

**Cell 1 Regional Coastal Monitoring Programme  
Update Report 7: 'Partial Measures' Survey 2015**



**Sunderland City Council  
Final Report**

**July 2015**

## Contents

Disclaimer .....	i
Abbreviations and Acronyms .....	ii
Water Levels Used in Interpretation of Changes .....	ii
Glossary of Terms.....	iii
Preamble.....	iv
1. Introduction .....	1
1.1 Study Area .....	1
1.2 Methodology.....	1
2. Analysis of Survey Data.....	6
2.1 Whitburn Bay.....	6
2.2 Hendon to Ryhope (incl. Halliwell Banks) .....	7
3. Problems Encountered and Uncertainty in Analysis.....	11
4. Recommendations for 'Fine-tuning' the Monitoring Programme .....	11
5. Conclusions and Areas of Concern .....	11

## Appendices

Appendix A	Beach Profiles
Appendix B	Cliff Top Survey

## List of Figures

Figure 1	Sediment Cells in England and Wales
Figure 2	Survey Locations

## List of Tables

Table 1	Analytical, Update and Overview Reports Produced to Date
Table 2	Sub-division of the Cell 1 Coastline

Authors	
Emma Allan	CH2M
Dr Paul Fish – Review of Draft	CH2M
Dr Paul Fish – Approval of Final	CH2M

## Disclaimer

Halcrow Group Limited ('Halcrow') is a CH2M HILL company. Halcrow has prepared this report in accordance with the instructions of our client Scarborough Borough Council (SBC) for the client's sole and specific use. Any other persons who use any information contained herein do so at their own risk. This report is a review of coastal survey information made available by SBC. The objective of this report is to provide an assessment and review of the relevant background documentation and to analyse and interpret the coastal monitoring data. Halcrow has used reasonable skill, care and diligence in the interpretation of data provided to them and accepts no responsibility for the content, quality or accuracy of any Third party reports, monitoring data or further information provided either to them by SBC or, via SBC from a Third party source, for analysis under this term contract.

Raw data analysed in this report is available to download via the project's webpage: [www.northeastcoastalobservatory.org.uk](http://www.northeastcoastalobservatory.org.uk). The North East Coastal Observatory does not "license" the use of images or data or sign license agreements. The North East Coastal Observatory generally has no objection to the reproduction and use of these materials (aerial photography, wave data, beach surveys, bathymetric surveys), subject to the following conditions:

1. North East Coastal Observatory material may not be used to state or imply the endorsement by North East Coastal Observatory or by any North East Coastal Observatory employee of a commercial product, service, or activity, or used in any manner that might mislead.
2. North East Coastal Observatory should be acknowledged as the source of the material in any use of images and data accessed through this website, please state "Image/Data courtesy of North East Coastal Observatory". We recommend that the caption for any image and data published includes our website, so that others can locate or obtain copies when needed. We always appreciate notification of beneficial uses of images and data within your applications. This will help us continue to maintain these freely available services. Send e-mail to [Robin.Siddle@scarborough.gov.uk](mailto:Robin.Siddle@scarborough.gov.uk)
3. It is unlawful to falsely claim copyright or other rights in North East Coastal Observatory material.
4. North East Coastal Observatory shall in no way be liable for any costs, expenses, claims, or demands arising out of the use of North East Coastal Observatory material by a recipient or a recipient's distributees.
5. North East Coastal Observatory does not indemnify nor hold harmless users of North East Coastal Observatory material, nor release such users from copyright infringement, nor grant exclusive use rights with respect to North East Coastal Observatory material.
6. North East Coastal Observatory material is not protected by copyright unless noted (in associated metadata). If copyrighted, permission should be obtained from the copyright owner prior to use. If not copyrighted, North East Coastal Observatory material may be reproduced and distributed without further permission from North East Coastal Observatory.

## 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)
	Souter Point to Chourdon Point
HAT	3.18
MHWS	2.48
MLWS	-1.92

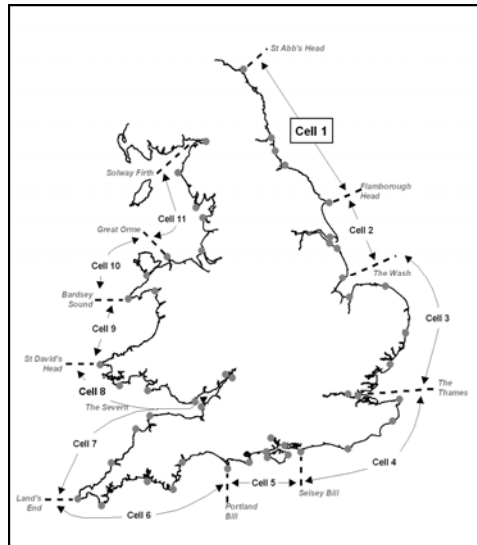
**Source:** *River Tyne to Flamborough Head Shoreline Management Plan 2.*  
Royal Haskoning, February 2007.

## 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 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	Oct 12	
5	2012/13	Sept-Oct 12	Mar 13	Mar 13	June 13	
6	2013/14	Sept-Oct 2013	Feb 14	Mar 14	July 14	
7	2014/2015	Sept-Nov 14	Feb 15	Mar-Apr 15	July 15 (*)	

(\*) The present report is **Update Report 7** and provides an analysis of the 2015 Partial Measures survey for Sunderland City Council's frontage.

## **1. Introduction**

### **1.1 Study Area**

Sunderland City Council's frontage extends from The Bents to Ryhope. For the purposes of this report and for consistency with previous reporting, it has been sub-divided into three areas, namely:

- Whitburn Bay
- Sunderland Harbour and Docks
- Hendon to Ryhope (including Halliwell Banks)

### **1.2 Methodology**

Along Sunderland City Council's frontage, the following surveying is undertaken:

- Full Measures survey annually each autumn comprising:
  - Beach profile surveys along 58 transect lines (commenced 2009)
  - Topographic survey at Whitburn Bay (commenced 2009)
  - Topographic survey at Hendon to Ryhope (including Halliwell Banks) (commenced 2009)
- Partial Measures survey annually each spring comprising:
  - Beach profile surveys along 16 transect lines (commenced 2009)
- Cliff top survey bi-annually at:
  - Hendon to Ryhope (including Halliwell Banks) (commenced 2009)

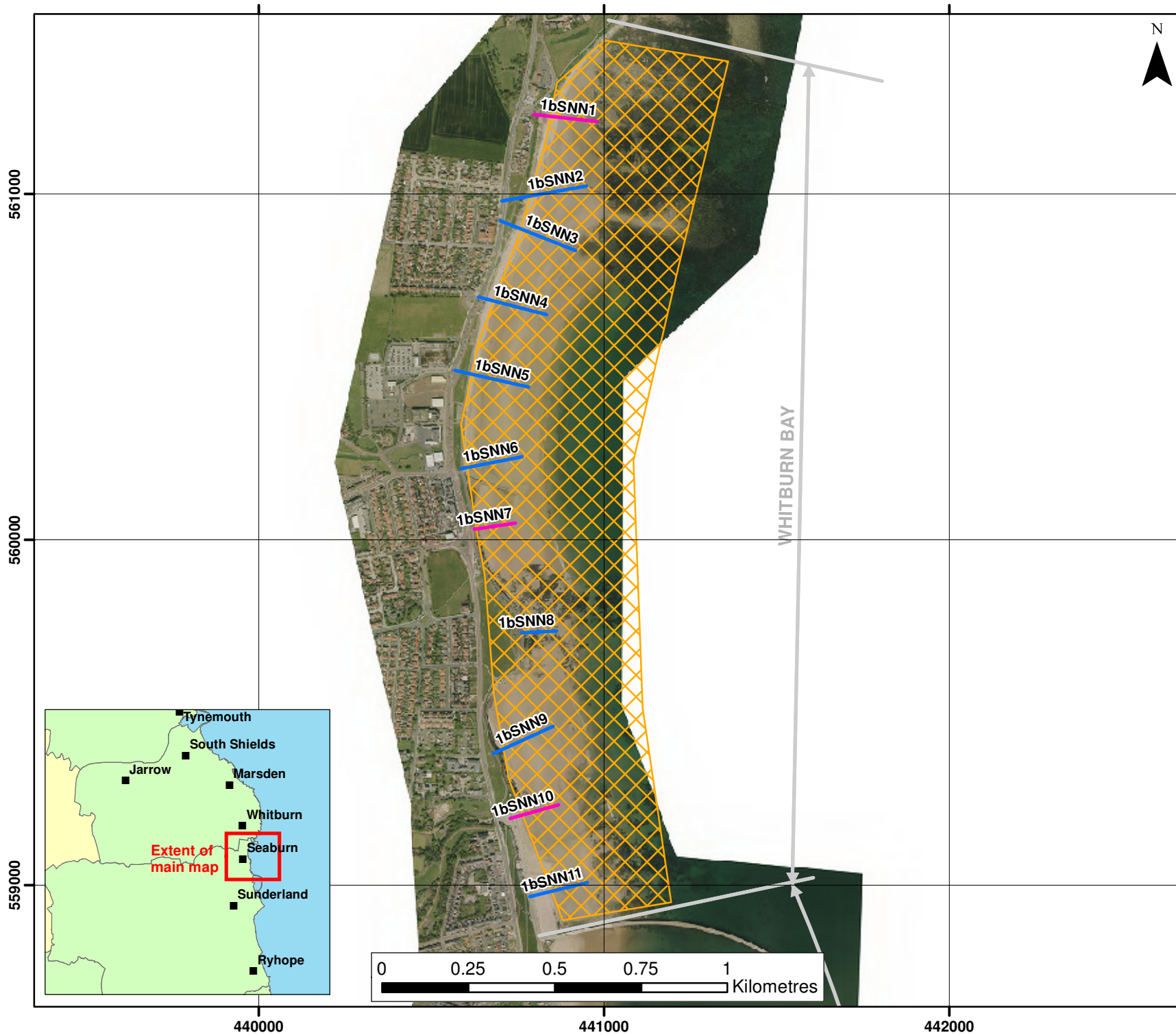
The location of these surveys is shown in Figure 2. The Partial Measures survey was undertaken along this frontage on the 20<sup>th</sup> March 2014 (Whitburn Bay) and 5<sup>th</sup> March 2014 (Hendon to Ryhope, including Halliwell Banks). During this time weather conditions varied considerably. Refer 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 (blue line)
- 6 monthly (pink line)

**Topographic Surveys**

- 6 monthly (green grid)
- yearly (yellow grid)
- 5 yearly (brown grid)

**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**  
**Whitburn Bay**  
**Sunderland City Council**

Update Report 7  
 Partial Measures Survey  
 Spring 2015

**ch2m**<sup>SM</sup>

Halcrow Group Ltd, Lyndon House, 62 Hagley Road, Edgbaston, Birmingham, B16 8PE

Tel: +44 (0)121 456 2345  
 Fax: +44(0)121 456 1569  
 www.ch2m.com

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



**KEY**

**Topographic Profiles**  
 — Annual  
 — 6 monthly

**Topographic Surveys**  
 [Green cross-hatch] 6 monthly  
 [Yellow cross-hatch] yearly  
 [Brown cross-hatch] 5 yearly

**Cliff Top Monitoring Pegs**  
 [Purple bar] 50m centres  
 [Green bar] 100m centres  
 [Red bar] 300m centres  
*(Indicative survey extents shown)*

