Environmental Report

ROYAL HASKONING

Sandsend Road PAR

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1 Introduction

This report has been produced in support of the Sandsend Road Project Appraisal Report (PAR) to provide an environmental baseline of the area that has the potential to be affected by the proposed works. This information has been used to identify key environmental constraints and opportunities to inform the options appraisal process and to appraise the preferred option, providing appropriate avoidance and / or mitigation measures, where required.

2 Baseline environment

2.1 Socio-economic context

2.1.1 Local community

Sandsend is a small coastal village located on the North Yorkshire coast, 4km west of Whitby. There is a small independent grocery store and a doctor's surgery, the latter is at risk of coastal erosion. In addition, there is a primary school in the village of Lythe to the west of Sandsend. All other facilities and services including emergency services (ambulance, fire and police), secondary schools, supermarkets, train station, petrol station, medical services and hospital (A&E provided by Scarborough or Middlesbrough), are located in Whitby. Whitby is also likely to be the major centre of employment for residents of the village. A total of 12 properties would be lost from the failure of the existing defences and subsequent coastal erosion.

2.1.2 Tourism and recreation

The coast and beach are key elements of the overall visitor product and experience at Sandsend, forming an integral part of its appeal and which is appreciated by a very high proportion of visitors to the area. Sandsend beach was awarded Keep Britain Tidy's 'Quality Coast' Award during 2011 and is a Blue Flag bathing beach.

Coastal recreational opportunities within and immediately adjacent to the proposed scheme include walking along the beach, swimming, surfing, windsurfing, fishing, mountain biking, cycling, sea canoeing and sailing. The Cleveland Way National Trail, a 109 mile National Trail from the North York Moors to Filey, follows the coastline, with the section from Raithwaite Gill to Sandsend being at risk from coastal erosion should the defences fail. There are a number of formal and informal access points to the beach along this section of the frontage.

2.2 Critical infrastructure

The A174 and underlying services (including Yorkshire Water, Transco, BT and Northern Electric) are considered the most significant critical infrastructure within the study area. The A174 road provides the main access to Sandsend from Whitby. The loss of the A174 road would result in a diversion of 22km and effectively isolate the village from Whitby.

2.3 Biodiversity, flora and fauna

There are no European, internationally or nationally designated sites for nature conservation that would be affected by the proposed scheme. The coastal slope is locally designated as Upgang Beck to Sandsend Cliffs Site of Importance for Nature Conservation[1] (SINC) and Maritime Cliff and Slope BAP habitat. The SINC is designated for its mosaic of coastal cliff habitats, including unimproved neutral and calcareous grasslands, coastal grassland.

The coastal slope comprises mainly rank grassland, with scattered scrub of brambles (*Rubus fruticosus agg*), gorse (*Ulex europaeus*) and, more locally, eared willow (*Salix aurita*). The dominant species was false oat grass (*Arrhenatherum elatius*) with frequent cocks foot (*Dactylis glomerata*), red fescue (*Festuca rubra*), Yorkshire fog (*Holcus lanatus*), lesser knapweed (*Centaurea nigra*), white clover (*Trifolium repens*), creeping thistle (*Cirsium arvense*), fleabane (*Pulicaria dysenterica*), colts foot (*Tussilago farfara*) and field horsetail (*Equisetum arvense*).

The largest block calcareous grassland has developed following mechanical levelling of a landslip. The citation for this SINC identifies that the area contains bird's foot trefoil, red and white clovers (*Trifolium pratense* and *T. repens*), lesser trefoil (*T. dubium*), rough hawkbit (*Leontodon hispidus*), colt's foot, lesser knapweed, field horsetail, common spotted orchid (*Dactylorhiza fuchsii*), early purple orchid (*Orchis mascula*), bee orchid (*Ophrys apifera*), eyebright (*Euphrasia agg*.) and fairy flax (*Linum catharticum*).

There are no sites within the proposed study area or immediately adjacent to the study area which are designated for their ornithological interest. Rocky shores along the frontage from Sandsend to Whitby (such as those approximately 600m north-west of the proposed scheme) are, however, known to provide a suitable habitat for a range of shorebird species, such as oystercatcher, sanderling and ringed plover.

2.4 Water

2.4.1 Bathing waters

The objective of the Bathing Waters Directive (76/160/EEC) is to protect public health and the environment from faecal pollution in areas designated as bathing waters. Designated bathing waters require regular water quality monitoring, carried out by the Environment Agency, throughout the bathing season (15th May to 30th September) to ascertain whether they meet mandatory or guideline standards. Guideline standards are 20 times stricter than the mandatory standard, and meeting the guideline standard is one of the main criteria for the award of the European blue flag status.

