

**Cell 1 Regional Coastal Monitoring Programme
Analytical Report 1: 'Full Measures' Survey 2008**



South Tyneside Council

**South Tyneside Council
Final Report**

May 2009

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Abbreviations and Acronyms

Acronym / Abbreviation	Definition
AONB	Area of Outstanding Natural Beauty
DGM	Digital Ground Model
HAT	Highest Astronomical Tide
LAT	Lowest Astronomical Tide
MHWN	Mean High Water Neap
MHWS	Mean High Water Spring
MLWN	Mean Low Water Neap
MLWS	Mean Low Water Spring
m	metres
ODN	Ordnance Datum Newlyn

Glossary of Terms

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

Preamble

The Cell 1 Regional Coastal Monitoring Programme covers approximately 300km of the north east coastline, from the Scottish Border (just south of St. Abb's Head) to Flamborough Head in East Yorkshire. This coastline is often referred to as 'Coastal Sediment Cell 1' in England and Wales (Figure 1). Within this frontage the coastal landforms vary considerably, comprising low-lying tidal flats with fringing salt marshes, hard rock cliffs that are mantled with glacial till to varying thicknesses, softer rock cliffs, and extensive landslide complexes.

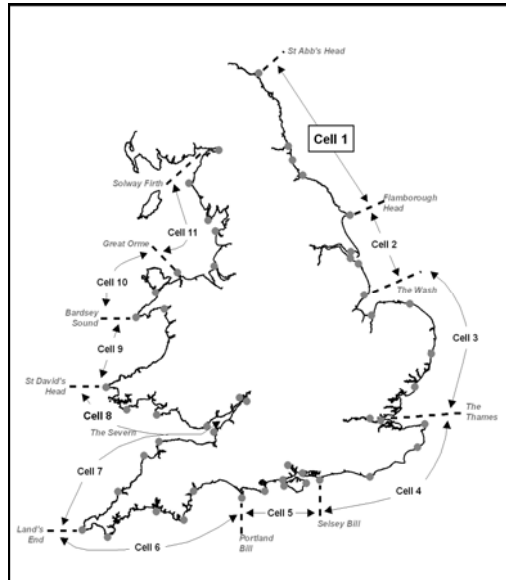


Figure 1 Sediment Cells in England and Wales

The programme commenced in its present guise in September 2008 and is managed by Scarborough Borough Council on behalf of the North East Coastal Group. It is funded by the Environment Agency, working in partnership with the following organisations.



The data collection, analysis and reporting is being undertaken as a partnership between the following organisations:



The main elements of the Cell 1 Regional Coastal Monitoring Programme involve:

- beach profile surveys
- topographic surveys
- cliff top recession surveys
- real-time wave data collection
- bathymetric and sea bed characterisation surveys
- aerial photography
- walk-over surveys

The beach profile surveys, topographic surveys and cliff top recession surveys are undertaken as a 'Full Measures' survey in autumn/early winter every year. Some of these surveys are then repeated the following spring as part of a 'Partial Measures' survey.

Each year, an Analytical Report is produced for each individual authority, providing a detailed analysis and interpretation of the 'Full Measures' surveys.

This is followed by a brief Update Report for each individual authority, providing ongoing findings from the 'Partial Measures' surveys.

Annually, a Cell 1 Overview Report is also produced. This provides a region-wide summary of the main findings relating to trends and interactions along the entire Cell 1 frontage.

To date the following reports have been produced:

Table 1 Analytical, Update and Overview Reports Produced to Date

Year		Full Measures		Partial Measures		Cell 1 Overview Report
		Survey	Analytical Report	Survey	Update Report	
1	2008/09	Sep-Dec 08	May 09 ^(*)	Mar-May 09		-

^(*) The present report is **Analytical Report 1** and provides an analysis of the 2008 'baseline' Full Measures survey for South Tyneside Council's frontage.

In addition, separate reports are produced for other elements of the programme as and when specific components are undertaken, such as wave data collection, bathymetric and sea bed sediment data collection, aerial photography, and walk-over visual inspections.

For purposes of analysis, the Cell 1 frontage has been split into the sub-sections listed in the Table 2.

Table 2 Sub-divisions of the Cell 1 Coastline

Authority	Zone
Northumberland County Council	Spittal A
	Spittal B
	Goswick Sands
	Holy Island
	Bamburgh
	Beadnell Village
	Beadnell Bay
	Embelton Bay
	Boulmer
	Alnmouth Bay
	High Hauxley and Druridge Bay
	Lynemouth Bay
	Newbiggin Bay
	Cambois Bay
	Blyth South Beach
North Tyneside Council	Whitley Sands
	Cullercoats Bay
	Tynemouth Long Sands
	King Edward's Bay
South Tyneside Council	Littehaven Beach
	Herd Sands
	Trow Quarry (incl. Frenchman's Bay)
	Marsden Bay
Sunderland Council	Whitburn Bay
	Harbour and Docks
	Hendon to Ryhope (incl. Halliwell Banks)
Durham County Council	Featherbed Rocks
	Seaham
	Blast Beach
	Hawthorn Hive Blackhall Colliery
Hartlepool Borough Council	North Sands
	Headland
	Middleton
	Hartlepool Bay
Redcar & Cleveland Borough Council	Coatham Sands
	Redcar Sands
	Marske Sands
	Saltburn Sands
	Cattersty Sands (Skinningrove)
Scarborough Borough Council	Staithes
	Runswick Bay
	Sandsend Beach, Uppgang Beach and Whitby Sands
	Robin Hood's Bay
	Scarborough North Bay
	Scarborough South Bay
	Cayton Bay
Filey Bay	

1. Introduction

1.1 Study Area

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

- Littlehaven Beach
- Herd Sands
- Trow Quarry (incl. Frenchman's Bay)
- Marsden Bay

1.2 Methodology

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

- Full Measures survey annually each autumn/early winter comprising:
 - Beach profile surveys along 17 no. transect lines
 - Topographic survey along Herd Sands
 - Topographic survey along Trow Quarry (extending to Frenchman's Bay)
- Partial Measures survey annually each spring comprising:
 - Beach profile surveys along 11 no. transect lines
- Cliff top survey (in Full Measures and Partial Measures but only once every 2 years) at:
 - Trow Point

The location of these surveys is shown in Figure 2. Also enclosed on the accompanying CD-ROM is a file which can be opened in Google Earth showing the locations of the surveys.

The baseline Full Measures survey was undertaken along this frontage in November 2008, when weather conditions were rainy with moderate winds. The sea state was rough.

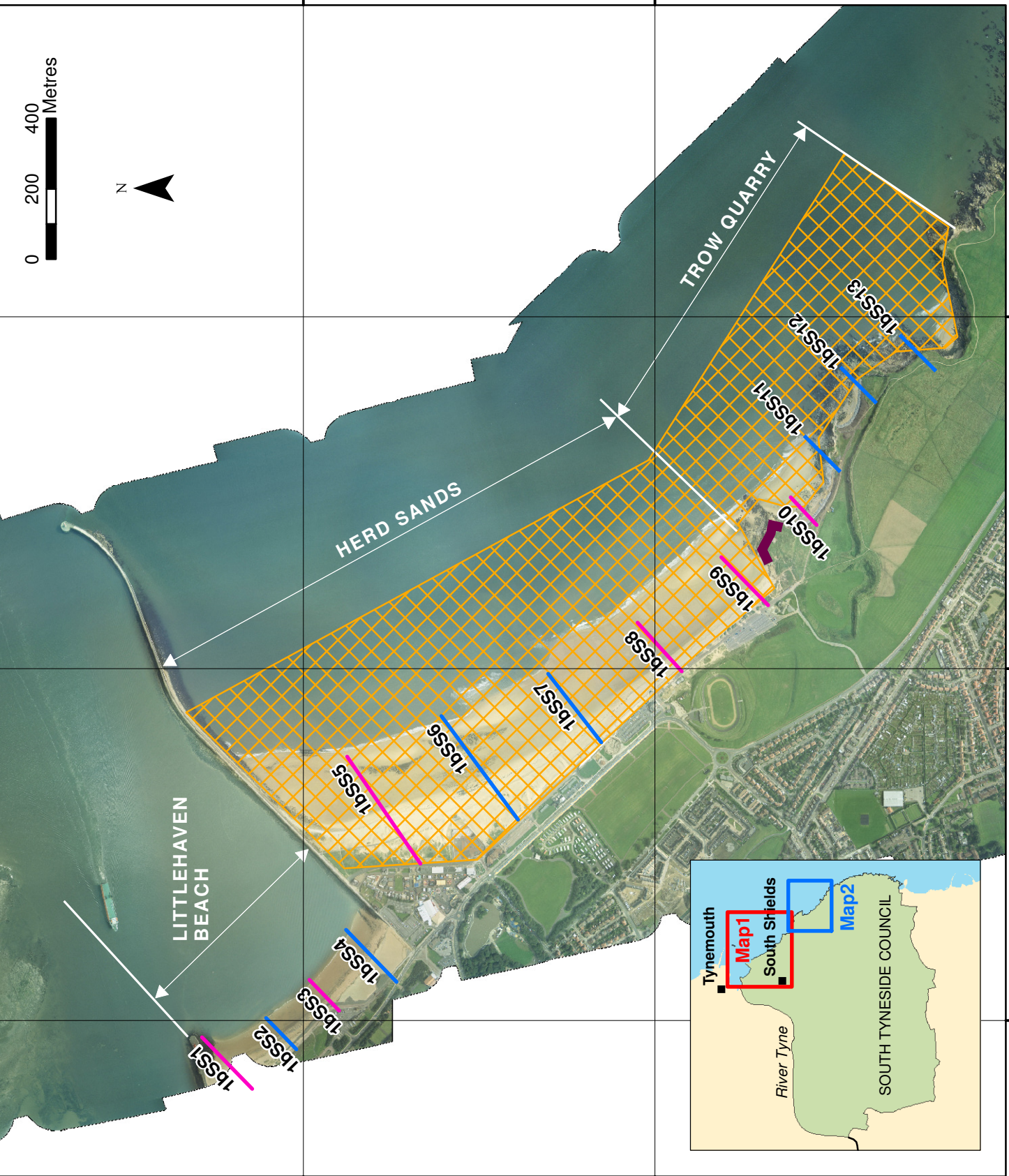
All data have been captured in a manner commensurate with the principles of the Environment Agency's *National Standard Contract and Specification for Surveying Services* and stored in a file format compatible with the software systems being used for the data analysis, namely SANDS and Arc-GIS. This data collection approach and file format is comparable to that being used on other regional coastal monitoring programmes, such as in the South East and South West of England.

Upon receipt of the data from the survey team, they are quality assured and then uploaded onto the programme's website for storage and availability to others and also input to SANDS and GIS for subsequent analysis.

The Analytical Report is then produced following a standard structure for each authority. This involves:

- description of the changes observed since the previous survey and an interpretation of the drivers of these changes (Section 2);
- documentation of any problems encountered during surveying or uncertainties inherent in the analysis (Section 3);
- recommendations for 'fine-tuning' the programme to enhance its outputs (Section 4); and
- providing key conclusions and highlighting any areas of concern (Section 5).

Data from the present survey are presented in a processed form in the Appendices.



