



Cell 1 Regional Coastal Monitoring Programme Walkover Inspection Surveys 2016

Sunderland City Council



September 2016

Sunderland City Council

Walkover Inspection Surveys 2016

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¹ Scarborough Borough Council is acting as client on behalf of all Local Authorities within 'Coastal Cell 1'.

Preamble

The Cell 1 Regional Coastal Monitoring Programme covers approximately 300km of the north east coastline, from the Scottish Border (just south of St. Abb's Head) to Flamborough Head in East Yorkshire. This coastline is often referred to as 'Coastal Sediment Cell 1' in England and Wales (Figure 0-1). 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.

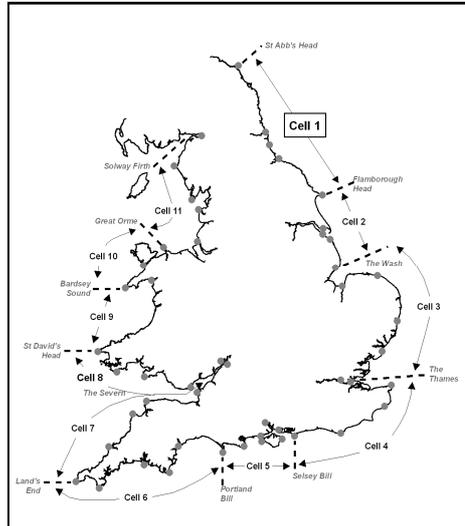


Figure 0-1 - Sediment Cells in England and Wales

The work commenced with a three-year monitoring programme in 2008 that was managed by Scarborough Borough Council on behalf of the North East Coastal Group. This initial phase was followed by a five-year programme which started in 2011 and the current five-year programme which started in 2016. The programme funded by the Environment Agency, working in partnership with the following organisations.



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

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

Royal HaskoningDHV has been appointed to provide Analytical Services in relation to the Cell 1 Regional Coastal Monitoring Programme 2016 - 2021.

The present report is **Walkover Inspection Surveys 2016** and provides a summary of the main findings from the walkover inspections of Sunderland City Council's frontage that are undertaken once every 2 years.

In addition, separate reports are produced for other elements of the programme as and when specific components are undertaken, such as beach profile, topographic and cliff top surveys, wave data collection, bathymetric and sea bed sediment data collection, and aerial photography.

1. Introduction

1.1 Study Area

Sunderland City Council's frontage is approximately 10km in length overall and extends from The Bents in the north, to Ryhope Dene in the south and is shown in **Figure 1-1**. The frontage includes three management areas, MA6, MA7 and MA8 from the Shoreline Management Plan.

In accordance with previous coastal inspection surveys, this frontage is sub-divided into approximately coastal 36 assets, 31 of which are man-made assets while 5 are natural assets. Detailed maps showing the location of each of these assets are presented in **Appendix A**.

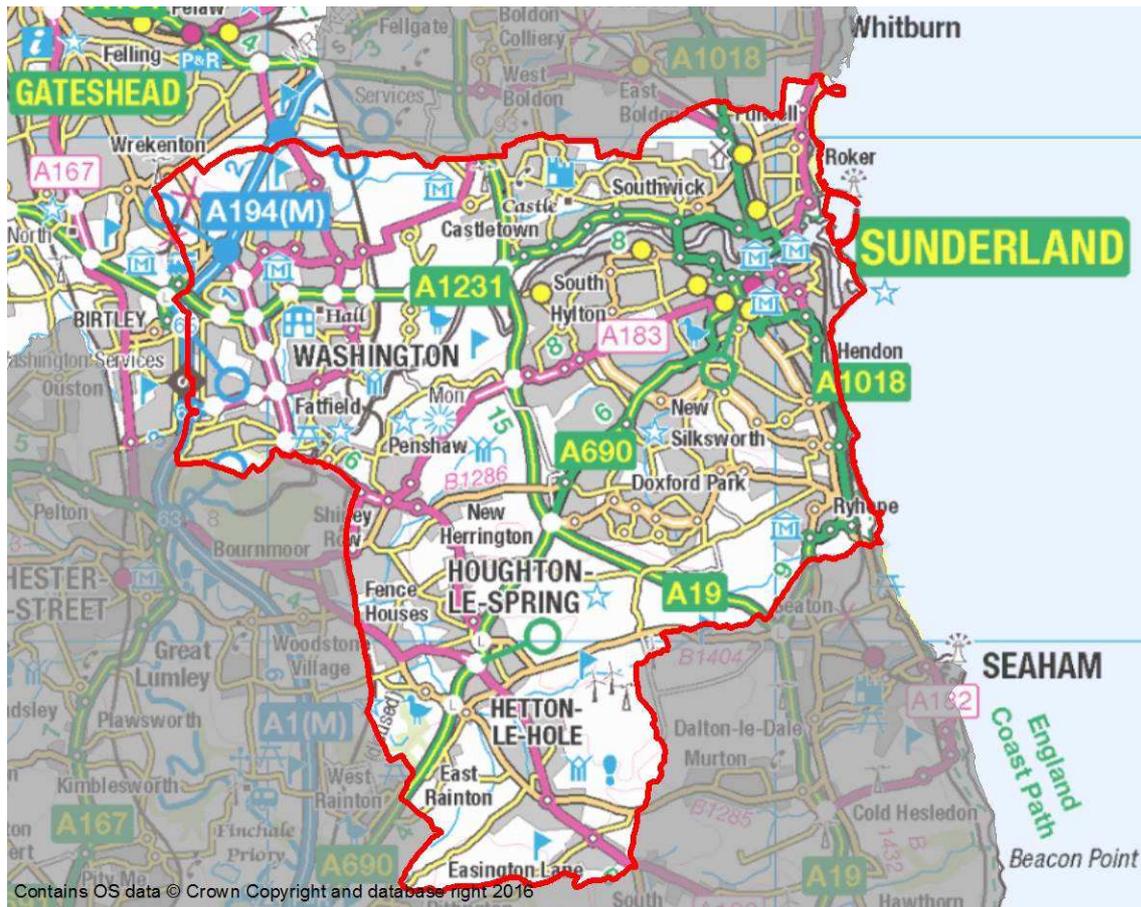


Figure 1-1: Sunderland City Council study area

1.2 Methodology

This section presents the approach taken by the asset inspectors for the Sunderland City Council coastal frontage.

The walkover inspection surveys for the Sunderland City Council frontage were undertaken on 22nd June, 19th July and 21st July 2016. The weather experienced during the inspections was dry and fine with no access or visibility problems caused by adverse weather.

The frontage has been split into a number of 'asset lengths' (Appendix A), as defined in the National Flood and Coastal Defence Database (NFCDDB) that was established by the Environment Agency.

The walkover inspections cover both built defence assets and natural defence assets such as cliffs, slopes and dunes. All assets were visually inspected, photographed and graded based on their condition and an estimate made of their residual life.

For built assets the grading classification was undertaken in accordance with the Condition Assessment Manual (EA, 2012), with estimates made of the urgency of any necessary repairs. An extract of the grading classification for built assets is presented in *Table 1-1*. For ease of reference the built asset photographs presented in this report have also been bordered with the colours key indicated below.

Grade	Rating	Description
1	Very Good	'As built' condition or cosmetic defects that have no effect on performance.
2	Good	Minor defects that will not reduce overall performance of the asset.
3	Fair	Defects that could reduce overall performance of the asset.
4	Poor	Defects that would significantly reduce overall performance of the asset.
5	Very Poor	Severe defects resulting in overall performance failure of the asset.

Table 1-1: Condition assessment grading for man-made assets.

In addition to the above grading classification, for natural assets such as cliffs and slopes the same five point activity scale used in previous walkover inspections within Cell 1 was used. This grading classification is presented in *Table 1-2*. For ease of reference the natural asset photographs presented in this report have also been bordered with the colours key indicated below.

Grade	Class	Description
1	Dormant	Features with no interaction with marine processes.
2	Inactive	Features with no visible evidence of erosion or landsliding activity.
3	Locally active	Features with localised evidence of small erosion or landsliding activity.
4	Partly active	Features with widespread evidence of small erosion or landsliding activity or areas of intense erosion or landsliding.
5	Totally active	Features with large-scale or intense erosion or landsliding.

Table 1-2: Condition assessment grading used for natural assets (cliffs/ slopes).

This report provides an overview of the findings from the walkover inspections, summarising each locality in general but also specifically identifying individual assets in 'poor' or 'very poor' condition. It is anticipated that this summary will help identify areas for maintenance or capital investment. Full details of the inspection of each asset are provided in **Appendix B**.

In addition to this report, full details of the inspection and a selection of appropriate photographs have been entered into the SANDS (Shoreline And Nearshore Database System) database and provided along with this report with SANDS viewer software.

2. Overview

The following significant findings were observed during the 2016 walkover inspection surveys:

- There are many major defects that require attention at Old North Pier and on many of the assets within the Port of Sunderland.
- Several assets would benefit from maintenance, but previous repairs to many of the assets which were heavily damaged by storms in 2013-14 are remaining effective.

3. Condition Assessment

3.1 Souter Point to Roker Pier (MA 06)

3.1.1 The Bents

Sunderland City Council's coastal frontage starts midway through the SMP2 Management Area 06 at The Bents, near Whitburn. The most northerly asset is an undefended grassed slope, NFCDD Asset Reference Number 121AB901B0602C01, located landward of the Whitburn Steel rock outcrop. This asset length is continuous across the local authority boundary into South Tyneside Council's coastal responsibilities and consists of a grassy coastal slope fronted by vegetated sand dunes. The dunes appeared stable and accreting with embryo dunes at the top of the beach. The northern part of this asset switches to an eroding clay cliff north of the local authority boundary.



Well vegetated slope with embryonic dune growth. (Asset Ref No. 121AB901B0602C01)



View towards north boundary, shingle berm at toe. (Asset Ref No. 121AB901B0602C01)

The promenade at South Bents, Asset Reference Number 121AB901B0603C01, is fronted by concrete and masonry seawalls. The beach level at the time of the inspection in June 2016 appears similar to the September 2014 beach levels and the shingle present against the masonry seawall at the southern end was again visible. The concrete section of wall at the northern end was in fair condition, fronted by higher beach sand levels to the north.

The masonry wall at the southern end, previously damaged by storms over the southern length, has had the coping blocks and handrailing replaced, see photos below.



