ROYAL HASKONING

# Cell 1 Regional Coastal Monitoring Programme
# Update Report 2: 'Partial Measures' Survey 2010

NORTHUMBERLAND
Northumberland County Council

## Northumberland County Council
## Final Report

**June 2010**

## Contents



### Appendices



### List of Figures



### List of Tables

## 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 |
| MLWN | 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) | | |
|---|---|---|---|
| | Berwick upon Tweed | Holy Island | North Sunderland |
| 1 in 200 year | 3.4 | 3.4 | 3.5 |
| HAT | 2.8 | 2.8 | 2.8 |
| MHWS | 2.2 | 2.4 | 2.4 |
| MLWS | -1.9 | -1.8 | -1.7 |
| **Water Level Parameter** | **Water Level (mODN)** | | |
| | **Amble** | **Blyth** | **River Tyne** |
| 1 in 200 year | 3.5 | 3.6 | 3.7 |
| HAT | 3.1 | 3.1 | 3.1 |
| MHWS | 2.4 | 2.4 | 2.4 |
| MLWS | -1.9 | -1.8 | -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 Northumbrian Coastal Authorities Group (NCAG[1]) Monitoring Programme began in April 2002 with a survey of profile lines along various sections of the coastline between Berwick-upon-Tweed and the River Tyne. These were fully repeated in September 2002 and since then annual surveys of all profiles have been 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.

At various times, additional beach profile lines have been added and topographic surveys at Holy Island, Alnmouth and Sandstell Point, and cliff top surveys at Newbiggin Caravan Park, Sandy Bay Caravan Park and Cambois Bay have been introduced.

In September 2008 the monitoring became incorporated within the wider Cell 1 Regional Coastal Monitoring Programme. This 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 (as before for Northumberland)
- topographic surveys (as before for Northumberland)
- cliff top recession surveys (as before for Northumberland)
- real-time wave data collection
- bathymetric and sea bed characterisation surveys south of the River Tyne
- aerial photography
- walk-over surveys

To date the following reports have been produced since incorporation within the Cell 1 Regional Coastal Monitoring Programme:

**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 | June 09 (^) | Mar 09 | June 09 | - |
| 2 | 2009/10 | Sep-Nov 09 | Mar 10 | Mar 10 | June 10 (*) | - |

(^) Combined report for Northumberland County Council and North Tyneside Council; subsequent reports have been separate.

(*) The present report is **Update Report 2** and provides an analysis of the 2010 Partial Measures survey for Northumberland County 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] NCAG become part of the wider North East Coastal Group (NECG) in September 2008.

# 1. Introduction

## 1.1 Study Area

Northumberland County Council's frontage extends from the Scottish Border in the north to Hartley in the south. For the purposes of this report, it has been sub-divided into fifteen areas, namely:

- Sandstell Point
- Spittal
- Goswick Sands
- Holy Island
- Bamburgh
- Beadnell Village
- Beadnell Bay
- Embleton Bay
- Boulmer
- Alnmouth Bay
- Hauxley & Druridge Bay
- Lynemouth Bay
- Newbiggin-by-the-Sea
- Cambois
- Blyth South Beach

## 1.2 Methodology

Along Northumberland County Council's frontage, the following surveying is undertaken:

- Full Measures survey annually each autumn/early winter comprising:
    - Beach profile surveys along 88 no. transect lines (78 no. since April 2002, with 10 no. added since Full Measures 2007)
    - Topographic survey along Holy Island (since Full Measures 2004)
    - Topographic survey along Alnmouth Bay (since Partial Measures 2005)
    - Topographic survey along Sandstell Point (since Full Measures 2009)

- Partial Measures survey annually each spring comprising:
    - Beach profile surveys along 39 no. transect lines (29 no. since April 2002, with 10 no. added since Full Measures 2007)
    - Topographic survey along Alnmouth Bay (since Partial Measures 2005)
    - Topographic survey along Sandstell Point (since Full Measures 2009)

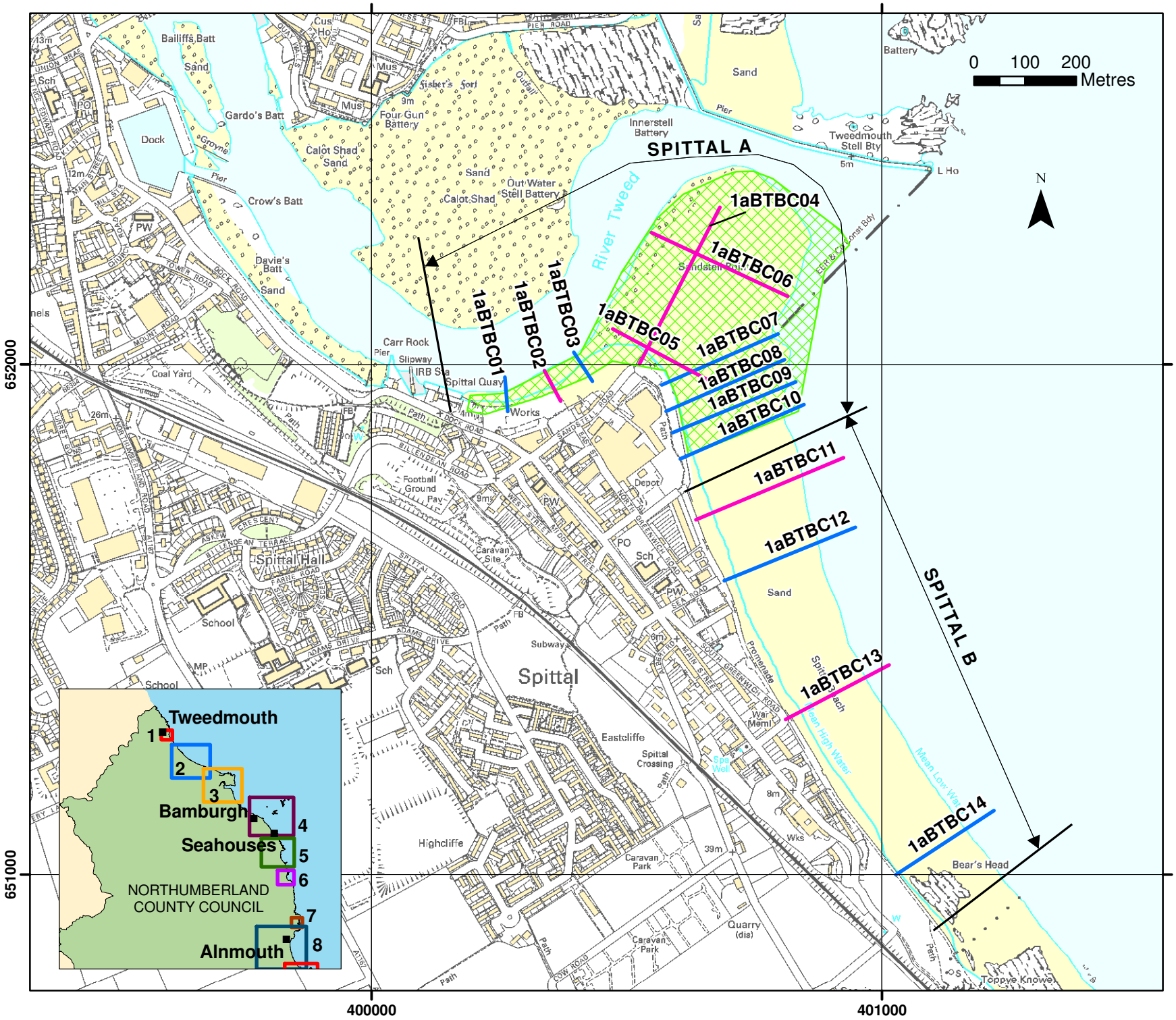
- Cliff top survey (bi-annually) at:
    - Cliff top survey at Newbiggin Caravan Park (since Full Measures 2007)
    - Cliff top survey at Sandy Bay Caravan Park (since Full Measures 2007)
    - Cliff top survey at Cambois (since Partial Measures 2009)

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.

The Partial Measures survey was started along this frontage in mid February 2010, when tidal conditions were favourable, weather conditions were generally fine with the odd foul day and the sea state was mostly calm. A short but particularly heavy storm (25-27$^{th}$ February 2010) then caused significant changes to a number of already surveyed beaches and therefore these profiles were re-surveyed. The survey was then completed between the end of February, throughout March and into early April 2010. This Partial Measures 2010 survey therefore provides a useful pre- and post-storm comparison along some beaches, although it should be noted that a series of storms occurred throughout the particularly severe winter of 2009/2010, and storm-related changes would be inherent in the mid-February 2010 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);
- providing key conclusions and highlighting any areas of concern (Section 5); and
- processed data from the present survey (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 Northumberland County Council Frontage

Update Report 2
'Partial Measures' Survey 2010

Drawing Scale 1:10,000 at A4

| | | |
|---|---|---|
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| Checked by: | NC | Date: 26/05/2010 |
| Approved by: | NC | Date: 26/05/2010 |

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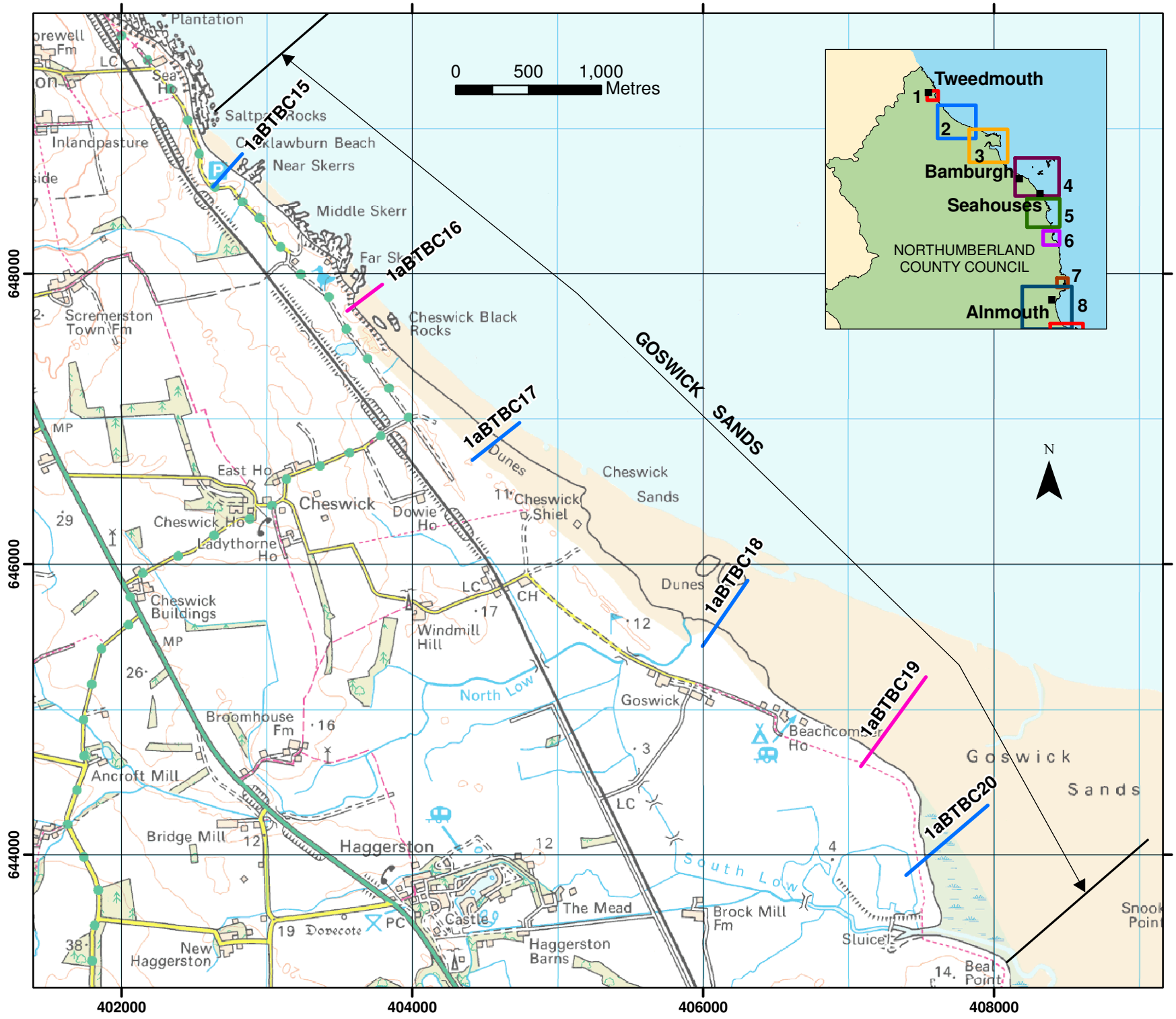


## SURVEY LOCATIONS

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- Annual
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**Topographic Surveys**
- 6 monthly
- yearly
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- Cliff Top Edge Survey

*(Indicative Survey Extents shown)*

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

# Figure 1 - Map 2 Northumberland County Council Frontage

Update Report 2
'Partial Measures' Survey 2010

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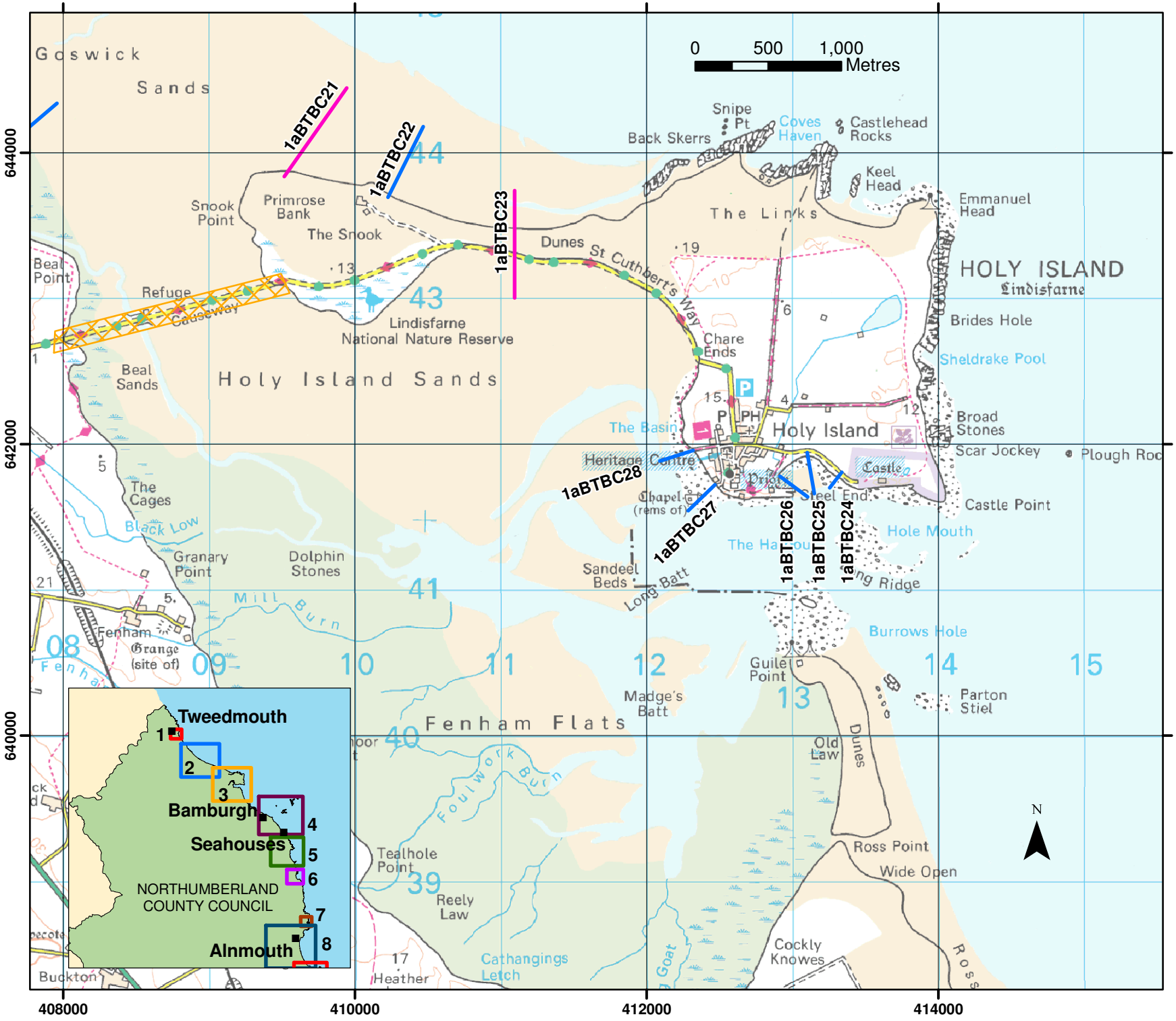


## SURVEY LOCATIONS

**Topographic Profiles**
- Annual
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**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 3 Northumberland County Council Frontage

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'Partial Measures' Survey 2010

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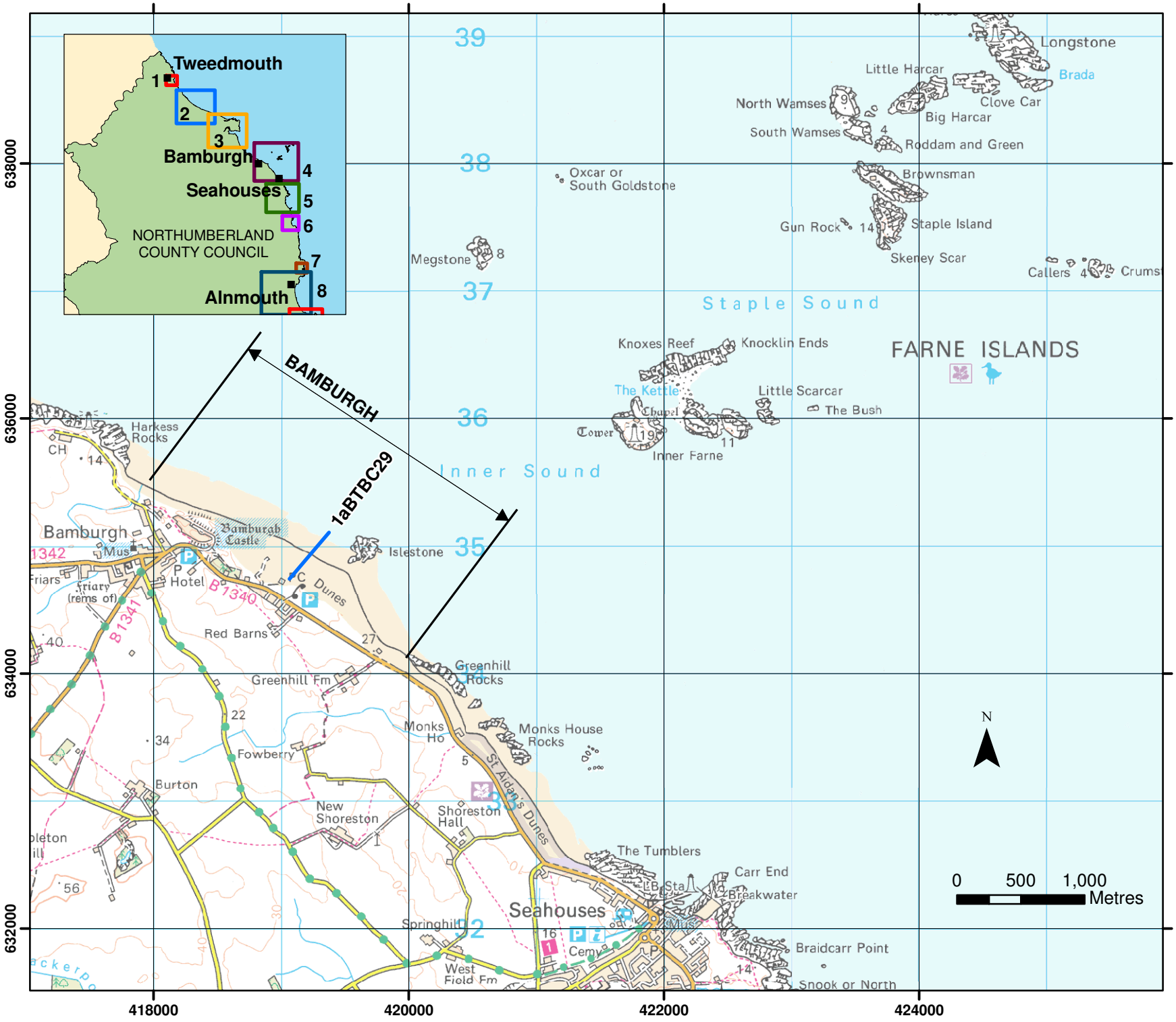


## SURVEY LOCATIONS

**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 4 Northumberland County Council Frontage

Update Report 2
'Partial Measures' Survey 2010

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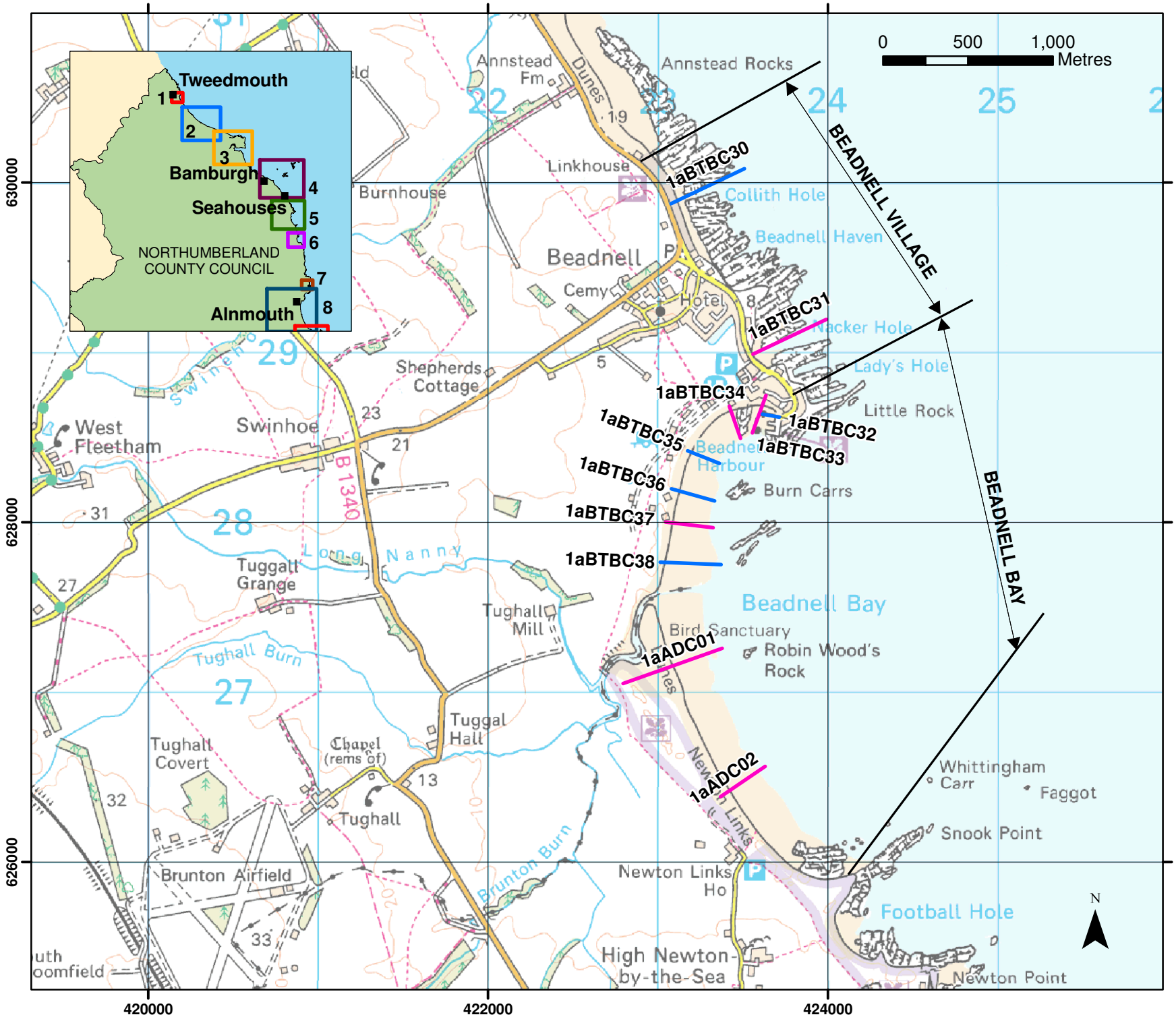


## SURVEY LOCATIONS

**Topographic Profiles**
- Annual
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**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 5 Northumberland County Council Frontage

Update Report 2
'Partial Measures' Survey 2010

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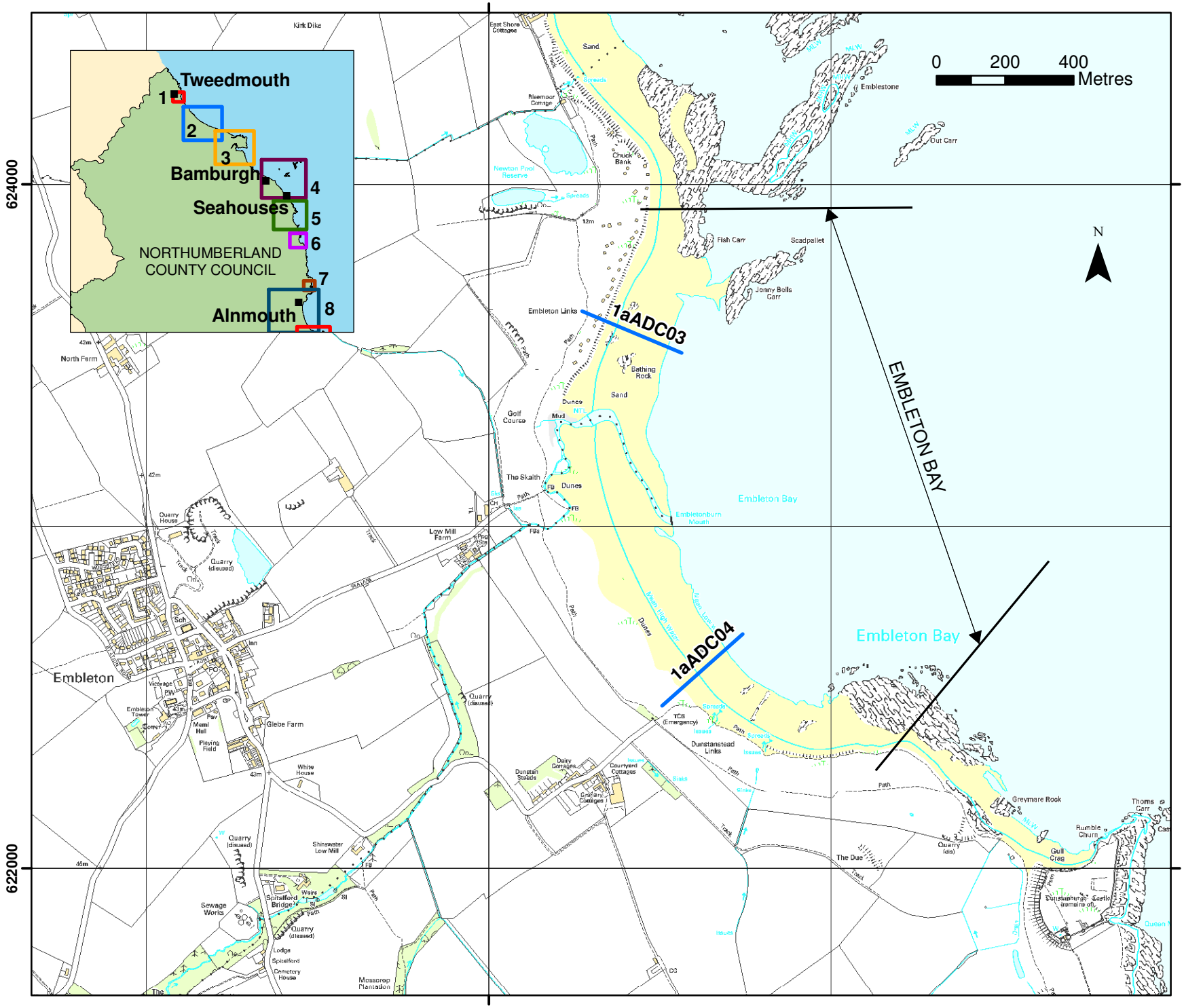


## SURVEY LOCATIONS

**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 6 Northumberland County Council Frontage

Update Report 2
'Partial Measures' Survey 2010

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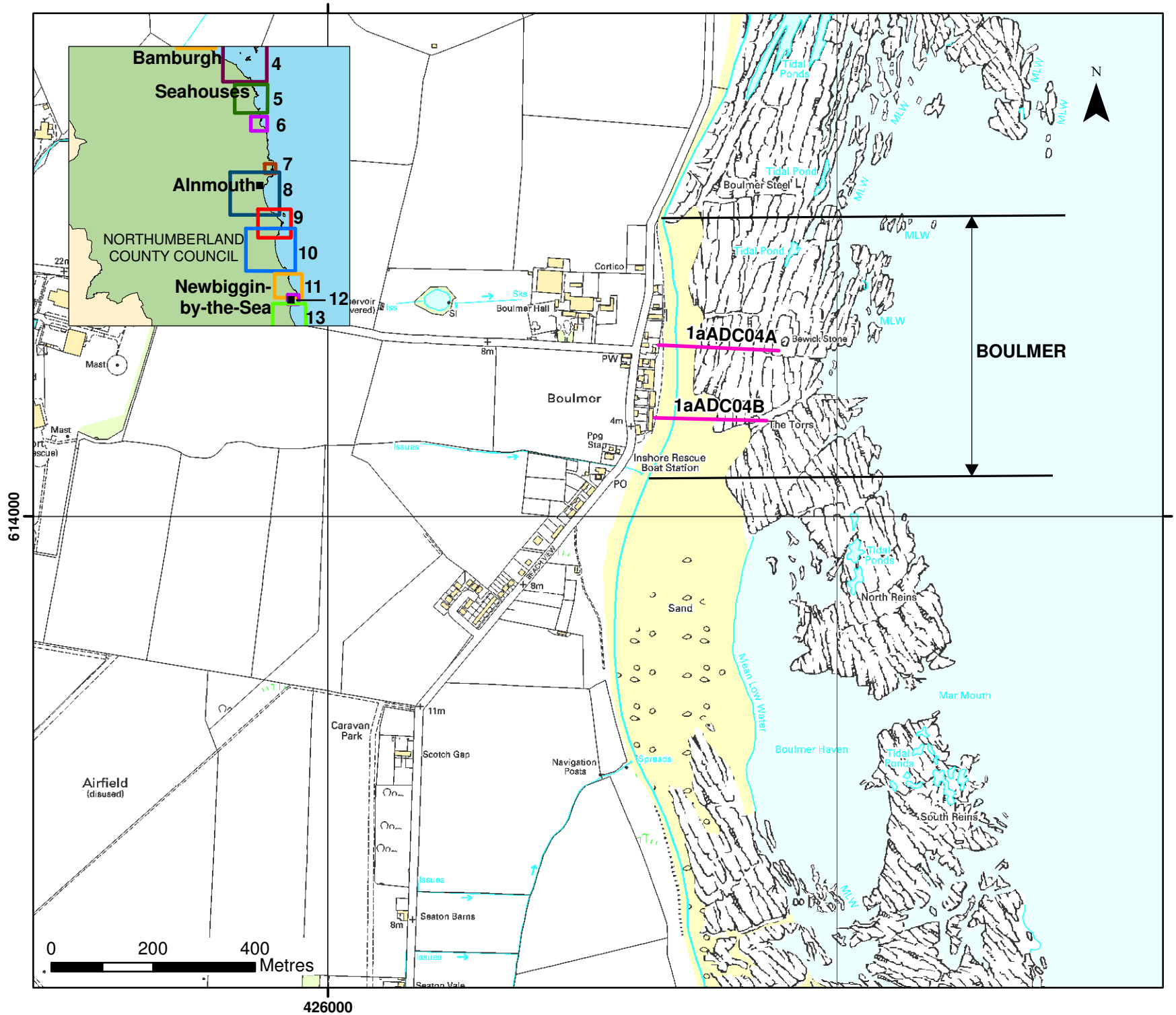


## SURVEY LOCATIONS

**Topographic Profiles**

- Annual
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**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 7 Northumberland County Council Frontage

Update Report 2
'Partial Measures' Survey 2010

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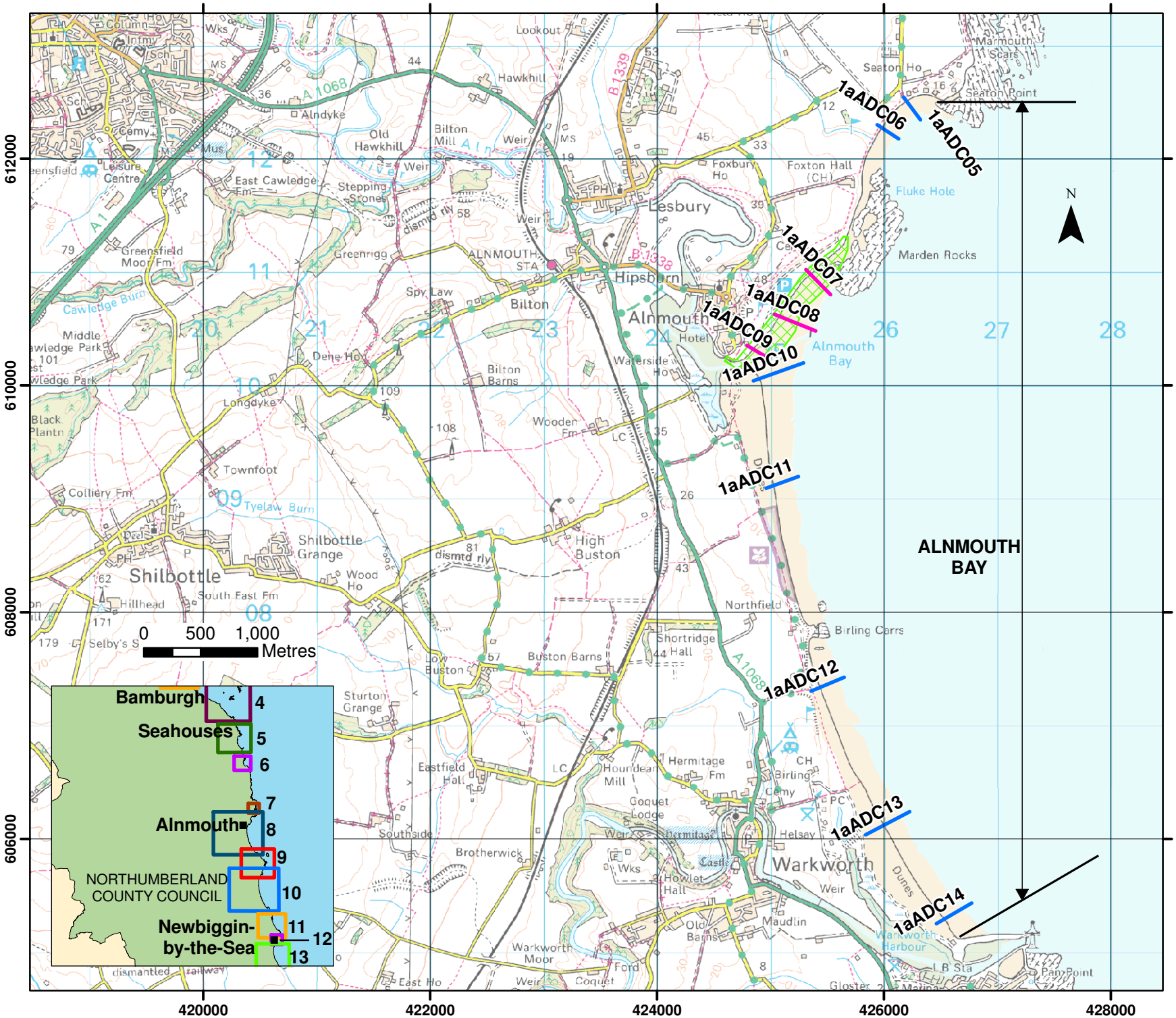


## SURVEY LOCATIONS

**Topographic Profiles**

- Annual
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**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 8 Northumberland County Council Frontage

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'Partial Measures' Survey 2010

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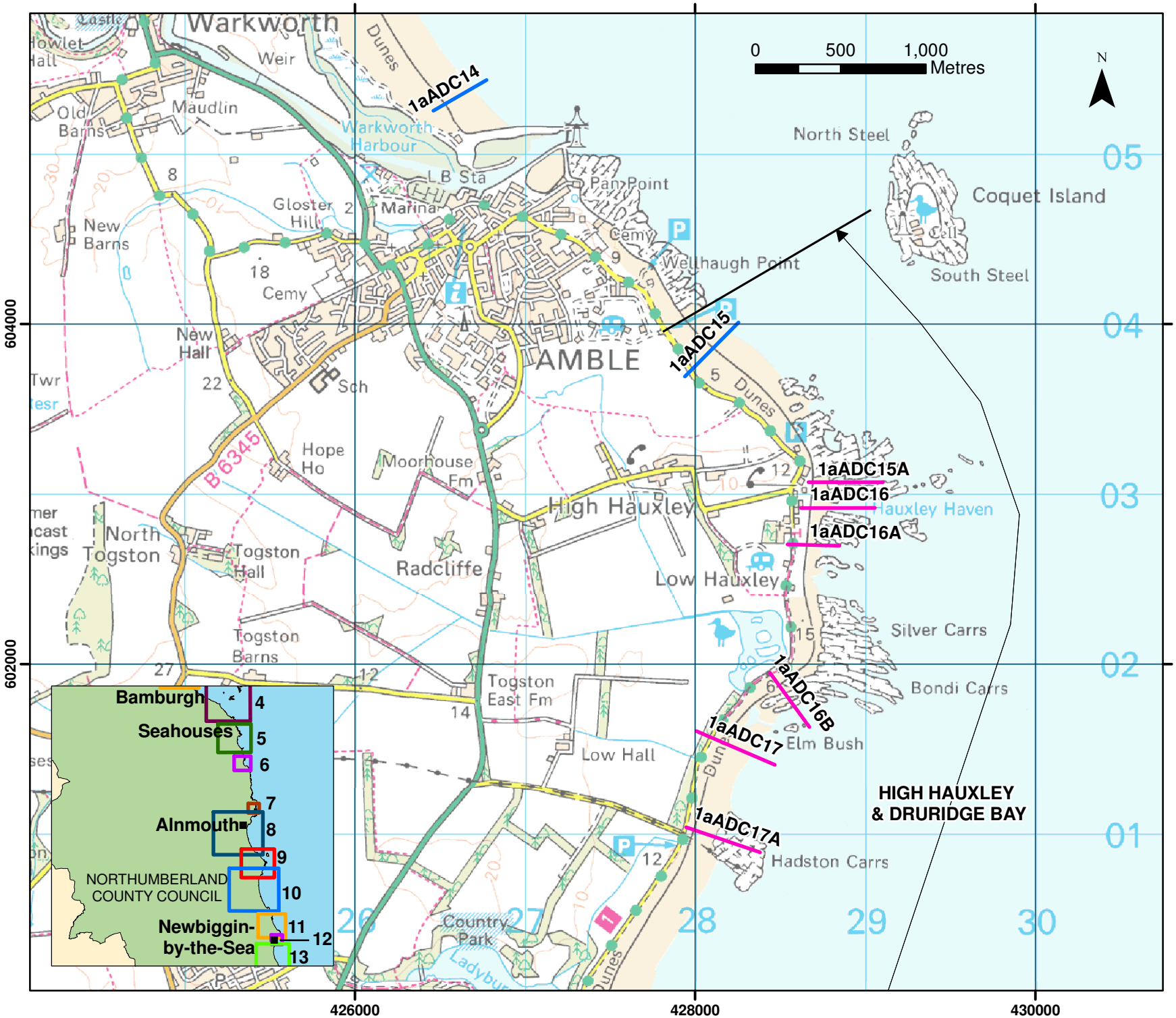


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*(Indicative Survey Extents shown)*

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

# Figure 1 - Map 9 Northumberland County Council Frontage

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'Partial Measures' Survey 2010

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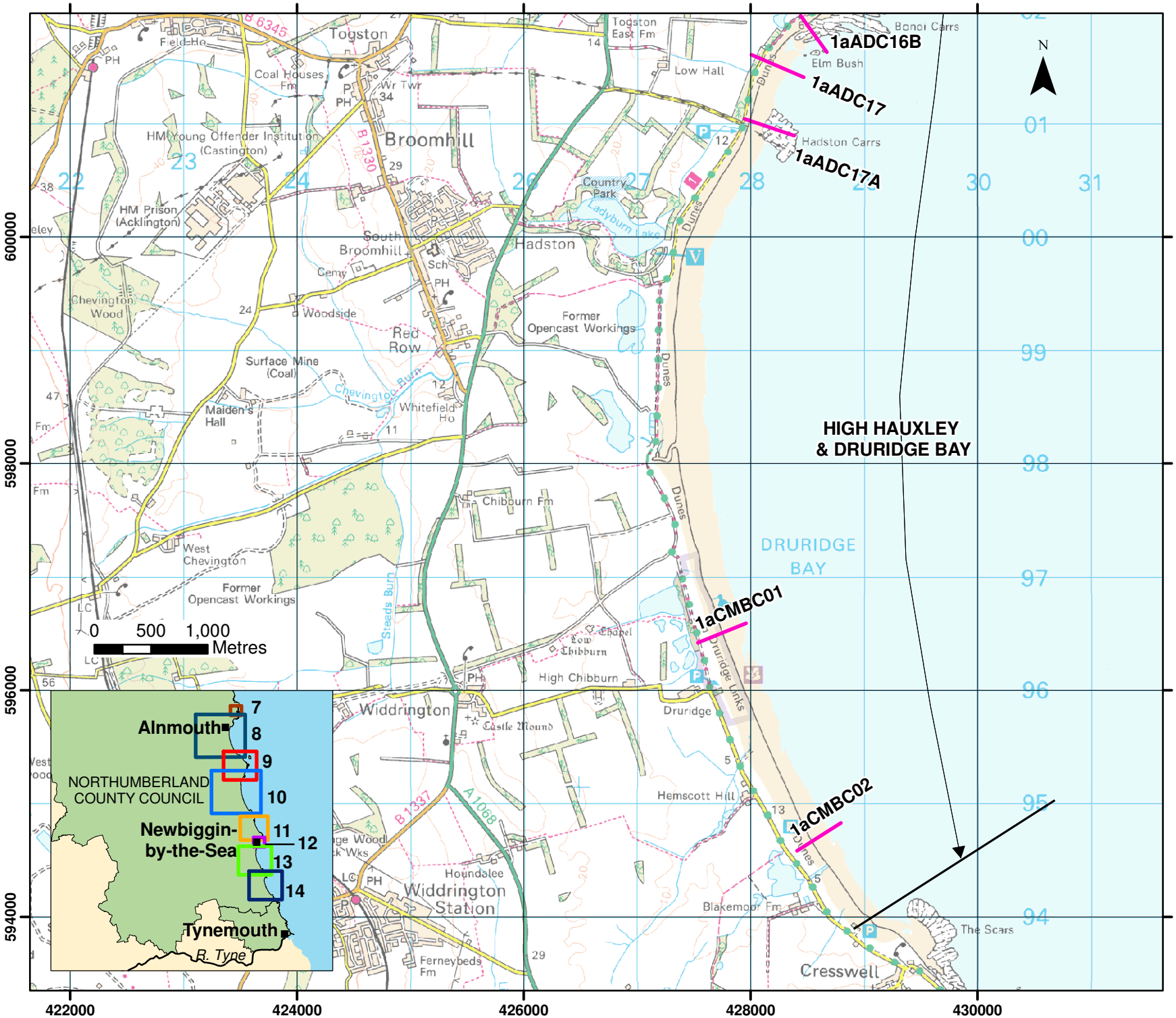


## SURVEY LOCATIONS

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**Topographic Surveys**
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- Cliff Top Edge Survey

*(Indicative Survey Extents shown)*

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

# Figure 1 - Map 10 Northumberland County Council Frontage

Update Report 2
'Partial Measures' Survey 2010

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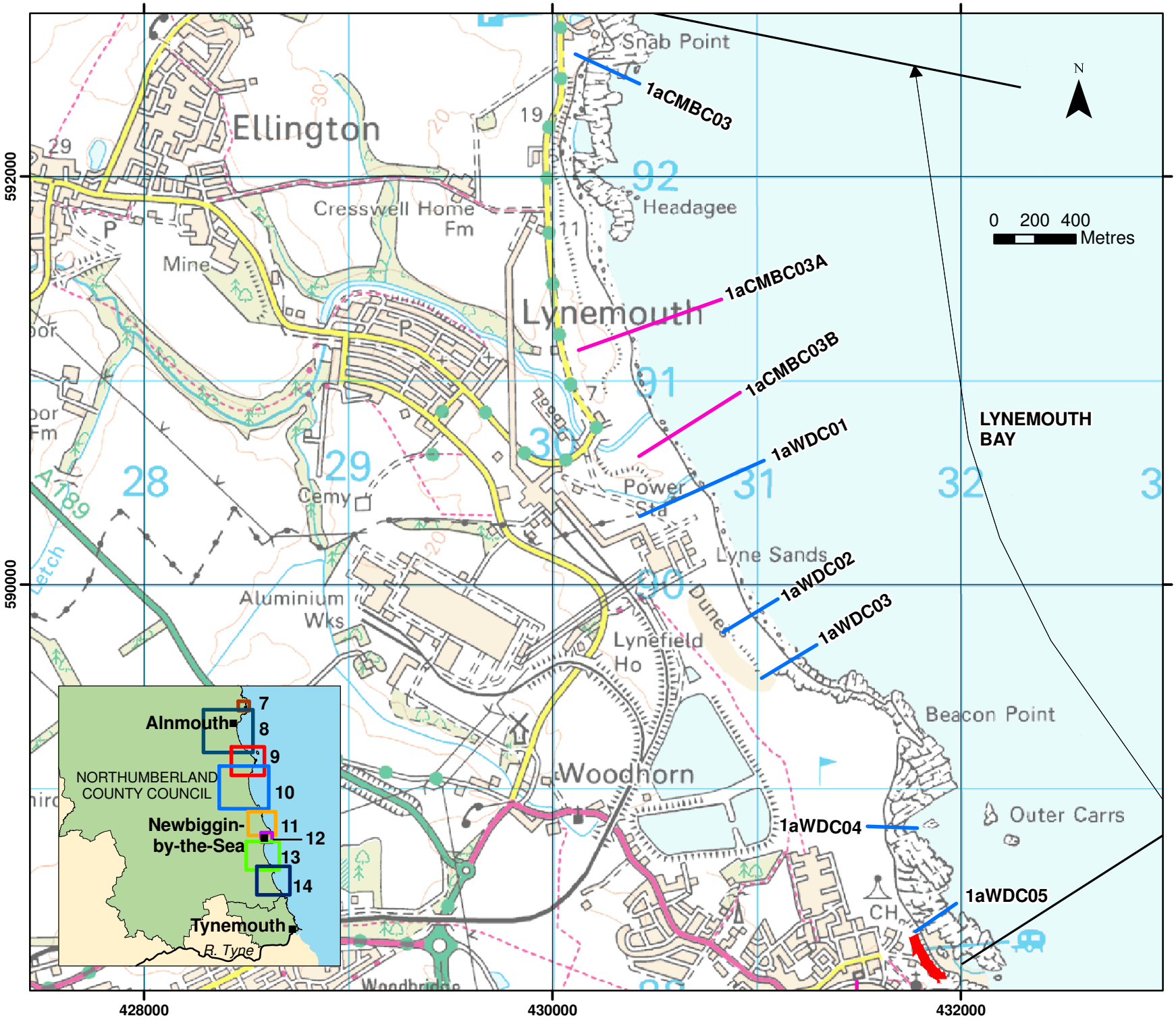


## SURVEY LOCATIONS

**Topographic Profiles**
- Annual
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**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 11 Northumberland County Council Frontage

Update Report 2
'Partial Measures' Survey 2010

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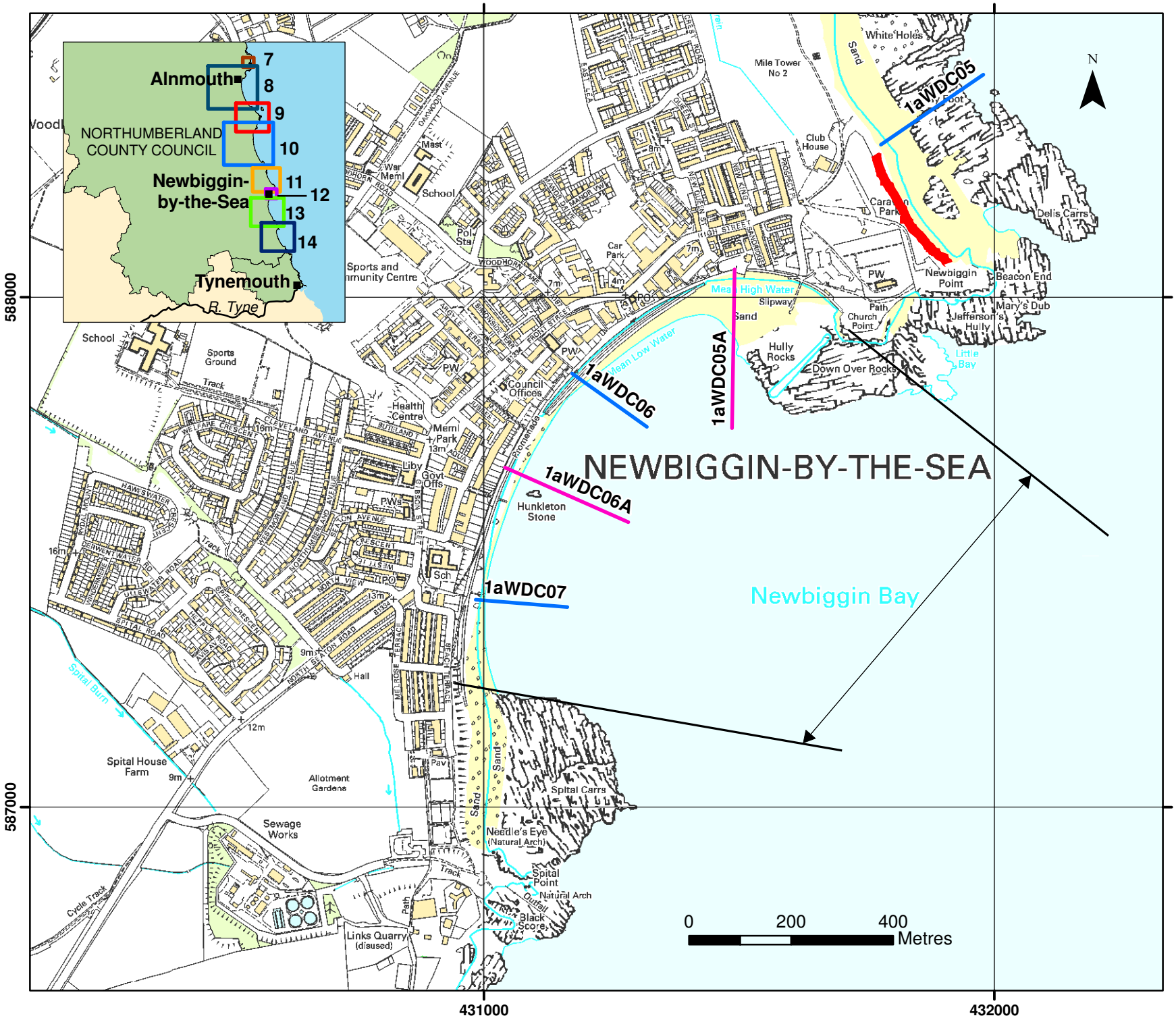


## SURVEY LOCATIONS

**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 12 Northumberland County Council Frontage

Update Report 2
'Partial Measures' Survey 2010

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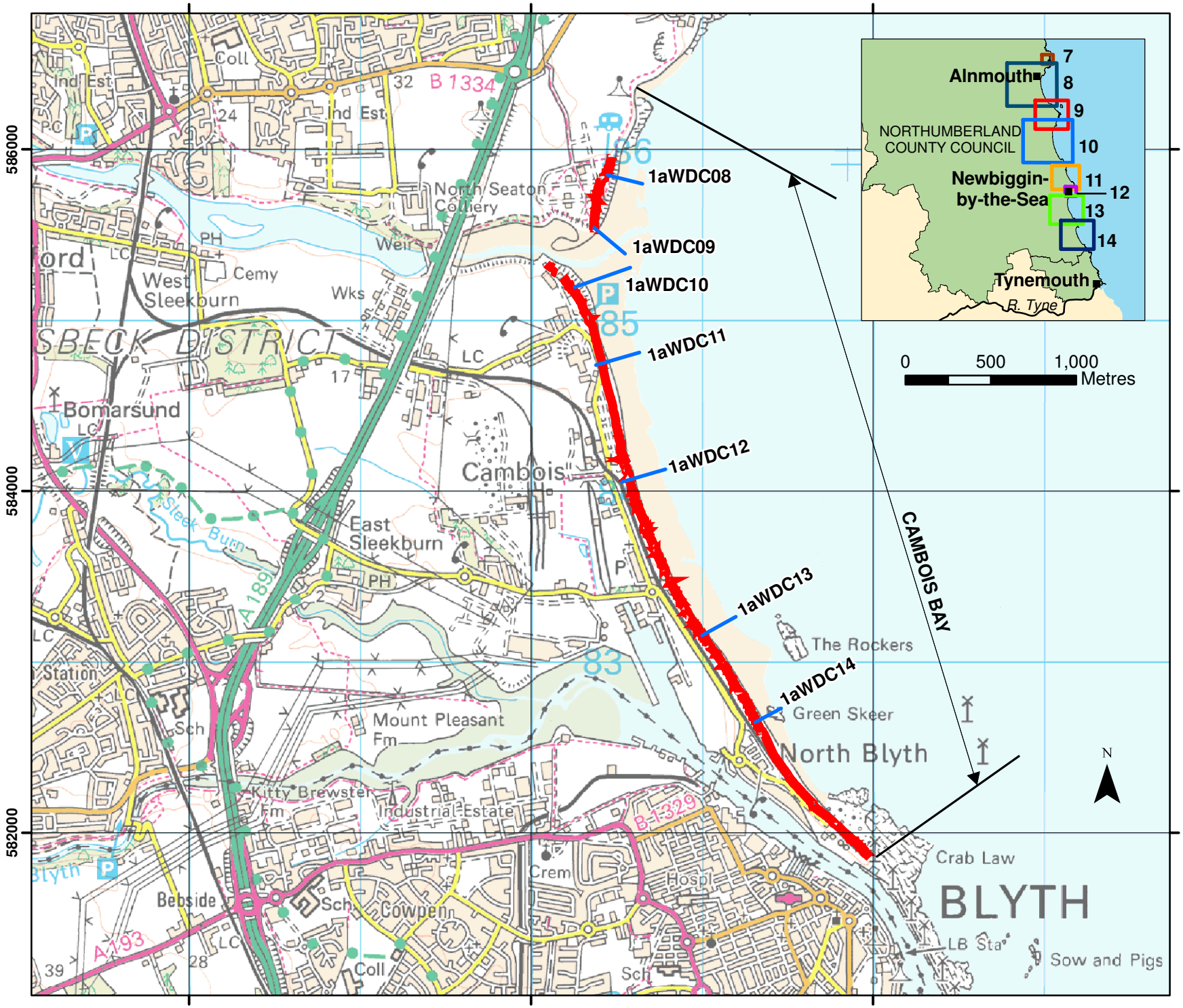


## SURVEY LOCATIONS

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**Topographic Surveys**
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*(Indicative Survey Extents shown)*

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

# Figure 1 - Map 13 Northumberland County Council Frontage

Update Report 2
'Partial Measures' Survey 2010

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| Approved by: | NC | Date: | 26/05/2010 |


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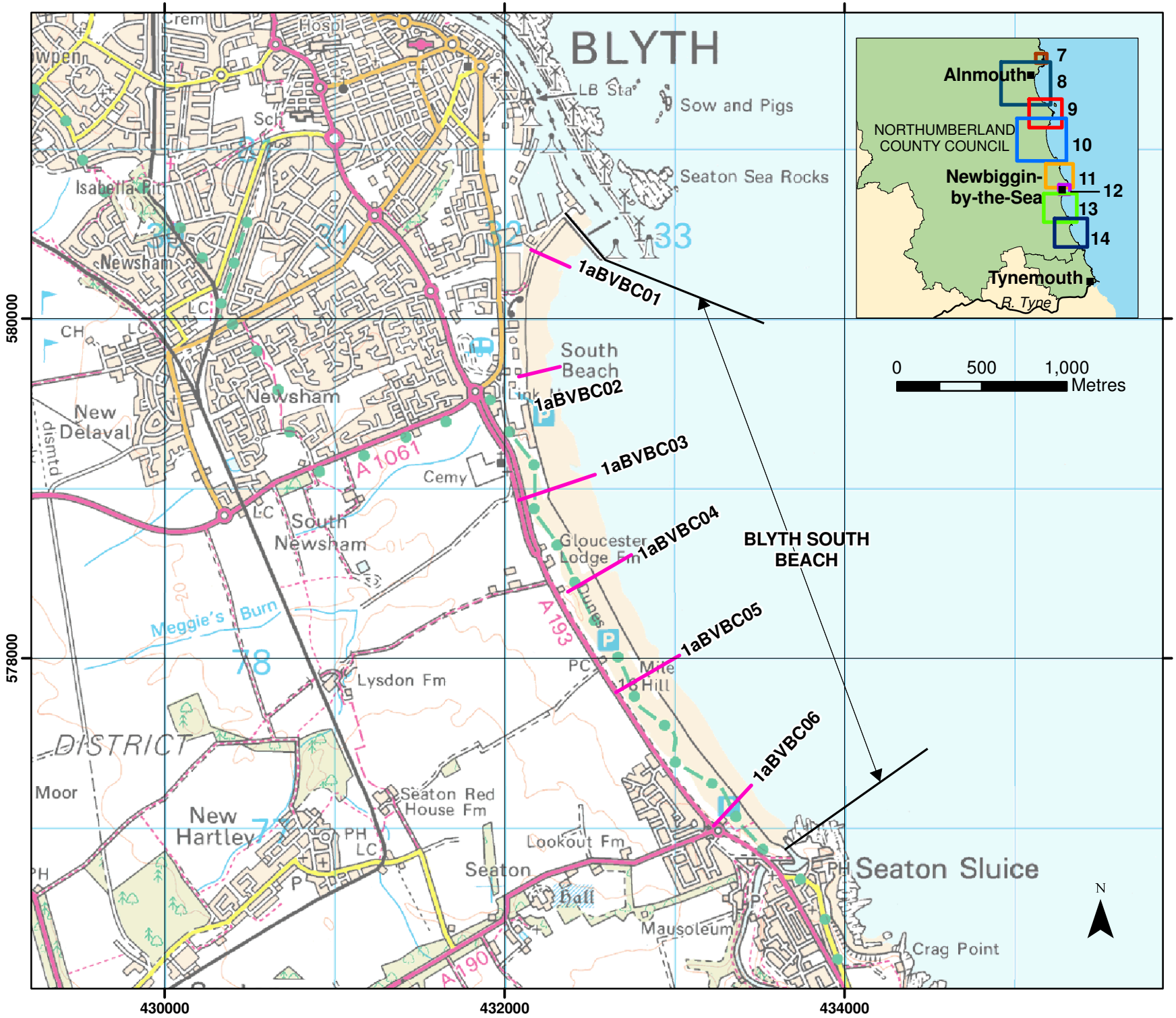


## SURVEY LOCATIONS

**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 14 Northumberland County Council Frontage

Update Report 2
'Partial Measures' Survey 2010

Drawing Scale 1:30,000 at A4

| | | |
|---|---|---|
| Drawn by: | TC | Date: 19/05/2010 |
| Checked by: | NC | Date: 26/05/2010 |
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# 2. Analysis of Survey Data

## 2.1 Sandstell Point

| Survey Date | Description of Changes Since Last Survey | Interpretation |
|---|---|---|
| **03-2010** | **Beach Profiles:**<br><br>Sandstell Point is covered by four beach profile lines during the Partial Measures survey, one along the inner estuary foreshore and three across the spit itself (Appendix A).<br><br>Profile BTBC02 cut-back at the seaward face of the dunes by around 1.15m between the previous survey (September 2009) and the first (pre-storm) Partial Measures survey (18th February 2010). The storm that followed the survey (25-27th February 2010) then resulted in a further cut-back of 1m in the seaward face to the second (post-storm) Partial Measures survey (31st March 2010). Material eroded from the seaward face was deposited on the foreshore below HAT, causing a large berm to form on the mid and upper beach. Between chainages of around 50m and 65m, record high levels were created due to this process.<br><br>Profile BTBC04 runs along the length of the spit and between September 2009 and February 2010 experienced a general accretion of sediment along its length, particularly at the toe of the dues at the landward end of the spit. The profile then experienced a redistribution of sediment from the landward end to further along the length during the late February 2010 storm, resulting in a generally higher, but flatter, profile by the March 2010 survey.<br><br>Profile BTBC05 is a cross-section of the spit, near its landward root. The profile exhibited redistribution of sediment from the high narrow berm that had formed between March and September 2009. By February 2010 the berm had reduced in crest height to around 1.95mODN and by March 2010 further still to a crest height of just over 1.5m. Profile BTBC06 is also a cross-section of the spit, but located nearer its seaward end. Here the large crest that was observed close to the river-side in the September 2009 survey (reaching a crest height of some 2.4mODN) had become flattened (to a maximum crest height of just under 1.2mODN) by February 2010. Then, by March 2010, storm-related changes resulted in further flattening of the crest and the creation of two berms, one slightly river-ward and the other slightly seaward. | The dunes along the inner face of the estuary continue to experience cut-back due to erosion. Along BTBC02 this has resulted in landward recession by up to 6m since the April 2002 survey. The creation of a wide and high berm along the foreshore may now provide a degree of protection against further erosion in the short-term. This is an area that will be inspected further during the forthcoming 2-yearly walk-over surveys in summer 2010.<br><br>After October 2008, the spit has adopted a different, generally lower and flatter, form to that recorded in the earlier surveys, with a lower crest, shifted more towards the river-side of the spit. This seem to have occurred at around the same time that erosion of the dunes along the inner estuary started to increase, suggesting the two processes are inter-related. The behaviour at and around the mouth of the estuary is presently being further investigated as part of the *Tweed Estuary Study*. |

| Survey Date | Description of Changes Since Last Survey | Interpretation |
|---|---|---|
| **03-2010** | **Topographic Survey:**<br><br>Due to the significant changes that have been observed from the analysis of beach profiles along the spit at Sandstell Point, and their apparent inter-connectivities with the behaviour of the dunes along the inner estuary (south bank), a topographic survey was introduced to the monitoring programme in November 2009. This is repeated at 6-monthly intervals.<br><br>Data from the March 2010 survey have been used to created a DGM (Appendix B – Map 1a) which has been compared against the previous survey from November 2009 (Appendix B – Map 1b).<br><br>The western (river-facing) bank of the spit generally experienced notable erosion of material, whilst the main body of the spit experienced a redistribution of sediment, with patches of erosion and accretion. Along the dune frontage to the west of the spit accretion, in the form of berm formation, was recorded along the foreshore. | The behaviour at and around the mouth of the estuary remains complex, but there appear to be inter-relationships between changes along the dunes, spit and adjacent beach. These inter-connectivities are presently being further investigated as part of the *Tweed Estuary Study*. |

## 2.2 Spittal

| Survey Date | Description of Changes Since Last Survey | Interpretation |
|---|---|---|
| **03-2010** | **Beach Profiles:**<br><br>Spittal is covered by two beach profile lines during the Partial Measures survey (Appendix A).<br><br>Along BTBC11 the berm previously recorded in September 2009 at a chainage of around 70m was lowered by February 2010, resulting in record low foreshore levels between chainages of 20m and 80m. At a chainage of 70m the levels reduced to -0.23mODN (some 0.7m lower than the previous 'record low' levels at this point). Material released from this erosion was moved further down the profile, creating a wide and high berm around MSL. Indeed, levels were so much higher here that record levels were almost reached. Between February and March 2010, the low levels recovered substantially as material was redistributed landwards from the berm.<br><br>Along BTBC13 the high beach levels previously recorded in September 2009 were altered by the redistribution of sediment predominantly seawards along the profile, raising levels seaward of a chainage of 35m, but reducing them landwards of this point with the exception of directly at the toe of the wall where levels increased marginally. Between February and March 2010, levels reduced along the entire profile length, increasing in magnitude towards the upper beach where they became some 1.2m lower at around HAT. | Profile BTBC11 appears to remain within the influence of changes occurring at the mouth of the River Tweed estuary around Sandstell Point. Profile BTBC13, being located slightly further south, appears less affected by these changes, but did experience storm-related lowering in February 2010. |

## 2.3 Goswick Sands

| Survey Date | Description of Changes Since Last Survey | Interpretation |
|---|---|---|
| **03-2010** | **Beach Profiles:**<br>Goswick Sands is covered by two beach profile lines during the Partial Measures survey (Appendix A).<br>Along BTBC16, the profile experienced erosion along the upper beach, including at the toe of the dune, and accretion along a length seaward of a chainage of around 60m. Although erosion occurred at the toe of the dunes, this did not trigger cut-back of the dune face and this may be avoided if the upper foreshore levels recover, as they did in 2008 after record low levels were recorded at the toe of the dunes in April of that year.<br>Along BTBC19, foreshore levels were low, but no lower than has been recorded on several previous occasions. However, the last four consecutive surveys (since October 2008) have revealed low levels, especially along the seaward limit of the profile, suggesting that recovery is limited. | The heavy winter of 2009/2010 caused notable change in profiles along BTBC16 and BTBC19 where low levels were recorded along the profiles, including at the toe of the dunes. To the March 2010 survey, this has not triggered cut-back of the dune face, however, and previous tendency along these profiles is for recovery following dune toe lowering. |

## 2.4 Holy Island

| Survey Date | Description of Changes Since Last Survey | Interpretation |
|---|---|---|
| **03-2010** | **Beach Profiles:**<br>Holy Island is covered by two beach profile lines during the Partial Measures survey (Appendix A).<br>Profiles BTBC21 and BTBC23 showed no significant change in profile form or level. | Holy Island profiles BTBC21 and BTBC23 remain stable. |

## 2.5 Beadnell Village

| Survey Date | Description of Changes Since Last Survey | Interpretation |
|---|---|---|
| **03-2010** | **Beach Profiles:**<br>Beadnell Village is covered by one beach profile line during the Partial Measures survey (Appendix A).<br>Along BTBC31, the profile remained relatively stable and changes since September 2009 were within the bounds of previous behaviour. | Beadnell Village profile BTBC31 remains stable. |

## 2.6 Beadnell Bay

| Survey Date | Description of Changes Since Last Survey | Interpretation |
|---|---|---|
| **03-2010** | **Beach Profiles:**<br><br>Beadnell Bay is covered by five beach profile lines during the Partial Measures survey (Appendix A).<br><br>BTBC33 experienced some cut-back at the toe of the dunes, but this was within previous envelopes of change and the foreshore should recover here as it has done on several previous occasions. The slightly lower foreshore levels between MSL and MHWS (recorded in September 2009) recovered by the March 2010 survey. Seaward of MSL the profile shows only minor variations in level and form.<br><br>More significant changes were recorded along BTBC34, where material redistribution from the upper beach (where foreshore levels dropped by up to 0.5m) to the lower beach (where levels increased by as much as 0.55m) was recorded. The changes remained within the envelope of previous behaviour.<br><br>Along BTBC37 (midway between Brunton Burn and Beadnell Harbour) the foreshore levels were low at the toe of the dunes, resulting in cut-back to a new record level; prior to this survey the levels were relatively healthy in September 2009. The consequence of this was that the lower 2m of dune-face cut-back, leaving the remaining dune above in an over-steep condition. Further seaward, the profile experienced a modest increase in level, including an in-filling of the runnel feature recorded in the previous survey.<br><br>Along ADC01, the seaward-face of the dunes was in a quite landward position and the crest level of the seaward dune crest was relatively low, but the changes were well within bounds of previous behaviour. Along the foreshore, a large berm and (landward) trough feature was formed, resulting in record high beach levels at a chainage of around 360m.<br><br>ADC02 also experienced change along the dunes, with cut-back at the toe to a record landward position, leaving over-steep dune crest above the toe. The last time the toe of the dunes was close to this position, in September 2003, the foreshore and dunes subsequently recovered over time. | Beadnell Bay was characterised by some cut-back at the toe of the dunes over the winter of 2009/2010. Whilst this has resulted in over-steep conditions in the seaward face of some dunes, possibly leading to subsequent slumping, the changes are (generally) within the envelopes of previous behaviour. In the past, when low foreshore levels have led to cut-back at the toe of the dunes, subsequent surveys have revealed a progressive process of subsequent dune and foreshore recovery. Such changes are anticipated in Beadnell Bay, although the forthcoming 2-yearly walk-over surveys in summer 2010 will pay particular attention to this. |

## 2.7 Boulmer

| Survey Date | Description of Changes Since Last Survey | Interpretation |
|---|---|---|
| **03-2010** | **Beach Profiles:**<br><br>Boulmer is covered by two beach profile lines during the Full Measures survey (Appendix A). These were introduced to the programme during the Full Measures survey of 2007.<br><br>Profile ADC04A experienced stability in the seaward face down to the foreshore and relatively minor changes along the foreshore between September 2009 and February 2010. Between MHWS and HAT the foreshore levels were low, but seaward of MHWS the previously low foreshore had recovered, suggesting a redistribution of sediment occurred. Between February and March 2010, the profile did suffer the effects of the storm which occurred, resulting in some lowering of the previously recovered foreshore levels seaward of MHWS down to a chainage of around 50m. All changes, however, were within the envelope of previous change.<br><br>Profile ADC04B experienced a recovery in the previously-recorded foreshore lowering at the dune toe, but elsewhere changes were relatively minor between September 2009 and February 2010. The effects of the storm in late February 2010 were not noted along this profile, as relatively little change occurred between the February and March 2010 surveys. | Boulmer remained relatively stable over the winter of 2009/2010, with changes confined to the foreshore and being within the bounds of previous survey records.<br><br>Profile ADC04B, being slightly further south of ADC04A, is characterised somewhat more by cobbles along the foreshore, and therefore this profile was less affected by the February 2010 storm than the slightly sandier frontage along the upper section of ADC04A. |

## 2.8 Alnmouth

| Survey Date | Description of Changes Since Last Survey | Interpretation |
|---|---|---|
| **03-2010** | **Beach Profiles:**<br><br>Alnmouth Bay is covered by three beach profile lines during the Partial Measures survey (Appendix A). These are all located in the area of beach to the north of the River Aln estuary.<br><br>Along ADC07 the large berm that was previously observed along the seaward length of the profile was flattened considerably by February 2010, and material was removed from the upper foreshore and deposited in a berm, raising foreshore levels, at around MSL. The upper foreshore lowering was by around 0.3m. Subsequent to this, between February and March 2010, the profile flattened and cut-back at the toe of the dunes by around 1m was recorded following the storm that occurred at the end of February 2010.<br><br>Between September 2009 and February 2010, ADC08 experienced erosion along its entire length, with lowering of up to 0.5m. There was no significant change at the toe of the dunes, and all changes were well within the bounds of previous behaviour. Between February and March 2010, lowering occurred along the entire profile length, reaching changes of up to 0.3m at the upper beach.<br><br>Profile ADC09 experienced significant erosion to March 2009, but started to recover to September 2009. By February 2010, further significant changes were observed, with the previous partially-recovered foreshore levels at the toe once again experiencing erosion (although remaining above the record low March 2009 levels, except for a small section directly at the dune toe where further cut0-back occurred). In addition, substantial recovery in level was recorded along the lower foreshore, seaward of around MHWN. Between February and March 2010, this profile exhibited slight general accretion along its length. | The surveyors reported that a large amount of sand was eroded along profiles ADC07 and ADC08 during the storm of February 2010, leaving several anti-tank blocks visible and an obvious step in the toe of the dunes. It is also clear that significant changes remain ongoing nearer the mouth of the River Aln estuary along profile ADC09.<br><br>Whilst the recently-recorded changes are certainly notable, they generally remained within the bounds of previous behaviour, which appears significantly linked to the alignment of the channel at the mouth of the estuary. |

| Survey Date | Description of Changes Since Last Survey | Interpretation |
|---|---|---|
| **03-2010** | **Topographic Survey:**<br><br>The northern part of Alnmouth Bay (to the north of the River Aln estuary) is covered by bi-annual topographic survey which commenced in April 2005. Data from the current survey (March 2010) have been used to create a DGM (Appendix B – Map 2a). This has been compared against a similar DGM created using the September 2009 data (Appendix B – Map2).<br><br>Universally along the surveyed section, the upper beach and toe of the dunes has suffered erosion. The mid-beach section, especially in the north and south of the frontage, has generally experienced accretion, while in the central section of frontage erosion has been more widespread across the foreshore. | The channel of the River Aln estuary currently flows in a north-easterly direction upon exiting the estuary, which means that it runs close to the shore before turning seawards to discharge midway along this frontage. This brings tidal and wave energy closer to the toe of the dunes, leaving them more susceptible to erosion. Over the winter of 2009/2010 the dunes and upper beach have experienced erosion, with the material largely being drawn down the beach. Lowering throughout much of the central section of this frontage makes it particularly susceptible to subsequent storms.<br><br>Despite this, these changes do generally remain within the envelope of previous observations, and the beach has previously progressively recovered following similar storm-related damage. |