- SURVEY LOCATIONS**
- Topographic Profiles**
- Annual
 - Bi-Annual
- Topographic Surveys**
- 6 monthly
 - yearly
 - 5 yearly
- Cliff Top Monitoring Pegs**
- @ 50 centres
 - @ 100 centres
 - @ 300 centres
- (Indicative Survey Extents shown)*

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Figure 2 - Map 1
South Tyneside
Council Frontage

Analytical Report 1
 'Full Measures' Survey 2008

Drawing Scale 1:15,000 at A4

Drawn by: TC Date: 08/05/2009

Checked by: NC Date: 08/05/2009

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SURVEY LOCATIONS

Topographic Profiles

- Annual
- Bi-Annual

Topographic Surveys

- 6 monthly
- yearly
- 5 yearly

Cliff Top Monitoring Pegs

- @ 50 centres
- @ 100 centres
- @ 300 centres

(Indicative Survey Extents shown)

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

Figure 2 - Map 2 South Tyneside Council Frontage

Analytical Report 1
 'Full Measures' Survey 2008

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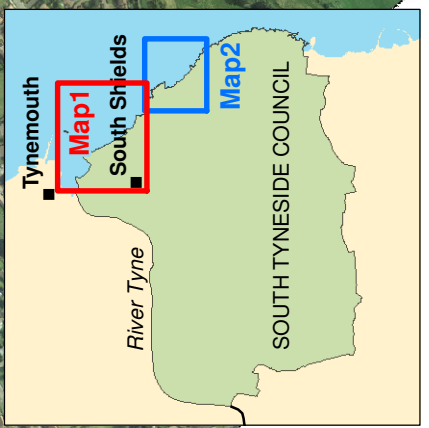
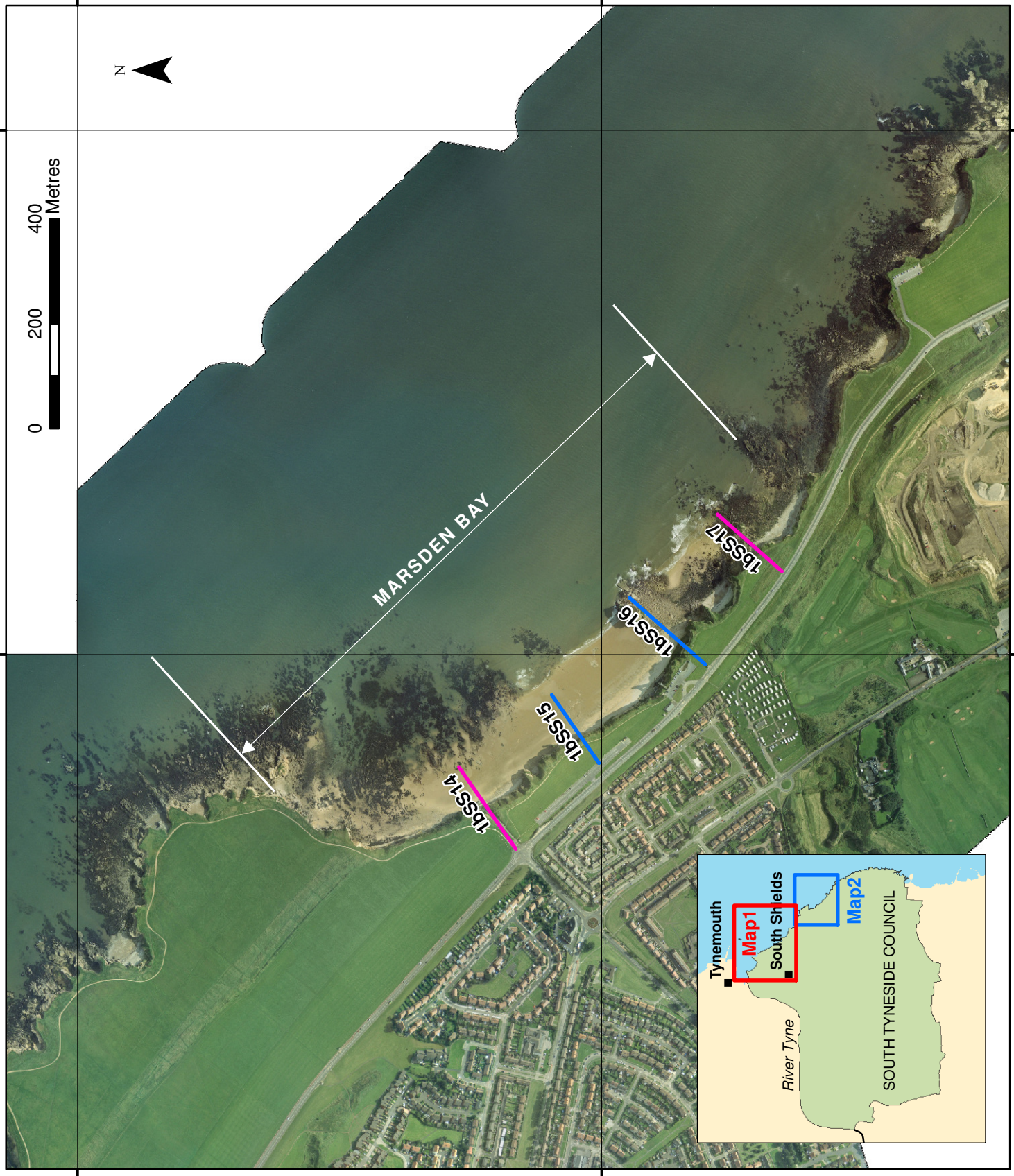


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2. Analysis of Survey Data

2.1 Littlehaven Beach

Survey Date	Description of Changes Since Last Survey	Interpretation
<p>11-2008 (Baseline)</p>	<p>Beach Profiles:</p> <p>Littlehaven Beach is covered by four beach profile lines, spaced between South Groyne and South Pier (Appendix A).</p> <p>SS1 is at the northern end, close to the Little Haven Hotel. The profile line starts across some of the hotel grounds before crossing the dunes and extending across the foreshore to low water. The dune crest level peaks at around 5.8mODN, with the backing land varying between 5.2mODN and 5.4mODN. The dunes and backing land are located well above the levels of MHWS, HAT and the 1 in 200 year extreme water level event.</p> <p>Profiles SS2 and SS3 are located in front of the Littlehaven Sea Wall – an area of present ongoing investigation into options for re-alignment. SS2 is about 75m south of the <i>Conversation Piece</i> art feature and the profile starts across open amenity land before crossing the seawall and then extending down the beach to around MLWS level. The seawall crest is recorded as peaking at about 4.5mODN, with sand levels at the toe of the wall at around 4.1mODN. Both of these levels are well above levels of MHWS and HAT, but the 1 in 200 year extreme sea level would interact with beach material (as presently recorded) only around 7m away from the face of the wall.</p> <p>SS3 shows a very different profile, with low beach levels at the toe of the wall. This profile line is located close to where the seawall protrudes seaward. It starts across the car park and then crosses the seawall crest, which peaks at around 4.4mODN. There is then a drop of some 1.8m down to beach levels. From the toe of the seawall, the beach profile extends down to around MHWS.</p> <p>SS4 is at the southern end of the beach, where the seawall is set further landward. The profile line starts across the dune/scrubland seaward of the B1334 road and extends across the seawall to the beach. There is a substantial width of beach, of around 60m, where levels are at or around a very healthy value of 3.9mODN before the profile levels drop down to MLWS.</p>	<p>The dunes in the north of Littlehaven Beach along SS1 are expected to be relatively stable as long as the sheltering effect of the South Groyne and both the North and South Piers at the entrance to the River Tyne estuary remains.</p> <p>If beach levels along SS2 were to drop, it could be envisaged that the toe of the seawall may be exposed and subject to attack. If high water levels combined with storm wave conditions, upper beach material could readily be removed.</p> <p>Low beach levels along SS3 give rise to some concern since it could lead to undermining of the wall toe, or overtopping by waves of the wall crest. The low beach levels at the seawall also offer only limited protection to the wall itself against direct wave attack.</p> <p>Beach width and levels along SS4 are relatively healthy, helped by the groyne-effect of the South Pier which acts to retain sand within Littlehaven Beach.</p>

2.2 Herd Sands

Survey Date	Description of Changes Since Last Survey	Interpretation
<p>11-2008 (Baseline)</p>	<p>Beach Profiles:</p> <p>Herd Sands is covered by five beach profile lines, spaced between South Pier and the rock headland of Trow Point (Appendix A).</p> <p>SS5, at the northern end, starts across the dunes that have built up immediately adjacent to the South Pier. These dunes are around 150m in width and contain several ridges. The landward dune crest peaks at a maximum crest level of 7.2mODN. The seaward face of the dunes exhibits a relatively steep and very distinct slope, leading down to the foreshore. MHWS acts mid-way up this distinct slope. Beach levels in front of the toe of this slope are relatively low, being around 0.7mODN and shelve steeply down to low water.</p> <p>There is a slightly narrower width of dunes, around 100m, along SS6. Here there are only two distinct dune crests, both quite narrow and steep. The seaward crest is the highest, reaching a crest level of around 7.7mODN. The toe of this fronting ridge is well above HAT, being at around 4mODN, but upper beach levels just 10m or so in front of the toe are within a zone located between the levels of MHWS and the 1 in 200 year storm event.</p> <p>Along SS7, the profile line starts at the promenade in front of the amphitheatre, at a level of around 4.9mODN, and extends seaward across the foreshore. Beach levels at the toe of the promenade were healthy and reached almost up to promenade level.</p> <p>SS8 is located near to Gypsies' Green and extends from the promenade seaward across the foreshore. This promenade severs the backing dune/scrubland from the fronting beach. The promenade reaches a crest level of just under 5.4mODN, but there is a sudden drop of some 0.8m down to beach levels. From the toe of the defence, a narrow width of around only 20m exists before the beach levels drop, initially very steeply and then more gradually, down to low water.</p> <p>At the southern end of Herd Sands, SS9 shows that a narrow but high (around 9.8mODN) dune ridge has developed in the lee of Trow Point. The toe of these dunes and upper beach levels are relatively healthy, with the profile exhibiting a classic concave morphology down to low water.</p>	<p>It appears that MHWS would act part-way up the slope on the seaward face of the dunes along SS5. This suggests that covered by the wind-blown sand may be an underlying structure of some form which is helping to stabilise the dunes.</p> <p>SS6 could be subject to erosion at the toe of the dunes during storm events, especially if coinciding with high spring tides. Due to the steep and narrow morphology of the seaward dune crest, this could lead to step-back of the shoreline during a major event.</p> <p>SS7 presently has healthy beach levels in front of the promenade.</p> <p>SS8 has low and relatively narrow beach levels in front of the promenade, with a relatively rapidly shelving profile to seaward. It will be important to continue to monitor this section for changes in beach levels that could lead to increased exposure for the promenade. It is the frontage between the amphitheatre and Gypsies' Green that appears the most vulnerable, based on the DGM that has been created from the topographic survey.</p> <p>From SS9 it appears that Trow Point provides an important anchoring effect on Herd Sands, by stabilising beach levels, leading to dune development, in the southern part of the frontage.</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>Topographic Survey:</p> <p>Herd Sands is covered by an annual topographic survey between the South Pier and Trow Point. Data have been used to create a DGM (Appendix B – Map 1).</p> <p>This DGM shows the high topographic level contours in the north of the frontage and along a thin narrow strip to the south of the bay, where the dunes are present in both areas. Also notable is how the levels drop in the area between the amphitheatre and Gypsies' Green.</p> <p>This DGM will be used as a baseline against which future topographic surveys will be compared on an annual basis to identify areas of accretion and erosion.</p>	