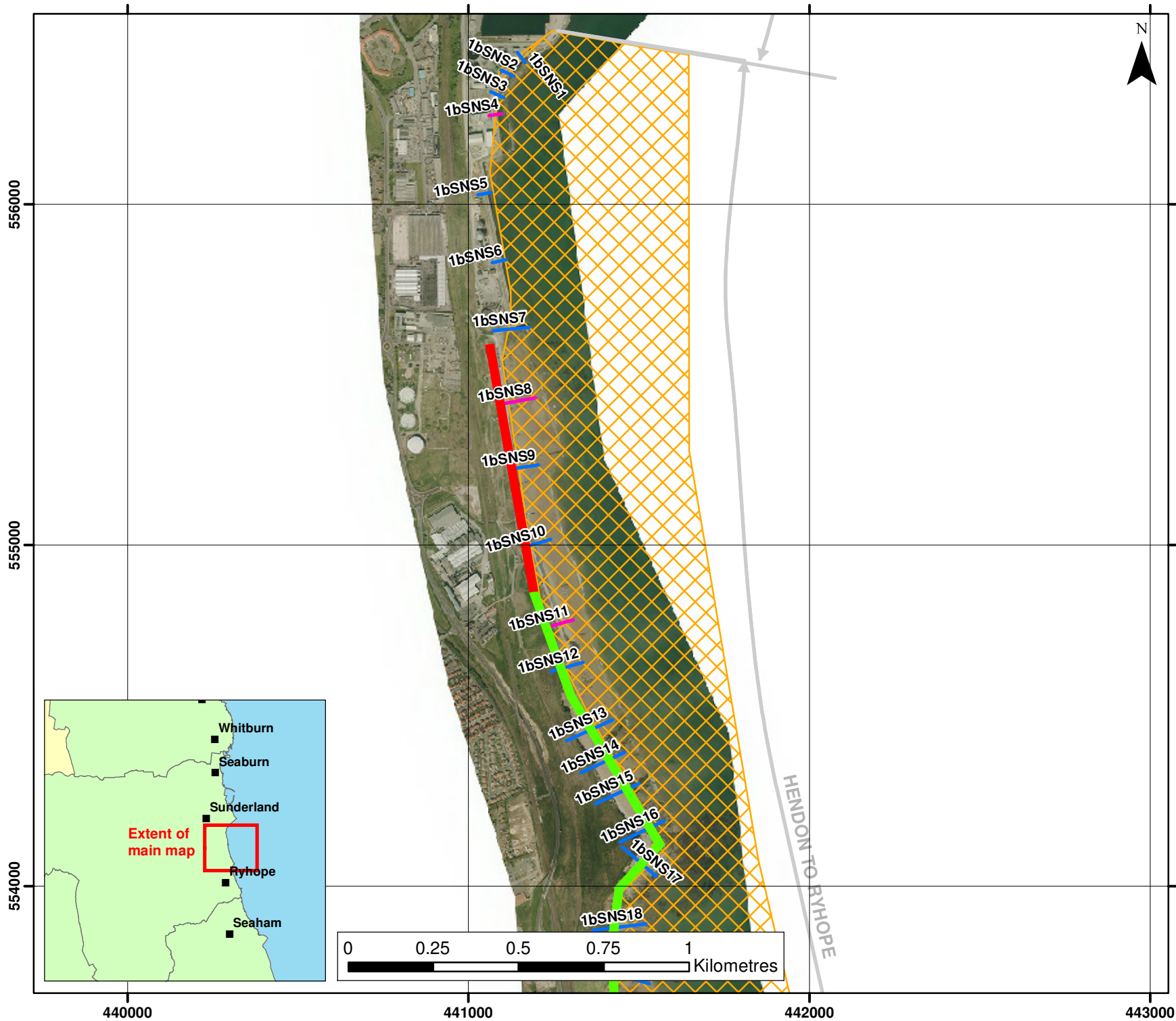
Client: North East Coastal Group  
 Project: Cell 1 Regional Coastal Monitoring Programme 2011 to 2016

**Figure 2- Map 2  
 Survey Locations  
 Sunderland Harbour  
 and Docks  
 Sunderland City Council**

Update Report 7  
 Partial Measures Survey  
 Spring 2015

**ch2m**  
 Halcrow Group Ltd, Lyndon House, 62 Hagley Road, Edgbaston, Birmingham, B16 8PE  
 Tel: +44 (0)121 456 2345  
 Fax: +44(0)121 456 1569  
 www.ch2m.com

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



**KEY**

**Topographic Profiles**  
 — Annual  
 — 6 monthly

**Topographic Surveys**  
 [Green cross-hatch] 6 monthly  
 [Orange cross-hatch] yearly  
 [Brown cross-hatch] 5 yearly

**Cliff Top Monitoring Pegs**  
 [Purple bar] 50m centres  
 [Green bar] 100m centres  
 [Red bar] 300m centres  
*(Indicative survey extents shown)*

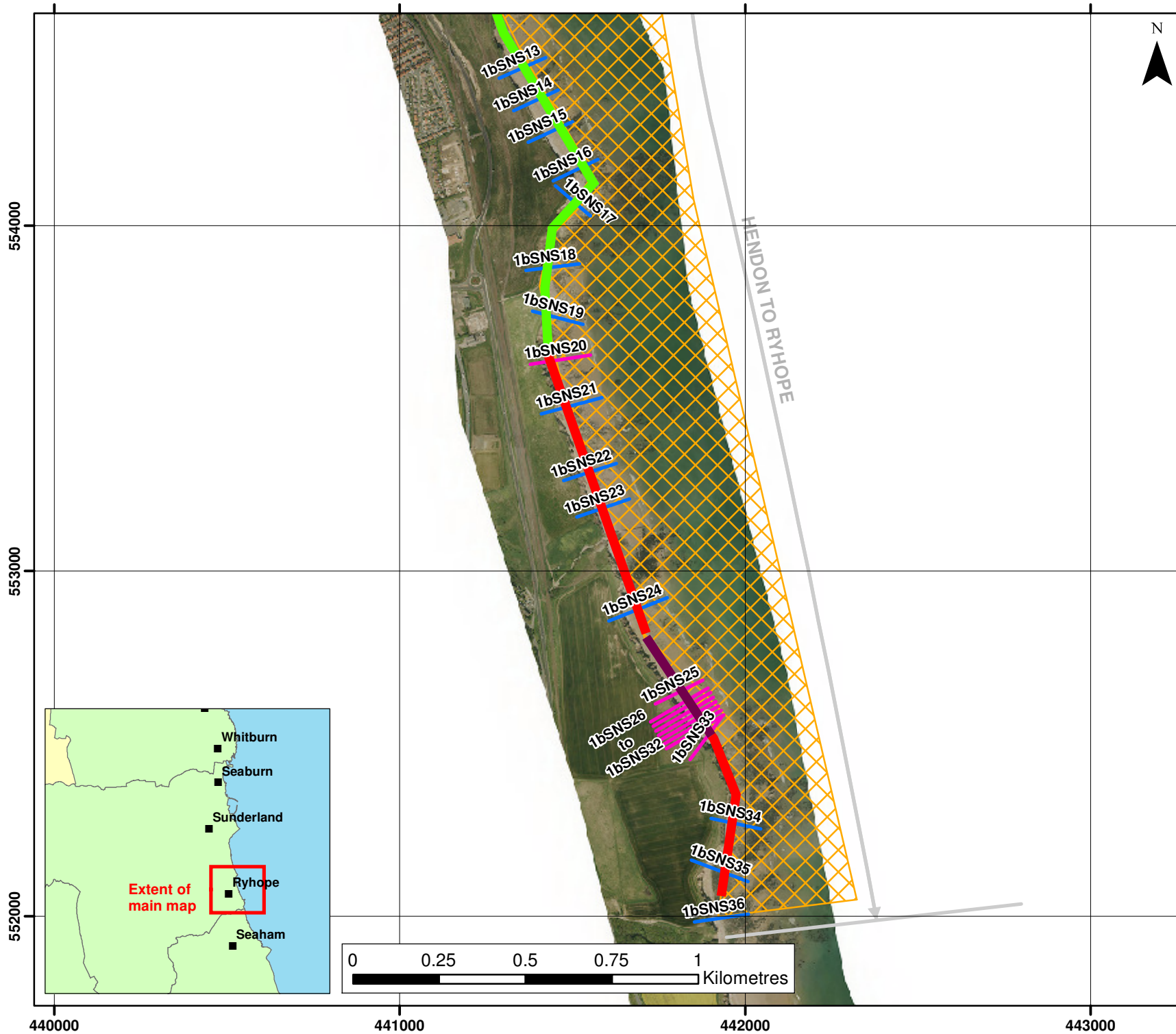
Client: North East Coastal Group  
 Project: Cell 1 Regional Coastal Monitoring Programme 2011 to 2016

**Figure 2- Map 3**  
**Survey Locations**  
**Hendon to Ryhope North**  
**Sunderland City Council**

Update Report 7  
 Partial Measures Survey  
 Spring 2015

**ch2m**  
 Halcrow Group Ltd, Lyndon House, 62 Hagley Road, Edgbaston, Birmingham, B16 8PE  
 Tel: +44 (0)121 456 2345  
 Fax: +44(0)121 456 1569  
 www.ch2m.com

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



**KEY**

**Topographic Profiles**  
 — Annual (blue line)  
 — 6 monthly (magenta line)

**Topographic Surveys**  
 ▨ 6 monthly (green cross-hatch)  
 ▨ yearly (yellow cross-hatch)  
 ▨ 5 yearly (purple 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 4**  
**Survey Locations**  
**Hendon to Ryhope South**  
**Sunderland City Council**

Update Report 7  
 Partial Measures Survey  
 Spring 2015

**ch2m**<sup>SM</sup>

Halcrow Group Ltd, Lyndon House, 62 Hagley Road, Edgbaston, Birmingham, B16 8PE  
 Tel: +44 (0)121 456 2345  
 Fax: +44(0)121 456 1569  
 www.ch2m.com

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

## 2. Analysis of Survey Data

### 2.1 Whitburn Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
April 2015	<p><b>Beach Profiles:</b></p> <p>Whitburn Bay is covered by three beach profile lines for the Partial Measures survey (Appendix A). The last survey was Full Measures, undertaken in autumn 2014.</p> <p><b>1bSNN1</b> is just to the south of Sunderland City Council's northern boundary. Since the last survey the boulders at the toe of the dunes have not changed. Beach levels around a chainage of 80m have increased to form a small berm approximately 4m high, but seaward of chainage 80m to chainage 180m, beach levels have fallen by approximately 0.6m.</p> <p><b>1bSNN7</b> is at Seaburn, north of Parson's Rock. Beach levels in front of the seawall have increased across the length of the profile by approximately 0.4m. The profile form has remained the same.</p> <p><b>1bSNN10</b> is located mid-way between Parson's Rock and Roker Pier. Beach levels have generally reduced across the profile by up to 0.4m, with the exception of a small section between a chainage of 20m and 30m where a small berm has formed approximately 0.4m in height.</p>	<p>Along the length of Whitburn Bay beaches have been dynamic, with a widespread fall of 0.4m to 0.6m and formation of a berm on the upper beach. This probably reflects storm conditions over the winter/spring. In the centre of Whitburn Bay at profile 1bSNN7, beaches have accreted.</p> <p><b>Longer term trends:</b> Profiles in Whitburn Bay are within the bounds of previous survey, although between a chainage of 30m and 60m of profile 1bSNN10, beach levels at the lowest since surveys began in 2009.</p>

## 2.2 Hendon to Ryhope (incl. Halliwell Banks)

Survey Date	Description of Changes Since Last Survey	Interpretation
<p><b>March 2015</b></p>	<p><b>Beach Profiles:</b></p> <p>Hendon to Ryhope is covered by thirteen beach profile lines for the Partial Measures survey (Appendix A). The last survey was Full Measures, undertaken in autumn 2014.</p> <p>Profile <b>1bSNS4</b> includes a seawall and rock revetment, after which it extends across boulders to low water. There is no change compared to previous surveys.</p> <p>Profile <b>1bSNS8</b> extends across the seawall, rock revetment, a rocky upper beach and sandy middle and lower beach. Beach levels at the toe of the rock revetment have reduced slightly and this is evident from the survey photograph where there has been some scour around the rock toe (see Plate 1). Seaward of the rock revetment beach levels have increased across the profile to a chainage of 85m by approximately 0.4m.</p> <p>Profile <b>1bSNS11</b> starts at the coastal slope backing the sea wall and extends over the rock armour and beach. Beach levels have reduced from the toe of the rock armour to the seaward end of the profile. Erosion is greatest at the toe of the rock armour where up to 1m lowering has occurred resulting in exposure of rock and a change in beach sediment type from sand to shingle (Plates 2 and 3).</p> <p>Profile <b>1bSNS20</b> is located at Shirley Banks. The cliff and beach has not changed since the last survey.</p> <p>Profile <b>1bSNS25</b> is located at Halliwell Banks. The top of the cliffs, cliff face and cliff toe have not changed since the last survey. Beach levels are generally unchanged, with the exception of the formation of a small berm at the cliff toe that is approximately 0.5m in height (Plate 4).</p> <p>Profiles <b>1bSNS26 to 1bSNS33</b> are located on Halliwell Banks to assess erosion of a former land fill site. Cliff tops are between 26m and 27mOD, with fronting beaches typically around 1m lower than previously seen. At profiles <b>1bSNS26, 1bSNS27</b> and <b>1bSSN28</b>, the cliff face has eroded by approximately 1m at the toe and beach levels have decreased by 0.2m to 0.4m across the profile. At profiles <b>1bSNS29</b> and <b>1bSNS30</b>, the pattern of change is similar to profiles 1bSN26 to 1bSNS28, with erosion of up to 5m at the cliff toe. Beach levels have fallen across the profile by approximately 0.4m. At profiles <b>1bSNS31</b> to <b>1bSNS33</b>, the cliff has remained stable while beach levels have fallen by approximately 0.4m.</p>	<p>Profile 1bSNS4 extends onto rocks and then into water and shows no change.</p> <p>At South Hendon (1bSNS8), sand levels have generally increased across the beach profile but at profile 1bSNS11, beach levels have fallen.</p> <p>At Profile 1bSNS20 the cliff and beach has remained stable since the last survey.</p> <p>At profile 1bSNS25, to the north of the landfill site, the cliff and beach are unchanged.</p> <p>At the landfill site (profiles 1bSSN26 to 1bSSN33) the cliff has eroded, up to 5m loss recorded at the toe. To the south of the landfill site at profile 1bSNS33, the cliff top has remained stable. At all locations the beach has lowered although the overall form of the profile has remained the same.</p> <p><b>Longer term trends:</b> In general, the profile change along the Hendon to Ryhope frontage is within the bounds of previous surveys; the only exception is at profile 1bSNS8 where beach levels between a chainage of 50m and 90m are the highest recorded since surveys began in March 2009.</p> <p>At the landfill site (profiles 1bSSN25 to 1bSSN33), the cliff and beach are within the bounds of previous surveys. However, profiles 1bSNS26 to 1bSNS31 show significant recession of the cliff toe.</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
<p><b>March 2015</b></p>	<p><b>Cliff-top Survey:</b></p> <p>32 ground control points (numbered 1-32) were established along the cliff top between Hendon and Ryhope in March 2009, with a further three (28A, 28B and 28C) added in September 2009. Note: the numbering of ground control points is not intended to correlate with that of the beach profile lines and reference should be made to Appendix B - Map 1 and Appendix B – Map 2 for the location of ground control points.</p> <p>Measurements are taken from each ground control point along a fixed bearing to the edge of the cliff top. These cliff top surveys are undertaken bi-annually and are intended to inform on erosion rates of the sea cliffs extending from the defended industrial areas at Hendon southwards along the undefended cliffs to Ryhope Dene.</p> <p>The results from the cliff top monitoring are anticipated to have an accuracy of <math>\pm 0.2\text{m}</math> due to the technique used. These cliff top surveys are undertaken bi-annually and are intended to inform on erosion rates of the sea cliffs extending from the defended industrial areas at Hendon southwards along the undefended cliffs to Ryhope Dene. Appendix B – Table B1 provides results from the March 2009 cliff top survey, 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 original (March 2009) and previous (October 2011) cliff top surveys.</p> <p>Results show that since the last survey, three locations have eroded, Point 20 by 0.4m; Point 24 by 0.3m; and Point 27 by 6.7m. Since surveys began in March 2009 (September 2009 for 28A and 28B) erosion has occurred at 23 ground control points.</p>	<p>Since the last survey, the cliffs at Halliwell Banks (specifically points 20, 24 and 27) have eroded by as much as 6.7m, although 0.3 to 0.4m is more typical. These records support the cliff recession documented by the shore profiles.</p> <p><b>Longer term trends:</b> Since 2009, the cliffs immediately north of a Salterfern Rocks (points 8-10), along the length of Halliwell Banks (points 19-28A), and immediately south of Pincushion (points 31 and 32) have eroded. Greatest erosion has occurred at points 10, 21, 25, 27 and 28 between 4m and 11m have been lost.</p>