Sandsend beach is designated as a bathing water area. The water quality is currently classified by the Environment Agency as 'higher'. This means that the water meets the stricter UK standards of the Bathing Water Directive.

[1] A SINC is a non-statutory designation which seeks to protect areas of high wildlife value at a local level.

2.4.2 Water Framework Directive

The Water Framework Directive (WFD) (2000/60/EC) establishes a legal framework to protect and restore clean water across Europe and to ensure its long term sustainable use. WFD waterbodies that have the potential to be affected by the proposed scheme include:

- Newholme Beck river waterbody that runs through the culverted Raithwaite Gill;
- East Row Beck river waterbody to the immediate west;
- Yorkshire North coastal waterbody; and,
- Esk and Yorkshire Coast Ravenscar groundwater waterbody.

The river waterbodies are not classified as heavily modified, whilst the coastal waterbody is classified heavily modified. No mitigation measures have been proposed for the coastal waterbody.

2.4.3 River and groundwater quality

None of the river waterbodies identified above are monitored for water quality by the Environment Agency. The Environment Agency has classified the bedrock underlying the Study Area as a 'Secondary A' aquifer, which are permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases form an important source of base flow to rivers. These are generally aquifers previously classified as minor aquifers. There are no groundwater source protection zones (GSPZs) within the Study Area (Environment Agency, 2011).

2.5 Landscape / seascape character and visual amenity value

There are no designated 'Areas of Outstanding Natural Beauty' (AONB) within the study area.

2.5.1 National Character Areas

Natural England has divided England into 159 'National Character Areas' (previously Joint Character Areas), which have similar landscape character at the national scale. The Study Area is located within the Yorkshire and Humber National Character Area (Natural England, 2011).

2.5.2 Local Character Areas

The Yorkshire and Humber National Character Area is subdivided into a number of Local Character Areas (LCA). The Study Area falls within the North Yorkshire Moors and Cleveland Hills LCA (Area 25).

The North York Moors and Cleveland Hills are a very clearly demarcated block of high land in the north east of the counties of Yorkshire and Cleveland. The most significant landscape features within LCA 25 and of relevance to the proposed scheme are (Natural England, 2011):

- panoramic views over moorland ridges, dales, surrounding lowland vales and the sea; and,

- distinctive and dramatic coastal landscapes with high cliffs, small covers and bays, coastal towns and fishing villages.

The landscape setting of the coast at Whitby is defined by prominent sea cliffs, Sandsend Ness at its western limit and Whitby Abbey headland to the east. A broad, 4km long sandy shore is present between these features. On the cliff tops, the western edge of the built up area of Whitby gives way to an undeveloped coastal landscape between Upgang and East Row. Deep wooded valleys extend inland from coastal settlements of East Row and Sandsend, with Whitby Harbour marking the termination of the River Esk valley (Scarborough Borough Council, 2002).

2.5.3 Seascape character

The proposed scheme is located within the North Yorkshire and Cleveland Heritage Coast[2]. A number of Heritage Coast targets were set nationally relating to landscape, public access and environmental health issues, which are still relevant today. The current management strategy for the heritage coast will continue to work towards such targets as follows:

Landscape conservation:

- The creation or retention of a strip of grassland or semi-natural vegetation along the heritage coasts behind the beach or cliff edge, normally accommodating the cliff path, or where appropriate in the landscape, a fields width;
- The removal or amelioration of eyesores identified in the management plan; and,
- The protection and enhancement of landscape features identified in the management plan.

Recreation:

- A continuous path stretching the length of the Heritage Coast; and,
- The whole of the public rights of way within the Heritage Coast to be properly managed.

Beach and water quality:

- All intensively used beaches on Heritage Coasts to be designated as bathing beaches; and,
- Litter clearance and collection related to the highest standards for amenity beaches.

2.6 Archaeology and cultural heritage

Sandsend is an area of special architectural and historic interest and was designated as a Conservation Area in 1974. A character appraisal and management plan was proposed in September 2011 to ensure that the qualities of the area are properly preserved, by controlling development so that it is in keeping with existing appearance and to manage to conservation interest. This document is currently out to public consultation.

[2] Heritage Coast is a non-statutory designation and is designed to cover the most unspoilt areas of undeveloped coastline around England and Wales.