2.3 Trow Quarry

Survey Date	Description of Changes Since Last Survey	Interpretation
<p>11-2008 (Baseline)</p>	<p>Beach Profiles:</p> <p>Trow Quarry is covered by four profile lines (Appendix A).</p> <p>SS10 is in the northern end of Graham's Sand and was surveyed following completion of the rock armour revetment in this bay in November 2008. The profile line starts on the amenity grassland at Trow Lea (around 9.7mODN) and then extends across the re-graded coastal slope, the revetment structure, and the foreshore. The undulation in foreshore level between around 60m and 90m chainage is where some rock outcrops exist.</p> <p>SS11 is at the very southern end of Graham's Sand and extends from the coastal slope (around 9.6mODN) across the temporary construction haul road. Where the profile increases dramatically in level, between 34m and 39m chainage, it is clipping the western edge of Target Rock. Just seaward of here, the profile runs across rocky foreshore, as indicated by the sharp variations in level, before reaching more uniform levels.</p> <p>SS12 is located towards the southern end of Southern Bay and extends from the amenity grassland (around 14.7mODN) down the re-graded coastal slope and across the rock armour revetment to the foreshore, from where levels gradually drop down to low water.</p> <p>SS13 is located just to the east of Frenchman's Point and extends from the cliff top amenity grassland (21.2mODN) to the near vertical cliff edge. There is then a rocky foreshore located at the toe of the cliffs.</p>	<p>SS10 shows that the rock armour revetment, completed in 2008, was maintaining its 'as built' gradient and foreshore levels at the toe were unaffected by the scheme.</p> <p>SS11 is presently located along an area of coastline that is not envisaged to change in position or level due to the nature of the underlying geology. Whilst the 2008 survey provides a useful characterisation of this section of coast, it is considered more advantageous to move the profile slightly further north to a new location with Graham's Sand.</p> <p>SS12 shows that the rock armour revetment, completed in 2008, was maintaining its 'as built' gradient and foreshore levels at the toe were unaffected by the scheme.</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>Topographic Survey:</p> <p>Trow Quarry is covered by an annual topographic survey within Graham's Sand, Southern Bay and Frenchman's Bay. Data have been used to create a DGM (Appendix B – Map 1).</p> <p>From this DGM, it can be seen that the extent of data coverage is somewhat limited. This is because: (i) construction of the Trow Quarry coastal defence scheme was ongoing at the time of the survey and certain sections of frontage could not be accessed; and (ii) beach levels appeared very low, leaving a large area of bedrock exposed – this area is difficult to survey in a meaningful manner due to the highly undulating nature of the surface topography.</p> <p>In order to gain maximum use from these data, the 2008 baseline DGM has been compared against a DGM created from an earlier survey from October 2006. Appendix B – Map 2 shows the difference in beach levels in the areas that were common to both the October 2006 and the November 2008 surveys. From this 'difference plot' it can be seen that beach levels were several tens of centimetres lower in November 2008 than they were in October 2006 in Graham's Sand (up to 1.0m lower in one place), but were generally higher in the centre of Southern Bay. The low beach levels in November 2008 demonstrate how variable the sand coverage at Trow Quarry can be, since aerial photography from October 2008 shows near complete burial of major rock outcrops in the centre of Graham's Sand by sand. It is anticipated that beach levels at this time were closely matched to those recorded on the October 2006 survey. Consequently, beach levels here are very strongly affected by storm wave conditions which can remove the covering veneer of sand from the rocky foreshore.</p> <p>This DGM will be used as a baseline against which future topographic surveys will be compared on an annual basis to identify areas of accretion and erosion.</p> <p>Cliff-top Survey:</p> <p>Six ground control points have been established around Trow Point for purposes of cliff top monitoring. The maximum separation between any two points is 50m, but in most cases the points are located at much closer spacing. The cliff top surveys are to be undertaken as part of both the Full Measures and Partial Measures surveys, but only once every 2 years. Data collection will involve a distance offset measurement from the ground control point to the cliff edge along a fixed bearing.</p>	<p>Given that SS12 and SS13 are both in relatively stable areas, it is considered more advantageous to move these lines to within Southern Bay so that the effects of the 2008 coastal defence scheme can be better determined. Section 4 contains further details of this recommended 'fine-tuning'.</p> <p>The advantage of having the existing SS12 and SS13 from the baseline survey, however, is that these lines could also be re-surveyed at future intervals and compared against this 2008 baseline.</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
	Appendix C provides results from the 2008 (baseline) survey showing the position from the ground control point to the edge of the cliff top along the defined bearing. Future reports will show results from subsequent surveys and provide a means of assessing erosion since the baseline survey.	

2.4 Marsden Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
<p>11-2008 (Baseline)</p>	<p>Beach Profiles:</p> <p>Marsden Bay is covered by four profile lines (Appendix A).</p> <p>SS14 is located towards the northern end of Marsden Bay, at the northern-most access point. The profile extends across the coastal cliff, which has a bevelled shape, to the concrete platform at the cliff toe. Beach levels at the toe of this structure are relatively low, at around only 2mODN, which means that MHWS will be intercepted by the wall. Beach levels drop from here at a uniform gradient to low water at the time of the survey.</p> <p>SS15 extends from the public car park (at over 30mODN) across the cliff top grassland to the cliff edge. A near-vertical drop then occurs to the cliff toe, where a small amount of scree is deposited. Beach levels then gradually drop off to low water.</p> <p>SS16, which extends out to Marsden Rock, shows a very similar profile, although there is a near-horizontal ledge at the cliff toe.</p> <p>SS17 exhibits a very similar form to SS15 and SS16, although foreshore levels are lower than along SS16.</p>	<p>Low beach levels in the north of the Bay may affect the condition of the wall at the toe of the concrete wall at northern-most access point (SS14).</p> <p>Elsewhere within the Bay (SS15, SS16 and SS17), the behaviour tends to be linked to small and localised rock falls releasing debris to the toe of the cliff, where it accumulates as scree.</p> <p>SS15, which extends out to Marsden Rock, runs across a slightly elevated platform of boulders and scree which has accumulated in the lee of the rock stack, forming a tombolo feature.</p>

3. Problems Encountered and Uncertainty in Analysis

The timing of the Full Measures survey coincided with construction of the Trow Quarry coastal defence scheme. Whilst this did not adversely impact on the beach profile surveys, the extent of the topographic surveying at both Graham's Sand and Southern Bay was limited by ongoing construction activities. Despite this, some survey data was acquired, mainly in areas of foreshore covered by sand, rather than exposed bed rock, and a DGM has been created.

To enhance the analysis in this area, a DGM has also been created using the more comprehensive topographic survey that was undertaken in October 2006 to inform the design of the coastal defence scheme. By comparing those areas successfully surveyed in the 2008 baseline against this pre-scheme DGM, best value has been derived from the more limited 2008 survey.

It is intended that future topographic surveys at Trow Quarry will exhibit improved extents of coverage as the construction activities are now complete and access will be easier.

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

As discussed in Section 2.3, whilst profile lines SS11, SS12 and SS13 provide useful data in their present locations, it is considered that they would provide enhanced benefit if SS11 was relocated within Graham's Sand to better complement the location of SS10, and if both SS12 and SS13 were relocated to within Southern Bay. Suggested revised locations are shown in Figure 3.

No other changes are recommended at the present time.

5. Conclusions and Areas of Concern

- The dunes along the northern section and the beach levels along the southern section of Littlehaven Beach are expected to remain relatively stable as long as the sheltering effect of the South Groyne and both the North and South Piers at the entrance to the River Tyne estuary remain intact. The resulting implication is that these structures need to be adequately maintained into the future.
- The Littlehaven Sea Wall, however, has low beach levels at its toe, particularly where it protrudes seaward to intercept the high water mark. If further lowering occurs, it could lead to undermining of the wall toe, or overtopping by waves of the wall crest. The low beach levels also offer only limited protection to the sea wall itself against direct wave attack.
- In the vicinity of Gypsies' Green, there are low and relatively narrow beach levels in front of the promenade. It will be important to continue to monitor this section for changes in beach levels that could lead to increased exposure for the promenade.
- Trow Point provides an important anchoring effect on Herd Sands and by stabilising beach levels here has helped with the development of a small dune system.
- The rock armour revetment, completed in 2008, remained in an 'as built' configuration, with foreshore levels at the toe of the structure unaffected by the scheme.
- Low beach levels in the north of Marsden Bay may affect the condition of the concrete wall at the toe of the northern-most access point, but elsewhere within the Bay behaviour tends to be linked to small and localised rock falls releasing debris to the toe of the cliff, where it accumulates as scree.

- REVISED SURVEY LOCATIONS**
- Topographic Profiles**
- Annual
 - Bi-Annual
- Topographic Surveys**
- 6 monthly
 - yearly
 - 5 yearly
- Cliff Top Monitoring Pegs**
- @ 50 centres
 - @ 100 centres
 - @ 300 centres
- (Indicative Survey Extents shown)*

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Figure 3 - Map 1
South Tyneside
Council Frontage
 Analytical Report 1
 'Full Measures' Survey 2008

Drawing Scale: 1:15,000 at A4

Drawn by: TC **Date:** 08/05/2009

Checked by: NC **Date:** 08/05/2009

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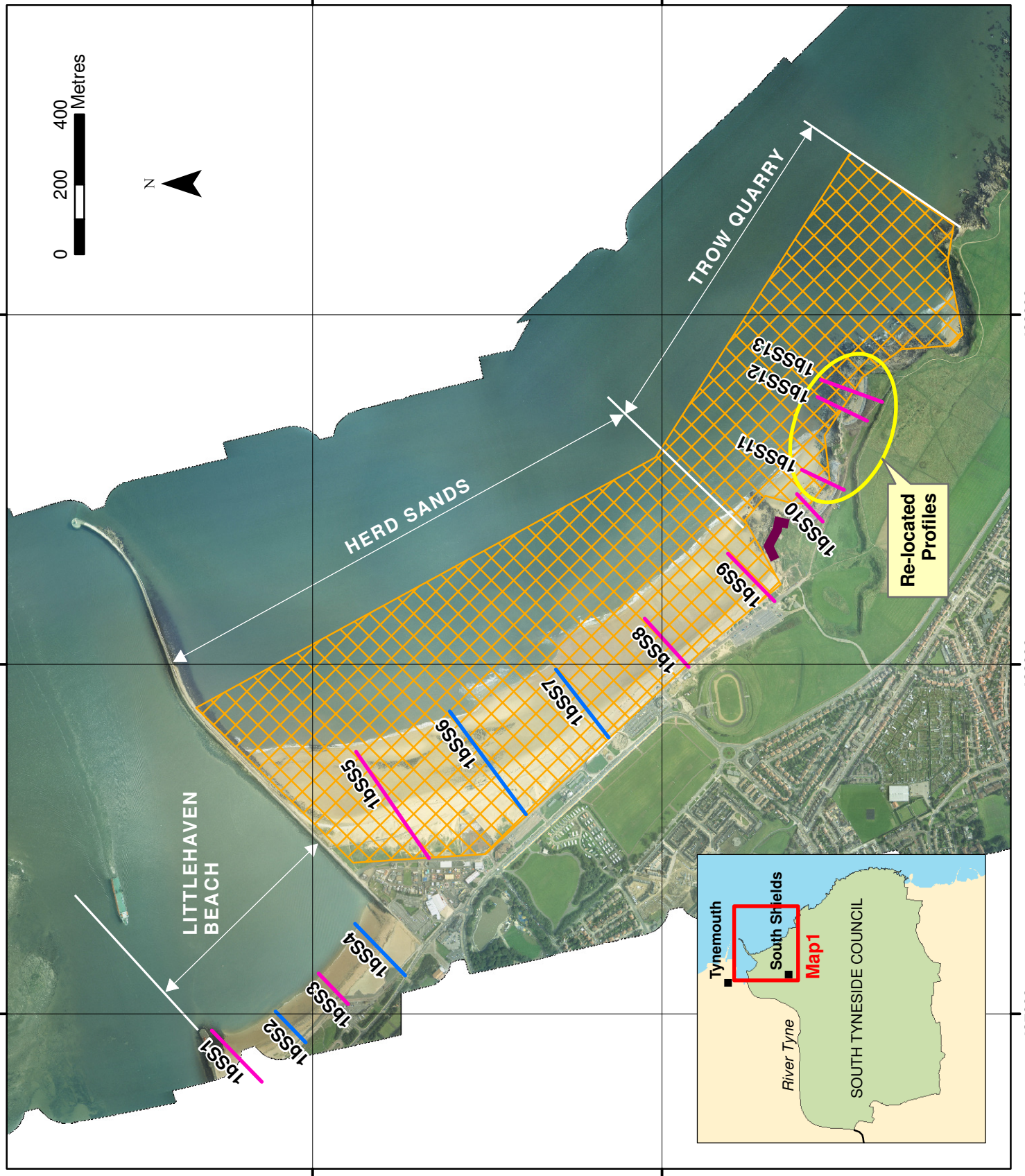
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Appendices

