



Cell 1 Regional Coastal Monitoring Programme Walkover Inspection Surveys 2020



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Scarborough Borough Council

November 2020

Scarborough Borough Council

Walkover Inspection Surveys 2020

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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 seabed 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 2020** and provides a summary of the main findings from the walkover inspections of Scarborough Borough 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 seabed sediment data collection, and aerial photography.

1. Introduction

1.1 Study Area

Scarborough Borough Council's coastal frontage extends from Staithes in the north to Speeton in the south, and is shown in **Figure 1-1**. Detailed maps showing the location of each of the coastal defence assets considered in this report are presented in **Appendix A**. In addition, the cliffs within the frontage have been classified according to their characteristic behaviour condition and a series of Cliff Behaviour Units (CBUs) have been defined and mapped. The location of the CBUs is presented in **Appendix B**.



Figure 1-1: Scarborough Borough Council study area

1.2 Methodology

This section presents the approach taken by the asset inspectors for the Scarborough Borough Council coastal frontage.

The walkover inspection surveys for the Scarborough Borough Council frontage were undertaken between July and October 2020. The weather conditions experienced during the inspections were generally warm and fine with no access or visibility problems caused by adverse weather despite some drizzle and light rain on occasions.

The frontage has been split into a number of 'asset lengths' (Appendix A), as defined in the National Flood and Coastal Defence Database (NFCDD) 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.

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

2.1 Overview of Coastal Slope Condition Assessment

There is significant variation in the level of cliff activity within the SBC region, reflecting the diverse geology, history of landsliding and the range of cliff protection and stabilisation measures in place to tackle erosion and slope instability issues.

In total 265 cliff behaviour units (CBUs) have been assessed across the region during the 2020 walkover survey, of which Partly Active and Locally Active cliffs are the most common equating to 83% of the total. (Figure 1).



Figure 1 – Cliff activity classification within SBC frontage

The clear majority (approximately 90%) of the 265 units surveyed during the 2020 walkover retained the same activity status as they had in 2018, with only around 4% worsening and around 6% improving in condition, of which the vast majority improved from partly active to locally active.

Along Whitby West Cliff there are broken drainage pipes and split stone-filled plastic basket gabions along sections that have suffered from past shallow slippages that require some maintenance.

The Scarborough Spa Slope Stabilisation scheme was completed in February 2020 and is designed to ensure that the stability of the slopes to the rear of the Spa Complex is improved for the next 100 years.

At the South Cliff Clock Café, a shallow-seated slippage occurred earlier in 2018 which lead to the collapse of a historic masonry retaining wall and resulted in the closure of the Victorian beach chalets. A capital scheme is underway to stabilise the slope and construct a new retaining wall and works are scheduled for completion in December 2020.

Within Filey Bay, the Flat Cliffs emergency works were completed in summer 2018. The temporary works were designed to improve the stability of the cliffs at the sole access road to the Flat Cliffs hamlet. The drainage pipes appeared to be working as designed during the 2020 inspection although the toe of the cliff has continued to retreat exposing many of the pipes and leaving an unsightly appearance.

2.2 Overview of Coast Protection Asset Condition Assessment

There is a large number of built coastal defence assets along this stretch of coastline, generally associated with the coastal towns and villages. Many of these assets are in good or fair condition but there is a large number that require minor repair works, a few where more significant works are recommended and several locations where urgent attention to provide further, more detailed, assessments are recommended. The most common works required include blockwork repointing, resealing of joints, reinforcement of undercut sections, repairing cracks and resurfacing.

A brief overview for each of the key locations of coastal defences, highlighting areas of concern is given below.

MU4 – Staithes

- The North Breakwater has been undercut on the inner-facing side, perhaps caused or exacerbated by propeller thrust. The sheet piles around the seaward end of the structure are significantly corroded although it is assumed that these are permanent formwork for previous in *situ* concrete pours rather than structural elements.
- Some of the structures extending into the beck as either riverside walls or property walls are locally in poor condition, with notable gaps and voids, despite previous repairs.

MU7 - Runswick Bay

• There is ongoing erosion of the coastal slopes to the south of the rock armour revetment protecting the car parks and beach access. Surplus rock armour from the Runswick Bay Coastal Protection Scheme was placed in July 2018 to provide some protection against outflanking of the revetment. Beyond the rock armour, the slopes should continue to be monitored.

MU9 – Sandsend Village

- The concrete sea wall around the car park at the western end of Sandsend has previously shown exposed rebar on the apron which should be re-covered, although was buried by high beach levels during the 2020 inspections.
- The concrete sea wall extending from Sandsend Beck to the east has deteriorating timber breastwork at the toe, but this was buried by high beach levels at the time of the 2020 inspections.
- The stepped concrete revetment along the Sandsend Road frontage was constructed in 2015/16 to replace a failing older asset. The defence remains in very good (as built) condition, but with some (structurally insignificant) chipping to the step edges. Outflanking at the eastern end has been noted, but this is now being countered by the placement of large beach boulders.

MU11-13 – Whitby

- Whitby West Beach promenade deck has suffered cracking in the past. Some previous repairs are re-opening, requiring further attention.
- The sea wall sections of West Beach not protected by a fronting rock revetment have extensive abrasion and undercutting. Some affected sections have been covered by a new toe beam, but this does not cover the full extent of defective toe.
- The defences below Whitby Pavilion Theatre remain in poor condition and would benefit from repairs.

- A major capital scheme to refurbish the Whitby Harbour Piers was undertaken in 2018/19. This has repaired the previously identified defects.
- The quay walls within Whitby Harbour are generally in fair condition, but with some locally specific defects.

MU16 – Robin Hood's Bay

- The large vertical defence wall continues to show deterioration with seepage, cracking and outflanking of the northern end now evident. The wall is scheduled for capital refurbishment. Maintenance activities to repair extensive spalling were ongoing during the 2020 inspection.
- Outflanking of the rock revetment to the south of the village, caused by activity in the cliff units in this area.

MU20-21 – Scarborough North Bay and Headland

- Overall, the structures in North Bay are in fair condition, but due to their age require ongoing maintenance to infill open joints and cracks.
- The stretch of frontage immediately north of Peasholm Gap, in front of the beach huts, experienced significantly higher beach levels in 2020 than on previous inspections, reaching the crest of the seawall in places.
- The asset in the poorest condition is the slipway in front of Oasis Café. A pre-existing large
 vertical crack on the wingwall has deteriorated and a block is now missing adjacent to the crack.
 Surrounding blocks appear loose and are at risk of being displaced. Although it is fenced off
 numerous members of the public were observed still using this as an access.

MU21-22 – Scarborough Harbour

- Overall, the structures are in fair condition and have experienced previous repairs and maintenance works. However, due to their age they require ongoing maintenance to infill open joints and cracks.
- The most notable defects are on the seaward end and outer face of the West Pier, where repairs are recommended.
- The new RNLI station was completed in 2016 including new lengths of surrounding seawall.

MU22-23 – Scarborough South Bay

- Overall, the structures are in fair condition, but due to their age require ongoing maintenance to infill open joints and cracks.
- Some capital refurbishment was undertaken on the Spa sea wall as part of the wider coast protection and slope stabilisation works. Generally, the condition of the repairs is fair to good.
- At the promenade, between the Scarborough Spa and the Clock Tower Café a steel framework has been erected beneath the upper promenade. The condition of the steelwork and associated concrete is good. However, the promenade structure itself including the upper and lower deck is in poor condition and continues to deteriorate.
- The Scarborough Spa Cliff Stabilisation Scheme commenced in June 2018 and completed in February 2020. The works comprised installation of around 4,500 soil nails from 4m to 20m in

length to stabilise shallow slips and installation of around 200 piles from 20m to 35m in length to stabilise deeper-seated slips. Drainage was also installed to help relieve ground water pressure.

 In March 2018, the retaining wall behind the southernmost row of historic chalets on the slope below the Clock Café failed. A capital scheme is underway and is scheduled for completion in December 2020. The works comprise the removing of damaged chalets, collapsed wall and failed slope material, regrading the remaining slope. Installation of approximately 90 soil nails, installation of high tensile steel surface mesh, installation of drainage and construction of reinforced earth retaining wall using layers of geogrid with integrated concrete blockwork.

MU24-25 - Cayton Bay

• The repairs to the defences around the public access steps which were undertaken shortly after the 2016 inspection were found to be in fair condition. However, overall, the structures remain in very poor condition and present a potentially significant health and safety risk to members of the public.

MU28a-29a – Filey

- The slipway at Filey sailing club is beginning to become undercut, with a significant section of the slipway breaking away. The scour hole at the north end of sheet pile defences has been repaired.
- The main sea wall defences through the town remain largely unchanged since 2018. The structures show evidence of significant maintenance and repair works over recent years, but ongoing maintenance work is required due to the age of the structure. The abrasion to the lower courses of blockwork does appear to have worsened locally, with water noted to be seeping out in places. Higher beach levels than in 2018 meant that many of the outlets were buried by sand.
- A short section of rock revetment, with gabion baskets beneath, is located at the southern end of the sea wall near Martin's Gill. A depression in the crest of this structure suggests movement of the cliff behind, although this has not worsened since 2018. The coastal slopes behind the revetment still appear to be active and some form of improved outflanking defence remains necessary in the medium term.
- The Flat Cliffs emergency works were completed in 2018. The geotextile bags at the toe of the cliff were mostly fully buried by beach sediment at the time of the 2020 inspections. The toe of the cliff has continued to slowly retreat, exposing drainage pipes along the full length which, in many places, have come separated at their terminal end and now litter the upper beach. It was noteworthy that several of the drainage pipes were discharging water at the time of inspection suggesting they are still operating as expected.

3 Condition Assessment

3.1 Management Unit 4 – Staithes

Coastal Slope Condition Assessment

This Management Unit comprises the high cliffs of Cowbar Nab composed of sandstone and those behind and immediately to the east of Staithes composed of sandstone overlain by ironstone, all fronted by a rock platform.

The eastward facing cliff of Cowbar Nab (MU4/1a and E60/1a) is steep and composed of unvegetated sandstone. The cliff exhibits overhangs and scars with some rock falls at its base. This level of activity means that these units are classified as Partly Active, unchanged from 2020. During the survey, small sized material could be heard falling from the cliff. Signage is present to warn people of the danger of falling rocks.

Unit MU4/1b is the south facing side of Cowbar Nab which runs adjacent to the north bank of Staithes Beck. This sandstone unit is sheltered from wave action behind the harbour walls. The cliff fails occasionally and is therefore classified as Locally Active, unchanged from 2018. During the survey, small material could be heard falling from the cliff.





East-facing Cowbar Nab. **E60/1a** (right) and South MU4/1a (left). Partly Active in September 2020 **MU4**/

South-facing Cowbar Nab along Staithes Beck *MU4/1b* (Partly Active in September 2020)

Unit MU4/2 is located behind Staithes Harbour. This sandstone cliff is well vegetated with small localised slumps and is classified as Locally Active, unchanged from 2020.

Further east, beyond the extent of Staithes Harbour is unit MU4/3. The cliffs are steep and the unvegetated sandstone is exposed to wave action at the toe. The unit is classified as Locally Active.

During July and August 2018 some high-profile incidents of cliff activity occurred along the coastline within the north of the borough, including the collapse of a section of cliff to the east of Staithes on 8th August, where tragically a young child was killed. These units are classed as Locally Active and as such are expected to experience some localised occurrences of activity and indeed there are warning signs erected on the cliff face and the approaches to the foreshore to this effect. Despite the signage, on the day of the survey, people were observed in close proximity to the bottom of the cliffs. This is likely to remain an issue in this area due to the interesting cliff face (caves/cracks etc.) which is easily accessible from the popular beach.





MU4/2 Locally Active in September 2020

Accumulation of small stone fallen from above. **MU4/2** Locally Active in September 2020



MU4/3 Locally Active in September 2020

Coast Protection Asset Condition Assessment

Upstream of the Staithes Beck footbridge, there are two areas of repair which were completed in 2013 and appeared to remain in good condition. These areas do not constitute coast protection assets in the present inspections but are included here for wider interest.



North bank: Works completed in 2013 to repair collapsed cliff (no asset ref)



South bank: Stone-filled gabion baskets constructed in 2013 to repair collapsed wall (no asset ref)

The lower rails of the guardrails crossing the footbridge were observed to be significantly corroded and the steel tubes had rusted through locally.



Footbridge – corrosion of bottom rail (no asset ref).

At Staithes Harbour, the breakwater arms were protected in 2002 through the placement of 5-8 tonne rock armour on the seaward side. This acts to provide a greater defended height and to dissipate wave energy from the breakwater surface. Stainless steel handrails and a new concrete topping, cast over the original outer breakwater, added further height to the structures.

The North Breakwater (0402C01) is in fair condition overall, but certain elements are poor. The rock armour added in 2002 to the seaward face and extending around the seaward end of the breakwater mostly remains in Good condition, tightly packed and maintaining a consistent profile, however two crest blocks are missing (approx. 30m from landward end and approx. 10m from seaward end). There appears to have been some historic movement of rock armour at the eastern extent of the structure where a gap/low spot in the armour at crest level appears to coincide with high block(s) at the toe. This has been observed previously and the rock armour appears stable. Steel handrails are in good condition throughout.

Local abrasion and spalling of the concrete cap/crest along the southern edge may present a health and safety risk as the size of the gap between the bottom rail and the crest is increased locally in combination with a potential trip hazard due to uneven surface. Some areas appear to be ponding water which leaves them susceptible to freeze-thaw action.



Rock armour revetment on seaward face of North Breakwater (/0402C01)



Corroded steel sheet piling on inner face of North Breakwater. Rock armour profile appears similar to 2018 inspection (/0402C01)

The sheet piling on the inner face and the seaward end of the breakwater is heavily corroded with significant loss of section in the uppermost 2m. It is assumed that this sheet piling served as formwork for *in situ* concrete pours rather than a standalone structural element.

Thirty metres from the landward extent of the structure, the deck splits into two levels, with the lower level having cracking and abrasion in places. There is also abrasion, significant in localised patches, and rust-staining along parts of the inner-facing edge of the North Breakwater's deck and wall. The eastern-most sixty metres, (beyond the first elbow) is more significantly affected.

Twenty metres from the eastern end of the breakwater there is a crack which runs the full width of the deck and the full thickness of the crest wall suggesting a previous global movement. The crack has previously been filled with sealant, however this has now largely been washed-out/lost. The dimensions and extent of the crack has not changed significantly since the July 2018 inspection.

Undercutting / opening of a construction joint along the inner-facing side of the North Breakwater wall was previously reported in 2016 and 2018 inspections although water levels in 2020 prevented observation of the same, with the exception of the landward extent of the structure.

The concrete access ramp and baffle units at the landward extent of the structure are in good condition. Several smaller rock armour units have fallen/washed onto the ramp but there is no sign of damage and any significant detriment to performance of wider revetment is not expected.





Crack in deck and crest wall (/0402C01). No significant change from 2018.

Crack in deck and crest wall (/0402C01). No Small rock armour units on slip way (/0402C01).



Rust staining of inside face and crest wall (/0402C01)



Recess with ponding water adjacent to wall crest (/0402C01)



Spalling / abrasion along edge of crest locally (/0402C01)



Spalling / abrasion and cracking of crest locally (/0402C01)



Inside face of breakwater structure (/0402C01)



Detail on potential undercutting (left) and opening of construction joint (right) (/0402C01)

The rock armour revetment running south from the North Breakwater to the end of Cowbar Lane (/0402C02) was constructed after the 2002 upgrade to the main breakwaters and is generally in good condition. The crest level at the northern extent appears to be slightly lower, exposing the concrete walkway to the rear. It is not clear if rock armour has been displaced or if the revetment has undergone a larger scale movement/settlement although this area appears very similar to 2018 so assumed to be stable. The short section of seawall which is exposed at the southern end of the rock armour, adjacent to the slipway, is in fair condition, with evidence of local abrasion of the vertical faces and the crest and cracking and open joints between concrete blocks.





Lower crest level at northern extent of rock Rock revetment (/0402C02) revetment (/0402C02)

The defences that extend into the northern side of Staithes Beck are split into two asset lengths (/0402C03 and /0402C06), with the intersection at the west side of the RNLI slipway. The eastern section (/0402C03), which is in fair overall condition includes the slipway with gabion baskets beneath and a vertical concrete wall to the rear, tapering into a stone blockwork wall at the landward end of the slipway. The gabions are in a fair condition despite some settlement, but the stone wall is in poor condition along its length, with open joints between blocks and one local void caused by a missing block. Masonry has continued to erode since the 2018 survey, leaving the mortar of previous repointing standing proud. The concrete wall to the rear of the slipway appears in fair condition along its landward section, but in poor condition further seaward with longitudinal cracks and cold joints.



Poor condition masonry wall to rear of slipway (/0402C03)



Missing blockwork in masonry wall to rear of slipway (/0402C03)



Cracks and cold joints in concrete seawall to rear of slipway (/0402C03)



Timber slipway. Minor settlement of blocks within gabions beneath (/0402C03)

The walls between the RNLI slipway and the footbridge over Staithes Beck (/0402C06) comprise a variety of masonry and concrete blockwork structures and are generally in a fair condition, reduced to poor condition locally with missing mortar, settlement of blockwork and exposure of the toe (previous small boulder sized rock appears to have been largely washed away). The more recently constructed wall immediately in front of the RNLI building is in good condition, but there is a void in the older stone blockwork wall at its interface with the newer wall which could compromise overall stability if voiding occurs behind. The external dimensions of this void do not appear to have increased since first reported in 2016.



Wall on northern side of beck (missing blocks, open joints and voids) (/0402C06)



Vegetation growth along crest and into joints in upper part of wall face. (/0402C06)

On the south side of the beck, a variety of wall construction details extends from the footbridge over Staithes Beck (/0402C04). There is evidence of previous repairs, with the overall condition of the asset generally fair, locally this reduces to poor, with sections of open joints, loose blockwork, abrasion, cracking and vegetation growth.







Open joints and loose masonry blocks locally (/0402C04)

The walls continue as a series of masonry blockwork walls, often exterior walls of private properties (/0402C22), which continue to display visible loss of mortar causing open joints and missing blocks and vegetation growth locally. It is recognised that some previous repairs have been undertaken, but deterioration continues. Although undercutting of the toe has previously been reported in several locations, exposing timber piling, this was not observed during the 2020 inspections.



Cracking and open joints locally (/0402C22)

Cracking and open joints locally (/0402C22)

The masonry blockwork side walls to the slipway (/0403C05), are in poor condition, with missing blocks, open joints and undermining at the toe, more apparent at the lower elevations at the seaward extent of the structure. Some of the open joints are in an area of previous repair and need re-filling to prevent further deterioration. A void was observed at the interface between the concrete abutment of the seawall fronting the Crab and Lobster and the south face of the slipway.



North face of slipway (/0403C05)



South face of slipway (/0403C05)



Void at interface between sea wall and south face of slipway (/0403C05)

Whilst repairs and improvements have previously been undertaken to the sea wall west of the Cod & Lobster (/0403C05), the wall remains heavily abraded and cracked in places, although in fair overall condition. There is notable cracking and loss of render at the interface between adjacent seawall sections. The concrete groyne (/0403C07) limiting sediment movement within the harbour is in fair condition.



Concrete groyne (/0403C07)



Concrete sea wall in Fair condition (/0403C05)



Abrasion and cracking to seawall face and crest at interface between different wall sections (/0403C05)

The seawalls extending to the Staithes Harbour Office (/0403C01 and /0403C02) are in fair condition, with previous repairs to cracks holding well. However, there is one full height vertical crack at the interface of adjacent wall sections which needs filling. This was reported in the 2018 inspection and does not appear to have deteriorated significantly although has widened/opened slightly, more apparent in the lower section of the wall. The slipway and adjacent boat storage area at Staithes Harbour Office remain in good condition.



Concrete access steps (/0403C01)



Previous repair to vertical crack washed out (/0403C01)



Slipway at Staithes Harbour Office (/0403C01)

The inner harbour concrete breakwater (/0403C04) remains in good condition. A crack was observed at the crest on the inside/south face. At approximately mid-length, a crack extends the full width of the in-situ deck and aligns with vertical cracks in the walls however these appear to be historic and do not suggest continued global movement/displacement. No apparent changes from 2018 inspection. Steel guardrails appeared to be in good condition.

The main South Breakwater of Staithes harbour (/0403C03) is also in good overall condition, although there is minor abrasion and spalling at the access steps and around construction joints and one local area of cracking at the edge of the deck and wall on the lower (inner-most) deck of the structure. This may have been caused by an impact from a vessel (noting local deformation of guardrail tube). This defect has worsened slightly since 2018 inspection as more loose concrete has been washed out. Steel guardrails generally appeared to be in good condition.



Inner harbour concrete breakwater (/0403C04) In



Inner harbour concrete breakwater (/0403C04)



Local abrasion, cracking and spalling inside face of South Breakwater (/0403C03)



Local damage. Cracking and loose concrete to crest of South Breakwater. (/0403C03)

The rock armour revetment appears to be in good condition with generally consistent crest level and slope profiles. Several smaller rock armour pieces appear to have been lifted/displaced and are sitting on top of the larger armour and four small rock armour pieces are located on the concrete crest (outer limb of the structure) having been displaced from the rock armour crest. There is no apparent damage to the concrete crest and the absence of these units will not be of significant detriment to the performance of the wider revetment. The rock armour fillet between the two breakwaters has several blocks displaced locally and sitting slightly seaward of the majority of the rock but the defence is generally in good condition.



(/0403C03)



Displaced rock armour on concrete crest Rock armour on East face of breakwater (/0403C03)

3.2 Management Unit 5 – Jet Wyke

Coastal Slope Condition Assessment

Jet Wyke forms the embayment between Penny Steel and Old Nab and consists of unit MU5/1, which remains classified as Partly Active in 2018. The lower slopes of the cliff are very steep, unvegetated and subject to gradual marine erosion. The upper cliff is composed of softer material and supports some vegetation cover, with evidence of local slumps.

At the eastern extent of the unit is the western side of Old Nab, a headland composed of highly weathered shales with sparse vegetation cover. This unit has not changed activity status and remains as Partly Active in 2020.



MU5/1 Partly Active in September 2020.



Extensively weathered headland at Old Nab **MU5/1** Partly Active in September 2020.

Coast Protection Asset Condition Assessment

There are no coastal defence assets within this Management Unit.

3.3 Management Unit 6 - Old Nab to Runswick Bay

This Management Unit consists of three Sub-management Units; MU6A – Brackenberry Wyke, MU6B - Port Mulgrave; and MU6C – Lingrow Cliffs.

MU6A – Brackenberry Wyke

This Sub-management unit consists of unit MU6/1 only.

This section of cliff line remains classified as Partly Active in 2020, unchanged since 2012. The northern extent of MU6/1 forms the eastern side of Old Nab, characterised by steep slopes with no vegetation cover. Further south in the bay, some vegetation is supported on the upper slopes with exposed shales lower down showing evidence of on-going erosion. Marine erosion is cutting into the stratified rock at the base of the cliffs.



Looking north across Brackenberry Wyke. Looking south across Brackenberry Wyke. MU6/1 Partly Active in September 2020.



MU6/1 Partly Active in September 2020.

MU6B – Port Mulgrave

This Sub-management unit consists of units MU6/2 to MU6/5.

Units MU6/2 (debris lobe), MU6/3 and MU6/4 (coastal slopes) all show evidence of localised instability but also are substantively vegetated and therefore remain classified as Locally Active in 2020.



MU6/2 Locally Active in September 2020.



Steepest slopes with no vegetation cover and evidence of minor local activity. MU6/3 Locally Active in September 2020.

Unit MU6/5 is the most southerly cliff within this Sub-management unit. A few months prior to the August 2016 inspections, a large landslip occurred within the unit, rendering the public footpaths unsafe. As a result, the public footpaths were closed by the North York Moors National Park Authority and this remained the case in July 2018.

During the 2020 survey, the footpaths were open again. The informal ("unauthorised") access down the steepest slopes has been replaced/upgraded with steel steps and handrails.





"Unauthorised" access route to foreshore within **MU6/4** July 2018.

Upgraded access route within **MU6/4** September 2020.



Public footpaths reopened (closed in 2016 and 2018).

It is understood that in October 2018, a man collecting fossils was caught in a local landslip and buried to his waist, sustaining serious injuries. He was initially aided by fishermen and was then airlifted to safety within an hour following a joint operation by the local coastguard, ambulance, police and fire services.

There is a lack of evidence of significant continued activity other than minor changes in the size of debris fan and a reprofiling of the toe section of the failure and this unit remains as Partly Active in September 2020.



MU6/5 – View of the landslip looking across Port Mulgrave from west to east (Partly Active in July 2018).



MU6/5 – View of the landslip looking across Port Mulgrave from west to east (Partly Active in September 2020).

MU6C – Lingrow Cliffs

This Sub-management unit consists of units MU6/6 to MU6/8.

Unit MU6/6 forms the northern part of the Lingrow Cliffs. The upper slopes support some vegetation cover while lower slopes are actively eroding. A debris fan from a localised rock fall observed in the 2018 survey remained largely unchanged. The unit continues to be classified as Partly Active in 2020 due to extensive cracks/fractures in the upper material and evidence of rock falls.



MU6/6 - Localised rock fall (Partly Active)

MU6/6 – Localised rock fall and debris fan, Partly Active in 2020.

Significant cracking and local rockfalls **MU6/6** Partly Active in 2020.