Sandy upper beach surface in front of concrete seawall. (Asset Ref No. 121AB901B0603C01)



Shingle exposed in front of masonry section of wall similar to 2014 and 2010. (Asset Ref No. 121AB901B0603C01)



New exposed aggregate concrete surfacing on promenade behind seawall at southern end.
(Asset Ref No. 121AB901B0603C01)



Coping blocks and handrails replaced following storm damage.
(Asset Ref No. 121AB901B0603C01)

3.1.2 Seaburn

The beach level falls to the southern end of Whitburn Sands, exposing more of the seawall. The structure here is formed from masonry with a concrete coping (Asset Ref. No. 121AB901B0603C02). The repairs from storm damage are continuous across this defence, with concrete coping blocks and handrails replaced, as well as new promenade surface landward of the seawall.

There are two concrete outfall structures located immediately seaward of the seawall. The previous inspections in 2010 and 2012 noted there were cracks present at the construction joints around the outfall structures suggesting minor settlement may have occurred. Excessive movement of the outfalls could damage the seawall behind, hence cracks should be repaired and settlement monitored. The beach levels were relatively high and so the toe piling was not visible.



Repaired concrete coping above masonry seawall.
(Asset Ref No. 121AB901B0603C02)



Repaired concrete coping above outfall structure.
(Asset Ref No. 121AB901B0603C02)



New exposed aggregate concrete surfacing on promenade behind seawall at southern end. (Asset Ref No. 121AB901B0603C02)

The wall between Dykelands Road and the roundabout at Seaburn Terrace (Asset Ref No. 121AB901B0603C03) was in fair overall condition. Similar to the 2014 inspection, rust staining was present throughout the crest wall although this is likely to have arisen from fixings from previous benches. There was also extensive cracking to the crest wall, although the seaward masonry wall face was generally in fair condition.

The beach levels were similar to September 2014 and the toe was not visible. Previously, in May 2013, low beach levels had exposed the toe which was undercut locally with evidence of previous bag-work repairs that needed to be extended to prevent further undermining and loss of fill.

The steps at Seaburn Terrace roundabout are generally in fair to poor condition, with hand railing failed and steps heavily abraded exposing reinforcement in the wing-wall.



Cracking in seaward side of crest wall.
(Asset Ref. No. 121AB901B0603C03)



Rust staining at fixings from previous seats, cracking in crest wall. (Asset Ref. No. 121AB901B0603C03)



Higher beach level covering toe. Missing mortar / open joints between blocks (Rust staining at fixings from previous seats, cracking in crest wall).
(Asset Ref. No. 121AB901B0603C03)



Steps at traffic roundabout: handrails heavily corroded, lower steps abraded exposing reinforcement and covered in algae.
(Asset Ref. No. 121AB901B0603C03 / B0604C01)

The seawall south of Seaburn Terrace was in fair condition, except for a section of coping which had broken off causing chloride staining. Across the seawall there were small areas of chloride staining. Beach levels appeared similar to the inspection in September 2014. The landward concrete retaining wall appeared to be in good condition.



Beach levels similar to September 2014.
(Asset Ref. No. 121AB901B0604C01)



Damaged section of coping and chloride staining (Asset Ref. No. 121AB901B0604C01)

3.1.3 Parsons' Rocks

The grouted stone revetment landward of the promenade around Roker Cliff Park has had voids and damage identified in all inspections since 2008. This appears to be at least partly related to storm wave overtopping damage during the winter of 2013/14. As noted in previous reports, it would be prudent to infill the voids to minimise the risk of further expansion and the potential reduction in stability of the embankment above.



(Asset Ref. No. 121AB901B0604C02)



(Asset Ref. No. 121AB901B0604C02)



(Asset Ref. No. 121AB901B0604C02)



(Asset Ref. No. 121AB901B0604C02)

The masonry seawall backing Parson's Rocks is in fair condition. The masonry structure ties in with the elevated limestone rock outcrop which is abrading and eroding in places, for example at the old steps just north of the point and on the southern flank where there is a void starting to extent below the promenade. Maintenance repairs are recommended to prevent any damage from escalating.



View northwards from Parsons Rocks, seawall generally in good condition.
(Asset Ref. No. 121AB901B0604C02)



Eroded natural rock at access steps to Parsons Rocks (access to steps blocked by handrail).
(Asset Ref. No. 121AB901B0604C02)



Remains of previous access steps breaking up onto foreshore. (Asset Ref. No. 121AB901B0604C02)



Uneven surface of promenade behind wall (Asset Ref. No. 121AB901B0604C02)



Eroded limestone outcrop void beneath promenade at south of Parsons Rocks. (Asset Ref. No. 121AB901B0604C02)



Damage to coping on ramp south of Parsons Rocks. (Asset Ref. No. 121AB901B0604C02)

3.1.4 Roker

South of Parsons' Rocks the high masonry wall around the headland extending south of the ravine at Roker Park (Asset Ref. No. 121AB901B0605C01) was in generally good condition, with minor mortar loss, and cracked blocks in places. The natural cliff above appeared to be relatively stable. At the most exposed section where the wall is most seaward, before the return to Roker Park, a single facing block remains missing from the wall (see photograph below right), identified in September 2014. This should be repaired before the damage spreads.



Masonry wall generally in good condition (Asset Ref. No. 121AB901B0605C01)



Missing block on most exposed seaward extent of wall. (Asset Ref. No. 121AB901B0605C01)

The low level concrete encasing wall fronting Marine Walk was in good to fair condition following improvement works a few years ago. Vertical cracks in the encasing concrete of the northern section were noted in the majority of blocks. No corrosion of handrail fixings was observed, which was identified in 2014. Improvements to the promenade were undertaken in 2012. Windblown sand was observed on the promenade and roundabout which was being cleared by workmen.



Low concrete encased wall at Marine Walk in fair to good condition. (Asset Ref. No. 121AB901B0605C02)



Damaged concrete access steps needing repair. (Asset Ref. No. 121AB901B0605C02)



Southern section of masonry wall protected by wide beach in good overall condition. (Asset Ref. No. 121AB901B0605C02)



Localised recent damage to coping stone. (Asset Ref. No. 121AB901B0605C02)

3.2 Roker Pier to New South Pier (Sunderland Harbour MA 07)

3.2.1 Roker Pier

Roker Pier is located to the north of the mouth of the River Wear. Due to refurbishment works carried out in 2014, it was not possible to access the pier during the previous inspection. Refurbishment works were completed to the pier in 2014, including concrete resurfacing of the deck slab with “blockwork formwork” finish, foundation repairs including placing underwater concrete, and repointing of joints. Furthermore the lanternhouse (lighthouse) has been restored and a final phase of works is expected to restore the pier tunnel to enable visits by the public.

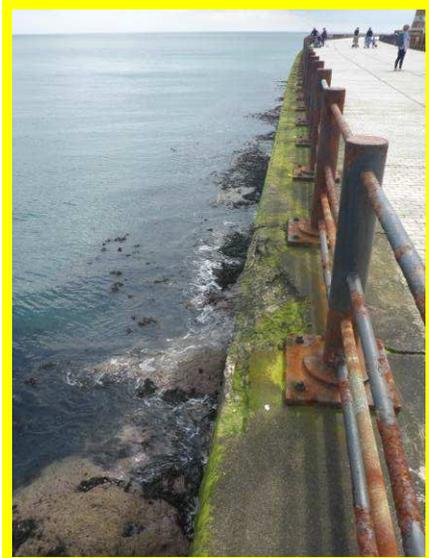
The pier structure was generally in good condition, with minor defects noted. The most significant defects were corroded and failed handrail along the pier which was stained the coping stones and requires repair or replacement. There was occasional damage to blocks and coping stones on both the northern and southern faces of the pier.



New concrete surfacing of pier (Asset Ref. No. 121AB901B0702C04)



Recently refurbished lighthouse appears in good condition. (Asset Ref. No. 121AB901B0605C02)



Typical localised damage to coping stone.



Concrete structure adjacent lighthouse heavily abraded on northern and top face.
(Asset Ref. No. 121AB901B0605C02)



Rust staining on masonry from corroded handrail
(Asset Ref. No. 121AB901B0605C02)



Handrail needing replacement
(Asset Ref. No. 121AB901B0605C02)



Failed handrail posing public safety risk.
(Asset Ref. No. 121AB901B0702C05)

The masonry wall at the northern side of the root of the pier (Asset Ref. No. 121AB901B0702C05) appeared in fair to good condition, although there was localised abrasion and loss of mortar in joints on both the seaward and landward faces.

The masonry splash wall at the southern side of the root of the pier (Asset Ref. No. 121AB901B0702C05), appeared in fair condition although there were several sections of damaged concrete coping. Beach levels were typically at the base of the coping stone.



View on northern side of masonry wall at root of pier – localised abrasion and mortar loss observed.
(Asset Ref. No. 121AB901B0702C05)



View on masonry splash wall at southern root of pier – several sections of damaged/broken off coping.
(Asset Ref. No. 121AB901B0702C05)

3.2.2 Roker Beach

South of Roker Pier the masonry and concrete seawall, asset 121AB901B0702C01 is in fair overall condition with evidence of previous patch repairs and multiple horizontal cracks in the concrete sections as seen in the inspections in 2012 and 2014. The promenade surface appeared to be in fair condition. In some areas, spalling has taken place between the horizontal cracks. The level of the wide fronting beach protecting this wall appeared similar to or slightly lower than that seen in 2014.



Multiple patch repairs and horizontal cracks in concrete wall. (Asset Ref. No. 121AB901B0702C01)



Example of spalling between horizontal cracking
(Asset Ref. No. 121AB901B0702C01)

The rock armour revetment to the south of the public car park appeared to be in good condition. There appeared to be good interlock between the rocks, and an even crest level. As the rock was placed in front of the seawall, it was not possible to inspect the face of the wall. The promenade crest appeared in good condition.

The rock armour revetment was narrower at the northern end adjacent to the lifeboat slipway, the slipway appeared in good condition.



Rock armour and promenade crest in good condition. (Asset Ref. No. 121AB901B0702C02)



Slipway in good condition. (Asset Ref. No. 121AB901B0702C02)

3.2.3 Old North Pier

The 2010 report noted that the Old North Pier is not included in Sunderland City Council's revenue or capital programmes for coastal defences as it is classified as a river wall rather than coastal defence. As noted in the 2010 report, the Old North Pier structure will act to retain beach material to the north and act to reduce sediment passing into the navigation channel through the harbour entrance. The structure is included in the present condition assessment for reference.

The structure remains fenced off to members of the public with signs describing the structure as unsafe and therefore assessment was not possible. From the landward end the structure appeared in similar condition to that reported in previous inspections with missing concrete and masonry from both sides of the grouted revetment forming the north face and the masonry wall forming the southern face.