Appendix A
Beach Profiles

Beach Profile

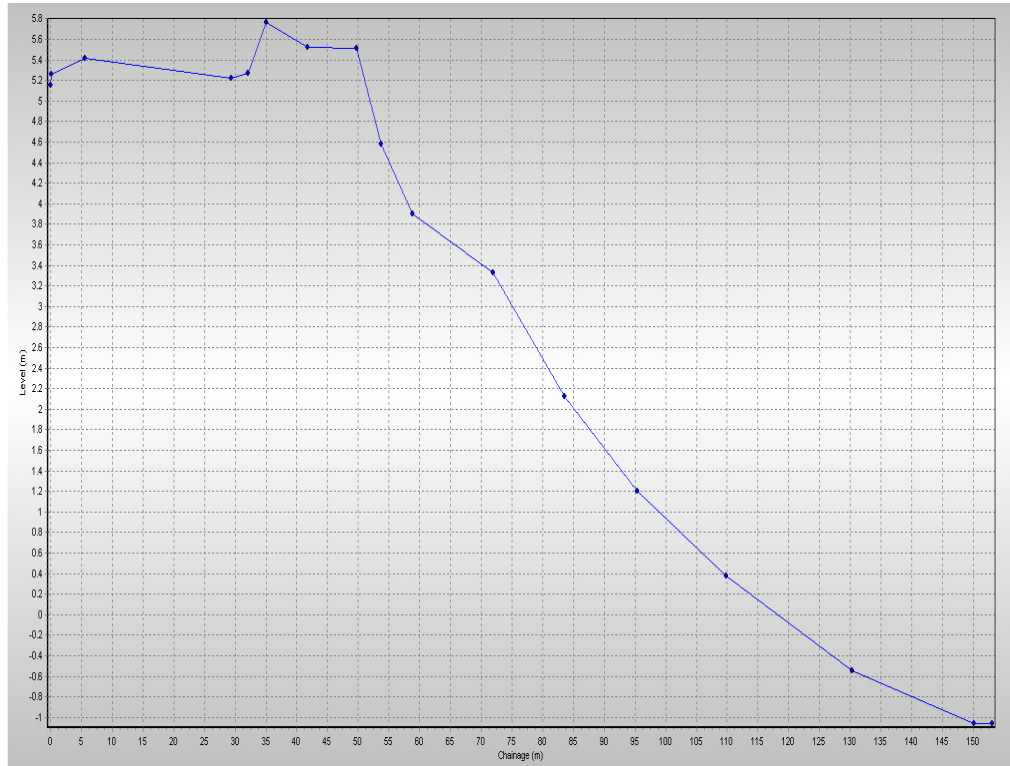
1bSS1

Date 02/11/2008 **Inspector** RH
Wind Light **Sea State**
Summary

Low Tide (m)
Visibility Good **Low Tide Time**
Rain No

Easting 436810.000 **Northing** 568148.060 **Bearing** 45

Chainage	Level
0.000	5.154
0.124	5.257
5.546	5.418
29.331	5.226
32.084	5.272
35.067	5.766
41.722	5.522
49.698	5.514
53.681	4.582
58.886	3.906
71.885	3.326
83.487	2.129
95.436	1.199
109.882	0.374
130.277	-0.544
150.080	-1.061
153.087	-1.058



Beach Profile

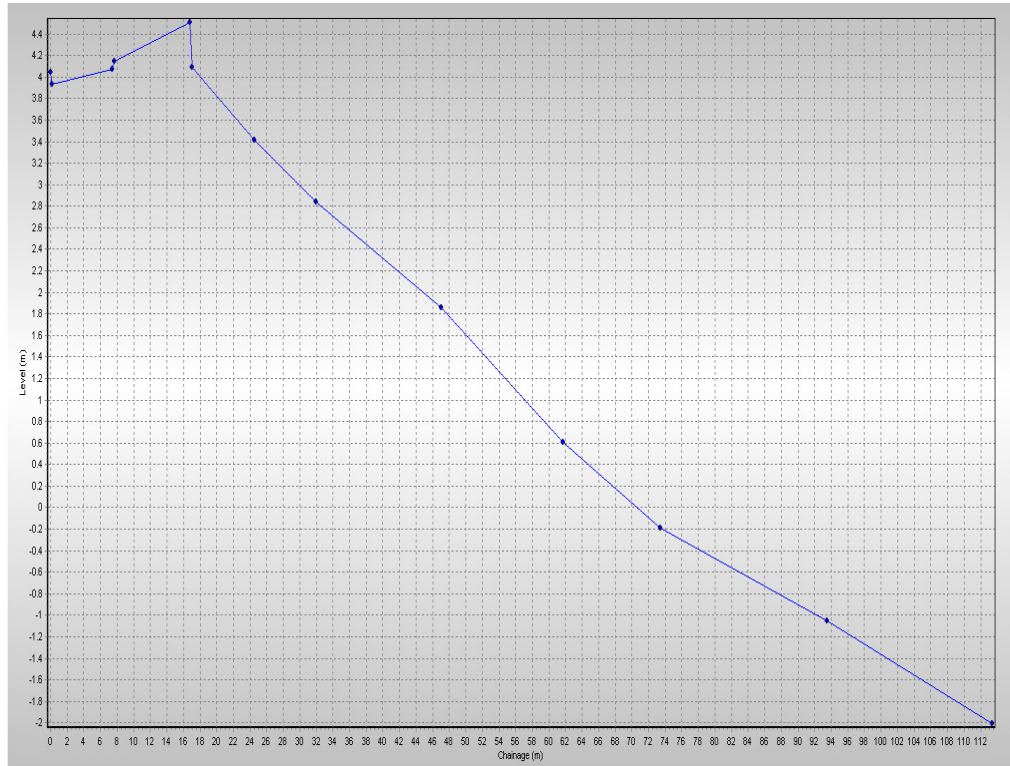
1bSS2

Date 02/11/2008 **Inspector** RH
Wind Light **Sea State**
Summary

Low Tide (m)
Visibility Good **Low Tide Time**
Rain No

Easting 436919.710 **Northing** 568022.390 **Bearing** 45

Chainage	Level
0.000	4.040
0.160	3.935
7.460	4.070
7.640	4.143
16.810	4.508
17.050	4.091
24.520	3.415
31.970	2.836
47.040	1.857
61.740	0.604
73.420	-0.188
93.530	-1.050
113.390	-2.007



Beach Profile

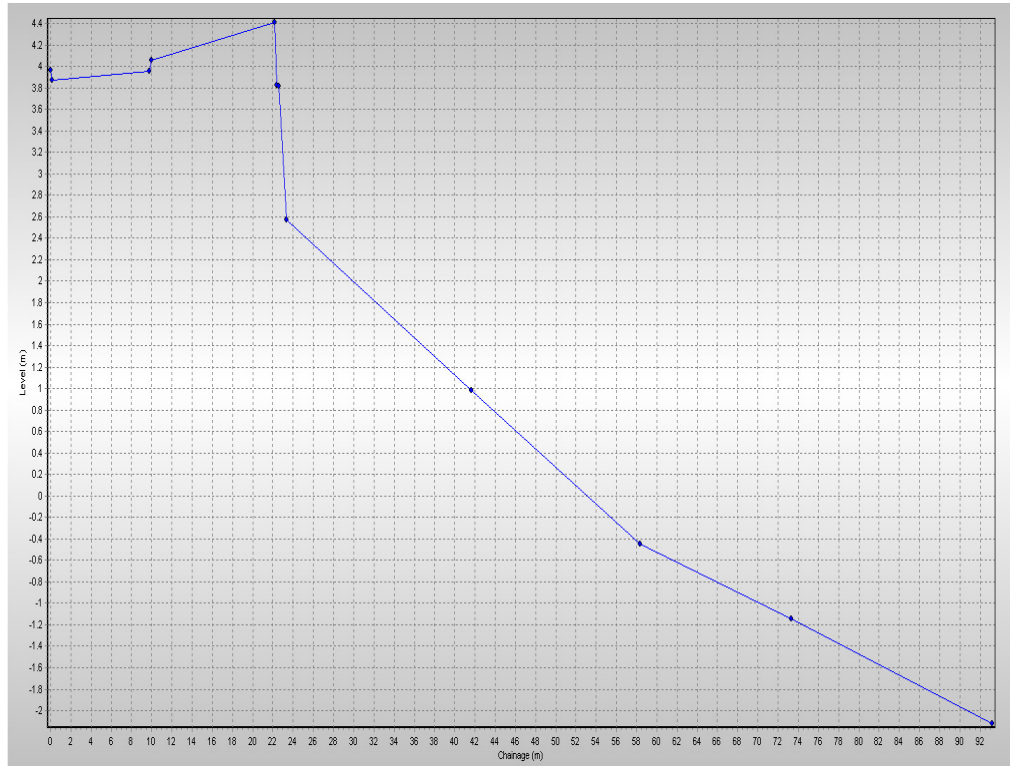
1bSS3

Date 02/11/2008 **Inspector** RH
Wind Light **Sea State**
Summary

Low Tide (m)
Visibility Good **Low Tide Time**
Rain No

Easting 437034.010 **Northing** 567902.480 **Bearing** 45

Chainage	Level
0.000	3.961
0.170	3.873
9.790	3.959
9.980	4.058
22.140	4.410
22.380	3.828
22.610	3.813
23.350	2.575
41.660	0.986
58.370	-0.446
73.280	-1.146
93.200	-2.120



Beach Profile

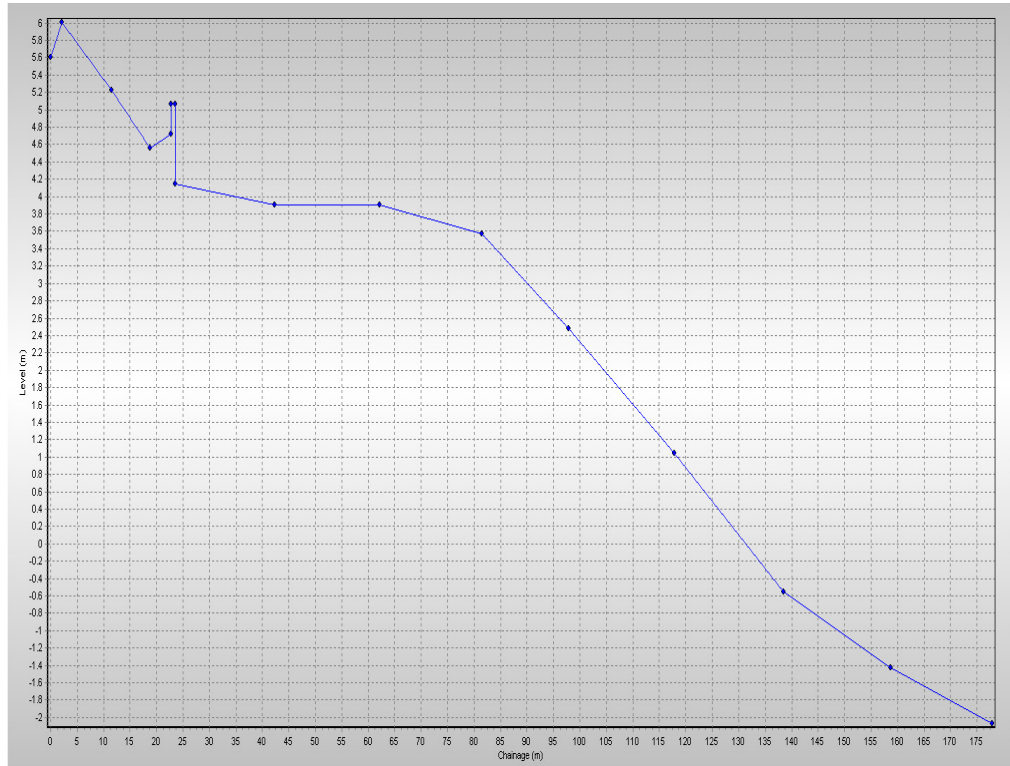
1bSS4

Date 02/11/2008 **Inspector** RH
Wind Light **Sea State**
Summary

Low Tide (m)
Visibility Good **Low Tide Time**
Rain No

Easting 437113.940 **Northing** 567736.450 **Bearing** 45

Chainage	Level
0.000	5.603
2.160	6.007
11.530	5.227
18.800	4.560
22.770	4.715
22.780	5.064
23.530	5.060
23.540	4.143
42.350	3.907
62.100	3.904
81.520	3.573
97.810	2.485
117.870	1.042
138.490	-0.559
158.710	-1.432
177.890	-2.070



