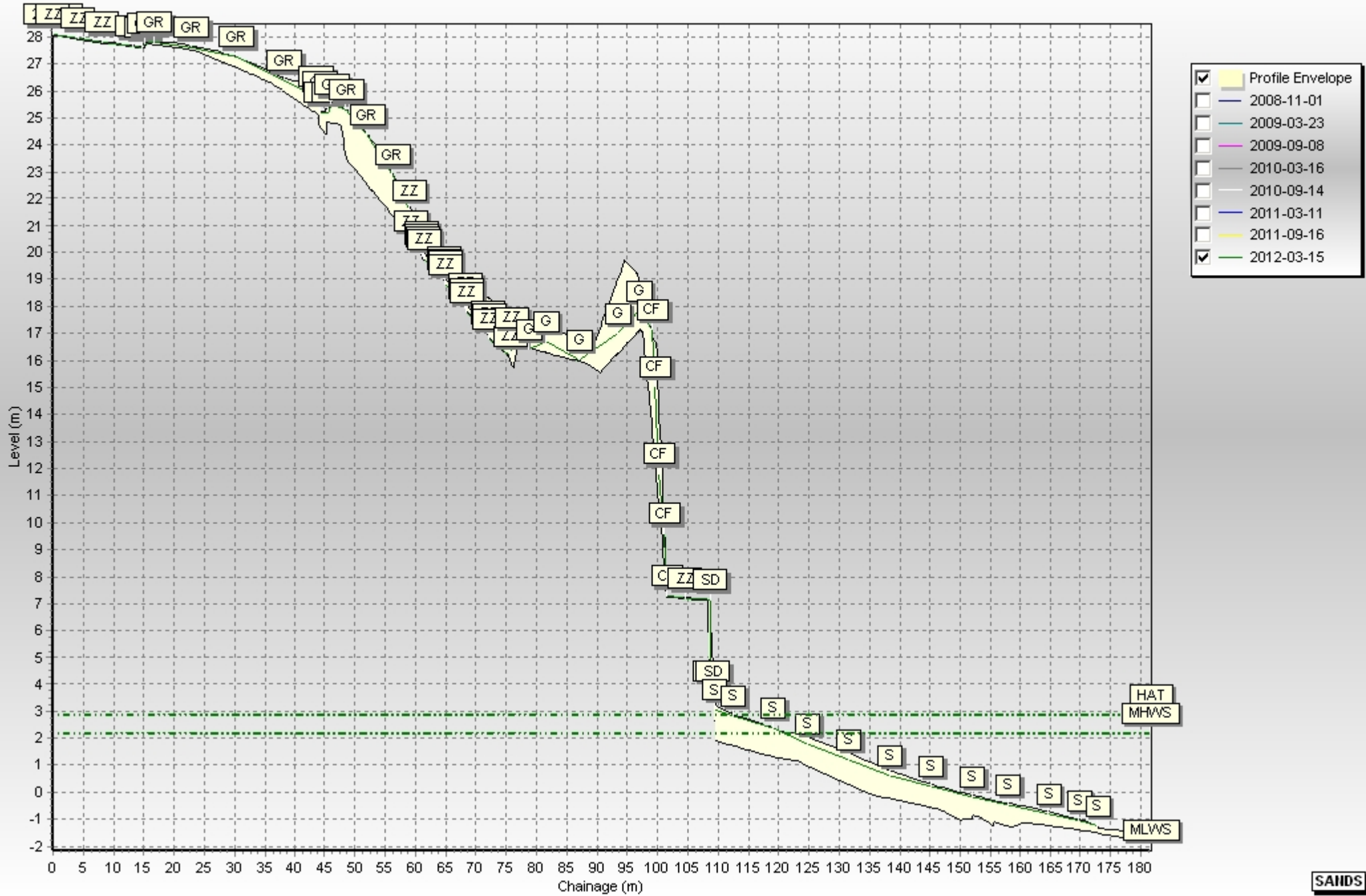
Beach Profiles: 1bSS12



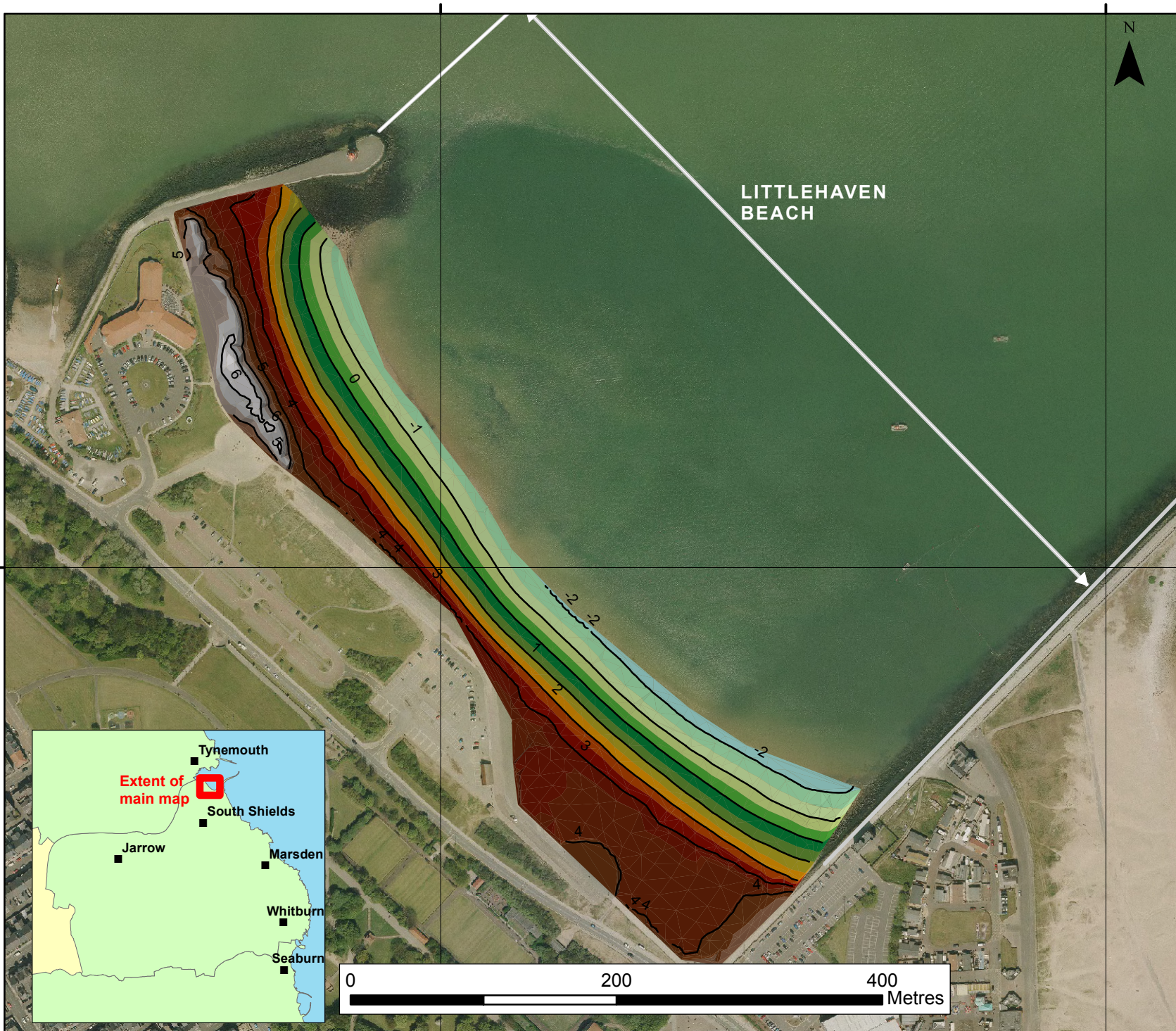
Beach Profiles: 1bSS13



Beach Profiles: 1bSS14



Appendix B
Topographic Survey



KEY

Elevation (m OD)