The proposed works are outside of the Sandsend Conservation Area. There are no known features of archaeological interest within the proposed coastal slope re-grade area; however, seven Cultural Heritage and three Defence of Britain sites are present within Raithwaite Gill, as well as six Cultural Heritage and two Defence of Britain sites adjacent to the existing revetment (NAA, 2011).

2.7 Land quality

A combined geotechnical and geo-environmental ground investigation was undertaken during October 2011, following the production of a Geotechnical Desk Study (Royal Haskoning, 2011a) and Contaminated Land Desk Study Addendum (Royal Haskoning, 2011b).

The ground investigation, undertaken by Soil Mechanics and supervised by Royal Haskoning, identified that the soils in the top of the coastal slope comprised topsoil (described as sandy slightly gravelly clay), over glacial till (described as firm to stiff dark brown / orange slightly sandy slightly gravelly clay). Mudstone was encountered at a minimum depth of 20.10m below ground level (bgl). No made ground soils were encountered at the top of the coastal slope.

Made ground soils were encountered at the toe of the coastal slope in the form of macadam to a maximum depth of 0.2mbgl. Made ground described as dark grey sandy clayey gravel and sandy gravelly clay was present to maximum depth of 3.4mbgl. Weathered mudstone was present beneath the made ground deposits in two of the three boreholes advanced at the bottom of the slope at a minimum depth of 3.1mbgl.

Soil sample results were compared against Contaminated Land Exposure Assessment (CLEA) Generic Assessment Criteria (GAC) based on a residential without garden land use scenario. One exceedance of the GAC for benzo(a)pyrene was reported in a topsoil sample at 3.86mg/kg compared to the GAC of 1.1mg/kg. Although this level is not considered to present a significant risk based on the proposed end use, further risk assessment may be required. Discussions with the Local Authority are required to determine whether further risk assessment is required. Concentrations of manganese exceeded the GAC in two of the three topsoil samples and one out of four clay samples; however, these levels were considered to represent natural background levels in soils.

The results of the leachate analyses were compared against WFD Environmental Quality Standards (EQS), where available. Where these standards were unavailable, EQS's applicable under freshwater fish, bathing, dangerous substances and groundwater directives were used, or alternatively EU drinking water standards were applied. Exceedances were identified for the following:

- leachable dissolved chromium concentrations exceeded the WFD annual mean value for good status coastal and transitional water bodies in all samples (topsoil and clay). The concentrations of leachable dissolved chromium in the topsoil samples were determined to be 0.035 and 0.005 mg/l compared to the WFD EQS of 0.0006 mg/l. The concentrations of leachable dissolved chromium in the clay samples were determined to range from 0.003 to 0.004 mg/l, compared to the WFD EQS of 0.0006 mg/l;
- leachable dissolved copper concentrations exceeded the WFD EQS in all samples (topsoil and clay). The concentrations of leachable dissolved copper detected in topsoil samples were determined to be 0.046 and 0.148 mg/l compared to the WFD EQS of

0.005 mg/l. The concentrations of leachable dissolved copper in the clay samples were determined to range from 0.006 to 0.007 mg/l, compared to the WFD EQS of 0.005 mg/l;

- leachable concentrations of dissolved zinc exceeded the WFD annual mean value for good status coastal and transitional water bodies in the majority of samples. Two out of three leachate analyses on clay samples recorded concentrations of 0.16 mg/l and 0.083 mg/l, which exceeded the EQS of 0.04 mg/l. The leachable zinc concentrations recorded in both topsoil samples were 0.076 and 0.252 mg/l, which exceeded the EQS of 0.04 mg/l; and,
- Leachable dissolved aluminium concentrations exceeded the EU Drinking Water Standard (DWS) of 0.2 mg/l in all samples. The concentrations of leachable aluminium ranged from 0.54 mg/l to 1.68 mg/l in the clay samples and in the topsoil samples, the concentrations of leachable aluminium were recorded to be 0.29 mg/l and 1.07 mg/l.

The exceedances of leachable chromium, copper, zinc and aluminium are not considered to present a significant risk to controlled waters if the soils are re-used at Raithwaite Gill. The metal concentrations reported are considered to present a low risk and potentially representative of background concentrations.

Leachable dissolved mercury was not detected in any of the samples. However, it should be noted that the laboratory's limit of detection of 0.0001 mg/l is greater than the WFD EQS for other surface waters of 0.00005mg/l.

