



**Cell 1 Regional Coastal Monitoring Programme
Analytical Report 2: 'Full Measures' Survey 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 |
| 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 (NCAG¹) Monitoring Programme began in April 2002 with a survey of profile lines along various sections of the coastline between Berwick-upon-Tweed and the River Tyne. These were fully repeated in September 2002 and since then annual surveys of all profiles have been undertaken as a 'Full Measures' survey in autumn/early winter every year. Some of these surveys are then repeated the following spring as part of a 'Partial Measures' survey.

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

In September 2008 the monitoring became incorporated within the wider Cell 1 Regional Coastal Monitoring Programme. This covers approximately 300km of the north east coastline, from the Scottish Border (just south of St. Abb's Head) to Flamborough Head in East Yorkshire. 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.

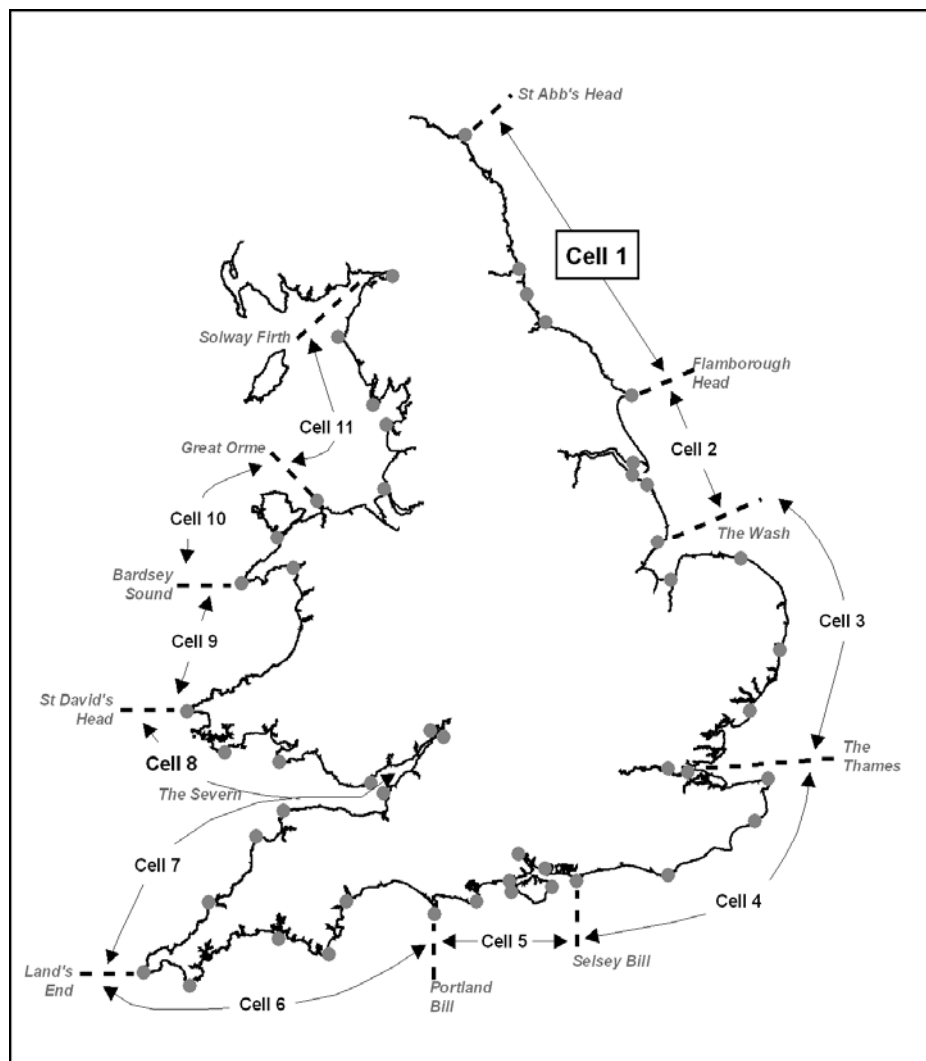


Figure 1 Sediment Cells in England and Wales

¹ NCAG become part of the wider North East Coastal Group (NECG) in September 2008.

The Cell 1 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 (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

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.

A Cell 1 Overview Report will also be produced periodically. This will provide a region-wide summary of the main findings relating to trends and interactions along the entire Cell 1 frontage within distinct time phases of the programme, defined by specific funding allocations. The first such report is expected to be produced in spring 2011 (covering 2008 – 2011) when the initial three year funding allocation comes towards an end.

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

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

^(*) The present report is **Analytical Report 2** and provides an analysis of the 2009 Full Measures survey for Northumberland County 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 | Sandstell Point |
| | Spittal |
| | Goswick Sands |
| | Holy Island |
| | Bamburgh |
| | Beadnell Village |
| | Beadnell Bay |
| | Embelton Bay |
| | Boulmer |
| | Alnmouth Bay |
| | High Hauxley and Druridge Bay |
| | Lynemouth Bay |
| | Newbiggin-by-the-Sea |
| | 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 |
| Hartlepool Borough Council | Blackhall Colliery |
| | North Sands |
| | Headland |
| | Middleton |
| Redcar & Cleveland Borough Council | Hartlepool Bay |
| | Coatham Sands |
| | Redcar Sands |
| | Marske Sands |
| | Saltburn Sands |
| Scarborough Borough Council | Cattersty Sands (Skinningrove) |
| | Staithes |
| | Runswick Bay |
| | Sandsend Beach, Upgang Beach and Whitby Sands |
| | Robin Hood's Bay |
| | Scarborough North Bay |
| | Scarborough South Bay |
| | Cayton Bay |
| Filey Bay | |

1. Introduction

1.1 Study Area

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

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

1.2 Methodology

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

- Full Measures survey annually each autumn/early winter comprising:
 - Beach profile surveys along 88 no. transect lines (78 no. since April 2002, with 10 no. added since Full Measures 2007)
 - Topographic survey along Holy Island (since Full Measures 2004)
 - Topographic survey along Alnmouth Bay (since Partial Measures 2005)
 - Topographic survey along Sandstell Point (since Full Measures 2009)
- Partial Measures survey annually each spring comprising:
 - Beach profile surveys along 39 no. transect lines (29 no. since April 2002, with 10 no. added since Full Measures 2007)
 - Topographic survey along Alnmouth Bay (since Partial Measures 2005)
 - Topographic survey along Sandstell Point (since Full Measures 2009)
- Cliff top survey (bi-annually) at:
 - Cliff top survey at Newbiggin Caravan Park (since Full Measures 2007)
 - Cliff top survey at Sandy Bay Caravan Park (since Full Measures 2007)
 - Cliff top survey at Cambois (since Partial Measures 2009)

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

The Full Measures survey was undertaken along this frontage over a number of days in September, October and November 2009, when weather conditions were generally fine but with the odd foul day and the sea state was mostly calm.

This Analytical Report presents the following:

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

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

SURVEY LOCATIONS

Topographic Profiles

- Annual
- Bi-Annual

Topographic Surveys

- 6 monthly
- yearly
- 5 yearly

- Cliff Top Edge Survey
- (Indicative Survey Extents shown)

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

Figure 1 - Map 1 Northumberland County Council Frontage

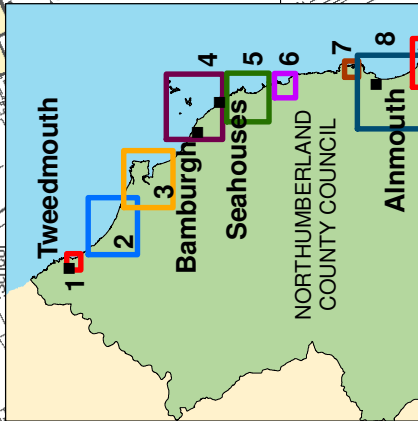
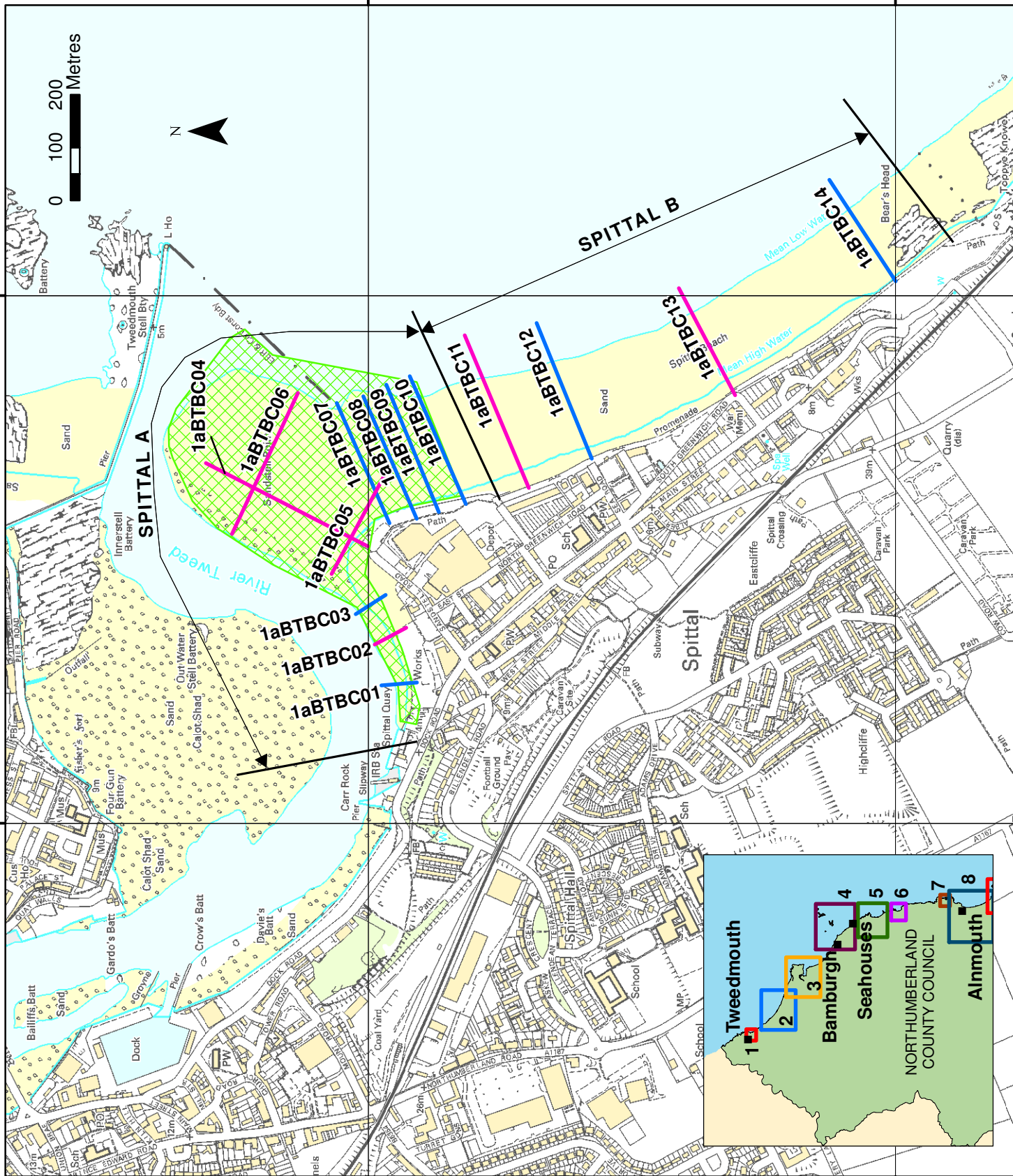
Analytical Report 2
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 Approved by: NC Date: 14/12/2009



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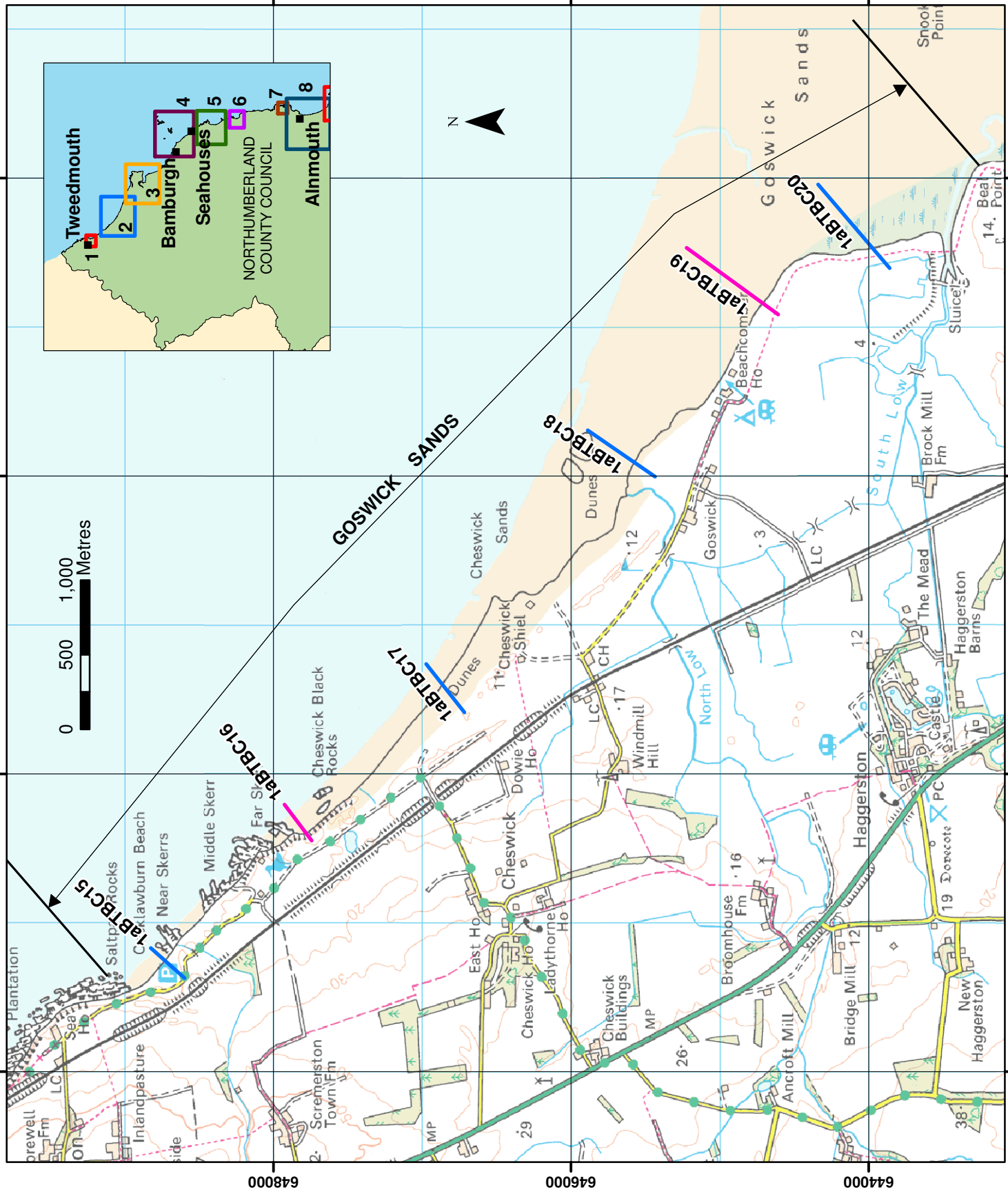


