



**Cell 1 Regional Coastal Monitoring Programme
Update Report 3: 'Partial Measures' Survey 2011**



North Tyneside Council

June 2011

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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
m	metres
MHWN	Mean High Water Neap
MHWS	Mean High Water Spring
MLWS	Mean Low Water Neap
MLWS	Mean Low Water Spring
MSL	Mean Sea Level
ODN	Ordnance Datum Newlyn

Water Levels Used in Interpretation of Changes

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

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

Glossary of Terms

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

Preamble

The Cell 1 Regional Coastal Monitoring Programme covers approximately 300km of the north east coastline, from the Scottish Border (just south of St. Abb's Head) to Flamborough Head in East Yorkshire.

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	Sep-Dec 08	May 09	Mar-May 09	June 09	-
2	2009/10	Sep-Dec 09	Mar 10	Mar-May 10	May 10 ^(*)	-
3	2010/11	Sep-Nov 10	Dec 10	Mar-May 11	June 11 ^(*)	July 2011

^(*) The present report is **Update Report 3** and provides an analysis of the 2011 Partial Measures survey for North Tyneside Council's frontage. It is intended as a brief update of the key findings from this survey to maintain an understanding of ongoing changes.

1. Introduction

1.1 Study Area

North Tyneside Council's frontage extends from Hartley in the north to the River Tyne in the south. For the purposes of this report, it has been sub-divided into four areas, namely:

- Whitley Sands
- Cullercoats Bay
- Tynemouth Longsands
- King Edward's Bay (sometimes known as Tynemouth Shortsands)

1.2 Methodology

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

- Full Measures survey annually each autumn/early winter comprising:
 - Beach profile surveys along 8 no. transect lines (since 2002)
 - Beach profile surveys along an additional 2 no. transects (since 2010)
 - Topographic survey along Whitley Sands (commenced in 2010)

A topographic survey along Tynemouth Longsands is also planned for the next Full Measures survey, which is likely to be undertaken in late autumn 2011 (subject to financial and contractual arrangements).

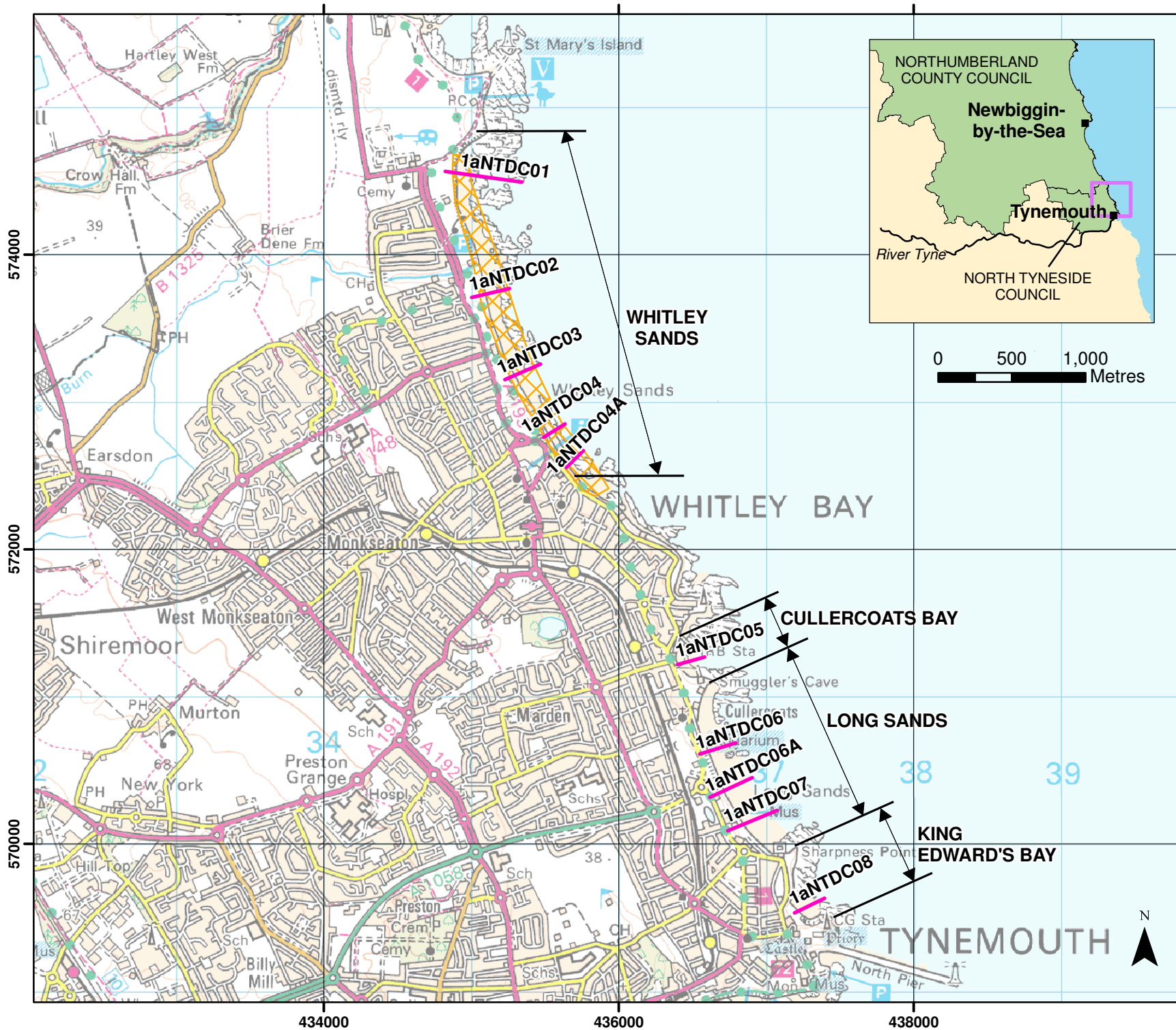
- Partial Measures survey annually each spring comprising:
 - Beach profile surveys along all 10 no. transect lines (since 2010)

The location of these surveys is shown in Figure 1. They have also previously been provided on a digital file which can be opened in Google Earth showing the locations of the surveys.

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.



SURVEY LOCATIONS

Topographic Profiles

- Annual
- Bi-Annual

Topographic Surveys

- 6 monthly
- yearly
- 5 yearly

- Cliff Top Edge Survey
(Indicative Survey Extents shown)

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

**Figure 1 - Map 1
 North Tyneside Council Frontage**

Update Report 3
 'Partial Measures' Survey 2011

Drawing Scale 1:35,000 at A4

Drawn by: TC	Date: 05/05/2011
Checked by: NC	Date: 12/05/2011
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2. Analysis of Survey Data

2.1 Whitley Sands

Survey Date	Description of Changes Since Last Survey	Interpretation
03-2011	<p>Beach Profiles:</p> <p>Whitley Sands is covered by five beach profile lines (Appendix A). Four of these were initially surveyed annually each autumn between 2002 and 2009. From spring 2010 onwards, they have been surveyed 6-monthly and a fifth profile has been added at the southern end of the frontage.</p> <p>NTDC01 is located in the north of Whitley Sands, along the undefended cliffs just to the south of Trinity Road Car Park. The surveyors report that the cliff front is now too steep for safe access. The profile survey shows some cut-back of the cliff top and face. Although there has been some recovery of beach levels directly at the toe of the cliff following the low values recorded in September 2010, the levels here remain relatively low (at around 2.7mODN). The profile shows a significant berm which reaches a peak elevation of 2mODN at a chainage of 60m. A significant volume of sand appears stored within this feature. At the seaward end of the profile the outcropping rock is exposed.</p> <p>NTDC02 to NTDC04A extend across the cliffs/slopes, promenade and seawall before progressing across the foreshore towards low water.</p> <p>Along NTDC02, beach levels at the toe of the sea wall returned to the low values that were recorded the preceding March, having been higher in September 2010. In contrast to March 2010, however, levels remained low along the profile length to a chainage of around 100m, after which a large berm was present. At the seaward end of the profile the outcropping rock is exposed.</p> <p>A similar trend was observed along NTDC03, although the berm was closer to shore (peaking in height at a chainage of around 55m). Although the lower foreshore levels were low, sand was still present and no rock was exposed. A small patch of rock outcrop was exposed along the upper foreshore at a chainage of around 20m (Plate 1).</p>	<p>The undefended cliffs along the north of Whitley Sands have eroded, causing retreat of the cliff top and face. This has released material to the foreshore, some of which has remained at the cliff toe, some of which has contributed to the development of a mid-shore berm, and some of which is likely to have been washed away from the area. The sand veneer that often covers parts of the rock platform on the lower foreshore was totally absent at the time of the survey, indicating relatively heave sea states prior to the survey.</p> <p>The pattern of change along NTDC02 to NTDC04A was a consistent one across the frontage of low upper beach levels, a mid-beach berm and low lower beach levels (in some cases with bedrock exposed along the lower foreshore). This suggests that the frontage was notably affected by winter wave action, with material drawn down from the profile during stormier sea states and then starting to return in spring in the form of a mid-beach berm along the whole frontage. The changes were (generally) within the bounds of previous fluctuation in level, except for the recently-added profile NTDC04A (although there are only three surveys along this profile line).</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
03-2011	<p>Along NTDC04, beach levels were low at both the upper and lower foreshore, separated by a berm which peaked in elevation at a chainage of around 50m.</p> <p>Profile NTDC04A was recorded for the first time during the March 2010 survey. It is located at the southern end of the Whitley Sands frontage and extends from the promenade, some 3m down the face of the sea wall to its toe, and then across the predominantly sandy foreshore. Beach levels were low at the toe of the sea wall and a berm was then observed at a chainage of around 15-30m. Lower foreshore levels were the lowest recorded to date (three surveys since March 2010) and rock was observed to outcrop from the sand veneer at a chainage of around 75-85m. In previous surveys to date this had always been covered by sand.</p>	See previous page.