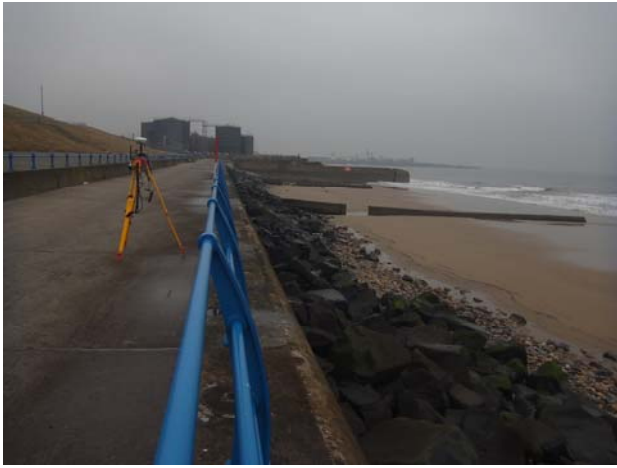


Plate 1 – Survey photograph 1bSNS8\_20150308\_N5.JPG



Plate 2 – Survey photograph 1bSNS11\_20150308\_N8.JPG



Plate 3 – Survey photograph 1bSNS8\_20140913\_N7.JPG





Plate 3 – Survey photograph 1bSNS25\_20150308\_UP3.JPG

### **3. Problems Encountered and Uncertainty in Analysis**

#### **Individual Profiles**

n/a

#### **Cliff Top Surveys**

n/a

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

No changes are recommended at the present time.

### **5. Conclusions and Areas of Concern**

- At Whitburn Bay, the recorded profiles present no causes for concern.
- At Hendon to Ryhope (incl. Halliwell Banks), the greatest amount of erosion of 10.7m was recorded to have taken place between March 2009 and March 2015 and 6.7m since the last survey, is at Point 27, which is on the northern border of the landfill site. Erosion either side varies from 1.6m to 7.6m erosion and should therefore be monitored closely.
- Elsewhere at Hendon to Ryhope (incl. Halliwell Banks), the cliff the recorded profiles and cliff top surveys present no causes for concern.

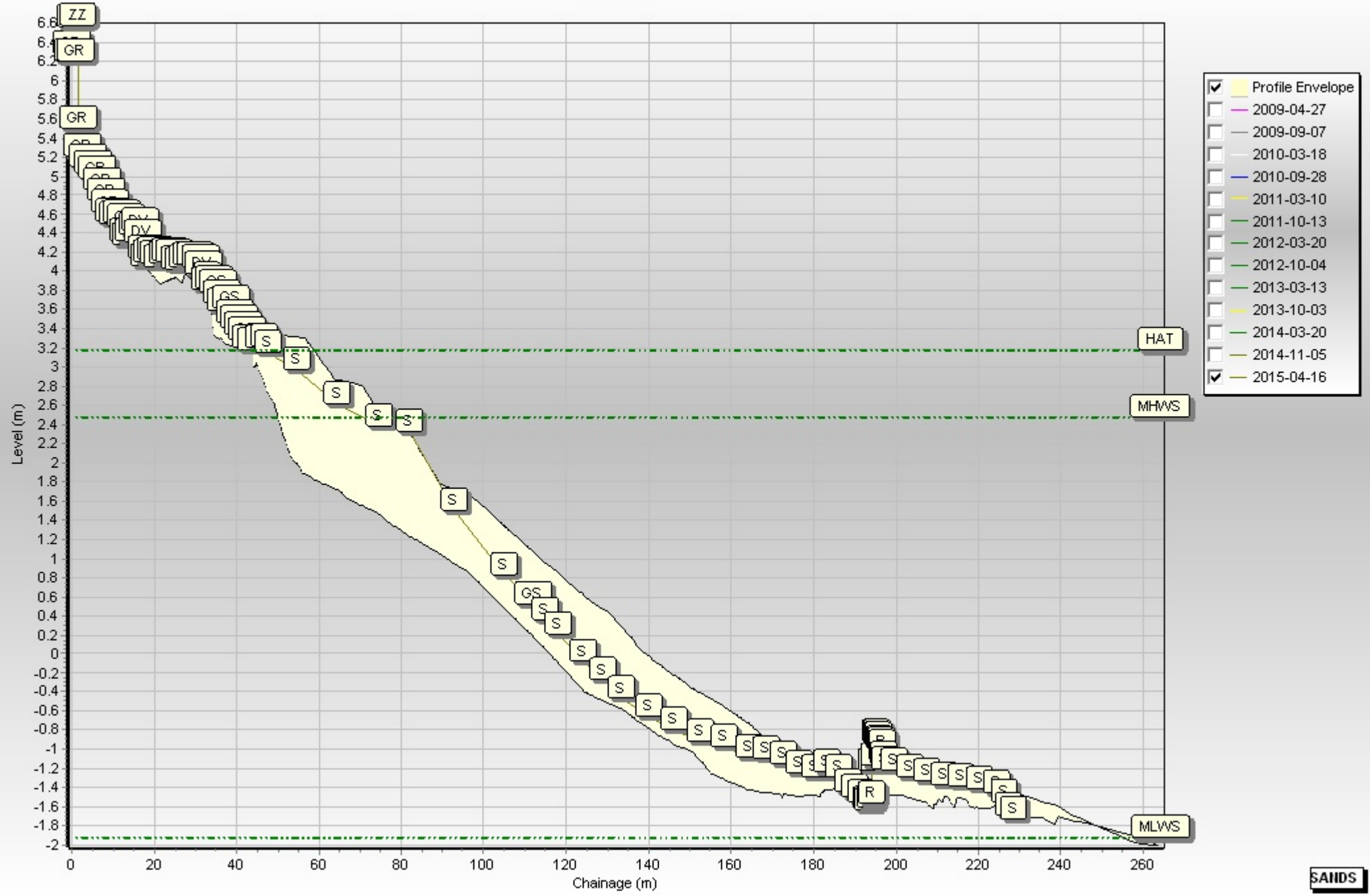
## **Appendices**

**Appendix A**  
**Beach Profiles**

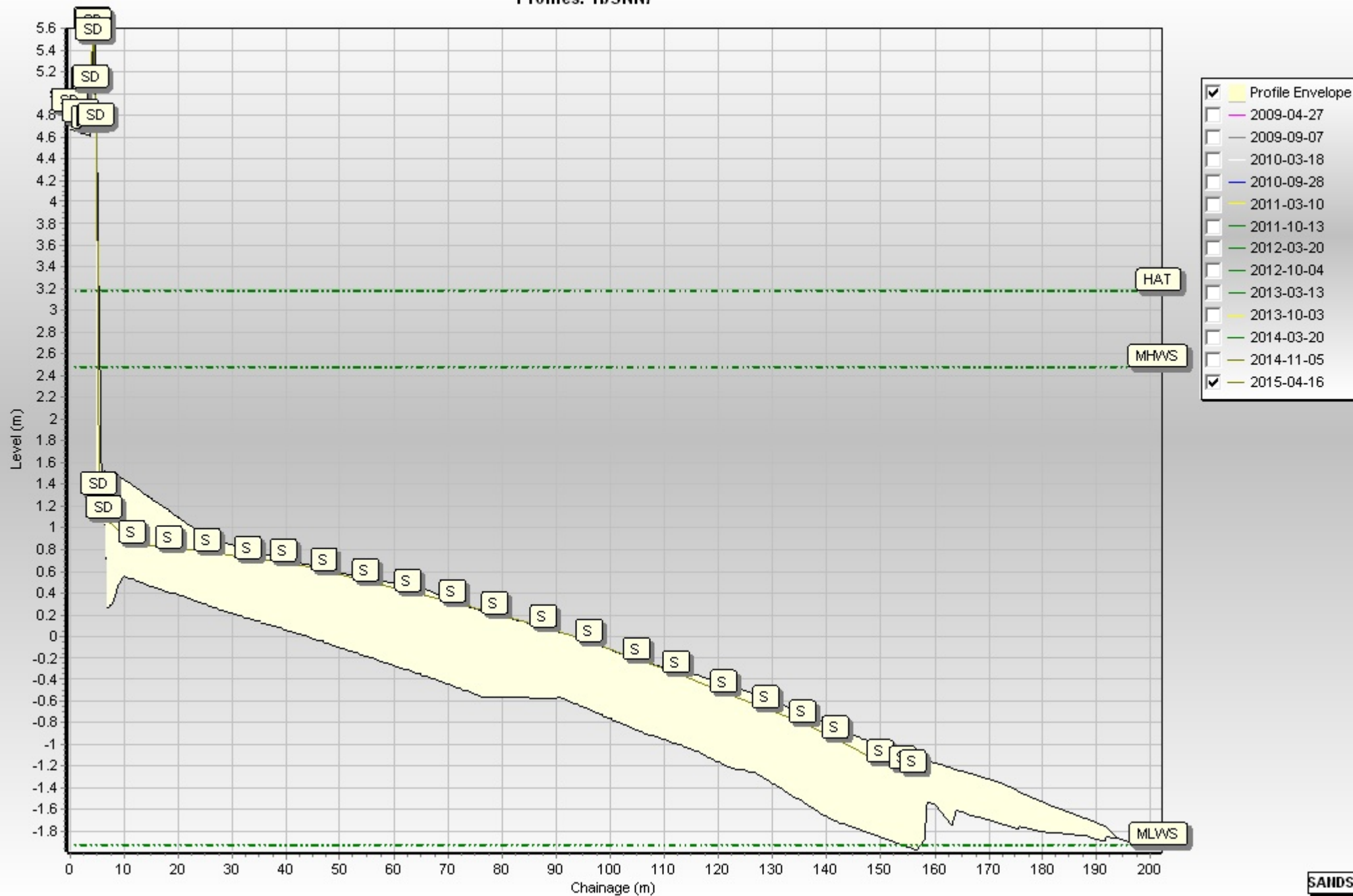
The following sediment feature codes are used on some profile plots:

<b>Code</b>	<b>Description</b>
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