0002000

651000

401000

400000



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 2
Northumberland County
Council Frontage**

Analytical Report 2
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648000 646000 644000 642000 402000 404000 406000 408000

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 3
 Northumberland County
 Council Frontage**

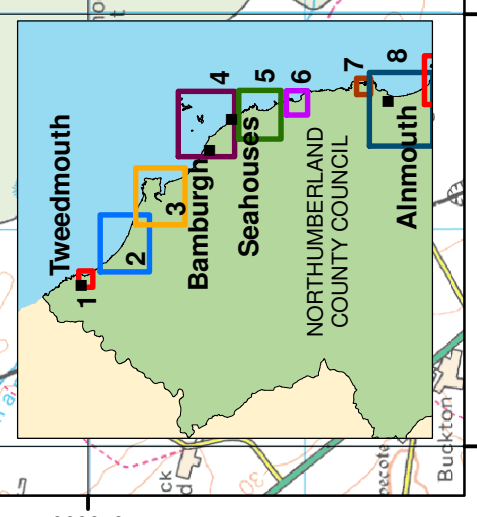
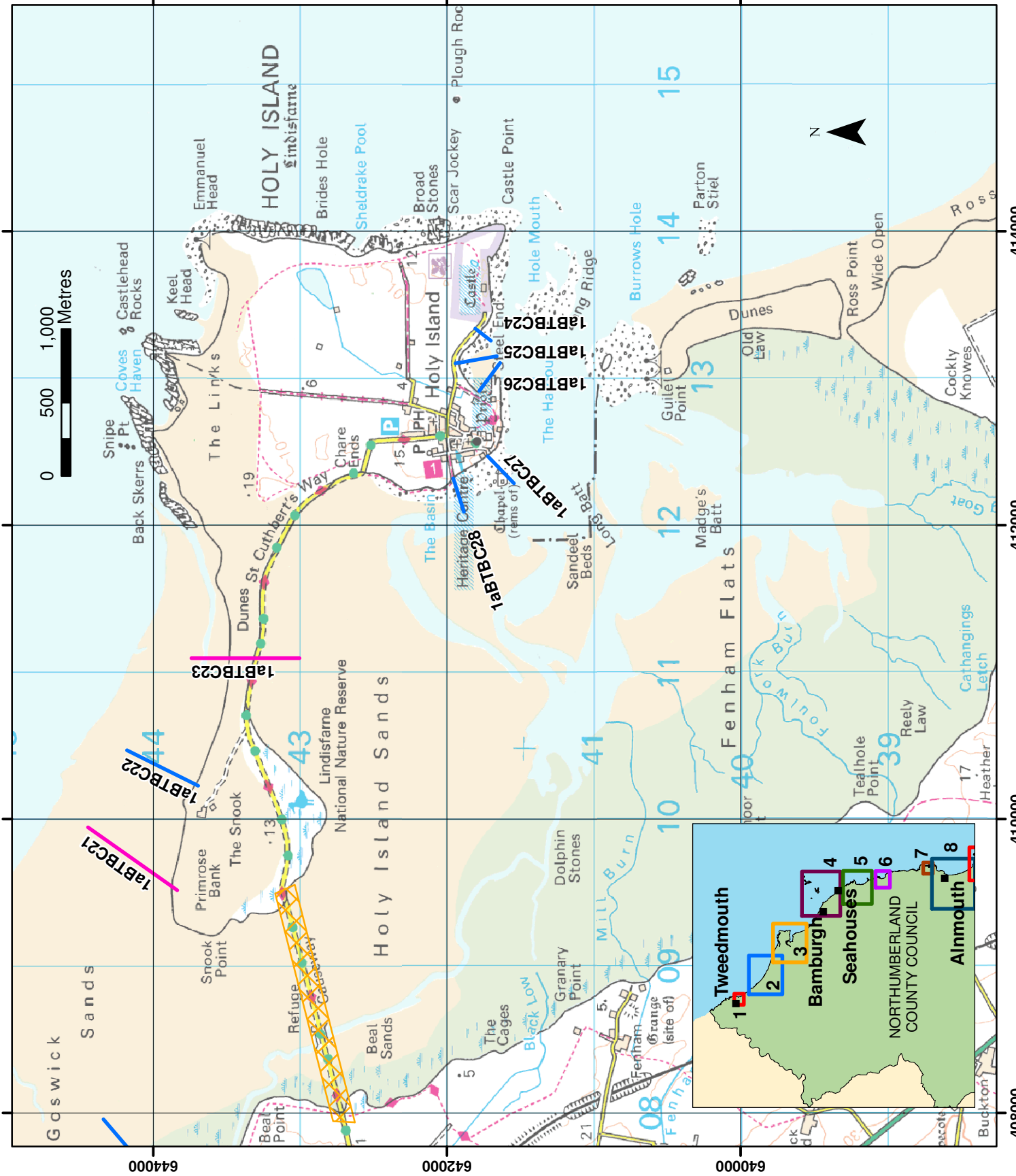
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SURVEY LOCATIONS

Topographic Profiles

- Annual
- Bi-Annual

Topographic Surveys

- 6 monthly
- yearly
- 5 yearly

- Cliff Top Edge Survey
- (Indicative Survey Extents shown)

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

Figure 1 - Map 4 Northumberland County Council Frontage

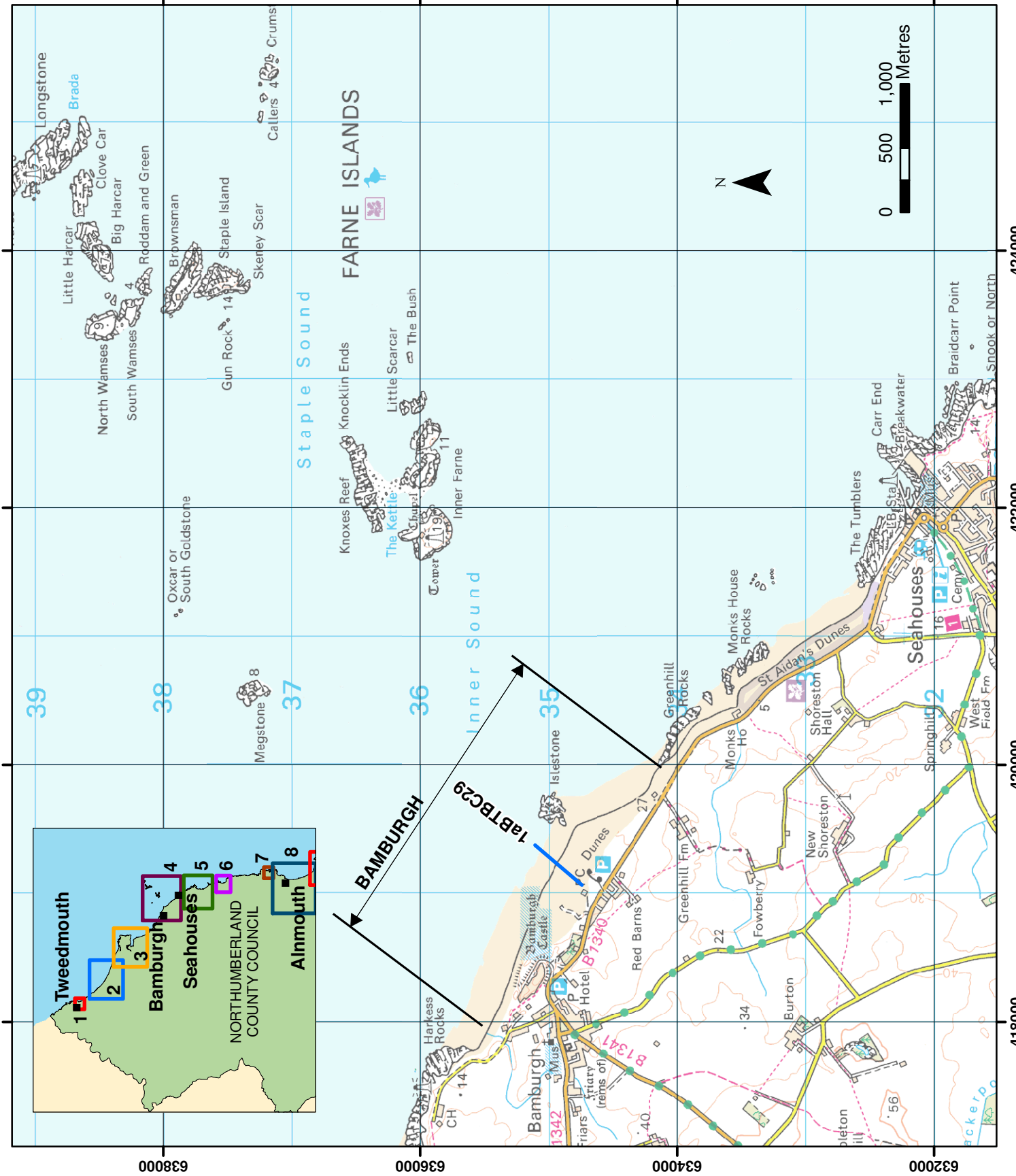
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418000 420000 422000 424000

638000 636000 634000 632000

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

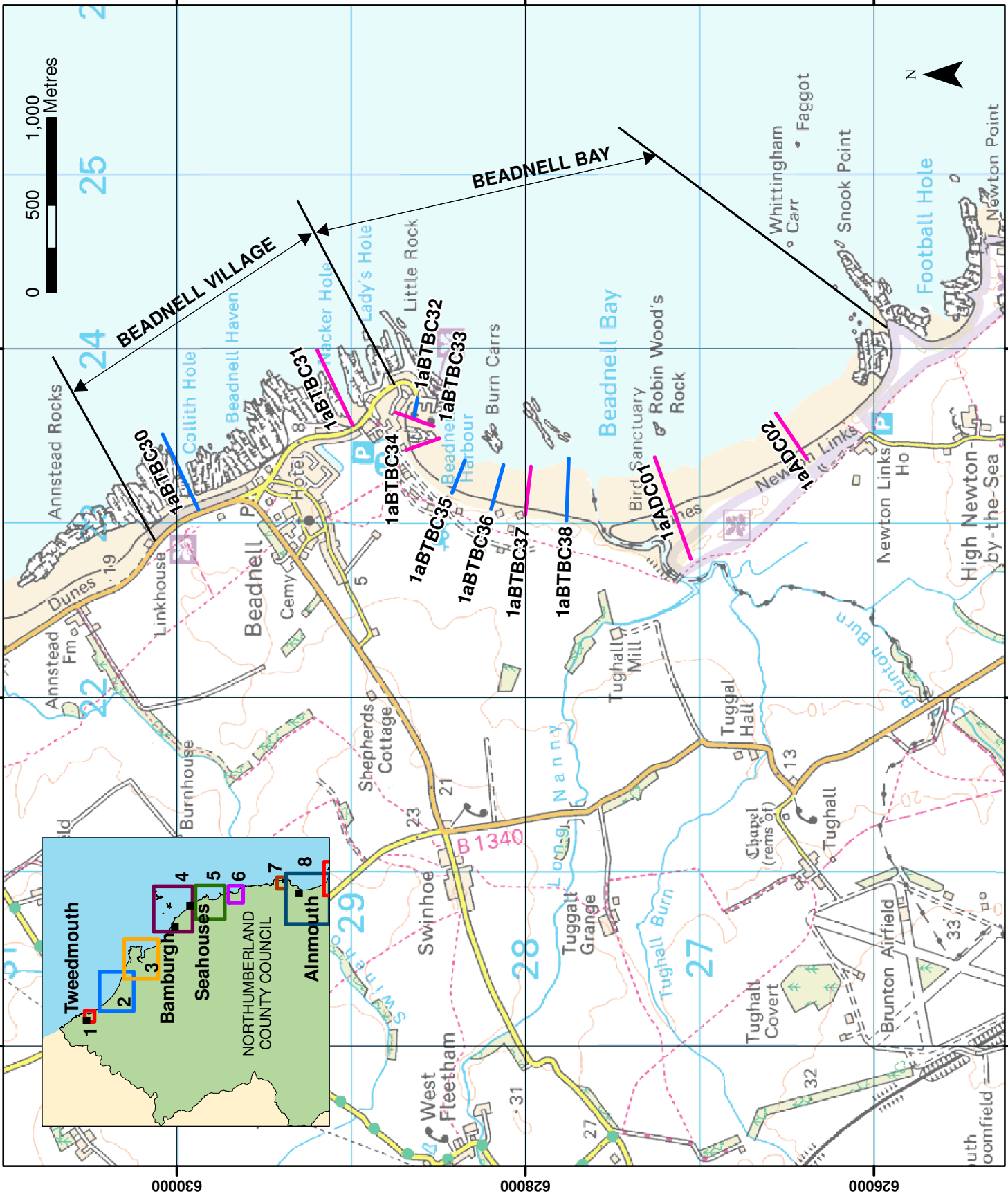
Project: Cell 1 Regional Coastal Monitoring Programme

Figure 1 - Map 5
Northumberland County
Council Frontage
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SURVEY LOCATIONS

Topographic Profiles

- Annual
- Bi-Annual

Topographic Surveys

- 6 monthly
- yearly
- 5 yearly

- Cliff Top Edge Survey
- (Indicative Survey Extents shown)