Unit MU6/7 forms the central part of this Sub-management unit and consists of a large relict debris run-out lobe. The cliff is well-vegetated with only localised activity at the toe. It remains classified as Locally Active in 2020, unchanged since 2002.

Unit MU6/8 is located north of the northern end of Runswick Bay seawall. The main bulk of the cliff is mudstone capped by sandstone. The main mudstone part of the cliff is vegetated in its upper part and is eroding in its lower part with debris fans splayed across the toe and occasional rock falls at the base. The sandstone top is a vertical unvegetated cliff. The activity in the mudstone cliff means the unit is classified as Partly Active in 2020, unchanged since 2002.



MU6/7 Locally Active in 2018.



MU6/8, Partly Active in September 2020.



MU6/8 Partly Active in September 2020 – more recent local failure from upper slope.

Coast Protection Asset Condition Assessment

There are no coastal assets within Sub-management Units 6A and 6C.

MU6B (MA20) - Port Mulgrave

The jetty of the former port and ironstone mine at Port Mulgrave has been derelict for many years and is considered to be redundant. Virtually all coastal defences have been lost to the sea. What is left of the southern breakwater is undergoing large scale cracking, deformation, undercutting and outflanking and failure of more recently added gabions. It is estimated that more than half of its original length has now been eroded. The rate of deterioration appears to have slowed as the remains of the structure appeared very similar to observed in 2016 and 2018 (\0502C01).





Dilapidated asset in 2016 (\D0502C01)

Dilapidated asset in 2018 (/D0502C01)



Dilapidated asset in 2020 (\D0502C01)



Dilapidated asset in 2020 (/D0502C01)

3.4 Management Unit 7 – Runswick Bay

Runswick Bay is a deep, wide bay located between mudstone headlands to the west (Cobble Dump) and east (Kettle Ness). The bay has a sand beach in its western two-thirds where the backing cliffs are composed of glacial till at sea level. Further to the east the beach gives way to a rock shore platform where the backing cliffs are mudstone. The village of Runswick Bay is protected by concrete seawalls and rock revetments.

This Management Unit is divided into two Sub-management Units; MU7A – Runswick Bay Village and MU7B – Runswick Sands.

MU7A – Runswick Bay Village

This Sub-management Unit consists of units MU7/1 and MU7/2.

Unit MU7/1 includes Runswick Bay village and the adjacent glacial till slopes. It is well vegetated and defended at the toe by seawalls and rock armour. This unit is classified as Dormant in 2020, unchanged since 2018.

Unit MU7/2 occupies the area adjacent to and south of Runswick Bay village. It is well vegetated glacial till and defended at the toe by rock armour. The southern extent of the existing revetment was strengthened in July 2018 using surplus rock armour from the Coastal Protection works. A rock armour fillet was extended for approx. 30m to the south along the toe of the coastal slopes. There is evidence of minor shallow slumps to the southern extent of Unit MU7/2 and therefore it is classified as Locally Active in 2020, unchanged from 2018.



Slopes of Runswick Bay village. **MU7/1** Dormant in September 2020.



MU7/2 Locally Active behind new rock armour fillet in September 2020.

MU7B – Runswick Sands

This Sub-management Unit consists of units MU7/3 and MU7/4.

Unit MU7/3N is adjacent to and south of the southern end of Runswick Bay sea defences and comprises glacial till forming a landslide complex down to beach level. A rock armour fillet was formed along the toe of the slope over a length of approximately 30m south of the existing revetment using surplus (8-10 Tonne) rock from the Coastal Protection works (July 2018). The cliff slope is relatively shallow and well vegetated, and erosion is occurring along the active toe. Beach levels were higher than during the 2018 survey, particularly around the rock armour and this will offer some protection to the toe, however mudslides and shallow slumps are evident at the top of the beach, and the unit retains the 2018 grading of Partly Active in 2020.

Unit MU7/3S is located to the south of the access to the sailing club boat storage area and is of a similar geomorphology to unit MU7/3N, however the till is well vegetated almost to beach level. Single layer of rock armour (<500kg) used to protect slope at the mouth of the river. Smaller cobbles/beach material also appears to have been used but has been displaced. There is little evidence of significant activity at the toe, and so is classified as Locally Active, the same as 2018.



MU7/3N foreground and MU7/3S background.



Active toe of till cliffs in Runswick Bay. MU7/3N Partly Active in September 2020.





Slips were threatening the stability of timber buildings/sheds (use unknown) **MU7/3N** Partly Active in July 2018.

Structures no longer present in September 2020. **MU7/3N** Partly Active in July 2020.



Well vegetated till in Runswick Bay. **MU7/3S** Locally Active in September 2020.



Localised scour around pill box **MU7/3S**, Locally Active in September 2020.
MU7/4 consists of a steep unvegetated cliff toe composed of mudstone, behind which are shallower well-vegetated, mid-to-upper slopes of till with local slumping. The cliff toe is generally steep, and several small caves are evident at the northern extent. The caves do not appear to have changed significantly, however the mudstone across the openings appears to have eroded slightly since 2018 inspection. The unit remains classified as Locally Active.





Caves in mudstone cliffs. **MU7/4** Locally Active in July 2018

Caves in mudstone cliffs. **MU7/4** Locally Active in September 2020



Local slumps in more steeply sloped till. **MU7/4** Locally Active in September 2020

Coast Protection Asset Condition Assessment

MU7A – Runswick Bay

Properties in the north of Runswick Bay are protected by sea wall defences, while rock armour revetment extends around the toe of the cliffs further south in the village to reduce the risk of landslips. Capital works were undertaken between March and July 2018, comprising the construction of the Runswick Bay Coastal Protection Scheme. Enabling works were completed by Yorkshire Water in 2017, comprising the realignment of a combined sewer on the foreshore, to run immediately in front of the seawall. The sewer is now buried beneath the rock armour.

The Coastal Protection Scheme comprised installation of concrete toe protection and local repairs to the existing masonry seawalls and prior to the construction of a rock armour fillet at the toe to protect the seawall over approximately 250m length of frontage (from the Yorkshire Water pumping station to approximately 15m North of the Upgarth Hill / Cauldron Cliff seawall with breaks for public access and the Runswick Beck). The scheme incorporated a new set of reinforced concrete access steps through the rock armour.

Existing foreshore rocks were placed against the toe rocks of the new structure to allow seeding of the new rock armour and to encourage fast colonisation of vegetation/fauna. Environmental enhancement was provided through increasing the textural complexity of the granite rock armour blocks by cutting artificial rock pools and grooves into selected rocks to encourage the colonisation and survival of intertidal species.

Surplus rock armour was placed at the southern end of the existing rock revetment protecting the car parks (/0602C01), over a length of approximately 30m. This rock acts to protect the high-tide beach access ramp and to reduce the risk of outflanking of the revetment and excessive erosion of the coastal slopes to the south.



Rock armour fillet at toe of existing seawall



Artificial rock pool, surface scoring and natural seed rocks – ecological enhancement at the toe of the new rock armour fillet.

The rock armour revetment is in Very Good condition. The typical detail is a minimum 3.5m wide crest and a 1:3 slope profile to toe rocks which are placed in a trench excavated 0.5m into the bedrock. The foreshore had recovered, and beach levels were higher than the 2018 inspection (carried out shortly after completion of construction).

The 2018 wall repairs focused on repairing abrasion at the toe of the wall and did not address the previously reported issues in the upper sections of the seawall.

Above the rock armour fillet, the northernmost sea wall (/0601C01) is suffering from heavy surface abrasion on its facing, cracking and spalling to the concrete coping and wash-out of the joints under the coping along most of its length. The flexible sealant in the expansion joints between the capping beam and the deck slabs and separating the deck slabs is brittle and washed out across most of the structure. The joints are open to around 20mm width and there is minor differential settlement between slabs. Vegetation is present in some of the joints.



Loss / wash-out of mortar beneath coping. Local abrasion (/0601C01)



Abrasion and cracking of concrete coping (/0601C01)



Open expansion joint with vegetation growth (/0601C01)

Moving south, the protruding section of wall (/0601C06) protecting the thatched cottage is in fair condition. Previously identified cracks in the concrete wall and toe apron were repaired and the masonry wall repointed locally prior to the placement of rock armour in 2018.

Cracks in the upper masonry seawall were filled and the wall repointed locally with marine mortar. The bag work and mass concrete structures to the rear of the rock armour and moving up the Runswick Beck are generally in Fair to Poor condition with cracking and open joints. The Thatched Cottage has significant cracks running the full height of the gable end, with no significant change observed from the 2018 survey.



Variety of concrete bag work and in situ concrete pours at Runswick Beck (/0601C06)



Cracks filled and masonry repointing in front of Thatched Cottage (/0601C06)

The main length of masonry sea wall below the properties (/0601C03) is in good condition. Previous repair work to masonry wall are evident, particularly at the crest where a range of materials including concrete, brickwork and cobbles have been used to fill voids or replace missing blocks. The masonry wall was repointed with marine mortar.

In this section, the rock armour crest detail was modified locally to accommodate access to two existing Yorkshire Water rodding eyes from the crest of the seawall. Smaller rock armour pieces are placed to surround the raised concrete platform and pipework.



Rock armour pieces around Yorkshire Water rodding eyes.

A set of 2.5m wide reinforced concrete access steps (three flights and two landings) was installed, centred on the location of the previous narrow access steps which were backfilled with mass concrete. SBC installed handrails shortly after the 2018 inspection. The rock armour detail is modified locally to tie into the steps (higher crest, rocks down profile above step tread level).

The concrete deck and crest wall above the rock armour and seawall are generally in fair condition with evidence of previous repairs locally which are holding up reasonably well. The flexible sealant in the expansion joints is brittle and missing in places. The structures at the foot of the slope comprise masonry retaining walls/property walls which vary from Good to Fair condition. Minor cracking, open joints and recessed mortar were observed locally.



Concrete crest wall (retaining wall and property walls) (/0601C03)



Brittle sealant in expansion joints (vertical and horizontal). Vegetation growth locally. (/0601C03)



Reinforced Concrete access steps (/060C03)



Reinforced concrete access steps, railings added August 2018 (/060C03). Note accumulation of material including cobble/boulder size at foot of steps.

To facilitate access during the construction of the Coastal Protection Scheme, the concrete breakwater or groyne (/0601C02) to the north of the pumping station and was broken out over approximately 10m length, centred on the elbow/bend. This work identified the construction detail of the breakwater as mass concrete/boulder core with a concrete outer casing (walls and crest) with minimal reinforcement (mesh and dowels locally). Upon completion of rock armour placement, the breakwater was reinstated through casting mass concrete. On the western face at the inside of the elbow a joint can be seen – this was a later concrete pour undertaken to correct a misalignment in the shutters during the initial concrete pour.

Whilst the new concrete is in Good condition and local repairs/filling of cracks and voids were also carried out in the original concrete at the tie-ins, overall the structure remains in Poor condition due to significant abrasion of concrete, opening of the construction joint between wall and crest concrete and potential undermining of the seaward end (not observed in 2020 as obscured by higher beach levels).

The landward section of the breakwater (approx. 4m from seawall on crest and 10m from seawall on either side) is covered by rock armour.



July 2018 - Significant abrasion of concrete. Opening of joint between wall and crest concrete – largely obscured by vegetation (/0601C02)



September 2020 – note higher beach levels. Tracks from SBC contractor removing seaweed on day of survey (/0601C02)





Opening of construction joint, cracking of Fine crack running through all three visible original concrete at interface with repair faces of the structure (/0601C02) (/0601C02)

The sea wall around the Yorkshire Water pumping station comprises masonry cladding to a reinforced concrete structure with concrete toe protection and is in Good condition (/0601C07), with minor loss of mortar locally. Immediately to the north of the pumping station, Yorkshire Water raised the existing manhole chamber to match the crest height of the seawall to ensure the chamber was accessible after the construction of the rock armour fillet. The mass concrete surround (to precast concrete manhole rings) is in very good condition as is the new edge protection/handrailing installed at the crest. The rock armour fillet incorporates a break to allow access to the existing steps and then runs to its easternmost extent at which point it ties into the former lifeboat slipway. The two exposed ends of rock armour are in good condition with no evidence of displacement and the access to the steps remains clear.



Break in rock armour fillet at pumping station (/0601C07)

Pumping station and raised manhole chamber (/0601C07)

South of the pumping station, the defences comprise the slipway of the former lifeboat station which is generally in Fair condition with abraded concrete piers and severely corroded steel edge protection. The timber decking was generally in good condition. The Runswick Rescue slipway features open joints and cracks in the concrete to the exposed face but overall, the structure appeared in Fair condition. The concrete forming the boat storage area and the access ramp in front of the café is in Good condition with only minor local defects such as abrasion on exposed edges at construction joints, minor cracking and loose timbers/steps. A minor longitudinal crack was observed in the centre of the top two concrete panels of the access ramp.



Former lifeboat slipway. Beach levels and seaweed largely obscure previous repairs/concrete pours at the toe (/1003C04)



Open joints / cracks in Runswick Rescue slipway (/1003C04)



Boat storage area (/1003C04)



Concrete access ramp (/1003C04)

The rock armour revetment (/0602C01) remains generally in Very Good condition, with the rocks tightly packed with no significant voids and consistent crest level and seaward slope profile.

The high-level beach access ramp (facilitating access during high tides which cut off the main concrete slipway was refurbished in July 2018. Surplus rock armour from the CPS works was placed along the seaward edge of the ramp and forming a fillet at the toe of the previously undefended cliffs to the south over a length of approximately 30m with the aim of mitigating the risk of outflanking.

The large rock armour units to the seaward side of the access ramp remain in situ and continue to provide protection to the ramp and the toe of the coastal slope, however it appeared that the surface may require attention with respect to use by pedestrians e.g. through placing smaller rock/sand. It is understood that SBC carry out this work periodically.





Rock armour revetment (/0602C01)



High level access ramp (/0602C01)

High level access ramp (/0602C01)



Rock armour toe protection south of high-level access ramp (/0602C01)

MU7B – Runswick Sands

The Sailing Club is located in the bay some 600m south of the village, where the beach is wider. It has been constructed on timber struts and features a mix of coastal defences (/0602C05).

A number of boulders and concrete blocks are present in front of a timber sleeper retaining wall defences This defence, and the backing white-washed concrete wall to the north, are both in fair condition, however, the condition of several of the timber sleepers appears to have deteriorated since the 2018 inspection. Timber sleepers are exposed and damaged locally, however the concrete behind appears in fair condition – the timber appears to be permanent formwork for *in situ* concrete pour.

South of the whitewashed wall, the retaining wall is formed from pre-cast concrete beams below timber sleepers, both set between steel I-beams at 3m centres.

Single layer rock armour protection is present on slopes both sides of the Calais Beck to the north of the Sailing Club.

The southern extent of the asset comprises concrete cubes/tank blocks and rock armour. This is not of formal construction detail, however, appears to be offering some protection to the slope and building behind.



Sailing Club defences (/0602C05)



Sailing Club defences (/0602C05)

3.5 Management Unit 8 - Runswick Bay to Sandsend

This Management Unit is divided into two Sub-management Units; MU8A – Runswick Sands to Kettle Ness and MU8B - Kettle Ness to Sandsend.

MU8A – Runswick Sands to Kettle Ness

This Sub-management Unit consists of units MU8/1 to MU8/4.

Unit MU8/1 is located behind Runswick Sands. The toe is steep with little or no vegetation cover and composed of mudstone (a continuation of unit MU7/4). There is little evidence of recent activity such as rock falls and slides. The mid and upper slopes comprise more densely vegetated till with localised slumping. The unit is classified as Locally Active in 2020, unchanged since 2018.

Unit MU8/2 is a shallow-angle relict debris run-out lobe with a well-defined head scarp. The cliff toe is steep and composed of mudstone with localised rock falls on the fronting shore platform. The mid and upper slope is densely vegetated. This unit is classified as Locally Active in 2020, unchanged since 2018.

MU8/3 is located in front of the village of Kettleness. The cliff is high and steep with only the very top part covered in vegetation. The cliff slope comprises large debris flows, which extend as fans from near the cliff top to the toe, and slumps. This level of activity means this unit is classified as Partly Active, the same as 2018.

MU8/4 is immediately west of Kettle Ness headland. This unit is classified as Partly Active in 2020, unchanged since 2002.



Steep mudstone cliffs with overlying shallower sloping till with local slumps. **MU8/1** Locally Active in September 2020.



Relict debris run-out lobe. **MU8/2** Locally Active in September 2020.



Steeper upper slopes. **MU8/2** Locally Active in September 2020



Steep cliff with debris flows. **MU8/3** Partly Active in September 2020.



MU8/4 (foreground) and west side of **MU8/5** (background) both Partly Active in September 2020.

MU8B - Kettle Ness to Sandsend

This Sub-management Unit consists of units MU8/5 to MU8/15.

Unit MU8/5 forms the headland of Kettle Ness. This area has historically been extensively quarried for alum and as a result is now subject to ongoing erosion of the exposed weak bedrock. It remains classified as Partly Active in 2020, unchanged since 2018.





West side of Kettleness headland. **MU8/5** Partly Active in September 2020.

East side of Kettleness headland. **MU8/5** Partly Active in September 2020.

Unit MU8/6 is located to the east of the Kettle Ness headland and remains classified as Partly Active in 2020. Along most of its length this unit is steep with little vegetation cover. Evidence of recent erosion/slips were observed in the headscarp.



MU8/6 Partly Active in September 2020.



Cracking in exposed headscarp of **MU8/7**, Locally Active in September 2020.

Units MU8/7 and MU8/8 comprise the relict debris run out lobes of Seaveybog Hill and Ovalgate Cliff. They are generally well-vegetated, but localised activity at the toe and headscarp mean the units are classified as Locally Active in 2020.

Unit MU8/9 is located at Loop Wyke and is classified as Partly Active in 2020. The upper slopes support extensive vegetation cover, but the lower slopes are steeper, free of vegetation and subject to on-going toe erosion. The exposed headscarp comprises exposed rock which is steep and heavily weathered.



MU8/8 Locally Active in September 2020.

MU8/9 Partly Active in September 2020.

Unit MU8/10 forms a relict debris slide lobe. The unit is well-vegetated with localised erosion at the headscarp and the toe. This unit is classified as Locally Active in 2020.

Unit MU8/11 is located at Keldhowe Steel and is classified as Partly Active in 2020. The upper slopes are vegetated, with localised areas of activity at the headscarp. The lower slopes are experiencing ongoing toe erosion.

Unit MU8/12 is south of Keldhowe Steel and is classified as Partly Active in 2020. The upper slopes are vegetated, with localised areas of activity at the headscarp. The lower slopes are experiencing on-going toe erosion.

Units MU8/13, MU8/14 and MU8/15 form the headland of Sandsend Ness and its adjacent cliffs. All units remain classified as Partly Active in 2020. The toes of these cliffs are subject to ongoing erosion and there is also evidence of localised erosion on the upper slopes.



U8/9 and **MU8/11** are Partly Active sea cliffs. **MU8/10** is a debris slide deposit classified as Partly Active in September 2020.



MU8/12 Partly Active in September 2020. MU8/13 Partly Active in September 2020. Evidence of recent headscarp failures.





MU8/14 Partly Active in September 2020.





MU8/15 Partly Active in September 2020.

Coast Protection Asset Condition Assessment

Two short lengths of retaining walls believed to have been originally intended to protect and support the disused railway line were identified along this section of coast in the 2009 inspection report. These are a brickwork wall at Deepgrove Wyke and a masonry wall south of The Scar that was noted to have failed. However, these two walls were not classed as coastal defences and were reported to be redundant in 2010, so as in all inspections since 2010, they have not been included in this inspection report. There is no safe means of access to inspect the structures in detail, however from a distance, there appears to be little change in the structures or their immediate surroundings.



Redundant masonry retaining wall in MU8/14

3.6 Management Unit 9 – Sandsend

Coastal Slope Condition Assessment

This Management Unit is divided into three Sub-management Units.

MU9A and MU9B – Sandsend Village

Management units MU9/1 and MU9/2 are Dormant cliffs behind Sandsend village. They are defended at the toe by a sea wall, groynes and rock armour. No evidence of activity was seen in 2020.



MU9/1 and MU9/2 are located close to Sandsend and show no signs of activity (Dormant). (Figure reproduced from August 2014)

MU9C – East Sandsend

This Sub-management unit consists of unit MU9/3 only. This unit is located above the concrete revetment sea defences immediately to the east of Sandsend. The previously failing sea defences had been replaced by a new stepped concrete apron with upper Dycel units by the time of the 2016 inspections, and the backing slopes had been stabilised. The slopes had historically been subject to slippage which, at times, caused the temporary closure of the A174 Sandsend Road. The intent of the slope stabilisation works is to improve the condition of the slopes to an inactive state through means of re-grading, drainage and seeding. Overall, the stabilisation scheme is working well, and one local area of shallow slippage observed in 2018 has since been remediated.



MU9/3 Coastal slopes to rear of new sea defences generally in an inactive state following capital works involving re-grading, drainage and seeding as part of the Sandsend Road Coast Protection & Slope Stabilisation Scheme

Coast Protection Asset Condition Assessment

MU9A and MU9B – Sandsend Village

Coastal defences at Sandsend village vary from fair to poor condition.

The most northerly defence is located at Sandsend car park. It is a sloping concrete revetment with a recurve crest wall (\D0701C02). The concrete wall remains in fair condition with minimal damage to the surface. At the time of the inspections there were high beach levels and marine growth covering the toe of the structure, but in previous inspections it has been recorded that the revetment has lost thickness of concrete at the base through abrasion, with exposure of reinforcement bars. Encasement of this reinforcement is advised from a structural perspective, as well as preventing any Health & Safety incidents occurring due to sharp edges of the exposed bars on this popular amenity beach. At the northern end of the structure is a tie-in section, comprised of steel sheet piling which is heavily corroded. At the southern end is a slipway adjacent to Sandsend Beck. The slipway is undermined in places, despite previous repairs at this location.



Sandsend car park sea wall (\D0701C02)



Exposed rebar evident in 2018 (but covered in 2020 by beach sand or marine growth) (\D0701C02)

A concrete seawall (\D0702C01) extends from Sandsend Beck towards the east. The groyne field fronting the seawall is derelict and the remains have no significant impact on sand movement. The wall is heavily abraded. Whilst timber breastwork was exposed at the toe in the 2009 survey and has been observed to have progressively deteriorated since to 2016, it was covered by beach sand at the time of the 2018 and 2020 inspections. There are occasional cracks in the wall and significant abrasion at the steps.



Poor condition sea wall (\D0702C01)



Poor condition sea wall (\D0702C01)

The newer short section of masonry blockwork sea wall (\D0702C04) that supports a cantilevered promenade just north of East Row Beck is in fair condition. Although the steel toe piling was observed in 2016 to be corroded and abraded, it was covered by beach sand at the time of the 2018 and 2020 inspections. Towards the eastern end, there are voids and undermining of a concrete apron which should be further investigated. The timber decking of the cantilever footway was destroyed during the December 2013 surge and repairs were made late 2014.





Masonry blockwork sea wall with cantilevered footway (\D0702C04)

Masonry blockwork sea wall with cantilevered footway (\D0702C04)

The low masonry wall (\D0702C03) that returns into both sides of East Row Beck adjacent to the road bridge is in fair condition. There is a slipway on each side of the beck, with gabion baskets on the eastern side protecting the café. These gabions are in fair condition, but with some 'sagging' of the baskets, perhaps due to being under filled, and one missing block (currently 'plugged' with a large sandstone beach bolder in the blockwork wall below, although this was not observed in 2020 due to high beach levels.

MU9C – East Sandsend

The sloping concrete revetment (\D0702C02) which used to provide the main coastal defence to the A174 Sandsend Road against erosion and overtopping was in a poor and deteriorating condition for many years and became further damage by the December 2013 storm surge, resulting in a previous grading of very poor condition in 2014, despite post-storm repairs.



Previous storm damage and very poor condition of sloping revetment



Previous temporary repairs to sloping revetment at Sandsend Road (\D0702C02)

These failing structures have now been replaced by new coastal defences constructed between early 2015 and summer 2016. The new defences comprise a lower section with a stepped revetment built from pre-cast concrete units and a buried concrete toe beam that was cast *in situ*, with an upper section of interlocking pre-cast Dycel units. Natural coastal slope extends above the upper units to the plateau upon which the highway and footpaths sit, with re-graded and stabilised high coastal slopes to landward of the road. Sloping concrete tie-in revetments exist at either end of the structure. The overall plan form of the new defence adopts a subtle 'S' curve when viewed in plan.



Cross section of coastal defences at Sandsend Road in near 'as built' condition showing stepped pre-cast apron and upper Dycel units (\D0702C02)

At lengths along the frontage is a series of ribs used as areas for connecting pre-cast units and accommodating subtle changes in alignment. Several of the ribs incorporate drainage outfalls. Formalised access steps are located at discrete points along the frontage.

The main observations from the 2020 inspections are:

- Outfall drains are freely running
- Toe beam and lower steps are covered with beach sand
- Some chipping damage has occurred to the edge of the steps (confined to lower steps at the western end but becoming more frequent and higher up the structure to its central and southern sections).
- Outflanking at the eastern end is being adequately addressed by large beach boulders

At the eastern end of the concrete defences, Raithwaite Gill has been infilled with material won from re-grading of the backing coastal slopes. The outfall which discharges through the gill has been extended to accommodate this infill.

With construction of the scheme having been completed in August 2016, the new defences remain in very good (near 'as built') condition, but with some minor (cosmetic) chipping to the step edges.