Upstream of the Old North Pier adjacent the yachting club is "Rat House Corner", a popular fishing spot, where the defence is comprised of sheet pile wall with concrete capping beam. It was not possible to visually assess the condition of the sheet piles, however the concrete capping beam appeared in fair condition with small areas of damage at corners.



View on northern face of Old North Pier, minimum 3 No. voids observed in face. (Asset Ref. No. 121AB901B0702C03)



Old North Pier closed to Public. (Asset Ref. No. 121AB901B0702C03)



Void in northern face of Old North Pier, photo taken from beach. (Asset Ref. No. 121AB901B0702C03)



Southern face of Old North Pier – several large voids and undercutting (Asset Ref. No. 121AB901B0702C03)



Southern deck slab of Old North Pier, photo taken through barrier fence. (Asset Ref. No. 121AB901B0702C03)



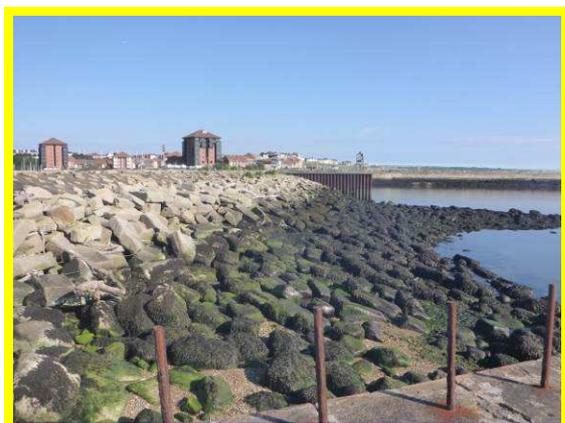
Concrete promenade at "Rat House Corner" in fair condition. (Asset Ref. No. 121AB901B0702C03)

3.2.4 River Wear to New South Pier

The frontage to the south of the mouth of the River Wear is inaccessible to members of the public as it is located within the restricted area of the Port of Sunderland. Access to the port for purposes of inspections was arranged through Sunderland City Council, who own and operate the port.

The northernmost structure consists of a rock armour revetment which is in fair overall condition. The rock armour is loosely placed with some gaps towards toe and lacks interlock, the profiling of the rock armour is fairly uniform, as shown in image below. The crest section of rock is grouted with concrete and is generally in fair condition except for a localised section where some damage has taken place. The revetment ties into a sheet piled river/navigational wall to the north and a masonry sea wall with a precast concrete recurve crest to the south, which extends to the rear as a secondary wall.

The rear wall was inspected only at the seaward end, and is in good condition, with minor spalling and cracking of the concrete and spalling the surface of the concrete walkway to the rear. The very seaward end, see below left, has reinforcement bars standing vertically from the top of the concrete wall and it appears these were placed to allow the continuation to form a boundary wall which was not completed. There appeared to have been little change to the asset since the previous inspection in September 2014.



View of rock revetment from south showing loosely placed armour
(Asset Ref. No. 121AB901BO703C03)



View of revetment from New South Pier
(Asset Ref. No. 121AB901BO703C03)

The masonry and concrete sea wall to the south, which links into the north face of the New South Pier, is in fair overall condition. There are missing blocks at the northern end, where there is risk of outflanking causing the wall to start unravelling, although the situation in 2016 looks very similar to the photographs from the 2014 report as well as those from previous reports e.g. 2010, 2013. As noted in both the 2012/13 and 2014 reports, the concrete apron to the rear of the wall (south part only) has experienced a significant deterioration due to wave overtopping with sections of concrete missing. The rubble protecting the embankment is still lacking and provides little protection to wave overtopping. As recommended in previous reports the surfacing to the rear should be repaired / replaced and voids in the rubble surface immediately behind the wall should be filled in order to avoid wave overtopping causing further erosion and pooling behind the wall destabilising the structure.



Crest and rear embankment damage due to wave overtopping.
(Asset Ref. No. 121AB901BO703C02)



Masonry wall in fair condition except for missing blocks at North end.
(Asset Ref. No. 121AB901BO703C02)

3.2.5 New South Pier

As in previous inspections, New South Pier appeared to be generally in good condition above the waterline with only minor defects of mortar loss between masonry blocks and cracking / spalling to concrete elements noted, although inspection of the seaward face was limited to the inner 1/3rd as it was only viewed from land. There are several areas of damage to upper slabs and open joints along the top of the upper wall crest, see photo below left. There were no signs of global movement or distress to indicate major problems with the foundations of the structure, but an underwater survey is recommended, particularly towards the seaward end as wave action within the central chamber was noted in the 2010 report indicating that there must be voids in the structure.

As noted in previous reports there are a number of large blocks missing at the seaward end of the pier, although this is not new damage. It is however advised that the end of the pier is repaired in order to prevent the area of damage spreading.

It was noted that the navigation light support and cable stays near the seaward end are highly corroded and in need of replacement in order to prevent it from falling and potentially damaging the pier further.

Along the southern face of the wall between upper and lower deck there are localised sections of heavily abraded brickwork.



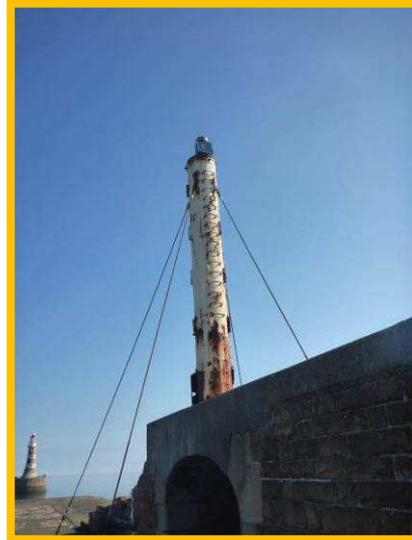
Voids in blockwork of upper deck appear to have been repaired although further damage has taken place. (Asset Ref. No. 121AB901B0703C01)



View of south face of wall from land. (Asset Ref. No. 121AB901B0703C01)



View of north face and lower deck level of New South Pier from seaward end. (Asset Ref. No. 121AB901B0703C01)



Navigation light support column and cables remain highly corroded and in poor condition. (Asset Ref. No. 121AB901B0703C01)



Abraded brickwork at wall between lower and upper deck. (Asset Ref. No. 121AB901B0703C01)



Missing blockwork from seaward end of upper deck, concrete slabs of lower deck spalled. (Asset Ref. No. 121AB901B0703C01)

3.3 Sunderland Harbour to Pincushion Rocks (MA 08)

3.3.1 New South Pier to South Outlet

The seawall to the south of New South Pier (Asset Ref. No. 121AB901B0801C03) is a masonry wall continuous with the southern face of New South Pier. In the 2010 inspection a void was visible at the base of the wall, with approximately eight masonry blocks missing from the seaward face (below left). The void was not visible in 2013, 2014 or 2016 as there appeared to be a small area of additional rock in front of the location to shield it from further damage. Above the location of the void the concrete deck slabs had been repaired previously and cracking between the slabs and the wall was noted in 2010.

Upon inspecting the masonry wall in 2016, approximately 4 No. new missing blocks were identified in the middle of the wall adjacent to a significant open horizontal joint, approximately 10m length (see image below left). This may be caused by settlement of the wall.

The deck slabs above the void remain lifted above the coping blocks as noted in the 2014 report (see image below right). Furthermore, the slabs still lack a proper method of drainage which leaves them vulnerable to damage from pooling. There is also some cracking in the concrete deck of the northern part of the wall shown in the image to the bottom left.

The rock armour to the southern part of the wall is in fairly good condition with good interlocking and a relatively even profile. The beach level appears to be significantly lower than in previous inspections, revealing more rock armour.

Detailed structural investigation of the wall is recommended.



Old void covered with rock (left),
New missing blocks and open joint (right).
(Asset Ref. No. B901B0801C03)



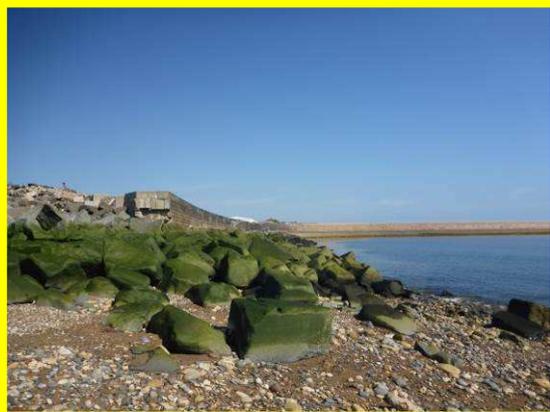
Deck slab lifted above coping block.
(Asset Ref. No. B901B0801C03)



Cracking in concrete on deck above masonry wall. (Asset Ref. No. B901B0801C03)



Pooling marks indicate crest slabs are sagging in middle. (Asset Ref. No. B901B0801C03)



Southern end of wall remains damaged as in previous inspections, beach level lower than in 2013 and 2014 inspections revealing rock. (Asset Ref. No. B901B0801C03)

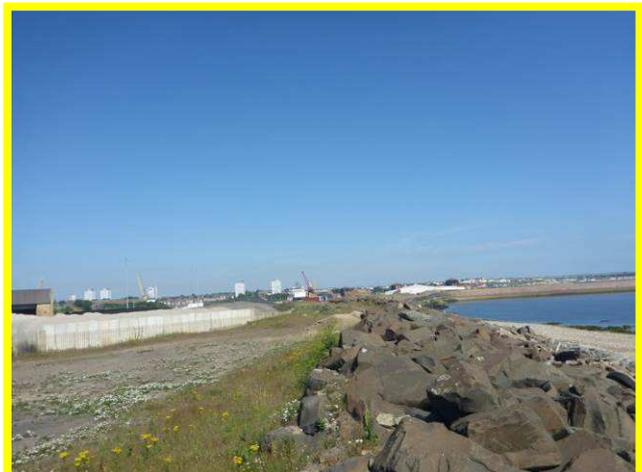


Rock armour at southern end of wall in good condition. (Asset Ref. No. B901B0801C03)

South of the seawall there are two length of rock armour sea defence (121AB901B0801C02 and 121AB901B0801C06) with the remains of a collapsed concrete groyne (121AB901B0801C01) between. The rock revetment (mixed with some concrete blocks and rubble/debris) was in fair condition with some minor displacement of material and local slumping of crest. The revetment remained in similar condition to previous inspections.