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

Figure 1 - Map 6 Northumberland County Council Frontage

Analytical Report 2
 'Full Measures' Survey 2009

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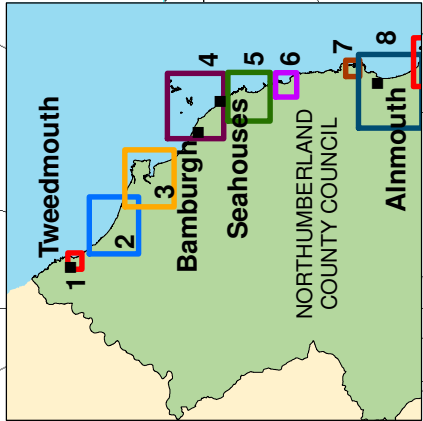
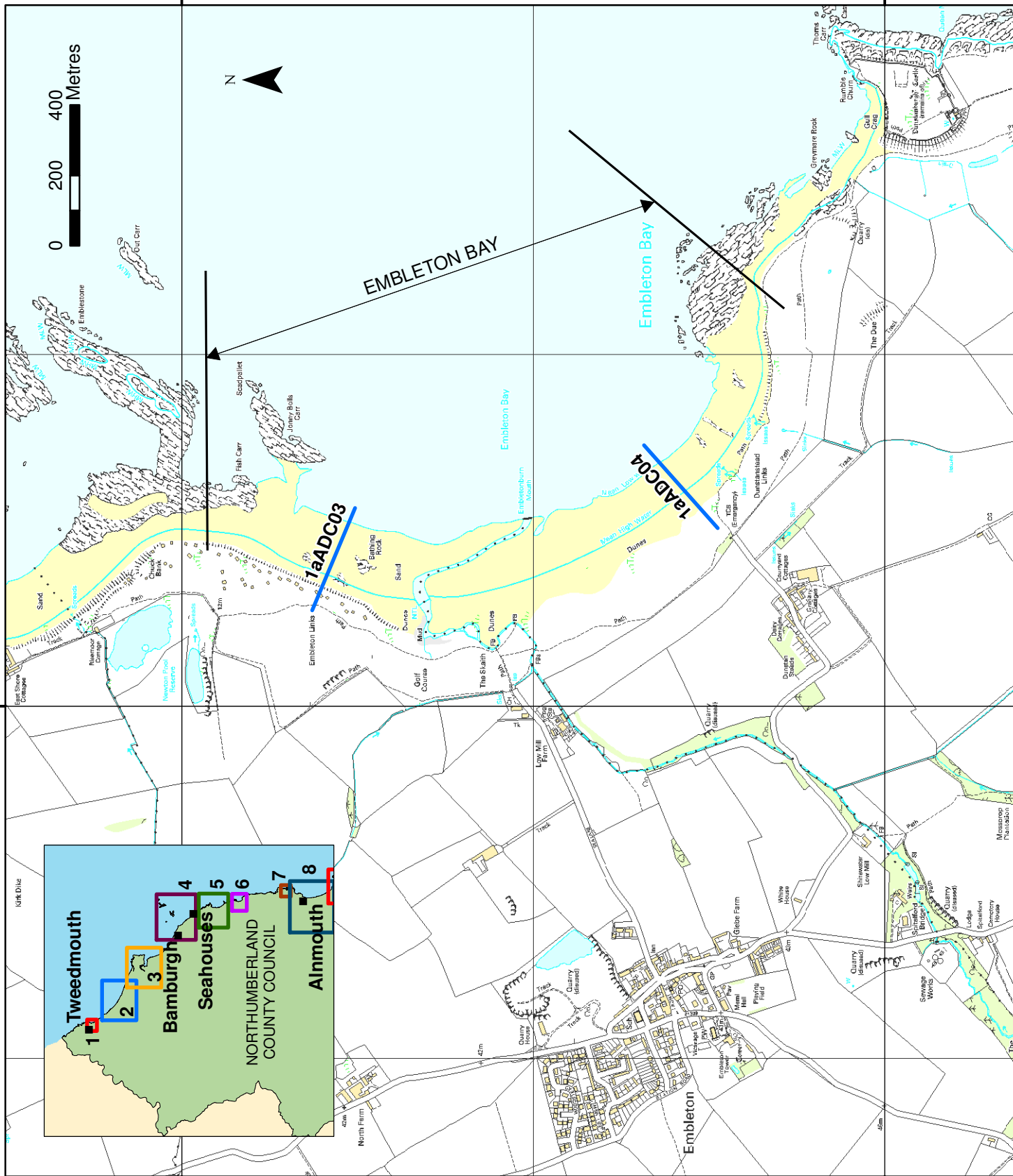
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SURVEY LOCATIONS

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

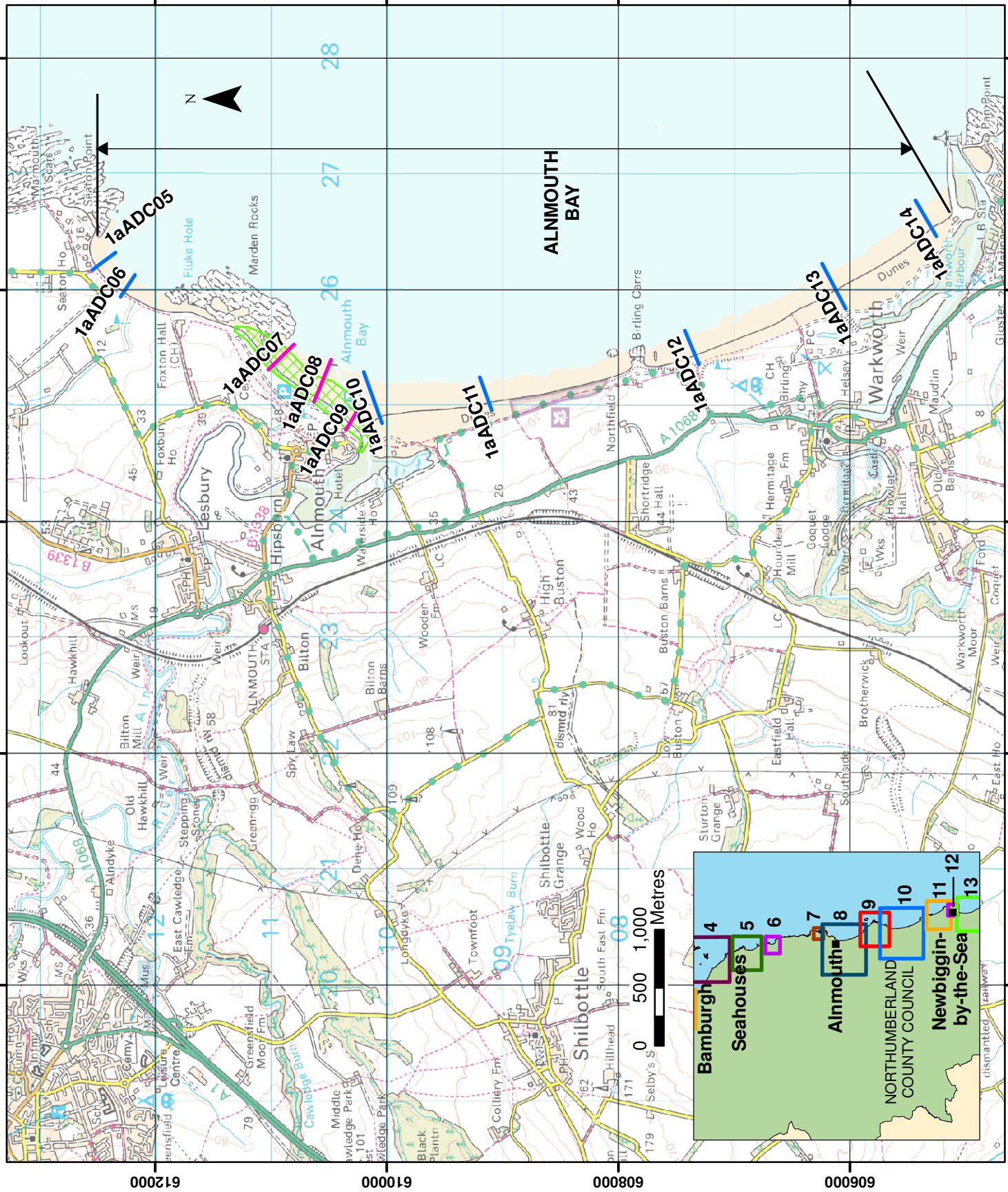
Figure 1 - Map 8 Northumberland County Council Frontage Analytical Report 2 'Full Measures' Survey 2009

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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 10
Northumberland County Council Frontage

Analytical Report 2
 'Full Measures' Survey 2009

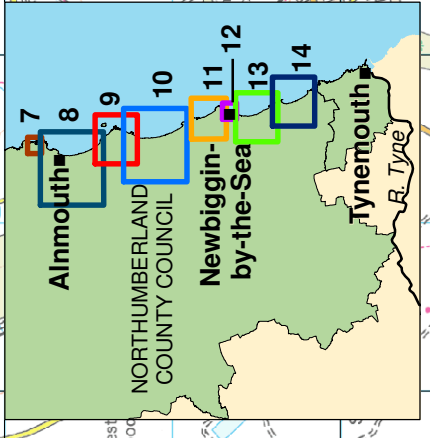
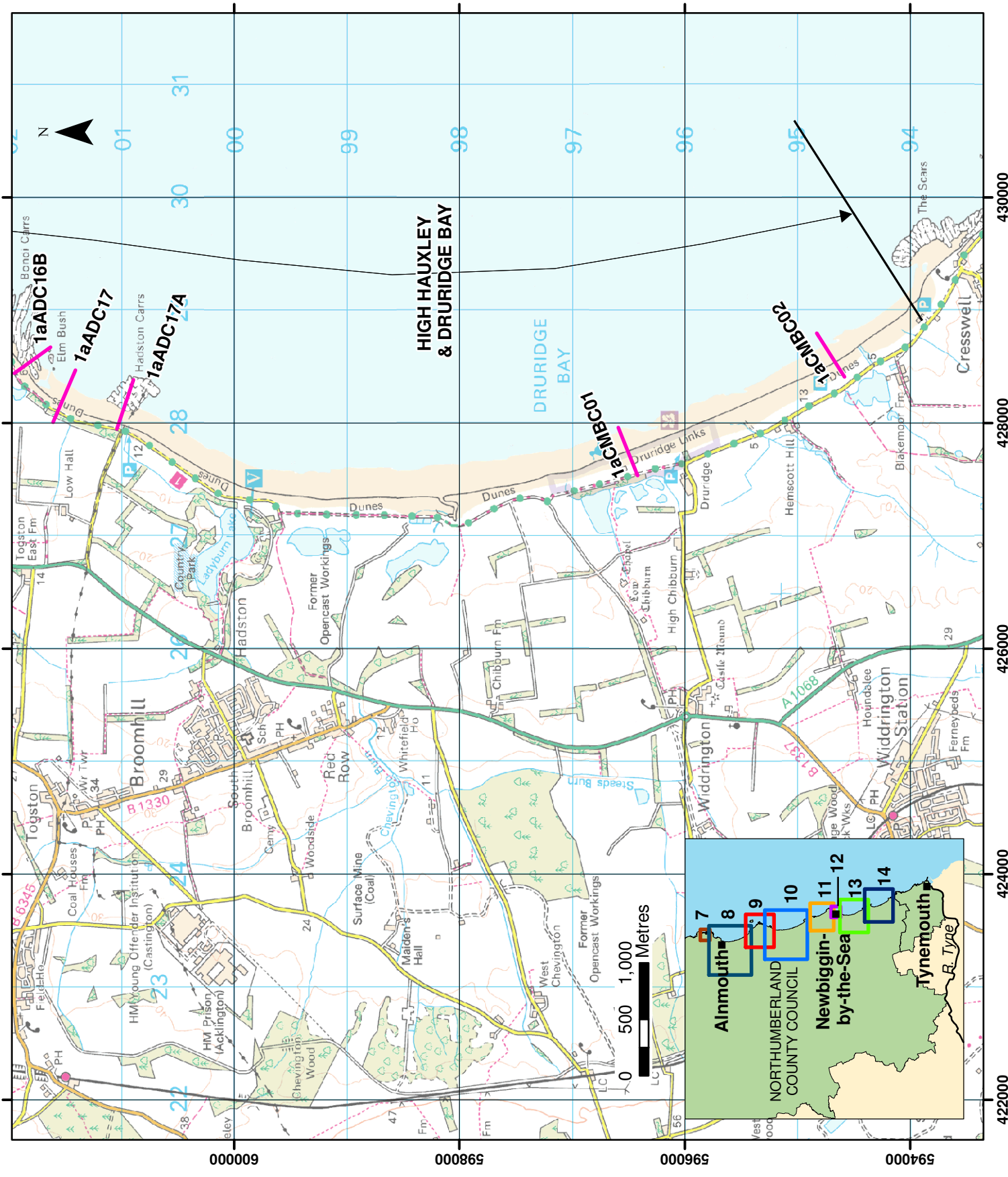
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SURVEY LOCATIONS

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

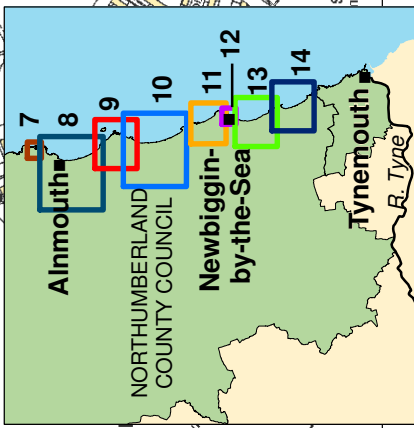
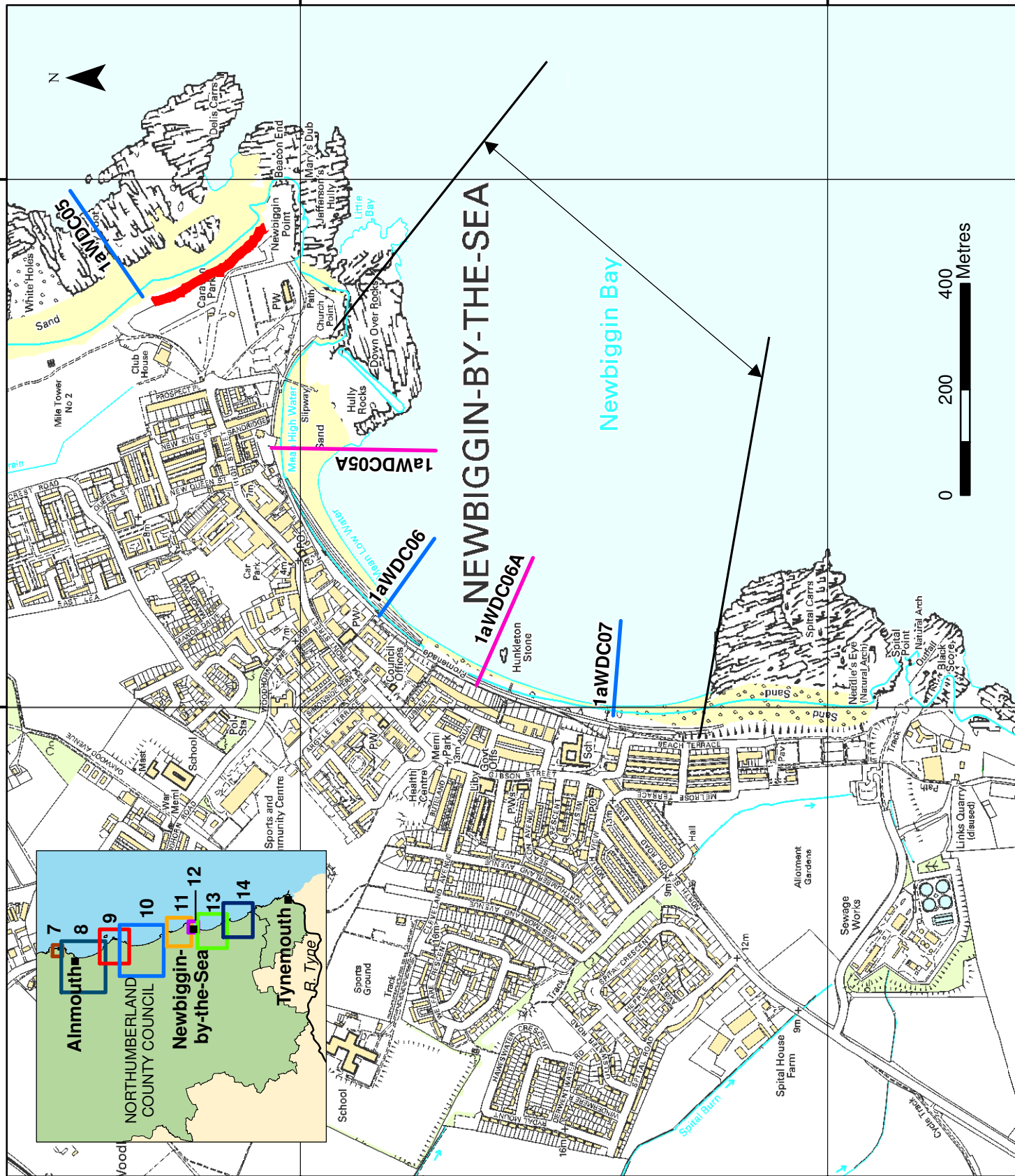
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SURVEY LOCATIONS