3 Environmental constraints

The following environmental constraints have been identified that could affect the options being considered:

- the foreshore area is known to be well used by the public for tourism and recreational uses, therefore the proposed works have the potential to affect the tourism and recreational value of the area;
- There are four WFD waterbodies that could be affected by the proposed works. In addition, Sandsend beach is a designated bathing water;
- the A174 (Sandsend Road) provides the main vehicular access from Whitby to Sandsend. Any disruption to this road could impact upon local businesses in Sandsend which rely on tourist trade;
- the coastal slopes within the study area form part of the Upgang Beck to Sandsend Cliffs SINC and Maritime Cliff and Slope BAP habitat;
- The proposed works have the potential to affect the local landscape / seascape character;
- the site is located within the Yorkshire and Cleveland Heritage Coast; as such, development within this boundary will need to consider the Heritage Coast's objectives;
- there are known Cultural Heritage and Defence of Britain sites within Raithwaite Gill and adjacent to the existing revetment. There is therefore potential to cause disturbance to these known features or interest during construction. There is also the potential to encounter unknown features of archaeological interest during any excavation works;

- A construction method statement will be required to ensure suitable mitigation for construction works (e.g. materials to be used, timing of works, prevention of pollution etc);
- Any construction project in England which started after 6th April 2008 and has a value of over £300,000 has a legal requirement to have a Site Waste Management Plan (SWMP) in place. The SWMP will detail how resources will be managed, and waste materials controlled, at all stages during the construction period; and,
- Appendix F provides an Indicative Landscape Plan showing the key environmental constraints.

4 Environmental impacts of alternative options

A range of options were considered at PAR stage for implementing the preferred strategic option of retaining the A174 along its current alignment, both to deal with the upper coastal slope issues and the replacement of the existing coastal revetment. From a longer list of options, two options for management of the coastal slope and two options for management of revetment were taken forward for further consideration, as summarised below and described in detail in **Appendix A**.

- Option 1 - Do Nothing
- Option 2 - Do Minimum
- Option 3a - Upper coastal slope would be re-graded with geotextile erosion control mats and installation of trench drains with filter drain at the top of the slope, and vegetation planting/seeding.
- Option 3b - Installation of 4m high king post barrier wall at toe of upper coastal slope to catch any material falling off the slope, with filter drains at intervals up the slope.
- Option 4a - Concrete stepped revetment constructed over the existing revetment with a rock revetment extending across the mouth of Raithwaite Ravine.
- Option 4b - Rock armour revetment constructed over the existing revetment and extending across the mouth of Raithwaite Ravine.

The potential key positive and negative environmental impacts of the detailed options being considered are presented in **Table 4.1**. Only the potential impacts that differ between the options are presented here allowing for a comparison of each option's positive and negative impacts against each other. Mitigation measures and enhancement opportunities have also been proposed, where required.

Table 4.1 Key positive and negative environmental impacts of short listed options.

Key Positive Impacts	Key Negative Impacts	Mitigation / Enhancement Opportunity
Option 1 - Do Nothing.		
Population and human health		
	Loss of 12 properties within MU4. In the short term, risk remains to users of the A174 and Cleveland Way walk from ongoing slope failures prior to loss of the road. Access to the beach would be reduced, resulting from the loss of the road and car	

Key Positive Impacts	Key Negative Impacts	Mitigation / Enhancement Opportunity
	parks. Sandsend would no longer be located on the coastal route, and would no longer be easily accessible from Whitby; therefore, tourist numbers would likely fall which could impact upon local businesses. Emergency services (e.g. police and ambulances) will be forced to travel 22km further once the A174 coastal road is lost in year 20, resulting in longer response times and increased risk to life for patients. There would also likely be increased traffic congestion on alternative roads which would impact upon local users. The degradation and failure of the defences would likely result in health and safety issues to beach users. The Cleveland Way walk would be lost in year 20, which would reduce people's access to footpaths, reducing the areas recreational potential.	
Critical infrastructure and material assets		
	In addition to the loss of the A174 road, as described above, would be loss of the services present under the road, which includes BT, Yorkshire Water and Northern Electric. The car park which exists alongside the A174 and a doctor's surgery would be lost.	
Biodiversity, flora and fauna		
Benefit to Maritime Cliff and Slope BAP habitat by allowing the coastline to naturally erode.	The option would result in the loss of ancient woodland, lowland woodland BAP habitats and a SINC as the coastline retreats.	
Water		
The Newholme Beck (Raithwaite Gill) would be allowed to revert back to a more natural geomorphological state by allowing the existing culvert to degrade. Natural geomorphological evolution of Yorkshire North coastal waterbody permitted.	Water quality in the coastal waterbody would likely be reduced due to the release of blast furnace slag and soils within the coastal slope as the defences fail and the coastline retreats. This could potentially affect the chemical and physico chemical quality elements of the waterbody depending on the potential presence of contaminates. There are likely to be impacts on the biological quality elements due to smothering of benthic communities from increased fines entering the system. Potential for bathing water to be affected through the loss of Yorkshire Water's services. Should contaminates be present in the coastal slope, the adjacent Newholme Beck and East Row Beck could be adversely affected.	