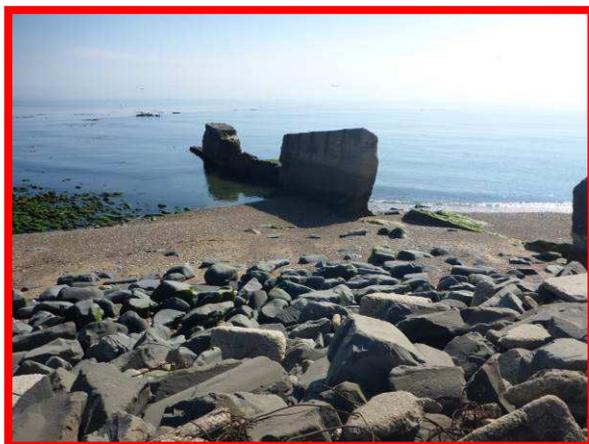


Rock/rubble revetment north of derelict groyne) in fair condition. (Asset Ref. No.121AB901B0801C02)



Uneven crest level of revetment. (Asset Ref. No.121AB901B0801C02)

The groyne appeared in a similar condition to that reported in 2014 and other past inspections, suggesting minimal change. The remains do not appear to have adverse effects on the surrounding rock armour and although, the beach has accreted since 2010, the groyne is considered to have a negligible effect on wave energy and sediment transport along the frontage. A degree of protection will be provided by the South Rocks outcrop, erosion of which is possibly the source of the shingle accumulation on the northern part of the beach.



Derelict concrete groyne from north.
(Asset Ref. No. 121AB901B0801C01)



Derelict concrete groyne from south.
(Asset Ref. No. 121AB901B0801C01)

South of the groyne is another section of rock revetment in fair condition, with interlocked rocks although crest remains uneven similar to section north of derelict groyne.

3.3.2 South Outlet

The South Outlet is formed between the North East Pier and the South West Breakwater. The assets are in generally poor condition and have experienced further degradation since the 2014 inspections, although there were no significant new failures. The size of the structures means that they will continue to provide some protection to the headland even if no remedial action or maintenance program is undertaken.

As noted in the previous reports, to ensure that the protection provided is sufficient for the needs of the Port a strategy should be developed for the South Outlet defences, which incorporates the development plans of the Port. The South West Breakwater requires extensive remedial work and the North East Pier requires major refurbishment or possible replacement although the importance of maintaining the South Outlet is unlikely to be significant enough to justify the significant capital expenditure required unless it were associated with redevelopment of the area behind.

The North East Pier is split into 3 asset lengths. The seaward defence to the north is asset 121AB901B0801C05, which consists of a variety of derelict concrete, masonry and sheet pile structures with limited armouring with mixed rock and concrete blocks supplemented by a bund of stacked rock and demolition waste at the crest. This is in poor condition, see below, and if the vacant land to the rear is to be redeveloped it is recommended that additional rock armour is placed to improve the standard of defence.



Derelict former defence structures with stacked bund of rock armour at crest.
(Asset Ref. 121AB901B0801C05)



Derelict former defence structures.
(Asset Ref. No. 121AB901B0801C05)

At the inner end of the North East Pier is asset B901B0801C07 and asset B901B0801C04 is located at the outer end of the pier. The inner end of the pier remains in similar condition to the 2014 inspection. The seaward facing concrete structures are heavily abraded exposing reinforcement. The deck of the pier is heavily spalled with cracking throughout. The inner end of the pier is backed by rubble armour which is in fair condition.

The seaward section of North East Pier, including the roundhead and both faces is asset 121AB901B0801C04, and is in very poor condition, although there appears to have been little change since 2010. The deck remains severely abraded with missing sections and exposed reinforcement observed throughout. As reported in previous years the roundhead of the structure has become detached, leaving the exposed nose of the pier vulnerable to wave attack causing ongoing loss of material from the end of the breakwater. The nose of the pier appears to have been undercut further since the 2014 inspection suggesting that the nose could detach from the pier in the future if nothing is done to prevent it.



Abraded concrete structure with cracks in concrete and rust staining.
(Asset Ref. No. 121B901B0801C07)



Reinforcement exposed.
(Asset Ref. No. 121B901B0801C07)



Heavily abraded deck. (Asset Ref. No. 121B901B0801C04)



Failed roundhead of Pier. Existing nose of pier appears to be undercut further than 2014. (Asset Ref. No. 121B901B0801C04)



Outer end of North East Pier viewed from south. (Asset Ref. No. 121B901B0801C04)

The South Outlet basin has been partly filled and protected with random tipped rubble which is comprised of broken sections of concrete slabs, masonry, rock and debris see images below. Although this affords a degree of protection, it is not a formal defence so is assessed as poor condition. There are three asset lengths in NFCDD, which are from north to south 121AB901B0801C08, 121AB901B0802C07 and 121AB901B0802C06. All three assets in this area appear to be in similar poor condition to the 2014 report.

The heavily corroded sheet pile wall at asset 121AB901B0802C07 crumbled when touched. However the likelihood of water reaching the structure is low due to its distance from the shoreline and height above the water line.



Tipped rubble at northern end of south outlet basin. (Asset Ref. No. 121AB901B0801C08)



Sheet pile wall at south-west side of South Outlet. (Asset Ref. No. 121AB901B0802C07)



Heavily corroded sheet pile wall (Asset Ref. No. 121AB901B0802C07).



South side of basin taken from end of North East Pier. (Asset Ref. No.121B901B02C06)

The South West Breakwater was in similar condition as past inspections. As described in the 2010 to 2014 reports the South West Breakwater is in a derelict condition, with significant damage to and loss of deck sections, displaced core blocks to landward (north) side, missing sections of concrete blockwork and severe damage.

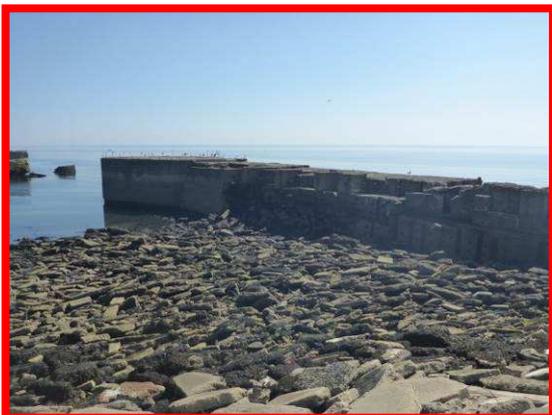


Image showing missing blockwork from landward side of SW Breakwater. (Asset Ref. No. 121AB901B0802C05)



Displaced core blocks of SW Breakwater. (Asset Ref. No. 121AB901B0802C05)



Missing section from seaward side of SW Breakwater.
(Asset Ref. No. 121AB901B0802C05)



Demolition waste tipped on landward side, damaged blocks.
(Asset Ref. 121AB901B0802C05)

3.3.3 Spur Barrier to Hendon Banks Barrier

Located to the south of the South West Breakwater is a large concrete seawall with sheet piled toe and set back crest wall, asset 121AB901B0802C04, approximately 500m length, terminating at the north end of the sewage treatment works. The asset was in fair overall condition, with localised damage and cracking/spalling of concrete and missing sealant in some construction joints. The toe piles appear corroded although they could only be viewed from a distance, and an underwater inspection is recommended as voids through the piles could lead to loss of fill material and destabilisation of the wall. The recently replaced flood boards noted in the 2014 report remain.



Spur barrier wall.
(Asset Ref. No. 121AB901B0802C04)



Cracking and spalling of upper sea wall.
(Asset Ref. No. 121AB901B0802C04)



Corroded sheet pile wall at toe. (Asset Ref. No. 121AB901B0802C04)



Missing section of lower deck slab. (Asset Ref. No. 121AB901B0802C04)



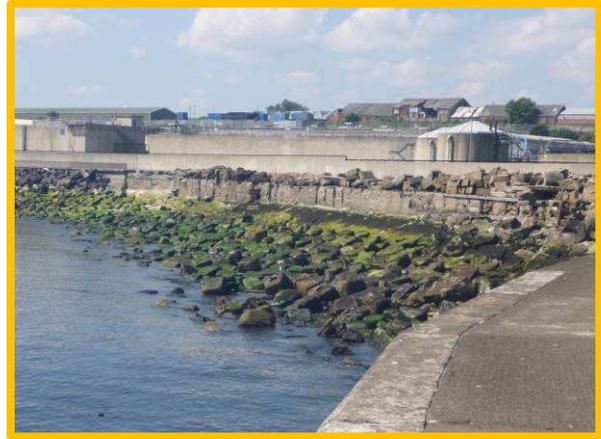
Flood boards remain (Asset Ref. No. 121AB901B0802C04)

Seaward of the sewage treatment works there is a relatively new concrete boundary wall, which remains in good condition. However, this is fronted by a section of seawall, asset 121AB901B0802C03, which is in poor (failing) condition. The crest apron consists of broken rubble, rock, and demolition waste, hence during a storm wave overtopping could easily displace this material and undermine the boundary wall.

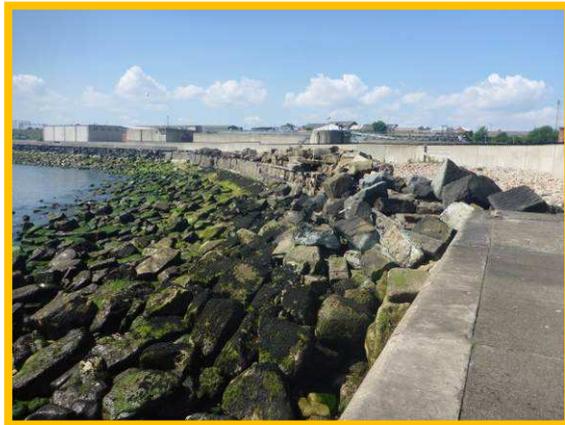
The old in-situ concrete seawall has limited protection from rock armour at the toe. The most northern part of the sea wall appears to have collapsed and been filled in with rock/rubble armour, image lower left. There appears to have been little or no change to this asset since the previous 2014 inspection. As noted in the 12/13 report, it is recommended that a capital improvement scheme is considered for this section due to the high value infrastructure located to the rear.