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 13 Northumberland County Council Frontage

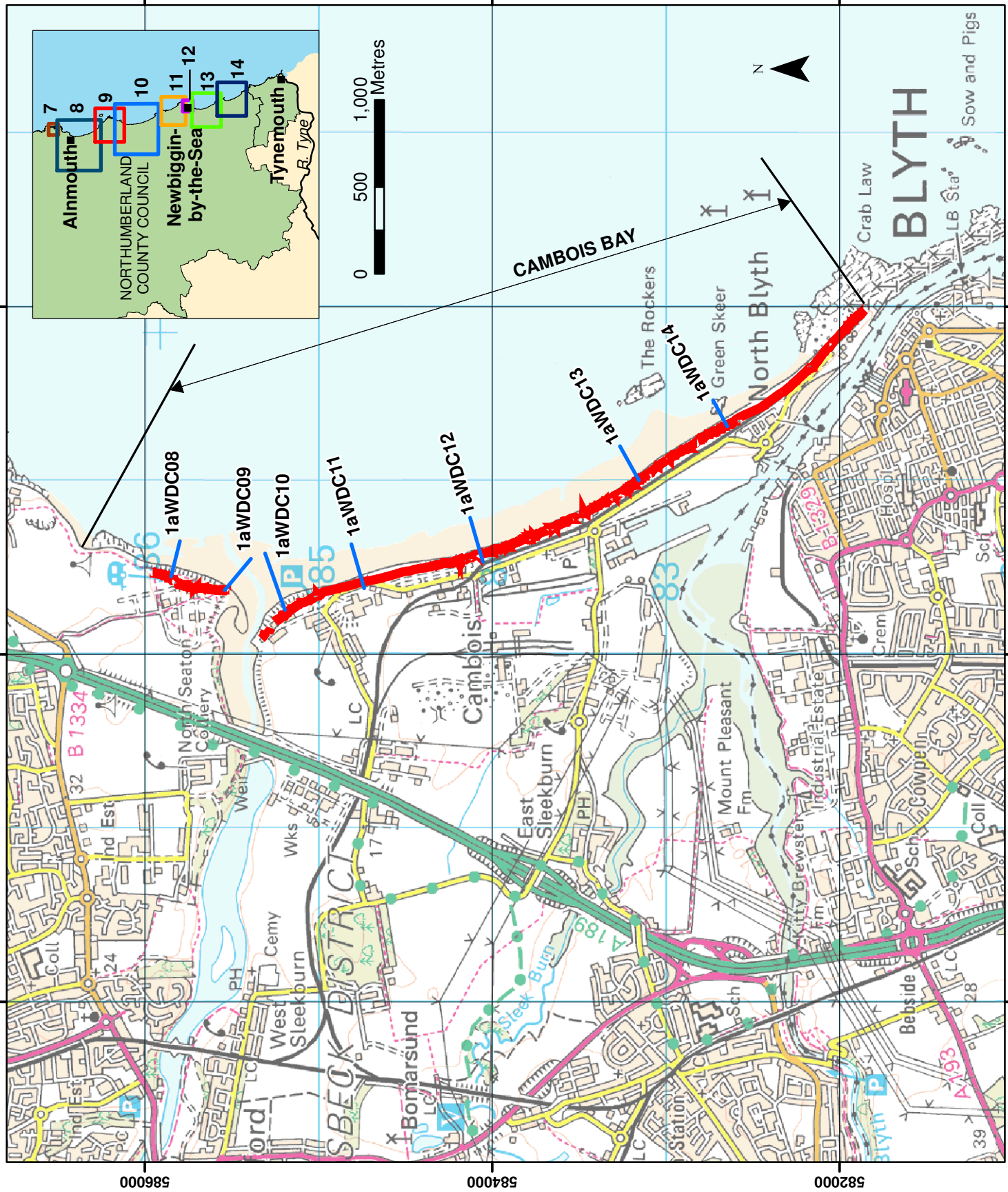
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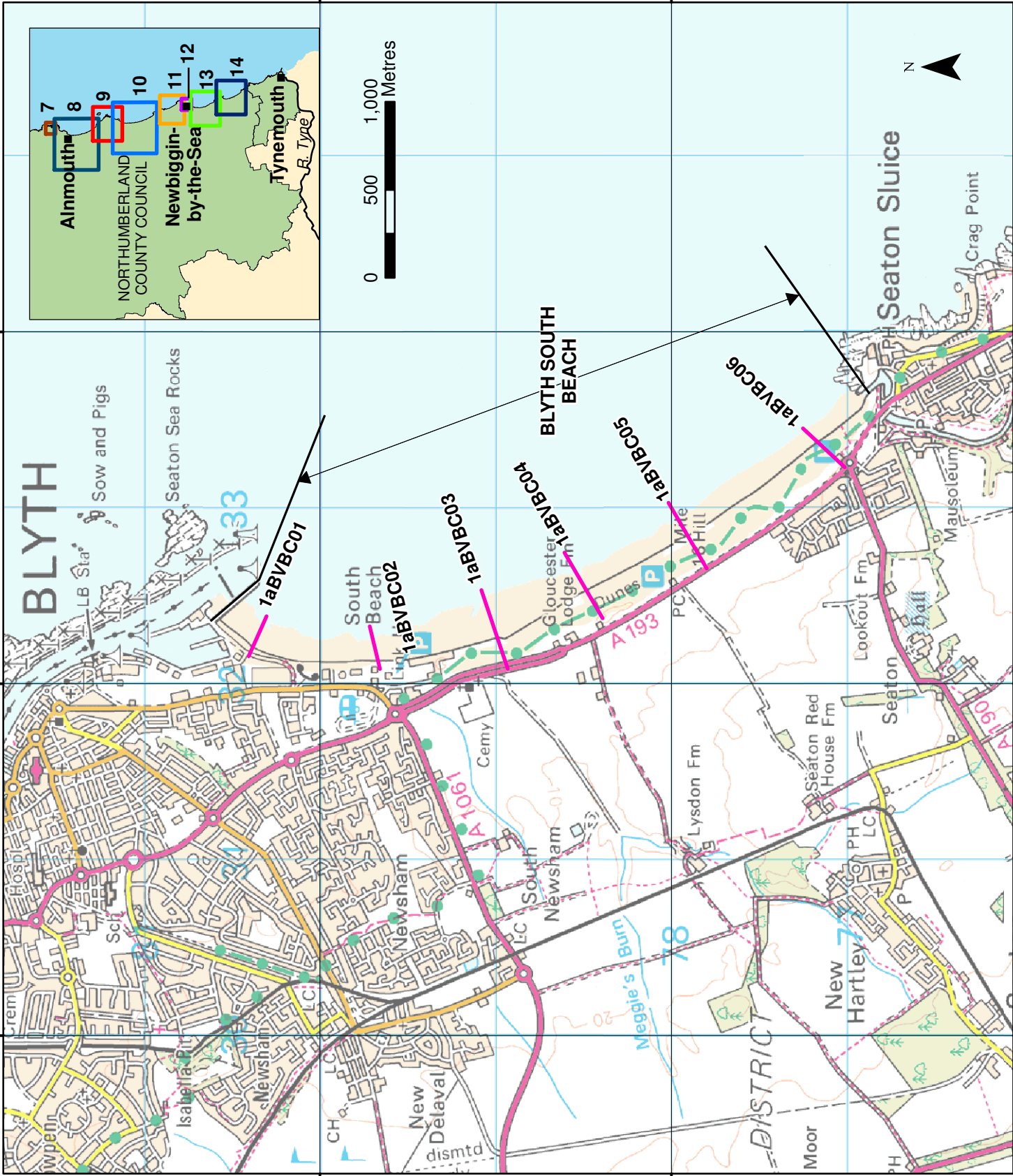
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SURVEY LOCATIONS

Topographic Profiles

- Annual
- Bi-Annual

Topographic Surveys

- 6 monthly
- yearly
- 5 yearly

- Cliff Top Edge Survey
- (Indicative Survey Extents shown)

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

Figure 1 - Map 14
Northumberland County Council Frontage
 Analytical Report 2
 'Full Measures' Survey 2009

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2. Analysis of Survey Data

2.1 Sandstell Point

| Survey Date | Description of Changes Since Last Survey | Interpretation |
|-------------|---|--|
| 09-2009 | <p>Beach Profiles:</p> <p>Sandstell Point is covered by ten beach profile lines during the Full Measures survey (Appendix A). Profiles BTBC01 to BTBC03 are located in front of the dunes on the south bank of the estuary. Along BTBC01 the dune crest is now some 3.5m further inland and around 0.15m lower than that was recorded in November 2006. There appears to have been a general progression of the retreat along this frontage at regular intervals between successive (annual) surveys since the onset of this process a few years ago. BTBC02 is surveyed 6-monthly and shows that the dune retreat has stopped following the March 2009 survey. Around MHW level, the foreshore has been drawn down to a low value, however, and therefore continued recession of the upper beach and dune may yet still be experienced in future surveys. Between October 2008 and September 2009, the dune has retreated by around 1m along BTBC03. Foreshore levels, however, improved, especially above MHWS and HAT.</p> <p>Profiles BTBC04 (longitudinal section) and BTBC05 and BTBC06 (both cross-sections) cover the spit at Sandstell Point. BTBC04 showed significant change between October 2008 and March 2009 and although some further lowering occurred, particularly at the toe of the dunes and in terms of flattening of the berm previously observed at a chainage of around 250m, the rate of change substantially reduced. BTBC05 and BTBC06 show west (i.e. the river channel) on the right hand side of the plots. The spit has started to build up a narrower but taller ridge along both profiles following the flattening that was previously observed between November 2008 and March 2009, indicating some signs of recovery.</p> <p>BTBC07 to BTBC10 are located along the open coast, just south of Spittal Point. All four profiles exhibited the lowest recorded foreshore levels in the October 2008 surveys and all four demonstrated identical trends to the current survey, with further lowering just above MSL due to the formation of a runnel. Seaward of this feature a berm was also present on all profiles.</p> | <p>The dunes along the south bank of the River Tweed estuary have eroded back further since the October 2008 surveys. The relatively stability in dune position along BTBC02 since the March 2009 survey, however, suggests that the cut-back mostly occurred during this period, with probably relative stability in position since. It is likely that the upper beach level increases along BTBC01 and BTBC03 are due to the deposition of material liberated from the landward dune recession.</p> <p>Significant changes continue along the spit at Sandstell Point, although some signs of build up of a narrow and high crest on the river-side of the spit is evident following the previous flattening which occurred between October 2008 and March 2009.</p> <p>Along the open coast adjacent to the spit, beach levels remain low, but a trough and berm feature was observed in all four profiles.</p> |

| Survey Date | Description of Changes Since Last Survey | Interpretation |
|-------------|---|---|
| 11-2009 | <p>Topographic Survey:</p> <p>Due to the significant changes that have been observed from the beach profiles along the spit at Sandstell Point, and the three dimensional nature of these changes, a topographic survey was introduced to the monitoring programme in November 2009.</p> <p>Data from this 'baseline' topographic survey (November 2009) have been used to create a DGM (Appendix B – Map 1a) using a Geographical Information System (GIS).</p> | <p>Comparisons between future 6-monthly surveys and the November 2009 'baseline' will help better understand the changes occurring at the mouth of the River Tweed estuary.</p> |

2.2 Spittal

| Survey Date | Description of Changes Since Last Survey | Interpretation |
|-------------|---|---|
| 09-2009 | <p>Beach Profiles:</p> <p>Spittal is covered by four beach profile lines during the Full Measures survey (Appendix A).</p> <p>Along BTBC11 the accretion noted at the toe of the sea wall between October 2008 and March 2009 continued to September 2009, with current levels now some 0.6m higher than recorded in October 2008. The record low levels along the upper beach in March 2009 had substantially recovered, with a large berm formed above HAT. Associated with this, a runnel at a chainage of around 50m resulted in localised further lowering. Seaward of this feature, another berm was present.</p> <p>Along BTBC12 upper foreshore levels, landward of HAT, accreted, but between MHWS and MSL lowering occurred to set new record low values. Seaward of MSL levels remained relatively low down to the line of low water.</p> <p>BTBC13 shows a notable increase in foreshore levels over a cross-shore length of some 40m since March 2009. The lower profile was relatively steeply-sloping down to low water.</p> <p>BTBC14 showed a similar trend, with upper beach levels some 1.4m higher in places than recorded during the October 2008 survey.</p> | <p>Spittal continues to exhibit quite notable changes in foreshore level along the measured profiles. Overall, upper foreshore levels were relatively higher than those recorded in the previous surveys, although the low profiles exhibited steeply dropping gradients down to low water.</p> |

2.3 Goswick Sands

| Survey Date | Description of Changes Since Last Survey | Interpretation |
|-------------|---|--|
| 09-2009 | <p>Beach Profiles:</p> <p>Goswick Sands is covered by six beach profile lines during the Full Measures survey (Appendix A). Previously low beach levels along BTBC15 had recovered by the time of the current survey (September 2009), especially around MSL. The steeper drop-off in lower profile gradient towards low water did, however, cut landwards by around 10m. Similar trends were also observed along profile BTBC16 and BTBC17. Along the latter profile, upper beach levels, around MHWS and HAT increased by up to 2m.</p> <p>Along BTBC18, BTBC19 and BTBC20 profile form and position remained relatively stable.</p> | <p>Goswick Sands exhibited recovery along its northern sections and considerable stability in the south. The area between North Low and South Low (BTBC18 to BTBC20) has remained relatively stable since the surveys began, due mainly to a large expanse of protective sand flat that is built out towards Snook Point on Holy Island.</p> |