Key Positive Impacts	Key Negative Impacts	Mitigation / Enhancement Opportunity
Landscape and seascape		
	The erosion of the frontage would have a significant adverse impact on the local landscape / seascape character, through the degradation of the defences and loss of natural assets. Erosion of the coastline would give a threatening aspect to the existing pleasurable coastal setting. The existing visual amenity value would be reduced due to slippages of the coastal slope and erosion of the defences and coast road. The erosion of the frontage would both support and conflict with the Heritage Coast's objectives.	
Historic environment		
	Damage or loss of a number of cultural heritage sites and Defence of Britain sites along the frontage. Potential for the loss of unknown archaeological deposits or interest features within the coastal slope.	
Soils and geology		
	There would be loss of agricultural land (<1 hectare) present at the top of the coastal slope.	
Option 2 – Do Minimum.		
Assets would remain protected for an additional five years compared to the Do Nothing option.	Over the first five years, the coastal slope will continue to undergo minor failures requiring clear up and temporary piecemeal stabilisation works and resulting in periodic temporary road closures.	Construction works should follow industry best practice guidance (i.e. CIRIA).
	Repairs would be undertaken on an emergency basis, which could coincide with peak tourism period.	Production of a construction method statement will ensure suitable mitigation for construction works (e.g. materials to be used, timing of works, prevention of pollution, prevention etc).
	Following the first five years the key negative impacts would be the same as for the Do Nothing option.	A Site Waste Management Plan (SWMP) will be implemented prior to the commencement of works, if required.
Option 3a – Stabilise the coastal slope and new outfall beneath the road.		
Reduced disturbance and improved health and safety to human receptors through the prevention of slippages onto the A174.	Loss of small area of agricultural land due to re-grading.	Construction works should follow industry best practice guidance (i.e. CIRIA).
The re-use of the material in Raithwaite Gill will improve protection of the A174.	Re-grading of the slope could affect unknown features of archaeological interest.	Works should be undertaken outside of peak tourism period.

Key Positive Impacts	Key Negative Impacts	Mitigation / Enhancement Opportunity
A number of archaeological sites are present within Raithwaite Gill. The deposition of material from the coastal slope onto these features would allow for the *in-situ* preservation of such features and sites.	The re-use of the material in Raithwaite Gill will result in the loss of SINC and BAP habitat.	Production of a construction method statement will ensure suitable mitigation for construction works (e.g. materials to be used, timing of works, prevention of pollution, prevention etc).
		A Site Waste Management Plan (SWMP) will be implemented prior to the commencement of works. Site Investigation undertaken during October 2011 will determine the presence of contaminants within the coastal slope and potential to re-use.
		An archaeological watching brief is likely to be required to identify any as yet un-recorded features during the excavations required for the slope stabilisation works. More detailed archaeological recording of the identified sites is likely to be required around the Raithwaite Gill deposition area, prior to in-filling works.
		A reseeding strategy will need to be put in place to mitigate for the damage to the SINC and BAP habitat and which aims to enhance biodiversity.
Option 3b - Construction of a catch wall and new outfall beneath the road.		
Reduced disturbance and improved health and safety to human receptors through the prevention of slippages onto the A174.	Significant adverse impact to the visual amenity value of the area and local landscape / seascape character due to the presence of the wall.	Construction works should follow industry best practice guidance (i.e. CIRIA).
No disturbance to unknown features of archaeological interest potential located in coastal slope.	Unstable slope material to be sent to landfill.	Works should be undertaken outside of peak tourism period.
Continual slippages could benefit Maritime Cliff and Slope BAP habitat through the exposing of bare ground.	A174 and underlying services at Raithwaite Gill would remain at risk.	Production of a construction method statement will ensure suitable mitigation for construction works (e.g. materials to be used, timing of works, prevention of pollution,