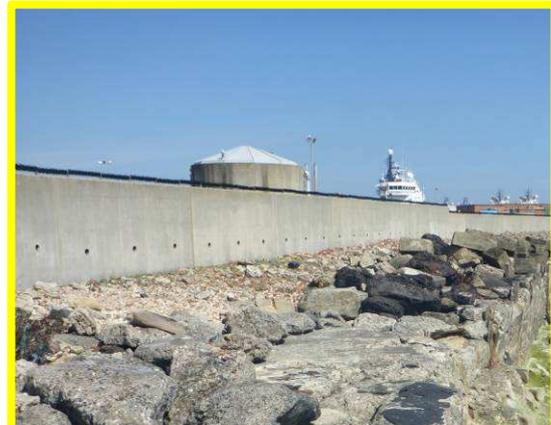
Sea wall in similar or worse condition to 2014.
(Asset Ref. No. 121B901B0802C03)



Rock armour in similar poor condition to 2014.
(Asset Ref. No. 121B901B0802C03)



Collapsed section of wall infilled with
rock/rubble. (Asset Ref. No.
121B901B0802C03)



Concrete boundary wall with unprotected crest
apron. (Asset Ref. No. 121B901B0802C03)

The defence protecting the Sewage Treatment Works, asset 121AB901B0802C02, is in fair overall condition but some of the rock armour appears small sized and inadequately interlocked, with movement during storms causing damage to the concrete wall during storms. Several smaller rocks remained on the crest slab similar to the 2014 inspection. It is recommended that the armour is re-profiled and topped up with larger armour and better interlock. There was evidence of damage to the seaward edge of the crest slab particularly towards the south end of the defence where it is more exposed.

At the south end of this section the rock armour terminates at a concrete groyne which extends from the defence 121AB901B0802C01 to the south, with the toe protected by sheet piles and some rock armour. There appeared to be some undercutting and missing masonry which was also noted in the 2014 inspection that should be repaired, additional rock armour to the south side is recommended.



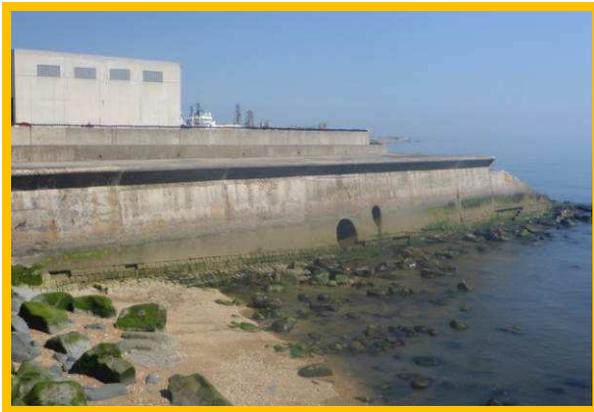
Displaced rocks and damage to coping exposing corroded reinforcement.
(Asset Ref. No. 121AB901B0802C02)



Image of asset taken from spur barrier wall.
(Asset Ref. No. 121AB901B0802C02)

The most southerly defence within the port area is asset 121AB901B0802C01, which remains in the same poor condition similar to 2014. The 2012/13 report noted that a single section of the rear flood wall had failed, presumably during storm wave impact, and was repaired in 2014. Some crest wall sections, are spalled and heavily stained with rust. The south facing wall adjacent the sewage treatment works has several missing masonry blocks.

The toe piles are badly corroded and abraded with holes through. A length of coping beam at the seaward edge has been lost towards the south, as image below. Cracking between crest slab and cope, shown in image below, indicates that further sections of coping could be lost in storms. It is recommended to consider placing rock armour in front of this wall.



Missing facing masonry requires attention.
(Asset Ref. No. 121AB901B0802C01)



Cracking between coping and deck slab towards North. (Asset Ref. No. 121AB901B0802C01)



Cracking in concrete deck surface.
(Asset Ref. No. 121AB901B0802C01)



Missing coping beam and corroded / holed
sheet pile wall toe.
(Asset Ref. No. 121AB901B0802C01)



Crest wall spalled and corrosion stained (Asset Ref. No. 121AB901B0802C01)

The breakwater marking the southern extent of the Port of Sunderland has failed at the seaward end, below (left), but was in a similar condition to that reported in 2008 to 2014. In NFCDD this structure forms part of the asset length to the south, 121AB901B0803C02.



Breakwater with nose detached, from north side.
(Asset Ref. No. 121AB901B0803C02.)



Breakwater with nose detached, from south side. (Asset Ref. No. 121AB901B0803C02)

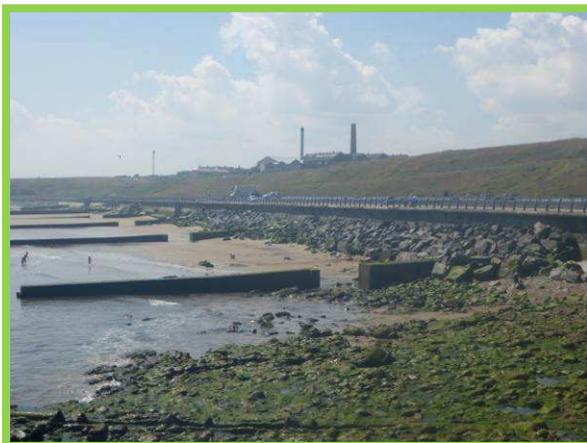


Spalled deck surface of breakwater. (Asset Ref. No. 121AB901B0803C02.)

3.3.4 Port of Sunderland to Grangetown (Hendon Seawall)

South of the port boundary is the concrete Hendon Seawall, Asset Ref. No. 121AB901B0803C02, which was in fair overall condition similar to 2014. Rock armour protection has been placed in front of the wall in several sections and this was in good condition with appropriate voids and interlock between units. There are twelve concrete groyne on the foreshore which appear to be having limited impact on the control of sediment movement.. Each groyne has access points through the structures on the upper foreshore.

The groynes are in fair condition, but are notably abraded towards the inner end. There is a concrete sewage outflow pipe that runs from the beach out to sea, this is protected by a pile wall which is heavily corroded however the concrete appears to be in fair condition. Steel toe piling was visible along significant lengths of the wall where it is not protected by rock armour, but the piles were heavily corroded and abraded with limited remaining life. Furthermore, the railings on the ramp down to the beach towards the northern end of the asset have failed due to corrosion.



Rock armour in good condition.
(Asset Ref. No. 121AB901B0803C02)



Failed railings towards northern end of beach.(Asset Ref. No. 121AB901B0803C02)



Inner end of groyne heavily abraded.
(Asset Ref. No. 121AB901B0803C02)



Concrete sewage outflow pipe in fair condition,
corroded piling.
(Asset Ref. No. 121AB901B0803C02)



Highly abraded and corroded steel toe piling. (Asset Ref. No. 121AB901B0803C02)

Similar to 2014, sealant was missing from construction joints in the concrete slabs in a number of locations. Minor spalling was evident around drainage holes with exposed reinforcement in the crest wall to the southern part of the defence. There was also abrasion evident to the front face of the wall in places as shown below. Additional rock armour to protect the failing piles and abraded wall should be considered in future.



Missing sealant between slabs.
(Asset Ref. No. 121AB901B0803C02)



Seawall abraded exposing reinforcement.
(Asset Ref. No. 121AB901B0803C02)

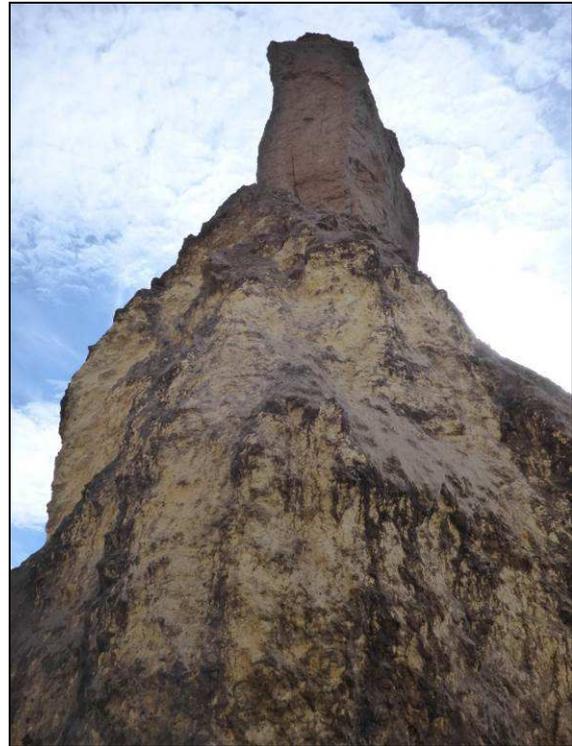
3.3.5 Hendon Seawall to Ryhope Dene

The natural coastal frontage extending from the southern end of the Hendon Seawall to Ryhope Dene comprises of Magnesian Limestone cliffs overlain by softer glacial till.

Generally, the cliffs are relatively stable with occasional local minor rock falls in the limestone or slumps in the till. In places along this frontage there are caves, arches and sea stacks present.



Sea stack near Ryhope Village Dene (Asset Ref. No. 121AB901B0804C02)



Sea stack at Pincushion (Asset Ref. No. 121AB901B0804C02)

The cliffs become more unstable along Halliwell Banks (/0804C02, between Ryhope Village Dene and Ryhope Dene). Just south of Ryhope Village Dene, slumps can be seen in places over the full height of the cliffs and water seepage through the cliffs is frequent. There are several precipitous sections where there are cracks and overhangs, with considerable water seepage adding to the likelihood of further imminent collapses.



Slumped cliff section at Halliwell Banks (Asset Ref. No. 121AB901B0804C02)



Precipitous cliff section at Halliwell Banks (Asset Ref. No. 121AB901B0804C02)

In the vicinity of a large rock stack along Pincushion Rocks, there have been recent slumps in the till section which connects the stack to the main cliff. There are many further localised slumps in the cliffs all around the Pincushion Rocks headland.



Slumped cliff section near sea stack along Pincushion Rocks (Asset Ref. No. 121AB901B0804C02)



Detail of slumped cliff section near sea stack along Pincushion Rocks (Asset Ref. No. 121AB901B0804C02)

The slumping continues along the southern section of Halliwell Banks all the way to Ryhope Dene. Some of these appear quite recent and there are many areas with extensive water seepage. Slumps also are apparent either side of Ryhope Dene and there is an extensive area of sand martin nests in the relatively freshly exposed sheer face to the immediate north of the dene.

4. Comparison with Previous Assessment

The previous formal walkover inspections across the whole study frontage were undertaken in summer/autumn 2014.

Many structures were identified as being in fair, poor or very poor condition at that time and these findings remain valid in most locations where such grading was applied.

Some previous storm damage in winter 2013-14 has been repaired and the works are holding well. Also, Roker Pier and lighthouse was refurbished in 2014.

5. Problems Encountered and Uncertainty in Analysis

All assets were inspected at suitable stages of the tide and therefore there were no major problems encountered.