Plate 1 – Rock Outcrop on Upper Foreshore of NTDC03



2.2 Cullercoats Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
03-2011	<p>Beach Profiles:</p> <p>Cullercoats Bay is covered by one beach profile line (Appendix A). This was surveyed annually each autumn between 2002 and 2009. From spring 2010 onwards, it has been surveyed 6-monthly.</p> <p>The cliff top position along NTDC05 has remained constant since surveys began in April 2002, but there are apparent changes at the toe of the cliff between September 2009 and March 2011. A section of cliff just above the toe appears to have slightly cut back. The foreshore levels remain similar to all previous surveys.</p>	<p>The surveyors report that the cliff top and large parts of the face have not been surveyed due to exposure. Instructions have been given to the surveyors at this profile not to attempt a cliff top or cliff face capture if conditions are unsafe. Therefore it is unclear whether the apparent cut back near the toe of the cliff is an actual change (i.e. notching at the cliff toe) or whether this is an artefact of the survey points. The next survey should clarify this situation. The foreshore levels remain highly stable as the beach is well sheltered by the Cullercoats piers.</p>

2.3 Tynemouth Longsands

Survey Date	Description of Changes Since Last Survey	Interpretation
03-2011	<p>Beach Profiles:</p> <p>Tynemouth Longsands is covered by three beach profile lines (Appendix A). Two of these were initially surveyed annually each autumn between 2002 and 2009. From spring 2010 onwards, they have been surveyed 6-monthly and a third profile has been added in the centre of the frontage.</p> <p>NTDC06 is located approximately 150m south of the access road/ramp towards the north of the bay. There has been no further landward cut back since the severe change at the toe of the dunes which was recorded between October 2009 and mid-February 2010. This resulted at the time in the lowest recorded beach levels since monitoring began in April 2002. Since then foreshore levels have recovered progressively to the present date. There is, however, still evidence of slippage down the face of the dunes, with some sections appearing to remain somewhat unstable.</p> <p>A new profile, NTDC06A, was added to the surveys for the first time in March 2010 and has shown good stability in both dune and beach levels since that time.</p> <p>Profile NTDC07 is located approximately 50m south of the access route through the dunes towards the southern end of the bay. Here, the surveyors did not attempt access to part of the profile because dune vegetation was being re-seeded and the area was fenced off. Along the profile the beach levels remained similar to those recorded in September 2010 and are generally quite stable along this section.</p>	<p>The storms across winter 2009/2010 caused measurable damage along Tynemouth Longsands.</p> <p>Since that time there has been general recovery of, or stability in, beach levels.</p> <p>The most severely affected profile by that earlier storm damage (NTDC06) does still show some signs of relict and ongoing slumping down the dune face, suggesting that the cut-back at the toe has created unstable conditions which are taking some time to fully manifest as slumps.</p>

2.4 King Edward's Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
03-2011	<p>Beach Profiles:</p> <p>King Edward's Bay is covered by one beach profile line (Appendix A). This was surveyed annually each autumn between 2002 and 2009. From spring 2010 onwards, it has been surveyed 6-monthly.</p> <p>Profile NTDC08 experienced a localised dip in beach level between chainages of 5-15m and more extensive lowering, by up to 0.2m seaward of a chainage of 50m. There were no berm features present along the profile.</p>	<p>King Edward's Bay has historically had a tendency to exhibit successive bermed and flat profile features, but the form of the profile remains similar in the September 2010 and March 2011 surveys, albeit with slight beach lowering along the upper beach to the latter date.</p>

3. Problems Encountered and Uncertainty in Analysis

The undefended section of cliff along NTDC01 is now too steep for safe access to the cliff face.

In Cullercoats Bay, the cliff face was not surveyed along profile NTDC05 due to high exposure on the day of the survey.

Along profile NTDC07, part of the dunes was not surveyed because the area was fenced off in order to attempt to establish dune vegetation.

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

Following implementation of the recommendation made in *Analytical Report 2* for the introduction of beach profile surveys to the Partial Measures campaign along all 10 no. transects, there are no further changes recommended at the present time.

The first of a series of annual topographic surveys at Whitley Sands will be undertaken during the Full Measures surveys 2010. This will help provide further understanding relating to what are quite clear seasonal variations in foreshore level and form.

5. Conclusions and Areas of Concern

- The North Tyneside frontage has previously demonstrated measurable fluctuations in foreshore level and form between successive surveys but remained broadly similar in from between the September 2010 and March 2011 surveys in Cullercoates Bay, Tynemouth Longsands and King Edward's Bay.
- Measurable changes were observed consistently across Whitley Sands, with beach lowering along the upper and lower foreshores, with a berm formed along the mid-beach level.
- There was notable erosion of the undefended cliffs to the north of Whitley Sands and some of the material released from the cliffs remains at the toe of the cliffs, some will have moved to help form the mid-beach berm, and some would have moved away from the area by tidal and wave action.
- Slumping was observed in the dune face along part of Tynemouth Longsands (NTDC06), but here the dune toe has not eroded further landwards and the other profiles from Longsands reveal stable dune and beach formations.
- Overall there are no major concerns from the March 2011 data, although especially along Whitley Sands beach levels were quite low.