- 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
- 2 - -1.5
- 2.5 - -2
- 1m Contour

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme 2011 to 2016

**Appendix B- Map 1a
Topographic Survey
Littlehaven Beach
South Tyneside Council**

Update Report 4
Partial Measures Survey
Spring 2012

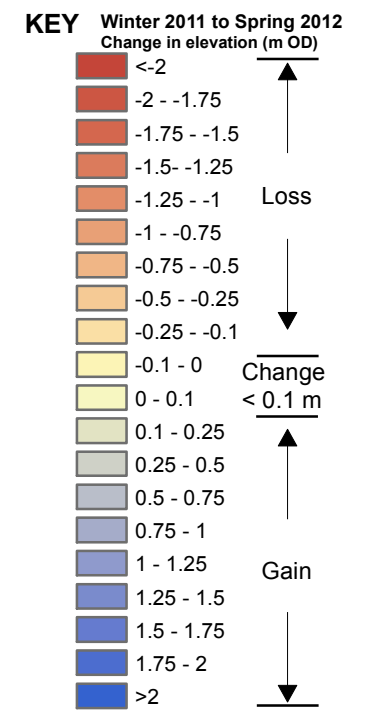


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Photography courtesy of North East Coastal Observatory
www.northeastcoastalobservatory.org.uk



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

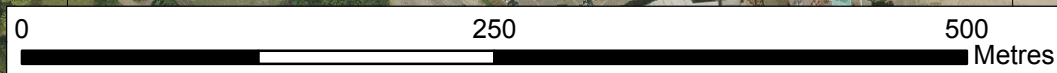
**Appendix B- Map 1b
Topographic Difference
Littlehaven Beach
South Tyneside Council**

Update Report 4
Partial Measures Survey
Spring 2012

Halcrow
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568000



437000

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Appendix C
Topographic Survey