Access to inspect the assets around the Port of Sunderland was arranged with Sunderland City Council. All structures were inspected from the deck and it is recommended that a programme of vessel-based inspections (and if necessary underwater inspections) is undertaken by the Council to inform their ongoing maintenance and capital investment regimes in the port.

6. Conclusions and Recommended Actions

Further to the visual inspection of all assets, specific conclusions and recommendations for individual assets are given in **Appendix B**.

All condition assessment data and selected photographs have been uploaded to SANDS (Shoreline And Nearshore Database System). This includes all data and photographs from the previous inspections since 2002 that were originally held on an MS Access Databases that had become obsolete.

Appendices

Appendix A

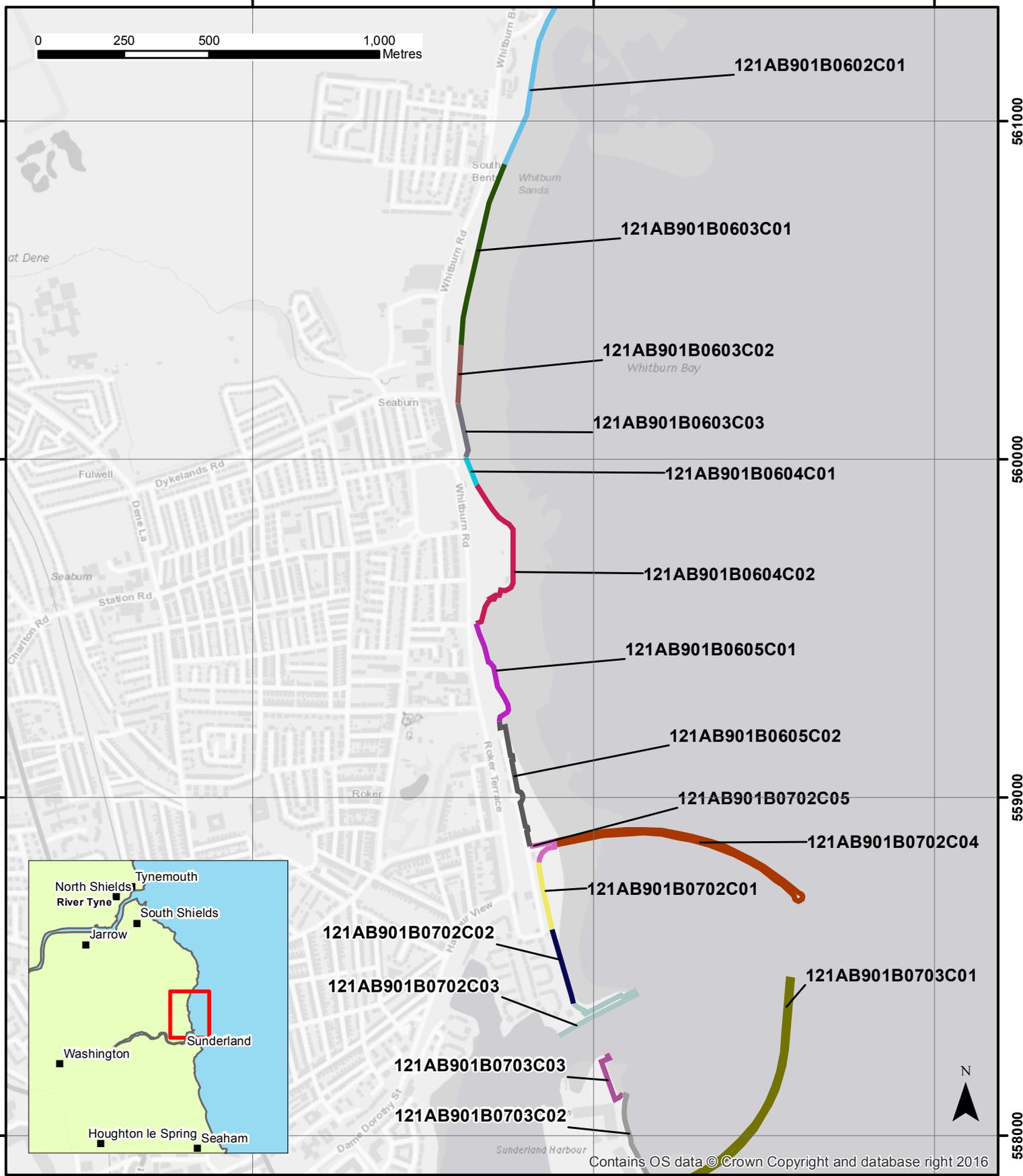
Asset Location Maps

440000

441000

442000

0 250 500 1,000 Metres



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Legend

-  Asset location
-  NFCDD Asset Number

Figure 1 - Map 1

Sunderland City Council Frontage

Asset Inspection Report

Drawing Scale 1:15,000 at A4

Client:
North East Coastal Group

Project:
Cell 1 Regional Coastal Monitoring Programme

WATER
Royal HaskoningDHV
Marlborough House
Marlborough Crescent
Newcastle upon Tyne
NE1 4EE

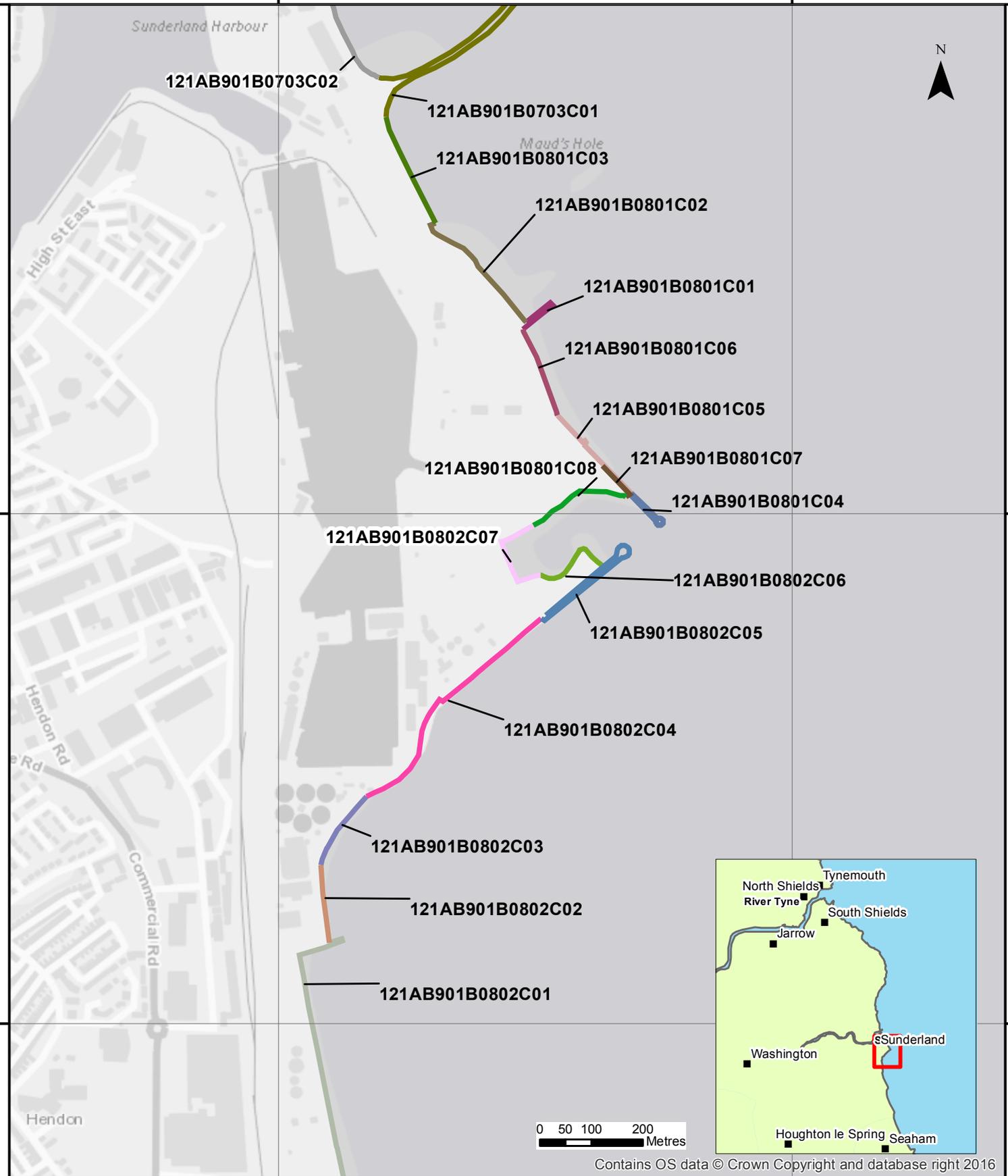
Tel: +44 (0)191 211 1300
Fax: +44 (0)191 211 1313
www.royalhaskoning.com