Appendices

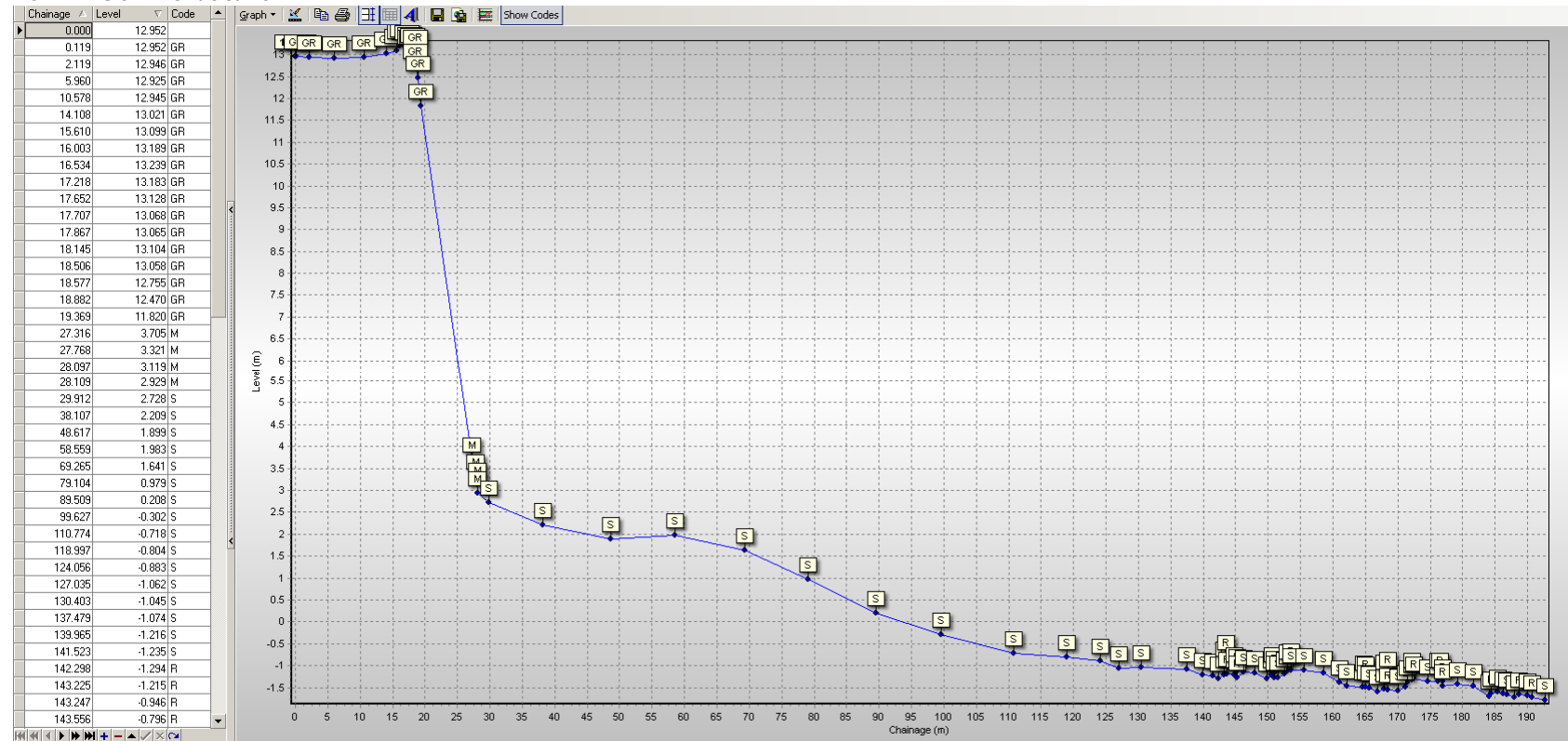
Appendix A
Beach Profiles

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

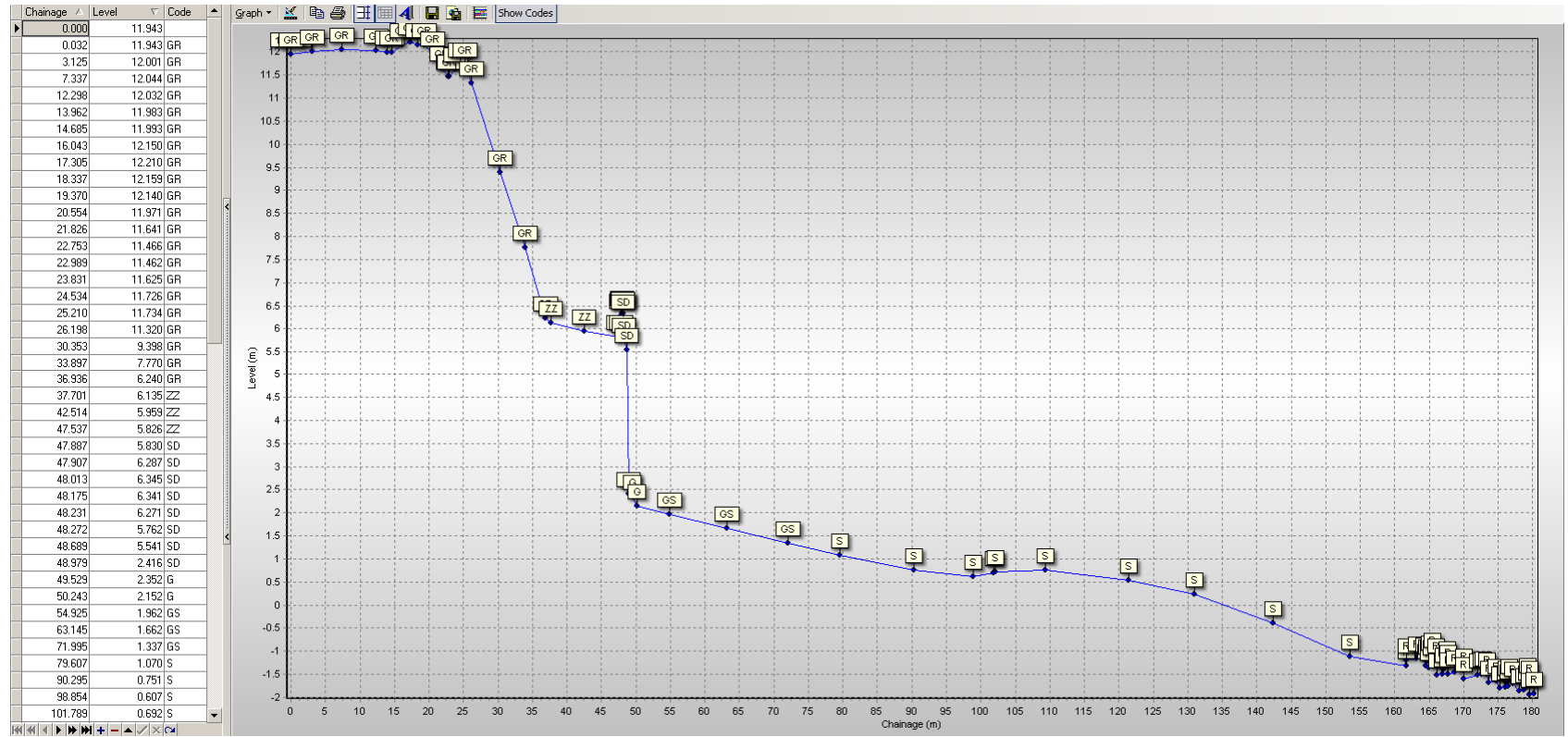
Code	Description
M	Mud
S	Sand
G	Gravel
GS	Gravel & Sand
GM	Gravel & Mud
MS	Mud & Sand
B	Boulders
R	Rock
SD	Sea Defence
SM	Salt Marsh
GR	Grass
D	Dune (non-vegetated)
DV	Dune (vegetated)
F	Forested
X	Mixture
FB	Obstruction
CT	Cliff Top
CE	Cliff Edge
CF	Cliff Face
SH	Shell
W	Water Body
ZZ	Unknown

