ROYAL HASKONING

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

Northumberland County Council

NORTHUMBERLAND
Northumberland County Council

July 2011

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Abbreviations and Acronyms

Acronym / Abbreviation	Definition
AONB	Area of Outstanding Natural Beauty
DGM	Digital Ground Model
HAT	Highest Astronomical Tide
LAT	Lowest Astronomical Tide
m	metres
MHWN	Mean High Water Neap
MHWS	Mean High Water Spring
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, Sandstell Point and Newbiggin Bay, 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	-
3	2009/10	Sep-Nov 10	Dec 10	Mar-April 11	July 11 (*)	July 11

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

(*) The present report is **Update Report 3** and provides an analysis of the 2011 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)
    - Topographic survey along Newbiggin Bay (since Full Measures 2010)

- 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)
    - Topographic survey along Newbiggin Bay (since Full Measures 2010)

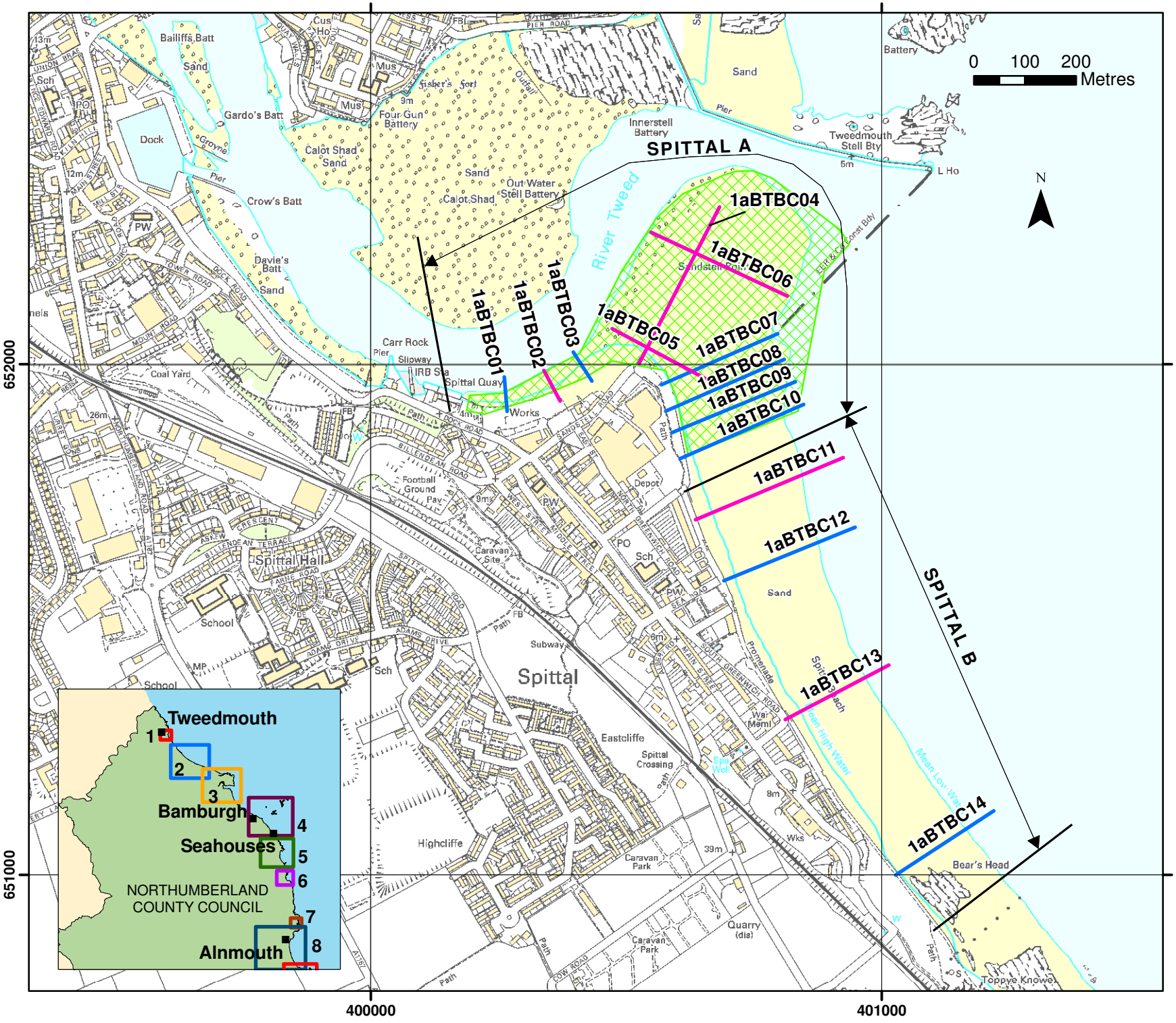
- Cliff top survey (bi-annually) at:
    - Cliff top survey at Newbiggin Caravan Park (since Full Measures 2007)
    - Cliff top survey at Sandy Bay Caravan Park (since Full Measures 2007)
    - Cliff top survey at Cambois (since Partial Measures 2009)

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 undertaken along this frontage in March and April 2011, when weather conditions were generally fine and the sea state was mostly calm.

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 3
'Partial Measures' Survey 2011

Drawing Scale 1:10,000 at A4

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Royal Haskoning
Marlborough House
Marlborough Crescent
Newcastle upon Tyne
NE1 4EE

Tel: +44 (0)191 211 1300
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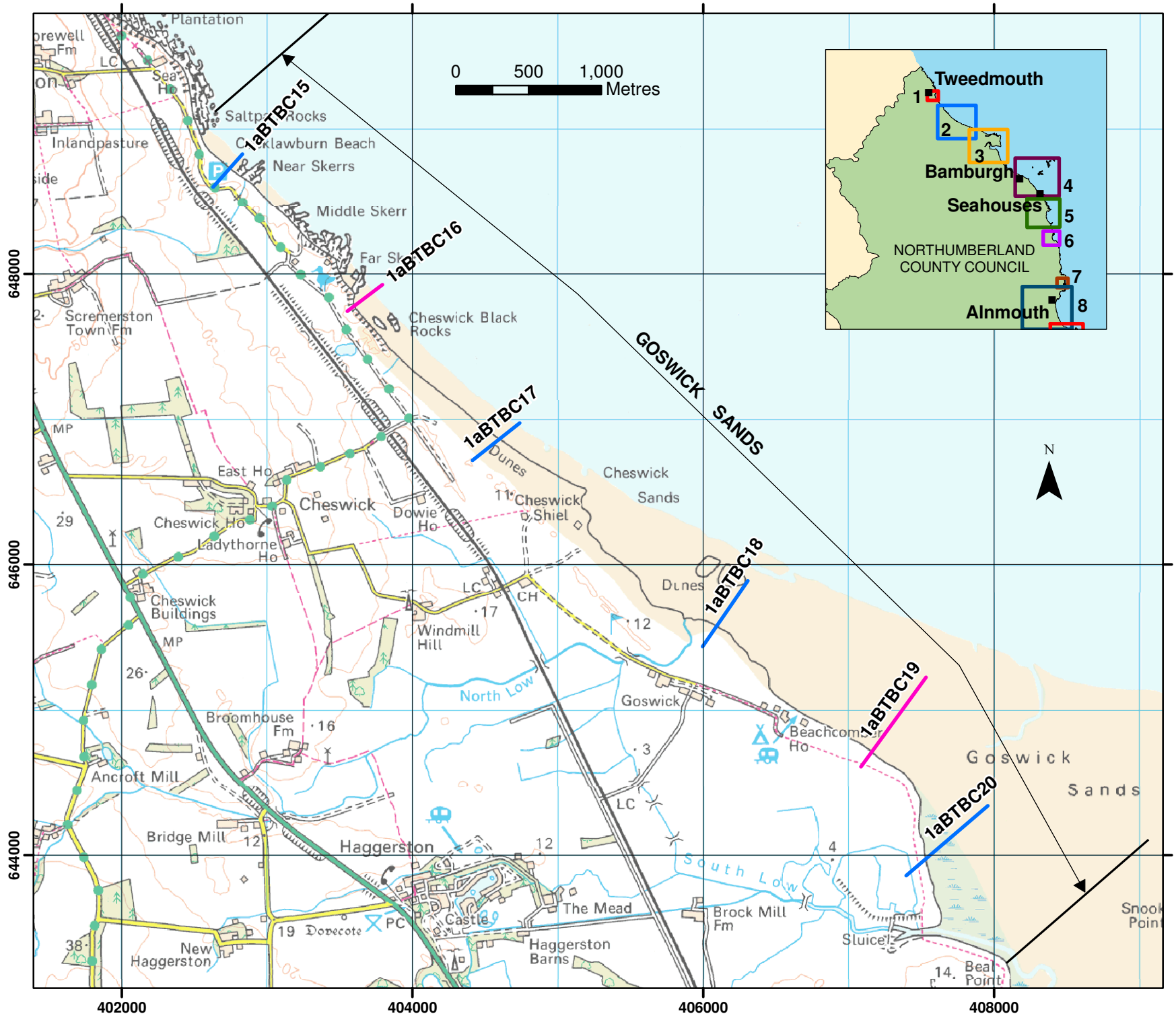

SURVEY LOCATIONS

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(Indicative Survey Extents shown)

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Figure 1 - Map 2 Northumberland County Council Frontage

Update Report 3
'Partial Measures' Survey 2011

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Marlborough Crescent
Newcastle upon Tyne
NE1 4EE

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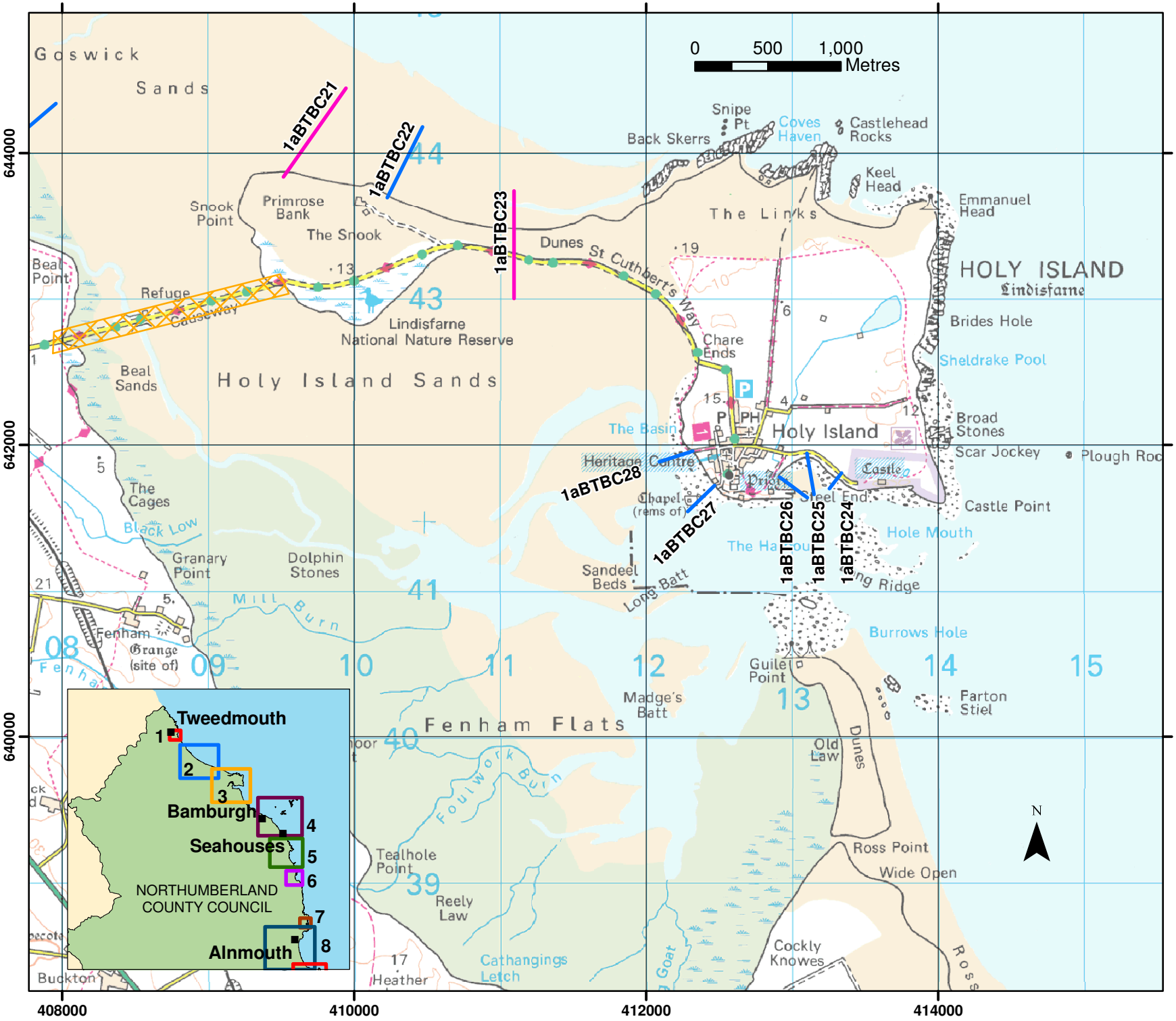

SURVEY LOCATIONS

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Topographic Surveys
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(Indicative Survey Extents shown)

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Figure 1 - Map 3 Northumberland County Council Frontage

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'Partial Measures' Survey 2011

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Royal Haskoning
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Newcastle upon Tyne
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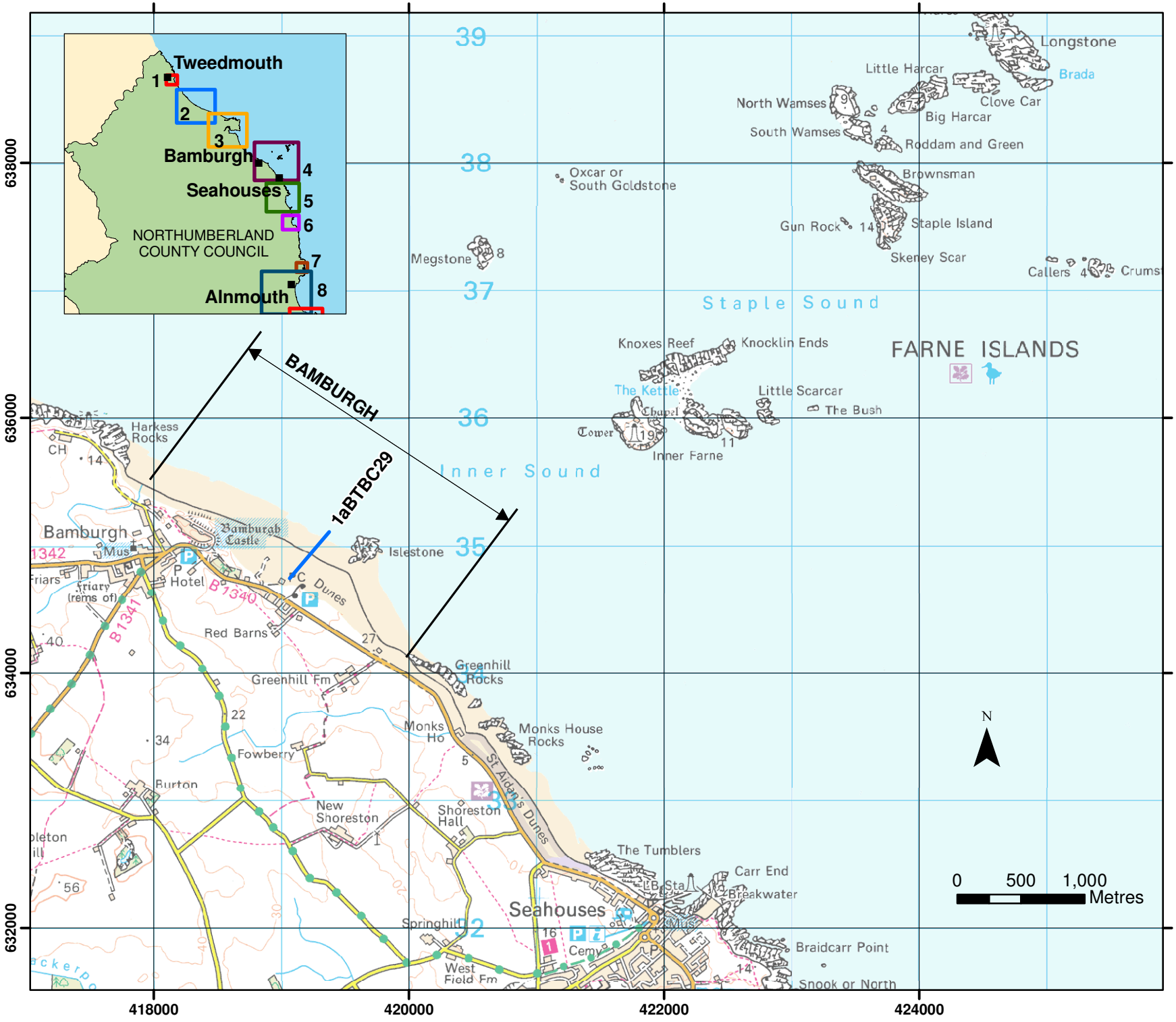

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- Cliff Top Edge Survey

(Indicative Survey Extents shown)

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Project: Cell 1 Regional Coastal Monitoring Programme

Figure 1 - Map 4 Northumberland County Council Frontage

Update Report 3
'Partial Measures' Survey 2011

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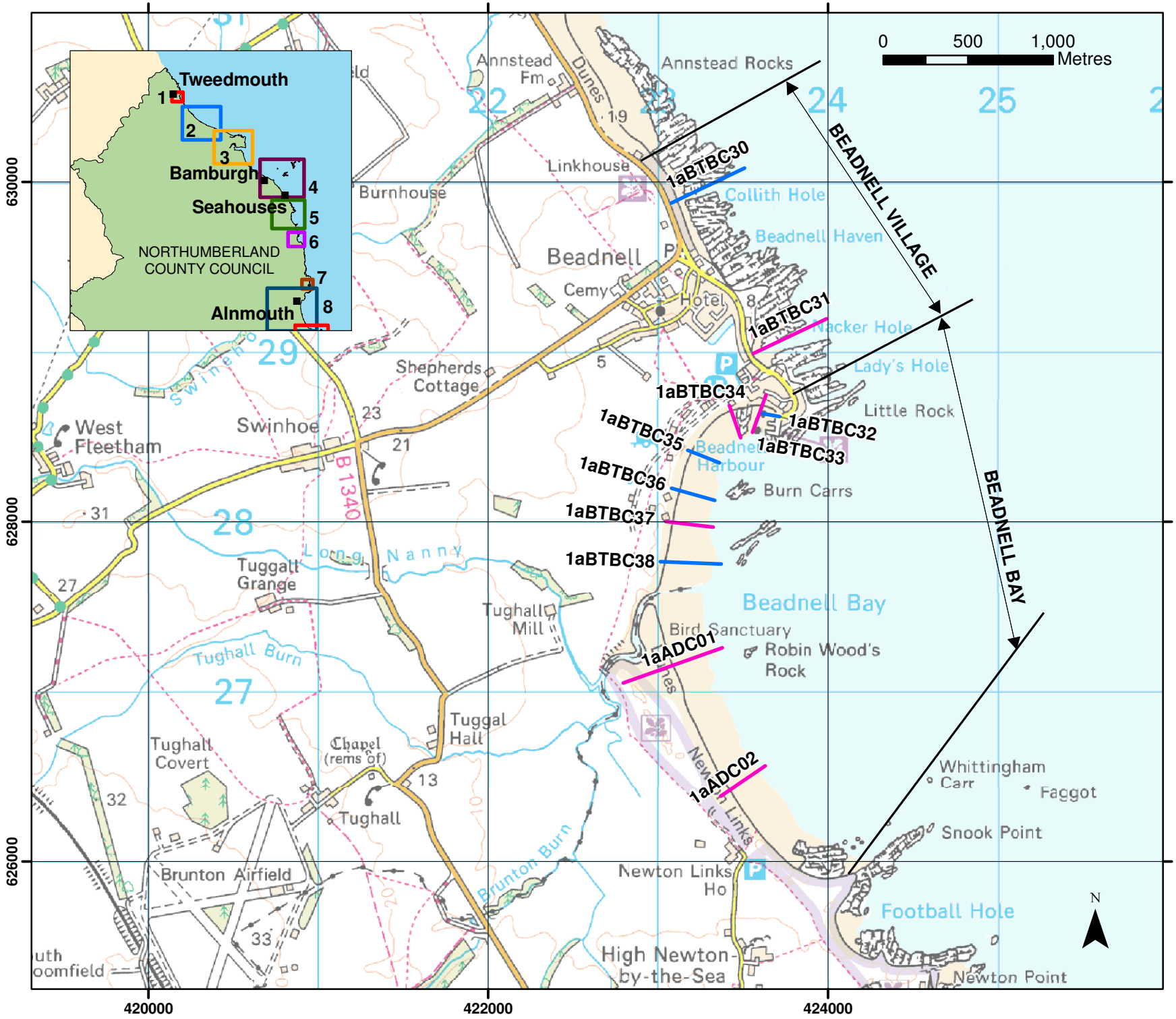

SURVEY LOCATIONS

Topographic Profiles
- Annual
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Topographic Surveys
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- 5 yearly

- Cliff Top Edge Survey

(Indicative Survey Extents shown)

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Project: Cell 1 Regional Coastal Monitoring Programme

Figure 1 - Map 5 Northumberland County Council Frontage

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'Partial Measures' Survey 2011

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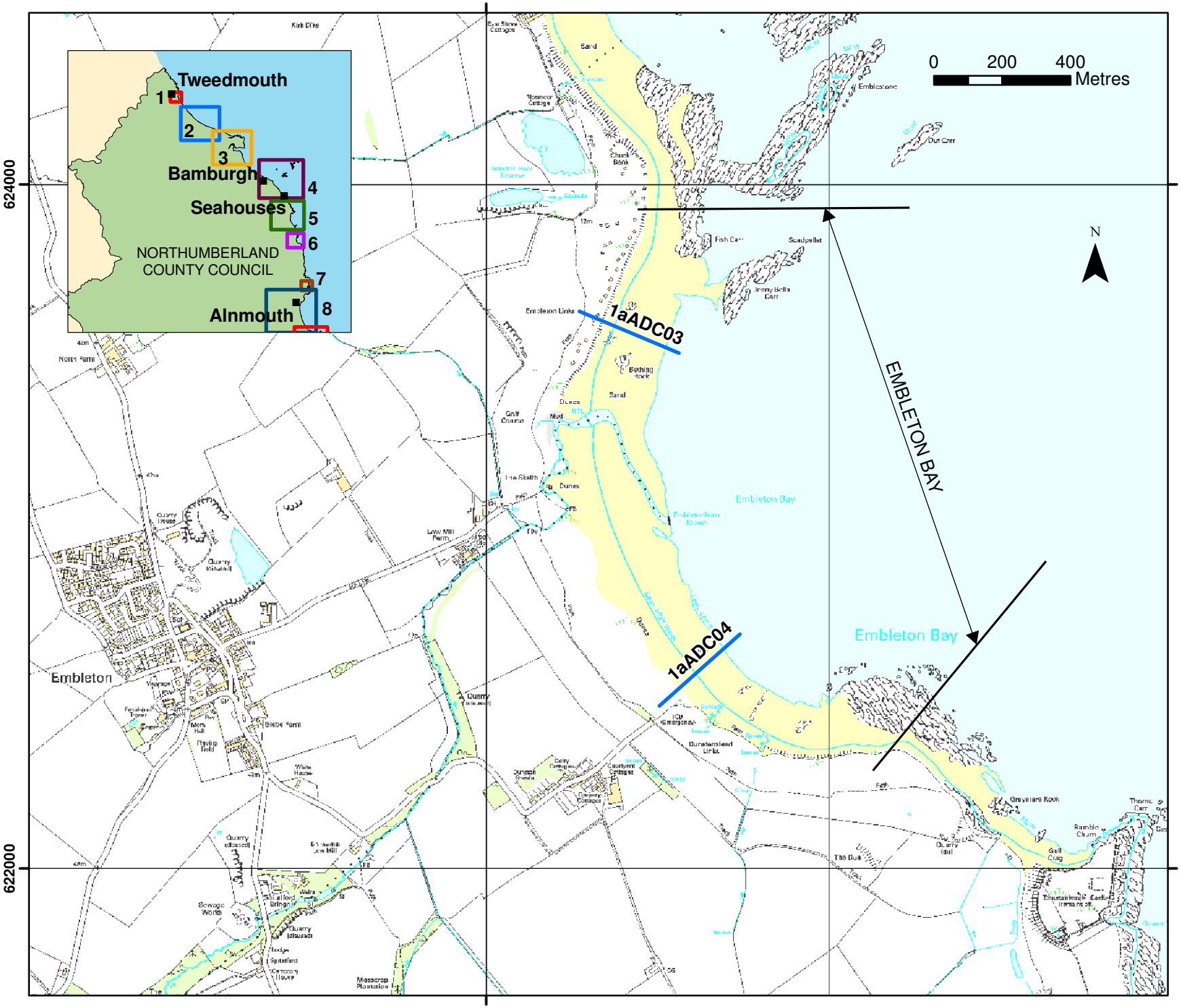

SURVEY LOCATIONS

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- Annual
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Topographic Surveys
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- 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 6 Northumberland County Council Frontage

Update Report 3
'Partial Measures' Survey 2011

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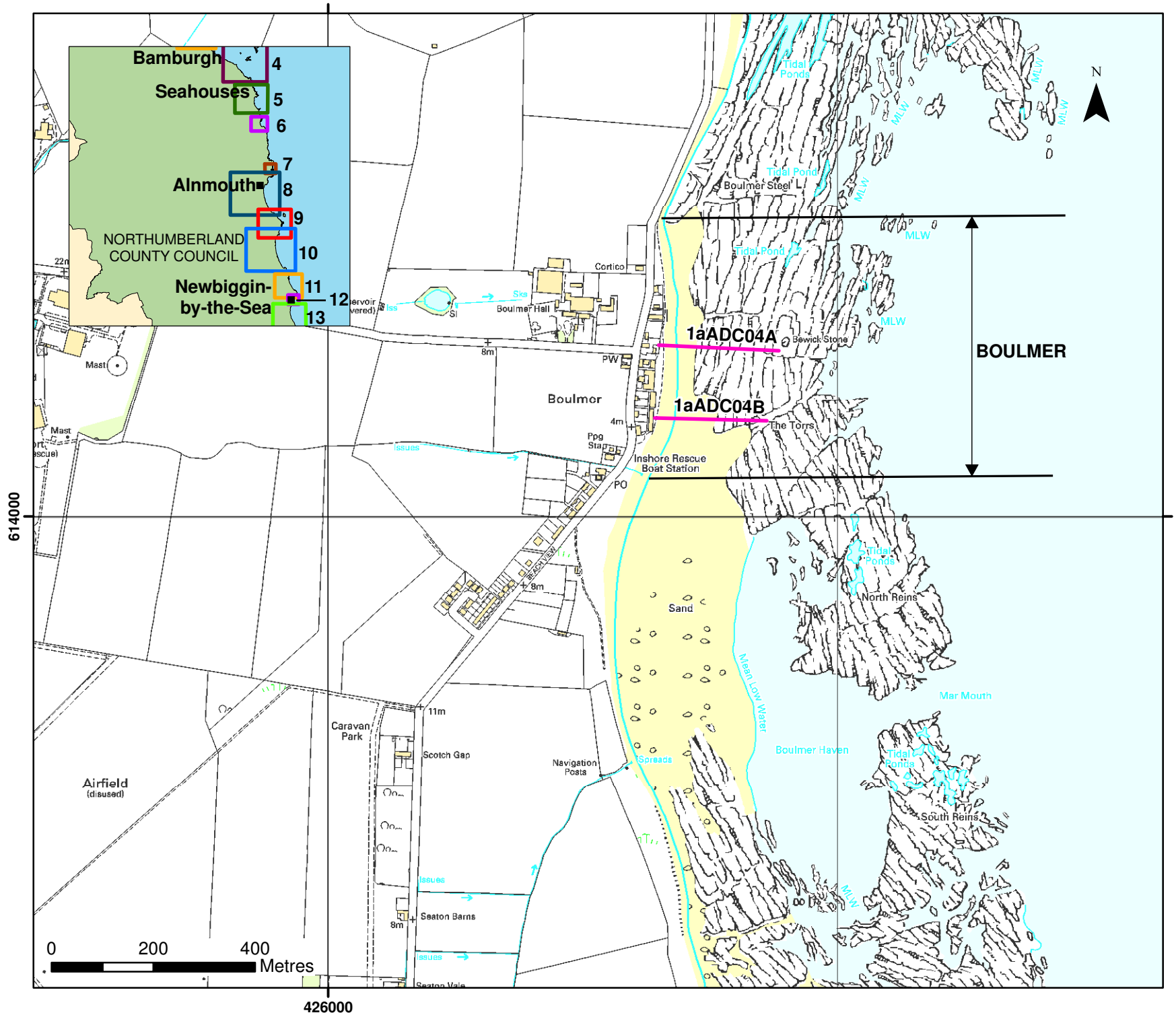

SURVEY LOCATIONS

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 3
'Partial Measures' Survey 2011

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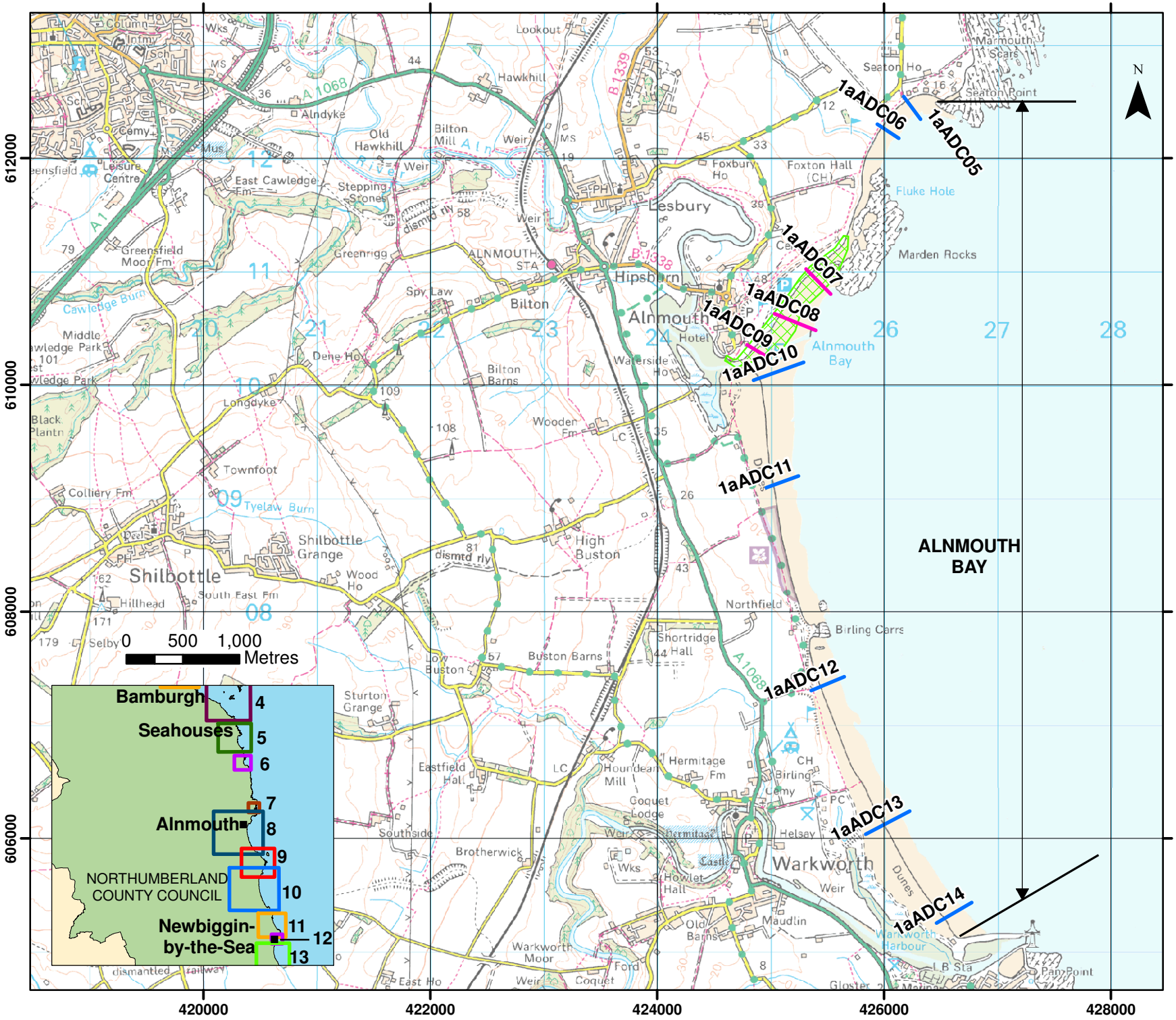

SURVEY LOCATIONS

Topographic Profiles

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Topographic Surveys

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Project: Cell 1 Regional Coastal Monitoring Programme

Figure 1 - Map 8 Northumberland County Council Frontage

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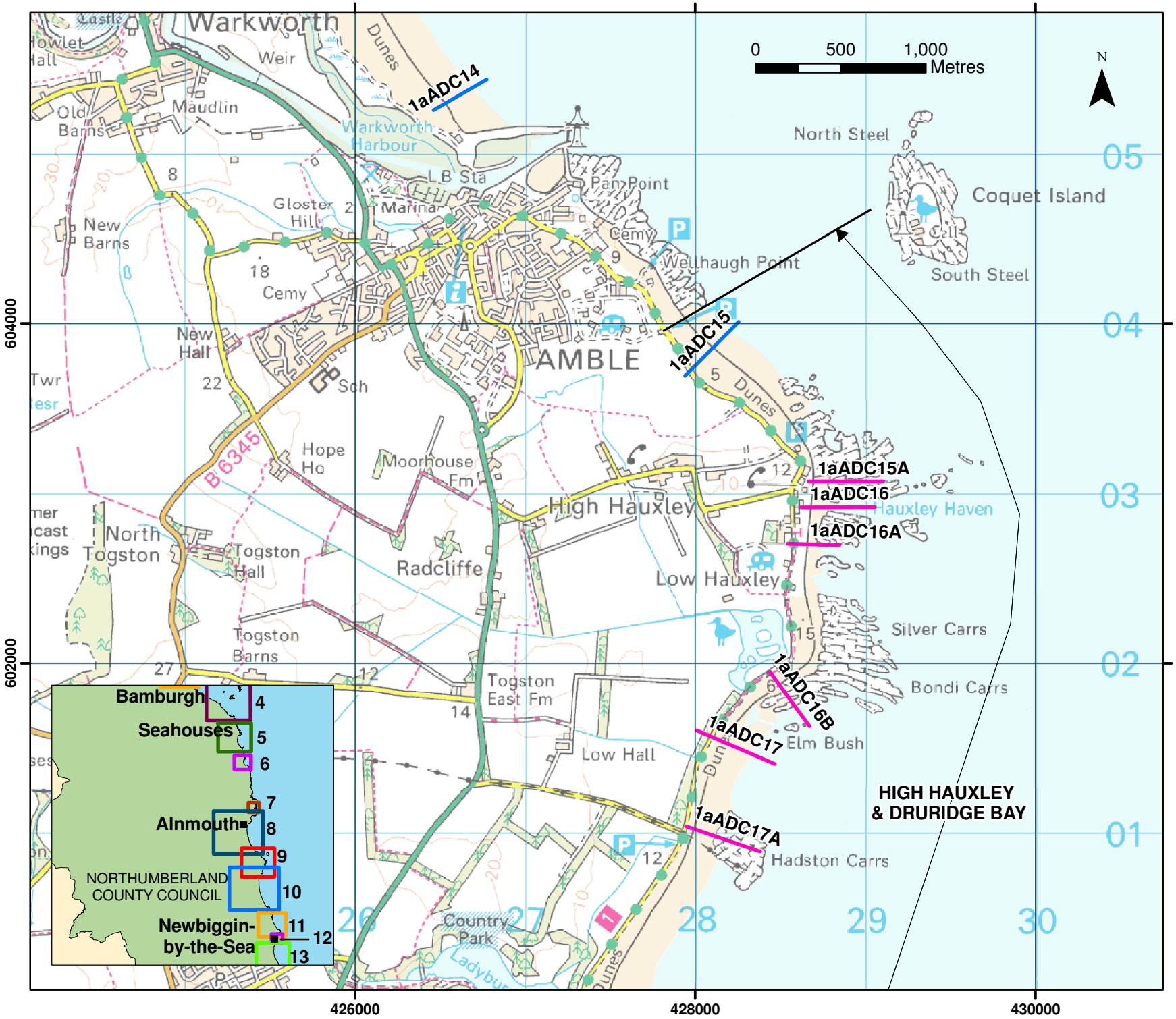

SURVEY LOCATIONS

Topographic Profiles
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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 9 Northumberland County Council Frontage

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'Partial Measures' Survey 2011

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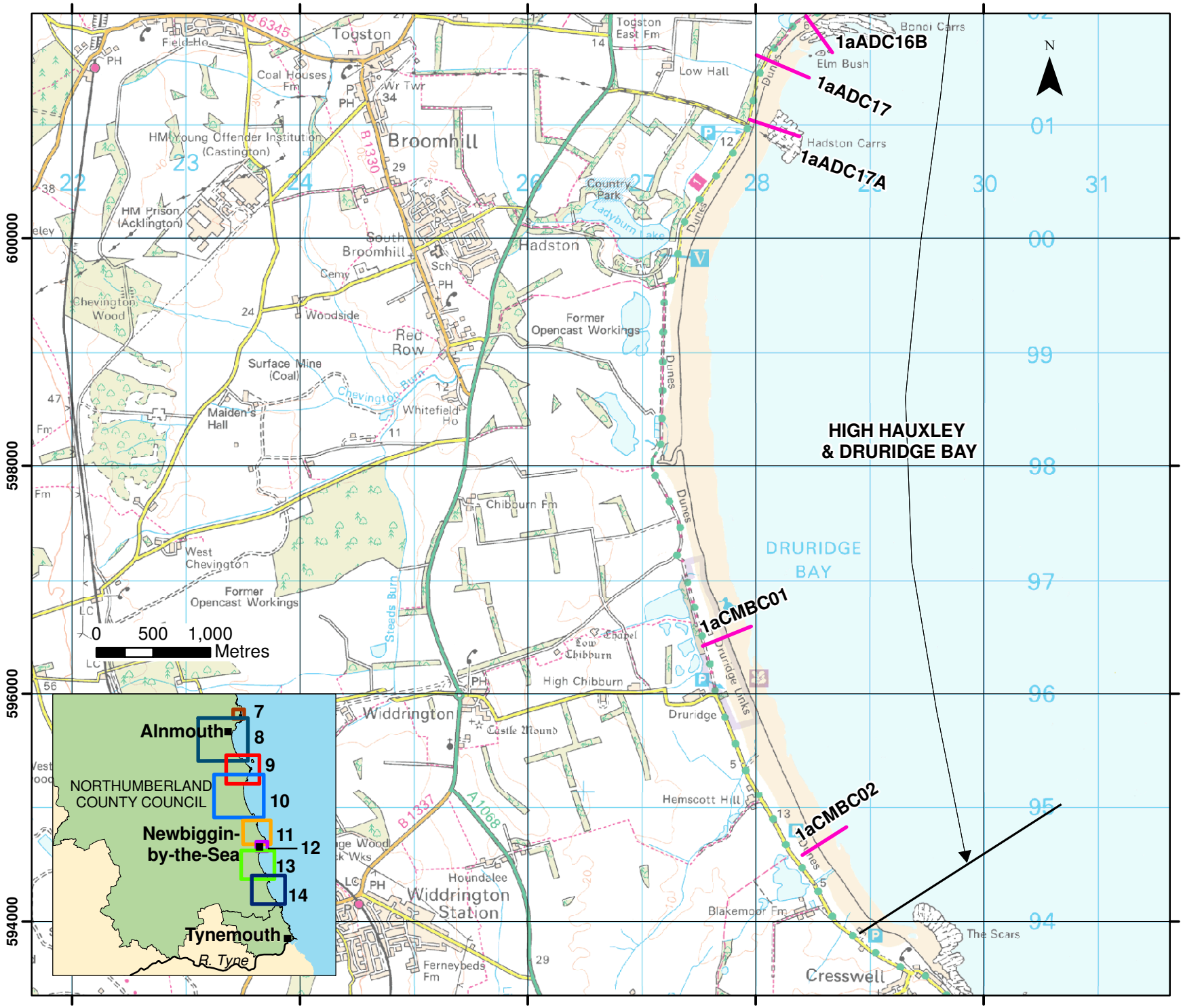

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Topographic Surveys
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(Indicative Survey Extents shown)

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Figure 1 - Map 10 Northumberland County Council Frontage

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'Partial Measures' Survey 2011

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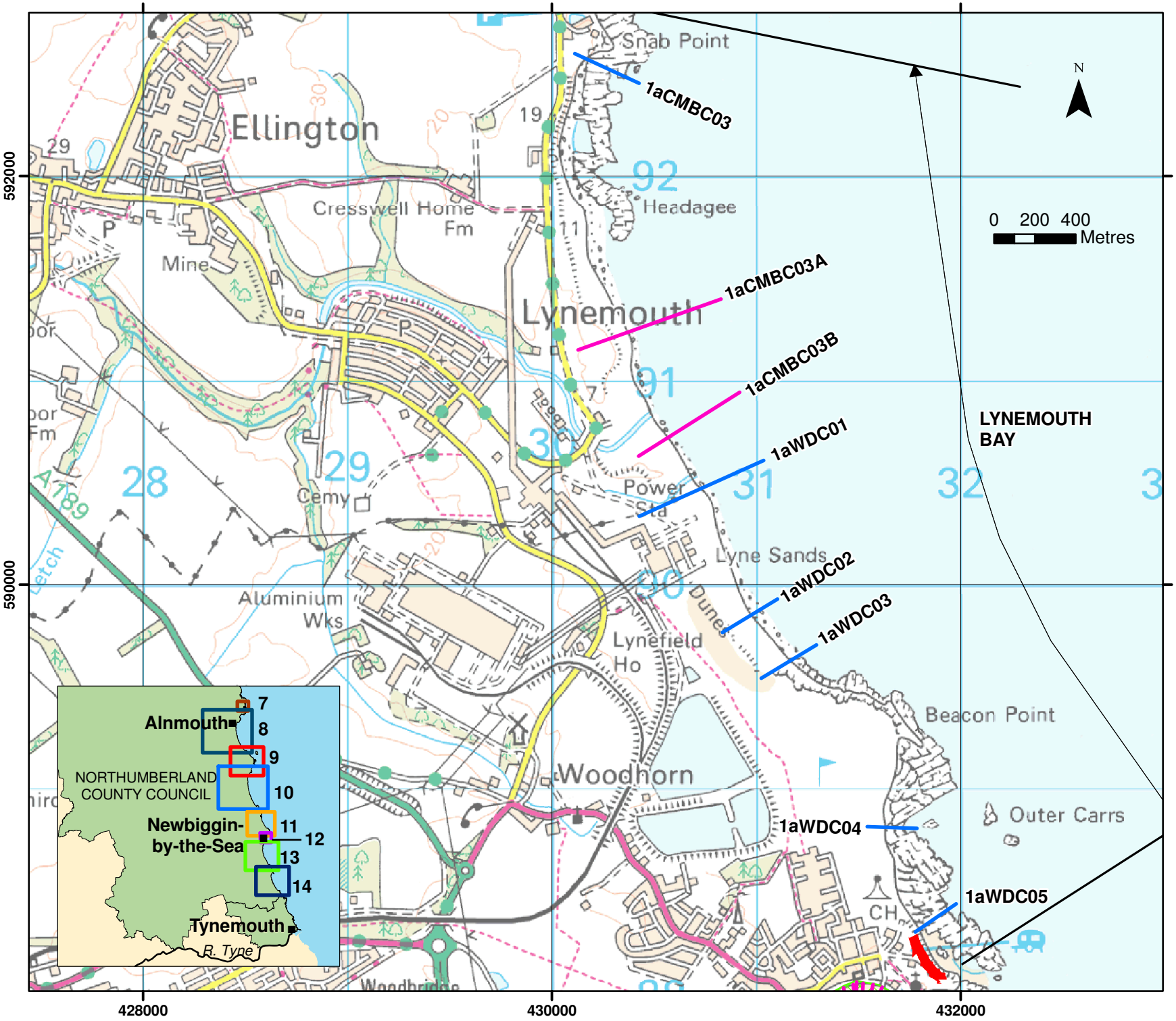

SURVEY LOCATIONS

Topographic Profiles
- Annual
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Topographic Surveys
- 6 monthly
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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 11 Northumberland County Council Frontage

Update Report 3
'Partial Measures' Survey 2011

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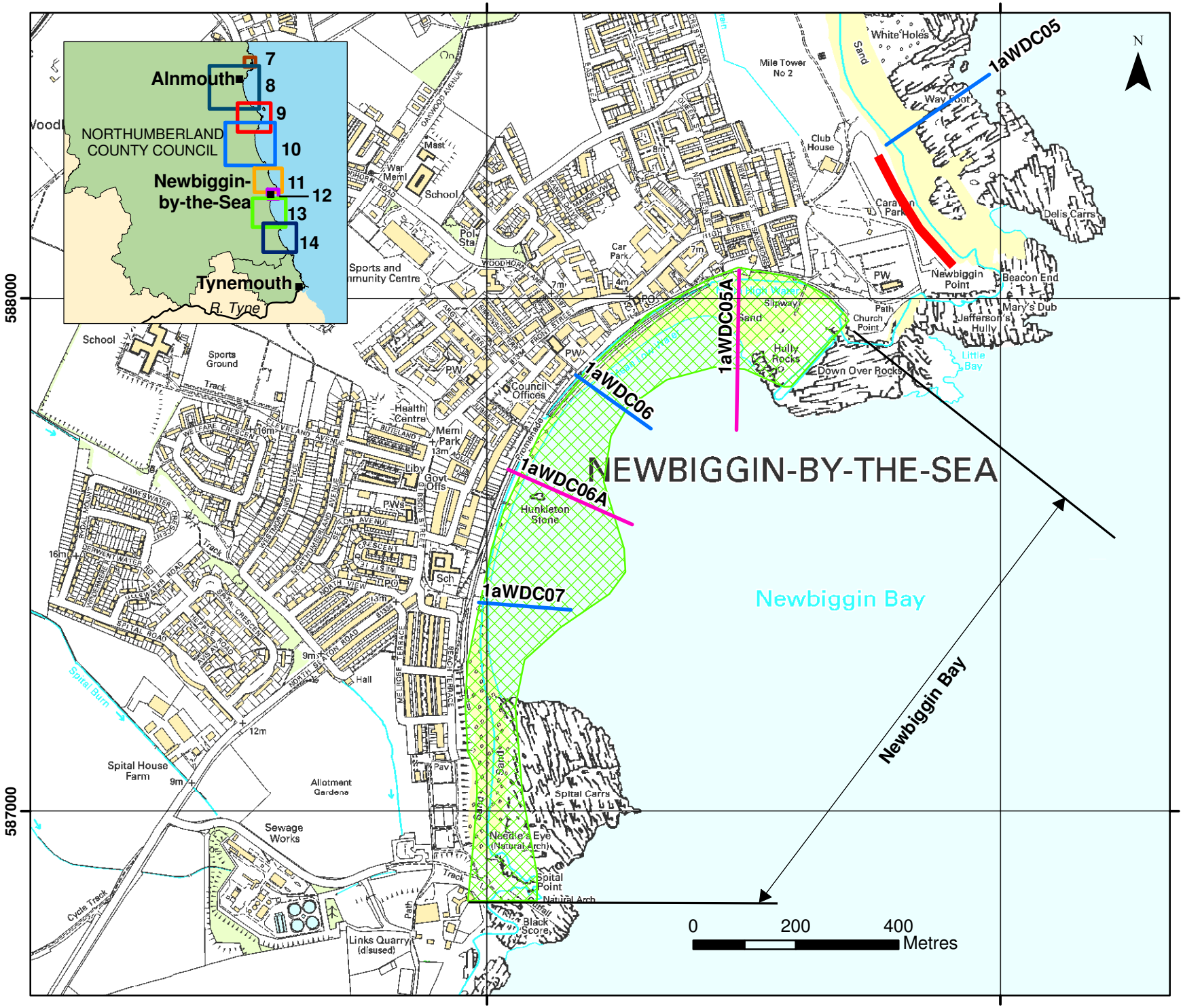

SURVEY LOCATIONS

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 3
'Partial Measures' Survey 2011