## 2.9 High Hauxley and Druridge Bay

| Survey Date | Description of Changes Since Last Survey | Interpretation |
|---|---|---|
| **04-2010** | **Beach Profiles:**<br><br>High Hauxley to Druridge Bay is covered by eight beach profile lines during the Partial Measures survey (Appendix A). Four of these (with 'A' or 'B' suffices) were added to the programme in October 2007.<br><br>Along profile ADC15A, the profile remained relatively stable between September 2009 and February 2010 at the toe of the dunes across a beach width of about 10m, but seaward of here the entire profile experienced lowering, typically by around 0.5m but locally greater where berms became flattened and the foreshore lowered. During the storm at the end of February 2010, further lowering occurred along the entire profile length, typically by around 0.3m. This included lowering and cut-back directly at the toe of the dunes, resulting in over-steep conditions in the dune face.<br><br>Between September 2009 and February 2010, profile ADC16 experienced a redistribution of sediment, with two berms becoming flattened and the two corresponding troughs becoming in-filled. Between mid-February and early April 2010 foreshore lowering occurred in response to the storm, especially along the lower foreshore but also along the upper foreshore, with modest accretion observed along a short mid-section of beach.<br><br>Profile ADC16A experienced some lowering and cut-back directly at the toe of the dunes between September 2009 and February 2010, but generally accretion elsewhere along the profile. Between February and April 2010, foreshore lowering and dune cut-back was observed at the toe of the dunes, whilst the foreshore experienced a redistribution of sediment, with lowering of the lower foreshore and accretion on the mid foreshore.<br><br>Relatively little change was recorded along profile ADC16B between September 2009 and February 2010, except for around MHWN where sand was deposited in between the outcropping sections of rocky foreshore. This process continued between February and April 2010.<br><br>Between September 2009 and February 2010 there was a slight cut-back of the toe of the dunes along ADC17 (although not as much as was recorded during a previous survey in April 2006). This was in addition to slight lowering along the upper foreshore and slight accretion along the lower foreshore. All changes were within previous bounds of change. Despite further lowering at the toe of the dunes to April 2010, the dune toe position did not cut back further landward. | High Hauxley experienced notable changes over the winter of 2009/2010, especially with respect to cut-back of the dune toe and lowering of some sections of foreshore. Along many profiles, the dune cut-back continued as the storm at the end of February 2010 caused further changes. |

| Survey Date | Description of Changes Since Last Survey | Interpretation |
|---|---|---|
| | Profile ADC17A also experienced cut-back of the toe of the dunes although, again, a previous survey (this time April 2008) had recorded a more landward position. Foreshore lowering extended down the upper beach from the toe of the dunes to a chainage of around 42m, but further seaward along the profile accretion was recorded, first a modest increase in levels and then, around MSL, through the formation of a large berm. The storm at the end of February 2010, caused the subsequent April 2010 survey to reveal a flattening of this berm, with some increase in mid beach levels caused by sediment redistribution from the berm, together with lowering at the dune toe<br><br>Along CMBC01, significant lowering and landward cut-back occurred at the toe of the dunes. As measured at the line of HAT, the landward recession of the upper foreshore was of the order of 20m. Whilst the dune crest and seaward face largely remained intact (except for the marked changes at the toe), the dune is left in a near-vertical, over-steep form and unless the foreshore and dune toe recovers is likely to be highly susceptible to slumping, thus lowering the dune crest.<br><br>A similar pattern of upper foreshore lowering and cut-back at the dune toe was observed along CMBC02, although here the changes remained within the bounds of previous surveys and the landward recession (as measured along the mark of HAT) was less, although still highly significant, at around 10m. | The southern part of Druridge Bay experienced significant changes, with landward recession in the width of the upper beach by 10-20m and undercutting at the dune toe leading to over-steep conditions in the dune face. Of the two profile lines, CMBC01 experienced the greatest change and it is important to monitor whether this section recovers or whether the dune face experiences a large-scale slump. The changes along CMBC02, whilst large, have previously been observed, with beach recovery following. The changes experienced along CMBC01 however have never been recorded in our surveys since 2002. |

## 2.10 Lynemouth

| Survey Date | Description of Changes Since Last Survey | Interpretation |
|---|---|---|
| **03-2010** | **Beach Profiles:**<br><br>Lynemouth is covered by two beach profile lines during the Partial Measures survey (Appendix A). Two of these, profiles CMBC03A and CMBC03B, were added to the programme in October 2007.<br><br>Along CMBC03A a small amount of accretion occurred along much of the profile between September 2009 and March 2010, including at the toe of the slag bank. In contrast, significant erosion occurred along CMBC03B. The surveyors reported 'a large step-back in the slag stockpile' and the survey data revealed that the lowering in foreshore levels was in excess of 1.1m (at the mark of MHWS) and the landward cut-back at the toe of the slag bank was in excess of 6m. At the crest of the slag bank the landward recession was of the order of 8m, meaning that a width of slag bank of only around 15m now remains. | The profiles along CMBC03A and CMBC03B have been experience ongoing change since the surveys were introduced here in October 2007.<br><br>Whilst foreshore lowering has previously been experience along CMBC03A, this has not, to date, initiated landward cut-back of the slag bank. The most recent changes, indicating accretion along much of the profile, suggest that some material has been liberated from elsewhere along the frontage and deposited along this section, providing temporary reversal on the general erosional trend.<br><br>Further south, along CMBC03B, the foreshore lowering has been observed in accompaniment to the landward recession of the slag bank. The most recent survey records a notable acceleration in both foreshore lowering and slag bank recession, which is now an issue of concern. The consequences of this cut-back will be further considered during the imminent walk-over inspections of the frontage in summer 2010. |

## 2.11 Newbiggin-by-the-Sea

| Survey Date | Description of Changes Since Last Survey | Interpretation |
|---|---|---|
| **04-2010** | **Beach Profiles:**<br><br>Newbiggin-by-the-Sea is covered by two beach profile lines during the Partial Measures survey (Appendix A). These were added to the programme in October 2007 specifically to help assess the performance of the capital scheme involving beach replenishment and construction of an offshore breakwater.<br><br>Profile WDC05A is in the north of Newbiggin Bay and following the September 2009 survey experienced a modest loss of material from the beach face and the formation of a storm-driven berm above HAT to February 2010. The storm that occurred towards the end of February 2010 then drove further sediment from the mid and upper shore face across the crest of the berm to deposit it on the landward side by the April 2010 survey.<br><br>Along WDC06A the replenished beach experienced foreshore lowering and erosion along its seaward face to February 2010. At the mark of MHWS, the beach cut landwards by 8m, leaving the lowest foreshore levels on the seaward face since the surveys began in October 2007. Some of the eroded material was driven over the crest of the beach berm and deposited on the landward side, raising beach levels between the promenade and the berm crest. Between February and April 2010, further landward recession of the seaward face of the beach occurred, by around a further 7.5m at the mark of MHWS. This survey now represents the lowest beach levels at this profile since the replenishment scheme was completed in 2007. | Profile WDC05A experienced dramatic increases in beach level between October 2007 and April 2008 following the replenishment scheme. Since then changes have been mostly continued accretion, slowing down in rate of change to the survey in September 2009. Over the winter of 2009/2010, the profile then experienced typical storm-related behaviour which masked any longer-term trends. |

| Survey Date | Description of Changes Since Last Survey | Interpretation |
|---|---|---|
| **02-2010** | **Cliff Top Survey:**<br><br>Data relating to the cliff top surveys are best viewed as digital 'kmz' files loaded into Google Earth.<br><br>**Newbiggin Caravan Park:**<br><br>This survey was introduced to the monitoring programme in September 2007 and is repeated at 6-monthly intervals. It covers the cliffs in front of Newbiggin Caravan Park, located to the immediate north of Newbiggin Point. Now that the survey has been undertaken on six separate occasions, real trends can start to be determined.<br><br>The northern part of this frontage (approximately 70m in length) is unprotected by defences. Since the previous (September 2009) survey only small-scale changes have occurred, with approximately three locations experiencing localised slumps in the cliff. When compared against the first survey (September 2007), however, this undefended cliff line has eroded along its entire length, resulting in landward recession of between 0.3m and 1.0m.<br><br>The central section of this frontage (approximately 125m in length) is protected by concrete blocks and rubble. The general stability between September 2009 and February 2010 suggests that this has been partly effective in protecting many sections of this cliff, but elsewhere recession has continued, although the magnitude of erosion is less than that recorded along the undefended cliffs in the northern part of the frontage. Typically, between the first and present surveys, erosion has been of the order of 0.2m, but locally it has been up to 0.7m.<br><br>The southern section of surveyed cliff (around 80m in length) is fronted by a rocky shore platform. This also affords some protection to the backing cliffs, as suggested by their relatively stability between September 2009 and February 2010. When compared against the first survey (September 2007), however, modest erosion of the order of 0.1m can be discerned, but locally this can reach up to 0.75m. | Changes in the cliff top position along Newbiggin Caravan Park are occurring along the entire length, but the magnitude of the change is greatest along the undefended cliffs in the northern section. The central and southern sections are somewhat more protected by concrete blocks and a rocky shore platform, respectively. |

## 2.12 Cambois

| Survey Date | Description of Changes Since Last Survey | Interpretation |
|---|---|---|
| **03-2010** | **Cliff Top Surveys**:<br><br>Data relating to the cliff top surveys are best viewed as digital 'kmz' files loaded into Google Earth.<br><br>**Sandy Bay Caravan Park:**<br><br>This survey was introduced to the monitoring programme in September 2007 and is repeated at 6-monthly intervals. It covers the cliffs in front of the southern sections of Sandy Bay Caravan Park (i.e. the area where caravans are closest to the cliff edge), located to the immediate north of the mouth of the River Wansbeck estuary. When considering changes between the previous survey (September 2009) and the current survey (February 2010), there has been general erosion of around 0.1m, but locally up to 0.3m, along almost the entire length. Across the most southerly 85m, however, the cliff top has receded more notably, with over 3.2m recorded in one location. When considering changes between the first survey (September 2007) and the current survey (February 2010), there has been erosion over the entire length. In northern and central sections this has locally been up to 0.75m, but this increases in the south to over 3.4m.<br><br>**Cambois:**<br><br>This survey was introduced to the monitoring programme in April 2009 and is repeated at 6-monthly intervals. It covers the cliffs along Cambois, extending between the mouth of the River Wansbeck estuary (south bank) and the East Pier at Blyth Harbour. Between September 2009 and February 2010, there has been a notable failure along a 15m section of cliff just to the south of Cambois House, resulting in cut-back of the cliff top by 1m. Between here and the beach access (just to the north of the revetment) there is a further six failures, of lengths between 1m and 11m each, causing erosion locally of between 0.75m and 1.1m. The cliff behind the revetment remains stable, but the undefended cliff further south again exhibits localised erosion in two areas (each approximately 7m in length and cutting the cliff-line back by up to 1.1m) before generally becoming more stable until the 300m approaching the round-about, where the cliff line appears to have eroded back by between 1-2m along this section. Further south the cliffs are stable, especially in the sections behind the revetments. | In previous surveys, the cliffs at Sandy Bay Caravan Park have largely eroded through occasional small-magnitude and localised slumps. Between September 2009 and February 2010, the entire cliff line appears to have been more active, with almost the entire frontage experiencing some landward recession. This has been particularly acute along the southern-most section of the cliff top, which has always been particularly active. These recorded changes show that the Sandy Bay Caravan Park cliff top has been active over the winter of 2009/2010.<br><br>**IMPORTANT NOTE:**<br><br>Just to the north of the surveyed area, around Coffin Rocks and Bull Rock, an angler tragically died after falling around 15m from the cliff top onto the beach when the cliff edge he was standing on collapsed. This happened on the evening of 6th January 2010 following a prolonged period of adverse weather, including heavy snow and ice. It is likely that the freeze-thaw cycles on the cliff face weakened the rock structure and the increased loading on the cliff from the deep snow and ice further contributed to the rock fall. This section of cliff top is not currently surveyed.<br><br>The Cambois cliffs are locally active, although at present no assets are threatened. As these cliff top surveys are relatively new to the programme, future surveys will reveal whether this is an ongoing trend or an artefact of the heavy winter of 2009/2010. |

## 2.15 Blyth South Beach

| Survey Date | Description of Changes Since Last Survey | Interpretation |
|---|---|---|
| **04-2010** | **Beach Profiles:**<br><br>Blyth South Beach is covered by six beach profile lines during the Partial Measures survey (Appendix A).<br><br>BVBC01 is located towards the north of South Beach, in front of the area of land owned by Port of Blyth. Between September 2009 and February 2010 notable changes occurred, especially with the lowering of the profile between MHWS and MHWN to new record low levels. The previously-recorded trough at around MSL became infilled. The storm conditions that were experienced at the end of February 2010 caused cut back at the toe and seaward face of the narrow width of dunes which front the port access road. This resulted in a near-vertical seaward face to the narrow dunes. Such an overstep condition is likely to result in slumping unless the foreshore recovers.<br><br>Along BVBC02, notable lowering was observed between September 2009 and February 2010, particularly along the upper beach (above MHWN), although this remained within the previous envelope of behaviour, and between chainages of 80m and 100m, where new record low levels were observed. Between February and April 2010, levels at the toe of the sea wall and seaward of a chainage of 40m recovered, but modest lowering was recorded between HAT and around MHWN.<br><br>Profile BVBC03 experienced a significant change in form, with the large berm that was recorded in September 2009 being flattened and the upper beach levels, landward of a chainage of around 150m, experiencing notable lowering, resulting in landward recession of the foreshore at around the HAT mark by around 7m. Despite this, the changes were within the bounds of previous behaviour. Between February and April 2010slight further cut-back at the toe of the dunes and slight further lowering occurred, but again the changes just remain within the envelope of previous change. | Generally, Blyth South Beach appears to have experienced 'typical' winter response to storms, with signs of some recovery to April 2010, although in some places the storm-related erosion has been notable.<br><br>This includes along BVBC01 where a narrow and now over-steep dune remains. It will be important to continue to monitor this section as there is only a thin 'buffer' between the sea and the port access road. |

| Survey Date | Description of Changes Since Last Survey | Interpretation |
|---|---|---|
| **04-2010** | Between September 2009 and February 2010, the large berm previously recorded above HAT became flattened and the upper foreshore landward of around MHWN experienced lowering, with the profile seaward of this limit becoming flatter and slightly higher in level. Between February and April 2010, the dune toe eroded slightly and the foreshore down to a chainage of around 90m lowered slightly, but seaward of this limit the lower foreshore experienced modest accretion.<br><br>The two distinct berms previously recorded along BVBC05 in September 2009 became flattened and record low beach levels were observed along the upper foreshore in February 2010, between the toe of the dunes and a chainage of around 110m. This process caused the upper foreshore (as measured at the mark of HAT) to cut back by around 30m, resulting in erosion at the dune toe and leaving the lower 1.5m of the dune in a near-vertical and over-steepened condition. By April 2010, the low levels at the toe of the dunes and along the upper foreshore had started to recover.<br><br>Along BVBC06, he berm previously recorded in September 2009 became flattened and the sediment was deposited on the lower foreshore and into the nearshore zone. By April 2010 a small berm had re-formed around MHWS. | Profile BVBC05 also experienced oversteepening at the toe and lower section of dunes over the winter of 2009/2010 but has already shown signs of recovery in foreshore level by April 2010. |

## 3. Problems Encountered and Uncertainty in Analysis

Surveying the cliff top along Cambois Bay is more difficult than the similar surveys at Newbiggin Caravan Park and Sandy Bay Caravan Park because along Cambois Bay, especially in the northern section, the cliff edge is less distinct due to vegetation coverage and a bevelled form, rather than a distinct cliffed edge. Due to this a degree of surveyor interpretation needs to be made in definition of the cliff 'top'. Consequently a long-term record is required before results from this surveying technique become truly meaningful.

The surveyors noted that quicksand had formed around the seaward end of Sandstell Point and at the seaward end of some profiles along the Spittal foreshore. Surveys were conducted along the profile lines as far as was deemed safe given these conditions.

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

No changes are recommended at the present time.

## 5. Conclusions and Areas of Concern

- Significant changes have been recorded on a quite widespread basis since the September 2009 survey across much of Northumberland County Council's coastal frontage. The most significant changes relate to foreshore lowering, cliff recession, dune erosion, and erosion of protective foreshore slag banks.
- It is likely that the winter of 2009/2010 caused much of the change that has been observed, due to the heavy rainfall, snowfall and prolonged sub-zero temperatures which persisted and would have affected cliff stability, and due to the coincidence of high tides and heavy storms towards the spring equinox in 2010.
- The occurrence of a particularly heavy storm in late February 2010, after some surveys had commenced, gave the opportunity to provide 'added value' repeat surveys following the storm to show its impact on certain frontages.
- Many frontages experienced upper foreshore lowering, leading to erosion and cut-back at the toe of dunes. In many situations, such toe erosion led to over-steepened conditions in the dune face and slumping of sand from the dune onto the foreshore. The areas particularly affected by these processes were:
    - Spittal (south bank of Tweed Estuary)
    - Goswick Sands
    - Beadnell Bay
    - Alnmouth
    - High Hauxley
    - Druridge Bay
    - Blyth South Beach
- In most cases the dune erosion and foreshore lowering, despite being quite dramatic, remained within the bounds of previously recorded behaviour and in some areas evidence of beach and dune recovery was recorded in the post-storm surveys of March or April 2010. Where such recovery has not yet been captured by surveys, there are historic records in most areas showing that these frontages can progressively recover over time.

- The principal exceptions to the above generalisation, where dune erosion appears either an ongoing trend or linked to more complex behaviour are at Spittal (on the south bank of the Tweed Estuary where 6m erosion has occurred since April 2002), Alnmouth (especially in the vicinity of the River Aln Estuary) and the northern end of Blyth South Beach (where only a very narrow dune width exists in front of the access road to the port).
- All dunes areas will be inspected for signs of recovery (or further erosion) during the forthcoming walk-over inspections in summer 2010.

**Dune erosion at Alnmouth Bay**

**Dune erosion at High Hauxley**

- Cliff top surveys at Newbiggin Bay Caravan Park and Sandy Bay Caravan Park have previously shown localised erosion due to small, discrete slumping events. Across the winter of 2009/2010 the net effect has been the almost universal cut back of the entire cliff line along these frontages.

- At Newbiggin Bay the semi-protected lengths of cliff (where blocks and rubble has been tipped or where rock foreshore platform fronts the cliff) eroded at a lesser rate than the unprotected cliffs along the northern section of the surveyed area.

- At Sandy Bay Caravan Park, the recession was greatest at the southern end of the surveyed frontage (below) and in location exceeded 3m between September 2009 and March 2010.


**Cliff Top Recession at Sandy Bay Caravan Park**

- At Cambois, the cliff top recession remained locally active rather than continuous across the whole length of the bay.

- At Lynemouth, the ongoing foreshore lowering and landward recession of the slag bank near the power station accelerated dramatically, now leaving only 15m width of protective slag bank. This will be considered in more detail during the forthcoming walk-over inspections during summer 2010.

- At Newbiggin Bay, the recharged beach experienced erosion along the surveyed profiles, reducing levels to their lowest values since the scheme was completed in 2007. The profiles also exhibited storm-related changes, with some sand stripped from the seaward face of the profile and driven landwards over the beach berm where it was deposited.

- In addition to these changes, which are attributable to the heavy winter weather and heavy sea state conditions since the September 2009 survey, complex patterns of behaviour remain ongoing at the mouth of the River Tweed estuary and the mouth of the River Aln estuary. The former are being further investigated as part of the *Tweed Estuary Study*.

- The forthcoming walk-over inspections of summer 2010 provide an opportunity to identify whether the beaches and dunes are starting to recover following the storm damage, and whether there are any management implications associated with persistent trends of dune, cliff and slag bank erosion.

# Appendices

# Appendix A

# Beach Profiles

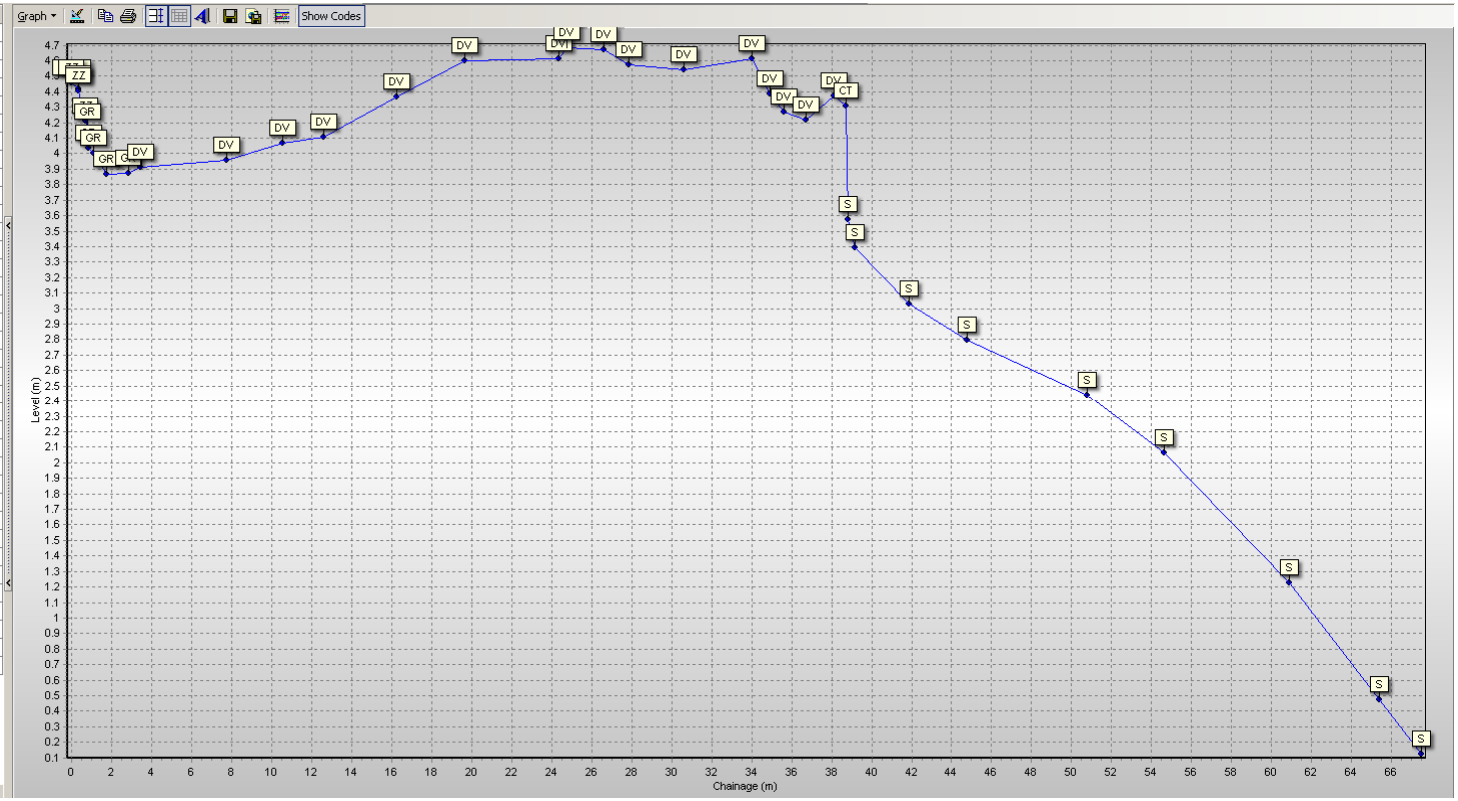
The following sediment feature codes are used on some profile plots:

| 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 |

## Berwick

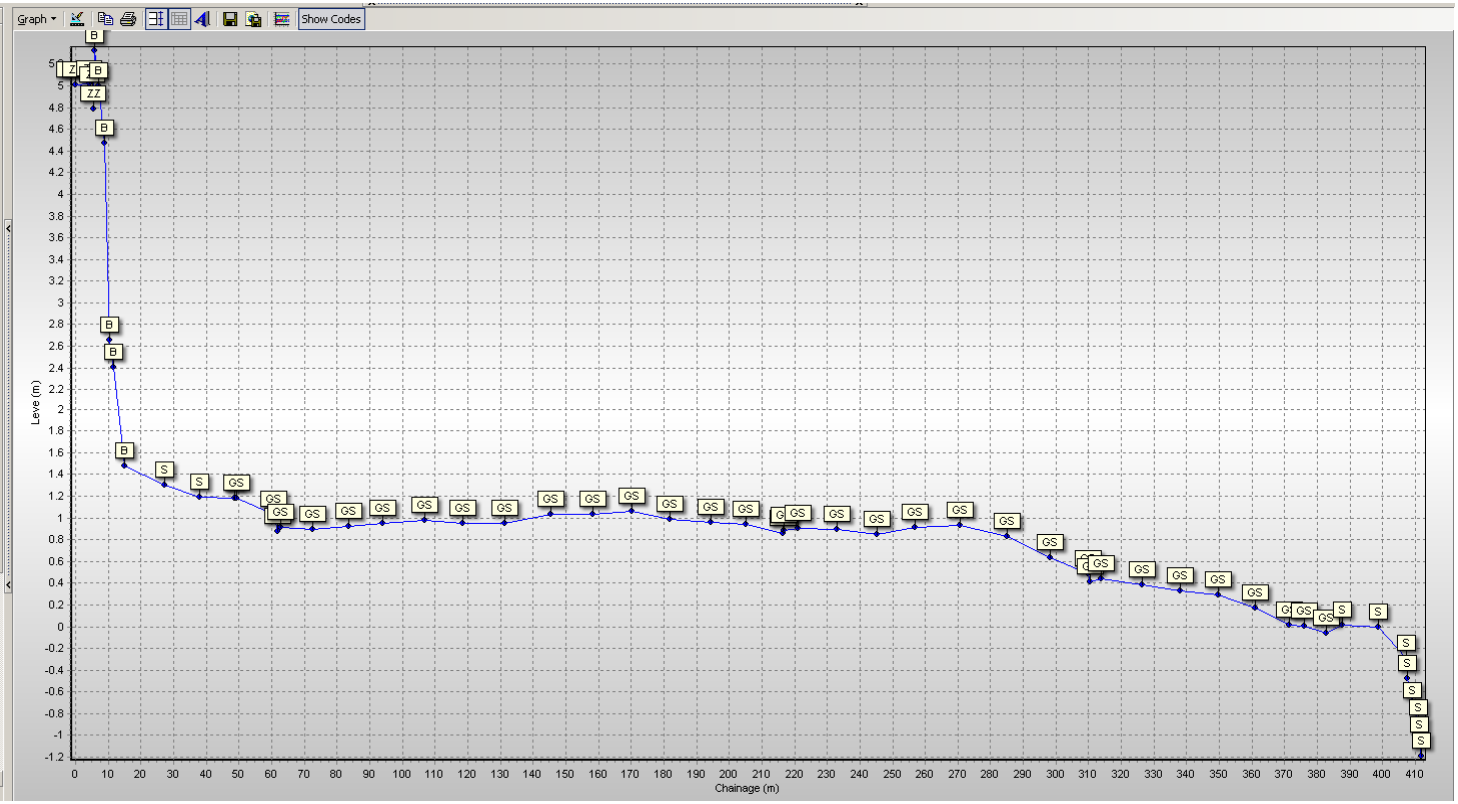
1aBTBC02 - 31/03/2010

| Chainage | Level | Code |
|---|---|---|
| 0.000 | 4.458 | |
| 0.017 | 4.458 | ZZ |
| 0.335 | 4.418 | ZZ |
| 0.358 | 4.407 | ZZ |
| 0.711 | 4.213 | ZZ |
| 0.803 | 4.174 | GR |
| 0.855 | 4.033 | GR |
| 1.090 | 4.004 | GR |
| 1.746 | 3.866 | GR |
| 2.867 | 3.876 | GR |
| 3.462 | 3.915 | DV |
| 7.755 | 3.955 | DV |
| 10.545 | 4.069 | DV |
| 12.630 | 4.104 | DV |
| 16.258 | 4.367 | DV |
| 19.671 | 4.599 | DV |
| 24.386 | 4.610 | DV |
| 24.788 | 4.684 | DV |
| 26.621 | 4.669 | DV |
| 27.888 | 4.574 | DV |
| 30.600 | 4.542 | DV |
| 34.031 | 4.613 | DV |
| 34.916 | 4.386 | DV |
| 35.624 | 4.267 | DV |
| 36.729 | 4.220 | DV |
| 38.114 | 4.373 | DV |
| 38.726 | 4.306 | CT |
| 38.830 | 3.577 | S |
| 39.192 | 3.390 | S |
| 41.877 | 3.031 | S |
| 44.772 | 2.797 | S |
| 50.759 | 2.439 | S |
| 54.642 | 2.066 | S |
| 60.905 | 1.228 | S |
| 65.411 | 0.474 | S |
| 67.489 | 0.124 | S |



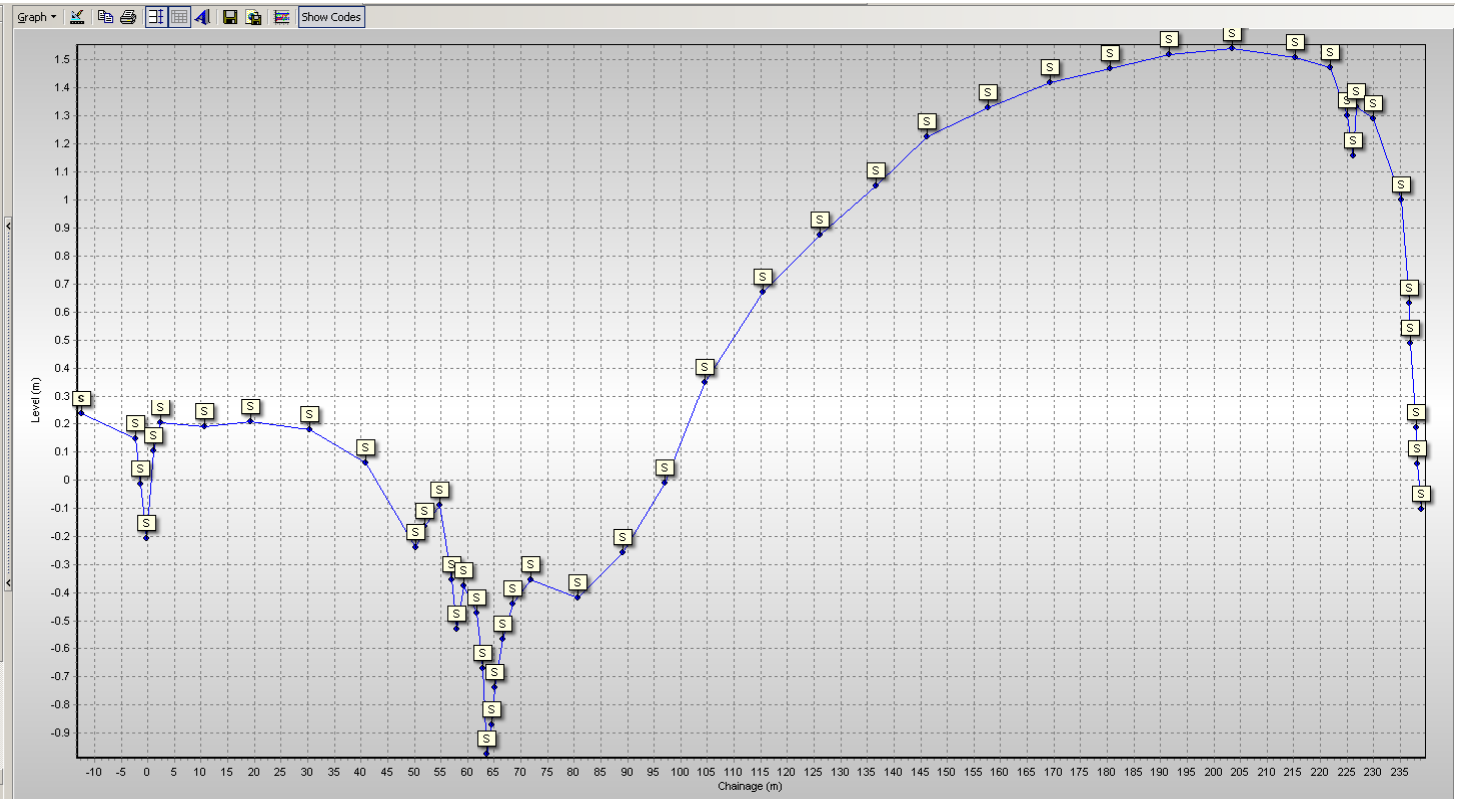
# 1aBTBC04 - 31/03/2010

| Chainage | Level | Code |
|---|---|---|
| 0.000 | 5.008 | |
| 0.033 | 5.008 | ZZ |
| 4.151 | 5.023 | ZZ |
| 5.055 | 4.962 | ZZ |
| 5.605 | 4.791 | ZZ |
| 5.842 | 5.325 | B |
| 7.157 | 5.002 | B |
| 9.020 | 4.473 | B |
| 10.449 | 2.658 | B |
| 11.617 | 2.407 | B |
| 14.980 | 1.480 | B |
| 27.141 | 1.298 | S |
| 37.856 | 1.195 | S |
| 48.771 | 1.182 | S |
| 49.331 | 1.181 | GS |
| 60.673 | 1.031 | GS |
| 61.821 | 0.879 | GS |
| 62.772 | 0.909 | GS |
| 72.552 | 0.894 | GS |
| 83.466 | 0.921 | GS |
| 94.148 | 0.954 | GS |
| 106.974 | 0.974 | GS |
| 118.615 | 0.948 | GS |
| 131.367 | 0.954 | GS |
| 145.497 | 1.029 | GS |
| 158.228 | 1.035 | GS |
| 170.345 | 1.065 | GS |
| 181.789 | 0.991 | GS |
| 194.412 | 0.955 | GS |
| 205.189 | 0.939 | GS |
| 216.407 | 0.857 | GS |
| 216.774 | 0.886 | GS |
| 220.918 | 0.900 | GS |
| 232.871 | 0.892 | GS |
| 245.117 | 0.849 | GS |
| 256.910 | 0.914 | GS |
| 270.797 | 0.930 | GS |
| 285.020 | 0.831 | GS |
| 298.370 | 0.637 | GS |
| 310.005 | 0.490 | GS |
| 310.512 | 0.410 | GS |
| 313.741 | 0.441 | GS |



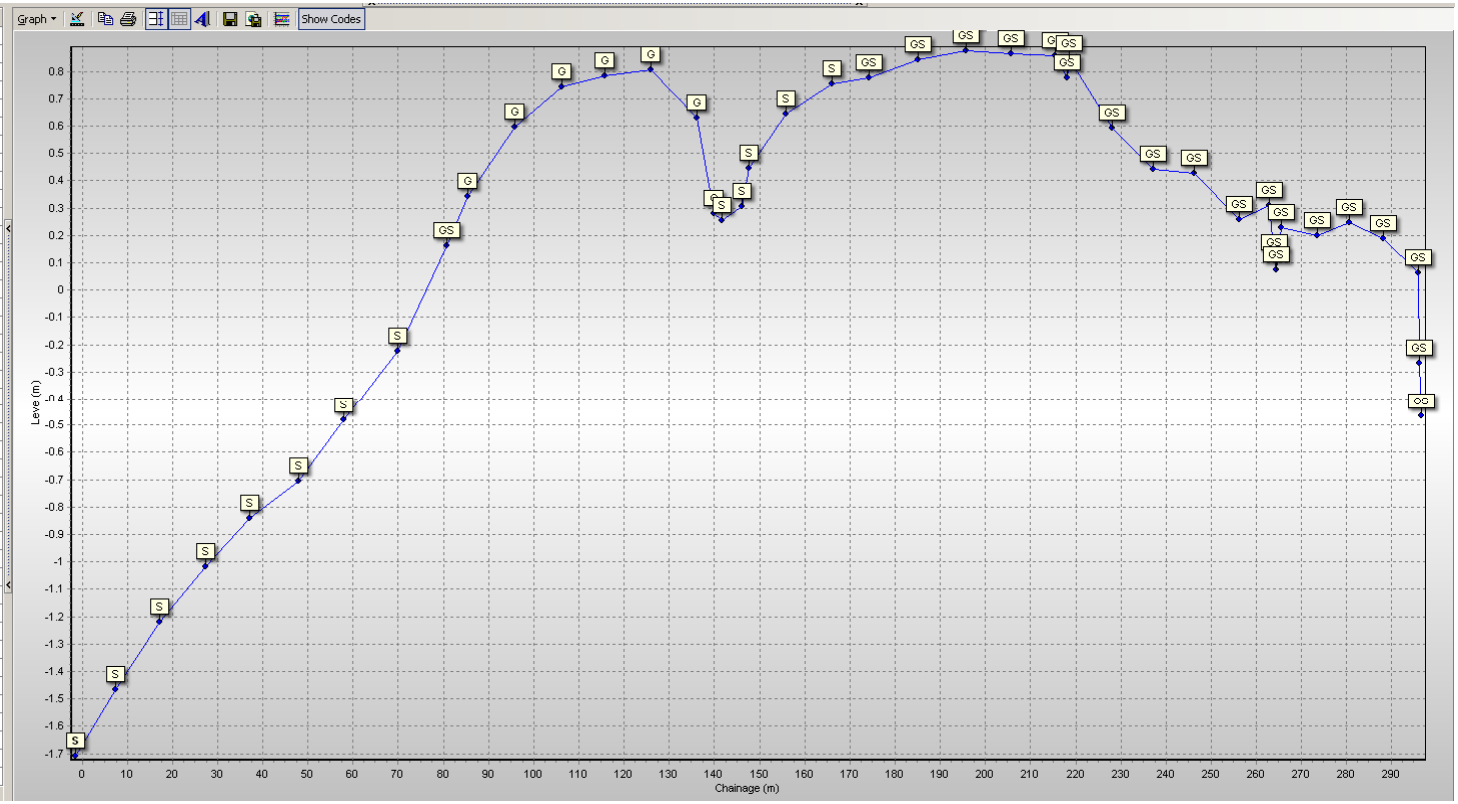
# 1aBTBC05 - 31/03/2010

| Chainage | Level | Code |
|---|---|---|
| -12.426 | 0.236 | S |
| -2.209 | 0.144 | S |
| -1.389 | -0.015 | S |
| -0.250 | -0.207 | S |
| 1.098 | 0.104 | S |
| 2.321 | 0.204 | S |
| 10.599 | 0.190 | S |
| 19.274 | 0.208 | S |
| 30.349 | 0.179 | S |
| 40.930 | 0.061 | S |
| 50.357 | -0.240 | S |
| 51.875 | -0.166 | S |
| 54.761 | -0.089 | S |
| 56.959 | -0.356 | S |
| 58.040 | -0.530 | S |
| 59.351 | -0.376 | S |
| 61.661 | -0.473 | S |
| 62.864 | -0.671 | S |
| 63.670 | -0.974 | S |
| 64.586 | -0.871 | S |
| 65.097 | -0.739 | S |
| 66.585 | -0.566 | S |
| 68.511 | -0.441 | S |
| 71.954 | -0.356 | S |
| 80.719 | -0.419 | S |
| 89.209 | -0.257 | S |
| 97.086 | -0.012 | S |
| 104.493 | 0.348 | S |
| 115.411 | 0.671 | S |
| 126.082 | 0.876 | S |
| 136.546 | 1.052 | S |
| 146.254 | 1.227 | S |
| 157.679 | 1.331 | S |
| 169.274 | 1.421 | S |
| 180.648 | 1.468 | S |
| 191.649 | 1.519 | S |
| 203.465 | 1.541 | S |
| 215.303 | 1.509 | S |
| 221.869 | 1.474 | S |
| 225.148 | 1.300 | S |
| 226.263 | 1.157 | S |
| 226.771 | 1.332 | S |



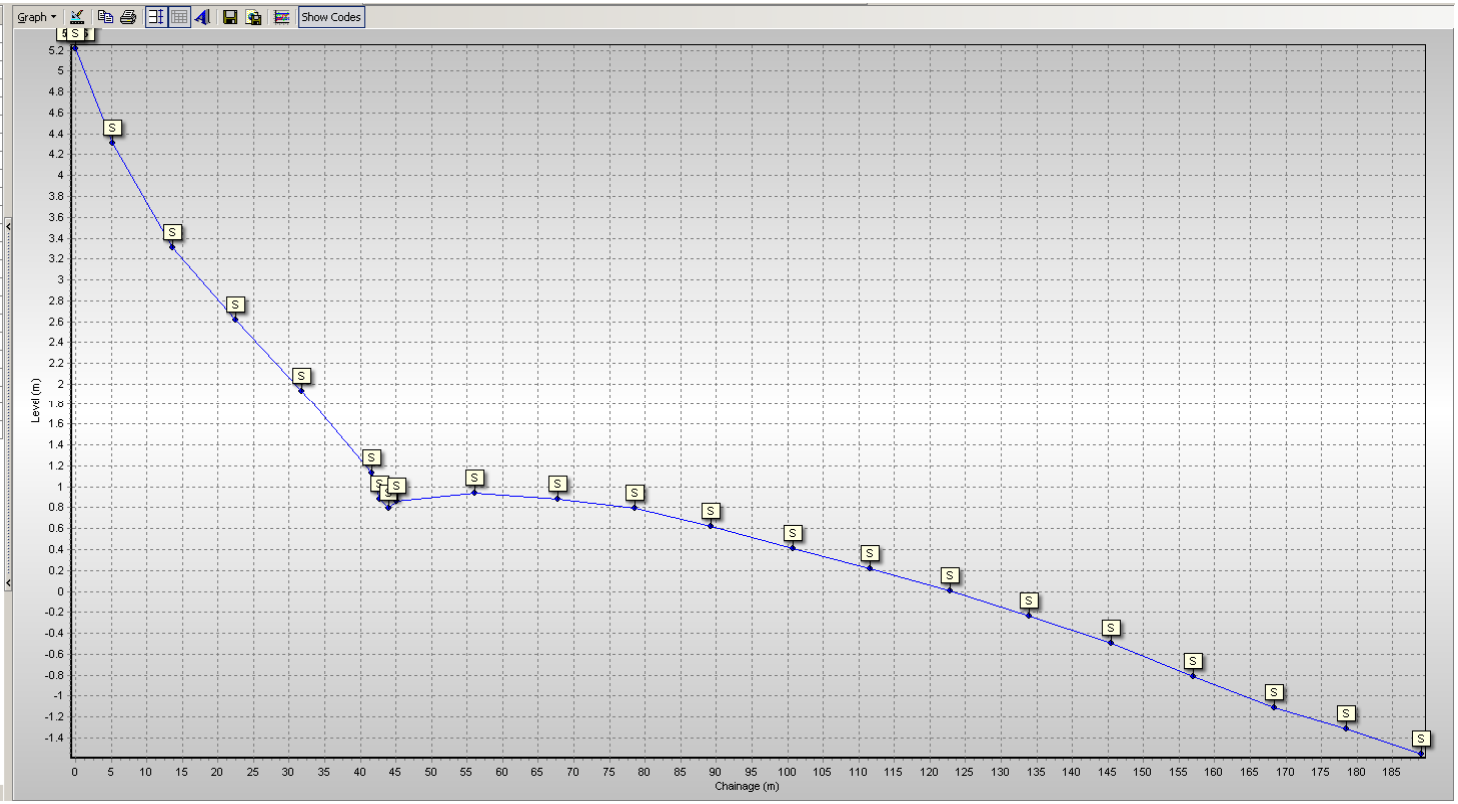
# 1aBTBC06 - 31/03/2010

| Chainage | Level | Code |
|---|---|---|
| -1.447 | -1.709 | S |
| 7.422 | -1.468 | S |
| 17.128 | -1.219 | S |
| 27.346 | -1.018 | S |
| 37.140 | -0.840 | S |
| 47.856 | -0.704 | S |
| 57.969 | -0.482 | S |
| 69.858 | -0.223 | S |
| 80.838 | 0.162 | GS |
| 85.484 | 0.343 | G |
| 95.877 | 0.598 | G |
| 106.189 | 0.745 | G |
| 115.683 | 0.785 | G |
| 125.898 | 0.805 | G |
| 136.169 | 0.631 | G |
| 139.837 | 0.279 | G |
| 141.625 | 0.256 | S |
| 146.217 | 0.307 | S |
| 147.724 | 0.445 | S |
| 155.854 | 0.644 | S |
| 165.949 | 0.753 | S |
| 174.336 | 0.775 | GS |
| 185.150 | 0.844 | GS |
| 195.696 | 0.876 | GS |
| 205.603 | 0.864 | GS |
| 215.544 | 0.857 | GS |
| 218.155 | 0.775 | GS |
| 218.618 | 0.846 | GS |
| 228.155 | 0.594 | GS |
| 237.195 | 0.443 | GS |
| 246.142 | 0.426 | GS |
| 256.284 | 0.259 | GS |
| 262.805 | 0.309 | GS |
| 263.978 | 0.118 | GS |
| 264.424 | 0.073 | GS |
| 265.482 | 0.230 | GS |
| 273.425 | 0.198 | GS |
| 280.500 | 0.246 | GS |
| 288.076 | 0.188 | GS |
| 295.978 | 0.063 | GS |
| 296.074 | -0.267 | GS |
| 296.546 | -0.465 | GS |



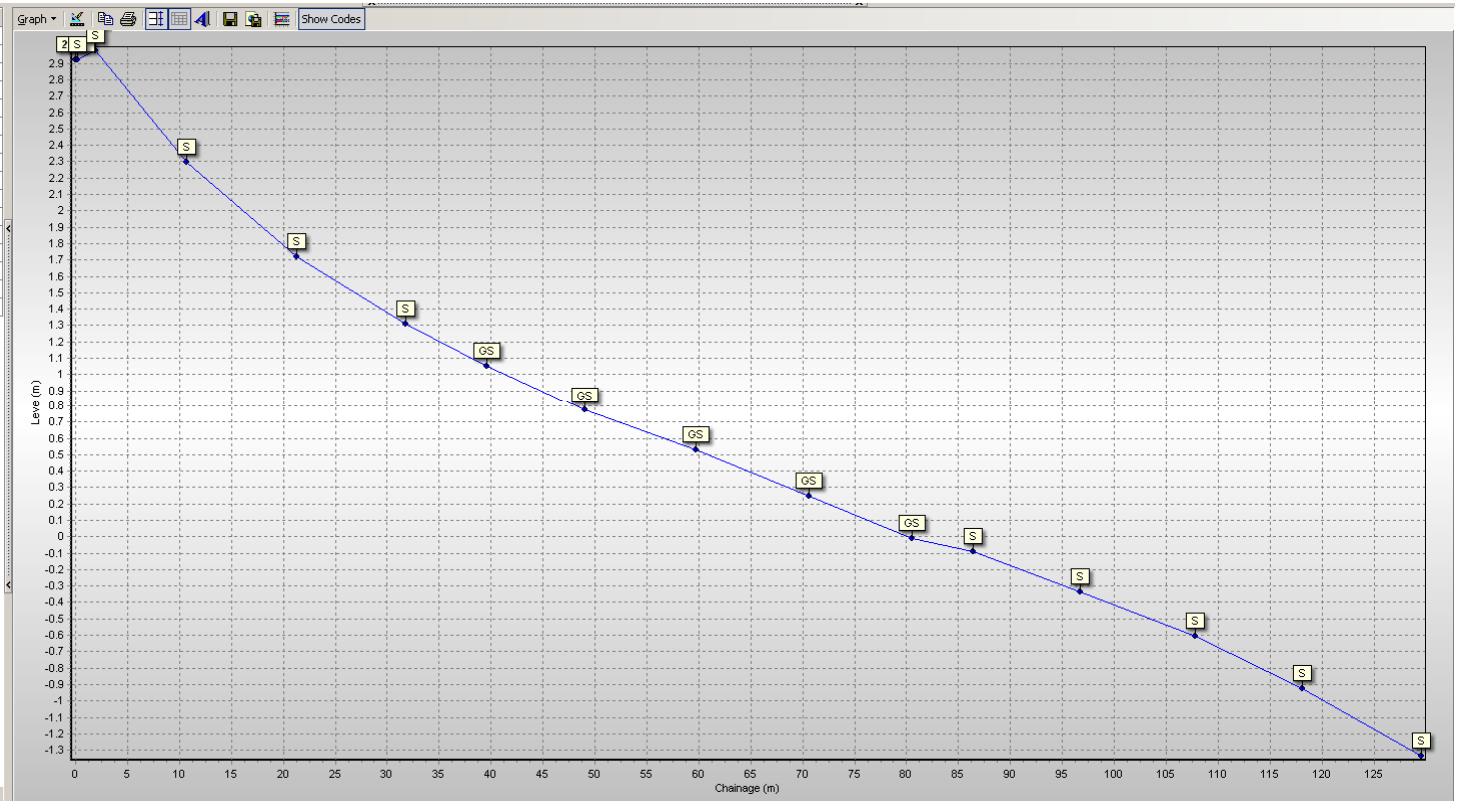
# 1aBTBC11 - 31/03/2010

| Chainage | Level | Code |
|---|---|---|
| 0.000 | 5.216 | |
| 0.007 | 5.216 | S |
| 5.188 | 4.308 | S |
| 13.667 | 3.311 | S |
| 22.446 | 2.616 | S |
| 31.813 | 1.927 | S |
| 41.587 | 1.131 | S |
| 42.772 | 0.877 | S |
| 43.954 | 0.799 | S |
| 45.082 | 0.865 | S |
| 56.138 | 0.938 | S |
| 67.722 | 0.883 | S |
| 78.512 | 0.791 | S |
| 89.183 | 0.618 | S |
| 100.734 | 0.409 | S |
| 111.637 | 0.219 | S |
| 122.813 | 0.007 | S |
| 133.956 | -0.232 | S |
| 145.526 | -0.495 | S |
| 156.991 | -0.817 | S |
| 168.346 | -1.108 | S |
| 178.501 | -1.318 | S |
| 189.030 | -1.555 | S |



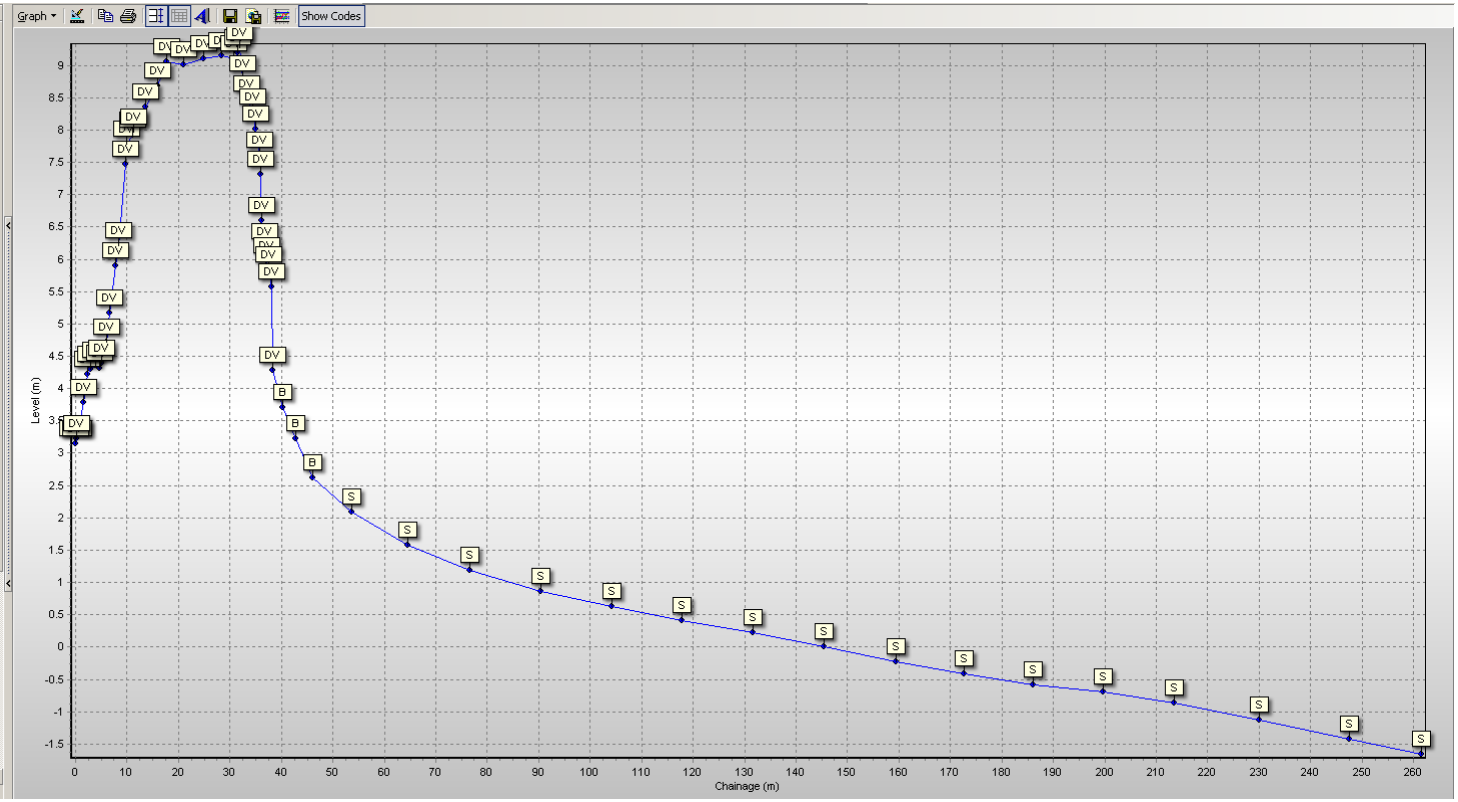
# 1aBTBC13 - 31/03/2010

| Chainage | Level | Code |
|---|---|---|
| 0.000 | 2.921 | |
| 0.211 | 2.921 | S |
| 1.972 | 2.978 | S |
| 10.726 | 2.294 | S |
| 21.307 | 1.720 | S |
| 31.761 | 1.307 | S |
| 39.561 | 1.054 | GS |
| 49.073 | 0.777 | GS |
| 59.755 | 0.529 | GS |
| 70.567 | 0.250 | GS |
| 80.528 | -0.011 | GS |
| 86.382 | -0.092 | S |
| 96.753 | -0.334 | S |
| 107.763 | -0.605 | S |
| 118.108 | -0.924 | S |
| 129.566 | -1.336 | S |



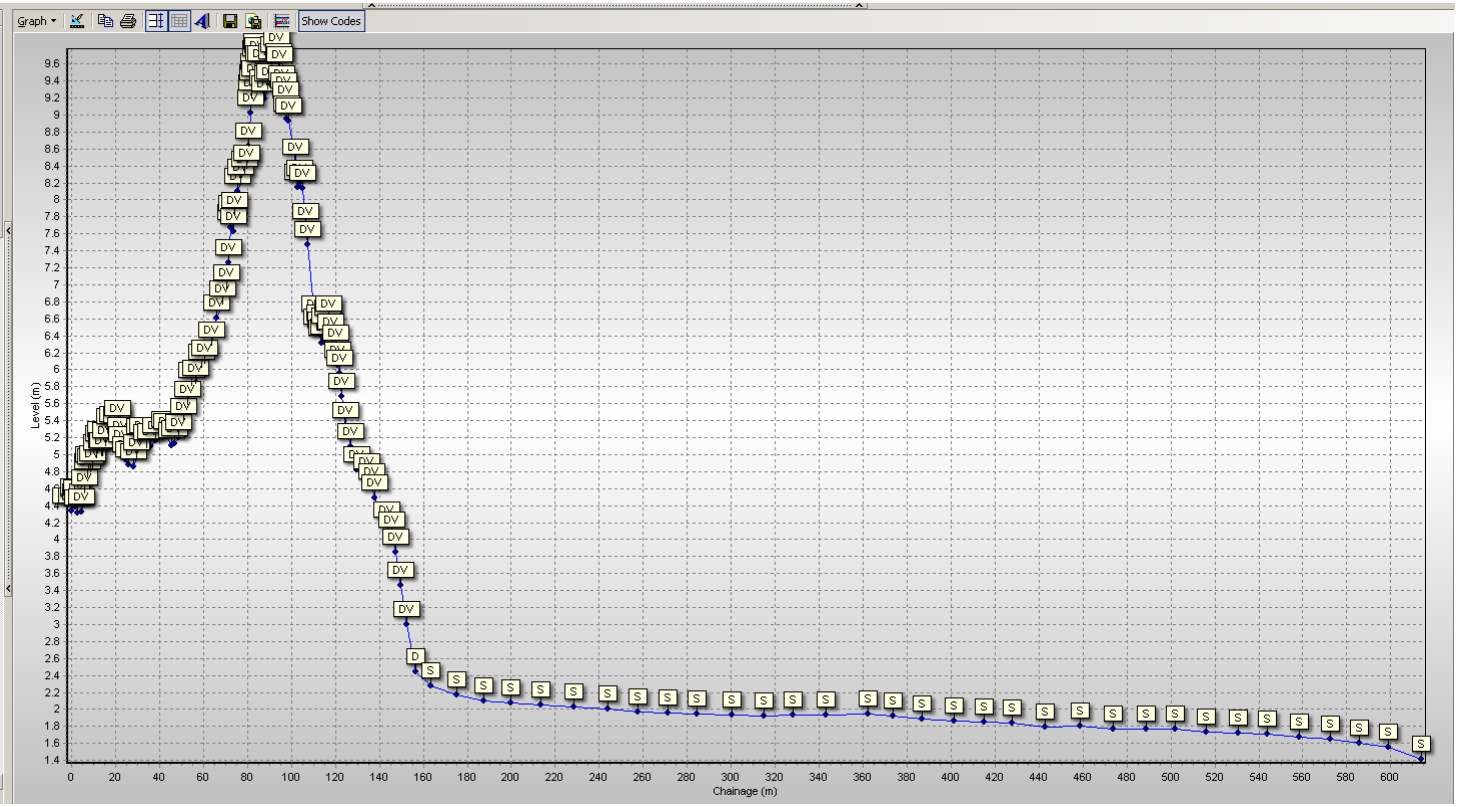
# 1aBTBC16 - 16/03/2010

| Chainage | Level | Code |
|---|---|---|
| 0.000 | 3.150 | |
| 0.020 | 3.150 | DV |
| 0.240 | 3.230 | DV |
| 1.605 | 3.777 | DV |
| 2.372 | 4.213 | DV |
| 2.864 | 4.301 | DV |
| 3.867 | 4.362 | DV |
| 4.629 | 4.312 | DV |
| 5.075 | 4.395 | DV |
| 6.115 | 4.717 | DV |
| 6.650 | 5.161 | DV |
| 7.727 | 5.901 | DV |
| 8.283 | 6.216 | DV |
| 9.726 | 7.473 | DV |
| 10.007 | 7.783 | DV |
| 11.016 | 7.920 | DV |
| 11.359 | 7.973 | DV |
| 13.659 | 8.355 | DV |
| 16.011 | 8.680 | DV |
| 17.711 | 9.051 | DV |
| 21.085 | 9.009 | DV |
| 24.853 | 9.107 | DV |
| 28.308 | 9.149 | DV |
| 30.722 | 9.103 | DV |
| 31.522 | 9.203 | DV |
| 31.938 | 9.273 | DV |
| 32.384 | 8.790 | DV |
| 33.306 | 8.482 | DV |
| 34.476 | 8.272 | DV |
| 34.934 | 8.020 | DV |
| 35.686 | 7.614 | DV |
| 36.021 | 7.314 | DV |
| 36.091 | 6.601 | DV |
| 36.664 | 6.190 | DV |
| 37.128 | 5.984 | DV |
| 37.608 | 5.840 | DV |
| 38.050 | 5.579 | DV |
| 38.283 | 4.276 | DV |
| 40.254 | 3.714 | B |
| 42.837 | 3.222 | B |
| 46.170 | 2.622 | B |
| 53.701 | 2.084 | S |



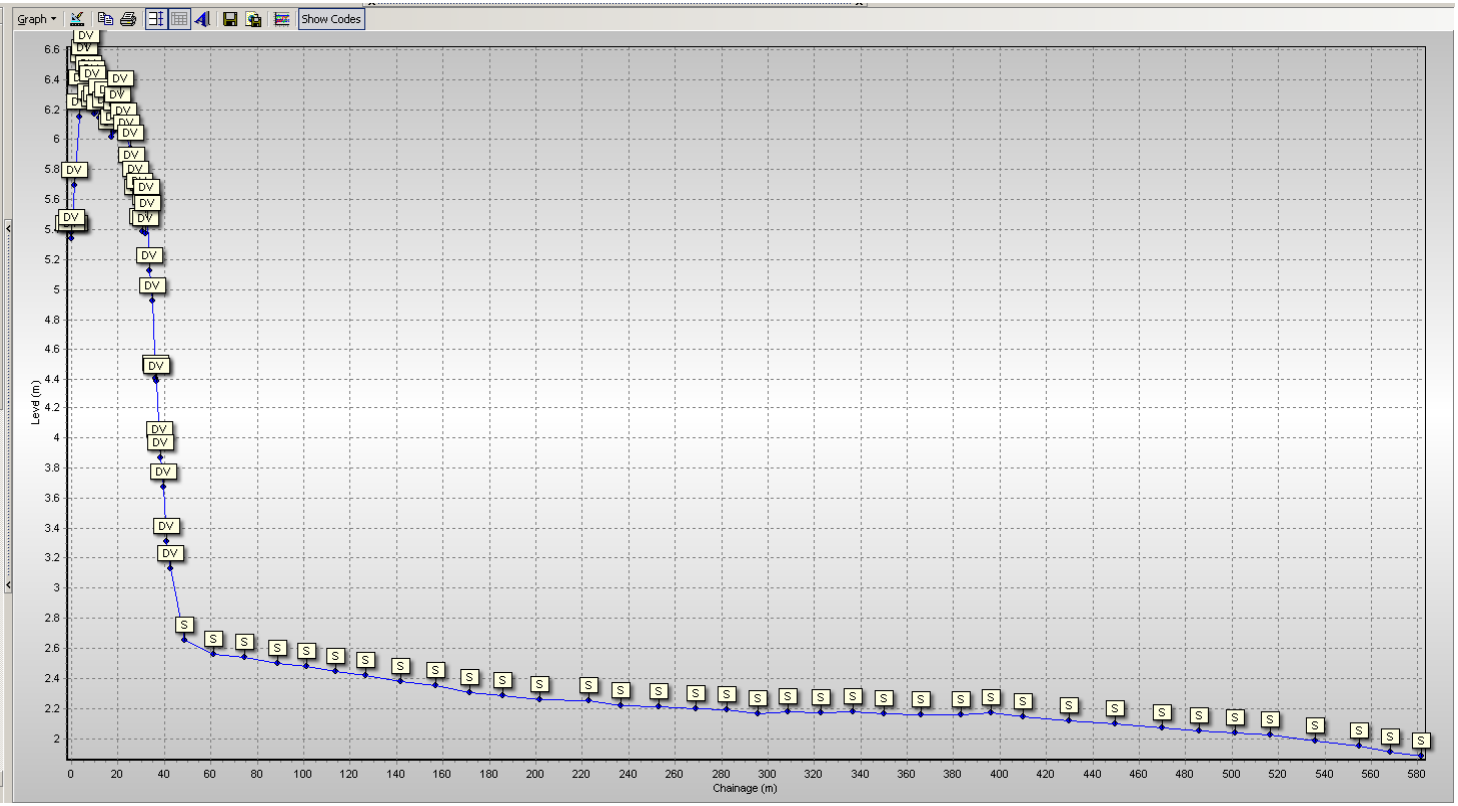
# 1aBTBC19 - 16/03/2010

| Chainage | Level | Code |
|---|---|---|
| 0.000 | 4.331 | |
| 0.050 | 4.331 | DV |
| 0.691 | 4.415 | DV |
| 1.117 | 4.446 | DV |
| 1.622 | 4.390 | DV |
| 2.287 | 4.427 | DV |
| 2.915 | 4.317 | DV |
| 4.610 | 4.324 | DV |
| 5.791 | 4.554 | DV |
| 7.165 | 4.741 | DV |
| 7.776 | 4.820 | DV |
| 8.531 | 4.795 | DV |
| 9.444 | 4.830 | DV |
| 11.157 | 4.964 | DV |
| 12.253 | 5.074 | DV |
| 13.161 | 5.115 | DV |
| 13.676 | 4.993 | DV |
| 14.303 | 4.989 | DV |
| 15.491 | 5.110 | DV |
| 17.227 | 5.269 | DV |
| 18.469 | 5.292 | DV |
| 20.402 | 5.283 | DV |
| 20.762 | 5.366 | DV |
| 22.136 | 5.161 | DV |
| 22.903 | 5.053 | DV |
| 24.537 | 4.938 | DV |
| 26.114 | 4.887 | DV |
| 28.007 | 4.863 | DV |
| 29.514 | 4.965 | DV |
| 30.848 | 5.155 | DV |
| 32.530 | 5.162 | DV |
| 33.925 | 5.088 | DV |
| 35.791 | 5.100 | DV |
| 38.337 | 5.167 | DV |
| 42.242 | 5.232 | DV |
| 43.456 | 5.207 | DV |
| 45.361 | 5.106 | DV |
| 46.851 | 5.133 | DV |
| 48.684 | 5.196 | DV |
| 50.856 | 5.389 | DV |
| 52.937 | 5.591 | DV |
| 54.659 | 5.818 | DV |



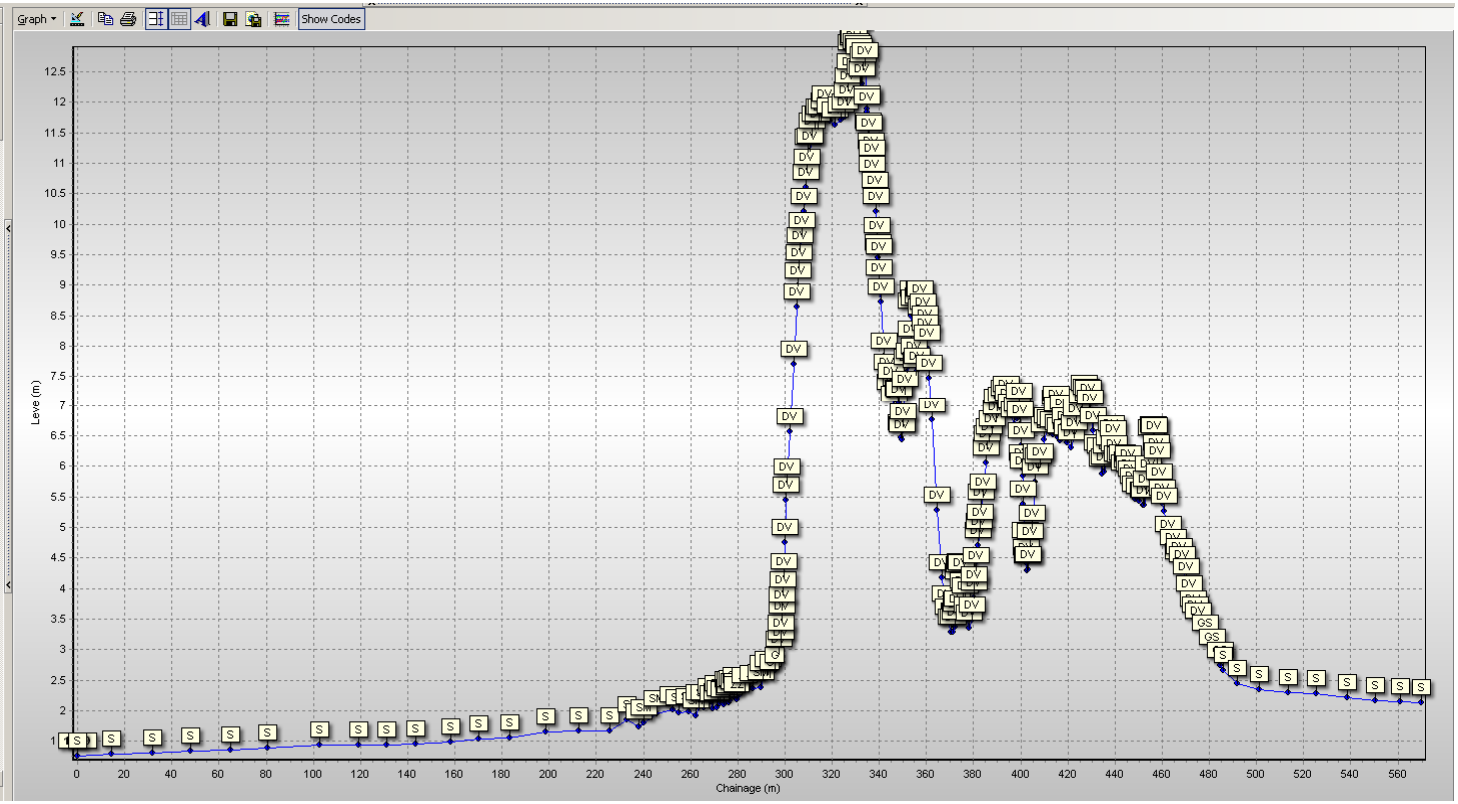
# 1aBTBC21 - 16/03/2010

| Chainage | Level | Code |
|---|---|---|
| 0.000 | 5.340 | |
| 0.018 | 5.340 | DV |
| 0.112 | 5.381 | DV |
| 1.415 | 5.697 | DV |
| 3.320 | 6.149 | DV |
| 4.511 | 6.312 | DV |
| 5.098 | 6.463 | DV |
| 5.683 | 6.513 | DV |
| 6.632 | 6.592 | DV |
| 7.410 | 6.406 | DV |
| 8.045 | 6.220 | DV |
| 8.536 | 6.368 | DV |
| 9.257 | 6.335 | DV |
| 9.880 | 6.171 | DV |
| 10.661 | 6.202 | DV |
| 12.037 | 6.141 | DV |
| 12.968 | 6.253 | DV |
| 14.534 | 6.165 | DV |
| 15.471 | 6.232 | DV |
| 17.393 | 6.019 | DV |
| 18.153 | 6.051 | DV |
| 19.286 | 6.145 | DV |
| 19.763 | 6.198 | DV |
| 21.216 | 6.301 | DV |
| 22.456 | 6.089 | DV |
| 23.823 | 6.009 | DV |
| 25.401 | 5.940 | DV |
| 26.065 | 5.797 | DV |
| 27.508 | 5.703 | DV |
| 28.293 | 5.584 | DV |
| 29.126 | 5.620 | DV |
| 30.430 | 5.386 | DV |
| 31.745 | 5.371 | DV |
| 32.024 | 5.514 | DV |
| 32.484 | 5.581 | DV |
| 32.820 | 5.474 | DV |
| 33.611 | 5.124 | DV |
| 34.963 | 4.927 | DV |
| 36.119 | 4.410 | DV |
| 36.679 | 4.388 | DV |
| 37.762 | 3.952 | DV |
| 38.420 | 3.863 | DV |