North Tyneside

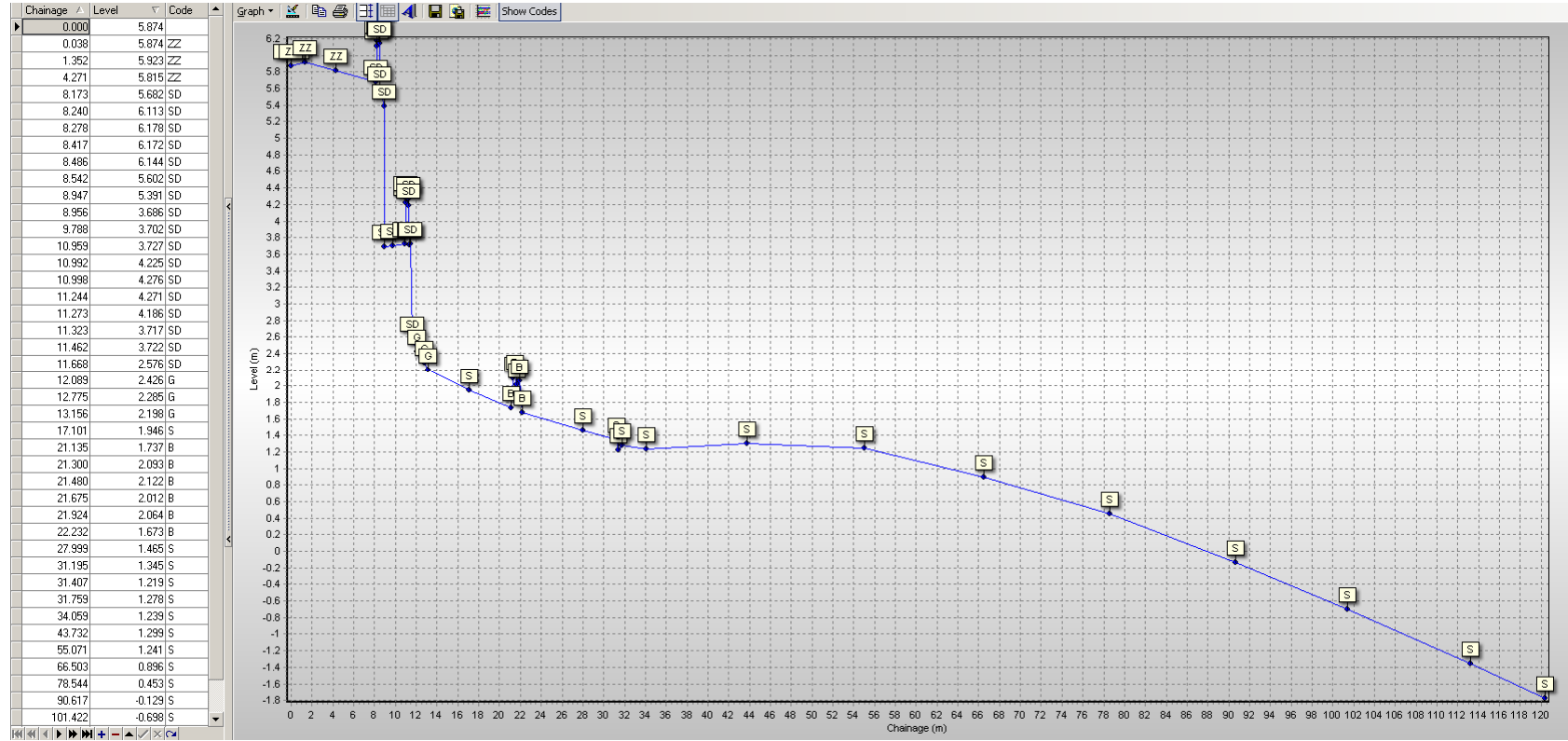
1aNTDC01 - 04/03/2011



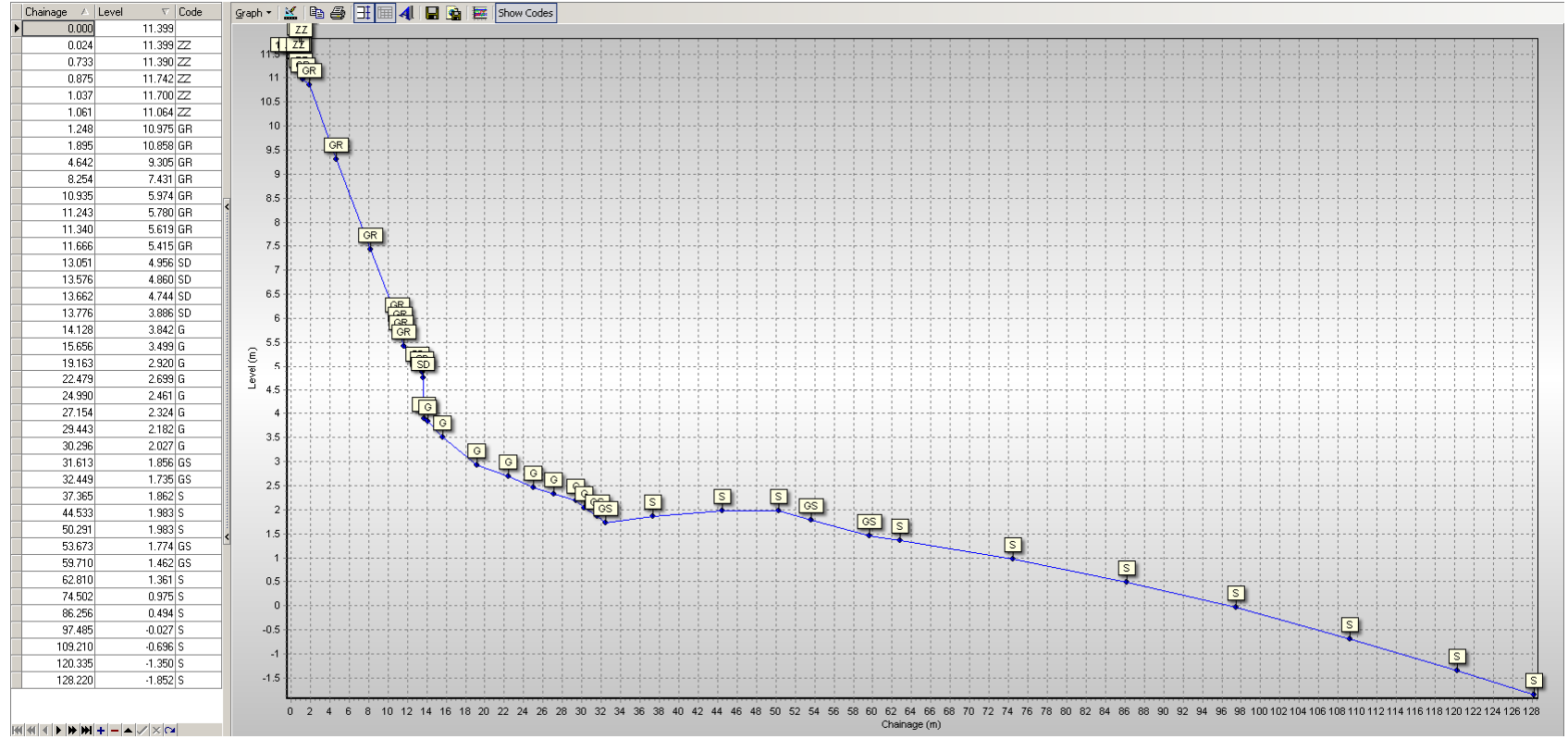
1aNTDC02 - 04/03/2011



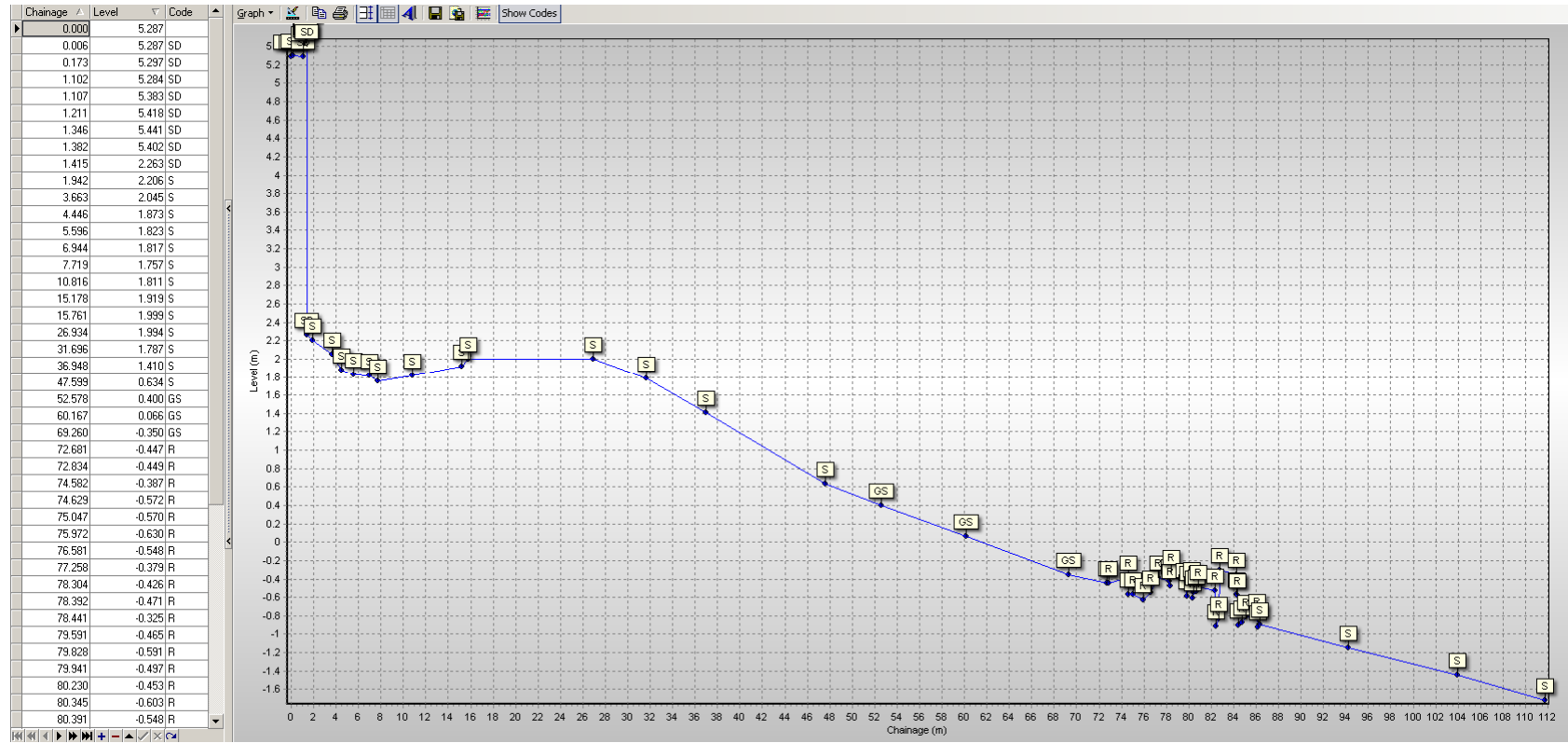
1aNTDC03 - 04/03/2011



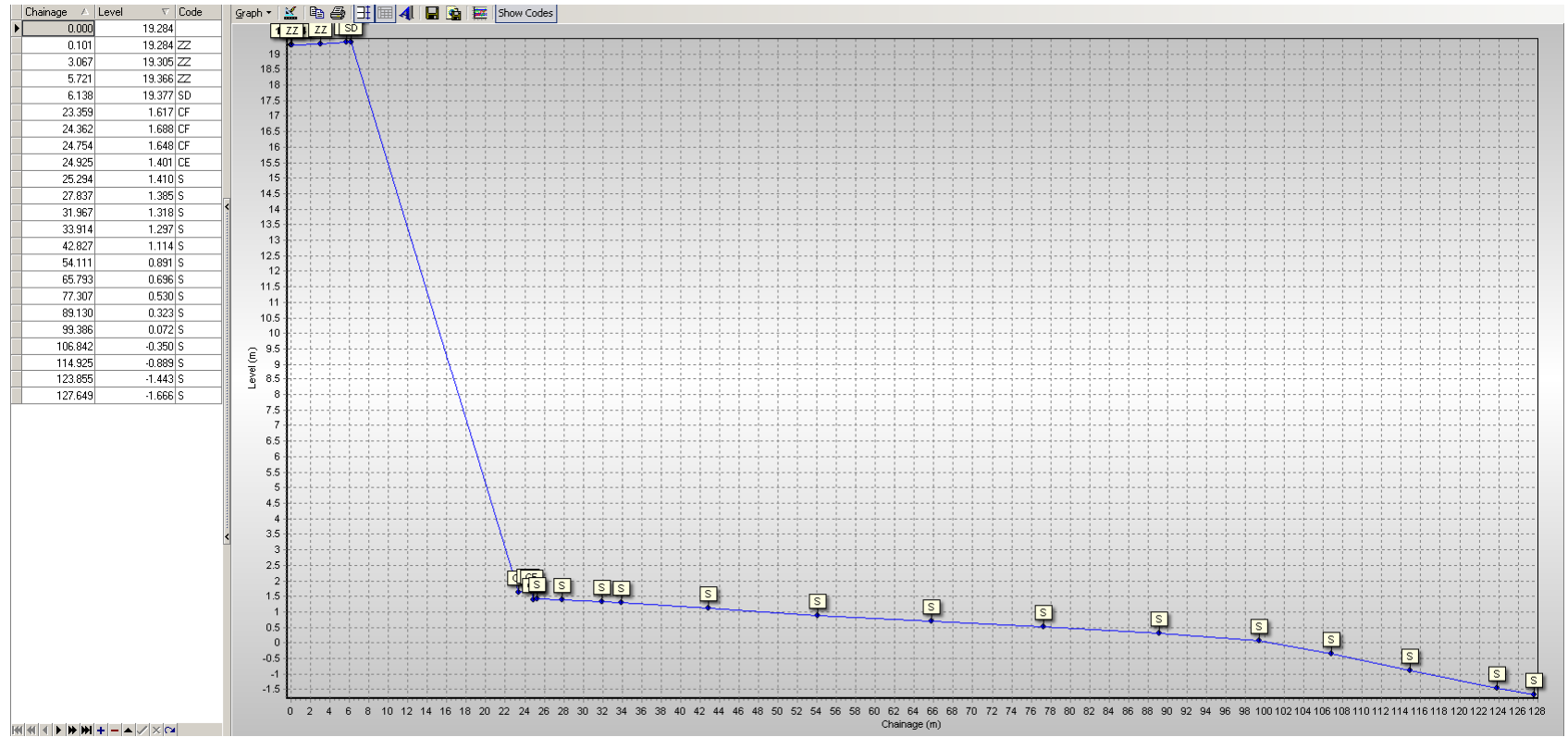