441000

442000

558000



557000

556000

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Legend

-  Asset location
-  NFCDD Asset Number

Figure 1 - Map 2

Sunderland City Council Frontage

Asset Inspection Report

Drawing Scale 1:15,000 at A4

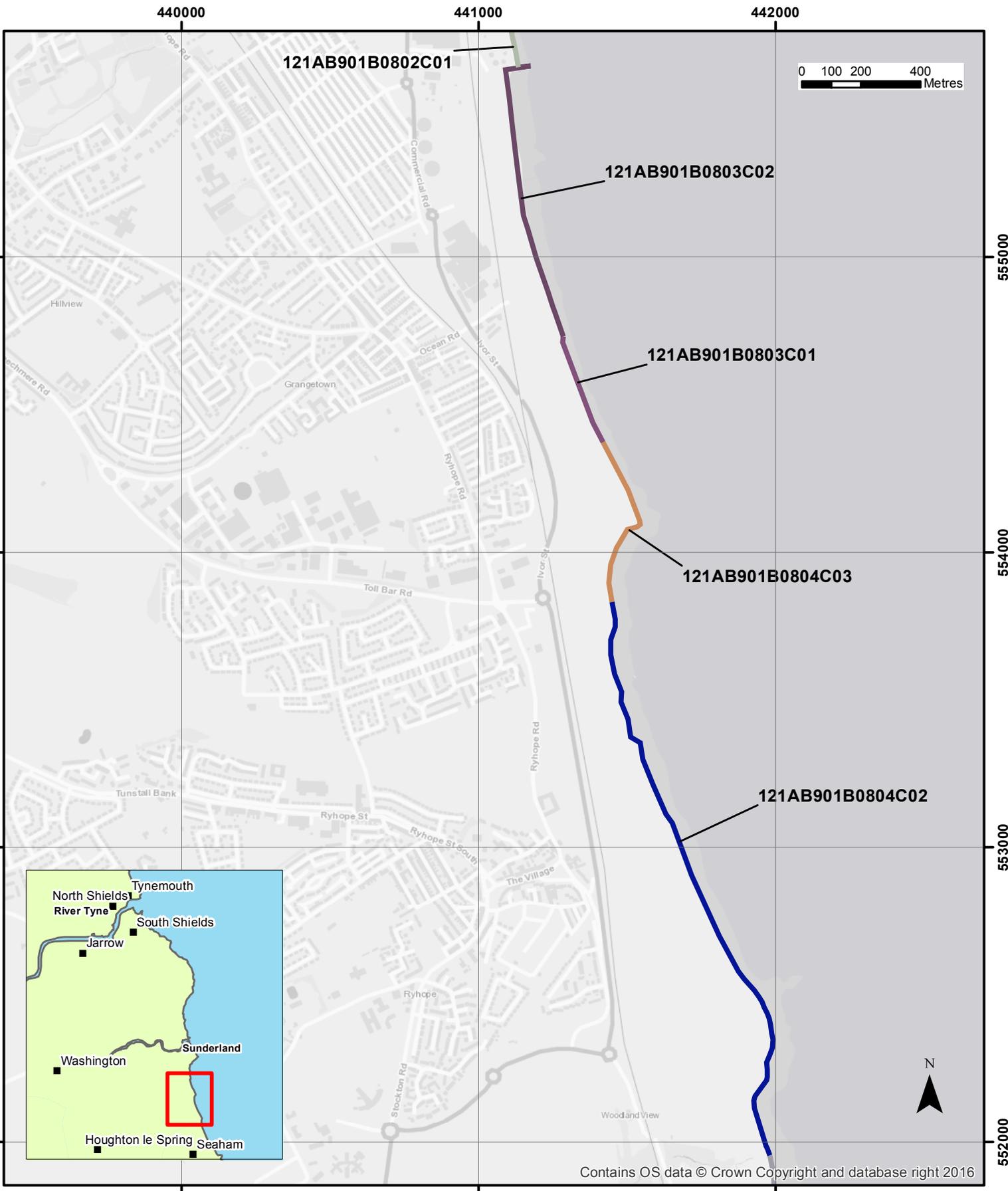
Client:
North East Coastal Group

Project:
Cell 1 Regional Coastal Monitoring Programme

WATER
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NE1 4EE

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Fax: +44 (0)191 211 1313
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Legend

 Asset location

 NFCDD Asset Number

Figure 1 - Map 3

Sunderland City Council Frontage

Asset Inspection Report

Drawing Scale 1:15,000 at A4

Client:
North East Coastal Group

Project:
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Appendix B Asset Condition & Recommendations

Asset NFCDD Reference Number	Alternative Asset Reference	Description of Asset (As recorded in NFCDD)	Asset Type (As recorded in NFCDD)	Asset Location description (As recorded in NFCDD)	Asset Length (m)	Inspection Date	Inspection Comments for 2016	Overall Condition	Worst Condition	Residual Life (Years)	Recommendations	Urgency
121AB901B0602C01		Undefended frontage	Undefended frontage		609.3	22/06/2016	As 2014: Beach backed by dunes in north which appear stable/accreting in front of coastal slope with embryo dunes forming on beach. Switches to eroding cliff at northern boundary.	2	2	>20	Continue to monitor	Routine
121AB901B0603C01	CPSE-220/6901/01	Concrete wall to promenade and to main coast road	Wall		551.6	22/06/2016	Walkway landward of sea wall replaced with new exposed concrete aggregate finish surface along entire length. Concrete wall in north: cracking and spalling to promenade wall below coping along significant lengths, rear revetment has some damage e.g. at picnic area. Masonry wall in south: some damage to coping blocks in north, new coping blocks installed at south.	3	4	11-20	Repair cracks and spalling on face of concrete wall	Routine
121AB901B0603C02	CPSE-220/6902/01	690201 Masonry wall badly cracked over 30m section, possible settlement or undermining	Wall		172.4	22/06/2016	Cope stones recently replaced, and walkway landward of seawall replaced with new exposed concrete exposed aggregate finish surface. Minor leakage through face of wall, occasional cracked blockwork. 1 No. riser of access steps damaged. Cracking and rust staining above outfall structure, security screen heavily corroded and needs replacing.	3	3	11-20	Repair cracking/damage, investigate leakage and locally repoint.	Routine
121AB901B0603C03	CPSE-220/6903/02	Masonry wall, recurve concrete coping and parapet wall	Wall		164	22/06/2016	As 2014: Some open joints between masonry blocks. Cracks in bullnose in many places and cracking in crest wall. Corrosion on landward side from previous seat fixings. At access steps, abrasion and heavy algal growth at base and handrailing failed. Beach levels similar to 2014.	3	4	11-20	Infill cracks and replace repoint locally	Routine
121AB901B0604C01	CPSE-220/6904/01	Concrete encasement to old wall in good condition. Highly reflective wall effecting beach levels to North.	Wall		88.6	22/06/2016	Signs of localised chloride attack/staining in face of encasement wall. Coping stone damaged / broken off adjacent steps. Landward concrete retaining wall and prom surfacing in good condition.	3	3	>20	Repair local damage/spalling	Routine
121AB901B0604C02	CPSE-220/6905/03	Masonry wall with concrete coping. Concrete splash wall/grouted rubble revetment / natural slopes to rear.	Wall		528.1	22/06/2016	Seawall in fair condition. Heavy algal growth down face of wall at surface water outlets north of Parsons Rocks. Stone/grout revetment above promenade remains in failed condition. Void remains under promenade at grouted section south of Parsons Rocks. Asphalt surface of promenade above seawall generally in fair condition with some uneven sections and surface cracks. Coping locally abraded/spalled although generally in fair/good condition. Remains of former access steps south of Parsons Rocks breaking up with blockwork debris on foreshore.	3	4	>20	Repair rear revetment, repair/repoint damaged coping. Investigate and repair void under promenade.	Routine
121AB901B0605C01	CPSE-220/6906/01	Concrete block wall above masonry wall cladding high cliff. Crest of wall 12.4mODN. Some blocks cracked	Wall		323.7	22/06/2016	High masonry wall above beach in good condition. Some localised mortar loss in low masonry wall, and one block has been lost, localised abrasion damage in cope, occasional cracked blocks.	3	3	>20	Replace missing block. Infill cracks and repoint	Routine
121AB901B0605C02	CPSE-220/6907/01	Concrete encasement of seawall. Masonry wall at southern extent.	Wall		418	22/06/2016	Seawall in good condition. Vertical cracking in faces of majority of concrete encasements. Damage to coping in masonry wall. Steps damaged opposite Smugglers Inn.	2	3	>20	Undertake localised repairs to cracks, joints and steps.	Routine
121AB901B0702C05	CPSE-220/6908/01	Masonry wall with concrete coping running into Roker Pier.	Wall		161.9	22/06/2016	Masonry walls at root of Roker Pier in good condition. Some localised mortar loss and abrasion of blockwork. Several sections of localised mortar loss on landward (pier) side.	2	3	>20	Localised repointing	Routine

Asset NFCDD Reference Number	Alternative Asset Reference	Description of Asset (As recorded in NFCDD)	Asset Type (As recorded in NFCDD)	Asset Location description (As recorded in NFCDD)	Asset Length (m)	Inspection Date	Inspection Comments for 2016	Overall Condition	Worst Condition	Residual Life (Years)	Recommendations	Urgency
121AB901B0702C04	CPSE-220/6909/01	Roker Pier: Masonry and concrete structure protects harbour and retains beach to north.	Breakwater		1579	22/06/2016	Pier and lighthouse generally in good condition. New concrete deck surface completed in 2014. Occasional abrasion damage to copestones on both faces of pier. Extensive lengths of handrailing are heavily corroded and failed in localised sections. Damage includes bent/snapped railings, holes in infill mesh. Localised mortar loss below coping on north face above Roker Beach.	2	3	>20	Localised repointing and blockwork repairs, replace handrailing	Routine
121AB901B0702C01	CPSE-220/6910/02	Intermittent concrete splash wall.	Wall		201.8	22/06/2016	As 2014: Wall generally in fair condition. Some spalling and abrasion of front face. Several horizontal cracks concrete in face of walls, with some spalling between cracks.	3	4	11-20	Repointing and infill spalled sections	Routine
121AB901B0702C02	CPSE-220/6911/03	New splash wall behind car park except over short section where wall is advanced. Rock armour revetment fronting concrete seawall.	Wall		228.4	22/06/2016	As 2014: Rock revetment placed in front of splash wall. Coping and promenade surface in good condition, face of wall not visible behind rock armour. Rock revetment in good condition with even crest profile and good interlock.	2	2	>20	Monitor	Routine
121AB901B0702C03		Masonry and concrete pier structure. Access prohibited.	Breakwater		480.8	22/06/2016	Old North Pier as 2014. Access prohibited due to unsafe structure. Inspection based on view from landward end of structure and on Roker Beach. 3 No. major holes in northern face with missing blockwork, several holes visible on southern face/apron. At "Rats Corner" section upstream, localised damage to concrete coping, sheet piles not sufficiently visible for inspection.	4	4	11-20	Full inspection / survey of structure / confirm future strategy.	Routine
121AB901B0703C03	CPSE-220/6912/02	Armoured toe to grouted revetment	Armour	NZ41065810, NZ41035824	187.8	19/07/2016	Similar to 2014: Rock armour loosely placed with some gaps towards toe and lacking interlock, slab shaped surface profile. Crest section of rock grouted with concrete has some localised damage to rocks/cracked grout. Asset in fair condition overall.	3	4	11-20	Consider topping up and reprofiling rock armour in longer term. Re-grout damage at crest.	Routine
121AB901B0703C02	CPSE-220/6913/01	Masonry Quay wall. Development land to rear and crest wall above.	Wall	NZ41195785, NZ41085812	307.8	19/07/2016	As 2014: wave overtopping has caused erosion to high level berm at south end. Coping of wall appears in fair condition. Missing blocks observed at northern corner of structure. Overtopping has also broken up concrete apron on landward side of wall.	3	4	11-20	Reprofile embankment and place rock armour on seaward side to prevent further erosion of embankment. Alternatively construct crest wave return wall. Repair missing blocks at northern end of wall.	Urgent
121AB901B0703C01	CPSE-220/6914/01	New South Pier, precast concrete and concrete bed footing founded to rock. Inspection and maintenance on a regular basis.	Breakwater	NZ41205777, NZ41575846	1625.7	19/07/2016	Similar to 2014: several large blocks remain missing at roundhead. Some spalling and cracking on lower deck of breakwater. Occasional open joints on landward side of upper wall below cope stones. Navigation pole and stays remains heavily corroded and in poor condition. Upper deck of breakwater not inspected at seaward end due to risk of fall from height. Damaged areas of upper deck appear to have been repaired although localised damage remains. No inspection of seaward face possible without boat.	2	3	11-20	Undertake full survey/underwater inspection. Replace missing blocks at seaward end. Remove or replace navigation pole.	Routine
121AB901B0801C03	CPSE-220/6915/01	Masonry wall undermined in poor condition. Docks behind.	Wall	NZ41305757, NZ41205777	229.4	19/07/2016	Small area of rock remains at area where void identified in 2010 inspection. Approx. 4 No. blocks are missing from middle of wall and there appears to be open joints as a result of settlement of approx 10m length section. Deck slabs remain lifted above coping of wall. Some deck slabs appear to be sagging in the middle. Open joints and spalling adjacent cope stones. No crest slab at south end as 2014 inspection, consequently no drainage from wave overtopping.	4	4	11-20	Undertake detailed structural inspection of asset including inspection of toe in area of settled blocks. Extend rock armour in front of wall, provide drainage through wall from overtopping. Repair crest slab.	Urgent
121AB901B0801C02	CPSE-220/6916/01	Rock and rubble armour in good condition.	Armour	NZ41485737, NZ41305757	282.6	19/07/2016	As 2014. Rock armour in fair overall condition with even profile and good interlock. Demolition waste and debris mixed in. Slightly uneven crest.	3	3	11-20	Continue to monitor	No Repairs
121AB901B0801C01	CPSE-220/6917/01	Concrete groyne in state of collapse.	Wall	NZ41475736, NZ41535740	141.5	19/07/2016	As 2013. Structure remains in a collapsed state. Landward section of asset integrated with rock armour. Remains will have limited effect on sediment transport and waves.	5	5	0	Confirm asset as redundant	No Repairs

