



# **NECAG Coast Protection Assets and Coastal Slope Condition Analysis**

## **South Tyneside Council Final Report**



**South Tyneside Council**

**April 2009**



## Preamble

The North East Coastal Authorities Group (NECAG) comprises the following organisations, each of whom has certain responsibilities for managing the coastline between the River Tyne and Flamborough Head:

- South Tyneside Council;
- Sunderland City Council;
- Easington District Council;
- Hartlepool Borough Council;
- Redcar and Cleveland Borough Council;
- Scarborough Borough Council;
- East Riding of Yorkshire Council;
- Environment Agency;
- North York Moors National Park;
- Natural England;
- The National Trust.

Collectively, NECAG produced a 'second generation' Shoreline Management Plan (or 'SMP2') for its coastal frontage in 2007. In this SMP2, recommendations were made for condition assessments of the coastal protection assets and coastal cliffs and slopes along this frontage, as part of a broader coastal monitoring programme.

To this end, Scarborough Borough Council, acting as the 'lead authority' for NECAG, commissioned a team from Royal Haskoning and Halcrow to undertake the '*NECAG Coastal Protection Assets and Coastal Slope Condition Analysis*' between August 2008 and January 2009. Fieldwork was undertaken in the summer to winter of 2008.

The joint team approach between Royal Haskoning and Halcrow has enable skilled staff with previous expertise of the specific stretches of frontage to work together and offer best value to NECAG. The asset and slope inspectors have included Chartered Engineers (focusing mainly on the built coastal protection structures) and Engineering Geomorphologists (focusing mainly on the natural cliffs and coastal slopes) ensuring suitable skills are applied to each length of frontage.

To ensure a consistency of approach in reporting, a standard template has been used for each of the seven Local Authorities within NECAG. In addition, the findings from the inspections have been entered into the Environment Agency's National Flood and Coastal Defence Database (NFCDD) for each identified length of 'defence', be it an engineered structure or a natural cliff/slope. This ensures that each Local Authority is complying with its High Level Target to ensure that the NFCDD is regularly updated.

Following these initial 2008/09 inspections, it is intended that future inspections are undertaken within the recently commissioned Cell One Coastal Monitoring Programme, which again is being undertaken jointly by Royal Haskoning and Halcrow under Scarborough Borough Council's leadership. This ensures that future work will be undertaken by the same teams and that the 2008/09 inspections will provide a baseline against which future changes, such as deterioration of defences or erosion of cliffs, can be compared.

## 1. Introduction

### *Methodology*

The structural assessment of coastal protection assets along the South Tyneside Council frontage was carried out by a team of asset inspectors and structural engineers during November and December 2008. All assets were graded based on their condition, residual life and urgency of repair work. Observations were photographed and all data were stored in the National Flood and Coastal Defence Database (NFCDD). Brief descriptions of the condition of the coastal margin for any areas of undefended coastline were also entered into the NFCDD.

The asset descriptions provide an overview of findings, summarising each locality and identifying individual assets of poor condition, failing structures and assets that have the potential to fail. It is anticipated that this will help identify areas for investment, including repair work, replacement or the installation of a different asset type. This report will also highlight assets with a certain level of importance or interest.

The asset condition assessments for the South Tyneside Council frontage were undertaken on the 25th November and the 16th December 2008. The weather experienced during the surveys was fair with no visibility problems.

### *Study Area*

South Tyneside's frontage extends from the River Tyne entrance in the north, to the outfall south of Whitburn in the south. The frontage can be split into two lengths; the northern section of the frontage, from the River Tyne to Trow Point is generally characterised by man-made defences and the southern section from Trow Point to south of Whitburn is generally characterised by undefended Magnesian Limestone cliffs.

The man-made defences to the north protect the recreational ground, amusements, hotels restaurants and accommodation on the South Shields coast. The South Pier provides important protection to the River Tyne entrance and retains the large sandy beach of Herd Sand to the south.

The cliffs to the south front a large area of National Trust owned land including The Leas and Souter Lighthouse.

## 2. Overview

The coastal defence assets of the South Tyneside Council frontage are generally in good condition. Minor remedial work as part of a routine maintenance programme carried out alongside regular asset inspections will provide an appropriate solution to the majority of issues/defects identified. However, some structures were also identified as requiring more urgent remedial action. These are described below:

- South Groyne, Littlehaven  
The structure was in good to fair condition overall, but a specific problem was identified towards the roundhead of the structure, seaward of the Groyne Lighthouse. Extensive cracking was observed which is indicative of settlement occurring at the end of the structure and further survey is required to establish the scale of the problem.