1aNTDC04 - 04/03/2011



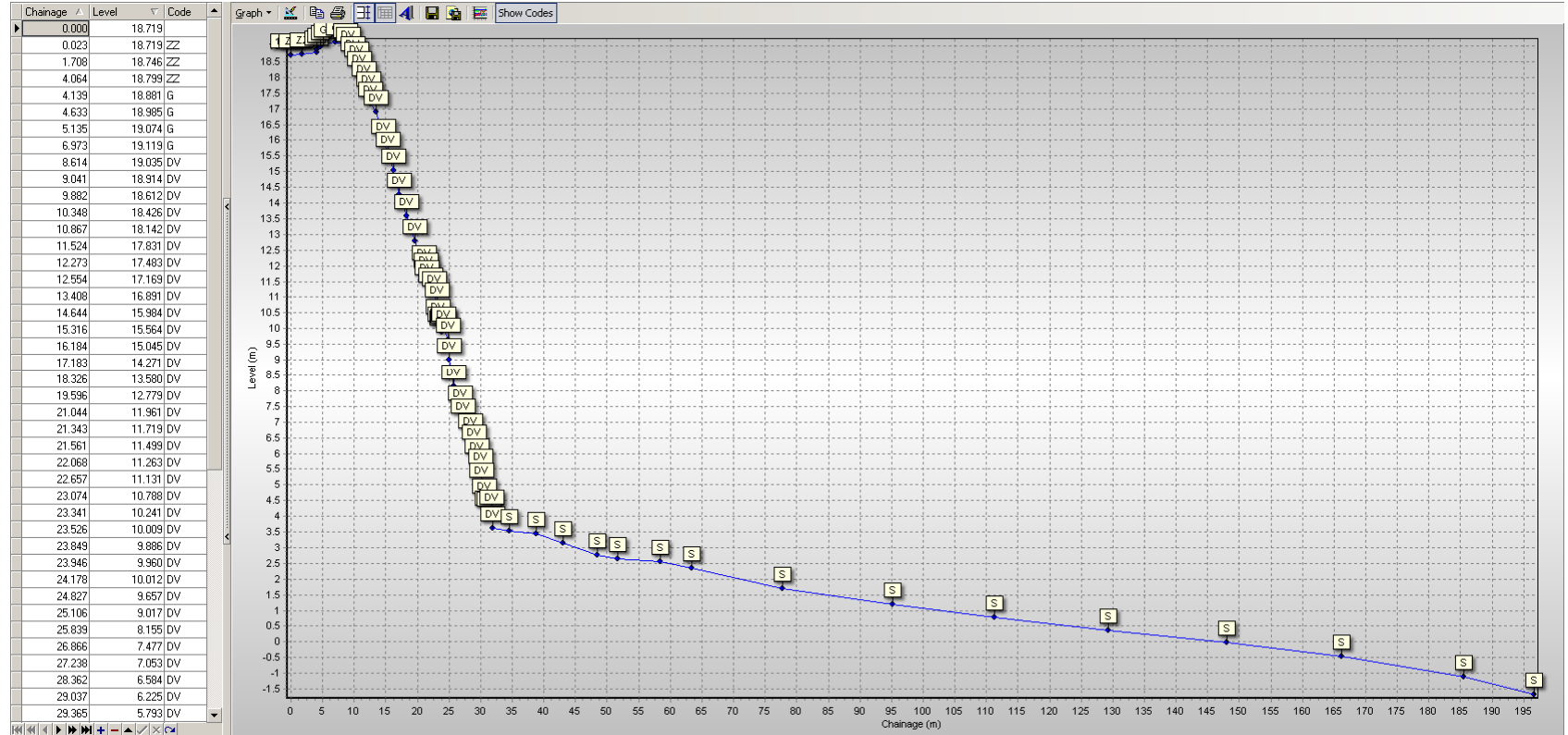
1aNTDC04A - 04/03/2011



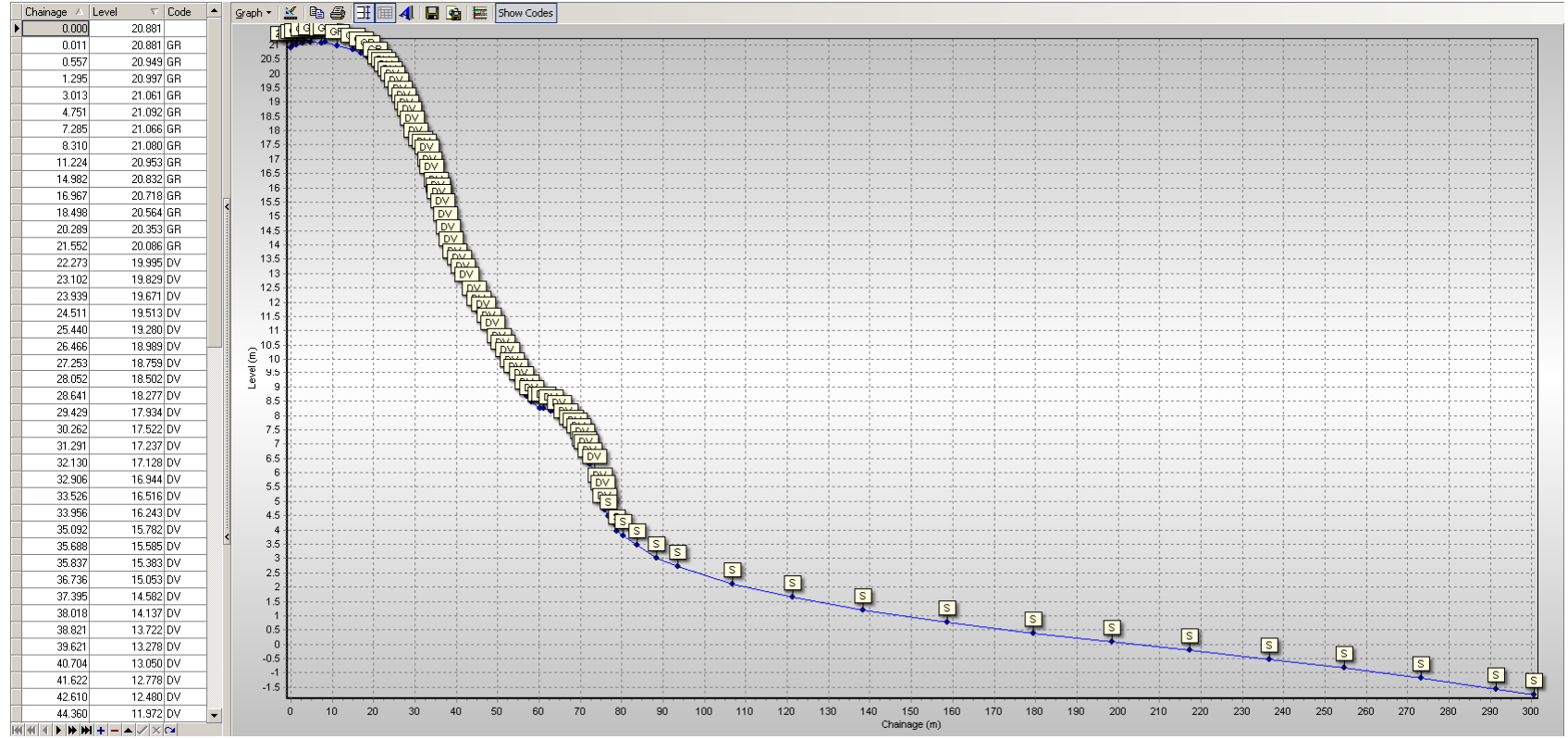
1aNTDC05 - 04/03/2011



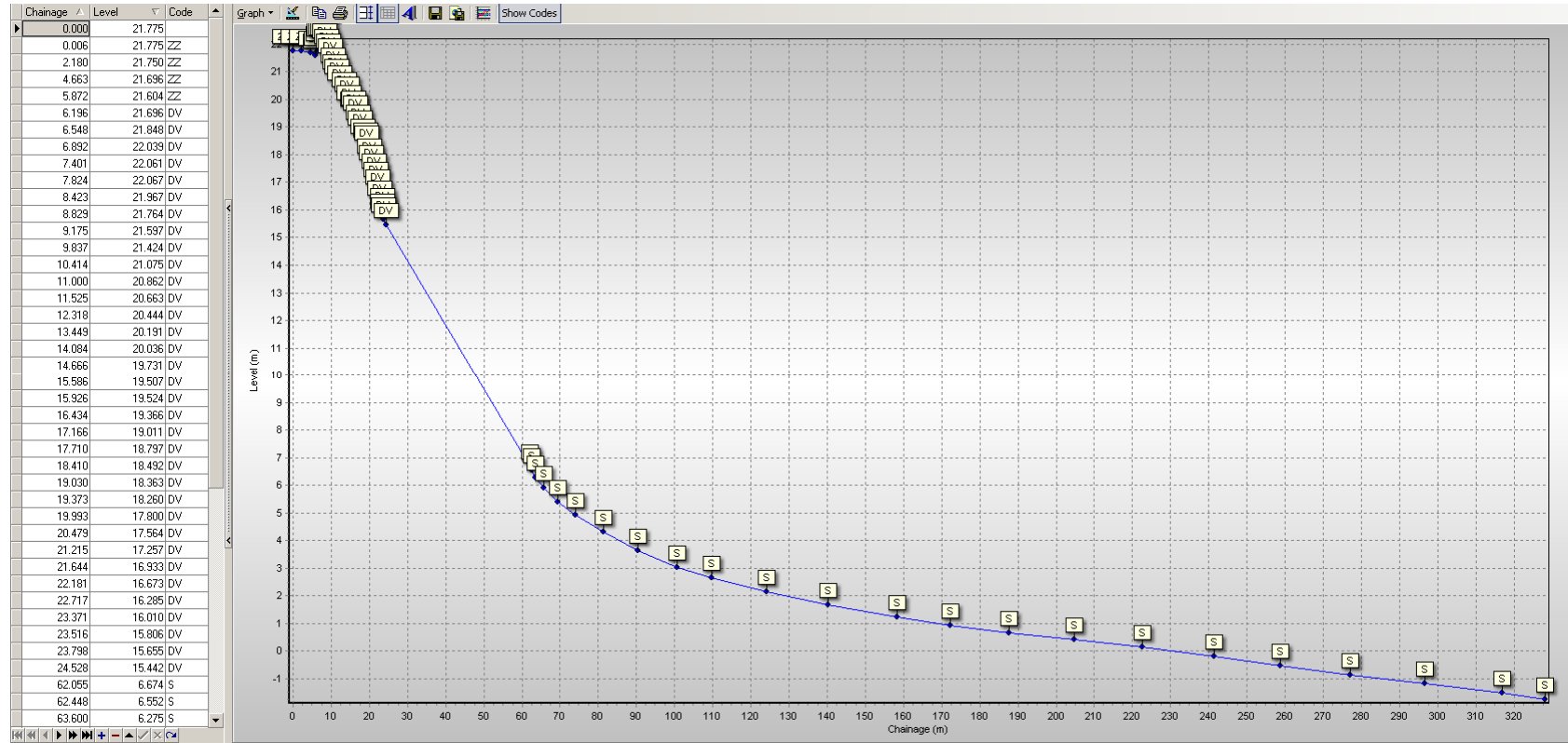
1aNTDC06 - 04/03/2011



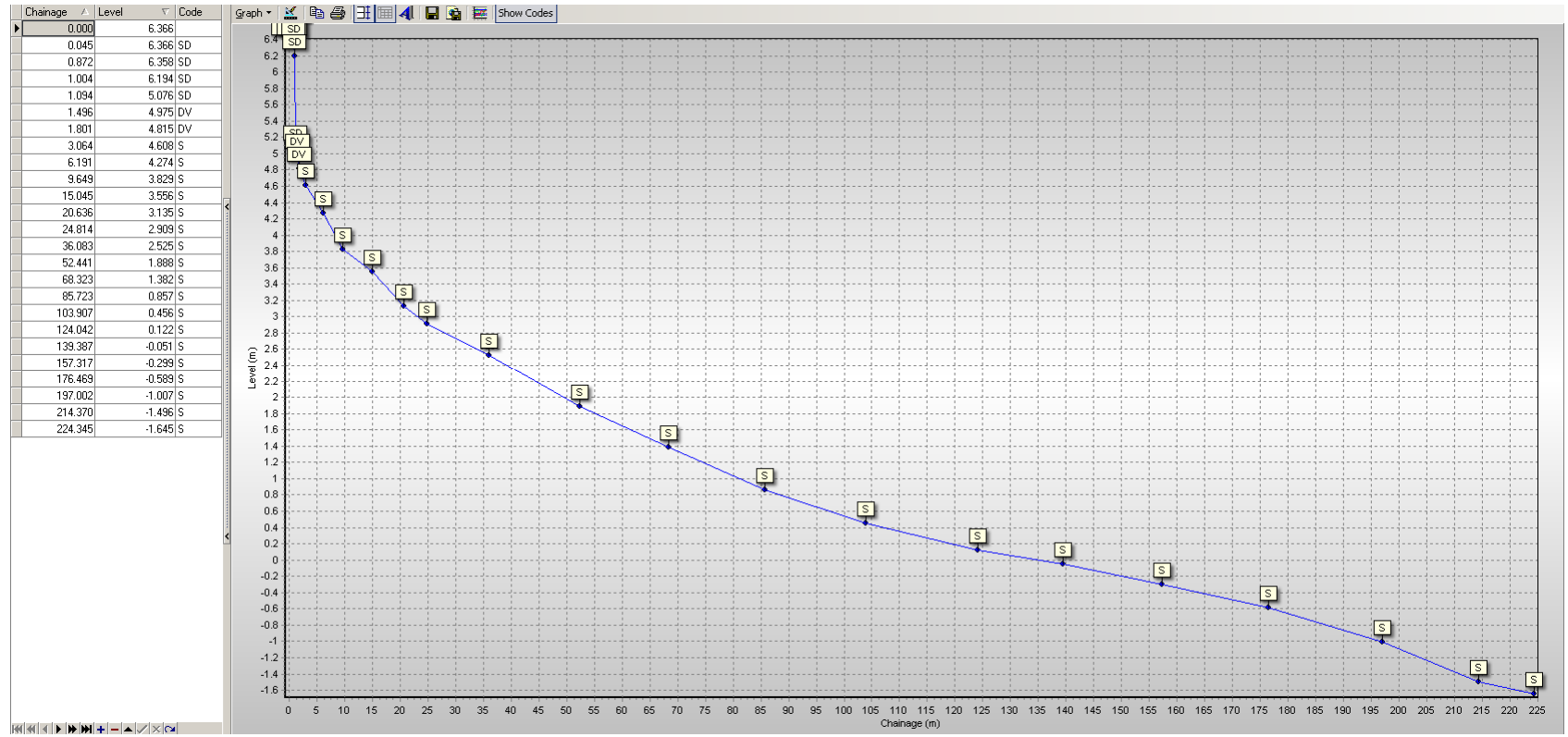