3.7 Management Unit 10 – Upgang Beach

Coastal Slope Condition Assessment

This Management Unit comprises units MU9/4, MU10/1 and MU10/2.

Unit MU9/4 is comprised of well vegetated slopes which are protected along part of its length by the new coastal defence scheme which was officially opened on 19th August 2016. The slope stabilisation works have also extended partly into this unit and their intent is to render the slopes inactive. At the eastern end of the unit, where the new coastal defences tie-in into Raithwate Gill, material won from the slope re-grading works in Units MU9/3 and MU9/4 has been placed to substantially infill Raithwaite Gill. The original outfall through the Gill was extended and material was placed and shaped within the Gill, with a new footpath constructed to provide access from the highway to the foreshore. The backing slopes behind the new coastal defences and the material infilling Raithwaite Gill are both currently inactive and have become well vegetated since the 2016 inspections.

MU10/1 was inactive in 2012, but this was revised to Locally Active following the December 2013 storm surge that caused toe erosion. This erosion has stopped, and the classification returned to inactive in 2016 and has remain as such ever since.

MU10/2 comprises the till cliffs behind Upgang Beach that are prone to episodic mudslides and block failures. Vegetation cover is limited along the cliff face and the unit is classified as Partly Active in 2020, unchanged since the 2005 survey.



MU9/4 Infilling of Raithwaite Gill at the eastern end of the coastal slopes (Inactive)



MU10/2 Slumping cliffs along Upgang beach (Partly Active) i

Coast Protection Asset Condition Assessment

There are no coast protection assets within this Management Unit.

3.8 Management Unit 11 – Whitby West

Coastal Slope Condition Assessment

This Management Unit is divided into 2 Sub-management Units.

MU11A – Whitby Sands West

This Sub-management Unit consists of units MU11/1 and MU11/2.

These units are comprised of re-graded slopes protected by a sea wall and promenade. The slopes are well-vegetated, and whilst they are generally stable there is evidence of localised instability in the slope in places within both units. There is evidence of some previous stabilisation works and in one location within MU11/1 these have become exposed and the stone-filled plastic baskets have split, requiring repair or replacement. Both these units are classified Locally Active.



MU11/1 Evidence of slumping and broken pipe in the lower coastal slopes (Locally Active)



MU11/1 Cliff drainage (Locally Active)

MU11B – Whitby Sands East

This Management Sub-Unit consists of units **MU11/3** and **MU11/4** that are protected by a variety of coastal structures. The coastal slope of **MU11/3** has localised failures of the till and is therefore classified as Locally Active. Exposed rock faces are showing minor erosion in the absence of defences in places within **unit MU11/4**, which remains classified as Locally Active.

Coast Protection Asset Condition Assessment

MU11A – Whitby Sands West and MU11B – Whitby Sands East

This Management Unit encompasses various sea walls and rock revetment to the west of Whitby Harbour. The most westerly defence is a rock armour revetment fronting the seawall and promenade (\D0801C01). As in previous inspections, the rock armour is in good condition with only minor movement visible. The asset is in overall good condition although the promenade is rated as fair despite areas of repairs, due to previous longitudinal cracking. There is also local damage to the wall to the rear of the promenade.





Rock revetment, promenade and coastal slopes of Whitby West Cliff (\D0801C01)

Damage to low wall at rear of promenade (\D0801C01)

There are two sections of seawall along the frontage with no protective rock armour. One occupies a short gap between the two areas of rock armour, whilst the other is to the east, backed by beach chalets on the promenade. Both sections have experienced considerable abrasion damage to the face. Due to the absence of rock armour, the toe at both sections has also been subject to undercutting. Recent repairs (prior to the 2016 inspection) appear to have cast a new concrete toe over much of the affected sections, but their overall condition remains poor and there are short lengths adjacent to where the new toe ends where boulders and rock outcrops are present and the original toe is still being undercut (although this was not observed in 2020 due to high beach levels). There is also local damage (cracking and abrasion) to the wall coping beam and at each set of access steps along these lengths with no protective rock armour.

East of the beach chalets the steps and ramps show signs of repairs but are generally in poor overall condition with defects such as undercutting, erosion, cracking, exposure of aggregate and rounding of step edges. In general, all sections of sea wall between the eastern end of the rock revetment and the Whitby Pavilion show extensive damage to the coping and abrasion to the face and are in overall poor condition.





Seawall at gap in rock armour revetment (\D0802C01)

Seawall to east of rock armour revetment (\D0802C01)

The masonry blockwork walls by the RNLI lifeguard station are in fair overall, with a new capping beam recently constructed to repair previously reported damage.

The area below the Whitby Pavilion consists of a variety of defences, which are formed in several vertical stages or layers, with concrete/stone on the beach and with cliff toe protection walls formed of timber breastwork, rock armour and vertical walls. These have multiple defects and remain in poor

condition. To the east of the theatre, the natural cliff is intermittently defended with a series of blockwork and brickwork sections. These vary in construction and are generally in fair condition. Previously reported areas of undercutting were not noted during the inspections due to high beach levels.

The Battery Wall, just west of Whitby West Pier, is formed of large sandstone blocks. Although repairs to some gaps between blocks are evident, further repairs are deemed advisable pro-active measures, especially at the wing wall of the access steps to the beach. Despite this, the asset remains in overall fair condition.





Open joints in wing wall to access steps (\D0802C12)

Battery Wall, with some open joints between blocks (\D0802C12)

3.9 Management Unit 12 – Whitby

Coastal Slope Condition Assessment

This Management Unit consists of unit **MU12/1**, which is situated beneath Whitby Abbey and St Mary's Church on the town's East Cliff. The slopes comprise a well-vegetated debris apron with toe protection afforded by the harbour walls. Localised activity occurs at the headscarp and in the debris apron. This unit is classified as Locally Active.



MU12/1 Slumps in lower cliff (Locally Active)

<u>Note</u>: A significant but localised failure of the headscarp occurred on 29 November 2012, which lead to loss of part of the graveyard of St Mary's church and deposition of debris on properties along Henrietta Street. It is thought that the failure was associated with damaged drainage pipes and the very wet conditions of 2012 and was unrelated to coastal erosion.

Coast Protection Asset Condition Assessment

This Management Unit encompasses the harbour structures and quay walls of Whitby Harbour.

The harbour piers and pier extensions were inspected during a low spring tide to maximise the visibility, but even at low tide parts of the structures are below water and so not visible. There is now reinstated pedestrian access onto the East Pier extension, so this was observed from the timber superstructure for the first time in several years.

The piers have each been classified as very good following the 2018/19 capital refurbishment works which have rectified many previously identified defects. There are new chain link barriers that can be erected overtopping conditions persist on both piers, and signs on the East Pier warning the public of risks from high winds, sea states (overtopping), uneven surface, trips, and falls from unguarded edges. A new wave run-up deflector wall has been constructed at the top of the Battery Parade slipway, adjacent to the West Pier.



West Pier, very good condition following capital works (\803C02)



East Pier, very good condition following capital works (\803C02)



West Pier extension, generally in fair condition (\803C01)



East Pier extension, generally in fair condition (\803C04)

The pier extensions are generally considered to be in fair condition, despite considerable abrasion along almost their entire length, although it should be noted that the lower sections of each structure were fully submerged by water at the time of the inspections. An urgent works scheme was undertaken in 2011/12 to repair the southern end of the East Pier extension where a large void had formed in the structure behind the sheet pile toe which had failed following corrosion and abrasion.

The western quayside of the Risk Esk from the harbour to the Swing Bridge consists partly of blockwall quay walls, similar in construction to the harbour piers, and partly of sections of concrete slab suspended over the original quay wall with concrete filled vertical and raking steel pile supports. The quayside structures are generally in fair condition, but poor in places due to specific localised defects. For example, in the blockwork sections, there are sections of wall with open joints which require sealing. In the suspended deck section, there remains corrosion to the steel piles. It was not possible to inspect the underside properly as this would require a boat even at low tide. A more detailed structural inspection of the quay walls is therefore recommended.

The eastern quayside of the Risk Esk consists partly of blockwall quay walls, similar in construction to the harbour piers, and partly of sections of property walls. Like the western quayside, the quayside structures are generally in fair condition, but poor in places due to specific localised defects. For example, in the property wall sections there are areas of sunken blocks or missing pointing and in the blockwork quay walls there are also several areas of open joints and heavily abraded blocks, most notably on Tate Hill Pier.

North of Tate Hill Pier, the harbour wall is fronted by a sand beach, initially with a variety of riparian walls at the back and then with a rock revetment protecting the toe of the slope at the Haggerlythe. Due to near-vertical nature of the slopes immediately above the revetment, before they taper back to a more nature angle, this area should be given further consideration in due course, as recommended in the Whitby Coastal Strategy.

3.10 Management Unit 13 – Whitby East

Coastal Slope Condition Assessment

This Management Unit is divided into 2 Sub-management Units:

MU13A – Cliffs east of Whitby Harbour

Unit **MU12/2** comprises high cliffs protected by rock armour. There is evidence of a past rockfalls from the upper part of the cliff in the form of debris slopes and almost the entire cliff face is exposed, with very little vegetation cover. The cliffs therefore remain classified as Partly Active.



MU12/2 Cliffs east of Whitby (Partly Active)

MU13B – Whitby East to Widdy Head

This Sub-management Unit consists of **units MU13/1 to MU13/6** and part of unit MU14/1 (which is discussed under Management Unit 14).

Unit MU13/1 is located immediately east of Whitby and is again classified as Partly Active in 2020. The lower slopes are almost entirely exposed and are subject to marine erosion. The upper slopes are actively retreating through periodic rockfalls. Erosion of the upper slopes is encroaching on the coastal path in several areas and as a result the ongoing diversion of the coastal path is evident. It is recommended that the footpath is again diverted around pinch point sections where there is now no buffer from the coastal footpath to the cliff top (photograph below).

Unit MU13/2 comprises the eroded headland of Saltwick Nab. This unit is continuing to actively erode and supports little vegetation cover. Riling and gullying are evident on the exposed faces. As a result, this unit remains classified as Partly Active in 2020.

The cliffs within **unit MU13/3** are located within Saltwick Bay and contain access onto the beach. The cliffs in this section are protected to some extent from marine action by the high stable beach. As a result, the unit is generally less active and well vegetated and as a resulted is classified as Locally Active.



MU13/1 Cliffs east of Whitby (Partly Active)



MU13/2 Saltwick Nab (Partly Active)



MU13/3 Saltwick Bay (Locally Active)



MU13/1 Cliff erosion encroaching coastal path (Partly Active)



MU13/2 Saltwick Nab (Partly Active)



MU13/4 East of Saltwick Bay (Locally Active)



MU 13/5 Black Nab (Locally Active)



MU13/5 Vegetation covering majority of debris lobe at Black Nab (Locally Active)





MU 13/6 Unvegetated eroding cliffs at Whitby Lighthouse (Partly Active)

MU13/6 Recent slump encroaching coastal path with temporary fencing present. (Partly Active)

Unit MU13/4 is located in the southern half of Saltwick Bay up until the eroded headland of Black Nab. The beach narrows as it progress's south. Consequently, the cliff unit is subject to more regular wave attack at the toe and some the slopes are active and exposed. There is evidence of small slumps of debris and rockfall activity and there is ongoing localised and minor recession of the headscarp. This unit remains classified as Locally Active in 2020.

Unit MU13/5 is formed by the shallow, relict debris flow lobe at Black Nab. The slopes of this unit are well vegetated, with minor localised activity evident at the toe. The unit remains classified as locally active in 2020.

Unit MU13/6 is a long, steep-faced unit near the Whitby Fog Signal and the Lighthouse. The slopes are largely exposed with evidence of rockfalls from the upper cliff. There are also signs of ongoing weathering and marine erosion of the lower layers. This is particular apparent to the North of the lighthouse. This unit remains classified as Partly Active in 2020. It was noted erosion of the upper slopes is encroaching on the coastal path in one area with temporary fencing present. It recommended that this diversion is formalised.

Coast Protection Asset Condition Assessment

MU13A – Cliffs east of Whitby Harbour

There is a section of rock armour giving protection to the toe of Abbey Cliff directly to the east of Whitby Harbour's East Pier. The rock armour varies in size from 1-4 tonnes to 5-8 tonnes. It remains in fair overall condition in 2020.



Rock armour protection to toe of Abbey Cliff (\803C06)

MU13B – Whitby East to Widdy Head

There are no coastal assets within this Sub-management Unit.

3.11 Management Unit 14 – Widdy Head to Pursglove Stye Batts

Coastal Slope Condition Assessment

The only unit within this Management Unit is **MU14/1**. The slopes are generally steep and partly vegetated. Small areas of erosion are evident, particular in the upper till layers, despite this the cliffs appear stable. The tension cracks, at the foot of timber steps south of Whitby Lighthouse, noticed in the 2018 inspection were concealed by vegetation growth in 2020. The cliffs within this unit remain classified as Locally Active.



MU14/1 Looking North - Vegetation growing locally on face of cliff (Locally Active)



MU14/1 Stable cliffs, upper slopes and debris aprons generally vegetated (Locally Active)

Coast Protection Asset Condition Assessment

There are no coastal assets within this Management Unit.

3.12 Management Unit 15 – Pursglove Stye Batts to Robin Hood's Bay

Coastal Slope Condition Assessment

This Management Unit consists of units MU15/1 to MU15/4.

Unit MU15/1 is a long unit, generally well vegetated at the cliff top and classified as Locally Active due to a small number of localised areas of intense erosion in places and a substantively unvegetated cliff toe.

Unit MU15/2 is located at Far Jetticks. This cliff has widespread activity, with ongoing marine erosion evident at the toe and localised activity on the cliff face. It remains classified as Partly Active in 2020. A series of arcuate tension cracks were observed during the 2014 inspections (and seen during the subsequent inspections including 2020) on the cliff top at grid reference 495076 507274, indicating an incipient failure that poses a hazard to walkers on the Cleveland Way. The site has previously been brought to the attention of Scarborough Borough Council who have informed the North York Moors National Park Authority. It appears the tension cracks have not significant worsened since 2018, demonstrated in the comparison photos below. Tension cracks were also observed adjacent to the coastal footpath to the south of Far Jetticks and should be monitored.

Unit MU15/3 is largely comprised of the headland of Bay Ness, north of Robin Hood's Bay. The cliffs are high and steep and composed mainly of sandstone overlain by a thin cap of glacial till. There is evidence of debris fans in the lower half of the cliff face with localised slumping of the head scarp cut into the till. Several exposed head scarps are going to potentially undermine the Cleveland Way. This unit was downgraded from Partly Active to Locally Active in 2014 and remains classified as Locally Active in 2020.

Just north of Robin Hood's Bay village is **Unit MU15/4**, which has a similar geomorphology to MU15/3, although the till cap appears to be less active than further north. A loose debris apron is present locally at the toe of the cliffs towards the south of the unit. This unit remains classified as Locally Active in 2020.





MU15/1 Vegetated slopes at cliff top (Locally Active)

MU15/2 Ongoing erosion at Far Jetticks (Partly Active)


Tension cracks at **MU15/2** (Partly Active)



MU15/2 Local erosion at northern part of unit, vegetated upper slope (Locally Active)



Tension cracks at MU15/2 (Partly Active)



MU15/2 Tension cracks on access path to the south of Far Jetticks



MU15/3 Vegetated slopes at cliff top (Locally Active)



MU15/4 Local slumping of headscarp adjacent coastal path (Locally Active)

There are no coastal assets within this Management Unit.

3.13 Management Unit 16 – Robin Hood's Bay

Coastal Slope Condition Assessment

This stretch of coast comprises a deep, wide bay located between a sandstone, ironstone and mudstone headland to the north and sandstone and mudstone to the south. Although similar in shape to other bays, Robin Hood's Bay is not 'till controlled' but formed in an anticlinal structure where less resistant mudstone located centrally has been eroded. The bay contains an extensive shore platform of mudstone. At points around the bay, till approaches sea level and forms the entire cliff.

This Management Unit is divided into three Sub-management Units; Mu16A – Robin Hood's Bay Village, Mu16B – South of Robin Hood's Bay Village and Mu16C – Cowling Scar.

MU16A – Robin Hood's Bay Village

This Sub-management Unit is composed of units MU16/1, MU16/2 and MU16/3.

Unit MU16/1 is the composite cliff complex fronting the northern part of Robin Hood's Bay village and is classified as Partly Active in 2020, no change from 2014. The cliff comprises a near-vertical lower cliff of mainly sandstone overlain by shallower sloping heavily vegetated glacial till with evidence of slumping and recession of the head scarp.

Units MU16/2 is a stabilised landslide that forms the southern part of Robin Hood's Bay village. There is little evidence of any activity and so it remains classified as Inactive in 2018. MU16/3 protected by sea defences retains its Dormant status in 2020.





MU16/1 Sandstone cliff overlain by shallow till MU16/2 Stabilised landslide (Inactive) (Partly Active)

MU16B – South of Robin Hood's Bay Village

This Sub-management Unit consists of unit MU17/1, which is defended at the toe by a seawall and rock armour. The slopes show little evidence of recent activity. As a result, this unit is classified as Dormant in 2020, no change from 2014.

MU16C – Cowling Scar

This Sub-management Unit consists of unit MU17/2 and part of unit MU17/3.

Unit MU17/2 comprises glacial till cliffs to beach level protected by rock armour at their toe. The slopes are vegetated however the levels of activity on the cliff face has increased since the 2016 survey. Generally, the flatter mid-slope is well vegetated whilst the headscarp and toe are exposed with extensive evidence of recent slumping. This unit remains classified as Partly Active in 2020, due to widespread evidence of instability. During the 2020 survey it was noted that the Cleveland Way footpath continues to be undermined along the headscarp of the management unit. This has led to multiple sections of the footpath being lost through landslip. Temporary diversions are in place with flexible jointed plastic matting replacing the stone flagstones which have fallen down the face of the cliff.



Head scarp of **MU17/2** (Partly Active in June 2016)



MU17/2 Undermined Cleveland Way footpath route and temporary diversion (Partly Active).



MU17/2 Undermined Cleveland Way footpath route and temporary diversion (Partly Active).



MU17/2 Undermined Cleveland Way footpath route and temporary diversion (Partly Active).



Toe of **MU17/2** showing ongoing slumping (Partly Active).



Protected toe of till cliffs in Robin Hood's Bay. **MU17/2** (Partly Active in June 2016)



Looking towards headscarp of **MU17/2** note slumping on mid slope (Partly Active).



Slumped toe of till cliffs behind revetment. **MU17/2** (Partly Active)

Further south, within unit MU17/3, defences are absent, and the cliffs are active. There is massive slumping at beach level and in the mid to upper slopes. This unit is classified as Partly Active in 2020, no change from 2014.



Active toe of till cliffs in Robin Hood's Bay. **MU17/3** (Partly Active)



Active toe of till cliffs in Robin Hood's Bay. **MU17/3** (Partly Active)



Vegetated mid-slope of MU17/3 (Partly Active)



Vegetated mid-slope of MU17/3 (Partly Active)

MU16A – Robin Hood's Bay

Robin Hood's Bay village is defended by an extensive system of coastal protection defences which were upgraded and extended in 2001. Most of the defences at Robin Hood's Bay are in a fair to good condition, but the older original structures dating from the 1970s are showing evidence of damage and defects. A capital maintenance scheme for the large vertical sea wall (/D1003C02) that protects the main part of the lower village is currently under design. Maintenance recommendations elsewhere include re-pointing and repairing cracks in the walls and keeping localised areas of vegetation growth in the walls under control to avoid damage.

The most northern defence is a section of rock armour that gives some limited protection to the cliff toe to the north of the northern slipway / beach access ramp (/1002C02). This rock armour was constructed as part of the 2001 scheme and remains in good condition. South of the access ramp the rock armour (/1002C01) fronts the wingwall of the slipway / ramp from the boatyard and then a large blockwork sea wall also built in 2001. Overall, both the wall and the revetment are in good condition. Cliffs to the rear of the slipway have rock netting which remains in good condition. There is evidence of small periodic rockfalls from above the slipway, just north of the rock netting. It is recommended that this netting is extended to prevent further activity.



Rock revetment fronting sea cliffs (/1002C02)



Rock revetment fronting large sea wall (/1003C01)

The rock armour extends south of the end of the wall, remaining in good condition, to protrude beyond the toe of the short length (~25m) of adjacent undefended shale cliffs. The cliff (/1003C03) is generally eroding at a slow rate, however there is continued activity adjacent the interface with the sea wall to the south, particularly at the headscarp and also in the lower reaches. Numerous patch repairs have been made to the interface to address outflanking concern. In 2020 it was noted that a large concrete repair had been made at the base of the wall since the previous inspections.



Rock revetment protruding beyond undefended cliffs (/1003C01)



Erosion of cliffs immediately adjacent to northern end of large sea wall (/1003C03)





Evidence of ongoing headscarp recession (/1003C01).

Path repairs to address outflanking at northern end of large sea wall (/1003C03)

The large vertical pre-cast concrete panel wall that was constructed in 1975 (1003C02) remains in poor condition, showing extensive evidence of surface cracking and spalling, rust marks indicating corrosion of the reinforcement steel, mineral encrustation, seepage, frequent open joints, and extensive cracking and repair work to the crest of the wall. Generally, the wall appeared in similar condition to 2018, however it was noted during the 2020 survey that there was further outflanking of the transition to the shale cliffs at the north end of the wall and additional evidence of spalling across the wall face. During the 2020 inspection maintenance activities to repair spalling and damage to some panels was ongoing.

During the 2020 survey beach levels were noted as being higher than 2020 meaning that previously



reported undercutting was not visible.

Large sea wall in poor condition will benefit from future planned capital scheme (/1003C02)



Typical defects on large sea wall (/1003C02)

Immediately south of the large concrete sea wall, a private blockwork wall fronts the Bay Hotel (/1003C04). This wall extends south to the central slipway and is in overall poor condition. Ongoing maintenance activities are undertaken *ad hoc* on the asset. These include grouting of open joints and sealing the open interface with the precast concrete seawall to the north. Generally, the repairs appear to work effectively, however there remains a number of open joints visible in the wall face. Additionally, the low beach levels exposed voids in the concrete toe at beach level.





Blockwork wall in poor condition fronting the Bay Hotel (/1003C04)

Interface of blockwork wall (/1003C04) and concrete seawall to north.

The adjacent central slipway (/1003C05) is in an overall fair condition, with some areas of minor damage, typically cracking and minor voiding of the structure. A larger void reported in the 2018 inspection appears to have been repaired. The concrete apron at the seaward end of the slipway is undercut and generally is in poor condition. Beach levels in 2020 were marginally higher than in 2018 meaning that the extent of undercutting at the apron was difficult to ascertain.

The mixed construction defence (/1003C06) on the south side of the slipway has mass concrete toe at the base with a variety of stone and blockwork above. The defence has a patchwork of previous repairs and repointing throughout but despite this a small number of open joints remain (mostly in areas of previous repairs) and there is one area of cracking in the concrete at the apron. This does not appear to have worsened since the 2018 inspection, although it remains an area of concern. It is recommended that this is repaired to prevent further damage to the structure. Overall, the structure remains in fair condition, but benefits from ongoing ad hoc maintenance activities.



Slipway in fair condition (/1003C05)



Voiding in slipway toe (/1003C05)



Undercutting of slipway toe (/1003C05)



Blockwork wall (/1003C06)



Longstanding crack in toe apron (/1003C06)



Seawall of mixed construction and concrete toe and apron in in fair condition (/1003C06)



Loose, degraded mortar on blockwork wall (/1003C06)



Longstanding crack in toe apron (/1003C06)

At the south of the village is the concrete sea wall at the Quarter Deck (/1003C10). This structure was given rock armour toe protection as part of the 2001 scheme. The rock armour remains in good condition whilst the sea wall is in fair condition. There has been little change over the previous two years. Some notable defects remain at the access steps at the southern end of the wall, with render cracking and falling away and abrasion of the concrete beneath. There is also some local abrasion and spalling at the coping and around joints. There has been some localised loss of joint sealant, however generally the sealant remains in good condition.





Concrete sea wall generally in fair condition Defects at access steps (/1003C10) (/1003C10)



Rock revetment remains in good condition. Note visible concrete toe beam (/1003C09)



Rock revetment and slipway remain in good condition (/1003C09)

South of the Quarter Deck there is a length of rock armour defence with a slipway / ramp, both of which were constructed in 2001 and remain in good condition in 2018 (/1003C09). One or two displaced armourstones from the revetment are now almost fully buried below beach level.

To the immediate south of the ramp is a short section of rock armour built in 2001 to stabilise the cliff (/1003C07). Since 2016 there has been further significant slumping behind the revetment and in one place, just south of the snout of the slipway, the cliff has overtopped the crest. In addition to this, the defence is at risk of being outflanked at its southern end. It is recommended that the situation in this area is monitored and considerations are made for the revetment to be realigned once the cliff has retreated sufficiently.



Slipway remains in good condition (/1003C09)



Displaced rock armour stones at the toe of the slipway (/1003C09)



Outflanking of rock armour (/1003C07)



Slumping of cliffs behind rock armour (/1003C07)

3.14 Management Unit 17 – Cowling Scar to Peak Steel

Coastal Slope Condition Assessment

This Management Unit is divided into two Sub-management Units; MU17A – Boggle Hole and MU17B– Boggle Hole to Peak Steel.

MU17A – Boggle Hole

This Sub-management Unit consists of part of unit MU17/3 only. This unit is described under Management Unit 16C.