- Harbour Drive Seawall, Littlehaven  
The seawall is in poor condition, with missing coping stones exposing tarmac and leading to material loss. Extensive erosion has exposed wooden piles at the toe and within the structure. A more recent concrete encasement to the southern end of the asset is in good condition although a low beach level exposes the original concrete wall and timber piles at the toe of the wall.

### 3. Condition Assessment

#### *Littlehaven*

The grouted masonry revetment was in fair condition although voids were opening up at the toe due to erosion of mortar and missing masonry blocks (below). Local repairs to infill the voids should be carried out along with general replacement of missing masonry blocks and infilling of cracked mortar throughout the structure.



The South Groyne acts to retain Herd Sand to the south. The grouted stone breakwater was in fair condition (below, left). There were minor voids due to missing masonry, a problem which was generally worse on the north face of the structure. A layer of rock armour was present at the toe of the groyne, along the northern face of the structure. Several rock armour units had been displaced, generally from the downstream end of the revetment. There was extensive cracking of the tarmac towards the roundhead of the structure, seaward of the Groyne Lighthouse (below, right). These cracks suggest settlement of the seaward end of the structure. A detailed survey of the structure should be undertaken to identify the scale of and establish a cause for the settlement. The cracks should be filled to prevent water ingress into the structure and further damage caused by mechanical weathering.



In the 1998 survey the frontage defending the hotel was described as a picket fence installed to create a dune. There was no fence present in the current inspection and it was unclear if the fence was buried under the sand or if it had been removed or destroyed. Low level sand dunes were present which were vegetated although erosion caused predominantly by members of the public walking through the dunes had reduced the vegetation coverage and the level of the dunes particularly around the central section (below).



The sea wall to the south of the Little Haven hotel was in poor condition in places. To the north of the wall, several sections of concrete coping were absent (below, left). Here, the tarmac promenade was exposed and beginning to erode, with further material loss. To the south the concrete of the wall has eroded significantly (below, right). Large cracks were opening into voids, with timber piles visible at the toe and within the structure. Remedial action is necessary to prevent increased erosion which could lead to undercutting of the promenade and potential failure of the wall.



The southern extent of the wall has a concrete outer face (right). The concrete is in very good condition although a risk of undercutting remains as the original wall and timber piles are still exposed at the toe. This should be monitored as undercutting will reduce the effectiveness of the structure above. A potential solution to the damaged wall to the north would be to extend the concrete outer face.





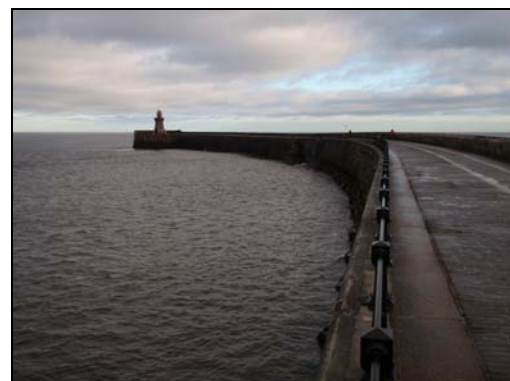
The seawall to the south is concrete with a concrete apron (left). The structure is in very good condition, with minor surface defects at the crest and some erosion at the apex of the curve. The low beach level has exposed the piles beneath the concrete apron which showed evidence of scour and significant corrosion. Deterioration of the piles could lead to undercutting of the apron and undermining of the wall, therefore the condition of the piles should be monitored.

The defences to the north of South Pier consist of a low concrete wall which is in fair condition although many of the construction joints have widened and require infilling with sealant. There is a large crack passing through the full height of the wall which should be infilled. Minor spalling is evident around drainage outlets with water storage landward of the wall indicating potential drainage problems. These should be investigated to prevent mechanical weathering of the rear of the wall.



### *South Pier*

South Pier was in good condition. Minor repointing and replacement of missing/cracked masonry blocks should be carried out as part of routine maintenance work.



The stone embankment in front of the dunes to the south of South Pier (right), appears to have thinned out towards the southern end although the beach level was high at the time of survey and possibly buried some of the stones. The dunes had significant areas which were not vegetated although they generally appeared stable with no significant erosion of the seaward slopes.



The masonry and brickwork defences protecting the seafront amenities and car park were in very good condition. Chesnut fencing was present in order to manage beach levels in front of the structures (left).