Beach Profile

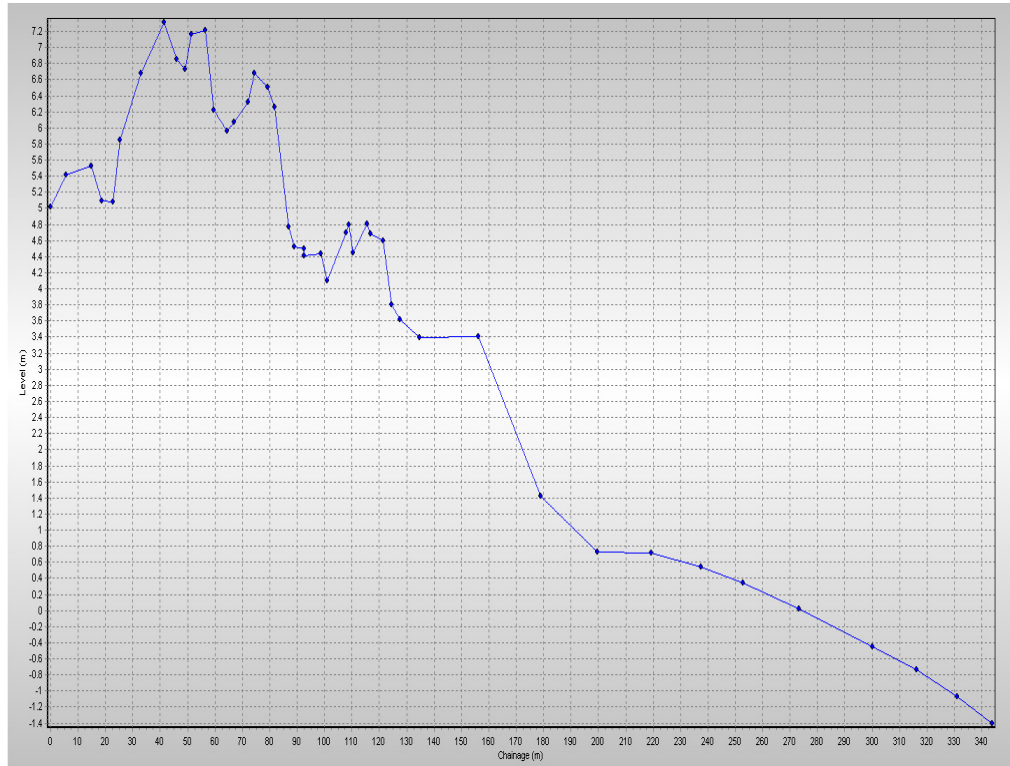
1bSS5

Date 02/11/2008 **Inspector** RH
Wind Light **Sea State**
Summary

Low Tide (m) **Low Tide Time**
Visibility Good **Rain** No

Easting 437448.700 **Northing** 567670.000 **Bearing** 55

Chainage	Level
0.000	5.016
5.715	5.420
14.717	5.531
18.554	5.092
22.763	5.080
25.301	5.843
32.863	6.676
41.535	7.312
46.096	6.858
49.017	6.726
51.379	7.164
56.616	7.219
59.475	6.223
64.499	5.964
67.013	6.067
72.176	6.314
74.328	6.674
79.340	6.511
81.713	6.260
86.790	4.776
89.063	4.528
92.561	4.496
92.615	4.407
98.584	4.431
100.851	4.100
107.873	4.696
108.820	4.794
110.530	4.448
115.604	4.810
116.923	4.688
121.340	4.596
124.474	3.806
127.633	3.616
134.611	3.389
156.152	3.406
178.817	1.420
199.548	0.726
219.422	0.721
237.430	0.544
252.841	0.349
273.175	0.016
300.009	-0.447
316.137	-0.740
331.008	-1.066
343.810	-1.405



Beach Profile

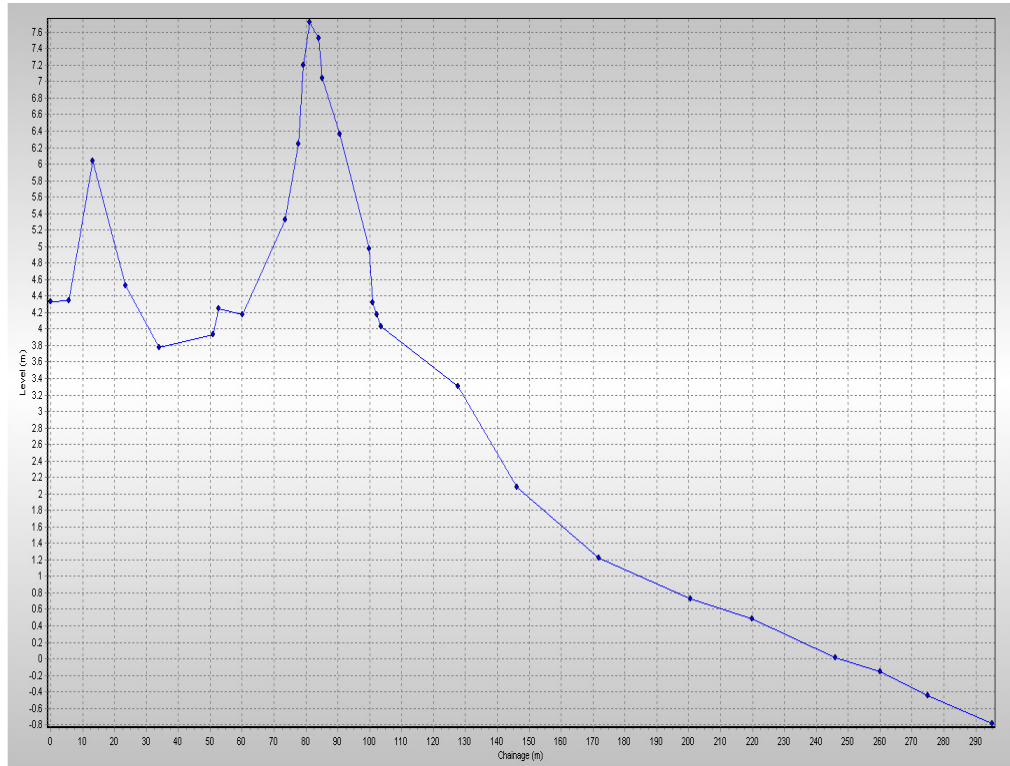
1bSS6

Date 02/11/2008 Inspector RH
Wind Light Sea State
Summary

Low Tide (m) Low Tide Time
Visibility Good Rain No

Easting 437573.880 Northing 567388.820 Bearing 53

Chainage	Level
0.000	4.336
5.727	4.346
13.110	6.040
23.422	4.523
34.045	3.773
50.821	3.937
52.611	4.245
60.018	4.175
73.537	5.324
77.655	6.239
79.158	7.193
81.181	7.718
84.068	7.527
85.128	7.042
90.687	6.365
99.844	4.970
101.042	4.316
102.210	4.176
103.626	4.033
127.609	3.303
146.049	2.087
171.850	1.224
200.512	0.722
219.879	0.479
245.916	0.015
260.039	-0.155
274.970	-0.446
295.129	-0.785



Beach Profile

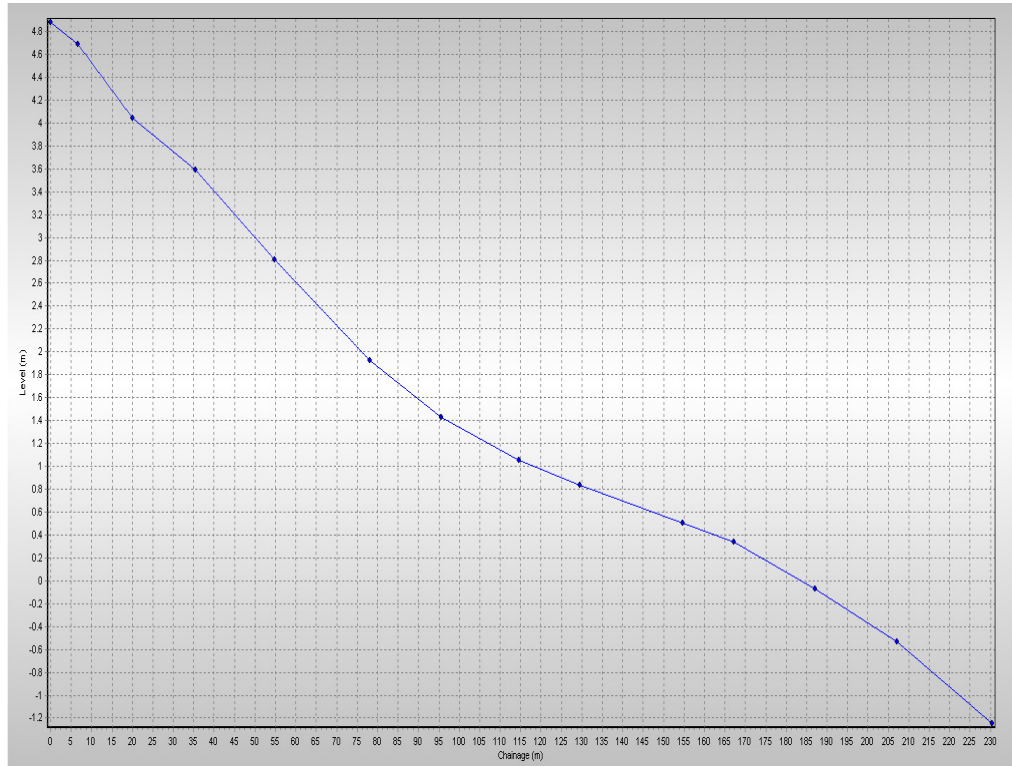
1bSS7

Date 02/11/2008 **Inspector** RH
Wind Light **Sea State**
Summary

Low Tide (m)
Visibility Good **Low Tide Time**
Rain No

Easting 437793.070 **Northing** 567153.710 **Bearing** 52

Chainage	Level
0.000	4.879
6.739	4.684
19.958	4.045
35.406	3.586
54.879	2.804
78.108	1.927
95.543	1.429
114.520	1.050
129.519	0.835
154.628	0.508
167.153	0.334
186.990	-0.071
207.059	-0.531
230.407	-1.248



Beach Profile

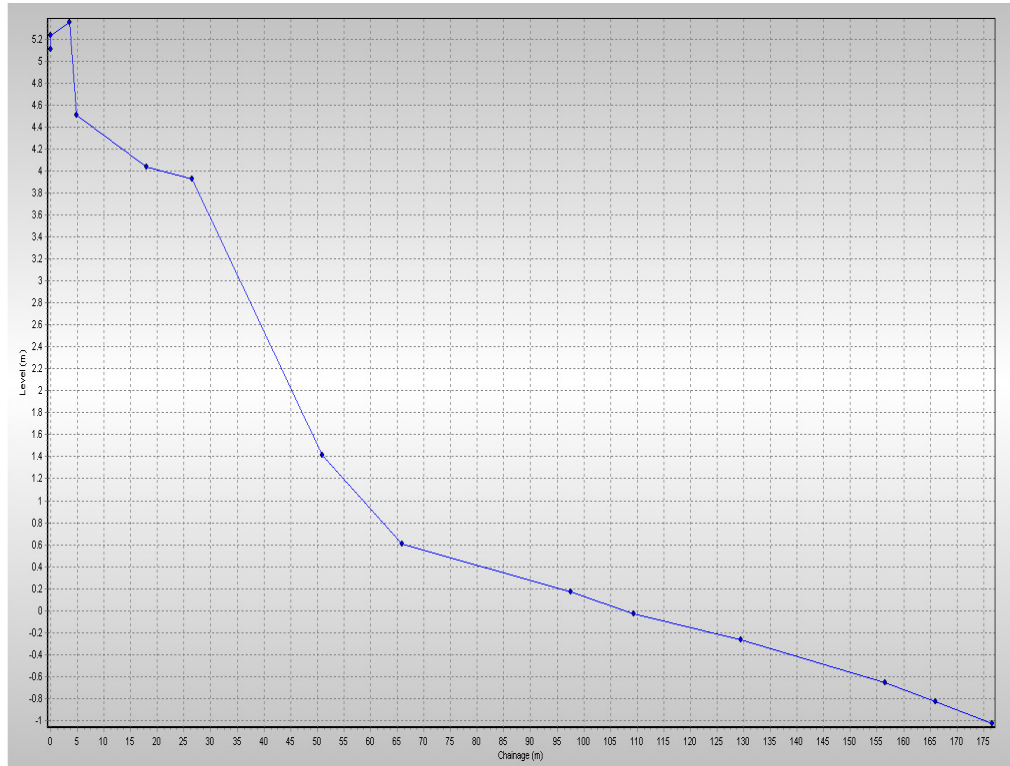
1bSS8

Date 02/11/2008 **Inspector** RH
Wind Light **Sea State**
Summary

Low Tide (m)
Visibility Good **Low Tide Time**
Rain No

Easting 437996.550 **Northing** 566926.500 **Bearing** 48

Chainage	Level
0.000	5.109
0.065	5.235
3.563	5.351
4.795	4.510
17.926	4.031
26.462	3.928
50.957	1.411
65.900	0.603
97.619	0.166
109.346	-0.026
129.402	-0.262
156.575	-0.658
166.005	-0.827
176.599	-1.028