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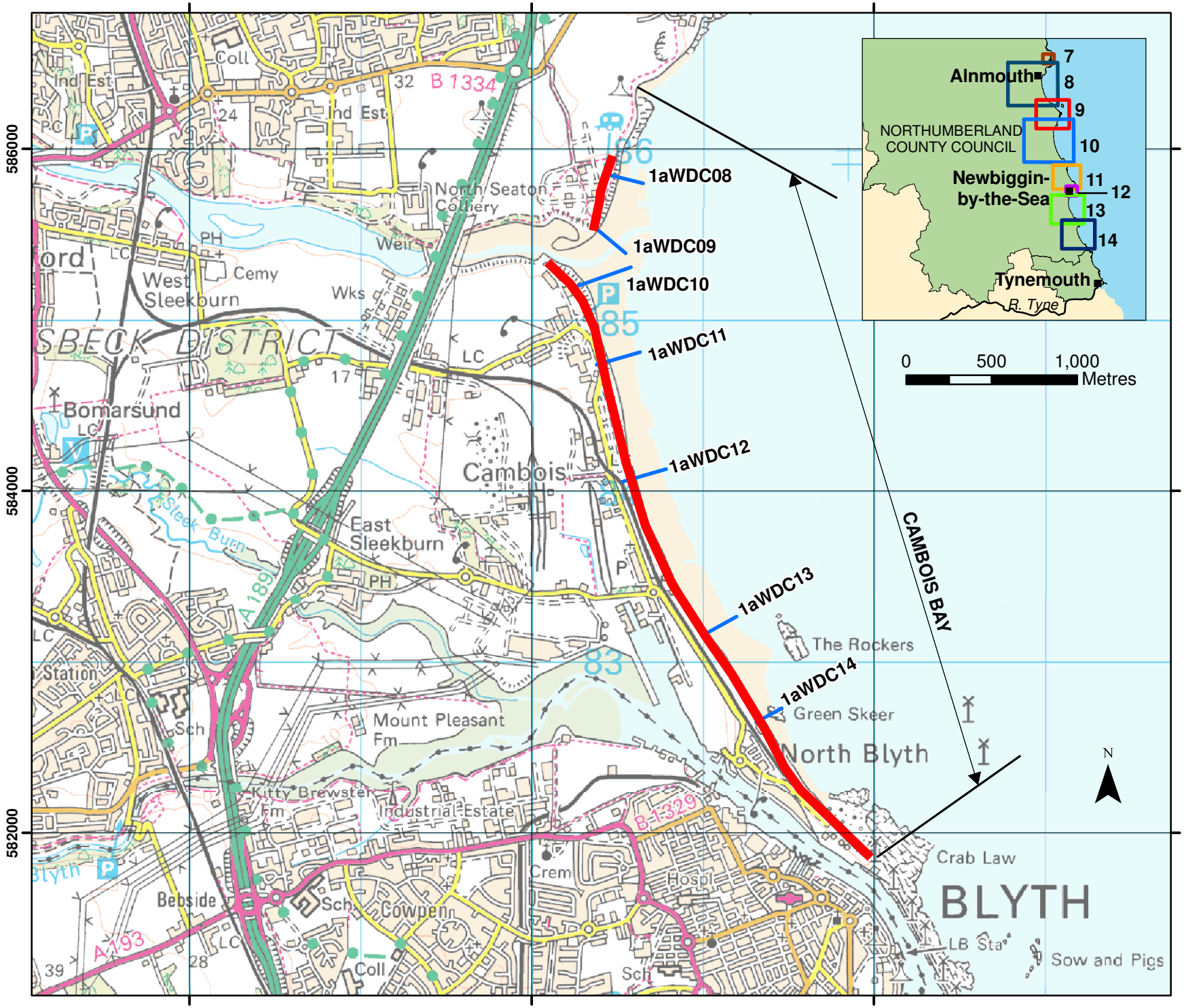

SURVEY LOCATIONS

Topographic Profiles
- Annual
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Topographic Surveys
- 6 monthly
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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 13 Northumberland County Council Frontage

Update Report 3
'Partial Measures' Survey 2011

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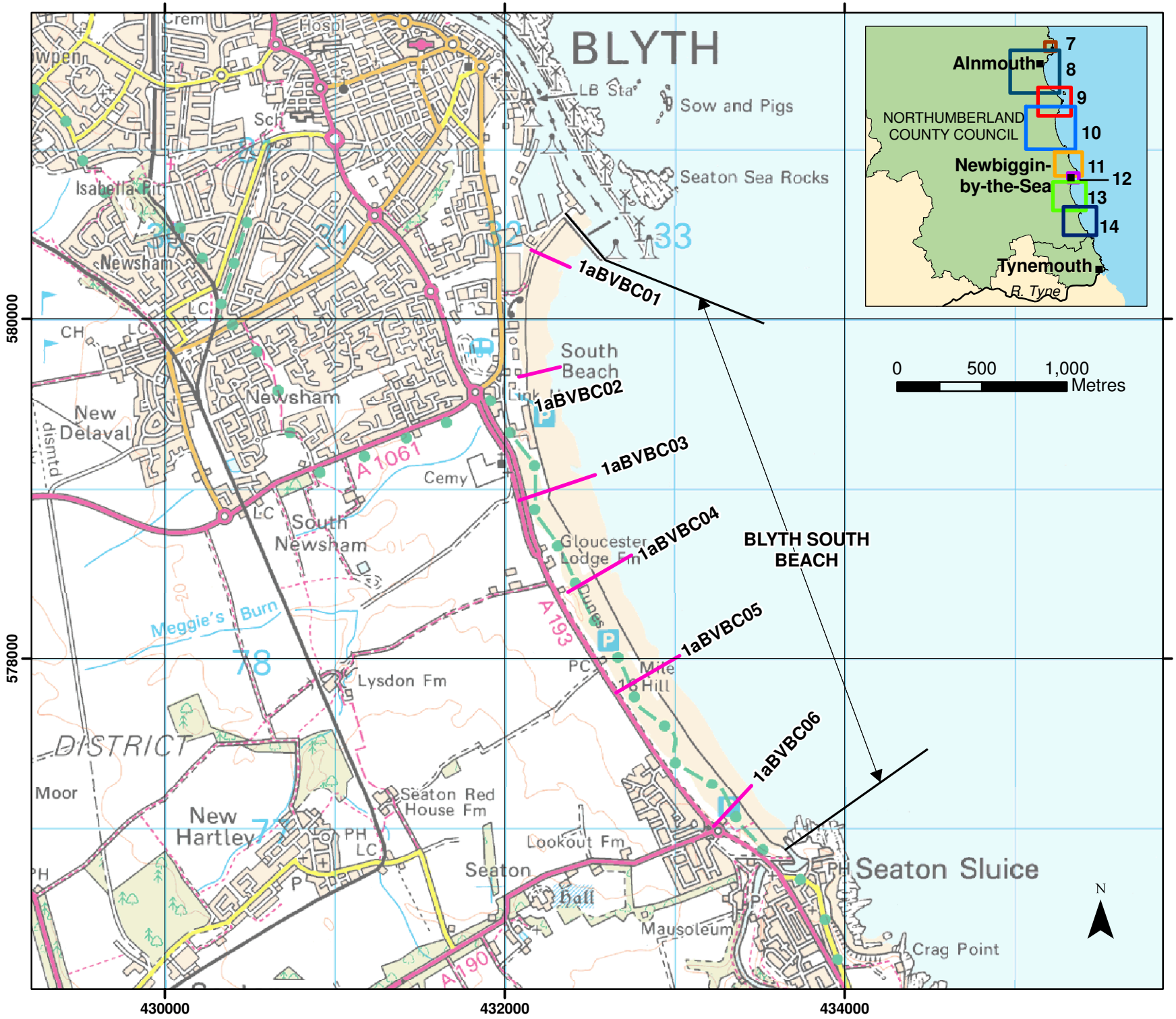

SURVEY LOCATIONS

Topographic Profiles
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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 14 Northumberland County Council Frontage

Update Report 3
'Partial Measures' Survey 2011

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2. Analysis of Survey Data

2.1 Sandstell Point

Survey Date	Description of Changes Since Last Survey	Interpretation
03-2011	**Beach Profiles:** 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). Following the notable erosion that occurred in both dune position and foreshore levels along profile BTBC02 to September 2009, there has been progressive recovery of the foreshore to March 2010 (although with some ongoing dune cut-back), again to September 2010 (now with a stable dune position) and again to March 2011 (again with a stable dune position). The result is that the foreshore levels in March 2011 up to around HAT were higher than have previously been recorded, with a berm formed just above the level of HAT. Profile BTBC04 runs along the length of the spit and between September 2010 and March 2011 there was a significant change as the large bank feature that had formed seaward of a chainage of around 140m had once again become flattened, with resultant levels similar to those recorded in September 2009 and March 2010. Profiles BTBC05 and BTBC06 are both transects taken across the spit, with BTBC05 near its landward root and BTBC06 slightly north of the centre of the spit. Both plots show west (i.e. the river channel) on the right hand side and east (i.e. the seaward face) on the left hand side. BTBC05 showed three distinct berms across the spit, with one high narrow berm located near the river channel reaching a level in excess of MHWS. This is similar in form to the high, narrow berm that was recorded in September 2009 but subsequently flattened and widened in latter surveys. There was some accretion on the seaward face of the spit, and some modest cut-back on the river-facing side of the spit along this transect. BTBC06 also showed the re-formation of a narrow but high berm near the river channel, with its position, height and form very reminiscent of that previously recorded in September 2009 but subsequently flattened. However, the large bank identified on the centre of the spit crest in September 2010 had been removed by March 2011.	The dunes along the inner face of the estuary (as measured along BTBC02) have stabilised since March 2010, despite cut-back occurring quite rapidly prior to that. In part, this has been connected to the progressive recovery of foreshore levels since very low values in September 2009 to the point where levels up to HAT are now very high. This provides a good degree of protection to the backing dunes. It will be interesting to see whether this foreshore accretion ultimately leads to dune advance as sand is blown further up the beach to the toe of the dunes or whether it just helps to maintain a stable dune position. There appears to be an ongoing cycle of sediment redistribution on the spit, with sometimes narrow, high berm crests observed, especially towards the river channel side of the spit, and other times wider and lower crest banks more centrally located on the spit. There appears to be ongoing connectivity between these changes on the spit and the erosion or accretion along the foreshore and dunes along the inner estuary.

Survey Date	Description of Changes Since Last Survey	Interpretation
03-2011	**Topographic Survey:** Due to the significant changes that have been observed from the analysis of beach profiles along the spit at Sandstell Point, and their three-dimensional nature, a topographic survey was introduced to the monitoring programme in November 2009. This is repeated at 6-monthly intervals. Data from the March 2011 survey have been used to created a DGM (Appendix B – Map 1a) which has been compared against the previous topographic survey from August 2009 (Appendix B – Map 1b). The western (river-facing) bank of the spit generally experienced notable accretion of material as a narrow but high berm was re-formed. The only exception to this was near the root of the spit where a local zone of erosion was noted, which partly extended into the frontage along the inner estuary (although not as far upstream as profile BTBC02 which recorded accretion along the foreshore). The main body of the spit experienced two distinct zones of behaviour. The landward half experienced accretion, while the seaward half experienced erosion as the previously recorded low but wide 'bank' along the centre of the spit was flattened. Along the dune frontage to the west of the spit there was erosion near the root of the spit (as discussed above), accretion in the centre of this bay and stability at the western end.	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*. The three-dimensional topographic surveys enhance the understanding of changes identified by the profile analysis and confirm the ongoing sediment redistribution cycles on the spit, with different berm positions and morphologies located between successive surveys as a result of the adjustments to prevailing conditions.

2.2 Spittal

Survey Date	Description of Changes Since Last Survey	Interpretation
03-2011	**Beach Profiles:** Spittal is covered by two beach profile lines during the Partial Measures survey (Appendix A). Along BTBC11 the beach levels at the upper section of beach were locally very high at around 5.2mODN along a width of around 7.5m but then lowered since September 2010 along the remainder of the transect, especially so seaward of around 100m chainage. A small berm was formed on the foreshore at around 90m chainage. Similar upper beach accretion was observed along BTBC13, but in contrast to the behaviour along profile BTBC11 there was notable accretion since September 2009 along the remainder of the transect down to low water.	It is possible that some of the material removed from BTBC11 between September 2010 and March 2011 has been moved alongshore in a southerly direction to feed profile BTBC13. All changes are within previous bounds of behaviour and therefore present no management concerns.

2.3 Goswick Sands

Survey Date	Description of Changes Since Last Survey	Interpretation
03-2011	**Beach Profiles:** Goswick Sands is covered by two beach profile lines during the Partial Measures survey (Appendix A). Recent surveys along BTBC16 have shown some lowering of the foreshore at the toe of the dunes, but no cut-back in dune position. Between October 2010 and March 2011 a significant volume of accretion occurred, setting new record high beach levels since monitoring began along this frontage in 2002. In places the accretion over the past five months has been in excess of 0.5m. Along BTBC19, foreshore levels recovered modestly from the fairly low values recorded in September 2009, but the profile along this section has shown very little variability along the mid and upper beach sections, with variances being of the order of 0.1m only. Further seaward along the profile, the variability increases slightly, but in March 2011 the levels along the lower foreshore remained healthy.	Previous notable changes due to heavy winter conditions have occurred along these transects, but the foreshore levels now seem to be recovered. Along both transects very healthy levels were recorded.

2.4 Holy Island

Survey Date	Description of Changes Since Last Survey	Interpretation
03-2011	**Beach Profiles:** Holy Island is covered by two beach profile lines during the Partial Measures survey (Appendix A). Profiles BTBC21 and BTBC23 showed no significant change in profile form or level. There was a modest berm formed along the lower foreshore on both transects which had not been recorded previously.	Holy Island profiles BTBC21 and BTBC23 remain stable, with healthy foreshore levels and dunes.

2.5 Beadnell Village

Survey Date	Description of Changes Since Last Survey	Interpretation
03-2011	**Beach Profiles:** Beadnell Village is covered by one beach profile line during the Partial Measures survey (Appendix A). 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
03-2011	**Beach Profiles:** Beadnell Bay is covered by five beach profile lines during the Partial Measures survey (Appendix A). BTBC33 experienced some cut-back at the toe of the dunes, but accretion further along the profile down to low water. Along BTBC34 beach levels at the toe of the dunes remained low, but this transect also experienced accretion further along the profile down to low water. Along BTBC37 (midway between Brunton Burn and Beadnell Harbour) there was a small degree of cut-back within the dune face, but otherwise very similar profile form to previous surveys, with some modest accretion on the foreshore. Along ADC01, there was some cut-back at the toe of the dunes, but within the bounds of previous dynamic behaviour. Foreshore accretion occurred along the upper beach, but with lowering along the lower beach. ADC02 also experienced a degree of lowering at the toe of the dunes but seaward of a chainage of 90m (a beach width of around 40m from the dune toe) the foreshore experienced modest accretion.	Beadnell Bay was characterised by relatively modest changes, generally with lowering at the toe of the dunes (or low levels at the dunes maintained since the October 2010 survey) and accretion along parts of, or all of, the rest of the foreshore transect.

2.7 Boulmer

Survey Date	Description of Changes Since Last Survey	Interpretation
03-2011	**Beach Profiles:** Boulmer is covered by two beach profile lines during the Partial Measures survey (Appendix A). These were introduced to the programme in October 2007. Profile ADC04A experienced some cut-back in position of the seaward face of the dunes but this is typical of the dynamic nature of this section. At the toe of the dune to foreshore levels lowered to equal record low values, but accretion occurred lower down the profile to a chainage of around 50m, after which the rock platform was exposed on the foreshore. Profile ADC04B experienced a very slight degree of cut-back at the toe of the dunes, but some slight accretion along the profile down to a chainage of around 65m, after which the rock platform was exposed on the foreshore.	The two profiles at Boulmer both showed some slight lowering or cut-back at the toe of the dunes, with some accretion further down the profile, but no changes were of significant concern for management.

2.8 Alnmouth

Survey Date	Description of Changes Since Last Survey	Interpretation
03-2011	**Beach Profiles:** 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. Along ADC07 the position and form of the dunes remained unchanged, but upper foreshore lowering occurred to a chainage of around 170m. Typically levels were some 0.2m lower than those recorded in September 2009. Seaward of 170m chainage, a wide and low berm had formed. ADC08 typically experienced accretion of sediment along the entire profile, with a distinct berm formed on the mid beach and another formed on the lower beach. Along ADC09 there was accretion of up to 0.8m at the toe of the dunes, but seaward of a chainage of around 55m there was erosion on the lower foreshore. This reached a maximum difference in level since September 2010 of 1.6m at a chainage of around 140m.	The surveyors reported that section ADC09 was shorter than that recorded in September 2009 because the river channel was closer to shore. This is the probable cause of the notable lower foreshore erosion along this transect. Elsewhere, the other two transects did not show a consistent trend of behaviour, suggesting that sediment is being redistributed along this frontage as a consequence of the change in river channel position across the foreshore, rather than there being a governing net trend of erosion or accretion.
03-2011	**Topographic Survey:** 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 2011) have been used to create a DGM (Appendix B – Map 2a). This has been compared against a similar DGM created using the September 2010 data (Appendix B – Map 2b). Different sections of this beach appear to have experienced different trends. The channel of the River Aln estuary has cut back landwards, affecting erosion at the southern section of the frontage, although some upper foreshore accretion occurred at the toe of the dunes (as captured in profile ADC09). There is then a section in front of the seafront car park where two zones of accretion have occurred along the foreshore, forming mid-beach and lower-beach berms (as captured in profile ADC08). The remaining section of frontage then generally experienced foreshore lowering (as captured in profile ADC07).	This section of frontage is quite highly dynamic, with changes apparently linked , at least in part, to the changes in position of the channel of the River Aln estuary as it exits to sea across the foreshore. This often leads to different behaviour in different parts of the frontage as sediment is redistributed in response to changing exposure.

2.9 High Hauxley and Druridge Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
03-2011	**Beach Profiles:** 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. Along profile ADC15A, there was accretion of up to 0.15m seaward of a chainage of around 50m, but landward of this was similar magnitude lowering of the upper foreshore, except for directly at the toe of the dunes, were there was further accretion. Profile ADC16 experienced a stable beach form across the dunes and down to a chainage of around 130m, but lowering of the lower foreshore by typically 0.1 to 0.2m. Profile ADC16A experienced a stable beach form across the dunes and down to a chainage of around 105m, with redistribution of sediment thereafter. This was caused by flattening of a berm observed at a chainage of 120m in October 2010, with the liberated sediment deposited on the lower foreshore to raise levels by around 0.1m. Along profile ADC16B there was some removal of the thin sand veneer previously covering parts of the lower foreshore rocks, but accretion of up to 0.1m was recorded higher up the profile, including to the toe of the dunes. Profiles ADC17 and ADC17A both showed minor redistribution of sediment since October 2010, with modest recovery of levels at the dune toe. Along CMBC01, there has been erosion of a large proportion of the dune face, with the surveyor's notes reporting that more anti-tank blocks are now visible than on recent visits. The material eroded from the dune face appears to have been deposited on the upper foreshore in the form of a berm located just above MHWS. Further seaward along the profile, fluctuations in level have occurred as the berm previously recorded near low water in October 2010 was flattened. CMBC02 showed stability in the dune position and form, but mirrored the lower foreshore changes along CMBC01 with the berm previously recorded near low water being flattened and some of the material contributing to accretion on the upper beach.	High Hauxley experienced only modest changes since the previous survey. Overall, there has been progressive, slow recovery of foreshore levels following the storm damage that occurred to the beach and dunes early in 2010. Parts of the southern section of Druridge Bay continued to experience significant changes, with notable erosion of the dune face along CMBC01.

2.10 Lynemouth

Survey Date	Description of Changes Since Last Survey	Interpretation
03-2011	**Beach Profiles:** Lynemouth is covered by two beach profile lines during the Partial Measures survey (Appendix A), namely profiles CMBC03A and CMBC03B, which were both added to the programme in October 2007. Along CMBC03A the position of the slag bank at the rear of the foreshore has remained stable, whilst the foreshore has shown some minor variations since October 2010. Previous surveys have shown some progressive cut-back of the foreshore, but this appears to have stabilised in the March 2011 survey. Significant erosion of the foreshore has been reported over the past several years along CMBC03B, leading to significant slag bank erosion. In the March 2011 survey, the slag bank appears to have been re-graded back to a shallower angle. This is confirmed by the surveyor's notes, which record this was achieved through use of mechanical plant. This process has resulted in some material being deposited from the slag bank onto the foreshore, raising levels by a minimum value of around 0.5m.	The profiles along CMBC03A and CMBC03B have been experience ongoing change since the surveys were introduced here in October 2007. Whilst the foreshore cut back appears to have stabilised between October 2010 and March 2011 along CMBC03A, there still remains only a very narrow beach width before slag bank erosion will commence. Along CMBC03B, the rate of erosion of the slag bank (some 17m in the three years between October 2007 and October 2010) appears to have prompted management intervention by Rio-Tinto Alcan, the owners of the Lynemouth Power Station. The combined effect of re-grading of the slope to a shallower angle together with the foreshore accretion should slow or arrest the rate of recession. This will be confirmed through analysis on ongoing surveys in future reports.

2.11 Newbiggin-by-the-Sea

Survey Date	Description of Changes Since Last Survey	Interpretation
03-2011	**Beach Profiles:** Newbiggin-by-the-Sea is now covered by four beach profile lines during the Partial Measures survey (Appendix A). Two of these (with 'A' suffices) 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. It should be noted that an extended series of profiles and a topographic survey are also recorded via the Cell 1 Regional Coastal Monitoring Programme for purposes of post-project evaluation of this capital scheme. These data have been analysed and reported to Northumberland County Council in a stand-alone report in 2011. Profile WDC05A is in the north of Newbiggin Bay and following the September 2010 survey experienced a redistribution of sediment, with some material eroded from the recharged seaward face and deposited further landward up the profile causing accretion along the upper beach, across a width of around 35m. This has resulted in a relatively high berm formed on the upper beach well above HAT. Some material liberated from the erosion on the recharged seaward face has also been deposited on the lower foreshore. Along section WDC06 the recharged beach has cut back landward sufficiently that the stepped toe of the concrete seawall is now visible. As measured at the line of MHWS, this landward recession has been around 12m over 2.5 years. Along WDC06A the erosion of the seaward face of the recharged beach has stopped, but the beach berm above HAT has reduced in level. There still remains a relatively wide and high beach fronting the sea wall. Profile WDC07 has high beach levels at the toe of the wall (which are know to have caused problems in terms of blown sand across the promenade) but the seaward face of the recharged beach has continued to erode landwards. As measured at the line of MHWS, this landward recession has been around 6m over 2.5 years.	The upper foreshore deposition along WDC05A has created a high beach levels, with several changes in gradient formed that lead to a high berm above HAT and a steep seaward gradient. This undulating and, in places, steep beach form is known to have caused some problems for the local boat club and the RNLI in launching and recovering vessels from the beach and is going to be addressed later in 2011 through a sand recycling scheme across the Bay. The intent of this will be to reduce the accretion in the northern part of the bay and re-create the design profiles in the central part of the bay where recharge material is being eroded as the beach form re-adjusts to the presence of the offshore breakwater. It is anticipated that such recycling will be an ongoing maintenance aspect associated with the capital recharge scheme.

Survey Date	Description of Changes Since Last Survey	Interpretation
03-2011	**Cliff Top Survey:** Data relating to the cliff top surveys are best viewed as digital 'kmz' files loaded into Google Earth. **Newbiggin Caravan Park:** 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. The northern part of this frontage (approximately 70m in length) is unprotected by defences. Since the previous (September 2010) survey only small-scale changes have occurred, with approximately two locations experiencing localised slumps in the cliff. One is a small slump along a length of around 1.5m where the cliff top has cut back by up to 0.4m. The other is a slightly longer length of around 3m, where the cut-back has been around 0.5m. When compared against the first survey (September 2007), this undefended cliff line has eroded along its entire length, resulting in landward recession of typically around 0.5m but in one place up to 1.5m. The central section of this frontage (approximately 125m in length) is protected by concrete blocks and rubble. The general stability between September 2010 and March 2011 suggests that this has been partly effective in protecting many sections of this cliff, but in one location along a length of around 4m cut back by 0.9m has occurred. Typically, between the first and present surveys, erosion has been of the order of 0.2m, but locally it has now been up to 0.9m. 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 2010 and March 2011. 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
03-2011	**Cliff Top Surveys**: Data relating to the cliff top surveys are best viewed as digital 'kmz' files loaded into Google Earth. **Sandy Bay Caravan Park:** 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 2010) and the current survey (March 2011), there has been erosion generally occurring in small slumps, typically resulting in around 0.75m – 0.9m cut back in cliff top position along lengths of typically 2m - 4m. Across the most southerly section, however, the cliff top has receded more notably, with up to 1.5m cut-back recorded along a cumulative length of some 42.5m, including one length of 30m where erosion has occurred along the whole section. When considering changes between the first survey (September 2007) and the current survey (March 2011), 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 4.5m. **Cambois:** 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 2010 and March 2011, there has been a notable slump adjacent to the garden of Cambois House along a length of around 8m, where the cliff top has cut back by around 1m in position. Similar slumps have also occurred at three further locations running south towards the cottages. In front of the cottages, the entire cliff line appears to have cut back over a length of around 100m, with a recession in cliff top position of typically just over 1m. The cliff behind the revetment remains stable. Further south, the frontage has been relatively stable, although with modest (<0.2m) cut back in places while at the very southern end the sections behind the revetments also remain stable.	In previous surveys, the cliffs at Sandy Bay Caravan Park have largely eroded through occasional small-magnitude and localised slumps. Since September 2009, however, 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 2010/2011, especially so along a 30m length towards the south of the frontage. **IMPORTANT NOTE:** 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. The Cambois cliffs are locally active, with particularly notable change adjacent to the garden of Cambois House (local) and immediately in front of the cottages (much more widespread, covering a frontage of around 100m).

2.15 Blyth South Beach

Survey Date	Description of Changes Since Last Survey	Interpretation
03-2011	**Beach Profiles:** Blyth South Beach is covered by six beach profile lines during the Partial Measures survey (Appendix A). BVBC01 is located towards the north of South Beach, in front of the area of land owned by Port of Blyth. Between September 2010 and March 2011 notable lowering occurred along the upper beach, with levels similar to those recorded in April 2010. There was, however, no erosion in dune position, although a near-vertical dune face remains observed. The lower foreshore accreted sediment and was relatively healthy. Along both BVBC02 and BVBC03, redistribution of sediment resulted in areas of deposition of up to around 0.2m in level along the upper foreshore. Elsewhere the profiles remained stable or exhibited lowering in level associated with the formation of a trough and berm feature along the lower foreshore. Profile BVBC04, located just to the south of Gloucester Lodge Farm in the centre of South Beach, showed a very significant lowering in level at the toe of the dunes, with levels in places some 1m lower than those recorded in September 2010. The whole profile along this transect suffered from notable erosion and levels were at, or near, record low values. In contrast, there was some recovery in beach level observed along BVBC05 from the low values that were recorded in September 2010. Profile BVBC06 showed only modest redistribution of sediment between around MSL and HAT.	Blyth South Beach continues to show dynamic behaviour in some areas, but with no consistent trend along the frontage as a whole. The upper foreshore lowering in the northern section along BVBC01 has not to date resulted in erosion of the backing dunes. The section to the north of Gloucester Lodge Farm has altered due to the formation of a trough and berm feature along the lower foreshore. Beach levels in the south of the bay have recovered or remain stable. The only area of concern is currently along BVBC04, just to the south of Gloucester Lodge Farm. This is an area that continues to suffer from dynamic response to the relatively high exposure conditions caused by its position and orientation within the bay. Previously attempts have been made to repair dune damage using sand-filled geotextile bags, sand recharge to the dunes and the placement of Christmas trees, but these do not alter the exposure conditions along the frontage.

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.

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

No changes are recommended at the present time.

5. Conclusions and Areas of Concern

- Changes over the winter of 2010/11 have been much more modest throughout Northumberland than those which were recorded over the winter of 2009/10 when significant dune and cliff erosion occurred.
- The dunes and foreshore along the south bank of the River Tweed estuary appear to have stabilised or accreted along the western and central parts of the inner estuary, although erosion has continued along the eastern section.
- This behaviour appears to be strongly linked to changes in the position and form of Sandstell Point spit, which has tended towards a higher narrow berm on the river side of the spit, in contrast to the wider but lower berm previously recorded as being more centrally located on the spit in the last survey.
- Profiles recorded at Goswick Sands, Holy Island, Beadnell Village, Beadnell Bay and Boulmer are very similar to previous surveys and show no signs for concern.
- The foreshore at Alnmouth Bay, north of the river outlet, continues to be dynamic, but with no consistent trend across the frontage as a whole. The changes observed appear, in part, to be linked to changes in position of the river channel as it flows across the foreshore to discharge at sea.
- At High Hauxley there has been progressive, but slow, recovery in upper foreshore levls following the notable storm damage that occurred early in 2010.
- Within Druridge Bay, there has been notable erosion of the dune face along profile CMBC01.
- The slag banks that were previously being eroded at a rapid rate along parts of Lynemouth Bay have been mechanically re-graded to a shallower slope angle, with some of the material contributing to notable accretion on the foreshore. Continued monitoring will be necessary to determine whether this has been successful in slowing or arresting the recession rates.
- Natural redistribution of sand continues to occur in Newbiggin Bay following the capital recharge and breakwater scheme which was completed in 2007. Based on the monitoring data. A sand recycling scheme is to be instigated later in 2011 to restore design profiles in the centre of the bay, where erosion is occurring, and reduce accumulating sand levels in the north of the bay, which locally is causing problems of wind-blown sand and providing logistical difficulties in the launching or recovery of vessels.
- There are ongoing concerns related to high exposure conditions in the central sections of Blyth South Beach. The most recent survey shows notable lowering of the foreshore directly at the toe of the dunes, which could lead to dune erosion.

Appendices

Appendix A

Beach Profiles

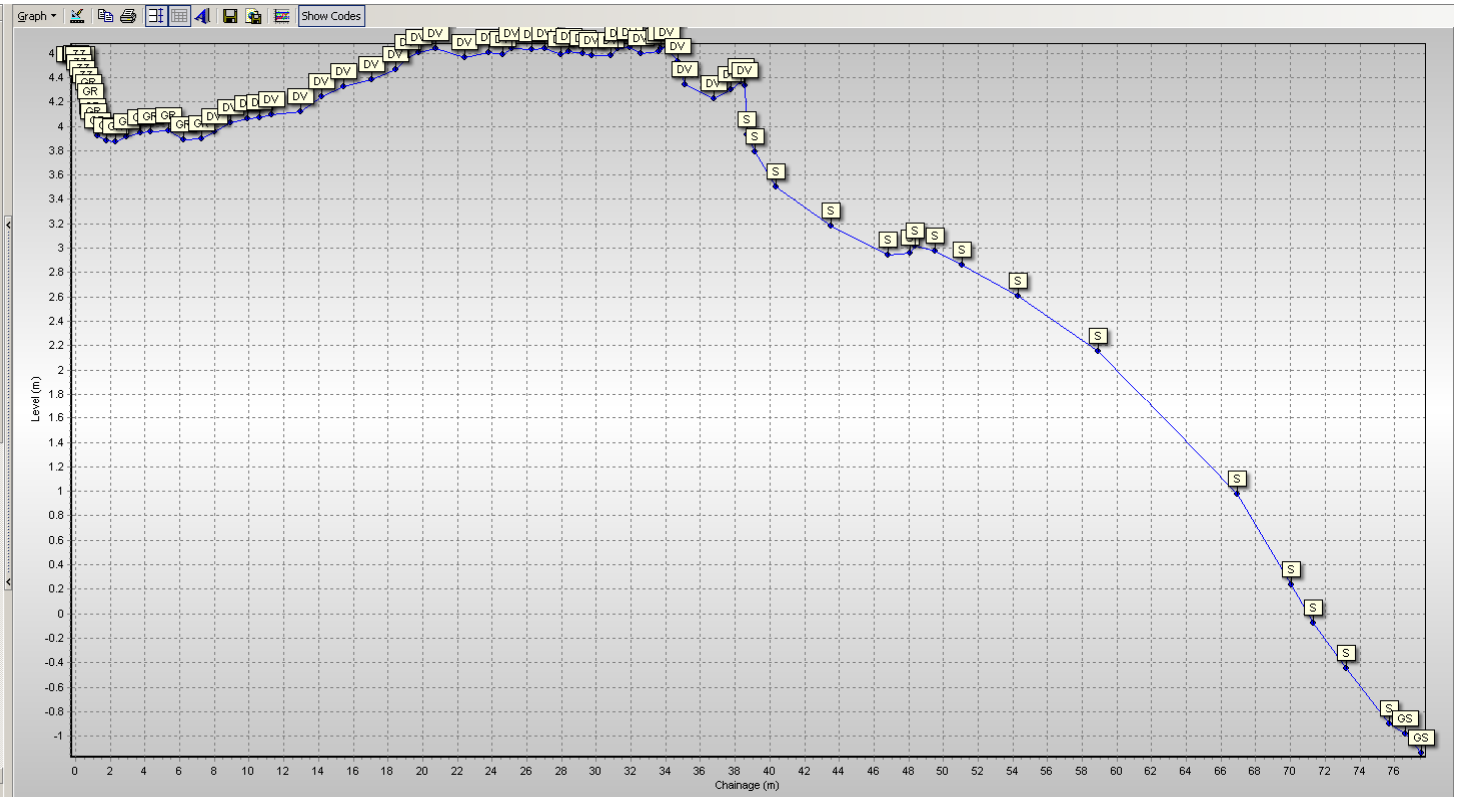
The following sediment feature codes are used on some profile plots:

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

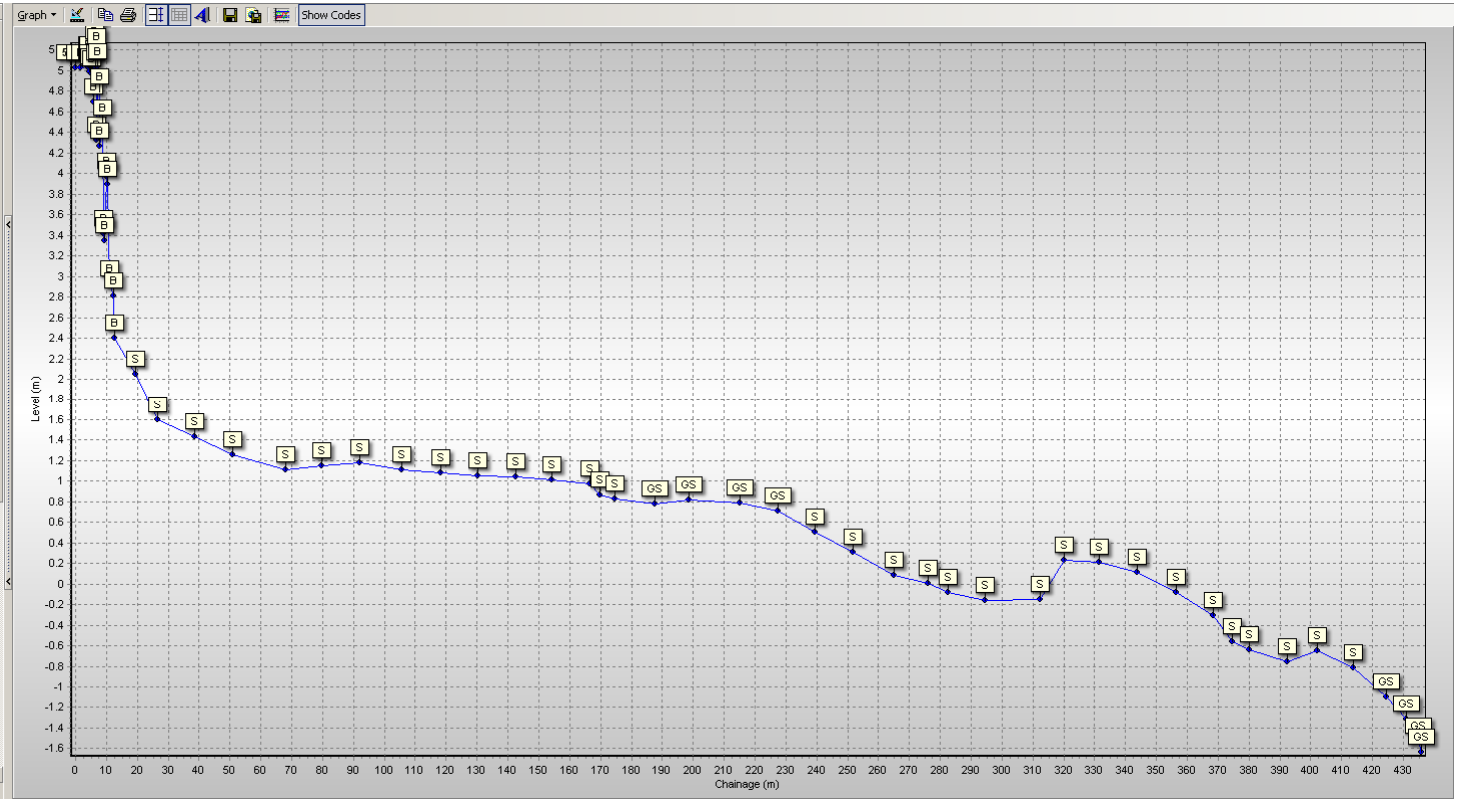
1aBTBC02 - 09/03/2011

Chainage	Level	Code
0.000	4.464	
0.005	4.464	ZZ
0.039	4.472	ZZ
0.165	4.467	ZZ
0.252	4.402	ZZ
0.397	4.351	ZZ
0.549	4.293	ZZ
0.741	4.236	GR
0.878	4.163	GR
0.991	4.039	GR
1.066	3.994	GR
1.275	3.920	GR
1.770	3.883	GR
2.315	3.876	GR
2.941	3.911	GR
3.774	3.947	GR
4.351	3.957	GR
5.340	3.966	GR
6.198	3.890	GR
7.243	3.896	GR
8.029	3.952	DV
8.915	4.032	DV
9.890	4.065	DV
10.586	4.074	DV
11.322	4.092	DV
12.993	4.123	DV
14.173	4.244	DV
15.461	4.322	DV
17.038	4.386	DV
18.463	4.468	DV
19.132	4.567	DV
19.750	4.605	DV
20.748	4.640	DV
22.411	4.562	DV
23.788	4.605	DV
24.621	4.590	DV
25.128	4.640	DV
26.310	4.626	DV
27.054	4.640	DV
27.987	4.586	DV
28.440	4.611	DV
29.243	4.596	DV



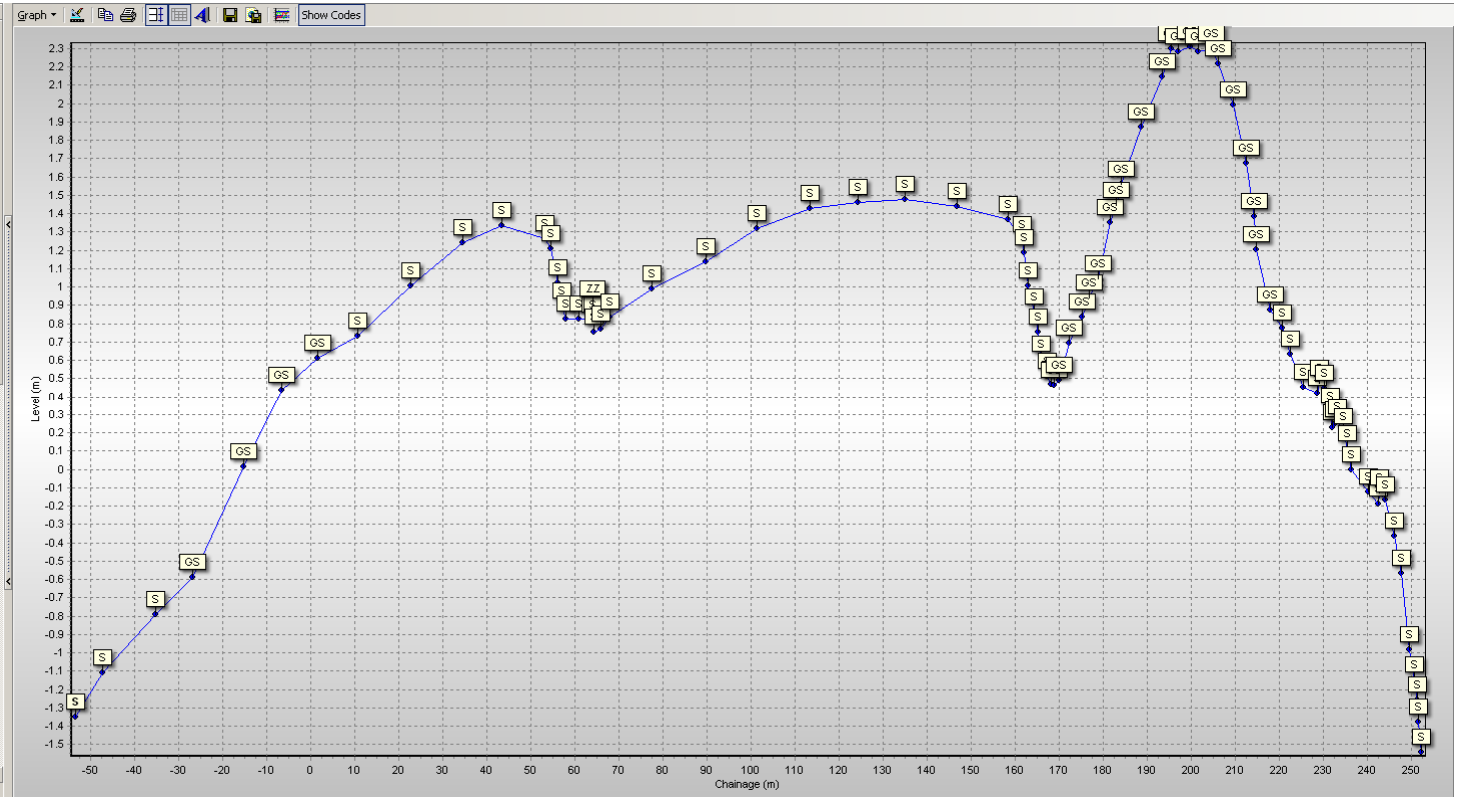
1aBTBC04 - 09/03/2011

Chainage	Level	Code
0.000	5.033	
0.045	5.033	B
1.605	5.028	B
3.940	5.038	B
3.981	5.107	B
4.117	5.104	B
4.181	5.028	B
4.391	4.988	B
5.122	4.975	B
5.895	4.699	B
6.053	5.234	B
6.450	5.025	B
6.688	5.184	B
6.813	4.326	B
7.000	5.040	B
7.689	4.796	B
7.716	4.271	B
8.868	4.489	B
9.134	3.417	B
9.317	3.353	B
10.019	3.977	B
10.482	3.898	B
10.883	2.926	B
12.363	2.808	B
12.613	2.399	B
19.378	2.053	S
26.631	1.604	S
38.603	1.433	S
50.756	1.256	S
68.036	1.112	S
79.776	1.151	S
92.089	1.181	S
105.683	1.109	S
118.186	1.080	S
130.252	1.053	S
142.556	1.039	S
154.285	1.009	S
166.448	0.973	S
169.812	0.870	S
174.609	0.824	S
187.535	0.775	GS
198.752	0.814	GS



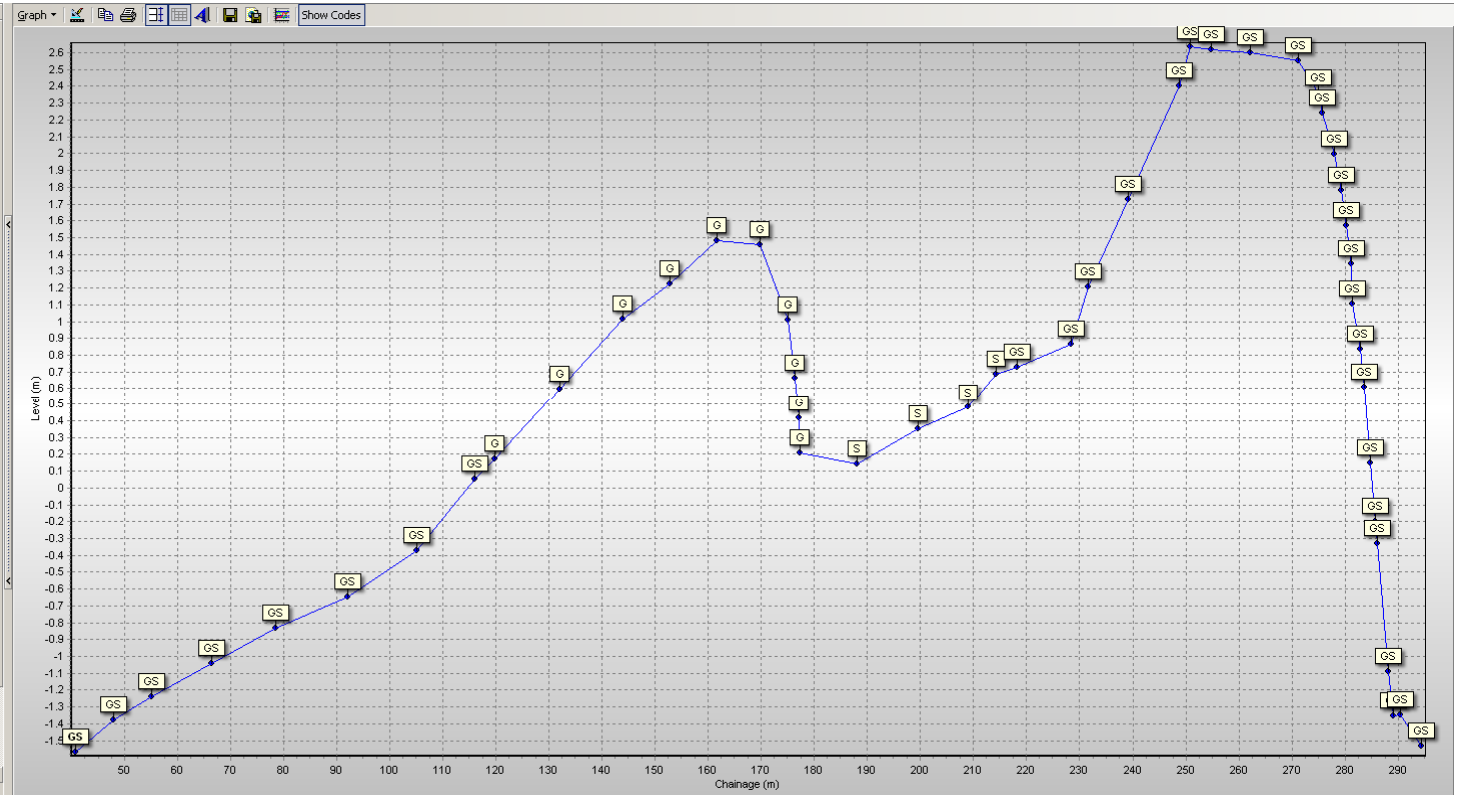
1aBTBC05 - 09/03/2011

Chainage	Level	Code
-53.479	-1.350	S
-47.298	-1.107	S
-35.295	-0.794	S
-26.964	-0.586	GS
-15.290	0.015	GS
-6.691	0.434	GS
1.497	0.610	GS
10.509	0.731	S
22.685	1.008	S
34.546	1.241	S
43.323	1.335	S
53.204	1.264	S
54.348	1.206	S
55.997	1.024	S
56.902	0.896	S
57.866	0.825	S
60.933	0.823	S
63.471	0.817	S
63.934	0.819	S
63.941	0.905	ZZ
64.002	0.905	ZZ
64.122	0.752	S
65.905	0.771	S
67.825	0.837	S
77.401	0.992	S
89.620	1.135	S
101.245	1.317	S
113.214	1.429	S
124.293	1.459	S
134.865	1.476	S
146.734	1.437	S
158.225	1.368	S
161.378	1.256	S
161.923	1.184	S
162.896	1.006	S
164.221	0.862	S
165.059	0.752	S
165.865	0.606	S
167.182	0.515	S
168.014	0.467	S
168.759	0.463	GS
169.879	0.489	GS



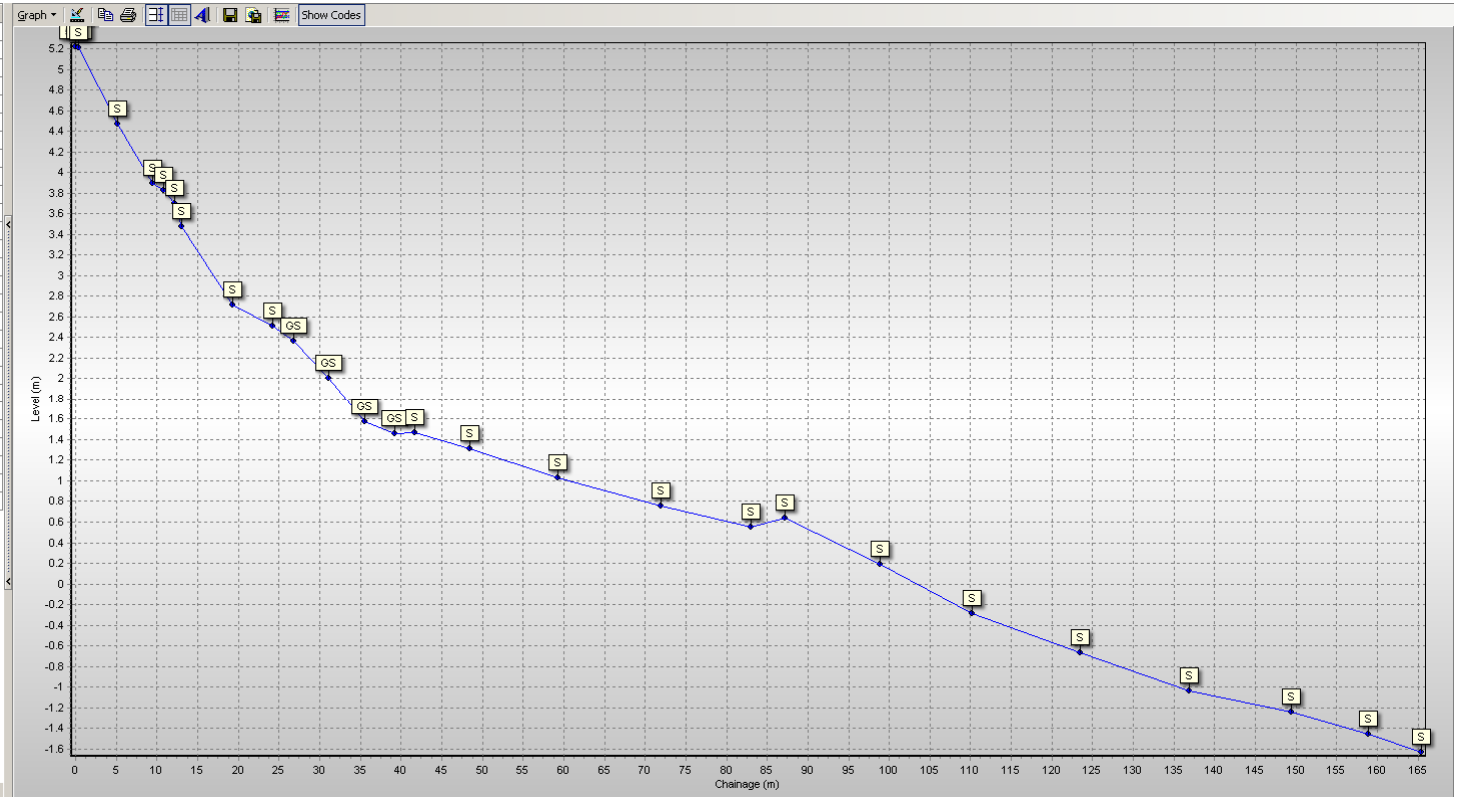
1aBTBC06 - 09/03/2011

Chainage	Level	Code
40.767	-1.568	GS
47.844	-1.377	GS
55.138	-1.237	GS
66.344	-1.044	GS
78.539	-0.834	GS
92.065	-0.646	GS
104.989	-0.371	GS
116.068	0.052	GS
119.719	0.173	G
132.059	0.597	G
143.868	1.014	G
152.783	1.227	G
161.582	1.480	G
169.664	1.460	G
175.066	1.011	G
176.364	0.663	G
177.042	0.418	G
177.276	0.209	G
188.119	0.144	S
199.629	0.354	S
208.917	0.483	S
214.276	0.688	S
218.137	0.728	GS
228.476	0.867	GS
231.632	1.209	GS
239.100	1.729	GS
248.704	2.402	GS
250.880	2.636	GS
254.790	2.616	GS
262.076	2.603	GS
271.145	2.550	GS
274.890	2.358	GS
275.732	2.239	GS
278.030	1.996	GS
279.277	1.779	GS
280.204	1.569	GS
281.121	1.345	GS
281.370	1.107	GS
282.822	0.838	GS
283.640	0.611	GS
284.785	0.148	GS
285.777	-0.197	GS