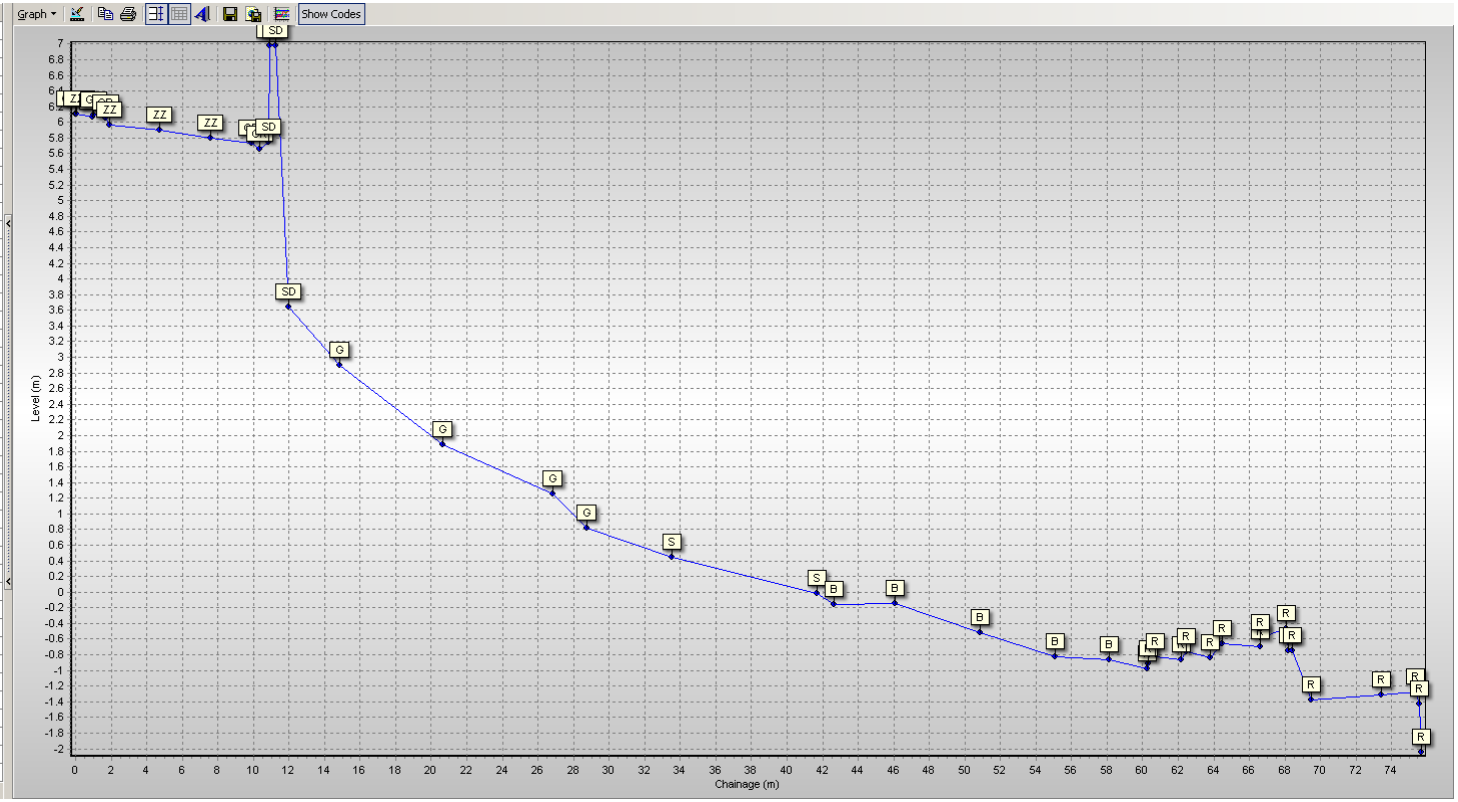
# 1aBTBC23 - 16/03/2010

| Chainage | Level | Code |
|---|---|---|
| 0.000 | 1.259 | |
| 0.039 | 1.259 | S |
| 14.491 | 1.288 | S |
| 31.824 | 1.313 | S |
| 47.945 | 1.349 | S |
| 64.874 | 1.364 | S |
| 80.768 | 1.396 | S |
| 102.526 | 1.441 | S |
| 119.115 | 1.439 | S |
| 130.964 | 1.440 | S |
| 143.608 | 1.465 | S |
| 158.287 | 1.493 | S |
| 170.089 | 1.537 | S |
| 183.259 | 1.551 | S |
| 198.489 | 1.655 | S |
| 212.715 | 1.670 | S |
| 225.639 | 1.668 | S |
| 232.985 | 1.850 | S |
| 237.932 | 1.736 | SM |
| 240.050 | 1.797 | SM |
| 245.865 | 1.949 | SM |
| 252.540 | 2.025 | SM |
| 255.220 | 1.973 | SM |
| 259.354 | 1.987 | SM |
| 262.281 | 1.924 | SM |
| 263.640 | 2.058 | SM |
| 265.699 | 2.050 | SM |
| 268.818 | 2.147 | SM |
| 269.633 | 2.037 | SM |
| 271.116 | 2.050 | SM |
| 271.813 | 2.194 | SM |
| 272.338 | 2.117 | SM |
| 274.166 | 2.097 | SM |
| 276.011 | 2.267 | SM |
| 276.166 | 2.128 | SM |
| 276.627 | 2.166 | SM |
| 276.749 | 2.266 | SM |
| 277.530 | 2.283 | SM |
| 278.570 | 2.229 | SM |
| 279.340 | 2.333 | SM |
| 279.492 | 2.231 | SM |
| 279.782 | 2.180 | ZZ |



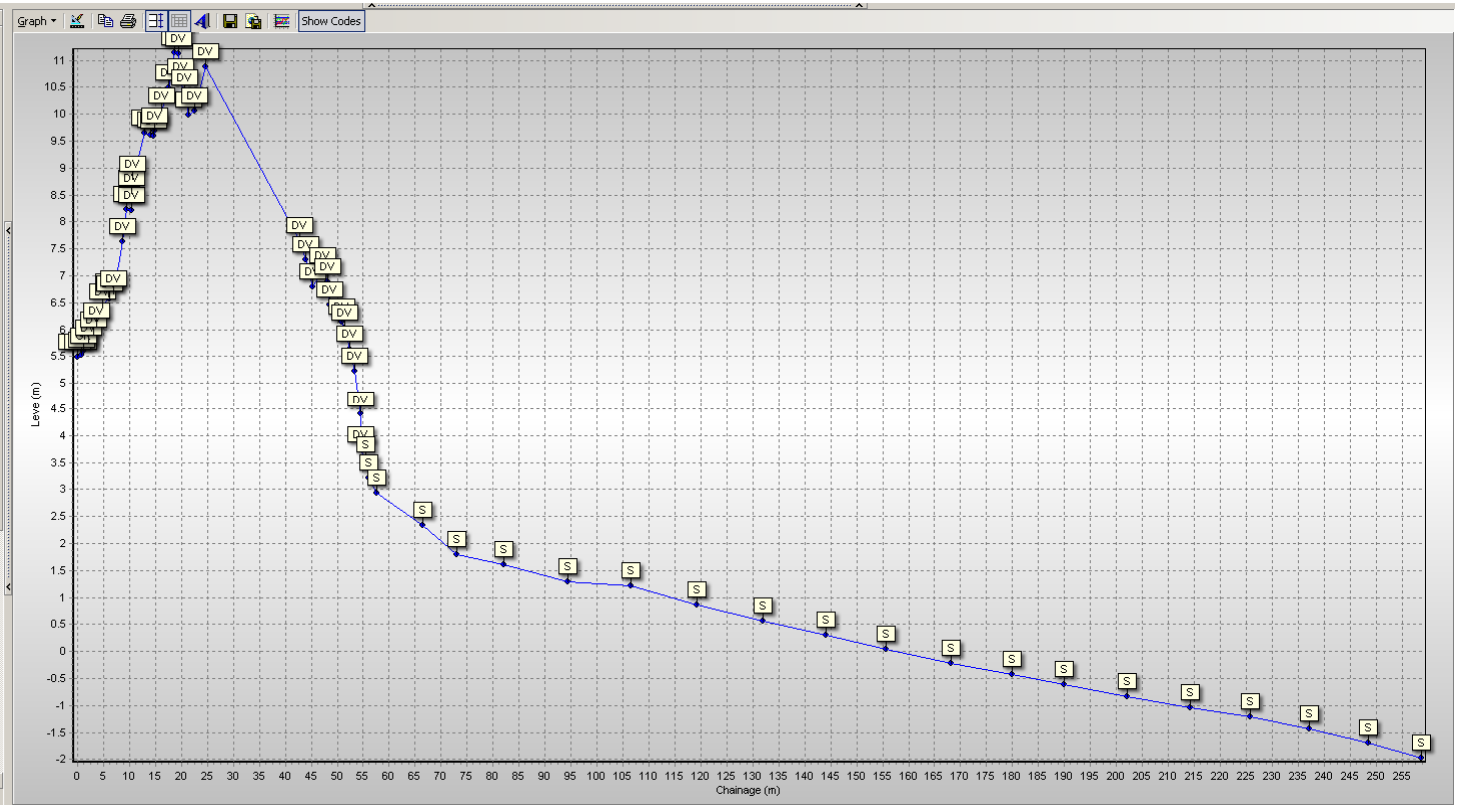
# 1aBTBC31 - 17/03/2010

| Chainage | Level | Code |
|---|---|---|
| 0.000 | 6.107 | |
| 0.079 | 6.107 | ZZ |
| 0.969 | 6.070 | ZZ |
| 1.013 | 6.093 | GR |
| 1.666 | 6.057 | GR |
| 1.907 | 5.966 | ZZ |
| 4.747 | 5.895 | ZZ |
| 7.568 | 5.794 | ZZ |
| 9.893 | 5.733 | GR |
| 10.379 | 5.657 | GR |
| 10.841 | 5.741 | SD |
| 10.931 | 6.979 | SD |
| 11.241 | 6.975 | SD |
| 11.977 | 3.639 | SD |
| 14.875 | 2.900 | G |
| 20.663 | 1.887 | G |
| 26.858 | 1.253 | G |
| 28.758 | 0.817 | G |
| 33.527 | 0.447 | S |
| 41.675 | -0.019 | S |
| 42.627 | -0.158 | B |
| 46.063 | -0.140 | B |
| 50.857 | -0.516 | B |
| 55.065 | -0.830 | B |
| 58.112 | -0.867 | B |
| 60.257 | -0.983 | R |
| 60.303 | -0.917 | R |
| 60.690 | -0.819 | R |
| 62.169 | -0.863 | R |
| 62.468 | -0.762 | R |
| 63.826 | -0.834 | R |
| 64.454 | -0.652 | R |
| 66.602 | -0.698 | R |
| 66.624 | -0.578 | R |
| 68.103 | -0.462 | R |
| 68.171 | -0.747 | R |
| 68.422 | -0.744 | R |
| 69.503 | -1.371 | R |
| 73.398 | -1.307 | R |
| 75.321 | -1.279 | R |
| 75.545 | -1.427 | R |
| 75.673 | -2.044 | R |



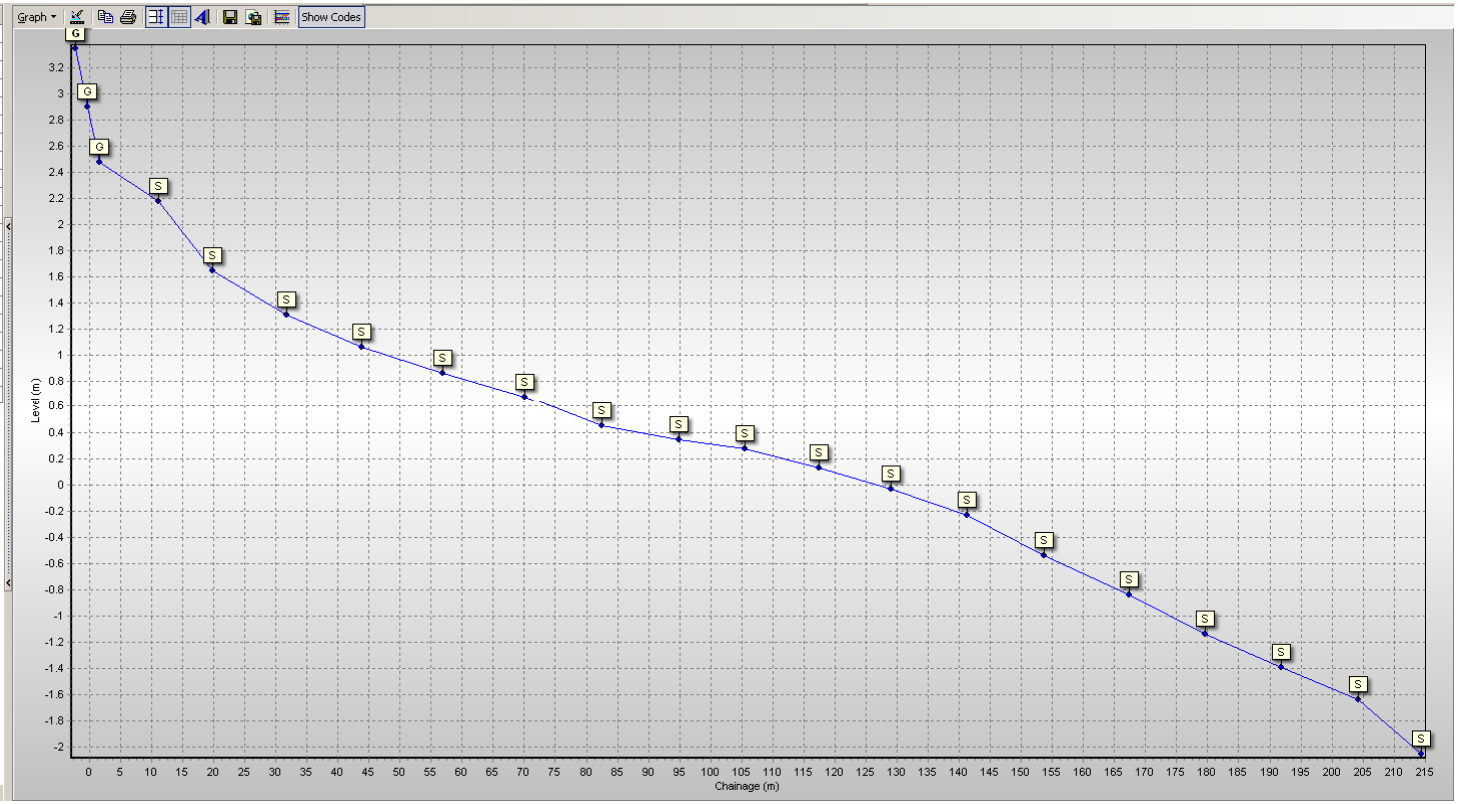
# 1aBTBC33 - 17/03/2010

| Chainage | Level | Code |
|---|---|---|
| 0.000 | 5.498 | |
| 0.012 | 5.498 | GR |
| 0.781 | 5.522 | GR |
| 1.077 | 5.607 | GR |
| 2.027 | 5.747 | DV |
| 3.020 | 5.893 | DV |
| 3.712 | 6.069 | DV |
| 4.863 | 6.415 | DV |
| 5.960 | 6.614 | DV |
| 6.209 | 6.564 | DV |
| 7.002 | 6.661 | DV |
| 8.673 | 7.629 | DV |
| 9.472 | 8.230 | DV |
| 10.360 | 8.211 | DV |
| 10.420 | 8.531 | DV |
| 10.672 | 8.786 | DV |
| 12.978 | 9.647 | DV |
| 14.040 | 9.614 | DV |
| 14.732 | 9.601 | DV |
| 14.832 | 9.689 | DV |
| 16.236 | 10.052 | DV |
| 17.596 | 10.495 | DV |
| 18.646 | 11.143 | DV |
| 19.403 | 11.126 | DV |
| 19.825 | 10.604 | DV |
| 20.632 | 10.406 | DV |
| 21.383 | 9.980 | DV |
| 22.486 | 10.068 | DV |
| 24.589 | 10.882 | DV |
| 42.679 | 7.662 | DV |
| 43.975 | 7.296 | DV |
| 45.215 | 6.798 | DV |
| 47.283 | 7.090 | DV |
| 48.088 | 6.885 | DV |
| 48.639 | 6.469 | DV |
| 50.873 | 6.135 | DV |
| 51.367 | 6.038 | DV |
| 52.485 | 5.646 | DV |
| 53.409 | 5.223 | DV |
| 54.473 | 4.405 | DV |
| 54.575 | 3.728 | DV |
| 55.548 | 3.552 | S |



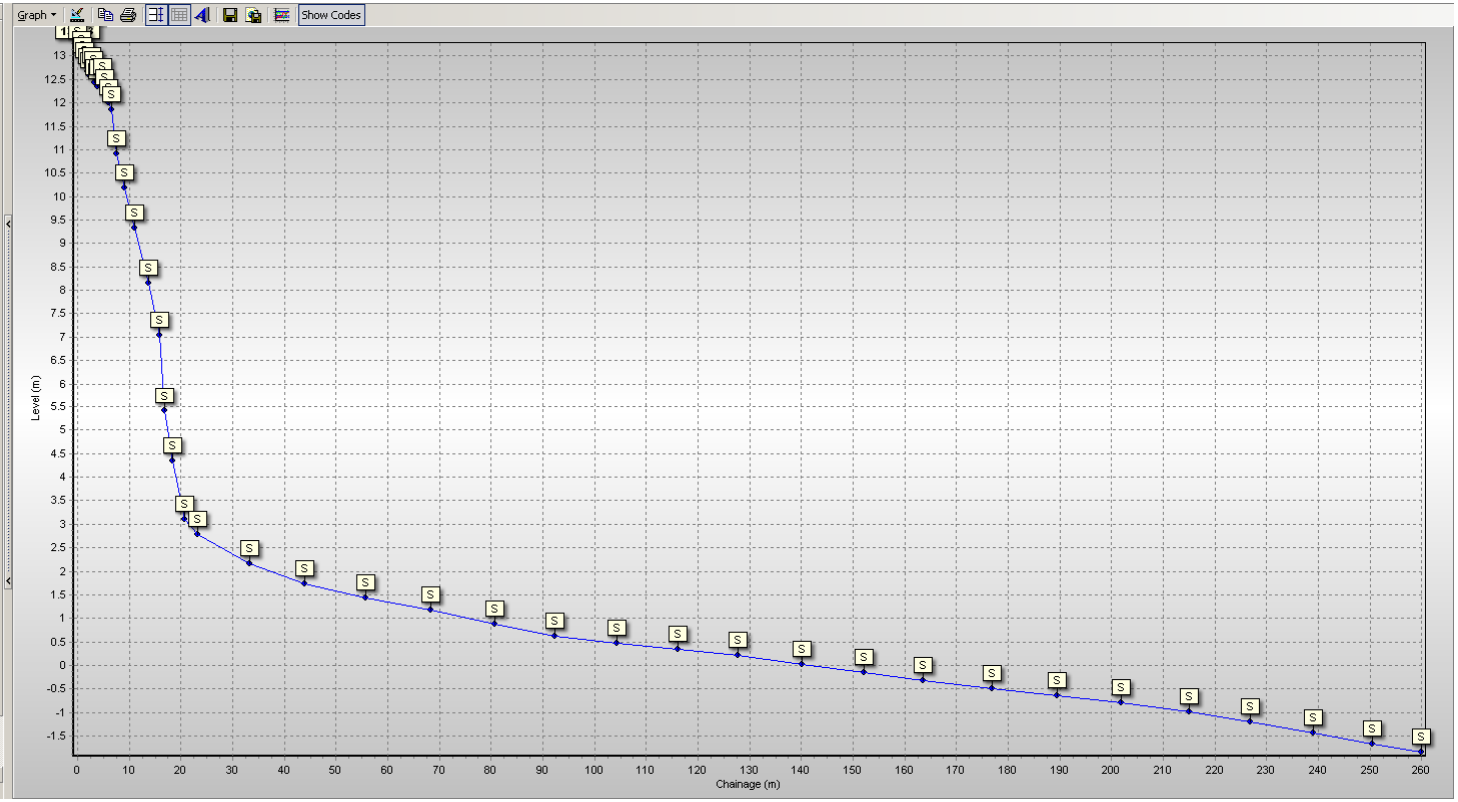
# 1aBTBC34 - 17/03/2010

| Chainage | Level | Code |
|---|---|---|
| -2.230 | 3.344 | G |
| -0.247 | 2.895 | G |
| 1.558 | 2.474 | G |
| 11.066 | 2.180 | S |
| 19.856 | 1.646 | S |
| 31.777 | 1.308 | S |
| 43.911 | 1.062 | S |
| 56.846 | 0.861 | S |
| 70.095 | 0.678 | S |
| 82.489 | 0.452 | S |
| 94.913 | 0.344 | S |
| 105.602 | 0.270 | S |
| 117.395 | 0.129 | S |
| 129.107 | -0.031 | S |
| 141.254 | -0.232 | S |
| 153.629 | -0.539 | S |
| 167.340 | -0.842 | S |
| 179.673 | -1.139 | S |
| 191.897 | -1.394 | S |
| 204.249 | -1.637 | S |
| 214.401 | -2.052 | S |

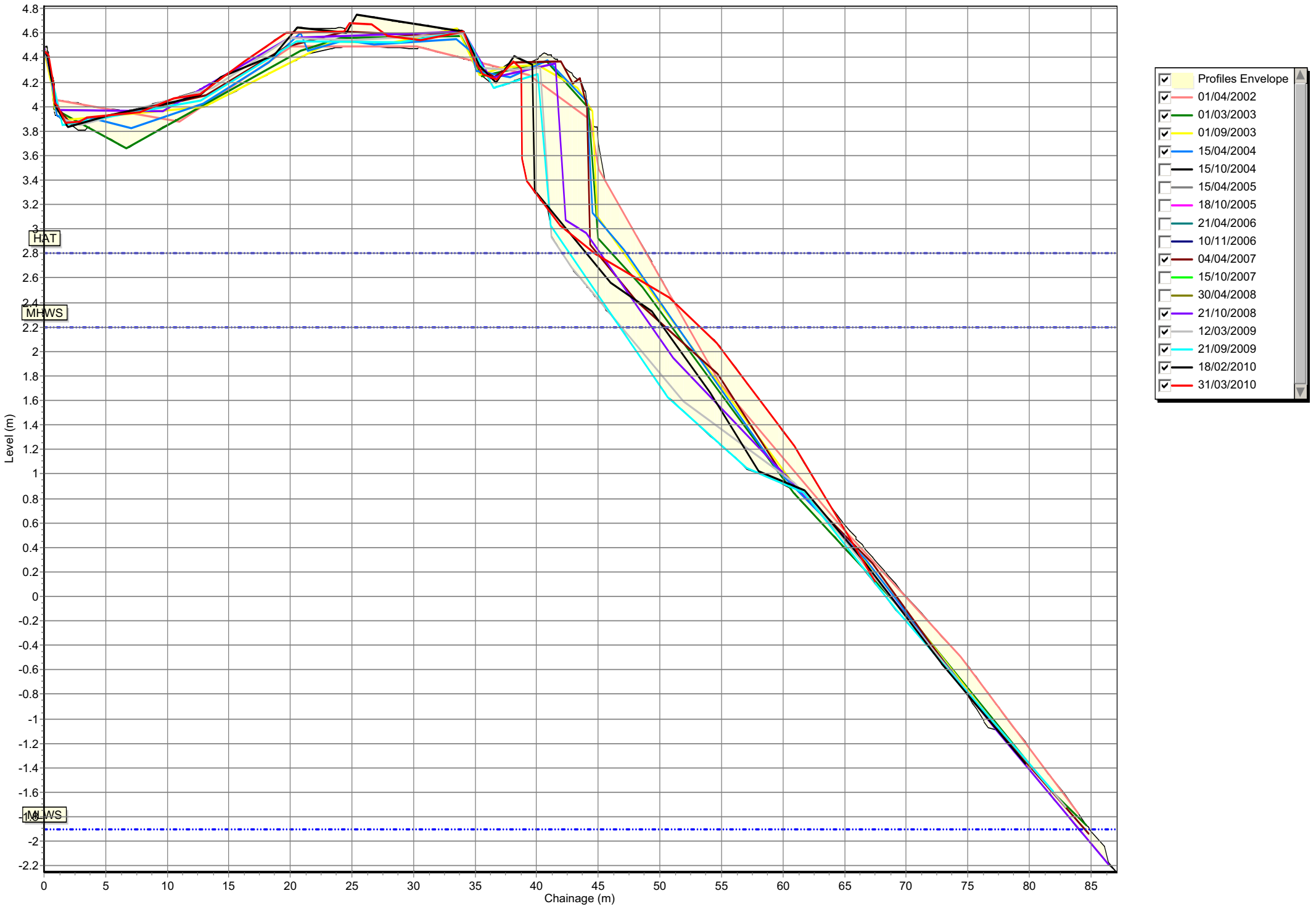


# 1aBTBC37 - 17/03/2010

| Chainage | Level | Code |
|---|---|---|
| 0.000 | 13.203 | |
| 0.049 | 13.203 | S |
| 0.775 | 13.030 | S |
| 1.020 | 12.898 | S |
| 1.343 | 12.807 | S |
| 1.952 | 12.665 | S |
| 2.417 | 12.592 | S |
| 2.761 | 12.695 | S |
| 3.027 | 12.601 | S |
| 3.335 | 12.431 | S |
| 3.834 | 12.355 | S |
| 4.054 | 12.425 | S |
| 4.897 | 12.448 | S |
| 5.217 | 12.220 | S |
| 5.964 | 12.004 | S |
| 6.669 | 11.854 | S |
| 7.531 | 10.920 | S |
| 9.124 | 10.176 | S |
| 10.983 | 9.328 | S |
| 13.678 | 8.153 | S |
| 15.794 | 7.034 | S |
| 16.905 | 5.410 | S |
| 18.366 | 4.334 | S |
| 20.763 | 3.100 | S |
| 23.236 | 2.777 | S |
| 33.275 | 2.156 | S |
| 43.882 | 1.725 | S |
| 55.795 | 1.436 | S |
| 68.226 | 1.168 | S |
| 80.676 | 0.886 | S |
| 92.390 | 0.616 | S |
| 104.221 | 0.470 | S |
| 116.123 | 0.340 | S |
| 127.808 | 0.212 | S |
| 140.216 | 0.023 | S |
| 152.154 | -0.158 | S |
| 163.601 | -0.314 | S |
| 176.828 | -0.485 | S |
| 189.412 | -0.642 | S |
| 201.893 | -0.786 | S |
| 215.103 | -0.983 | S |
| 226.843 | -1.194 | S |

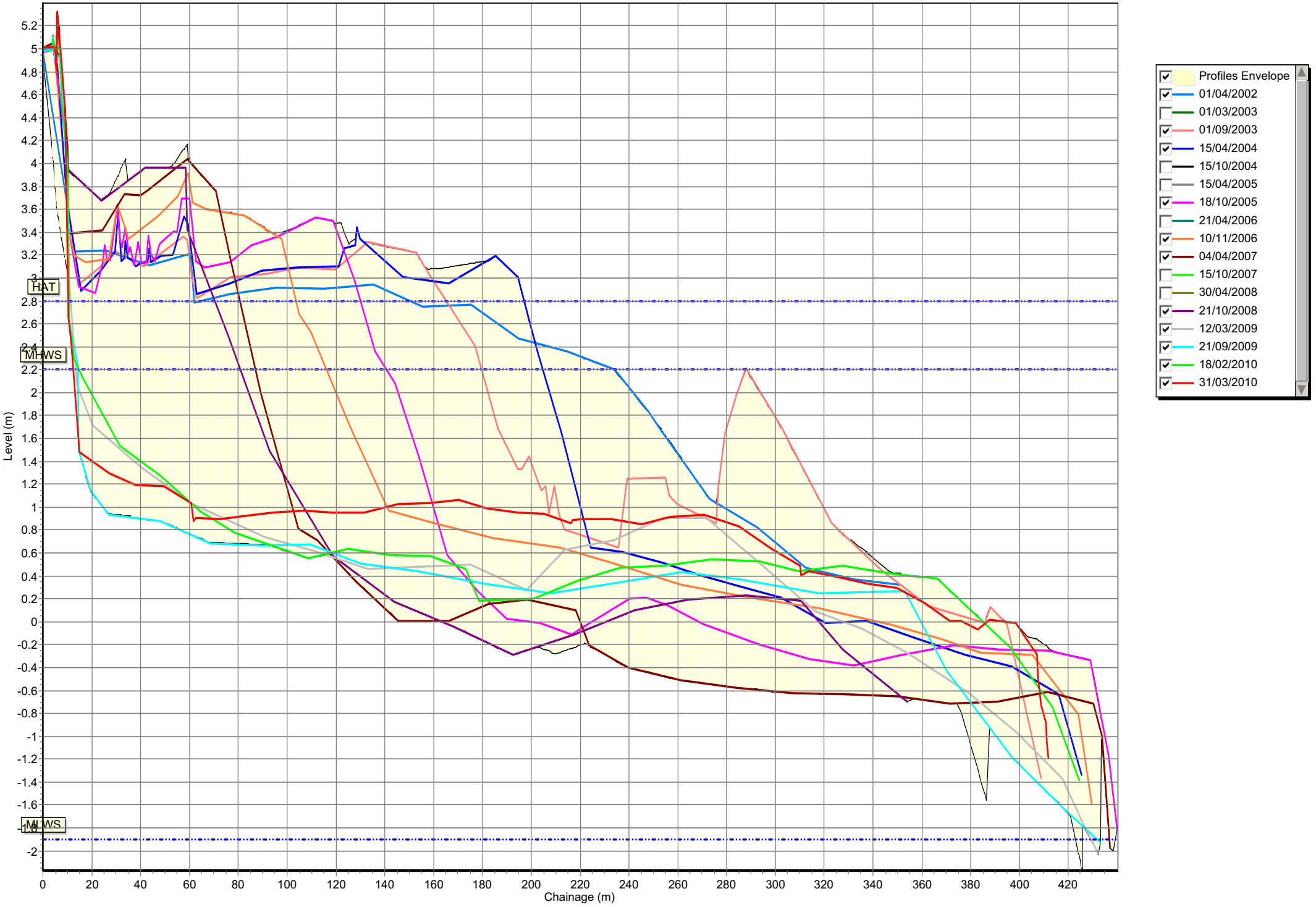


# Beach Profiles: 1aBTBC02

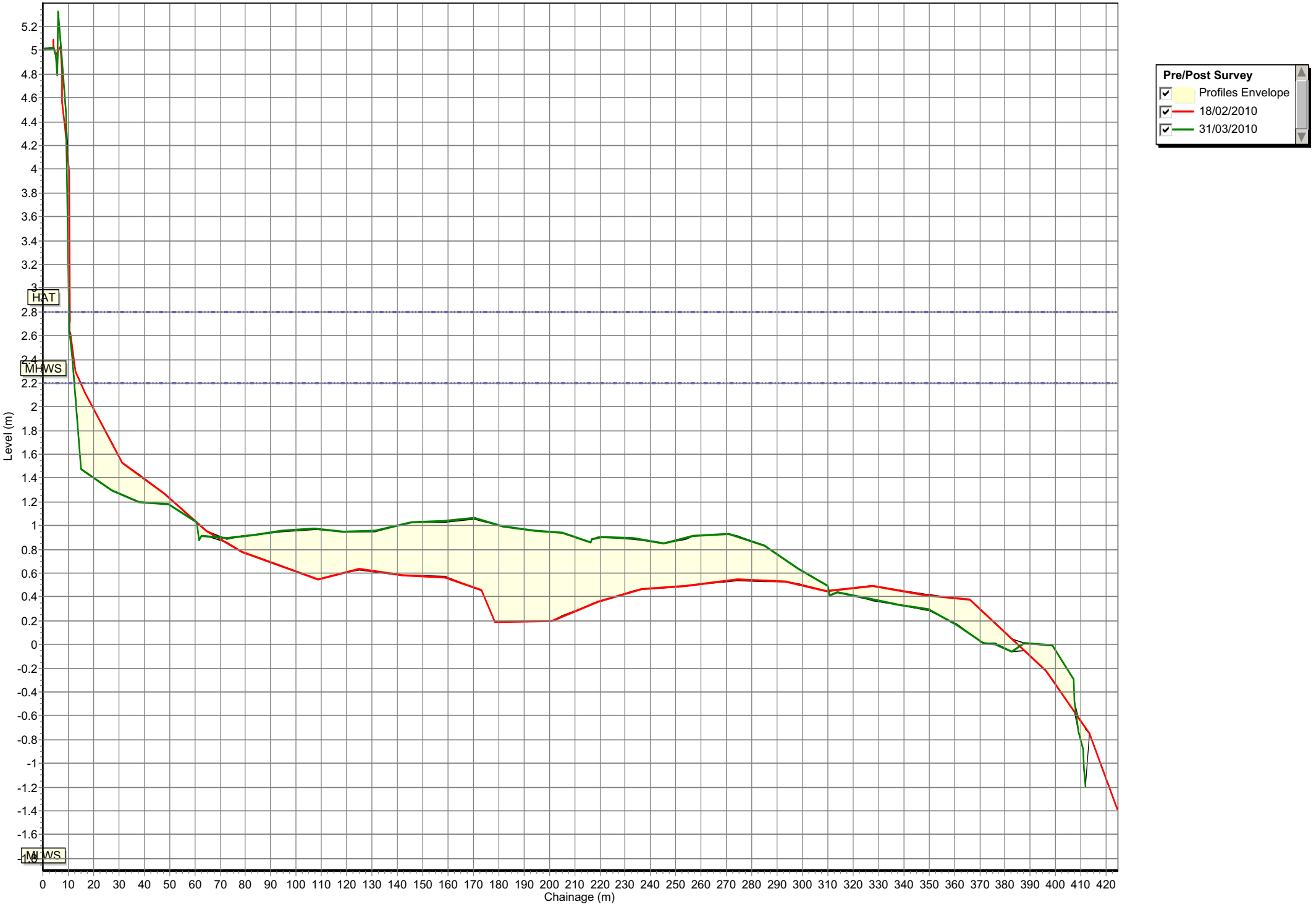


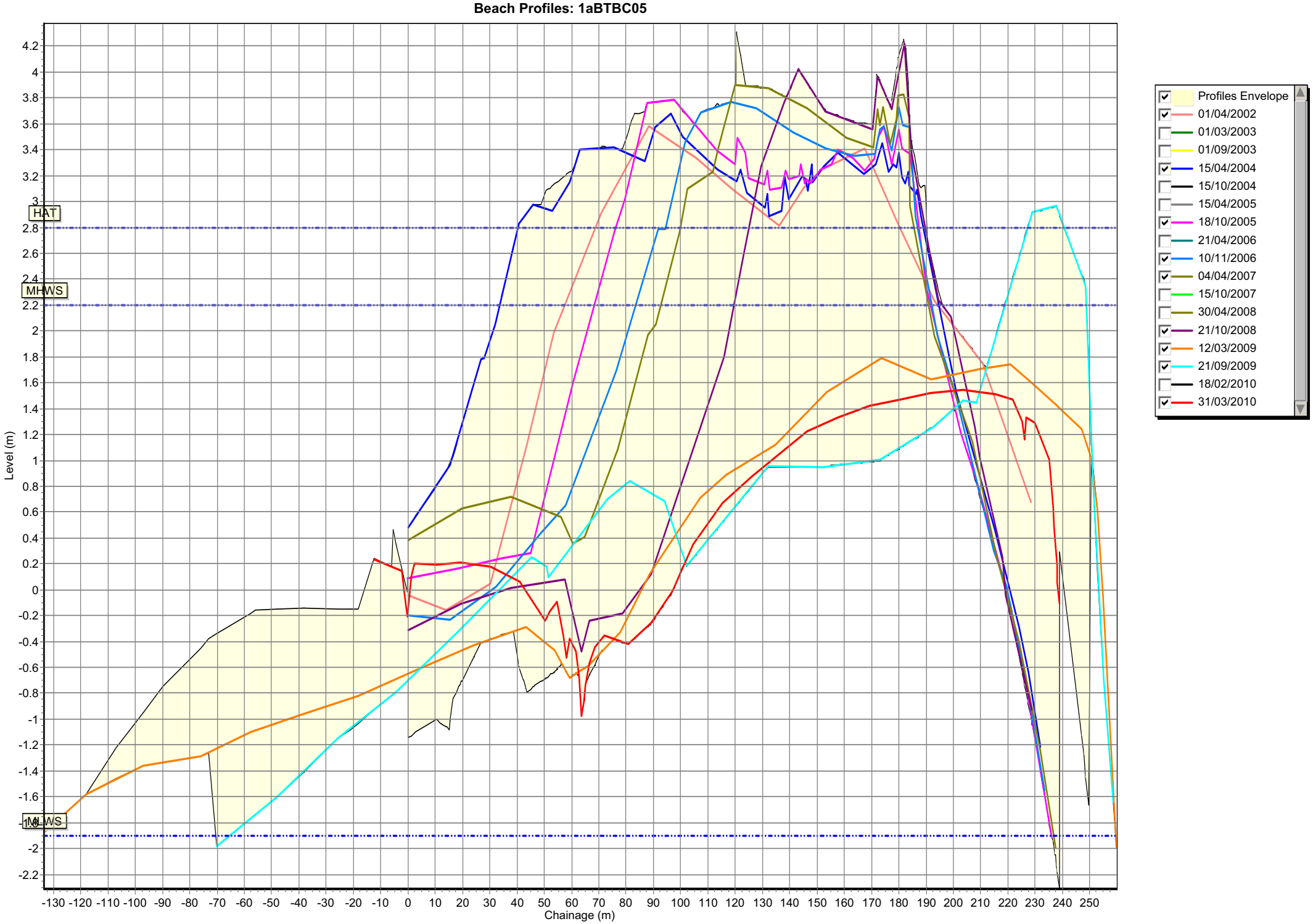
# Beach Profiles: 1aBTBC02

# Beach Profiles: 1aBTBC04

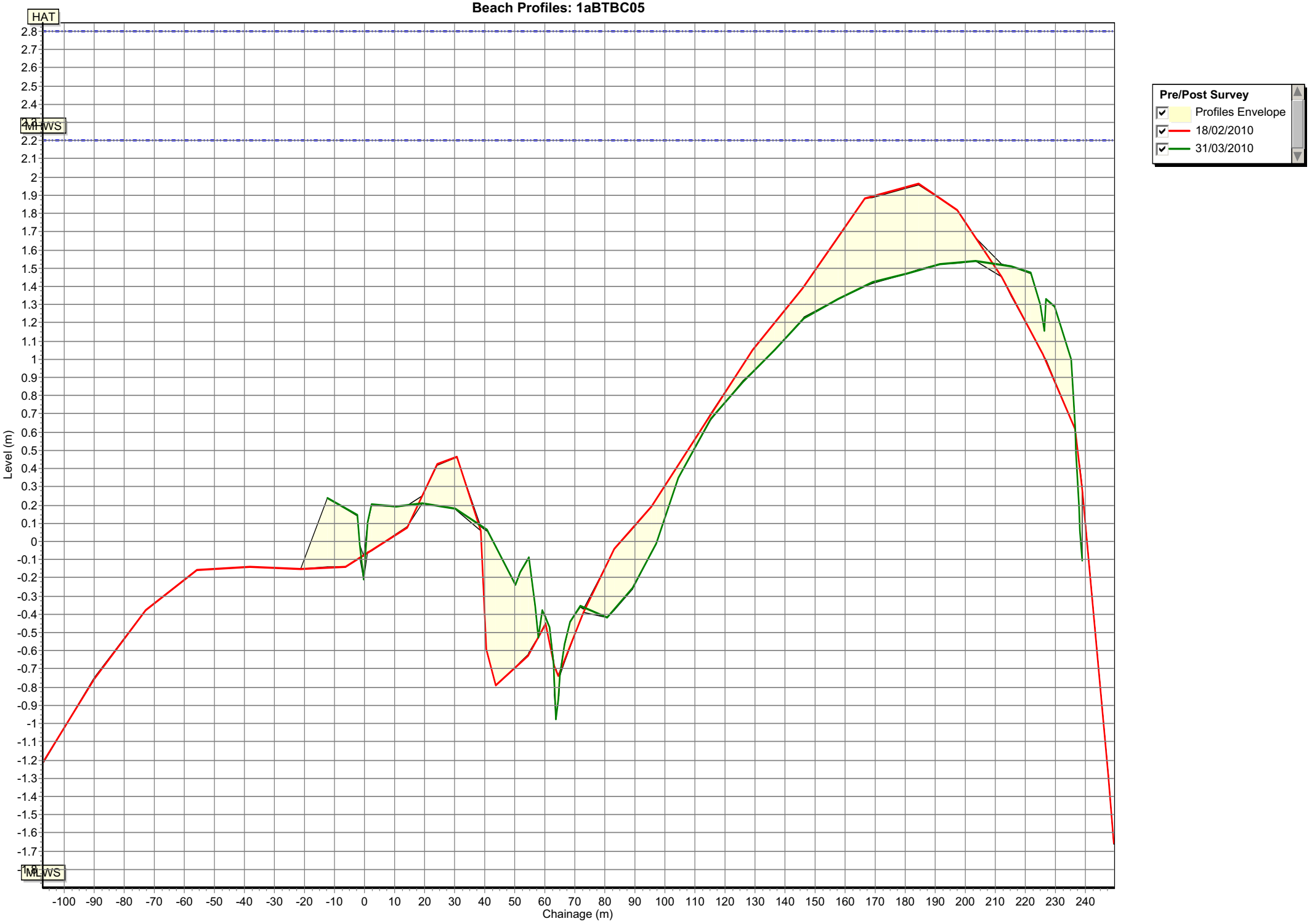


# Beach Profiles: 1aBTBC04

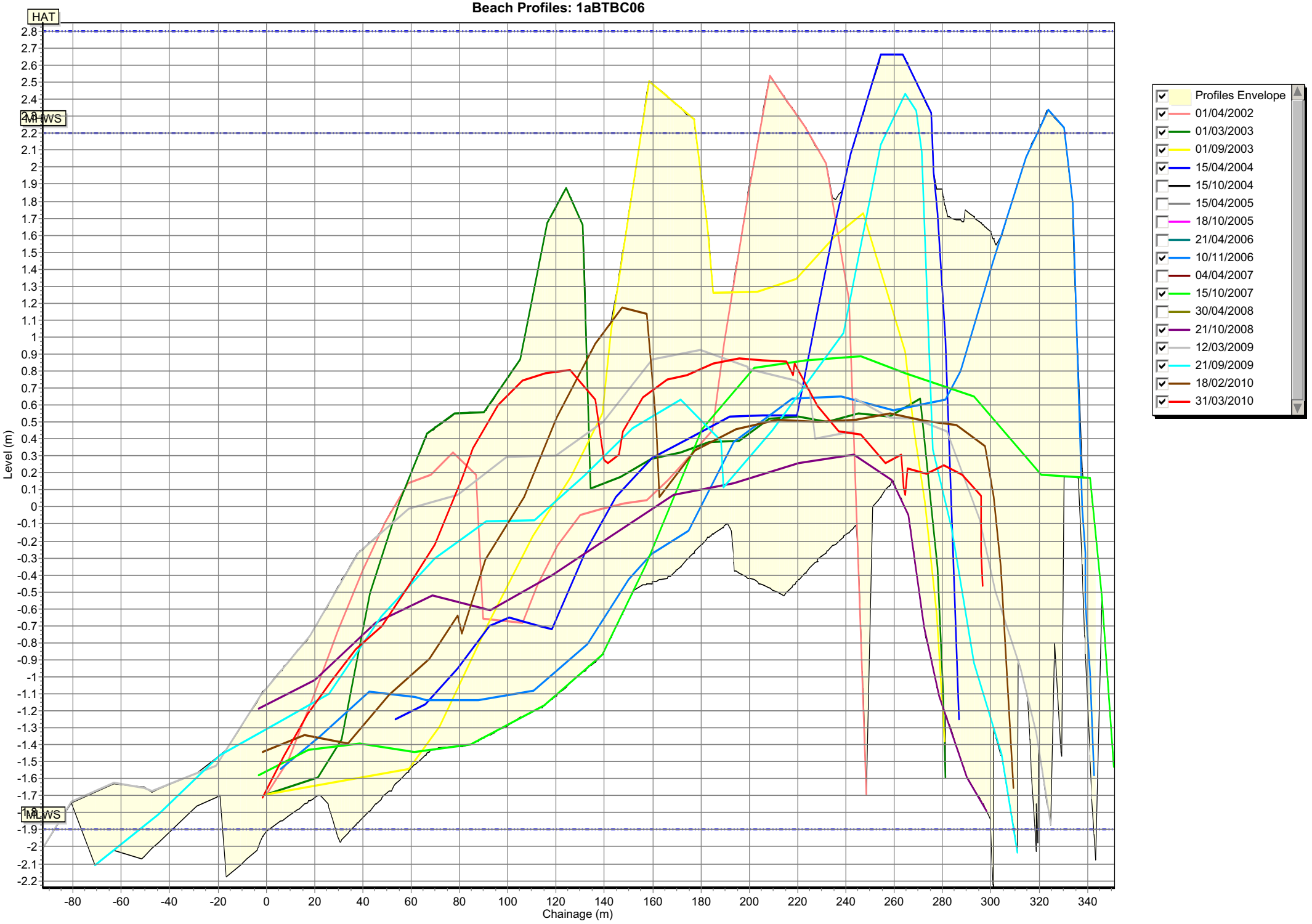



Beach Profiles: 1aBTBC05
Level (m)
Chainage (m)
HAT
MHWS
MLWS
Profiles Envelope
01/04/2002
01/03/2003
01/09/2003
15/04/2004
15/10/2004
15/04/2005
18/10/2005
21/04/2006
10/11/2006
04/04/2007
15/10/2007
30/04/2008
21/10/2008
12/03/2009
21/09/2009
18/02/2010
31/03/2010

# Beach Profiles: 1aBTBC05

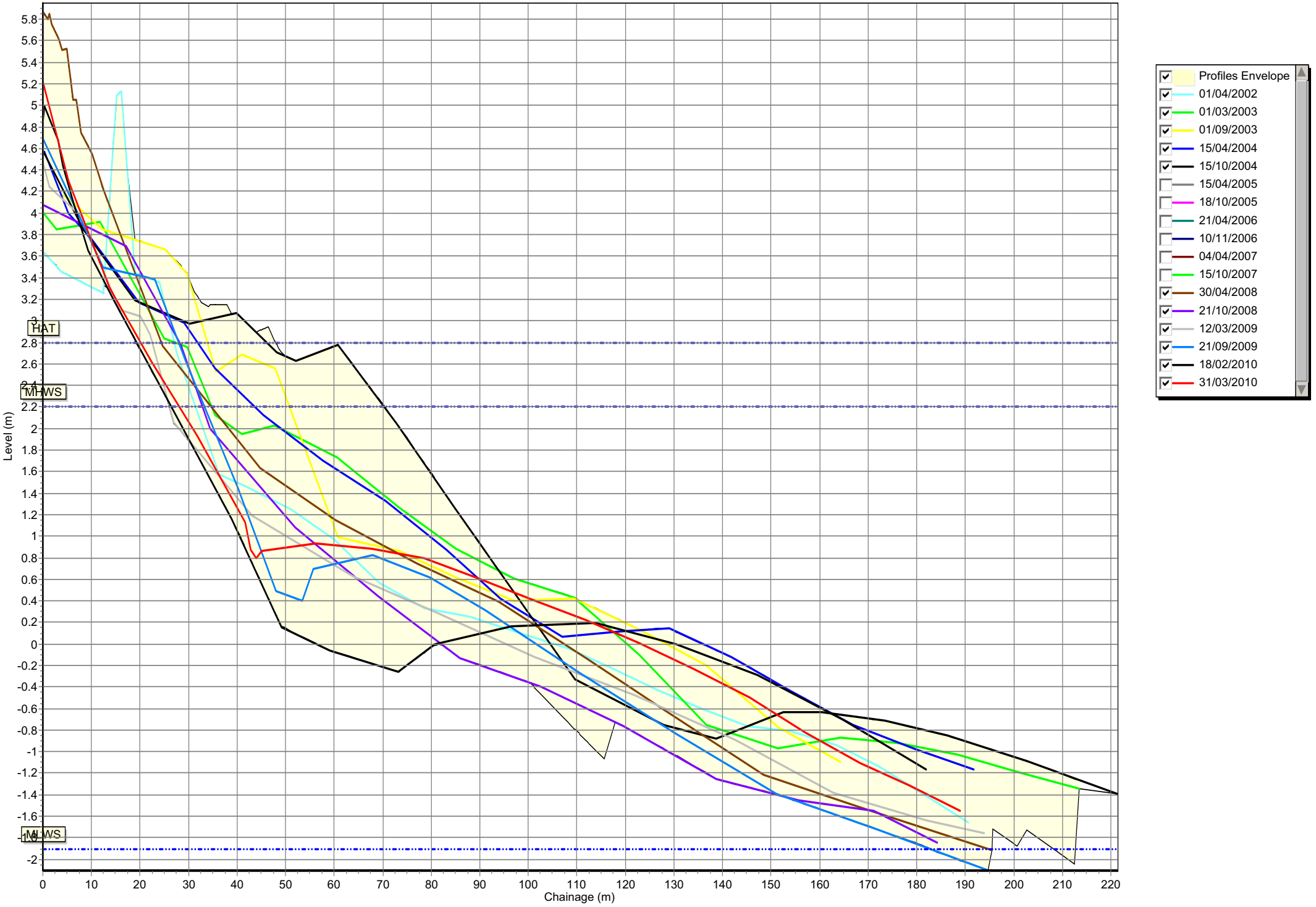


# Beach Profiles: 1aBTBC06



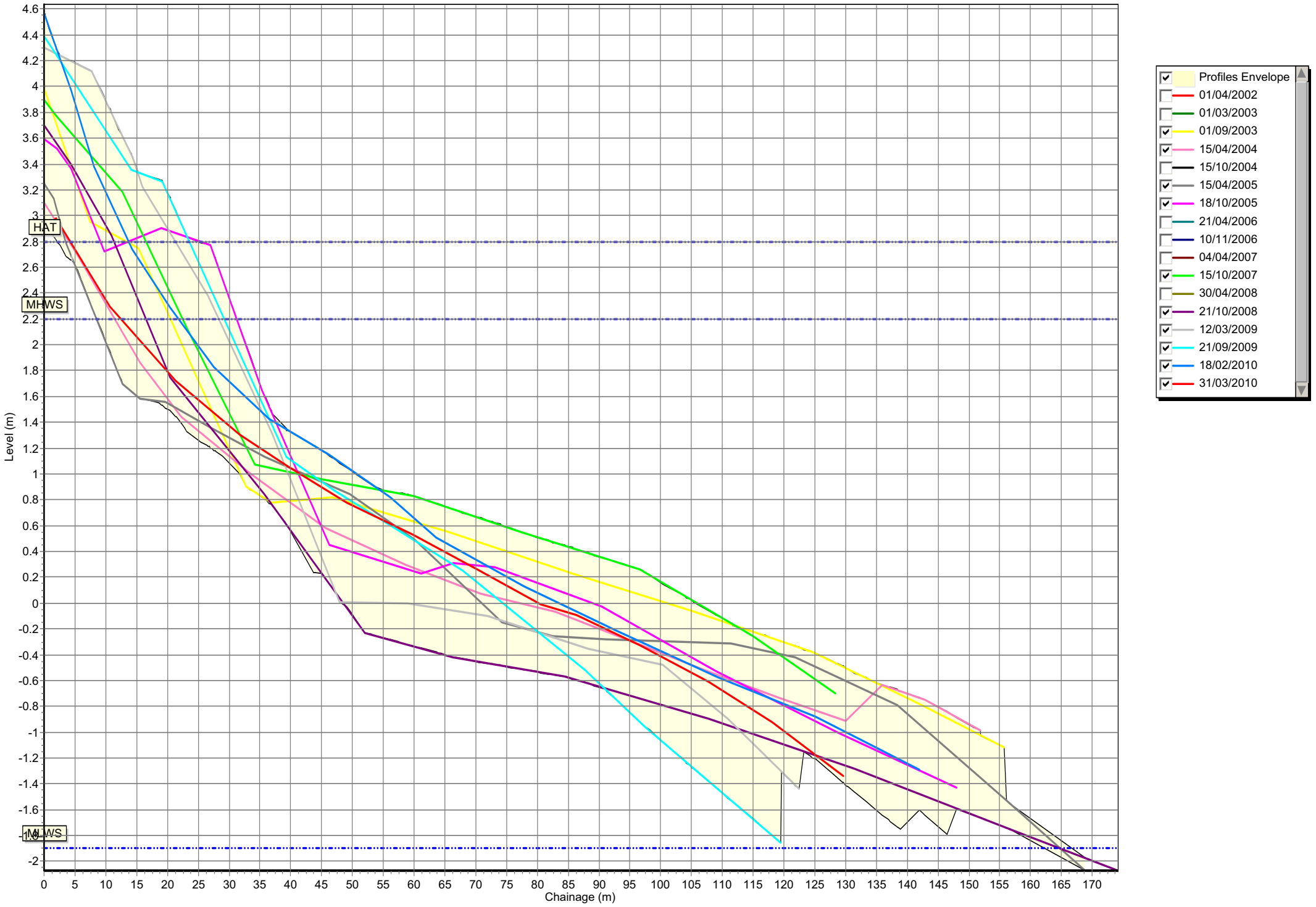

Beach Profiles: 1aBTBC06
HAT
MHWS
MLWS
Level (m)
Chainage (m)
Pre/Post Survey
Profiles Envelope
18/02/2010
31/03/2010

# Beach Profiles: 1aBTBC11



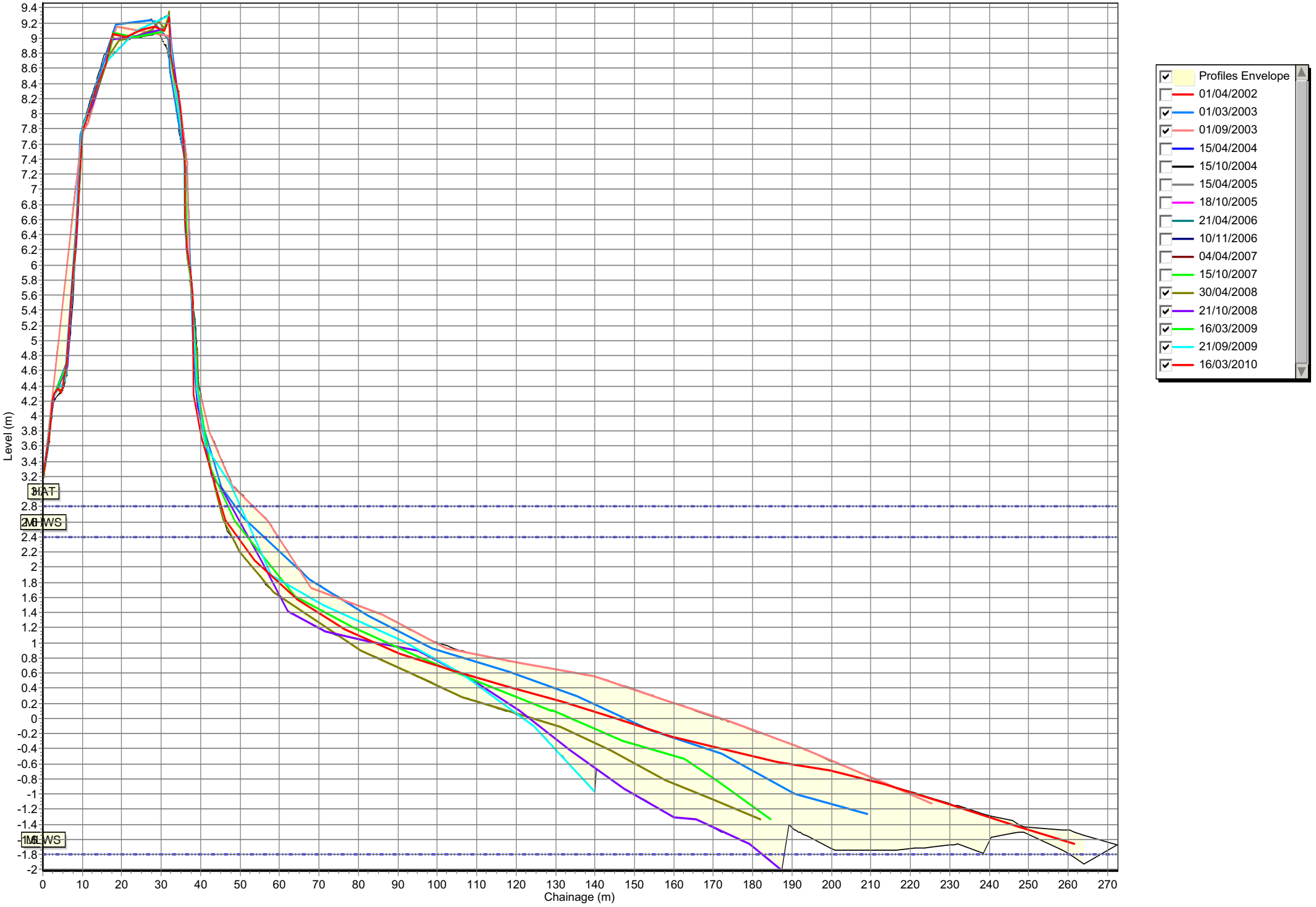
# Beach Profiles: 1aBTBC11

# Beach Profiles: 1aBTBC13

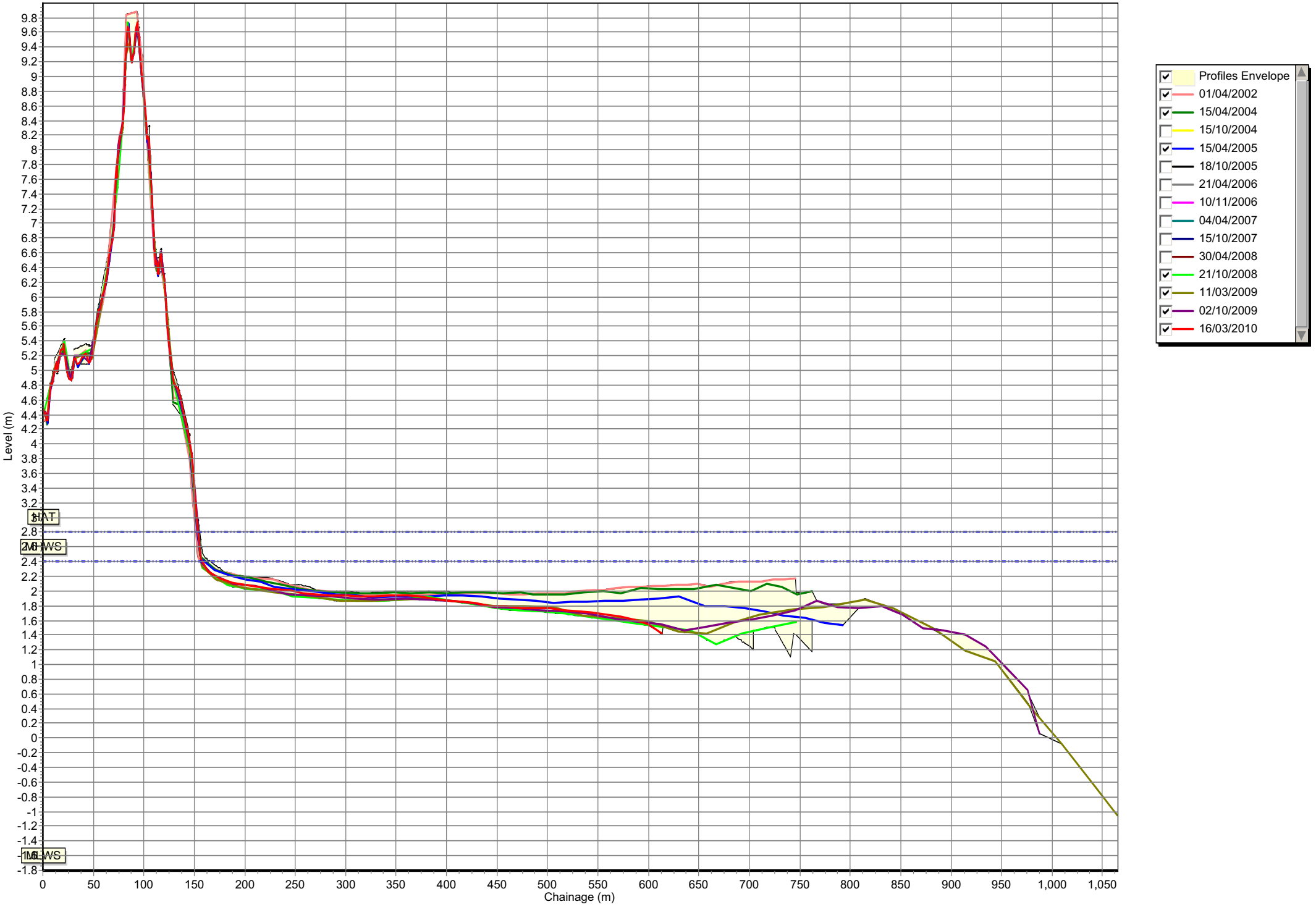


# Beach Profiles: 1aBTBC13

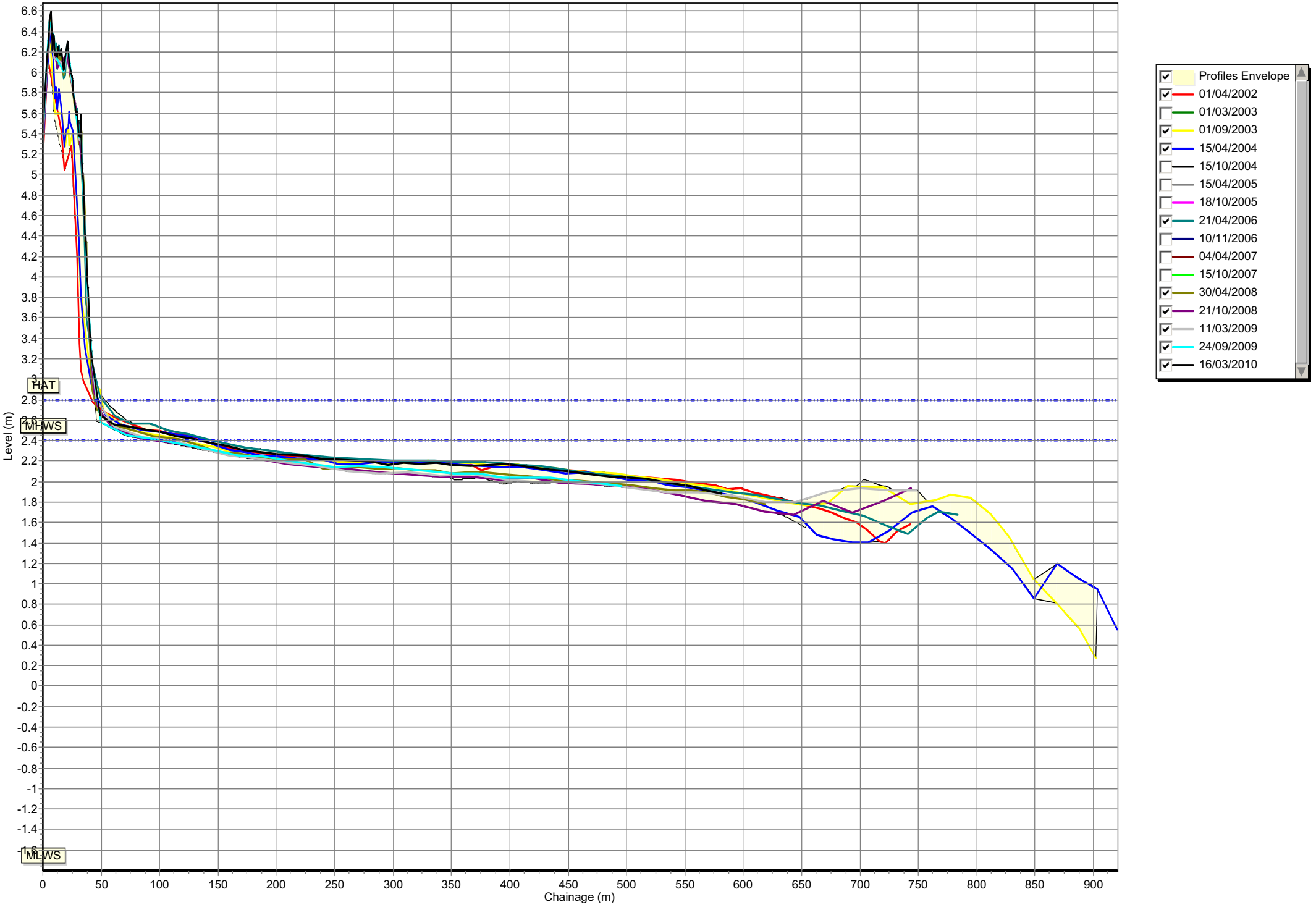
# Beach Profiles: 1aBTBC16

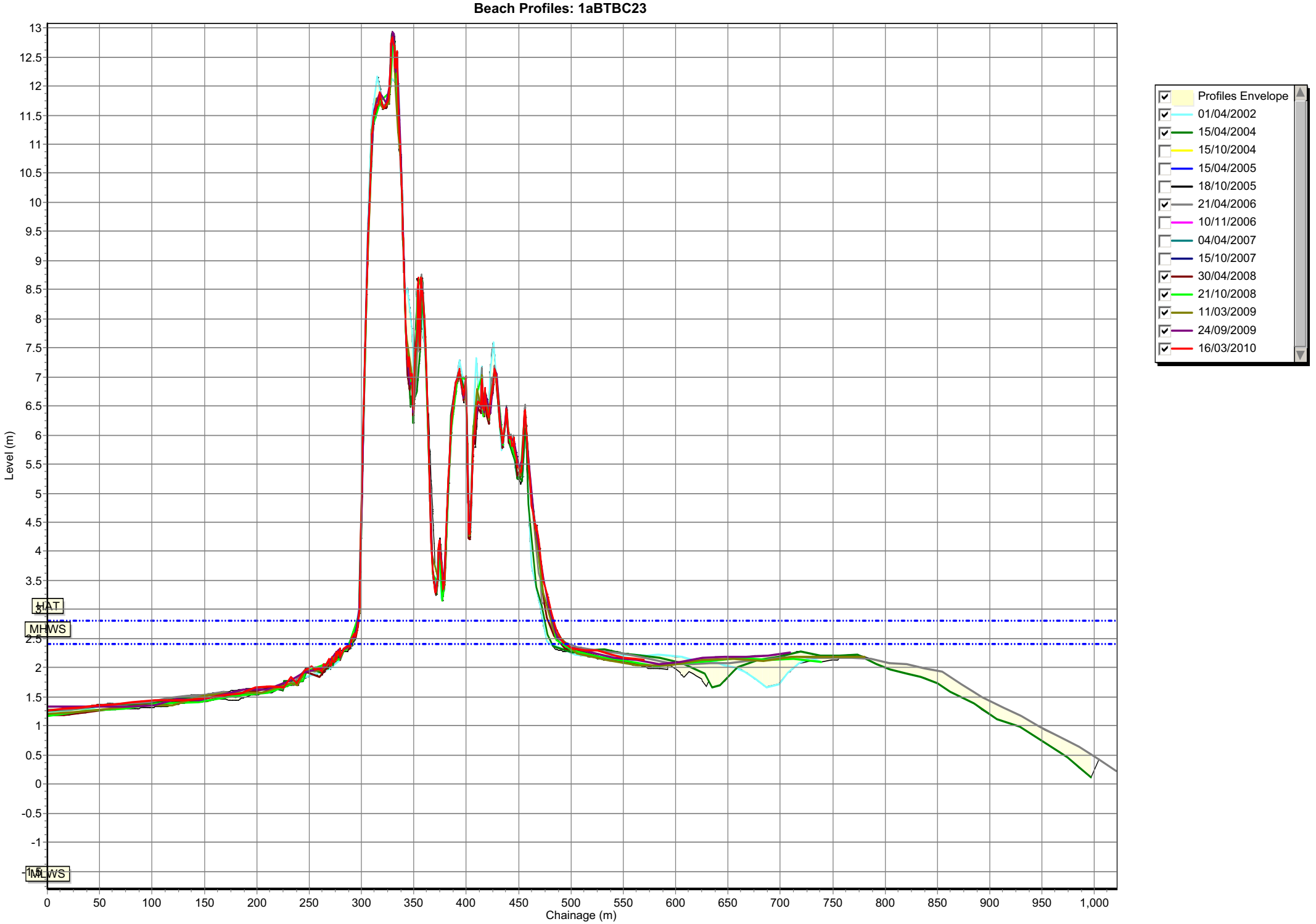


# Beach Profiles: 1aBTBC19

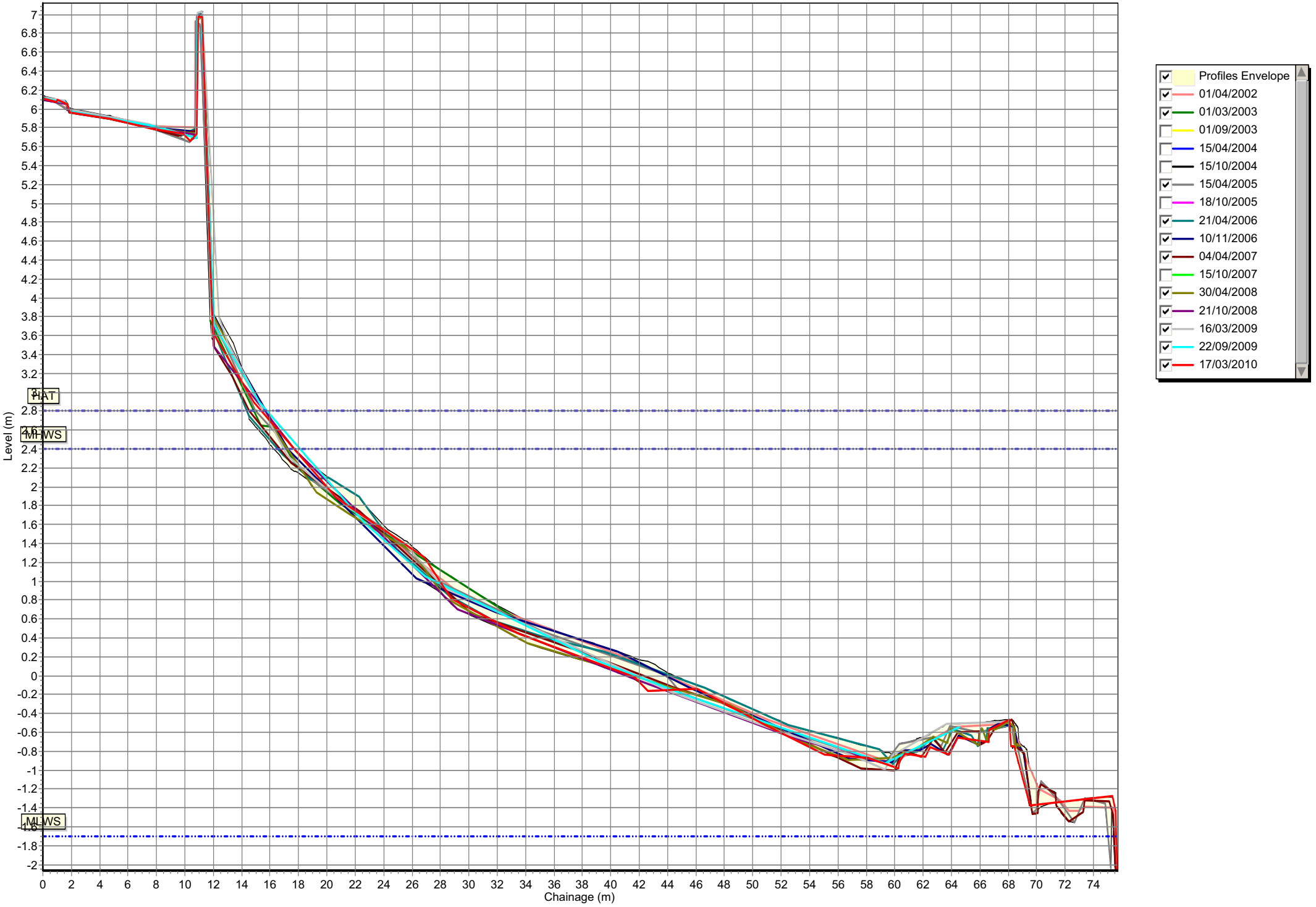


# Beach Profiles: 1aBTBC21



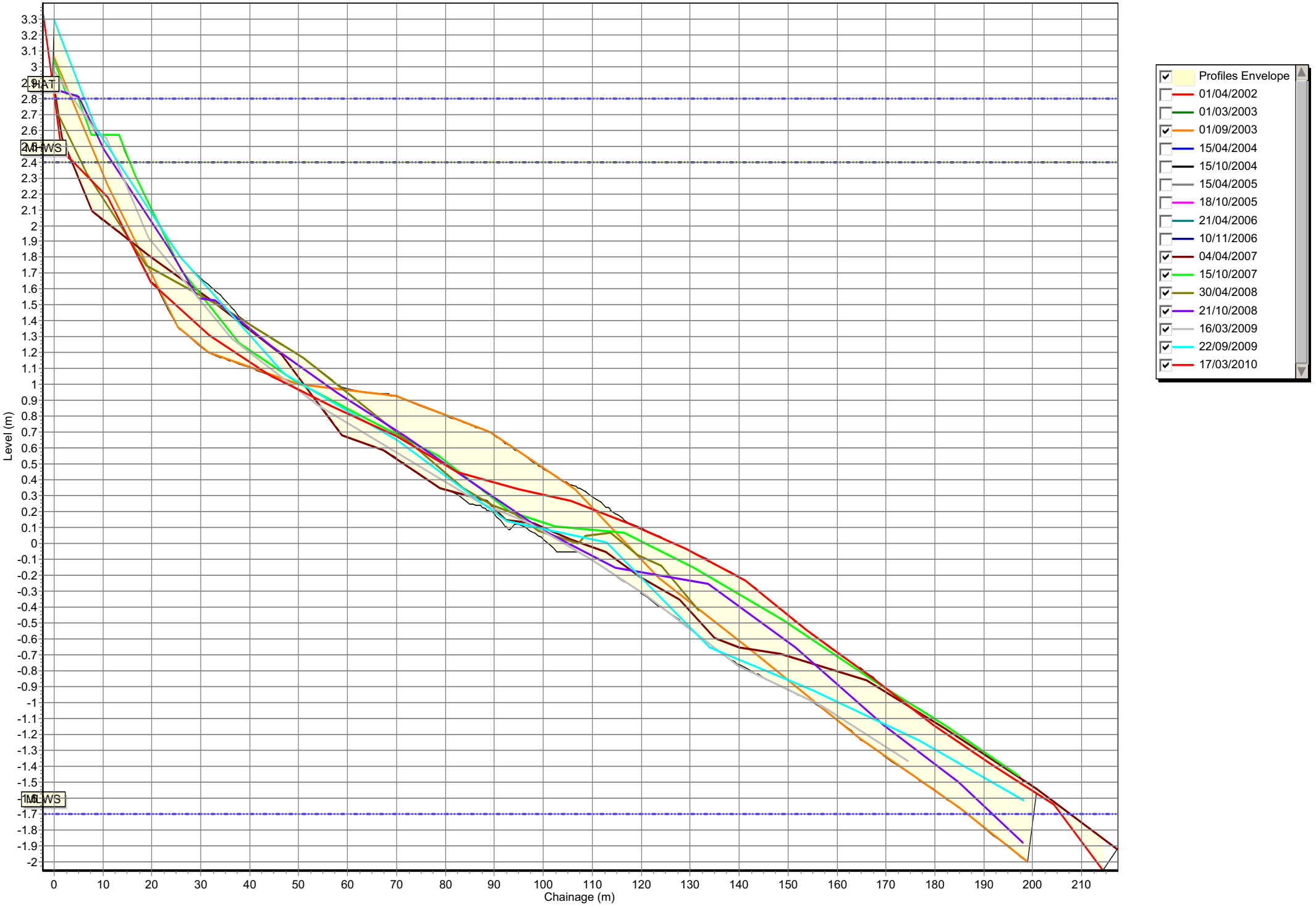

Beach Profiles: 1aBTBC23
Level (m)
Chainage (m)
HAT
MHWS
MLWS
Profiles Envelope
01/04/2002
15/04/2004
15/10/2004
15/04/2005
18/10/2005
21/04/2006
10/11/2006
04/04/2007
15/10/2007
30/04/2008
21/10/2008
11/03/2009
24/09/2009
16/03/2010