Beach Profile

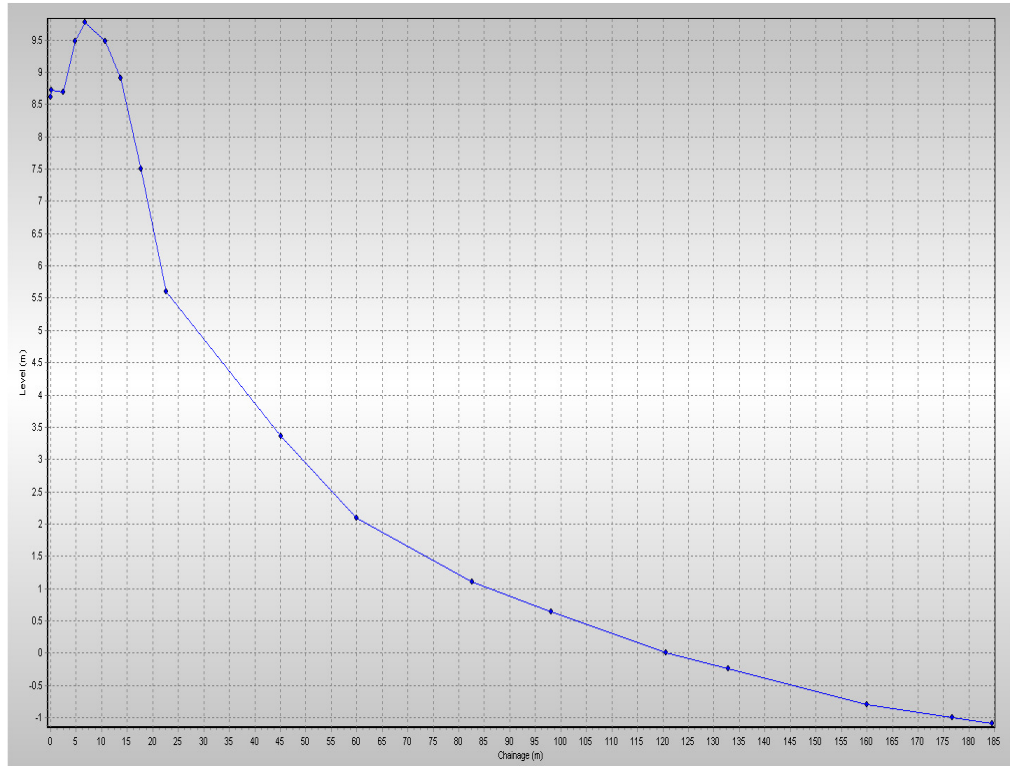
1bSS9

Date 02/11/2008 **Inspector** RH
Wind Light **Sea State**
Summary

Low Tide (m)
Visibility Good **Low Tide Time**
Rain No

Easting 438183.430 **Northing** 566678.820 **Bearing** 46

Chainage	Level
0.000	8.606
0.081	8.728
2.472	8.695
4.777	9.478
6.784	9.771
10.644	9.477
13.678	8.907
17.634	7.500
22.574	5.605
45.182	3.357
59.979	2.092
82.599	1.105
98.102	0.643
120.548	0.009
132.820	-0.234
159.942	-0.799
176.693	-0.992
184.546	-1.091



Beach Profile

1bSS10

Date 02/11/2008 **Inspector** RH
Wind Light **Sea State**
Summary

Low Tide (m)
Visibility Good **Low Tide Time**
Rain No

Easting 438408.760 **Northing** 566539.730 **Bearing** 47

Chainage	Level
0.000	9.724
9.883	9.519
15.864	6.842
16.753	6.780
21.205	5.798
24.046	3.997
33.966	2.843
45.668	1.324
59.020	0.412
71.173	0.347
81.864	0.033
93.345	-0.341
98.801	-0.741
114.310	-1.041



Beach Profile

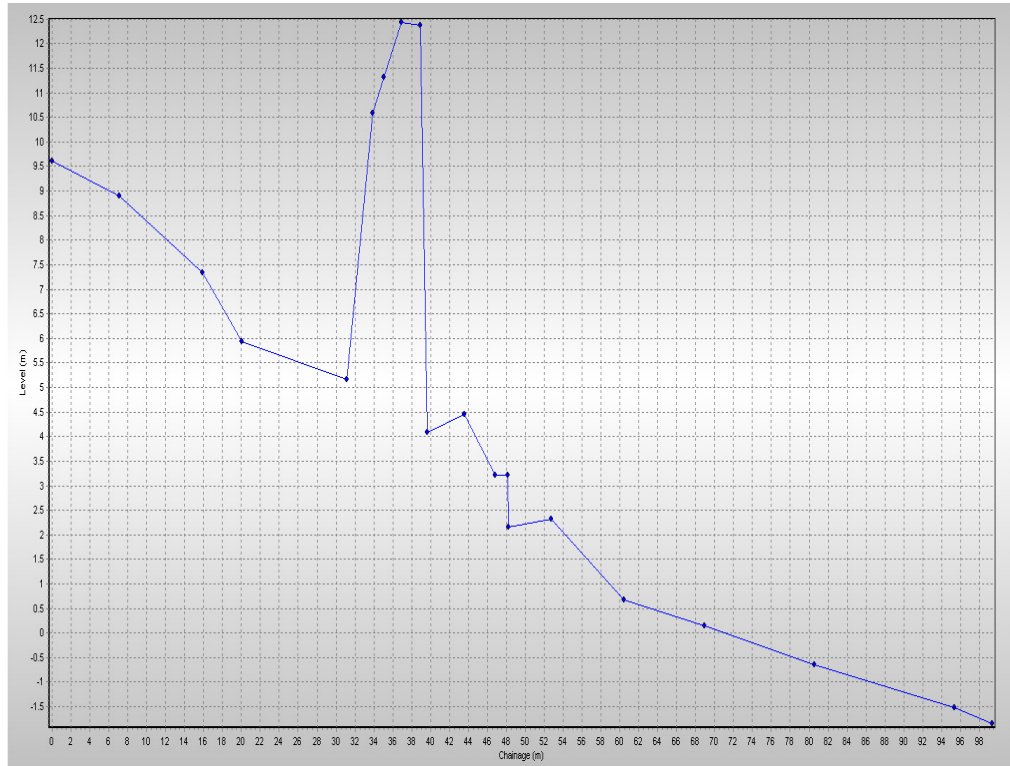
1bSS11

Date 02/11/2008 **Inspector** RH
Wind Light **Sea State**
Summary

Low Tide (m)
Visibility Good **Low Tide Time**
Rain No

Easting 438561.550 **Northing** 566477.430 **Bearing** 48

Chainage	Level
0.000	9.620
7.099	8.894
15.906	7.332
20.014	5.930
31.143	5.154
33.913	10.593
35.035	11.320
36.938	12.434
38.907	12.371
39.657	4.096
43.535	4.443
46.802	3.216
48.120	3.223
48.257	2.151
52.718	2.317
60.400	0.675
68.941	0.143
80.555	-0.645
95.324	-1.511
99.342	-1.843



Beach Profile

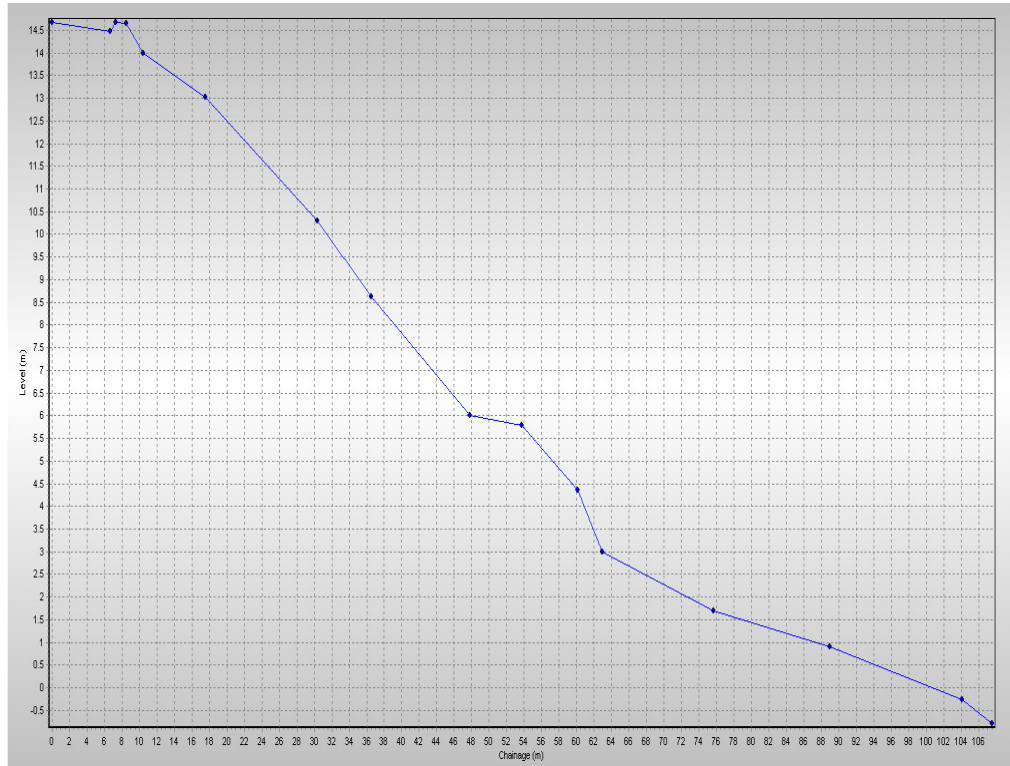
1bSS12

Date 02/11/2008 **Inspector** RH
Wind Light **Sea State**
Summary

Low Tide (m)
Visibility Good **Low Tide Time**
Rain No

Easting 438759.410 **Northing** 566377.730 **Bearing** 48

Chainage	Level
0.000	14.666
6.656	14.470
7.322	14.673
8.506	14.660
10.407	13.993
17.558	13.026
30.322	10.301
36.542	8.633
47.782	6.001
53.753	5.794
60.111	4.361
62.972	2.996
75.708	1.693
88.956	0.916
104.072	-0.268
107.555	-0.788