1aNTDC06A - 04/03/2011



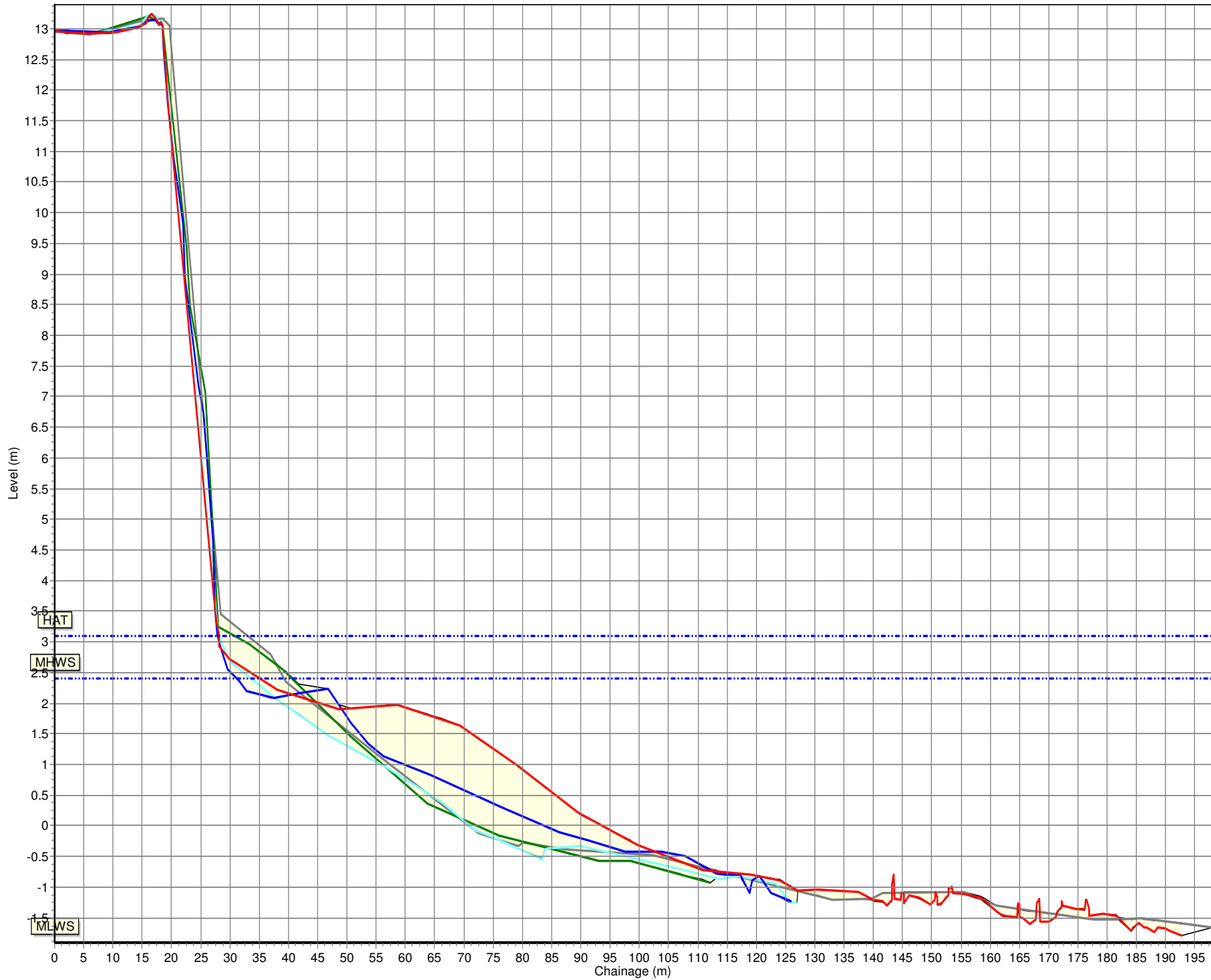
1aNTDC07 - 04/03/2011



1aNTDC08 - 04/03/2011



Beach Profiles: 1aNTDC01



- Profiles Envelope
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- 01/10/2009
- 29/03/2010
- 20/09/2010
- 04/03/2011