Cliff Top Survey

Trow Quarry

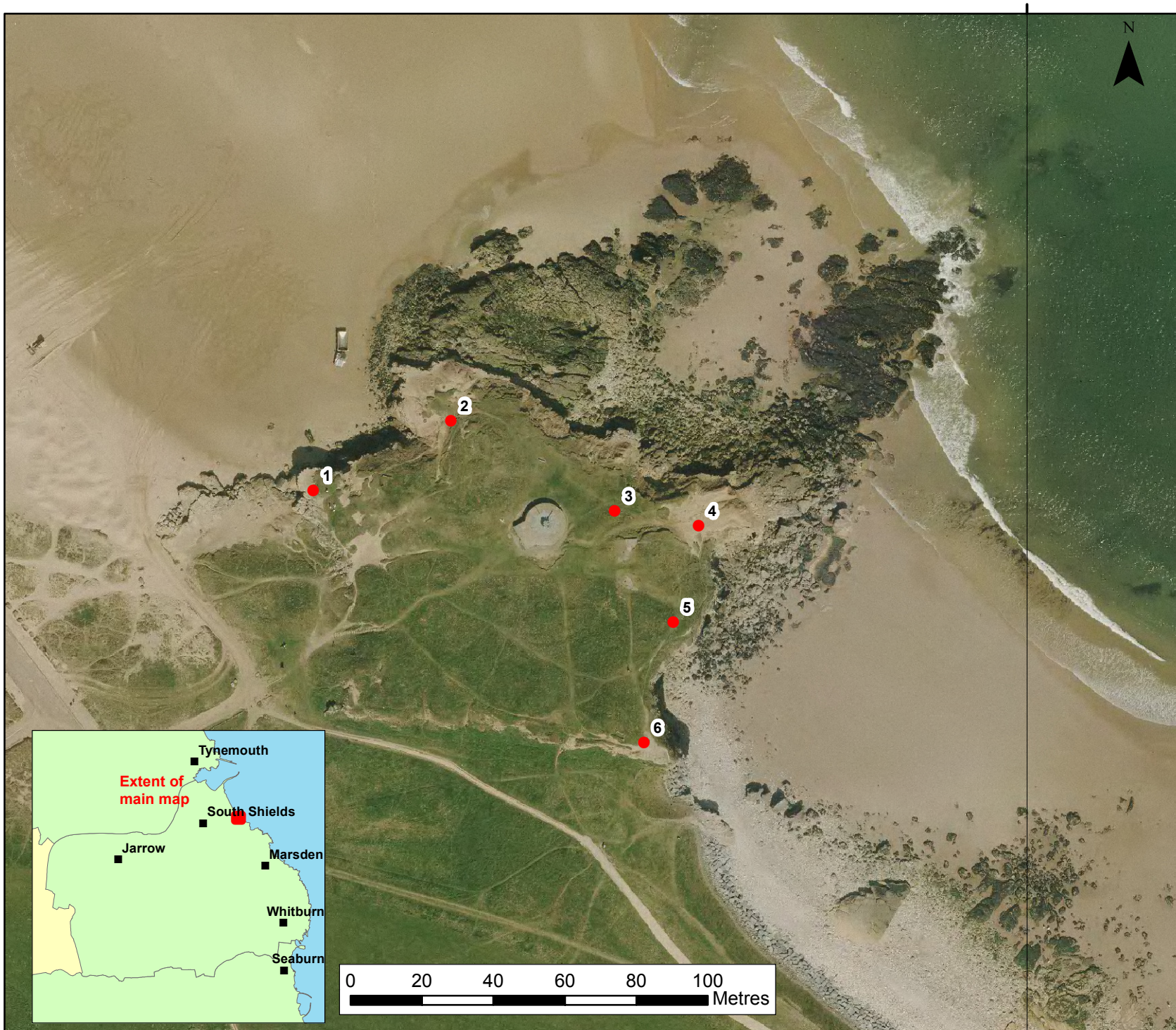
Six ground control points have been established at Trow Quarry (Figure C1). The maximum separation between any two points varies along the coast, reflecting the degree of risk from the erosion.

The cliff top surveys at Trow Quarry are undertaken bi-annually. Measurements are taken from a fixed ground control point along a fixed bearing to the edge of the cliff top.

Table C1 provides baseline information about these ground control points and results from the 2011 (baseline) survey showing the position from the ground control point to the edge of the cliff top along the defined bearing. Future reports will show results from subsequent surveys and provide a means of assessing erosion since the baseline survey.

Table C1 – Cliff Top Surveys at Trow Quarry

Ground Control Point Details				Distance to Cliff Top (m)		Total Erosion (m)	Erosion Rate (m/year)
Ref	Easting	Northing	Bearing (°)	Baseline Survey (Sept 2011)	Present Survey (Mar 2012)	Baseline (March 2009) to Present (Oct 2011)	Baseline (March 2009) to Present (Oct 2011)
1	tbc	tbc	tbc	7.04	6.9	-0.1	-0.3
2	tbc	tbc	tbc	9.39	9.4	0.0	0.1
3	tbc	tbc	tbc	7.02	7.1	0.1	0.1
4	tbc	tbc	tbc	10.46	10.5	0.1	0.2
5	tbc	tbc	tbc	7.01	7.2	0.2	0.4
6	tbc	tbc	tbc	10.21	10.5	0.2	0.6



KEY

- Cliff top survey locations

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme 2011 to 2016

**Appendix C- Map 1
Cliff Top Survey
Trow Quarry
South Tyneside Council**

Update Report 4
Partial Measures Survey
Spring 2012



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