# Beach Profiles: 1aBTBC31

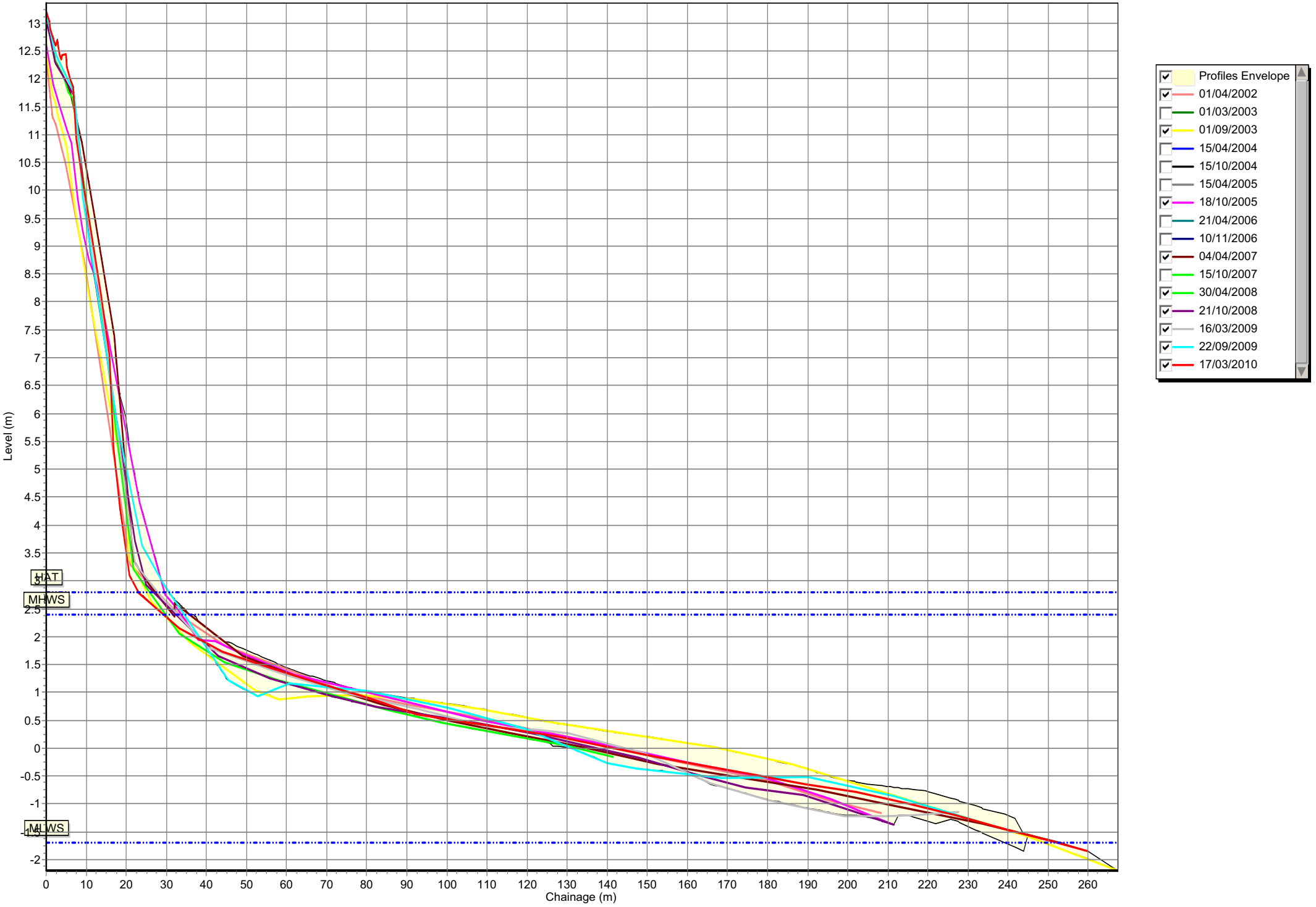


# Beach Profiles: 1aBTBC33

**Beach Profiles: 1aBTBC34**



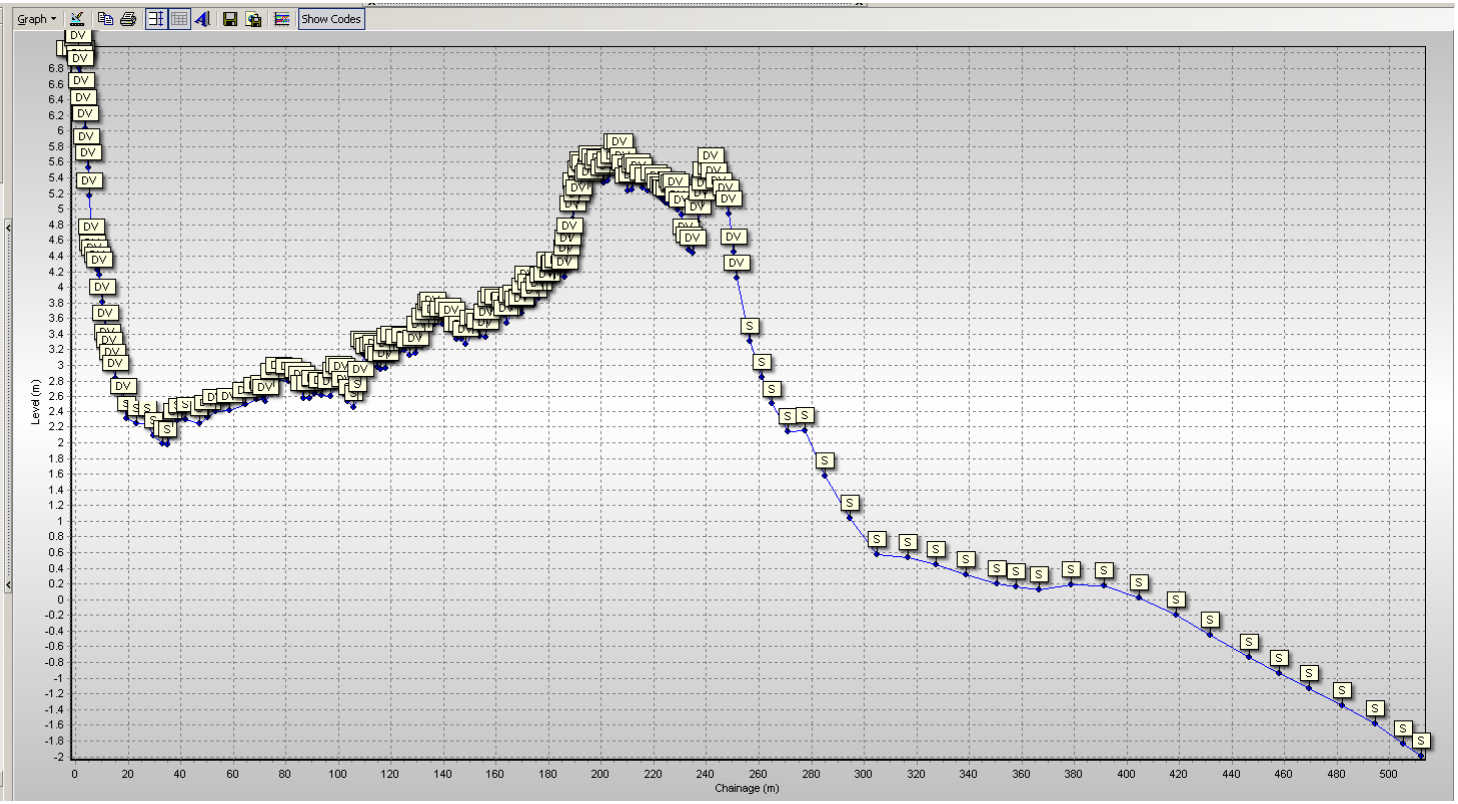
# Beach Profiles: 1aBTBC37



## Alnwick

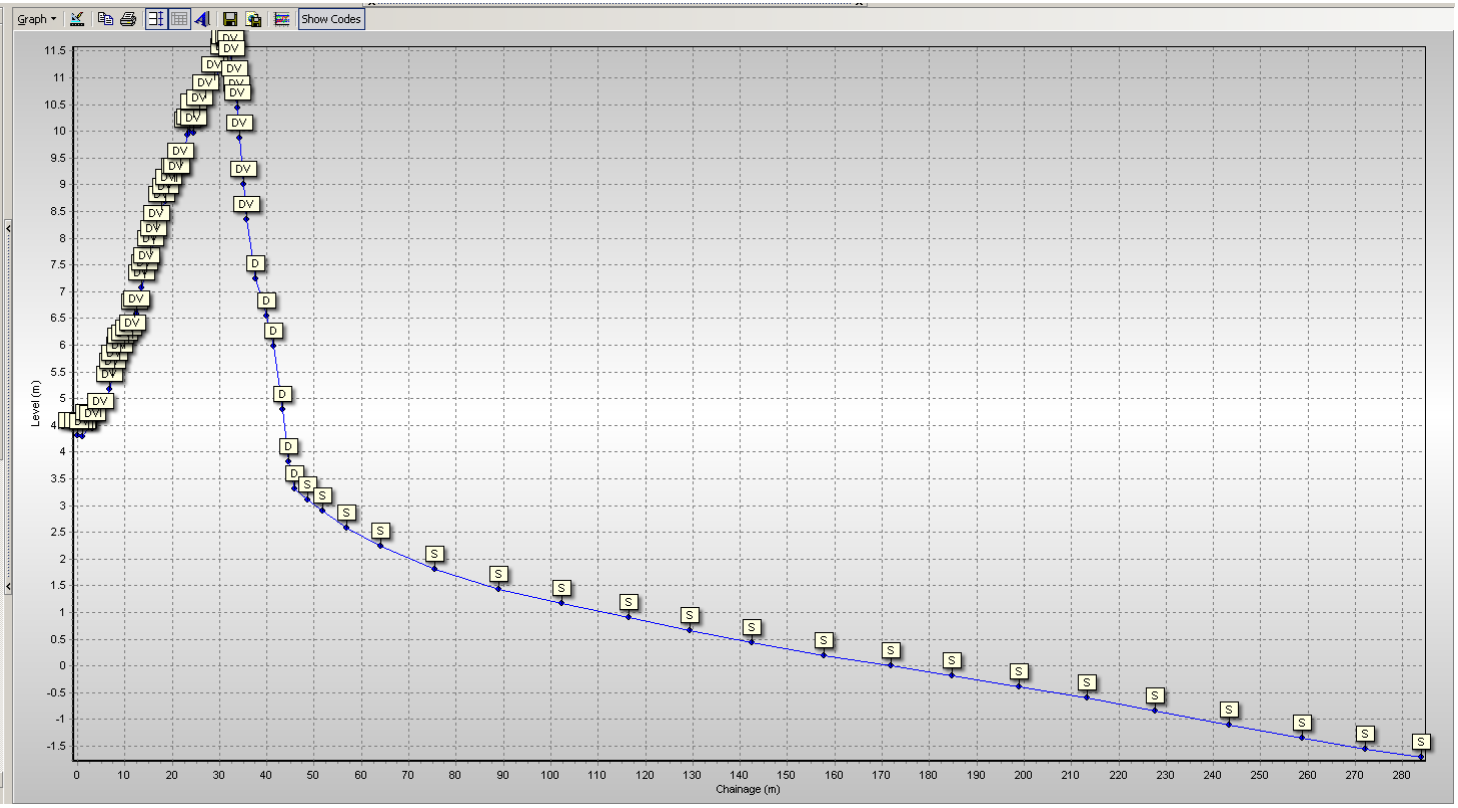
1aADC01 - 17/03/2010

| Chainage | Level | Code |
|---|---|---|
| 0.000 | 6.864 | |
| 0.121 | 6.864 | DV |
| 0.874 | 6.998 | DV |
| 1.099 | 7.031 | DV |
| 1.390 | 6.806 | DV |
| 1.937 | 6.737 | DV |
| 2.408 | 6.457 | DV |
| 3.000 | 6.235 | DV |
| 3.843 | 6.026 | DV |
| 4.226 | 5.737 | DV |
| 4.856 | 5.533 | DV |
| 5.457 | 5.175 | DV |
| 5.975 | 4.582 | DV |
| 6.572 | 4.370 | DV |
| 7.176 | 4.306 | DV |
| 8.299 | 4.215 | DV |
| 9.301 | 4.154 | DV |
| 10.280 | 3.807 | DV |
| 11.316 | 3.471 | DV |
| 12.141 | 3.227 | DV |
| 13.069 | 3.130 | DV |
| 14.006 | 2.976 | DV |
| 15.352 | 2.839 | DV |
| 18.089 | 2.541 | DV |
| 19.539 | 2.307 | S |
| 23.380 | 2.246 | S |
| 27.260 | 2.243 | S |
| 29.623 | 2.086 | S |
| 33.023 | 1.980 | S |
| 35.091 | 1.971 | S |
| 36.872 | 2.209 | S |
| 38.981 | 2.280 | S |
| 41.846 | 2.295 | S |
| 47.316 | 2.248 | S |
| 50.283 | 2.315 | DV |
| 53.431 | 2.401 | DV |
| 58.794 | 2.413 | DV |
| 64.539 | 2.483 | DV |
| 68.780 | 2.550 | DV |
| 71.699 | 2.583 | DV |
| 72.286 | 2.523 | DV |
| 75.218 | 2.737 | DV |



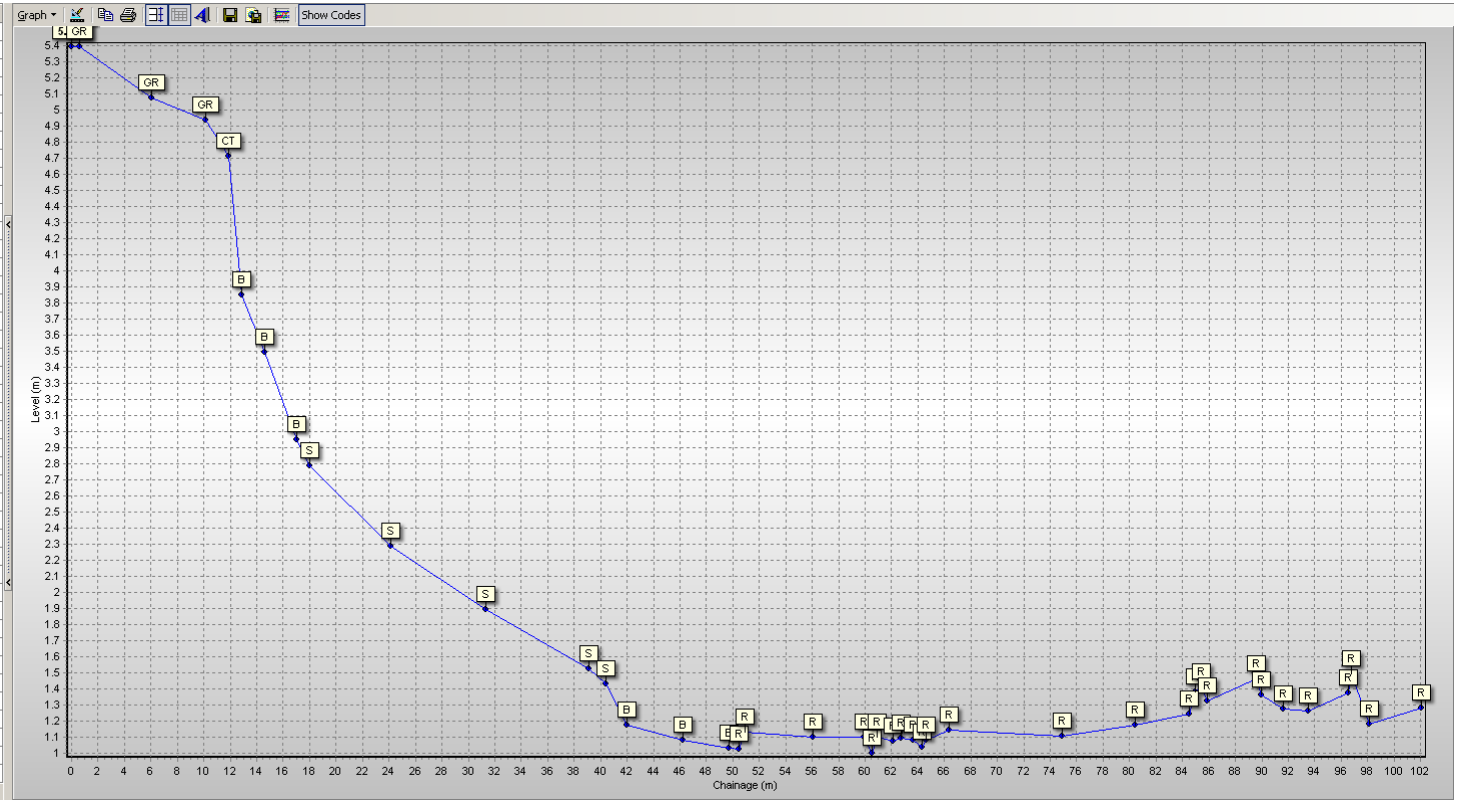
# 1aADC02 - 17/03/2010

| Chainage | Level | Code |
|---|---|---|
| 0.000 | 4.312 | |
| 0.056 | 4.312 | DV |
| 1.029 | 4.297 | DV |
| 2.409 | 4.454 | DV |
| 3.105 | 4.446 | DV |
| 4.921 | 4.663 | DV |
| 6.685 | 5.170 | DV |
| 7.376 | 5.428 | DV |
| 7.905 | 5.576 | DV |
| 8.812 | 5.713 | DV |
| 9.158 | 5.895 | DV |
| 9.918 | 5.954 | DV |
| 10.725 | 6.031 | DV |
| 11.572 | 6.131 | DV |
| 12.129 | 6.522 | DV |
| 12.420 | 6.586 | DV |
| 13.520 | 7.078 | DV |
| 14.171 | 7.258 | DV |
| 14.524 | 7.387 | DV |
| 15.441 | 7.715 | DV |
| 16.159 | 7.902 | DV |
| 16.753 | 8.175 | DV |
| 17.823 | 8.547 | DV |
| 18.541 | 8.690 | DV |
| 19.268 | 8.868 | DV |
| 20.524 | 9.061 | DV |
| 20.992 | 9.069 | DV |
| 21.878 | 9.352 | DV |
| 23.236 | 9.937 | DV |
| 23.776 | 9.995 | DV |
| 24.498 | 9.963 | DV |
| 24.624 | 10.269 | DV |
| 25.744 | 10.351 | DV |
| 27.047 | 10.620 | DV |
| 28.864 | 10.965 | DV |
| 30.818 | 11.310 | DV |
| 31.040 | 11.498 | DV |
| 31.962 | 11.509 | DV |
| 32.325 | 11.457 | DV |
| 32.622 | 11.273 | DV |
| 33.121 | 10.895 | DV |
| 33.630 | 10.606 | DV |



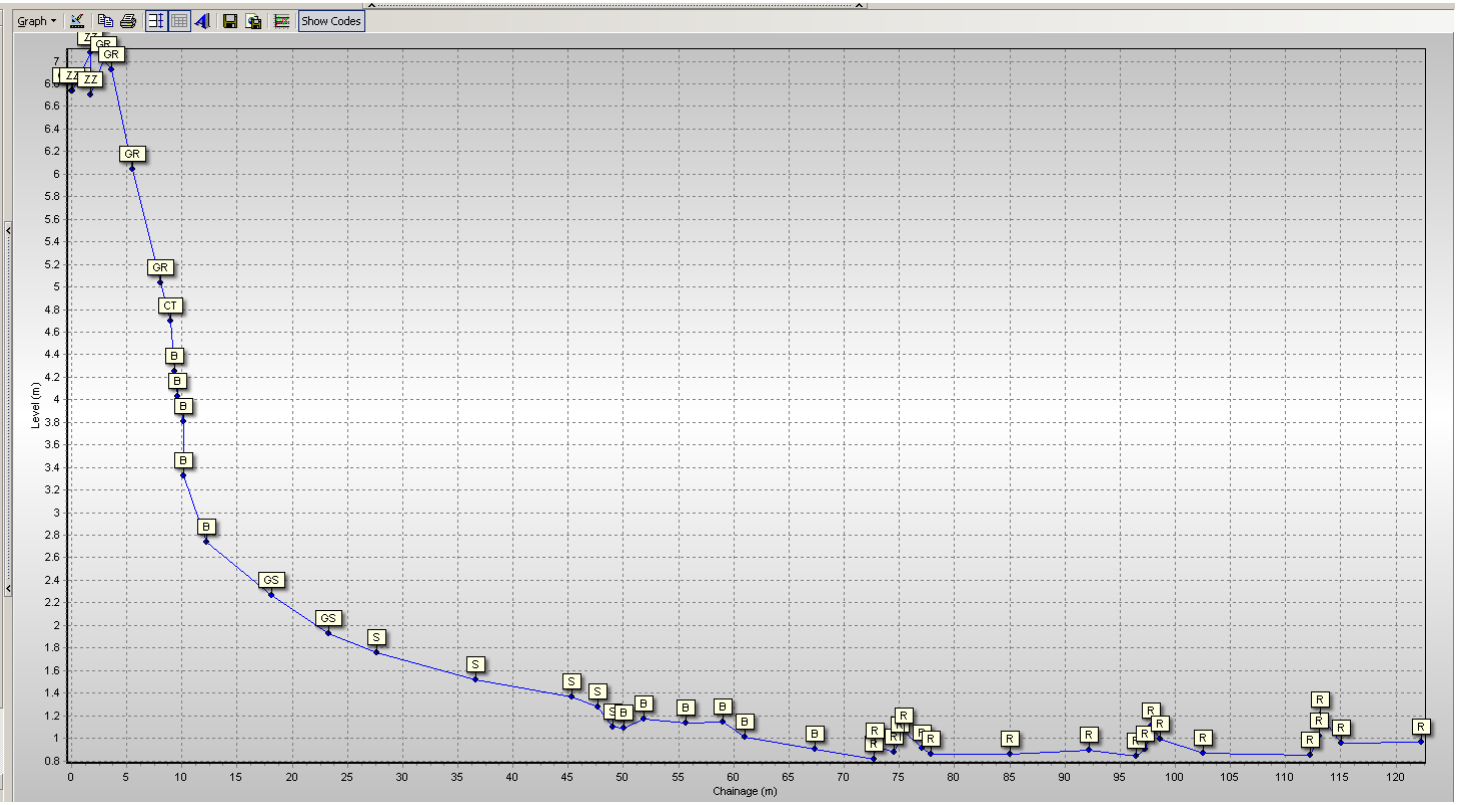
# 1aADC04A - 15/03/2010

| Chainage | Level | Code |
|---|---|---|
| 0.000 | 5.394 | |
| 0.621 | 5.394 | GR |
| 6.067 | 5.073 | GR |
| 10.130 | 4.937 | GR |
| 11.881 | 4.714 | CT |
| 12.873 | 3.849 | B |
| 14.612 | 3.495 | B |
| 17.002 | 2.950 | B |
| 18.033 | 2.788 | S |
| 24.103 | 2.288 | S |
| 31.317 | 1.893 | S |
| 39.094 | 1.528 | S |
| 40.383 | 1.434 | S |
| 41.991 | 1.176 | B |
| 46.196 | 1.080 | B |
| 49.686 | 1.031 | B |
| 50.471 | 1.023 | R |
| 50.897 | 1.132 | R |
| 56.074 | 1.104 | R |
| 59.933 | 1.104 | R |
| 60.534 | 1.001 | R |
| 60.906 | 1.101 | R |
| 62.085 | 1.074 | R |
| 62.733 | 1.096 | R |
| 63.595 | 1.085 | R |
| 64.306 | 1.036 | R |
| 64.606 | 1.083 | R |
| 66.327 | 1.147 | R |
| 74.932 | 1.105 | R |
| 80.390 | 1.179 | R |
| 84.533 | 1.247 | R |
| 84.981 | 1.383 | R |
| 85.421 | 1.416 | R |
| 85.850 | 1.325 | R |
| 89.551 | 1.461 | R |
| 89.976 | 1.364 | R |
| 91.596 | 1.279 | R |
| 93.495 | 1.263 | R |
| 96.561 | 1.374 | R |
| 96.769 | 1.496 | R |
| 98.128 | 1.182 | R |
| 102.065 | 1.280 | R |



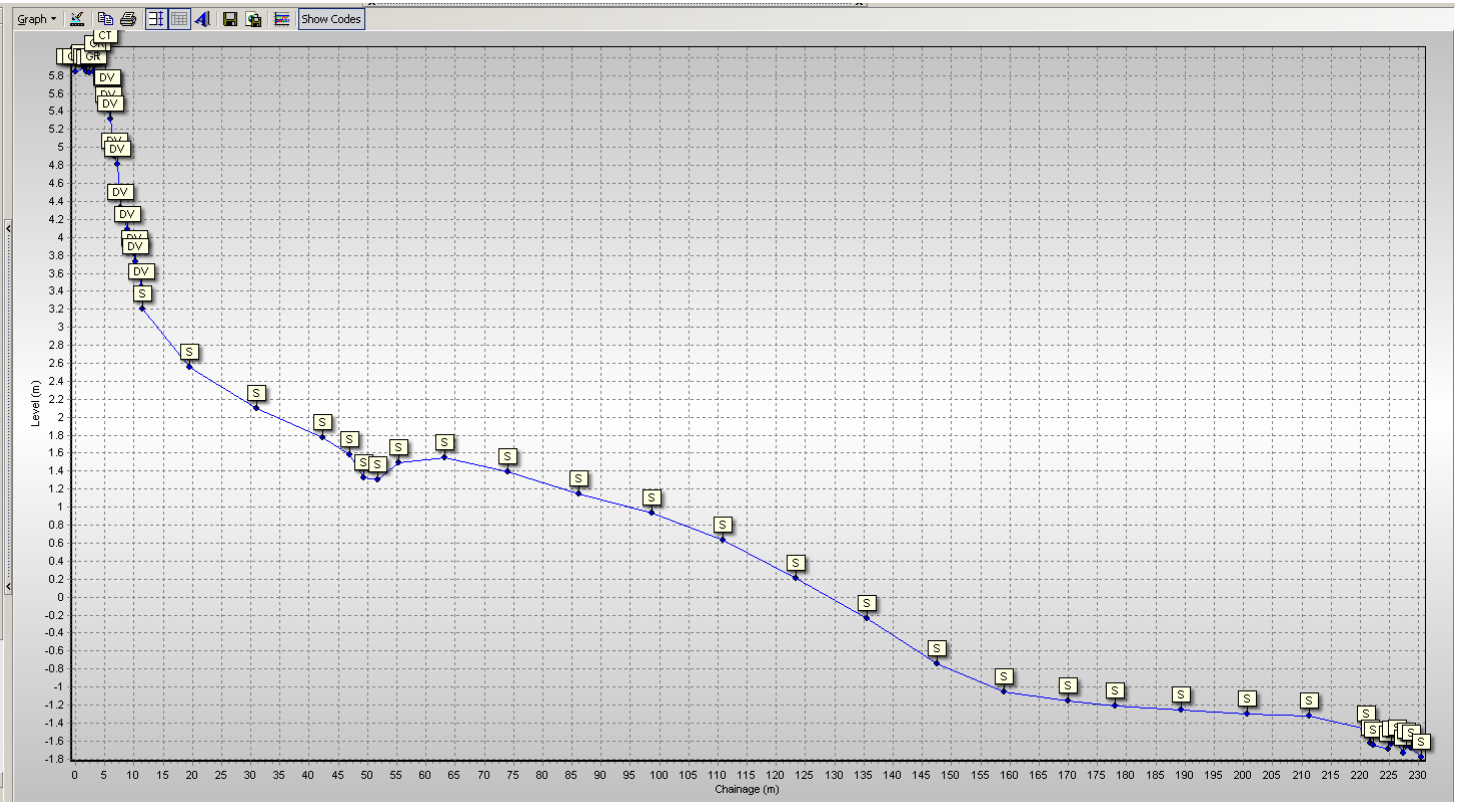
# 1aADC04B - 15/03/2010

| Chainage | Level | Code |
|---|---|---|
| 0.000 | 6.741 | |
| 0.110 | 6.741 | ZZ |
| 1.713 | 7.076 | ZZ |
| 1.713 | 6.705 | ZZ |
| 2.908 | 7.011 | GR |
| 3.635 | 6.922 | GR |
| 5.551 | 6.043 | GR |
| 8.093 | 5.033 | GR |
| 8.967 | 4.696 | CT |
| 9.349 | 4.251 | B |
| 9.568 | 4.030 | B |
| 10.162 | 3.803 | B |
| 10.172 | 3.329 | B |
| 12.202 | 2.736 | B |
| 18.143 | 2.269 | GS |
| 23.326 | 1.923 | GS |
| 27.620 | 1.758 | S |
| 36.658 | 1.521 | S |
| 45.327 | 1.366 | S |
| 47.645 | 1.280 | S |
| 49.010 | 1.096 | S |
| 50.025 | 1.094 | B |
| 51.873 | 1.171 | B |
| 55.696 | 1.139 | B |
| 59.031 | 1.140 | B |
| 60.974 | 1.006 | B |
| 67.370 | 0.901 | B |
| 72.747 | 0.814 | R |
| 72.848 | 0.931 | R |
| 74.483 | 0.875 | R |
| 75.098 | 0.982 | R |
| 75.411 | 1.067 | R |
| 77.092 | 0.915 | R |
| 77.909 | 0.860 | R |
| 85.028 | 0.858 | R |
| 92.201 | 0.891 | R |
| 96.440 | 0.845 | R |
| 97.267 | 0.905 | R |
| 97.831 | 1.110 | R |
| 98.663 | 0.995 | R |
| 102.553 | 0.870 | R |
| 112.216 | 0.850 | R |



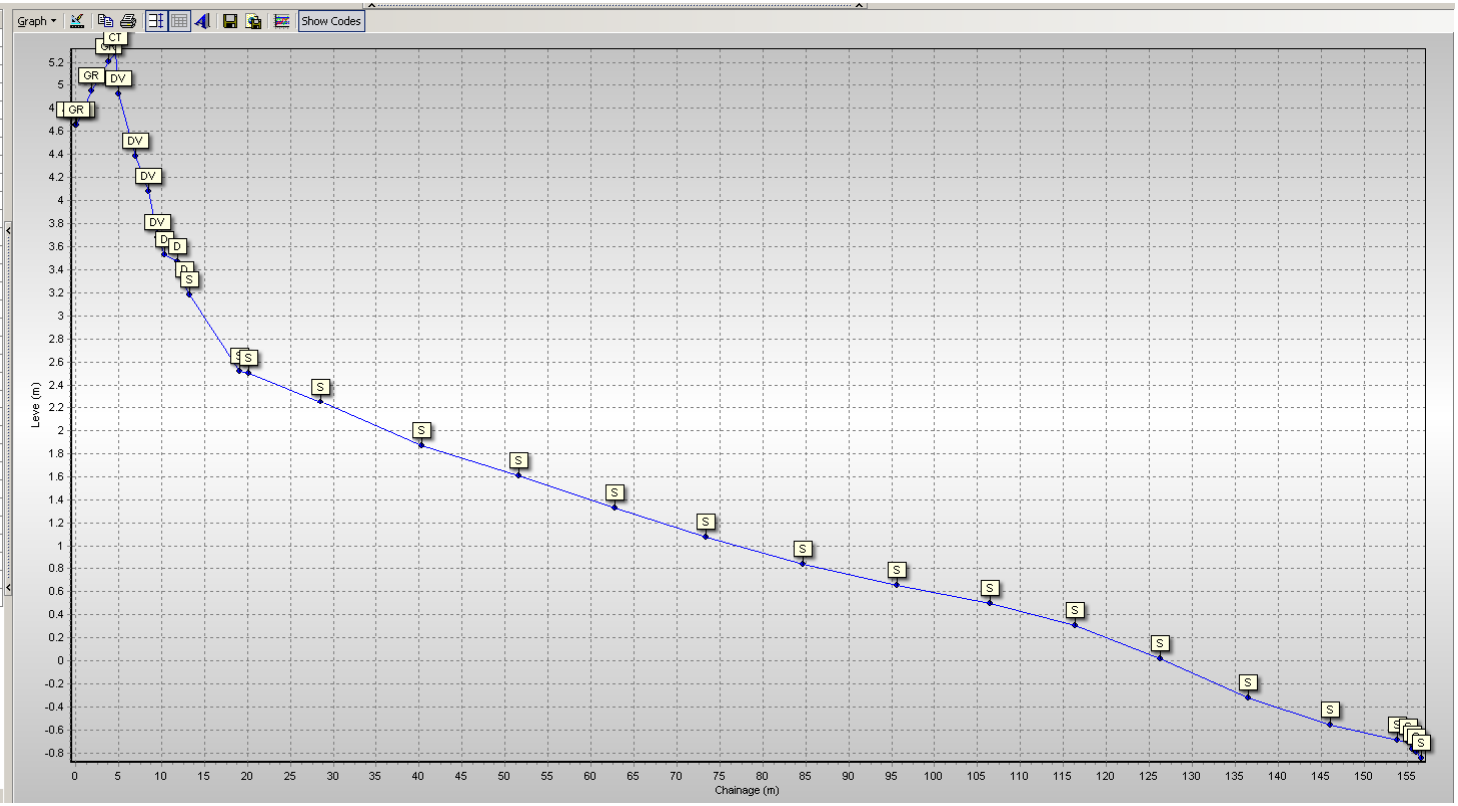
# 1aADC07 - 30/03/2010

| Chainage | Level | Code |
|---|---|---|
| 0.000 | 5.845 | |
| 0.030 | 5.845 | GR |
| 1.489 | 5.882 | GR |
| 1.922 | 5.836 | GR |
| 2.462 | 5.832 | GR |
| 3.138 | 5.839 | GR |
| 3.855 | 5.985 | GR |
| 5.058 | 6.075 | CT |
| 5.329 | 5.603 | DV |
| 5.418 | 5.609 | DV |
| 5.584 | 5.411 | DV |
| 6.054 | 5.315 | DV |
| 6.658 | 4.899 | DV |
| 7.146 | 4.812 | DV |
| 7.795 | 4.329 | DV |
| 8.887 | 4.091 | DV |
| 10.097 | 3.820 | DV |
| 10.326 | 3.724 | DV |
| 11.230 | 3.447 | DV |
| 11.425 | 3.199 | S |
| 19.534 | 2.551 | S |
| 30.991 | 2.099 | S |
| 42.359 | 1.772 | S |
| 46.991 | 1.587 | S |
| 49.433 | 1.322 | S |
| 51.802 | 1.302 | S |
| 55.269 | 1.489 | S |
| 63.161 | 1.552 | S |
| 74.032 | 1.394 | S |
| 86.259 | 1.149 | S |
| 98.657 | 0.935 | S |
| 110.794 | 0.631 | S |
| 123.342 | 0.210 | S |
| 135.546 | -0.239 | S |
| 147.530 | -0.743 | S |
| 159.095 | -1.052 | S |
| 170.046 | -1.157 | S |
| 178.073 | -1.211 | S |
| 189.371 | -1.253 | S |
| 200.733 | -1.301 | S |
| 211.260 | -1.325 | S |
| 221.019 | -1.466 | S |



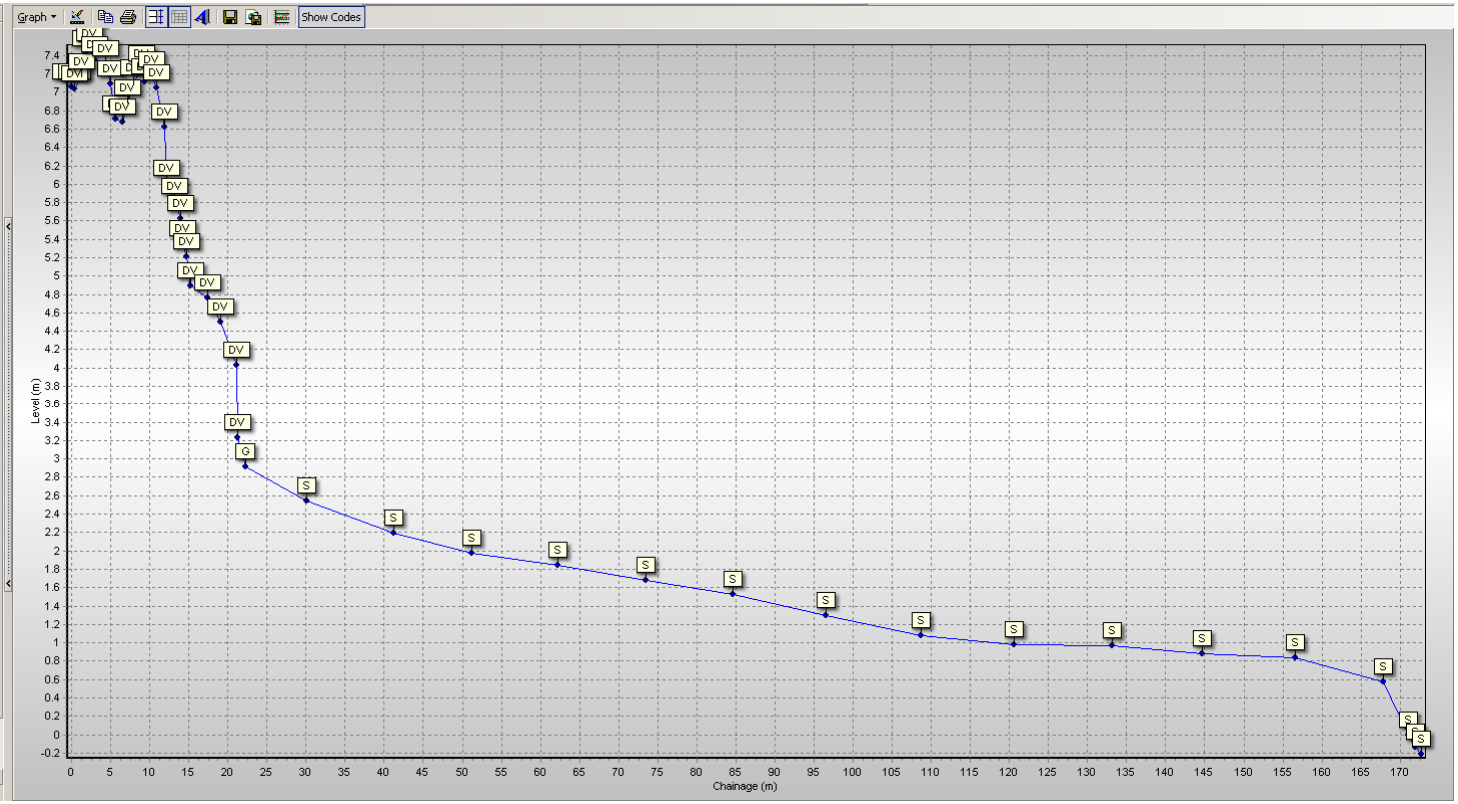
# 1aADC08 - 30/03/2010

| Chainage | Level | Code |
|---|---|---|
| 0.000 | 4.652 | |
| 0.089 | 4.652 | GR |
| 1.869 | 4.948 | GR |
| 3.861 | 5.203 | GR |
| 4.656 | 5.283 | CT |
| 5.051 | 4.925 | DV |
| 6.941 | 4.384 | DV |
| 8.488 | 4.081 | DV |
| 9.515 | 3.680 | DV |
| 10.378 | 3.531 | D |
| 11.850 | 3.472 | D |
| 12.745 | 3.268 | D |
| 13.309 | 3.183 | S |
| 19.093 | 2.524 | S |
| 20.209 | 2.499 | S |
| 28.501 | 2.249 | S |
| 40.335 | 1.868 | S |
| 51.578 | 1.604 | S |
| 62.777 | 1.330 | S |
| 73.381 | 1.075 | S |
| 84.652 | 0.842 | S |
| 95.658 | 0.653 | S |
| 106.487 | 0.496 | S |
| 116.427 | 0.306 | S |
| 126.263 | 0.017 | S |
| 136.579 | -0.320 | S |
| 146.051 | -0.554 | S |
| 153.859 | -0.688 | S |
| 155.187 | -0.700 | S |
| 155.598 | -0.767 | S |
| 156.111 | -0.795 | S |
| 156.676 | -0.843 | S |



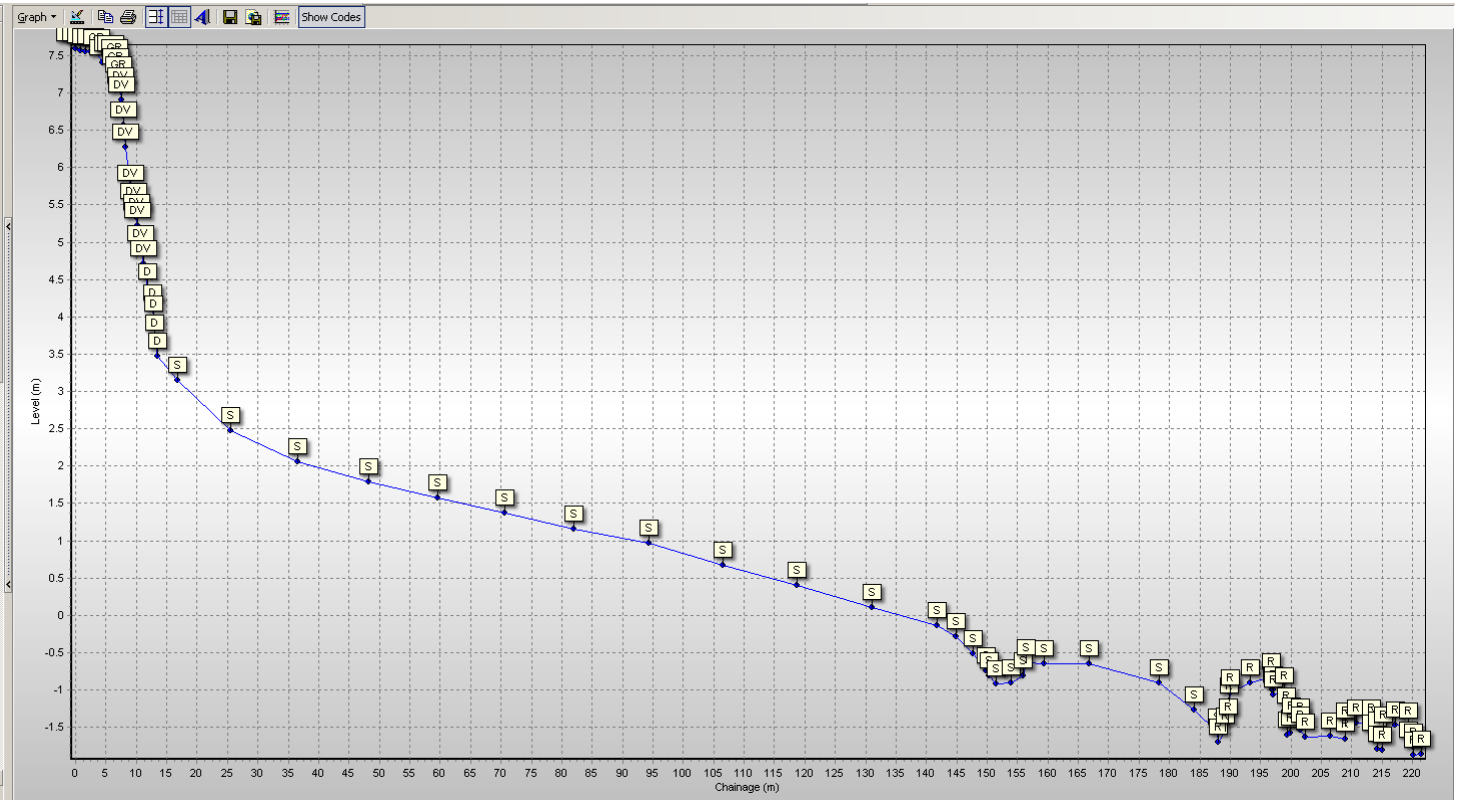
# 1aADC09 - 30/03/2010

| Chainage | Level | Code |
|---|---|---|
| 0.000 | 7.061 | |
| 0.014 | 7.061 | DV |
| 0.366 | 7.043 | DV |
| 1.224 | 7.171 | DV |
| 1.826 | 7.420 | DV |
| 2.365 | 7.475 | DV |
| 3.003 | 7.357 | DV |
| 4.329 | 7.312 | DV |
| 5.039 | 7.091 | DV |
| 5.621 | 6.709 | DV |
| 6.541 | 6.678 | DV |
| 7.200 | 6.880 | DV |
| 7.964 | 7.108 | DV |
| 8.911 | 7.260 | DV |
| 9.288 | 7.113 | DV |
| 10.238 | 7.188 | DV |
| 10.927 | 7.047 | DV |
| 11.917 | 6.620 | DV |
| 12.106 | 6.014 | DV |
| 13.140 | 5.812 | DV |
| 13.895 | 5.624 | DV |
| 14.165 | 5.350 | DV |
| 14.699 | 5.215 | DV |
| 15.280 | 4.892 | DV |
| 17.355 | 4.763 | DV |
| 19.054 | 4.496 | DV |
| 21.145 | 4.033 | DV |
| 21.212 | 3.231 | DV |
| 22.337 | 2.910 | G |
| 30.056 | 2.547 | S |
| 41.182 | 2.190 | S |
| 51.163 | 1.977 | S |
| 62.244 | 1.844 | S |
| 73.469 | 1.677 | S |
| 84.598 | 1.526 | S |
| 96.599 | 1.292 | S |
| 108.665 | 1.077 | S |
| 120.651 | 0.981 | S |
| 133.129 | 0.969 | S |
| 144.744 | 0.884 | S |
| 156.599 | 0.832 | S |
| 167.869 | 0.571 | S |



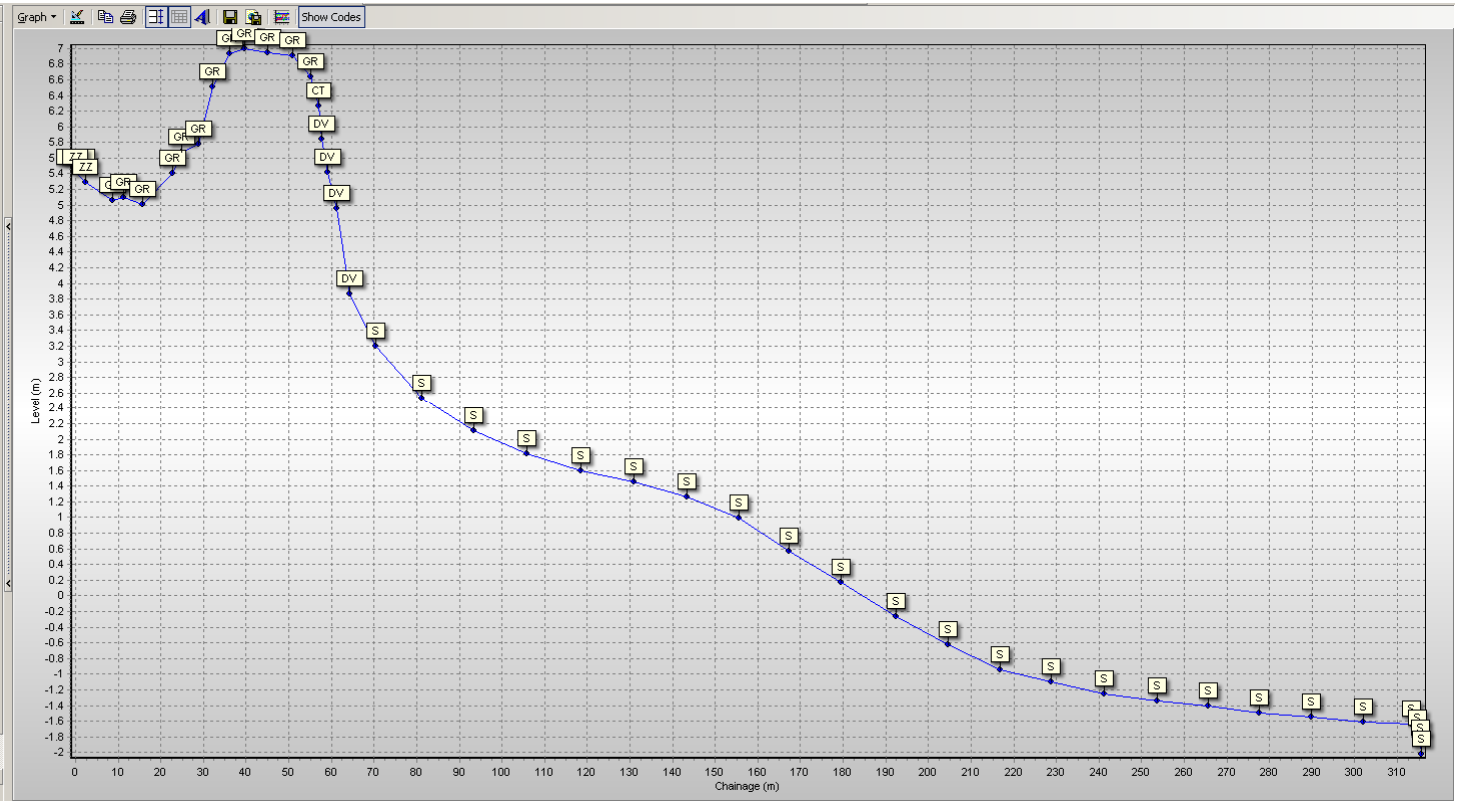
# 1aADC15A - 01/04/2010

| Chainage | Level | Code |
|---|---|---|
| 0.000 | 7.594 | |
| 0.027 | 7.594 | GR |
| 0.845 | 7.561 | GR |
| 1.664 | 7.550 | GR |
| 2.410 | 7.560 | GR |
| 3.390 | 7.542 | GR |
| 4.501 | 7.407 | GR |
| 5.308 | 7.453 | GR |
| 5.731 | 7.457 | GR |
| 6.434 | 7.409 | GR |
| 6.577 | 7.288 | GR |
| 7.048 | 7.175 | GR |
| 7.352 | 7.022 | DV |
| 7.586 | 6.911 | DV |
| 7.935 | 6.573 | DV |
| 8.203 | 6.279 | DV |
| 9.097 | 5.725 | DV |
| 9.628 | 5.474 | DV |
| 9.984 | 5.328 | DV |
| 10.252 | 5.218 | DV |
| 10.654 | 4.917 | DV |
| 11.152 | 4.713 | DV |
| 11.867 | 4.406 | D |
| 12.760 | 4.122 | D |
| 12.911 | 3.967 | D |
| 12.933 | 3.715 | D |
| 13.553 | 3.478 | D |
| 16.811 | 3.144 | S |
| 25.601 | 2.482 | S |
| 36.576 | 2.052 | S |
| 48.308 | 1.786 | S |
| 59.674 | 1.576 | S |
| 70.702 | 1.373 | S |
| 82.019 | 1.152 | S |
| 94.344 | 0.964 | S |
| 106.577 | 0.670 | S |
| 118.782 | 0.408 | S |
| 130.991 | 0.101 | S |
| 141.808 | -0.142 | S |
| 144.901 | -0.287 | S |
| 147.674 | -0.520 | S |
| 149.761 | -0.746 | S |



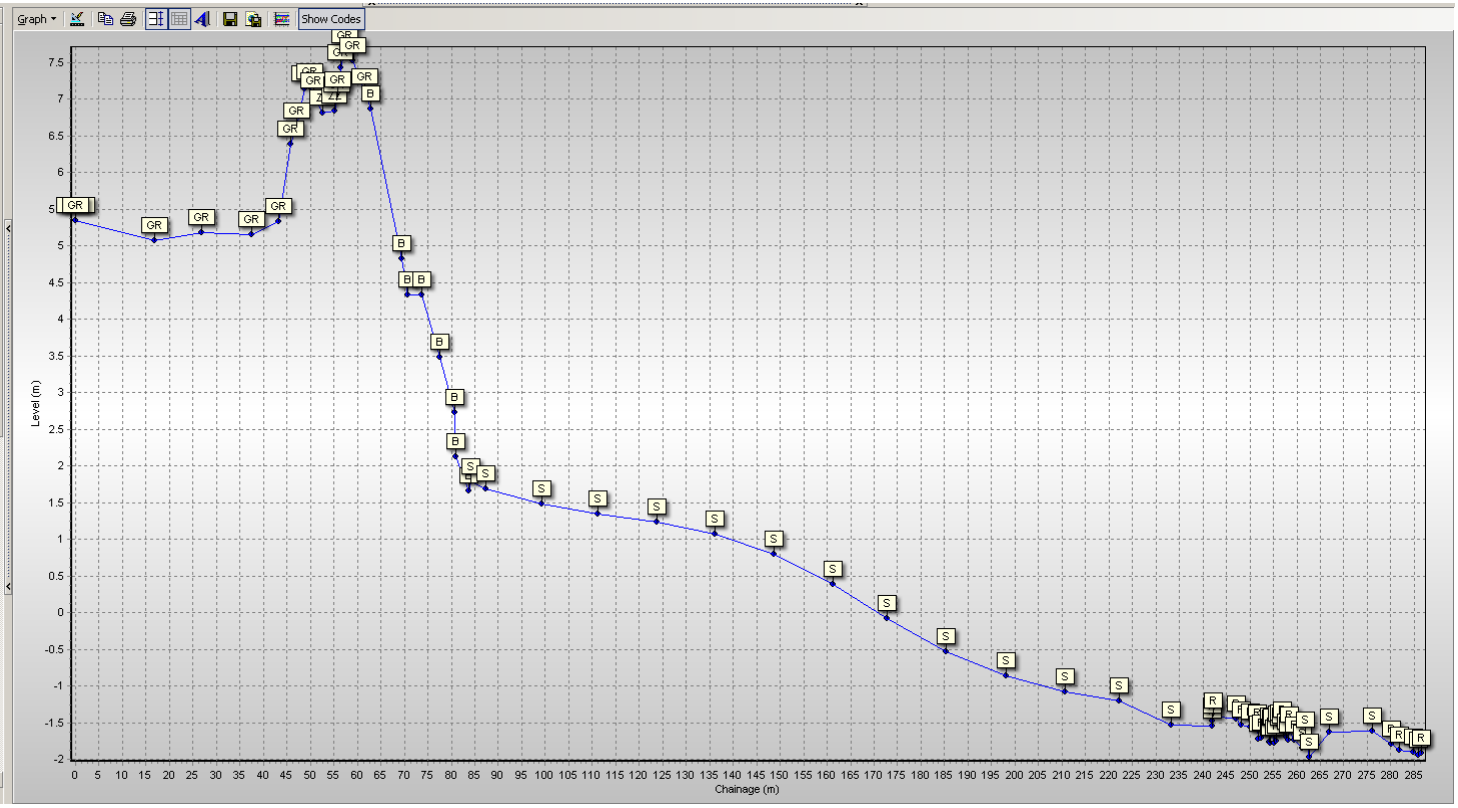
# 1aADC16 - 01/04/2010

| Chainage | Level | Code |
|---|---|---|
| 0.000 | 5.422 | |
| 0.055 | 5.422 | ZZ |
| 2.393 | 5.296 | ZZ |
| 8.571 | 5.066 | GR |
| 11.373 | 5.096 | GR |
| 15.795 | 5.008 | GR |
| 22.779 | 5.404 | GR |
| 24.836 | 5.679 | GR |
| 28.954 | 5.776 | GR |
| 32.245 | 6.514 | GR |
| 36.052 | 6.931 | GR |
| 39.548 | 6.997 | GR |
| 45.043 | 6.946 | GR |
| 50.886 | 6.908 | GR |
| 55.046 | 6.639 | GR |
| 56.946 | 6.272 | CT |
| 57.789 | 5.838 | DV |
| 59.154 | 5.413 | DV |
| 61.198 | 4.951 | DV |
| 64.330 | 3.865 | DV |
| 70.317 | 3.205 | S |
| 81.258 | 2.530 | S |
| 93.457 | 2.115 | S |
| 105.767 | 1.816 | S |
| 118.396 | 1.593 | S |
| 131.051 | 1.450 | S |
| 143.264 | 1.265 | S |
| 155.546 | 0.992 | S |
| 167.386 | 0.576 | S |
| 179.453 | 0.167 | S |
| 192.307 | -0.258 | S |
| 204.579 | -0.625 | S |
| 216.768 | -0.941 | S |
| 228.711 | -1.101 | S |
| 241.226 | -1.250 | S |
| 253.549 | -1.343 | S |
| 265.665 | -1.408 | S |
| 277.687 | -1.495 | S |
| 289.690 | -1.546 | S |
| 301.967 | -1.607 | S |
| 313.375 | -1.630 | S |
| 314.746 | -1.753 | S |



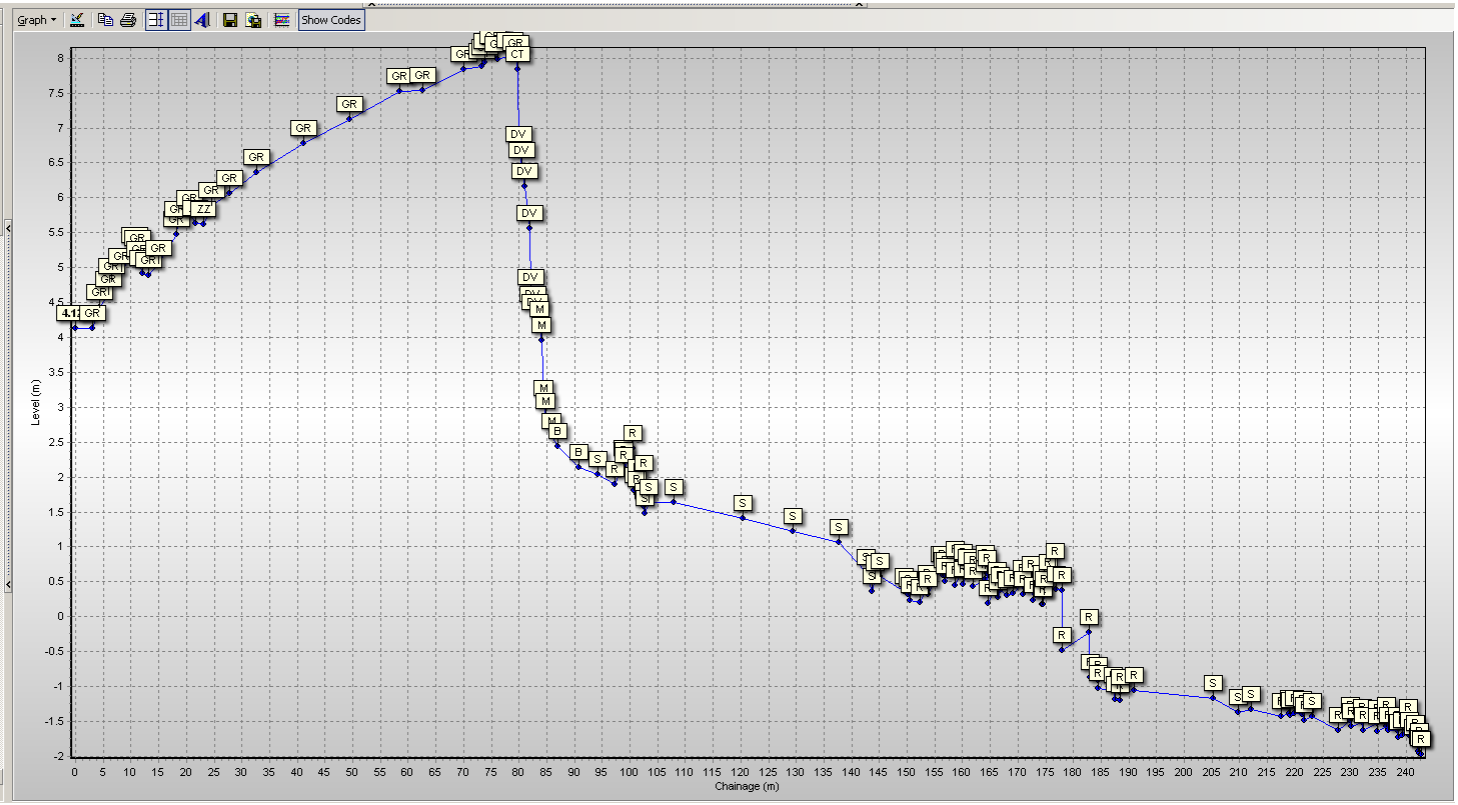
# 1aADC16A - 01/04/2010

| Chainage | Level | Code |
|---|---|---|
| 0.000 | 5.347 | |
| 0.051 | 5.347 | GR |
| 16.879 | 5.072 | GR |
| 26.760 | 5.184 | GR |
| 37.471 | 5.155 | GR |
| 43.263 | 5.335 | GR |
| 45.695 | 6.381 | GR |
| 47.003 | 6.632 | GR |
| 48.862 | 7.145 | GR |
| 49.865 | 7.170 | GR |
| 50.654 | 7.045 | GR |
| 52.635 | 6.816 | ZZ |
| 55.276 | 6.841 | ZZ |
| 55.499 | 6.986 | GR |
| 55.917 | 7.056 | GR |
| 56.410 | 7.432 | GR |
| 57.223 | 7.661 | GR |
| 59.047 | 7.528 | GR |
| 61.653 | 7.102 | GR |
| 62.794 | 6.866 | B |
| 69.459 | 4.829 | B |
| 70.782 | 4.330 | B |
| 73.696 | 4.328 | B |
| 77.469 | 3.485 | B |
| 80.802 | 2.727 | B |
| 80.963 | 2.121 | B |
| 83.807 | 1.656 | B |
| 84.119 | 1.777 | S |
| 87.388 | 1.683 | S |
| 99.374 | 1.488 | S |
| 111.217 | 1.348 | S |
| 123.782 | 1.238 | S |
| 136.065 | 1.072 | S |
| 148.655 | 0.791 | S |
| 161.165 | 0.387 | S |
| 172.775 | -0.080 | S |
| 185.400 | -0.527 | S |
| 198.206 | -0.859 | S |
| 210.719 | -1.083 | S |
| 222.284 | -1.203 | S |
| 233.342 | -1.529 | S |
| 241.913 | -1.543 | R |



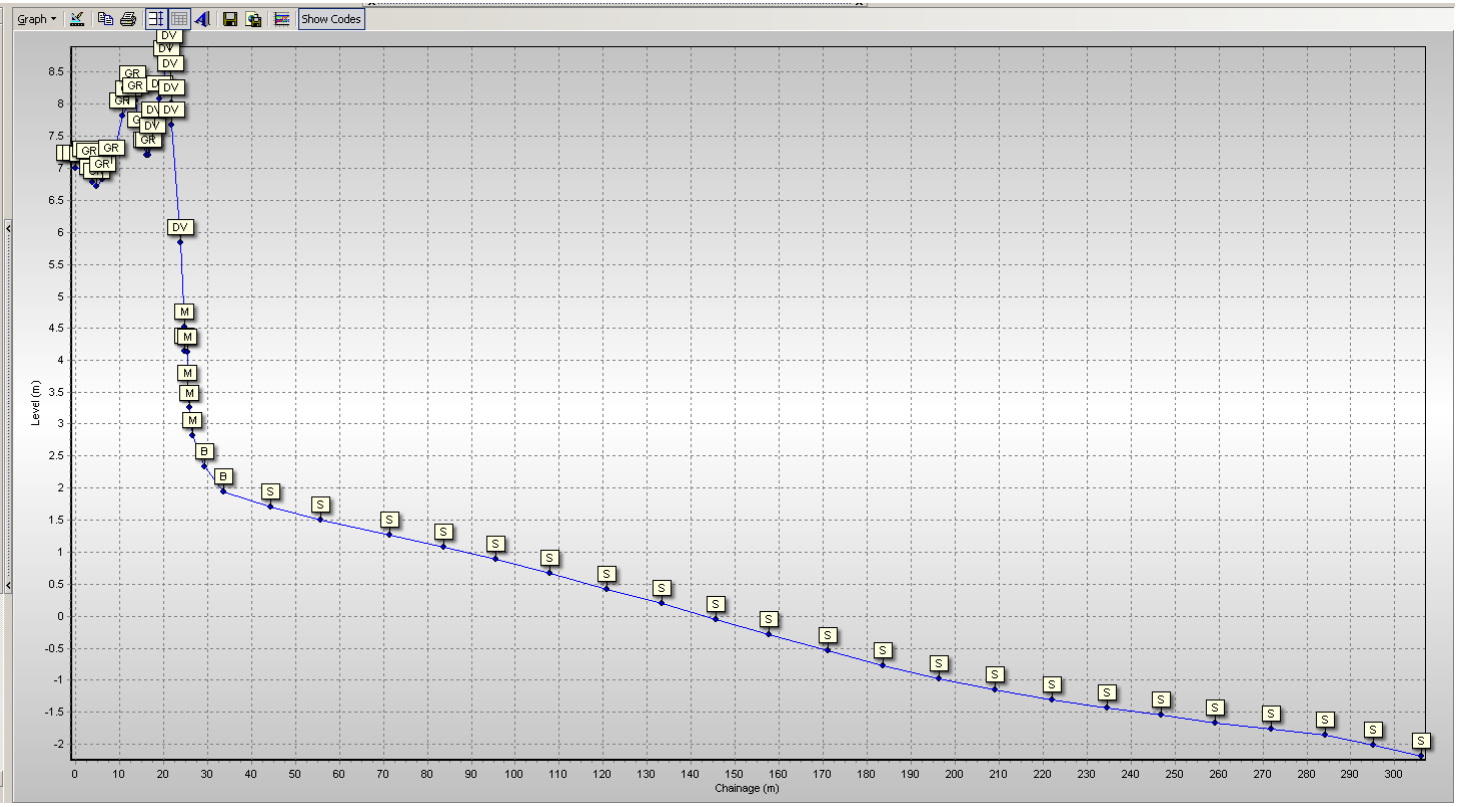
# 1aADC16B - 01/04/2010

| Chainage | Level | Code |
|---|---|---|
| 0.000 | 4.129 | |
| 3.149 | 4.129 | GR |
| 4.412 | 4.433 | GR |
| 5.936 | 4.621 | GR |
| 6.534 | 4.805 | GR |
| 8.377 | 4.948 | GR |
| 10.574 | 5.252 | GR |
| 11.229 | 5.197 | GR |
| 11.487 | 5.052 | GR |
| 12.150 | 4.923 | GR |
| 13.226 | 4.886 | GR |
| 15.002 | 5.060 | GR |
| 18.163 | 5.476 | GR |
| 18.323 | 5.613 | GR |
| 20.569 | 5.774 | GR |
| 21.573 | 5.639 | ZZ |
| 23.037 | 5.623 | ZZ |
| 24.478 | 5.889 | GR |
| 27.850 | 6.063 | GR |
| 32.608 | 6.359 | GR |
| 41.101 | 6.774 | GR |
| 49.479 | 7.117 | GR |
| 58.545 | 7.519 | GR |
| 62.544 | 7.537 | GR |
| 70.104 | 7.840 | GR |
| 73.358 | 7.882 | GR |
| 73.850 | 7.937 | GR |
| 74.094 | 8.032 | GR |
| 75.283 | 8.097 | GR |
| 76.173 | 7.981 | GR |
| 78.330 | 8.035 | GR |
| 79.468 | 7.991 | GR |
| 79.860 | 7.833 | CT |
| 79.991 | 6.690 | DV |
| 80.500 | 6.462 | DV |
| 81.048 | 6.160 | DV |
| 81.907 | 5.562 | DV |
| 82.173 | 4.642 | DV |
| 82.545 | 4.406 | DV |
| 82.821 | 4.291 | DV |
| 83.721 | 4.188 | M |
| 84.030 | 3.953 | M |



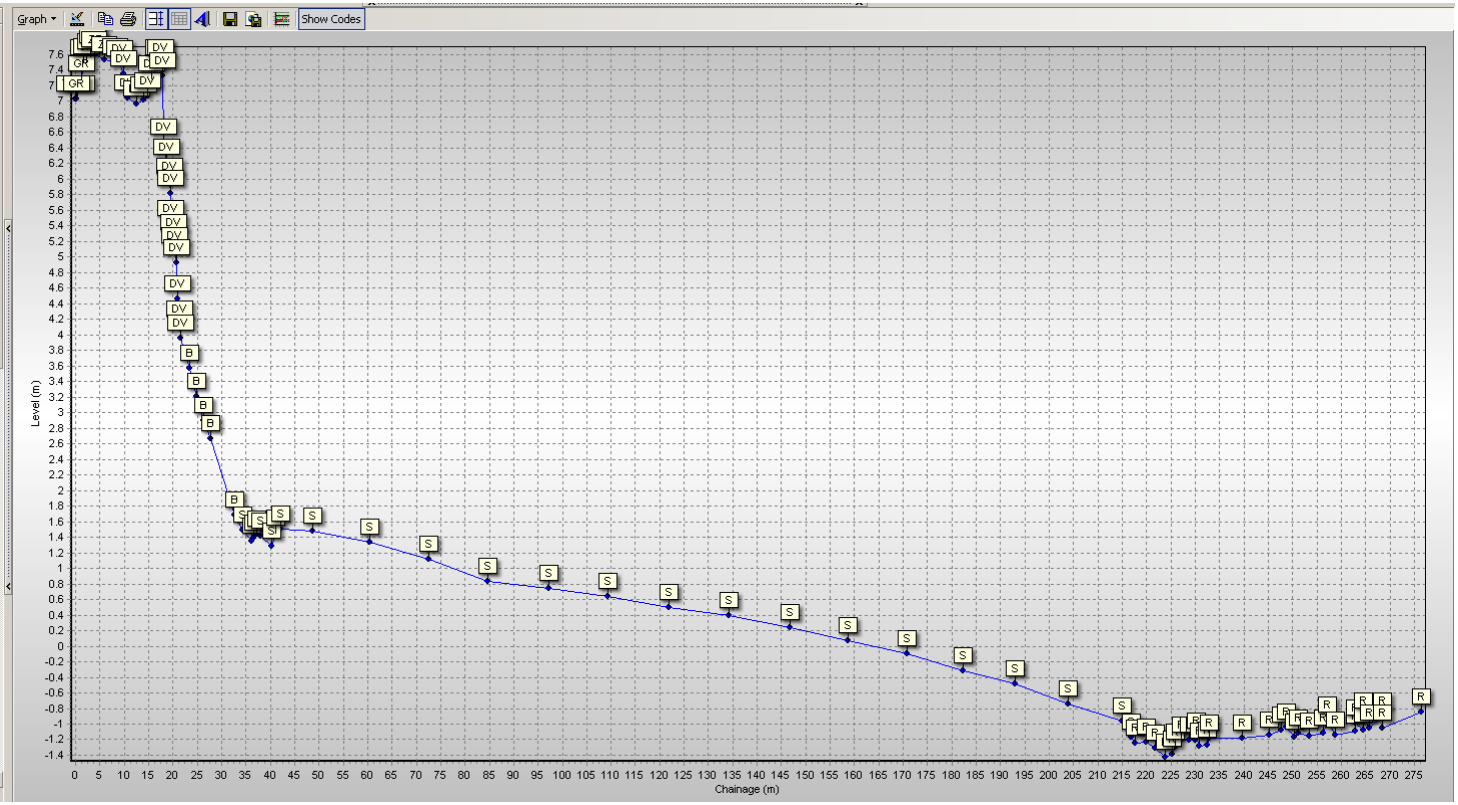
# 1aADC17 - 01/04/2010

| Chainage | Level | Code |
|---|---|---|
| 0.000 | 6.997 | |
| 0.051 | 6.997 | ZZ |
| 1.700 | 6.987 | ZZ |
| 2.263 | 7.063 | GR |
| 3.131 | 7.034 | GR |
| 3.771 | 6.777 | GR |
| 4.694 | 6.713 | GR |
| 6.218 | 6.829 | GR |
| 8.247 | 7.078 | GR |
| 10.590 | 7.810 | GR |
| 12.113 | 7.998 | GR |
| 12.963 | 8.238 | GR |
| 13.552 | 8.052 | GR |
| 14.807 | 7.516 | GR |
| 16.190 | 7.204 | GR |
| 16.587 | 7.197 | GR |
| 17.437 | 7.429 | DV |
| 17.864 | 7.670 | DV |
| 19.187 | 8.076 | DV |
| 20.693 | 8.626 | DV |
| 21.447 | 8.833 | DV |
| 21.581 | 8.390 | DV |
| 21.799 | 8.011 | DV |
| 21.874 | 7.678 | DV |
| 23.992 | 5.844 | DV |
| 24.867 | 4.527 | M |
| 24.895 | 4.142 | M |
| 25.483 | 4.124 | M |
| 25.582 | 3.563 | M |
| 25.883 | 3.251 | M |
| 26.627 | 2.822 | M |
| 29.360 | 2.333 | B |
| 33.645 | 1.930 | B |
| 44.441 | 1.710 | S |
| 55.754 | 1.495 | S |
| 71.535 | 1.258 | S |
| 83.648 | 1.081 | S |
| 95.625 | 0.883 | S |
| 107.932 | 0.667 | S |
| 120.927 | 0.421 | S |
| 133.309 | 0.191 | S |
| 145.684 | -0.051 | S |