MU17B – Boggle Hole to Peak Steel.

This Sub-management Unit consists of units MU17/4 to MU17/9.

Units MU17/4 is located between Boggle Hole and just west of Stoupe Beck and has a near-vertical lower cliff formed in mudstone and an upper shallower part formed in glacial till. The unit was downgraded from Locally Active in 2016 to Partly Active in 2018, this status is retained following the 2020 survey. There is extensive activity at the toe and on lower face of the cliffs evidenced by numerous recently formed debris lobes. At the headscarp, further activity is visible and in places recession of the escarpment is causing the footpath to be undercut.

At the northern tip of MU17/4 directly to the south of Boggle Hole is a narrow, steep sided cove with a small cave located at its rear. In early July 2020, a small cliff collapse injured a young girl who was in the cove at the time. The collapse was described as "a square metre of material falling from a height of 30 feet". The child was left with serious, but not life-threatening injuries, and was taken to hospital. Due to the proximity of this location to the beach access and the popularity of Boggle Hole itself it is recommended that MU17/4 is monitored closely. Particularly the small cove area especially following heavy rainfall when the upper till slopes are most vulnerable.



Small cove at northern end of **MU17/4**. Cove formed of steep mudstone cliffs overlain with a shallow glacial till slope. (Partly Active).



Shallower glacial till slope, note evidence of recent rockfall above cave entrance. **MU17/4** (Partly Active).





Steep composite cliff of mudstone overlain by till. **MU17/4** (Partly Active).



Steep composite cliffs MU17/4 (Partly Active).

Active retreat of headscarp undermining footpath. **MU17/4** (Partly Active).



Steep composite cliffs MU17/4 (Partly Active).

MU17/5 is located south of Stoupe Beck and is classified as Partly Active, no change since 2014. The cliff toe is slumped till at beach level nearer Stoupe Beck becoming bedrock with overlying till to the southeast, which is regularly slumped over the cliff face and on to the beach. The mid and upper slopes of the composite cliff are shallower gradient. There is an ongoing active retreat of the unit headscarp undermining the Cleveland Way footpath, which in parts appears to have been diverted and stabilised since the last inspection.



Active till cliffs down to beach level in Robin Hood's Bay. **MU17/5** (Partly Active).



Active till cliffs down to beach level in Robin Hood's Bay. **MU17/5** (Partly Active).





Active till cliffs down to beach level in Robin Hood's Bay. **MU17/5** (Partly Active).



Headscarp recession undermining footpath. **MU17/5** (Partly Active).

Active till cliffs down to beach level in Robin Hood's Bay. **MU17/5** (Partly Active).



Vegetated mid-slopes. **MU17/5** in the distance (Partly Active).

In addition to the cliff activity within MU17/5 it is worth noting that the retreat of the headscarp has undercut a historic WW2 pill box which during the 2016 survey was seen to be at risk of collapse. The structure had been undercut and severed in two in 2018. There has been limited change since 2018. However, the seaward facing section now lies someway down the cliff face. Due to the highly active nature of the cliff in this location both pieces of the structure are at risk of collapsing onto the beach below, with the fully detached section posing a potentially imminent risk to users of the beach. Due to the difficulties associated with placing signage on the beach, and the inherent risks associated with access to the structure, options to minimise the risk to the public are not straightforward and will require some consideration.



Historic WW2 pillbox in 2016. MU17/5.



Historic WW2 pill box in 2020. MU17/5.

Further southeast, units MU17/6 and MU17/7 remain classified as Locally Active after being downgraded from Partly Active in 2016. The lower slopes are steep cliffs composed of mudstone overlain by shallower sloping till. The cliff face suffers localised rock falls and localised slumping of till from above.



Steep composite cliff of mudstone overlain by till. **MU17/6** Locally Active September 2020

Recent local rock fall in the mudstone cliff. **MU17/6** (Locally Active).

Units MU17/8 and MU17/9 are located immediately west of Peak Steel. **Unit MU17/8** has a steep lower slope which is actively eroding and a shallower upper slope which supports some vegetation cover. **Unit MU17/9** is steep with little vegetation. These units remain classified as Partly Active in 2018, as they have been since 2002.



Some vegetation cover visible along upper slopes of **MU17/8** (Partly Active).



Ongoing erosion of cliff face along **MU17/9** (Partly Active)

MU17A and MU17B – Boggle Hole to Peak Steel

There are no coastal defences present here, but fluvial assets include a stone slipway integrated with a concrete revetment, a fuel bund and the outfall of Mill Beck. Boggle Hole Youth Hostel and footbridge is located 50m upstream of the mouth of the beck. Access is provided to the beach via a concrete slipway.



Concrete slipway at Boggle Hole, note voiding and undercutting of concrete apron.



Blockwork wall with concrete toe at Boggle Hole.

A short section of rock armour revetment and concrete and timber piling are providing protection to the mouth of the Stoupe Beck just to the south of Boggle Hole. However, these are fluvial rather than coastal sea defences and are therefore not included in the coastal defence asset inspection.



Rock armour revetment on north side of Stoupe Beck.



Timber piles in poor condiition. Extensive voiding and undercutting visible.

3.15 Management Unit 18 – Peak Steel to southern end of Beast Cliff

Coastal Slope Condition Assessment

This Management Unit is divided into 2 Sub-management Units, as follows (Appendix A, Maps 4 and 5):

MU18A – Peak Steel to Blea Wyke Steel

This Sub-management Unit consists of units MU18/1 and MU18/2.

Unit MU18/1 is located at Peak Steel, below Ravenscar. The cliffs in this region have a distinct twotiered form. Much of the upper headscarp is densely vegetated with little evidence of recent activity. The lower headscarp, exposed to the sea, is more active and subject to episodic slides and falls evident. This unit is classified as Locally Active in 2020.

Unit MU18/2 is a well vegetated, relict system with no signs of activity. As a result, it is classified as Inactive.





MU18/1 Peak Steel (Locally Active)

MU18/2 Distinct two-tiered cliffs (Inactive)

MU18B – Common Cliff and Beast Cliff

This Sub-management Unit consists of **units MU18/3 and MU18/4**, both of which are classified as Locally Active. The cliffs have a distinct 'undercliff', likely to be formed by seepage erosion and land sliding processes. The slopes show only localised patches of activity, most noticeably along the headscarp of cliff which is experiencing localised recession.



MU18/3 Locally Active in 2020



MU18/4 Heavily vegetated upper slopes (Locally Active).

There are no coastal assets within this Management Unit.

3.16 Management Unit 19 – Beast Cliff to Scalby Ness

Coastal Slope Condition Assessment

This Management Unit is divided into 5 Sub-management Units (Appendix A, Maps 5 and 6).

During the 2018 walkover survey a section of footpath between Petard Point and Hayburn Wkye was temporarily closed due to a landslip. The closure was effective for a period of 6 months, between 6th April 2018 and 18 September 2018. During the 2020 inspection the footpath had reopened. The section of footpath between Petard Point and Hayburn Wyke was found to be in good condition during the 2020 walkover inspection and it was not obvious at which point the landslip had occurred. The landslip location may have been obscured by fresh vegetation growth.



Footpath closed during 2018 inspection.



The same location in 2020 with footpath reopened.

MU19A – Beast Cliff to Herbert Hole

This Sub-management Unit consists of **unit MU19/1** only. Due to the temporary footpath closure in 2018, it was not possible to assess the condition of the unit. However, the condition of the unit was changed to Partly Active due to the occurrence of the slip itself. The 2016 report noted that "The cliffs are relatively stable and failures are localised, although a large failure in the upper cliff did occur ~ 5-10yrs ago", it was not possible to confirm whether the slip which occurred in 2018 was related in any way to the historic slip. There is localised evidence of headscarp recession and some minor activity on the cliff face. MU19/1 has been altered from Partly Active to Locally Active in 2020.



MU19/1 Evidence of historic landslip in MU19/1.



MU19/1 localised recession of headscarp

MU19B – Herbert Hole to Tindall Point

This Sub-management Unit consists of unit MU19/2 and part of units MU19/1 (described previously) and MU19/3.

Unit MU19/2 is located on the north side of Hayburn Wyke and remains classified as Locally Active because of minor activity at the headscarp and some evidence of recent rockfalls at the toe. It was noted during the 2020 survey that several large rockfalls near the access to the beach reported in 2018 (see images below) had remained stable. There did not appear to have been further displacement of rock from the face of the cliff. Due to the proximity of the beach access to the cliff face is recommended that MU19/2 is monitored for further change, particularly following periods of adverse weather where the cliffs may become unstable. However due to the localised nature of the activity the overall condition of the unit remains unchanged.



MU19/2 Rockfall at the toe of cliff.



MU19/2 – Rockfall at toe of cliff, adjacent to waterfall.

The stabilisation works at the slopes around the footpath on the northern side of Hayburn Wyke were reported in the 2012 survey as being effective. However, it has been noted following inspections in 2014, 2016 and 2018 that there is deformation of the steps here, indicating possible renewed movement. During the 2020 inspection the steps were found to be in poor condition with further evidence of movement and deformation.

Unit MU19/3 is located around and to the south of Hayburn Wyke. These cliffs are well vegetated, with localised erosion at the toe and headscarp. A new large debris lobe was observed from beach level with some other smaller lobes visible across the southern section of the bay indicating renewed activity on the undercliff. From the Cleveland Way footpath, a much larger rotational slide was visible from the upper cliff. The headscarp of the slide has come very close to undermining the footpath and has a near vertical upper face. Several large mature trees have been displaced by the slide. Due to the increased level of activity at the toe and in the upper cliff the unit has been downgraded to Partly Active in 2020.



MU19/2 Looking north across Hayburn Wyke at the vegetated cliffs (Locally Active)



MU19/3 – Large new debris lobe on the undercliff on south side of Hayburn Wyke (Partly Active)



MU19/3 – Large landslide on the upper cliff of on south side of Hayburn Wyke (Partly Active)



MU19/3 – Well vegetated undercliff on south side of Hayburn Wyke (Partly Active)



MU19/3 – Several smaller new debris lobes on the undercliff on south side of Hayburn Wyke (Partly Active)



MU19/3 – Looking north along the Cleveland Way footpath. (Partly Active)

MU19C - Tindall Point to North of Cloughton Wyke

This Sub-management Unit comprises parts of units MU19/3 (described above) and MU19/4.

Unit MU19/4 is located immediately to the north of Cloughton Wyke. The unit is characterised by high, steep cliffs which are more active than those cliffs further north and south. There is some recession of the headscarp. This unit condition was noted as being Locally Active in 2020. There is

evidence of ongoing rockfall and recession along the headscarp, however activity is localised and concentrated on the upper cliff.

MU19D – Cloughton Wyke

This Sub-management Unit consists of units MU19/5 and MU19/6.

Unit MU19/5 is located on the northern side of Cloughton Wyke and is classified as Locally Active, unchanged since 2012. The near vertical cliffs are composed of hard rock which have failed through a series of small rockfalls. The cliffs support some vegetation, primarily in the northern end of the unit cover and are subject to ongoing marine erosion at the toe.

Unit MU19/6 forms the southern part of Cloughton Wyke and extends southwards to Long Nab. The lower cliff is near vertical and actively eroding. There is evidence of rockfall (large, angular boulders) from this part of the cliff onto the shoreline below. The upper part of the cliff is shallower angled and much less active. This unit condition was changed to Locally Active in 2018 and retains that status in 2020. Although some evidence of minor rockfall was still visible, activity on the cliff appears to have become more settled since2016. The stability of the upper reaches of cliff was evidenced by the increased vegetation coverage.



MU19/6 Rockfall on southern side of Cloughton Wyke (Locally Active)



MU19/6 Rockfall on southern side of Cloughton Wyke (Locally Active)

MU19E – Hundale Point to Scalby Ness

This Sub-management Unit consists of part of **unit MU19/6** (described previously) and **units MU19/7** to MU19/11.

Units MU19/7 and MU19/8 extend from Long Nab in the north to Cromer Point in the south. They remain classified as Locally Active in 2020 due to minor erosion activity evident at the toe and localised recession of the headscarp.

Units MU19/9 and MU19/10 are located between Cromer Point and Scalby Ness. The toe of these units is subject to marine action and the headscarp is steep, exposed and actively retreating through slippages at numerous places throughout the units. The cliffs retain their Partly Active status because of the extent of activity along their lengths being more than simply 'local'.

During the 2018 survey it was noted that the headscarp was actively undercutting the footpath and there was a significant risk to users of the path along several sections. This was due to the instability of the ground, evidenced by many minor landslips across the cliffs upper reach.



MU19/9 Retreat of headscarp (Partly Active)



MU19/9 Landsliding and retreat of headscarp (Partly Active)

The Scalby Ness headland comprises **unit MU19/11**. This area is well vegetated on its more landward extents, but was noted during the December 2013 inspections to be eroding severely in the lower half of the cliff with some failure in the upper part and was therefore upgraded to Partly Active; this status has been is retained in 2020, unchanged since 2014.



MU19/11 Active undercliff (Partly Active)



MU19/11 Activity in upper slopes of cliff above Sea Cut at Scalby Ness

MU19 – Beast Cliff to Scalby Ness

There are no formal sea defences within MU19. However, there is an outfall pipe which has been laid across the mouth of Scalby Beck and continues north across the foreshore in front of Scalby Ness. This acts as a weir controlling the flow of the beck at low tide. As the outfall pipe is not a coastal defence asset it has not been included in the inspections.

3.17 Management Unit 20 – Scarborough North Bay

Coastal Slope Condition Assessment

This Management Unit is divided into 2 Sub-management Units.

MU20A – Northern North Bay

This Sub-management Unit consists of units MU20/1 and MU20/2.

Both units are defended at the toe by the sea wall which runs the entire length of North Bay. The slopes are well vegetated, show no evidence of recent activity and are both classified as Dormant, as they were in previous surveys.





MU20/1 Cliffs in northern North Bay (Dormant)

MU20/2 Cliffs in northern North Bay (Dormant)

MU20B – Southern North Bay

This Sub-management Unit comprises units MU20/3, MU20/4a and MU20/4b.

Unit MU20/3 fronts Clifton Hotel and the Scarborough Bowls Centre. As per previous surveys the unit is well vegetated and shows no obvious evidence of recent instabilities. It is again classified as Dormant in 2020

Unit MU20/4a is located to the rear of North Sands. The relict slopes are well vegetated with only minor and localised evidence of erosion, it remains classified as Inactive, unchanged since previous surveys.



Looking across to North Sands Unit MU20/4b MU20/4a & MU20/3

Unit MU20/4b covers the area of Clarence Gardens and has previously been slightly more active than the adjacent unit MU20/4a. However, remediation works have repaired cracks and the slopes are now well vegetated with exposed rock at the headscarp. This unit was downgraded to Inactive in 2012 and retained this status in 2014. However, because of evidence of some (very) shallow slips in one local area near to parking bays, it was altered to Locally Active in 2016 and 2018. No further activity was noted during the 2020 inspection and therefore the condition has been returned to inactive.



MU20/4b Cliffs in southern North Bay (Locally Active)



MU20/4b Inactive



MU20/4b Inactive

MU20 – Scarborough North Bay

There are formal defences throughout the whole length of Scarborough North Bay, many of which are currently in fair condition but most of the concrete and blockwork structures show some evidence of defects such as cracking, loss of mortar, loss of expanding sealant and surface abrasion to the front face. There are also many defects such as structural cracks and abrasion in the back wall behind the promenade where this acts as a retaining wall to the road and in the promenade deck. Many major repairs and capital works improvement to refurbish the North Bay defences were undertaken in 2014 and are generally holding up well.

MU20A – Northern North Bay

Sealife Centre 20A/1

The most northerly seawall (/1201C01) starts adjacent to the footbridge at Scalby Mills and remains in fair condition. Moving south the seawall (/1201C02), around the promontory on which the Sea Life centre is built is in overall fair condition, but with some local areas of abrasion; most notably at the stepped concrete toe, north of the slipway. In the same location there is a failed outlet that has a broken crown although it is not envisaged to affect the performance. There is also heavy abrasion around the access steps at the junction with the adjacent seawall to the south. Previous joint repairs are holding well.



Beck condition Access Steps at Scalby Beck (/1201C01 001) seawall Scalby Fair at (/1201C01)



Fair condition seawall at Sea Life Centre Failing outlet through seawall (/1201C02) (/1201C02)



North Bay Cliffs – 20A/2 to 20A/7

A series of seawalls (/1201C03, C24, C25, and C04) lie between the Sea Life Centre and the small promontory at the south of the mini golf course. The seawalls within this frontage are formed of blockwork with a concrete crest wall with a promenade beyond, backed by a grouted stone revetment. There is abrasion damage to the front face, and spalling of the capping beam along the entire length of this frontage.

The northernmost section (/1201C03) has a short length of heavily corroded handrailing at the seaward edge of the promenade and notable abrasion damage to the deck. There also is a section (4-5m) of heavily abraded seawall face to the north that is now exposing reinforcement and requires attention. As reported in 2018, the damage to the wave return wall, steps and grouted stone revetment at the rear of the promenade has been repaired.





Heavily abraded seawall face with exposed reinforcement (/1201C03)

Fair condition seawall with recent repairs to toe apron (/1201C24)

The beach access steps along this frontage are particularly heavily abraded. The southernmost set of steps have been subject to substantial repairs which, to date, are holding well. The beach levels were locally low at the time of the inspections, exposing more of the sheet piled foundations than previously seen. The sheet piles show signs of corrosion at pile head highlighted by colour disfiguration and uneven surface. The side sheet piles appeared to have a minor lean seaward suggesting possible lateral movement, this should be monitored although it is thought that if movement was significant that the concrete would also be showing signs of stress which is was not. The concrete repairs extend northwards from the steps along the toe apron and remain effective.

The small crack between the repaired steps and the seawall, reported in 2018, did not appear to have deteriorated but should continue to be monitored



Corroded sheet pile foundation to access step landing (/1201C24)



Sheet Piles appear to have minor lean seaward (/1201C24)

The wall around the promontory (/1201C04) is more exposed and has had relatively recent repairs to both the front face and the low crest wall, these are still holding up well in 2020. It was reported in 2018 that heavy abrasion damage remained in other places (especially on the unrepaired sections of lower wall), although this was buried by high beach levels in 2020. There is damage to the rear promenade wall in two places – notable a section of missing blockwork, approx. four blocks, that requires attention. The new drainage outfall, entry guard and WaStop are in good condition.





Area of recent repairs to promontory wall Missing blockwork in rear wall (/1201C04) (/1201C04)

Between the promontory and Peasholm Gap, the frontage has been split into a series of asset lengths (/1201C10, C26, C11, C12, C13, C14, C15, C16, C05, C17, C18 and C06, running from north to south). The beach levels along this frontage were exceptionally high during the 2020 inspection, reaching to the crest along the majority of the frontage and almost overtopping in places. Three of the beach access steps were fully submerged. The cope that was exposed was showing signs of abrasion, with some sections recently repaired. A particular hotspot for abrasion damage was the intercept between the cope and the abutments right of the access steps.

Previous repairs to the grouted stone revetment to the rear of the promenade, below the beach huts, remained effective. Although mature vegetation growth was noted on the crest and should be removed. Abrasion damage continues to be evident to the access steps along this section, although several sets have recently been repaired.



High beach levels almost overtopping Mature Vegetation growth (/1201C05) (/1201C05)

As reported in 2018, the wall to the north of the ramp at Peasholm Gap (/1201C06) continues to show several (currently minor) vertical cracks. These were noted not to have worsened since the previous inspection. There was an area of notable abrasion damage to the facing.







Vertical cracks in wall protecting recent development (/1201C06)

Southern North Bay

Peasholm Gap and Clarence Gardens - 20B/1 to 20B/3

The beach levels at the wall at Peasholm Gap (/1201C19) were significantly higher during the 2020 inspection than on the previous inspection. It is estimated they could be as much 1.5m higher adjacent to the slipway. As a result, much of the lower courses, including the outlet, were buried. The extensive repairs, complete in 2014, are holding well and the core holes observed through blocks in 2018 have been filled. It was however reported in 2018 that there are still some damaged areas of blocks (thought to be buried with sediment in 2020) and spalling to the splash beam in areas not yet repaired. Overall, the wall remains in fair condition.





Previous repairs to wall at Peasholm Gap Slip way in fair condition (/1201C20) (/1201C19)

South of Peasholm Gap, Royal Albert Drive is protected by an increasingly high curve-profiled blockwork wall (/1201C07 and C21) that runs south to the slight promontory at the ramp opposite the recently redeveloped Oasis Café. The wall is in a generally fair condition. As reported in 2018, the previous repairs to joints, damaged wing-walls to beach access steps and entire sections of full height wall are holding well. The lower courses of the brickwork are showing signs of abrasion. There a couple of missing blocks adjacent to the access steps, these should be replaced before the defect deteriorates.

The access steps are in fair condition, however there is some minor undercutting to the lower steps. A full height vertical crack should also be monitored.

The promenade along part of this section was re-laid in 2012 but remaining poor in other sections. Beach levels were relatively low at the time of the inspections, exposing the concrete apron which seems in fair condition although was subject to extensive algae growth.



High curved-profile seawall (/1201C07)



Undercutting access steps (/1201C07)



Missing blockwork (/1201C07)



Vertical crack at access steps (/1201C07))

The slipway in front Oasis Café is fenced off to prevent access. However, members of the public were observed still using this ramp during the 2020 inspection. Further measures should be put in place to prevent this. The large vertical crack on the wingwall has deteriorated and a block is now missing adjacent to the crack. Surrounding blocks appear loose and are at risk of being displaced. The crack and blockwork defects appear to correlate to a depression in the deck suggesting settlement issues.



Access ramp still in use despite fencing Wing-wall at access ramp - 2020 (/1201C21)) (/1201C08)

At the southern end of the North Bay, there is a large stepped concrete blockwork sea wall structure (/1201C08) constructed with nine large buttresses/bastions which protrude from the wall out onto the beach. The apron of the structure becomes increasingly exposed with progression north along the wall. There is one longitudinal crack in the blockwork across several adjacent blocks. Although noticeable, this has not deteriorated since the last inspection. The promenade surface is poor in places.





Concrete blockwall wall with buttresses Longitudinal crack in blockwall wall (/1201C08) (/1201C08)

There is a short section of vertical blockwork wall (/1202C23) between the stepped concrete blockwork wall and the rock armour revetment to the south. This short wall is in fair condition overall, the missing blockwork at its southern end has been repaired. However, the lower three courses remain heavily abraded.

The southern-most section of defence in North Bay is the first section of the rock armour at Clarence Gardens that was constructed in 2004/5 (1202C01). This remains in good condition in 2020, protecting the original wall behind.



Repairs to southern end of wall (/1202C23)



Rock revetment fronting seawall remains in good condition (/1202C01)

3.18 Management Unit 21 – Castle Cliff, Scarborough

Coastal Slope Condition Assessment

This Management Unit is divided into 2 Sub-management Units.

MU21A – Castle Cliff

This Sub-management Unit consists of units MU21/1 and MU21/2.

Unit MU21/1 is located at The Holms and continues to be classified as Inactive, unchanged from previous surveys. The unit comprises a series of relict rotational landslides and is prone to rockfalls. However, there was no evidence during the 2020 inspection of recent rockfall activity.

Unit MU21/2 forms the Castle Cliff promontory and continues to be classified as Locally Active, unchanged from recent inspections. The cliffs are steep with extensive toe protection measures and rock netting on exposed faces. Locally, bedrock is exposed where it is subject to ongoing weathering and erosion from rainfall. There are rock fall debris piles at the toe of the cliff highlighting past activity. There is one historic rotational slip behind seating area on Marina Drive.



MU21/2 Historic rotational slip (Locally Active)



MU21/2 Rock fall debris at toe of cliff

MU21B – The Harbour

There are no natural cliff units within this Sub-management Unit.

MU21A/1 and 21A/2 – The Holms and Castle Headland

Part of the wider East Pier to the Holms Coast Protection Scheme, constructed between 2003 and 2005, protects this frontage with a rock armour revetment which extends from the southern end of North Bay (/1202C03). This continues through the Holms as rock armour with concrete toe piles to reduce the footprint of the defence, thus limiting encroachment into the foreshore SSSI (/1202C04). The toe piles appear to be effective but could only be inspected from the promenade, a healthy buildup of natural rock in front of the piling is offering further protection.

There is a continuous wave return wall along the crest of these defences, which remains in good condition along both asset lengths. Where there are beach access steps through the rock armour in the south part of North Bay (/1202C01), there is considerably more abrasion damage to the steps and locally scoured areas of the beach which leave a standing pool of water at low tide, making access to and from the beach difficult, but the structures themselves remain sound. The lower sections of the access steps (/1202C01) have steel edges in place which are now heavily corroded and starting to become a trip hazard.



Pooling making access diffcult (/1202C01)



Rock armour revetment and wave return wall Rock armour revetment and with natural rocks (/1202C03)



Steel edge corroding (/1202C01)



offering protection (/1202C04)

The section of defence continuing around the Castle Headland to the harbour is an Accropode revetment with concrete toe piles and a rock armourstone crest, with a concrete wave return wall (/1202C02). As reported previously, the inspection was limited to views from the crest wall and it was not possible to inspect the toe as along most of the length it is below water in all tide conditions. Overall, these defences remain in good condition with only localised evidence of concrete abrasion and cracks in the Accropodes. The crest wall is generally sound with only minor cracking and good joint seals. The promenade remains in overall good condition in the 2020 inspection.