Beach Profile

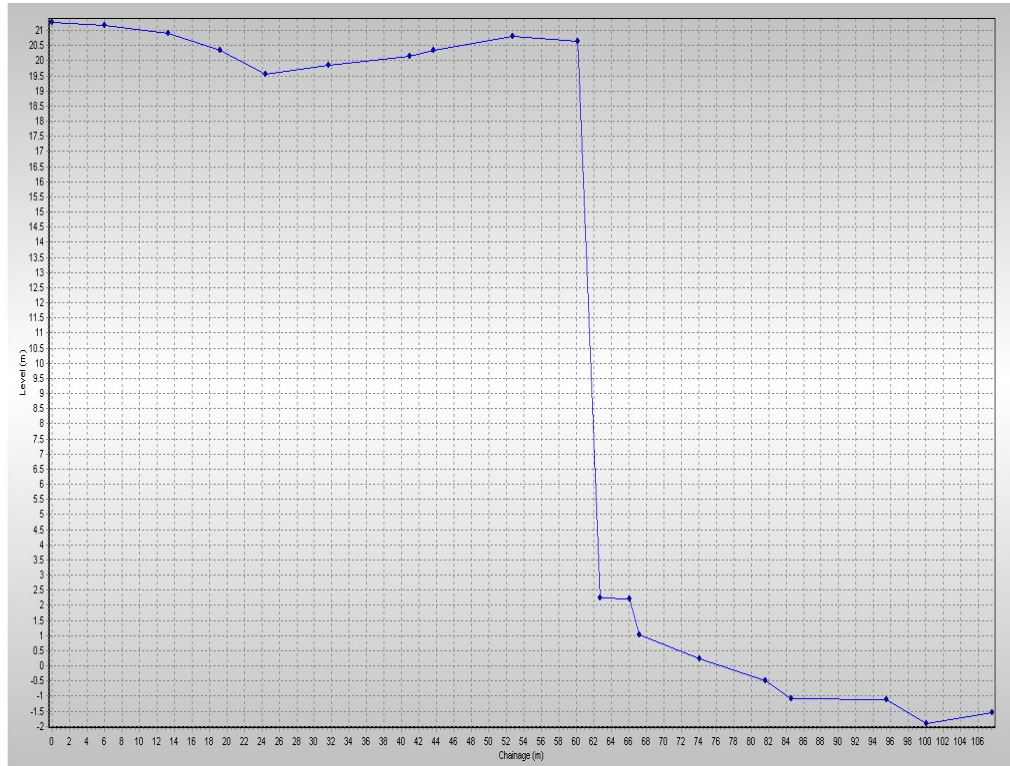
1bSS13

Date 01/11/2008 Inspector RH
Wind Light Sea State
Summary

Low Tide (m) Low Tide Time
Visibility Good Rain No

Easting 438847.300 Northing 566202.960 Bearing 47

Chainage	Level
0.000	21.269
5.991	21.167
13.263	20.912
19.249	20.341
24.446	19.566
31.626	19.862
40.927	20.140
43.620	20.334
52.731	20.812
60.160	20.658
62.743	2.239
66.086	2.218
67.185	1.035
74.132	0.220
81.615	-0.487
84.631	-1.072
95.505	-1.114
100.080	-1.907
107.587	-1.533



Beach Profile

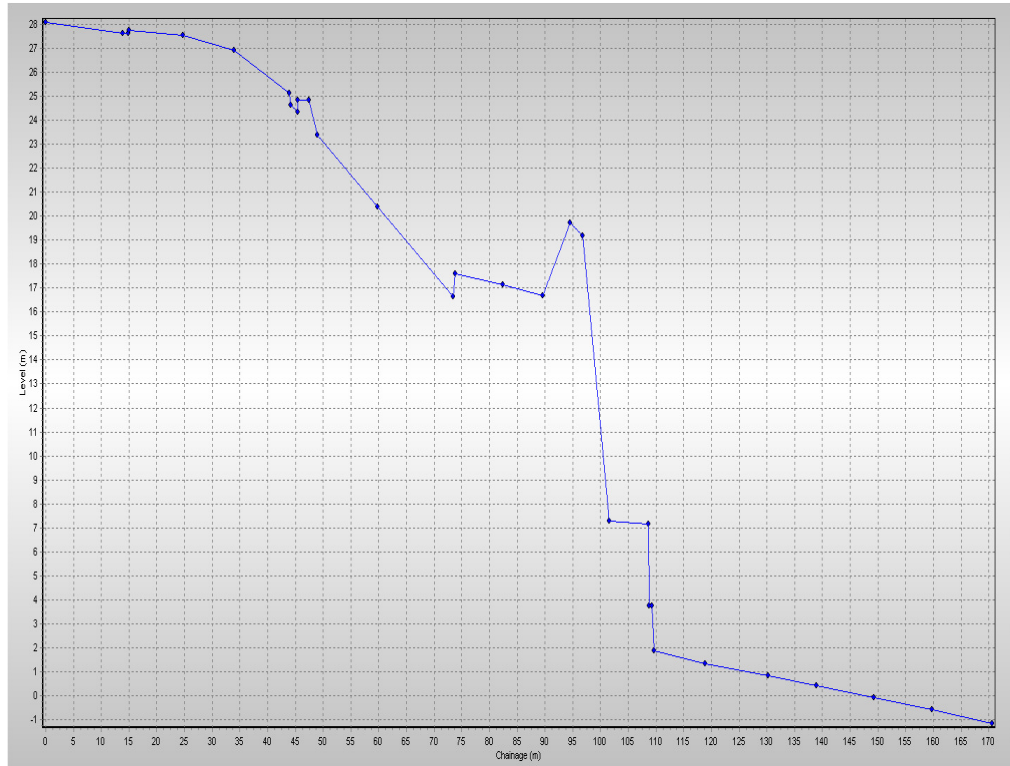
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Date 01/11/2008 **Inspector** RH
Wind Light **Sea State**
Summary

Low Tide (m)
Visibility Good **Low Tide Time**
Rain No

Easting 439630.450 **Northing** 565163.520 **Bearing** 55

Chainage	Level
0.000	28.068
13.839	27.619
14.864	27.613
15.062	27.750
24.737	27.531
33.955	26.918
43.968	25.105
44.179	24.626
45.410	24.346
45.465	24.832
47.483	24.815
48.900	23.355
59.811	20.368
73.445	16.633
73.879	17.597
82.380	17.137
89.643	16.695
94.530	19.701
96.750	19.179
101.537	7.268
108.706	7.140
108.712	3.753
109.258	3.744
109.656	1.893
118.907	1.324
130.182	0.855
138.908	0.417
149.269	-0.074
159.813	-0.554
170.603	-1.156



Beach Profile

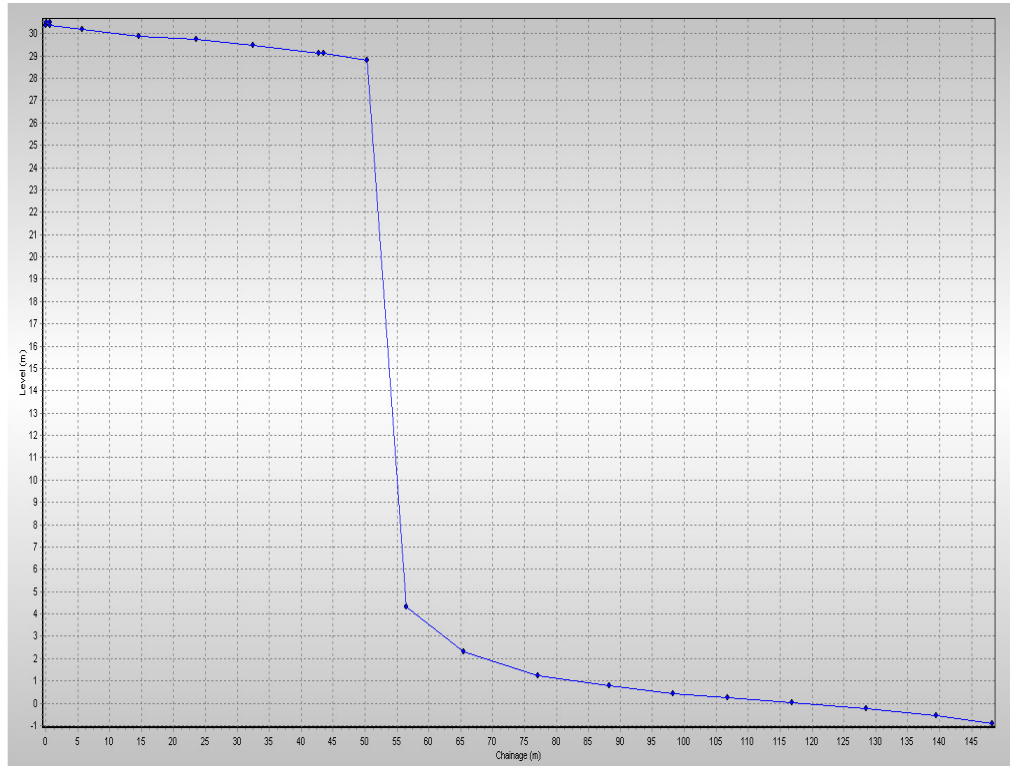
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Date 01/11/2008 **Inspector** RH
Wind Light **Sea State**
Summary

Low Tide (m)
Visibility Good **Low Tide Time**
Rain No

Easting 439795.290 **Northing** 565005.900 **Bearing** 55

Chainage	Level
0.000	30.374
0.078	30.506
0.608	30.504
0.622	30.355
5.671	30.171
14.593	29.878
23.557	29.752
32.451	29.472
42.777	29.100
43.508	29.108
50.341	28.813
56.473	4.318
65.424	2.321
77.067	1.226
88.227	0.774
98.250	0.442
106.748	0.230
116.922	0.020
128.470	-0.237
139.453	-0.562
148.232	-0.916



Beach Profile

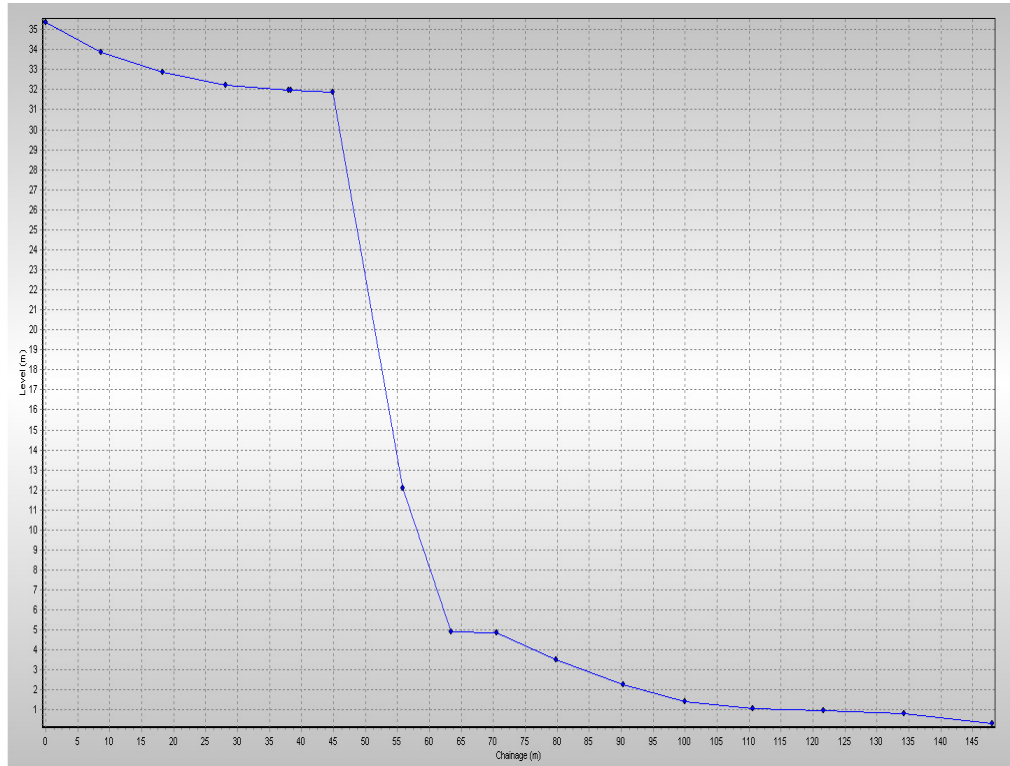
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Date 01/11/2008 **Inspector** RH
Wind Light **Sea State**
Summary

Low Tide (m)
Visibility Good **Low Tide Time**
Rain No

Easting 439981.410 **Northing** 564802.710 **Bearing** 42

Chainage	Level
0.000	35.358
8.662	33.856
18.276	32.847
28.146	32.223
37.973	31.974
38.286	31.983
44.917	31.858
55.825	12.093
63.411	4.885
70.492	4.868
79.867	3.502
90.294	2.278
99.981	1.434
110.607	1.084
121.682	0.987
134.285	0.836
148.029	0.324