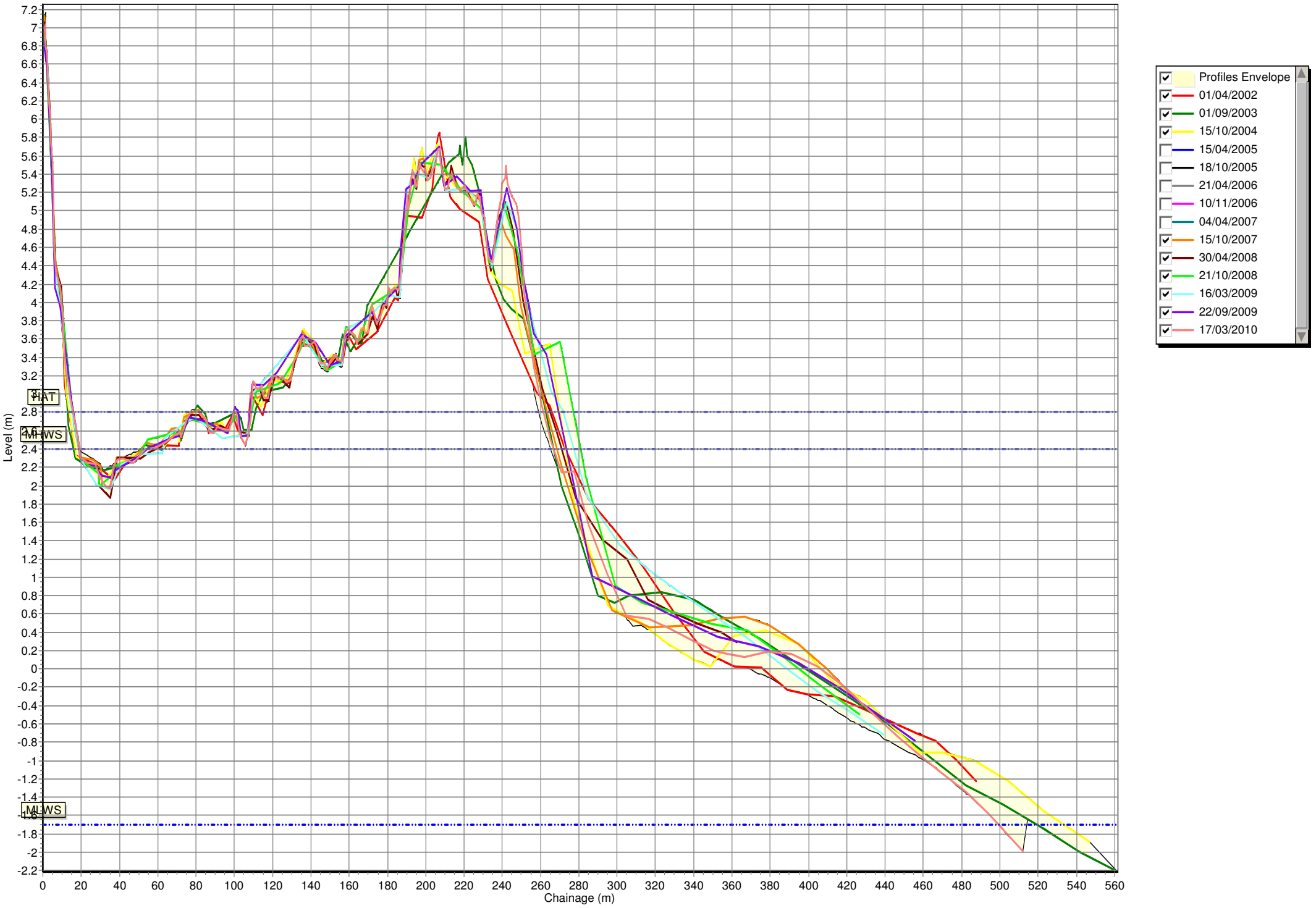


# 1aADC17A - 01/04/2010

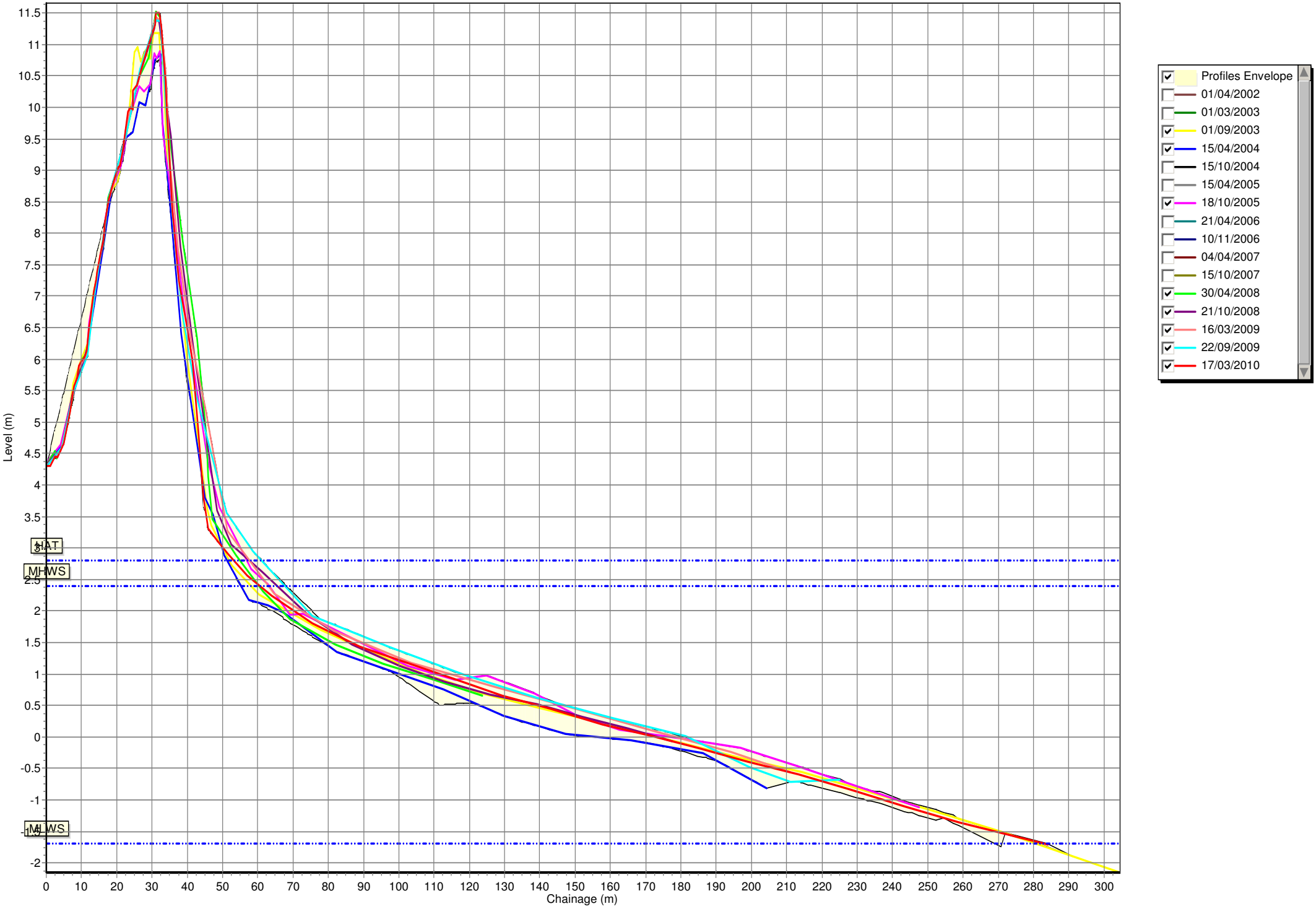
| Chainage | Level | Code |
|---|---|---|
| 0.000 | 7.025 | |
| 0.250 | 7.025 | GR |
| 1.211 | 7.292 | GR |
| 1.545 | 7.488 | GR |
| 2.279 | 7.505 | GR |
| 2.994 | 7.567 | GR |
| 3.484 | 7.649 | GR |
| 3.944 | 7.595 | ZZ |
| 5.948 | 7.533 | ZZ |
| 8.318 | 7.507 | ZZ |
| 8.953 | 7.476 | DV |
| 9.871 | 7.358 | DV |
| 10.739 | 7.041 | DV |
| 12.582 | 6.960 | DV |
| 13.969 | 7.021 | DV |
| 14.726 | 7.069 | DV |
| 15.540 | 7.294 | DV |
| 17.118 | 7.494 | DV |
| 17.560 | 7.500 | DV |
| 17.881 | 7.325 | DV |
| 18.042 | 6.480 | DV |
| 18.784 | 6.220 | DV |
| 19.230 | 5.967 | DV |
| 19.550 | 5.821 | DV |
| 19.588 | 5.431 | DV |
| 20.157 | 5.250 | DV |
| 20.257 | 5.076 | DV |
| 20.726 | 4.921 | DV |
| 20.909 | 4.460 | DV |
| 21.282 | 4.140 | DV |
| 21.565 | 3.960 | DV |
| 23.340 | 3.573 | B |
| 24.769 | 3.205 | B |
| 26.272 | 2.898 | B |
| 27.818 | 2.670 | B |
| 32.641 | 1.683 | B |
| 34.359 | 1.490 | S |
| 36.094 | 1.353 | S |
| 36.564 | 1.391 | S |
| 37.208 | 1.435 | S |
| 37.984 | 1.413 | S |
| 40.326 | 1.281 | S |



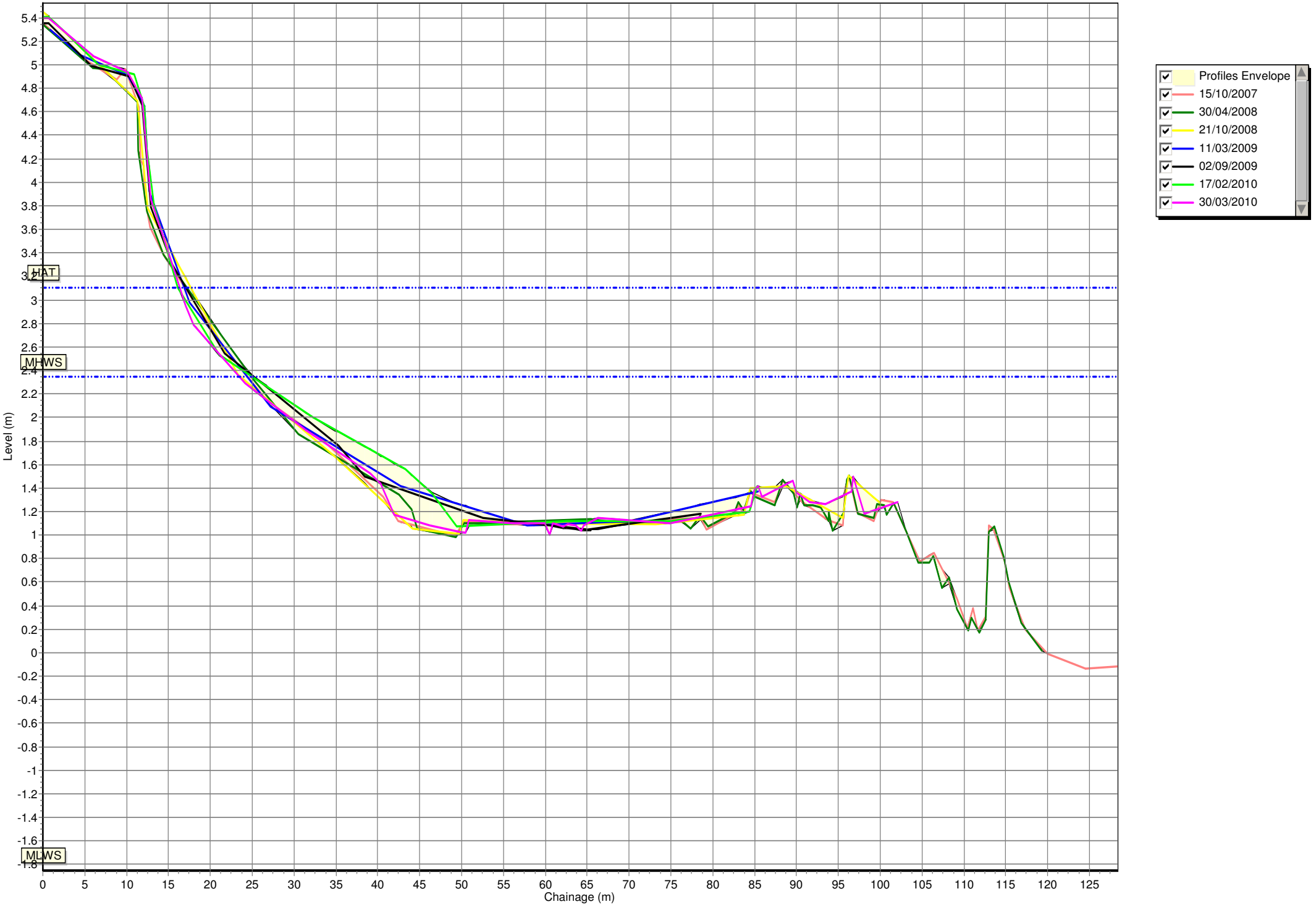
# Beach Profiles: 1aADC01



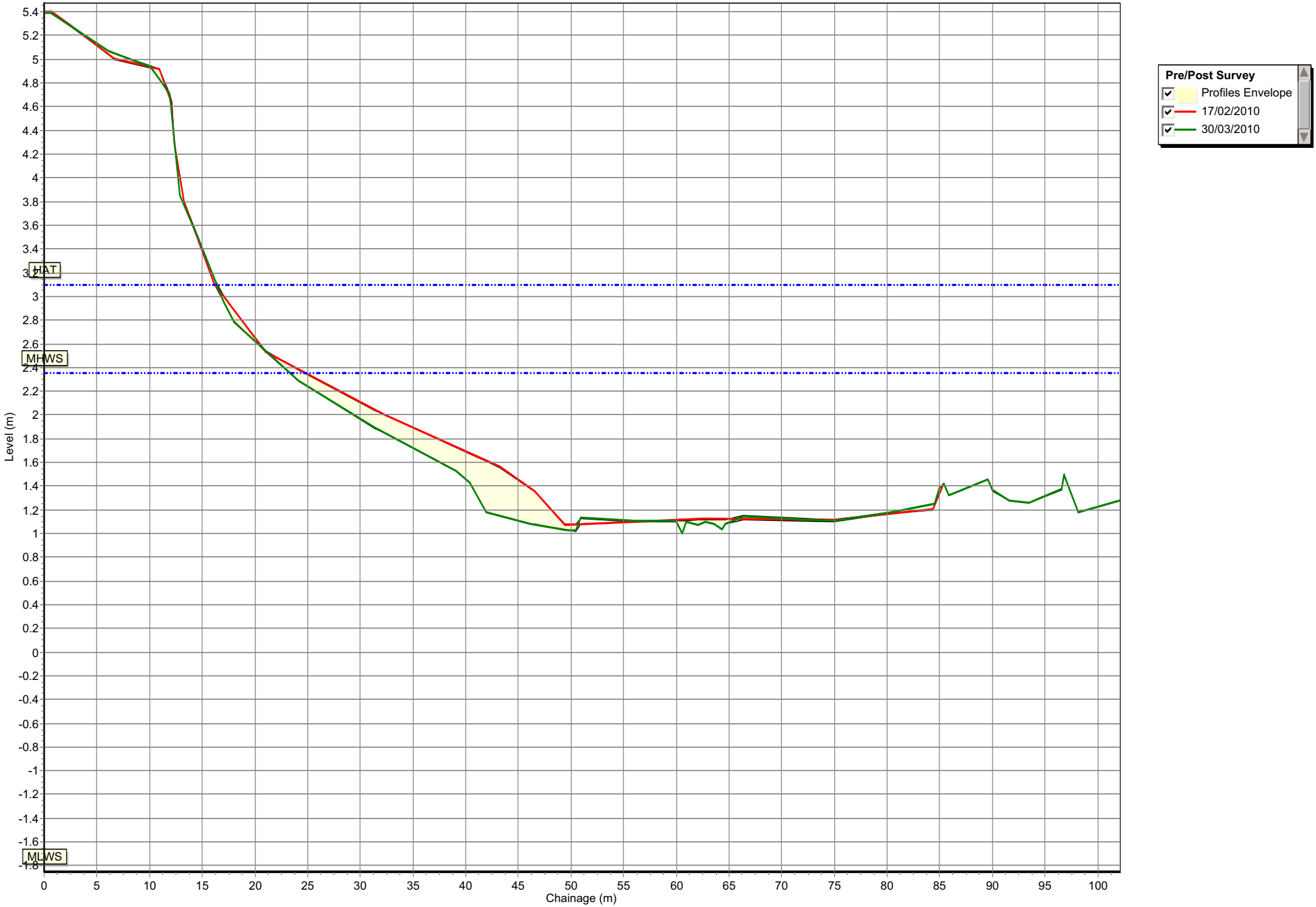
# Beach Profiles: 1aADC02



**Beach Profiles: 1aADC04A**

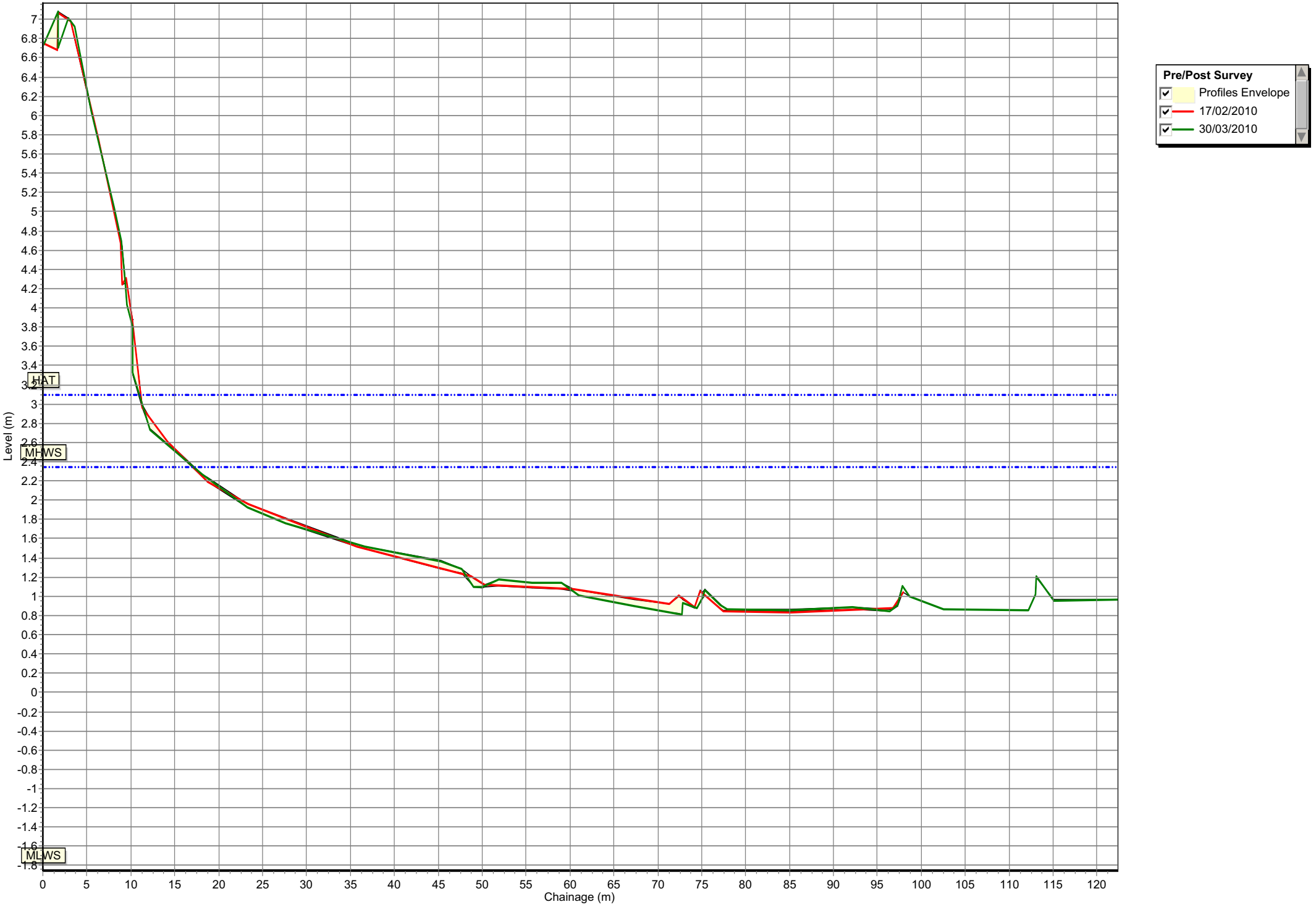


# Beach Profiles: 1aADC04A

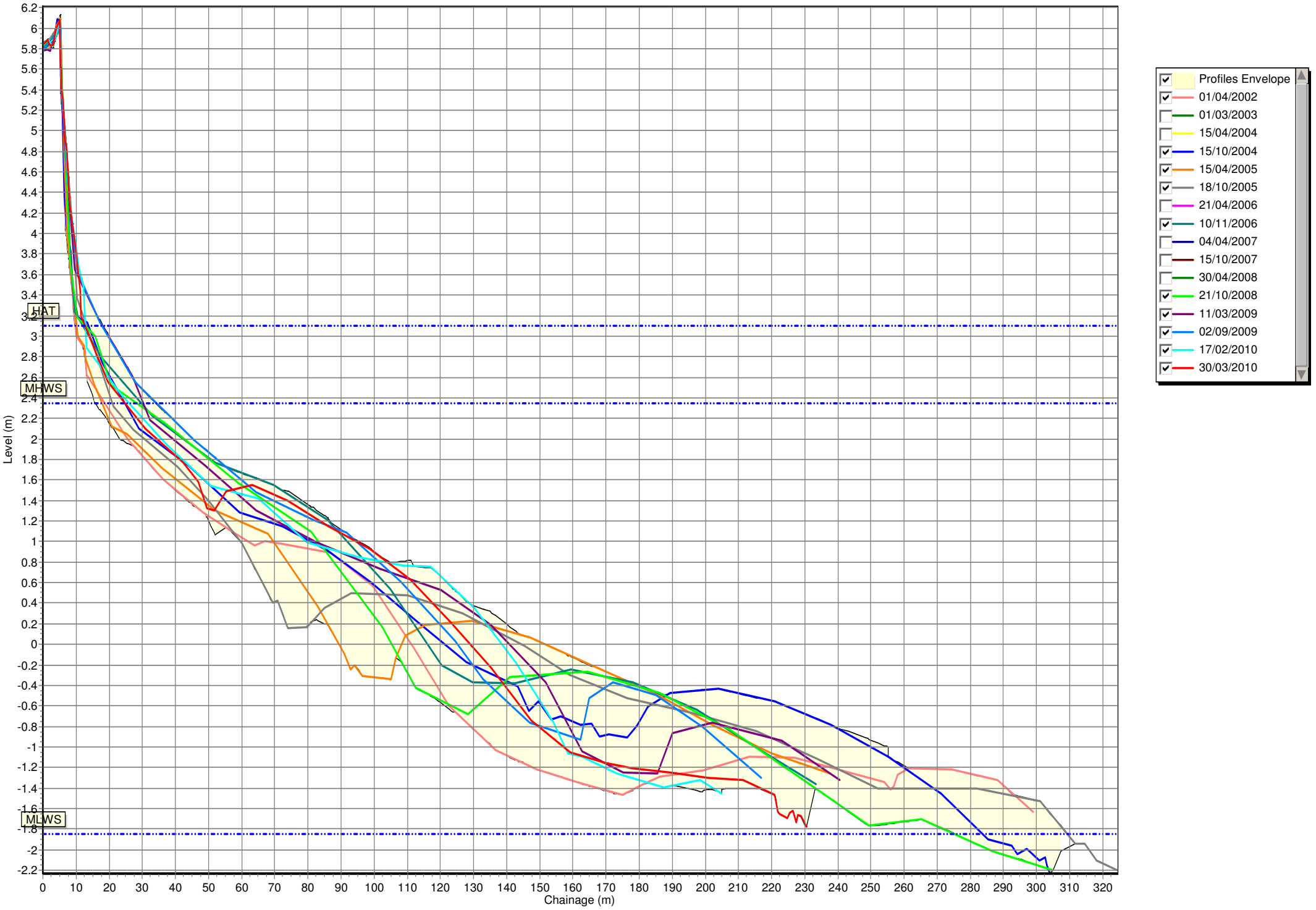


**Beach Profiles: 1aADC04B**

# Beach Profiles: 1aADC04B

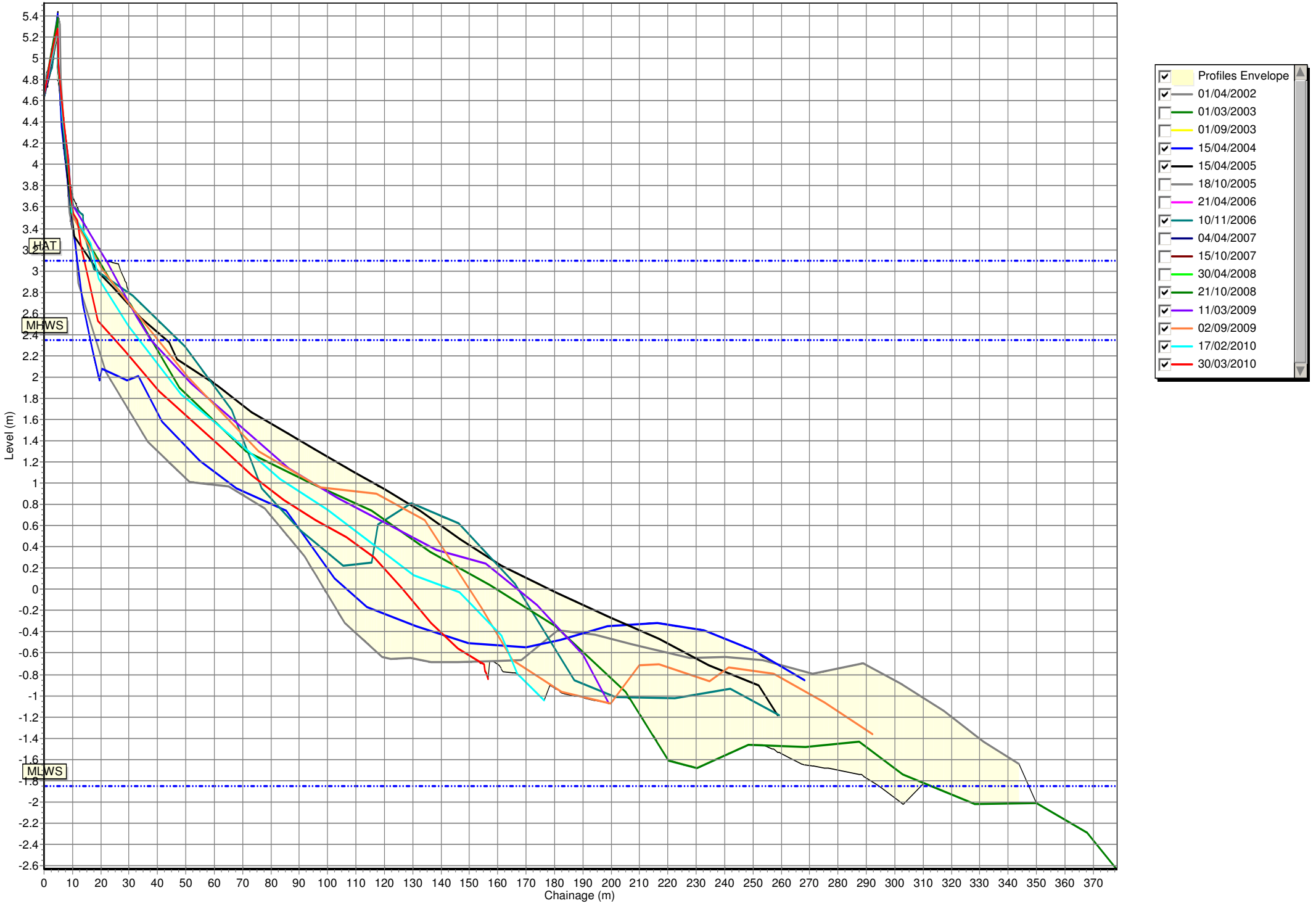


# Beach Profiles: 1aADC07



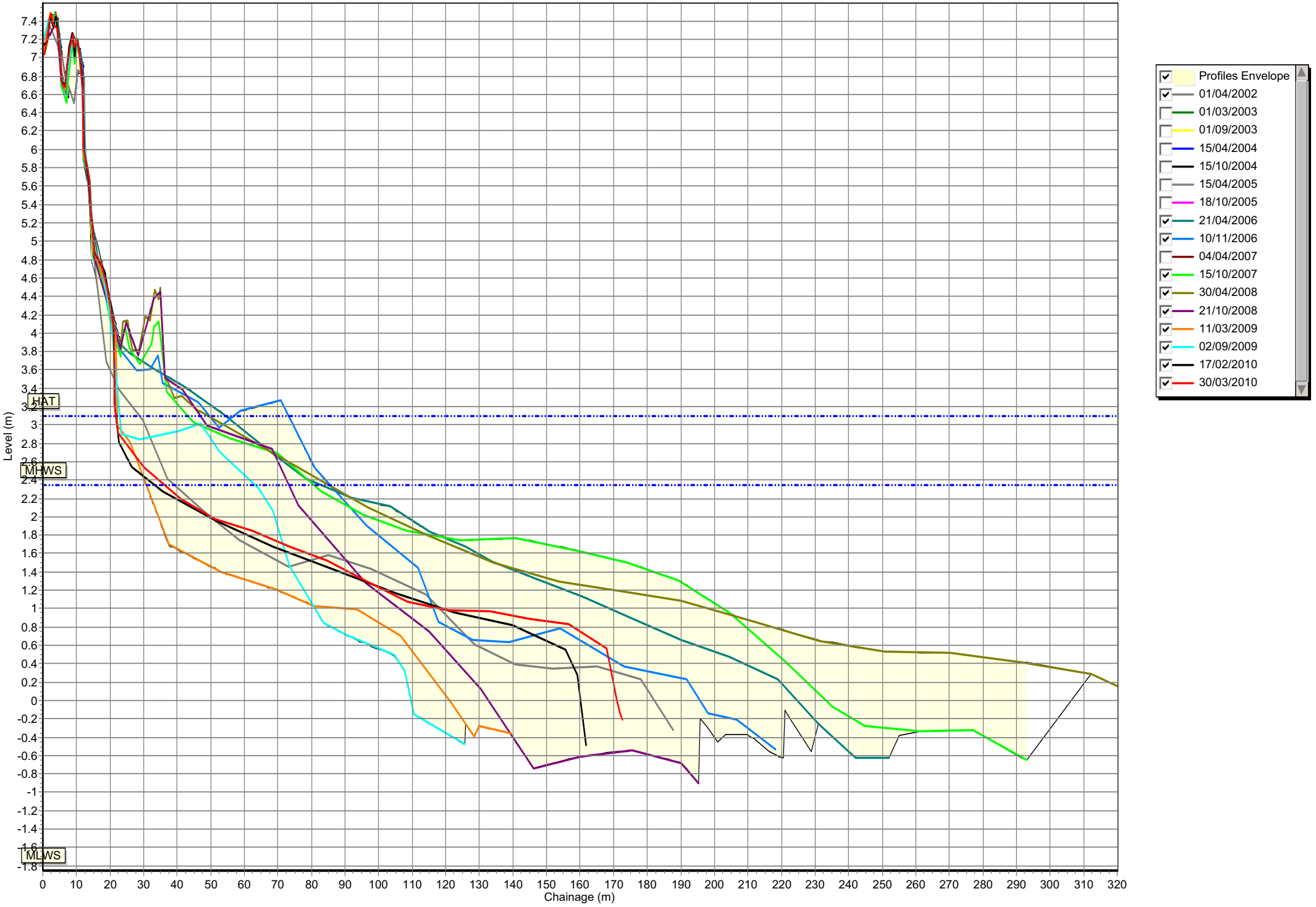
# Beach Profiles: 1aADC07

# Beach Profiles: 1aADC08

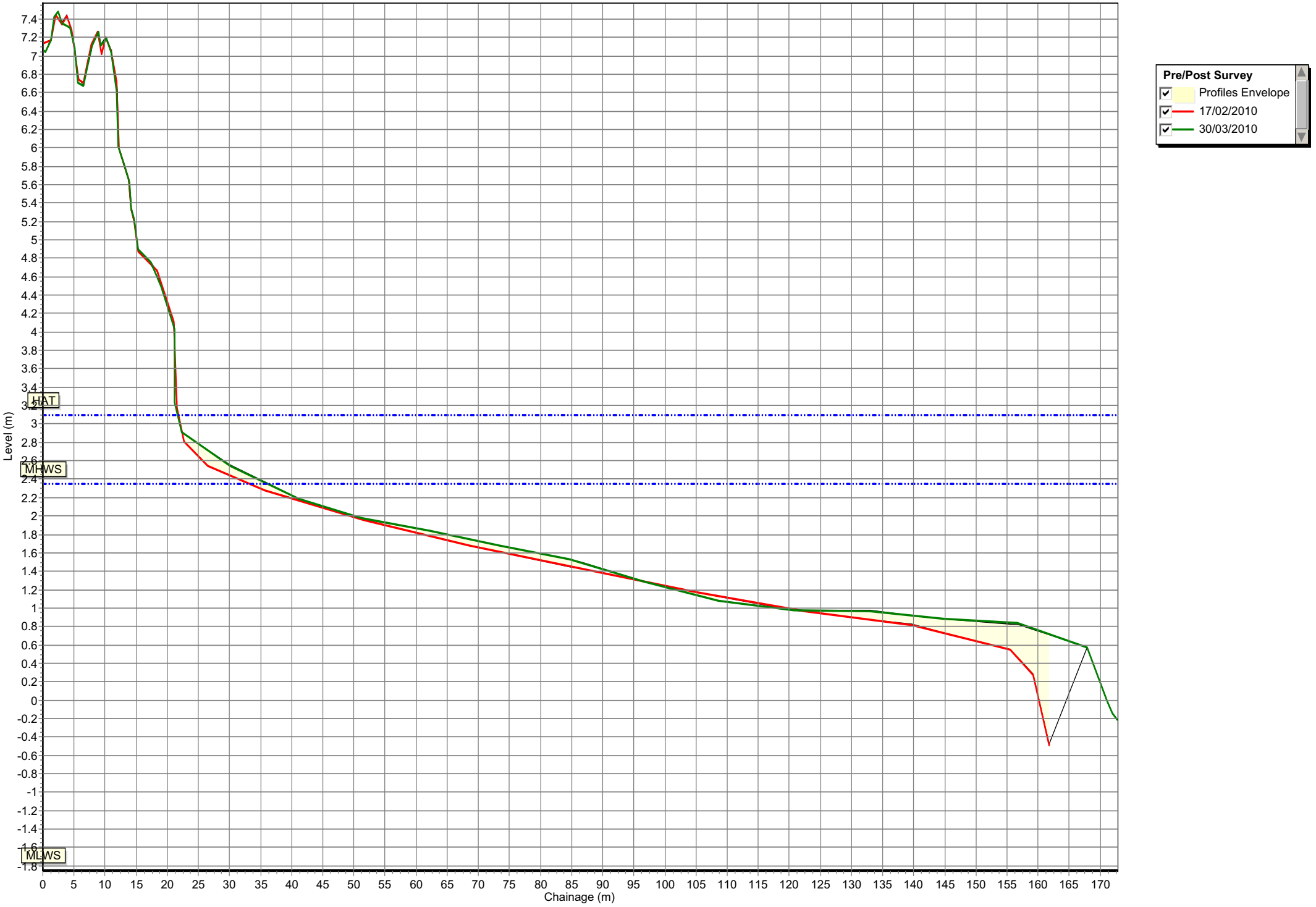


# Beach Profiles: 1aADC08

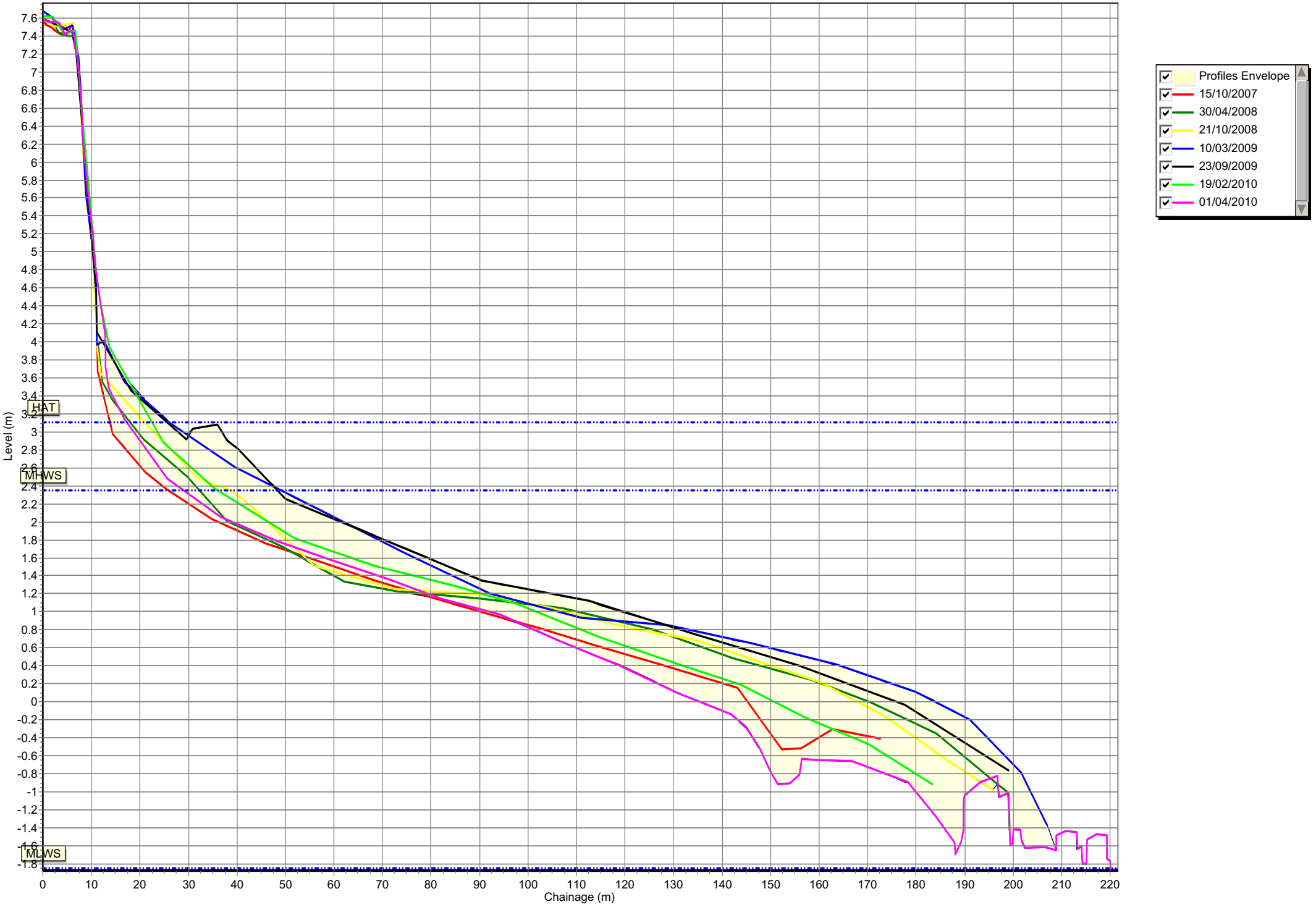
# Beach Profiles: 1aADC09



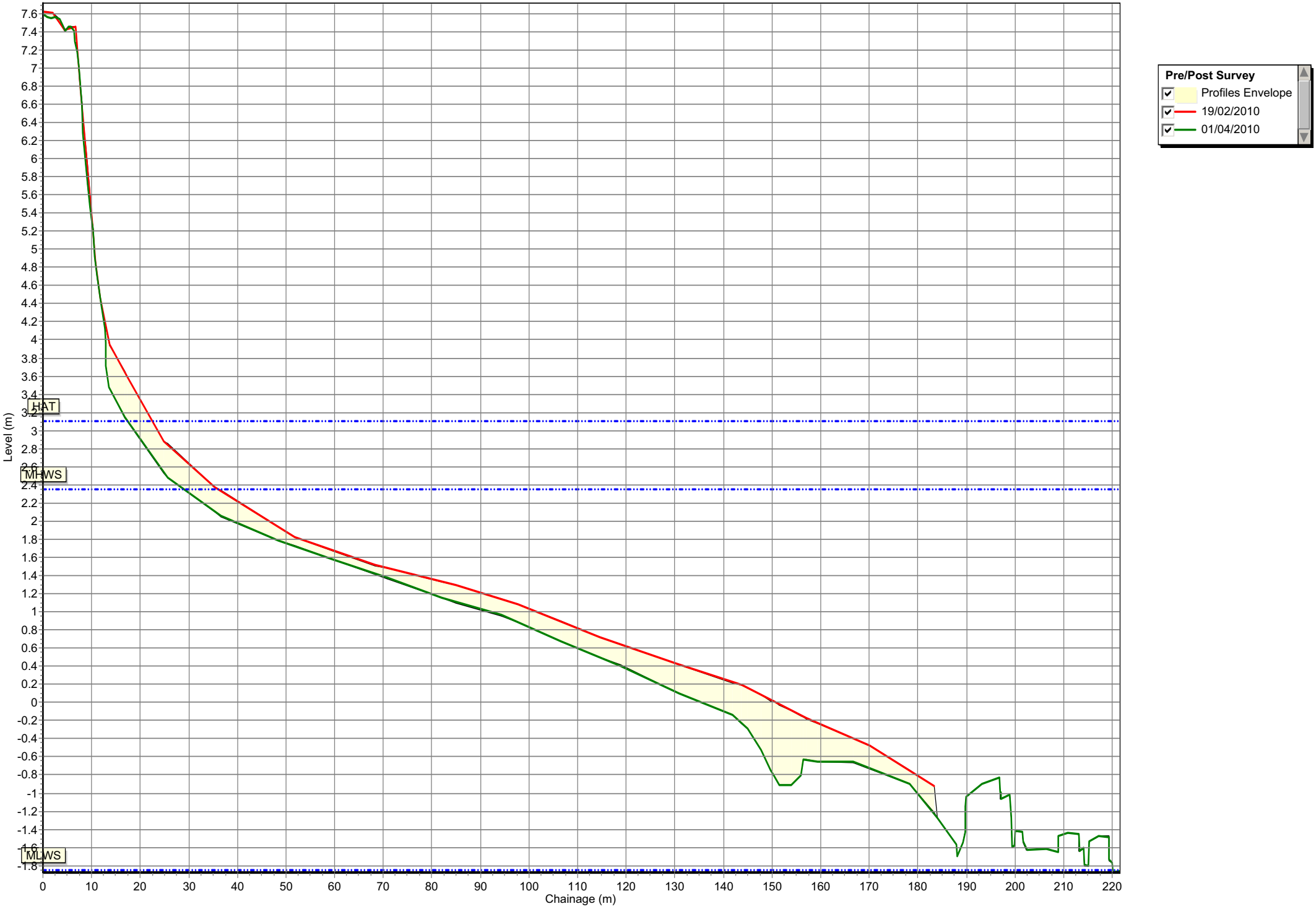
# Beach Profiles: 1aADC09



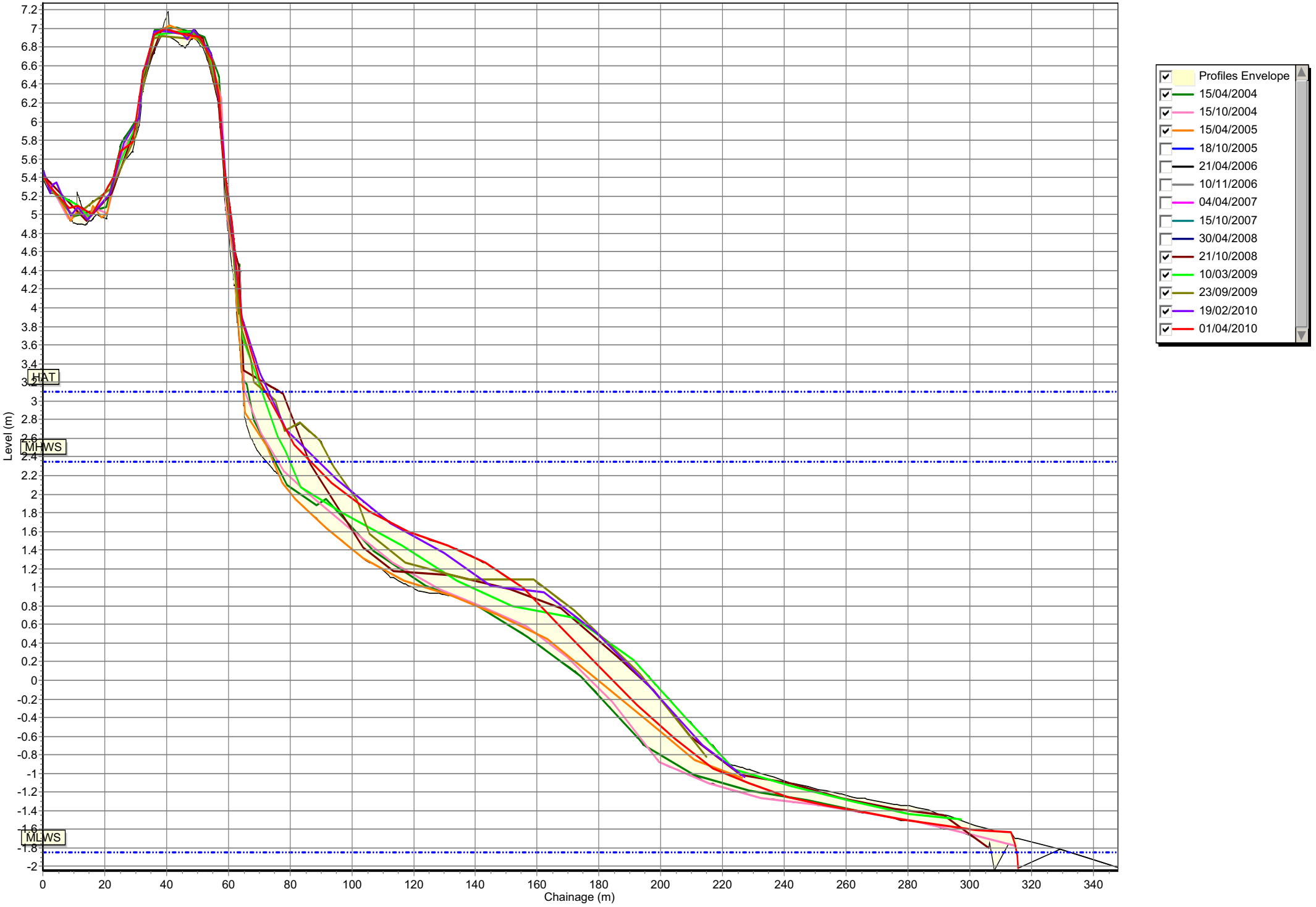
**Beach Profiles: 1aADC15A**



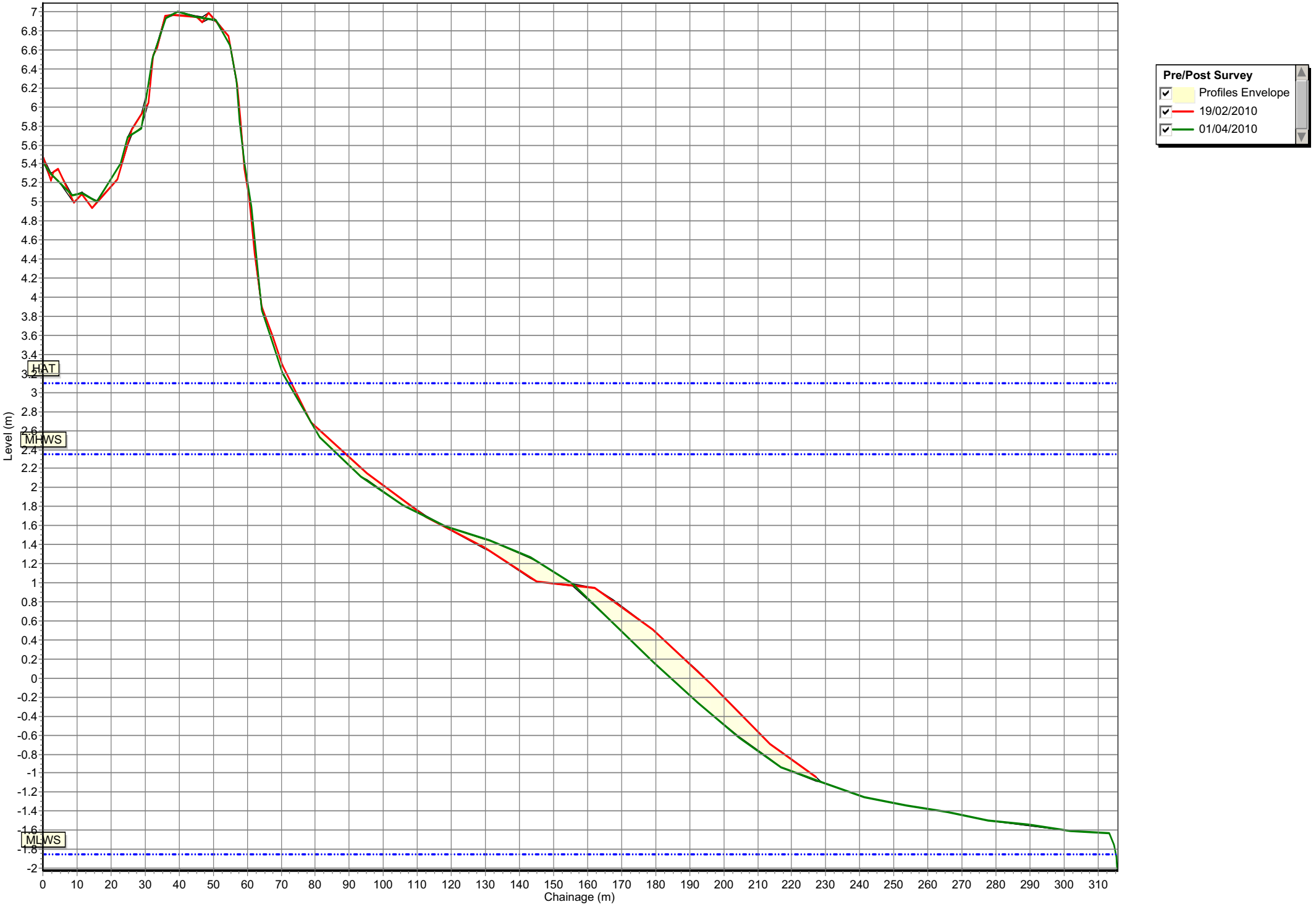
# Beach Profiles: 1aADC15A



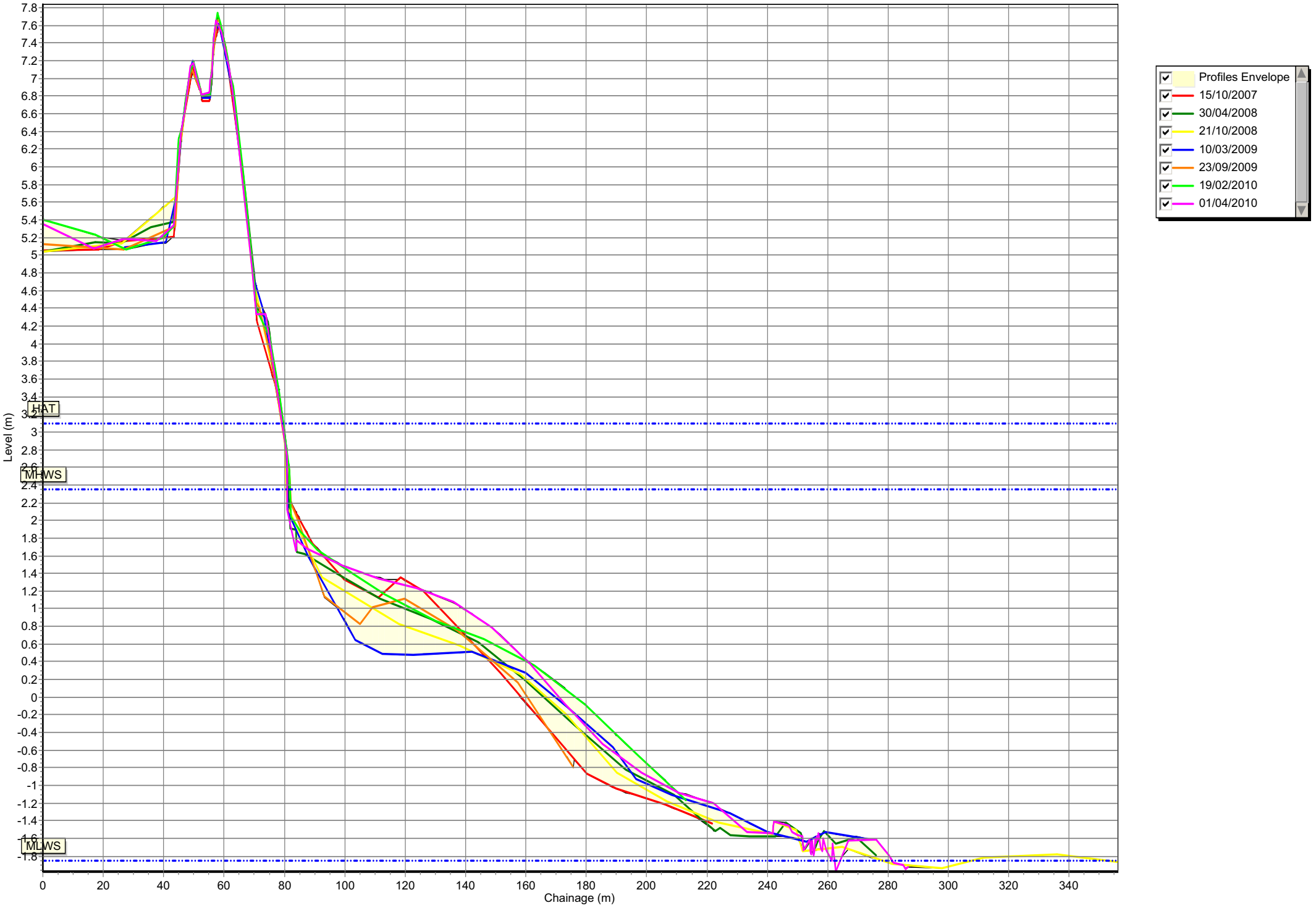
# Beach Profiles: 1aADC16



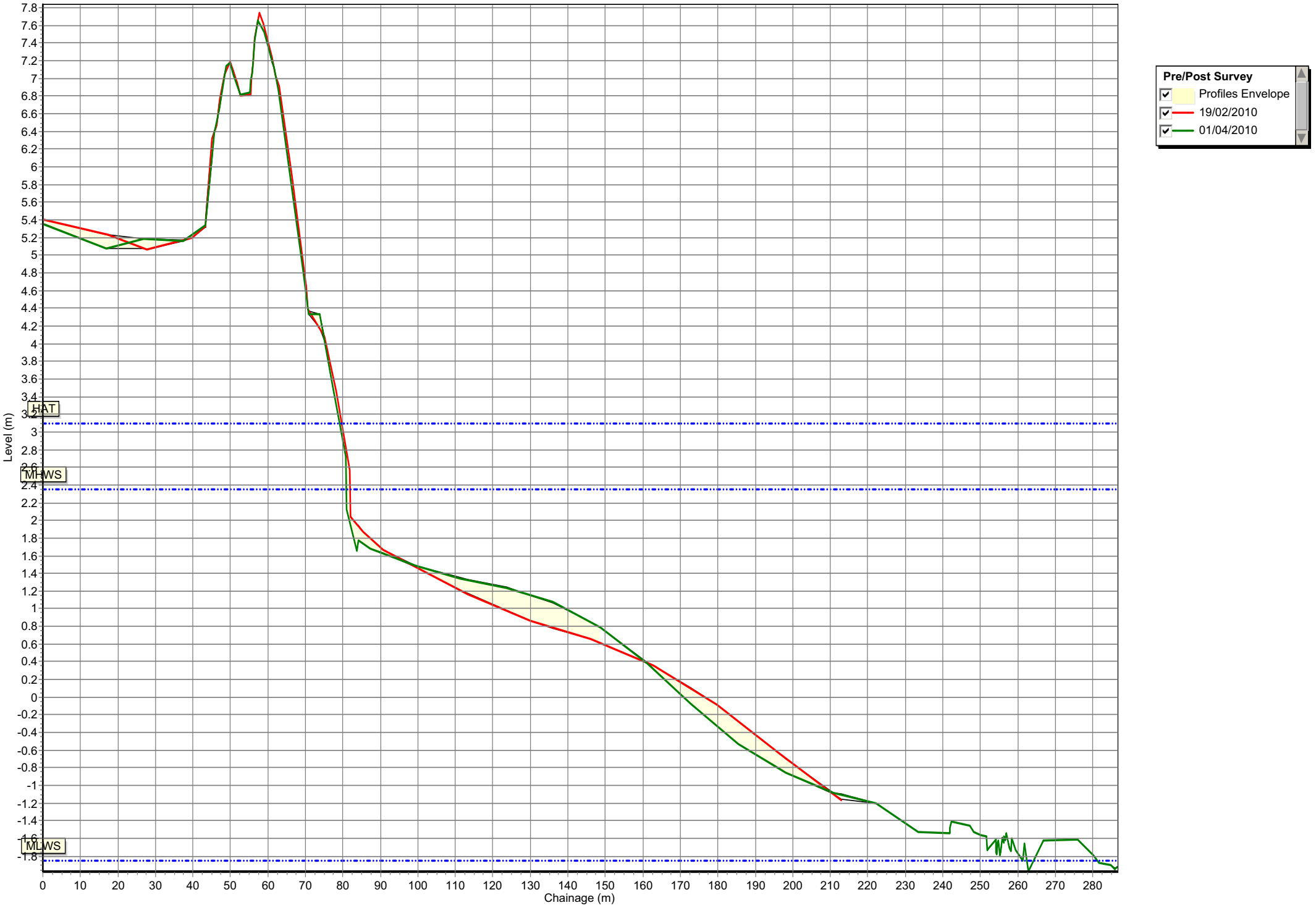
# Beach Profiles: 1aADC16



# Beach Profiles: 1aADC16A

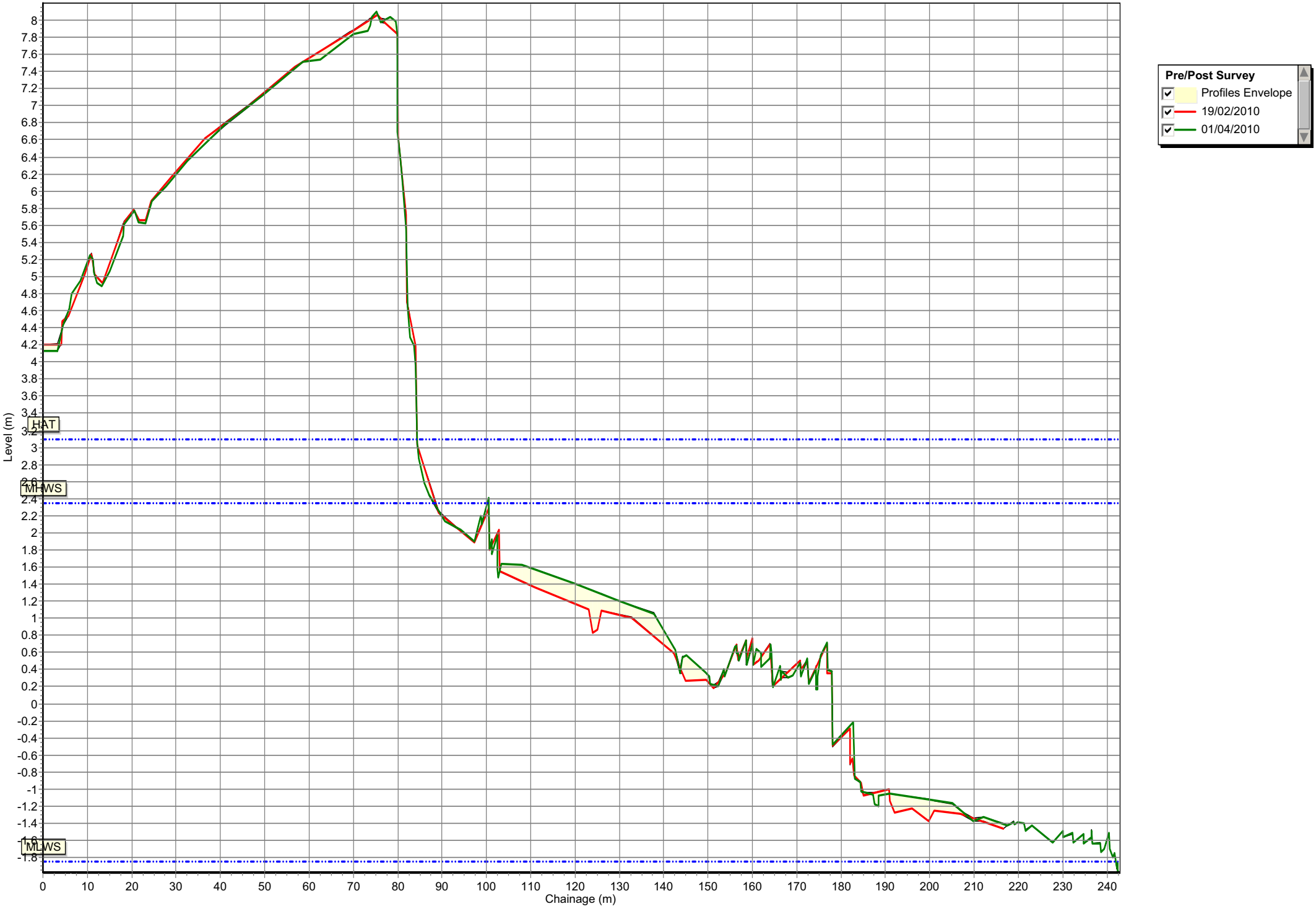


# Beach Profiles: 1aADC16A

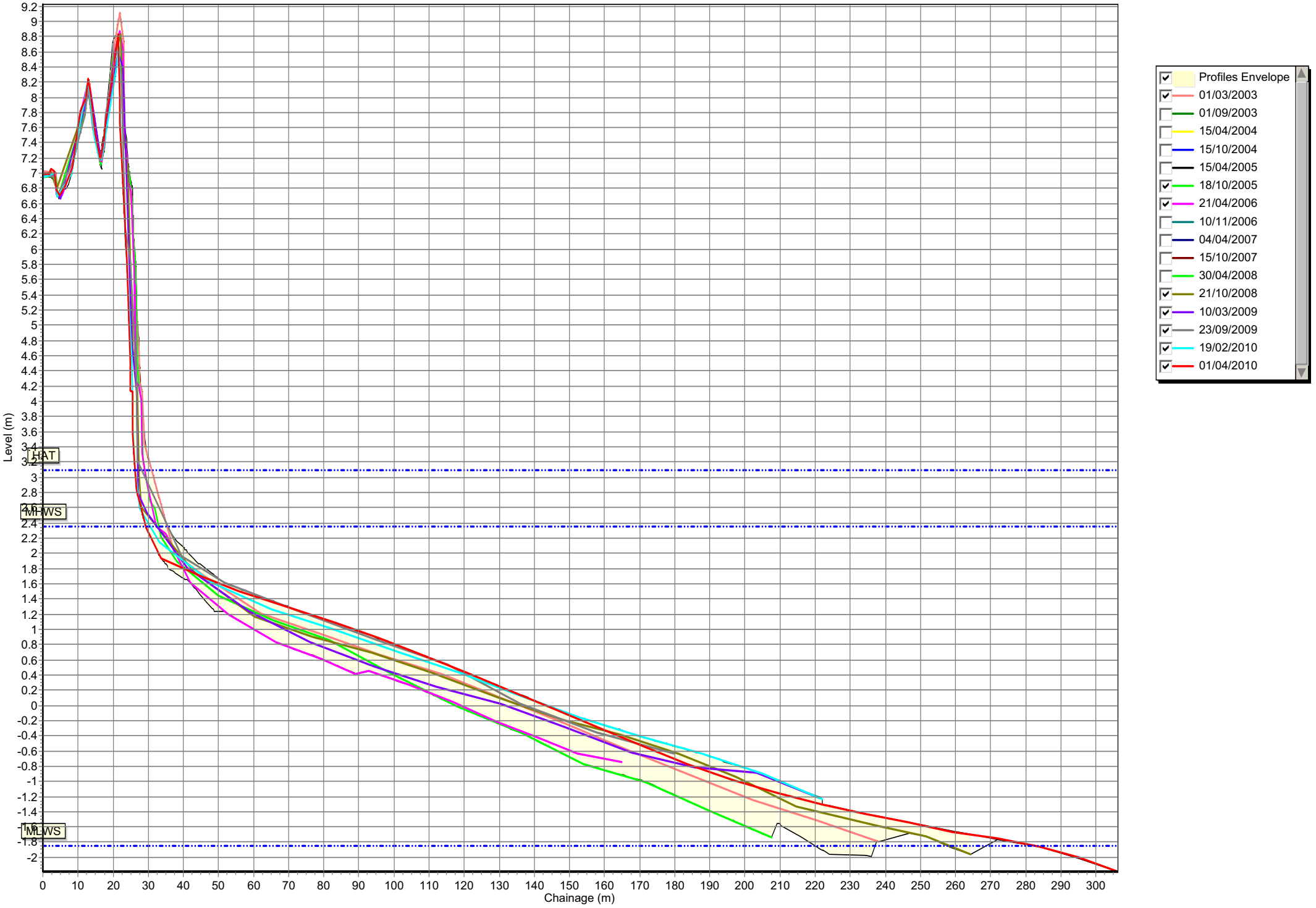


# Beach Profiles: 1aADC16B

# Beach Profiles: 1aADC16B

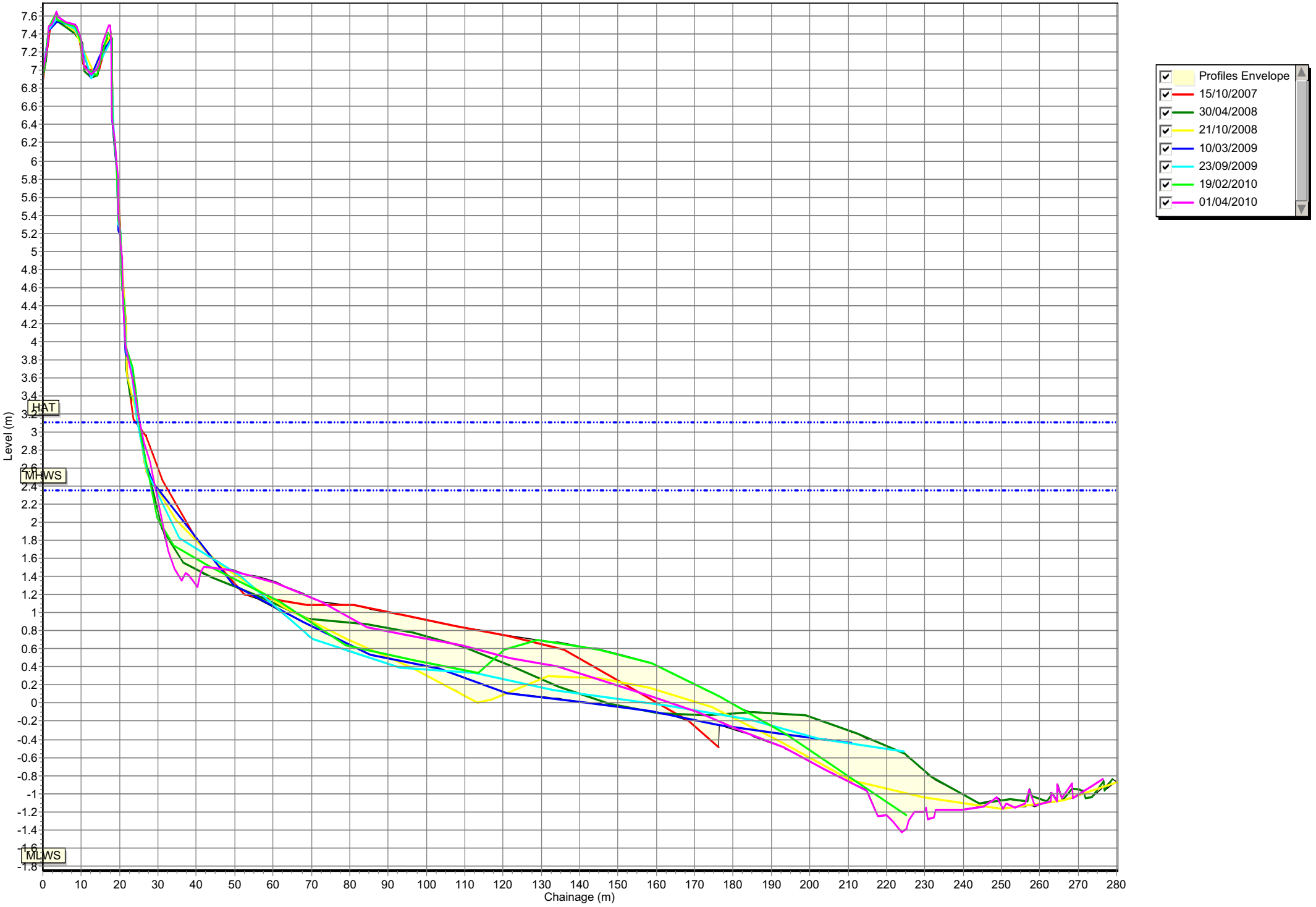


# Beach Profiles: 1aADC17



# Beach Profiles: 1aADC17

**Beach Profiles: 1aADC17A**

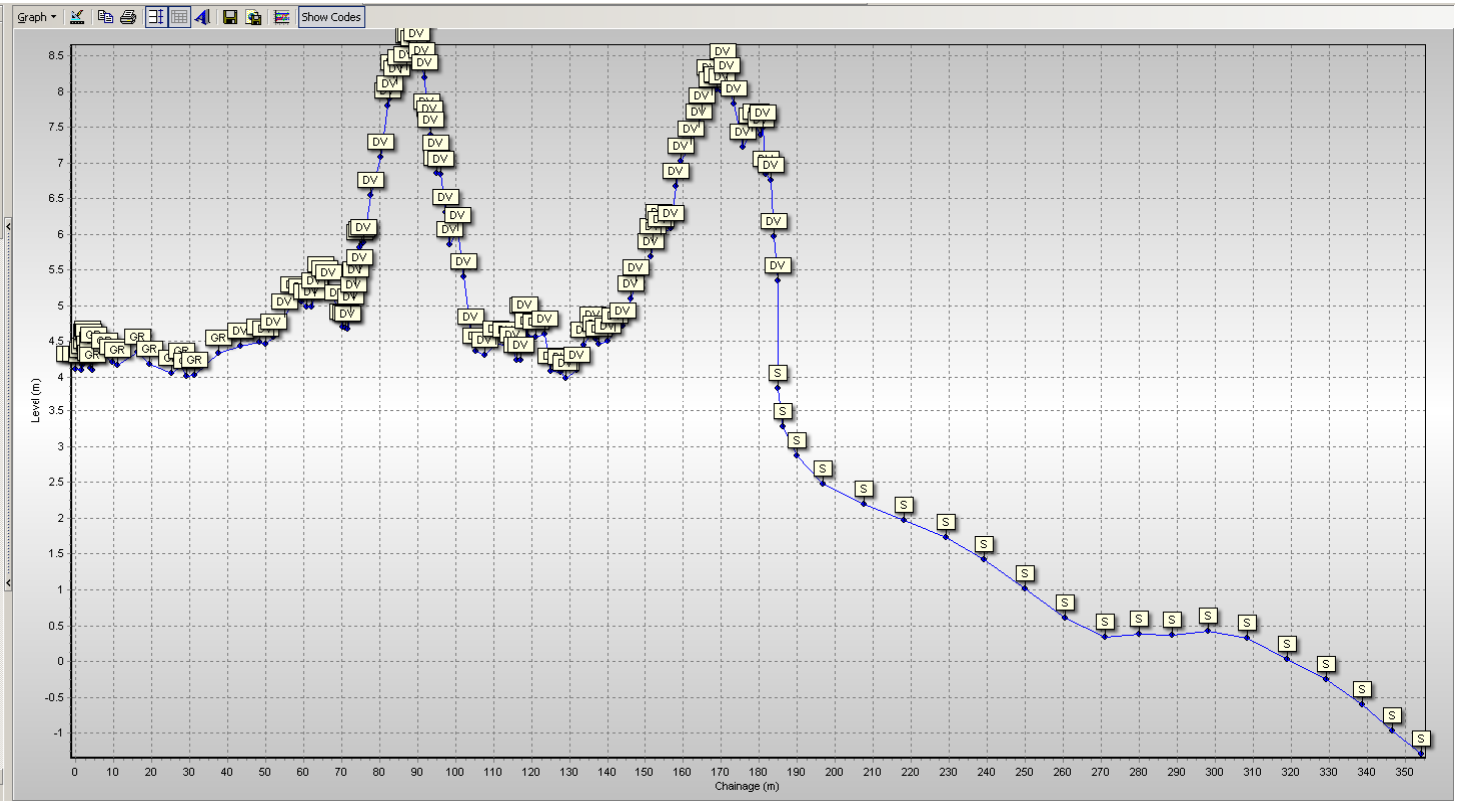


**Beach Profiles: 1aADC17A**

## Castle Morpeth

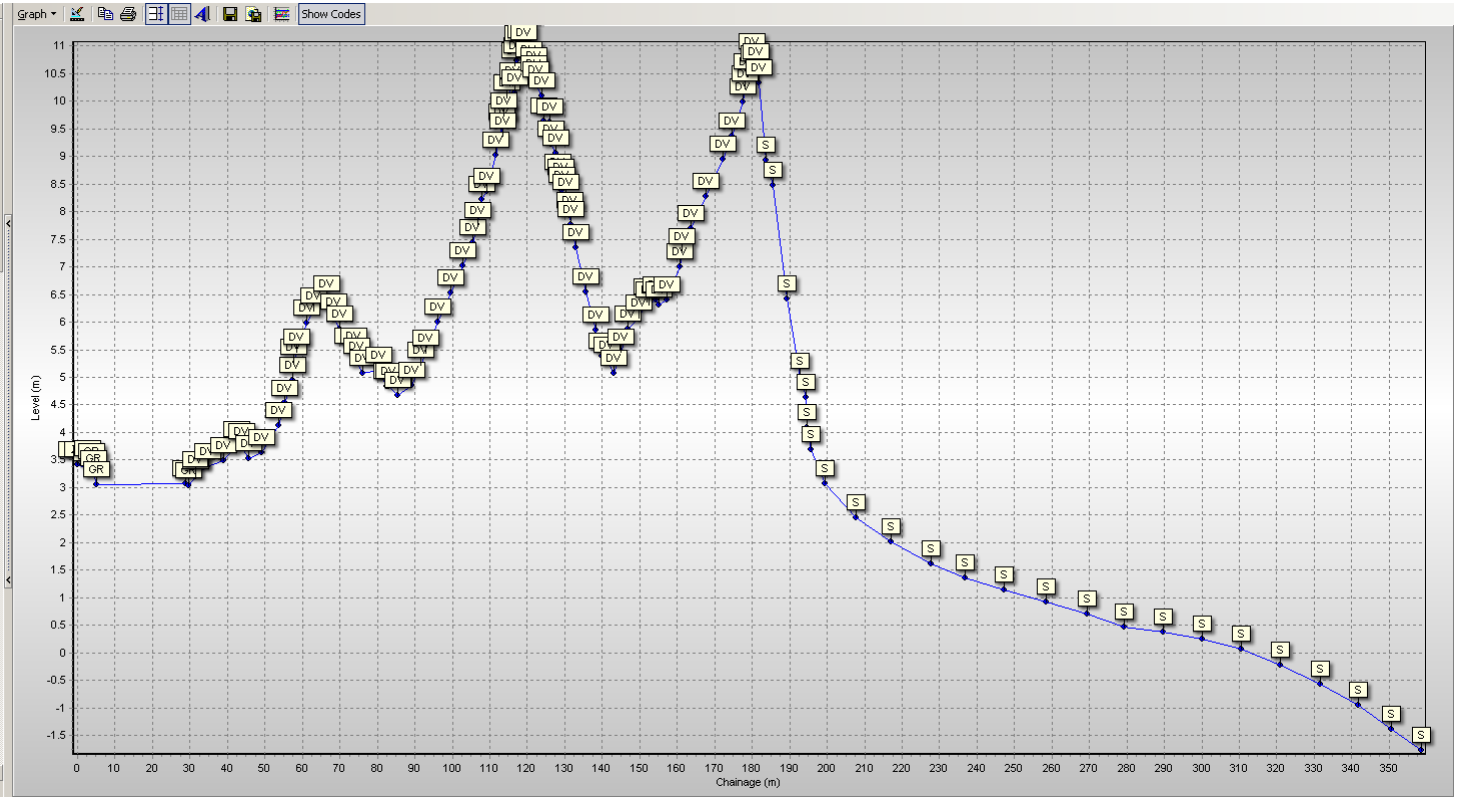
1aCMBC01 - 01/01/2010

| Chainage | Level | Code |
|---|---|---|
| 0.000 | 4.108 | |
| 0.047 | 4.108 | ZZ |
| 1.549 | 4.098 | ZZ |
| 1.715 | 4.161 | GR |
| 2.310 | 4.220 | GR |
| 2.793 | 4.290 | GR |
| 2.857 | 4.416 | GR |
| 3.111 | 4.468 | GR |
| 3.357 | 4.424 | GR |
| 3.735 | 4.257 | GR |
| 3.912 | 4.118 | GR |
| 4.451 | 4.309 | GR |
| 4.458 | 4.100 | GR |
| 4.714 | 4.372 | GR |
| 7.766 | 4.290 | GR |
| 9.647 | 4.203 | GR |
| 11.191 | 4.172 | GR |
| 16.203 | 4.351 | GR |
| 19.560 | 4.179 | GR |
| 25.335 | 4.061 | GR |
| 28.025 | 4.155 | GR |
| 29.363 | 4.016 | GR |
| 31.312 | 4.021 | GR |
| 37.580 | 4.333 | GR |
| 43.362 | 4.440 | GR |
| 43.447 | 4.434 | DV |
| 48.483 | 4.492 | DV |
| 49.985 | 4.465 | DV |
| 52.194 | 4.554 | DV |
| 55.095 | 4.837 | DV |
| 57.323 | 5.084 | DV |
| 59.622 | 5.049 | DV |
| 60.883 | 4.979 | DV |
| 62.108 | 4.981 | DV |
| 63.017 | 5.139 | DV |
| 64.625 | 5.362 | DV |
| 65.669 | 5.305 | DV |
| 66.732 | 5.249 | DV |
| 69.061 | 4.967 | DV |
| 70.404 | 4.704 | DV |
| 71.237 | 4.683 | DV |
| 71.679 | 4.670 | DV |