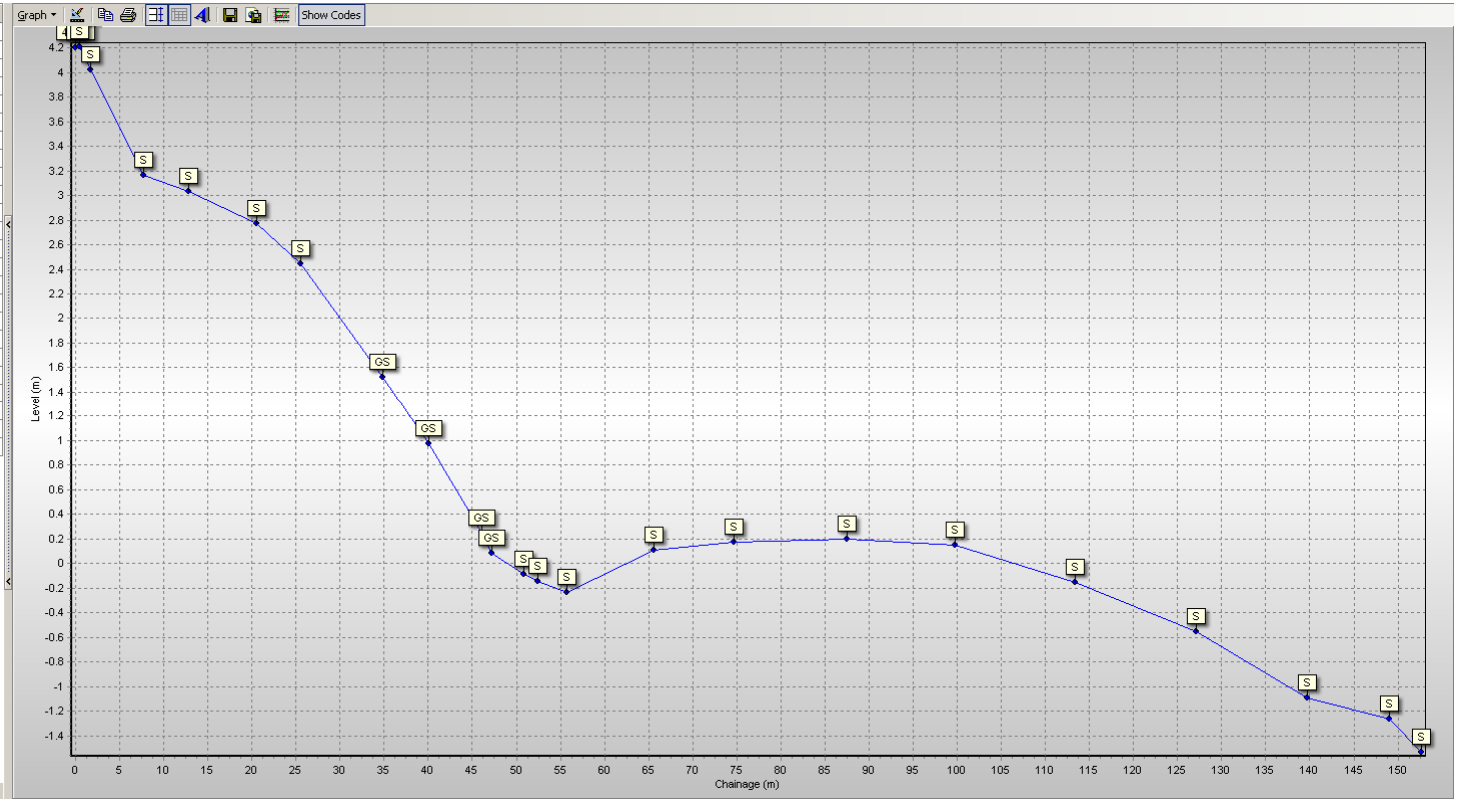
1aBTBC11 - 09/03/2011

Chainage	Level	Code
0.000	5.220	
0.022	5.220	S
0.310	5.207	S
5.133	4.471	S
9.528	3.898	S
10.804	3.822	S
12.211	3.695	S
13.023	3.477	S
19.310	2.719	S
24.246	2.510	S
26.752	2.365	GS
31.145	2.000	GS
35.593	1.574	GS
39.227	1.453	GS
41.675	1.471	S
48.442	1.316	S
59.234	1.031	S
71.954	0.755	S
82.955	0.552	S
87.247	0.636	S
98.927	0.190	S
110.175	-0.285	S
123.458	-0.670	S
136.857	-1.034	S
149.473	-1.245	S
158.828	-1.458	S
165.403	-1.632	S



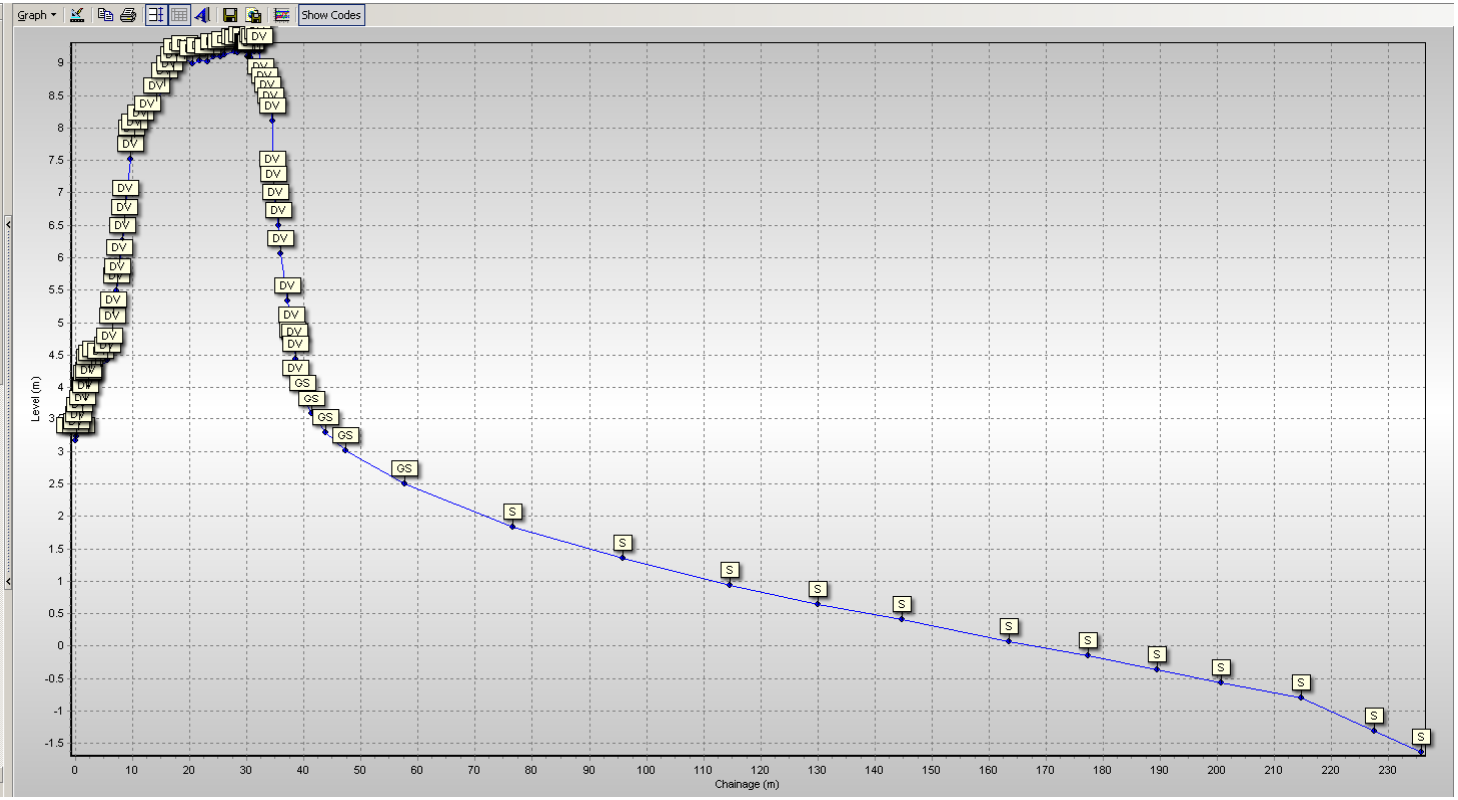
1aBTBC13 - 09/03/2011

Chainage	Level	Code
0.000	4.199	
0.043	4.199	S
0.474	4.209	S
1.703	4.023	S
7.678	3.162	S
12.855	3.033	S
20.525	2.771	S
25.540	2.445	S
34.875	1.522	GS
40.094	0.975	GS
46.064	0.250	GS
47.235	0.086	GS
50.904	-0.086	S
52.491	-0.145	S
55.786	-0.234	S
65.565	0.107	S
74.725	0.173	S
87.563	0.201	S
99.800	0.153	S
113.383	-0.150	S
127.144	-0.553	S
139.726	-1.087	S
148.980	-1.260	S
152.661	-1.532	S



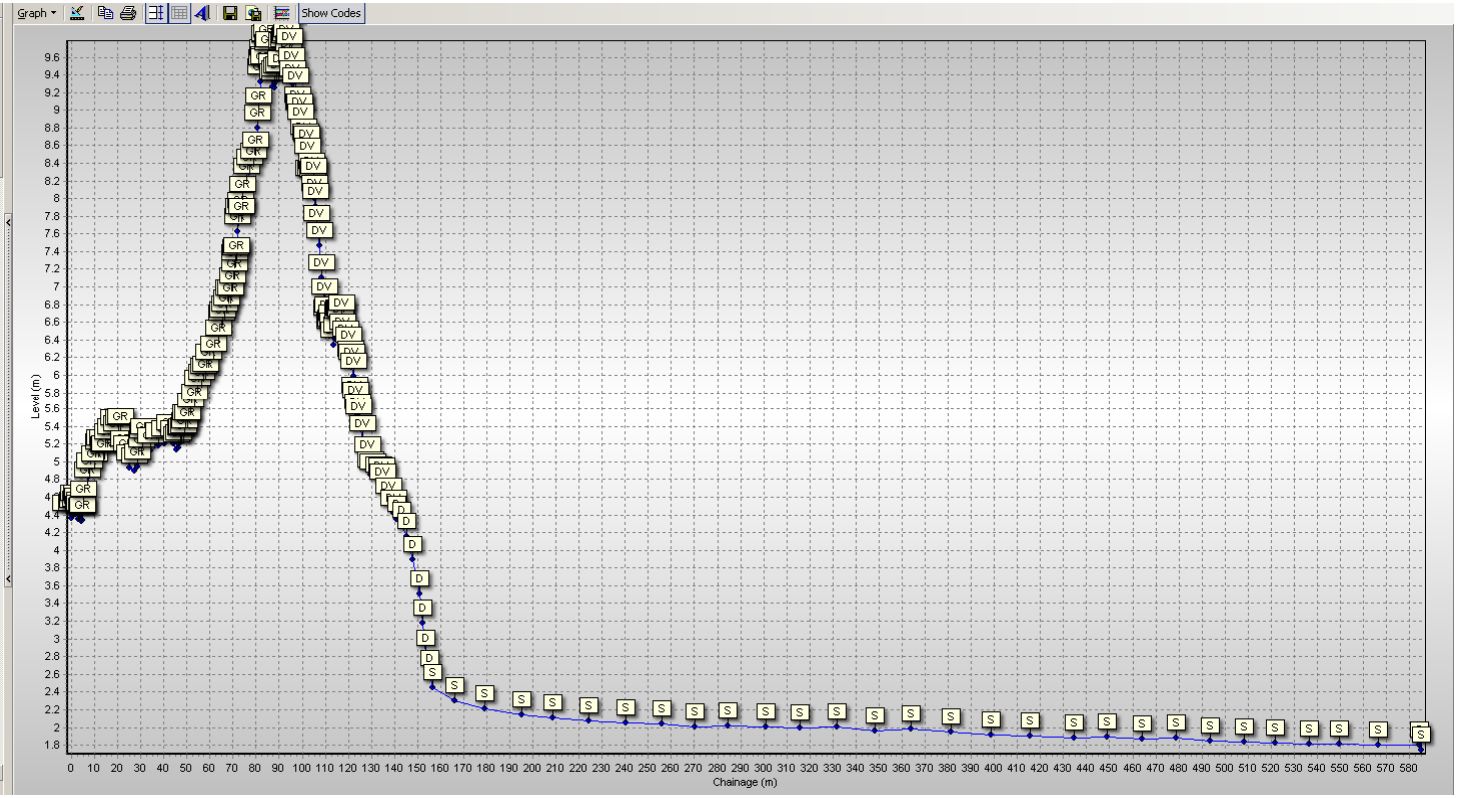
1aBTBC16 - 10/03/2011

Chainage	Level	Code
0.000	3.163	
0.010	3.163	DV
0.216	3.224	DV
0.442	3.342	DV
0.617	3.487	DV
1.221	3.601	DV
1.711	3.801	DV
1.896	3.985	DV
2.257	3.996	DV
2.336	4.035	DV
2.483	4.231	DV
2.727	4.291	DV
3.545	4.362	DV
4.402	4.330	DV
5.602	4.418	DV
5.972	4.553	DV
6.494	4.876	DV
6.663	5.118	DV
7.142	5.484	DV
7.342	5.630	DV
7.676	5.925	DV
8.251	6.264	DV
8.533	6.545	DV
8.825	6.840	DV
9.611	7.523	DV
9.890	7.764	DV
10.420	7.865	DV
11.316	7.993	DV
12.642	8.137	DV
14.138	8.416	DV
15.539	8.650	DV
16.410	8.749	DV
17.096	8.895	DV
17.622	9.012	DV
19.106	9.059	DV
20.521	8.996	DV
21.760	9.035	DV
23.211	9.013	DV
24.175	9.104	DV
25.355	9.097	DV
26.048	9.135	DV
27.873	9.181	DV



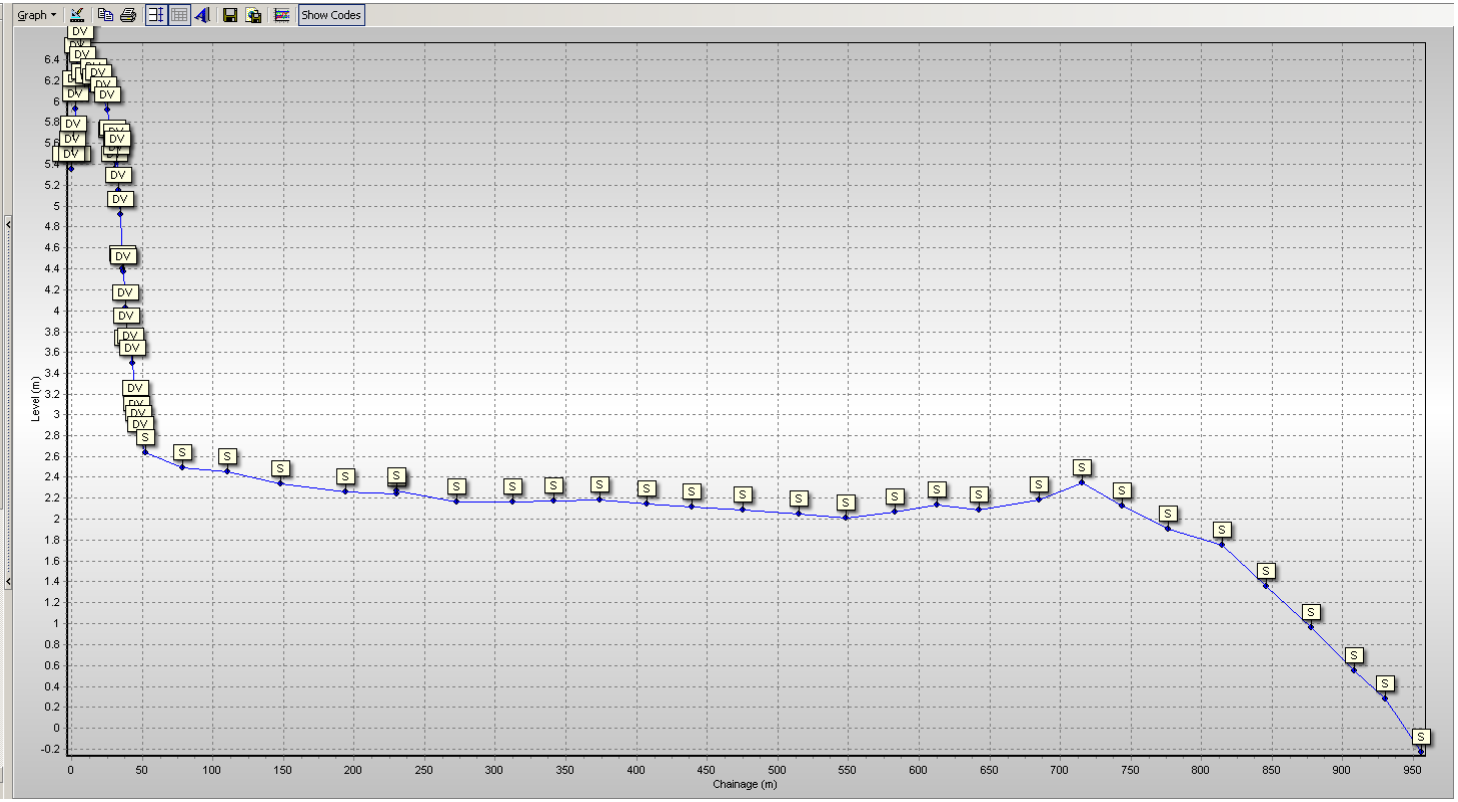
1aBTBC19 - 11/03/2011

Chainage	Level	Code
0.000	4.362	
0.038	4.362	GR
0.415	4.393	GR
0.876	4.476	GR
1.746	4.410	GR
2.136	4.479	GR
2.540	4.446	GR
2.923	4.349	GR
3.155	4.351	GR
3.362	4.394	GR
3.646	4.364	GR
4.316	4.322	GR
4.700	4.341	GR
5.339	4.517	GR
6.989	4.738	GR
7.906	4.839	GR
9.951	4.919	GR
11.587	5.055	GR
12.346	5.101	GR
13.313	5.106	GR
13.890	5.016	GR
14.504	5.038	GR
15.433	5.168	GR
16.750	5.226	GR
18.379	5.324	GR
19.583	5.256	GR
20.480	5.323	GR
21.145	5.343	GR
22.508	5.090	GR
23.932	5.027	GR
25.355	4.927	GR
27.437	4.896	GR
28.501	4.941	GR
30.214	5.079	GR
30.671	5.180	GR
31.323	5.231	GR
34.107	5.122	GR
37.776	5.181	GR
40.340	5.203	GR
42.662	5.267	GR
44.398	5.207	GR
45.410	5.136	GR



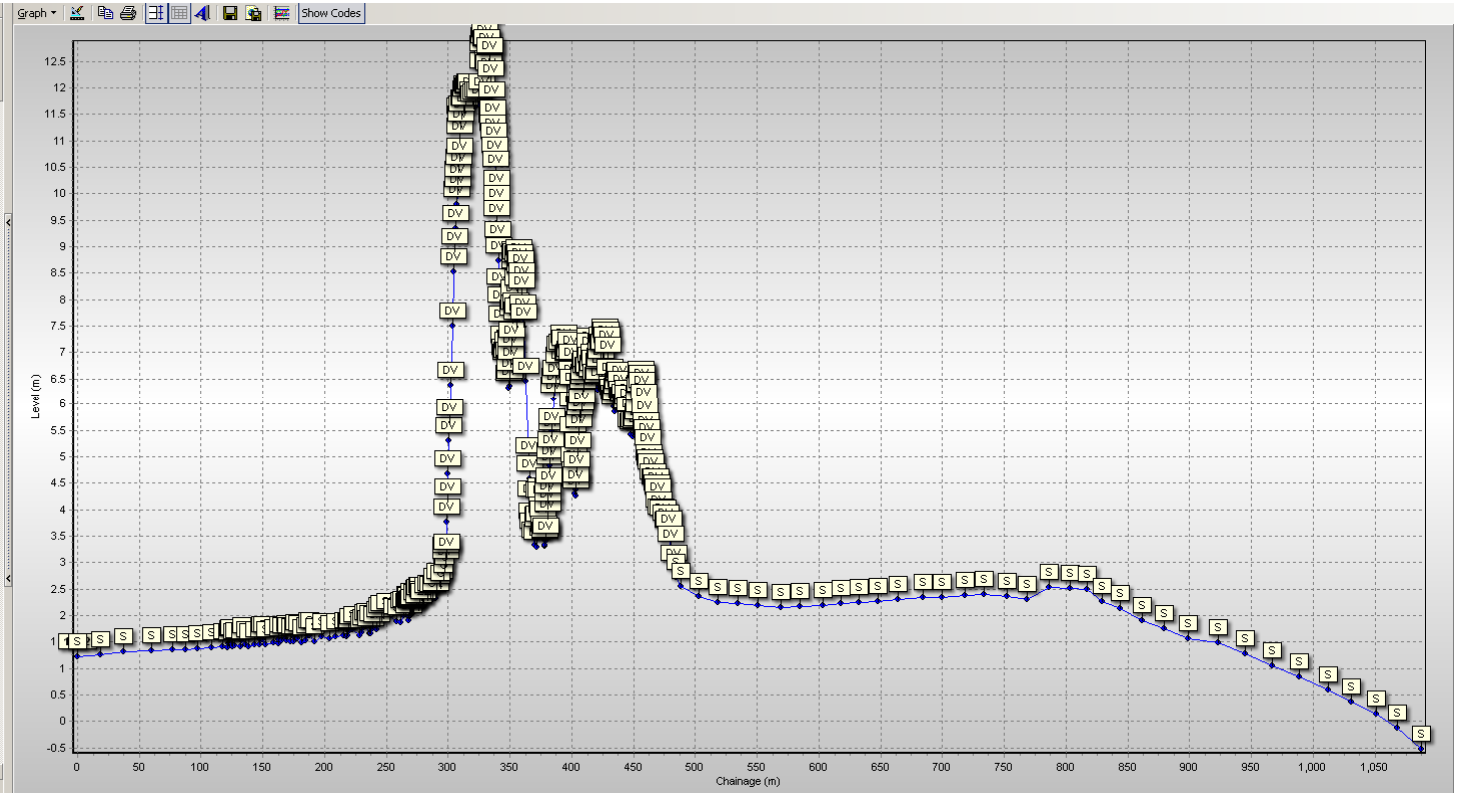
1aBTBC21 - 11/03/2011

Chainage	Level	Code
0.000	5.356	
0.070	5.356	DV
0.488	5.495	DV
1.123	5.641	DV
2.487	5.925	DV
3.090	6.076	DV
4.153	6.386	DV
6.276	6.524	DV
7.807	6.304	DV
9.427	6.142	DV
12.119	6.102	DV
15.933	6.191	DV
16.890	6.087	DV
19.074	6.131	DV
22.365	6.019	DV
25.211	5.918	DV
28.003	5.587	DV
29.204	5.605	DV
30.433	5.351	DV
31.598	5.415	DV
32.079	5.564	DV
32.680	5.494	DV
33.413	5.151	DV
34.501	4.923	DV
36.050	4.406	DV
36.980	4.375	DV
37.944	4.026	DV
38.964	3.806	DV
39.914	3.597	DV
41.473	3.611	DV
43.130	3.501	DV
45.442	3.111	DV
45.929	2.960	DV
47.696	2.865	DV
48.587	2.757	DV
52.177	2.630	S
78.291	2.486	S
110.841	2.452	S
148.401	2.332	S
194.323	2.255	S
230.161	2.244	S
230.239	2.273	S



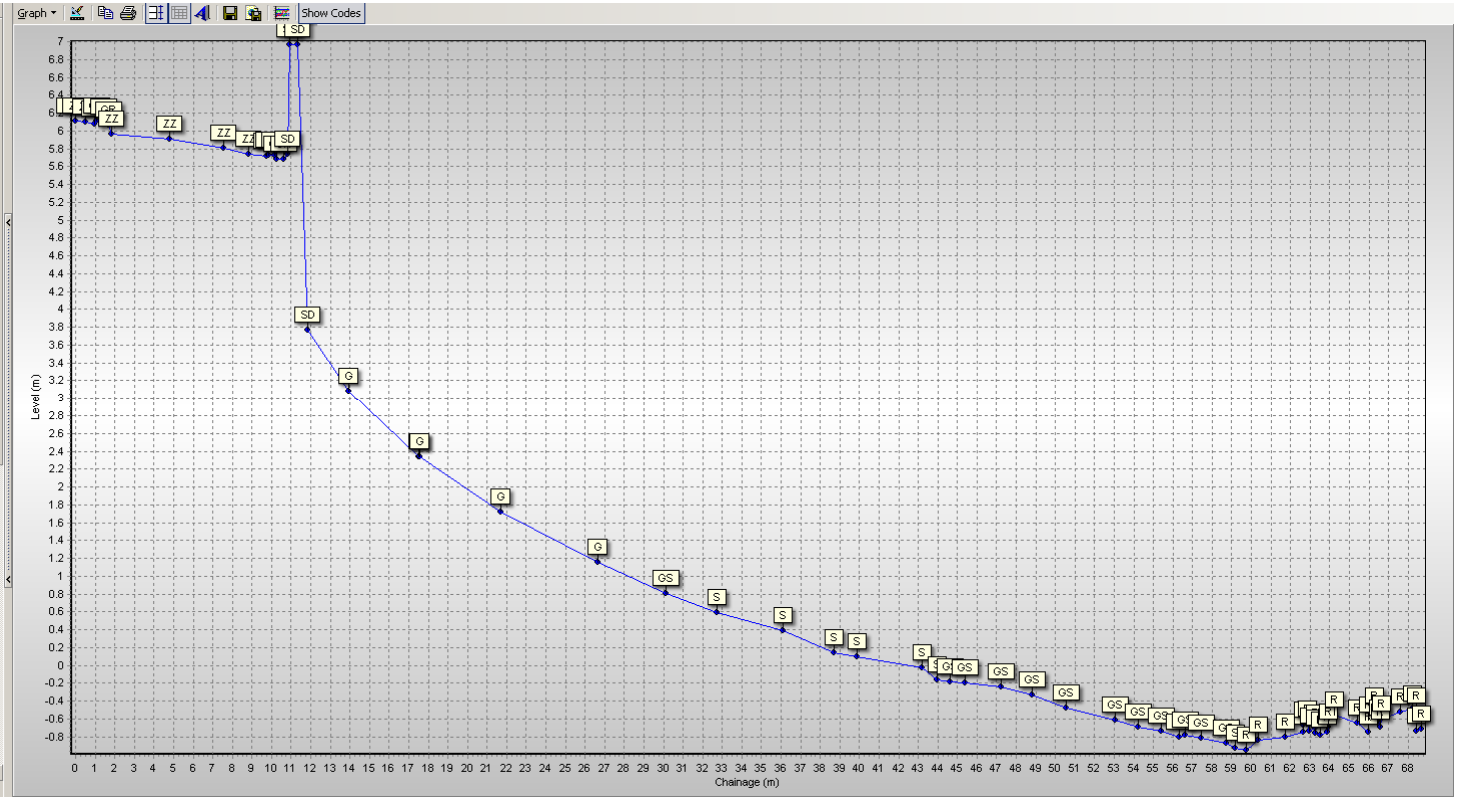
1aBTBC23 - 11/03/2011

Chainage	Level	Code
0.000	1.222	
0.380	1.222	S
18.788	1.263	S
37.192	1.320	S
59.823	1.335	S
76.590	1.345	S
87.798	1.357	S
97.084	1.380	S
108.474	1.390	S
117.026	1.408	S
121.694	1.399	S
121.927	1.458	S
123.265	1.485	S
125.168	1.407	S
127.090	1.425	S
131.913	1.400	S
132.717	1.516	S
135.690	1.448	S
138.340	1.409	S
143.552	1.446	S
147.570	1.447	S
148.492	1.539	S
150.070	1.544	S
151.839	1.454	S
158.312	1.476	S
162.633	1.461	S
162.940	1.535	S
165.149	1.521	S
168.586	1.568	S
169.635	1.515	S
172.297	1.506	S
175.209	1.495	S
175.616	1.583	S
177.796	1.569	S
181.428	1.488	S
184.780	1.520	S
186.097	1.613	S
188.085	1.627	S
191.688	1.512	S
197.811	1.605	S
204.061	1.569	S
209.036	1.605	S



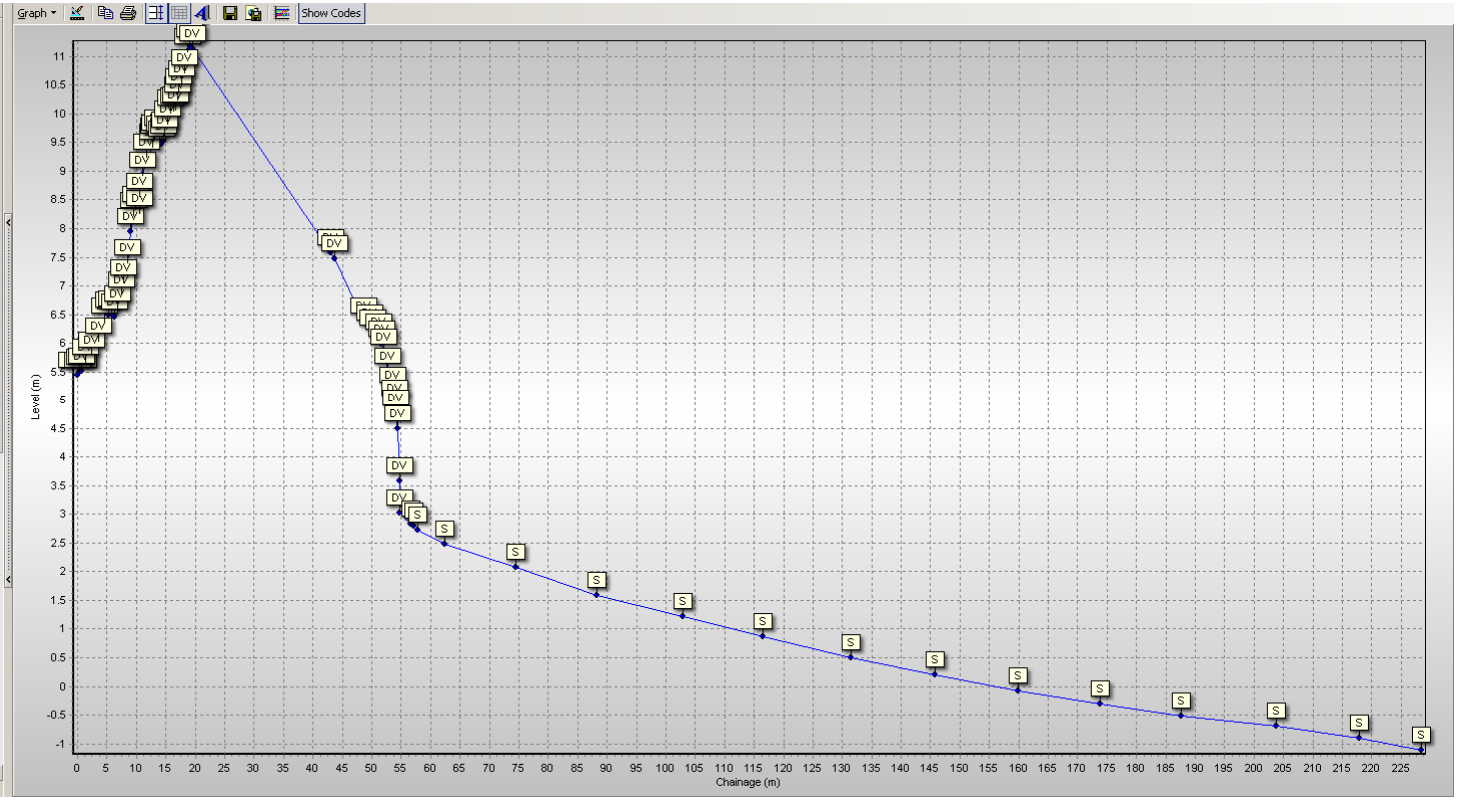
1aBTBC31 - 11/03/2011

Chainage	Level	Code
0.000	6.111	
0.010	6.111	ZZ
0.528	6.101	ZZ
0.995	6.077	ZZ
1.087	6.115	GR
1.413	6.105	GR
1.692	6.066	GR
1.846	5.964	ZZ
4.820	5.914	ZZ
7.582	5.804	ZZ
8.819	5.740	ZZ
9.741	5.719	ZZ
9.846	5.733	GR
10.181	5.727	GR
10.254	5.685	GR
10.613	5.681	GR
10.835	5.734	SD
10.930	6.967	SD
11.340	6.965	SD
11.850	3.767	SD
13.964	3.080	G
17.517	2.336	G
17.563	2.338	G
21.718	1.724	G
26.660	1.160	G
30.148	0.805	GS
32.731	0.591	S
36.105	0.392	S
38.698	0.137	S
39.902	0.101	S
43.199	-0.023	S
43.944	-0.159	S
44.651	-0.180	GS
45.372	-0.190	GS
47.245	-0.239	GS
48.807	-0.331	GS
50.561	-0.479	GS
53.077	-0.616	GS
54.215	-0.688	GS
55.423	-0.736	GS
56.328	-0.807	GS
56.641	-0.780	GS



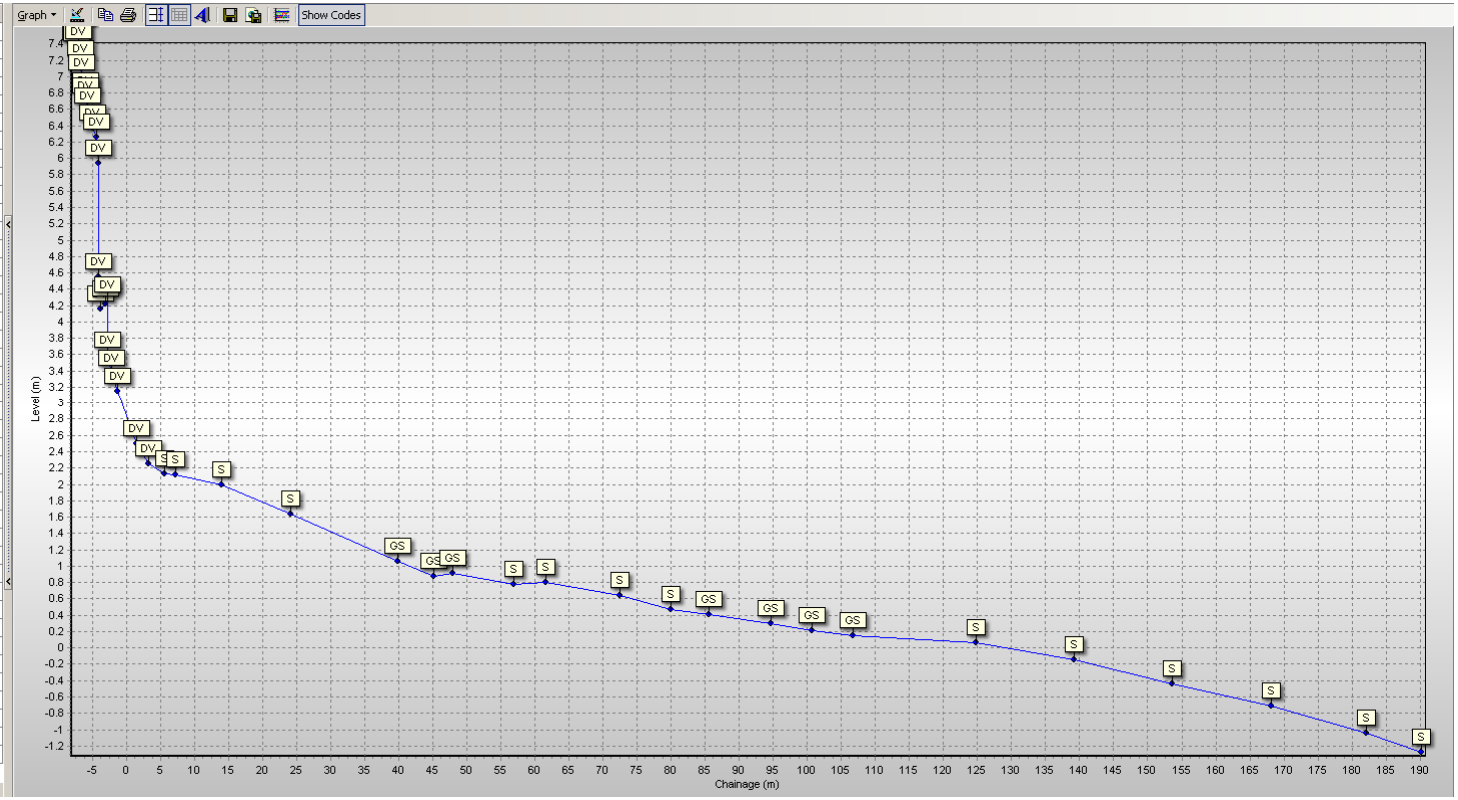
1aBTBC33 - 11/03/2011

Chainage	Level	Code
0.000	5.443	
0.019	5.443	DV
0.361	5.498	DV
0.632	5.512	DV
1.365	5.663	DV
2.414	5.795	DV
3.540	6.039	DV
4.662	6.393	DV
5.262	6.499	DV
5.851	6.508	DV
6.373	6.465	DV
6.849	6.607	DV
7.405	6.839	DV
7.905	7.052	DV
8.478	7.404	DV
8.974	7.949	DV
9.532	8.229	DV
9.910	8.331	DV
10.470	8.262	DV
10.481	8.567	DV
11.073	8.937	DV
11.743	9.240	DV
12.682	9.428	DV
12.883	9.523	DV
13.055	9.570	DV
13.540	9.667	DV
13.991	9.558	DV
14.221	9.476	DV
14.630	9.524	DV
14.846	9.636	DV
15.265	9.831	DV
15.752	10.012	DV
16.357	10.057	DV
16.671	10.072	DV
17.059	10.236	DV
17.205	10.378	DV
17.774	10.532	DV
18.145	10.713	DV
18.663	11.089	DV
19.038	11.207	DV
19.549	11.142	DV
43.067	7.580	DV



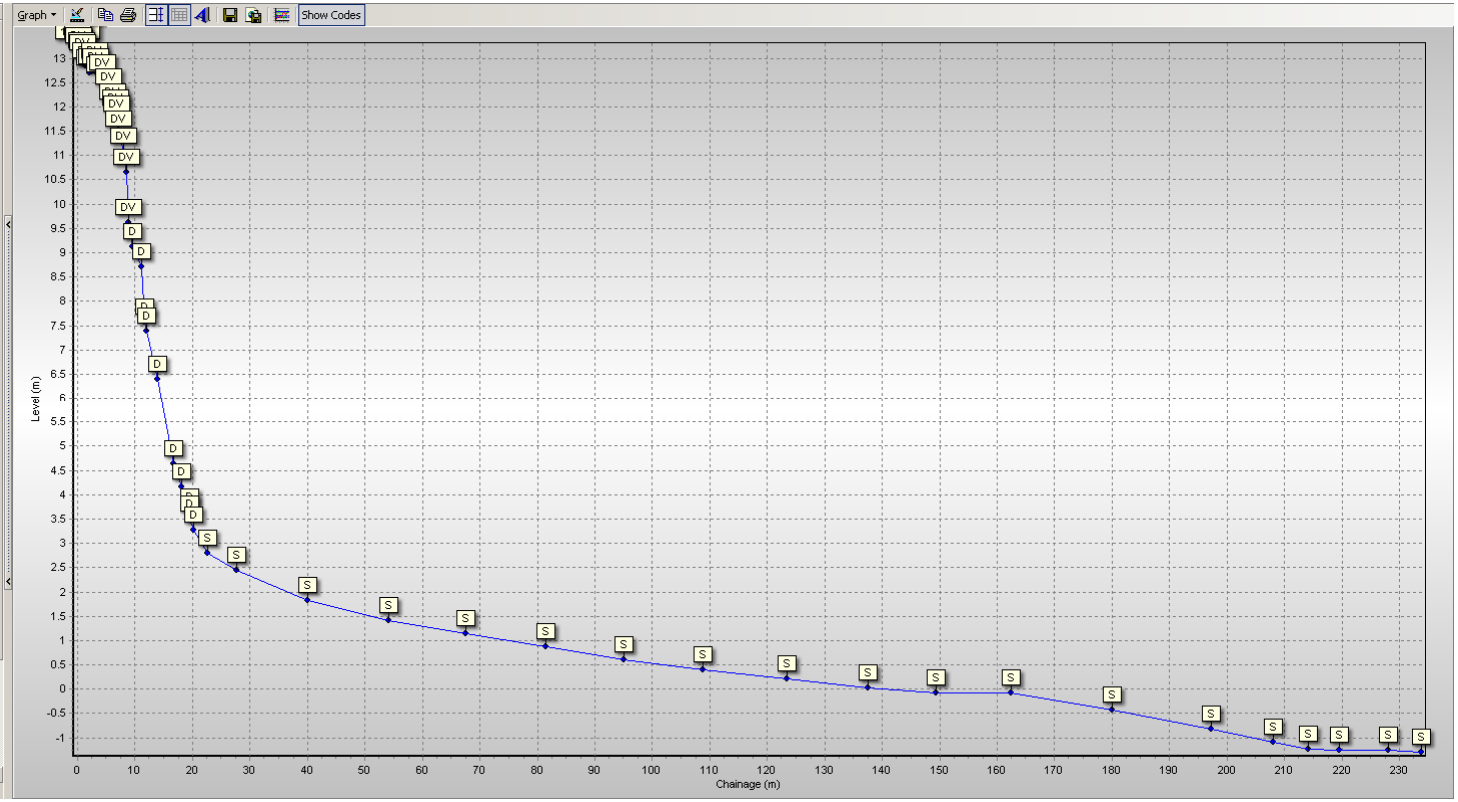
1aBTBC34 - 11/03/2011

Chainage	Level	Code
-7.455	7.358	DV
-7.320	7.341	DV
-7.030	7.367	DV
-6.733	7.158	DV
-6.643	6.990	DV
-6.004	6.759	DV
-5.977	6.707	DV
-5.693	6.583	DV
-4.920	6.376	DV
-4.402	6.260	DV
-4.099	5.935	DV
-4.081	4.547	DV
-3.750	4.153	DV
-3.104	4.220	DV
-2.824	4.272	DV
-2.799	3.587	DV
-2.185	3.367	DV
-1.325	3.155	DV
1.473	2.503	DV
3.262	2.250	DV
5.661	2.128	S
7.238	2.123	S
13.945	1.996	S
24.119	1.639	S
39.840	1.057	GS
45.179	0.880	GS
47.873	0.913	GS
56.881	0.772	S
61.582	0.805	S
72.461	0.641	S
80.001	0.470	S
85.634	0.410	GS
94.728	0.297	GS
100.637	0.210	GS
106.718	0.148	GS
124.815	0.063	S
139.238	-0.148	S
153.620	-0.435	S
168.125	-0.707	S
182.120	-1.038	S
190.191	-1.276	S



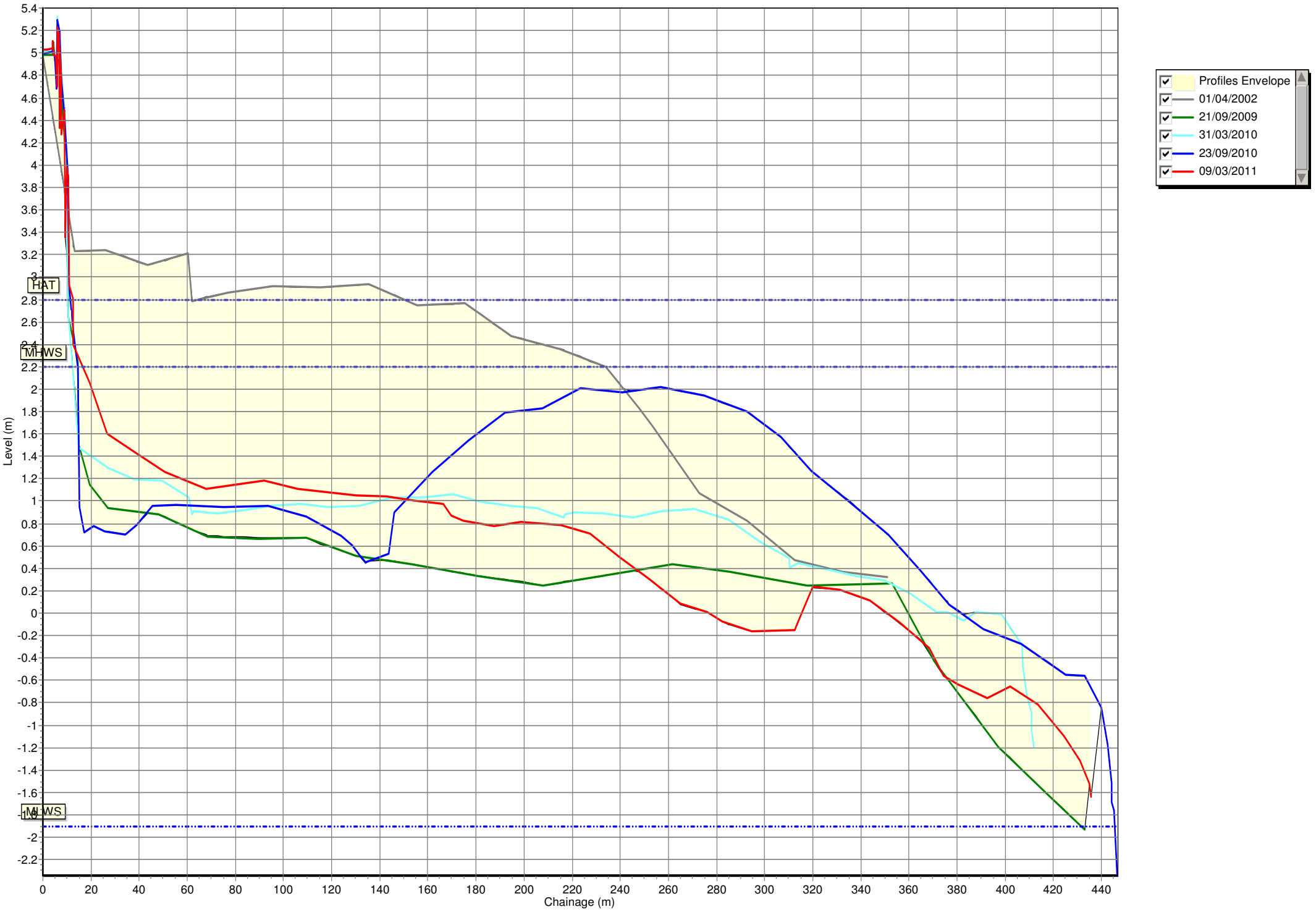
1aBTBC37 - 11/03/2011

Chainage	Level	Code
0.000	13.239	
0.016	13.239	DV
0.236	13.156	DV
0.703	13.063	DV
0.918	13.004	DV
1.452	12.844	DV
2.027	12.704	DV
2.513	12.712	DV
2.882	12.847	DV
3.157	12.727	DV
3.907	12.562	DV
4.411	12.606	DV
5.366	12.304	DV
6.126	11.994	DV
6.643	11.867	DV
6.866	11.756	DV
7.215	11.446	DV
7.922	11.089	DV
8.563	10.657	DV
8.809	9.612	DV
9.593	9.123	D
11.112	8.704	D
11.674	7.571	D
12.031	7.388	D
13.866	6.397	D
16.777	4.637	D
18.146	4.168	D
19.423	3.637	D
19.520	3.497	D
20.155	3.264	D
22.631	2.792	S
27.663	2.436	S
40.010	1.827	S
54.221	1.402	S
67.621	1.149	S
81.497	0.875	S
95.031	0.603	S
108.772	0.396	S
123.441	0.204	S
137.470	0.034	S
149.308	-0.073	S
162.454	-0.087	S