The defence at the southern end of Herd Sand consists of a concrete revetment (right), which was in good condition with minor spalling around construction joints. The revetment was fronted by chesnut fencing to encourage the accretion of wind-blown sand.



Seaward of the Mangos public house, dunes have formed over rock-filled gabion baskets (below). Local erosion of the dunes has taken place, the most significant of which was caused by members of the public walking through the dunes although also by surface water draining from the promenade. Members of the public should be discouraged from walking over the dunes and the drainage from the promenade may need attention to prevent excessive erosion of the dunes. The 2008 survey was carried out following heavy rainfall which is likely to have caused significant surface water run-off from the promenade as gulleys appeared to be blocked with sand. In eroded areas gabion baskets were visible and appear to be in good condition. The dunes should be monitored as the condition of the gabions beneath is unknown.





### *Trow Point to Frenchman's Point*

The 1998 NFCDD data included the coastline between Trow Point and Frenchman's Point as undefended frontage. A coastal defence scheme was constructed in 2008 and for the purposes of the current inspection, the frontage was sub-defended into the four assets below:

- Trow Point
- Graham's Sand
- Target Rock
- Southern Bay

### *Trow Point*

The Trow Point headland acts to retain Herd Sand to the north. The headland appeared relatively stable with no evidence of significant slope activity. Differential rates of erosion have led to the formation of voids towards the foot of the rock cliffs, more significantly on the southern face of the outcrop.

### *Trow Quarry*

The Trow Quarry Coastal Defence Scheme was completed between August and November 2008. The scheme consists of a granite rock armour toe revetment with re-grading of the coastal slope above in the two coastal bays of Graham's Sand (pictured, below left) and Southern Bay (pictured, below right), separated by the headland of Target Rock.



The defences were in very good condition, with the beach material returned to previous levels following construction work over summer and autumn 2008. The re-graded slopes were covered with a layer of imported topsoil which was seeded with Red Fescue (*Festuca Rubra*). Only small shoots were visible due to the planting occurring late in the growing season, although the vegetation was expected to grow fully in spring 2009.

### *Target Rock*

The rock headland of Target Rock was fractured with many loose and overhanging rocks. Differential erosion had led to the base of the headland eroding and causing undercutting of the material above and the formation of significant voids and caves within the outcrop (below). The undercutting was exacerbated by fissures eroded into the adjacent bedrock outcrop. A sink hole which had opened up to the rear of Target Rock was infilled with granite rock armour and covered with seeded topsoil as part of the 2008 construction works and this remedial work was in very good condition. The rock armour revetments tie into Target Rock and will act to prevent the outflanking of the rock which was beginning to occur. In general, the integrity of the outcrop worsened to the south.



### *Frenchman's Bay*

The northern extent of Frenchman's Bay is marked by the headland of Frenchman's Point. The cliff line is high, with an exposed rock foreshore with overlying sand in the shallow bays. The lower cliffs are extensively eroded with large voids and caves present (below, right). The steep upper cliffs appear stable and are largely devoid of vegetation.



## *Marsden Bay*

Marsden Bay is a 1.5km long bay with rock platforms to north and south, with a sand foreshore beneath steep Magnesian Limestone cliffs. There are several stacks (below, left) on the foreshore, including Marsden Rock, indicating differential erosion between harder and softer rock. There was evidence of a recent slope failure to the north of the bay (below, right).



There are two areas of man-made defence; to the northern end to the former lifeguard station and in the centre of the bay to the Grotto Public House/Restaurant and beach access.

At the former lifeguard station, the defences consist of a masonry faced concrete wall buttressed by concrete steps providing access to the foreshore (right). The steps are missing or damaged towards the foot of the structure, exposing a masonry wall and reinforcement in the concrete. Access to the foreshore is via undamaged steps at the north, with access to the damaged section prevented by steel guardrail. The remaining steps were undercut and this must be monitored as damage could extend north and make the access unusable. The building contained cracks and voids in the concrete and masonry of the foundations which should be infilled to prevent extensive damage to the structure.





The Marsden Grotto Public House/Restaurant is situated at the foot of the cliff and is defended by a masonry wall which is in good condition (left). Access to the foreshore is via a set of wooden steps which zig-zag down from a car park on the cliff top. The previous steps were replaced in 2007 along with the addition of rock netting to prevent minor rockfalls from the concreted limestone cliff face (below). The steps and netting were in very good condition.



The Lizard Point Headland comprises generally hard rock cliffs with small bays and an open area of land above. The cliffs appeared stable with local areas of vegetation growth. There was evidence of historic slumping and sliding in places although the cliffs generally appeared inactive.