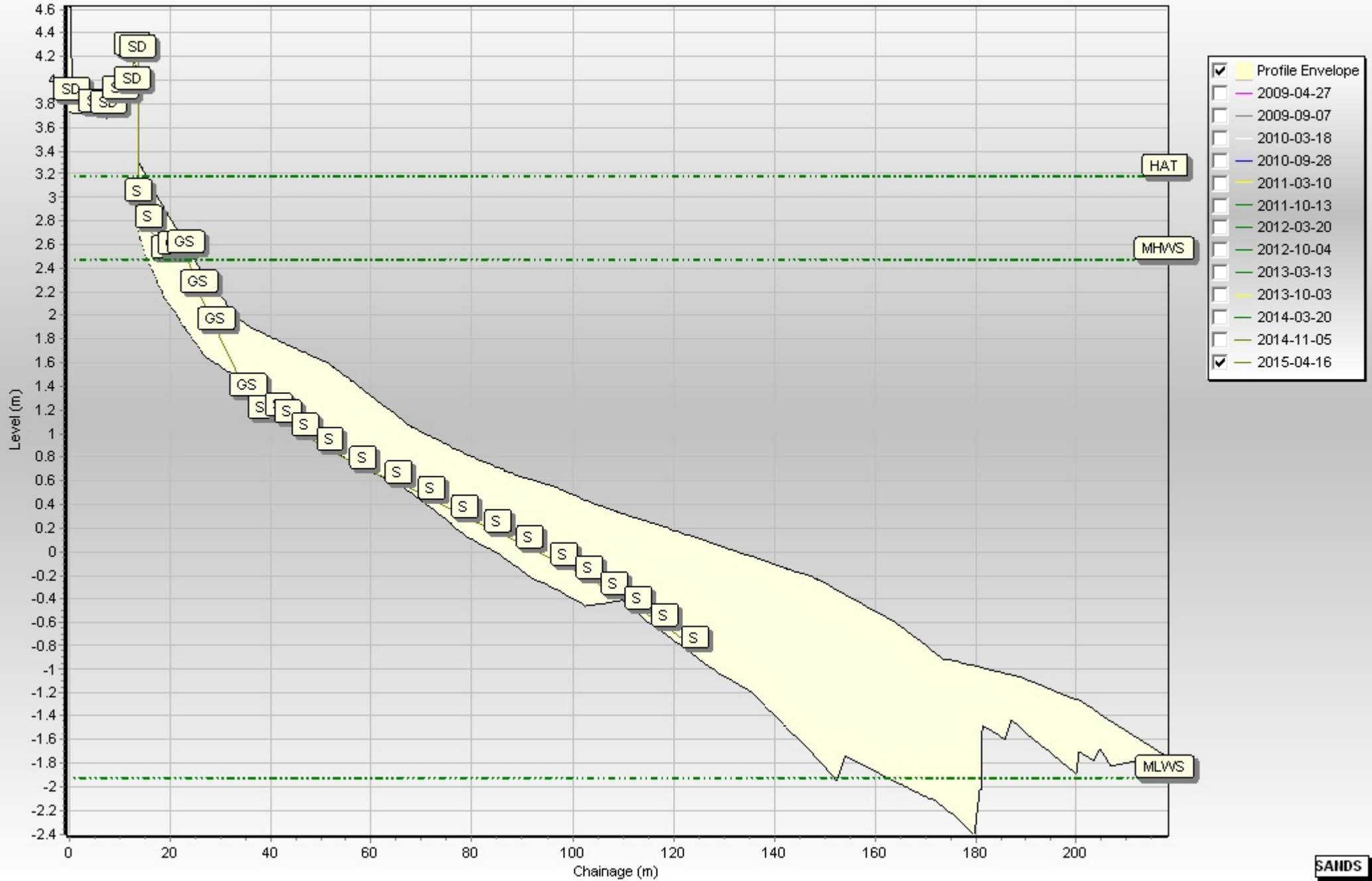
Profiles: 1bSNN1



### Profiles: 1bSNN7

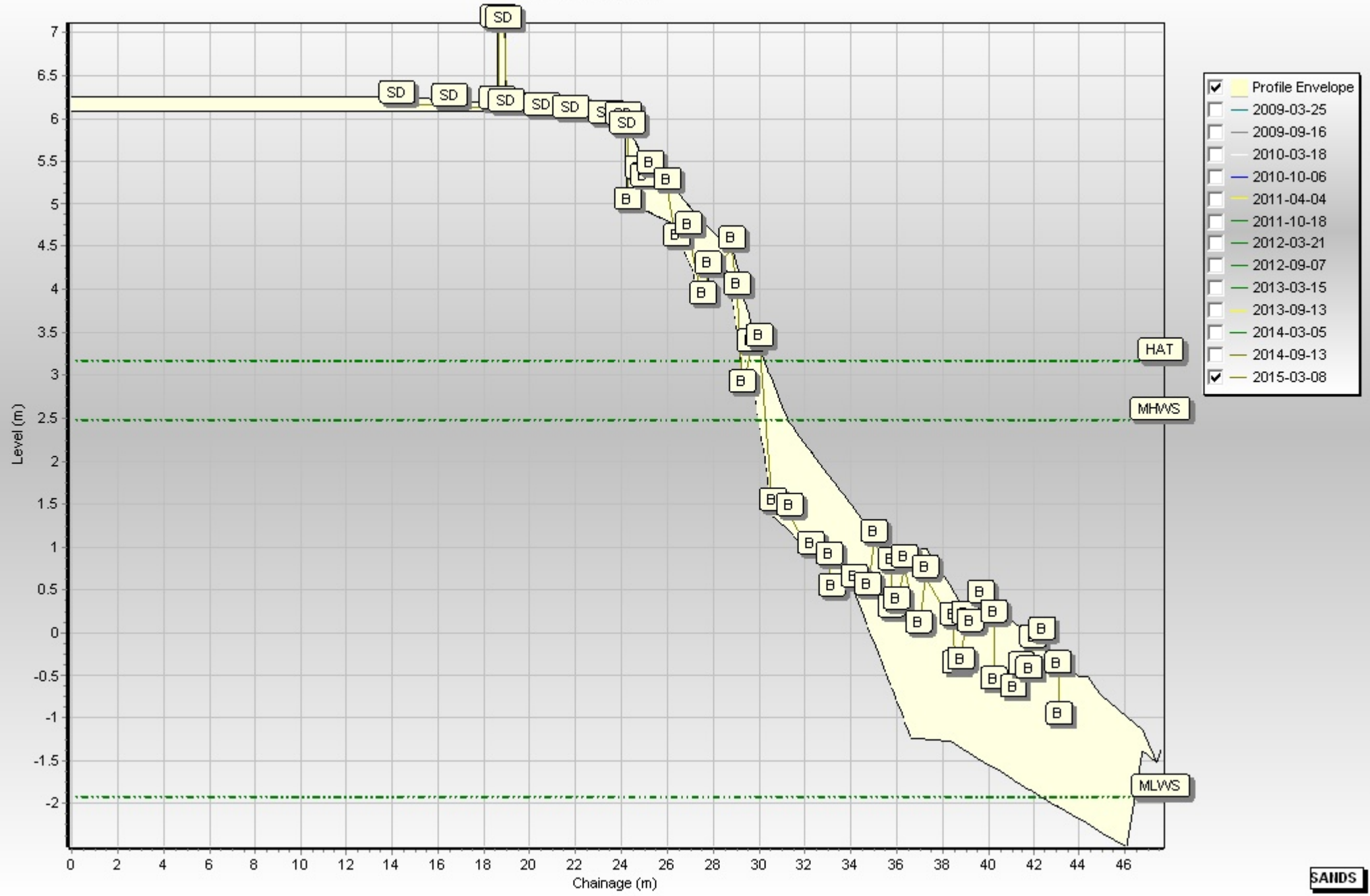


Profiles: 1bSNN10

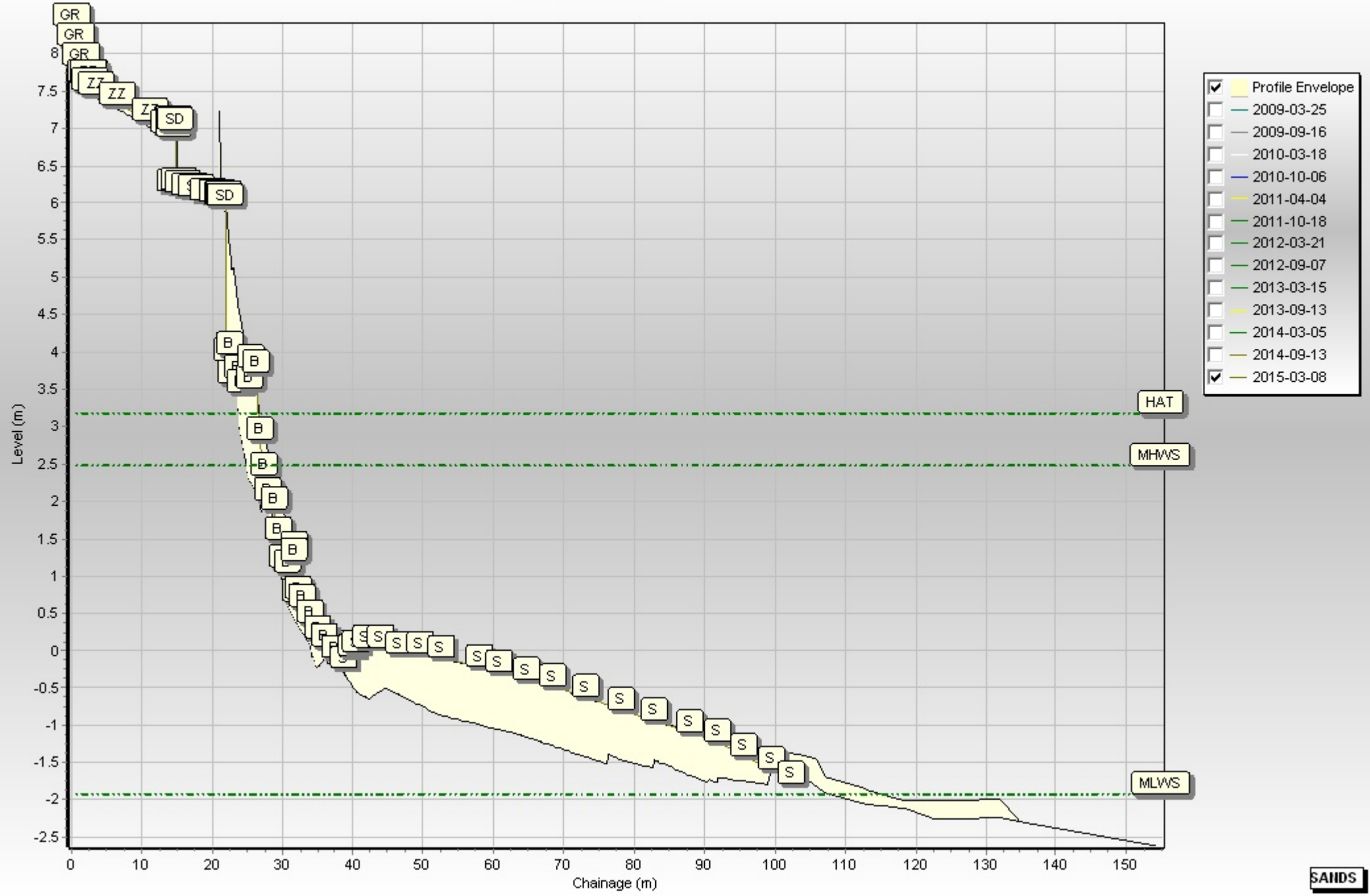




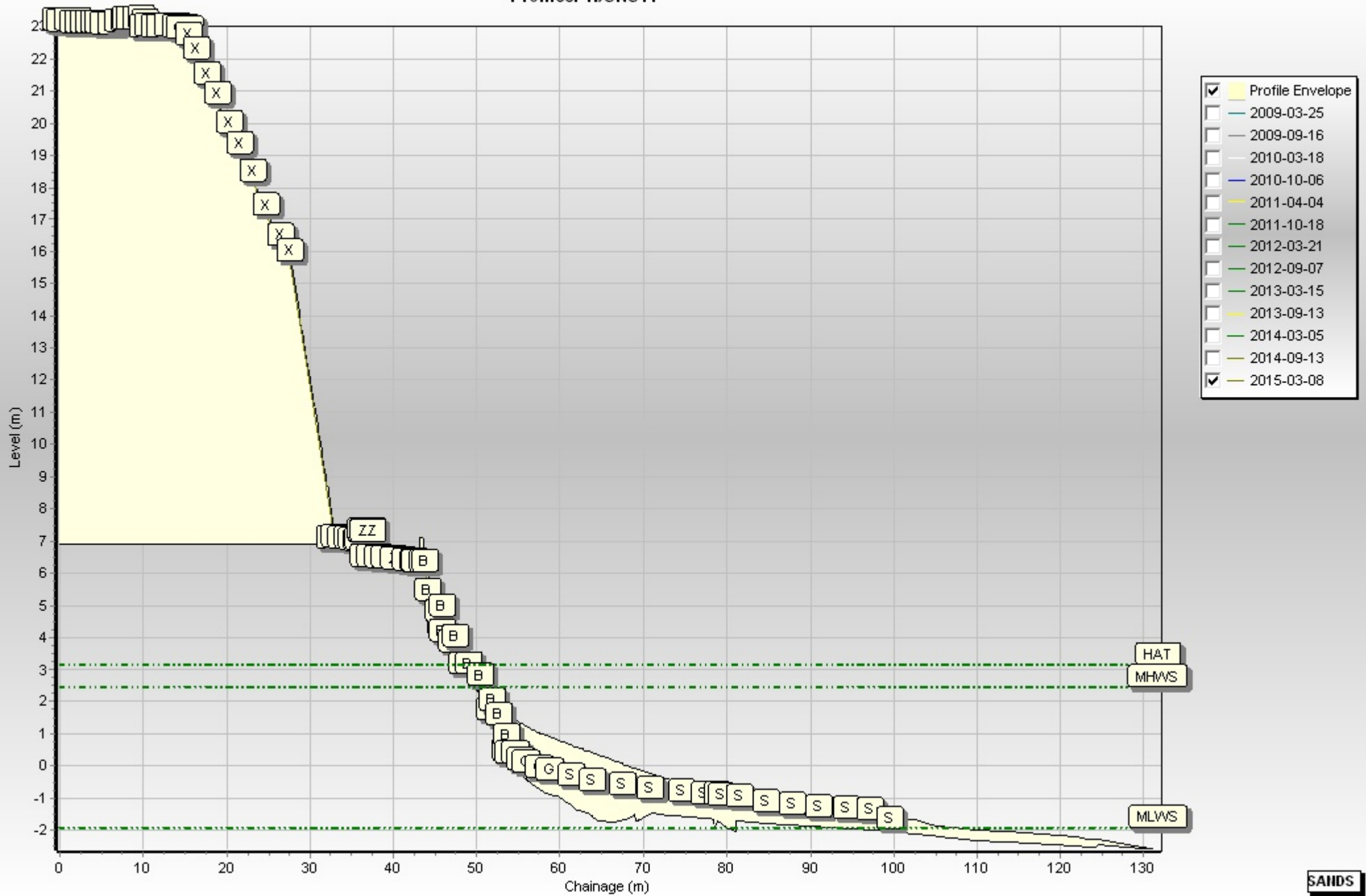
Profiles: 1bSNS4



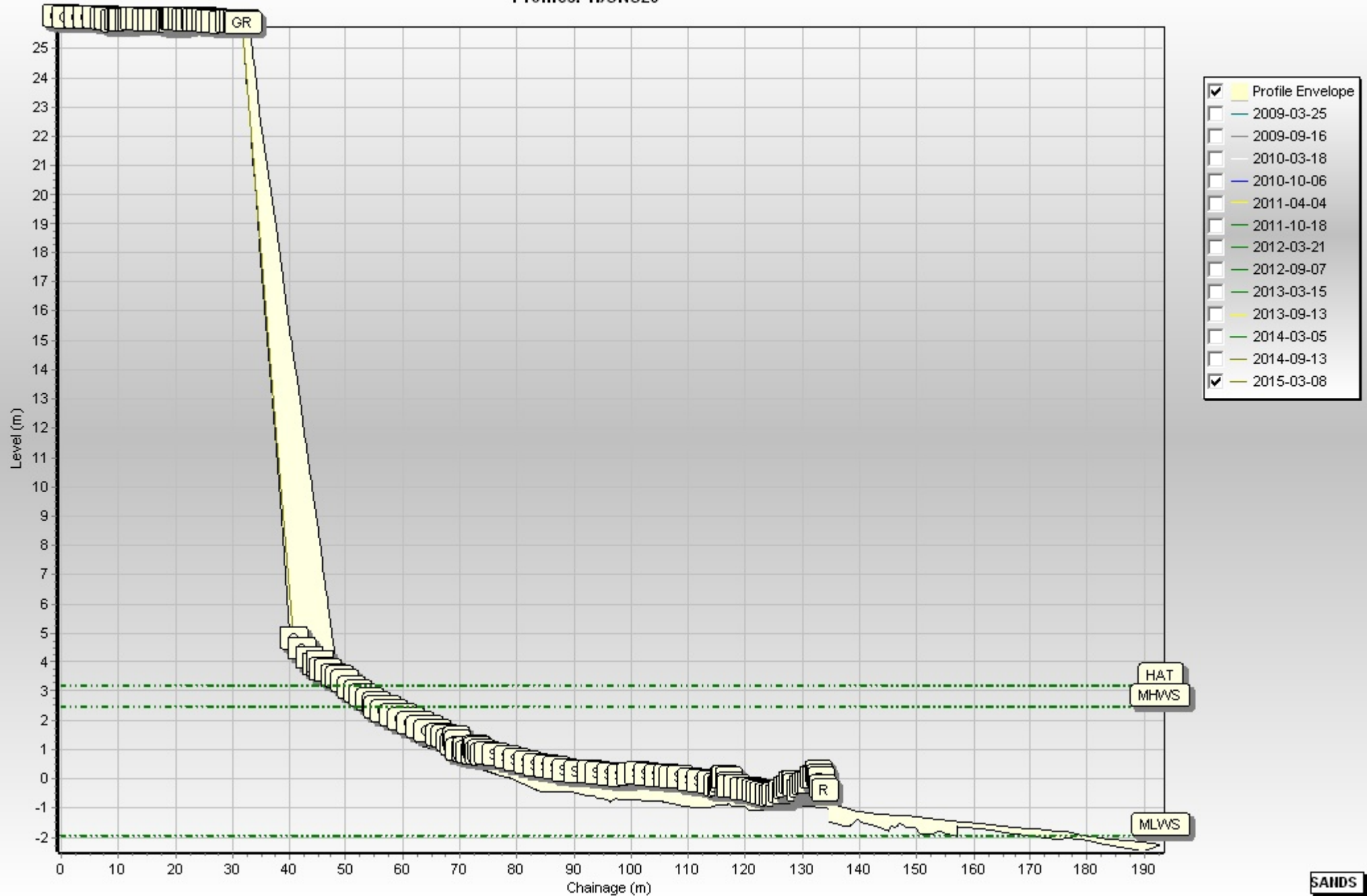
Profiles: 1bSNS8