2.4 Holy Island

| Survey Date | Description of Changes Since Last Survey | Interpretation |
|-------------|--|--|
| 09-2009 | <p>Beach Profiles:</p> <p>Holy Island is covered by eight beach profile lines during the Full Measures survey (Appendix A).</p> <p>BTBC21 to BTBC23 are located on the north side of the island, along The Snook. There is great stability in the sand flats and sand dunes measured along these profile lines.</p> <p>BTBC24 to BTBC28 are located on the south side of the island in the vicinity of the castle and priory. BTBC27 actually extends out to, and across, the small island upon which the remains of a chapel stand. All profiles show very little change since the previous survey.</p> | <p>The sand flats and sand dunes around Holy Island (as measured by the eight beach profile lines) remain very stable in both form and position.</p> |
| 10-2009 | <p>Topographic Survey:</p> <p>Holy Island causeway and adjacent sand flats are covered by an annual topographic survey which commenced in October 2004. The purpose of this survey was to determine whether raising of the causeway had any negative impacts on the adjacent sand flats in terms of accretion or erosion.</p> <p>Data from the current survey (October 2009) have been used to create a DGM (Appendix B – Map 2a) using a Geographical Information System (GIS). This figure shows that the channel of South Low is currently in a different position to that observed when the Ordnance Survey base-map was produced. This DGM has been compared against a similar DGM created using the October 2008 data (Appendix B – Map 2b). This shows, as in previous surveys, that changes between the two successive surveys are mostly very minor and where they do exist are mostly focused around the channel flanks, associated with channel widening due to heavier river outflow.</p> <p>Now that there is 5 years of data in existence, the DGM has also been compared against a similar DGM created using the October 2004 data (Appendix B – Map 2c) to identify longer-term trends. This shows that the most notable changes remain adjacent to the river channel, but there are a few zones where overall net accretion has occurred over this time, especially on the north of the causeway around 250m from South Low, the south of the causeway around 350m from South Low and to a lesser extent on both sides of the causeway around 150m from its landing at the island.</p> | <p>It has previously been noted that most changes between successive surveys along Holy Island causeway are located along the flanks of the channel of South Low. This trend continues to the current survey.</p> <p>By examining the current survey against the earliest survey, some 5 years ago, a longer-term picture can now be identified. This shows four distinct zones of small net accretion, although most of the adjacent sand flats are unaffected.</p> |

2.5 Bamburgh

| Survey Date | Description of Changes Since Last Survey | Interpretation |
|-------------|---|--|
| 09-2009 | <p>Beach Profiles:</p> <p>Bamburgh is covered by one beach profile line during the Full Measures survey (Appendix A), located approximately 750m south-east of the castle.</p> <p>BTBC29 shows great stability in the dunes and foreshore changes are within previous bounds of behaviour. A small berm was observed along the profile at a level of around MSL.</p> | Bamburgh beach (as measured along BTBC29) remains highly stable. |

2.6 Beadnell Village

| Survey Date | Description of Changes Since Last Survey | Interpretation |
|-------------|---|---|
| 09-2009 | <p>Beach Profiles:</p> <p>Beadnell Village is covered by two beach profile lines during the Full Measures survey (Appendix A).</p> <p>BTBC30 is around 300m to the north of the village and shows a stable dune position and upper foreshore accretion since the previous survey (October 2008).</p> <p>BTBC31 is in Nacker Hole and extends across the promenade and seawall. The upper beach level experienced a degree of accretion at the toe of the sea wall, but in general profile form remained relatively stable.</p> | The foreshores within Beadnell Village were relatively unchanged since previous surveys and show reasonably healthy conditions. |

2.7 Beadnell Bay

| Survey Date | Description of Changes Since Last Survey | Interpretation |
|-------------|--|--|
| 09-2009 | <p>Beach Profiles:</p> <p>Beadnell Bay is covered by nine beach profile lines during the Full Measures survey (Appendix A). BTBC32 to BTBC34 are located in the north of Beadnell Bay. BTBC32 is immediately in the lee of Beadnell Harbour. The most recent survey here shows signs of upper profile lowering along a 15m cross-section distance (between chainages of 10m and 25m) by around 0.25m since the previous survey (October 2008). This has reduced this section of the profile to a level similar to the previously recorded low values in this short section. Further seaward, however, there has been an increase in foreshore levels by up to around 0.2m. BTBC33 exhibited similar trends along the upper foreshore, although the accretion along the lower foreshore generally occurred between October 2008 and March 2009 surveys, with very minor local further accretion to September 2009. There was a small amount of material deposition directly at the toe of the dunes between the previous survey (March 2009) and the current survey. BTBC34 generally showed accretion between March 2009 and September 2009, with beach levels typically around 0.15m higher.</p> <p>BTBC35 to BTBC38 are located between Burn Carrs and the outfall of Brunton Burn/Long Nanny. BTBC35 showed recovery in foreshore level above MSL following the record low levels recorded in October 2008, but further lowering occurred along a 50m length of the profile below MSL. Along BTBC36 upper and lower beach levels recovered to very healthy states. The situation along BTBC37 was similar, although a runnel was formed at a chainage of around 50m. BTBC38 showed the presence of two ridge and runnel features above MSL and relatively low beach levels seaward.</p> <p>ADC01 and ADC02 are located along the frontage to the south of the outfall of Brunton Burn/Long Nanny. Although beach levels were quite low at the toe of the dunes along ADC01 compared to the previous survey (March 2009) they remained within the bounds of previous behaviour and no adverse effect was noted to the dune profile or position. Along ADC02 some cut-back of the dune face occurred (the dune crest was unaffected by this in height and position). This had the effect of building up the upper beach at the toe of the dunes. Elsewhere along the profile, foreshore levels were at their highest values for a number of years.</p> | <p>Changes in the north of Beadnell Bay, in the vicinity of the harbour, were within previous bounds of behaviour and generally showed recovery between October 2008 and March 2009, with marginal further recovery from then until September 2009.</p> <p>Between Burn Carrs and the outfall of Brunton Burn/Long Nanny, upper foreshore levels generally recovered, although a more mixed response was observed along the lower foreshore. Furthermore, along profiles closer to the river outfall, ridge and runnel features became noted, perhaps associated with secondary drainage flow from the river outfall.</p> <p>South of the river, some dune face cut-back was observed along one profile and further monitoring will reveal whether this will be followed by recovery or recession of the dune crest.</p> |

2.8 Embleton Bay

| Survey Date | Description of Changes Since Last Survey | Interpretation |
|-------------|---|--|
| 09-2009 | <p>Beach Profiles:</p> <p>Embleton Bay is covered by two beach profile lines during the Full Measures survey (Appendix A).</p> <p>The previous low levels recorded at the dune toe and upper beach along ADC03 remained, although there was a minor redistribution of sand at a chainage of around 90m, resulting in a berm formation between MHWS and HAT.</p> <p>Beach levels along ADC04 accreted at the toe of the dunes and above MHWN. A berm was formed above HAT. A second berm was formed lower down the profile towards low water.</p> | <p>The dune position and form remains unaffected by changes in the foreshore levels.</p> |

2.9 Boulmer

| Survey Date | Description of Changes Since Last Survey | Interpretation |
|-------------|--|--|
| 09-2009 | <p>Beach Profiles:</p> <p>Boulmer is covered by two beach profile lines during the Full Measures survey (Appendix A). These were added to the programme in October 2007.</p> <p>Along ADC04A some lowering occurred after the previous survey (March 2009) showed record high levels along the lower foreshore, covering some of the rocky foreshore with a veneer of sand. Despite this lowering, however, levels remained relatively high overall.</p> <p>Continued minor lowering occurred at the dune toe along ADC04B, but lower down the profile relatively high levels remained.</p> | <p>Whilst there are no major concerns at the present time, the persistent small-scale lowering of the beach at the dune toe needs continued observation.</p> |

2.10 Alnmouth

| Survey Date | Description of Changes Since Last Survey | Interpretation |
|-------------|--|---|
| 09-2009 | <p>Beach Profiles:</p> <p>Alnmouth Bay is covered by ten beach profile lines during the Full Measures survey (Appendix A).</p> <p>ADC05 and ADC06 are located in the small pocket beach that is contained by the rock outcrops of Brady Carrs and Marden Rocks. Both profiles exhibited very minor change since the previous (October 2009) survey, with slight accretion along the upper beach and a localised and slight lowering at around 1mODN.</p> <p>ADC07, ADC08 and ADC09 are located between Marden Rocks and the mouth of the River Aln estuary. Along ADC07 and ADC08, the high beach levels at the toe of the dunes (recorded in March 2009) remained, and accretion occurred down each profile to around the mid beach. Seaward of the mid beach, the profile form was influenced by the formation of a ridge and runnel feature. Between October 2008 and March 2009 profile ADC09 experienced significant change, with massive lowering of beach levels and the total wash-out of the pioneer dune line, linked to changes in the alignment of the outlet channel of the River Aln estuary. Between March 2009 and September 2009, notable foreshore recovery had occurred, although levels directly at the toe of the dunes remained as low as recorded on the previous survey.</p> <p>ADC10 to ADC14 are spaced between the south bank of the River Aln estuary and the North Breakwater of Warkworth Harbour at the mouth of the River Coquet estuary. Along ADC10 record low beach levels were recorded in October 2008. Further lowering continued to September 2009 resulting in very low beach levels between the toe of the dunes and MSL. Seaward of MSL a very large berm formed on the lower profile. Beach levels at the dune toe and along the upper foreshore recovered to a healthy state along ADC11 and a large protective berm was formed around MHWS and HAT along ADC12. Similar upper foreshore accretion occurred along ADC13, where a large berm also formed around MHWN, and also ADC14, although no berm was observed.</p> | <p>Profiles between Brady Carrs and Marden Rocks remain relatively stable.</p> <p>The greatest changes between Marden Rocks and the mouth of the River Aln remain linked with the migration of the river channel.</p> <p>Record low beach levels were recorded along ADC10, adjacent to the river mouth on the south side. The dunes have not yet started to erode, but are unlikely to withstand such low beach levels for any significant duration before recession commences.</p> <p>Further south along Alnmouth Bay all remaining profiles were in a very healthy state.</p> |

| Survey Date | Description of Changes Since Last Survey | Interpretation |
|-------------|---|---|
| 09-2009 | <p>Topographic Survey:</p> <p>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 (September 2009) have been used to create a DGM (Appendix B – Map 3a). This has been compared against a similar DGM created using the March 2009 data (Appendix B – Map 3b). This reveals that changes in the foreshore are greatest in the vicinity of the river channel. At the southern extent of the surveyed area erosion continues to dominate as the channel cuts closer to shore further still. There is then an area of notable erosion, with some material pushed up the beach profile (as previously described along Beach Profile ADC09).</p> | <p>The northern section of Alnmouth Bay, between the river mouth and Marden Rocks, continues to show notable redistribution of sand, with particular areas of erosion noted where the river channel is cutting closer to shore in the south of this zone.</p> |

2.11 High Hauxley and Druridge Bay

| Survey Date | Description of Changes Since Last Survey | Interpretation |
|-------------|--|---|
| 09-2009 | <p>Beach Profiles:</p> <p>High Hauxley to Druridge Bay is covered by nine beach profile lines during the Full Measures survey (Appendix A). Four of these (with 'A' or 'B' suffices) were added to the programme in October 2007.</p> <p>Profile ADC15 extends across the extensive dunes at Amble Links and then across the foreshore. Between October 2007 and October 2008 the seaward profile experienced notable landward recession, resulting in the lowest beach levels recorded to date. The main dunes field was unaffected. Between October 2008 and September 2009, further recession has not occurred, although the low levels have remained along the upper beach. Accretion of the mid and lower profile, below around MHWN, has occurred.</p> <p>ADC15A, ADC16 and ADC16A are all located around Hauxley Haven. The major accretion previously observed along ADC15A between October 2008 and March 2009 remained intact. Along ADC16 accretion occurred down to around MSL, including formation of a berm around MHWS. Profile ADC16A experienced a healthy recovery in beach levels when compared against the March 2009 survey which showed lowering in front of the revetment protecting Low Hauxley village.</p> <p>ADC16B, ADC17 and ADC17A are located between Bondi Carrs and Hadston Carrs and extend seawards from Togston Links. Profile ADC16B experienced lowering between October 2008 and March 2009 and low beach levels remained to the present survey. The backing dunes exhibited a stable position and form. ADC17 experienced a healthy beach growth by typically 0.4m along its entire length down to around MSL and stable foreshore levels thereafter. The relatively low beach levels along ADC17A persisted to the present survey, but with no adverse effects on the backing dunes.</p> <p>CMBC01 and CMBC02 are located in the southern sections of Druridge Bay. CMBC01 experienced the continued development of a berm around HAT since the previous survey (April 2009), mainly through redistribution of material from lower down the profile. CMBC02 experienced general accretion along the beach profile down to around MSL. The dunes along both profiles experienced no change in form or position.</p> | <p>Previous recession of the beach fronting Amble Links (along ADC15) has stopped, suggesting it was a single cut-back driven by a storm event rather than an ongoing trend.</p> <p>Beaches around Hauxley Haven were in a healthy condition, including signs of beach recovery from a previous low state immediately in front of Low Hauxley village.</p> <p>Towards Bondi Carrs (ADC16B) and Hadston Carrs (ADC17A) beach levels generally remained relatively low, but with no adverse effects on the backing dunes. In between these rock outcrops (along ADC17), the foreshore experienced notable recovery in level to a healthy state.</p> <p>Measured profiles in the southern half of Druridge Bay show stable dunes and minor beach fluctuations.</p> |

2.12 Lynemouth

| Survey Date | Description of Changes Since Last Survey | Interpretation |
|-------------|--|---|
| 09-2009 | <p>Beach Profiles:</p> <p>Lynemouth is covered by six beach profile lines during the Full Measures survey (Appendix A). Two of these, profiles CMBC03A and CMBC03B, were added to the programme in October 2007.</p> <p>CMBC03 is located just to the south of Snab Point headland and continues to exhibit great stability in the form and position of the cliff and rocky foreshore.</p> <p>CMBC03A and CMBC03B are located to the north of Lynemouth Power Station and both extend across the extensive slag banks before reaching the foreshore. Along CMBC03A some very slight recovery in foreshore levels has occurred along the whole profile length. There remains, however, only a very narrow width before the toe of the slag bank would start to become cut in to. Along CMBC03B the process of slag bank erosion has been progressively ongoing for some years. The most recent survey reveals a further cut back and lowering at the toe of the slag bank and further lowering of the foreshore levels.</p> <p>WDC01 extends from seaward of the rock revetment down to low water across the extensive slag banks. Significant landward cut-back has occurred since the previous survey (October 2008), resulting in a landward movement of the MHWS mark by 15m over the 11 months to the current survey (September 2009). This results in a net landward retreat of 24m since November 2006.</p> <p>WDC02 and WDC03 are to the south of the Power Station. Along both profiles there was cut-back of the seaward face of the profile (by around 4m (measured at MHWS) along WDC02 and by around 8m along WDC03) and redistribution of this material to the crest and landward slope of the slag heap fronting the dunes.</p> | <p>To the north of Lynemouth Power Station, there remains irreversible and ongoing foreshore lowering and landward retreat of the slag bank along CMBC03B. This appears a clear and consistent trend over recent years. Along profile CMBC03A, slightly further north, the onset of slag bank erosion has been anticipated since there is only a very narrow upper beach width seaward of its toe. For the first survey in a number of years, however, the otherwise general progressive erosional trend of the foreshore has (probably temporarily) ceased and slight accretion of the upper beach was observed.</p> <p>At the revetment extension in front of the coal stocking yard the foreshore has retreated landwards rapidly. It is understood that the bank is periodically replenished with slag by Alcan to prevent undermining of the backing rock revetment extension and recent trends in foreshore behaviour suggest this is an essential management practice.</p> <p>To the south of Lynemouth Power Station, the slag heaps continue to experience processes of wash-over, leading to landward migration of the seaward face and deposition of liberated material on the crest and landward slope of the bank.</p> |