Beach Profile

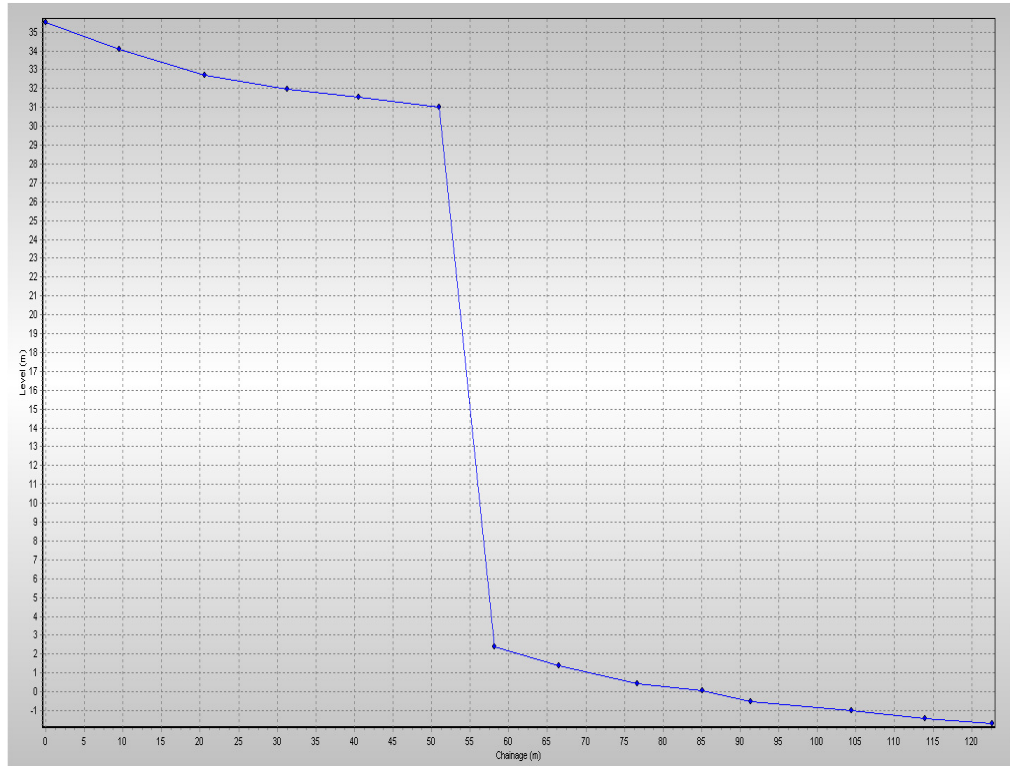
1bSS17

Date 01/11/2008 **Inspector** RH
Wind Light **Sea State**
Summary

Low Tide (m)
Visibility Good **Low Tide Time**
Rain No

Easting 440161.830 **Northing** 564656.790 **Bearing** 41

Chainage	Level
0.000	35.511
9.516	34.106
20.566	32.699
31.257	31.965
40.590	31.567
50.970	31.014
58.112	2.375
66.533	1.372
76.673	0.412
85.087	0.042
91.358	-0.526
104.469	-0.977
113.926	-1.429
122.662	-1.687



Appendix B
Topographic Survey

— Topographic Contours
at 1 metre interval

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

Appendix B - Map 1a South Tyneside Council Frontage

Analytical Report 1
'Full Measures' Survey 2008

Drawing Scale 1:11,500 at A4
Drawn by: TC Date: 08/05/2009
Checked by: NC Date: 08/05/2009
Approved by: NC Date: 08/05/2009

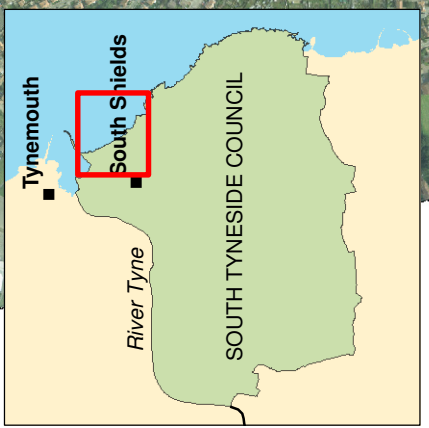
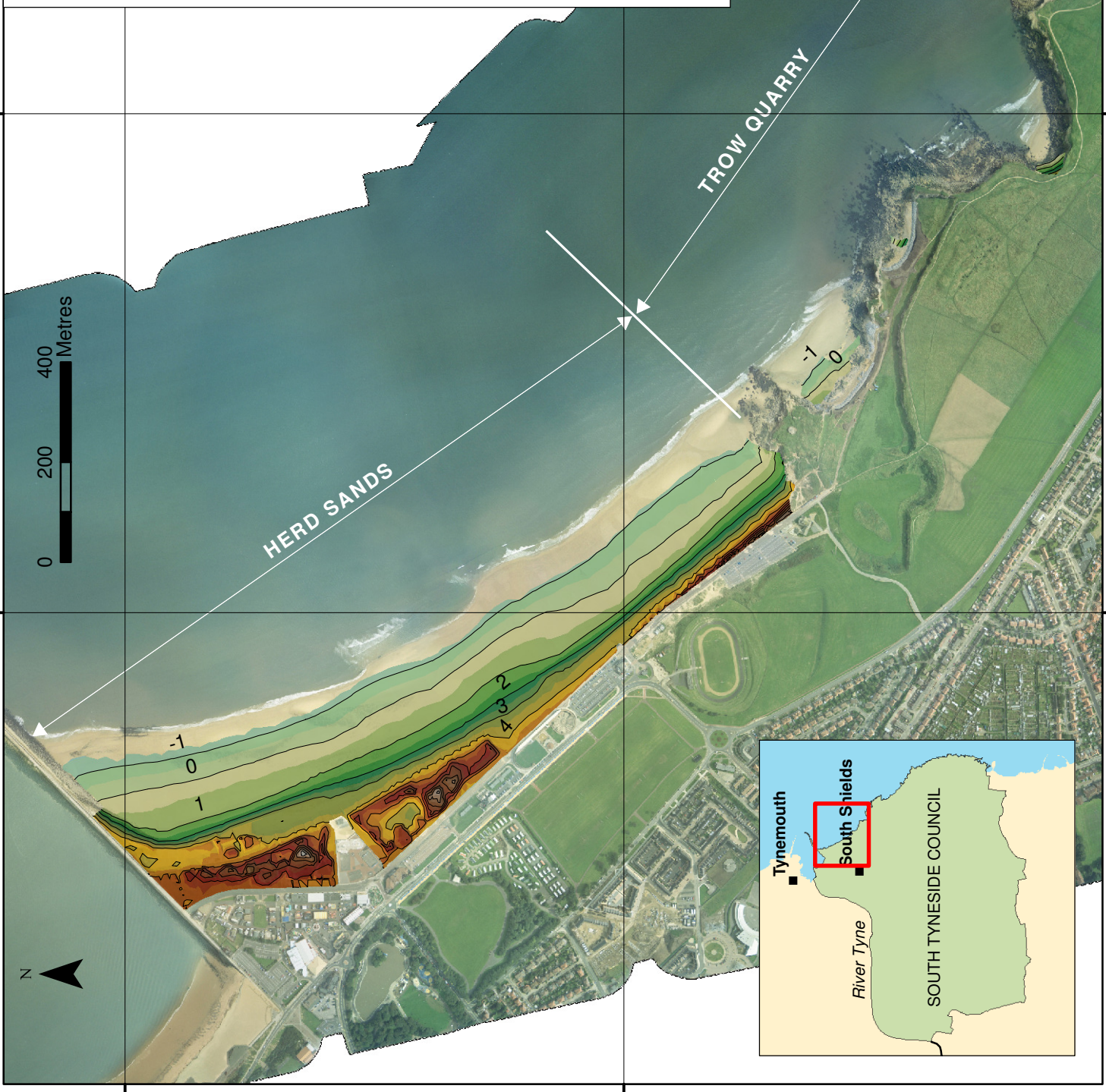
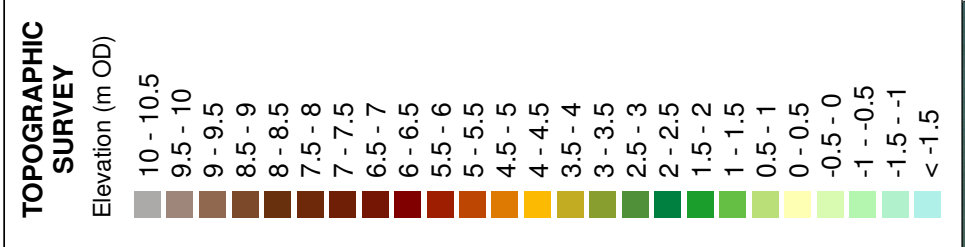
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Client: North East Coastal Group
 Project: Cell 1 Regional Coastal Monitoring Programme


Appendix B - Map 1b South Tyneside Council Frontage

Analytical Report 1
 'Full Measures' Survey 2008

Drawing Scale 1:3,000 at A4
 Drawn by: TC Date: 08/05/2009
 Checked by: NC Date: 08/05/2009
 Approved by: NC Date: 08/05/2009



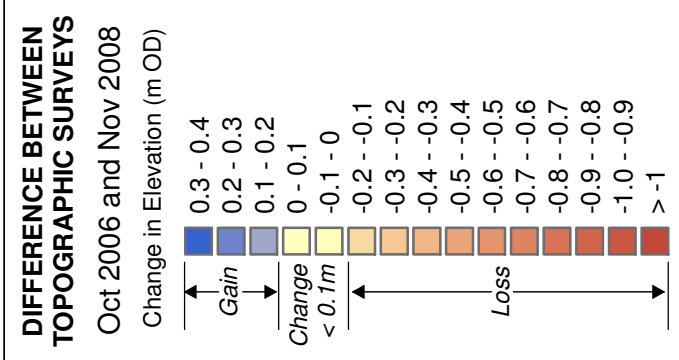
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Appendix C
Cliff Top Survey

Cliff Top Survey

Trow Quarry

Six ground control points have been established around Trow Point (Figure C1). The maximum separation between any two points is 50m, but in most cases the points are located at much closer spacing. These cliff top surveys are primarily intended to inform the Trow Quarry Monitoring Plan associated with the 2008 coastal defence scheme, but resulting data also provide useful information on rates of cliff top recession at Trow Point for the Cell 1 Regional Monitoring Programme.

The cliff top surveys at Trow Point are undertaken every second year, but as part of both the Full Measures and Partial Measures surveys in that year. Measurements are taken from a fixed ground control point along a fixed bearing to the edge of the cliff top.

Table C1 provides baseline information about these ground control points and results from the 2008 (baseline) survey showing the position from the ground control point to the edge of the cliff top along the defined bearing. Future reports will show results from subsequent surveys and provide a means of assessing erosion since the baseline survey.

Table C1 – Cliff Top Surveys at Trow Point

Ground Control Point Details					Distance to Cliff Top (m)			Total Erosion (m)		Erosion Rate (m/year)
Ref	Easting	Northing	Level (mODN)	Bearing (°)	Baseline Survey (Full 2008)	Previous Survey (N/A)	Present Survey (N/A)	Baseline (Full 2008) to Present (N/A)	Previous (N/A) to Present (N/A)	Baseline (Full 2008) to Present (N/A)
1	438300	566674	12.410	309	6.79	-	-	-	-	-
2	438338	566694	11.736	312	9.43	-	-	-	-	-
3	438384	566669	13.214	33	7.05	-	-	-	-	-
4	438408	566664	12.040	71	10.53	-	-	-	-	-
5	438401	566637	15.053	120	7.14	-	-	-	-	-
6	438392	566604	14.756	110	10.28	-	-	-	-	-



● Cliff Top Monitoring Points

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

Appendix C - Map 1 South Tyneside Council Frontage

Analytical Report 1
 'Full Measures' Survey 2008

Drawing Scale 1:3,500 at A4

Drawn by:	TC	Date:	08/05/2009
Checked by:	NC	Date:	08/05/2009
Approved by:	NC	Date:	08/05/2009

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