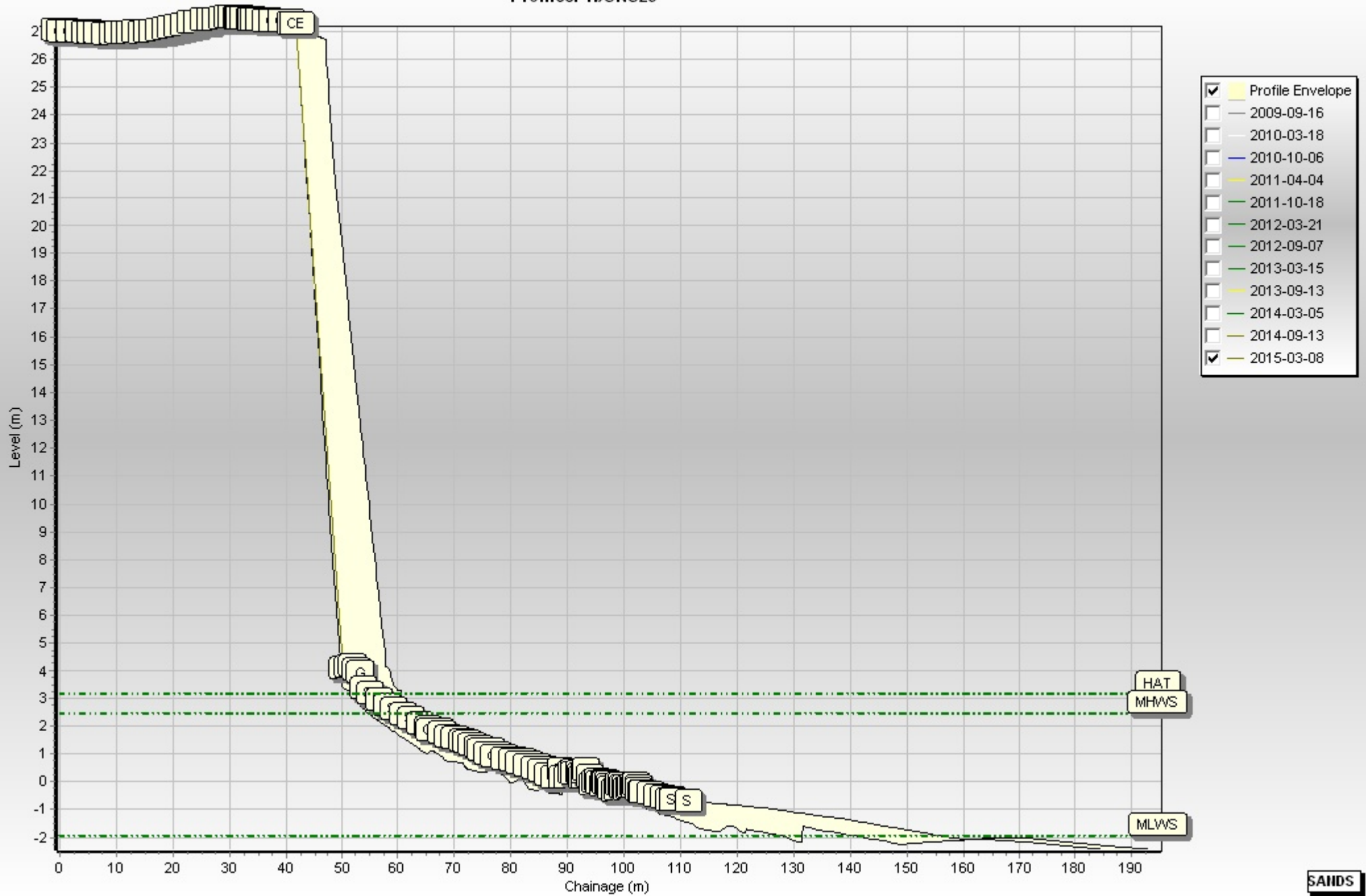
Profiles: 1bSNS11



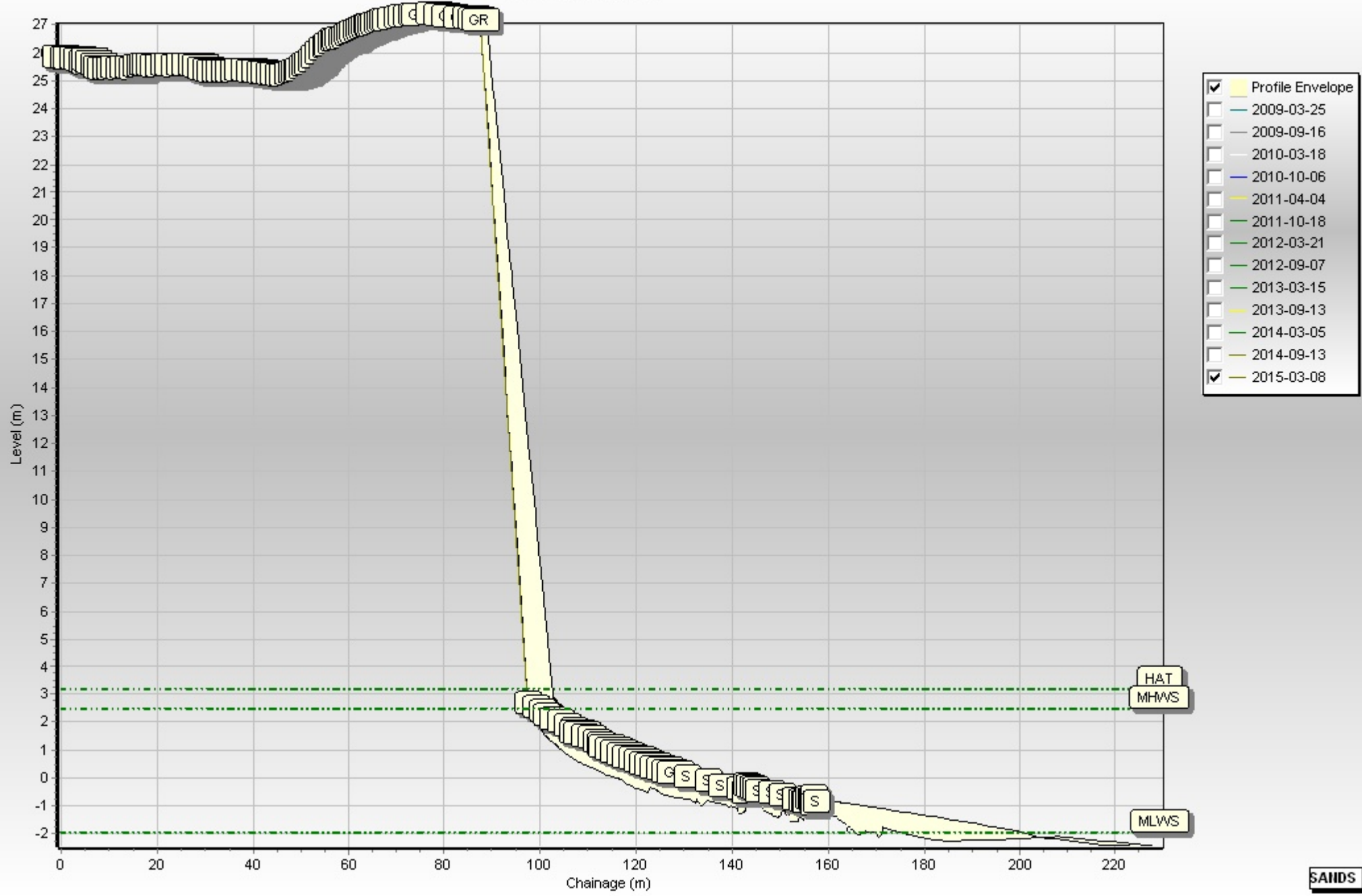
Profiles: 1bSNS20



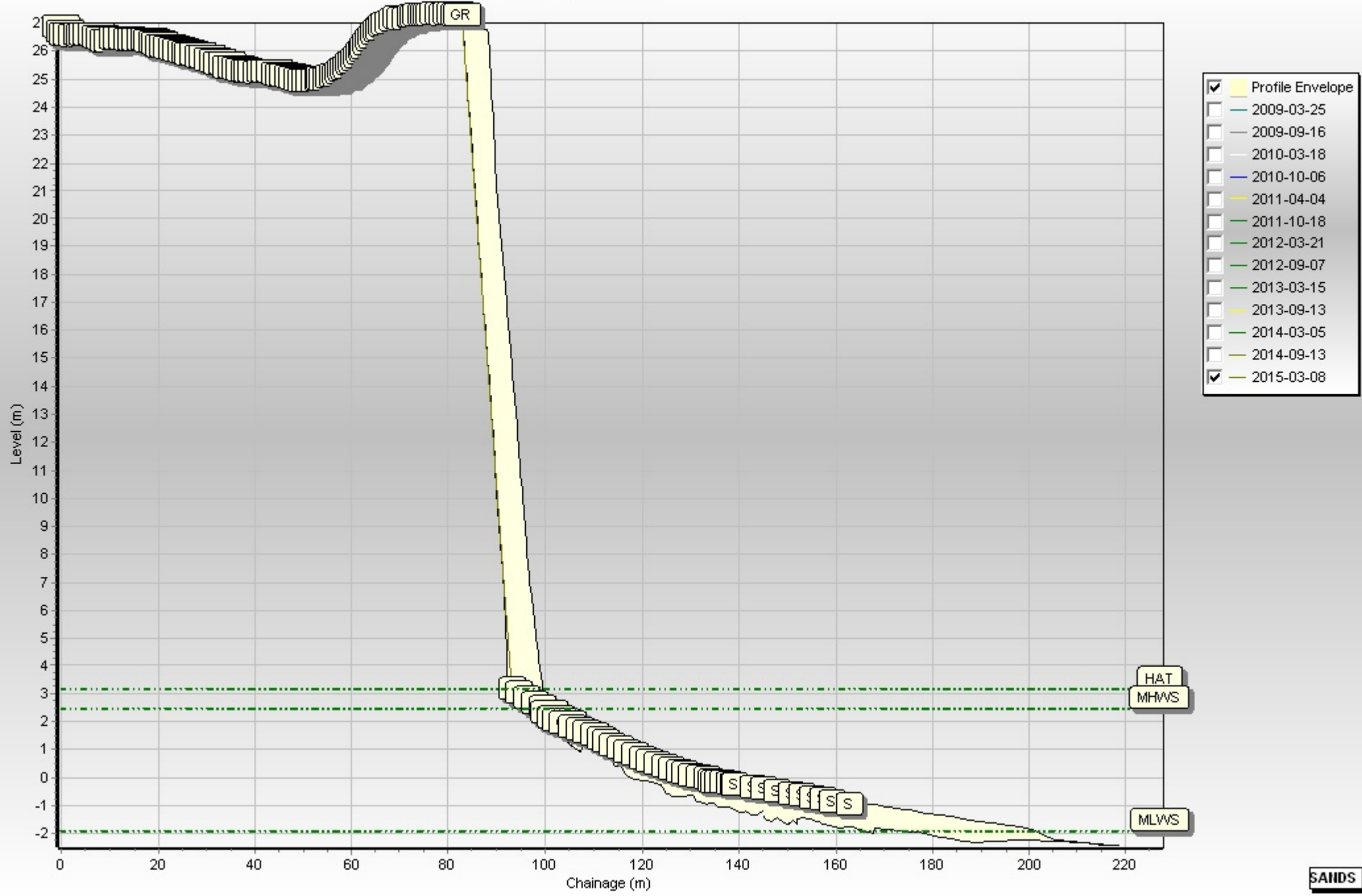
Profiles: 1bSNS25



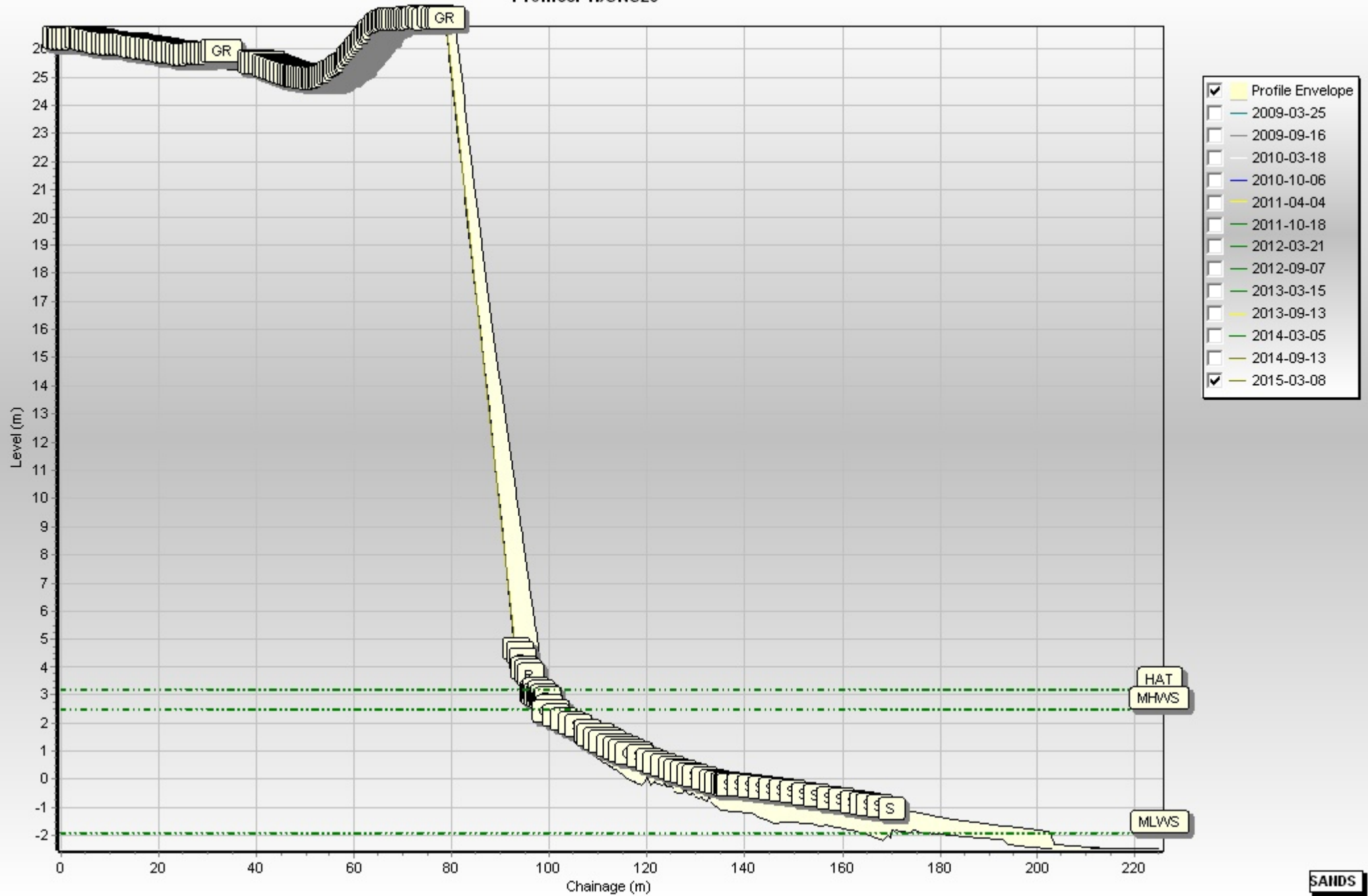
Profiles: 1bSNS26



Profiles: 1bSNS27

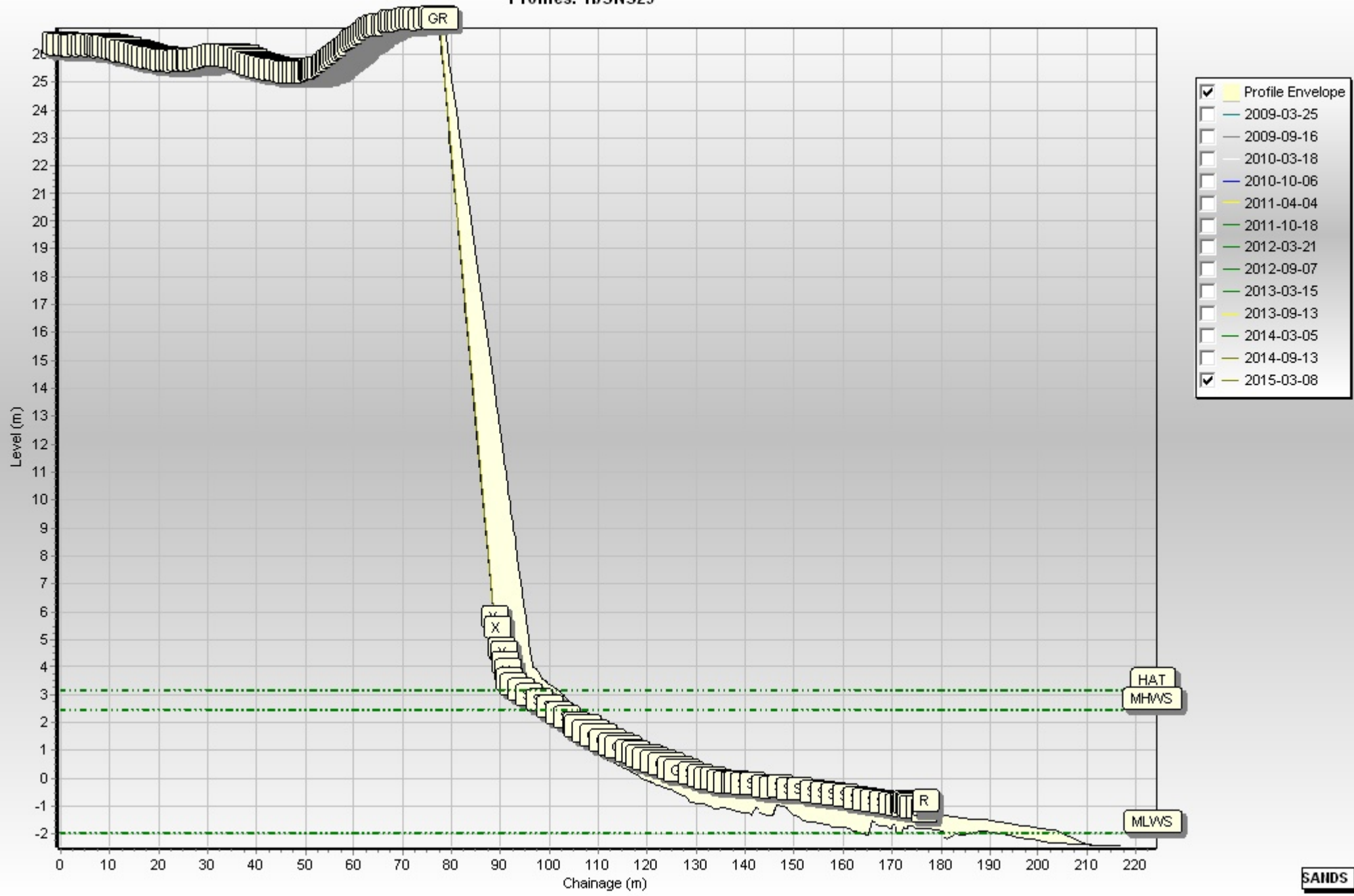