Accropode revetment with concrete toe piles, rock crest and wave return wall (/1202C02)



Example of locally abraded Accropode unit but otherwise good condition revetment (/1202C02)

MU21B/1 and 21B/2 – The Harbour

Scarborough Harbour comprises both the inner Old Harbour and the newer East Harbour and is located at the southern side of the Castle Headland at the old part of the town. There are continuous formal defences throughout the whole extent, ranging from the 2005 rock armour and Accropode sections to very old stone quay walls. Around the commercial side of the harbour many of the defences are aged and are constructed using sheet metal piles backfilled with mass concrete.

The outer facing pier of East Harbour's outer pier is protected by rock armour and Accropode units (/1301C01) and is in good overall condition. Towards the seaward end of the pier, many of the original wall blocks on the crest of the outer wall are heavily abraded and some are partially cracked.



East Harbour outer pier (/1301C01)



Abrasion towards seaward end of East harbour outer wall (/1301C01)

The inner facing wall of East Harbour's outer pier (/1301C16) was refurbished as part of the 2005 scheme, with missing blocks replaced and joints filled. Minor missing joints and cracks appear throughout the harbour masonry walls. The inner face remains in fair condition.

Despite timing the inspection around the low tide, the seaward end of the East Harbour's outer pier could not be inspected as it remained underwater. When looking back towards the pier from the south it was possible to identify several large lateral voids in the seaward face of the structure. These were not visible from the pier itself. A more thorough structural inspection of this area is recommended to determine the size and nature of these voids.



Access steps at nose of East Harbour pier in fair condition. (/01301C01)

Access steps at root of East Harbour pier in fair condition. (/1301C01)





Repairs to the crest of the original wall toward the seaward end of the East Harbour outer pier (/1301C16)

Voids visible around low water mark. (/1301C16)

At the landward end of East Harbour is a short section of low wall (/1301C02) which is largely obscured by fairground attractions and could not easily be inspected. However, as this wall is not subject to marine influence, its condition is somewhat less critical than other harbour structures. Where observable, the pointing between blocks was in good condition but render on the upper section of wall is starting the break away in places. This wall extends to a slipway to East Harbour which is located on the inner side of Vincent's Pier and remains in fair condition.

Vincent's Pier (/1301C04) separates East Harbour from Old Harbour and is in overall fair condition. The wall facing East Harbour is largely covered by timber boarding and algae growth, making inspection difficult, but where visible the blockwork and joints are sound. The pier deck is in good condition.






Wall of Vincent's Pier facing west (/1301C04)

At the harbour arm beyond the Captain Sydney Smith Bridge, near the lighthouse, the steel sheet piling on the outer wall (/1301C17) is corroded but no holes were obviously apparent. It is notable that the blockwork walls at the end and inner facing walls (/1301C03) of this pier have evidence of missing mortar and joints, the overall condition of the pier remains fair.



Corroded steel sheet piling (/1301C17)

Cracks and missing mortar on inner wall at entrance breakwater (/1301C03)

Moving westwards from the landward end of Vincent's Pier, the temporary portable cabins used by the RNLI have been removed upon completion of the new lifeboat station immediately adjacent to West Pier at the northern end of Scarborough South Bay. The promenade eastwards of here is supported by several arches built in front of the original quay. These remain in fair condition with well pointed stonework, however the previously reported damage to the concrete capping apron remains unrepaired and is in poor condition.





Some Cracking and missing joints to capping Con apron to wall south of roundabout opposite pile arcade. (/1301C05)

Corrosion and vegetation growth on steel sheet pile wall. (/1301C12)

West of the arches, the quay wall leading to the slipway midway along Sandgate is formed by steel sheet piling (1301C12) which is corroded but otherwise appears in fair condition. The slipway (1301C11) remains in fair condition, as is the short length of visible blockwork quay wall (1301C06) adjacent to the slipway. The handrail running along the edge of the blockwork key wall, above the slipway was damaged and requires repairing in two locations.

Immediately west of here is a concrete jetty which has been constructed to extend a suspended deck seaward of the wall. Previous inspections have reported signs of movement of the jetty and original quay wall, but this is not obviously apparent as has been reported in recent walkover inspection. There was no sign of cracking or lateral movement across the deck. The slipway and wall at the western end of Sandgate (/1301C14), adjacent to the West Pier, is generally in fair condition however some damage and displacement to the northern blockwork wall was noted during the inspection.



Slipway, quay wall and concrete jetty (/1301C11 and C06)



Suspended deck of concrete jetty (/1301C06)



Looking up towards suspended deck of concrete jetty (/1301C06)



Looking towards slipway at western end of Sandgate (/1301C14)



One area of damage to the handrailing along (/1301C06) above the slipway.



Minor damage and displacement to blockwork wall (/1301C14)

The inner face of the West Pier (/1301C13) appears to be mostly in fair condition, but the steel sheet piling is corroded. The seaward end (/1301C18) also has corroded steel sheet piling and longitudinal cracks in the concrete capping beam, reported in the 2018 inspection remain. As such the poor condition rating is retained following the 2020 inspection. Immediate repairs are recommended to the capping beam.



Corroded steel sheet piling on inner face of West Pier (/1301C13)



Corroded steel sheet piling notably worse directly adjacent slipway (/1301C13)



Corroded steel and cracked capping beam on seaward end of West Pier (/1301C1718)



Corroded steel and damage to capping beam on seaward end of West Pier (/1301C1718)

The outer face of West Pier (/1301C07) continues to show several significant defects including numerous longitudinal cold joints, several large full height cracks and exposure of aggregates. Its condition has been recorded as poor since 2009. Some previous repairs are obvious but in places cracks remain partly open. There is one area of voiding near the toe of the wall which was reported in 2018 and remains unchanged. There is extensive spalling and loss of render near the seaward end of this southern face. Repairs are recommended.



Longitudinal cold joints in south face of West Pier wall (/1301C07)



Evidence of spalling at base of south face of West Pier wall (/1301C07)



2018: Void at toe in south face of West Pier wall and damaged conduit (/1301C07)



Spalling and loss of render in south face of West Pier wall (/1301C07)

The poor condition of the seawall extends to its landward end (/1301C19), unchanged since 2018 and urgent repairs are recommended now that the RNLI lifeboat station is complete.



Large open joints and cracks are evident from along the wall's full extent (/1301C19)



Some evidence of voiding at toe of wall and full height cracks from crest to toe of wall (/1301C07)

3.19 Management Unit 22 – Scarborough South Bay

Coastal Slope Condition Assessment

This Management Unit is divided into two smaller Sub-management Units.

MU22A – St Nicholas Cliff

There are no natural cliff units defined within this Sub-management Unit, but terraced gardens are present near the Town Hall.



Terraced gardens at St. Nicholas Cliff

MU22B – South Cliff and Holbeck Gardens

This Sub-management Unit consists of **units MU22/1** to **MU22/8**, all of which are protected at the toe by the sea wall, promenade and in places, rock armour. Some areas within South Cliff Gardens have been subject to historic shallow slips which have been remediated by soil nails.

A major slope stabilisation scheme to reduce the risk of both shallow and deep-seated failures behind the Spa was completed at the end of 2019.

In March 2018, a section of retaining wall behind the chalets situated on the cliff failed and the area was fenced off awaiting repair. During the 2020 inspection works were ongoing to provide localised slope stabilisation in this location and to prevent further failures of the slope directly below the Clock Tower Café.

Holbeck Gardens was subject to a catastrophic deep-seated landslip in 1993 but has been stabilised since.

Unit MU22/1 is the most northerly unit located in Scarborough's South Bay and is classified as Inactive in 2020.

Unit MU22/2 comprises the area around and to the north of the Spa complex. The unit was downgraded from Locally Active to Inactive in 2012. Works to stabilise the cliffs behind the Spa begun in June 2018 and were completed in January 2020. The works undertaken included; installation of 4,585 no. soil nails to reduce the risk of shallow failures, and 225 no. steel piles to reduce the risk of deep-seated failures. Furthermore, an extensive programme of footpath reinstatement and landscaping was undertaken improving the condition and safety of the slopes. During the 2020 inspection, vegetation management works were ongoing across the slopes meaning that some of the footpaths were temporarily closed. The unit retains its Inactive status in 2020.



MU22/2 Soil nail installation on coastal slopes near the Spa in 2018



MU22/2 the same slope as above in 2020. Soil nails installed. Vegetation management ongoing.



MU22/2 Soil nail and slope mesh installation behind main Spa building in 2018



MU22/2 looking down behind main Spa building in 2020. Note vegetation management ongoing.

Unit MU22/3 is located just south of the Spa Complex near the cliff lift. The steep slopes of this unit are well vegetated with little evidence of instability. Therefore, this unit is classified as Inactive in 2014, unchanged since previous surveys.



MU22/3 Coastal slopes behind Spa looking towards cliff lift



MU22/3 (foreground) note recently cut vegetation and tree planting. **MU22/7** in the distance (inactive).

Units MU22/4 and MU22/5 comprise the northern part of the South Cliff Gardens and were both classified as Inactive in 2016, unchanged since previous surveys. In March 2018, a retaining wall at the back of some chalets below the Clock Café failed. This also caused large cracks to appear in the footpath above. During the 2020 inspection slope stabilisation works were ongoing in order reduce the risk of localised failures. MU22/4 has not been classified in 2020 due to the ongoing works within this whilst unit MU22/5 retains its inactive status.



MU22/4 large cracks in footpath above chalets in the location of the wall failure (Photo from 2018 Report).



MU22/4 slope stabilisation works ongoing during the 2020 inspection.

Unit MU22/6 is located behind the former bathing pool and is classified as Inactive in 2020, unchanged since previous surveys.

Unit MU22/7 is located at Holbeck Gardens and is classified as Locally Active in 2020, downgraded from Inactive in 2016 due to increased activity at the cliff toe. A number of footpaths within the unit have previously been closed due to cracking and ongoing instability. Generally, the slopes are well vegetated except for an area of exposed bedrock subject to small rockfalls at the cliff toe. The promenade at the base of the cliff is protected by a rockfall catch fence however since 2018 the promenade has been closed due to the increasing risk of rockfall from the cliff face.

Unit MU22/8 comprises the stabilised Holbeck Hall landslide run-out lobe and is protected at the toe by boulder armour. Localised sections near the headscarp are exposed. This unit is classified as Locally Active in 2020, unchanged since 2016.



MU22/8 Coastal slopes at Holbeck Hall MU22/8 Holbeck Hall landslide (Locally Active) landslide (Locally Active)



Coast Protection Asset Condition Assessment

MU22 – Scarborough South Bay

A wide range of coastal defence assets are located in Scarborough South Bay. Throughout the defences there are vertical cracks, defects and areas of heavily abraded blockwork. Although there are numerous defects to the sea walls, the structures are generally sound and well maintained but ongoing repair work is needed to maintain or improve the condition of the assets and capital schemes have been recommended in the Coastal Strategy at several locations. Common defects visible throughout include mortar loss, blockwork abrasion and surface cracking.

During the 2020 inspection beach levels across the northern end of the south bay were notably high meaning that many of the assets were not fully visible.

Foreshore Road and St Nicholas Cliff - MU 22A1/ and 22A/2

The South Bay defences start at the RNLI lifeboat station, adjacent to West Pier (/1301C08). The construction of the new RNLI Lifeboat Station has been completed since the last inspection. The works were completed in November 2016 and were generally found to remain in As Built condition during the 2020 inspection. Around the full perimeter of the seawall vegetation growth was observed. Although this does not pose an immediate risk to the structure it may lead to defects being missed or not identified. This impact of this is most notable beneath the slipway where vegetation growth now obscures the full height of the wall. Generally, the wall remains in As Built condition however one notable defect was observed adjacent the slipway where a block has come loose from the wall itself. Due to the small voids which have appeared either side of the block the defect poses a risk of water ingress into the structure itself, particularly if the block is further dislodged.





RNLI New lifeboat station and slipway (/1301C08)



New RNLI lifeboat station wall beneath slipway Dislodged block on new seawall (/1301C08) (/1301C08)

New RNLI lifeboat station wall (/1301C08)





Slipway next to RNLI station (/1301C20)

The low defence wall along the east side of Foreshore Road is split into a number of asset lengths between sets of access steps. These are, running from north to south /1301C15, C21, C22, C23, C24 and C25. Due to high beach levels at the time of inspections, sand was often flush with the promenade or, at best, only the top one or two courses of stone blocks were visible along most of this length. Due to the high beach levels, the northern section of frontage is classed as being in good condition, with the wall where exposed around the Olympia Leisure reducing to fair condition because of frequent washed out joints and abrasion to blocks, which would benefit from repair.





Beach levels flush with promenade at north end An area of abrasion at top of wall (/1301C23) of Foreshore Road seawall (/1301C15)

At the subway beach access in the vicinity of the Spa Bridge (1301C09), repairs have previously been made to the northern section of beach landing apron to the access steps and these remain in good condition. During the 2020 inspection it was noted that further repairs have been made to the access at the north, these repairs are in good condition and appear to have increased the resilience of the apron and access steps. However, despite these repairs, the central and southern sections of the apron remain in fair condition and are heavily abraded and in need of attention. It is worth noting that during the 2020 inspection beach levels were approximately 300mm higher than in 2018 meaning that the toe of the apron was not visible.



Repairs remain in good condition locally, but overall asset condition is fair (/1301C09)



Abrasion of toe apron south of previous repairs beach levels notably higher than 2018 (/1301C09)

Immediately south of the beach access steps, this wall continues alongside a beach access ramp (1301C10) and there is a vertical crack in the brick retaining wall to the rear of the ramp which needs monitoring for further movement and repair no repairs have been made since 2018 however the condition and state of the defect is also unchanged with no evidence of worsening. Some repairs have been undertaken on the main wall where significant defects were previous identified, but many defects remain including longitudinal and vertical cracks, gaps between the wall and its capping and the lower wing-wall of the access ramp, including around the Spa feature. The repairs will need attention to prevent further deterioration. Due to this, the wall remains as poor condition. The seaward end of the ramp has been recently repaired and those works are holding well.



Vertical crack in wall above access ramp Missing blocks around Spa feature (/1301C10) (/1301C10)

Spa Chalet – MU 22/A3

The recurved sea wall between Valley Road and the promontory at the Spa (/1301C26) continues to show occasional defects throughout, such as washout of joints and abrasion to the blockwork surface or coping, and some cracked blocks although they appear stable. It is in overall fair condition, with parts of the upper section having been rebuilt, but ongoing maintenance is needed. In one location, the timber piles at the toe of the structure were exposed and future inspections should check for signs of undercutting. High beach levels in 2020 mean that it was not possible to inspect undercutting of the timber piles.



Occasional minor defects but overall fair condition seawall (/1301C26)



Exposed timber piles on concrete apron. High beach levels obscured view of lower section of apron. (/1301C26)

The Spa – MU 22A/4 to 22B/2

The Spa frontage comprises the following elements:

- Northern tie-in masonry blockwork wall with access steps to the beach.
- Northern section (Spa and Sun Court) masonry blockwork wall with splash wall along the crest, and a concrete apron/sheet piling toe along part of the length. The section in front of the Sun Court additionally has a wave deflector just below the parapet.
- Closed colonnade section masonry blockwork wall with historic colonnade section, now closed-off with in-filled concrete blockwork.
- Open colonnade section featuring a sheltered seating area on the lower level and steps to the beach and upper promenade/road.
- Southern tie-in masonry blockwork wall with access steps to the beach.

The masonry sea wall at the northern end of the Spa frontage (/1301C27) remains in fair condition following previous repairs, including reinstatement of a section of the masonry/concrete parapet after December 2013 storm damage. Previous repairs to fill joints between blocks in the wall's face also remain effective, however there are other occasional open joints between blocks which would benefit from filling and cracks are evident across the corners or full height of the face of some blocks. In front of the Spa building's entrance, one section of sea wall has longitudinal cracks across three adjacent masonry blocks, which is likely to be an area of potential weakness.

Works were undertaken in June to August 2018 to construct a reinforced concrete toe to the northern section of 1301/C27. The more southern part of the wall already had an existing concrete toe with edge piles. The recently constructed reinforced concrete toe remains in good condition although some minor vegetation growth obscured the inspection somewhat. The remainder of the wall remains in fair condition. Beach levels were low enough in places to show that some of the toe piles on the more northern section are severely corroded with some voiding visible.

The drainage holes appear mostly in working order and the local area of wall containing ties shows no obvious signs of deflection.

In front of the Sun Court (/1301C28), the wall has a concrete 'nosing' intended to act as a wave deflector below the parapet. Previous repairs to this element remain effective. The concrete toe beam was partially exposed along the length of the Sun Court and visible sections appeared in fair condition.





Masonry sea wall at The Spa access steps in fair overall condition (/1301C27)

Example of gaps between blocks in sea wall (/1301C27)



Longitudinal cracks across blocks in sea wall (/1301C27)



Previous repairs to wave deflector wall in front of the Sun Court & concrete toe submerged beneath high beach levels (/1301C28)

The wall between the Sun Court and the closed colonnade (/1301C29), remains in fair overall condition but has several small open joints. Along the closed colonnade section (/1301C29) there have been a number of patch repairs undertaken over the preceding two years. The lower splash beam, below the bricked-up openings has been repaired and where repaired is in good condition. Elsewhere however along this wall the condition remains fair due to evidence of spalling, loss of concrete and open joints. Previously, repairs have been undertaken to the adjacent steps. The pillars between adjacent in-filled openings show some minor cracking and spalling.





Spalling to the lower splash beam at closed colonnade section and undercutting at toe (/1301C29)

Area of repairs undertaken adjacent to the steps (/1301C29)

Along the open colonnade section (1302C01) there are three flights of access steps from the lowlevel promenade to the beach, all of which are heavily abraded. The wall itself is in generally in poor condition despite previous December 2013 repairs remaining effective, with significant areas of open joints in other sections of the lower wall. During the 2020 inspection it was noted that works have been undertaken to support the upper promenade from beneath. The works are formed from a framework of galvanised steel columns set into square plinths. A horizontal I-section beam runs the full length of low-level promenade between the galvanised steel columns. The steelwork and concrete works are in as built condition. The concrete support pillars which form part of the original structure remain in a poor condition. The underside of the upper promenade deck is in poor condition with cracking, spalling and corrosion staining visible. Further repairs were noted to the face and toe of the lower wall. The repairs were noted as being in good condition with the original sections in fair condition. The access steps to the beach at the southern tie-in have been subjected to extensive repairs following previous damage in December 2013.



Repairs to lower wall at the open colonnade are in good condition with remaining sections of original wall in fair condition. (/1302C01)



Previous repairs at southern tie-in following December 2013 storm damage (/1302C01)





Steel columns and support beam supporting Concrete plinths in as built condition (/1302C01) upper promenade (/1302C01)



Damage to underside of upper promenade (/1302C01)

South Cliff Gardens – MU 22B/3 and 22B/4

The low stone wall at South Cliff Gardens (/1302C03) has had a considerable number of repairs and rebuilding over the last few years, however notable cracks and gaps remain in need of further attention. The wall remains largely unchanged in 2020.



Overall fair condition of low stone wall (/1302C03)



Overall fair condition of low stone wall and access steps (/1302C03)

The low stone wall continues at the rear of the promenade around South Cliff Gardens with a seawall in front (/1302C02). The seawall has a considerable number of historic repairs to the blocks and coping. Several repairs have been made since the previous inspection including repairs to a damaged section of the coping, the upper splash wall and at the southern end of the wall to the bagwork tie-in wall. At the southern tie-in the upper courses of the wall have been replaced with a tiered concrete wall which sits upon the original bagwork. The repairs which have been made to the defences have improved the overall condition of the wall to fair with the repairs remaining in good condition.

During the 2020 inspection works were ongoing to the slope at the rear of the low stone wall beneath the Clock Tower Café. Construction plant was noted as using the promenade which runs along the seawall (/1302C02) to transport material from the site. Access steps leading from the promenade to the Clock Tower were closed and Heras fencing restricted view of some parts of the wall.



Overall fair condition seawall is fair (/1302C02)



Bagwork/screed wall (/1302C02)



Repairs to wall face (centre) and coping (upper right) in good condition. Further spalling and damage visible (mid right) (/1302C02)



Repairs to splash wall on promenade in good condition (/1302C02).

South Bay Pool MU 22B/5

A concrete block wall (/1303C02) extends around the infilled lido pool, which is now used as a Star Disc. This wall has slightly stepped blocks on its face and these blocks and the wave return capping beam showed continued signs of considerable abrasion. Some areas of the wall have been subject to beneficial repairs, but there are numerous other areas of open joints. In one location, a failed outfall pipe extends across the foreshore. The wall's condition has previously been classed as poor and ongoing repairs/maintenance would be beneficial. It was notable in 2020 that one section of the wave return capping beam has been repaired and is in good condition.



Concrete block wall with open joints and heavy abrasion (/1303C02)



Previous repairs to wave return coping (/1303C02)

Holbeck Gardens MU 22B/6

There is a bastion groyne at the north of this frontage (/1304C02) which has trapped sand between here and the rock revetment around the Holbeck Hall landslide to the south. The lower sections of the backing seawall have areas of previously repaired and currently heavily abraded coping, with previous repairs also evident on the upper wall. The promenade deck which sits above the wall has been closed due to rockfall from the cliffs to its rear and as such could not be inspected along its full length. It was possible to view the promenade from a distance from the south and the condition appeared poor with evidence of extensive cracking.



Bastion groyne in overall fair condition (/1304C02)



Seawall in overall poor condition Cracks to bastion throughout. Mortar missing between blockwork in lower wall. Corroded handrail with missing sections. Full height cracks through uppermost wall. (/1304C02)



Upper prom has been fenced off and is in poor condition (/1304C02)



Missing pointing / open joints and damaged parts of upper and lower capping beam (/1304C02)

Holbeck Cliff MU 22B/7

The rock armour revetment (/1304C01) defending the relict debris flow lobe at the site of the Holbeck Hall landslide remains in good condition in 2020, with the armour tightly packed and good coverage. At the southern end of the defence the beach access ramp has a vertical drop to rocks onto the beach making its use difficult and there a crack in the most seaward concrete section which would benefit from repair. The condition of the slipway is such that it does present a health and safety risk to members of the public who may choose to access the beach in this location.



Rock revetment around debris lobe of Holbeck Hall landslide (/1304C01)



Vertical drop and crack in concrete at end of access ramp at south end of revetment (/1304C01)



Rock revetment around debris lobe of Holbeck Hall landslide (/1304C01)

3.20 Management Unit 23 – Holbeck to Knipe Point

Coastal Slope Condition Assessment

This Management Unit consists of a large number of units, from MU23/A in the north to MU24/A7 at Knipe Point in the south.

Unit MU23/A is located immediately south of the Holbeck Hall landslide run-out lobe and is classified as Partly Active. This unit has well-vegetated upper slopes, but the cliff experiences ongoing marine action and rockfalls.

Units MU23/B continues to be also classified as Partly Active in 2020.

Unit MU23/C is well-vegetated in the upper cliff but with a steep and eroding cliff toe and remains classified as Partly Active in 2020.

Units MU23/D1, MU23/D2 and MU23/D3 are located at Wheatcroft Cliff above Black Rocks. These units are active down much of their length, with ongoing recession of the headscarp, slumping in the mid-slope and erosion of the toe. They are classified as Partly Active in 2020.



MU23/A Partially active evidence of significant amount of fallen rock at toe of cliff



MU23/D Partially active with ongoing recession at the headscarp

View from MU23/A to MU23/D3 All Partly Active

Unit MU23/E is located at White Nab and remains classified as Locally Active in 2020. The slopes of this unit support some vegetation cover with intermittent areas of more intense erosion mid-slope and at the unit toe.

Unit MU23/F is a narrow, thin unit which follows a small valley occupied by an outflow channel for a pipeline and pumping station. The slopes inland are well vegetated and show very little evidence of recent activity. As a result, this unit has been classified as Inactive in 2020. Works have been undertaken to repair the Yorkshire Water outfall at this site relatively recently (with a replacement long sea outfall scheduled to be built in the future).





View from MU23/F to MU23/J (status varies as MU23/I4 and MU23/J (Knipe Point). below)



Headscarp recession has encroached on footpath. Note temporary boards to stabilise and mark path edge **MU23/F.**

Headscarp recession encroaching on footpath along **MU23/I.**

Units MU23/G1 and MU23/G2 form the northern part of Frank Cliff and are both classified as Partly Active in 2020. The upper slopes of these units support some vegetative cover. The unit toes are highly active with evidence of rockfalls, slumping and sliding onto the beach below.

Unit MU23/H forms the headscarp and upper zone of a large mudslide embayment at Frank Cliff. Little erosion is evident, and it is classified as Locally Active in 2020. Unit MU23/H2 forms the main body of the mudslide and has a greater level of activity, and is classified as Partly Active. The mudslide toe comprises a series of smaller mudslides forming units MU23/H1, MU23/H2a, MU23/H2b and MU23/H3. In 2020, Partly Active status has been retained for these lower units due to evident toe erosion.

Unit MU23/I comprises the main body of the Cornelian Bay mudslide and was classified as Locally Active in 2020. Although the overall condition of this management unit remains unchanged in 2020 it is worth noting that ongoing headscarp recession within the unit continues to pose a risk to the footpath and indicates a small degree of activity. **Units MU23/I1, MU23/I2 and MU23/I3** form smaller mudslides at the toe of unit 23/I. All these units have been classified as Locally Active.