2.13 Newbiggin-by-the-Sea

| Survey Date | Description of Changes Since Last Survey | Interpretation |
|-------------|--|---|
| 09-2009 | <p>Beach Profiles:</p> <p>Newbiggin-by-the-Sea is covered by six beach profile lines during the Full Measures survey (Appendix A). Two of these, profiles WDC05A and WDC06A, 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.</p> <p>WDC04 and WDC05 are to the north of Newbiggin Point. WDC04 showed cut-back between October 2007 and October 2008 at the toe of the cliffs, but this has not worsened. Along the foreshore modest beach recovery (up to 0.2m) occurred. Along WDC05, the berm that previously formed around HAT was notably removed, with some material being pushed up the beach to accrete at the toe of the cliffs but with levels below MHWS being relatively low. No changes were recorded along the rocky foreshore at the lower profile.</p> <p>WDC05A is in the north of Newbiggin Bay and experienced dramatic increases in beach level between October 2007 and April 2008 following the replenishment scheme. Since then changes have been mostly continued accretion, slowing down in rate of change to the current survey, which exhibited a modest increase in beach levels along the mid and upper beach, with a notable large berm still being evident above HAT.</p> <p>In the northern-central section of the bay, as measured along WDC06, the profile experienced a massive increase in sand volume following replenishment and then notable subsequent cut back to October 2008. Since then, further cut-back of the beach profile has occurred, by around a further 3m, although the profile slope remains constant. Since October 2007, there has been a cumulative cutback of the beach width by around 21m, as measured at MHWS.</p> <p>WDC06A is located centrally within Newbiggin Bay and after the major replenishment (captured on the October 2007 survey) experienced notable cut-back to April 2008 and then a degree of recovery to October 2008. Subsequent cut-back to April 2009 has once again recovered to the current survey (September 2009) which exhibits a similar profile to that recorded in October 2008.</p> | <p>To the north of Newbiggin Point, beach changes were within normal bounds of behaviour.</p> <p>Within Newbiggin Bay, there remains ongoing redistribution of sediment from northern-central sections of the bay (profile WDC06), where cut-back of the profile continues, to the north of the bay (profile WD05A), where accretion continues.</p> <p>In the centre of the bay, the cut-back along WDC06A appears to have occurred to an extent around which successive redistribution of sediment is now occurring along the profile length. There remains a very healthy width of beach between the sea wall and the level of HAT.</p> |

| Survey Date | Description of Changes Since Last Survey | Interpretation |
|-----------------------|--|---|
| | <p>Along WDC07, towards the south of the bay, the width between the sea wall and the crest of the upper beach berm remains consistent with that recorded in October 2008, but the seaward face of the berm and subsequent foreshore profile has further cut-back by around 4.5m (measured at MHWS).</p> | <p>In the south of the bay, along WDC07, cut-back of the seaward slope of the profile continues.</p> |
| <p>09-2009</p> | <p>Cliff Top Survey:</p> <p>Data relating to the cliff top surveys are best viewed as digital 'kmz' files loaded into Google Earth.</p> <p>Newbiggin Caravan Park:</p> <p>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.</p> <p>The northern part of this frontage (approximately 70m in length) is unprotected by defences. The frontage has remained relatively stable since the previous survey (April 2009), although along one 10m length cliff top cut back by between 0.25m and 0.6m has occurred and in another area a maximum cut-back of 0.5m has occurred along a 6m length. When compared against the first survey (September 2007) recession is more clearly identified, with up to 1m cumulative cut-back in places.</p> <p>The central section of this frontage (approximately 125m in length) is protected by concrete blocks and rubble. Due to this, most of the frontage is stable when compared against the previous (April 2009) survey.</p> <p>The southern section of surveyed cliff (around 80m in length) is fronted by a rocky shore platform. This section is also mostly relatively stable, when compared against the previous survey.</p> | <p>Changes in cliff top position along Newbiggin Caravan Park are mostly occurring in the undefended section in the north of the frontage. Central and southern sections exhibit little change.</p> |

2.14 Cambois

| Survey Date | Description of Changes Since Last Survey | Interpretation |
|-------------|--|---|
| 09-2009 | <p>Beach Profiles:</p> <p>Cambois is covered by seven beach profile lines during the Full Measures survey (Appendix A).</p> <p>Profiles WDC08 and WDC09 are located to the north of the River Wansbeck estuary in front of Sandy Bay Caravan Park.</p> <p>WDC08 extends from the cliff across the rock berm onto the foreshore. There are no significant changes in the cliff top position or cliff face at this profile, with accretion of foreshore levels observed seaward of the rock berm since the last survey (October 2008). Typically levels are 0.2m higher, but locally the increase is up to 0.4m.</p> <p>WDC09 extends from the cliffs at the very southern end of the Caravan Park. Here the cliff top and face has cut back by around 1.5m since the previous (October 2008) survey. Foreshore levels between the toe of the cliff and around MSL have also changed, with accumulation of material on the upper length and lowering on the lower length of this beach section. Seaward of around MSL the foreshore levels remain unchanged.</p> <p>Profiles WDC10 to WDC14 are all located along Cambois Bay, between the River Wansbeck and River Blyth estuaries.</p> <p>WDC10 is located just to the south of Cambois House. The significant beach lowering previously recorded along this section in October 2008 had substantially recovered by the time of the current survey, resulting in accretion by up to 1.5m in places along the foreshore. The profile form now exhibits a large berm between around MSL and MHWN, although levels landward of the berm remain similar to those low values recorded in October 2008.</p> <p>WDC11 extends across the rock revetment fronting the now disused foundry. Beach levels at the toe of the defence were around 0.2m lower than recorded on the previous survey (October 2008) but were within bounds of previously observed behaviour. Around MSL the profile accreted material.</p> | <p>To the north of the River Wansbeck estuary, along Sandy Bay Caravan Park, the existing rock berm is providing protection to the cliffs along WDC08, but the undefended cliffs further south at WDC09 are eroding.</p> <p>To the south of the River Wansbeck estuary, substantial (although not quite complete) recovery of previously low beach levels occurred adjacent to the river mouth and the foreshore lowering slightly south was within normal bounds of behaviour.</p> |

| Survey Date | Description of Changes Since Last Survey | Interpretation |
|-------------|--|---|
| 09-2009 | <p>Along WDC12, situated approximately mid-way along Cambois Bay, a berm and runnel was formed on the mid-beach, with some 0.3m of accretion along the upper beach. The position and form of the backing dunes remained stable.</p> <p>A similar trend was observed along both WDC13 and WDC14, although along the latter profile the mid-beach berm was far more distinct and the accretion along the upper beach reached up to 0.6m.</p> | <p>In the central and southern sections of Cambois Bay beaches received a net influx of sediment, creating healthy levels along much of the profile lengths.</p> |
| 09-2009 | <p>Cliff Top Surveys:</p> <p>Data relating to the cliff top surveys are best viewed as digital 'kmz' files loaded into Google Earth.</p> <p>Sandy Bay Caravan Park:</p> <p>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 closets to the cliff edge), located to the immediate north of the mouth of the River Wansbeck estuary.</p> <p>When considered as changes between the last survey (March 2009) and the current survey (September 2009), there has been mostly occasional erosion of around 0.15m to 0.2m in several places along the length. There are three areas of large erosion however, all to the south of the rock bunds. In these three areas, typically each only 3m to 5m in length, individual slumps have resulted in the loss of 0.8m to 1.0m of cliff top locally.</p> <p>When considering changes between the first survey (September 2007) and the current survey (September 2009), it is evident that a large length of this frontage has been actively eroding over the two years of monitoring, most often by small amounts (e.g. 0.1 to 0.3m), but in localised individual events by up to 2.5 or 3.5m. The most active area is to the south of the rock bunds and the most stable the very north. Even in the area fronted by rock bunds, the cliffs have eroded locally in places.</p> | <p>The cliffs along Sandy Bay Caravan Park continue to exhibit generally local and small-scale erosion in a number of discrete locations. Over the two years of cliff top surveying this aggregates as a general net recession of the overall cliff line by around 0.1m to 0.3m. Locally in individual slumps, mainly towards the very south of the site, recession over short lengths has been up to 3.5m. This has particular implications for the caravans located to the cliff edge in the south of the site.</p> <p>IMPORTANT NOTE:</p> <p>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.</p> |

| Survey Date | Description of Changes Since Last Survey | Interpretation |
|-------------|--|--|
| 09-2009 | <p>Cliff Top Surveys: Data relating to the cliff top surveys are best viewed as digital 'kmz' files loaded into Google Earth.</p> <p>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).</p> <p>The current survey (September 2009) is only the second survey along this frontage. It generally shows either stability in cliff top position or a landward movement of the cliff crest by around 0.1m to 0.15m along the frontage. There are only two notable areas of greater change. One is located in front of the properties in the north of the frontage (the two houses south of Cambois House) where around 3m of cut back appears to have occurred over a small (3m) length. The other is just to the north of the roundabout intersection where cut back has been between 0.5m and 0.7m in local areas.</p> | <p>The changes observed along the frontage may be mostly due to survey accuracy. This is because along most of the frontage the cliff edge cannot precisely be defined since it is mostly covered by vegetation and often is a bevelled slope requiring a degree of surveyor interpretation, rather than a distinct cliff edge. It is estimated that accuracy of this technique is around 0.15m and therefore a longer-term record is required to be meaningful. Further to the south, where a clear cliff edge is distinguishable behind the rock revetment, the survey is highly accurate.</p> |

2.15 Blyth South Beach

| Survey Date | Description of Changes Since Last Survey | Interpretation |
|-------------|--|---|
| 09-2009 | <p>Beach Profiles:</p> <p>Blyth South Beach is covered by six beach profile lines during the Full Measures survey (Appendix A).</p> <p>BVBC01 is located towards the north of South Beach, in front of the area of land owned by Port of Blyth. The recent survey shows some minor accretion at the dune crest and no change in the seaward face or position of the dune. There has been some modest redistribution of sand down to a chainage of around 80m, resulting in beach level fluctuations of around 0.2 to 0.3m, comprising both lowering and increases in level since the March 2009 survey. Between chainages of 80m and 135m, however, significant beach lowering has occurred, resulting in record low levels along part of this section.</p> <p>The low levels recorded in March 2009 at the toe of the sea wall and at the upper beach along BVBC02 recovered. Local draw-down of sand occurred at a chainage of around 35m, to levels exceeding the previous record low values. Seaward of this point, however, beach levels recovered to reasonably healthy values.</p> <p>Along BVBC03, material was eroded from the lower beach, especially around MSL, and deposited in the form of a very large berm around MHWS and HAT on the upper beach. This had the effect of creating the widest recorded beach to date as measured along the HAT level. The dune position and form remained stable.</p> <p>BVBC04, located just to the south of Gloucester Lodge Farm in the centre of South Beach, showed relatively modest changes since the March 2009 survey, with the creation of a small berm around HAT from local redistribution of sand from the flatter preceding profile form. Consequently, there has been progressive recovery in upper beach levels since the record low levels were observed in April 2008.</p> <p>BVBC05 and BVBC06 both similarly exhibited only modest and local changes in form and level, linked mainly to movement of material locally to form or enhance berms.</p> | <p>In general, surveys at BVBC01 have shown considerable beach variability over time. The surveys over recent years have shown low levels, and slow, progressive lowering of the foreshore but no change in the narrow strip of dunes fronting the boundary wall of the Port of Blyth. There has now been a dramatic lowering of the beach around, and up to 1m above, MSL, resulting in lowest ever recorded levels in this zone. This has not (to date) resulted in erosion of the dunes, but is an issue of concern that should be monitored closely in the future for signs of continued beach lowering (possibly leading to commencement of dune recession) or for evidence of beach recovery.</p> <p>Further south, along BVBC02 and BVBC03 notable fluctuations in beach level and form continue. There appears to be no consistent trends, however, and it is likely that changes are dictated by incoming wave direction, causing some local alongshore redistribution of sand as well as the cross-shore movement from upper to lower beach profiles (or <i>vice versa</i>). The low levels along BVBC01 and the beach recovery along BVBC02 and the record berms widths recorded on the upper beach at BVBC03 suggest a degree of sand movement from north to south.</p> <p>Beach level variability becomes slightly less with progression south along the frontage, but in all sections is linked mainly with sequences of berm formation and flattening.</p> |

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

- Significant changes, and inter-relationships, continue to be observed at the mouth of the River Tweed estuary. Along the dunes on the south bank continued erosion occurred. It is believed that the most recent cut back occurred significantly between October 2008 and March 2009, with greater stability since. Nonetheless, this remains a vulnerable area. The changes along Sandstell Point also remain significant, with signs recently of a build-up of sand in a narrow ridge on the previously flattened spit crest. Profiles immediately south of the spit, along the open coast, remained at low levels.
- Further south along Spittal, the previously low beach levels become somewhat restored along the upper beach, but the lower beach shelved off to low water steeply.
- Goswick Sands, Holy Island, Bamburgh and Beadnell Village all showed recovery or stability and show no concerns at the current time.
- In Beadnell Bay beach profiles changes tended to be greater than along coastlines further north, but remained within the bounds of previous behaviour, except for south of the outfall of Brunton Burn/Long Nanny (along profile ADC02) where dune cut-back occurred.
- Embleton Bay and Boulmer showed no major changes, although the persistent small-scale lowering of the beach and dune toe at Boulmer needs observation.
- Alnmouth Bay continues to exhibit notable change in the vicinity of the outfall of the River Aln estuary. Record low beach levels were recorded adjacent to the mouth on the south side, while to the north of the channel beach levels at the toe of the dunes remained low, despite foreshore recovery lower down the profile.
- No major concerns were identified in Hauxley and Druridge Bay although some profile levels remain low.
- Irreversible foreshore erosion remains ongoing at Lynemouth to the north of the Power Station and significant cut back of the slag was also noted seaward of the rock revetment extension to the coal stocking yard.
- The replenished beach within Newbiggin Bay continues to exhibit redistribution of sand, although the rates of change seem to be slowing.
- Along Newbiggin Caravan Park, the unprotected section of cliffs remains eroding in small discrete patches. In places, the cumulative cliff top cut back has reached up to 1m since September 2007.