Beach Profiles: 1aNTDC02



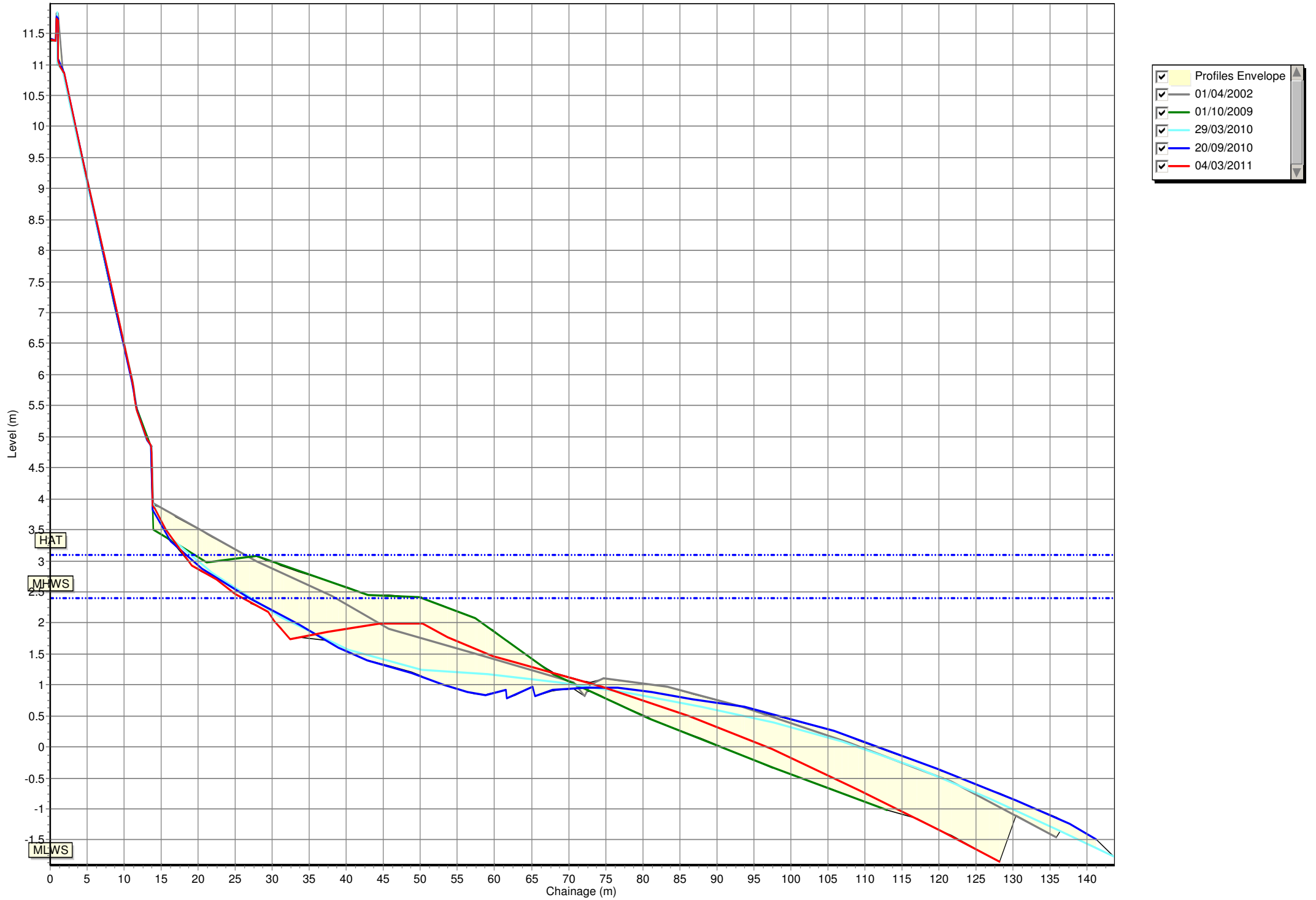
- Profiles Envelope
- 01/04/2002
- 01/10/2009
- 29/03/2010
- 20/09/2010
- 04/03/2011

Beach Profiles: 1aNTDC03



- Profiles Envelope
- 01/04/2002
- 01/10/2009
- 29/03/2010
- 20/09/2010
- 04/03/2011

Beach Profiles: 1aNTDC04

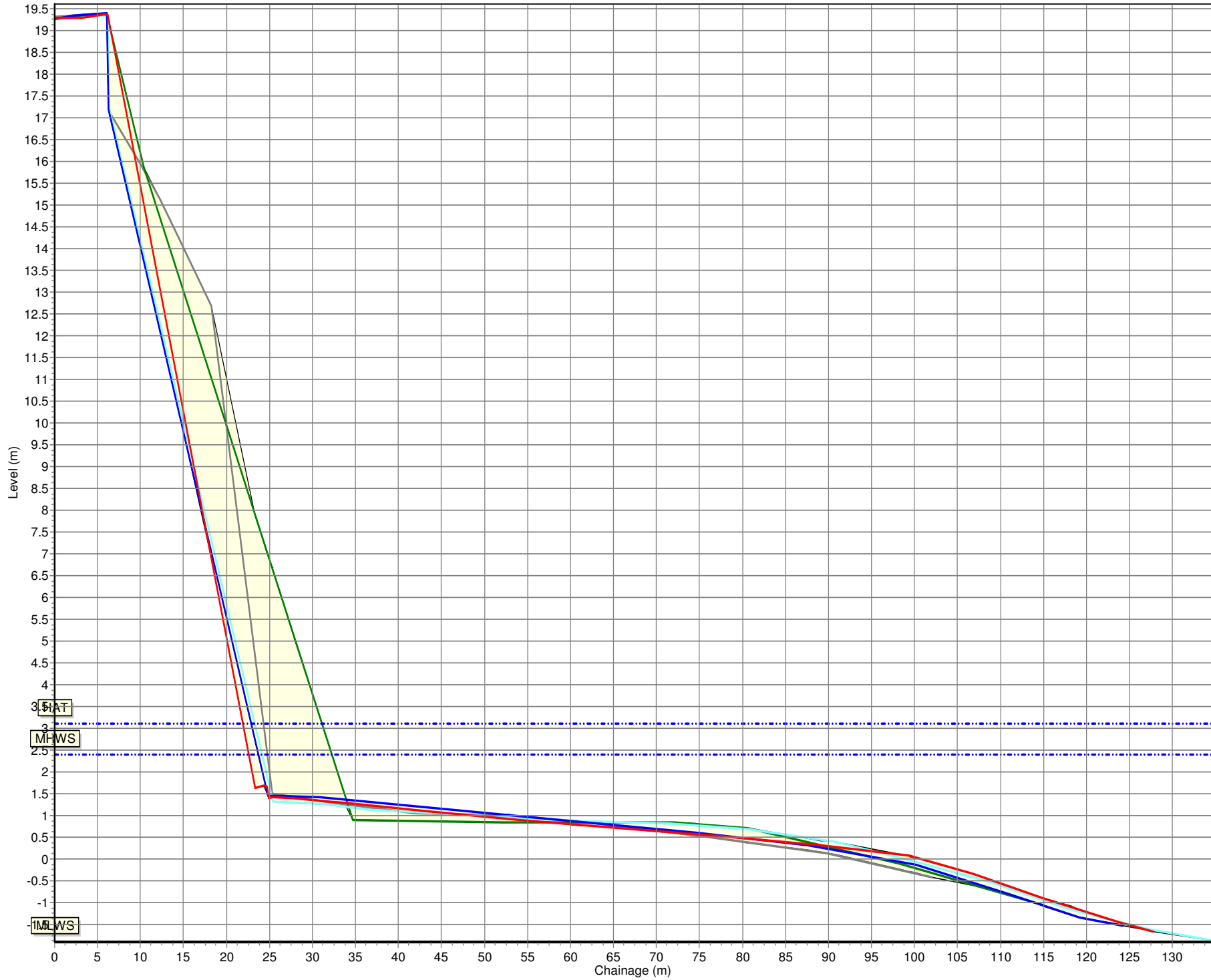


Beach Profiles: 1aNTDC04A



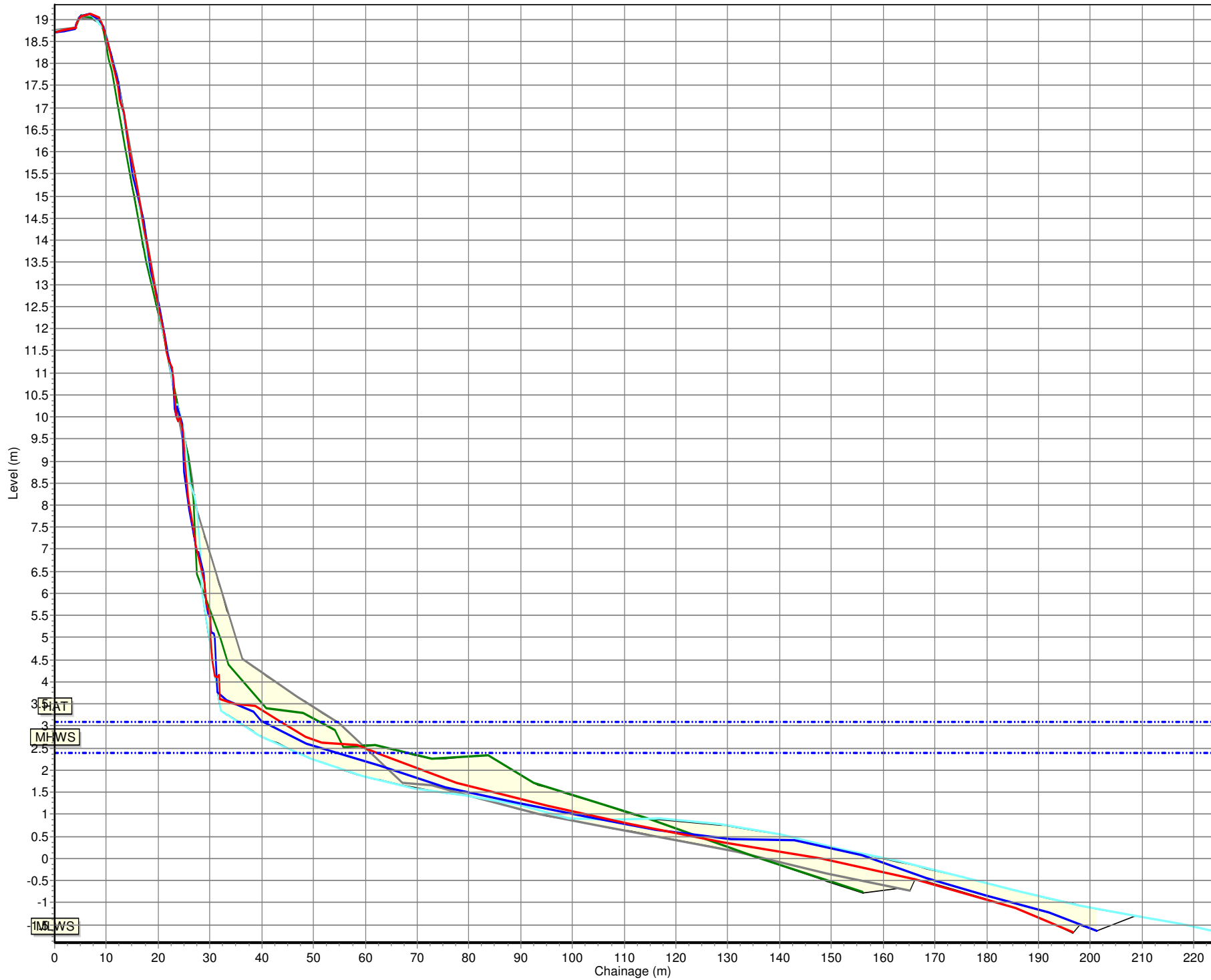
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Beach Profiles: 1aNTDC05