The Old Harbour Quarry to the south of Lizard Point comprises relatively low cliffs, quite deeply indented and caved in areas, with small pocket beaches. The cliff line acts as thin barrier in front of a now infilled and landscaped quarry area, extending back to the main coastal road. Locally caving of the cliff has reduced the width of solid rock barrier to as little as 2m, although more generally the barrier of natural rock is of the order of 20m. In places defence works have already been undertaken to resist local erosion (left).

Whitburn Point is a more consistent rock cliff frontage, although still caved, with a relatively deep capping of glacial till but with a relatively uniform rock platform to the foreshore.

Souter Bay is a wider, longer length of beach frontage with a raised beach behind (right). The sediments are held by Souter Point. The cliff line to the rear of the beach is set at a less steep angle, with a good coverage of vegetation. Towards the north there was evidence of minor slope failure in the softer material towards the crest of the cliffs. There was no evidence of recent rock falls or significant material loss from the lower cliffs.



#### 4. Comparison with Previous Assessment

The previous assessment available from NFCDD was carried out in March 1998. However, this data was frequently incomplete, lacking sufficient detail, spatially incorrect or missing entirely. Most asset inspections required the re-digitisation of assets within NFCDD to correct spatial positioning. As a result it was possible to make only very few direct comparisons.

The previous assessment suggested that a policy of 'No Repairs' was applicable for many assets. The current survey suggests that a routine monitoring and maintenance programme is more appropriate.

The most significant change to the defence assets along the South Tyneside frontage since the 1998 inspection is the addition of rock armour toe revetments within the bays of Graham's Sand and Southern Bay at Trow Quarry. The frontage was formerly classified as undefended between Trow Point and Frenchman's Point and this has been updated following the 2008 survey. The frontage is now undefended around the headlands of Trow Point, Target Rock and Frenchman's Point, with a rock revetment and re-graded and coastal slope in Graham's Sand and Southern Bay.

Other changes include the formation of sand dunes over the gabions placed seaward of the Mangos public house at the southern end of Herd Sand and the removal/burial of a picket fence in front of the Little Haven hotel, which has left this length of frontage undefended.

Differences in the condition grading between the 1998 and the 2008 data were found in several cases. The differences were due to repaired or replaced assets, or assets which had experienced degradation. The condition of the defence at the southern extent of Herd Sand was upgraded from Grade 3 (fair) to Grade 2 (good) due to the accretion of sand and the formation of dunes over the existing gabions.

Significant degradation of assets since the 1998 inspection is identified below:

- The condition of the South Groyne was downgraded from Grade 2 (good) to Grade 3 (fair).
- The condition of the Harbour Drive seawall in Littlehaven was downgraded from Grade 3 (fair) to Grade 4 (poor).
- The condition of the stone embankment to the south of South Pier was downgraded from Grade 2 (good) to Grade 3 (fair).

## **5. Problems Encountered and Uncertainty in Analysis**

All assets were inspected at suitable stages of the tide. Local tides tables provided key information for the appropriate planning of each day's inspections.