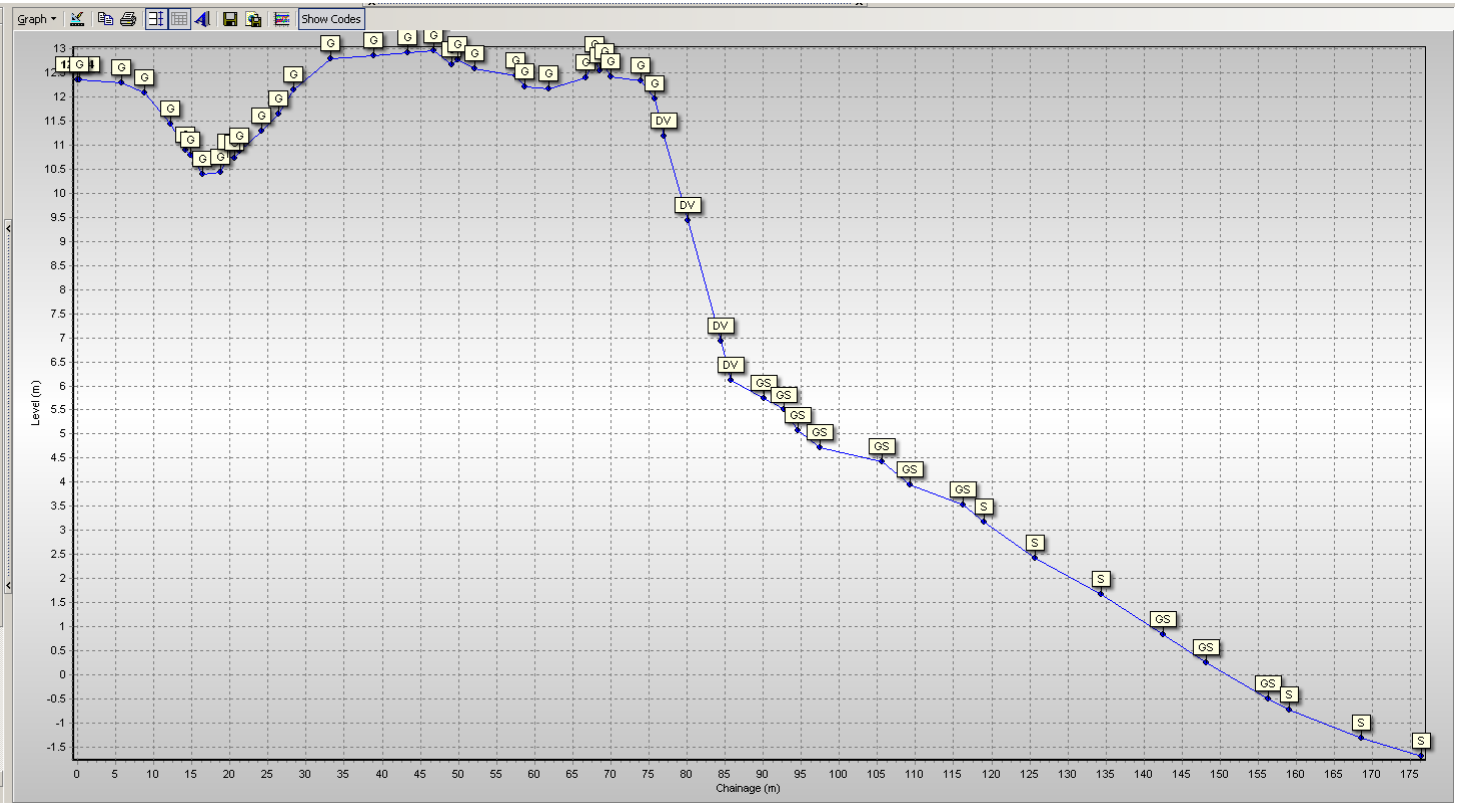
# 1aCMBC02 - 01/01/2010

| Chainage | Level | Code |
|---|---|---|
| 0.000 | 3.417 | |
| 0.036 | 3.417 | ZZ |
| 2.443 | 3.329 | ZZ |
| 2.571 | 3.427 | GR |
| 3.840 | 3.368 | GR |
| 4.307 | 3.253 | GR |
| 5.012 | 3.050 | GR |
| 28.826 | 3.061 | GR |
| 29.526 | 3.033 | GR |
| 31.542 | 3.196 | GR |
| 31.591 | 3.223 | DV |
| 34.631 | 3.375 | DV |
| 39.028 | 3.477 | DV |
| 42.427 | 3.767 | DV |
| 43.751 | 3.733 | DV |
| 45.712 | 3.524 | DV |
| 49.003 | 3.620 | DV |
| 53.756 | 4.119 | DV |
| 55.302 | 4.544 | DV |
| 57.275 | 4.950 | DV |
| 57.760 | 5.275 | DV |
| 58.546 | 5.467 | DV |
| 61.274 | 5.990 | DV |
| 63.114 | 6.201 | DV |
| 66.417 | 6.416 | DV |
| 68.328 | 6.091 | DV |
| 69.886 | 5.888 | DV |
| 71.988 | 5.483 | DV |
| 73.714 | 5.478 | DV |
| 74.413 | 5.292 | DV |
| 76.177 | 5.085 | DV |
| 80.491 | 5.131 | DV |
| 82.393 | 4.850 | DV |
| 83.028 | 4.847 | DV |
| 85.383 | 4.678 | DV |
| 89.264 | 4.859 | DV |
| 91.475 | 5.217 | DV |
| 93.025 | 5.450 | DV |
| 96.065 | 6.006 | DV |
| 99.684 | 6.539 | DV |
| 102.714 | 7.027 | DV |
| 105.589 | 7.439 | DV |



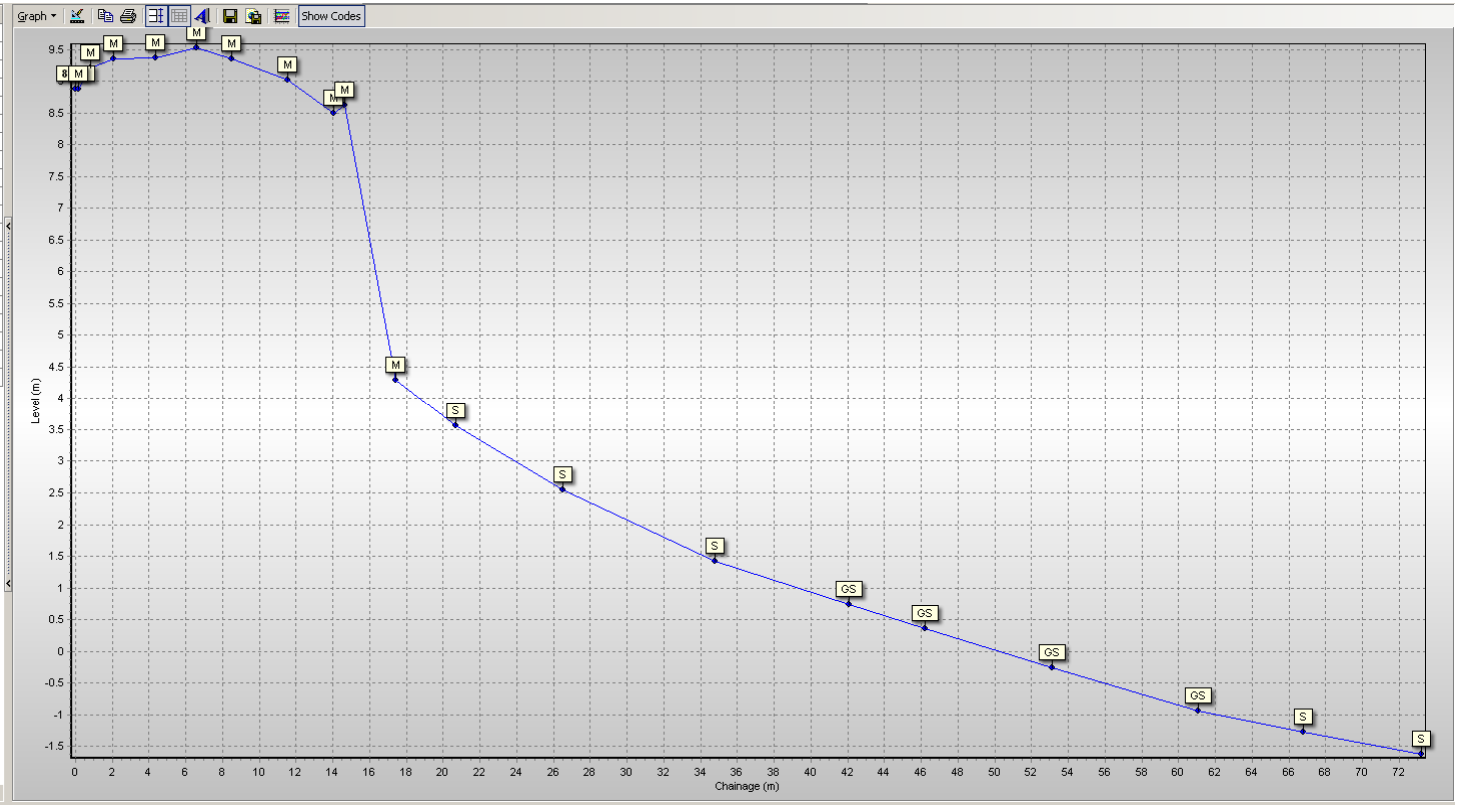
# 1aCMBC03A - 15/03/2010

| Chainage | Level | Code |
|---|---|---|
| 0.000 | 12.354 | |
| 0.203 | 12.354 | G |
| 5.737 | 12.296 | G |
| 8.797 | 12.095 | G |
| 12.199 | 11.440 | G |
| 14.183 | 10.892 | G |
| 14.809 | 10.788 | G |
| 16.383 | 10.393 | G |
| 18.829 | 10.436 | G |
| 19.711 | 10.748 | G |
| 20.613 | 10.736 | G |
| 21.343 | 10.881 | G |
| 24.173 | 11.301 | G |
| 26.451 | 11.660 | G |
| 28.373 | 12.143 | G |
| 33.287 | 12.793 | G |
| 38.910 | 12.851 | G |
| 43.396 | 12.925 | G |
| 46.789 | 12.963 | G |
| 49.131 | 12.670 | G |
| 49.956 | 12.770 | G |
| 52.168 | 12.582 | G |
| 57.560 | 12.439 | G |
| 58.731 | 12.206 | G |
| 61.915 | 12.174 | G |
| 66.699 | 12.391 | G |
| 67.866 | 12.768 | G |
| 68.588 | 12.552 | G |
| 69.171 | 12.627 | G |
| 70.032 | 12.417 | G |
| 73.897 | 12.343 | G |
| 75.788 | 11.961 | G |
| 76.965 | 11.201 | DV |
| 80.068 | 9.436 | DV |
| 84.512 | 6.944 | DV |
| 85.829 | 6.127 | DV |
| 90.168 | 5.745 | GS |
| 92.697 | 5.503 | GS |
| 94.582 | 5.059 | GS |
| 97.412 | 4.716 | GS |
| 105.573 | 4.417 | GS |
| 109.285 | 3.946 | GS |

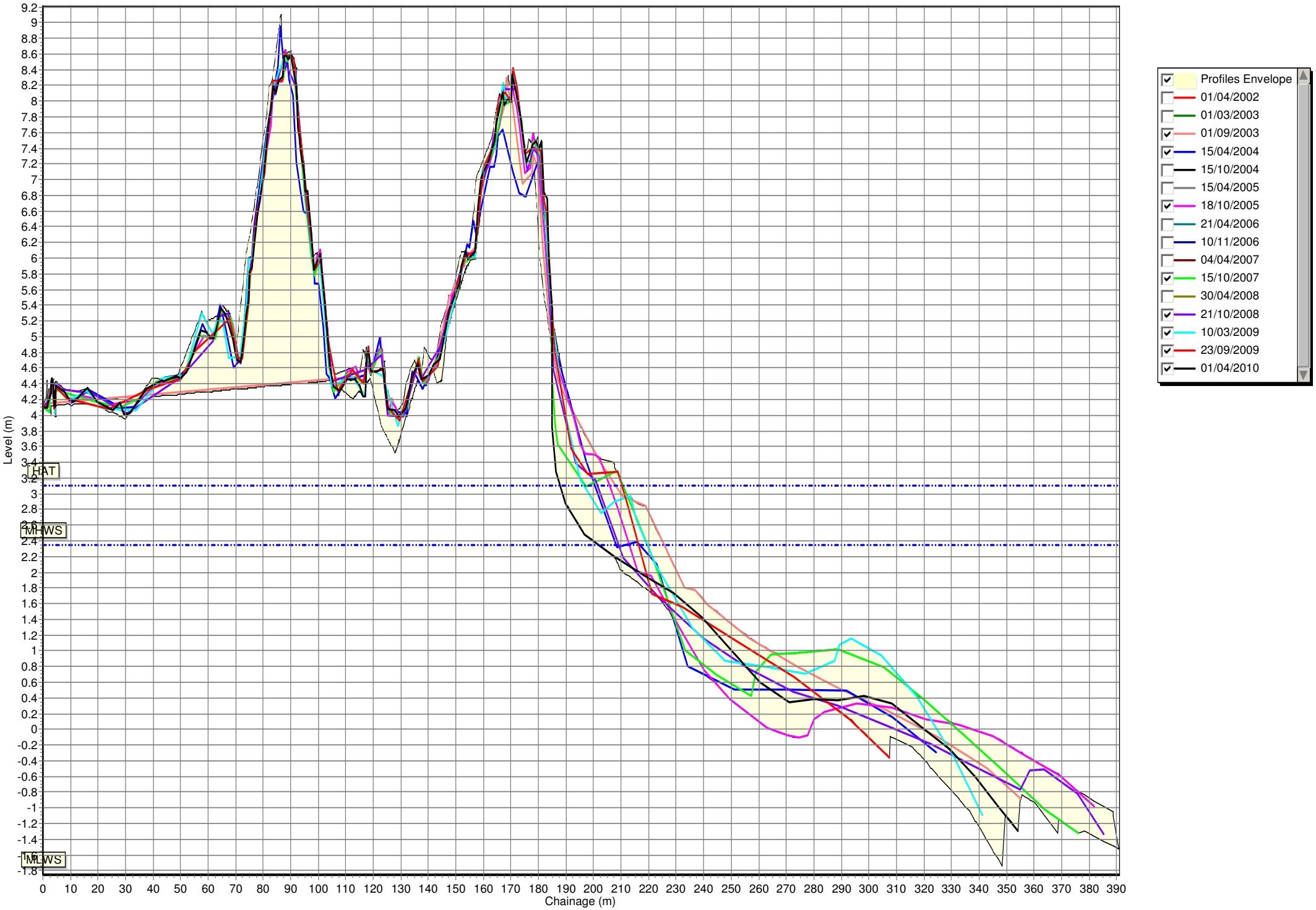


# 1aCMBC03B - 15/03/2010

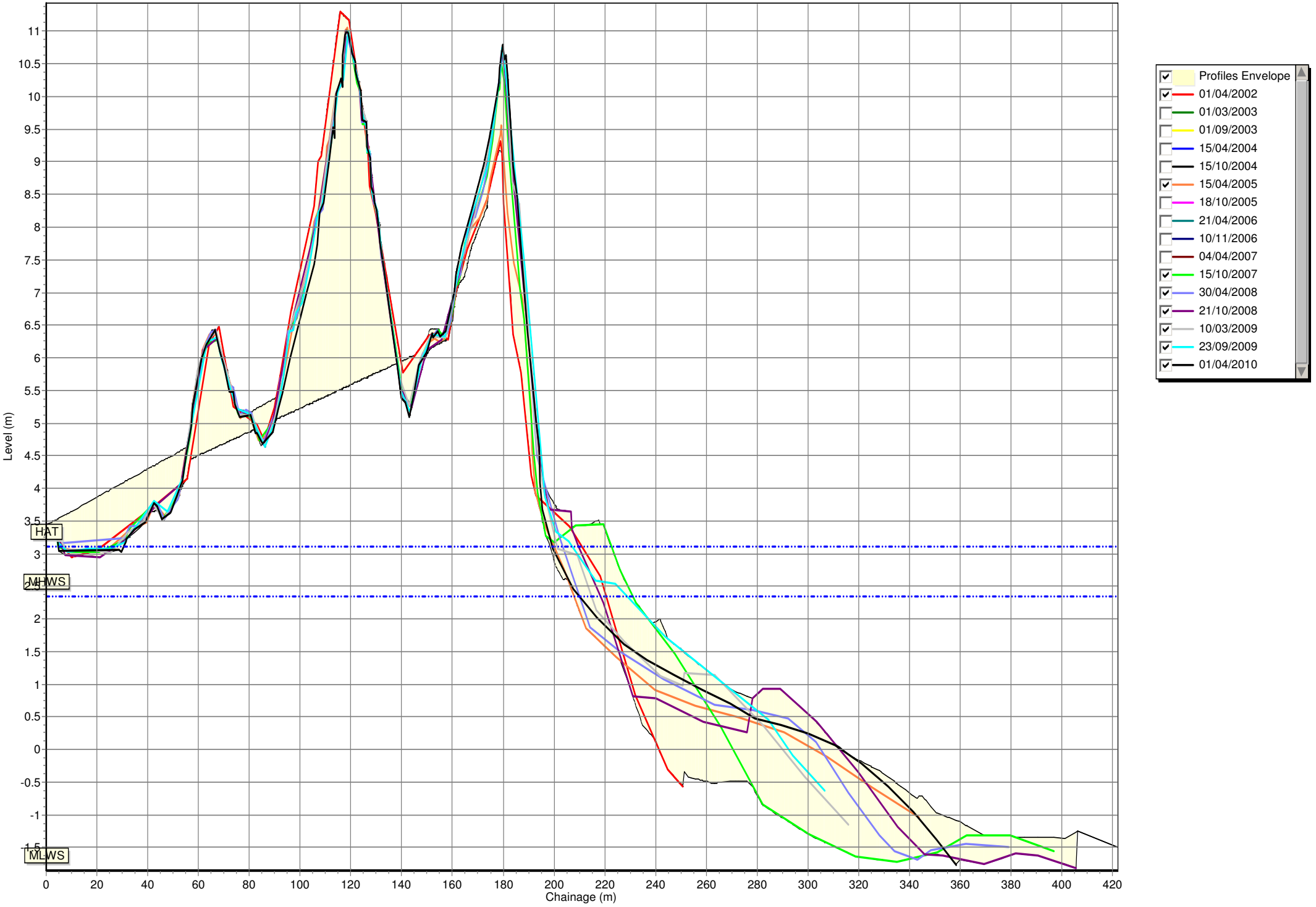
| Chainage | Level | Code |
|---|---|---|
| 0.000 | 8.873 | |
| 0.158 | 8.873 | M |
| 0.820 | 9.215 | M |
| 2.060 | 9.351 | M |
| 4.369 | 9.363 | M |
| 6.562 | 9.527 | M |
| 8.502 | 9.360 | M |
| 11.525 | 9.021 | M |
| 14.029 | 8.499 | M |
| 14.643 | 8.628 | M |
| 17.429 | 4.289 | M |
| 20.691 | 3.561 | S |
| 26.518 | 2.553 | S |
| 34.800 | 1.416 | S |
| 42.093 | 0.732 | GS |
| 46.219 | 0.363 | GS |
| 53.122 | -0.262 | GS |
| 61.064 | -0.938 | GS |
| 66.769 | -1.278 | S |
| 73.199 | -1.624 | S |



# Beach Profiles: 1aCMBC01

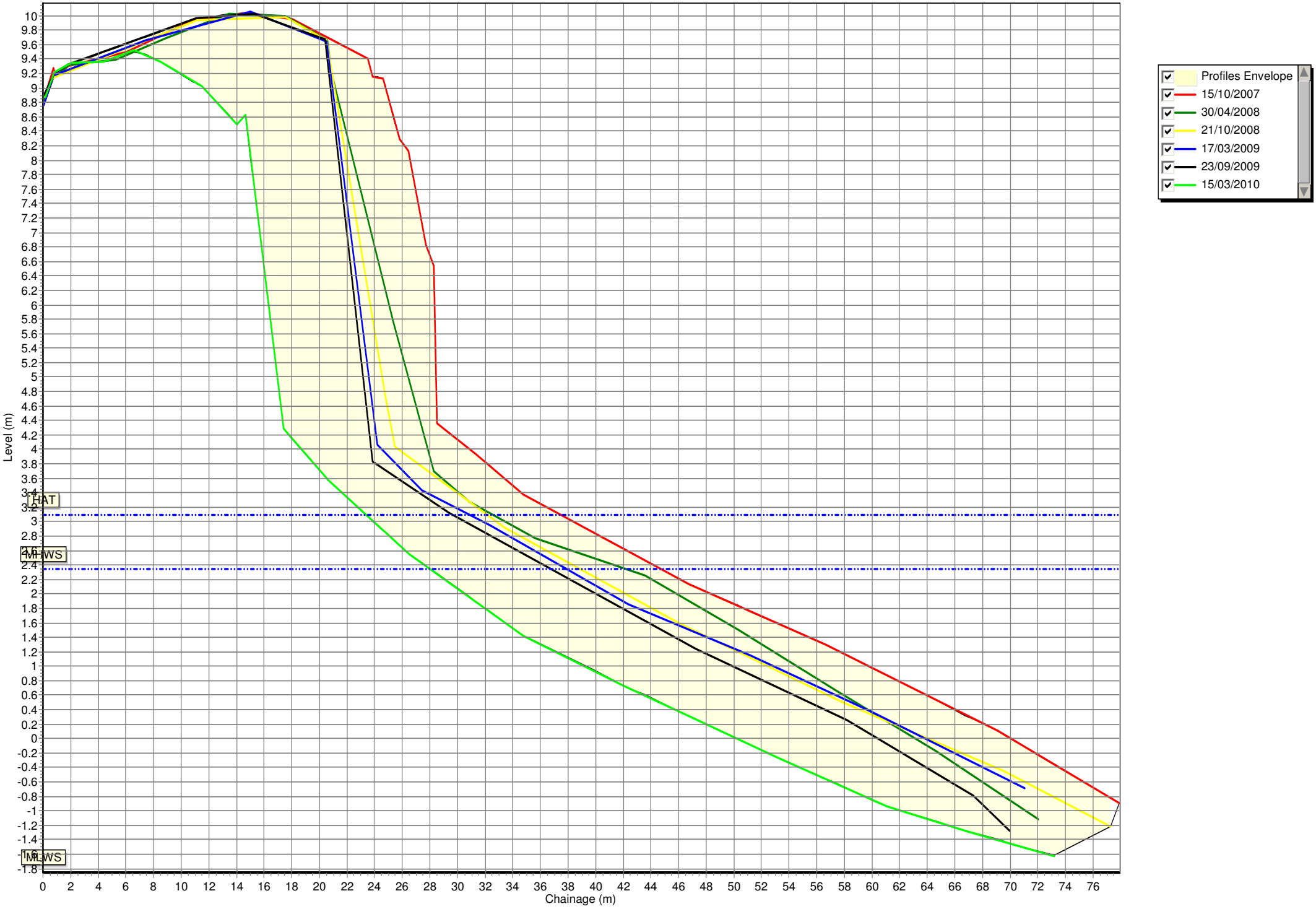


# Beach Profiles: 1aCMBC02



# Beach Profiles: 1aCMBC03A

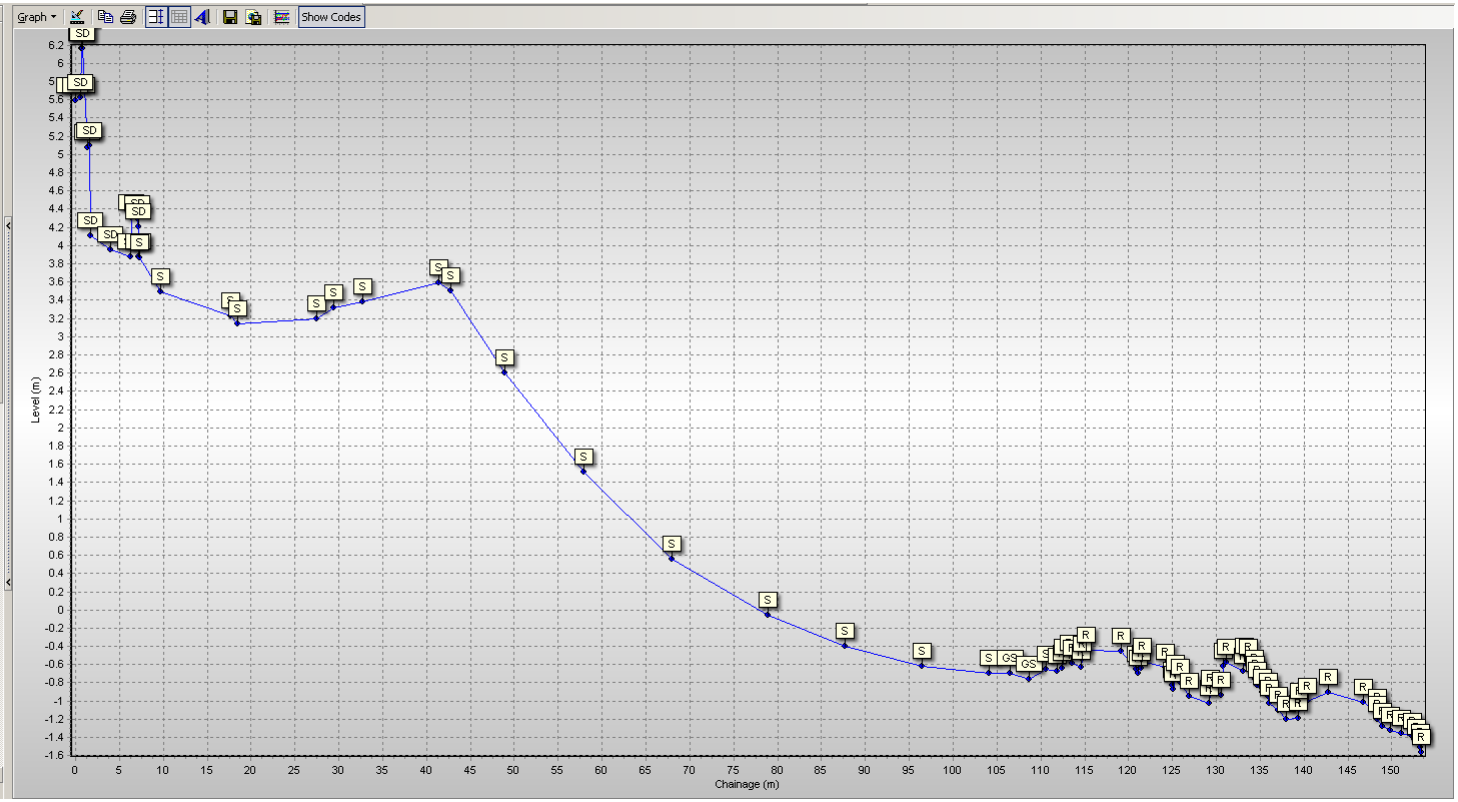
# Beach Profiles: 1aCMBC03B



## Wansbeck

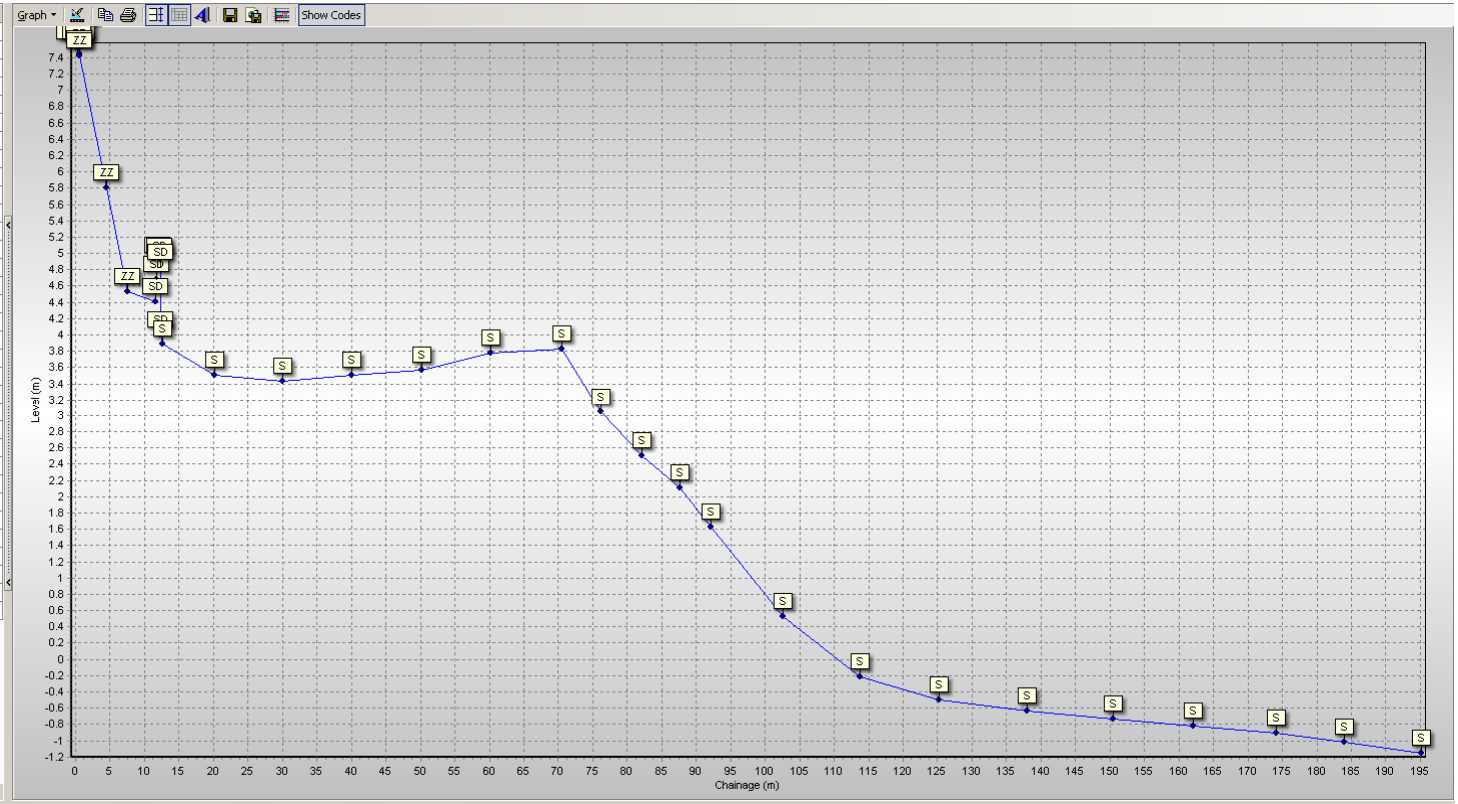
1aWDC05A - 14/04/2010

| Chainage | Level | Code |
|---|---|---|
| 0.000 | 5.589 | |
| 0.003 | 5.589 | SD |
| 0.592 | 5.622 | SD |
| 0.655 | 6.163 | SD |
| 0.841 | 6.160 | SD |
| 1.393 | 5.078 | SD |
| 1.612 | 5.093 | SD |
| 1.655 | 4.113 | SD |
| 4.008 | 3.958 | SD |
| 6.271 | 3.873 | SD |
| 6.354 | 4.309 | SD |
| 7.080 | 4.296 | SD |
| 7.156 | 4.204 | SD |
| 7.162 | 3.873 | SD |
| 7.300 | 3.861 | S |
| 9.724 | 3.489 | S |
| 17.713 | 3.226 | S |
| 18.445 | 3.143 | S |
| 27.480 | 3.194 | S |
| 29.397 | 3.315 | S |
| 32.717 | 3.384 | S |
| 41.379 | 3.587 | S |
| 42.818 | 3.506 | S |
| 48.873 | 2.601 | S |
| 57.928 | 1.516 | S |
| 67.997 | 0.555 | S |
| 78.919 | -0.053 | S |
| 87.671 | -0.399 | S |
| 96.422 | -0.618 | S |
| 104.111 | -0.694 | S |
| 106.470 | -0.693 | GS |
| 108.625 | -0.760 | GS |
| 110.555 | -0.652 | S |
| 111.847 | -0.677 | R |
| 112.480 | -0.640 | R |
| 112.551 | -0.570 | R |
| 113.285 | -0.532 | R |
| 113.626 | -0.590 | R |
| 114.656 | -0.633 | R |
| 114.744 | -0.545 | R |
| 115.131 | -0.440 | R |
| 119.202 | -0.450 | R |

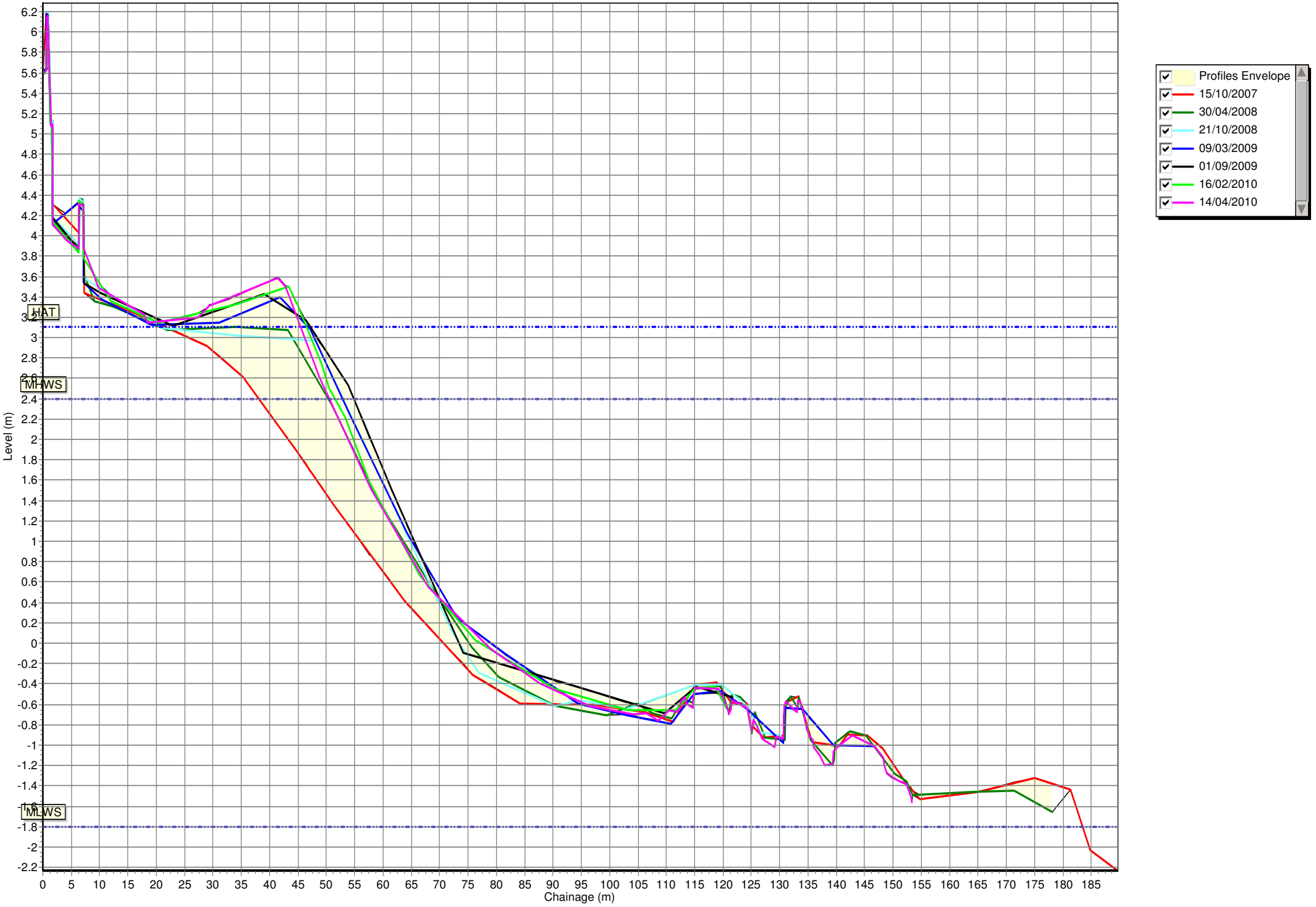


# 1aWDC06A - 14/04/2010

| Chainage | Level | Code |
|---|---|---|
| 0.000 | 7.535 | |
| 0.004 | 7.535 | ZZ |
| 0.451 | 7.505 | ZZ |
| 0.555 | 7.451 | ZZ |
| 0.604 | 7.427 | ZZ |
| 4.550 | 5.801 | ZZ |
| 7.547 | 4.530 | ZZ |
| 11.678 | 4.409 | SD |
| 11.708 | 4.677 | SD |
| 11.914 | 4.915 | SD |
| 12.253 | 4.905 | SD |
| 12.277 | 4.830 | SD |
| 12.302 | 3.996 | SD |
| 12.684 | 3.891 | S |
| 20.126 | 3.503 | S |
| 29.992 | 3.428 | S |
| 40.039 | 3.509 | S |
| 50.151 | 3.571 | S |
| 60.242 | 3.775 | S |
| 70.486 | 3.824 | S |
| 76.146 | 3.047 | S |
| 82.096 | 2.502 | S |
| 87.569 | 2.105 | S |
| 92.148 | 1.629 | S |
| 102.531 | 0.526 | S |
| 113.763 | -0.220 | S |
| 125.190 | -0.502 | S |
| 137.920 | -0.629 | S |
| 150.489 | -0.731 | S |
| 162.086 | -0.822 | S |
| 174.170 | -0.906 | S |
| 183.918 | -1.021 | S |
| 195.156 | -1.154 | S |



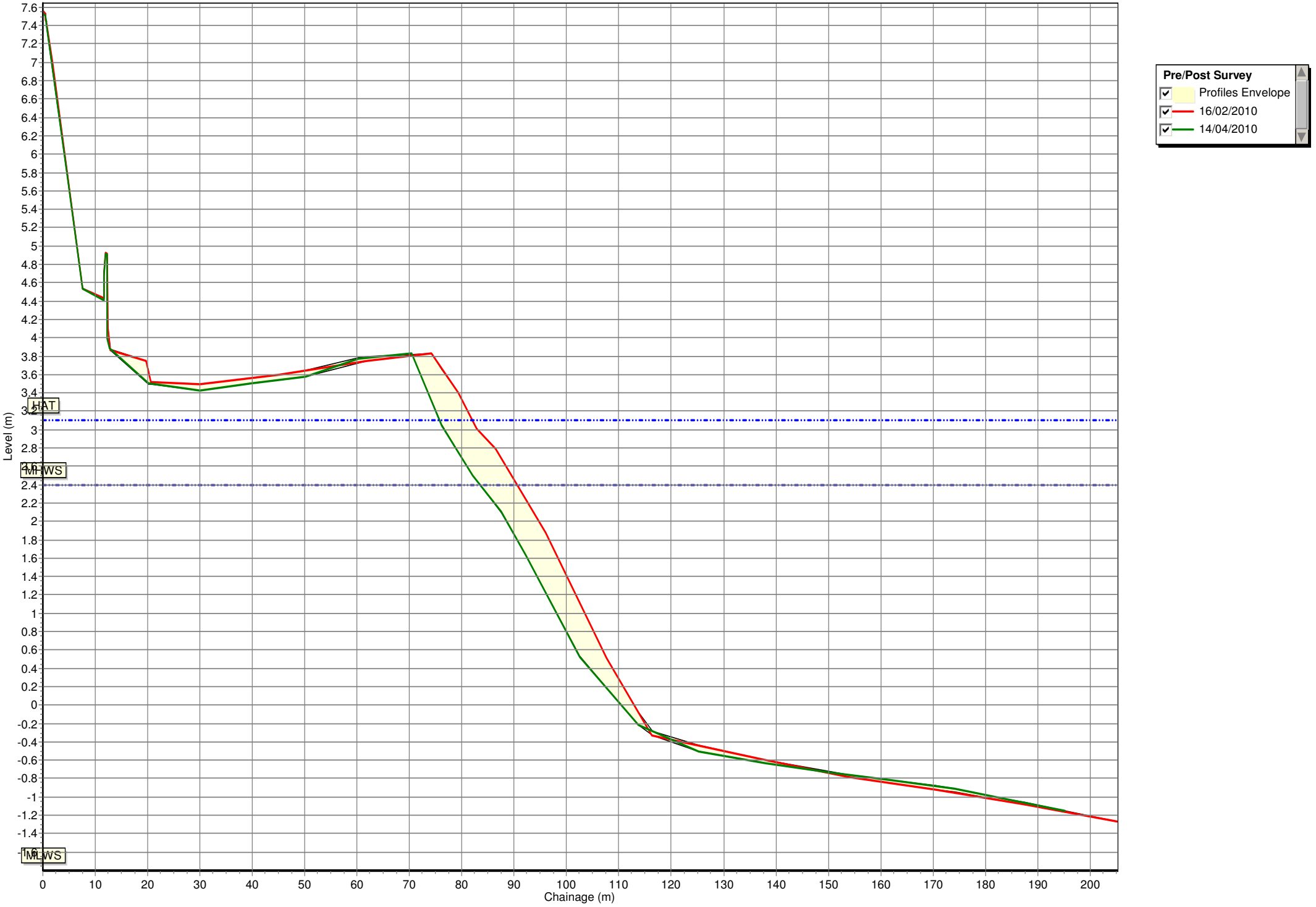
# Beach Profiles: 1aWDC05A



# Beach Profiles: 1aWDC05A

# Beach Profiles: 1aWDC06A

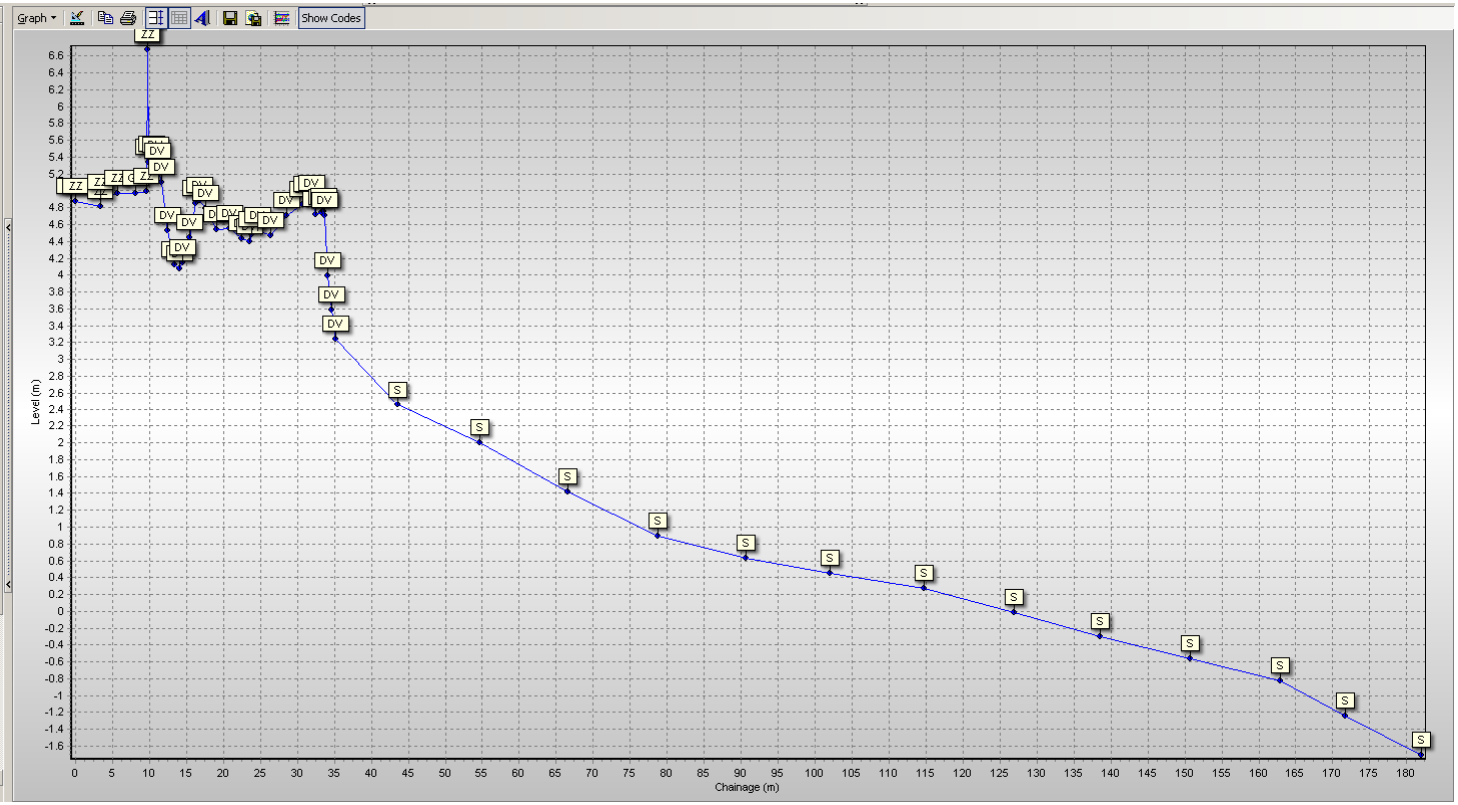
# Beach Profiles: 1aWDC06A



## Blyth

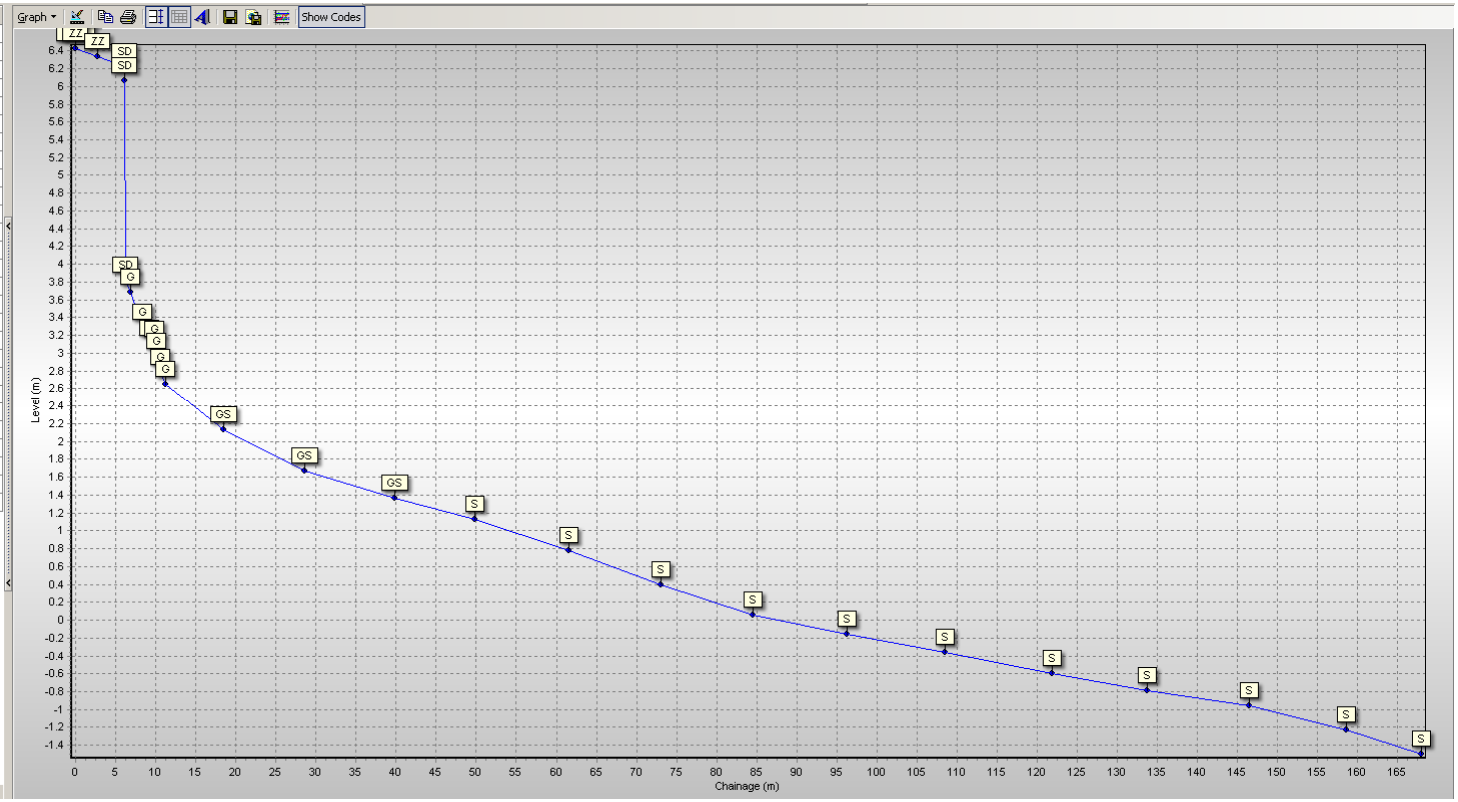
1aBVBC01 - 15/04/2010

| Chainage | Level | Code |
|---|---|---|
| 0.000 | 4.875 | |
| 0.026 | 4.875 | ZZ |
| 3.402 | 4.816 | ZZ |
| 3.417 | 4.927 | ZZ |
| 5.715 | 4.966 | ZZ |
| 8.051 | 4.969 | GR |
| 9.655 | 4.998 | ZZ |
| 9.736 | 6.675 | ZZ |
| 9.783 | 6.674 | ZZ |
| 9.871 | 5.344 | ZZ |
| 10.296 | 5.372 | DV |
| 10.762 | 5.368 | DV |
| 11.070 | 5.291 | DV |
| 11.637 | 5.104 | DV |
| 12.398 | 4.528 | DV |
| 13.412 | 4.126 | DV |
| 14.043 | 4.081 | DV |
| 14.438 | 4.146 | DV |
| 15.480 | 4.448 | DV |
| 16.259 | 4.845 | DV |
| 16.820 | 4.891 | DV |
| 17.573 | 4.791 | DV |
| 19.060 | 4.542 | DV |
| 20.821 | 4.557 | DV |
| 22.490 | 4.434 | DV |
| 23.583 | 4.393 | DV |
| 23.768 | 4.485 | DV |
| 24.591 | 4.525 | DV |
| 26.335 | 4.472 | DV |
| 28.616 | 4.705 | DV |
| 30.741 | 4.838 | DV |
| 31.286 | 4.903 | DV |
| 31.869 | 4.912 | DV |
| 32.512 | 4.717 | DV |
| 33.235 | 4.746 | DV |
| 33.495 | 4.755 | DV |
| 33.739 | 4.702 | DV |
| 34.125 | 3.994 | DV |
| 34.659 | 3.591 | DV |
| 35.222 | 3.241 | DV |
| 43.625 | 2.459 | S |
| 54.715 | 1.996 | S |



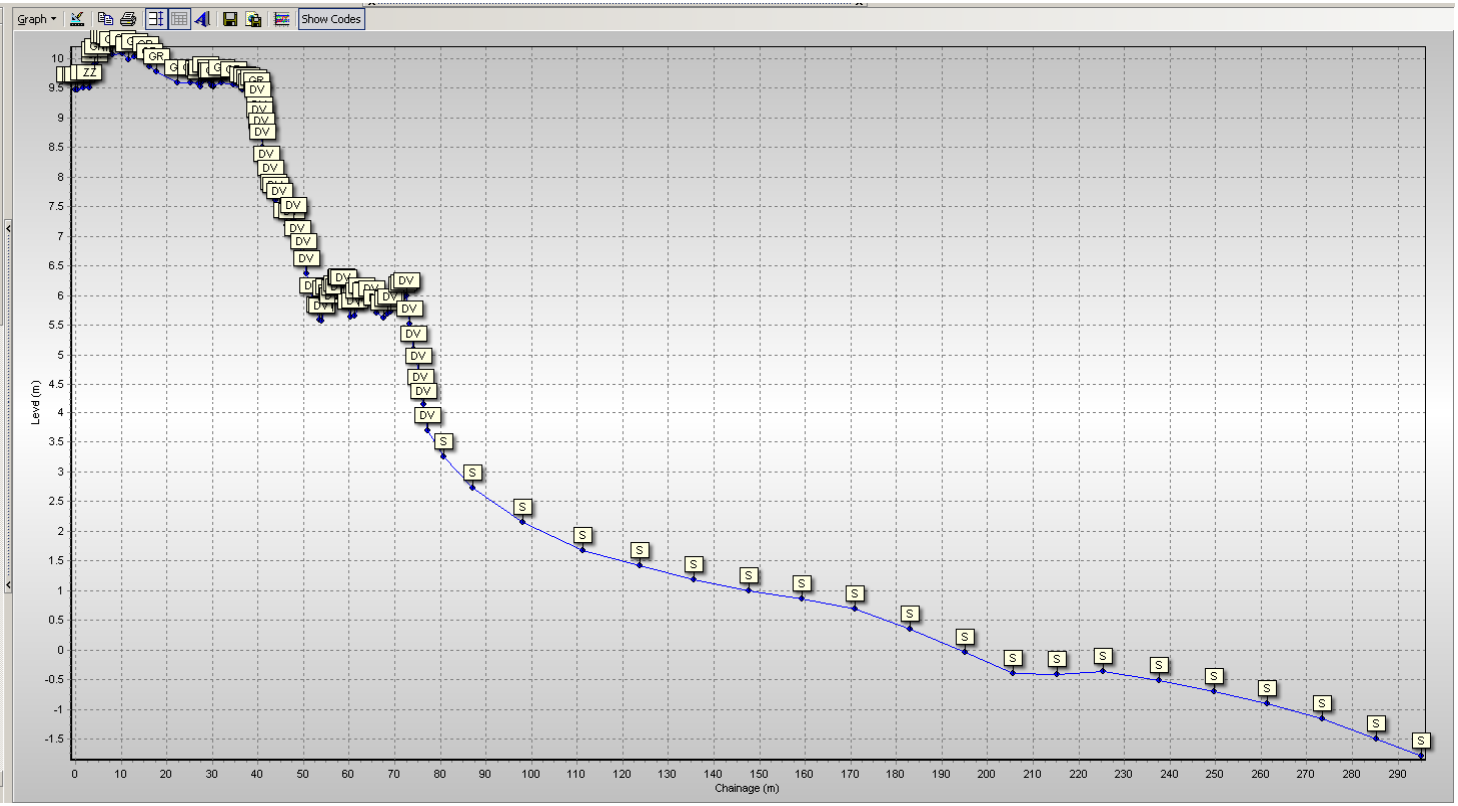
# 1aBVBC02 - 15/04/2010

| Chainage | Level | Code |
|---|---|---|
| 0.000 | 6.426 | |
| 0.029 | 6.426 | ZZ |
| 2.806 | 6.336 | ZZ |
| 6.061 | 6.221 | SD |
| 6.069 | 6.064 | SD |
| 6.289 | 3.821 | SD |
| 6.810 | 3.685 | G |
| 8.373 | 3.291 | G |
| 9.250 | 3.117 | G |
| 9.865 | 3.095 | G |
| 10.085 | 2.960 | G |
| 10.644 | 2.788 | G |
| 11.224 | 2.652 | G |
| 18.512 | 2.132 | GS |
| 28.564 | 1.674 | GS |
| 39.776 | 1.363 | GS |
| 49.767 | 1.129 | S |
| 61.507 | 0.778 | S |
| 73.013 | 0.394 | S |
| 84.548 | 0.059 | S |
| 96.306 | -0.161 | S |
| 108.557 | -0.359 | S |
| 121.830 | -0.592 | S |
| 133.708 | -0.793 | S |
| 146.416 | -0.961 | S |
| 158.521 | -1.225 | S |
| 167.940 | -1.499 | S |



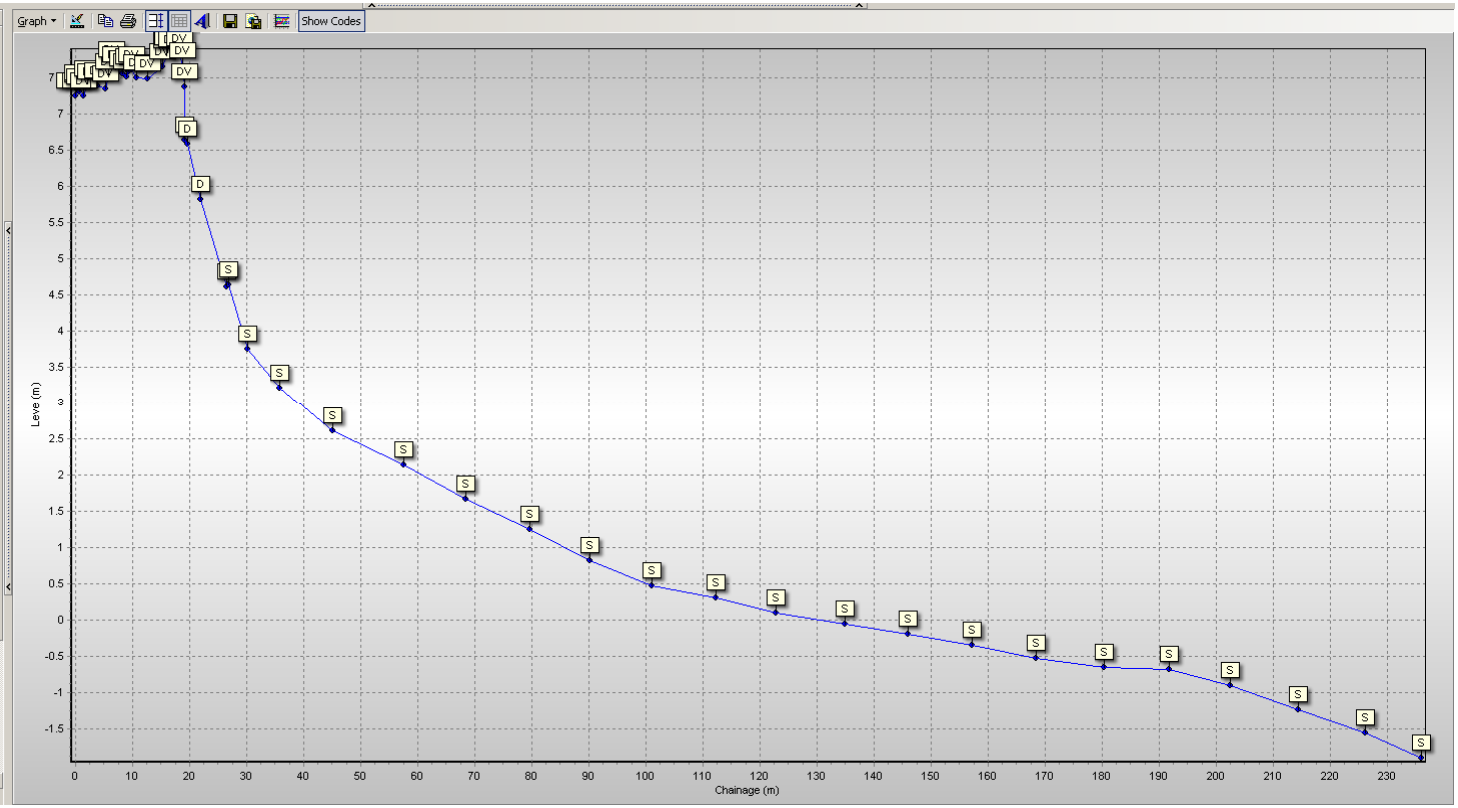
# 1aBVBC03 - 15/04/2010

| Chainage | Level | Code |
|---|---|---|
| 0.000 | 9.471 | |
| 0.017 | 9.471 | GR |
| 0.416 | 9.469 | ZZ |
| 1.655 | 9.508 | ZZ |
| 3.112 | 9.509 | ZZ |
| 4.080 | 9.806 | GR |
| 4.133 | 9.894 | GR |
| 4.839 | 9.950 | GR |
| 6.037 | 10.133 | GR |
| 6.761 | 10.131 | GR |
| 7.403 | 10.112 | GR |
| 8.205 | 10.065 | GR |
| 10.232 | 10.076 | GR |
| 11.710 | 9.976 | GR |
| 12.851 | 10.037 | GR |
| 15.256 | 9.984 | GR |
| 16.305 | 9.856 | GR |
| 17.800 | 9.783 | GR |
| 22.373 | 9.589 | GR |
| 25.307 | 9.589 | GR |
| 26.925 | 9.581 | GR |
| 27.328 | 9.526 | GR |
| 27.646 | 9.585 | GR |
| 28.505 | 9.641 | GR |
| 29.556 | 9.592 | GR |
| 29.768 | 9.537 | GR |
| 30.182 | 9.523 | GR |
| 30.360 | 9.539 | GR |
| 32.083 | 9.590 | GR |
| 34.579 | 9.551 | GR |
| 36.648 | 9.472 | GR |
| 37.499 | 9.459 | GR |
| 38.097 | 9.424 | GR |
| 38.579 | 9.356 | GR |
| 39.022 | 9.413 | GR |
| 39.763 | 9.371 | GR |
| 40.025 | 9.224 | DV |
| 40.268 | 8.955 | DV |
| 40.364 | 8.874 | DV |
| 40.836 | 8.692 | DV |
| 41.080 | 8.500 | DV |
| 41.931 | 8.131 | DV |



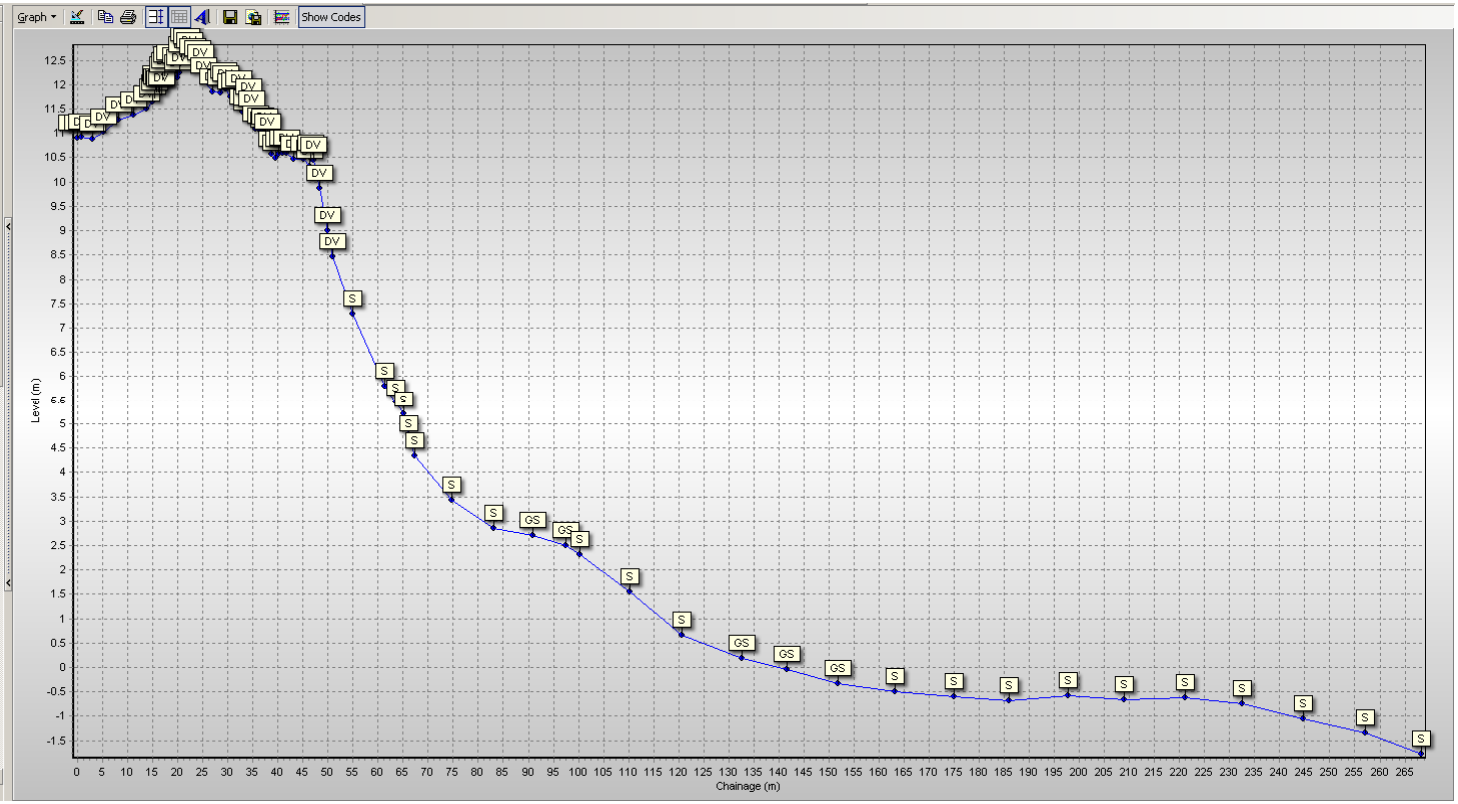
# 1aBVBC04 - 15/04/2010

| Chainage | Level | Code |
|---|---|---|
| 0.000 | 7.252 | |
| 0.018 | 7.252 | DV |
| 0.296 | 7.334 | DV |
| 0.423 | 7.369 | DV |
| 0.667 | 7.302 | DV |
| 1.376 | 7.258 | DV |
| 2.038 | 7.421 | DV |
| 2.559 | 7.380 | DV |
| 3.901 | 7.396 | DV |
| 5.281 | 7.356 | DV |
| 5.804 | 7.521 | DV |
| 6.325 | 7.685 | DV |
| 6.940 | 7.617 | DV |
| 8.310 | 7.555 | DV |
| 8.906 | 7.514 | DV |
| 9.237 | 7.581 | DV |
| 9.901 | 7.615 | DV |
| 10.703 | 7.508 | DV |
| 12.578 | 7.485 | DV |
| 15.305 | 7.650 | DV |
| 15.943 | 7.814 | DV |
| 16.139 | 7.849 | DV |
| 16.798 | 7.822 | DV |
| 18.325 | 7.831 | DV |
| 18.825 | 7.669 | DV |
| 19.105 | 7.376 | DV |
| 19.124 | 6.635 | D |
| 19.647 | 6.580 | D |
| 21.894 | 5.823 | D |
| 26.563 | 4.616 | D |
| 26.770 | 4.649 | S |
| 30.176 | 3.760 | S |
| 35.768 | 3.216 | S |
| 45.105 | 2.608 | S |
| 57.549 | 2.134 | S |
| 68.466 | 1.655 | S |
| 79.749 | 1.241 | S |
| 90.210 | 0.813 | S |
| 101.125 | 0.474 | S |
| 112.338 | 0.303 | S |
| 122.911 | 0.098 | S |
| 134.987 | -0.058 | S |