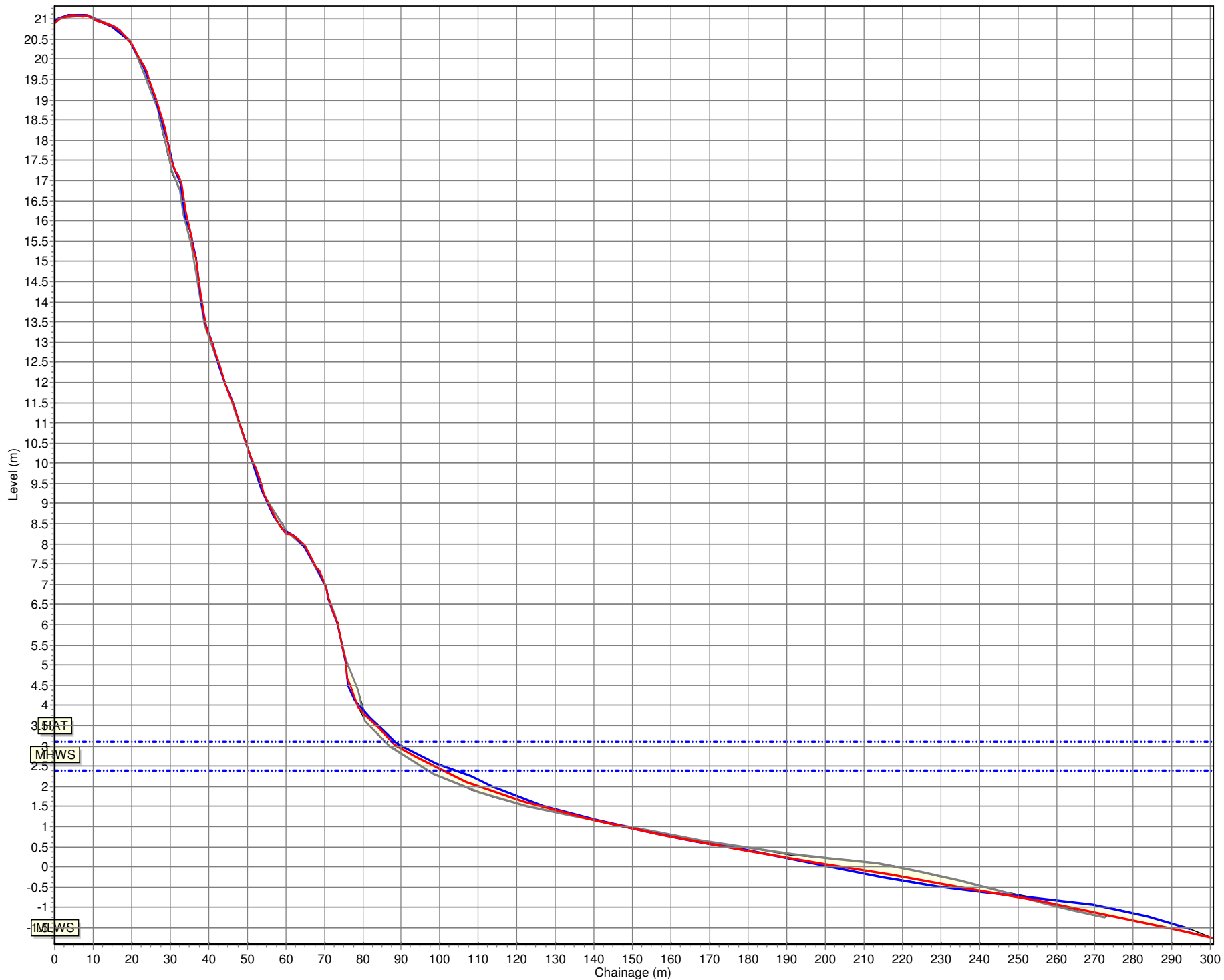
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- 04/03/2011

Beach Profiles: 1aNTDC06



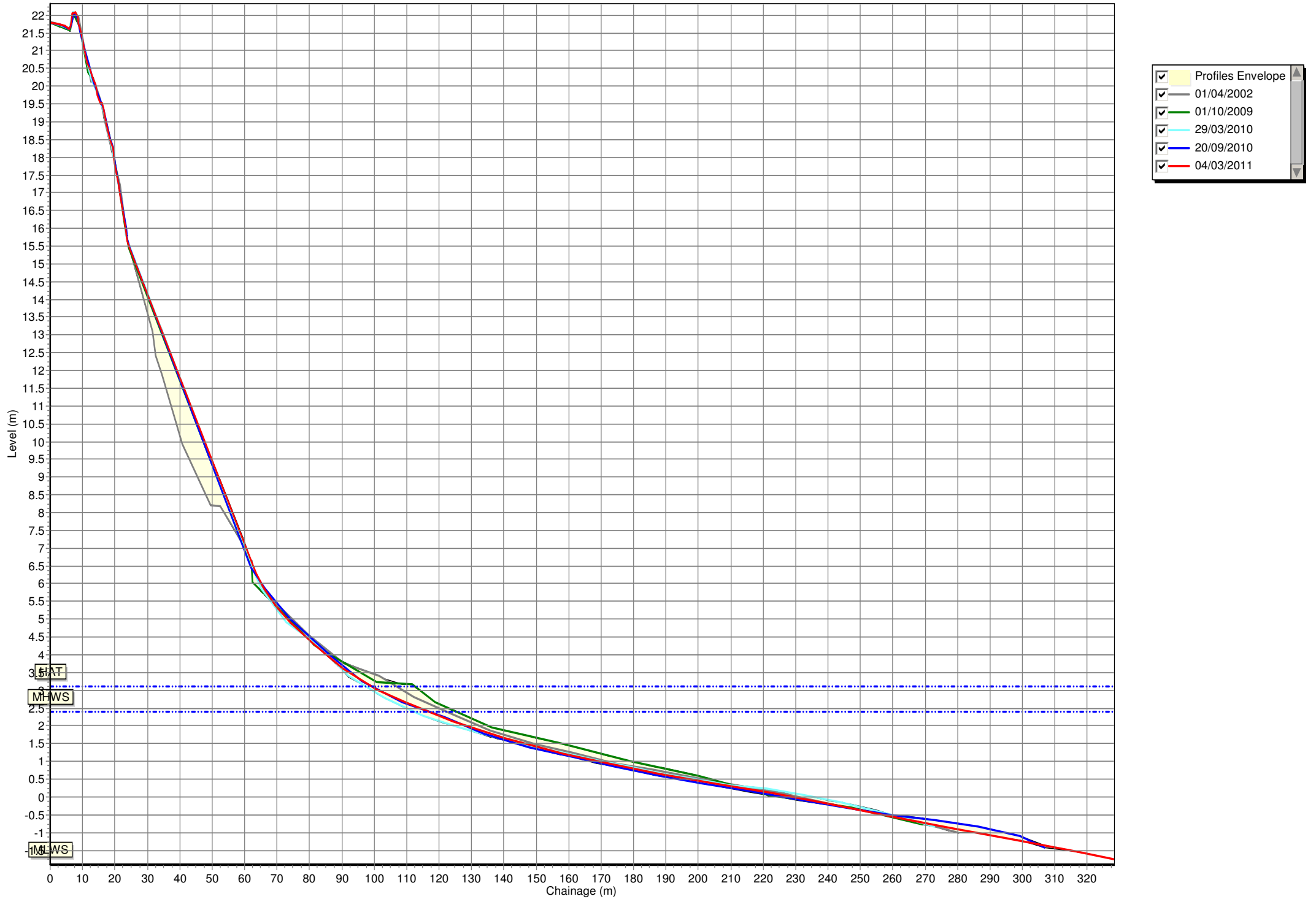
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- 01/10/2009
- 29/03/2010
- 20/09/2010
- 04/03/2011

Beach Profiles: 1aNTDC06A



- Profiles Envelope
- 29/03/2010
- 20/09/2010
- 04/03/2011

Beach Profiles: 1aNTDC07



Beach Profiles: 1aNTDC08



- Profiles Envelope
- 01/04/2002
- 01/10/2009
- 29/03/2010
- 20/09/2010
- 04/03/2011