Unit MU23/I4 is situated on the north side of the Knipe Point headland and is composed of soft glacial material. The unit was downgraded from Totally Active to Locally Active in 2012 before being upgraded to Partly Active in 2018, a grading it retains in 2020 due to ongoing erosion.

Unit MU23/J is also located on the north side of Knipe Point. This unit is composed of hard, well jointed rock and was upgraded from Locally Active to Partly Active in 2014 due to the actively

receding toe and exposed bedrock in the mid-cliff which is a source of rockfall. This classification is retained in 2020.

Coast Protection Asset Condition Assessment

There are no coastal defence assets within this Management Unit.

3.21 Management Unit 24 – Cayton Bay

Coastal Slope Condition Assessment

This Management Unit is divided into two Sub-management Units.

MU24A – Cayton Bay North

This Sub-management Unit consists of units MU24/A and MU24/A2, MU24/B and MU24/B1 to MU24/B10.

Immediately south of Osgodby Point, unit MU24/A comprises mudstone at beach level of the Cayton Cliff landslide complex. The wide expanse of Cayton Cliff is capped by till which is heavily vegetated. Significant recession of the head scarp occurred during an event in 2008-2009, resulting in the loss of land and properties at Knipe Point Drive. The cliff at the toe of the complex is steep and comprises uplifted debris from deep landslide movement. Only localised activity is evident at the toe and head scarp, with no evidence for movement in the body of the landslide, and so the unit is Locally Active in 2020, unchanged since 2012. The only notable change was that the upper beach levels appeared around 300mm lower around the toe of the debris lobe when comparing with the previous 2018 inspection. This does not seem to be causing an increase rate of erosion at the toe. The southern face of Knipe Point (subunit MU24/A7) was found to be Partly Active in 2020, as it has been since 2008.



Heavily vegetated till of Cayton Cliff. MU24/A Locally Active in August 2020



Toe of Cayton Cliff. MU24/A Locally Active in August 2020



Toe of Cayton Cliff. MU24/A Locally Active in MU24/A7 Partly Active in August 2020 August 2020



Tenants' Cliff is a complex of terraced landslips in mudstone and sandstone and is divided into 11 units. Unit MU24/B forms the main part of the Tenants' Cliff landslide and is classified as Inactive in 2020, no change from 2016. The toe of Tenants' Cliff is categorised into ten smaller landslide units comprised of massive displaced blocks of sandstone. The most northerly unit (MU24/B1 is classified as Locally Active. Along the toe of these units there is an ongoing accretion of pebbly material with the beach profile increasing in gradient into MU24/B2 which was observed to be Partly Active in 2020, downgraded from Locally Active in 2018. MU24/B3 to MU24/B8 remain classed as Partly Active in 2020. At MU24/B9, where there is intense ongoing erosion of the unit toe, is classified as Totally Active. It was also noted that various ad hoc repairs have been made to the walls northern extent to counteract the outflanking caused by the retreat of this unit. All these units are classified the same as they were in 2020 with the exception of MU24/B2. MU24/B10 is protected by the seawall which extends northwards from the pumping station. During the 2020 survey it was completely vegetated and is classified as Inactive.



Heavily vegetated part of Tenants' Cliff complex. **MU24/B** Inactive in August 2020



Toe of Tenants' Cliff complex. **MU24/B1** Locally Active in August 2020



Toe of Tenants' Cliff complex. **MU24/B4** (right) to **MU24/B6** (left) Partly Active in August 2020



Intense erosion in **MU24/B9** (Totally Active in August 2020)

MU24B - Cayton Bay South

This Sub-management Unit consists of units MU24/C to MU25/T.

Units MU24/C to MU24/O are composed of glacial till down to beach level and stretch south from the pumping station as Killerby Cliffs. Apart from MU24/F, MU24/G, MU24/H, they are all classified as Partly Active in 2020, unchanged from 2014. The Partly Active units show active recession of the head scarp and slumping in mid and lower slopes. At the cliff toes, there is evidence of instability through slumping and erosion. The exception to the Locally and Partly Active classifications is MU24/H which comprises the access route to the beach. The slope of this unit is engineered and well vegetated, with no obvious signs of recent activity, and so is classified as Inactive. The large bowl to the west of the beach access comprising of MU24/F and MU24G was noted as being well vegetated in 2020 with only some minor erosion of the toe, as such these units are classed as Locally Active. To the east of the beach access at MU24/I and MU24/J there is activity throughout the head scarp, and so both units are now classified as Locally Active. In the south-central units (MU24/K to MU24/O), the slumped till may be masking bedrock in the lower cliff. These cliff units show ongoing slumping and erosion and remain classed as Partly Active in 2020.





Toe of Killerby Cliffs. **MU24/C** Partly Active in August 2020

Till of Killerby Cliffs. **MU24/D** Partly Active in August 2020



Vegetated till slopes of Killerby Cliffs. **MU24/F** and G Locally Active in August 2020



Toe of Killerby Cliffs. **MU24/I** Partly Active in August 2020.



Toe of Killerby Cliffs. **MU24/J** Partly Active in August 2020



Till of Killerby Ciffs. **MU24/M1** (right) and **MU24/M2** (left) (both Partly Active in August 2020)

Units MU24/P to MU25/T are predominantly exposed near-vertical sandstone at the toe of a steep cliff overlain by mudstone with a thin capping of till. The sandstone is characterised by local rock falls on to the beach and platform with local small debris cones off the base of the mudstone. In 2016 all units MU24/P to MU25/T were downgraded from Partly Active (in 2014) to Locally Active. In 2018 MU24/P, MU24/Q and MU24/T showed further signs of activity and so regained their Partly Active status. Following the 2020 walkover inspection MU24/R and MU24/S have also regained their Partly Active status, meaning all units return to the same condition rating as 2014.

Due to the activity within cliff units MU24/L and MU24/M1 and the retreat of the headscarp at the boundary between the two units a historic WW2 pill box is significantly undercut and at imminent risk of collapse. In the 2020 walkover inspection it was noted that the undercut concrete base of the structure has collapsed and now rests high on the cliff face and is at risk of sliding onto the beach. Due the nature of the cliff units the structure poses a significant imminent risk to beach users. Additionally, the structure is easily accessible from the Cleveland Way path atop the cliff units, and has become a landmark feature. During the 2020 inspection several individual members of the public were seen standing on the structure, seemingly unaware to the degree it was undercut. Due to the high numbers of tourists anticipated to visit British beaches and coastal paths during the summer of 2020 the condition of the pill box presents an immediate concern.

Due to the difficulties associated with placing signage on the beach, and the inherent risks associated with access to the structure, options to minimize the risk to the public are not straightforward and will require some consideration.



Looking from up from the beach at the base of **MU24/M1** in September 2018.



Looking from up from the beach at the base of **MU24/M1** in August 2020.



Composite sandstone and mudstone cliffs in south Cayton Bay. **MU24/P** (right) and **MU24/Q** (left) (both Partly Active in August 2020)



Local rock fall and debris cone in **MU24/P** (Partly Active in August 2020)

Coast Protection Asset Condition Assessment

MU24A – Cayton Bay North

There are no coastal defence assets within this Sub-management Unit.

MU24B – Cayton Bay South

Cayton Bay is predominantly a natural bay, mostly free from coastal defences. However, there are a series of defences at Cayton pumping station, which extend to the beach access ramp to the south.

To the north of the pumping station (which is now converted to a private residence) is a private blockwork defence with concrete toe slab (/1402C02), which ties into the eroding cliffs to the north with a mixture of brick, stone blocks and concrete. The wall itself remains in fair condition and appears newer than the wall to the south. At the interface with the adjoining defence to the south there is evidence of leaching and moisture draining down the face of the wall from the cliff unit above. During the 2020 inspection it was noted slightly higher beach levels have in part covered a large void in the apron of 1402C02. The depth of the void is unknown however in the previous inspection it appeared to be in the order of 2 metres and may be encroaching beneath the base of the wall. Despite the higher beach levels in 2020 It is recommended that further investigation of this defect is undertaken determine the risk to the wall's stability. The remainder of the toe is in poor condition and is undercut in several places. The erosion of the undefended cliff immediately to the north of the tie-in appears to have slowed. Between 2012 and 2014, the wall became outflanked but in recent years it does not appear to have worsened. Despite this the northern transition remains at risk of being compromised by rockfall and erosional activity in this cliff unit.



Private sea wall in fair condition. Large void visible in wall apron. (/1402C02)



Erosion of undefended cliffs at tie-in of sea wall private sea wall (/1402C02)



Undercutting of concrete apron to private sea wall (/1402C02)



Private sea wall in fair overall condition but with the toe apron subject to ad hoc repairs (/1402C05)

There is a complex series of private blockwork and concrete sea walls (/1402C05) protecting the main pumping station building.

The condition of the defences varies with the higher, red brick walls appearing sound, the lower, concrete and sandstone blockwork remaining in fair condition but the apron at the toe being the worst affected. There was no notable change between the 2018 and the 2020 inspections. Numerous ad hoc repairs were noted as being in a variety of conditions with the lower grouted repairs being the worst affected. In some locations undercutting of the concrete apron is visible, and particularly around the apex of the bend in the structure, marine vegetation may have obscured further voiding. One sizeable void was noted higher up on the apron, the void is not new and does not appear to have increased in size however the depth and size of the void is unknown and requires further investigation.

Overall, the structure remains in fair condition following the 2020 inspection however, it is suggested that the condition is monitored closely if beach levels recede.



Private sea wall in fair overall condition but with Localised void in apron of private seawall the toe apron subject to ad hoc repairs and localised undermining (/1402C05)



(/1402C05)

Between the southern end of the pumping station defences and the landing of the beach access steps, there is a length of defence (/1402C04) which exhibited major undercutting and blockwork loss leading to washout of backing material observed during the 2016 inspection. Numerous repairs were made to the defence including a new section of mass concrete wall, repairs to the decking and infilling of the large voids created by washout of fill material. Beach levels along this section are up to 0.4m higher than in 2018, meaning undercutting and voiding which has previously been reported in this location is now partially concealed. Despite the repairs made following the damage in 2016 the defence remains in very poor condition and is considered a risk to the public due to; potential voids within the structure, the great variation in surface condition of the deck's slab and the localised outflanking and undermining of the footpath and upper retaining wall fronting the vegetated slope. It was also noted during the 2020 inspection that the mass concrete repair made to the wall following the 2016 inspection is itself now undercut and outflanked at one end. At the interface with the adjoining asset to the east (/1402C04), the wall continues to be undercut and there are numerous voids in the wall face.



Damage to seawall in June 2016 (/1402C04)



Seawall in August 2020. (/1402C04)



Undercutting at toe leading to voiding behind and break-up of deck (/1402C04)



Mass concrete repair to damaged section of wall note undercutting in foreground. (/1402C04)



Voiding and undercutting of structure at the interface between (/1402C04) and (/1402C06).



Deckslab repairs in fair condition. (/1402C04)



Missing blockwork in August 2020 (/1402C04)



Continued outflanking of upper retaining wall (/1402C04)

The concrete structure at the beach landing of the public access point remains in a very poor condition with large cracks and voids throughout (/1402C06). Ongoing maintenance activity, comprised of a poured concrete skim over much of the deck of structure, has covered and filled most voids resulting in a reduced the risk to the public. However, slumping and erosion in the cliff at the rear of the structure continue to threaten the upper access steps and structure as a whole. During the 2020 inspection the beach levels across Cayton Bay were found to be higher than in 2018, not quite returning to the 2016 levels. This is evidenced by an approximately 300mm rise in the beach level at the lower access steps, seen in the images below. During the 2020 inspection is was noted that the lower step has been extended at lower beach access steps. This has reduced the risk to members of the public accessing the beach via the steps. Due to higher beach levels it was not possible to examine the base of the platform or whether there is an additional lower step. It is recommended that this structure is urgently demolished, removed and replaced with a simple, safer and more adaptable public access.



Beach access in 2018 (/1402C06)



Beach access in 2020 (/1402C06)





Concrete skim repair has filled voids and cracks (/1402C06)

Concrete skim repair to deckslab in fair condition (/1402C04)

In addition to the damage sustained to the defence to the north of the beach access steps, the structure is also being undercut and outflanked at its western end and towards its rear. The footpath which runs up the bank towards Lucy's Shack is being undercut. A retaining sheet pile wall is effectively supporting the path; however, it can only be a temporary solution due to the risk of further outflanking and undermining.



Damage to rear of structure, washout of fill material (/1402C06)



Undermining of footpath beneath 'Lucy's Shack' (/1402C04)

Despite recent reactive repair work the condition of the defences at the Cayton Bay pump house access remains classified as very poor in 2020. The structures present a significant health and safety risk to the general public. It is recommended that access arrangements to Cayton Bay at this location are re-evaluated at the earliest opportunity in line with the *Filey & Cayton Bay Coastal Strategy*.

Around 300m south of the pumping station beach access, there is beach access point for the path from the public car park at the surf shop. There are a set of beach access steps that were previously protected by gabion baskets, which have distorted and split under wave action. This is not a formal coastal defence, so has no asset number. The structure presents a health and safety risk to the public due to the partially unprotected edges and is at risk of collapse due to outflanking and undermining.



Failed gabion baskets at surf shop car park beach access (no asset reference)



Failed gabion baskets at surf shop car park beach access (no asset reference)

3.22 Management Unit 25 – Lebberston Cliff and Gristhorpe Cliff

Coastal Slope Condition Assessment

This Management Unit consists of units MU25/U at Lebberston Cliff to MU25/AE at the eastern end of Gristhorpe Cliff.

Unit MU25/U is located above Red Cliff Hole and is classified as Locally Active in 2020, unchanged from 2016. The steep cliffs are characterised by localised areas of erosion, but are otherwise well vegetated.

Unit MU25/V is located at Lebberston Cliff and comprises a large, periodically active mudslide system. The unit appears to be prone to regular change and recession. Furthermore, in 2020 the headscarp shows signs of recent activity and now encroaches on the route of the footpath. This unit was downgraded from Totally Active to Partly Active following the 2012 walkover and this grading has been retained for 2020.



Composite sandstone and mudstone cliffs in south Cayton Bay. **MU24/T** (right) to **MU24/U** (left) (both Locally Active in Au)



MU24/V - view from directly above the mudslide (Partly Active). [Reproduced from August 2014].

Unit MU25/W is situated at Red Cliff Point and ongoing headscarp activity has caused this unit to retain its Partly Active status in 2020.

Unit MU25/X is classified as Partly Active in 2020. Despite being well vegetated, the slopes of this unit are subject to ongoing instability, with evidence of mud sliding and recession at the headscarp.

Units MU25/Y and MU25/Z are located at the northwest end of Gristhorpe Cliff and are classified as Partly Active in 2020. These units are characterised by numerous areas of activity, with ongoing headscarp recession, slumps across the mid-slope and erosion at the toe.

Unit MU25/AA comprises soft till cliff which continues to erode at the headscarp with slumping and sliding mid-slope. Marine erosion is apparent at the cliff toe and therefore a Partly Active status has been retained in 2020.

Units MU25/AB and MU25/AC form the main part of Gristhorpe Cliff and are adjacent to a caravan park. The upper cliff slopes are composed of soft glacial sediments and experience localised slumping, with headscarp recession. The face of the cliff is steeper with active erosion and formation of debris aprons. Unit **MU25/AB** is Partly Active, while **MU25/AC** is Locally Active. Neither unit has changed status since 2012.

Units MU25/AD and MU25/AE are similar in form to adjacent units MU25/AB and AC. There is some erosion of the headscarp and localised areas of more intense erosion on the lower slopes. These units are classified as Locally Active in 2020, unchanged since 2012.

Coast Protection Asset Condition Assessment

There are no coastal assets within this Management Unit.
3.23 Management Unit 26 – Newbiggin Cliff and North Cliff

Coastal Slope Condition Assessment

This Management Unit comprises **unit MU26/AF** in the northwest **to unit MU26/AX** just to the west of Filey Brigg.

Units MU26/AF, MU26/AG and MU26/AH are located at The Wyke, to the west of Newbiggin Cliff and are all classified as Locally Active in 2020, unchanged since inspections began in 2002. These units are characterised by a soft till overlying resistant rock cliff that is fronted by a debris apron. There is minor, localised activity within the till capping including recession of the headscarp in places. The rock cliff is largely stable, but the debris apron shows evidence of recent rock falls and is subjected to marine erosion.

Units MU26/AI and MU26/AJ form the western part of Newbiggin Cliff and are both classified as Partly Active in 2020. These units are of a similar form to the adjacent Locally Active units, described above. However, they are characterised by a greater level of activity within both the upper and lower cliff layers and less continuous vegetation cover.

MU26/AK and MU26/AL were changed in grading to Partly Active in 2016, having experienced widespread rockfalls and mudslides along their length. This status has been retained following the 2020 inspection. Recent activity was evident, particularly in MU26/AK where a large rockfall has occurred from the upper cliff, resulting in a large debris cone. it was noted that the debris cones along the base of these units have receded slightly indicating that the cliffs experience some degree of erosion along their toe. This may also indicate that they are not being recharged as regularly from activity in the cliff units above.



MU26/AF Soft till overlying resistant rock (Locally Active).



MU26/AK and MU26/AL Cliffs experiencing rockfalls and mudslides.

Units MU26/AM, MU26/AN and MU26/AO form the main part of Newbiggin Cliff and are classified as Locally Active in 2020, unchanged since 2002. These cliffs are again characterised by a soft upper layer, a hard rock middle layer and series of debris cones at the unit base. There is localised activity within these units, especially within the soft upper layer. All debris cones appeared reasonably stable and well vegetated with only localised areas of activity.

Unit MU26/AP was classified Partly Active in 2012 but downgraded to Locally Active during the 2014 survey. This classification has been retained in 2020 as there is no evidence of any increased activity.

Unit MU26/AQ was upgraded to Locally Active from Partly Active in the 2018 walkover inspection. There is no evidence of increased activity in 2020 and therefore the grading of Locally Active is retained.

Unit MU26/AR shows few signs of instability in the upper cliff and has been assigned Locally Active status in the 2020 survey.

Units MU26/AS to MU26/AT have all been assigned a status of Partly Active in 2020 due to intensive erosion of the headscarp. The remaining Units MU26/AU to MU26/AX retain their Locally Active status in 2020. These cliffs are comprised of soft glacial sediment and exhibit only localized, rather than widespread, erosion in the form of headscarp recession and mud sliding. There is also localised marine erosion of the toe.



MU26/AT Ongoing recession of the headscarp (Partly Active).



MU26/AZ and MU26/AX Shallower more stable slopes of easternmost assets in MU26.

Coast Protection Asset Condition Assessment

There are no coastal assets within this Management Unit.

3.24 Management Unit 27 – Filey Brigg

Coastal Slope Condition Assessment

This Management Unit comprises units MU27/AY to MU27/O on the northern and southern sides Filey Brigg.

Units MU27/AY and MU27/AZ both have a similar form to those units described in Management Unit 26, with till overlying rock cliffs and both are classified as Locally Active in 2020. The upper slopes are generally well vegetated and show intermittent zones of activity in the form of headscarp recession and rilling of exposed sediment.

Units MU27/BA to MU27/BD are located on the northern side of Filey Brigg and are all Partly Active in 2020. The upper slopes of these units support some discontinuous vegetation cover. Headscarp recession, localised mudslides and rilling are common in the upper till unit.

Unit MU27/BE, and 27/BF are also located on the northern side of Filey Brigg but until 2012 were less active than adjacent units. However, much of the upper slopes have been unvegetated and eroding since then and both retain classification of Partly Active in 2020.

Units MU27/A and MU27/B are located at the tip of Filey Brigg. Both remain classified as Partly Active in 2020. These units are composed entirely of the soft glacial material which is particularly susceptible to erosion. There is frequent mud sliding within these units.

Units MU27/C to MU27/G are located at the eastern end of the south side and of Filey Brigg. The cliffs are composed predominantly of vegetated glacial till with a low underlying cliff of limestone and sandstone to beach level. They contain local mid-slope activity and erosion of the cliff toes and are therefore classified as Locally Active in 2020, no change since 2012.

MU27H and MU27/I are in the central part of the south side of Filey Brigg and are variously vegetated and unvegetated. These units comprise simple mudslides, each with an arcuate head scarp and elongate flow tracks. They are classified as **Partly Active** in 2020, unchanged since 2016.

Units MU27/J to MU27/O are also located on the south side of the Brigg at its western end. They are predominantly unvegetated and are undergoing intense erosion. Therefore, they are classified as **Totally Active** in 2020.



Mainly unvegetated and eroding upper slopes on the north side of Filey Brigg. **MU27/BE** (Partly Active in August 2020)



Headscarp recession and mudslides in upper till unit on north side of Filey Brigg. **MU27/B** (Partly Active in August 2020)



Composite cliffs on the south side of Filey Brigg. **MU27/C** (right) to **MU27/F** (left) (**MU27/C** Partly Active, the remainder Locally Active in August 2020)



Composite cliffs on the south side of Filey Locally Active around access steps in 2020



Composite cliffs on the south side of Filey Brigg. **MU27/J** (Totally Active in 2020)



Composite cliffs on the south side of Filey Brigg. Central area Partly Active in 2020.



Composite cliffs on the south side of Filey Brigg. **MU27/K** (right) to **MU27/N** (left) (all Totally Active in 2020)



Composite cliffs on the south side of Filey Brigg. (all Totally Active in 2020)



Composite cliffs on the south side of Filey Brigg. (all Totally Active in 2020)

Coast Protection Asset Condition Assessment

There are no formal coast protection structures in this unit. However, at the eastern end of Filey Brigg a cabin structure and wall exists, tucked away against the cliffs. The structure comprises of a blockwork wall, poured concrete apron and blockwork cabin build onto the cliff strata. The previous inspection noted that undercutting is occurring to the apron as well as washout of the joints to the wall, the cabin is in structurally sound condition. Access is restricted due to the eroded path leading to the asset and as it is not a formal coast protection asset and has not been inspected since 2012.

3.25 Management Unit 28 – Filey Bay North

Coastal Slope Condition Assessment

This Management Unit is divided into two Sub-management Units; MU28A – North of Filey Town and MU28B – Filey Town Frontage.

MU28A – North of Filey Town

This Sub-management Unit consists of units MU27/P to MU27/X, located to the north of Filey town. **Units MU27/P to MU27/S** are situated below the North Cliff Country Park. These cliffs are composed of glacial till down to beach level and are undergoing erosion down much of their length.

The erosion is particularly intense along the steep toes in **MU27/R** through to **MU27/P**. Although At mid- and upper-slope levels, there is greater vegetation cover then compared to the cliff units on Filey Brigg itself, the erosion is wide-scale and therefore these units have been upgraded to **Totally Active** in 2020. **MU27/S** remains classified as **Partly Active** due to greater percentage of vegetation coverage.

Unit MU27/T surrounds the boat yard storage and comprises glacial till down to beach level. The cliff slope is relatively shallow with an exposed eroding toe, and shallow slumps across better vegetated mid- to upper slopes. This unit is classified as **Partly Active** in 2020, unchanged since 2014.

Unit MU27/U surrounds Filey sailing club is generally well vegetated but local erosion of the headscarp was noted. This unit remains classified as **Locally Active**.



Till cliffs between Filey Brigg and Filey sailing club. **MU27/Q** Partly Active in 2020





Till cliffs between Filey Brigg and Filey sailing club. **MU27/R** (right) to **MU27/T** Partly Active in 2020

Till cliffs between Filey Brigg and Filey sailing club. **MU27/Q** (right) to **MU27/R** Partly Active



Till cliffs at Filey Sailing Club. **MU27/T** Partly Active in 2020

Units MU27/V and MU27/W are located between the sailing club and the north end of Filey seawall. These units are classified as **Partly Active** in 2020 with large-scale head scarp recession, slumping throughout the profile and erosion at the toe. Cliff warning signs have been dislodged indicating slope movement.

Unit MU27/X is located behind the northern end of Filey seawall and town. It is classified as **Inactive** in 2020, downgraded from Locally Active in 2014.





Till cliffs between Filey Sailing Club and Filey town. **MU27/V** Partly Active in 2020

Till cliffs between Filey sailing club and Filey town. **MU27/W** Partly Active in 2020

MU28B – Filey Town Frontage

This Sub-management Unit consists of units MU28/Y and MU28/Z at Filey town.

Units MU28/Y and MU28/Z are located behind Filey seawall and town. They are classified as Inactive in 2020.

Coast Protection Asset Condition Assessment

MU28A – North of Filey Town

To the north of the town, Filey Sailing Club is located at the back of the beach and is partly protected by some coastal defences. However, the section of cliff below the boat park (which is located on a terrace part way up the cliff) north of the club building is undefended (/1601C01) and suffering active slumping along its length.

Immediately north of the club building there was formerly a defence structure (/1601C02) that consisted of timber breastwork retaining rock armour. However, all that remains of this now failed structure is the rock debris scattered on the beach. This asset is unchanged since 2018.





Undefended cliffs below boat storage yard R (/1601C01) b

Remnants of former defences north of club building (/1601C02)

At the club building, there is a section of sheet piling (/1601C03) which showed significant corrosion leading to sizeable holes forming in the steel in the central section and voids behind due to wash out of material in May 2015. At that time, the concrete slipway had been repaired not long before and the southern sections of steel piles had been replaced between 2009 and 2012. However, repairs have been made since May 2015 and the sheet piling is now in good condition, although minor surface corrosion noted. High shingle levels concealed much of the lower sheet piles during 2020 inspection, including the outfall. The scour hole (approx. 2m depth) that was noted at the northern end of the promenade in 2018 has since been repaired with concrete.