- Erosion remains ongoing also along Sandy Bay Caravan Park, with cut-back particularly severe at the southern boundary of the site.
- Profile BVBC01, at the northern end of Blyth South Beach, experienced significant lowering along one section of foreshore. Whilst this has not, to date, resulted in the onset of recession of the backing dunes, this area needs to be carefully monitored because only a very narrow dune width exists seaward of the Port of Blyth boundary fence, which would not function particularly effectively as a defence against sea flooding to the backing Port land and infrastructure.
- Further south, notable fluctuation continue to occur across central areas of Blyth South Beach, linked to the higher exposure of this area of frontage.

Appendices

Appendix A

Beach Profiles

Please see separate files

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 |

Appendix B
Topographic Surveys

Topographic Contours
at 1 metre interval

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

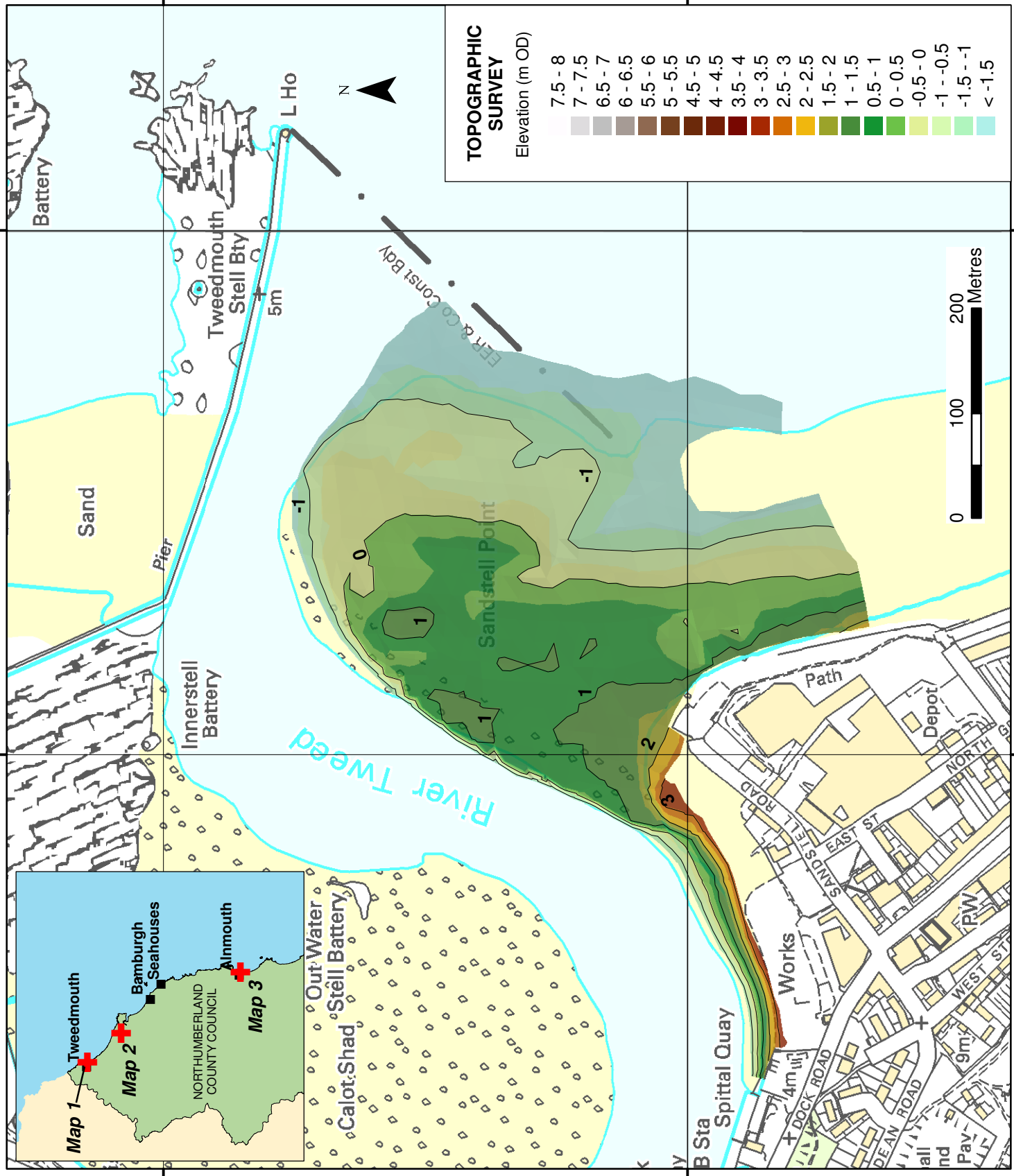
Appendix B - Map 1 Northumberland County Council Frontage

Analytical Report 2
'Full Measures' Survey 2009

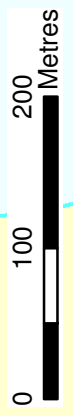
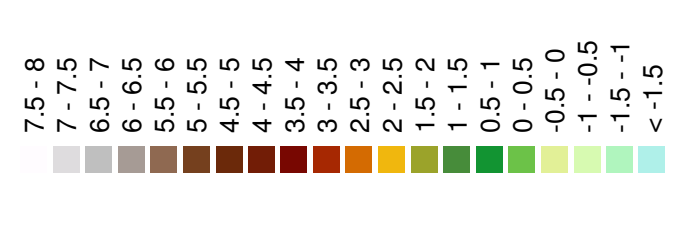
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Drawn by: TC Date: 07/12/2009
Checked by: NC Date: 14/12/2009
Approved by: NC Date: 14/12/2009

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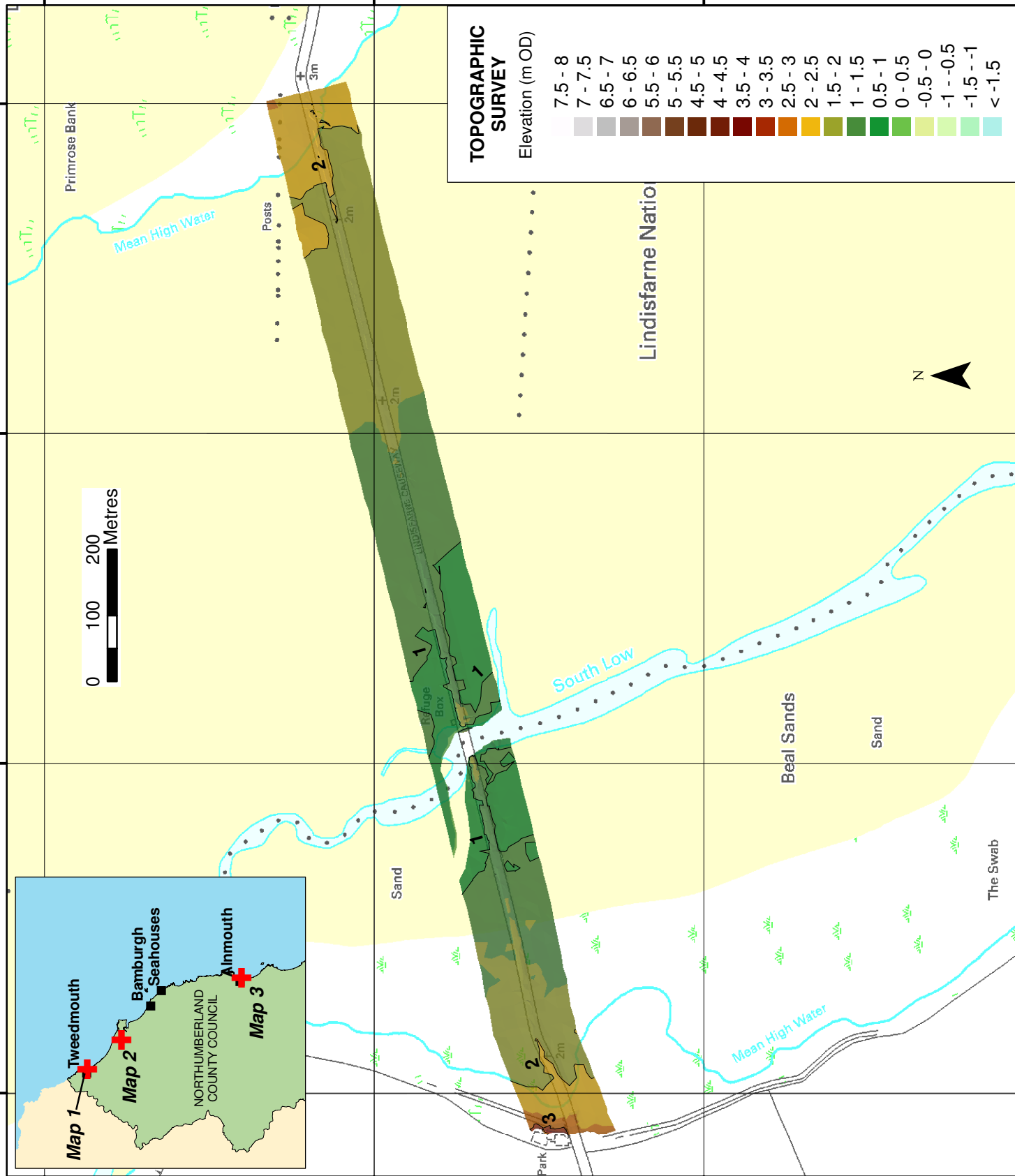
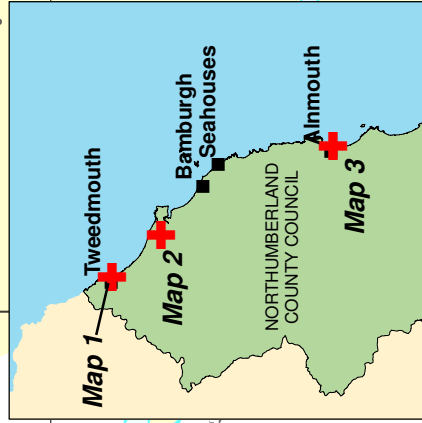
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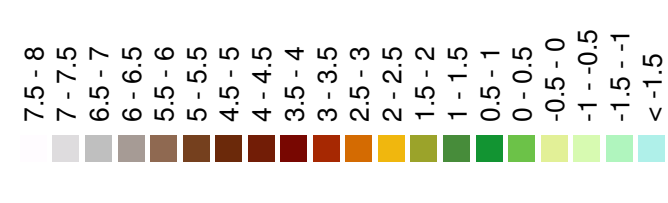
401000
400500

652500

652000



TOPOGRAPHIC SURVEY
Elevation (m OD)



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

Analytical Report 2
'Full Measures' Survey 2009

Drawing Scale 1:8,000 at A4
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643500

643000

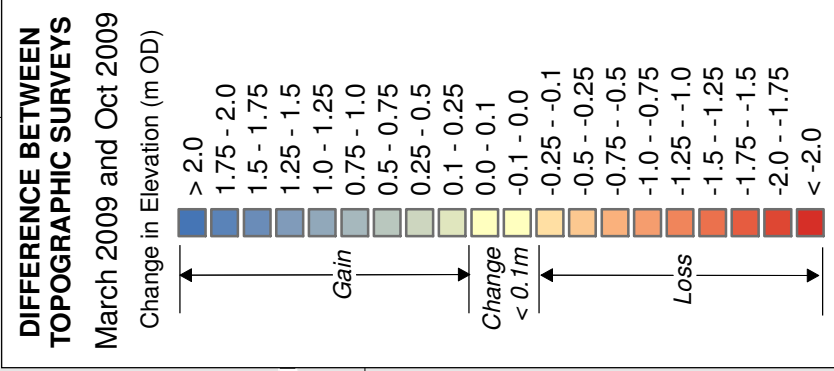
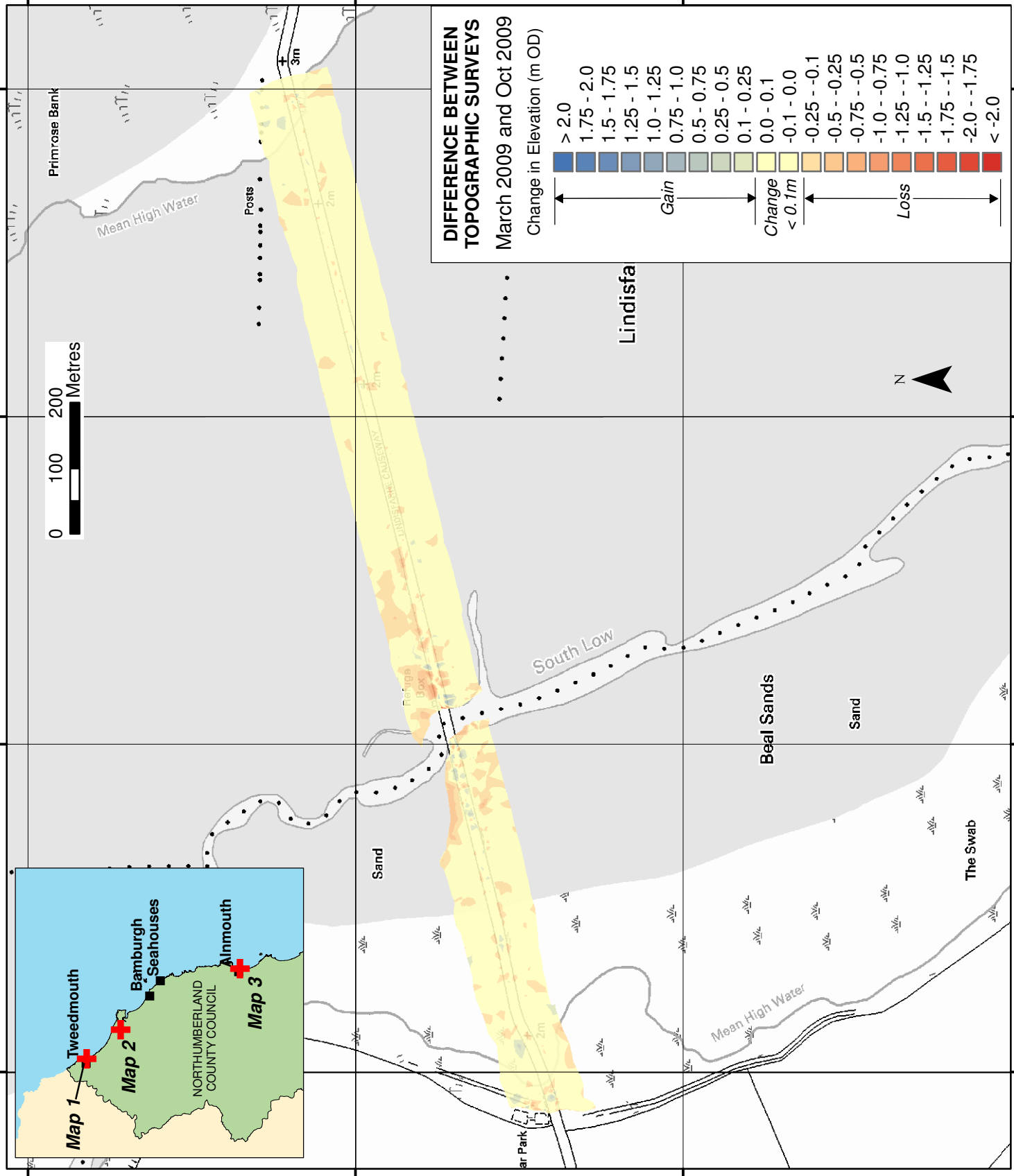
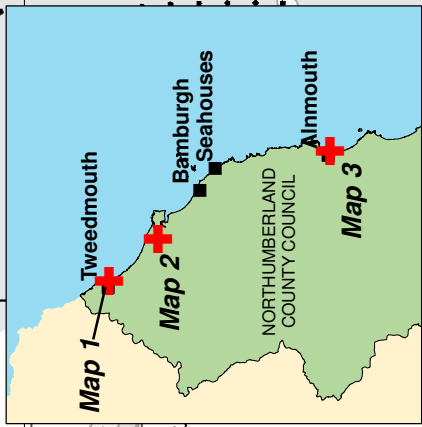
642500