Profiles: 1bSNS28

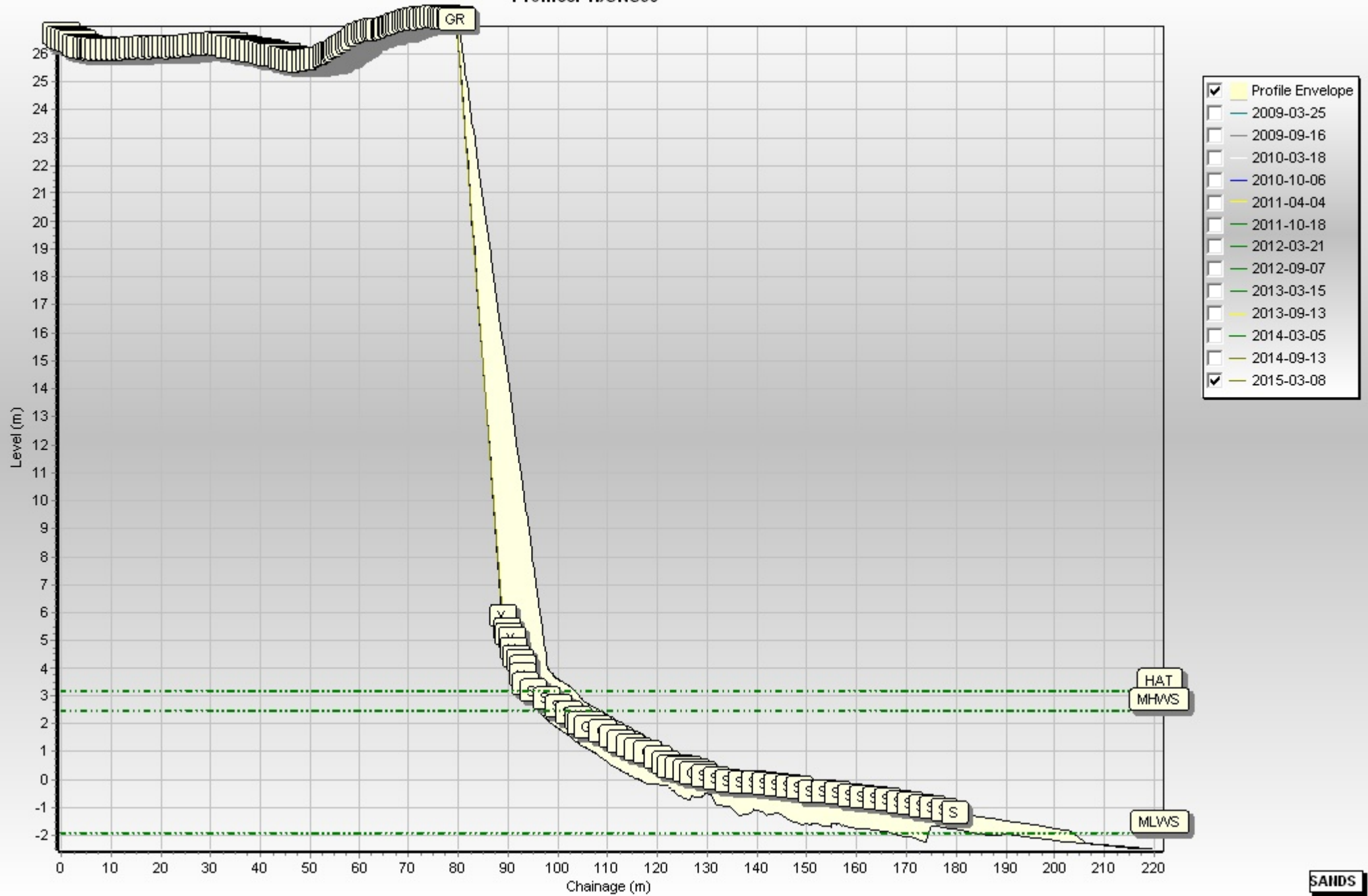




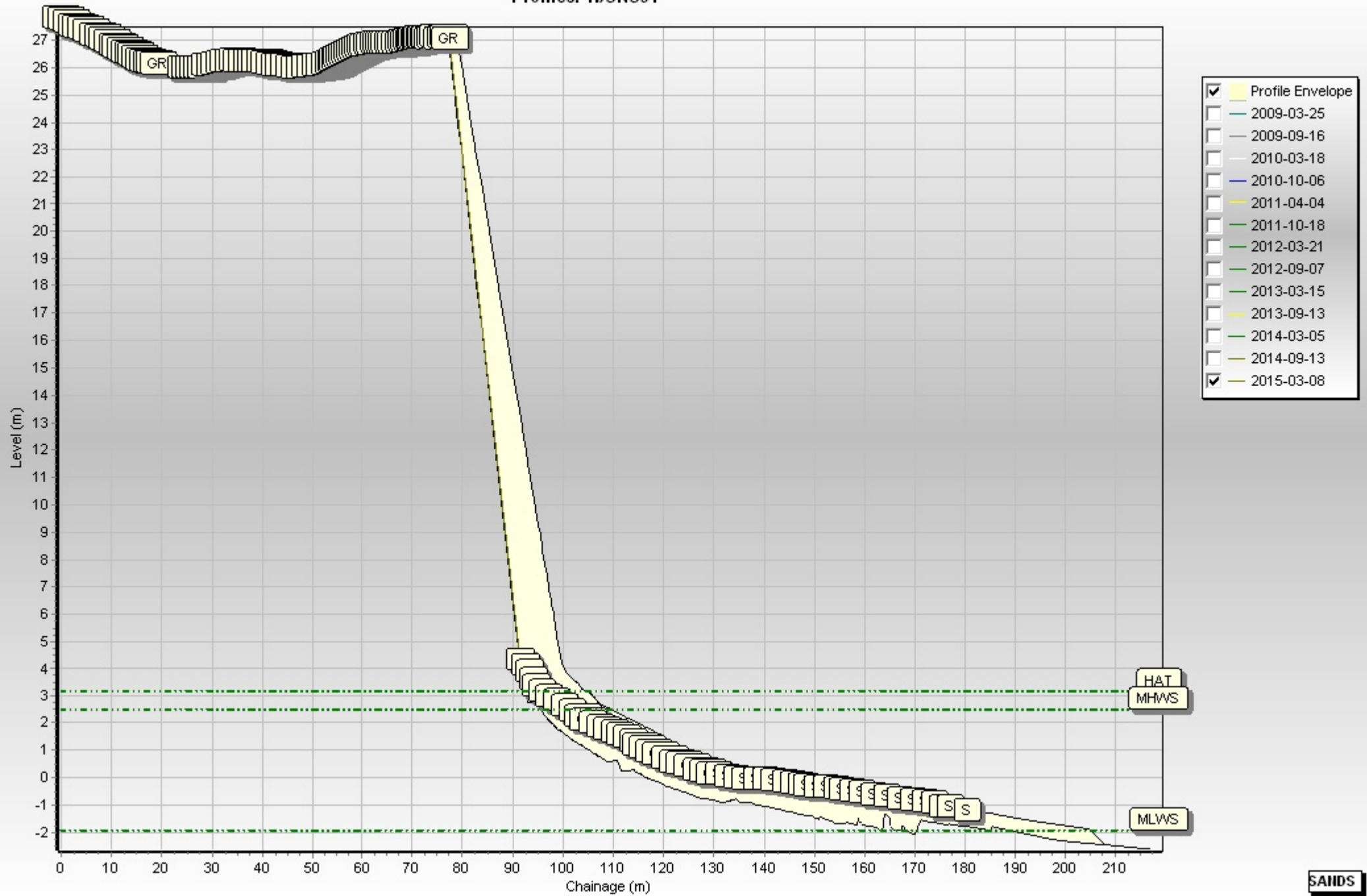
Profiles: 1bSNS29



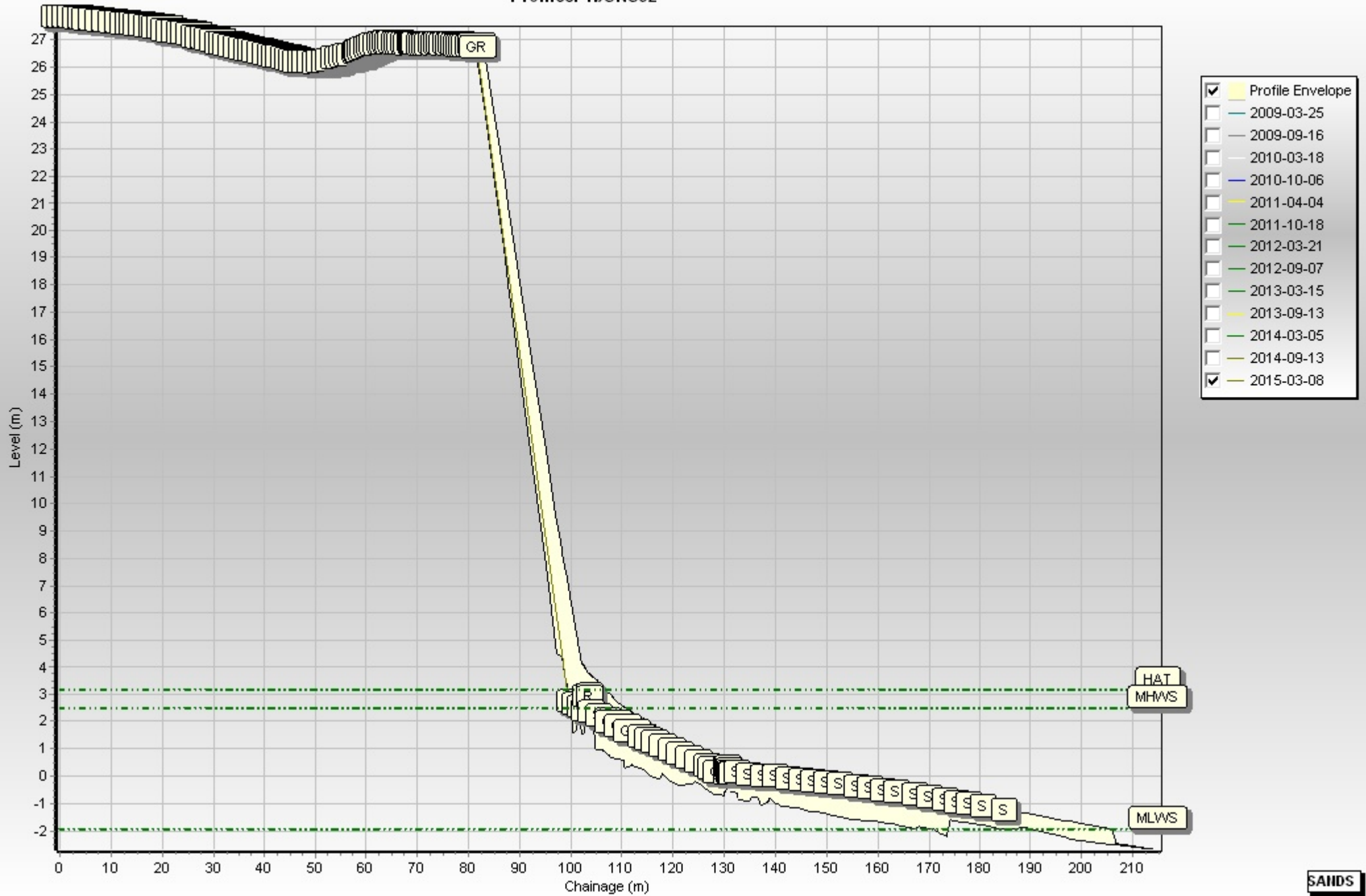
Profiles: 1bSNS30



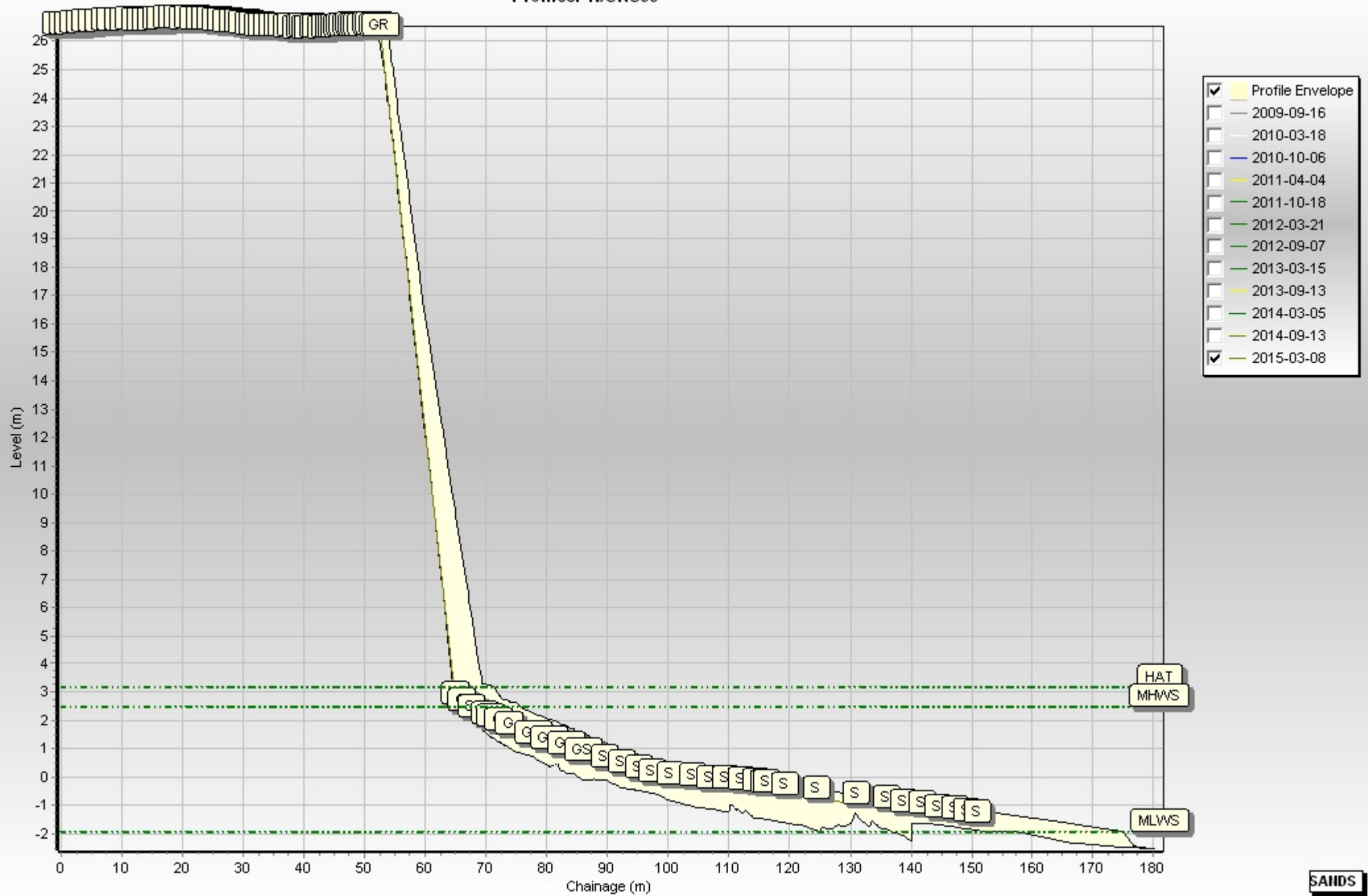
Profiles: 1bSNS31



Profiles: 1bSNS32



Profiles: 1bSNS33



**Appendix B**  
**Cliff Top Survey**

## Cliff Top Survey

### Hendon and Ryhope

Thirty-two ground control points have been established between Hendon and Ryhope (Map 1 and Map 2). The maximum separation between any two points varies along the coast, reflecting the degree of risk from the erosion.