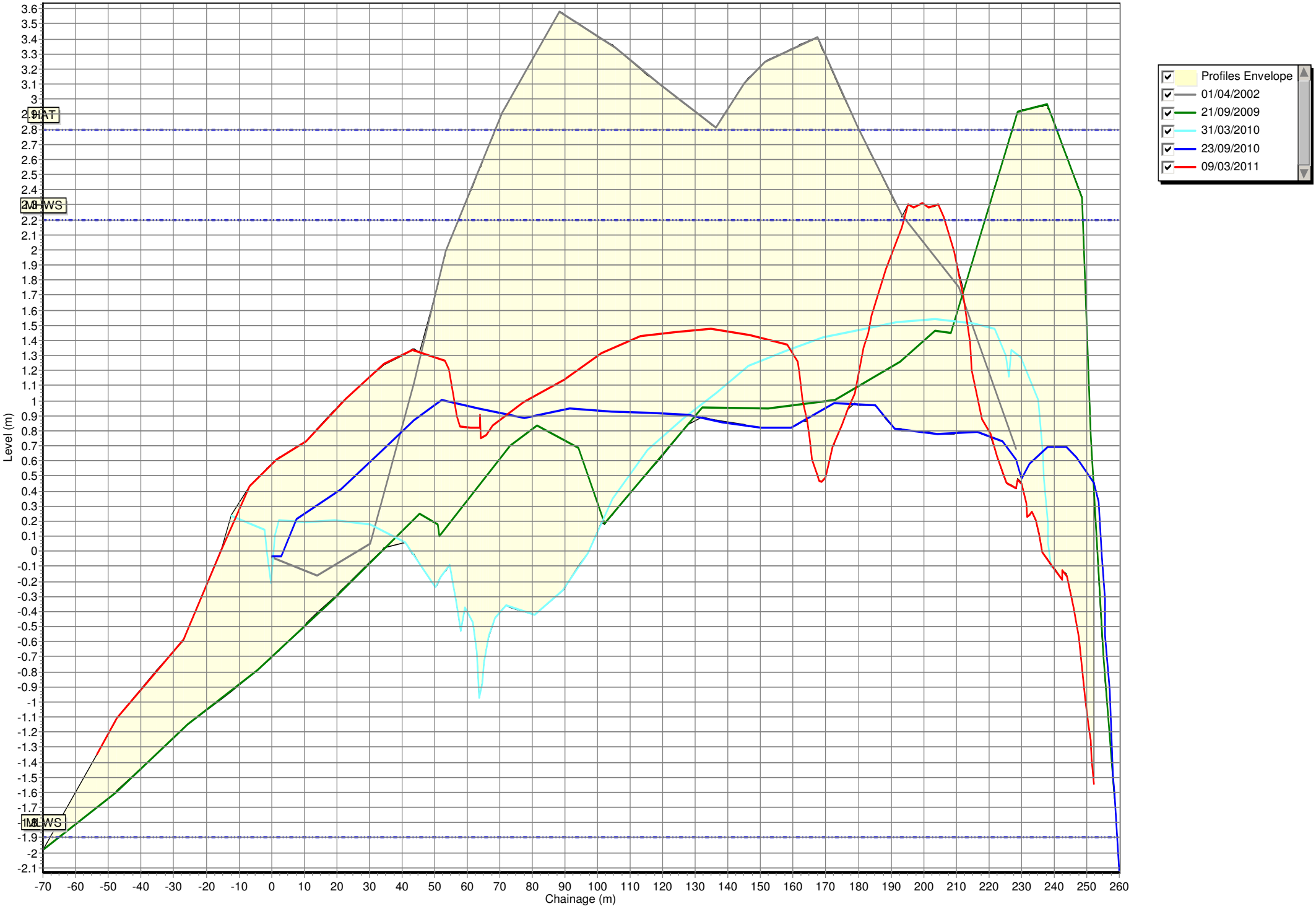


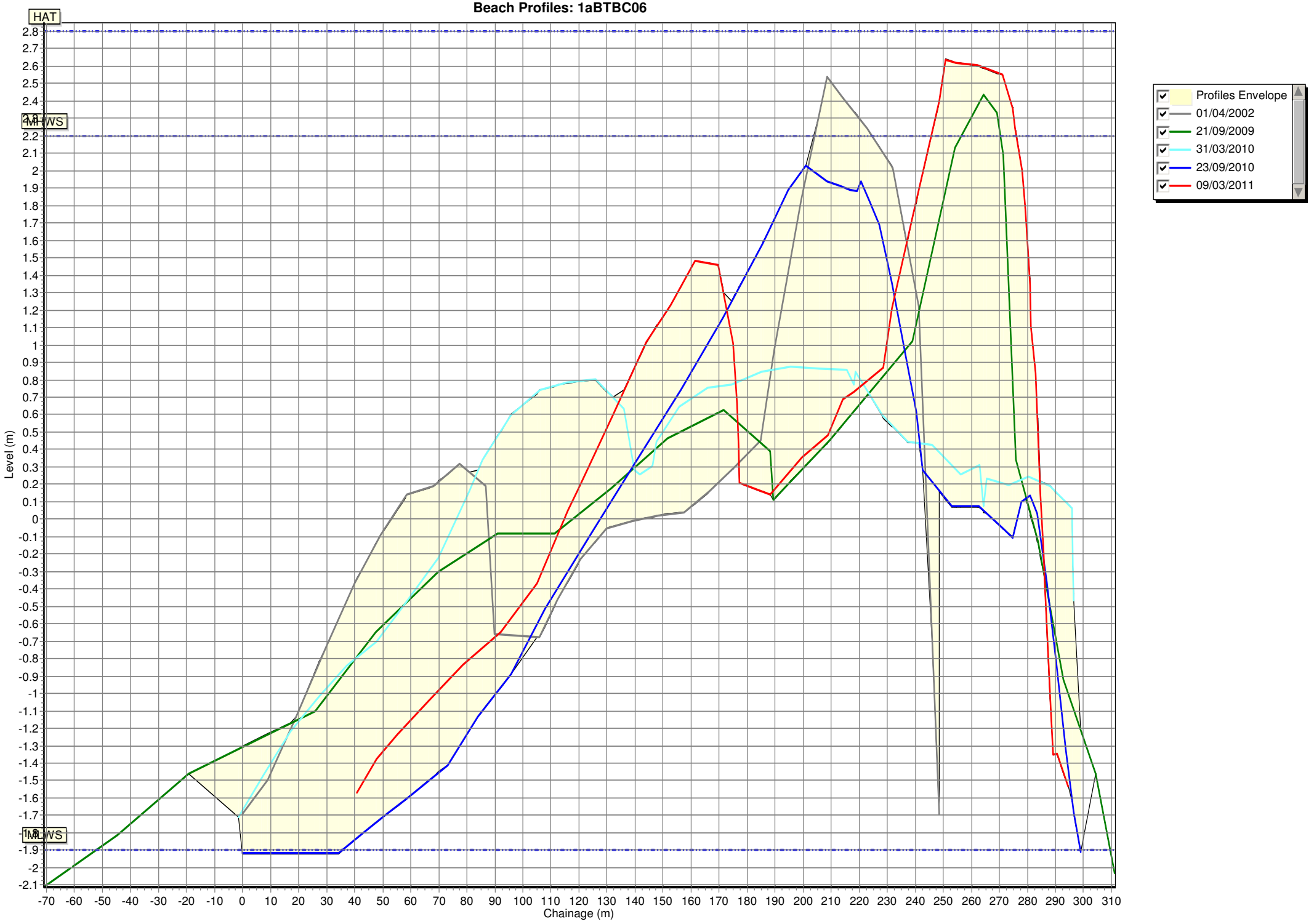
Beach Profiles: 1aBTBC02

Beach Profiles: 1aBTBC04



Beach Profiles: 1aBTBC05

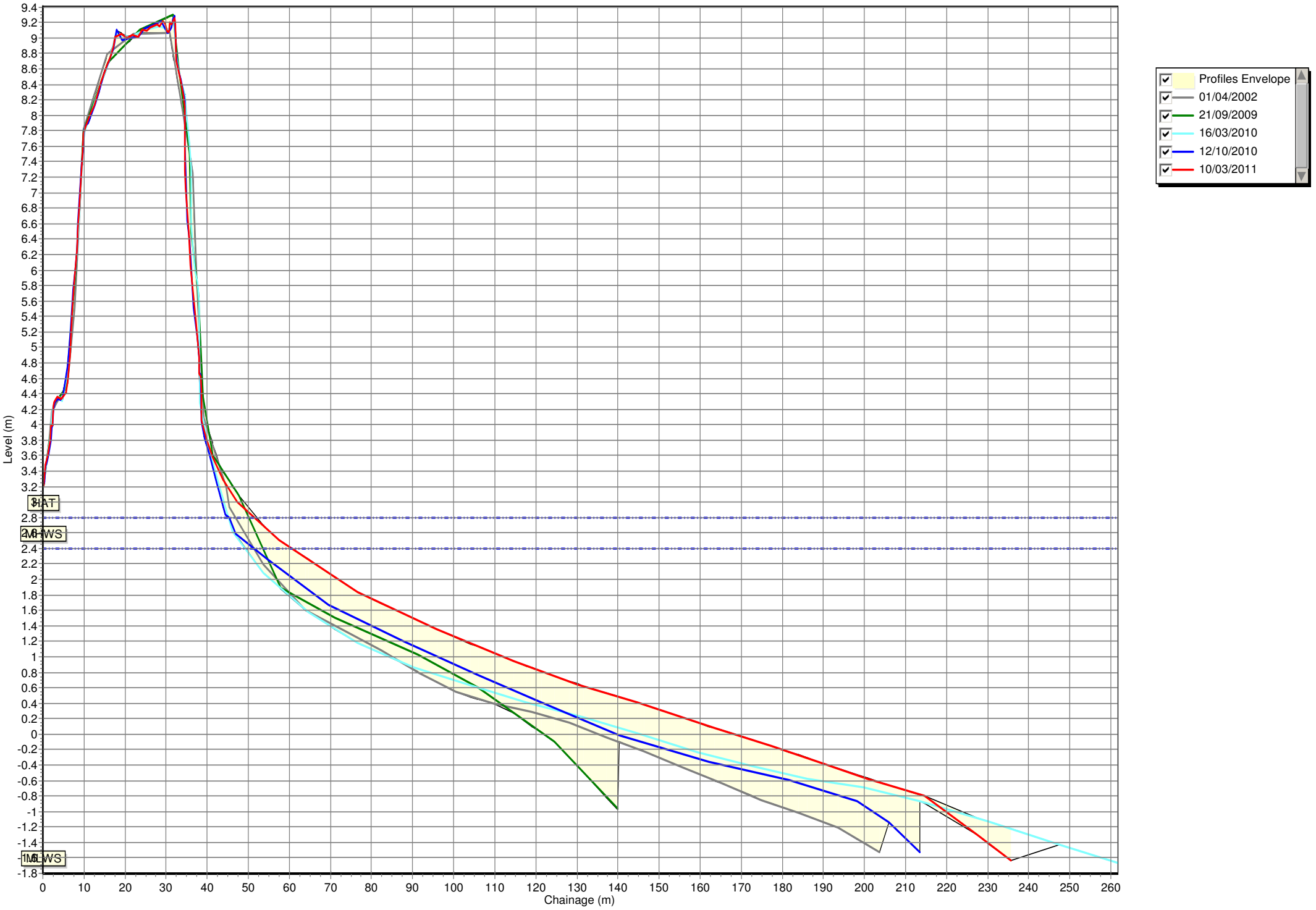



Beach Profiles: 1aBTBC06
HAT
MHWS
MLWS
Level (m)
Chainage (m)
Profiles Envelope
01/04/2002
21/09/2009
31/03/2010
23/09/2010
09/03/2011

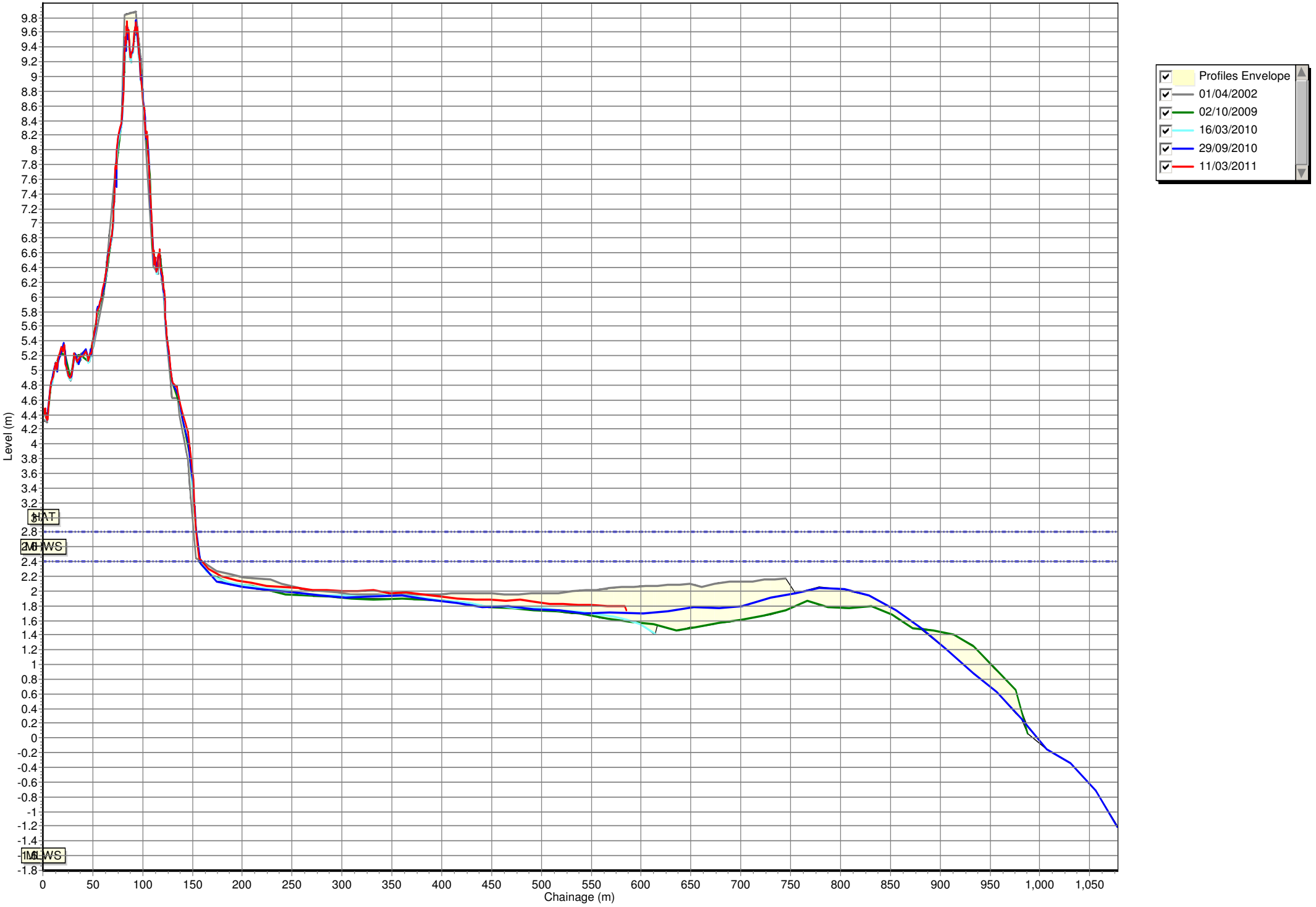
Beach Profiles: 1aBTBC11

Beach Profiles: 1aBTBC13

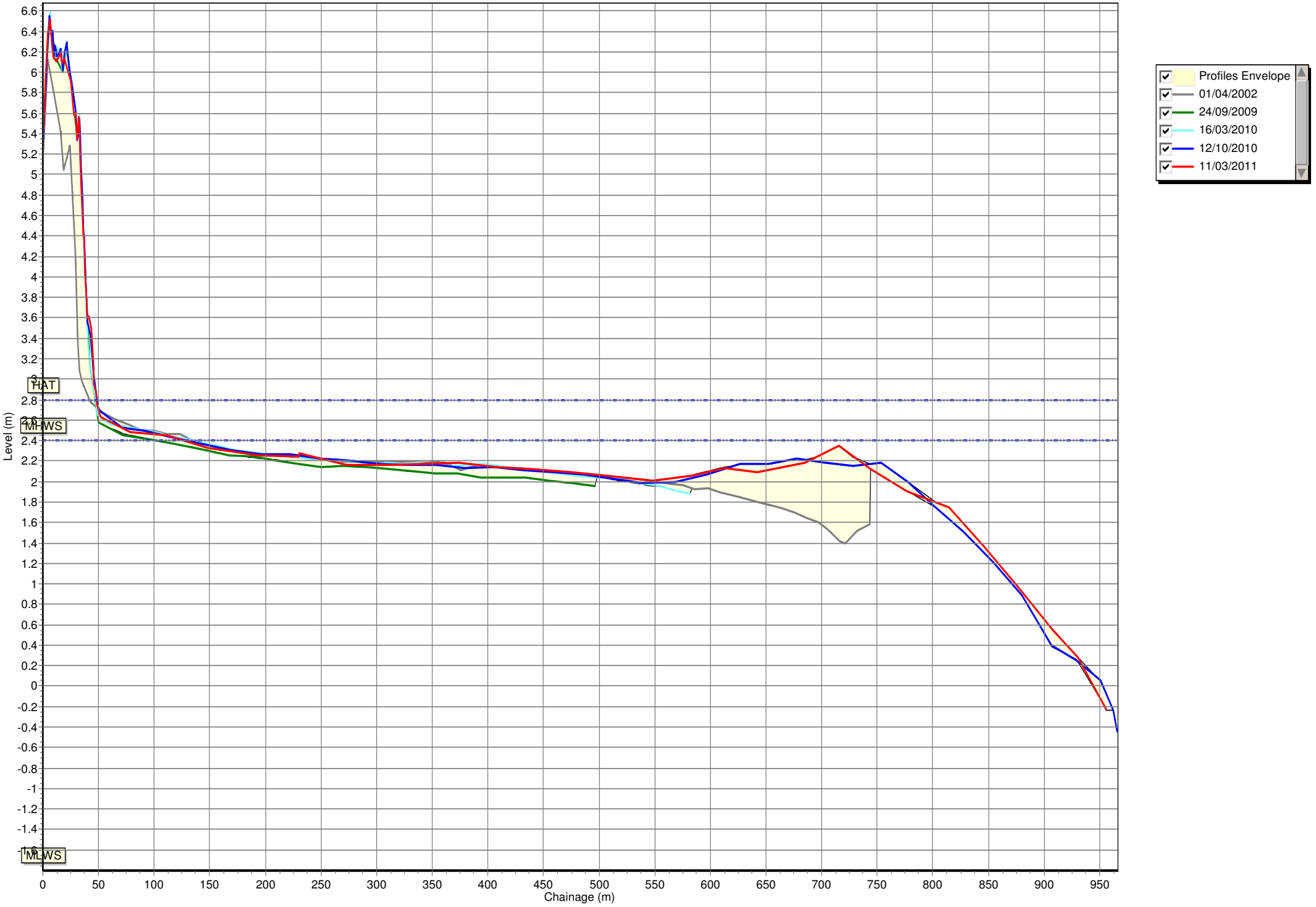
Beach Profiles: 1aBTBC16



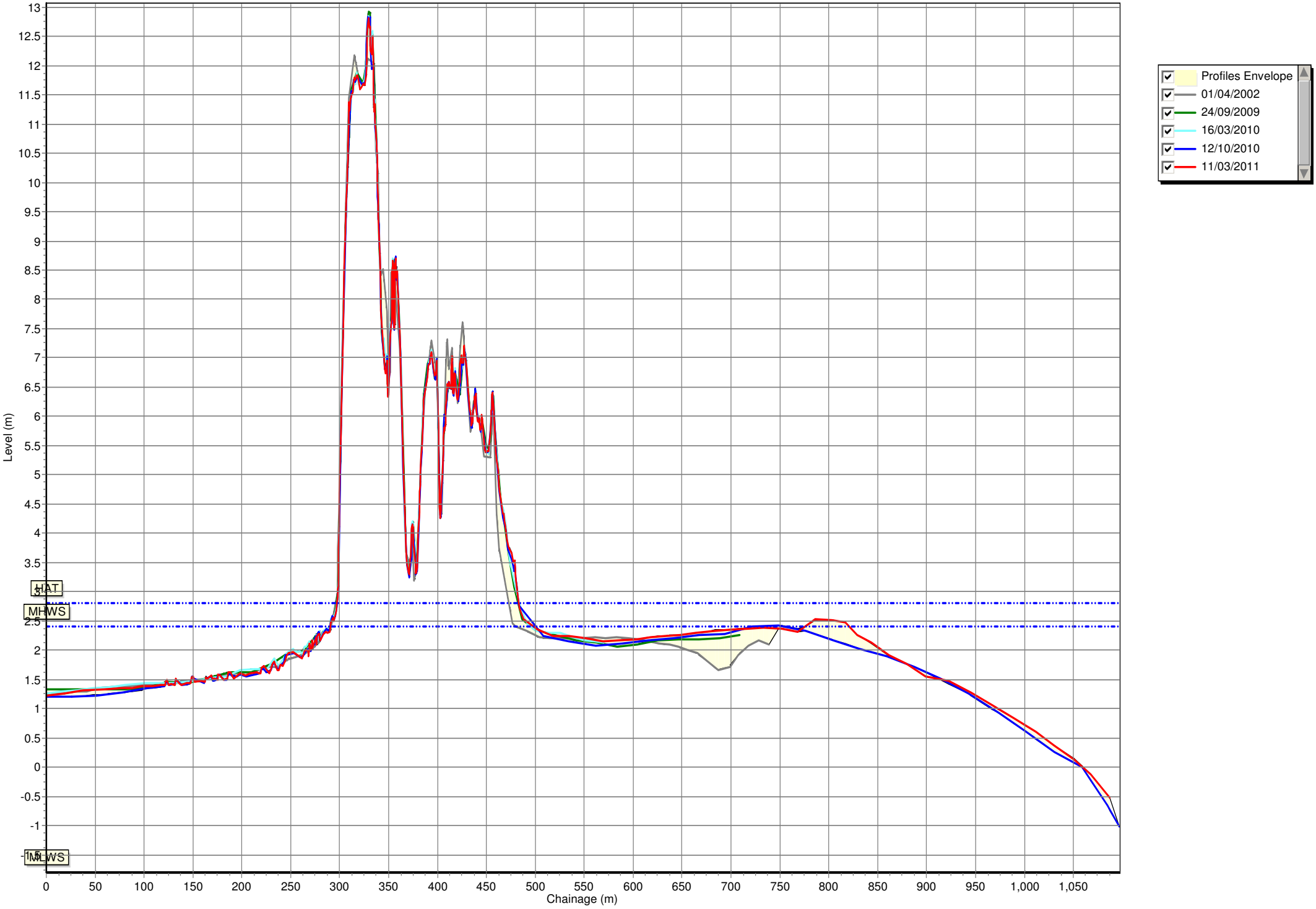
Beach Profiles: 1aBTBC19



Beach Profiles: 1aBTBC21

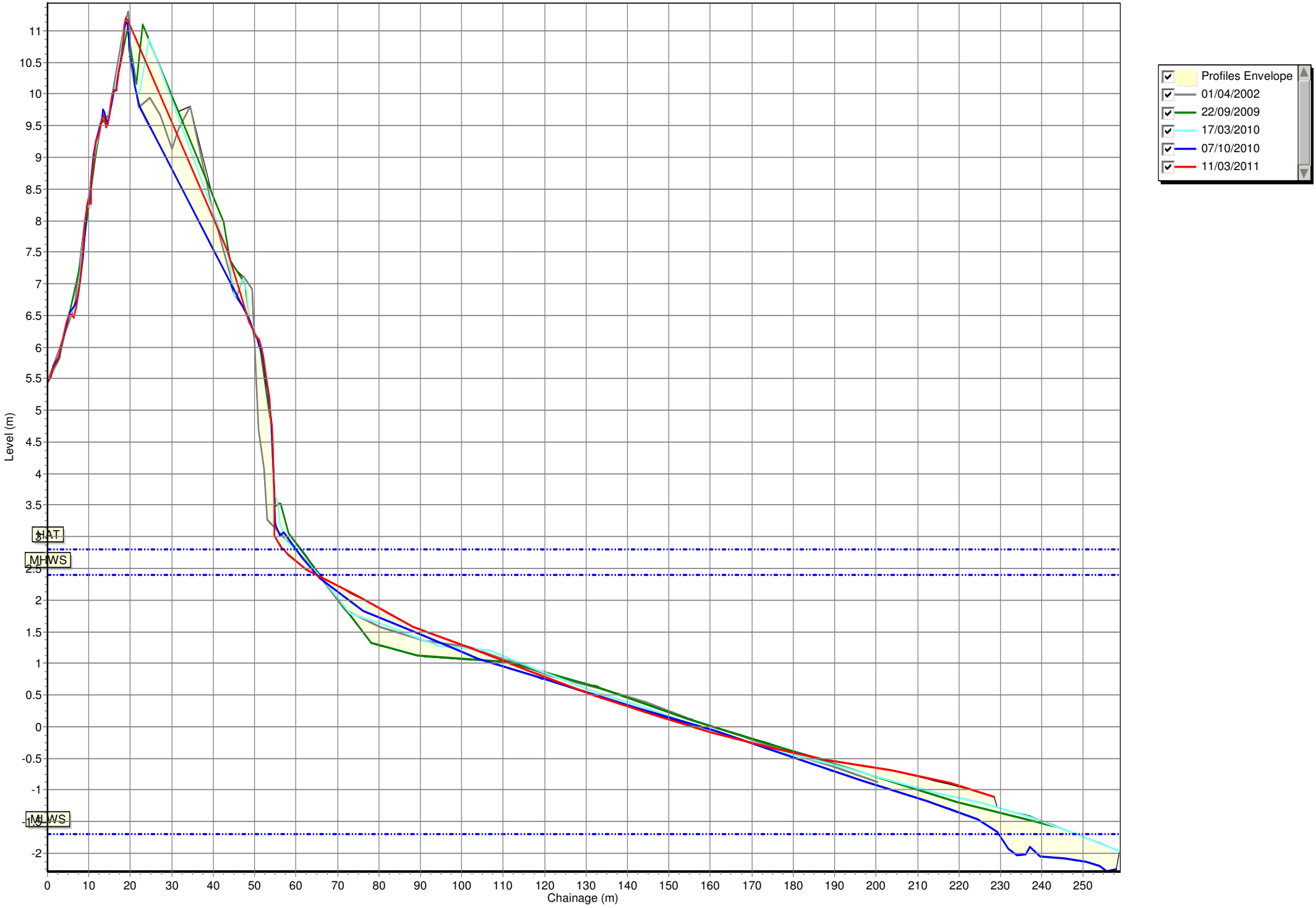


Beach Profiles: 1aBTBC23

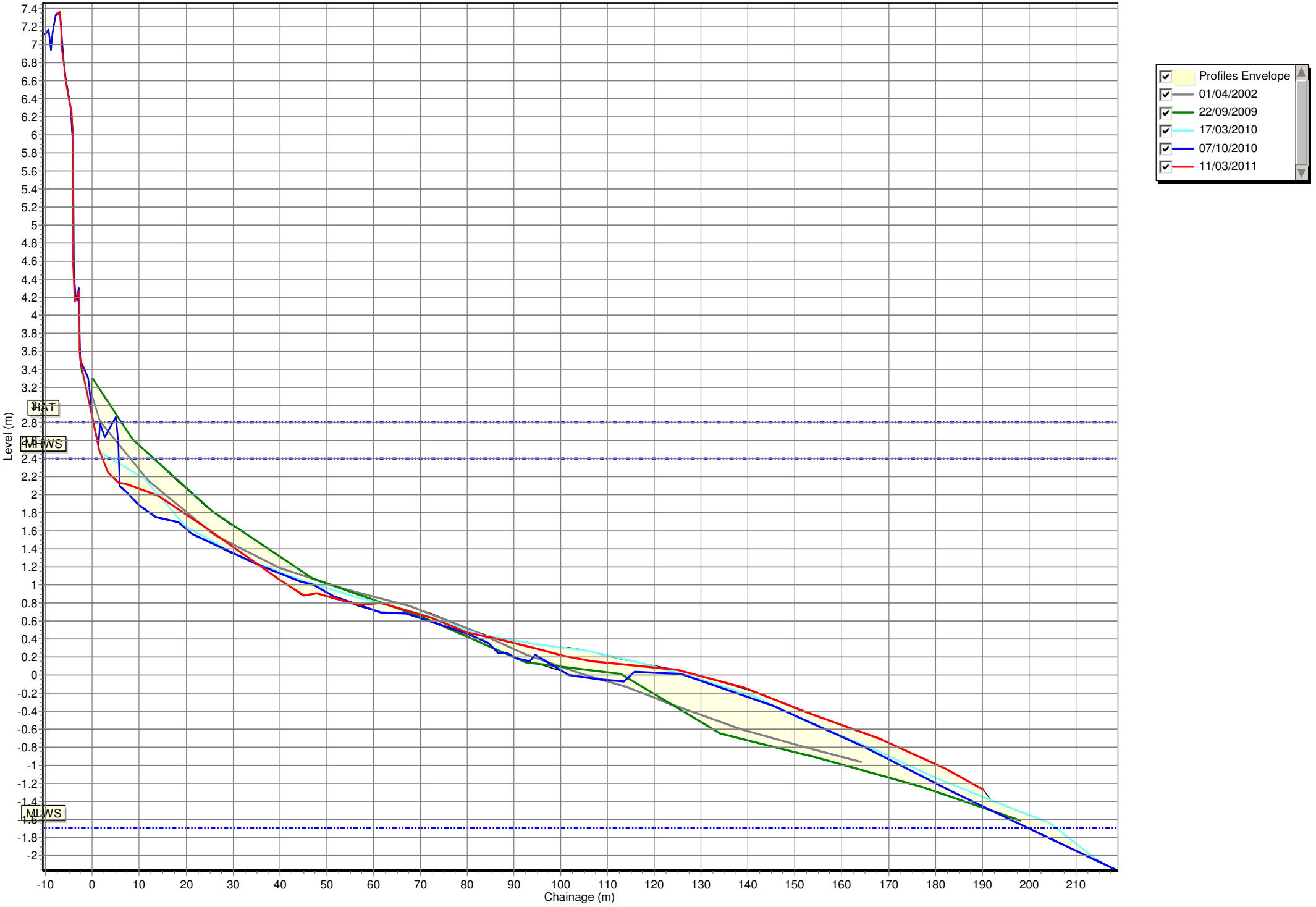


Beach Profiles: 1aBTBC31

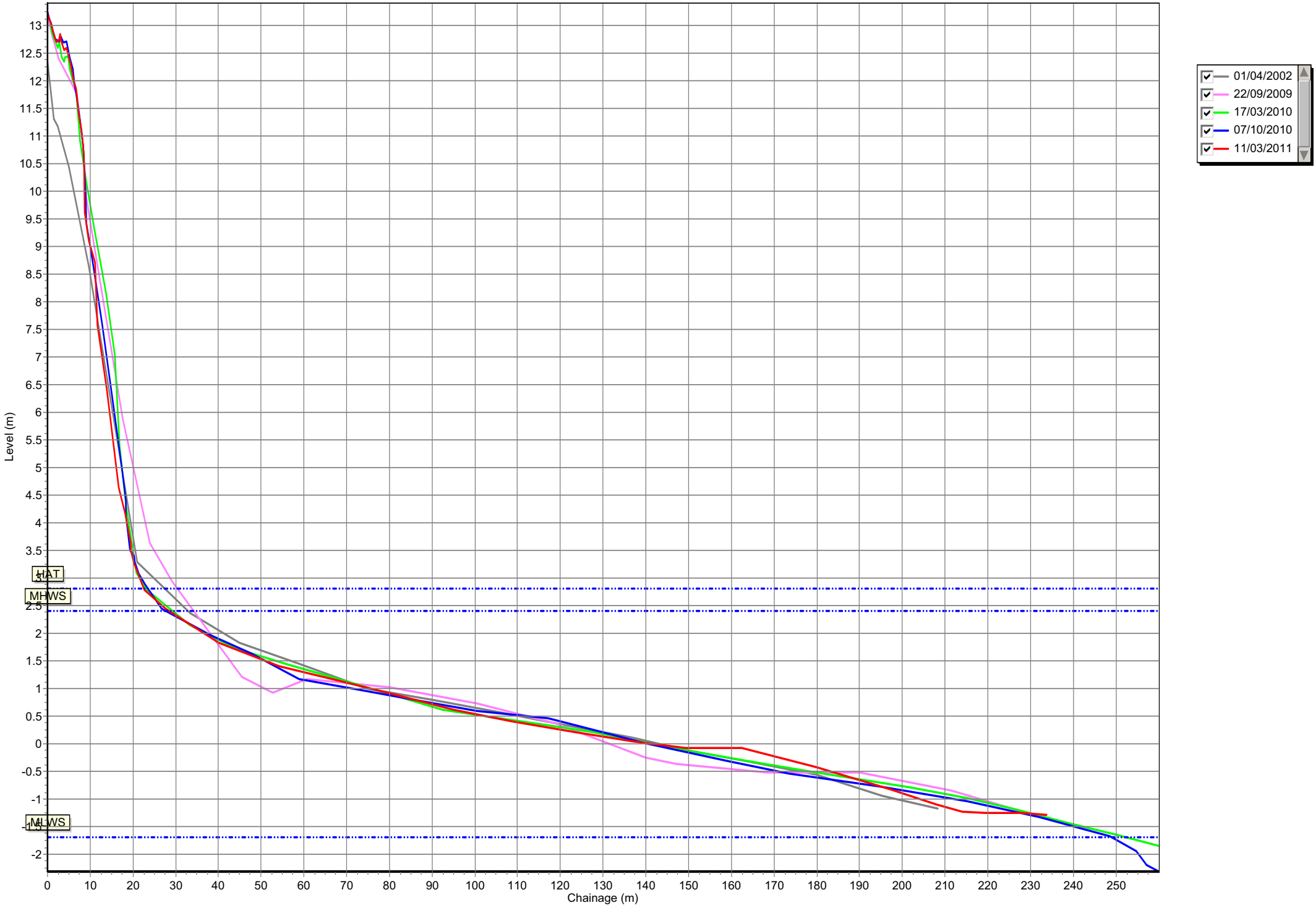
Beach Profiles: 1aBTBC33



Beach Profiles: 1aBTBC34



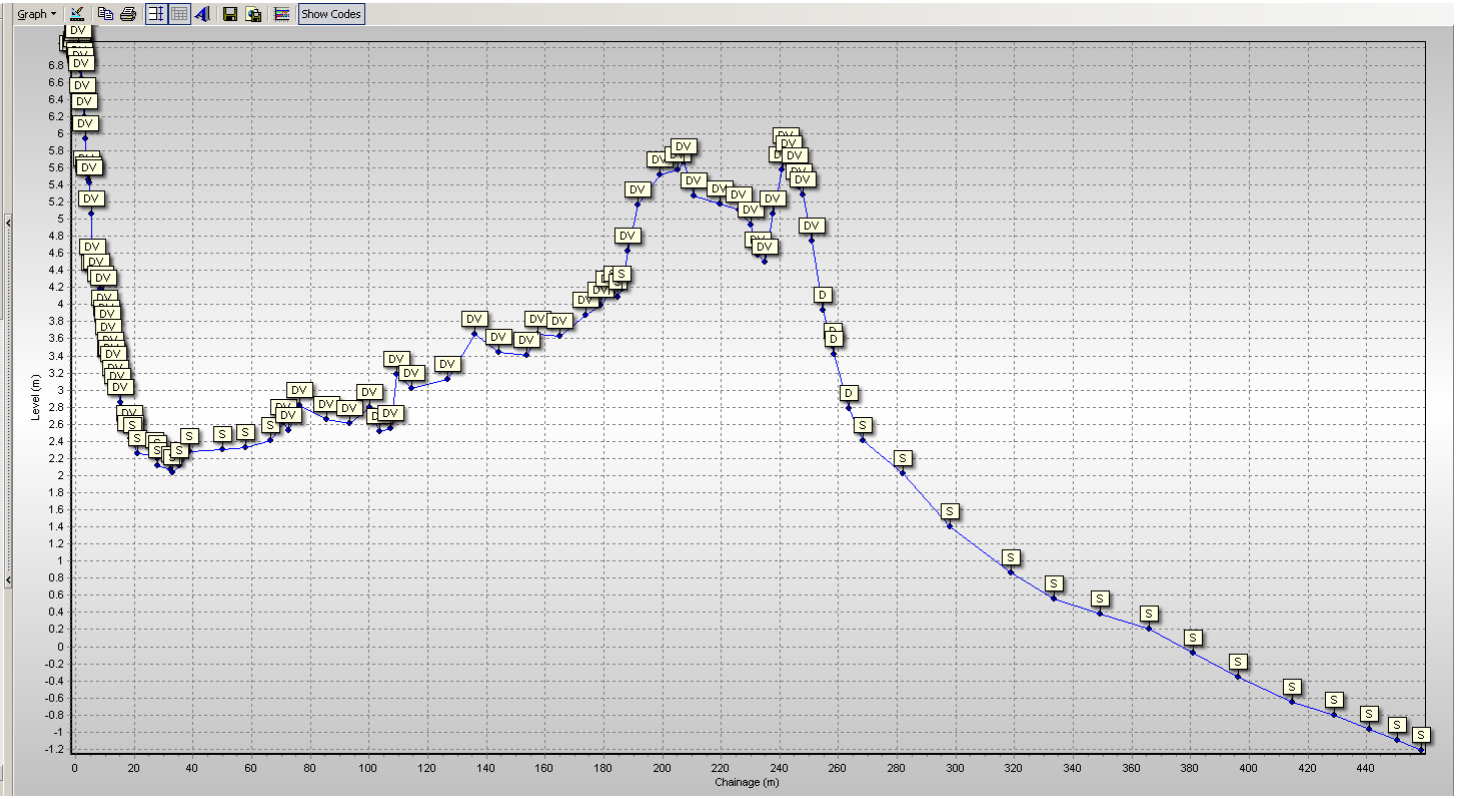
Beach Profiles: 1aBTBC37



Alnwick

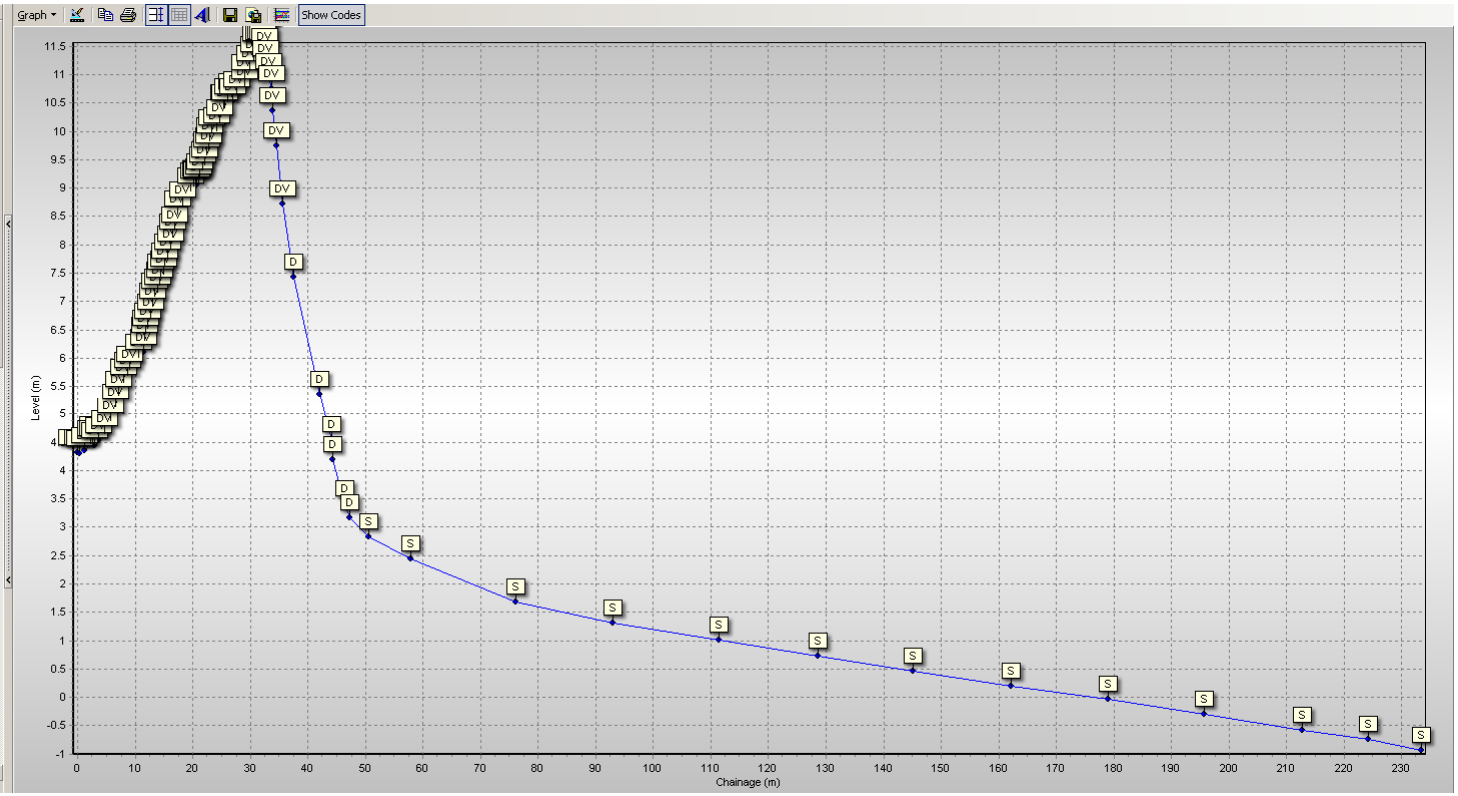
1aADC01 - 11/03/2011

Chainage	Level	Code
0.000	6.880	
0.103	6.880	DV
0.389	6.925	DV
0.747	6.994	DV
1.038	7.029	DV
1.295	6.794	DV
1.784	6.734	DV
2.147	6.642	DV
2.535	6.383	DV
3.057	6.194	DV
3.555	5.940	DV
3.917	5.531	DV
4.359	5.460	DV
4.705	5.422	DV
5.394	5.054	DV
5.873	4.495	DV
6.535	4.312	DV
7.124	4.317	DV
8.546	4.185	DV
9.381	4.129	DV
9.846	3.901	DV
10.664	3.782	DV
10.826	3.713	DV
11.285	3.556	DV
11.829	3.403	DV
11.928	3.305	DV
12.346	3.317	DV
12.989	3.240	DV
13.790	3.078	DV
14.205	2.984	DV
15.445	2.861	DV
18.286	2.549	DV
18.766	2.436	DV
19.518	2.409	S
21.004	2.263	S
26.856	2.232	S
27.838	2.196	S
27.996	2.111	S
32.246	2.075	S
33.119	2.034	S
35.418	2.114	S
38.833	2.286	S



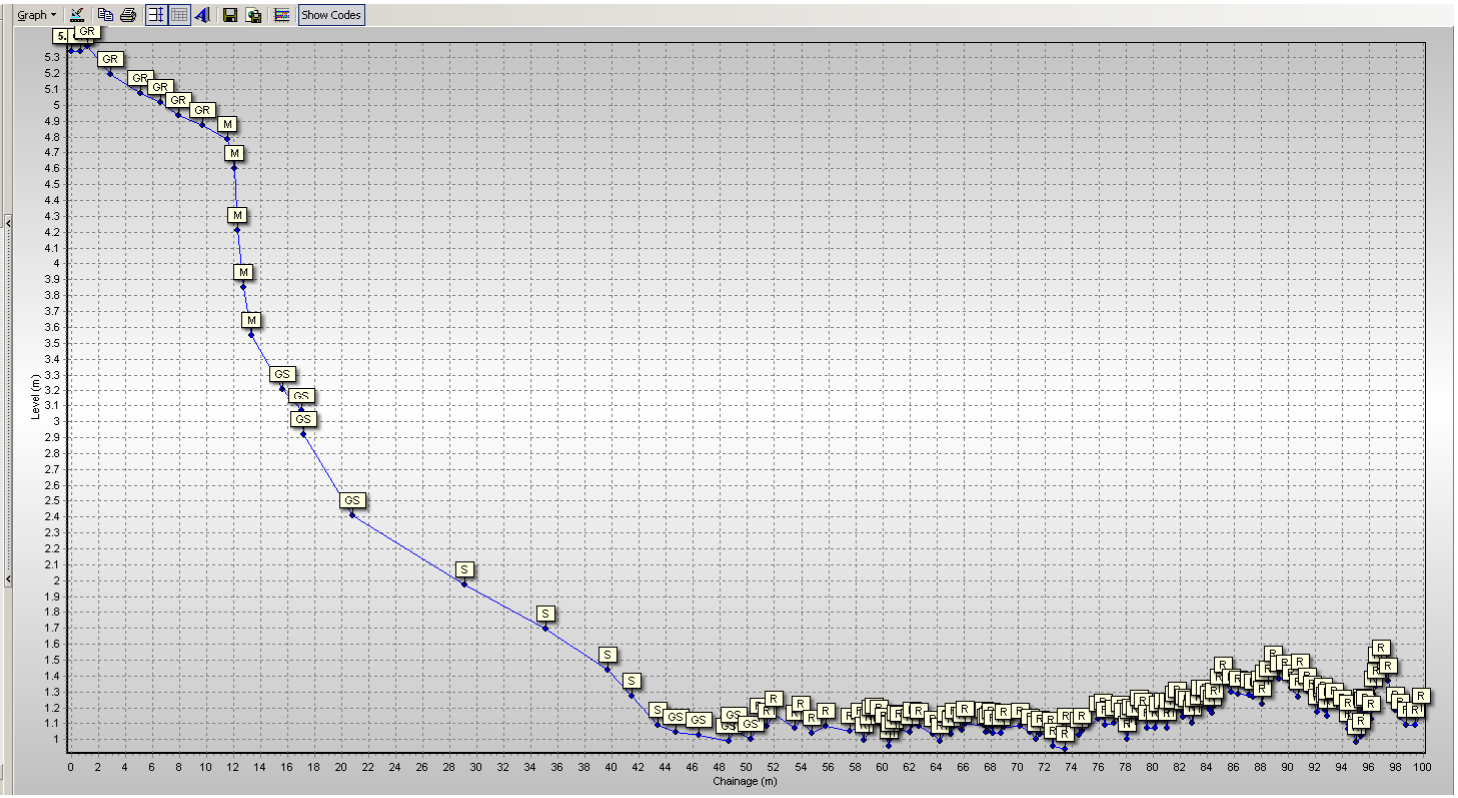
1aADC02 - 11/03/2011

Chainage	Level	Code
0.000	4.314	
0.047	4.314	DV
0.332	4.291	DV
1.174	4.344	DV
2.224	4.483	DV
2.530	4.544	DV
2.657	4.481	DV
2.995	4.448	DV
3.621	4.533	DV
4.714	4.657	DV
5.667	4.885	DV
6.571	5.135	DV
7.203	5.361	DV
7.972	5.573	DV
8.767	5.693	DV
9.040	5.809	DV
10.577	6.016	DV
11.439	6.108	DV
11.599	6.315	DV
11.827	6.441	DV
12.214	6.554	DV
12.696	6.716	DV
13.119	6.909	DV
13.420	7.091	DV
13.840	7.157	DV
14.288	7.289	DV
14.444	7.436	DV
14.869	7.488	DV
15.160	7.617	DV
15.672	7.785	DV
16.215	7.921	DV
16.473	8.129	DV
16.824	8.256	DV
17.442	8.546	DV
18.323	8.697	DV
19.620	8.946	DV
20.227	9.030	DV
20.491	9.079	DV
20.627	9.058	DV
21.002	9.100	DV
21.178	9.195	DV
21.700	9.329	DV