408000

408500

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Topographic Contours at 1 metre interval

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

Appendix B - Map 2b Northumberland County Council Frontage

Analytical Report 2
'Full Measures' Survey 2009

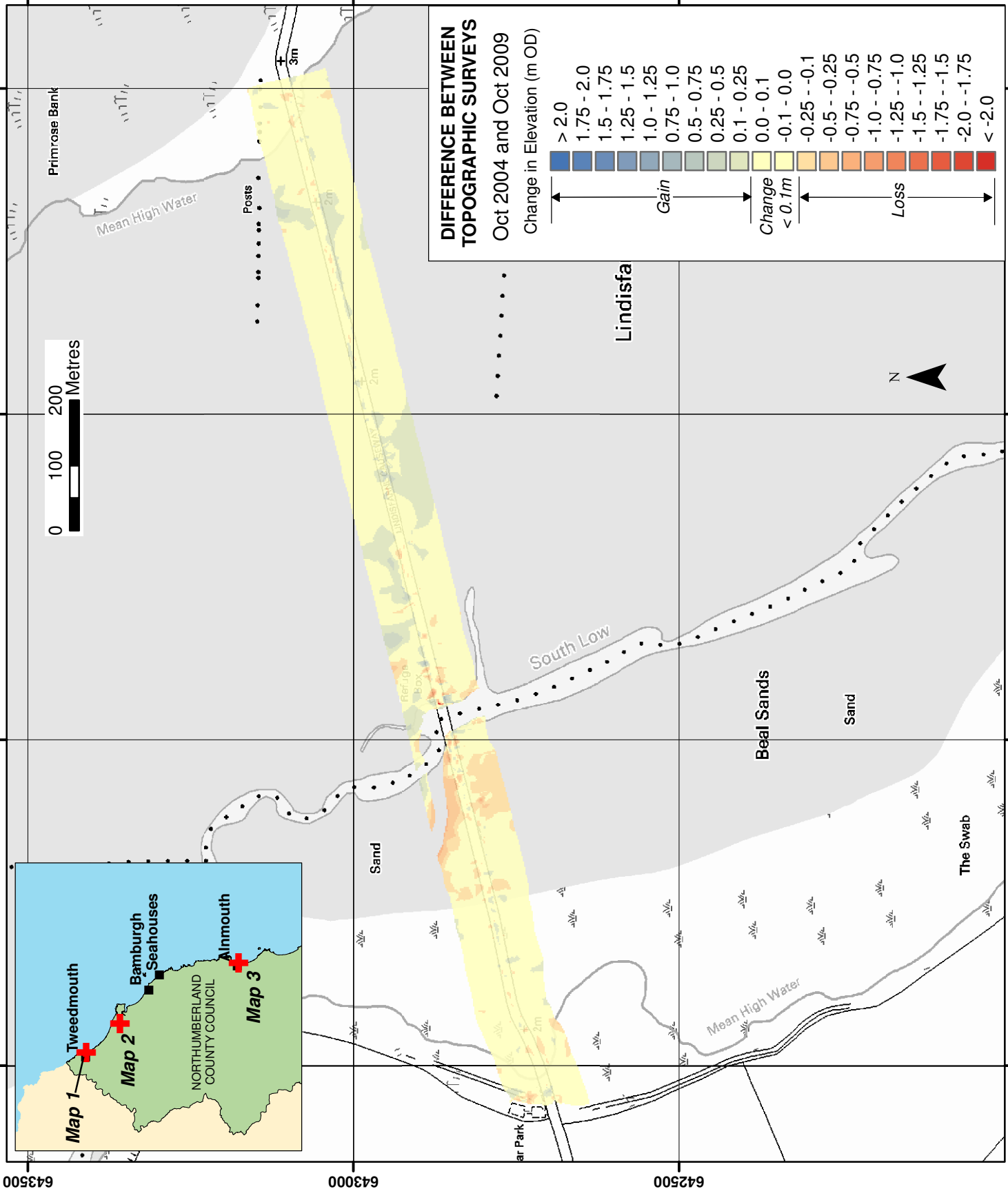
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Drawn by: TC Date: 07/12/2009
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| | | |
|---|---|--|
| <p>Topographic Contours at 1 metre interval</p> | <p>Client: North East Coastal Group Project: Cell 1 Regional Coastal Monitoring Programme</p> | <p>Appendix B - Map 2c Northumberland County Council Frontage</p> <p>Analytical Report 2 'Full Measures' Survey 2009</p> <p>Drawing Scale 1:8,000 at A4</p> <p>Drawn by: TC Date: 07/12/2009 Checked by: NC Date: 14/12/2009 Approved by: NC Date: 14/12/2009</p> <p>ROYAL HASKONING Royal Haskoning Meriborough House Meriborough Crescent Newcastle upon Tyne NE1 4EE</p> <p>Tel: +44 (0)191 211 1300 Fax: +44 (0)191 211 1313 www.royalhaskoning.com</p> <p>Reproduced from Ordnance Survey mapping with the permission of the Controller of Her Majesty's Stationery Office © Crown Copyright. Unauthorised reproduction infringes Crown Copyright and may lead to prosecution or civil proceedings. Northumberland County Council. Licence No. LA 100021901</p> |
|---|---|--|



— Topographic Contours
at 1 metre interval

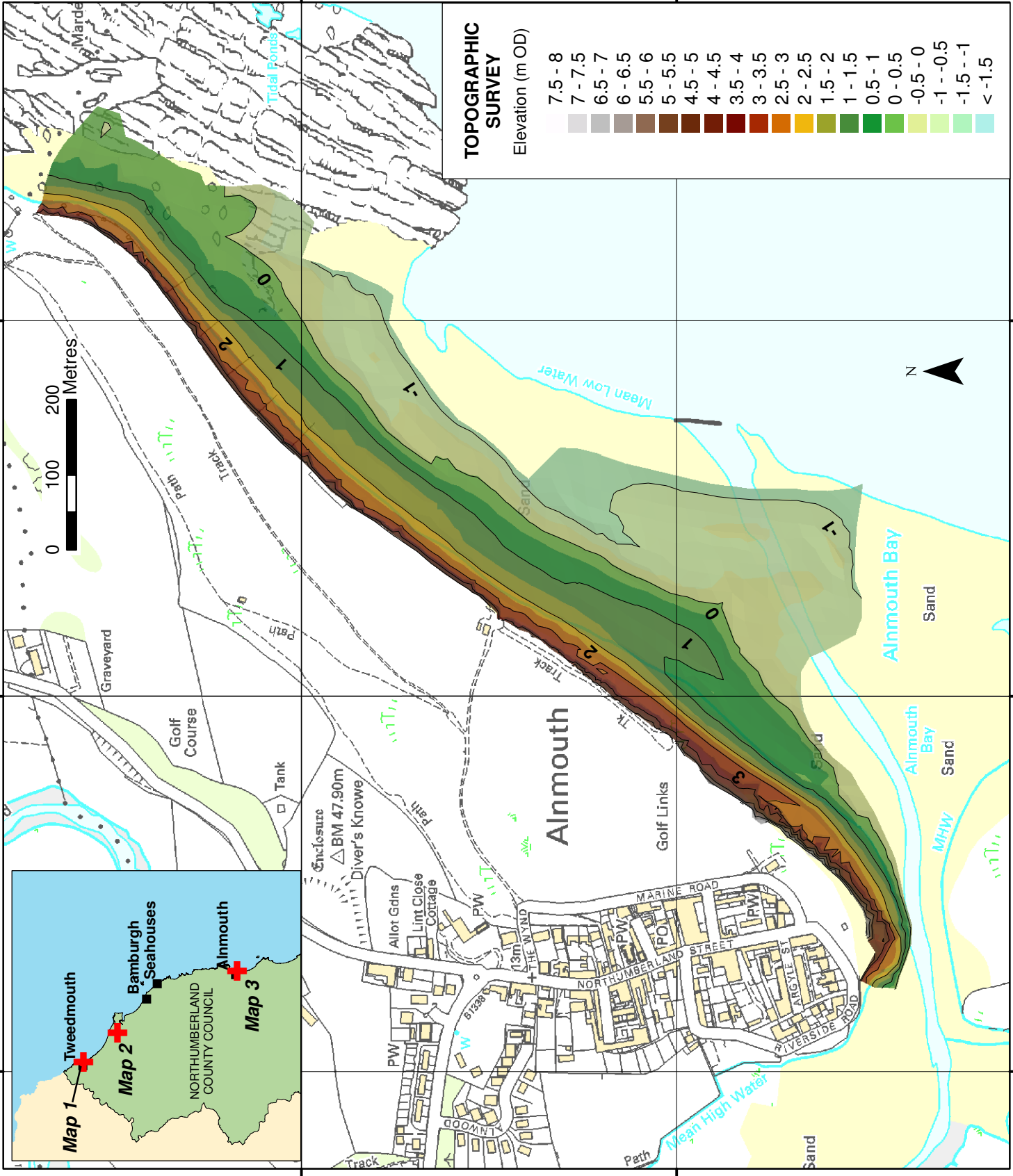
Client: North East Coastal Group
Project: Cell 1 Regional Coastal Monitoring Programme

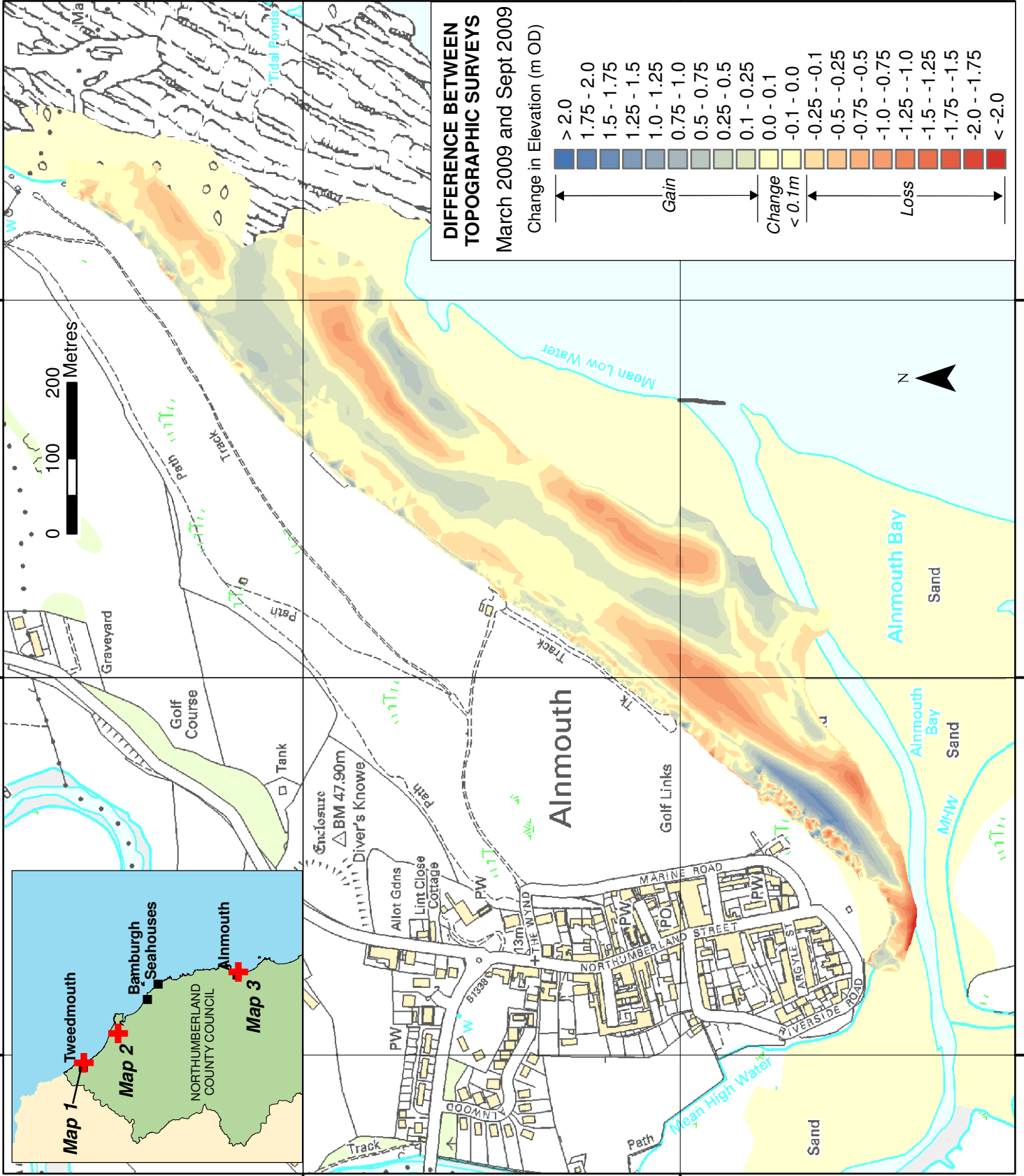
**Appendix B - Map 3a
Northumberland County
Council Frontage**
Analytical Report 2
'Full Measures' Survey 2009

Drawing Scale 1:7,000 at A4
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Topographic Contours at 1 metre interval

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

Appendix B - Map 3b
Northumberland County Council Frontage
 Analytical Report 2
 'Full Measures' Survey 2009

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611000 610500 610000

424500 425000 425500

Appendix C

Cliff Top Surveys

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