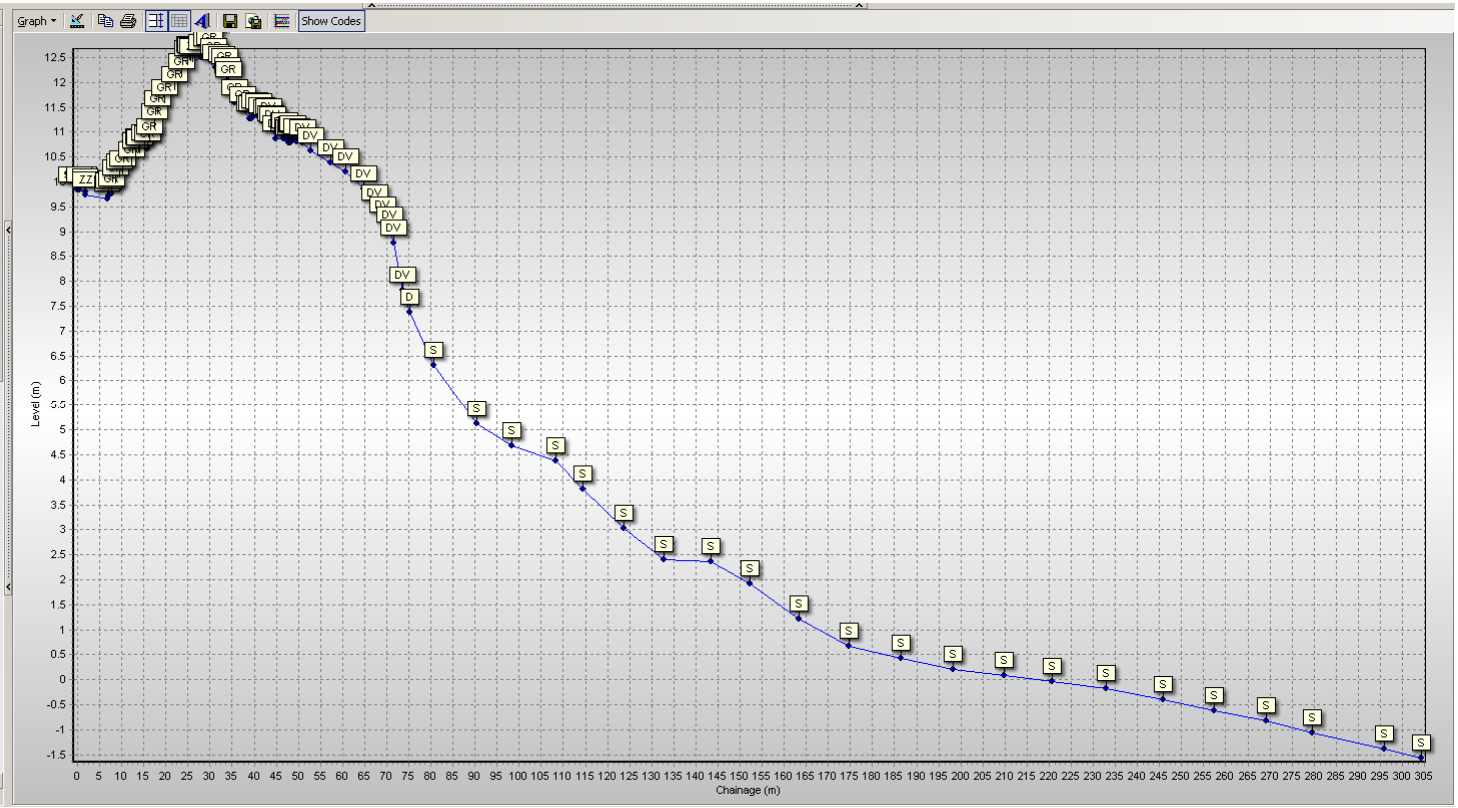
# 1aBVBC05 - 15/04/2010

| Chainage | Level | Code |
|---|---|---|
| 0.000 | 10.910 | |
| 0.033 | 10.910 | DV |
| 0.702 | 10.921 | DV |
| 3.073 | 10.876 | DV |
| 5.241 | 11.029 | DV |
| 8.164 | 11.264 | DV |
| 11.264 | 11.385 | DV |
| 13.859 | 11.507 | DV |
| 14.937 | 11.638 | DV |
| 15.335 | 11.726 | DV |
| 15.606 | 11.913 | DV |
| 15.795 | 11.841 | DV |
| 16.185 | 11.861 | DV |
| 16.477 | 11.815 | DV |
| 16.833 | 11.835 | DV |
| 16.885 | 12.091 | DV |
| 17.475 | 12.181 | DV |
| 17.808 | 12.305 | DV |
| 18.391 | 12.339 | DV |
| 19.646 | 12.279 | DV |
| 20.028 | 12.148 | DV |
| 20.470 | 12.239 | DV |
| 20.822 | 12.504 | DV |
| 21.162 | 12.739 | DV |
| 21.853 | 12.669 | DV |
| 22.297 | 12.600 | DV |
| 23.043 | 12.479 | DV |
| 23.885 | 12.427 | DV |
| 24.489 | 12.348 | DV |
| 25.229 | 12.078 | DV |
| 26.899 | 11.851 | DV |
| 28.621 | 11.826 | DV |
| 29.150 | 11.984 | DV |
| 29.620 | 11.915 | DV |
| 30.656 | 11.755 | DV |
| 31.266 | 11.761 | DV |
| 32.068 | 11.804 | DV |
| 32.915 | 11.442 | DV |
| 33.760 | 11.324 | DV |
| 33.795 | 11.420 | DV |
| 34.102 | 11.636 | DV |
| 34.723 | 11.392 | DV |

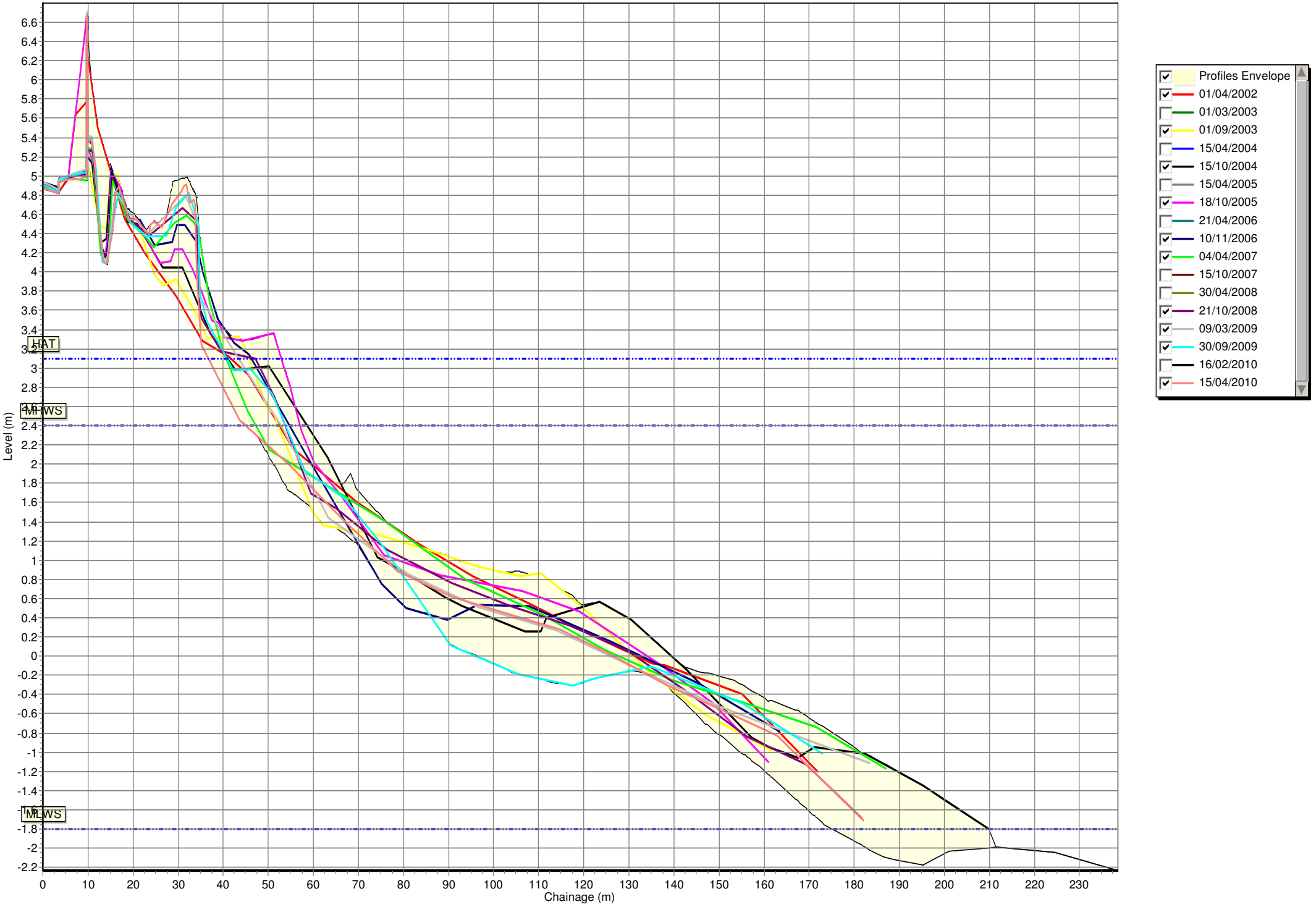


# 1aBVBC06 - 15/04/2010

| Chainage | Level | Code |
|---|---|---|
| 0.000 | 9.839 | |
| 0.535 | 9.839 | ZZ |
| 1.714 | 9.809 | ZZ |
| 1.752 | 9.734 | ZZ |
| 6.806 | 9.668 | ZZ |
| 7.021 | 9.729 | GR |
| 7.709 | 9.768 | GR |
| 8.572 | 9.974 | GR |
| 9.557 | 10.106 | GR |
| 10.113 | 10.160 | GR |
| 12.128 | 10.346 | GR |
| 13.113 | 10.533 | GR |
| 13.841 | 10.614 | GR |
| 14.103 | 10.592 | GR |
| 15.177 | 10.692 | GR |
| 15.767 | 10.669 | GR |
| 16.246 | 10.798 | GR |
| 17.551 | 11.104 | GR |
| 18.211 | 11.378 | GR |
| 19.793 | 11.597 | GR |
| 21.916 | 11.861 | GR |
| 23.565 | 12.120 | GR |
| 24.896 | 12.380 | GR |
| 25.305 | 12.458 | GR |
| 25.549 | 12.434 | GR |
| 26.141 | 12.427 | ZZ |
| 28.147 | 12.495 | ZZ |
| 29.118 | 12.582 | GR |
| 30.020 | 12.602 | GR |
| 30.803 | 12.416 | GR |
| 31.317 | 12.304 | GR |
| 32.519 | 12.260 | GR |
| 33.218 | 12.226 | GR |
| 33.881 | 12.037 | GR |
| 34.246 | 11.964 | GR |
| 35.530 | 11.594 | GR |
| 37.415 | 11.457 | GR |
| 38.892 | 11.275 | GR |
| 39.441 | 11.268 | GR |
| 40.069 | 11.333 | GR |
| 40.918 | 11.310 | GR |
| 41.662 | 11.241 | DV |

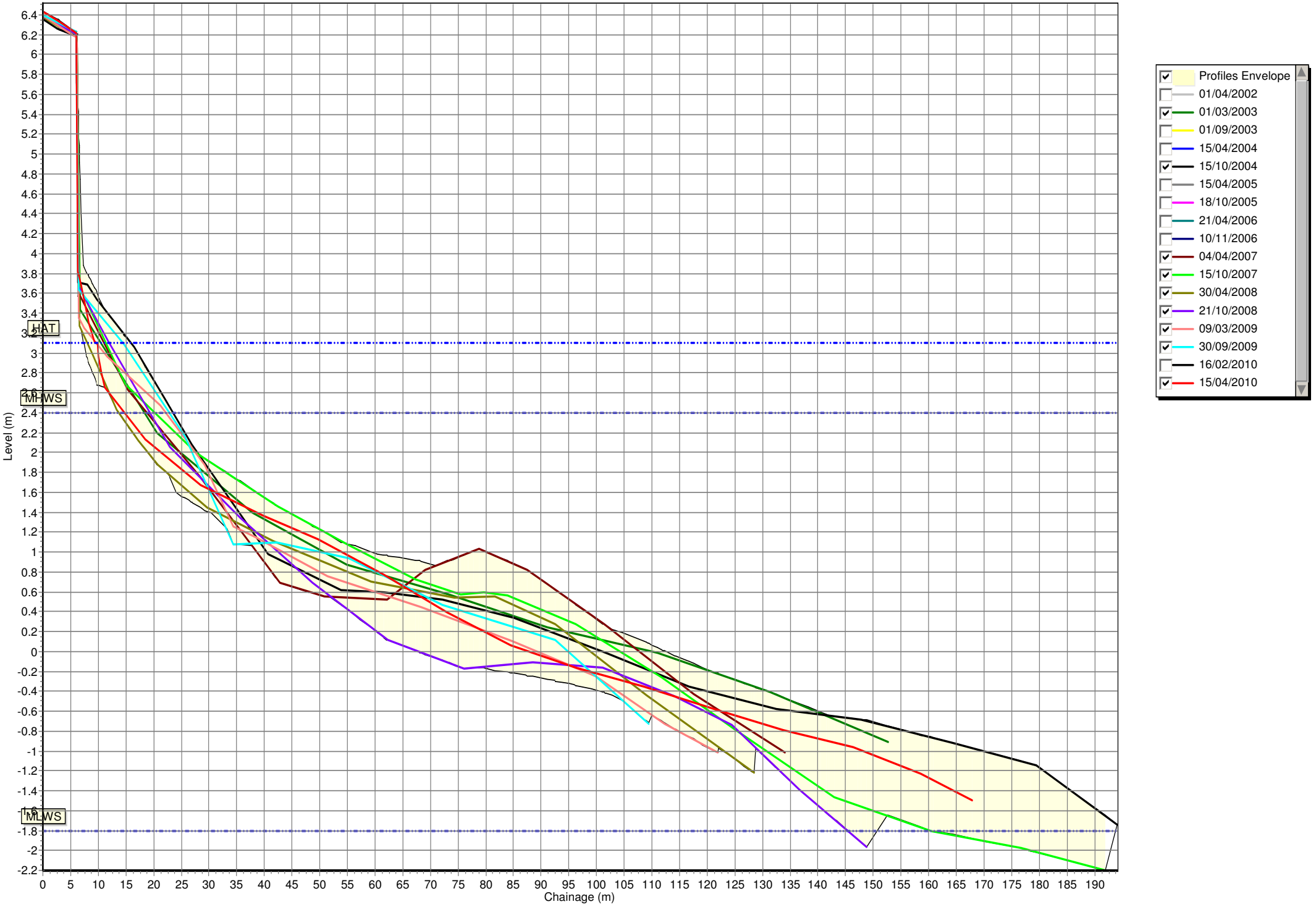


# Beach Profiles: 1aBVBC01



**Beach Profiles: 1aBVBC01**

**Beach Profiles: 1aBVBC02**

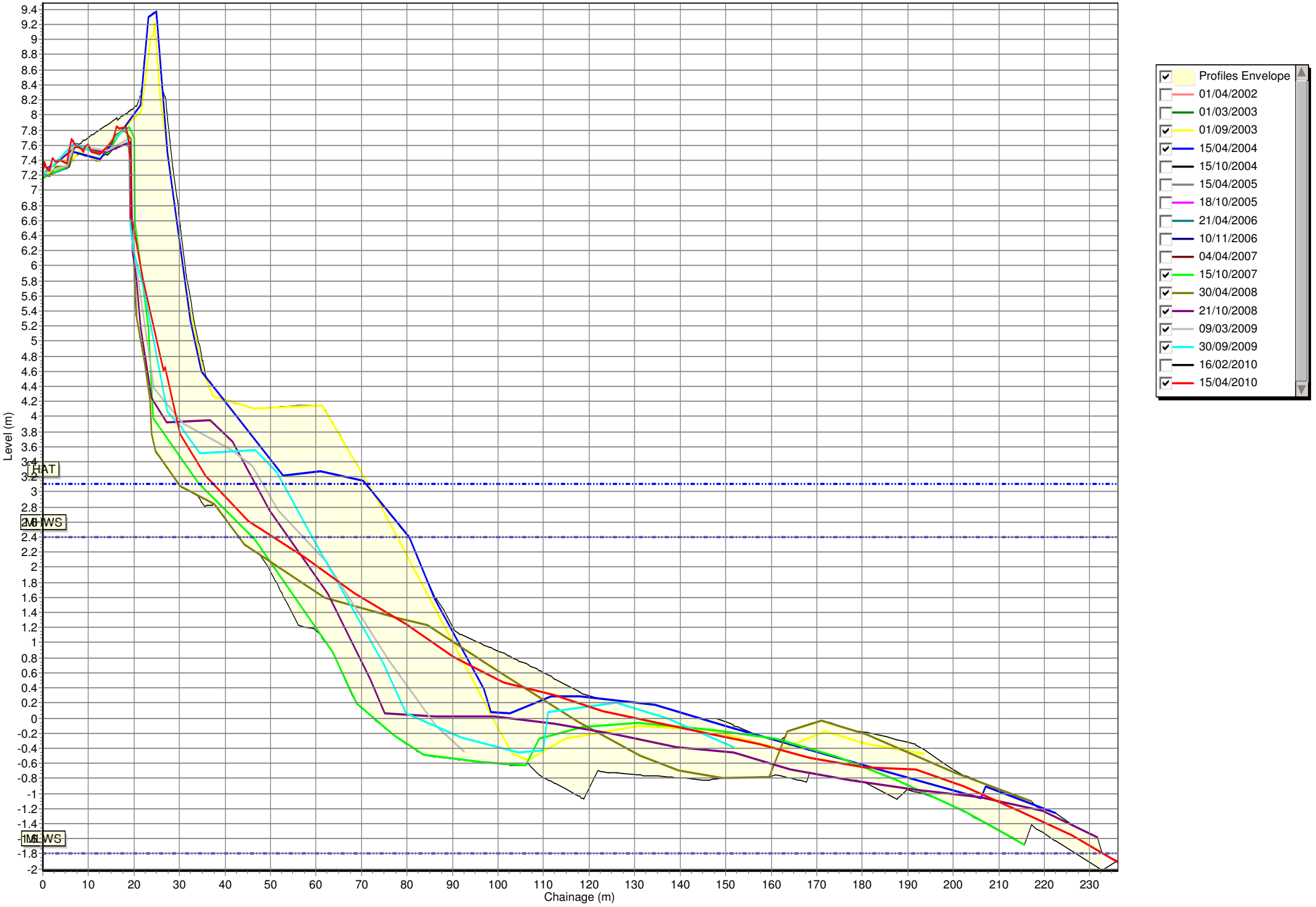


# Beach Profiles: 1aBVBC02

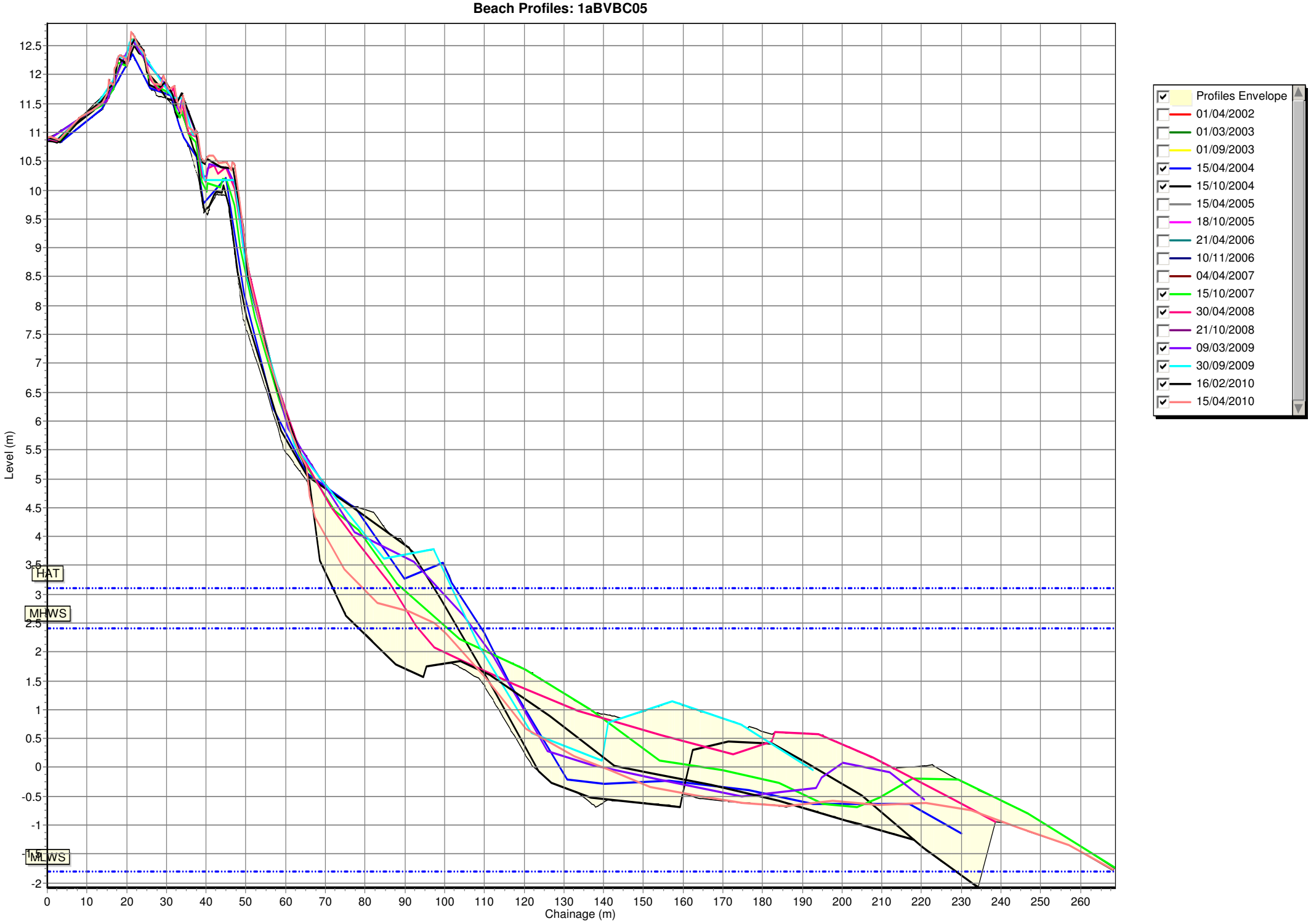
# Beach Profiles: 1aBVBC03

# Beach Profiles: 1aBVBC03

**Beach Profiles: 1aBVBC04**

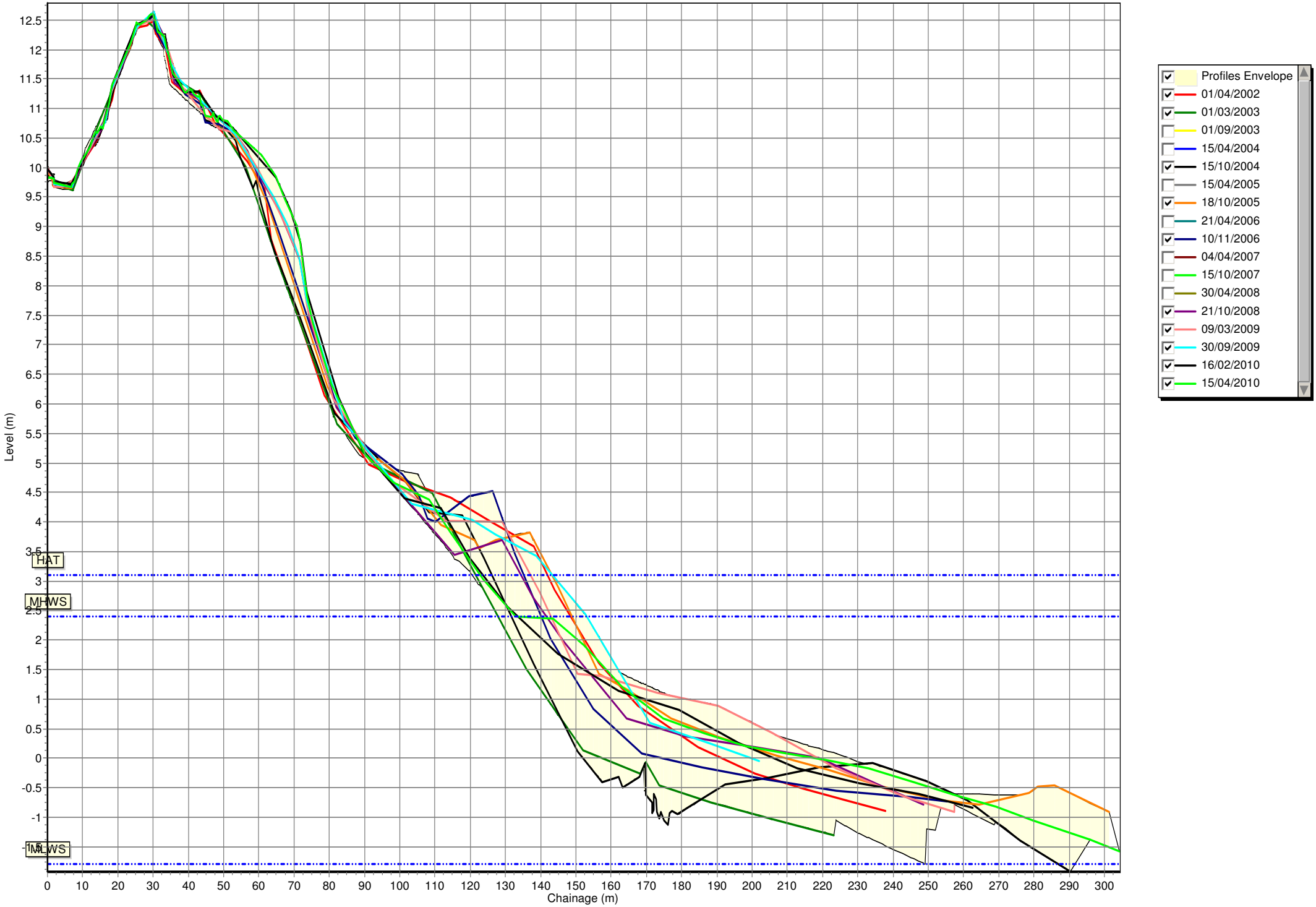


# Beach Profiles: 1aBVBC04


Beach Profiles: 1aBVBC05
Level (m)
Chainage (m)
HAT
MHWS
MLWS
Profiles Envelope
01/04/2002
01/03/2003
01/09/2003
15/04/2004
15/10/2004
15/04/2005
18/10/2005
21/04/2006
10/11/2006
04/04/2007
15/10/2007
30/04/2008
21/10/2008
09/03/2009
30/09/2009
16/02/2010
15/04/2010

# Beach Profiles: 1aBVBC05

# Beach Profiles: 1aBVBC06

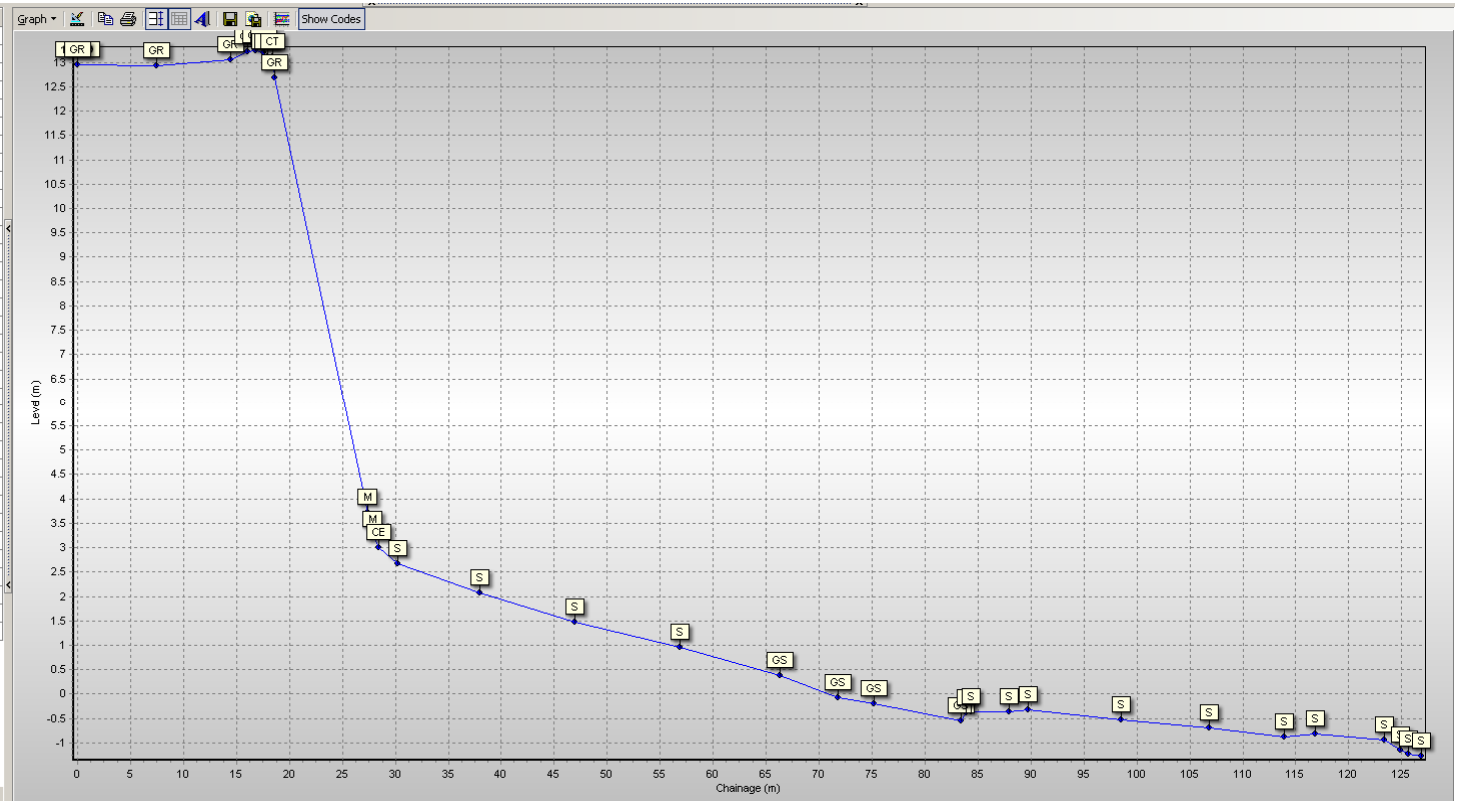


# Beach Profiles: 1aBVBC06

## North Tyneside

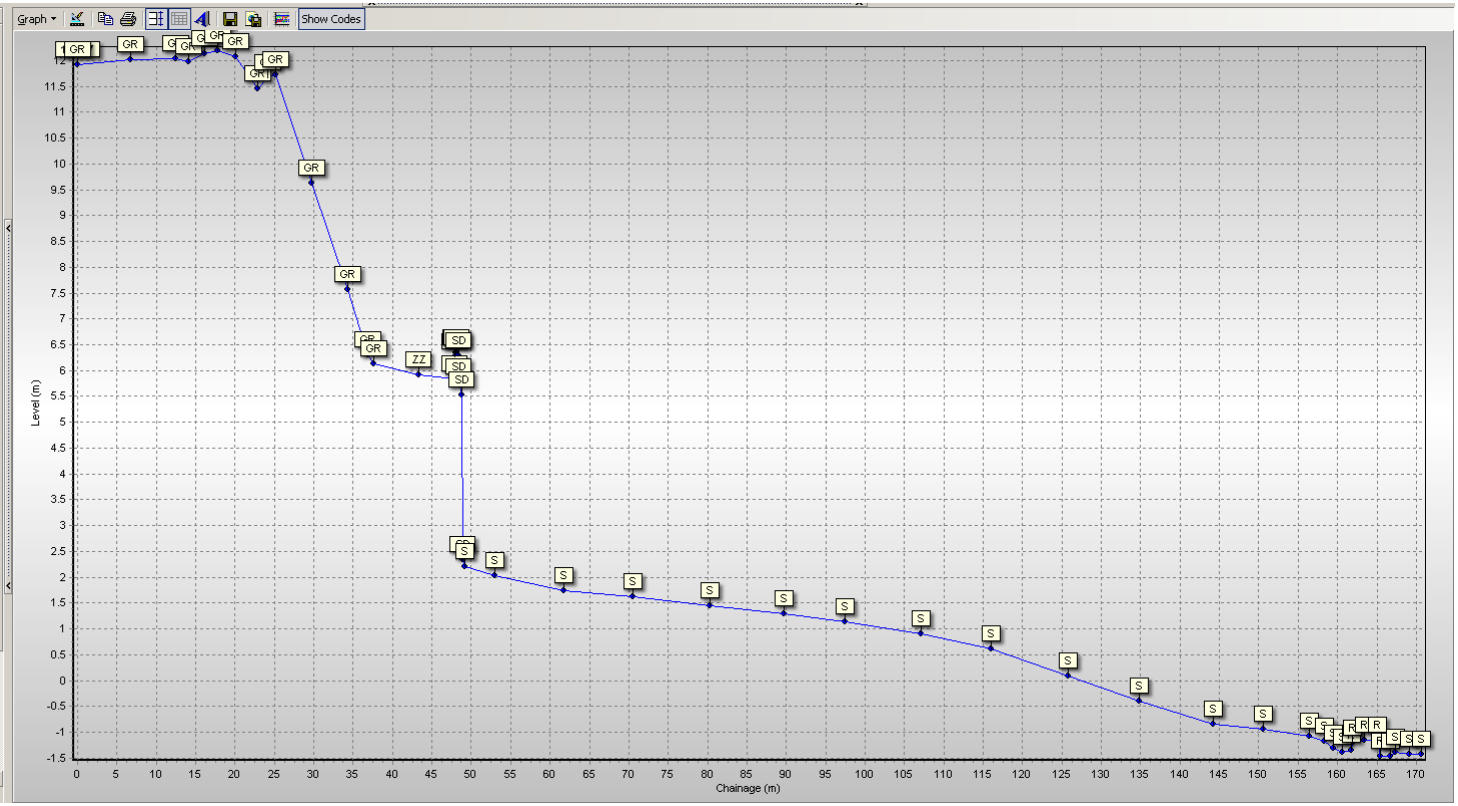
1aNTDC01 - 29/03/2010

| Chainage | Level | Code |
|---|---|---|
| 0.000 | 12.949 | |
| 0.024 | 12.949 | GR |
| 7.501 | 12.936 | GR |
| 14.440 | 13.053 | GR |
| 16.028 | 13.219 | GR |
| 16.836 | 13.240 | GR |
| 17.599 | 13.191 | GR |
| 17.641 | 13.107 | GR |
| 17.916 | 13.108 | GR |
| 18.436 | 13.119 | CT |
| 18.643 | 12.679 | GR |
| 27.407 | 3.729 | M |
| 27.857 | 3.264 | M |
| 28.394 | 2.994 | CE |
| 30.214 | 2.668 | S |
| 37.961 | 2.066 | S |
| 46.972 | 1.465 | S |
| 56.877 | 0.951 | S |
| 66.265 | 0.384 | GS |
| 71.752 | -0.071 | GS |
| 75.190 | -0.205 | GS |
| 83.392 | -0.544 | GS |
| 83.902 | -0.382 | S |
| 84.389 | -0.366 | S |
| 87.979 | -0.352 | S |
| 89.774 | -0.328 | S |
| 98.541 | -0.517 | S |
| 106.851 | -0.696 | S |
| 113.891 | -0.875 | S |
| 116.838 | -0.814 | S |
| 123.387 | -0.944 | S |
| 124.885 | -1.151 | S |
| 125.645 | -1.235 | S |
| 126.860 | -1.270 | S |



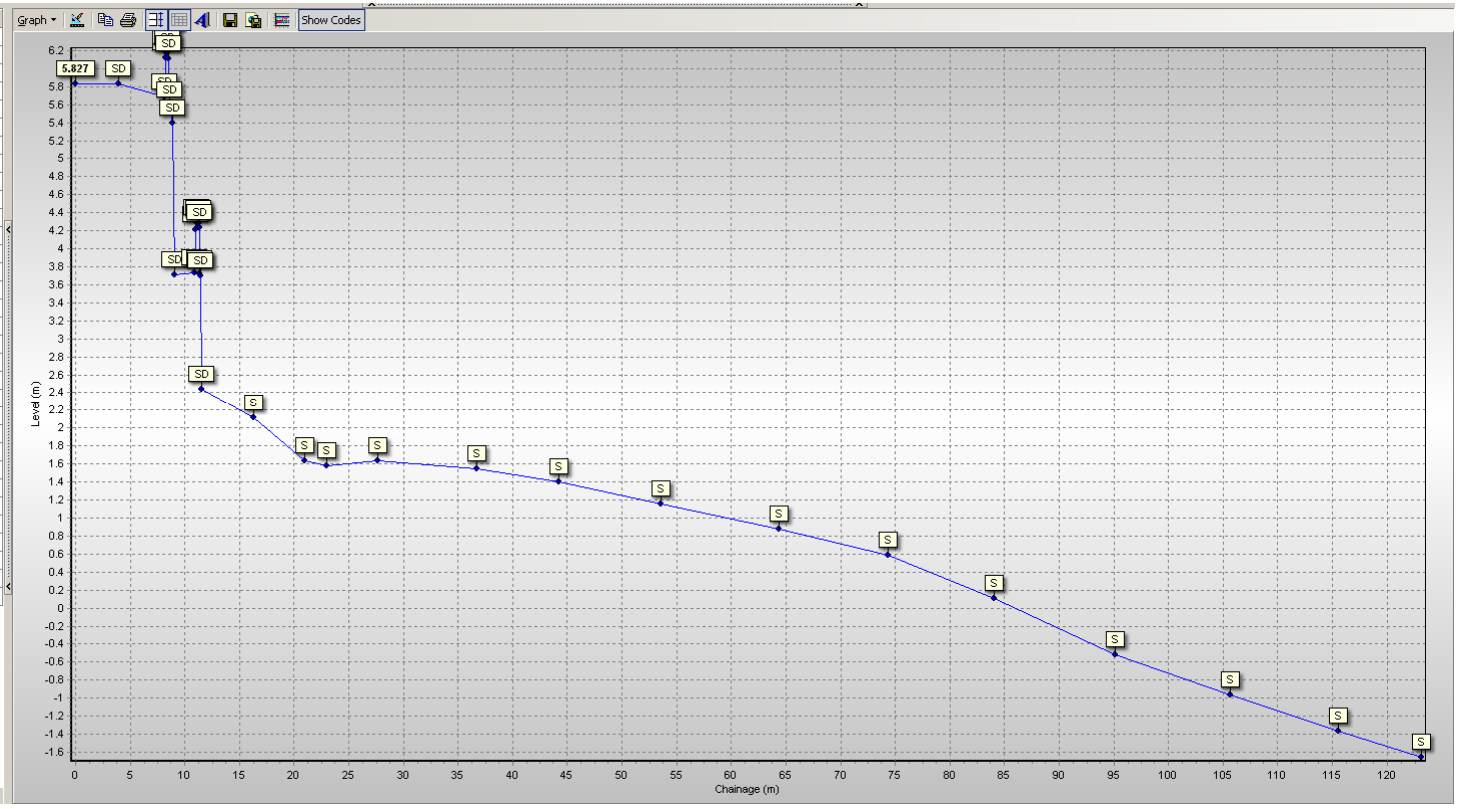
# 1aNTDC02 - 29/03/2010

| Chainage | Level | Code |
|---|---|---|
| 0.000 | 11.927 | |
| 0.054 | 11.927 | GR |
| 6.698 | 12.024 | GR |
| 12.402 | 12.032 | GR |
| 14.121 | 11.975 | GR |
| 16.142 | 12.140 | GR |
| 17.788 | 12.193 | GR |
| 20.122 | 12.081 | GR |
| 22.894 | 11.445 | GR |
| 24.169 | 11.674 | GR |
| 25.109 | 11.729 | GR |
| 29.721 | 9.633 | GR |
| 34.253 | 7.564 | GR |
| 36.807 | 6.310 | GR |
| 37.635 | 6.132 | GR |
| 43.302 | 5.922 | ZZ |
| 47.902 | 5.842 | SD |
| 47.909 | 6.276 | SD |
| 47.981 | 6.342 | SD |
| 48.222 | 6.349 | SD |
| 48.351 | 6.278 | SD |
| 48.399 | 5.773 | SD |
| 48.737 | 5.533 | SD |
| 48.942 | 2.343 | SD |
| 49.209 | 2.202 | S |
| 53.032 | 2.035 | S |
| 61.736 | 1.746 | S |
| 70.586 | 1.627 | S |
| 80.300 | 1.456 | S |
| 89.750 | 1.295 | S |
| 97.455 | 1.141 | S |
| 107.095 | 0.901 | S |
| 116.011 | 0.609 | S |
| 125.846 | 0.093 | S |
| 134.874 | -0.392 | S |
| 144.190 | -0.847 | S |
| 150.589 | -0.951 | S |
| 156.470 | -1.074 | S |
| 158.330 | -1.168 | S |
| 159.415 | -1.315 | S |
| 160.625 | -1.380 | S |
| 161.760 | -1.343 | R |



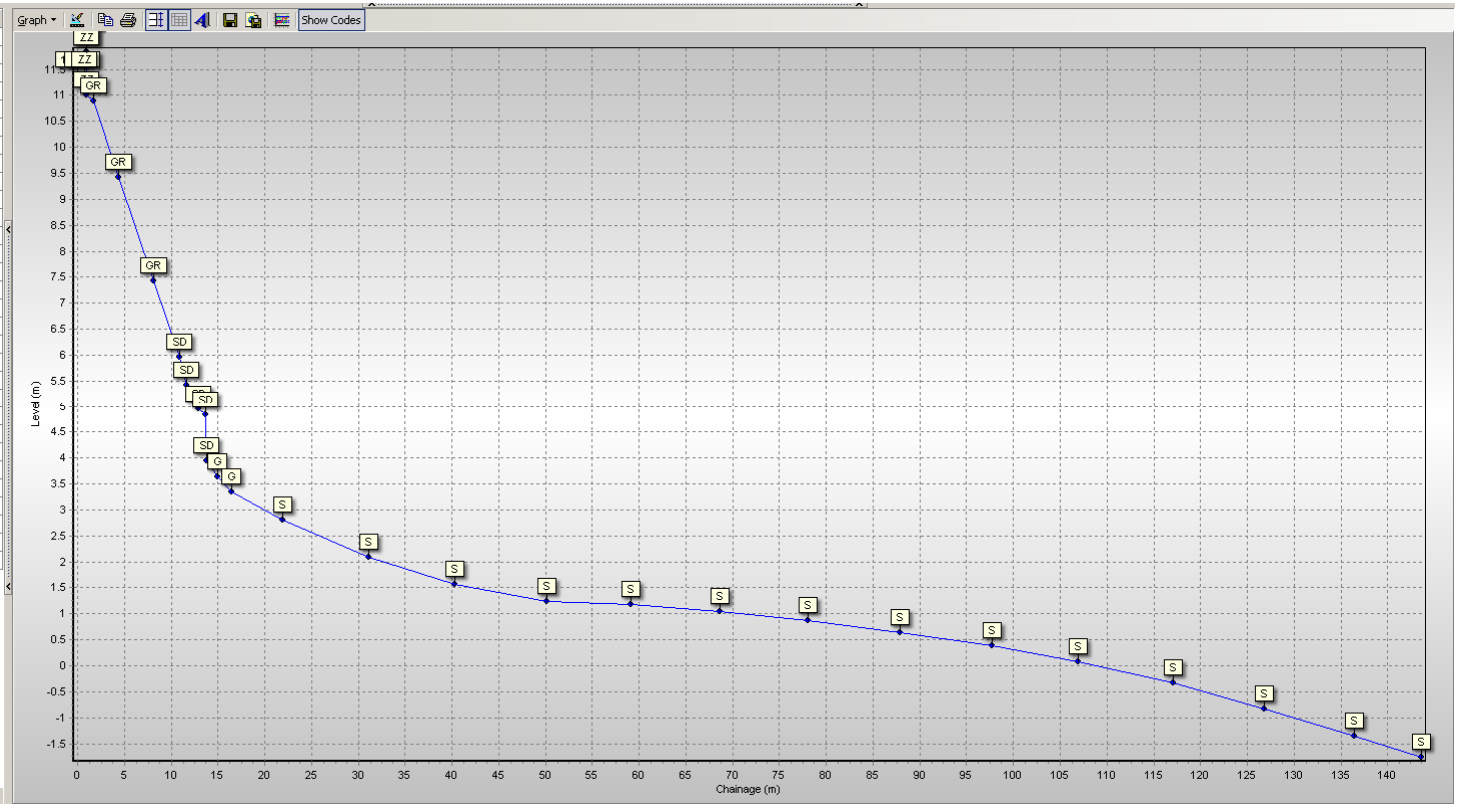
# 1aNTDC03 - 29/03/2010

| Chainage | Level | Code |
|---|---|---|
| 0.000 | 5.827 | |
| 3.958 | 5.827 | SD |
| 8.122 | 5.685 | SD |
| 8.203 | 6.118 | SD |
| 8.275 | 6.188 | SD |
| 8.439 | 6.177 | SD |
| 8.480 | 6.108 | SD |
| 8.566 | 5.602 | SD |
| 8.898 | 5.394 | SD |
| 9.020 | 3.715 | SD |
| 10.911 | 3.736 | SD |
| 10.971 | 4.218 | SD |
| 11.040 | 4.286 | SD |
| 11.287 | 4.285 | SD |
| 11.333 | 4.231 | SD |
| 11.368 | 3.718 | SD |
| 11.428 | 3.699 | SD |
| 11.549 | 2.439 | SD |
| 16.262 | 2.117 | S |
| 20.922 | 1.631 | S |
| 22.949 | 1.583 | S |
| 27.680 | 1.630 | S |
| 36.670 | 1.546 | S |
| 44.246 | 1.398 | S |
| 53.563 | 1.156 | S |
| 64.364 | 0.877 | S |
| 74.378 | 0.590 | S |
| 84.087 | 0.106 | S |
| 95.154 | -0.518 | S |
| 105.620 | -0.964 | S |
| 115.586 | -1.364 | S |
| 123.146 | -1.656 | S |



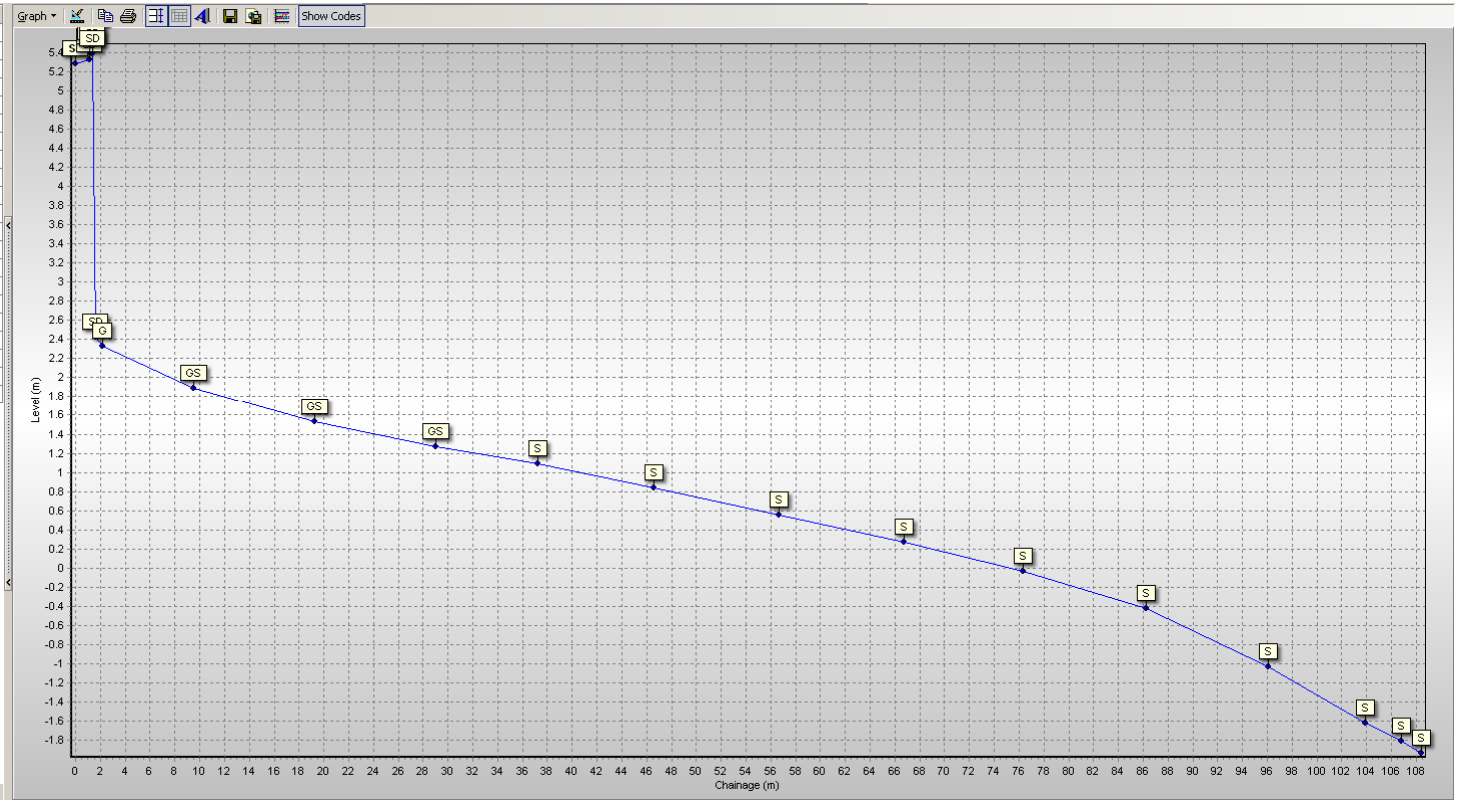
# 1aNTDC04 - 29/03/2010

| Chainage | Level | Code |
|---|---|---|
| 0.000 | 11.405 | |
| 0.016 | 11.405 | ZZ |
| 0.721 | 11.392 | ZZ |
| 0.909 | 11.841 | ZZ |
| 0.981 | 11.818 | ZZ |
| 0.998 | 11.004 | ZZ |
| 1.687 | 10.887 | GR |
| 4.396 | 9.413 | GR |
| 8.089 | 7.437 | GR |
| 10.942 | 5.964 | SD |
| 11.671 | 5.427 | SD |
| 12.973 | 4.962 | SD |
| 13.726 | 4.840 | SD |
| 13.778 | 3.949 | SD |
| 14.969 | 3.634 | G |
| 16.448 | 3.353 | G |
| 21.890 | 2.798 | S |
| 31.160 | 2.089 | S |
| 40.268 | 1.559 | S |
| 50.148 | 1.245 | S |
| 59.134 | 1.181 | S |
| 68.651 | 1.040 | S |
| 78.098 | 0.865 | S |
| 87.856 | 0.642 | S |
| 97.725 | 0.389 | S |
| 106.888 | 0.086 | S |
| 117.054 | -0.334 | S |
| 126.820 | -0.831 | S |
| 136.397 | -1.355 | S |
| 143.596 | -1.760 | S |



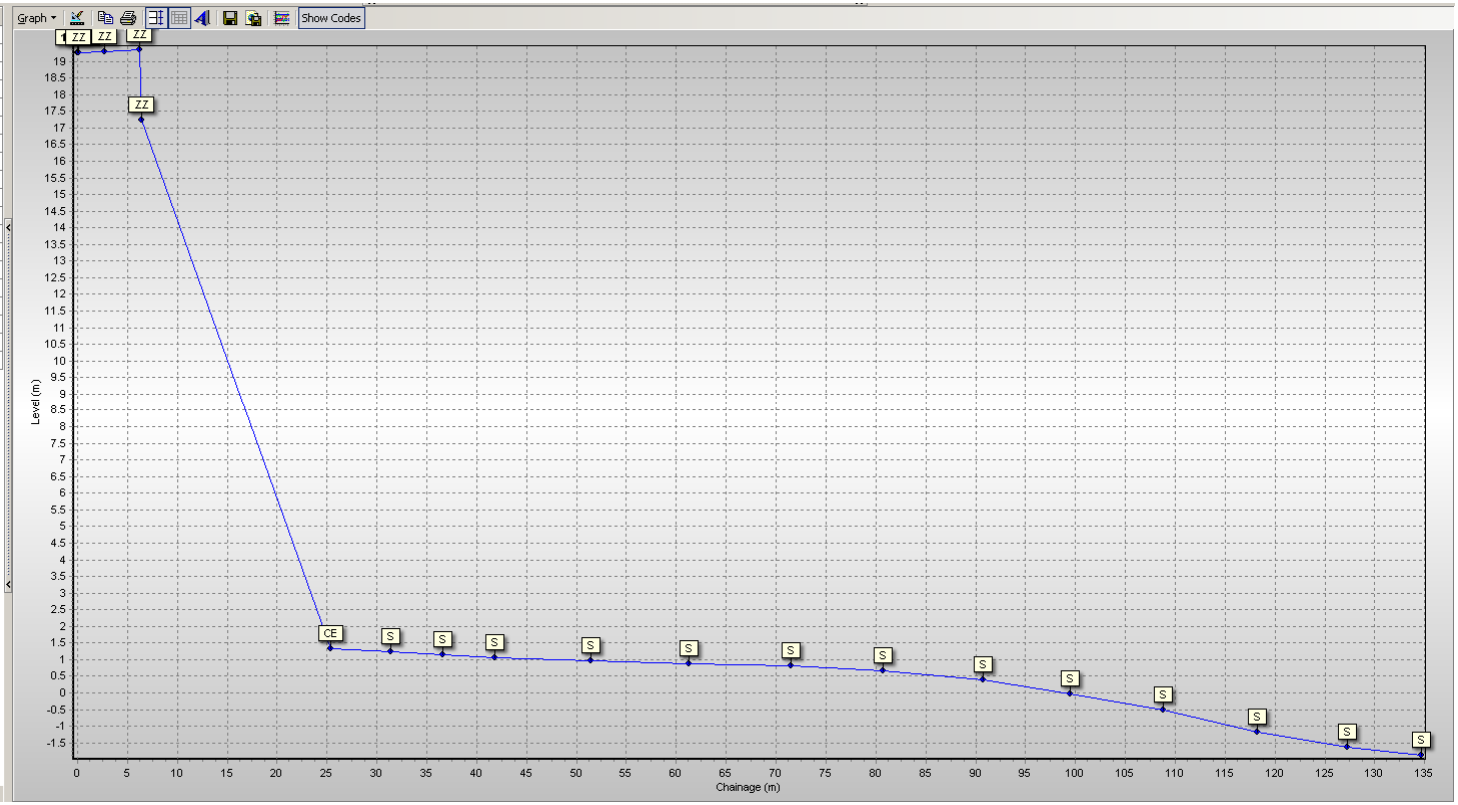
# 1aNTDC04A - 29/03/2010

| Chainage | Level | Code |
|---|---|---|
| 0.000 | 5.280 | SD |
| 1.096 | 5.324 | SD |
| 1.101 | 5.405 | SD |
| 1.206 | 5.452 | SD |
| 1.356 | 5.444 | SD |
| 1.408 | 5.385 | SD |
| 1.577 | 2.420 | SD |
| 2.198 | 2.334 | G |
| 9.517 | 1.887 | GS |
| 19.234 | 1.536 | GS |
| 29.027 | 1.269 | GS |
| 37.205 | 1.085 | S |
| 46.624 | 0.842 | S |
| 56.667 | 0.555 | S |
| 66.734 | 0.273 | S |
| 76.298 | -0.031 | S |
| 86.234 | -0.425 | S |
| 96.039 | -1.036 | S |
| 103.931 | -1.623 | S |
| 106.779 | -1.810 | S |
| 108.409 | -1.937 | S |



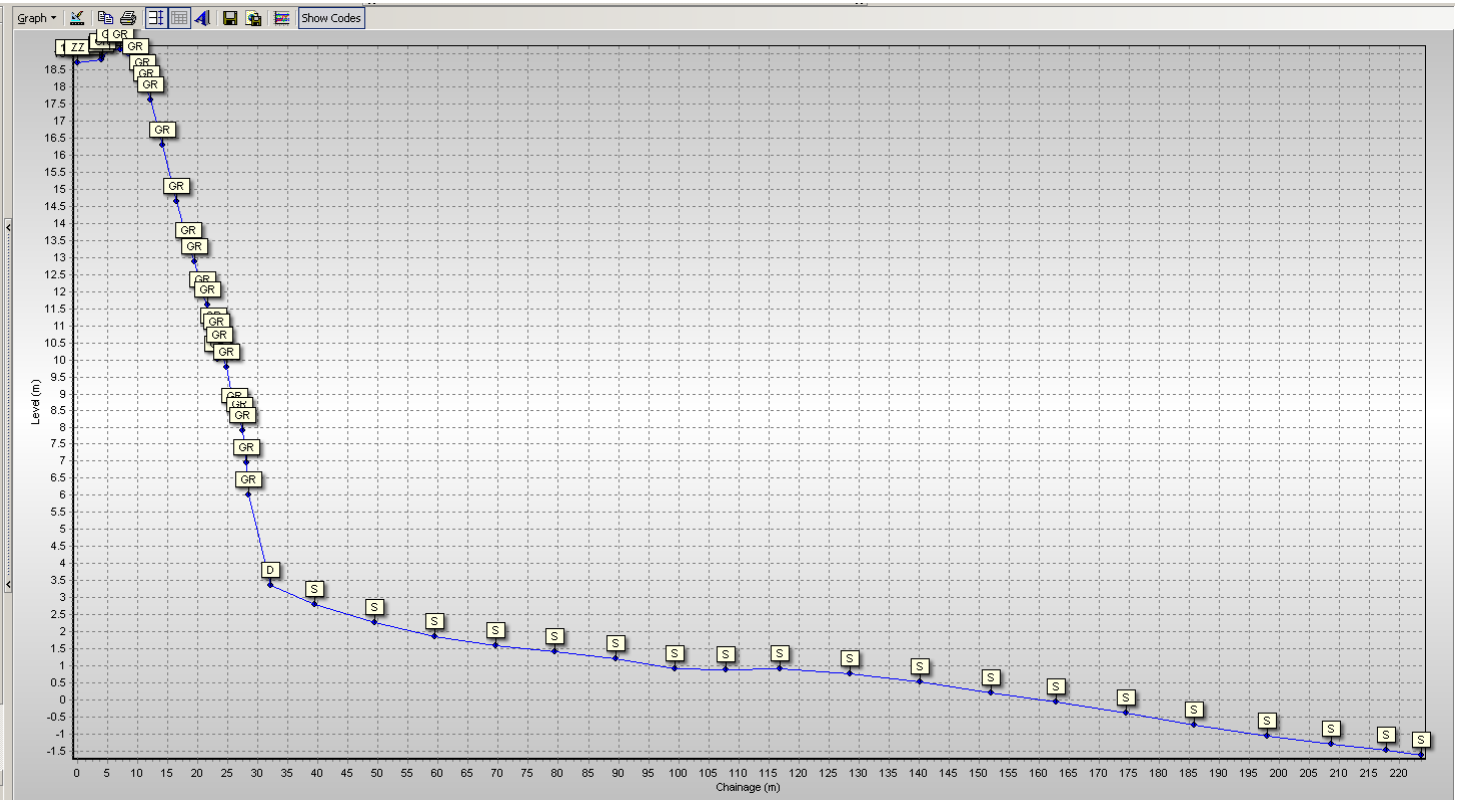
# 1aNTDC05 - 29/03/2010

| Chainage | Level | Code |
|---|---|---|
| 0.000 | 19.271 | |
| 0.109 | 19.271 | ZZ |
| 2.697 | 19.288 | ZZ |
| 6.219 | 19.350 | ZZ |
| 6.415 | 17.223 | ZZ |
| 25.415 | 1.315 | CE |
| 31.373 | 1.250 | S |
| 36.617 | 1.140 | S |
| 41.807 | 1.068 | S |
| 51.395 | 0.963 | S |
| 61.279 | 0.869 | S |
| 71.501 | 0.809 | S |
| 80.698 | 0.671 | S |
| 90.779 | 0.380 | S |
| 99.503 | -0.021 | S |
| 108.835 | -0.522 | S |
| 118.248 | -1.165 | S |
| 127.206 | -1.615 | S |
| 134.671 | -1.870 | S |



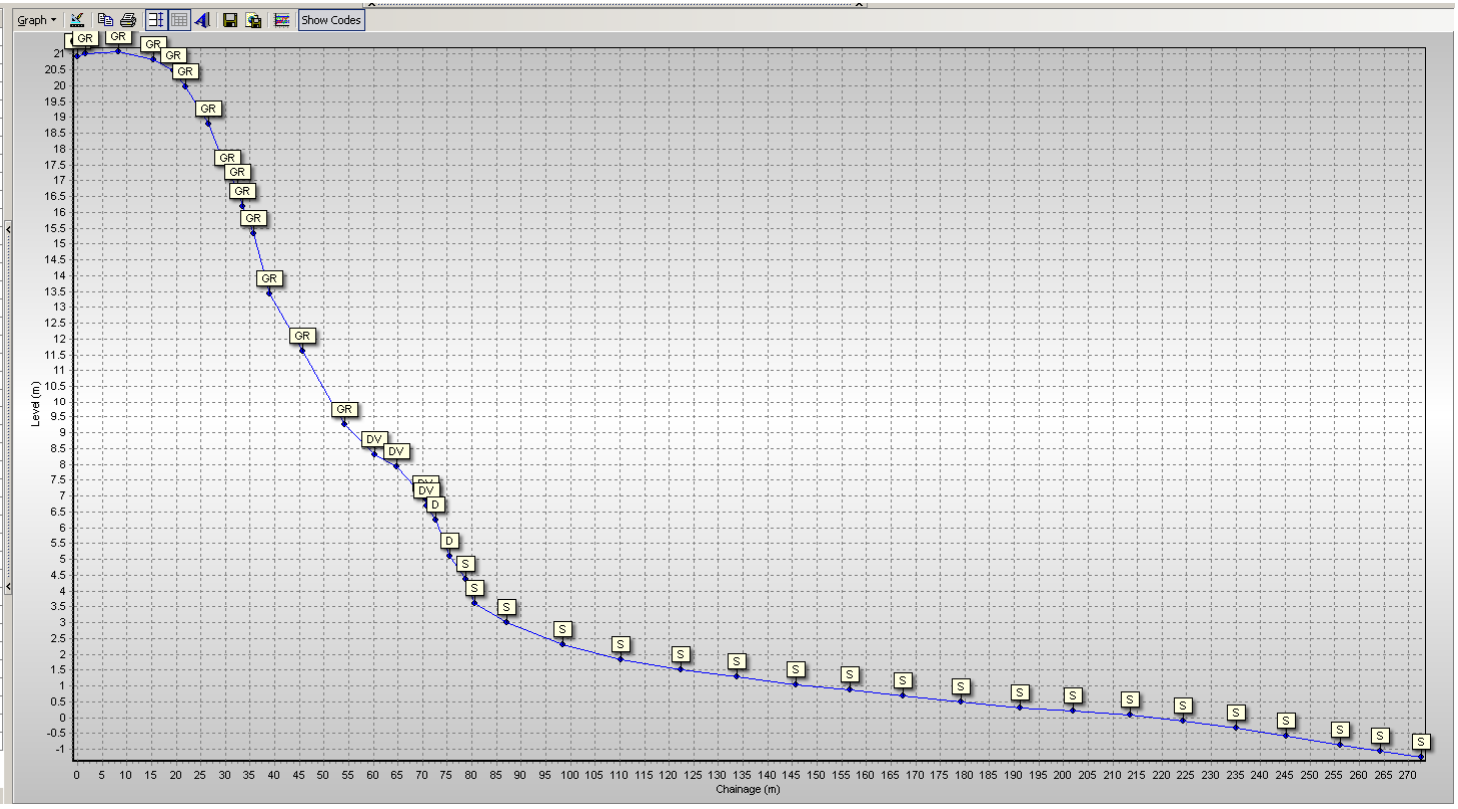
# 1aNTDC06 - 29/03/2010

| Chainage | Level | Code |
|---|---|---|
| 0.000 | 18.723 | |
| 0.038 | 18.723 | ZZ |
| 4.051 | 18.795 | ZZ |
| 4.145 | 18.897 | GR |
| 5.323 | 19.097 | GR |
| 7.194 | 19.104 | GR |
| 9.716 | 18.753 | GR |
| 10.838 | 18.270 | GR |
| 11.554 | 17.941 | GR |
| 12.164 | 17.624 | GR |
| 14.106 | 16.292 | GR |
| 16.537 | 14.655 | GR |
| 18.400 | 13.351 | GR |
| 19.399 | 12.896 | GR |
| 20.837 | 11.917 | GR |
| 21.679 | 11.601 | GR |
| 22.675 | 10.835 | GR |
| 23.073 | 10.683 | GR |
| 23.358 | 10.025 | GR |
| 23.608 | 10.287 | GR |
| 24.791 | 9.798 | GR |
| 26.186 | 8.498 | GR |
| 26.988 | 8.218 | GR |
| 27.497 | 7.886 | GR |
| 28.141 | 6.965 | GR |
| 28.486 | 6.021 | GR |
| 32.068 | 3.350 | D |
| 39.488 | 2.787 | S |
| 49.446 | 2.267 | S |
| 59.405 | 1.860 | S |
| 69.584 | 1.595 | S |
| 79.384 | 1.416 | S |
| 89.621 | 1.214 | S |
| 99.383 | 0.910 | S |
| 107.886 | 0.883 | S |
| 116.821 | 0.894 | S |
| 128.612 | 0.765 | S |
| 140.146 | 0.532 | S |
| 152.021 | 0.201 | S |
| 162.794 | -0.067 | S |
| 174.412 | -0.404 | S |
| 185.754 | -0.732 | S |



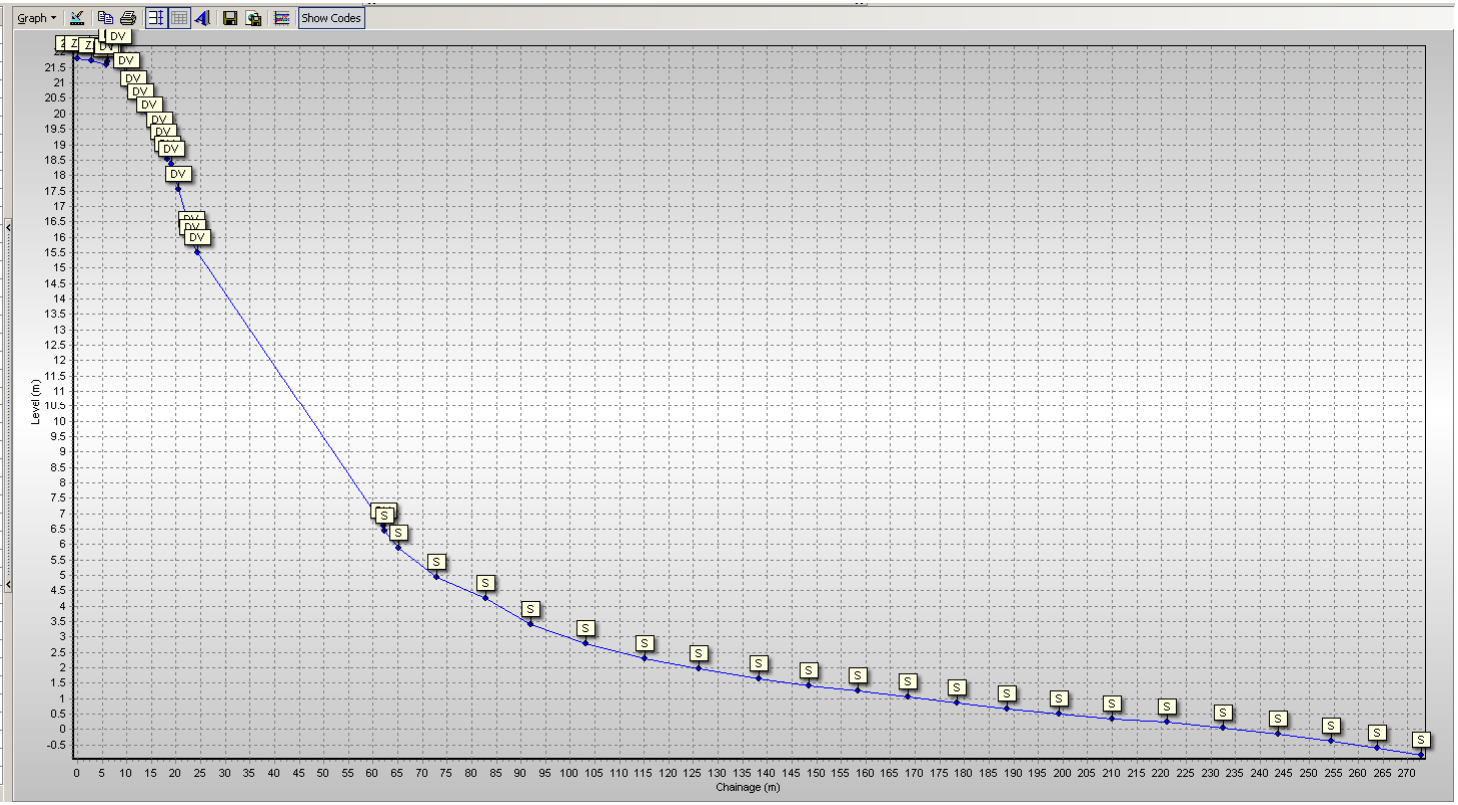
# 1aNTDC06A - 29/03/2010

| Chainage | Level | Code |
|---|---|---|
| 0.000 | 20.910 | GR |
| 1.719 | 21.027 | GR |
| 8.364 | 21.079 | GR |
| 15.502 | 20.816 | GR |
| 19.576 | 20.473 | GR |
| 21.907 | 19.971 | GR |
| 26.628 | 18.798 | GR |
| 30.374 | 17.223 | GR |
| 32.397 | 16.776 | GR |
| 33.460 | 16.183 | GR |
| 35.678 | 15.343 | GR |
| 39.021 | 13.425 | GR |
| 45.711 | 11.622 | GR |
| 54.157 | 9.254 | GR |
| 60.247 | 8.309 | DV |
| 64.842 | 7.940 | DV |
| 70.626 | 6.909 | DV |
| 70.875 | 6.683 | DV |
| 72.764 | 6.249 | D |
| 75.595 | 5.111 | D |
| 78.811 | 4.367 | S |
| 80.496 | 3.603 | S |
| 87.025 | 2.996 | S |
| 98.347 | 2.302 | S |
| 110.216 | 1.842 | S |
| 122.344 | 1.519 | S |
| 133.758 | 1.273 | S |
| 145.717 | 1.047 | S |
| 156.763 | 0.863 | S |
| 167.521 | 0.670 | S |
| 179.311 | 0.478 | S |
| 191.276 | 0.303 | S |
| 202.035 | 0.203 | S |
| 213.506 | 0.094 | S |
| 224.256 | -0.110 | S |
| 234.956 | -0.339 | S |
| 245.144 | -0.583 | S |
| 256.065 | -0.867 | S |
| 264.370 | -1.065 | S |
| 272.601 | -1.254 | S |