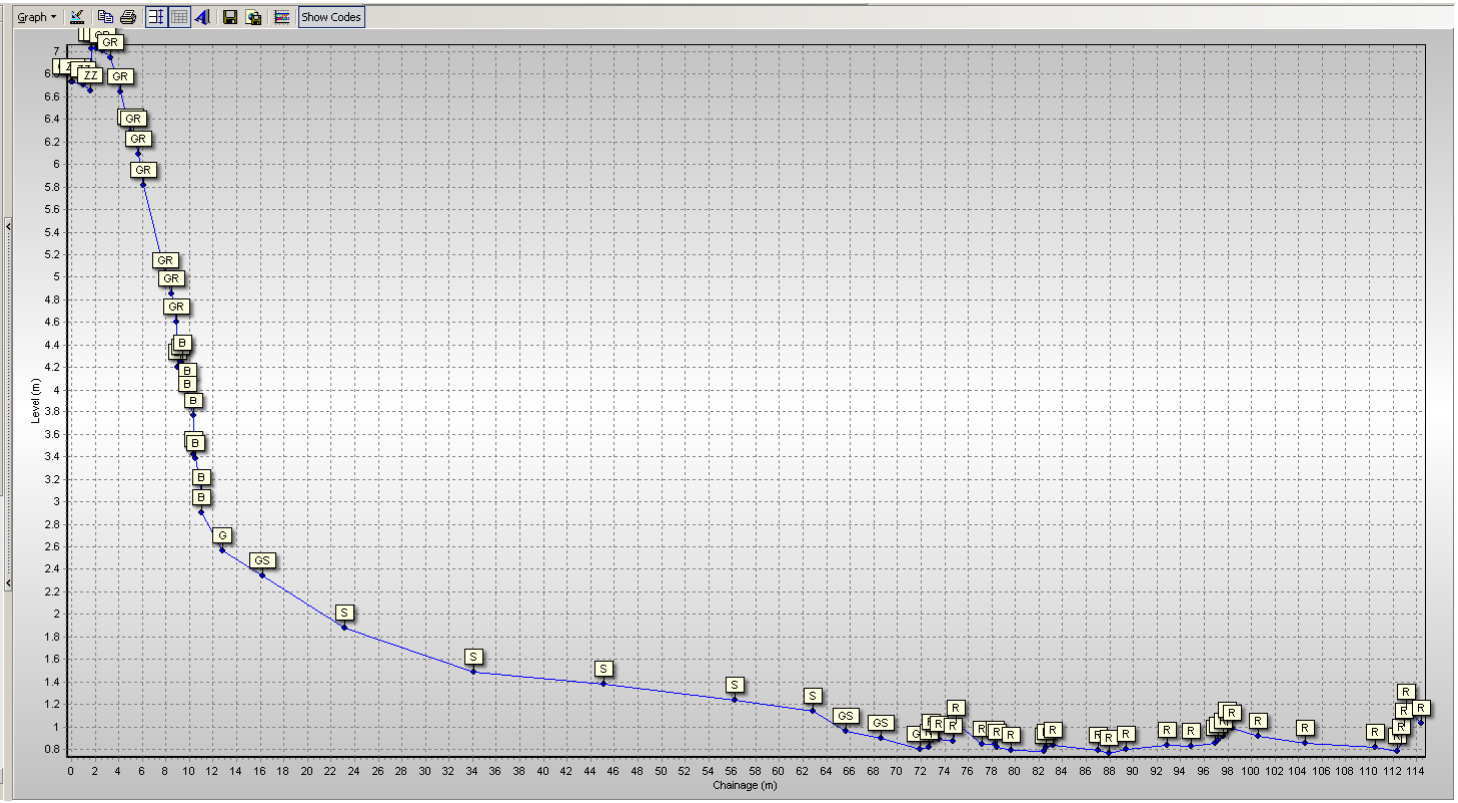
1aADC04A – 08/03/2011

Chainage	Level	Code
0.000	5.337	
0.634	5.337	GR
1.192	5.371	GR
2.879	5.196	GR
5.120	5.077	GR
6.555	5.016	GR
7.906	4.936	GR
9.722	4.873	GR
11.557	4.787	M
12.084	4.604	M
12.298	4.213	M
12.744	3.854	M
13.316	3.547	M
15.609	3.210	GS
17.013	3.069	GS
17.151	2.918	GS
20.809	2.407	GS
29.077	1.970	S
35.058	1.697	S
39.682	1.439	S
41.449	1.273	S
43.355	1.093	S
44.732	1.044	GS
46.444	1.027	GS
48.667	0.991	GS
49.031	1.057	GS
50.237	1.003	GS
50.884	1.115	R
51.429	1.083	R
51.998	1.162	R
53.555	1.070	R
53.933	1.128	R
54.806	1.039	R
55.831	1.082	R
57.584	1.054	R
58.297	1.081	R
58.632	0.998	R
58.983	1.047	R
59.144	1.104	R
59.364	1.117	R
59.728	1.106	R
60.076	1.054	R



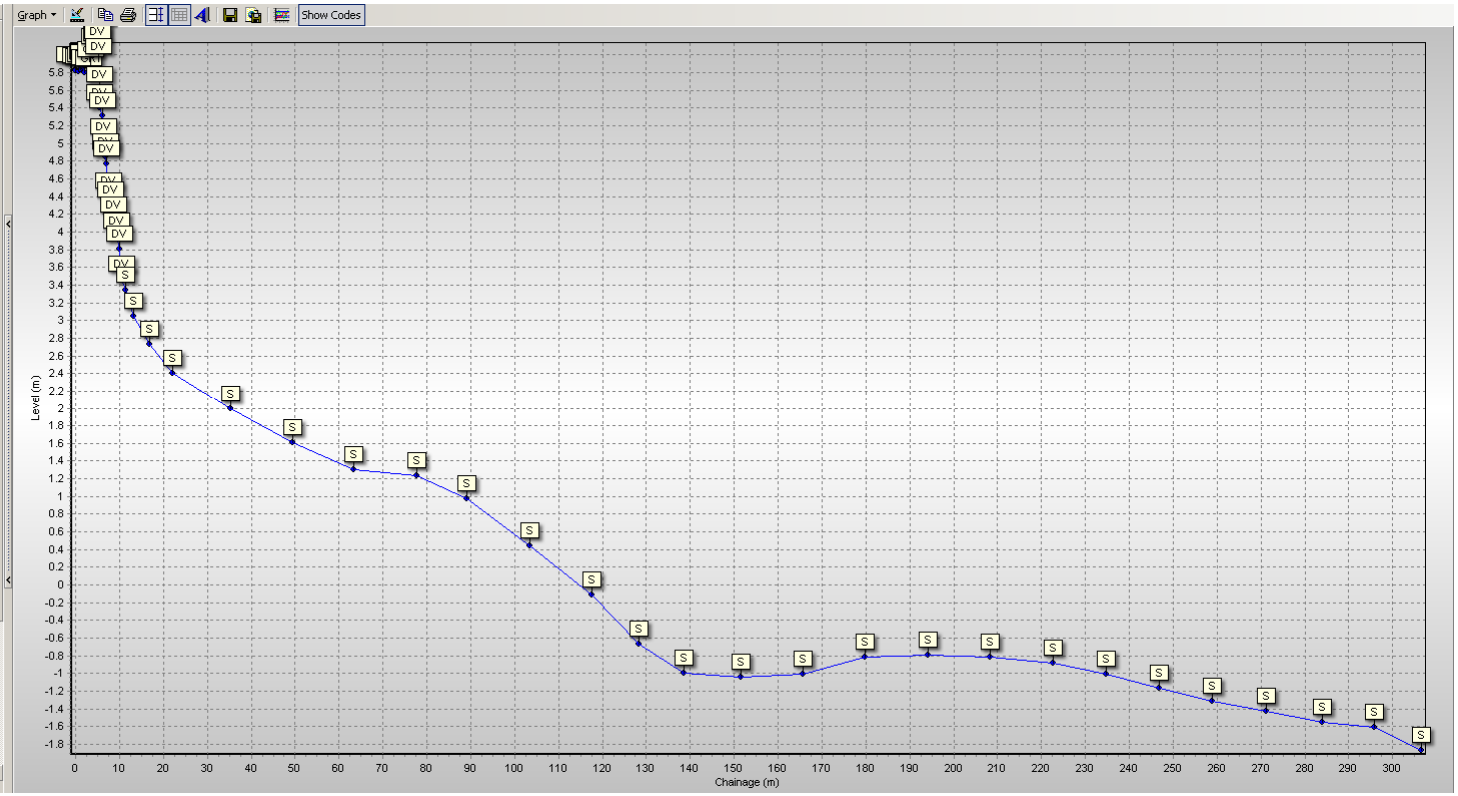
1aADC04B - 08/03/2011

Chainage	Level	Code
0.000	6.732	
0.049	6.732	ZZ
0.989	6.708	ZZ
1.647	6.647	ZZ
1.729	7.021	ZZ
2.091	7.025	GR
2.619	7.008	GR
3.267	6.941	GR
4.174	6.638	GR
5.016	6.288	GR
5.290	6.272	GR
5.677	6.092	GR
6.147	5.817	GR
7.986	5.017	GR
8.453	4.853	GR
8.897	4.603	GR
8.962	4.206	B
9.283	4.247	B
9.415	4.280	B
9.803	4.030	B
9.866	3.921	B
10.340	3.767	B
10.340	3.423	B
10.482	3.381	B
11.033	3.077	B
11.043	2.899	B
12.833	2.563	G
16.186	2.342	GS
23.117	1.879	S
34.061	1.491	S
45.082	1.383	S
56.238	1.235	S
62.822	1.136	S
65.612	0.965	GS
68.648	0.899	GS
71.901	0.800	GS
72.688	0.820	R
72.816	0.910	R
73.488	0.892	R
74.682	0.875	R
75.004	1.037	R
77.176	0.847	R



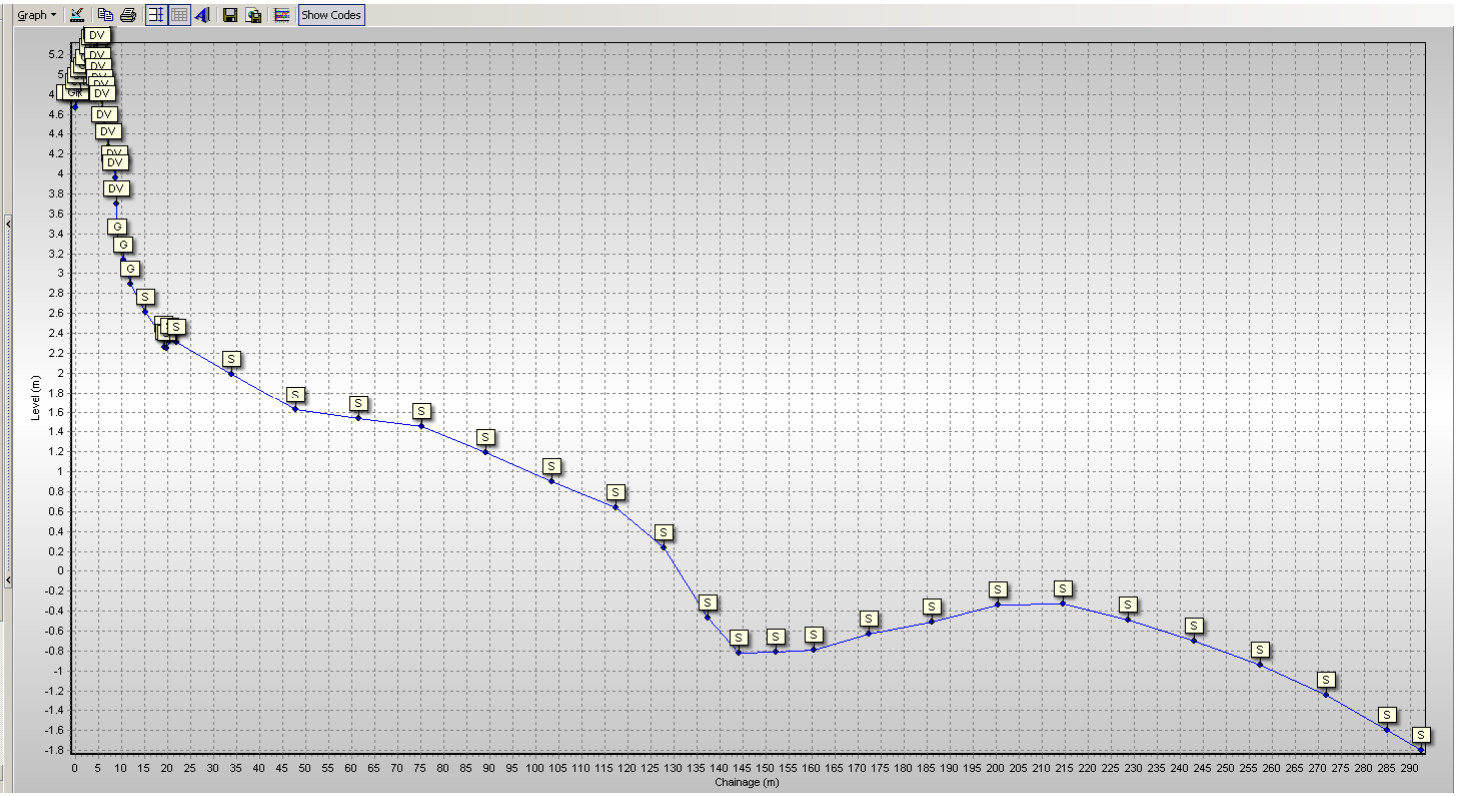
1aADC07 - 08/03/2011

Chainage	Level	Code
0.000	5.837	
0.030	5.837	GR
0.105	5.820	GR
0.769	5.812	GR
1.082	5.832	GR
1.599	5.868	GR
1.912	5.857	GR
2.124	5.801	GR
2.931	5.791	GR
3.527	5.893	GR
4.254	6.041	GR
4.869	6.070	GR
4.987	6.096	DV
5.290	5.931	DV
5.388	5.610	DV
5.553	5.410	DV
6.087	5.315	DV
6.465	5.025	DV
6.861	4.845	DV
7.131	4.773	DV
7.618	4.403	DV
7.981	4.308	DV
8.568	4.134	DV
9.271	3.951	DV
10.006	3.806	DV
10.424	3.465	DV
11.302	3.345	S
13.213	3.048	S
16.950	2.726	S
22.193	2.402	S
35.305	1.999	S
49.407	1.614	S
63.293	1.306	S
77.727	1.232	S
89.116	0.973	S
103.419	0.443	S
117.549	-0.110	S
128.423	-0.671	S
138.679	-0.992	S
151.504	-1.040	S
165.610	-1.012	S
179.908	-0.816	S



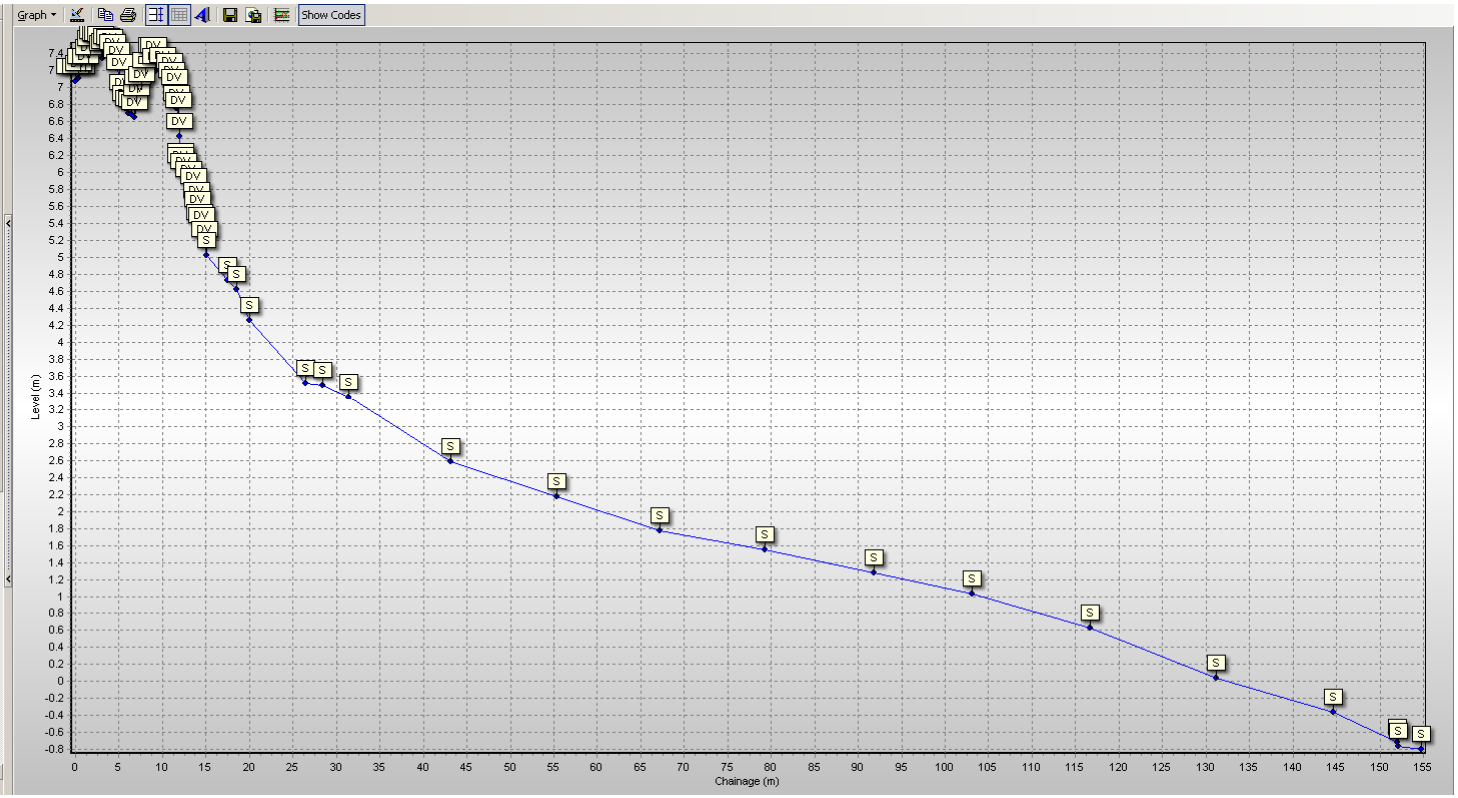
1aADC08 - 08/03/2011

Chainage	Level	Code
0.000	4.668	
0.066	4.668	GR
0.737	4.779	GR
1.099	4.836	GR
1.750	4.894	GR
2.385	4.942	GR
2.776	5.018	GR
3.601	5.133	GR
4.088	5.216	GR
4.457	5.280	GR
4.768	5.244	DV
4.849	5.043	DV
4.940	4.924	DV
5.245	4.818	DV
5.609	4.749	DV
5.950	4.654	DV
6.389	4.445	DV
7.116	4.271	DV
8.469	4.049	DV
8.761	3.957	DV
8.931	3.704	DV
9.204	3.314	G
10.445	3.140	G
12.011	2.897	G
15.225	2.610	S
19.022	2.338	S
19.255	2.255	S
19.728	2.245	S
20.360	2.318	S
21.853	2.312	S
33.946	1.989	S
47.749	1.626	S
61.592	1.532	S
75.179	1.450	S
89.113	1.191	S
103.500	0.896	S
117.366	0.641	S
127.764	0.231	S
137.476	-0.467	S
144.088	-0.826	S
152.251	-0.813	S
160.445	-0.794	S



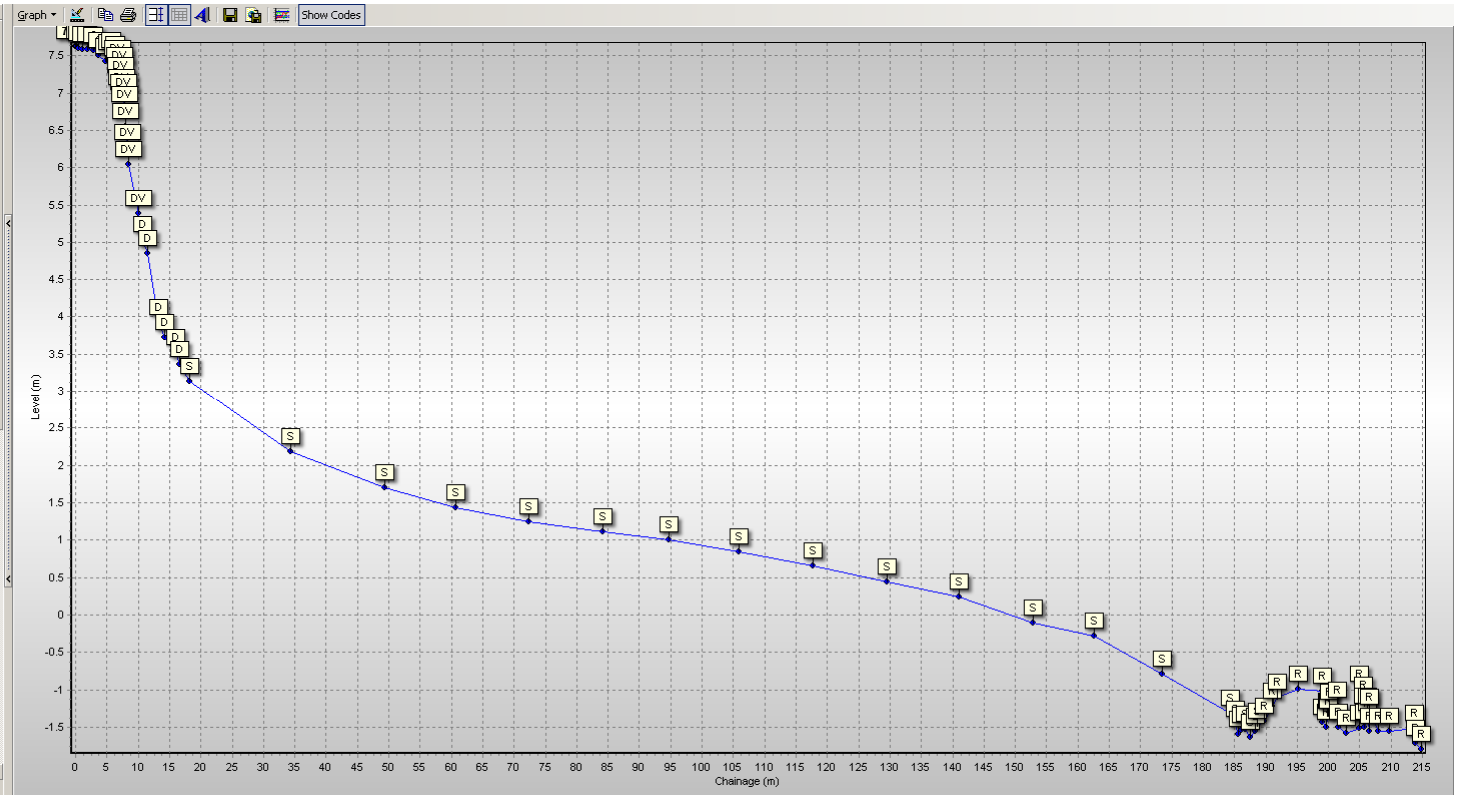
1aADC09 - 08/03/2011

Chainage	Level	Code
0.000	7.073	
0.039	7.073	DV
0.398	7.111	DV
0.624	7.190	DV
1.107	7.195	DV
1.474	7.304	DV
1.754	7.405	DV
1.921	7.488	DV
2.307	7.461	DV
2.484	7.462	DV
2.891	7.456	DV
3.050	7.348	DV
3.324	7.375	DV
3.555	7.425	DV
3.889	7.418	DV
4.293	7.360	DV
4.738	7.269	DV
5.070	7.128	DV
5.428	6.882	DV
5.738	6.753	DV
6.103	6.704	DV
6.442	6.687	DV
6.808	6.651	DV
6.990	6.817	DV
7.188	6.948	DV
7.602	6.979	DV
8.079	7.144	DV
8.698	7.328	DV
8.926	7.318	DV
9.211	7.192	DV
9.996	7.200	DV
10.780	7.130	DV
11.031	7.034	DV
11.343	6.945	DV
11.633	6.753	DV
11.837	6.672	DV
11.992	6.429	DV
12.093	6.075	DV
12.127	6.024	DV
12.418	5.952	DV
12.950	5.859	DV
13.533	5.778	DV



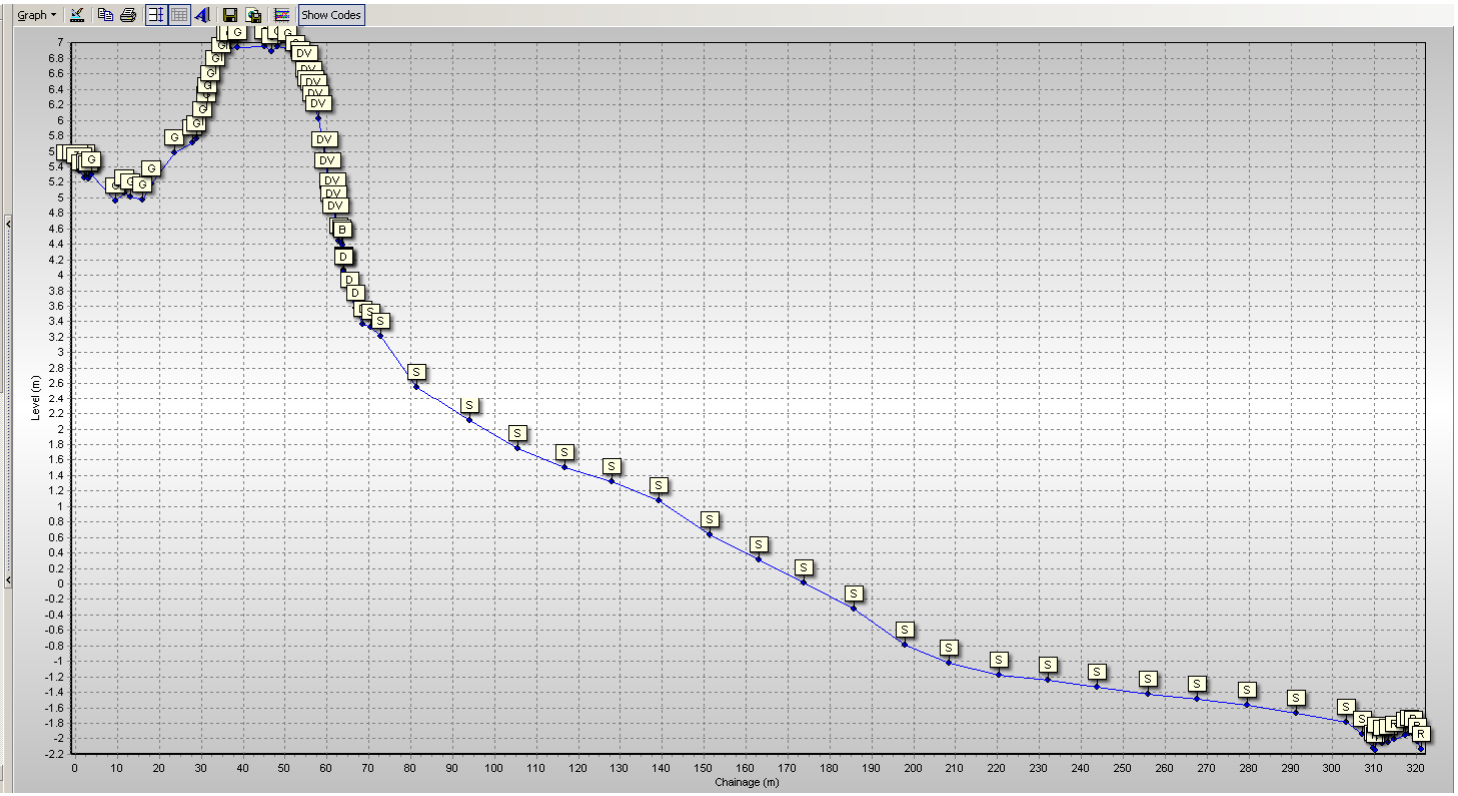
1aADC15A – 07/03/2011

Chainage	Level	Code
0.000	7.624	
0.090	7.624	G
0.513	7.595	G
1.174	7.585	G
1.959	7.587	G
2.826	7.569	G
3.721	7.509	G
4.808	7.420	G
5.326	7.474	G
5.769	7.498	G
6.380	7.447	G
6.767	7.400	DV
6.957	7.298	DV
7.179	7.169	DV
7.319	7.007	DV
7.630	6.940	DV
7.778	6.774	DV
8.031	6.553	DV
8.299	6.273	DV
8.534	6.041	DV
10.075	5.380	DV
10.720	5.043	D
11.426	4.848	D
13.290	3.926	D
14.248	3.723	D
15.898	3.525	D
16.555	3.367	D
18.172	3.139	S
34.313	2.181	S
49.379	1.698	S
60.718	1.436	S
72.382	1.252	S
84.211	1.111	S
94.641	1.005	S
105.902	0.842	S
117.767	0.653	S
129.542	0.449	S
141.103	0.245	S
152.843	-0.104	S
162.566	-0.285	S
173.403	-0.791	S
184.336	-1.310	S



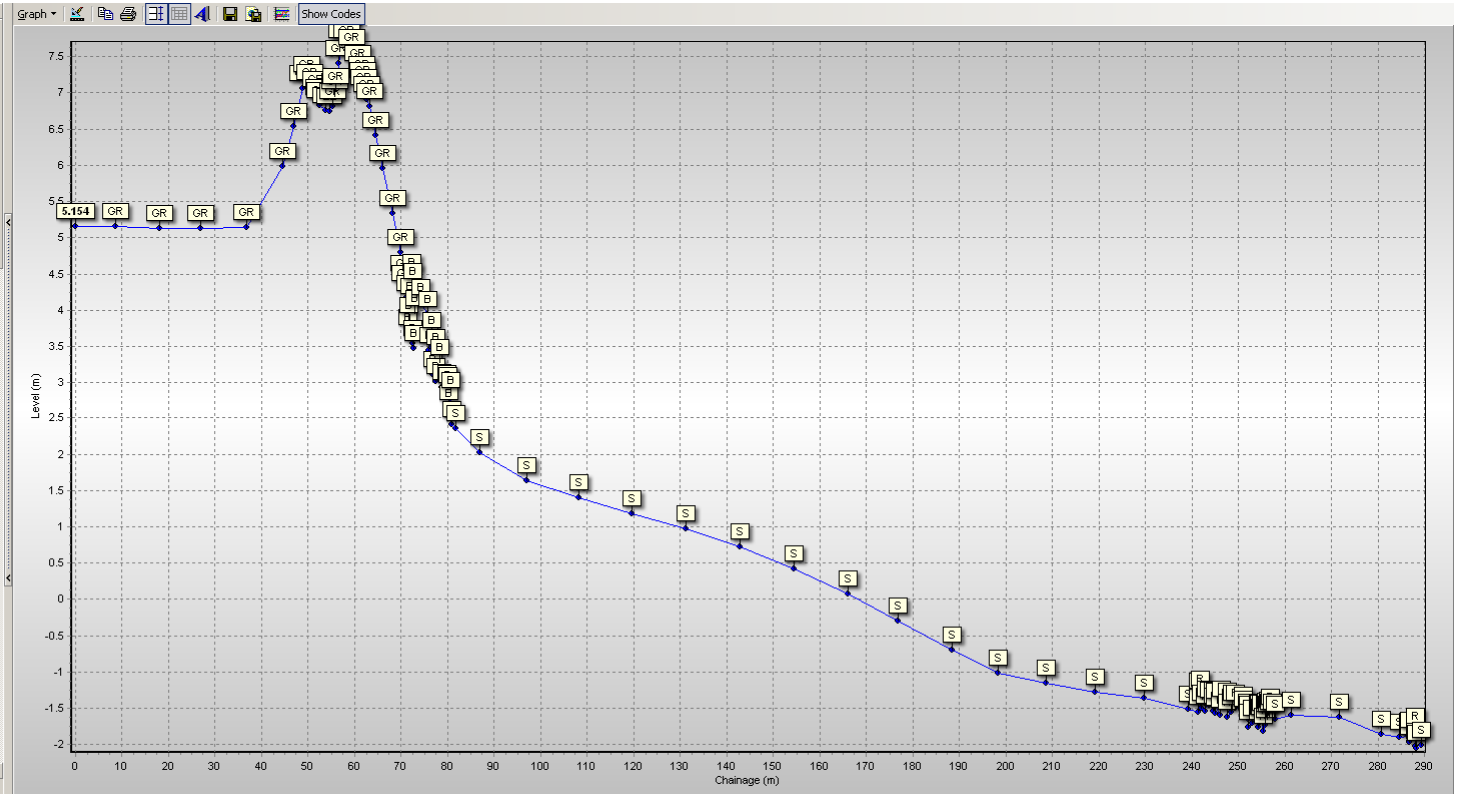
1aADC16 - 07/03/2011

Chainage	Level	Code
0.000	5.392	
0.049	5.392	ZZ
0.977	5.351	ZZ
2.264	5.253	ZZ
2.545	5.275	G
3.127	5.240	G
3.767	5.296	G
9.531	4.961	G
11.654	5.066	G
13.104	5.011	G
15.987	4.969	G
18.179	5.184	G
23.753	5.586	G
27.945	5.713	G
28.987	5.767	G
30.342	5.943	G
31.348	6.134	G
31.619	6.250	G
32.272	6.414	G
33.463	6.608	G
34.977	6.767	G
36.135	6.924	G
36.848	6.925	G
38.776	6.936	G
45.051	6.954	G
46.884	6.893	G
48.254	6.948	G
50.524	6.933	G
52.478	6.799	G
53.841	6.725	G
54.595	6.665	DV
55.578	6.466	DV
56.225	6.348	DV
56.936	6.290	DV
57.281	6.152	DV
57.926	6.021	DV
59.463	5.554	DV
60.282	5.279	DV
61.333	5.025	DV
61.660	4.862	DV
62.055	4.695	DV
62.824	4.442	D



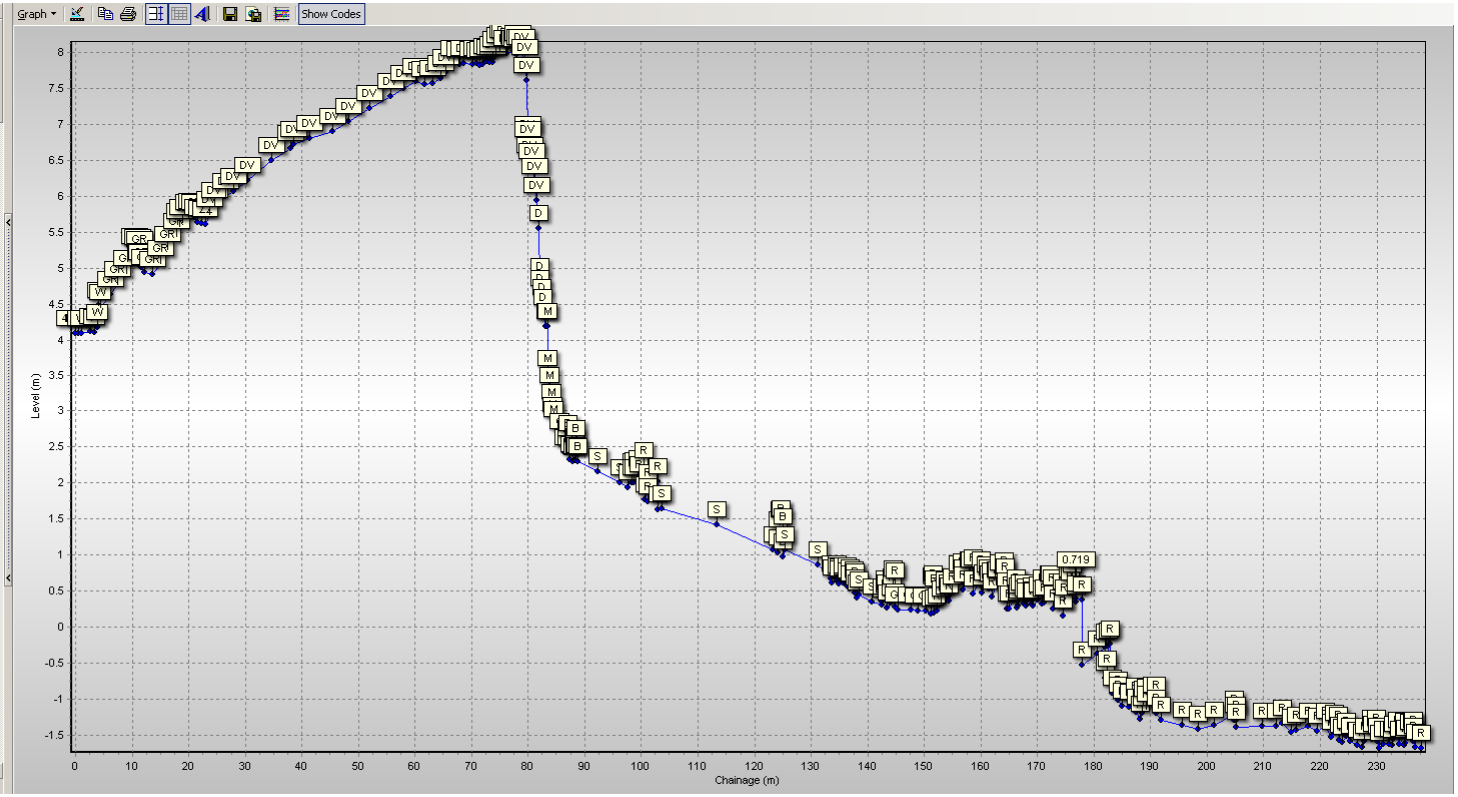
1aADC16A - 07/03/2011

Chainage	Level	Code
0.000	5.154	
8.580	5.154	GR
18.051	5.134	GR
26.921	5.133	GR
36.869	5.147	GR
44.566	5.986	GR
46.826	6.542	GR
48.724	7.061	GR
49.635	7.180	GR
50.226	7.072	GR
51.533	6.984	GR
52.294	6.866	GR
52.556	6.834	GR
53.667	6.755	ZZ
54.667	6.749	ZZ
55.283	6.812	GR
55.624	6.958	GR
56.006	7.014	GR
56.560	7.404	GR
57.247	7.656	GR
58.246	7.652	GR
59.309	7.564	GR
60.598	7.337	GR
61.418	7.180	GR
61.780	7.100	GR
61.957	7.007	GR
62.594	6.913	GR
63.226	6.807	GR
64.544	6.414	GR
66.070	5.963	GR
68.213	5.332	GR
69.862	4.791	GR
70.485	4.443	GR
70.810	4.301	GR
71.041	4.167	B
71.355	3.696	B
71.685	3.853	B
71.840	4.125	B
72.317	4.453	B
72.480	3.534	B
72.492	4.333	B
72.638	3.477	B



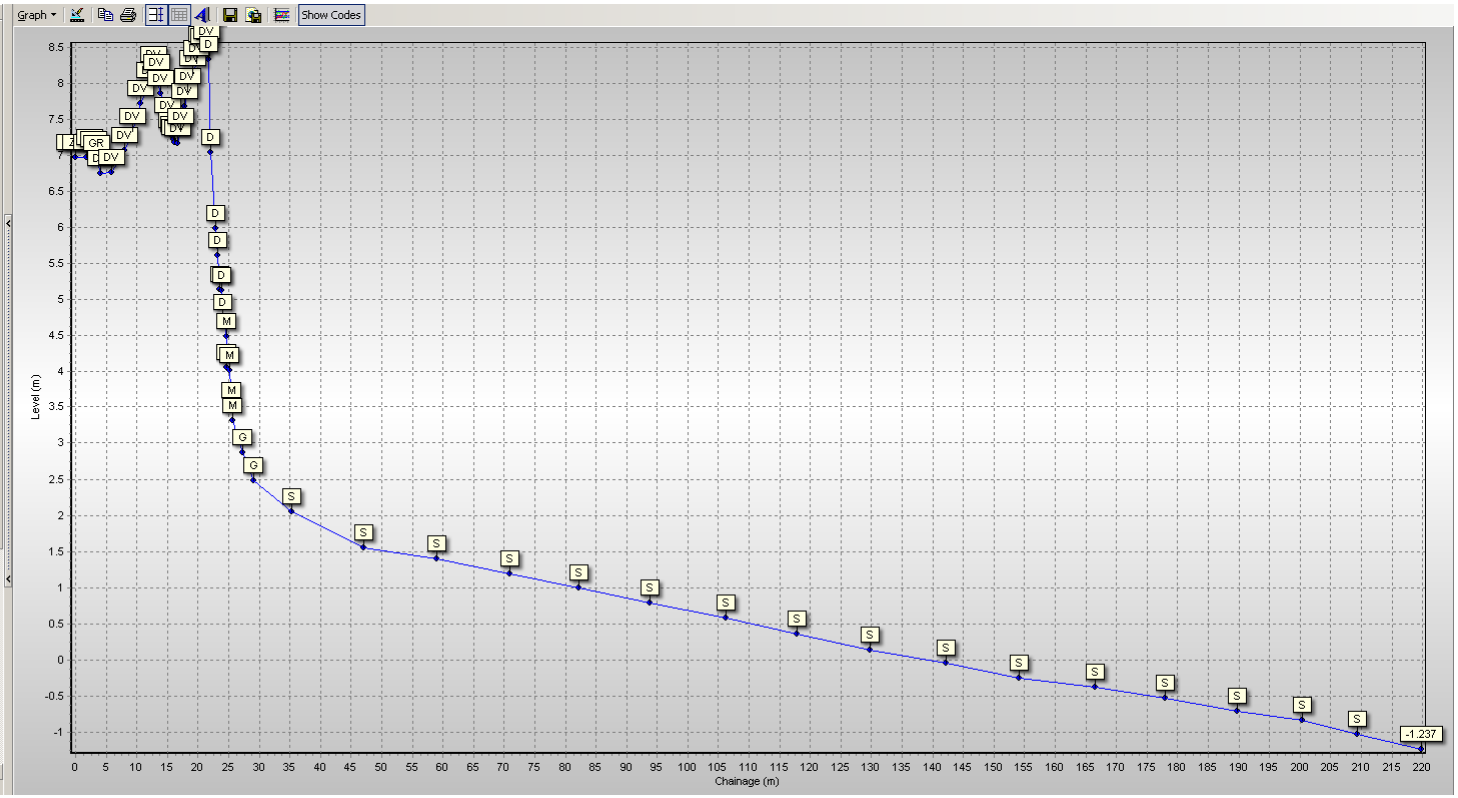
1aADC16B - 07/03/2011

Chainage	Level	Code
0.000	4.094	
0.464	4.094	W
1.099	4.088	W
2.635	4.113	W
3.380	4.108	W
3.913	4.179	W
4.095	4.485	W
4.435	4.450	W
6.134	4.636	GR
7.412	4.773	GR
8.982	4.927	GR
10.440	5.235	GR
10.904	5.221	GR
11.264	5.193	GR
11.432	5.029	GR
11.664	5.013	GR
12.203	4.940	GR
13.644	4.911	GR
14.964	5.065	GR
16.191	5.263	GR
17.865	5.445	GR
18.328	5.576	GR
18.879	5.639	GR
19.895	5.700	GR
20.542	5.716	GR
21.132	5.706	GR
21.641	5.637	ZZ
22.266	5.620	ZZ
23.063	5.609	ZZ
23.642	5.744	DV
24.543	5.878	DV
26.460	5.992	DV
27.926	6.069	DV
30.333	6.221	DV
34.681	6.503	DV
37.963	6.670	DV
38.567	6.726	DV
41.426	6.808	DV
45.442	6.896	DV
48.307	7.043	DV
51.967	7.214	DV
55.695	7.388	DV



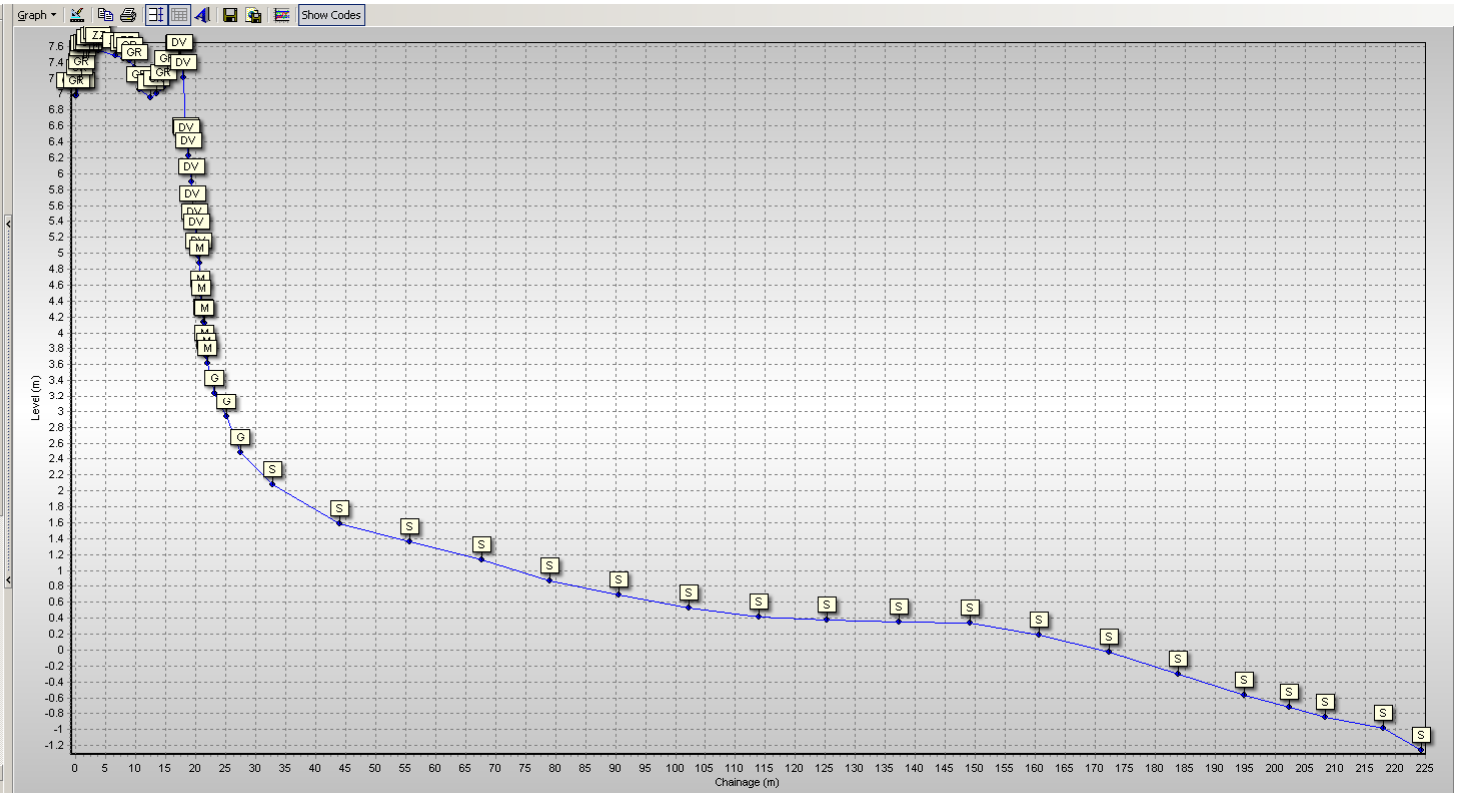
1aADC17 - 07/03/2011

Chainage	Level	Code
0.000	6.974	
0.064	6.974	ZZ
1.745	6.974	ZZ
2.278	7.038	GR
2.886	7.011	GR
3.445	6.962	GR
4.053	6.755	DV
5.861	6.769	DV
8.006	7.064	DV
9.359	7.338	DV
10.700	7.721	DV
12.143	7.968	DV
12.724	8.193	DV
13.221	8.077	DV
13.961	7.864	DV
15.008	7.479	DV
15.691	7.284	DV
16.064	7.226	DV
16.161	7.184	DV
16.611	7.170	DV
17.111	7.331	DV
17.822	7.685	DV
18.246	7.887	DV
19.058	8.138	DV
19.704	8.274	DV
20.568	8.468	DV
20.911	8.445	DV
21.449	8.512	DV
21.788	8.326	D
22.035	7.040	D
22.961	5.990	D
23.168	5.619	D
23.553	5.139	D
23.929	5.135	D
24.055	4.749	D
24.628	4.494	M
24.645	4.066	M
25.160	4.014	M
25.462	3.533	M
25.668	3.317	M
27.357	2.873	G
29.046	2.477	G