High shingle levels obscuring much of the sheet piles (/1601C03)



Repaired scour hole at northern end of promenade (/1601C03)



Undercutting of boatyard ramp (/1601C03)



Slipway cleared of cliff debris (/1601C03)

The previously repaired lower section of the access slipway remains in good condition. However, the undercutting of the section above this, reported previously, has deteriorated and requires attention. The earth movement onto the slipway has been cleared.

MU28B – Filey Town Frontage

The Filey Town frontage is protected by a sea wall just over 1km in length between Coble Landing in the north and Martin's Gill at the south and is split into 9 asset lengths. The sea wall generally remains graded in fair condition in the 2020 inspection. Although it shows evidence of minor, localised defects including cracks and chipping within the capping beam, surface abrasion to the face of lower blocks and mortar loss. However, the significant number of repairs and maintenance works to the defences between 2012 and 2014 are working effectively. The description of the inspection runs from north to south.

The most northerly asset in the defence system consists of the rear wall and slipway at Coble Landing (/1602C01). The slipway blockwork appeared in fair condition although high sediment levels concealed much of the lower slipway. As noted during previous inspections, the rear wall below the chalets has several horizontal cracks in the wall and is in fair to poor condition. The concrete cope beam, observed being replaced in the 2018 inspection, remains in good condition. The concrete rear ramp/wall is in poor condition with heavy abrasion, particularly at the wall joint, and voids in the deck towards toe of structure.



Voids in deck of rear ramp/wall at Coble Landing (/1602C01)



Heavy Abrasion damage to the rear wall (/1602C01)





Longitudinal cracks in rear wall, open joint Coble Landing slipway blockwork in fair condition (/1602C01) (/1602C01)

The next asset (/1602C09) is essentially a wing wall protecting the slipway, it remains in fair condition. Repairs to this wall were made between 2012 and 2014 and are holding well. Further repairs to the toe apron were observed in 2018 appear in good condition. The undercutting of the end of wall does not appeared to have worsened.





Previous repairs to slipway 'wing-wall' U (/1602C09)

wing-wall' Undercutting at end of *wing-wall'* (/1602C09)

The wall located north of Ravine Road (/1602C06) is in fair overall condition, although there are areas of damage that have been previously repaired. There are cracks / washed out joints / missing mortar between the masonry blocks at several locations.





Sea wall near Ravine Road in fair condition (/1602C06)

Occasional open joints with missing mortar (/1602C06)

The sections of sea wall between Ravine Road and the access point east of Cargate Hill Road (/1602C08) and between Cargate Hill Road and Crescent Hill (/1602C03) are both in fair overall condition, although in some sections several blocks have abrasion damage to the front face, particularly just above beach level. Many of the splash coping blocks have been replaced along the length of these assets, but others are cracked or damaged. The damage appears to get worse with progression south and is mainly focused around the lower blockwork or upper splash wall / coping.



Damage to coping/wave return on seawall south Previous repairs to coping and wave return of Ravine Road (/1602C08)



feature (/1602C08)



Abrasion damage and open joints in sea wall south of Cargate Hill (/1602C03)



Abrasion damage, several leaking joints (/1602C03)

The next defence assets to the south are the wall around the Royal Parade promontory (/1602C04) and the wall between here and the southern-most promontory (/1602C07). These sections of wall are in fair overall condition (including previous repairs to one long vertical gap between adjacent blocks running over half the height of the wall), although there is cracking to the coping and numerous abraded, chipped or damaged blocks. Previous repairs to the lower section of the access steps at Royal Parade are holding well but the cracks and open joints in the southern set of access steps makes it vulnerable to damage during storms.



Access steps in fair condition (/1602C04)



Historic horizontal cracking (/1602C05)

The southernmost section of the main wall includes the southern promontory and the return section to Martin's Gill (/1602C05). This structure is overall in fair condition, although there is chipping and cracking to the coping in small areas throughout length and numerous lower blocks area abraded. Cracks in the side wall to the slipway / access ramp at the southern end of the wall appear to have been filled. A drainage pipe behind the slipway was noted to be broken and it appears there has also been some washout of stone material.

A short section of rock revetment with gabion baskets beneath is located at the southern end of the sea wall near Martin's Gill (/1602C02). This defence extends into Sub-management Unit MU29A and is intended to manage the interface between the hard defences to the north and eroding natural cliff to the south. The rock armour has been re-profiled on occasion after movement of some armour stones during storms. A depression in the crest of the gabion baskets and armour stones was noted, however it is believed this was present in 2018 and has not worsened. The coastal slopes behind the revetment still appear to be locally active and some form of improved outflanking defence remains necessary in the medium term.



Slipway / access ramp at southern end of Filey Sea Wall (/1602C02)



Broken drainage outlet and washout of material behind slipway (/1602C02)



Crest depression in rock revetment at southern end of Filey Sea Wall (/1602C02)



Crest depression in rock revetment at southern end of Filey Sea Wall (/1602C02)

3.26 Management Unit 29 – Filey Bay

Coastal Slope Condition Assessment

This Management Unit is divided into three Sub-management Units.

MU29A - Muston Sands

This Sub-management Unit comprises units MU29/AA to MU29/AI along Muston Sands.

Units MU29/AA and MU29/AI which are composed of glacial till down to beach level and stretch south of Filey town. **MU29/AA** to **MU29/AF** are all classified as Partly Active in 2020, unchanged from 2018. **MU29/AG** to **MU29/AI** have been downgraded to locally active in 2020. The entire length of cliff is partly vegetated and suffers from head scarp erosion and slumps and slides are causing failure throughout the cliff face. The toes are undergoing various degrees of marine erosion and it is for this reason that the units to the south have been downgraded.

The concrete ramp / outfall structure at the Primrose Valley access MU29/AI and MU29/AJ was notably undermined.



Till cliffs adjacent to Filey town. **MU29/AA** Partly Active in 2020



Till cliffs along Muston Sands. **MU29/AC** Partly Active in 2020



Till cliffs along Muston Sands. **MU29/AB** Partly Active in 2020



Till cliffs along Muston Sands looking North. **MU29/AD** in foreground Partly Active in 2020



Till cliffs along Muston Sands. **MU29/AE** Partly Active in 2020



Till cliffs along Muston Sands. **MU29/AH** Partly Active in 2020



Undermined concrete access ramp at MU29/AI and MU29/AJ



Till cliffs along Muston Sands. **MU29/AF** (left) Locally Active transitioning to **MU29/AG** (right) Partly Active in 2020



Till cliffs along Muston Sands. **MU29/AI** Partly Active in 2020

MU29B – Hunmanby Sands

This Sub-management Unit consists of units MU29/AJ at Mile Haven to MU29/BE2 at Hunmanby Gap.

Units MU29/AJ to MU29/AP are classified as Locally Active in 2020 (down from Partly Active in 2018). The slopes are generally well vegetated, although as reported in 2018 there is local signs of slumping in the profiles. The toe erosion is less significant than elsewhere along the frontage.

At **MU29/AQ** the Flat Cliffs coastal slope stabilisation project was complete in 2018 which included the installation of inclined sub-horizontal drains in the cliff and geotextile sand containers at the toe. The geotextile sand containers cliffs were fully buried with beach sediment, and therefore were not inspected. The toe of the cliff has continued to slowly retreat exposing, and damaging, the drainage pipes. It was noted that several of the drainage pipes were discharging water at the time of the inspection meaning they are still performing as intended.

At **MU29/AS**, the gabion baskets below the outfall pipe have been replaced with a concrete equivalent, no sewage was observed on the structure. The rising main thrust block at the toe of the cliffs continues to be undermined/outflanked locally.



Till cliffs along Hunmanby Sands, outflanking at concrete blocks. **MU29/AJ** Locally Active in 2020



Till cliffs along Hunmanby Sands. **MU29/AK** Locally Active in June 2020



Till cliffs along Hunmanby Sands. **MU29/AP** Locally Active 2020



Eroded toe of till cliffs exposing damaged drains at Flat Cliffs. **MU29/AQ** Partly Active 2020





Toe of till cliffs at Flat Cliffs. **MU29/AQ** Partly Active in 2020

Toe of till cliffs at Flat Cliffs. **MU29/AR** Partly Active in 2020



Replaced gabion baskets and outflanked rising main **MU29/AS** Partly Active in 2020.

MU29/AT is classified as Locally Active in 2020 (unchanged from 2018) as it is generally well vegetated and there is only local evidence for toe erosion or activity at mid to upper levels. More intense erosion was again present along the full height of the cliff adjacent Butcher's Gap, with evidence of recent mud slips.



Well vegetated till cliffs along Hunmanby Sands. **MU29/AT** Locally Active in 2020



More intense erosion locally at Butcher's Gap. **MU29/AT** Locally Active in 2020

Units MU29/BA to MU29/BE2 are located between Butcher Haven and Hunmanby Gap and are all classified as Partly Active, unchanged from 2018. These cliffs are steeper than further north and are characterised by head scarp erosion and common areas of intense erosion. The toe of the cliffs are active with slumping and sliding on to the beach. A failed gabion structure in management unit **MU29/BE2** should be removed from the foreshore.



Till cliffs north of Hunmanby Gap. **MU29/BB** Partly Active 2020



Till cliffs north of Hunmanby Gap. **MU29/BD** Partly Active 2020



Till cliffs north of Hunmanby Gap. MU29/BE Partly Active 2020



Till cliffs at Hunmanby Gap. MU29/BE2 Partly Active 2020

MU29C – Reighton Sands

This Sub-management Unit consists of units MU29/BF near Hunmanby Gap to MU29/BQ below Reighton Moor.

Unit **MU29/BF** includes Hunmanby Gap itself. This unit is partly shielded from wave erosion by unit **MU29/BG** and is classified as Locally Active in 2020, unchanged from 2016. **MU29/BG** to **MU29/BJ** are located south of Hunmanby Gap. These cliffs are steep and affected by intense erosion throughout most of their height. The head scarp is retreating and there is significant slumping on to the beach. **MU/29BG** to **MU29/BJ** are classified as Totally Active in 2020, unchanged from 2016. In **MU29/BH**, a small dilapidated masonry structure at crest of the cliff is at risk of collapsing onto the foreshore.



Intense erosion of till cliffs south of Hunmanby Gap. (MU29/BG – Toally Active) shielding Hunamby Gap itself (MU29/BF - Locally Active)



Intense erosion of till cliffs south of Hunmanby Gap. MU29/BH Totally Active in 2020





Gap. MU29/BI Totally Active in 2020

Intense erosion of till cliffs south of Hunmanby Intense erosion of till cliffs south of Hunmanby Gap. MU29/BJ Totally Active in 2020

Further south, units MU29/BK to MU29/BQ are located above Reighton Sands. These units are again classified as Partly Active in 2020. They are characterised by steep slopes partially covered in vegetation. There is recession of the head scarp, common areas of erosion in the mid-slopes and slumping on to the beach. The toes are steep and eroding.



Till cliffs at Reighton Sands. MU29/BL Partly Active 2020

Till cliffs at Reighton Sands. MU29/BM Partly Active 2020



Till cliffs at Reighton Sands. **MU29/BQ** Partly Active 2020

Coast Protection Asset Condition Assessment

There are no formal coastal defence assets within Management Unit 29, although the rock revetment and baskets extend into this Sub-management Unit from MU28B. See the Coast Protection Asset Assessment section for MU28B for details. There are no other coastal defence assets within this Sub-management Unit.

3.27 Management Unit 30 – Filey Bay South

Coastal Slope Condition Assessment

This Management Unit is divided into two Sub-management Units.

MU30A – Reighton Gap

Sub-management Unit MU30A is located beneath Reighton Sands Holiday Village and consists of units MU29/BR to MU29/CCa.

Units MU29/BR, MU29/BS and MU29/CA form the majority of this Sub-management Unit and are classified as Partly Active in 2020. These units are partially vegetated, and contain large slumps, erosion at their head scarp.



Till cliffs beneath Reighton Sands Holiday Village. **MU29/BR** Partly Active 2020



Till cliffs beneath Reighton Sands Holiday Village. **MU29/BR** *Partly Active 2020*



Till cliffs beneath Reighton Sands Holiday Village. **MU29/BS** Partly Active in 2020

Till cliffs beneath Reighton Sands Holiday Village. **MU29/CA** Partly Active in 2020.

Unit MU29/CB is at the eastern end of the holiday village. The unit exhibits mudslides and an eroding head scarp, and is classified as Partly Active in 2020. The pillbox has been bypassed by the retreating cliff crest and appears at risk of toppling. Unit **MU29/CCa** forms a shallow mudslide embayment extending on to the beach. The unit is classified as Partly Active.



Till cliffs in MU29/CB (Left) Partly Active 2020 Till cliffs in MU29/CCa Partly Active 2020

Sub-management Unit 30B comprises units MU29/CC to MU29/CJ above Speeton Sands.

Unit MU29/CC forms a large, shallow, well vegetated embayment known as Middle Cliff with a steep well-defined eroding toe in mud. There is also activity at the unit head and mid slope. The unit is classified as **Partly Active** in 2020.

Unit MU29/CD is similar to MU29/CC but with more recent activity in the form of slumps, slides, block failures and mudflows at the toe. As a result, this unit is classified as **Partly Active** (unchanged)



Toe of mud cliff in MU29/CC Partly Active 2020



Toe of mud cliff in **MU29/CE** lookings towards **MU29/CD** Partly Active 2020

Unit MU29/CE is similar in form to unit MU29/CC. It has been downgraded to Partly Active in 2020 due to the steep eroding toe along sections. The upper slopes remain well vegetated.

Units MU29/CF to MU29/CI are located at Speeton Cliffs and are all classified as Locally Active in 2020. These units are characterised by outcrops of chalk near the unit toes which are actively eroding onto the beach below. In places, the headscarp is near vertical and exposed.

The high chalk cliffs within unit **MU29/CJ** are much steeper than those to the north, with large mantles of slumped material at the unit toe. This unit can only be inspected from afar as the tide reaches the toe of the cliffs even at low tide. As in 2018, there is some evidence of rockfall and marine erosion at the cliff base but otherwise the cliffs appear fairly stable. It is classified as Locally Active in 2020.



Well vegetated upper slope above steep eroding toe **MU29/CE** Partly Active 2020



Eroding chalk outcrop at toe **MU29/CF** Locally Active 2020



Eroding chalk outcrop at toe **MU29/CG** Locally Active 2020



Eroding chalk outcrop at toe **MU29/CH** Locally Active 2020



View southwards looking towards MU29/CI and MU29/CJ Locally Active 2020

Coast Protection Asset Condition Assessment

There are no coastal defence assets within this Management Unit.

4. Comparison with Previous Assessment

4.1 Coastal Slope Condition Assessment

The clear majority (**approximately 90%**) of the 265 units surveyed during the 2020 walkover retained the same activity status as they had in 2018. Indicating little significant change along the frontage.

Around **4%** of the units exhibited a worsening in condition, mostly changing from Locally Active to Partly Active. Some of this is due to an actual change in conditions at the site, but it must be acknowledged that some may be attributable to different interpretations of classification gradings by different cliff inspectors (or by the same cliff inspections on successive surveys).

Around **6%** of units demonstrated an improvement in condition, mostly from Partly Active to Locally Active. Again, some of this will be attributable to actual improvements in stability, but some will be due to different interpretations of classification gradings by different cliff inspectors. The majority of the improved condition scores were seen to the south of Muston Sands in Filey, where a stretch of units were changed from partly active to locally active due to the lack of recent activity observed, especially when comparing against adjacent partly active units along the same stretch.

As was previously reported sustained levels of high erosion were observed along part of **Tenants' Cliff** within Cayton Bay, along the south side of **Filey Brigg** and at **Hunmanby Gap**.

The Scarborough Spa Slope Stabilisation scheme was completed in February 2020 and is designed to ensure that the stability of the slopes to the rear of the Spa Complex is improved for the next 100 years.

At the South Cliff Clock Café, a shallow-seated slippage occurred early in 2018 which lead to the collapse of a historic masonry retaining wall and resulted in the closure of the Victorian beach chalets. A capital scheme is underway to stabilise the slope and construct a new retaining wall and works are scheduled for completion in December 2020.

Within Filey Bay, the Flat Cliffs emergency works were completed in summer 2018. The works were designed to (temporary) improve the stability of the cliffs at the sole access road to the Flat Cliffs hamlet. The drainage pipes appeared to be working as designed during the 2020 inspection although the toe of the cliff has continued to retreat exposing many of the pipes.

The large landslip which was reported at **Port Mulgrave** following the 2018 inspection did not appear to have exhibited any further significant movement in the interim.

4.2 Coast Protection Asset Condition Assessment

Generally, the condition of the defences has not changed dramatically since the last inspections in summer 2018. Recent repair work was evident in many places and therefore conditions of some defences improved. However, some defences where repair work has not been undertaken have deteriorated and are now in further need of repair.

MU4 – Staithes

There is little change since the previous inspections in the condition grading of the defences within Staithes harbour, with the overall classification generally ranging from fair to poor.

The rock armour to the harbour breakwaters remains mostly in good condition but the concrete piers and sea wall structures within the harbour are abraded in places and, where used, steel sheet piling is generally heavily corroded. The North Breakwater has undercutting on the inner-facing side, perhaps caused or exacerbated by propeller thrust.

Some of the structures extending into the beck as either riverside walls or property walls are locally poor in condition, despite obvious previous repairs. Typical defects include voids, missing blockwork and undercutting.

MU7 - Runswick Bay

The Runswick Bay Coastal Protection Scheme, constructed in 2017, has improved the condition of many of the assets along the seafront, particularly those towards the north of the Lifeboat station.

The scheme comprises of a rock armour fillet fronting the historic masonry blockwork seawall. Defects which were previously reported on the seawall, such as erosion, abrasion and undercutting were repaired prior to the construction of the rock armour fillet.

The older rock armour defences in front of the car park remain generally in very good condition, with the rocks tightly packed to a consistent profile. The southern extent of the revetment was refurbished in June 2018 using surplus rock armour from the Coastal Protection Scheme and appears to continue to protect the revetment from outflanking in addition to offering some protection to the high-level beach access ramp.

Defence to the Sailing Club, located some 600m south of the village, had been improved prior to the 2016 inspection. The defences which consist of the placement of a number of boulders and concrete blocks in front of the timber sleeper retaining wall remain in fair condition.

MU9 – Sandsend Village

The concrete sea wall around the car park at the western end of Sandsend was showing exposed rebar on the apron but this was not observed in 2020 due to high beach levels. The concrete sea wall extending from Sandsend Beck to the east had exposed timber breastwork at the toe in 2018 but again this was not observed in 2020 due to high beach levels.

During 2015/16, the failing sloping concrete revetment protecting Sandsend Road was replaced with a new defence structure. This comprises stepped concrete revetment with upper Dycel units and a concrete toe beam. This improved the condition of the defences from very poor to very good. Some local damage to the step corners on some of the pre-cast units exists, however this is cosmetic damage that does not unduly affect its coast protection function.

MU11-13 - Whitby

Whitby West Beach promenade deck has suffered cracking in the past. Some previous repairs are re-opening, requiring further attention. The sea wall sections not protected by a fronting rock revetment have extensive abrasion and undercutting. Some affected sections have been covered by a new toe beam, but this does not cover the full extent of defective toe. The defences below Whitby Pavilion Theatre remain in poor condition and would benefit from repairs.

Previous identified defects at Whitby Harbour Piers were repaired as part of a major capital scheme to refurbish the structures in 2019.

The quay walls within Whitby Harbour are generally in fair condition, but locally poor in places due to specific defects. For example, in the blockwork sections, there are sections of wall with open joints which require sealing and in the suspended deck section on the western quay there remains corrosion to the steel piles.

MU16 – Robin Hood's Bay

Defences around the settlement of Robin Hood's Bay are in a similar state to that observed during the 2018 surveys. The large vertical defence wall continues to show deterioration with spalling, seepage and cracking and is scheduled for capital refurbishment. Capital works are known to be planned in this frontage.

MU20-21 – Scarborough North Bay and Headland

Overall, the structures are in fair condition, but due to their age require ongoing maintenance to infill open joints and cracks. The stretch of frontage immediately north of Peasholm Gap, in front of the beach huts, experienced significantly higher beach levels in 2020 than during the 2018 inspections, reaching the crest of the seawall in places.

The asset in the poorest condition is the slipway in front of Oasis Café. A large vertical crack on the wingwall has deteriorated and a block is now missing adjacent to the crack. Surrounding blocks appear loose and are at risk of being displaced. Although it is fenced off, numerous members of the public were observed using this as an access route.

The rock armour and Accropode revetment with a raised concrete sea wall behind between the south end of Clarence Gardens and the East Pier of Scarborough Harbour remain in good condition.

MU21-22 – Scarborough Harbour

Overall, the structures are in fair condition and have experienced previous repairs and maintenance works. However, due to their age they require ongoing maintenance to infill open joints and cracks. The most notable defects are on the seaward end and outer face of the West Pier, where repairs are recommended.

MU22-23 – Scarborough South Bay

As is the case for North Bay, the defences in South Bay are generally in a similar state to when visited in 2018 and have benefited from some maintenance (joint sealing) in recent years around Foreshore Road and repairs around Spa Chalet (rebuilt wall sections). Overall, the structures are generally in fair condition, but due to their age require ongoing maintenance to infill open joints and cracks. High beach levels in 2020 meant that some previously reported defects were not visible at the time of the inspections.

Some capital refurbishment works were undertaken along the Spa sea wall in 2018 as part of the wider coast protection and slope stabilisation works. The repairs generally remain in good condition. A steelwork support frame has recently been erected beneath the promenade south of the Spa itself. Many of the sea walls south of the Spa are heavily abraded and locally damaged. Low beach levels had exposed the toe piles of several of the defences, in places these were found to be heavily corroded.

Capital works at the Clock Café Retaining Wall were ongoing during the 2020 survey and are scheduled to be completed in December 2020.

MU24-25 – Cayton Bay

The repairs to the defences around the public access steps which were undertaken shortly after the 2016 inspection were found to remain in fair condition. However, overall the structures remain in very poor condition and present a health and safety risk to members of the public accessing the beach.

MU28a-29a – Filey

The slipway at Filey sailing club is beginning to become undercut, with a significant section of the slipway breaking away. The scour hole at the north end of sheet pile defences has been repaired.

The main sea wall through the town remain largely unchanged since 2018. The structure shows evidence of significant maintenance and repair works over recent years, but ongoing maintenance work is required due to the age of the structure. The abrasion to the lower courses of blockwork does appear to have worsened locally, with water noted to be seeping out in places. Higher beach levels than in 2018 meant that many of the outlets were buried.

A short section of rock revetment with gabion baskets beneath is located at the southern end of the sea wall near Martin's Gill. A depression in the crest of this structure suggests movement of the cliff behind, although this has not worsened since 2018. The coastal slopes behind the revetment still appear to be active and some form of improved outflanking defence remains necessary in the medium term.

The Flat Cliffs emergency works were completed in 2018. The geotextile bags at the toe of the cliff were mostly fully buried by beach sediment at the time of the 2020 inspections. The toe of the cliff

has continued to slowly retreat, exposing drainage pipes along the full length which in many places have come separated at their terminal end, littering the upper foreshore. It was noteworthy that several of the drainage pipes were discharging water at the time of inspection suggesting they are still operating as expected.

5. Problems Encountered and Uncertainty in Analysis

As a result of the COVID-19 pandemic, the 2020 walkover inspections were undertaken slightly later in the year (from late June through to October). Previous inspections have typically started in May and finished in September. This may explain why the beach levels along many frontages were higher than observed on many past inspections.

5.1 Coastal Slope Condition Assessment

As in 2018, no significant problems were encountered during the inspections of the coastal slopes. Whilst a limited view of the cliff was afforded at a small number of locations, sufficient lengths of the cliff could be seen to assess its overall condition. Generally, the inspections along the more rural sections were undertaken from the clifftop path, but where public access permitted visits were made to additionally view the cliffs from the foreshore. The cliffs along the urban areas (such as Scarborough and Whitby) were observed from the promenade and from the cliff top.

5.2 Coast Protection Asset Condition Assessment

Very few problems were encountered during inspections of the coastal defence assets, largely due to careful logistical planning in advance to avoid the main tourist areas during busier times of the day (in order to be compliant with the bespoke Covid-19 risk assessments).

The toe of structures around Staithes Harbour, Whitby Harbour, Castle Cliff and Scarborough Harbour are constantly submerged by the tide and therefore an inspection of only the visible elements from land or pier deck was undertaken. If and when more detailed inspections of these assets are required, a vessel-based survey is recommended.

6. Conclusions and Recommended Actions

Further to the visual inspection of all assets, specific conclusions and recommendations for individual structural assets are given in the separate **Scarborough Asset Inspections Report 2020**.

In addition, the cliffs have been characterised according to their present activity status and details are given in **Appendix C**.

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 2008.