The cliff top surveys between Hendon and Ryhope 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 B1 provides baseline information about these ground control points and results from the 2009 (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.

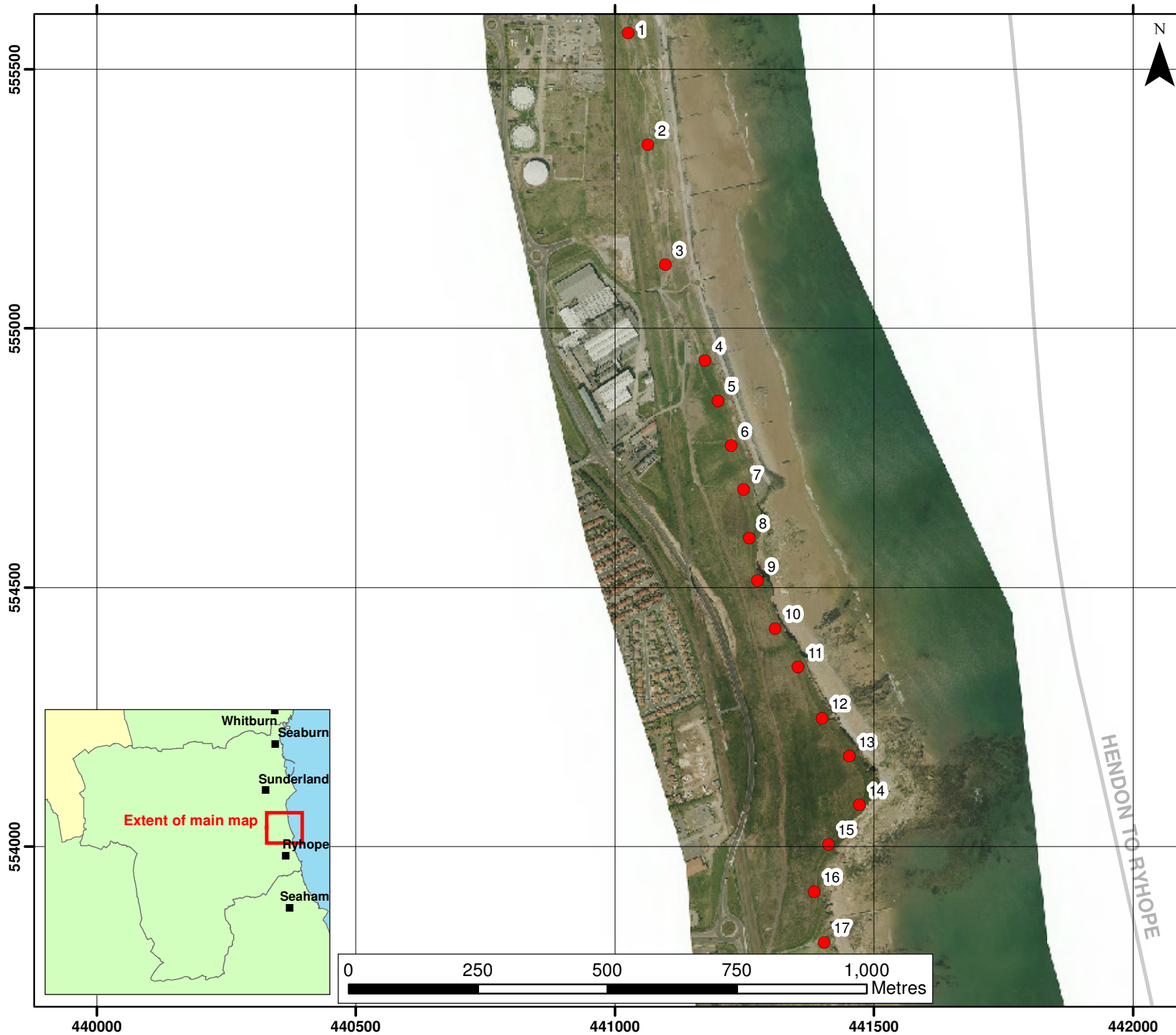
**Table B1 – Cliff Top Surveys between Hendon and Ryhope**

Ground Control Point Details				Distance to Cliff Top (m)			Total Erosion (m)		Erosion Rate (m/year)
Ref	Easting	Northing	Bearing (°)	Baseline Survey (March 09)	Previous Survey (Sept 2015)	Present Survey	Baseline (March 2009) to Present (March 2015)	Previous (Sept 2014) to Present (March 2015)	Baseline (March 2009) to Present (March 2015)
1	441025.693	555571.05	75	8.16	8.3	8.4	0.2	0.1	0.0
2	441064.379	555355.102	85	7.09	5.5	5.5	-1.6	0.0	-0.3
3	441098.006	555123.951	82	10.01	10.4	10.4	0.3	0.0	0.1
4	441174.024	554938.715	65	10.3	10.5	10.5	0.1	0.0	0.0
5	441199.072	554861.069	65	7.71	7.9	10.9	3.2	3.0	0.5
6	441224.468	554774.198	71	10.83	10.9	10.9	0.0	0.0	0.0
7	441248.356	554690.323	74	10.18	10.4	10.4	0.3	0.0	0.0
8	441259.318	554596.601	101	10.08	9.9	9.9	-0.2	0.0	0.0
9	441275.767	554513.436	66	10.52	6.6	6.6	-3.9	0.0	-0.7
10	441309.358	554421.341	58	8.77	1.6	1.5	-7.3	-0.1	-1.2
11	441353.953	554346.497	68	8.2	6.3	6.2	-2.0	-0.1	-0.3
12	441400.235	554248.163	56	6.17	6.1	6.0	-0.2	-0.1	0.0
13	441452.332	554174.695	63	11.61	8.7	8.7	-2.9	0.0	-0.5

Ground Control Point Details				Distance to Cliff Top (m)			Total Erosion (m)		Erosion Rate (m/year)
Ref	Easting	Northing	Bearing (°)	Baseline Survey (March 09)	Previous Survey (Sept 2015)	Present Survey	Baseline (March 2009) to Present (March 2015)	Previous (Sept 2014) to Present (March 2015)	Baseline (March 2009) to Present (March 2015)
14	441472.338	554080.529	127	7.33	7.1	7.4	0.1	0.3	0.0
15	441412.964	554005.114	122	7.84	8.0	7.9	0.1	-0.1	0.0
16	441384.81	553913.284	90	9.89	7.9	7.9	-2.0	0.0	-0.3
17	441404.06	553815.478	93	6.32	6.1	6.1	-0.2	0.0	0.0
18	441404.118	553723.584	119	8.1	8.1	8.0	-0.1	-0.1	0.0
19	441398.454	553632.787	78	8.23	5.4	5.6	-2.6	0.2	-0.4
20	441438.332	553452.873	71	10.09	6.8	6.5	-3.6	-0.4	-0.6
21	441506.093	553256.125	62	8.57	1.8	1.7	-6.9	-0.1	-1.2
22	441550.104	553158.687	103	6.57	3.4	3.5	-3.0	0.2	-0.5
23	441585.218	553076.454	64	8.11	7.9	7.9	-0.2	0.0	0.0
24	441624.391	552870.684	69	7.53	4.6	4.4	-3.2	-0.3	-0.5
25	441689.138	552758.042	70	14.58	7.0	7.0	-7.6	0.0	-1.3
26	441714.976	552713.261	54	12.87	11.3	11.3	-1.6	0.0	-0.3
27	441749.188	552674.376	62	14.56	10.6	3.9	-10.7	-6.7	-1.8
28	441776.586	552629.863	57	8.62	4.3	4.3	-4.4	0.0	-0.7
28A	441798.585	552586.342	56	13.63*	8.3	8.2	-5.5	-0.1	-1.0
28B	441817.389	552542.353	64	12.30*	11.3	11.3	-1.0	0.0	-0.2
28C	441852.155	552502.602	52	13.11*	13.0	13.0	-0.1	0.0	0.0
29	441880.149	552471.561	83	15.46	15.2	15.2	-0.3	0.0	0.0
30	441921.421	552269.043	97	8.55	7.7	7.6	-0.9	-0.1	-0.2
31	441853.064	552093.992	75	11.2	6.8	6.7	-4.5	-0.1	-0.8
32	441883.254	551988.482	96	9.82	5.0	5.0	-4.9	0.0	-0.8

\*Note that 28a-c baseline is September 2009.





**KEY**

● Ground Control Points

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme 2011 to 2016

**Appendix B - Map 1  
Ground Control Points  
Hendon to Ryhope North  
Sunderland City Council**

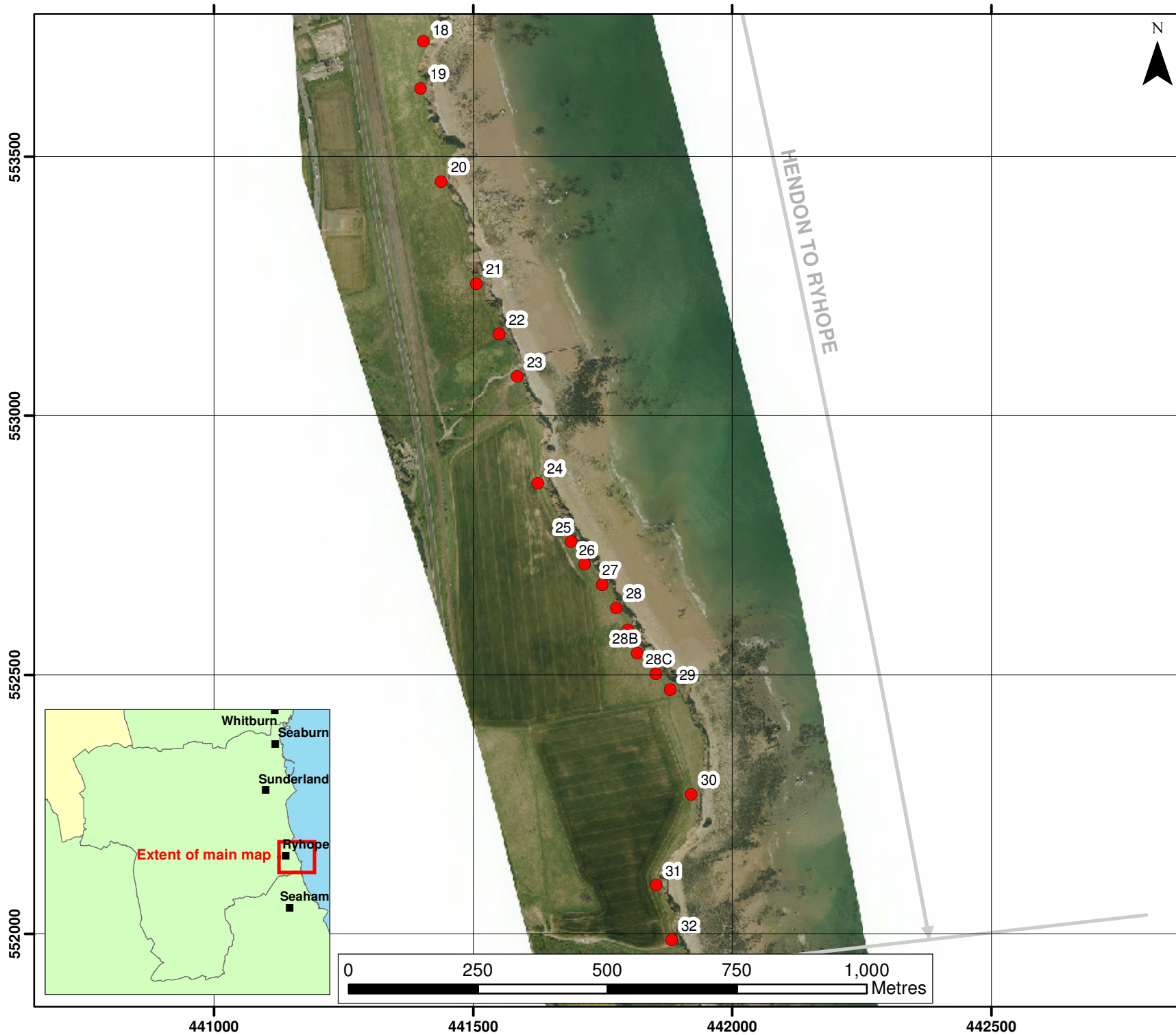
Update Report 7  
Partial Measures Survey  
Spring 2015



Halcrow Group Ltd, Lyndon House, 62 Hagley Road, Edgbaston, Birmingham, B16 8PE

Tel: +44 (0)121 456 2345  
Fax: +44(0)121 456 1569  
www.ch2m.com

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



**KEY**

- Ground Control Points

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme 2011 to 2016

**Appendix B - Map 2  
Ground Control Points  
Hendon to Ryhope South  
Sunderland City Council**

Update Report 7  
Partial Measures Survey  
Spring 2015



Halcrow Group Ltd, Lyndon House, 62 Hagley Road, Edgbaston, Birmingham, B16 8PE

Tel: +44 (0)121 456 2345  
Fax: +44(0)121 456 1569  
www.ch2m.com

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