Asset NFCDD Reference Number	Alternative Asset Reference	Description of Asset (As recorded in NFCDD)	Asset Type (As recorded in NFCDD)	Asset Location description (As recorded in NFCDD)	Asset Length (m)	Inspection Date	Inspection Comments for 2016	Overall Condition	Worst Condition	Residual Life (Years)	Recommendations	Urgency
121AB901B0801C06	CPSE-220/6917/02	Rubble revetment.	Revetment	NZ41545719, NZ41475736	181.9	19/07/2016	As 2014: rock revetment in fair condition. Even profiling at southern end with relatively good interlock. Sheet pile structure exposed towards southern end where there are gaps in rock armour.	3	4	>20	In-fill gaps in rock armour as required, continue to monitor.	Routine
121AB901B0801C05		Rubble revetment.	Revetment	NZ41685704, NZ41545719	217.5	19/07/2016	As 2014. Stacked bund of rock armour at crest backing various concrete/masonry/sheet piles derelict structures with scattered blocks of concrete and armour stone and debris.	4	4	>20	Review defence requirements for any new developments.	Routine
121AB901B0801C07	CPSE-220/6925/01	Derelict breakwater made irregularly from masonry blocks, concrete, bagwork and rubble. Section and type varies greatly along length.	Breakwater	NZ41675703, NZ41635709	86	19/07/2016	As 2014 poor to very poor condition. Extensive abrasion, cracking and spalling of concrete. Reinforcement exposed throughout structure. Landward side of pier backed by rubble armour which is in fair/poor condition.	4	5	1-5	Full survey. Significant repair works required, consider replacement or requirement for pier in wider strategy.	Urgent
121AB901B0801C04	CPSE-220/6918/02	Rock toe to old harbour wall.	Apron	NZ41685703, NZ41755698	184.5	19/07/2016	Derelict structure in similar condition to 2014 inspection. Heavily abraded deck and walls, exposing reinforcement. Roundhead failed. Extensive spalling and cracking of concrete on all sides of pier. End of pier appears to be more undercut than in previous 2014 inspection.	5	5	<10	Strategic review of South Outlet defence requirements	Urgent
121AB901B0801C08	CPSE-220/6926/01	Random rubble tipped into old dock to fill in front of buried quays.	Revetment	NZ41495697, NZ41675703	205.1	19/07/2016	Similar to 2014 inspection. Mainly demolition rubble in fair condition, no defined crest or profile. Some displacement of rubble due to wave overtopping of North East Pier.	3	3	11-20	Strategic review of South Outlet defence requirements, consider constructing formal revetment	Routine
121AB901B0802C07	CPSE-220/6927/02	Random brick rubble tipped to slope above piling.	Revetment	NZ41465686, NZ41495697	199.3	19/07/2016	Similar to 2014: sheet pile wall is heavily corroded (crumbles when touched). Rubble backing behind pile wall in fair condition. Rubble backfill in old dock basin seaward of piling with sandy foreshore between piles and rubble.	3	3	6-10	Consider within strategy for South Outlet defences	Routine
121AB901B0802C06	CPSE-220/6928/01	Partial rubble infilling of old dock. Slope variable	Revetment	NZ41515688, NZ41635689	166.6	19/07/2016	As 2014. Rubble infill of former dock consisting mainly of demolition waste such as broken concrete slabs. In poor condition.	3	4	11-20	Consider within strategy for South Outlet defences. Consider topping up or constructing rock revetment.	Routine
121AB901B0802C05	CPSE-220/6929/03		Breakwater	NZ41515679, NZ41685692	449.2	19/07/2016	As 2014. SW Breakwater in derelict condition. Many blocks missing and displaced from landward face. Unable to inspect seaward face of breakwater. Many large deck slabs are missing as in previous inspections.	5	5	6-10	Strategic review consider realignment landward and/or replace with revetment.	Urgent
121AB901B0802C04	CPSE-220/6919/03	Splash wall set back from main crest and with a crest of 8.0 mODN.	Splash Wall	NZ41175644, NZ41515679	511.2	19/07/2016	Spalling and corrosion marks in upper deck slabs and sea wall. Some coping stones along upper deck have been abraded. Section of lower deck slab missing towards northern end. Some sealant is missing between slabs in upper deck Pile wall at toe appears corroded.	3	4	11-20	Inspect piles from boat/diver. Replace sealant between slabs.	Routine
121AB901B0802C03	CPSE-220/6920/04	Rubble placed to top of seawall.	Bank	NZ41085631, NZ41175644	163.4	19/07/2016	Similar to 2014: Northern end of seawall is collapsed and has been filled in with rock and rubble. Seawall, a concrete clad timber structure, is failing along majority of length with informal rubble waste crest protection. Rock and concrete block foreshore fronting the retaining wall is in poor condition, lacking interlock with several displaced rocks. Seaward face of concrete boundary wall between STW and demolition rubble appears in good condition.	4	5	6-10	Review defence with regard to global stability and overtopping performance. Consider constructing revetment in front of existing failing structure.	Urgent
121AB901B0802C02	CPSE-220/6921/02	Splash wall with crest to 7.35mODN	Splash Wall	NZ41095615, NZ41085631	152.9	19/07/2016	As 2014. Some rock armour is too small/placed too steeply so has been displaced causing damage to concrete wall. Uneven crest height of rock armour as rock displaced. Damage to crest and coping, esp. at south, with crack and gaps between slabs, and some exposed reinforcement.	4	4	6-10	Top up rock armour and reprofile. Repair damage to coping and deck slabs.	Urgent

Asset NFCDD Reference Number	Alternative Asset Reference	Description of Asset (As recorded in NFCDD)	Asset Type (As recorded in NFCDD)	Asset Location description (As recorded in NFCDD)	Asset Length (m)	Inspection Date	Inspection Comments for 2016	Overall Condition	Worst Condition	Residual Life (Years)	Recommendations	Urgency
121AB901B0802C01	CPSE-220/6922/03		Splash Wall	NZ41135564, NZ41125616	616.9	19/07/2016	As 2014: Damage to crest slab around drain outlets. Sheet pile wall at toe of sea wall is heavily corroded and abraded with holes. Several missing masonry blocks at toe of wall in northern corner. Deck slab appears to have settled relative to coping blocks, potential for voids beneath. Sealant absent between some coping and deck slabs. Missing section of coping at southern end. Many sections of crest wall are heavily corroded with some spalling.	4	4	>20	Intrusive investigation to investigate cause of settled slabs combined with inspection of toe for undermining. Part of remediation of voiding and undermining could be undertaken by placing rock armour in front of sea wall.	Routine
121AB901B0803C02	CPSE-220/6923/08	Concrete sea wall with rock armour at toe	Sea Wall	NZ41285473, NZ41175565	1056.9	19/07/2016	As 2014. In some sections of wall, concrete face is heavily abraded exposing steel reinforcement. Sheet pile wall is heavily corroded along parts of wall toe. Some sections of failed railings due to corrosion. Nose of groyne at northern end port boundary remains collapsed. Gap in defence height at northern groyne. Some groynes are abraded at inner end exposing rebar, there are gaps in some groynes. Rock armour fronting sea wall is in fair condition. Sewage outflow pipe in fair condition, sheet piles heavily corroded but concrete remains in fair condition.	3	4	11-20	Review historic drawings to determine importance of sheet piles, consider extending rock armour. Replace sealant between coping slabs.	Routine
121AB901B0804C01	CPSE-220/6801/01	Eroding cliff to agricultural land.	Cliff - south of Ryhope Dene	NZ42335082, NZ41985195	1193.4	21/07/2016	Small-scale but regular ongoing slumping in soft material that overlays the solid geology base. Occasional caves and arches formed at the base of the cliffs. Many recent mudslides / slips of upper cliff onto beach,	4	4	>20	Continue monitoring.	No repairs
121AB901B0804C02		Undefended Frontage	Undefended Frontage	NZ41985195, NZ41445383	2040.3	21/07/2016	Continuous slope failures in upper cliff and mud slides evident. Lower rock cliff eroding although some protection from cobble beach..	4	4	>20	Monitor slope failure with regards to cliff top footpath.	Routine
121AB901B0804C03	CPSE-220/6924/01	Eroding cliff over full length but only 0.6Km reported to be in need of work.	Undefended Frontage	NZ41445383, NZ41415437	614.9	21/07/2016	Active erosion along length upper cliff not vegetated. Ongoing erosion at Ryhope Nook footpath - steps have been rebuilt...	4	4	>20	Monitor slope failure with regards to cliff top footpath.	Routine

	= condition worse than in 2012
	= condition improved since 2012