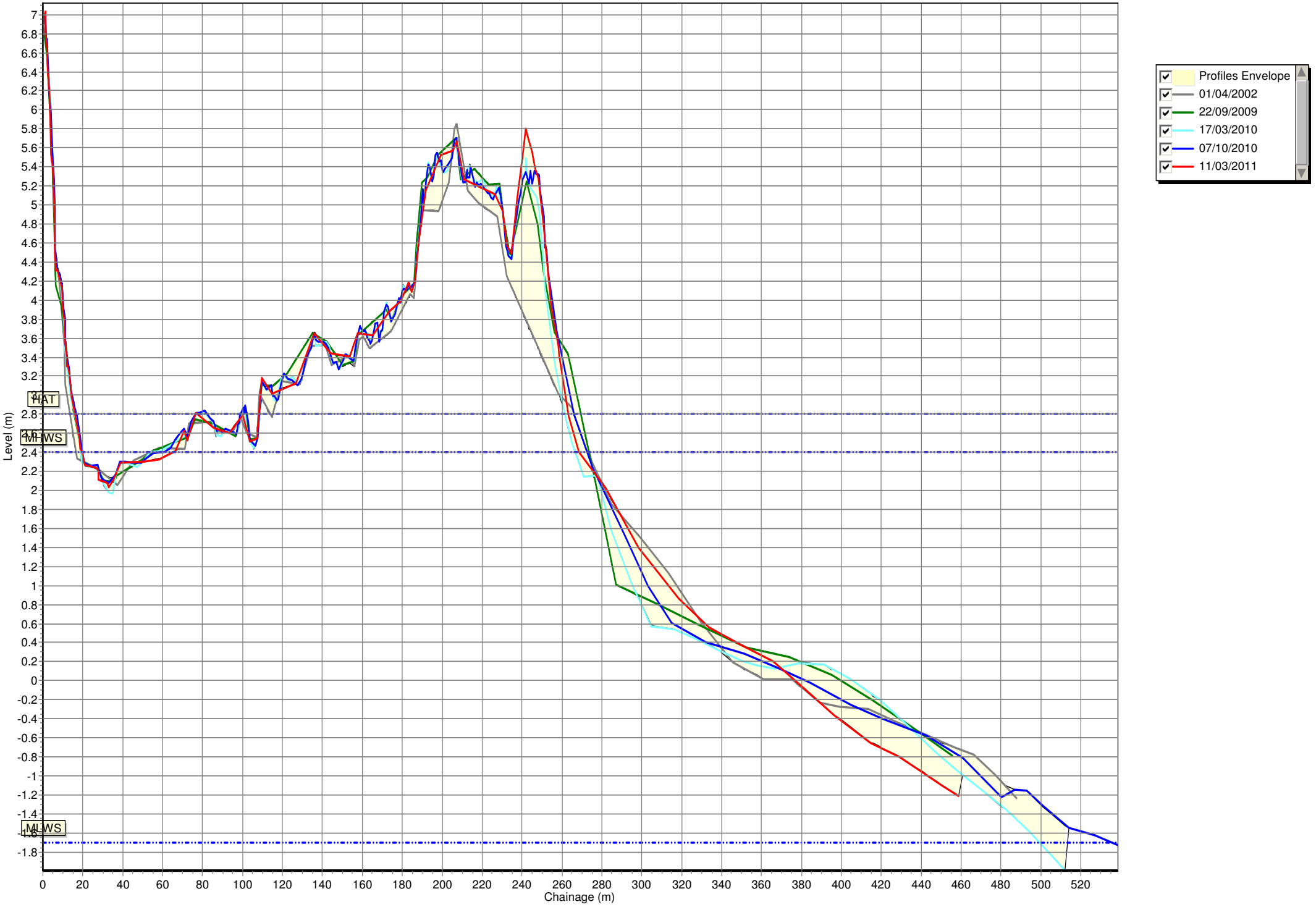


1aADC17A - 07/03/2011

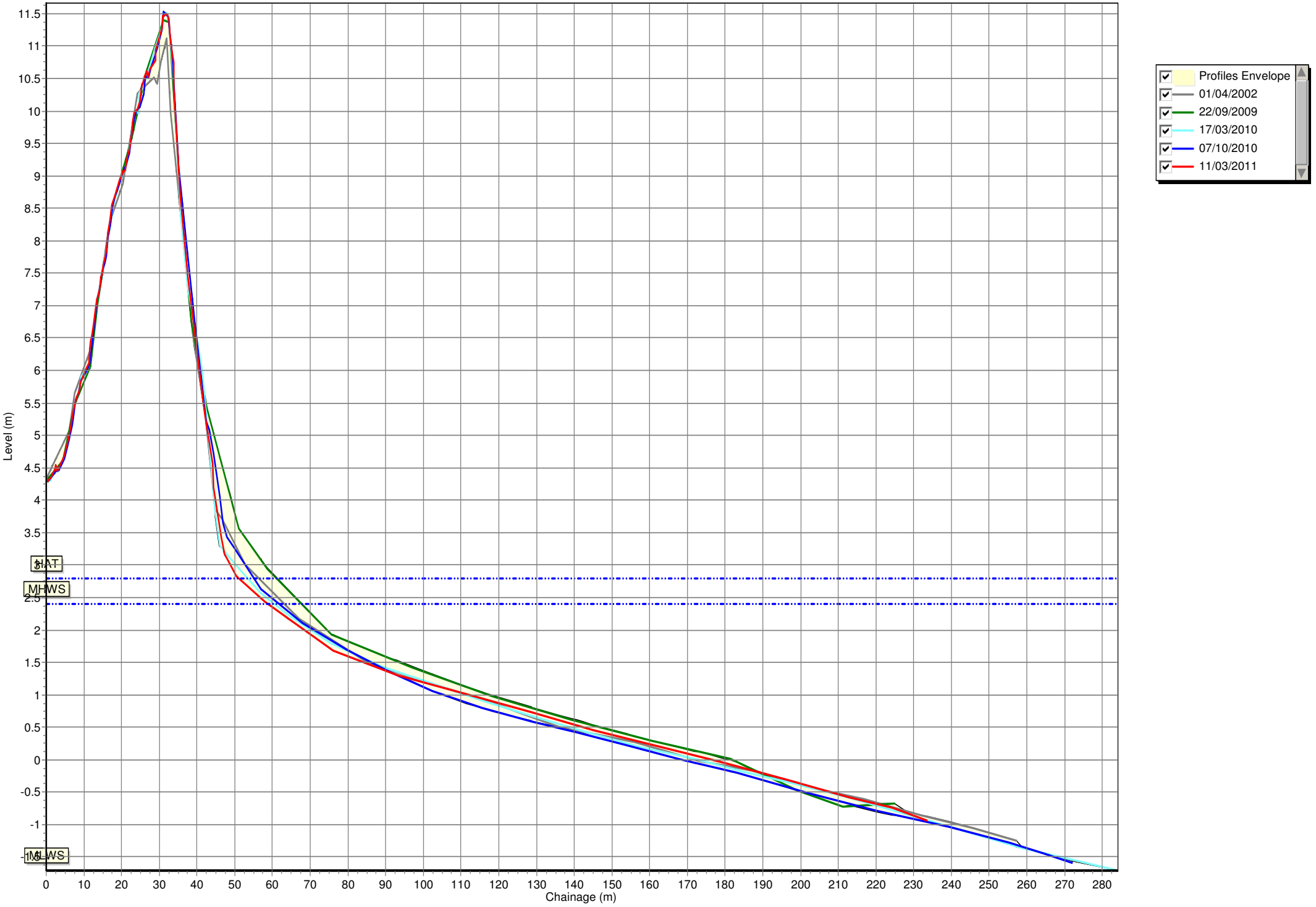
Chainage	Level	Code
0.000	6.977	
0.097	6.977	GR
0.718	7.140	GR
0.920	7.225	GR
1.232	7.380	GR
1.397	7.450	GR
1.836	7.457	GR
2.111	7.464	GR
2.415	7.525	GR
3.052	7.545	GR
3.493	7.598	GR
3.798	7.544	ZZ
6.726	7.482	ZZ
7.941	7.449	ZZ
8.469	7.481	ZZ
8.974	7.425	GR
9.834	7.336	GR
10.758	7.054	GR
12.491	6.956	GR
13.556	7.008	GR
14.731	7.083	GR
15.383	7.259	GR
17.199	7.449	GR
17.356	7.457	DV
18.087	7.210	DV
18.271	6.418	DV
18.514	6.382	DV
18.778	6.226	DV
19.326	5.897	DV
19.568	5.553	DV
19.902	5.325	DV
20.259	5.205	DV
20.554	4.958	DV
20.707	4.872	M
20.883	4.485	M
21.065	4.372	M
21.283	4.133	M
21.495	4.122	M
21.594	3.804	M
21.861	3.706	M
21.938	3.617	M
23.195	3.241	G

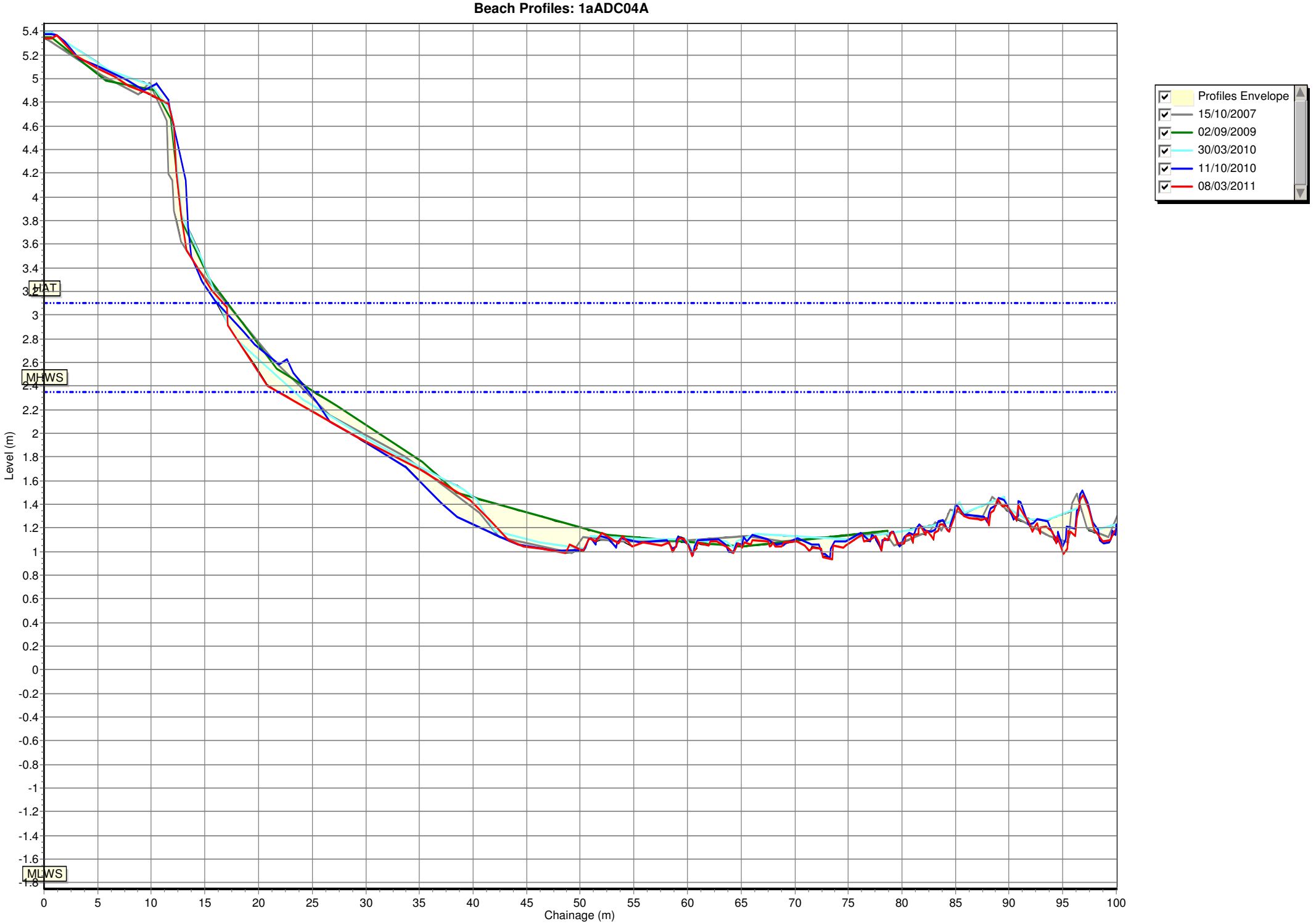


Beach Profiles: 1aADC01

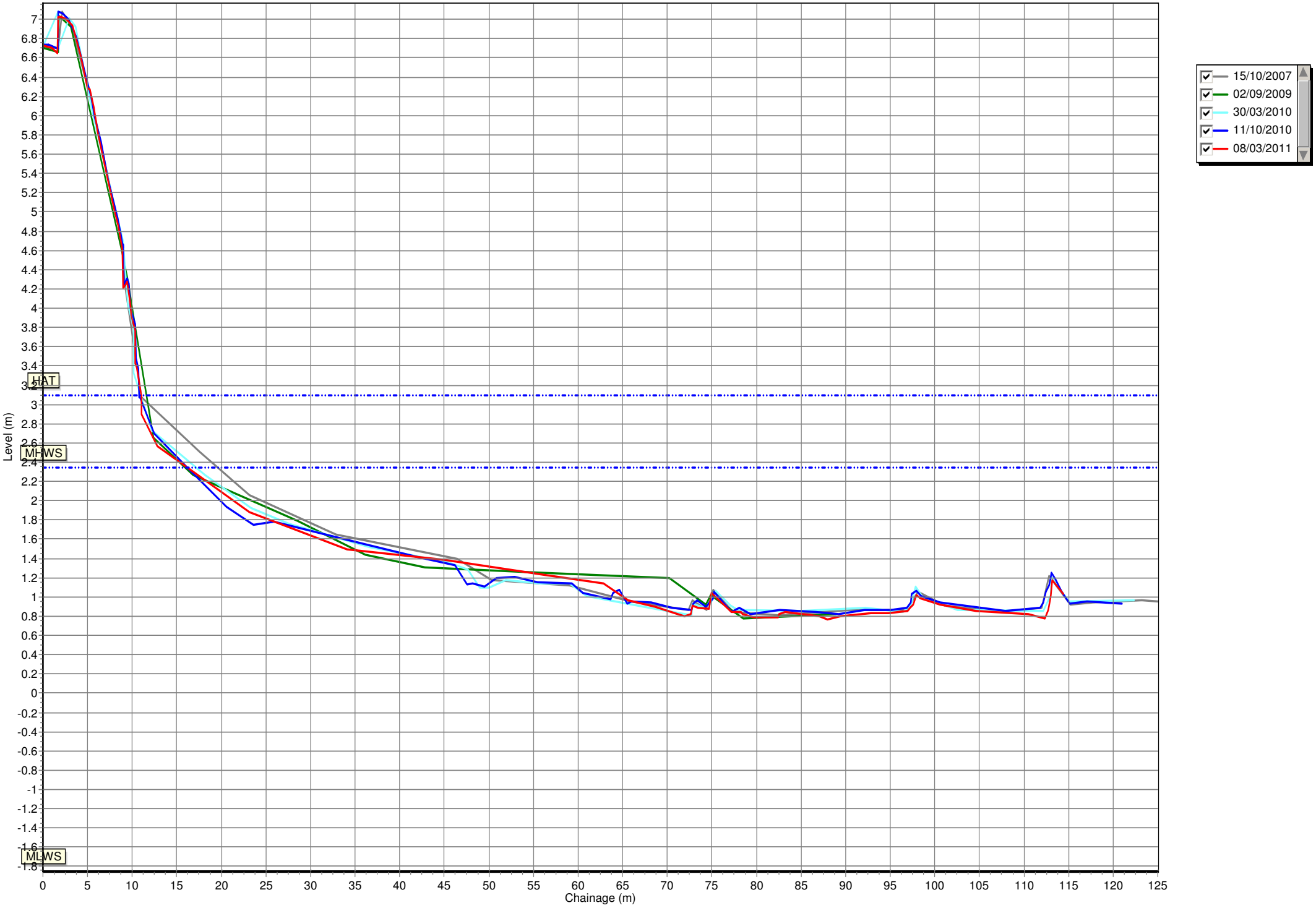


Beach Profiles: 1aADC02




Beach Profiles: 1aADC04A
Profiles Envelope
15/10/2007
02/09/2009
30/03/2010
11/10/2010
08/03/2011
HAT
MHWS
MLWS
Level (m)
Chainage (m)
5.4
5.2
5
4.8
4.6
4.4
4.2
4
3.8
3.6
3.4
3.2
3
2.8
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1.2
-1.4
-1.6
-1.8
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100

Beach Profiles: 1aADC04B

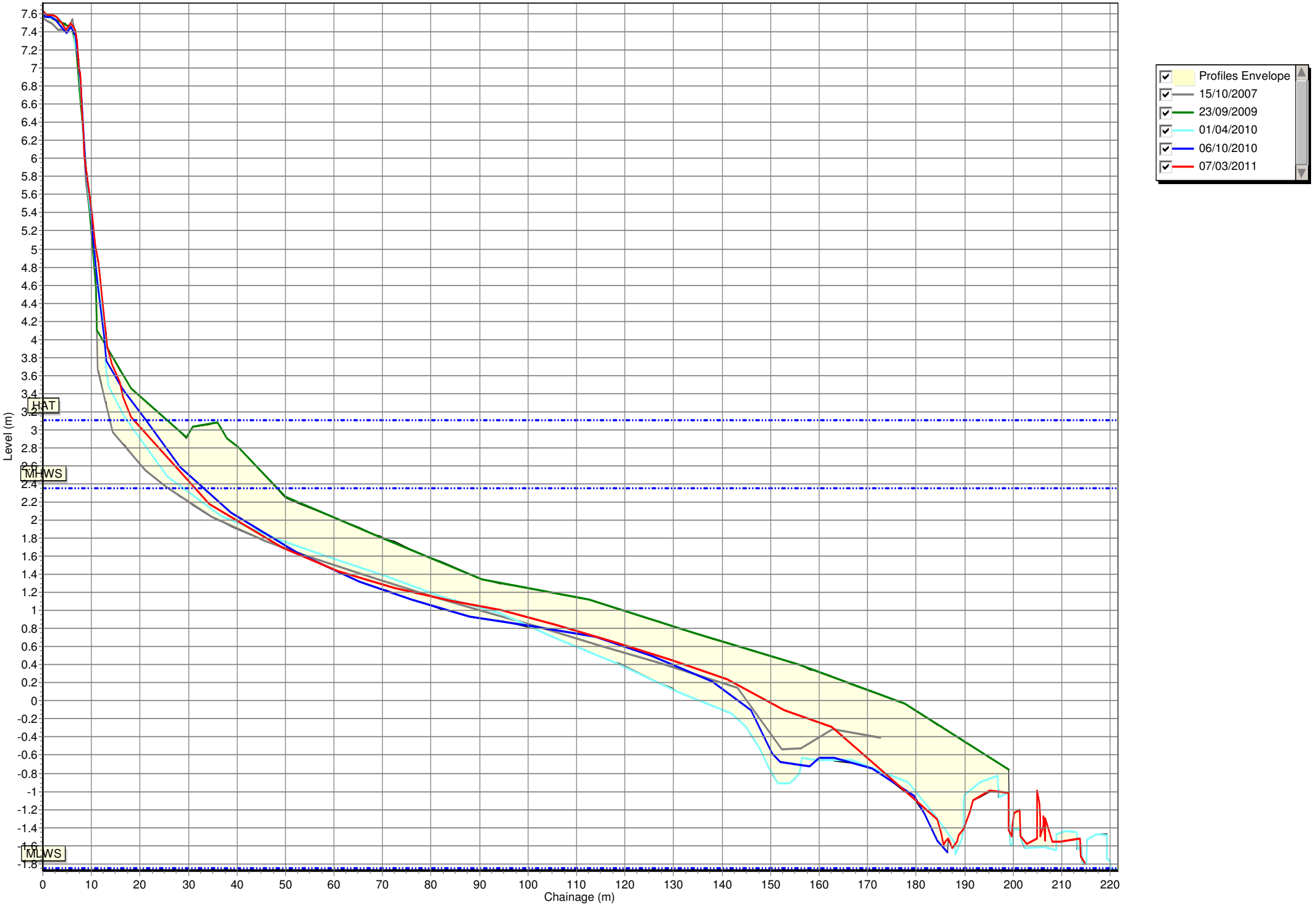


Beach Profiles: 1aADC07

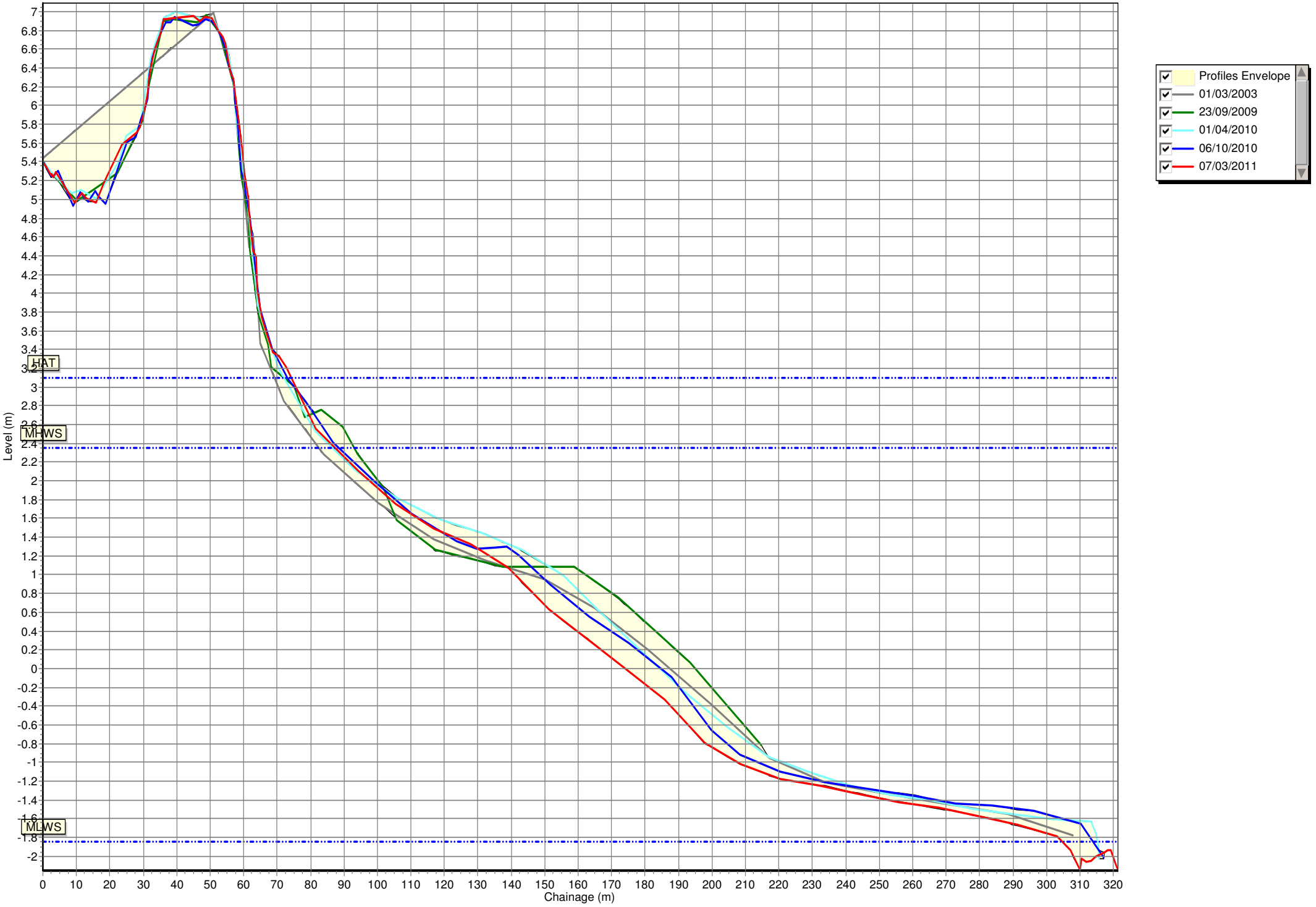
Beach Profiles: 1aADC08

Beach Profiles: 1aADC09

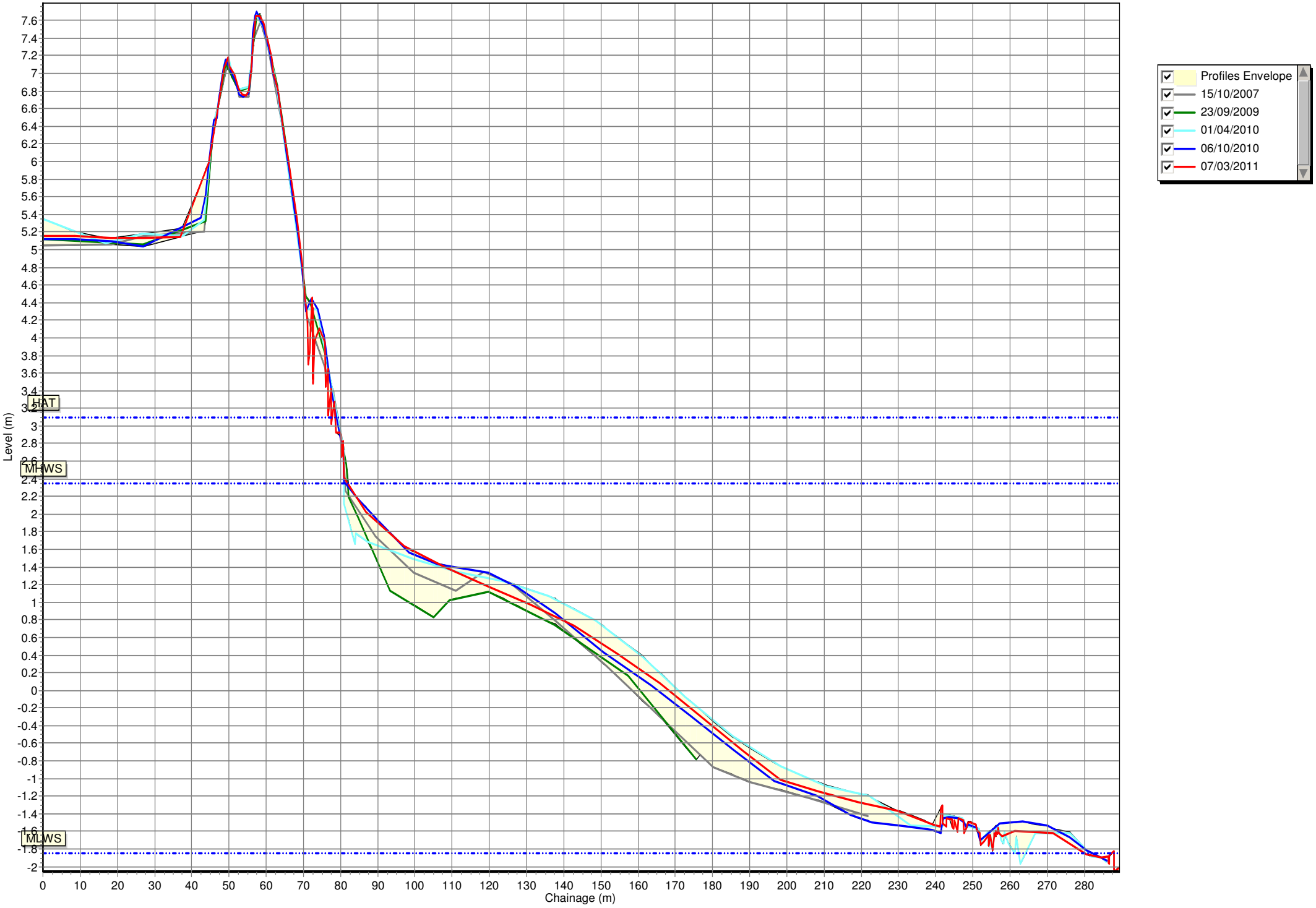
Beach Profiles: 1aADC15A



Beach Profiles: 1aADC16

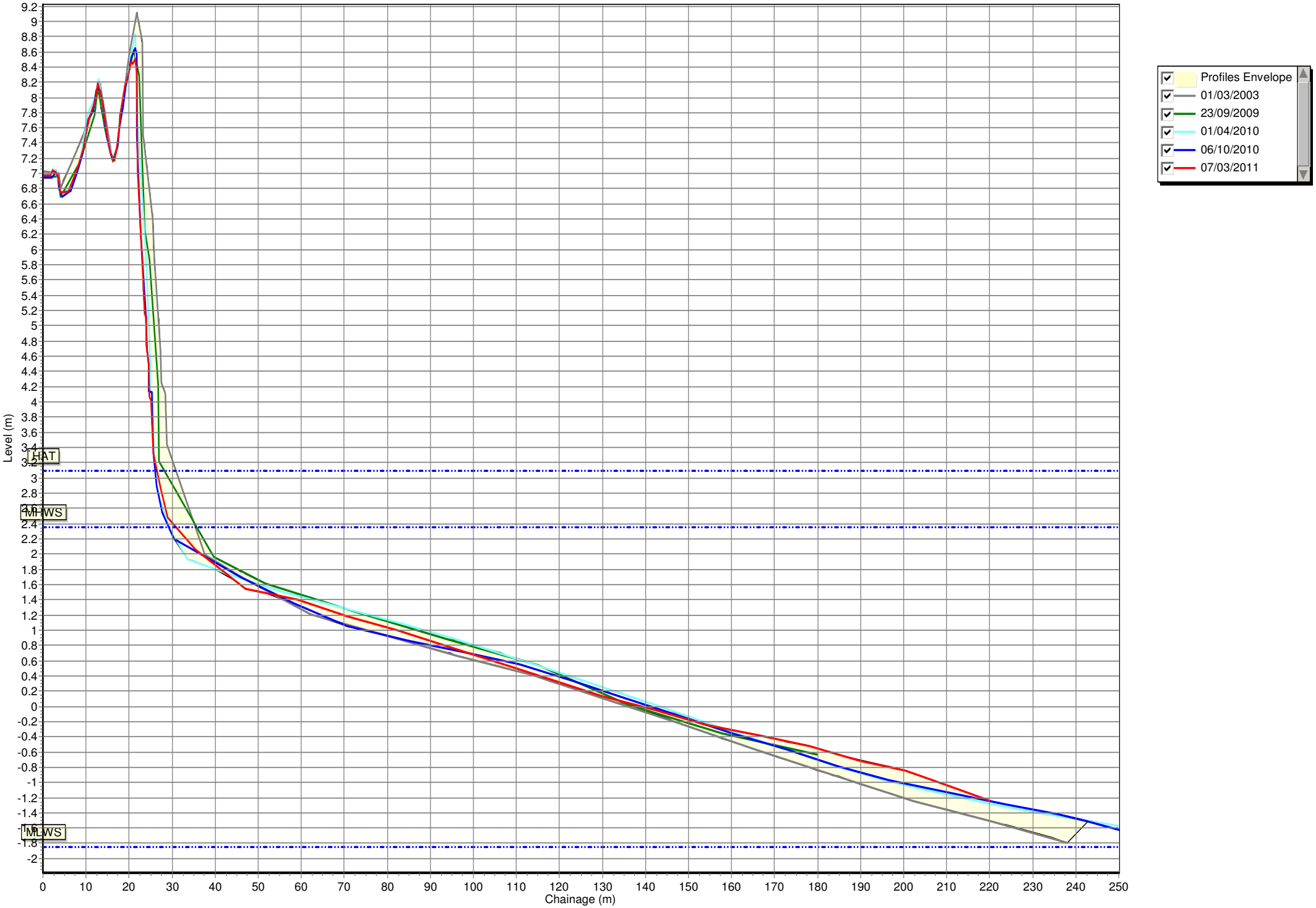


Beach Profiles: 1aADC16A

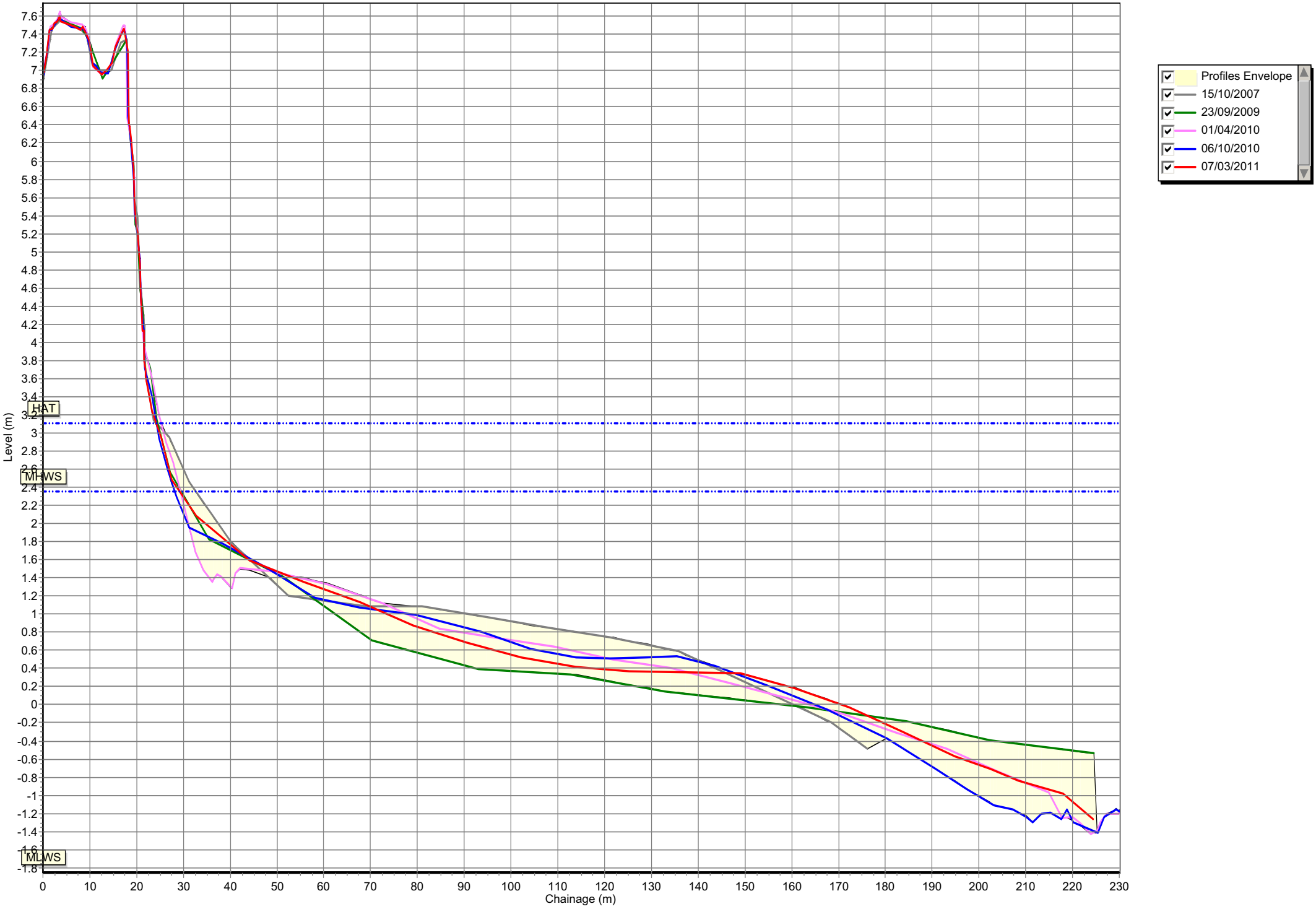


Beach Profiles: 1aADC16B

Beach Profiles: 1aADC17



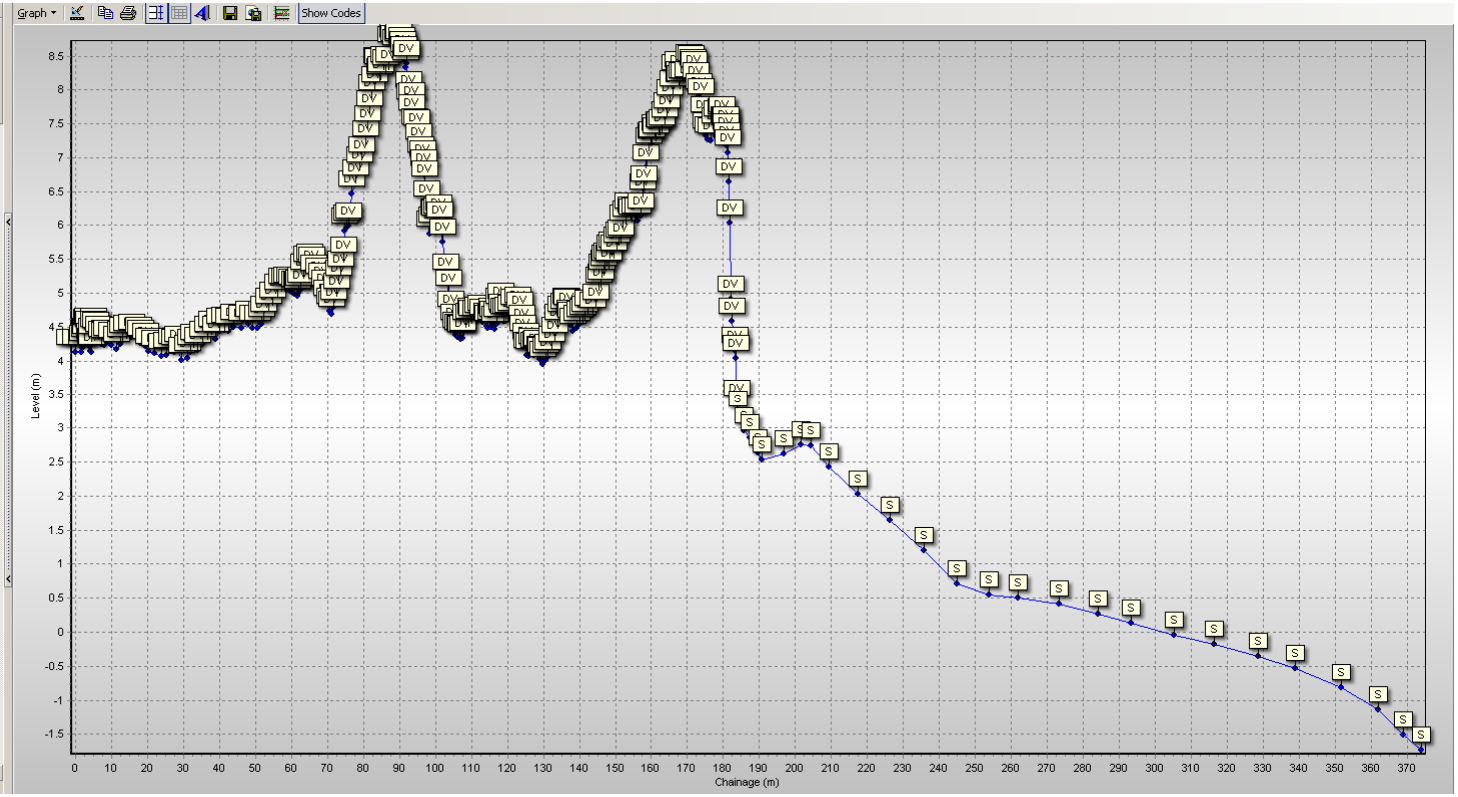
Beach Profiles: 1aADC17A



Castle Morpeth

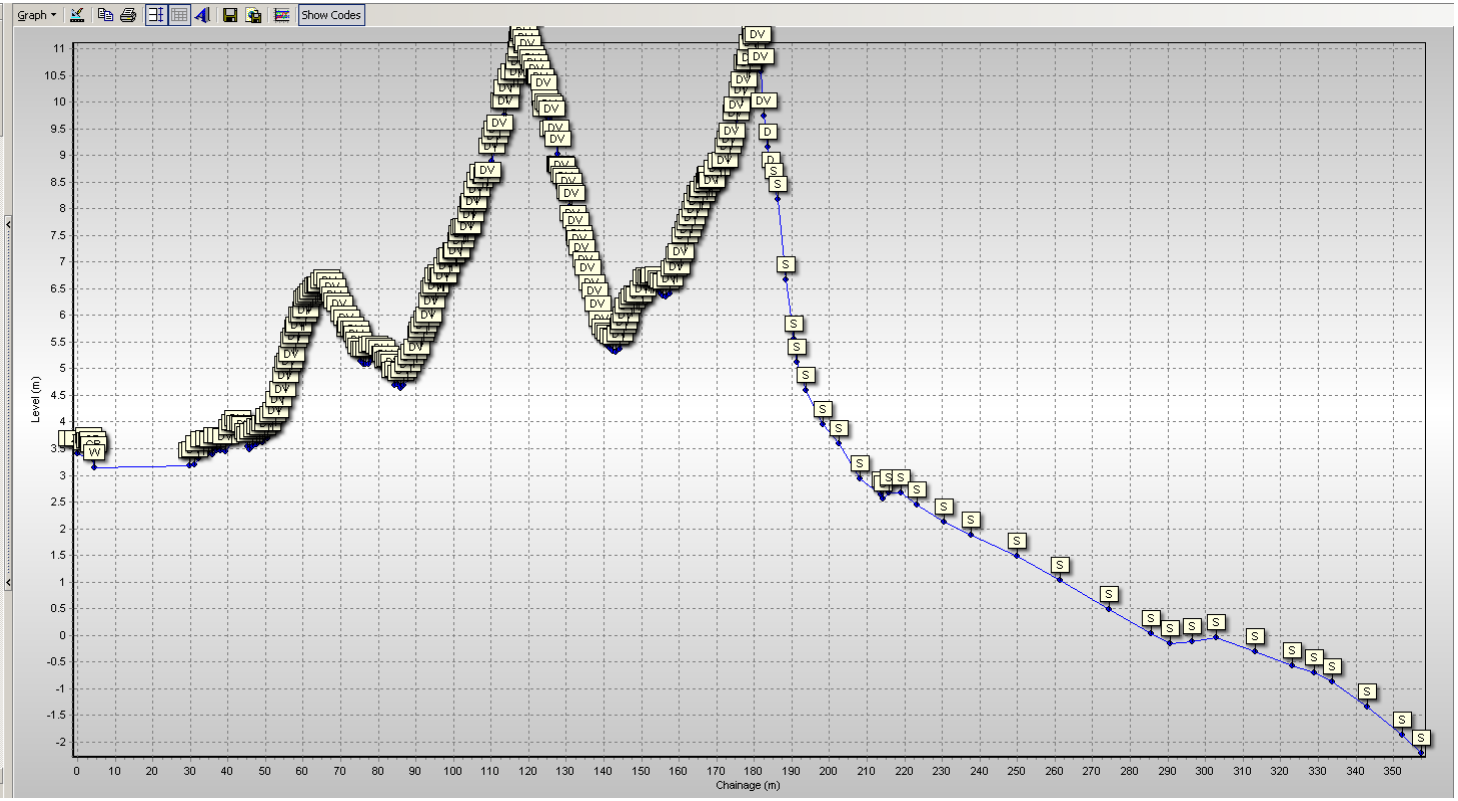
1aCMBC01 - 07/03/2011

Chainage	Level	Code
0.000	4.128	
0.068	4.128	ZZ
1.584	4.129	ZZ
1.856	4.184	DV
2.405	4.242	DV
2.767	4.295	DV
3.020	4.426	DV
3.385	4.446	DV
3.692	4.395	DV
3.940	4.210	DV
4.212	4.138	DV
4.475	4.125	DV
4.536	4.295	DV
4.877	4.434	DV
5.102	4.392	DV
5.540	4.378	DV
6.429	4.313	DV
7.331	4.240	DV
8.187	4.231	DV
8.620	4.264	DV
9.973	4.233	DV
11.480	4.172	DV
12.452	4.249	DV
13.154	4.300	DV
14.279	4.335	DV
15.585	4.349	DV
17.482	4.304	DV
18.175	4.255	DV
19.337	4.222	DV
20.195	4.137	DV
21.975	4.116	DV
23.913	4.069	DV
25.261	4.087	DV
26.597	4.142	DV
27.482	4.131	DV
28.374	4.175	DV
29.512	4.013	DV
31.151	4.046	DV
31.852	4.121	DV
32.717	4.195	DV
33.800	4.152	DV
35.442	4.244	DV



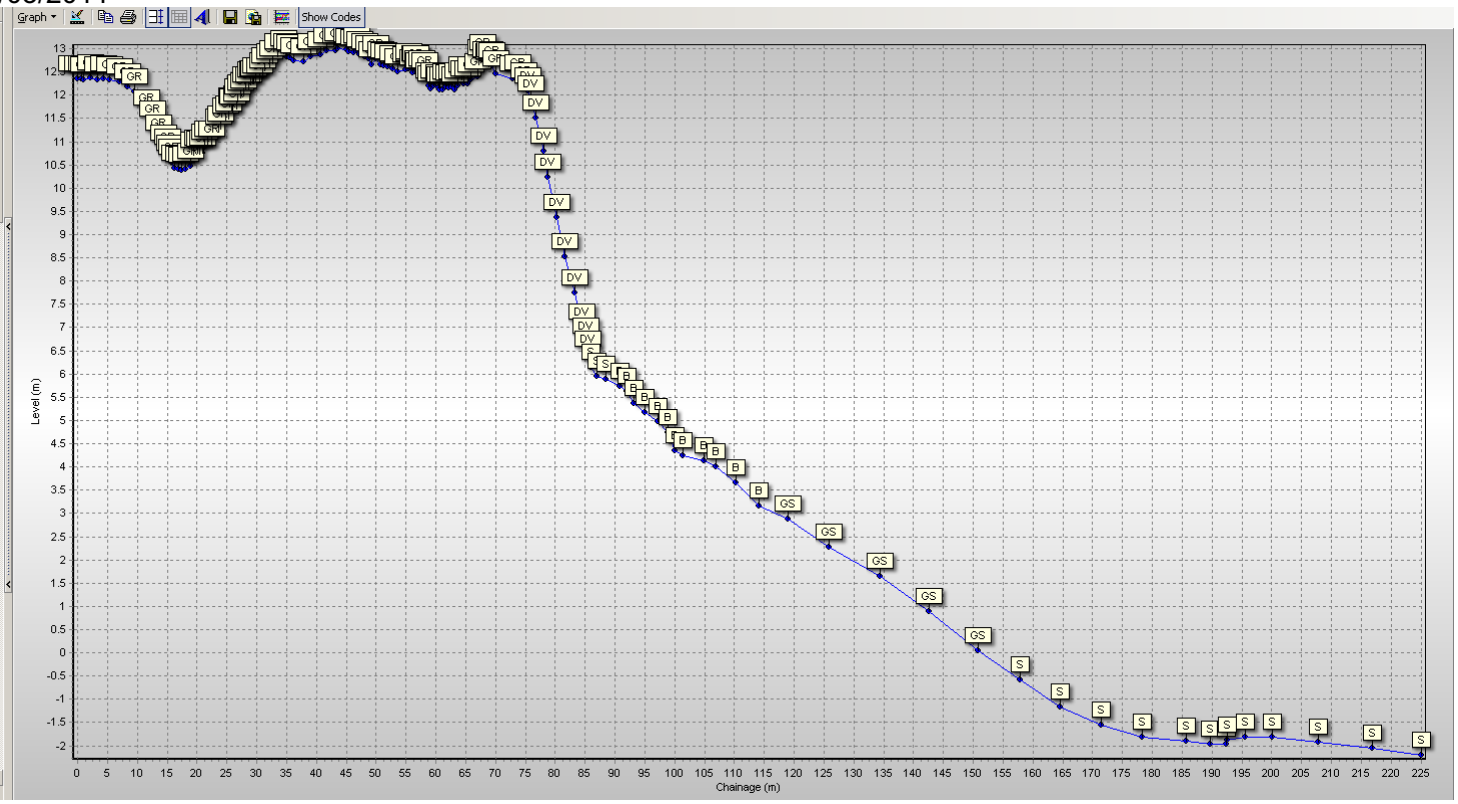
1aCMBC02 - 07/03/2011

Chainage	Level	Code
0.000	3.407	
0.069	3.407	ZZ
2.469	3.330	ZZ
2.915	3.470	GR
3.323	3.361	GR
3.765	3.368	GR
4.011	3.393	GR
4.377	3.300	GR
4.526	3.133	W
29.918	3.175	W
31.196	3.202	DV
32.212	3.317	DV
33.447	3.396	DV
34.741	3.399	DV
35.931	3.379	DV
37.058	3.471	DV
38.051	3.454	DV
39.341	3.449	DV
40.854	3.609	DV
41.765	3.708	DV
42.528	3.780	DV
43.243	3.693	DV
43.984	3.695	DV
44.532	3.666	DV
45.357	3.538	DV
45.837	3.479	DV
46.697	3.530	DV
47.677	3.579	DV
48.488	3.637	DV
49.192	3.610	DV
49.763	3.695	DV
50.583	3.693	DV
50.932	3.814	DV
51.994	3.855	DV
52.599	3.943	DV
53.615	4.135	DV
54.564	4.332	DV
55.427	4.603	DV
55.890	4.806	DV
56.302	4.859	DV
56.952	4.999	DV
57.367	5.247	DV



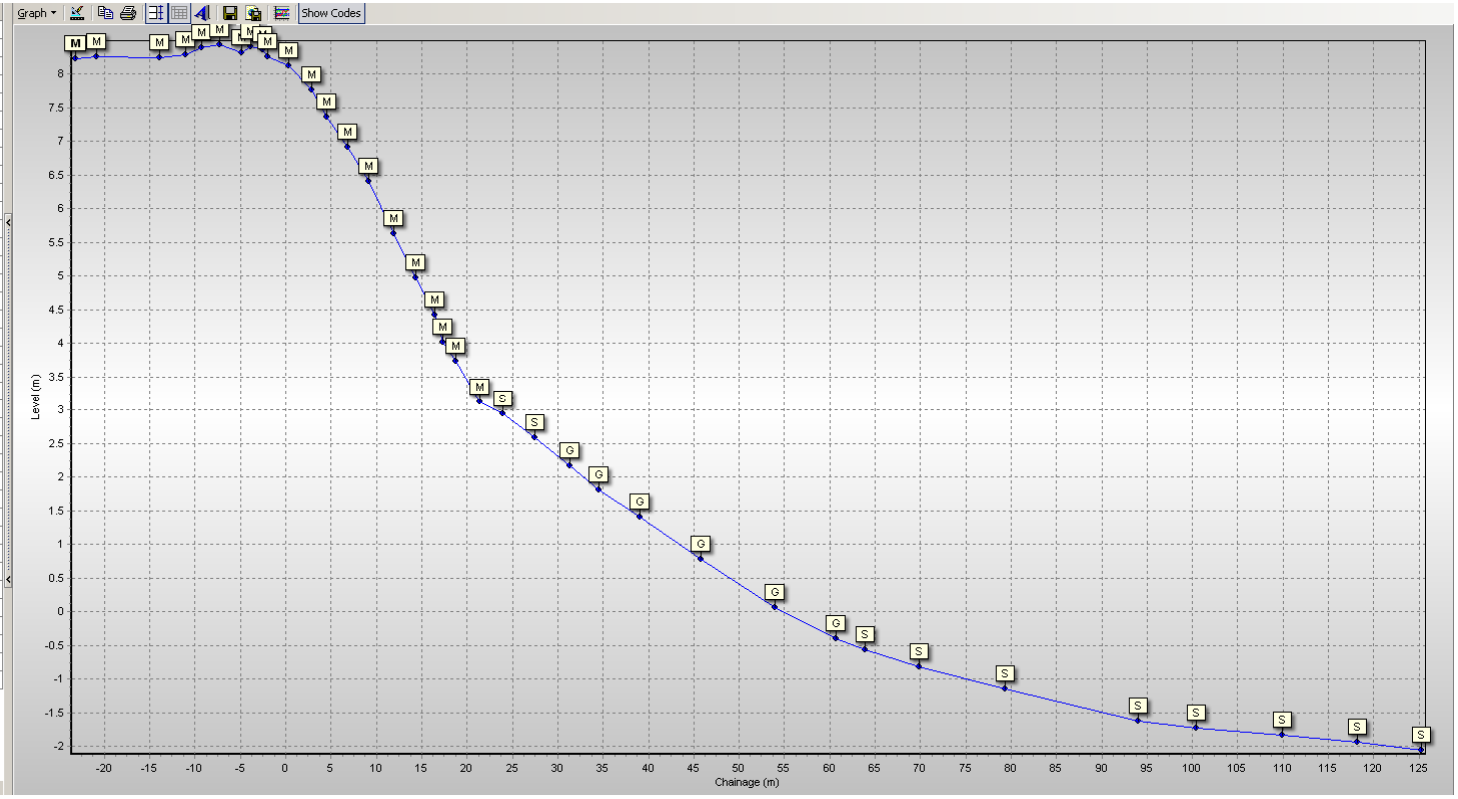
1aCMBC03A - 21/03/2011

Chainage	Level	Code
0.000	12.360	
0.034	12.360	GR
0.704	12.346	GR
1.030	12.322	GR
2.107	12.364	GR
3.300	12.331	GR
4.391	12.362	GR
5.352	12.337	GR
7.075	12.282	GR
8.427	12.182	GR
9.567	12.069	GR
11.594	11.622	GR
12.516	11.385	GR
13.504	11.074	GR
14.391	10.854	GR
15.031	10.779	GR
15.355	10.635	GR
15.709	10.559	GR
16.175	10.420	GR
16.932	10.405	GR
17.491	10.393	GR
18.113	10.417	GR
18.964	10.461	GR
19.423	10.708	GR
20.162	10.762	GR
20.495	10.731	GR
20.895	10.744	GR
21.269	10.882	GR
21.713	10.942	GR
22.537	10.937	GR
23.569	11.205	GR
24.013	11.273	GR
24.764	11.443	GR
25.335	11.479	GR
25.830	11.658	GR
26.012	11.636	GR
26.653	11.696	GR
26.822	11.845	GR
27.383	11.952	GR
27.874	11.984	GR
28.172	12.116	GR
28.713	12.112	GR