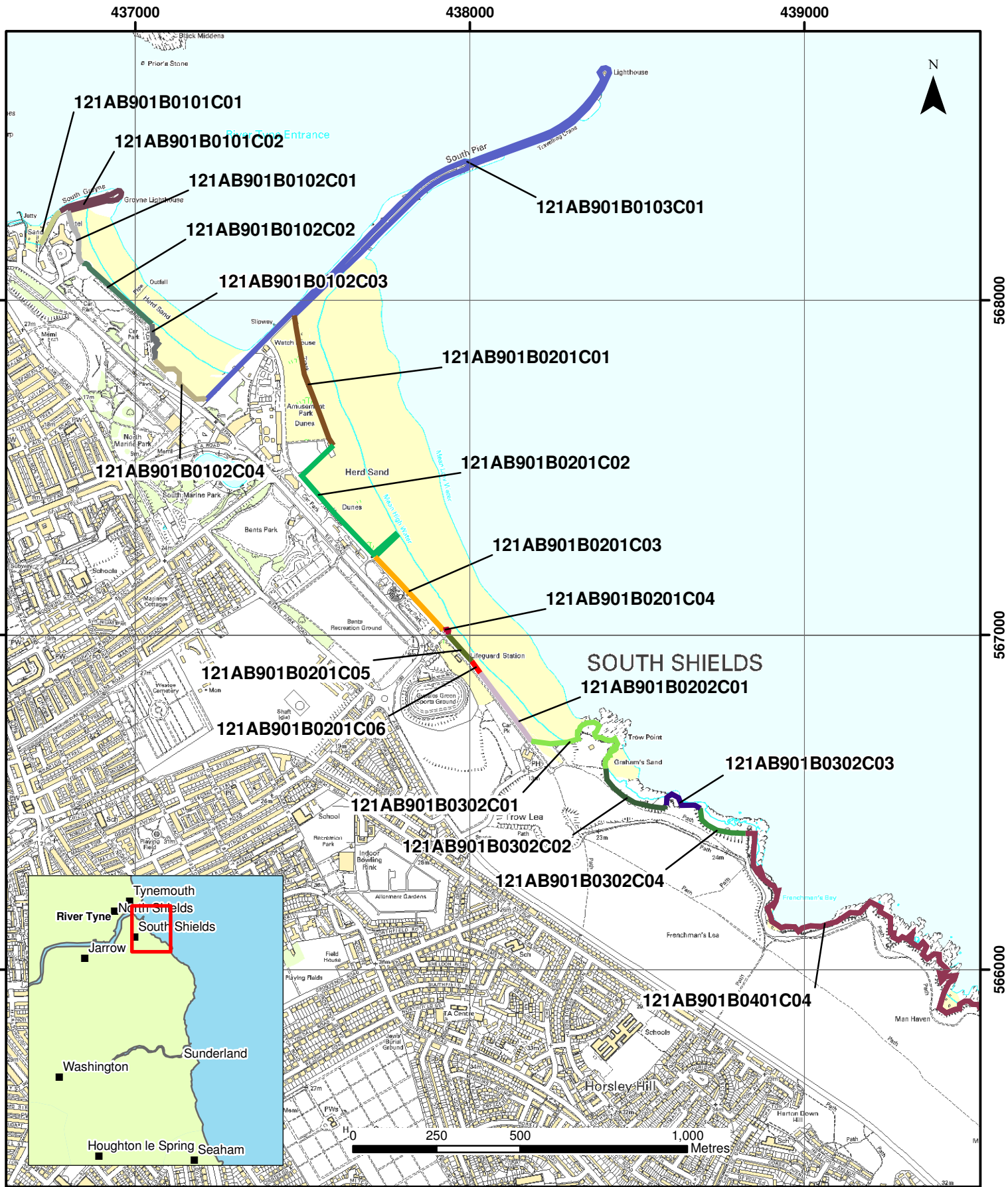
## **6. Conclusions and Recommended Actions**

It is highly recommended that continued monitoring is undertaken for all assets, with specific recommendations for individual assets given in the table below:



<b>Defence</b>	<b>Location</b>	<b>Priority</b>	<b>Date</b>	<b>Recommended Action</b>
121AB901B0101C01	Littlehaven	Medium	Nov 2008	Infill voids. Replace missing blocks.
121AB901B0101C02	South Groyne	High	Nov 2008	Infill cracks in deck. Replace missing mortar and masonry blocks. Full survey.
121AB901B0102C02	Littlehaven	High	Nov 2008	Replace missing coping stones. Make good damaged footpath. Local repair to damaged seawall. Consider extension of concrete encasement northwards.
121AB901B0102C03	Littlehaven	Low	Nov 2008	Patch repair to surface defect. Monitor undercutting.
121AB901B0102C04	Littlehaven	Low	Nov 2008	Infill cracks at construction joints.
121AB901B0103C01	South Pier	Medium	Nov 2008	Repoint masonry wall.
121AB901B0201C01	Herd Sand	Low	Nov 2008	Top up volume of stone.
121AB901B0201C05	Herd Sand	Low	Nov 2008	Patch repairs to spalling.
121AB901B0201C06	Herd Sand	Low	Nov 2008	Patch repairs to spalling.
121AB901B0202C01	Herd Sand	Low	Nov 2008	Monitor sand dunes. Discourage members of the public walking over the dunes. Address drainage from promenade.
121AB901B0401C01	Marsden Bay	Medium	Nov 2008	Local repairs to concrete steps. Infill cracks and voids. Monitor undercutting of remaining steps and former lifeguard building.