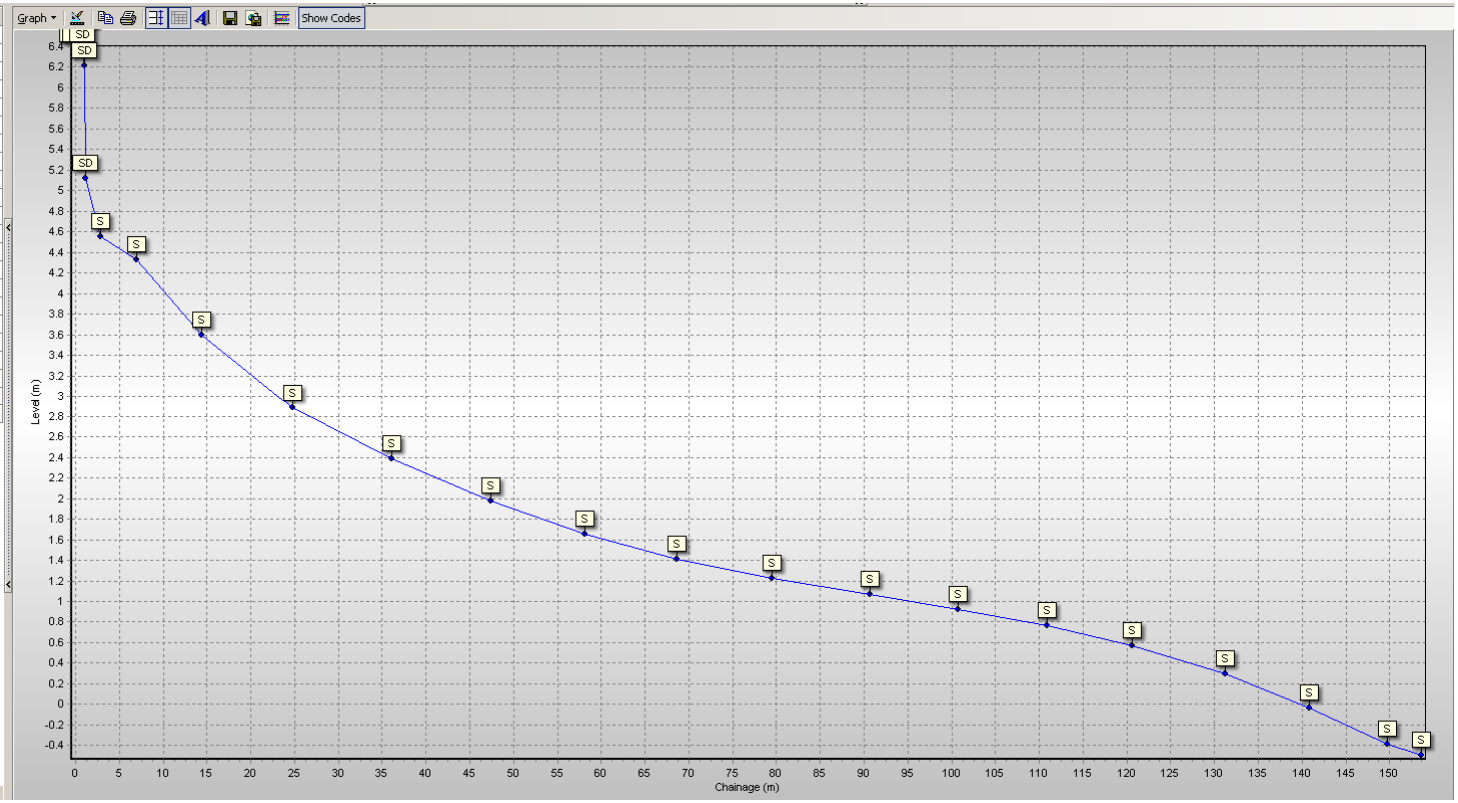
# 1aNTDC07 - 29/03/2010

| Chainage | Level | Code |
|---|---|---|
| 0.000 | 21.785 | |
| 0.024 | 21.785 | ZZ |
| 2.916 | 21.728 | ZZ |
| 5.875 | 21.603 | DV |
| 6.053 | 21.696 | DV |
| 6.990 | 22.081 | DV |
| 8.272 | 22.030 | DV |
| 10.004 | 21.225 | DV |
| 11.322 | 20.644 | DV |
| 12.710 | 20.213 | DV |
| 14.615 | 19.787 | DV |
| 16.607 | 19.306 | DV |
| 17.415 | 18.916 | DV |
| 18.263 | 18.533 | DV |
| 19.060 | 18.349 | DV |
| 20.475 | 17.562 | DV |
| 23.237 | 16.074 | DV |
| 23.439 | 15.827 | DV |
| 24.430 | 15.503 | DV |
| 62.058 | 6.609 | DV |
| 62.395 | 6.426 | S |
| 65.150 | 5.863 | S |
| 72.990 | 4.926 | S |
| 82.867 | 4.258 | S |
| 91.973 | 3.394 | S |
| 103.206 | 2.782 | S |
| 115.116 | 2.283 | S |
| 126.206 | 1.954 | S |
| 138.214 | 1.645 | S |
| 148.555 | 1.427 | S |
| 158.371 | 1.238 | S |
| 168.629 | 1.043 | S |
| 178.506 | 0.852 | S |
| 188.642 | 0.661 | S |
| 199.219 | 0.488 | S |
| 209.971 | 0.337 | S |
| 221.086 | 0.222 | S |
| 232.480 | 0.051 | S |
| 243.802 | -0.149 | S |
| 254.443 | -0.374 | S |
| 263.787 | -0.607 | S |
| 272.750 | -0.838 | S |

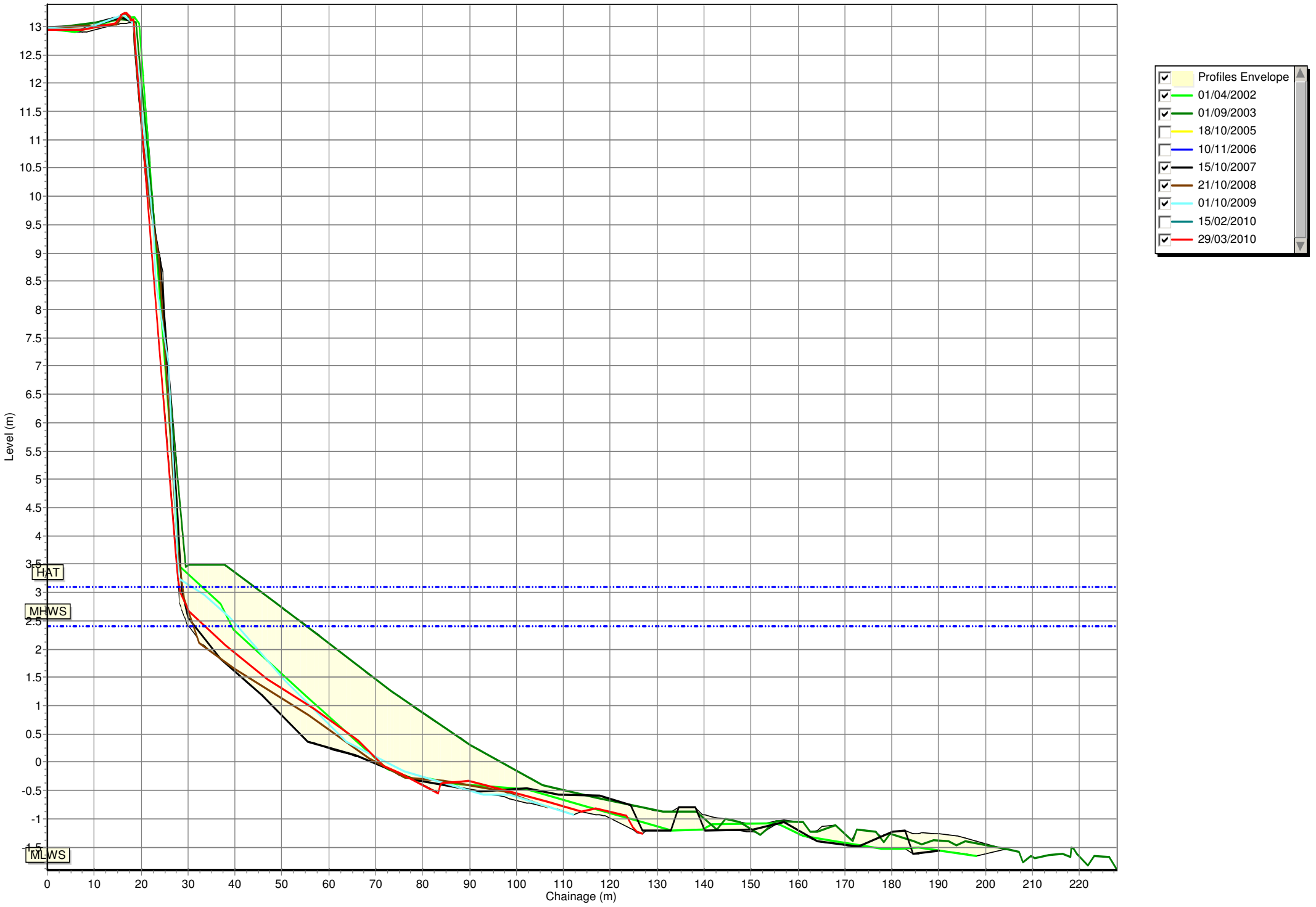


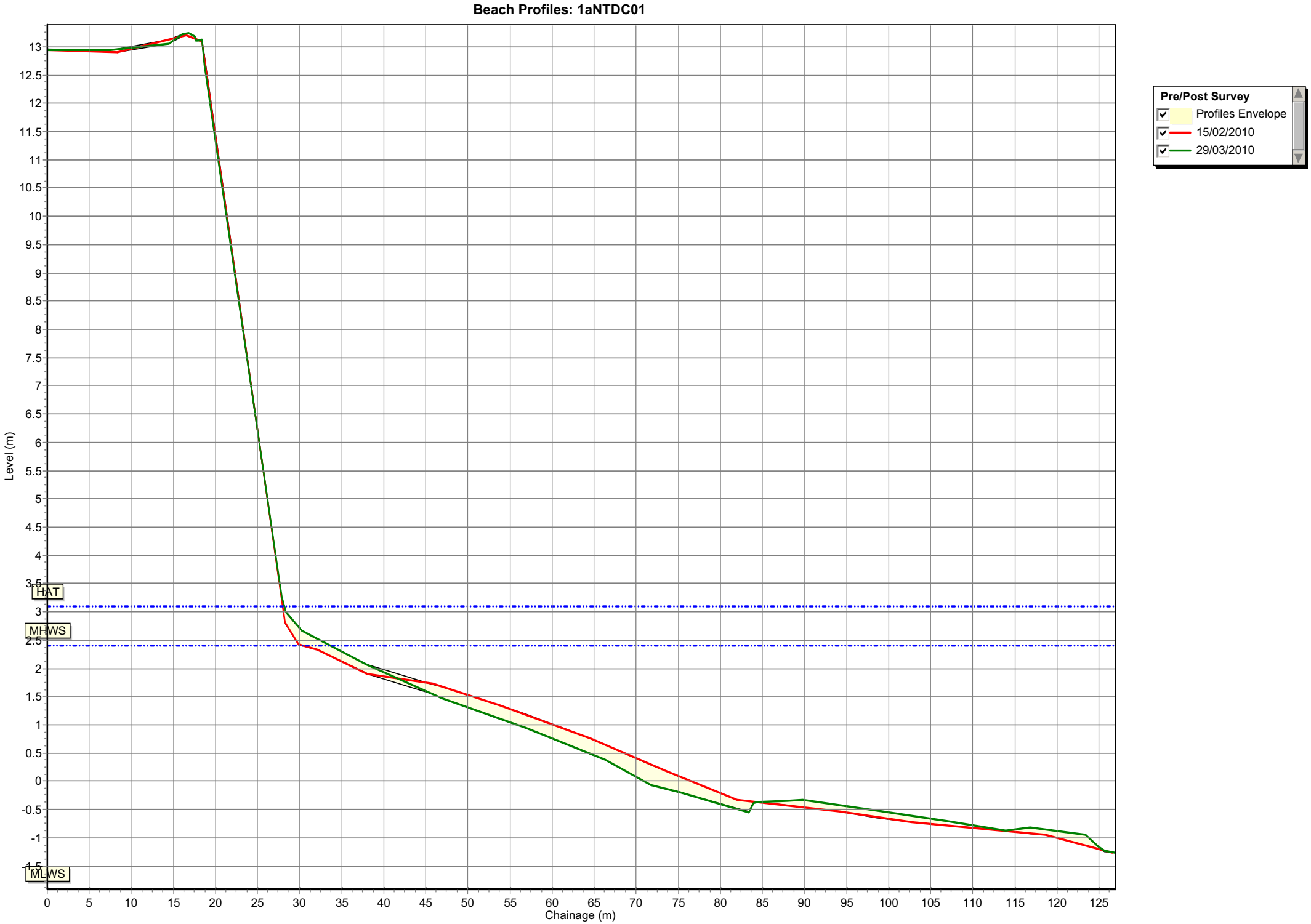
# 1aNTDC08 - 29/03/2010

| Chainage | Level | Code |
|---|---|---|
| 0.000 | 6.370 | |
| 0.015 | 6.370 | SD |
| 0.852 | 6.370 | SD |
| 1.010 | 6.218 | SD |
| 1.176 | 5.120 | SD |
| 2.818 | 4.558 | S |
| 6.996 | 4.329 | S |
| 14.335 | 3.601 | S |
| 24.821 | 2.886 | S |
| 36.078 | 2.387 | S |
| 47.390 | 1.975 | S |
| 58.130 | 1.654 | S |
| 68.653 | 1.410 | S |
| 79.543 | 1.229 | S |
| 90.669 | 1.069 | S |
| 100.735 | 0.924 | S |
| 110.937 | 0.764 | S |
| 120.607 | 0.569 | S |
| 131.233 | 0.296 | S |
| 140.777 | -0.036 | S |
| 149.728 | -0.385 | S |
| 153.621 | -0.494 | S |

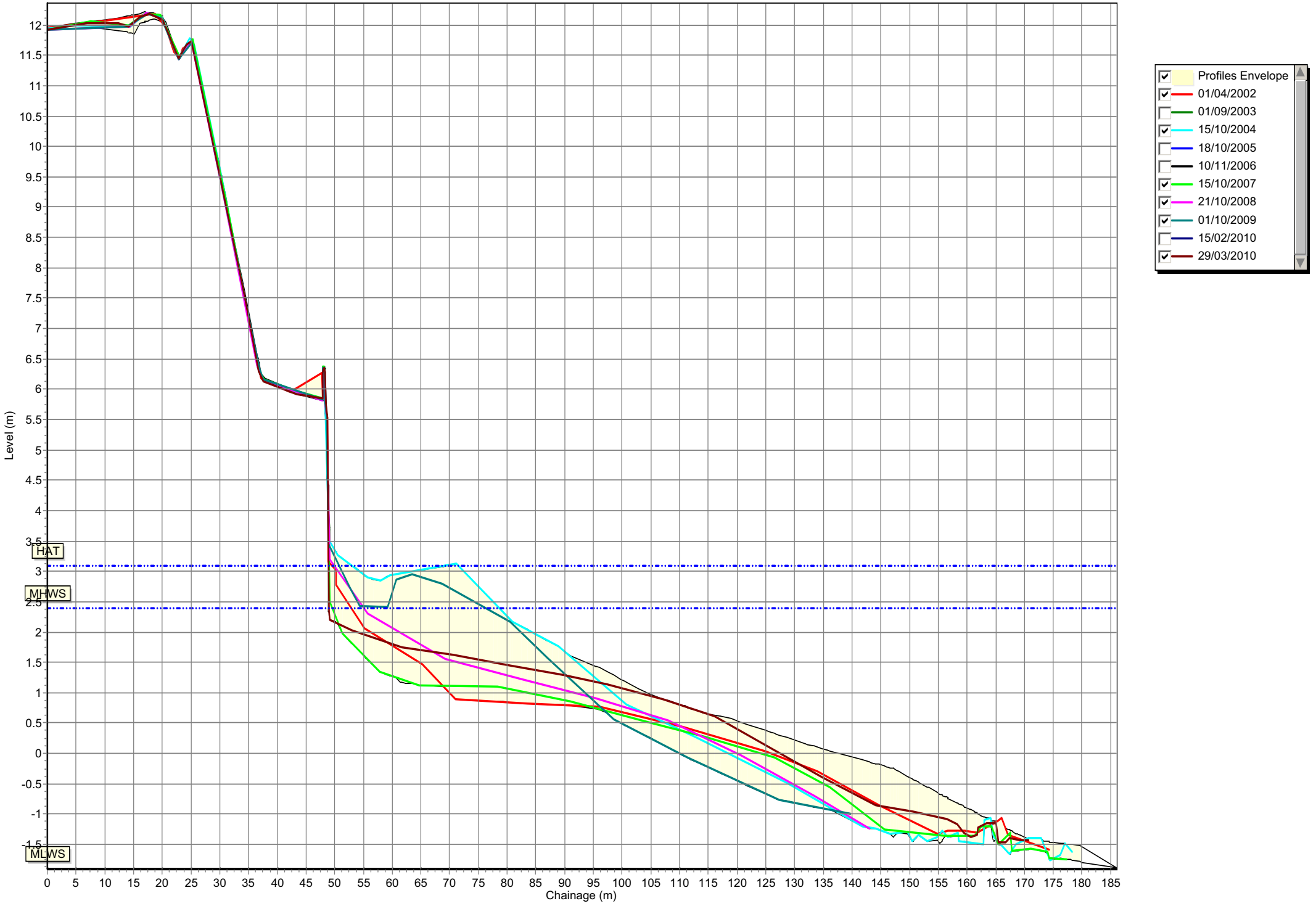


# Beach Profiles: 1aNTDC01




Beach Profiles: 1aNTDC01
Pre/Post Survey
Profiles Envelope
15/02/2010
29/03/2010
HAT
MHWS
MLWS
Level (m)
Chainage (m)
13
12.5
12
11.5
11
10.5
10
9.5
9
8.5
8
7.5
7
6.5
6
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
105
110
115
120
125

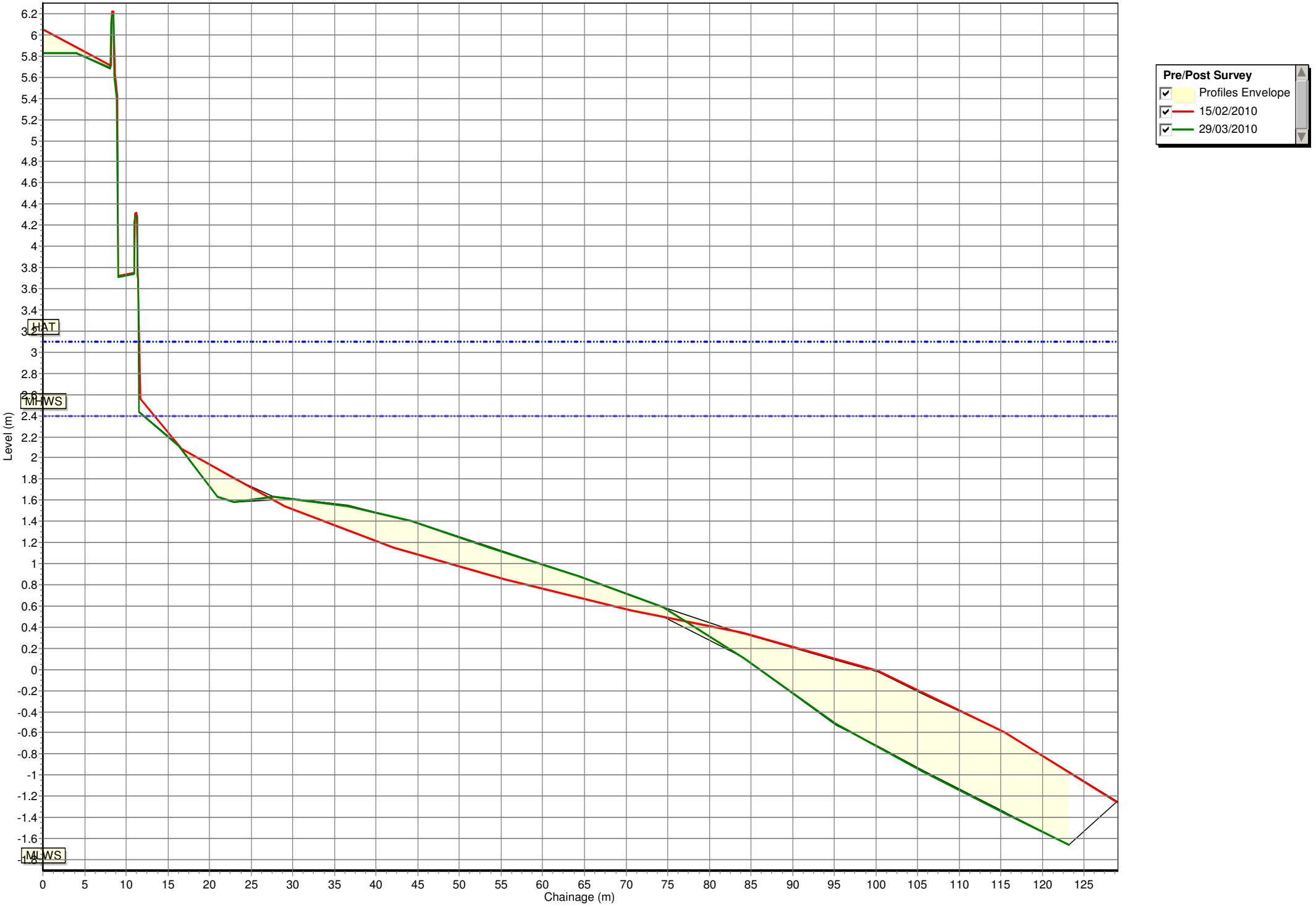
# Beach Profiles: 1aNTDC02



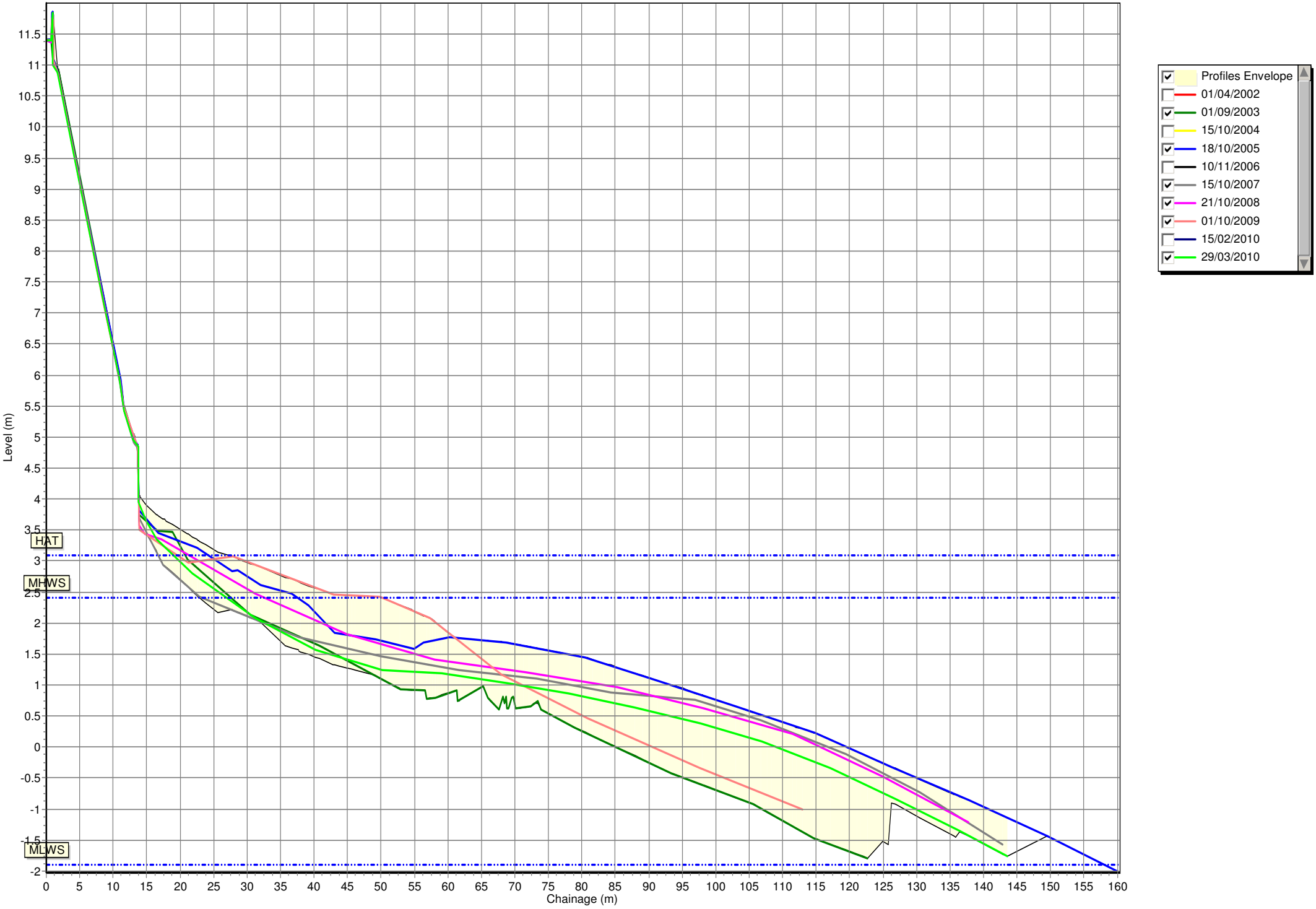

Beach Profiles: 1aNTDC02
Pre/Post Survey
Profiles Envelope
15/02/2010
29/03/2010
HAT
MHWS
MLWS
Level (m)
Chainage (m)
12
11.5
11
10.5
10
9.5
9
8.5
8
7.5
7
6.5
6
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125 130 135 140 145 150 155 160 165 170

# Beach Profiles: 1aNTDC03

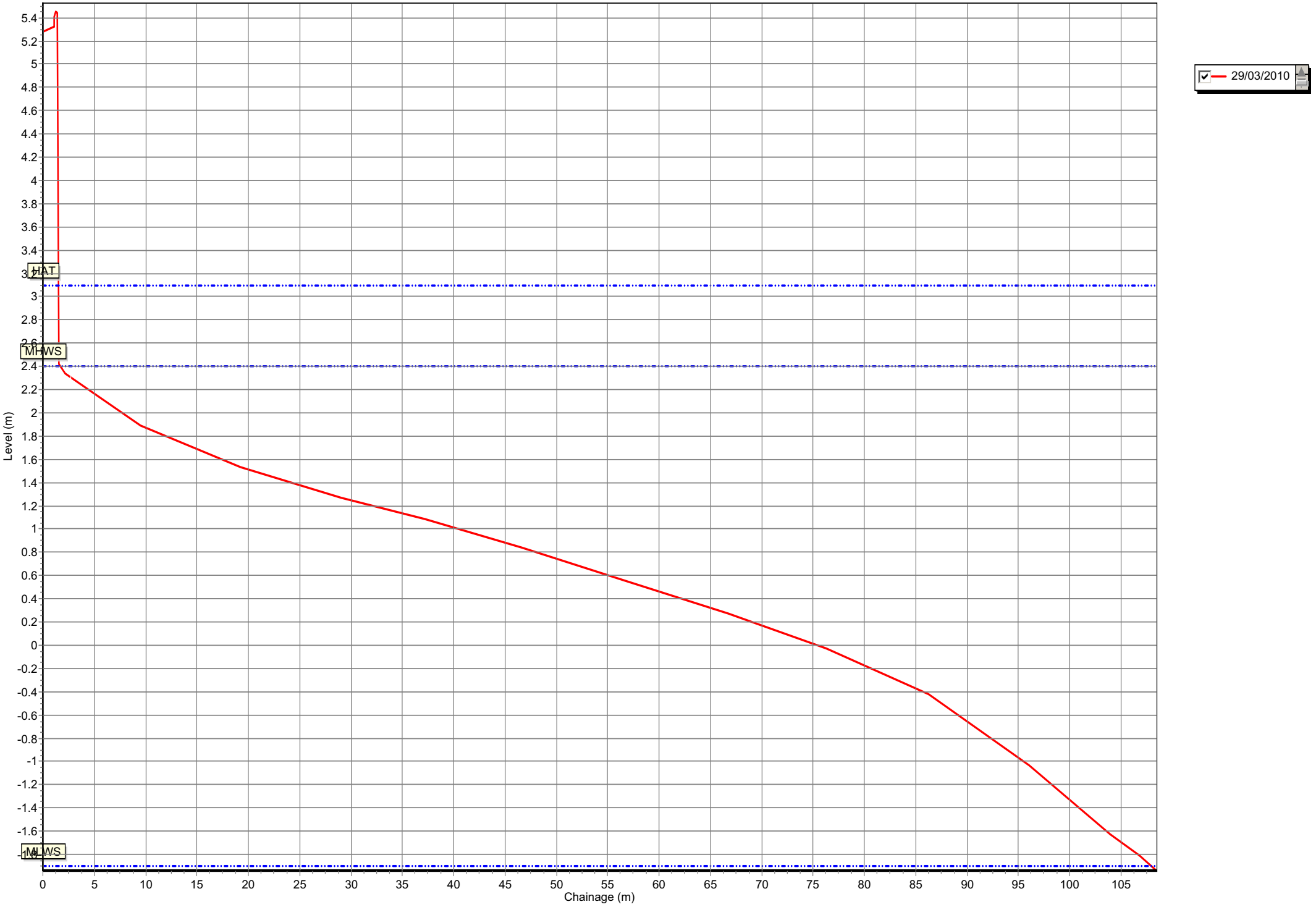
# Beach Profiles: 1aNTDC03



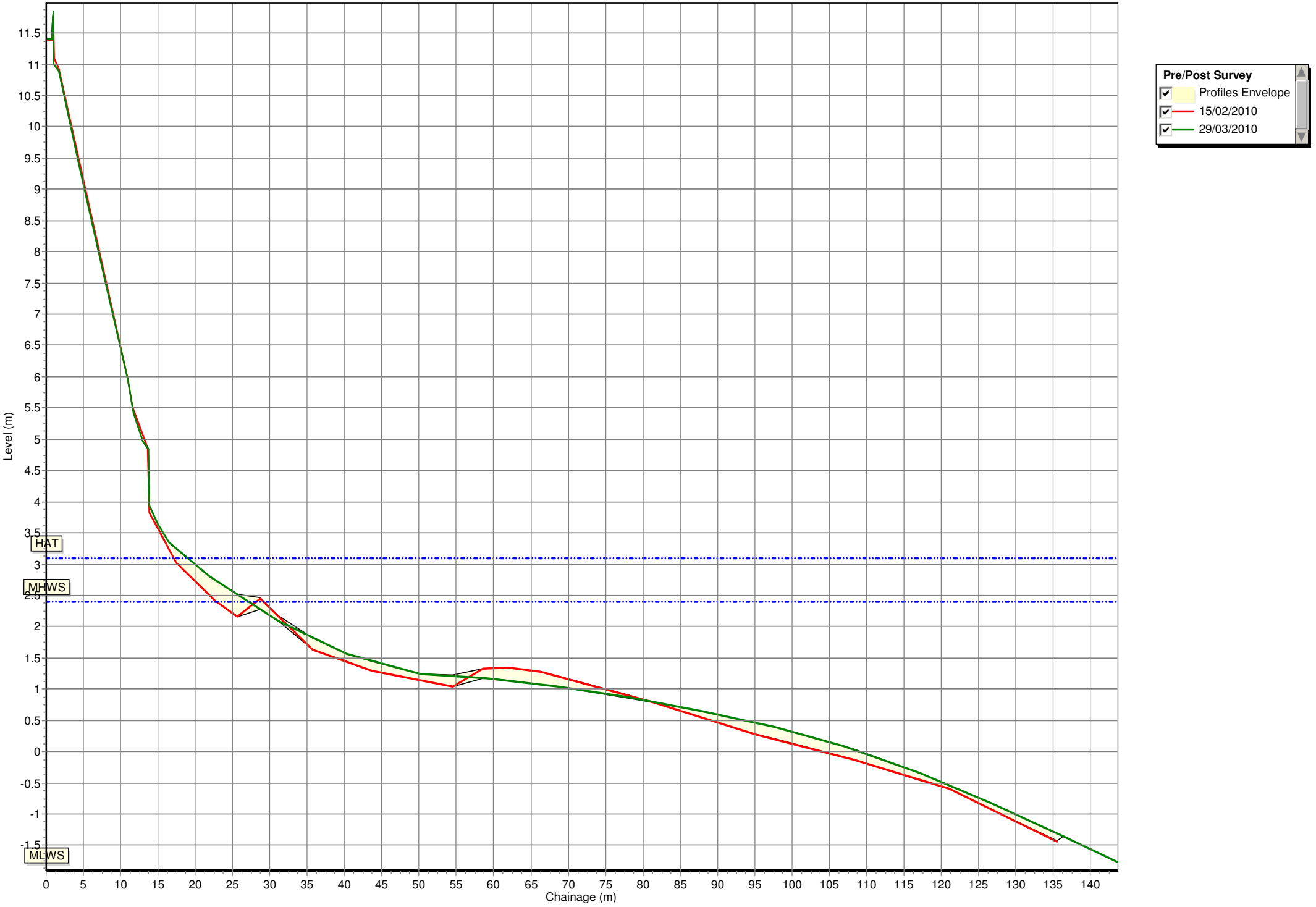
# Beach Profiles: 1aNTDC04



# Beach Profiles: 1aNTDC04A

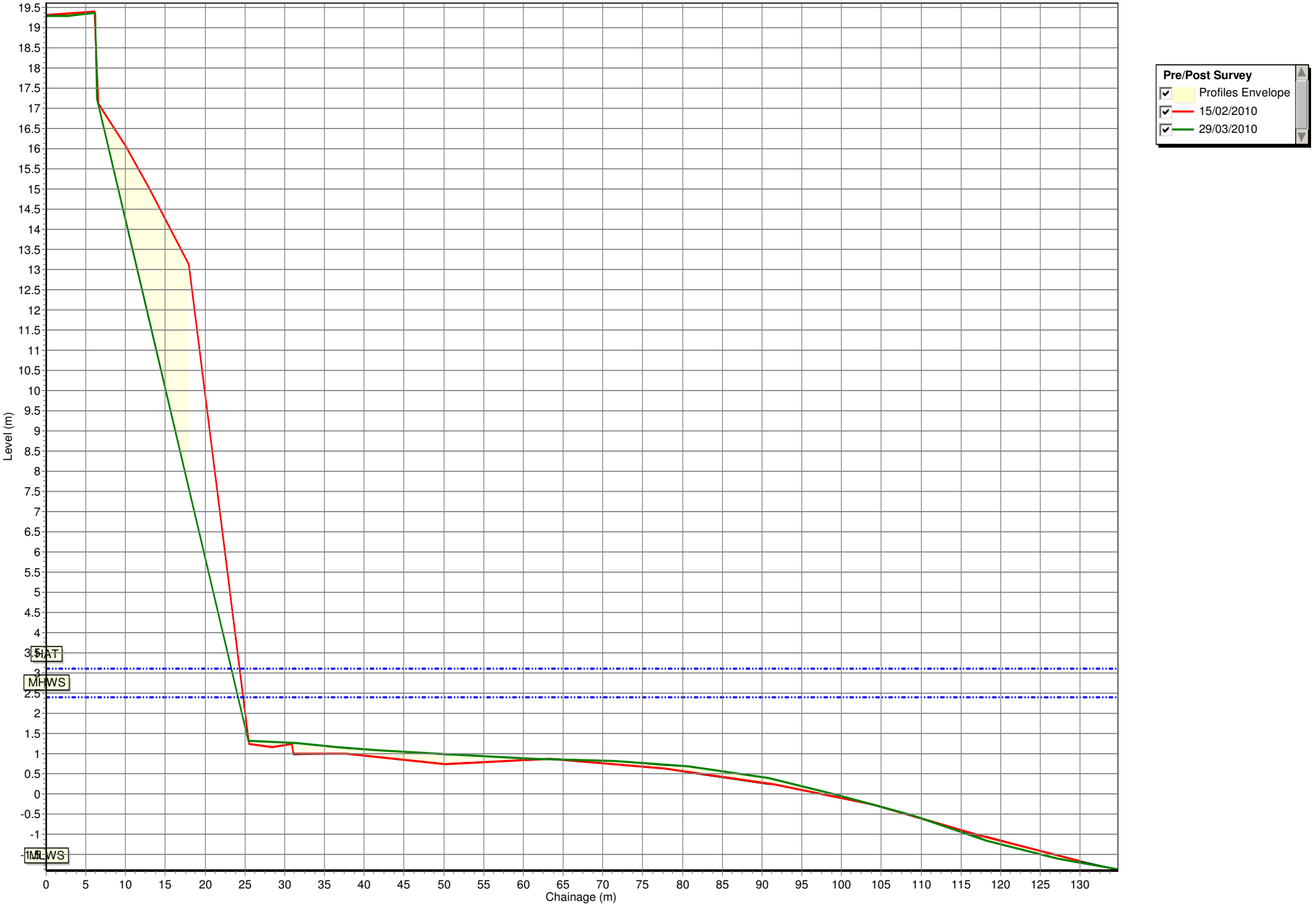


# Beach Profiles: 1aNTDC04

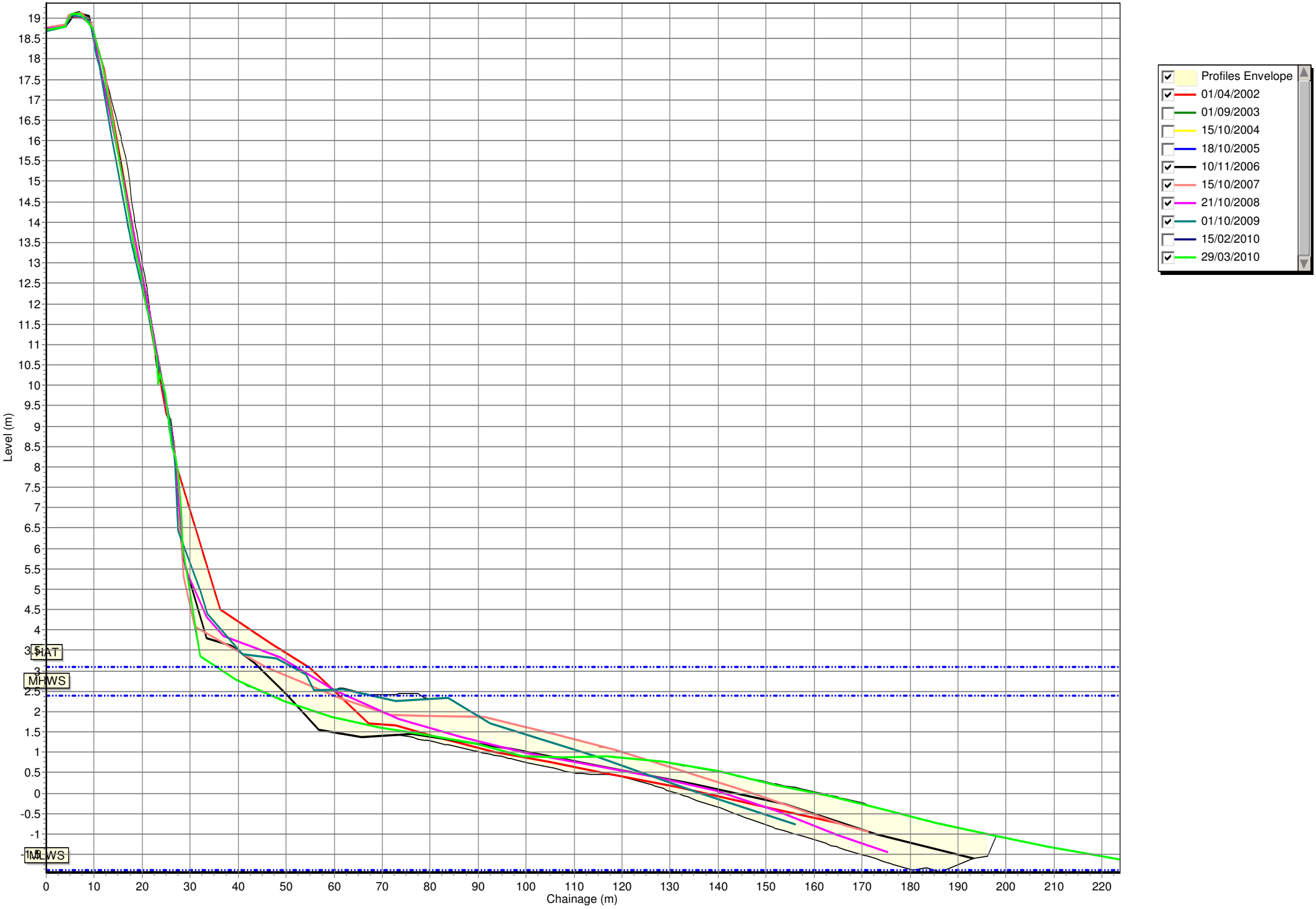


# Beach Profiles: 1aNTDC05

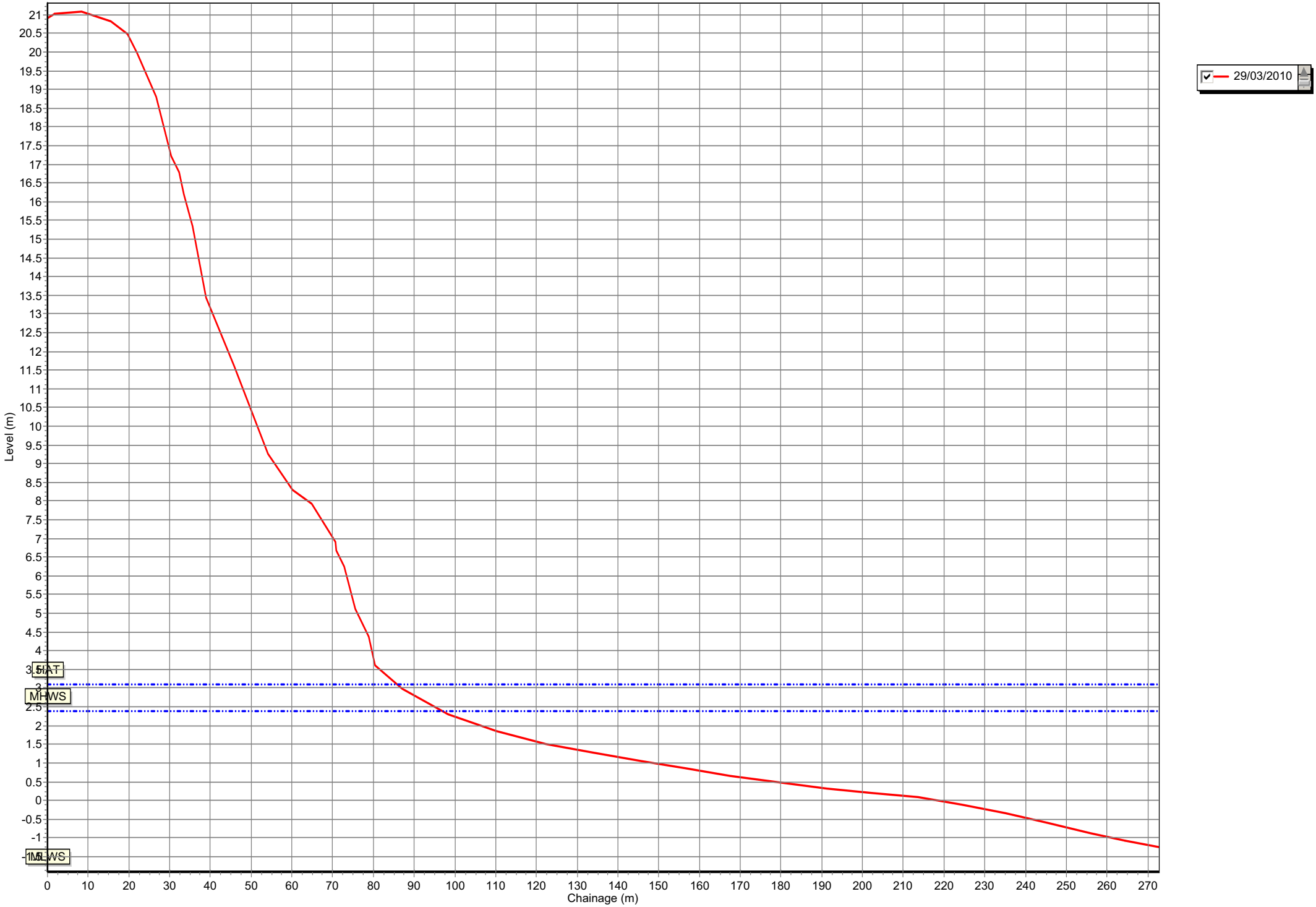
# Beach Profiles: 1aNTDC05



# Beach Profiles: 1aNTDC06

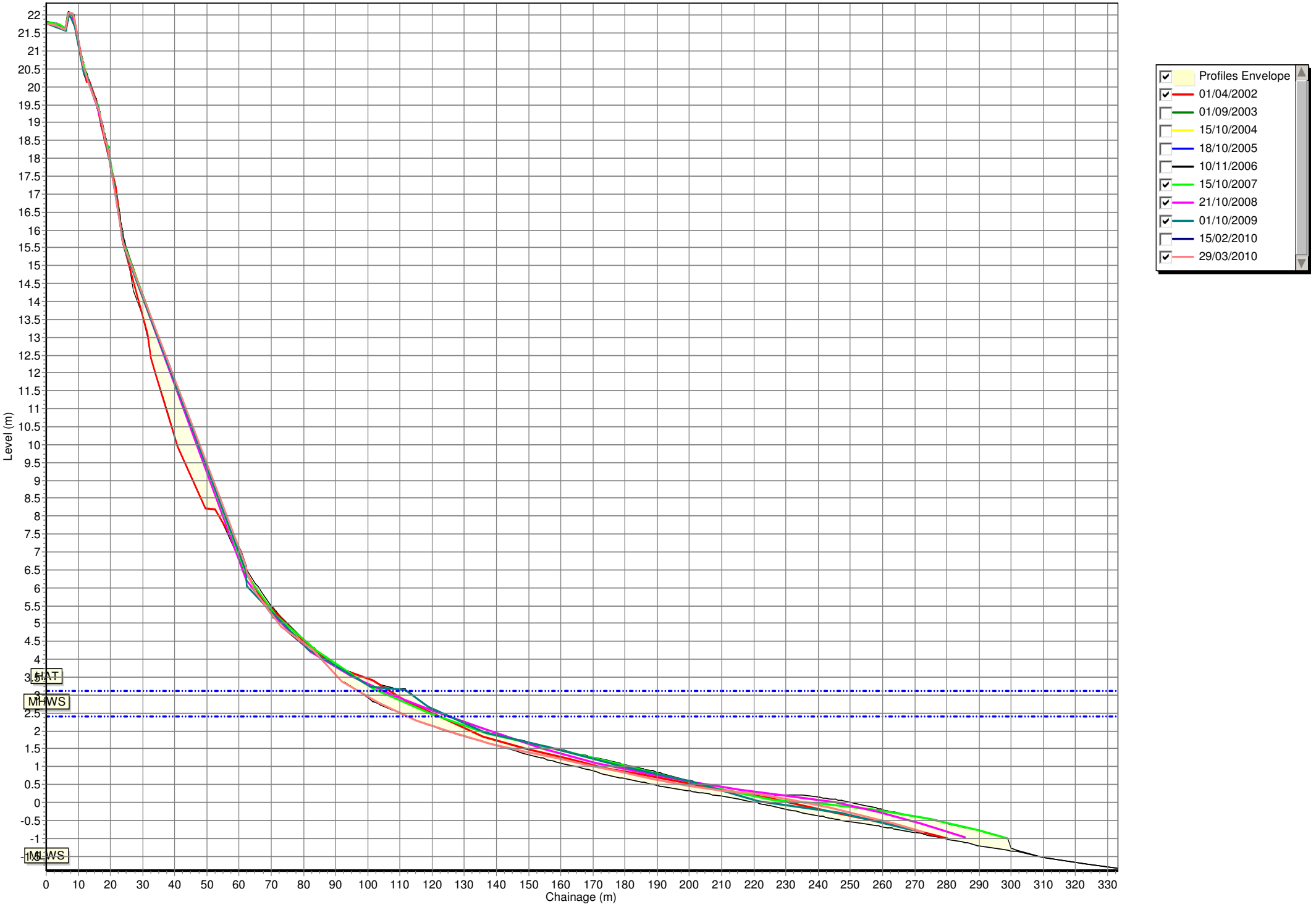


# Beach Profiles: 1aNTDC06A

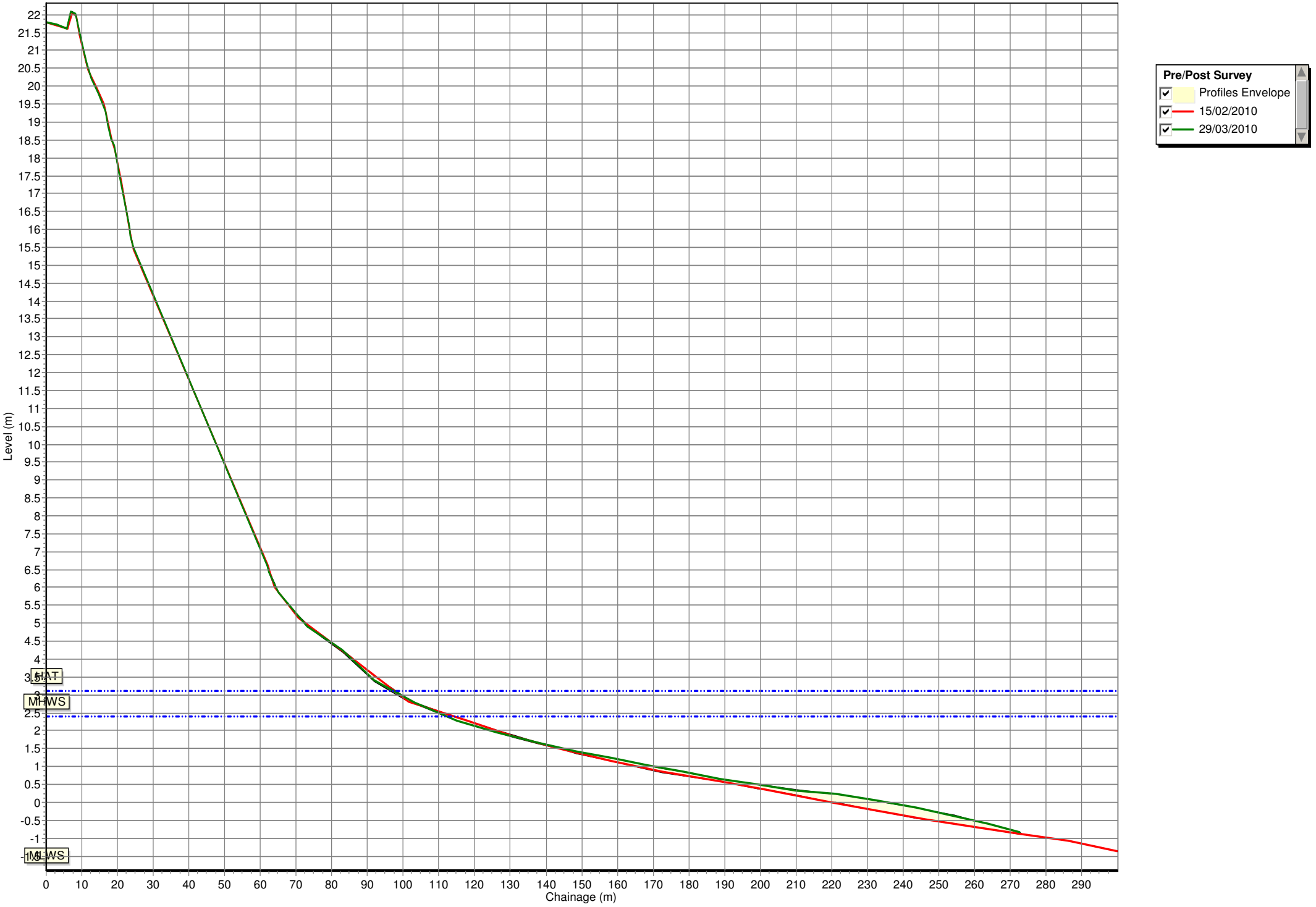


**Beach Profiles: 1aNTDC06**

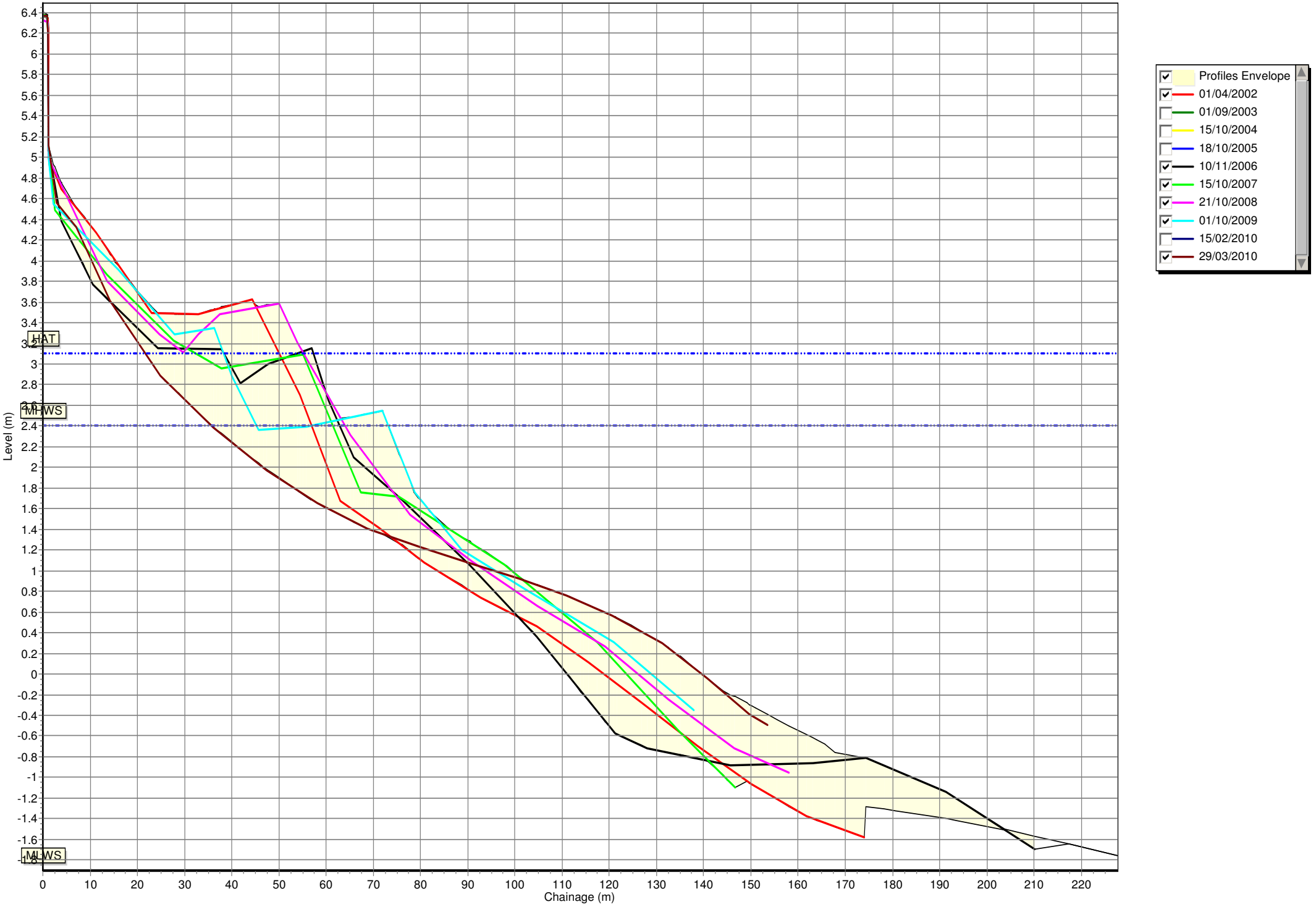
# Beach Profiles: 1aNTDC07



# Beach Profiles: 1aNTDC07



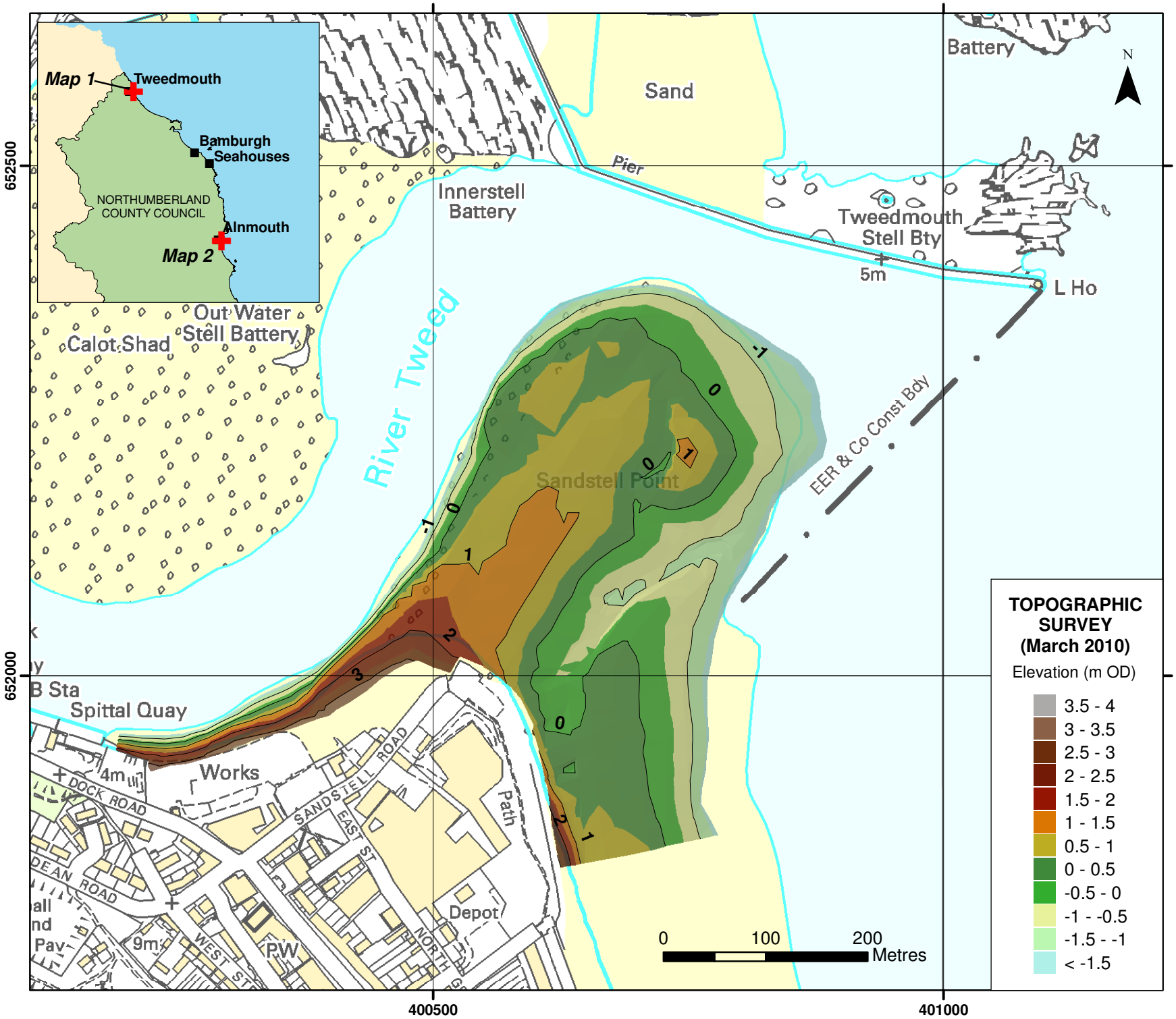
# Beach Profiles: 1aNTDC08



**Beach Profiles: 1aNTDC08**

# Appendix B

# Topographic Surveys


Map 1
Tweedmouth
Bamburgh
Seahouses
NORTHUMBERLAND
COUNTY COUNCIL
Alnmouth
Map 2
Battery
N
Sand
Pier
Innerstell
Battery
Tweedmouth
Stell Bty
5m
L Ho
Out Water
Stell Battery
Calot Shad
River Tweed
Sandstell Point
EER & Co Const Bdy
652500
652000
B Sta
Spittal Quay
Works
4m
DOCK ROAD
SANDSTELL ROAD
EAST ST
Path
Depot
9m
PW
WEST ST
NORTH
400500
401000
0
100
200
Metres
TOPOGRAPHIC SURVEY (March 2010)
Elevation (m OD)
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
< -1.5
Topographic Contours at 1 metre interval
Client: North East Coastal Group
Project: Cell 1 Regional Coastal Monitoring Programme
Appendix B - Map 1a
Northumberland County Council Frontage
Update Report 2
'Partial Measures' Survey 2010
Drawing Scale 1:5,000 at A4
Drawn by: TC Date: 19/05/2010
Checked by: NC Date: 26/05/2010
Approved by: NC Date: 26/05/2010
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Marlborough Crescent
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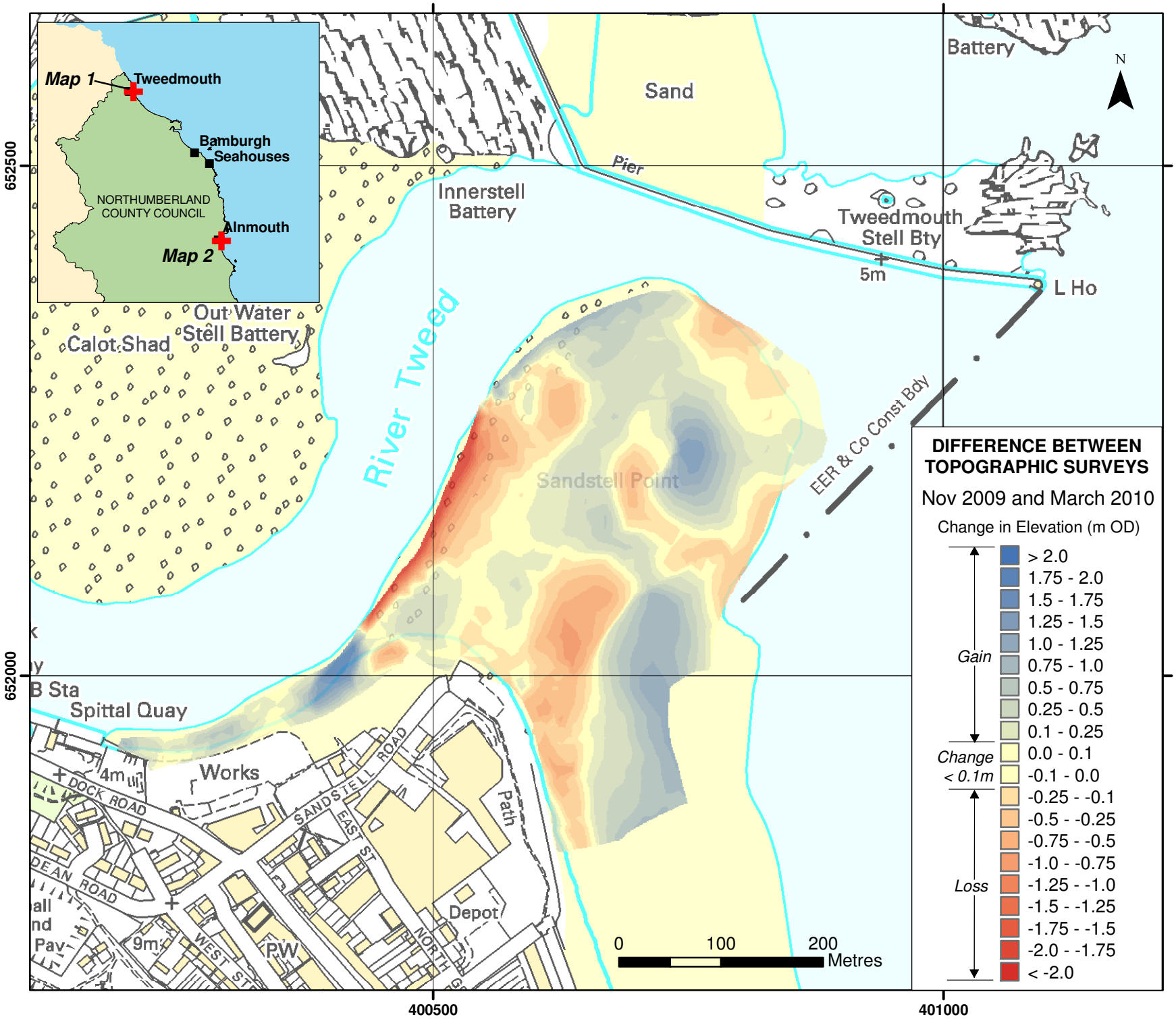
I:\9T6403\Technical_Data\gis\figure\4_PARTIAL_measure_report_2010\1_Northumberland\Appendix_B_Map1a_Berwick.mxd




**DIFFERENCE BETWEEN TOPOGRAPHIC SURVEYS**

Nov 2009 and March 2010

Change in Elevation (m OD)

| | |
|---|---|
| Gain | > 2.0 |
| | 1.75 - 2.0 |
| | 1.5 - 1.75 |
| | 1.25 - 1.5 |
| | 1.0 - 1.25 |
| | 0.75 - 1.0 |
| | 0.5 - 0.75 |
| | 0.25 - 0.5 |
| | 0.1 - 0.25 |
| Change < 0.1m | 0.0 - 0.1 |
| | -0.1 - 0.0 |
| Loss | -0.25 - -0.1 |
| | -0.5 - -0.25 |
| | -0.75 - -0.5 |
| | -1.0 - -0.75 |
| | -1.25 - -1.0 |
| | -1.5 - -1.25 |
| | -1.75 - -1.5 |
| | -2.0 - -1.75 |
| | < -2.0 |

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

# Appendix B - Map 1b Northumberland County Council Frontage

Update Report 2
'Partial Measures' Survey 2010

Drawing Scale 1:5,000 at A4

| | | | |
|---|---|---|---|
| Drawn by: | TC | Date: | 19/05/2010 |
| Checked by: | NC | Date: | 26/05/2010 |
| Approved by: | NC | Date: | 26/05/2010 |

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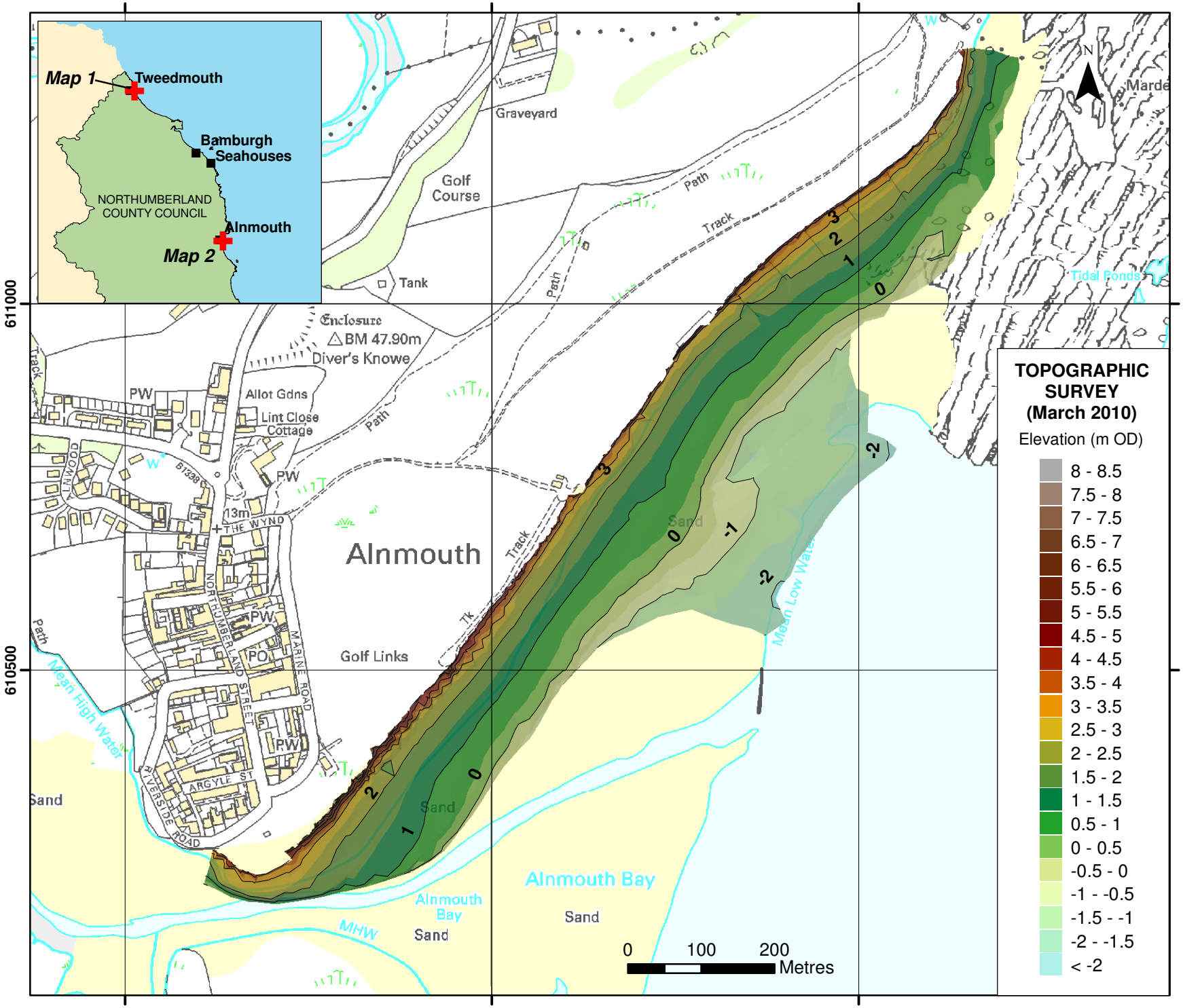


Topographic Contours at 1 metre interval

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

# Appendix B - Map 2a Northumberland County Council Frontage

Update Report 2
'Partial Measures' Survey 2010

Drawing Scale 1:7,000 at A4

| | | |
|---|---|---|
| Drawn by: | TC | Date: 19/05/2010 |
| Checked by: | NC | Date: 26/05/2010 |
| Approved by: | NC | Date: 26/05/2010 |


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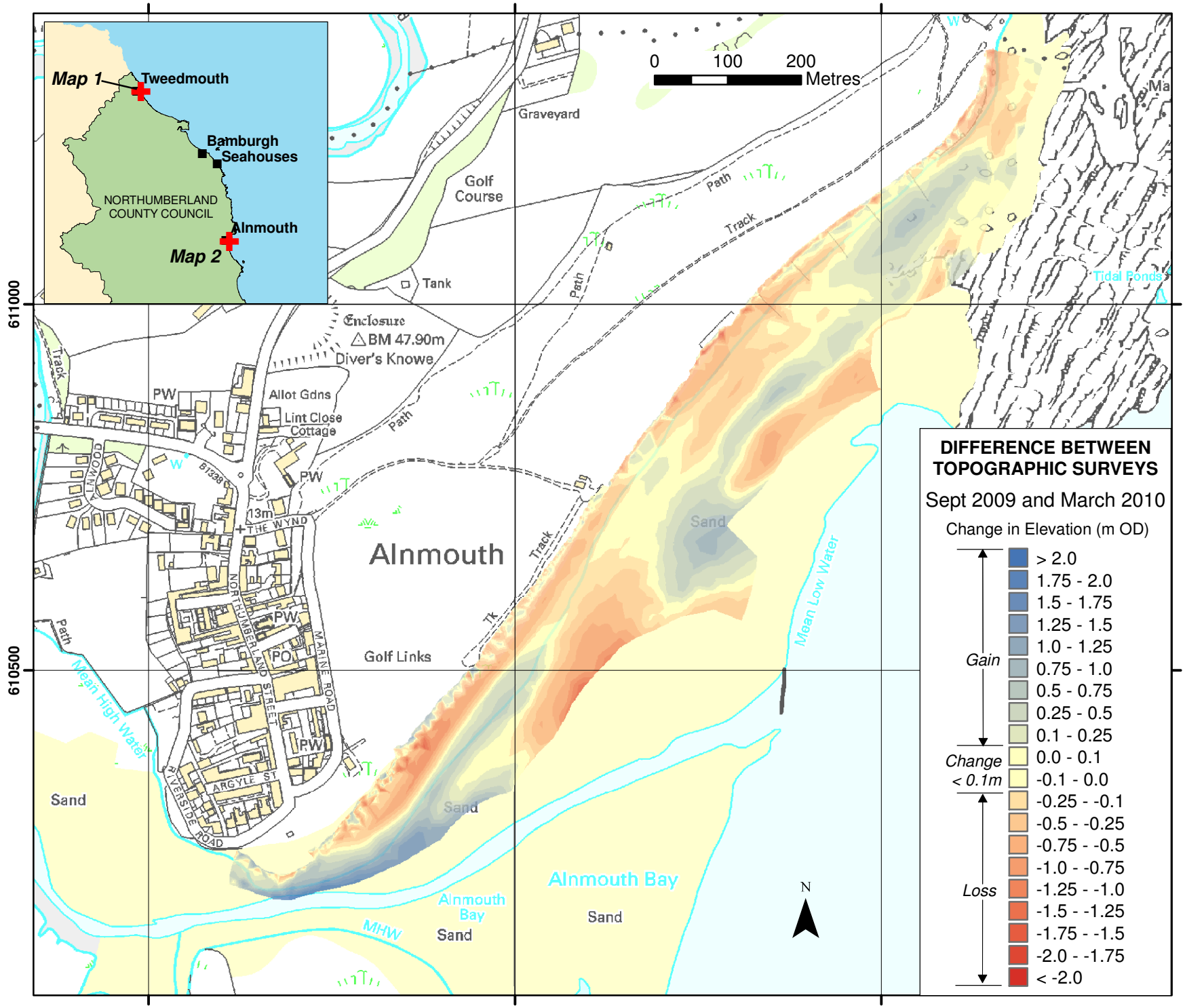


**DIFFERENCE BETWEEN TOPOGRAPHIC SURVEYS**

Sept 2009 and March 2010

Change in Elevation (m OD)

| | |
|---|---|
| Gain | > 2.0 |
| | 1.75 - 2.0 |
| | 1.5 - 1.75 |
| | 1.25 - 1.5 |
| | 1.0 - 1.25 |
| | 0.75 - 1.0 |
| | 0.5 - 0.75 |
| | 0.25 - 0.5 |
| | 0.1 - 0.25 |
| Change < 0.1m | 0.0 - 0.1 |
| | -0.1 - 0.0 |
| Loss | -0.25 - -0.1 |
| | -0.5 - -0.25 |
| | -0.75 - -0.5 |
| | -1.0 - -0.75 |
| | -1.25 - -1.0 |
| | -1.5 - -1.25 |
| | -1.75 - -1.5 |
| | -2.0 - -1.75 |
| | < -2.0 |

— Topographic Contours at 1 metre interval

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

# Appendix B - Map 2b Northumberland County Council Frontage

Update Report 2
'Partial Measures' Survey 2010

Drawing Scale 1:7,000 at A4

| | | |
|---|---|---|
| Drawn by: | TC | Date: 19/05/2010 |
| Checked by: | NC | Date: 26/05/2010 |
| Approved by: | NC | Date: 26/05/2010 |

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# Appendix C

# Cliff Top Surveys

Data relating to the cliff top surveys are best viewed as digital ‘kmz’ files loaded into Google Earth.