Key Positive Impacts	Key Negative Impacts	Mitigation / Enhancement Opportunity
		prevention etc).
	The option does not provide a permanent solution to the slope stability issue, and future landfalls are likely. Removal of fallen material behind the wall will result in disturbance to users of the A174.	A Site Waste Management Plan (SWMP) will be implemented prior to the commencement of works.
	Archaeological features in Raithwaite Gill remain at risk from erosion.	A precautionary archaeological watching brief required to identify any as yet un-recorded features during the excavations required for the slope stabilisation works.
		A restoration strategy will need to be put in place to repair any damage to the SINC and BAP habitat and which aims to enhance biodiversity.
Option 4a - Construction of a reinforced concrete stepped revetment with rock armour extension.		
Both options (4a and 4b) provide the greatest protection over a 100 year period.	The use of concrete has the greatest carbon footprint.	Consideration should be given to the used of materials will a lower carbon footprint, such as carbon capturing concrete.
Improved access to beach from A174.	Both options (4a and 4b) will result in the loss of SINC and BAP habitat resulting from the infilling of Raithwaite Gill.	Construction works should follow industry best practice guidance (i.e. CIRIA).
Stepped revetment considered to have less effect on local landscape and seascape character than rock along Sandsend Road.	Requirement for signage to deter people from climbing on rock armour. Furthermore, rock revetments accumulate litter.	Works should be undertaken outside of peak tourism period.
		Production of a construction method statement will ensure suitable mitigation for construction works (e.g. materials to be used, timing of works, prevention of pollution, prevention etc).
		A Site Waste Management Plan (SWMP) will be implemented prior to the commencement of works.
		A restoration strategy will need to be put in place to reduce the damage to the SINC and BAP habitat and which aims to enhance biodiversity.
		Potential to increase formal access to the beach from the A174 via the revetment. This will

Key Positive Impacts	Key Negative Impacts	Mitigation / Enhancement Opportunity
		have the added benefit of reducing trampling of the SINC and BAP habitat.
Option 4b - Construction of a rock armour revetment		
Both options (4a and 4b) provide the greatest protection over a 100 year period.	Increased sustainability issues in comparison with option 4a due to the requirement for increased volumes of quarry run rock.	Recycled rock material should be sourced, where possible.
Lower carbon footprint than option 4a.	Both options (4a and 4b) will result in the loss of SINC and BAP habitat resulting from the infilling of Raithwaite Gill.	Construction works should follow industry best practice guidance (i.e. CIRIA).
	Increased use of signage required and increased accumulation of debris in comparison with option 4a.	Works should be undertaken outside of peak tourism period.
	Larger footprint when compared to option 4a.	Production of a construction method statement will ensure suitable mitigation for construction works (e.g. materials to be used, timing of works, prevention of pollution, prevention etc).
	Potential health and safety issues due to rock armour preventing access to the A174, from Raithwaite Gill to Sandsend café.	A Site Waste Management Plan (SWMP) will be implemented prior to the commencement of works.
		A restoration strategy will need to be put in place to reduce the damage to the SINC and BAP habitat and which aims to enhance biodiversity.

Option 2 would delay the loss of the defences by an estimated five years; however, after this the protected assets would be lost. Option 3a is the environmentally preferred option due to the potential visual impacts, the continued disturbance to users of the A174 and the loss of archaeological features that would arise through the implementation of Option 3b. Option 4a is the environmentally preferred option due to the reduced footprint, improved access to the beach and reduced risk to beach users, and the reduced use of rock.

5 Environmental effects of the preferred option

This section provides an overview of the potential effects that could arise as a result of the proposed scheme and describes measures that have been identified to date to avoid or mitigate these effects throughout the development of the scheme, where appropriate. The locations of the proposed works are presented in **Figure 1**.

Given the nature and location of the scheme, the following aspects are considered relevant:

- Coastal processes;
- Biodiversity, flora and fauna;
- Water quality;
- Land quality;
- Road traffic;
- Noise and vibration;
- Air quality;
- Archaeology and cultural heritage;
- Landscape, seascape and visual amenity value; and,
- Tourism and recreation.

In addition to the receptor specific measures set out below to avoid / mitigate any adverse effects that could arise through the implementation of the proposed scheme, best practice guidance will be adhered to, such as:

- Pollution Prevention Guidelines - Works in, near or liable to affect watercourses: PPG 5; and,
- CIRIA Coastal and Marine Environmental Management Site Guide (CIRIA report C584).

5.1 Coastal processes

The proposed scheme has the potential to affect existing coastal processes through the continuation of the rock revetment across Raithwaite Gill and extending approximately 100m eastwards along the currently undefended cliffs. In order to understand the potential significance of any changes to coastal processes, it is recommended that a desk based study is undertaken to determine how the revetment would affect existing erosion rates, based upon the rates provided in the River Tyne to Flamborough Head SMP2, and sediment availability.