Appendices

Appendix A Asset Location Maps






















Appendix B Cliff Behaviour Units

























Appendix C Cliff Condition Assessments

MU4/1bDormantPartly ActivePartly ActiveDormantLocally ActiveLocally ActiveLocally ActiveLocally ActivePartly Active <th< th=""><th></th></th<>	
MU4/2DormantLocally ActiveLocally activeLocally ActivePartly ActivePartly ActiveLocally ActiveL	MU4/1b
MU4/3Partly ActivePartly ActivePartly ActivePartly ActivePartly ActivePartly ActivePartly ActiveDestly ActiveLocally ActivePartly ActiveP	MU4/2
MU5/1Partly ActivePartly Active<	MU4/3
MUG/1Partly ActiveLocally ActivePartly ActiveNot InspectedLocally ActiveLocally	MU5/1
MU6/2Totally ActivePartly ActivePartly ActivePartly ActiveLocally ActiveNot InspectedLocally ActiveLocally Active	MU6/1
MU6/3 Dormant Locally Active <thlocally active<="" th=""></thlocally>	MU6/2
MU6/4 Locally Active	MU6/3
	MU6/4
MU6/5 Partly Active Locally Active Locally active Locally Active Locally Active Not Inspected Locally Active Totally Active Partly Active Partly Active Partly Active	MU6/5
MU6/6 Partly Active Partly Active Partly Active Partly Active Partly Active Partly Active Not Inspected Partly Active Partly Active Partly Active Partly Active Partly Active Partly Active	MU6/6
MU6/7 Locally Active	MU6/7
MU6/8 Partly Active Locally Active Partly Active	MU6/8
MU7/1 Inactive Inactive Inactive Inactive Inactive Inactive Inactive Inactive Dormant Dormant Dormant Dormant	MU7/1
MU7/2 Inactive Locally Active Inactive Inactive Inactive Inactive Locally Active Locally Active Locally Active Locally Active Locally Active Locally Active	MU7/2
7/3N 7/3N 7/3N 7/3N 7/3N	
Partly Partly 7/3S Partly Loc	N4117/2
MU7/3 Locally Active Active Active Active Active Active Locally Active Active Active Locally Active Active Locally Active	MU7/3
MU7/4 Partly Active Locally Active L	MU7/4
MU8/1 Totally Active Locally Active	
MO8/2 Inactive Locally Active Locall	NU8/2
MU8/3 Totally Active Partly Ac	IVIU8/3
MU8/4 Partly Active Partly Act	NU08/4
MU8/5 Partly Active Partly Active Partly Active Partly Active Partly Active Partly Active Not Inspected Partly Active Partly Act	NU00/5
MU8/6 Party Active Locally Active Party Active Party Active Party Active Not inspected Party Active Party Act	
MU8/7 Inactive Locally Active Locally Active Locally Active Locally Active Not inspected Locally Active Locally	N/100/7
MUS/S Inactive Docally Active Docall	
MU8/10 Locally Active Party Active Party Active Party Active Party Active Not inspected Party Active Party Ac	NU8/9
MO8/10 Locally Active Locally active Locally active Locally Active Locally Active Not inspected Locally Active Locally Active Locally Active Locally Active Locally Active Locally Active Deathy Activ	NU08/10
MU8/12 Partly Active Locally Active Partly Active Partly Active Partly Active Not inspected Partly Active Partly A	NU00/11
MU8/12 Partly Active Partly Ac	NU 19/12
MU8/14 Totally Active Partly A	MU8/13
MU8/15 Totally Active Partly A	MU8/14
MU9/1 Dormant	MU9/15
MUQ/2 Dormant	MU0/2
MUQ/2 Inactive Partly Active Partly Active Partly Active Locally Active Locally Active Locally Active Inactive Inactive Inactive	MU03/2
MUR/A Inactive Partly Active Locally Active Locally Active Locally Active Locally Active Locally Active Locally Active Inactive Inactive Inactive Inactive Inactive	MU9/3
MU10/1 Partly Active Locally Active Inactive	MU10/1
MU10/2 Totally Active Partly A	MU10/2
MU11/1 Dormant Locally Active Inactive	MI 111 /1
MUL11/2 Inactive Inac	
MUL11/2 Dormant Locally Active Local	MU11/2
MULTI/A Locally Active Locally Activ	MI 111 /A

UNIT	2002	2005	2008	2009	2012	2013 post-surge	2014	2016	2018	2020
MU12/1	Dormant	Locally Active	Locally Active	Locally Active	Locally Active	Locally Active				
MU12/2	Inactive	Locally Active	Partly Active	Partly Active	Partly Active	Partly Active	Partly Active	Partly Active	Partly Active	Partly Active
MU13/1	Totally Active	Partly Active	Partly Active	Partly Active	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active
MU13/2	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active				
MU13/3	Totally Active	Partly Active	Locally active	Locally Active	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	Locally Active
MU13/4	Partly Active	Partly Active	Partly Active	Partly Active	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	Locally Active
MU13/5	Partly Active	Locally Active	Locally active	Locally Active	Partly Active	Not Inspected	Locally Active	Locally Active	Locally Active	Locally Active
MU13/6	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active				
MU14/1	Partly Active	Locally Active	Locally active	Locally Active	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	Locally Active
MU15/1	Partly Active	Locally Active	Locally active	Locally Active	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	Locally Active
MU15/2	Partly Active	Totally Active	Totally Active	Totally Active	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active
MU15/3	Partly Active	Not Inspected	Partly Active	Locally Active	Locally Active	Locally Active				
MU15/4	Partly Active	Not Inspected	Partly Active	Locally Active	Locally Active	Locally Active				
MU16/1	Partly Active	Partly Active	Partly Active	Partly Active	Partly Active					
MU16/2	Dormant	Dormant	Dormant	Dormant	Dormant	Locally Active	Locally Active	Inactive	Locally Active	Inactive
MU16/3	Dormant	Dormant	Dormant	Dormant	Dormant	Dormant	Dormant	Dormant	Dormant	Dormant
MU17/1	Dormant	Partly Active	Inactive	Inactive	Inactive	Inactive	Dormant	Dormant	Dormant	Dormant
MU17/2	Partly Active	Partly Active	Locally active	Locally Active	Partly Active	Partly Active	Partly Active	Partly Active	Partly Active	Partly Active
MU17/3	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active				
MU17/4	Partly Active	Not Inspected	Partly Active	Locally Active	Partly Active	Partly Active				
MU17/5	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active				
MU17/6	Partly Active	Locally Active	Locally active	Locally Active	Locally Active	Not Inspected	Partly Active	Locally Active	Locally Active	Locally Active
MU17/7	Partly Active	Partly Active	Locally active	Locally Active	Locally Active	Not Inspected	Partly Active	Locally Active	Locally Active	Locally Active
MU17/8	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active				
MU17/9	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active				
MU18/1	Inactive	Locally Active	Locally active	Locally Active	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	Locally Active
MU18/2	Inactive	Locally Active	Inactive	Inactive	Inactive	Not Inspected	Inactive	Inactive	Inactive	Inactive
MU18/3	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	Locally Active				
MU18/4	Inactive	Locally Active	Locally active	Locally Active	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	Locally Active
MU19/1	Locally Active	Not Inspected	Locally Active	Locally Active	Partly Active	Locally Active				
MU19/2	Partly Active	Partly Active	Locally active	Locally Active	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	Locally Active
MU19/3	Inactive	Locally Active	Locally active	Locally Active	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	Partly Active
MU19/4	Locally Active	Locally Active	Partly Active	Partly Active	Partly Active	Not Inspected	Partly Active	Partly Active	Locally Active	Locally Active
MU19/5	Partly Active	Partly Active	Locally active	Locally Active	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	Locally Active
MU19/6	Partly Active	Locally Active	Locally active	Locally Active	Locally Active	Not Inspected	Locally Active	Partly Active	Locally Active	Locally Active
MU19/7	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	Locally Active				
MU19/8	Partly Active	Locally Active	Locally active	Locally Active	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	Locally Active
MU19/9	Totally Active	Partly Active	Partly Active	Partly Active	Locally Active	Not Inspected	Locally Active	Partly Active	Partly Active	Partly Active
MU19/10	Totally Active	Partly Active	Partly Active	Partly Active	Locally Active	Not Inspected	Locally Active	Partly Active	Partly Active	Partly Active
MU19/11	Partly Active	Locally Active	Locally active	Locally Active	Locally Active	Partly Active	Partly Active	Partly Active	Locally Active	Locally Active
MU20/1	Dormant	Dormant	Dormant	Dormant	Dormant	Dormant	Dormant	Dormant	Dormant	Dormant

UNIT	2002	2005	2008	2009	2012	2013 post-surge	2014	2016	2018	2020
MU20/2	Dormant	Dormant	Dormant	Dormant	Dormant	Dormant	Dormant	Dormant	Dormant	Dormant
MU20/3	Inactive	Dormant	Dormant	Dormant	Dormant	Dormant	Dormant	Dormant	Dormant	Dormant
MU20/4a	Inactive	Locally Active	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive
MU20/4b	Inactive	Locally Active	Locally active	Locally Active	Inactive	Inactive	Inactive	Locally Active	Locally Active	Inactive
MU21/1	Inactive	Locally Active	Locally active	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive
MU21/2	Dormant	Locally Active	Locally Active	Locally Active	Locally Active	Locally Active				
MU22/1	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive
									Stabilisation	
	_					l			scheme	
MU22/2	Dormant	Locally Active	Locally active	Locally Active	Inactive	Inactive	Inactive	Inactive	ongoing	Inactive
MU22/3	Inactive	Locally Active	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive
									Partly Active	scheme
MU22/4	Inactive	Locally Active	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	r ur try / tetre	ongoing
MU22/5	Inactive	Locally Active	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive
MU22/6	Inactive	Locally Active	Locally active	Locally Active	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive
MU22/7	Inactive	Locally Active	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Locally Active
MU22/8	Dormant	Locally Active	Locally Active	Locally Active	Locally Active	Locally Active				
MU23/A	Locally Active	Locally Active	Partly Active	Partly Active	Partly Active	Partly Active	Partly Active	Partly Active	Partly Active	Partly Active
MU23/B	Partly Active	Partly Active	Locally active	Locally Active	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active
MU23/C	Locally Active	Locally Active	Partly Active	Partly Active	Partly Active					
MU23/D1	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active				
MU23/D2	Partly Active	Partly Active	Partly Active	Partly Active	Locally Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active
MU23/D3	Totally Active	Partly Active	Partly Active	Partly Active	Locally Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active
MU23/E	Locally Active	Partly Active	Locally active	Locally Active	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	Locally Active
MU23/F	Locally Active	Partly Active	Inactive	Inactive	Inactive	Not Inspected	Inactive	Inactive	Inactive	Inactive
MU23/G1	Partly Active	Totally Active	Locally active	Partly Active	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active
MU23/G2	Locally Active	Locally Active	Partly Active	Partly Active	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active
MU23/H	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	Locally Active				
MU23/H1	Locally Active	Totally Active	Totally Active	Totally Active	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active
MU23/H2a	Partly Active	Totally Active	Totally Active	Totally Active	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active
MU23/H2b	Partly Active	Totally Active	Totally Active	Totally Active	Locally Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active
MU23/H2	Locally Active	Partly Active	Partly Active	Partly Active	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active
MU23/I	Locally Active	Locally Active	Locally active	Partly Active	Partly Active	Not Inspected	Locally Active	Locally Active	Locally Active	Locally Active
MU23/I1	Locally Active	Partly Active	Partly Active	Partly Active	Partly Active	Not Inspected	Locally Active	Locally Active	Locally Active	Locally Active
MU23/I2	Locally Active	Partly Active	Locally active	Locally Active	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	Locally Active
MU23/I3	Partly Active	Partly Active	Locally active	Locally Active	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	Locally Active
MU23/I4	Partly Active	Partly Active	Totally Active	Totally Active	Locally Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active
MU23/J	Partly Active	Locally Active	Locally active	Locally Active	Locally Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active
MU24/A	Locally Active	Locally Active	Totally Active	Partly Active	Locally Active	Locally Active	Locally Active	Locally Active	Locally Active	Locally Active
MU24/A7	Locally Active	Locally Active	Partly Active	Partly Active	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active
MU24/A8	Locally Active	Locally Active	Partly Active	Partly Active	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active

UNIT	2002	2005	2008	2009	2012	2013 post-surge	2014	2016	2018	2020
MU24/B	Inactive	Inactive	Inactive	Inactive	Inactive	Not Inspected	Inactive	Inactive	Inactive	Inactive
MU24/B1	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	Locally Active				
MU24/B10	Inactive	Locally Active	Locally active	Inactive	Locally Active	Not Inspected	Inactive	Inactive	Inactive	Inactive
MU24/B2	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	Partly Active				
MU24/B3	Locally Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active				
MU24/B4	Locally Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active				
MU24/B5	Locally Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active				
MU24/B6	Locally Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active				
MU24/B7	Locally Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active				
MU24/B8	Locally Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active				
MU24/B9	Locally Active	Not Inspected	Totally Active	Totally Active	Totally Active	Totally Active				
MU24/C	Locally Active	Locally Active	Locally active	Partly Active	Locally Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active
MU24/D	Locally Active	Locally Active	Locally active	Partly Active	Locally Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active
MU24/E	Locally Active	Locally Active	Partly Active	Partly Active	Locally Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active
MU24/F	Locally Active	Not Inspected	Partly Active	Partly Active	Locally Active	Locally Active				
MU24/G	Locally Active	Not Inspected	Partly Active	Partly Active	Locally Active	Locally Active				
MU24/H	Locally Active	Locally Active	Inactive	Inactive	Inactive	Not Inspected	Inactive	Inactive	Inactive	Inactive
MU24/I	Locally Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active				
MU24/J	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	Partly Active				
MU24/K	Locally Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active				
MU24/L	Locally Active	Partly Active	Locally active	Locally Active	Locally Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active
MU24/M1	Locally Active	Partly Active	Partly Active	Partly Active	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active
MU24/M2	Dormant	Partly Active	Partly Active	Partly Active	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active
MU24/N	Locally Active	Partly Active	Totally Active	Partly Active	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active
MU24/0	Locally Active	Partly Active	Partly Active	Totally Active	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active
MU24/P	Locally Active	Locally Active	Partly Active	Partly Active	Partly Active	Not Inspected	Partly Active	Locally Active	Partly Active	Partly Active
MU24/Q	Locally Active	Locally Active	Partly Active	Partly Active	Partly Active	Not Inspected	Partly Active	Locally Active	Partly Active	Partly Active
MU24/R	Locally Active	Locally Active	Locally active	Partly Active	Partly Active	Not Inspected	Partly Active	Locally Active	Locally Active	Partly Active
MU24/S	Locally Active	Locally Active	Partly Active	Partly Active	Partly Active	Not Inspected	Partly Active	Locally Active	Locally Active	Partly Active
MU25/AA	Locally Active	Partly Active	Partly Active	Totally Active	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active
MU25/AB	Locally Active	Partly Active	Partly Active	Partly Active	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active
MU25/AC	Locally Active	Locally Active	Partly Active	Partly Active	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	Locally Active
MU25/AD	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	Locally Active				
MU25/AE	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	Locally Active				
MU25/T	Locally Active	Locally Active	Partly Active	Partly Active	Partly Active	Not Inspected	Partly Active	Locally Active	Partly Active	Partly Active
MU25/U	Locally Active	Locally Active	Partly Active	Locally Active	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	Locally Active
MU25/V	Locally Active	Partly Active	Locally active	Totally Active	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active
MU25/W	Locally Active	Locally Active	Totally Active	Locally Active	Locally Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active
MU25/X	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active				
MU25/Y	Locally Active	Locally Active	Locally active	Locally Active	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active
MU25/Z	Locally Active	Locally Active	Locally active	Locally Active	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active
MU26/AF	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	Locally Active				

UNIT	2002	2005	2008	2009	2012	2013 post-surge	2014	2016	2018	2020
MU26/AG	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	Locally Active				
MU26/AH	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	Locally Active				
MU26/AI	Locally Active	Locally Active	Partly Active	Partly Active	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active
MU26/AJ	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active				
MU26/AK	Locally Active	Partly Active	Partly Active	Partly Active	Locally Active	Not Inspected	Locally Active	Partly Active	Partly Active	Partly Active
MU26/AL	Locally Active	Locally Active	Partly Active	Partly Active	Locally Active	Not Inspected	Locally Active	Partly Active	Partly Active	Partly Active
MU26/AM	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	Locally Active				
MU26/AN	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	Locally Active				
MU26/AO	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	Locally Active				
MU26/AP	Locally Active	Locally Active	Locally active	Partly Active	Partly Active	Not Inspected	Locally Active	Locally Active	Locally Active	Locally Active
MU26/AQ	Partly Active	Partly Active	Partly Active	Partly Active	Locally Active	Not Inspected	Partly Active	Locally Active	Locally Active	Locally Active
MU26/AR	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	Locally Active				
MU26/AS	Locally Active	Locally Active	Locally active	Locally Active	Partly Active	Not Inspected	Partly Active	Locally Active	Locally Active	Locally Active
MU26/AT	Locally Active	Not Inspected	Partly Active	Locally Active	Partly Active	Partly Active				
MU26/AU	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	Locally Active				
MU26/AV	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	Locally Active				
MU26/AW	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	Locally Active				
MU26/AX	Locally Active	Locally Active	Partly Active	Locally Active	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	Locally Active
MU27/A	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active				
MU27/AY	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	Locally Active				
MU27/AZ	Locally Active	Locally Active	Partly Active	Partly Active	Partly Active	Not Inspected	Locally Active	Locally Active	Locally Active	Locally Active
MU27/B	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active				
MU27/BA	Locally Active	Totally Active	Totally Active	Totally Active	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active
MU27/BB	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active				
MU27/BC	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active				
MU27/BD	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active				
MU27/BE	Locally Active	Locally Active	Partly Active	Partly Active	Locally Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active
MU27/BF	Locally Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active				
MU27/C	Partly Active	Partly Active	Partly Active	Partly Active	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	Locally Active
MU27/D	Totally Active	Totally Active	Partly Active	Partly Active	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	Locally Active
MU27/E	Partly Active	Partly Active	Locally active	Locally Active	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	Locally Active
MU27/F	Partly Active	Partly Active	Locally active	Locally Active	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	Locally Active
MU27/G	Totally Active	Locally Active	Locally active	Locally Active	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	Locally Active
MU27/H	Partly Active	Partly Active	Locally active	Locally Active	Locally Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active
MU27/I	Partly Active	Partly Active	Locally active	Locally Active	Locally Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active
MU27/J	Totally Active	Partly Active	Locally active	Partly Active	Partly Active	Not Inspected	Partly Active	Partly Active	Totally Active	Totally Active
MU27/K	Totally Active	Partly Active	Partly Active	Partly Active	Partly Active	Not Inspected	Totally Active	Totally Active	Totally Active	Totally Active
MU27/L	Totally Active	Not Inspected	Totally Active	Totally Active	Totally Active	Totally Active				
MU27/M	Totally Active	Not Inspected	Totally Active	Totally Active	Totally Active	Totally Active				
MU27/N	Partly Active	Totally Active	Totally Active	Totally Active	Totally Active	Not Inspected	Totally Active	Totally Active	Totally Active	Totally Active
MU27/O	Totally Active	Partly Active	Totally Active	Totally Active	Partly Active	Not Inspected	Totally Active	Totally Active	Totally Active	Totally Active
MU27/P	Totally Active	Partly Active	Partly Active	Partly Active	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	Totally Active

UNIT	2002	2005	2008	2009	2012	2013 post-surge	2014	2016	2018	2020
MU27/Q	Totally Active	Partly Active	Partly Active	Partly Active	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	Totally Active
MU27/R	Locally Active	Partly Active	Partly Active	Partly Active	Locally Active	Not Inspected	Partly Active	Partly Active	Partly Active	Totally Active
MU27/S	Locally Active	Locally Active	Partly Active	Partly Active	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active
MU27/T	Locally Active	Partly Active	Partly Active	Partly Active	Partly Active	Partly Active				
MU27/U	Locally Active	Partly Active	Locally Active	Locally Active	Locally Active	Locally Active				
MU27/V	Totally Active	Partly Active	Partly Active	Partly Active	Partly Active	Partly Active	Partly Active	Partly Active	Partly Active	Partly Active
MU27/W	Partly Active	Locally Active	Locally active	Locally Active	Locally Active	Partly Active	Partly Active	Partly Active	Partly Active	Partly Active
MU27/X	Dormant	Locally Active	Locally Active	Inactive	Inactive	Inactive				
MU28/Y	Dormant	Dormant	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive
MU28/Z	Dormant	Dormant	Locally active	Locally Active	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive
MU29/AA	Partly Active	Locally Active	Partly Active	Partly Active	Locally Active	Partly Active	Partly Active	Partly Active	Partly Active	Partly Active
MU29/AB	Locally Active	Locally Active	Partly Active	Partly Active	Locally Active	Partly Active	Partly Active	Partly Active	Partly Active	Partly Active
MU29/AC	Locally Active	Partly Active	Locally Active	Partly Active	Partly Active	Partly Active				
MU29/AD	Locally Active	Partly Active	Partly Active	Partly Active	Partly Active	Partly Active				
MU29/AE	Locally Active	Partly Active	Partly Active	Partly Active	Partly Active	Partly Active				
MU29/AF	Locally Active	Partly Active	Partly Active	Partly Active	Partly Active	Partly Active				
MU29/AG	Partly Active	Locally Active	Locally active	Locally Active	Locally Active	Partly Active	Partly Active	Partly Active	Partly Active	Locally Active
MU29/AH	Locally Active	Partly Active	Partly Active	Partly Active	Partly Active	Locally Active				
MU29/AI	Partly Active	Locally Active	Locally active	Locally Active	Locally Active	Partly Active	Locally Active	Partly Active	Partly Active	Locally Active
MU29/AJ	Partly Active	Locally Active	Partly Active	Partly Active	Locally Active					
MU29/AK	Locally Active	Partly Active	Locally Active	Partly Active	Partly Active	Locally Active				
MU29/AL	Locally Active	Partly Active	Locally Active	Partly Active	Partly Active	Locally Active				
MU29/AM	Partly Active	Locally Active	Locally active	Locally Active	Locally Active	Partly Active	Locally Active	Partly Active	Partly Active	Locally Active
MU29/AN	Locally Active	Partly Active	Locally Active	Partly Active	Partly Active	Locally Active				
MU29/AO	Locally Active	Locally Active	Locally active	Partly Active	Locally Active	Partly Active	Locally Active	Partly Active	Partly Active	Locally Active
MU29/AP	Locally Active	Partly Active	Locally Active	Partly Active	Partly Active	Locally Active				
MU29/AQ	Locally Active	Partly Active	Locally Active	Partly Active	Partly Active	Partly Active				
MU29/AR	Locally Active	Partly Active	Partly Active	Partly Active	Partly Active	Partly Active				
MU29/AS	Locally Active	Partly Active	Partly Active	Partly Active	Partly Active	Partly Active				
MU29/AT	Locally Active	Partly Active	Locally Active	Locally Active	Locally Active	Locally Active				
MU29/BA	Partly Active	Locally Active	Locally active	Locally Active	Locally Active	Not Inspected	Locally Active	Partly Active	Partly Active	Partly Active
MU29/BB	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active				
MU29/BC	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active				
MU29/BD	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active				
MU29/BE	Locally Active	Locally Active	Partly Active	Partly Active	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active
MU29/BE2	New in 2009	New in 2009	New in 2009	Locally Active	Locally Active	Not Inspected	Locally Active	Partly Active	Partly Active	Partly Active
MU29/BF	Partly Active	Totally Active	Totally Active	Totally Active	Locally Active	Not Inspected	Locally Active	Locally Active	Partly Active	Locally Active
MU29/BG	Partly Active	Totally Active	Totally Active	Totally Active	Totally Active	Not Inspected	Totally Active	Totally Active	Totally Active	Totally Active
MU29/BH	Partly Active	Totally Active	Totally Active	Totally Active	Partly Active	Not Inspected	Totally Active	Totally Active	Totally Active	Totally Active
MU29/BI	Partly Active	Partly Active	Totally Active	Partly Active	Partly Active	Not Inspected	Totally Active	Totally Active	Totally Active	Totally Active
MU29/BJ	Locally Active	Partly Active	Partly Active	Partly Active	Partly Active	Not Inspected	Totally Active	Totally Active	Totally Active	Totally Active
MU29/BK	Locally Active	Partly Active	Partly Active	Partly Active	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	Totally Active
MU29/BL	Locally Active	Locally Active	Partly Active	Partly Active	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active

UNIT	2002	2005	2008	2009	2012	2013 post-surge	2014	2016	2018	2020
MU29/BM	Locally Active	Locally Active	Partly Active	Partly Active	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active
MU29/BN	Locally Active	Locally Active	Partly Active	Partly Active	Locally Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active
MU29/BO	Locally Active	Locally Active	Partly Active	Partly Active	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active
MU29/BP	Locally Active	Locally Active	Partly Active	Partly Active	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active
MU29/BQ	Locally Active	Locally Active	Partly Active	Partly Active	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active
MU29/BR	Locally Active	Partly Active	Partly Active	Partly Active	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active
MU29/BS	Locally Active	Partly Active	Partly Active	Partly Active	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active
MU29/CA	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active				
MU29/CB	Partly Active	Partly Active	Totally Active	Totally Active	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active
MU29/CC	Locally Active	Totally Active	Locally active	Locally Active	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active
MU29/CCa	Locally Active	Partly Active	Locally active	Locally Active	Totally Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active
MU29/CD	Locally Active	Locally Active	Locally active	Partly Active	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active
MU29/CE	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	Partly Active				
MU29/CF	Locally Active	Partly Active	Partly Active	Partly Active	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	Locally Active
MU29/CG	Locally Active	Partly Active	Partly Active	Partly Active	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	Locally Active
MU29/CH	Locally Active	Locally Active	Partly Active	Partly Active	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	Locally Active
MU29/CI	Locally Active	Locally Active	Partly Active	Partly Active	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	Locally Active
MU29/CJ	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	Locally Active				