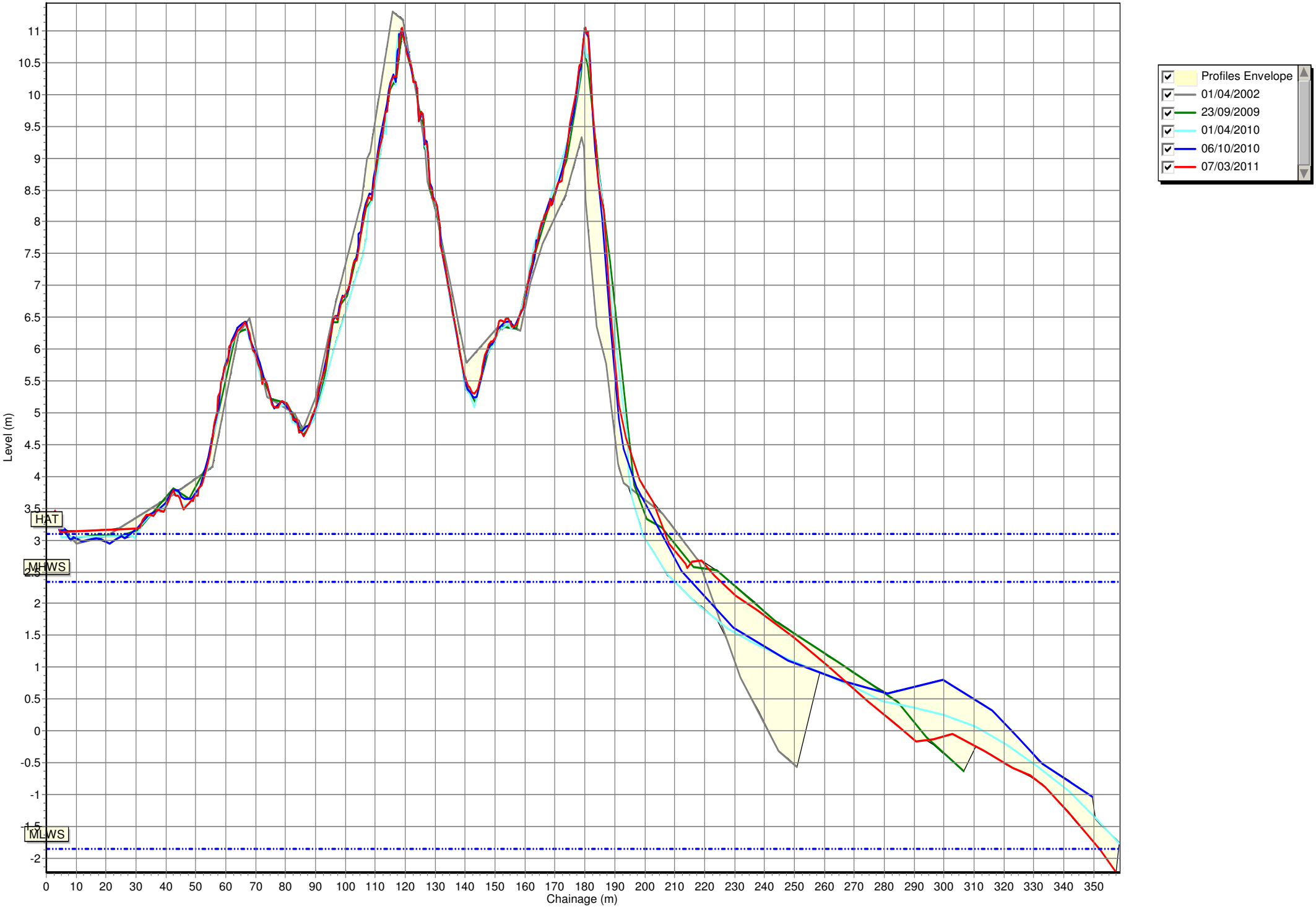
1aCMBC03B - 21/03/2011

Chainage	Level	Code
-23.184	8.235	M
-20.910	8.254	M
-13.879	8.242	M
-11.080	8.292	M
-9.277	8.401	M
-7.334	8.439	M
-4.902	8.315	M
-3.924	8.407	M
-2.529	8.362	M
-2.025	8.253	M
0.348	8.132	M
2.846	7.763	M
4.532	7.366	M
6.780	6.917	M
9.119	6.406	M
11.876	5.640	M
14.361	4.978	M
16.432	4.430	M
17.365	4.024	M
18.728	3.740	M
21.358	3.120	M
23.954	2.954	S
27.458	2.594	S
31.338	2.176	G
34.568	1.814	G
39.053	1.403	G
45.824	0.790	G
53.975	0.065	G
60.718	-0.394	G
63.887	-0.564	S
69.895	-0.817	S
79.326	-1.148	S
94.038	-1.623	S
100.396	-1.718	S
109.951	-1.829	S
118.232	-1.933	S
125.252	-2.053	S



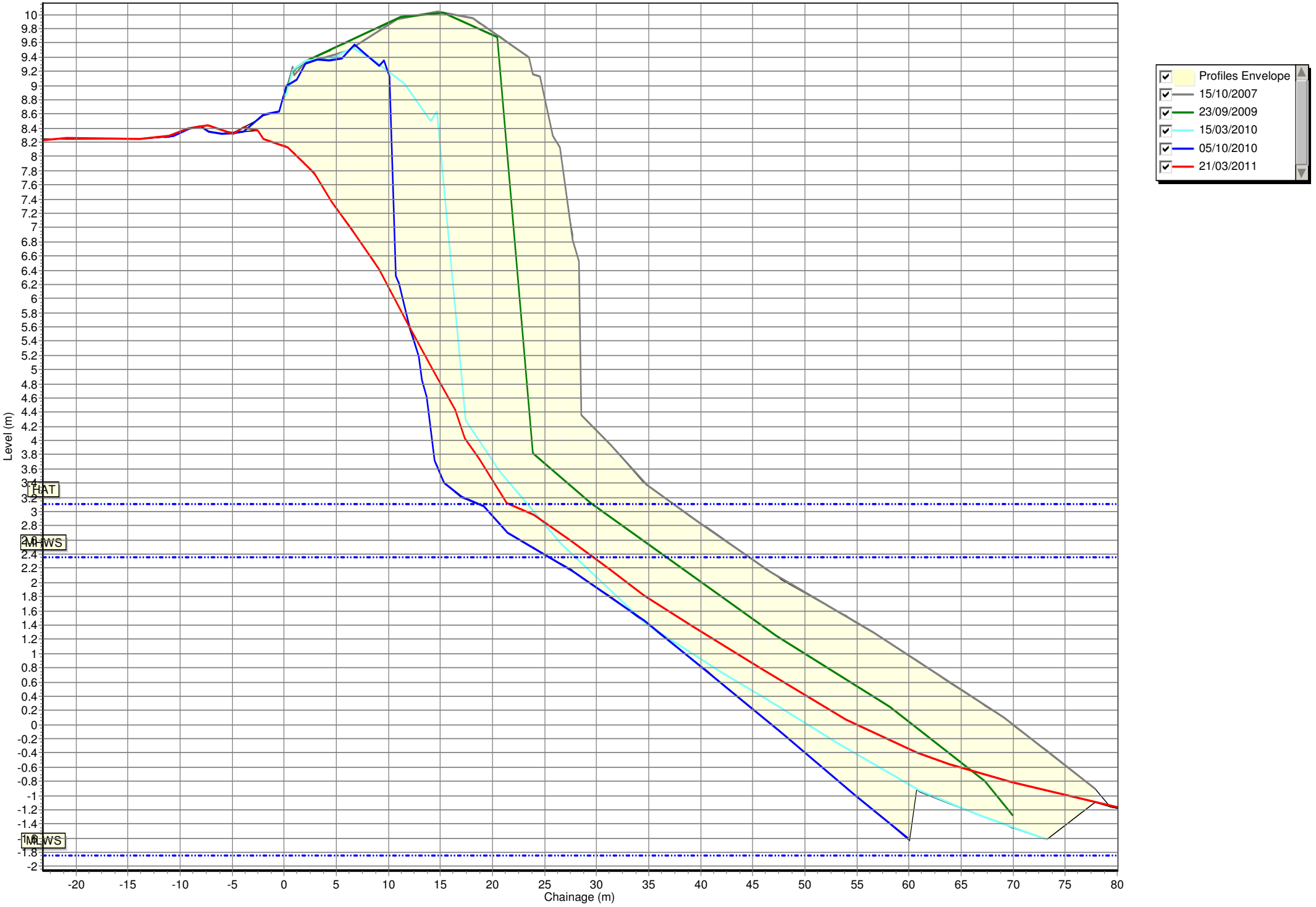
Beach Profiles: 1aCMBC01

Beach Profiles: 1aCMBC02



Beach Profiles: 1aCMBC03A

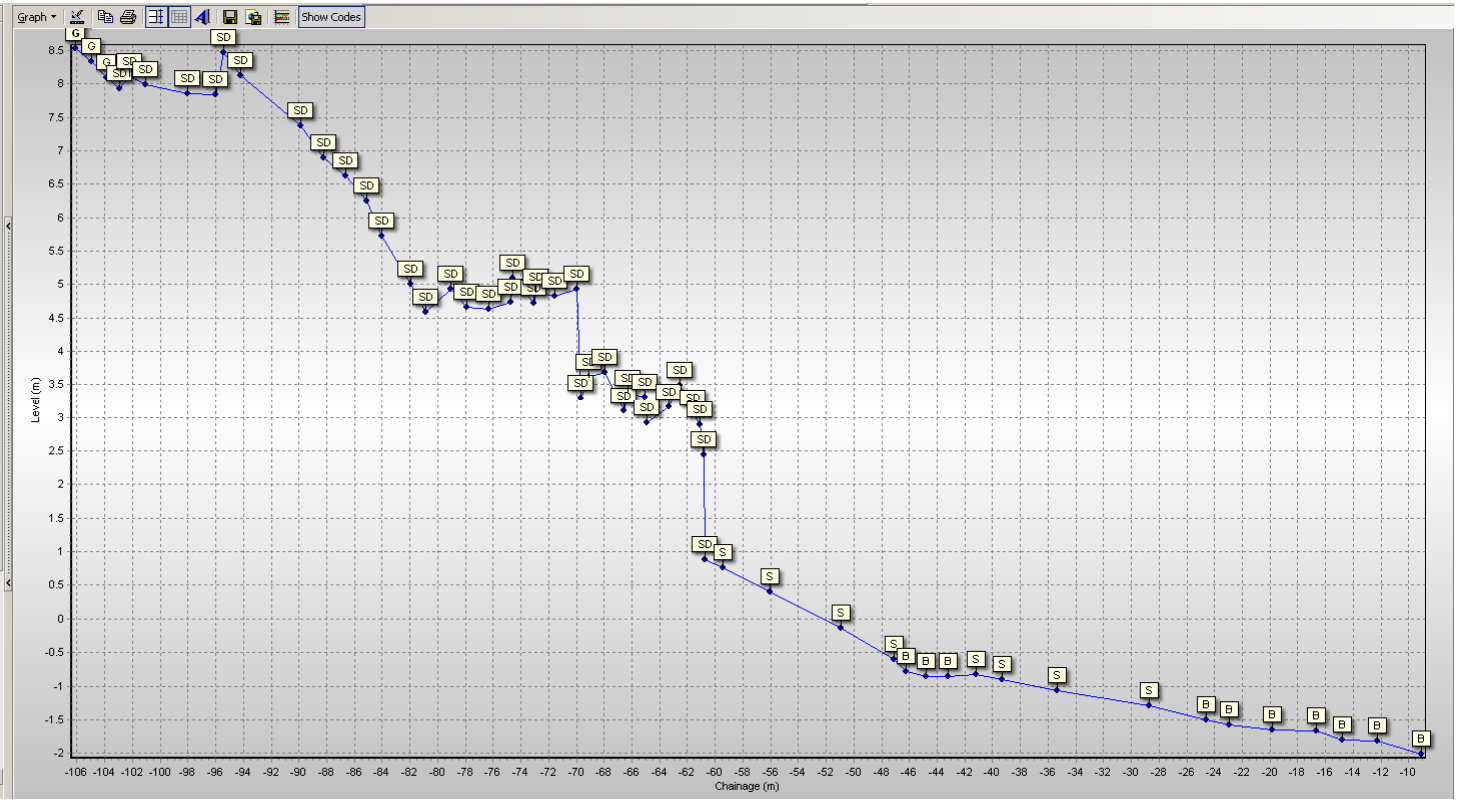
Beach Profiles: 1aCMBC03B



Wansbeck

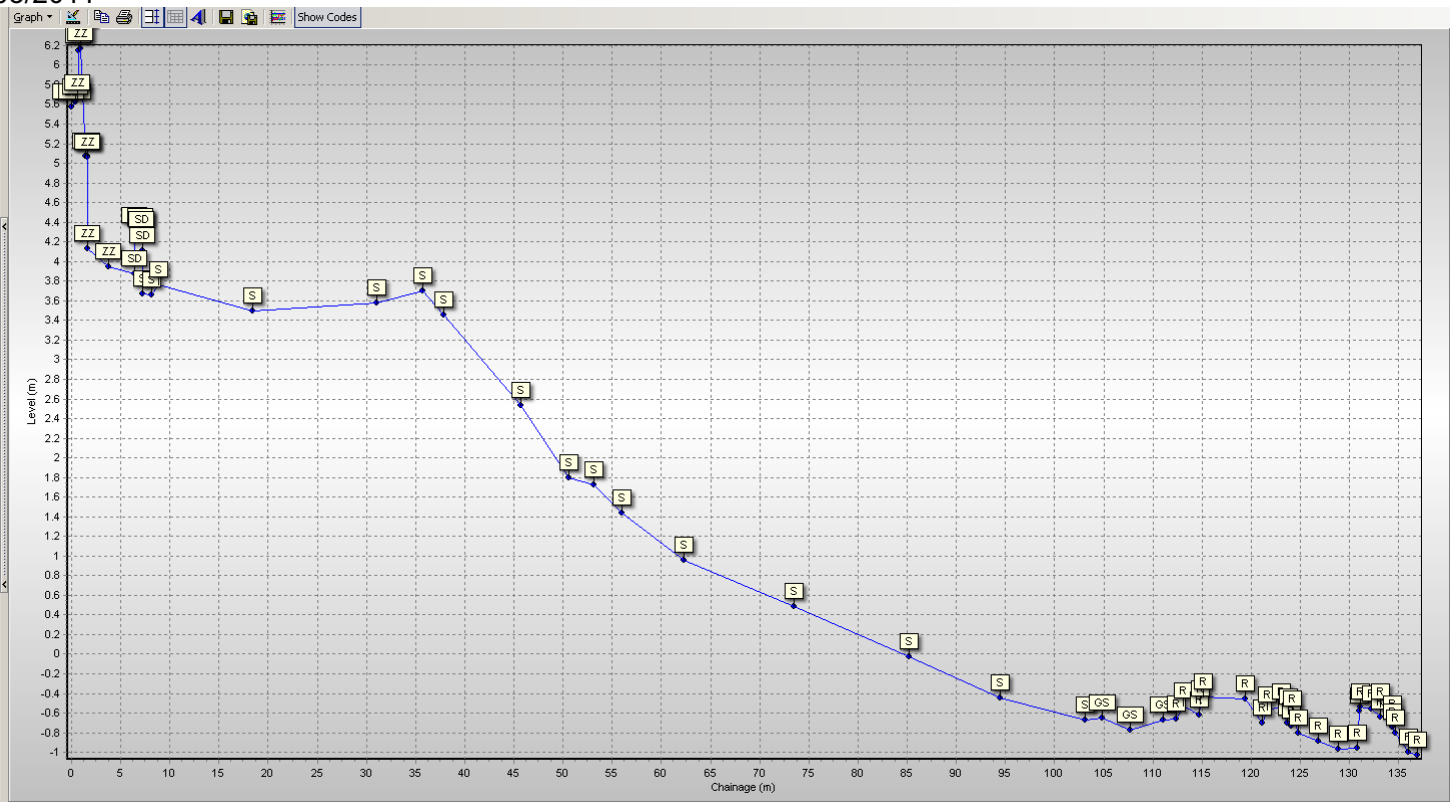
1aWDC01 - 21/03/2011

Chainage	Level	Code
-106.102	8.528	G
-104.982	8.331	G
-103.879	8.088	G
-102.943	7.931	SD
-102.188	8.106	SD
-101.046	7.986	SD
-97.990	7.850	SD
-96.008	7.837	SD
-95.394	8.473	SD
-94.168	8.122	SD
-89.902	7.381	SD
-88.239	6.900	SD
-86.619	6.629	SD
-85.114	6.243	SD
-83.998	5.729	SD
-81.932	5.009	SD
-80.864	4.589	SD
-79.074	4.928	SD
-77.885	4.667	SD
-76.313	4.629	SD
-74.705	4.737	SD
-74.577	5.094	SD
-73.041	4.722	SD
-72.893	4.890	SD
-71.521	4.826	SD
-69.972	4.927	SD
-69.713	3.296	SD
-69.120	3.615	SD
-67.939	3.681	SD
-66.566	3.107	SD
-66.292	3.373	SD
-65.078	3.311	SD
-64.889	2.922	SD
-63.348	3.164	SD
-62.552	3.493	SD
-61.595	3.072	SD
-61.078	2.889	SD
-60.800	2.435	SD
-60.760	0.883	SD
-59.401	0.764	S
-56.056	0.402	S
-50.954	-0.143	S



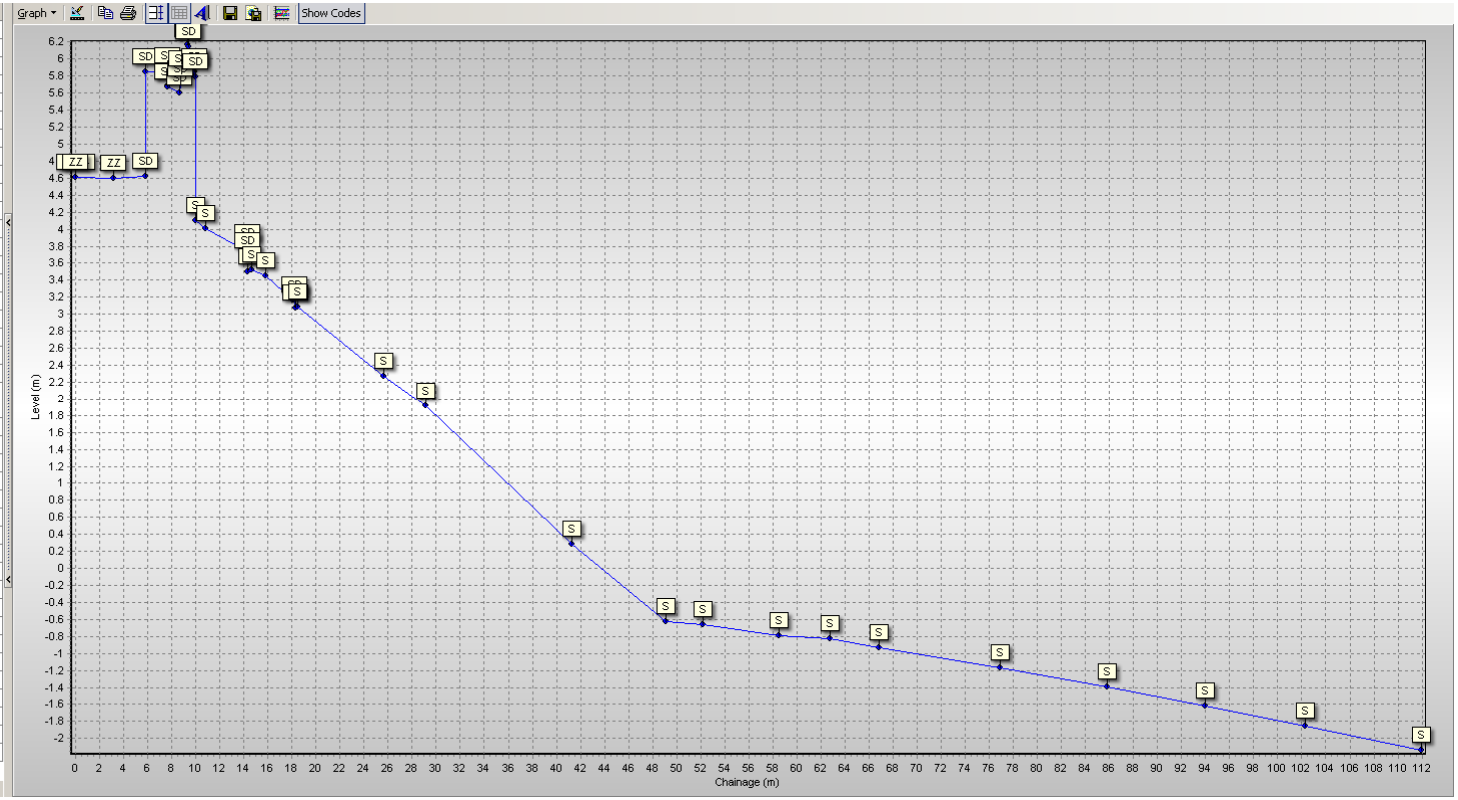
1aWDC05A – 02/03/2011

Chainage	Level	Code
0.000	5.579	
0.043	5.579	ZZ
0.378	5.629	ZZ
0.651	5.670	ZZ
0.662	6.144	ZZ
0.884	6.168	ZZ
1.390	5.074	ZZ
1.627	5.077	ZZ
1.652	5.058	ZZ
1.659	4.134	ZZ
3.758	3.950	ZZ
6.385	3.870	SD
6.417	4.311	SD
7.000	4.281	SD
7.003	4.300	SD
7.132	4.273	SD
7.209	4.112	SD
7.265	3.675	S
8.105	3.656	S
8.843	3.763	S
18.390	3.494	S
31.015	3.581	S
35.726	3.697	S
37.873	3.459	S
45.658	2.535	S
50.615	1.795	S
53.104	1.728	S
55.952	1.443	S
62.322	0.958	S
73.510	0.486	S
85.166	-0.026	S
94.514	-0.446	S
103.150	-0.671	S
104.855	-0.652	GS
107.676	-0.774	GS
111.012	-0.671	GS
112.359	-0.663	R
113.104	-0.531	R
114.703	-0.620	R
114.817	-0.506	R
115.148	-0.434	R
119.376	-0.458	R



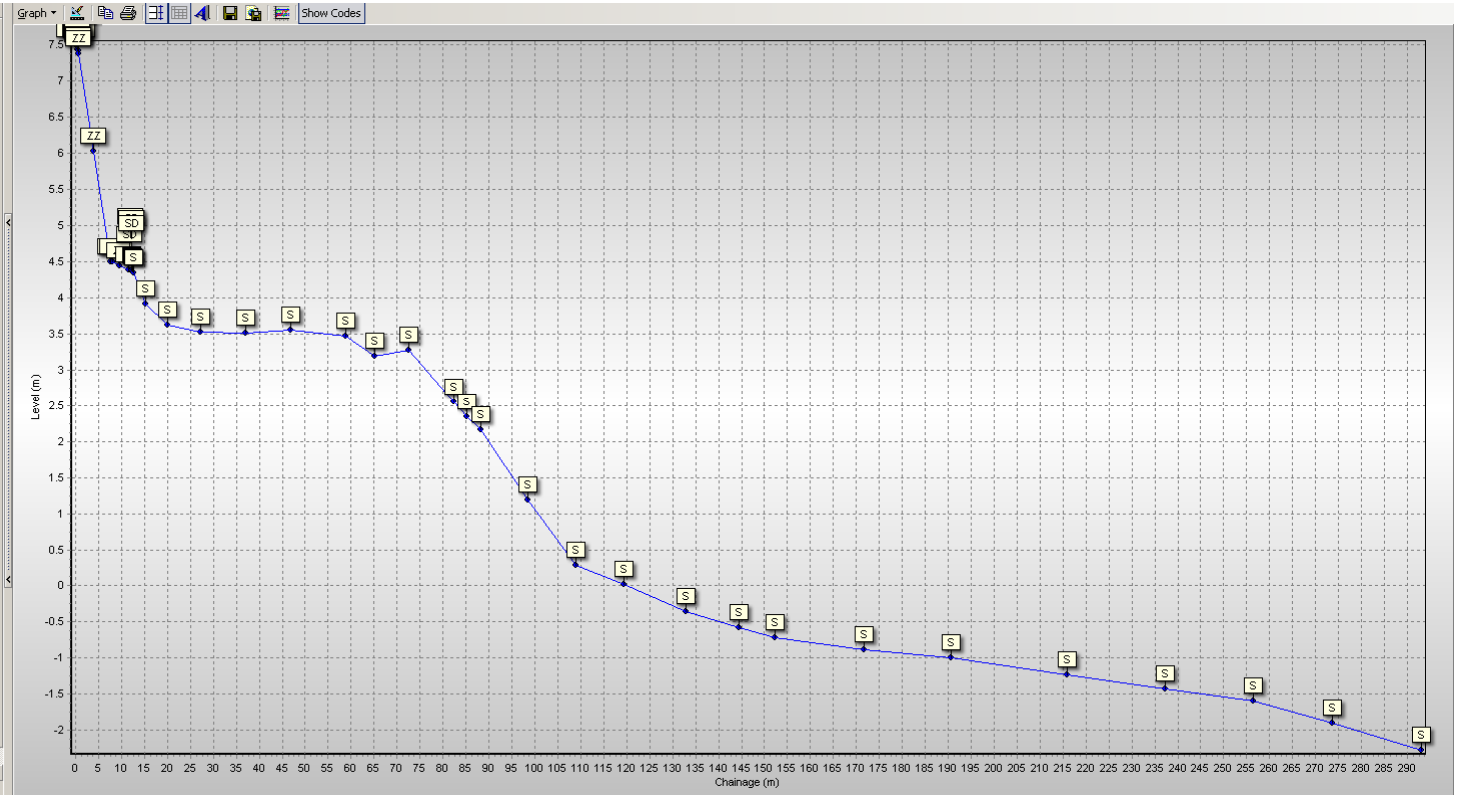
1aWDC06 - 02/03/2011

Chainage	Level	Code
0.000	4.614	
0.016	4.614	ZZ
3.186	4.602	ZZ
5.786	4.625	SD
5.815	5.854	SD
7.670	5.857	SD
7.673	5.689	SD
7.673	5.672	SD
8.674	5.606	SD
8.723	5.706	SD
8.827	5.829	SD
9.325	6.170	SD
9.416	6.142	SD
9.910	5.852	SD
9.923	5.848	SD
9.973	5.786	SD
10.004	4.098	S
10.806	4.003	S
14.009	3.763	S
14.276	3.785	SD
14.322	3.687	SD
14.353	3.500	S
14.619	3.527	S
15.789	3.448	S
18.040	3.173	S
18.245	3.165	SD
18.340	3.069	SD
18.439	3.084	S
25.675	2.271	S
29.110	1.912	S
41.267	0.282	S
49.076	-0.623	S
52.166	-0.663	S
58.546	-0.793	S
62.785	-0.824	S
66.841	-0.928	S
76.886	-1.171	S
85.852	-1.399	S
93.951	-1.616	S
102.318	-1.854	S
111.950	-2.138	S



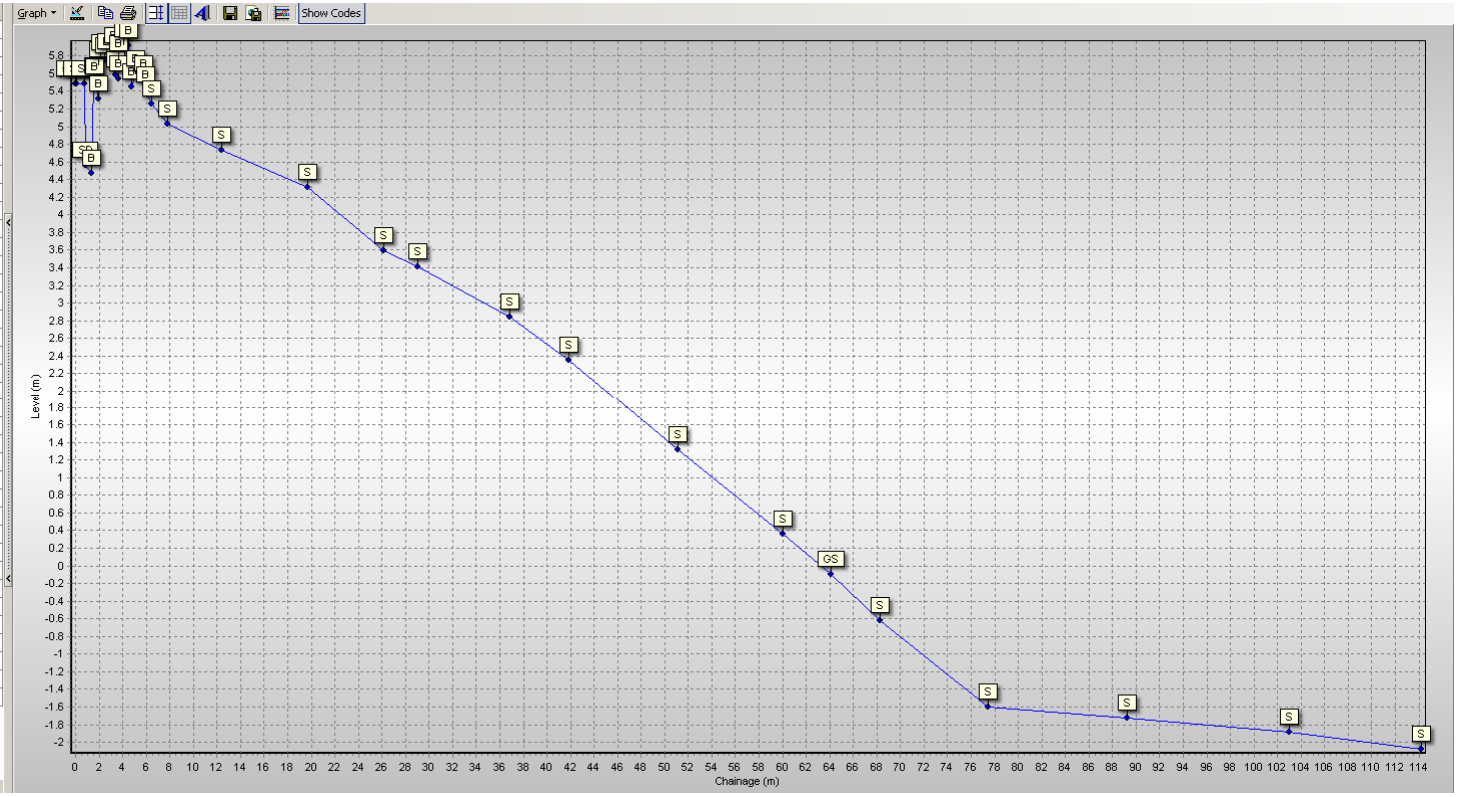
1aWDC06A - 02/03/2011

Chainage	Level	Code
0.000	7.496	
0.036	7.496	ZZ
0.278	7.477	ZZ
0.420	7.476	ZZ
0.429	7.427	ZZ
0.590	7.409	ZZ
0.683	7.375	ZZ
3.974	6.024	ZZ
7.530	4.497	ZZ
8.057	4.497	ZZ
9.490	4.446	ZZ
11.651	4.388	SD
11.678	4.655	SD
11.919	4.908	SD
12.236	4.889	SD
12.300	4.816	SD
12.306	4.364	S
12.380	4.355	S
12.612	4.347	S
15.290	3.914	S
20.144	3.625	S
27.136	3.521	S
36.954	3.514	S
46.888	3.555	S
58.765	3.466	S
65.251	3.187	S
72.483	3.273	S
82.278	2.556	S
85.207	2.341	S
88.215	2.156	S
98.488	1.190	S
108.926	0.285	S
119.290	0.025	S
132.870	-0.360	S
144.533	-0.576	S
152.326	-0.720	S
171.697	-0.876	S
190.700	-0.994	S
215.859	-1.227	S
237.184	-1.430	S
256.392	-1.594	S
273.604	-1.897	S

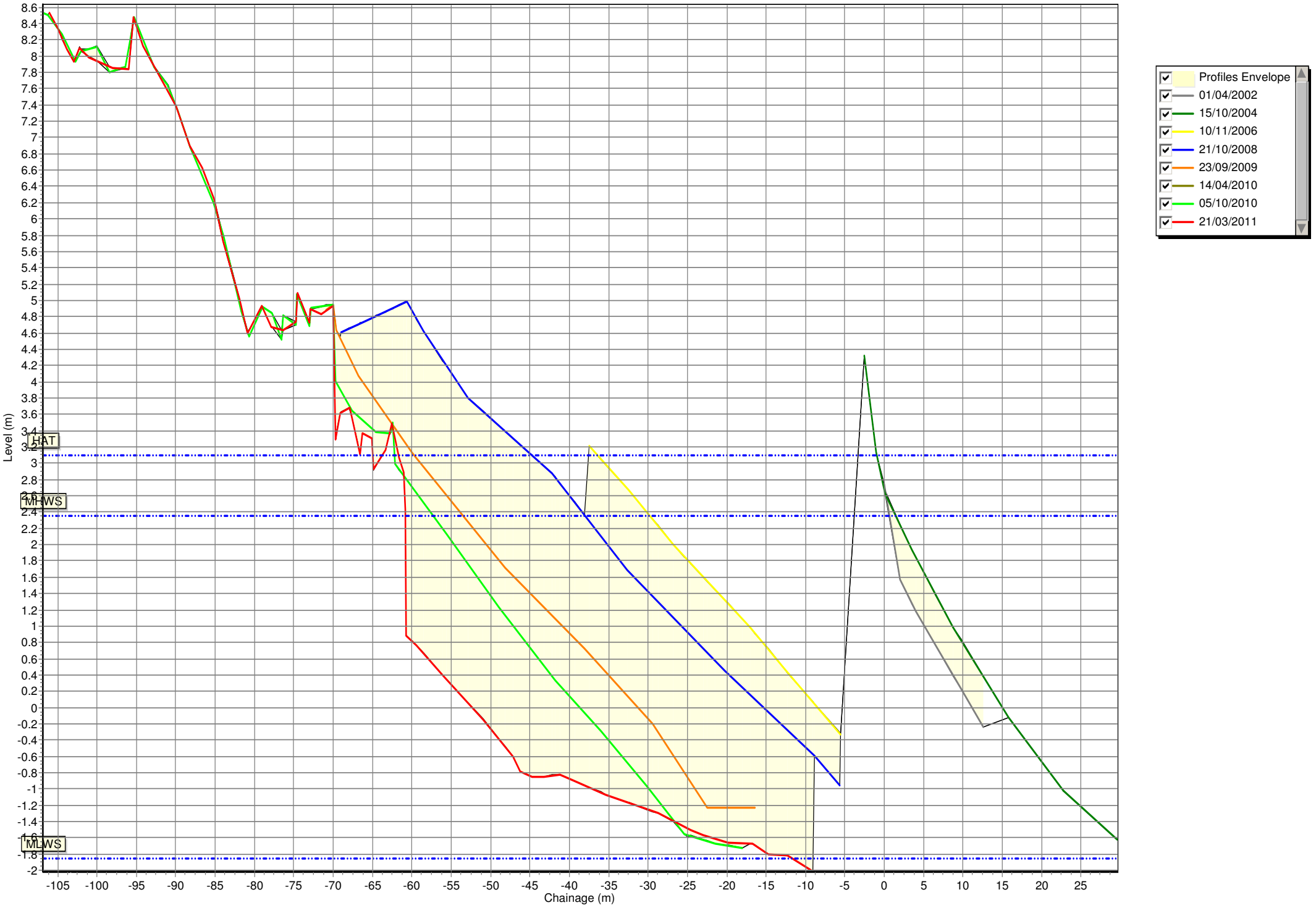


1aWDC07 - 02/03/2011

Chainage	Level	Code
0.000	5.488	
0.125	5.488	SD
0.750	5.486	SD
0.873	4.560	SD
1.363	4.467	B
1.566	5.517	B
1.641	5.511	B
1.922	5.311	B
1.940	5.697	B
2.142	5.786	B
2.493	5.746	B
2.637	5.793	B
3.264	5.863	B
3.417	5.589	B
3.631	5.541	B
3.659	5.771	B
4.115	5.929	B
4.483	5.915	B
4.755	5.448	B
5.060	5.596	B
5.804	5.544	B
5.917	5.412	B
6.468	5.258	S
7.817	5.034	S
12.359	4.732	S
19.667	4.314	S
26.165	3.596	S
29.005	3.412	S
36.837	2.845	S
41.878	2.354	S
51.111	1.311	S
60.071	0.365	S
64.140	-0.094	GS
68.300	-0.617	S
77.400	-1.594	S
89.209	-1.725	S
102.988	-1.887	S
114.208	-2.078	S



Beach Profiles: 1aWDC01



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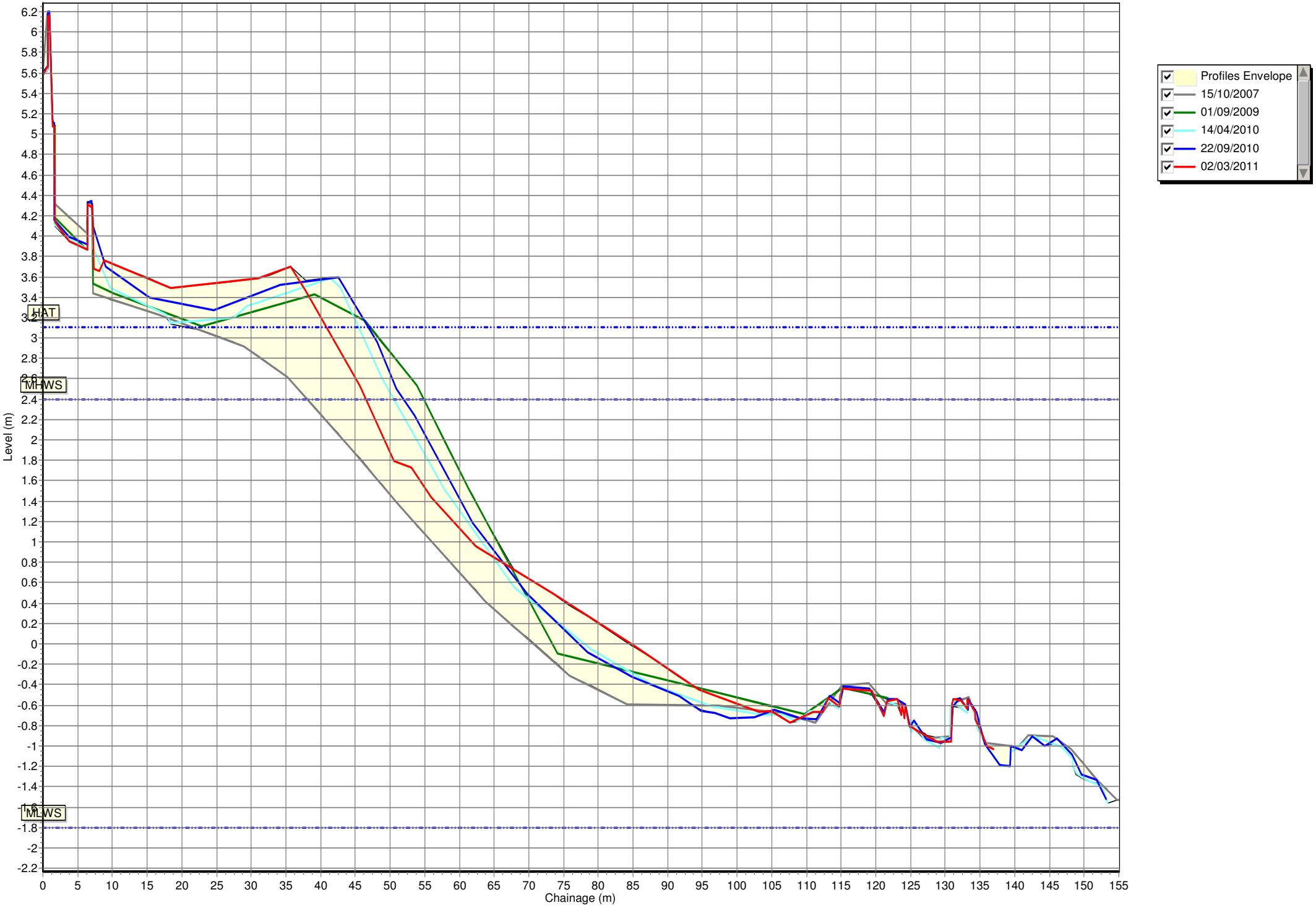
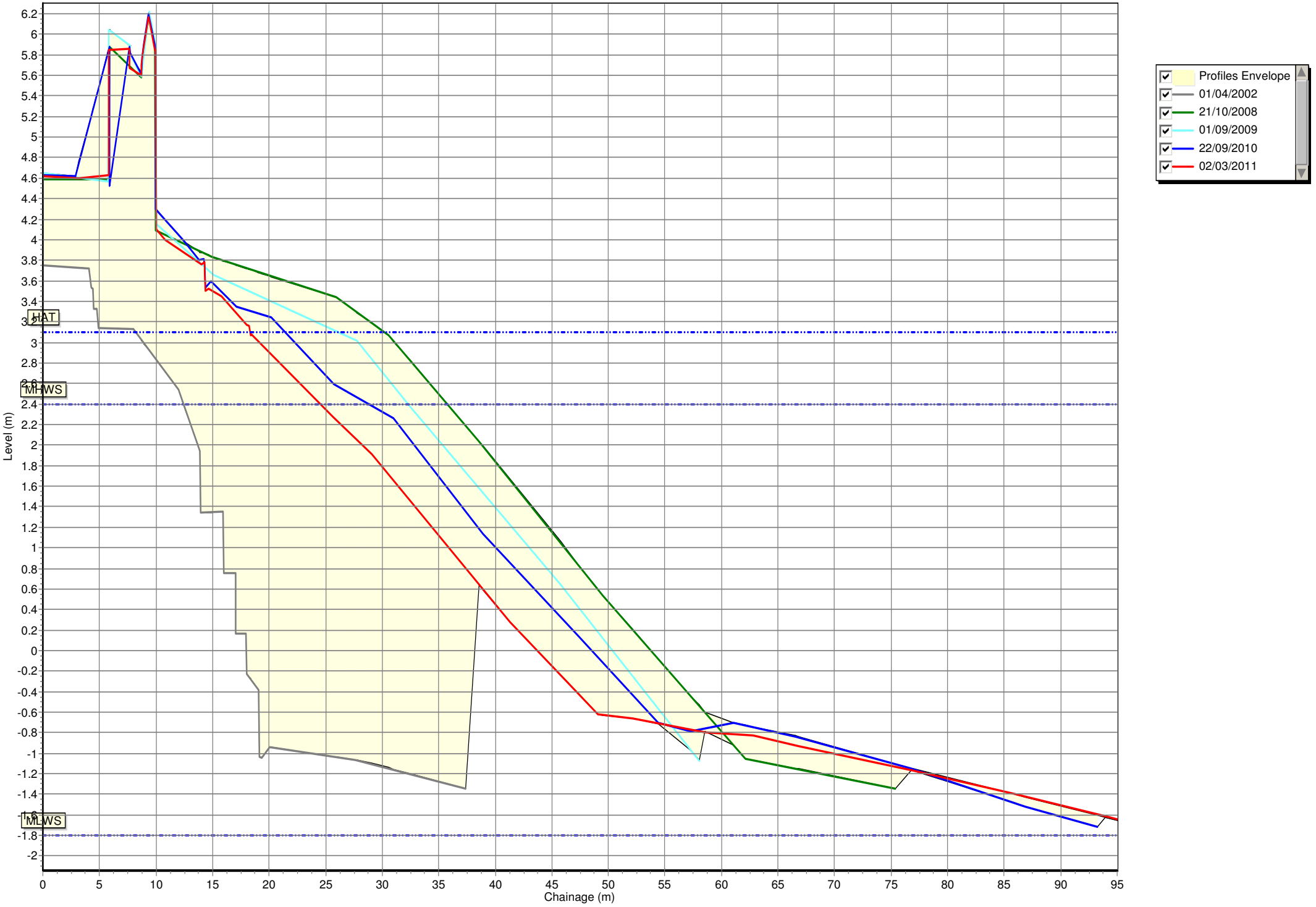


Beach Profiles: 1aWDC06



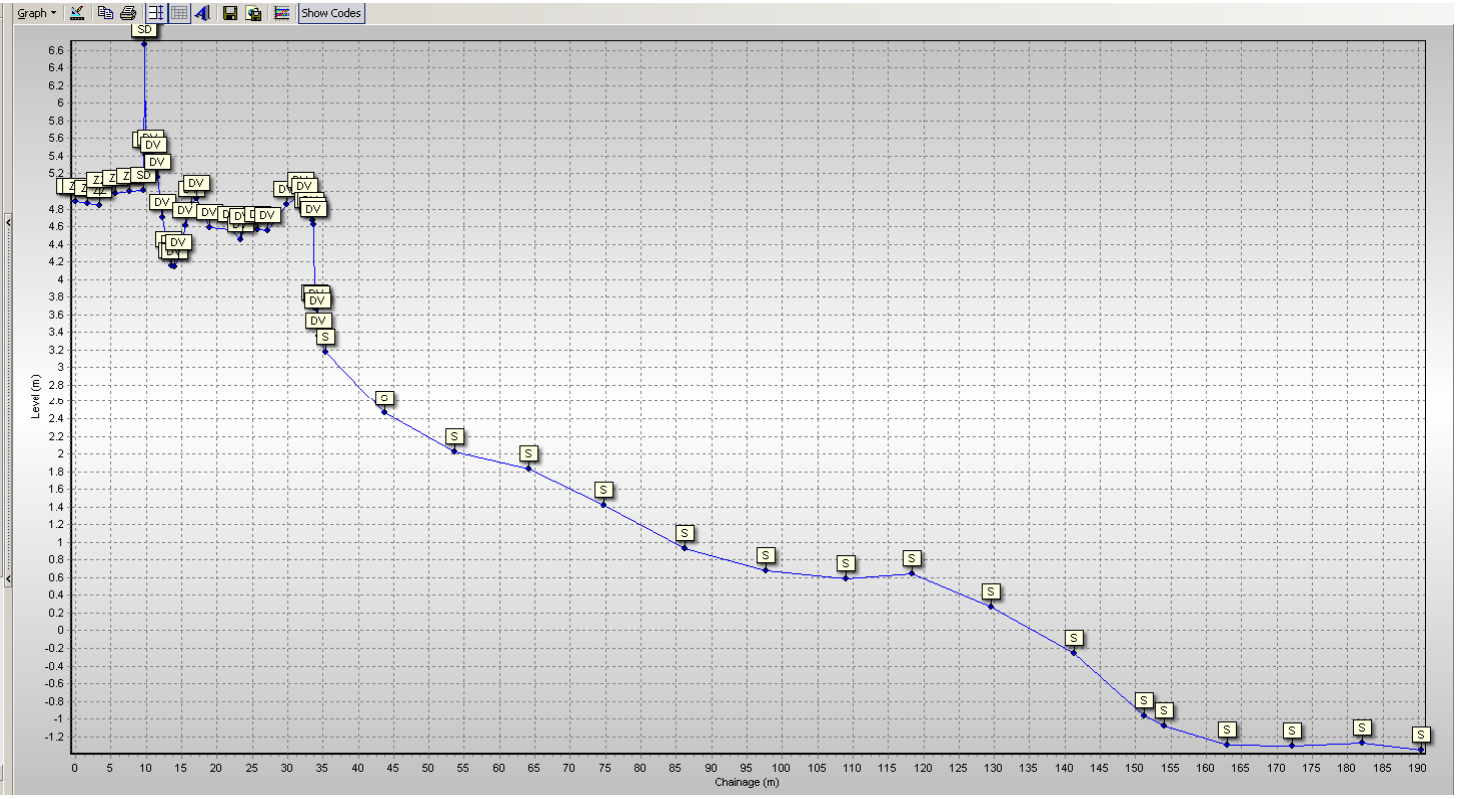
Beach Profiles: 1aWDC06A


Beach Profiles: 1aWDC07
Profiles Envelope
01/04/2002
21/10/2008
01/09/2009
22/09/2010
02/03/2011
HAT
MHWS
MLWS
Level (m)
Chainage (m)