5.2 Biodiversity, flora and fauna

A Phase 1 Habitat Survey, undertaken in September 2011, identified that the preferred options would affect semi-improved neutral grassland and coastal grassland habitats, as well as a small area of open yellow dune, present above the existing defences near Sandsend Café, and another small area of open fore dune, present in Raithwaite Gill (**Report N2** in **Appendix N**).

The following mitigation measures are recommended to avoid / mitigation for any potential impacts to biodiversity. These measures have been agreed with NYCC Ecologist.

- The survey did not record any floral species of note; however, it is known that, in particular, orchids are present and that the lack of any recordings may be a result of the timing of the survey. As such a Phase 2 habitat survey should be undertaken at the optimum time of the year, in late May – early June. A habitat assessment should be undertaken following survey along with a detailed assessment of predicted impacts of works on habitats within the SINC. Where possible, habitats should be replaced on a like

for like basis. Options for minimising adverse impacts to the SINC and BAP should then be evaluated, and finalised in consultation with NYCC Ecologist.

- If possible, the works should be undertaken outside the breeding bird season (typically beginning of March to end of August). Where this is unavoidable, the areas of vegetation likely to be directly disturbed or damaged should be cleared outside of the breeding bird season to deter birds from nesting. A suitably qualified ecologist should survey the works areas for the presence of nesting birds immediately prior to work commencing;
- The works areas, including vehicle access routes, should be delimited with tape or temporary fencing to avoid any accidental damage to adjacent habitats; and,
- Detailed hand searching by experienced ecologist of all suitable reptile habitats to be affected by works should be undertaken immediately before work (including site clearance work) starts. Vegetation clearance in advance of the reptile hibernation season may be advisable, following further ecological consultation. Details of appropriate receptor sites for any reptiles found should be agreed well in advance of any works taking place.

5.3 Water quality

With the exception of the groundwater waterbody, the proposed works have the potential to affect the status of the WFD waterbodies from accidental leaks and spillage, changes in coastal geomorphology and coastal processes. A WFD assessment will need to be undertaken on the proposed scheme to protect the status of the waterbodies that could be affected and to potentially identify measures to enhance them.

5.4 Land quality

On the basis of this preliminary investigation, as described in **Section 2.7**, it is considered likely that the excavated soils will be suitable for re-use at Raithwaite Gill. Consultation with the contaminated land officer at the local authority and a technical specialist in the groundwater and contaminated land team of the Environment Agency is proposed to confirm / approve the re-use of this material.

If any previously unidentified olfactory or visual evidence of contamination is observed during the construction phase of the project, work will be stopped, the material stockpiled, and appropriately sampled to send to the laboratory for analysis. At this time, liaison with a contaminated land and waste expert would be undertaken.

5.5 Road traffic

The delivery of equipment and materials to site is anticipated to be by road. In order to reduce the potential impact on road traffic the works are proposed to commence in September 2012 to avoid the peak tourism period. Should it be required, it is also suggested that delivery times could be organised to not coincide with peak traffic periods, such as commuting periods. In order to further reduce the potential impact to road traffic, the proposed works will be locally advertised, with a letter drop to all properties within 500m of the proposed works.

5.6 Noise and vibration

There are a number of commercial and residential properties within close proximity to the proposed works, including those along Meadowfield Land and the A174, and also Sandsend Café. The beach area surrounding the proposed works is also a popular location for walking and swimming.

In order to minimise the potential effects to beach users, information signs will be placed around the site compound providing contact details for any complaints to be sent to and addressed. Measures to reduce the potential effects to residential and commercial properties, the suggested working hours are to be restricted to (please note, these hours have not been confirmed with Scarborough Borough Council):

- Week days - daylight hours commencing no earlier than 08:00;
- Saturday - 09:00 to 17:00; and,
- Sunday - 10:00 to 16:00.

Furthermore, all local residents within 500m will be informed of the proposed works by letter drop, providing them with a contact details to address complaints to, so that they can be addressed.

5.7 Air quality

Construction work on some parts of the site will take place in relatively close proximity (within 500m) to residential properties, notably those along Meadowfield Lane and the A174. There is therefore a potential risk of nuisance due to fugitive dust emissions during activities such as earthmoving. In practice, however, this risk can be minimised through routine dust control procedures.

5.8 Archaeology and Cultural Heritage

In order to mitigate any adverse effects to the features of archaeological interest present, the following measures are proposed and which have been agreed with North Yorkshire County Council's Archaeologist:

- a written statement of investigation and recording which will be approved by the County Archaeologist (a detailed account of mitigation requirements and how they are to be met including working methods, anticipated outputs, the dissemination and archiving of information, monitoring and quality assurance arrangements and a timetable);
- watching brief for the slope re-grading works;
- detailed investigation and recording of the features known to be present within Raithwaite Gill; and,
- the recording of the features known to be present along the existing revetment.