**Legend**

-  Asset location
-  NFCDD Asset Number



Client: North East Coastal Authorities Group

Project: Coastal slope and asset condition inspection, summer 2008

**Map 1 - South Tyneside Council Frontage**

Asset Condition 2008

Drawing Scale 1:15,000 at A4



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**Legend**

-  Asset location
-  NFCDD Asset Number



Client: North East Coastal Authorities Group

Project: Coastal slope and asset condition inspection, summer 2008

**Map 2 - South Tyneside Council Frontage**

Asset Condition 2008

Drawing Scale 1:15,000 at A4



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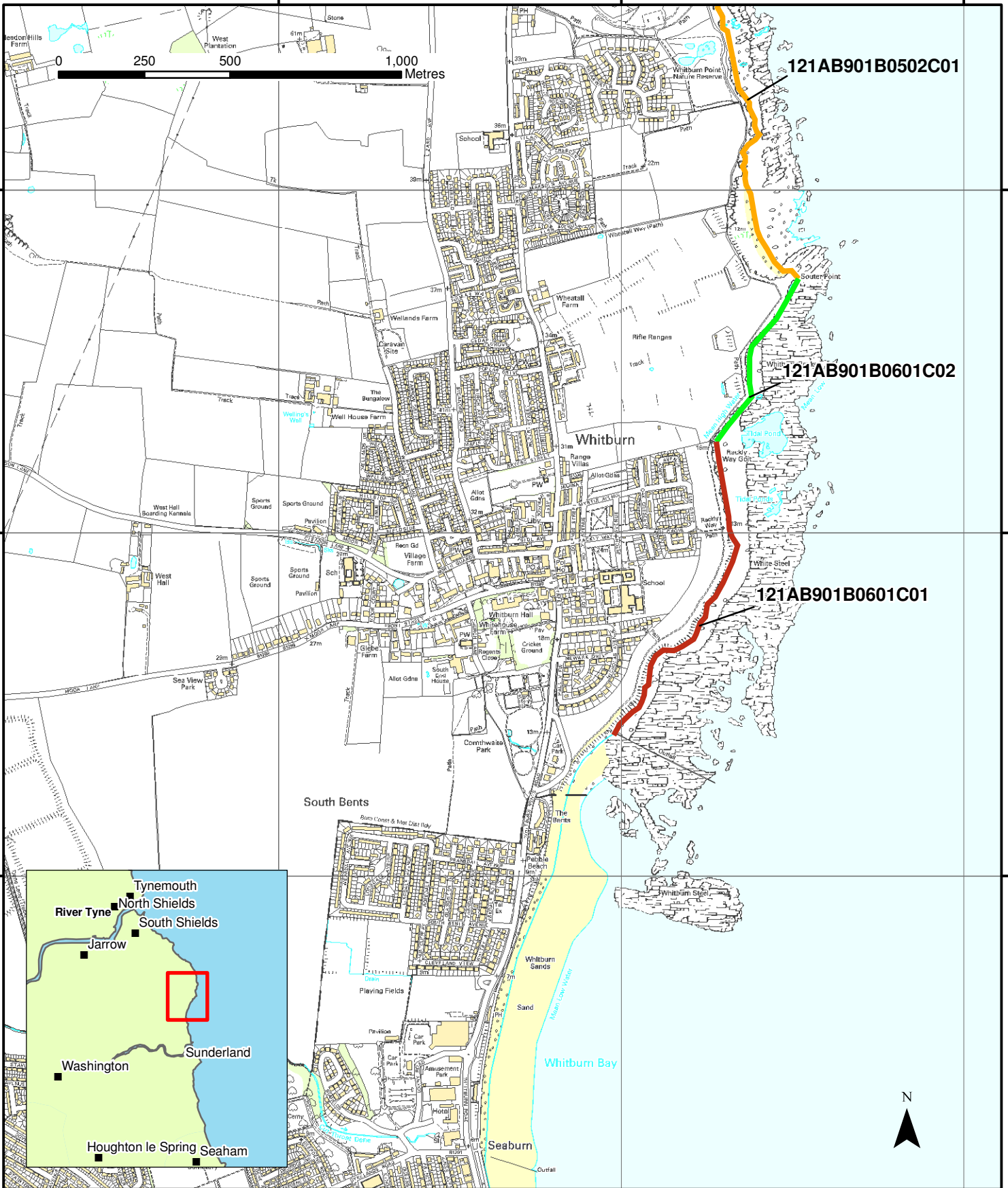
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
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**Legend**

-  Asset location
-  NFCDD Asset Number



Client: North East Coastal Authorities Group

Project: Coastal slope and asset condition inspection, summer 2008

**Map 3 - South Tyneside Council Frontage**

Asset Condition 2008

Drawing Scale 1:15,000 at A4



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