Blyth

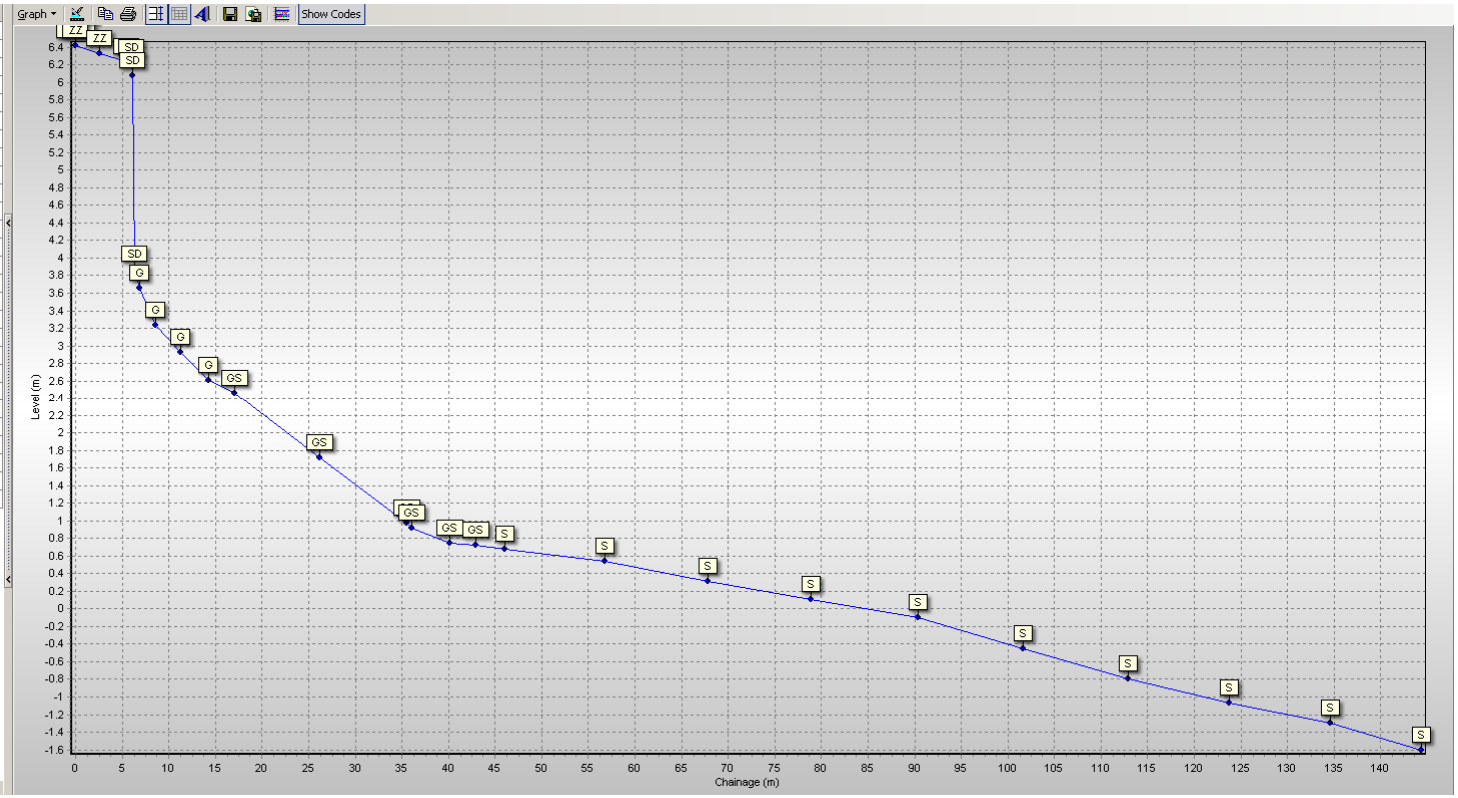
1aBVBC01 - 03/03/2011

Chainage	Level	Code
0.000	4.888	
0.036	4.888	ZZ
1.630	4.865	ZZ
3.415	4.838	ZZ
3.469	4.949	ZZ
5.687	4.976	ZZ
7.676	5.003	ZZ
9.668	5.014	SD
9.758	6.660	SD
9.798	6.665	SD
9.874	5.408	SD
10.604	5.431	DV
11.043	5.358	DV
11.625	5.155	DV
12.282	4.705	DV
13.112	4.287	DV
13.654	4.152	DV
14.023	4.147	DV
14.579	4.245	DV
15.629	4.608	DV
16.434	4.854	DV
17.096	4.923	DV
19.036	4.594	DV
21.993	4.566	DV
23.298	4.455	DV
23.674	4.545	DV
25.729	4.567	DV
27.245	4.550	DV
29.942	4.849	DV
31.798	4.960	DV
32.433	4.885	DV
32.782	4.727	DV
33.209	4.725	DV
33.569	4.671	DV
33.737	4.620	DV
33.897	3.674	DV
34.173	3.663	DV
34.251	3.586	DV
34.370	3.354	DV
35.346	3.180	S
43.735	2.465	S
53.678	2.023	S



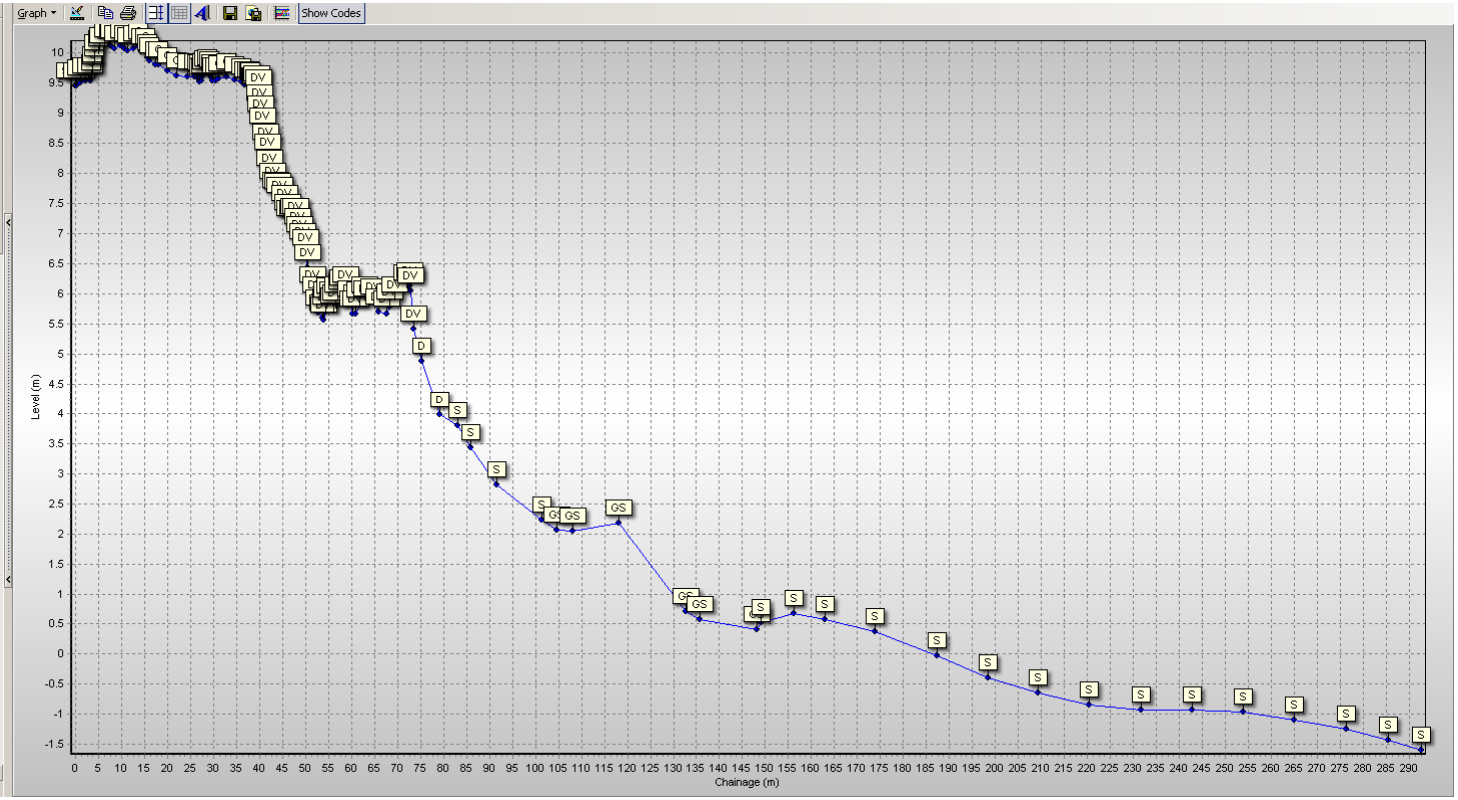
1aBVBC02 - 03/03/2011

Chainage	Level	Code
0.000	6.419	
0.011	6.419	ZZ
2.582	6.330	ZZ
5.495	6.232	SD
6.023	6.223	SD
6.150	6.082	SD
6.326	3.878	SD
6.859	3.656	G
8.605	3.232	G
11.218	2.928	G
14.252	2.603	G
17.096	2.457	GS
26.140	1.722	GS
35.489	0.975	GS
36.027	0.918	GS
40.095	0.747	GS
42.980	0.726	GS
46.000	0.674	S
56.777	0.536	S
67.792	0.318	S
78.905	0.106	S
90.402	-0.097	S
101.653	-0.448	S
112.870	-0.790	S
123.738	-1.070	S
134.590	-1.292	S
144.360	-1.605	S



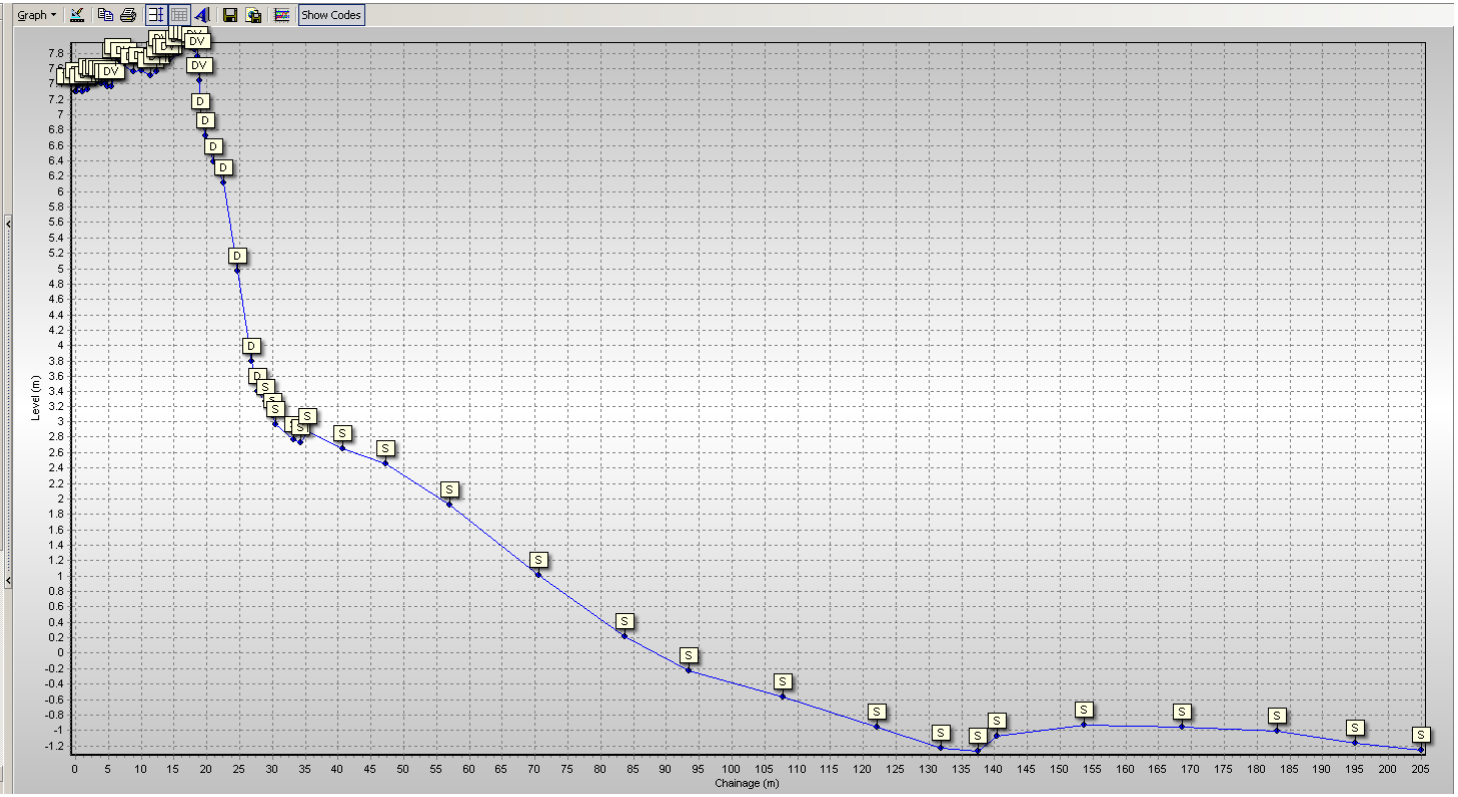
1aBVBC03 - 03/03/2011

Chainage	Level	Code
0.000	9.452	
0.018	9.452	G
0.309	9.457	ZZ
0.984	9.501	ZZ
2.235	9.529	ZZ
3.286	9.543	ZZ
3.485	9.589	G
3.624	9.685	G
3.778	9.718	G
4.076	9.820	G
4.190	9.926	G
5.073	9.991	G
5.322	10.044	G
6.351	10.129	G
7.391	10.137	G
7.706	10.124	G
8.414	10.070	G
9.701	10.117	G
10.656	10.074	G
11.376	10.031	G
12.715	10.074	G
13.619	10.106	G
14.284	10.022	G
15.293	10.017	G
15.707	9.921	G
15.993	9.868	G
17.400	9.805	G
17.988	9.811	G
19.941	9.702	G
22.080	9.613	G
24.470	9.611	G
25.904	9.596	G
26.467	9.588	G
26.901	9.593	G
27.087	9.520	G
27.354	9.534	G
27.572	9.595	G
28.149	9.647	G
28.744	9.673	G
29.237	9.636	G
29.654	9.594	G
29.842	9.539	G



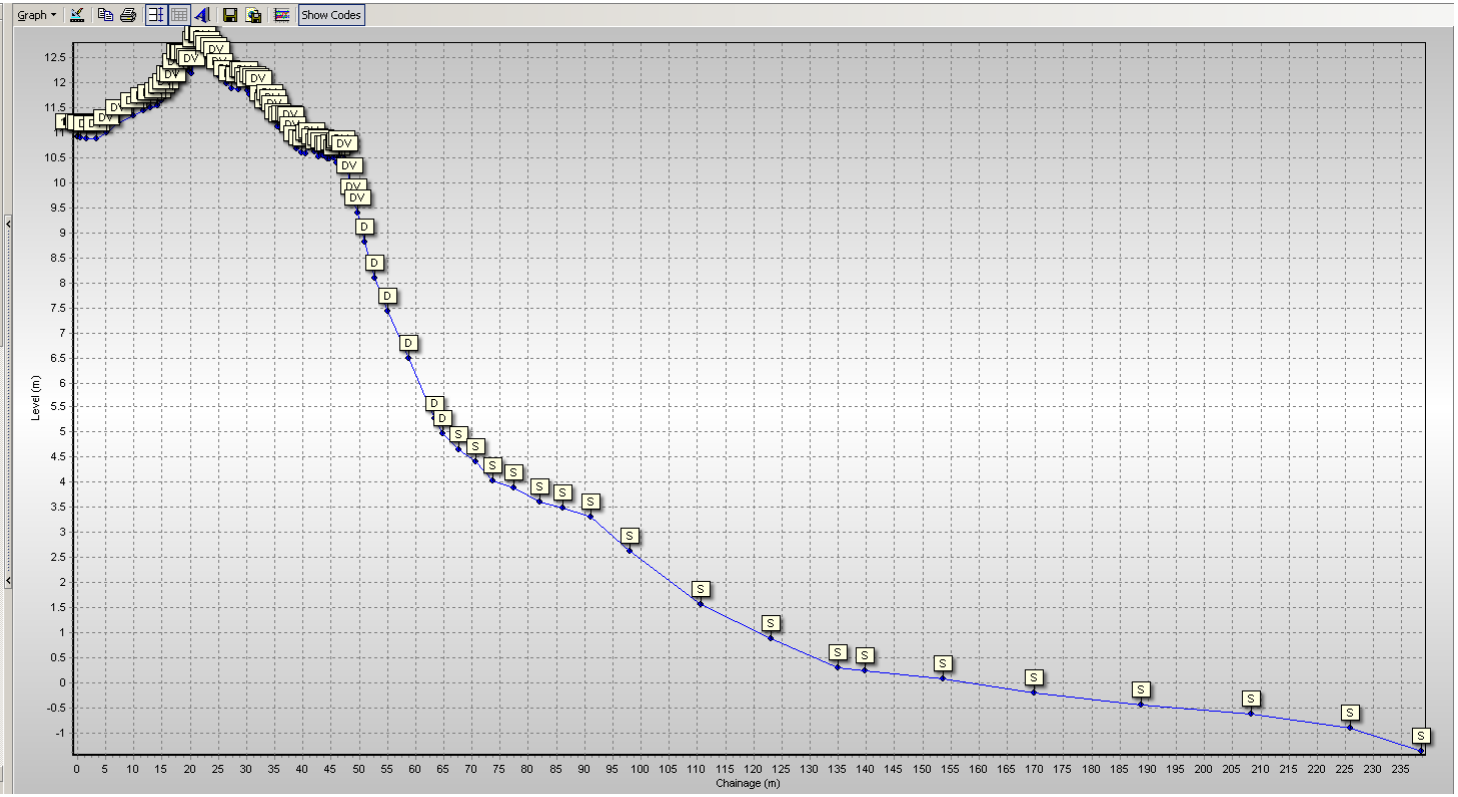
1aBVBC04 - 03/03/2011

Chainage	Level	Code
0.000	7.301	
0.177	7.301	DV
0.389	7.383	DV
1.102	7.295	DV
1.803	7.325	DV
2.369	7.434	DV
2.981	7.409	DV
3.520	7.424	DV
3.915	7.407	DV
4.630	7.397	DV
4.874	7.367	DV
5.447	7.361	DV
6.094	7.637	DV
6.476	7.696	DV
7.288	7.635	DV
8.832	7.554	DV
10.040	7.574	DV
11.499	7.505	DV
12.354	7.561	DV
12.841	7.649	DV
13.142	7.791	DV
13.735	7.691	DV
14.236	7.685	DV
15.718	7.798	DV
16.096	7.885	DV
16.905	7.880	DV
17.565	7.875	DV
18.198	7.847	DV
18.611	7.760	DV
18.877	7.439	DV
19.132	6.970	D
19.855	6.721	D
21.097	6.392	D
22.623	6.113	D
24.686	4.969	D
26.859	3.796	D
27.758	3.409	D
28.919	3.263	S
29.992	3.085	S
30.465	2.962	S
33.290	2.761	S
34.337	2.728	S



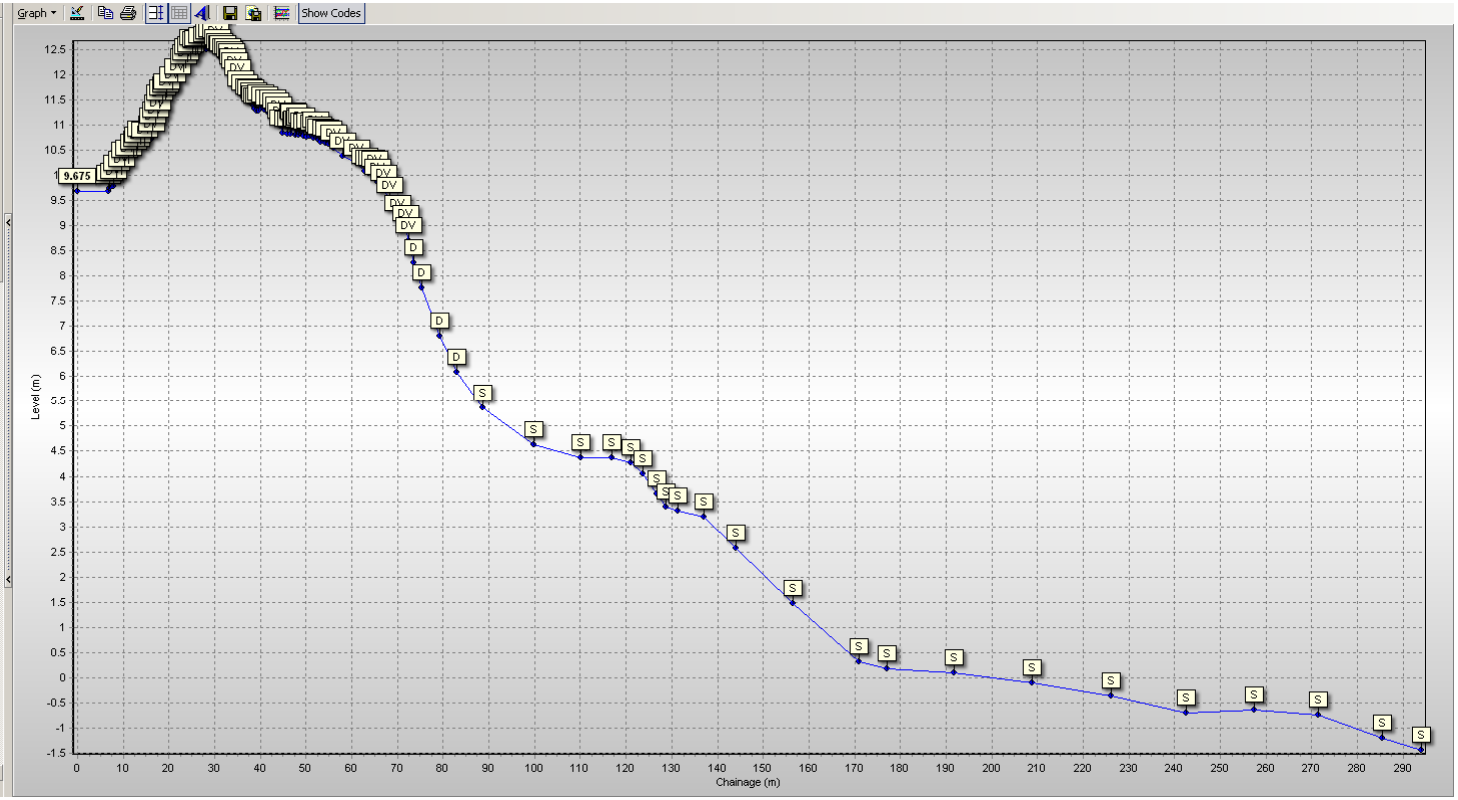
1aBVBC05 - 03/03/2011

Chainage	Level	Code
0.000	10.913	
0.130	10.913	DV
0.561	10.903	DV
1.580	10.890	DV
3.432	10.887	DV
5.080	11.010	DV
7.348	11.196	DV
9.969	11.341	DV
11.715	11.439	DV
12.947	11.510	DV
14.257	11.549	DV
14.973	11.651	DV
15.558	11.713	DV
16.254	11.876	DV
16.889	11.856	DV
17.389	12.123	DV
18.078	12.333	DV
18.588	12.327	DV
18.904	12.302	DV
19.564	12.306	DV
19.835	12.219	DV
20.200	12.186	DV
20.889	12.568	DV
21.258	12.702	DV
21.955	12.724	DV
22.140	12.666	DV
22.854	12.558	DV
23.279	12.487	DV
24.090	12.440	DV
24.680	12.357	DV
25.156	12.124	DV
26.439	11.977	DV
27.304	11.891	DV
28.656	11.857	DV
29.296	11.964	DV
29.692	11.972	DV
30.132	11.850	DV
30.544	11.768	DV
31.154	11.862	DV
31.550	11.822	DV
32.110	11.791	DV
32.886	11.476	DV



1aBVBC06 - 03/03/2011

Chainage	Level	Code
0.000	9.675	
6.796	9.675	ZZ
7.045	9.736	DV
7.866	9.773	DV
8.565	9.936	DV
9.544	10.019	DV
10.237	10.204	DV
11.196	10.233	DV
12.261	10.360	DV
12.854	10.425	DV
13.231	10.510	DV
13.849	10.615	DV
14.707	10.606	DV
16.274	10.729	DV
16.475	10.886	DV
16.987	10.995	DV
17.561	11.133	DV
18.034	11.338	DV
18.580	11.430	DV
19.177	11.501	DV
19.575	11.554	DV
20.723	11.700	DV
21.989	11.860	DV
23.302	12.065	DV
23.745	12.148	DV
24.147	12.259	DV
24.764	12.306	DV
25.246	12.432	DV
25.730	12.390	DV
26.215	12.425	ZZ
27.112	12.469	ZZ
28.169	12.504	ZZ
28.728	12.567	DV
29.336	12.598	DV
30.190	12.588	DV
30.578	12.444	DV
31.029	12.353	DV
31.421	12.328	DV
31.774	12.317	DV
32.370	12.266	DV
32.929	12.256	DV
33.348	12.205	DV

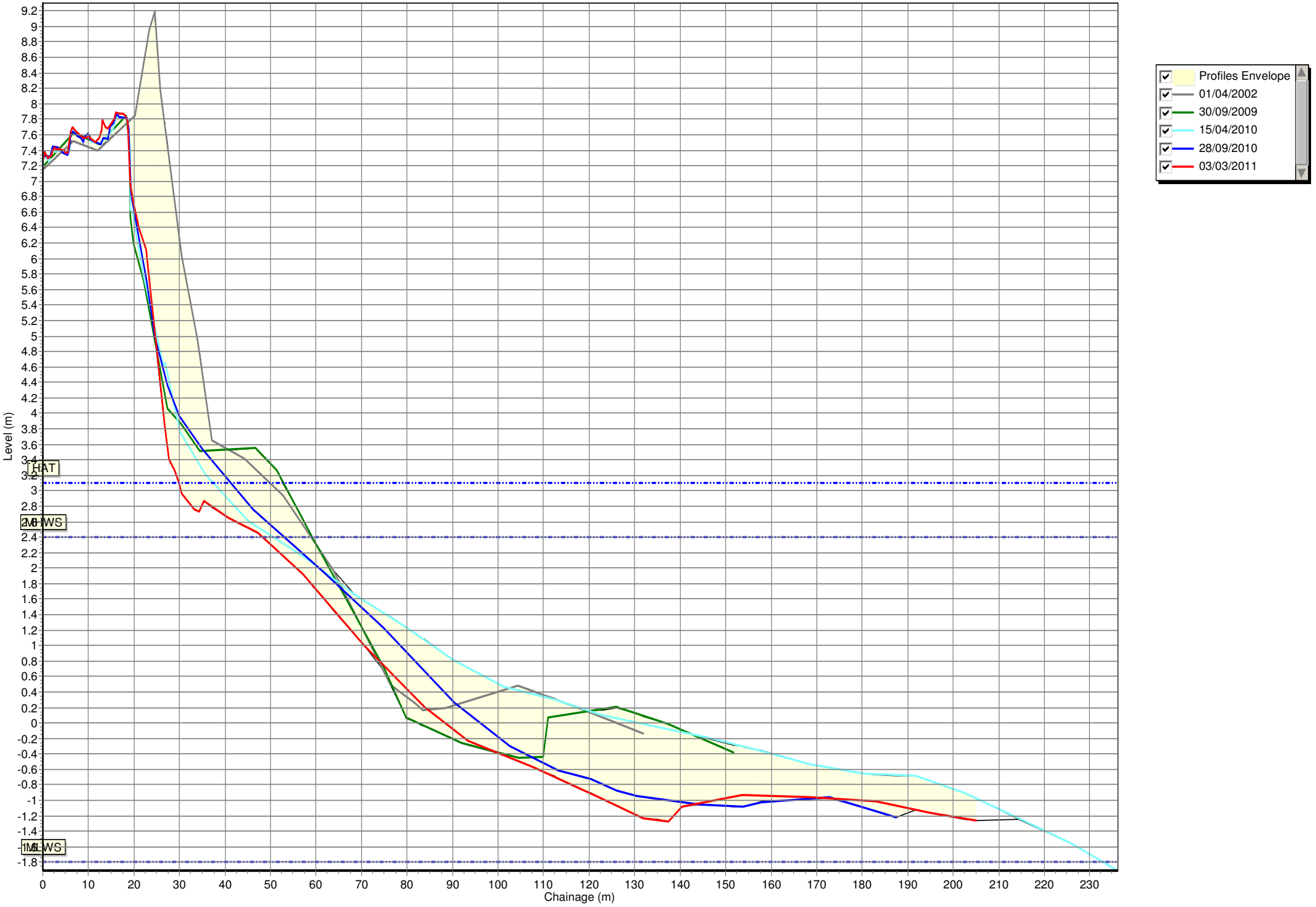


Beach Profiles: 1aBVBC01

Beach Profiles: 1aBVBC02

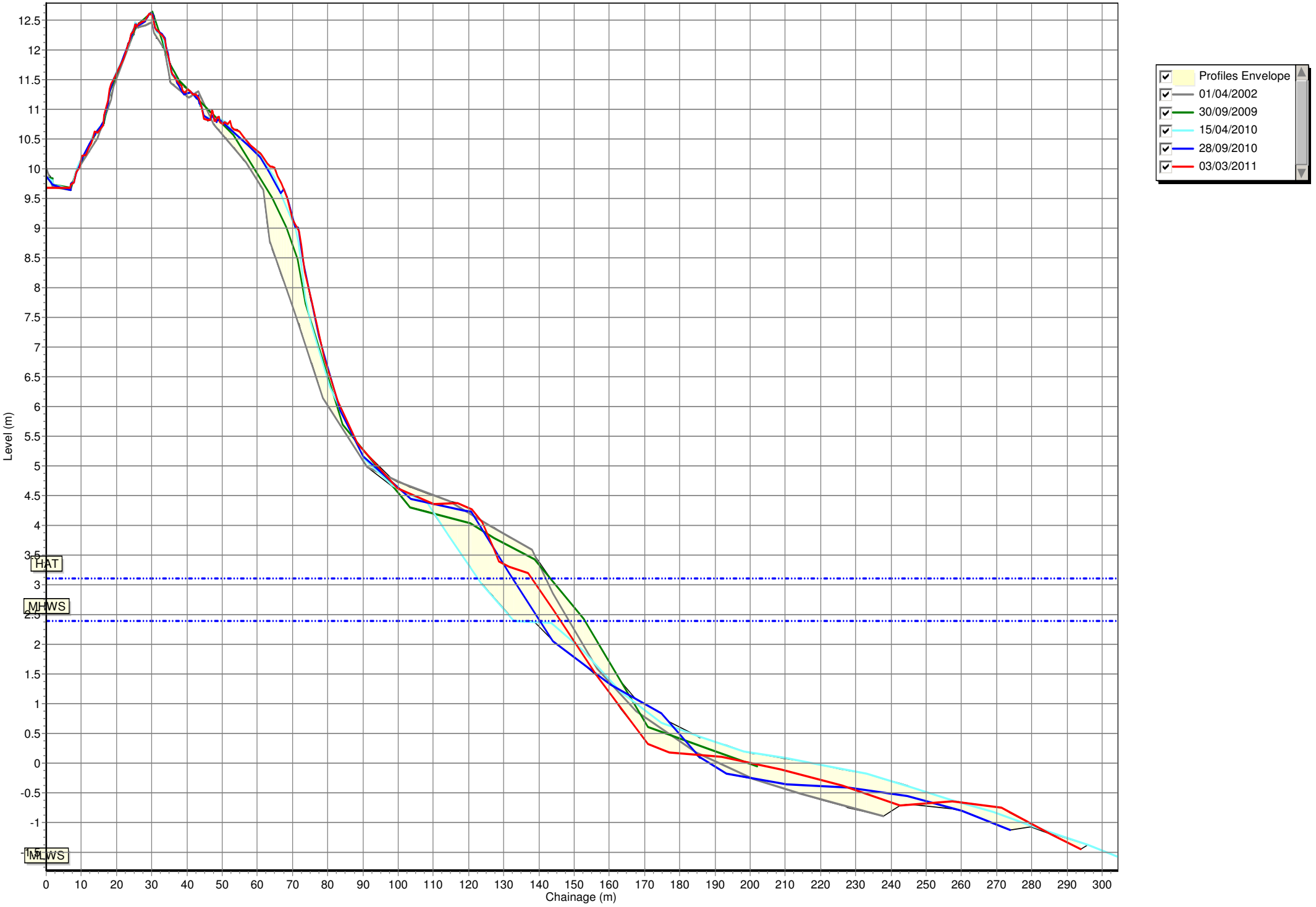
Beach Profiles: 1aBVBC03

Beach Profiles: 1aBVBC04



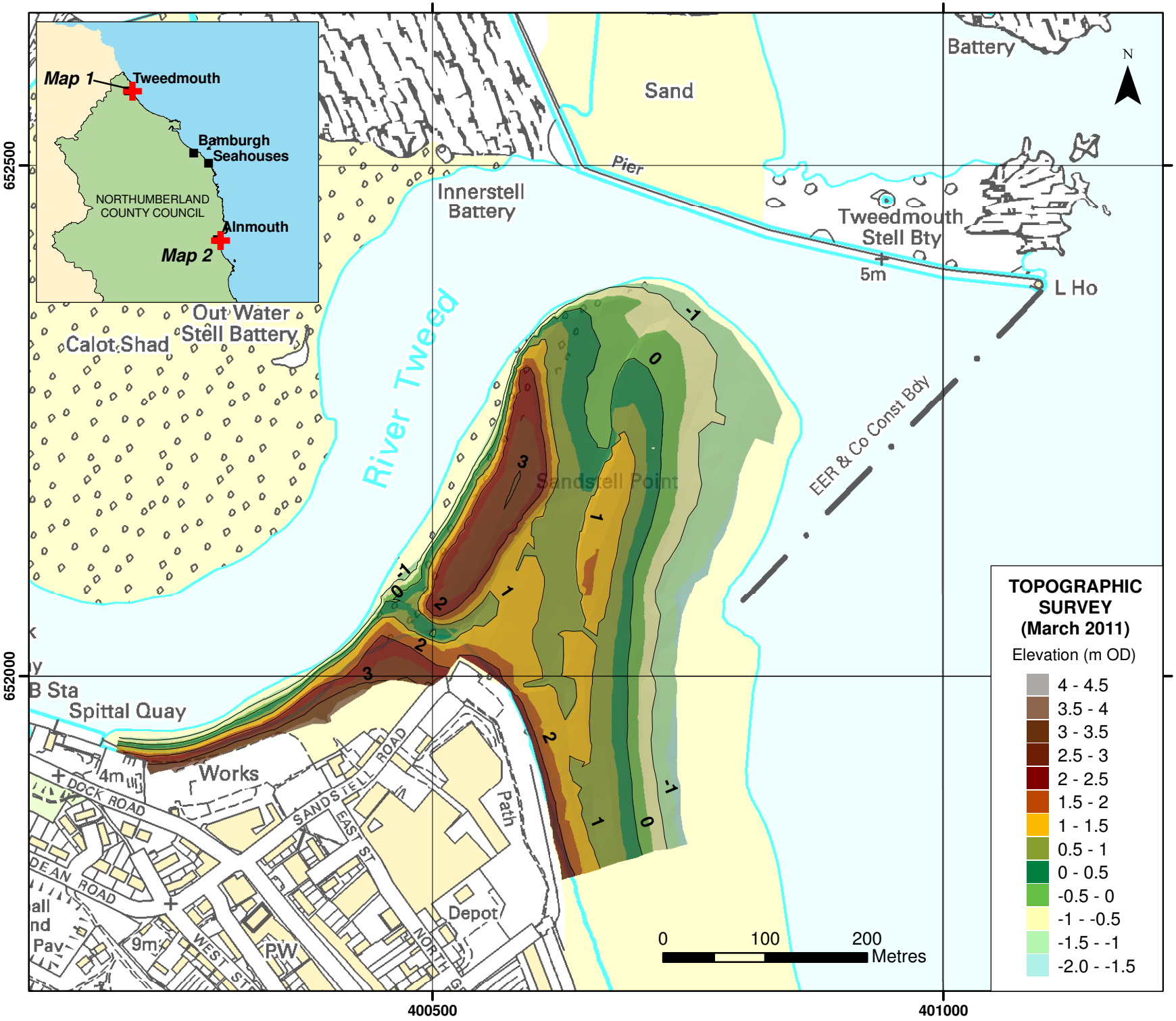
Beach Profiles: 1aBVBC05

Beach Profiles: 1aBVBC06



Appendix B

Topographic Surveys



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 3
'Partial Measures' Survey 2011

Drawing Scale 1:5,000 at A4

Drawn by:	TC	Date: 20/04/2011
Checked by:	NC	Date: 05/05/2011
Approved by:	NC	Date: 05/05/2011

ROYAL HASKONING

Royal Haskoning
Marlborough House
Marlborough Crescent
Newcastle upon Tyne
NE1 4EE

Tel: +44 (0)191 211 1300
Fax: +44 (0)191 211 1313
www.royalhaskoning.com

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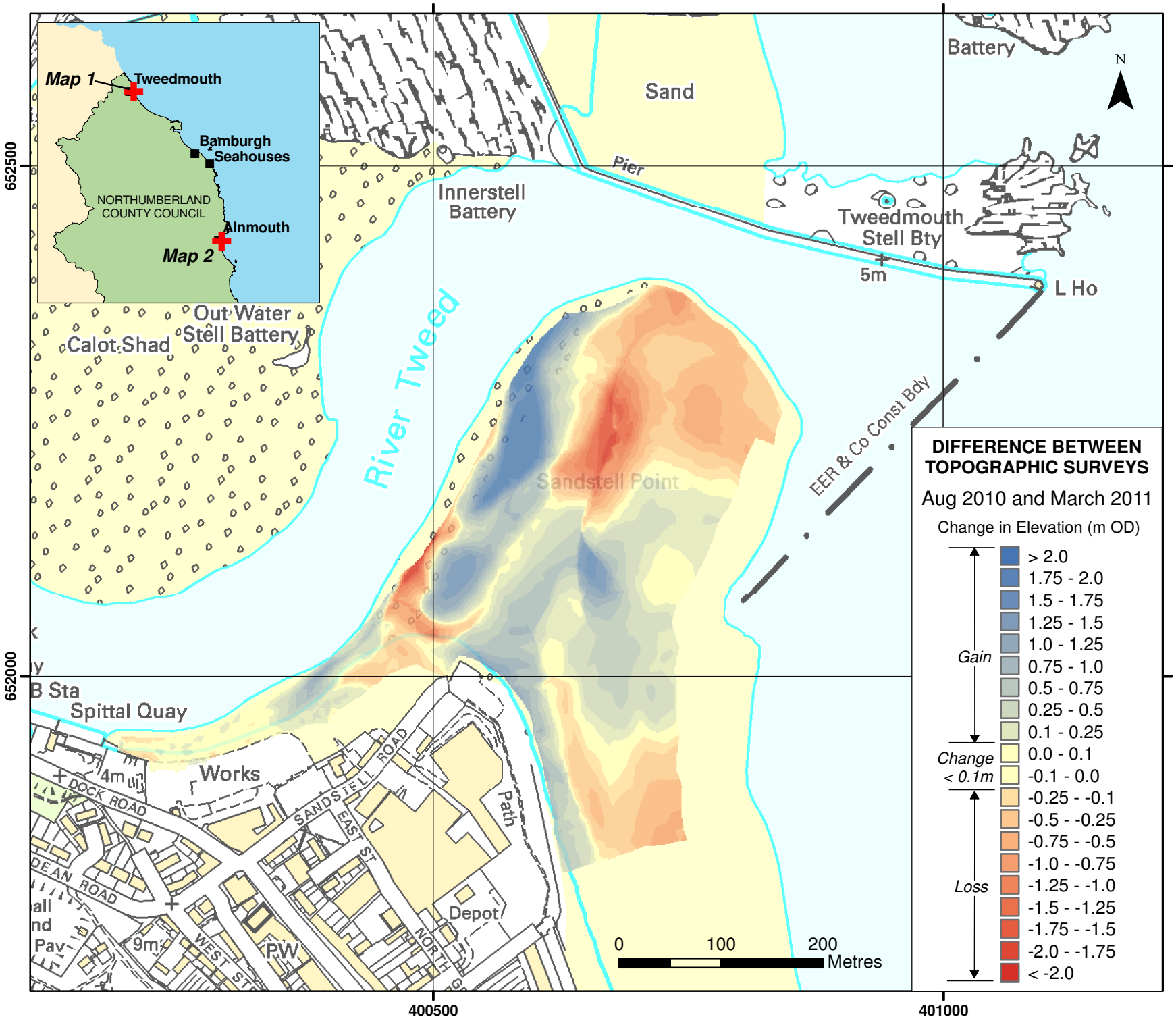

DIFFERENCE BETWEEN TOPOGRAPHIC SURVEYS

Aug 2010 and March 2011

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 3
'Partial Measures' Survey 2011

Drawing Scale 1:5,000 at A4

Drawn by:	TC	Date:	20/04/2011
Checked by:	NC	Date:	05/05/2011
Approved by:	NC	Date:	05/05/2011

ROYAL HASKONING
Royal Haskoning
Marlborough House
Marlborough Crescent
Newcastle upon Tyne
NE1 4EE

Tel: +44 (0)191 211 1300
Fax: +44 (0)191 211 1313
www.royalhaskoning.com

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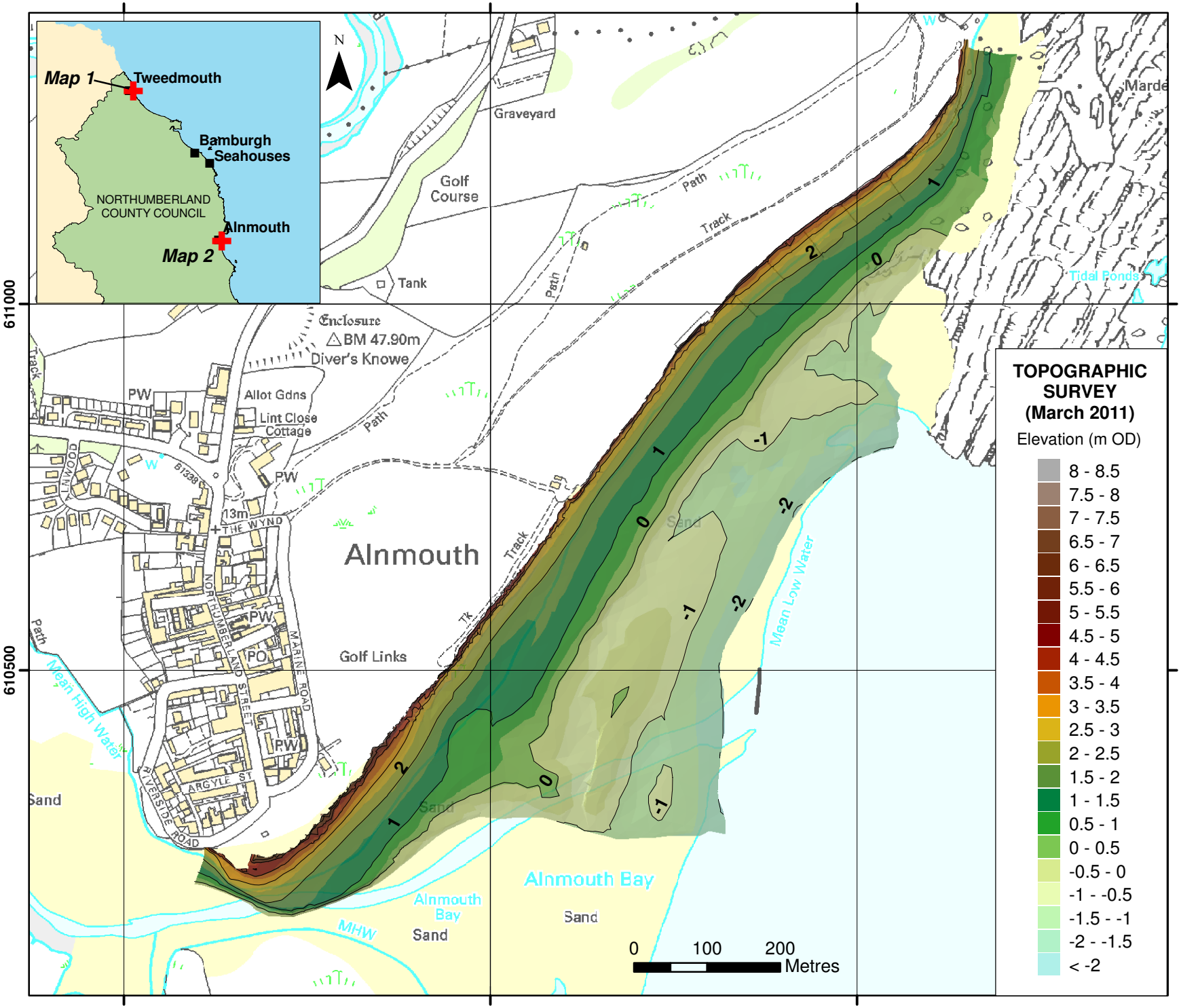

TOPOGRAPHIC SURVEY (March 2011)

Elevation (m OD)

- 8 - 8.5
- 7.5 - 8
- 7 - 7.5
- 6.5 - 7
- 6 - 6.5
- 5.5 - 6
- 5 - 5.5
- 4.5 - 5
- 4 - 4.5
- 3.5 - 4
- 3 - 3.5
- 2.5 - 3
- 2 - 2.5
- 1.5 - 2
- 1 - 1.5
- 0.5 - 1
- 0 - 0.5
- -0.5 - 0
- -1 - -0.5
- -1.5 - -1
- -2 - -1.5
- < -2

— 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 3
'Partial Measures' Survey 2011

Drawing Scale 1:7,000 at A4

Drawn by:	TC	Date:	05/05/2011
Checked by:	NC	Date:	12/05/2011
Approved by:	NC	Date:	12/05/2011

ROYAL HASKONING

Royal Haskoning
Marlborough House
Marlborough Crescent
Newcastle upon Tyne
NE1 4EE

Tel: +44 (0)191 211 1300
Fax: +44 (0)191 211 1313
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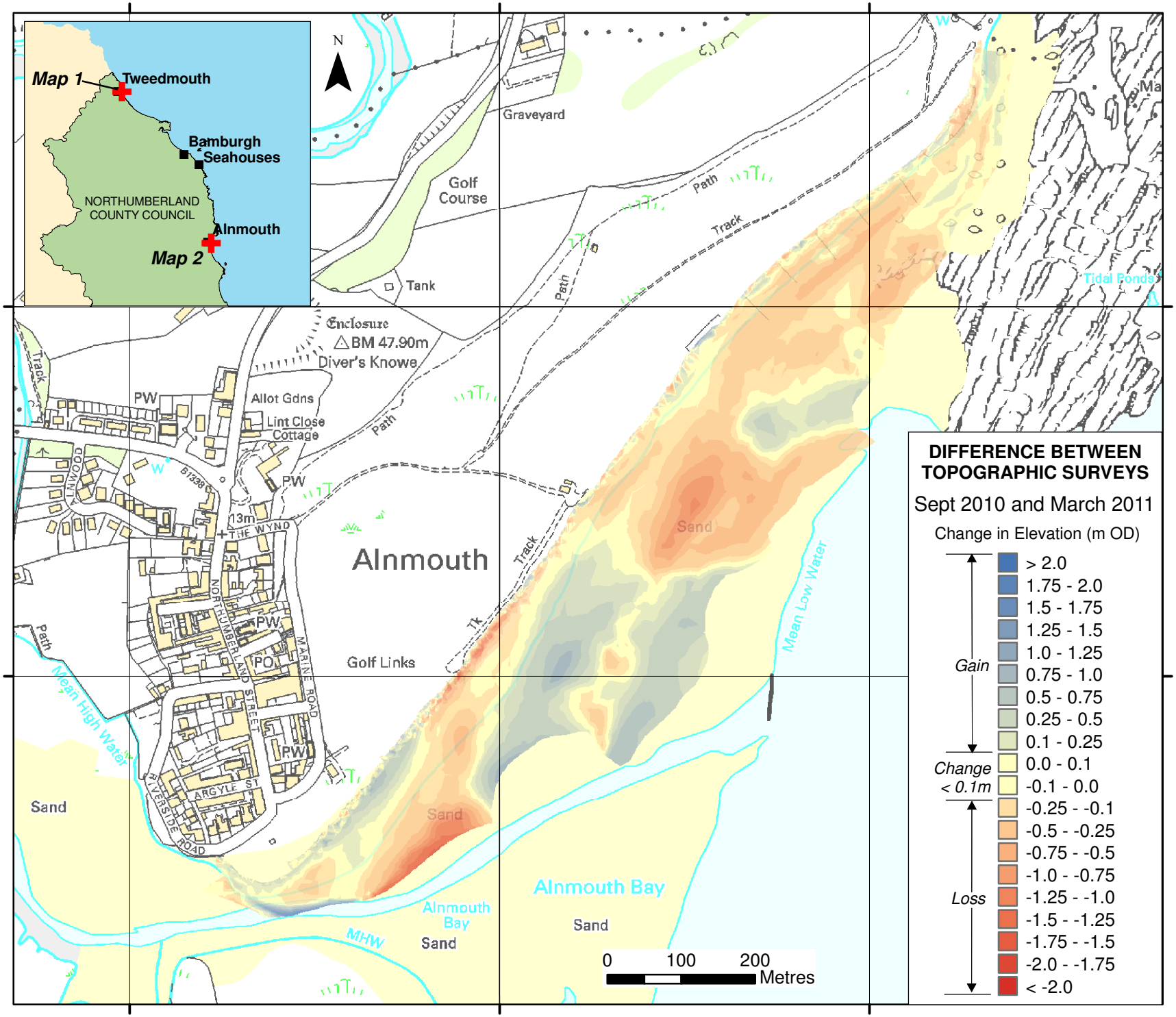

DIFFERENCE BETWEEN TOPOGRAPHIC SURVEYS

Sept 2010 and March 2011

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
	-0.25 - -0.1
	-0.5 - -0.25
	-0.75 - -0.5
	-1.0 - -0.75
Loss	-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 2b Northumberland County Council Frontage

Update Report 3
'Partial Measures' Survey 2011

Drawing Scale 1:7,000 at A4

Drawn by:	TC	Date:	05/05/2011
Checked by:	NC	Date:	12/05/2011
Approved by:	NC	Date:	12/05/2011

ROYAL HASKONING
Royal Haskoning
Marlborough House
Marlborough Crescent
Newcastle upon Tyne
NE1 4EE

Tel: +44 (0)191 211 1300
Fax: +44 (0)191 211 1313
www.royalhaskoning.com

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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.