5.9 Landscape, seascape and visual amenity value

The construction works will temporarily affect the local landscape / seascape character and amenity value. In addition to adhering to best practice guidance, the following measures are proposed to minimise any adverse effects:

- locally advertising the proposed works;
- conducting the works outside of the peak tourism period; and,
- informing local residents of the proposed works.

During operation, the proposed works are considered to affect the local landscape / seascape character and visual amenity value, through the stabilisation of the upper coastal slope, replacement of the existing defences with a stepped concrete revetment, the extension of the defence across Raithwaite Gill with a rock revetment.

The replacement of the existing defences is considered to improve the local landscape / seascape character and amenity value through the replacement of defences that are in a state if disrepair and by increasing access to the beach from the A174. Additional benefits will arise through the stabilisation and subsequent re-seeding of the upper coastal slope, which will allow for the establishment of grassland species and the prevention of slippages onto the A174.

The continuation of the revetment across Raithwaite Gill is considered to affect the local landscape / seascape character through the presence of the rock revetment and by making the frontage more linear. The infilling of Raithwaite Gill in the past to support the existing alignment of the A174, is considered to reduce the potential effects of continuing the revetment across the Gill.

A landscape / seascape character assessment should be undertaken to identify the potential impacts to, in particular, the North Yorkshire and Cleveland Heritage coast and to identify suitable mitigation measures, where required.

5.10 Tourism and recreation

The construction works have the potential to effect recreational users of the area through increased noise and vibration, increased traffic, reduced air quality, reduce access to the beach and visual impacts. In addition to the avoidance and mitigation measures proposed for the relevant receptors, the proposed works to the upper coastal slope are to take place outside of the peak tourism period, thereby reducing the disruption to users of the A174.

6 Policy constraints

6.1 River Tyne to Flamborough Head Shoreline Management Plan 2

The *River Tyne to Flamborough Head Shoreline Management Plan 2* was published in 2007 and formally approved by the Environment Agency in July 2009. At the Sandsend Road frontage the SMP2 recommends that a policy of Hold the Line is adopted in the first epoch and ‘Retreat or Realignment’ (subject to further investigations of options for the road) becomes adopted in the second and third epochs. These further investigations should include consideration of the option for road re-alignment.

During the present study, detailed investigations have been undertaken into various options for this frontage. This included an option of realigning the A174 Sandsend Road between Dunsley Lane and Cliff Lane to beyond the 100 year erosion line along the top of the coastal slope, and upgrading minor roads (farm roads) between Lythe and the A171 to 'A' class standard to provide an alternative route. Whilst re-alignment would technically be possible, it would require substantial slope stabilisation works before a new cutting could be made in the coastal slopes to accommodate a new road alignment. This would not be economically viable compared to the option of retaining the road on its present alignment. Similarly, whilst it would be possible to upgrade existing minor roads, there would be economic and social impacts of an unacceptable nature given that a more viable alternative exists. Both options were, therefore, ruled out on technical, economic and environmental grounds, resulting in the need to continue defence of the road in its present position. This has resulted in a change in the adopted SMP2 policy for this frontage in epochs 2 and 3 from 'Retreat or Realignment (subject to further investigations of options for the road)' to 'Hold the Line'.

7 Review of regulatory requirements

7.1 Marine and Coastal Access Act 2009

Part 4 of the Marine and Coastal Access Act (MCAA) 2009 provides the framework for the current marine licensing system for works below the level of mean high water spring (MHWS) tides. It is considered likely that the placement of a new revetment (including excavation of bedrock at the toe) will need a Marine License.

7.2 Town and Country Planning Act 1990

The Town and Country Planning Act 1990 is the principle legislation that governs planning permission and planning law in England and Wales. The procedural rules and regulations of this Act are set out in a number of Statutory Instruments (SIs).

7.3 Wildlife and Countryside Act 1981

Under the terms of Section 28(4)b of the Wildlife And Countryside Act 1981 as amended by Schedule 9 to the Countryside And Rights Of Way Act 2000, any operations within, or adjacent to, a Site of Special Scientific Interest (SSSI) require consent from Natural England. There are no SSSI's within or directly adjacent to the study area for the proposed works.

7.4 Natural Environment and Rural Communities Act 2006

Section 40(1) of the Natural Environment and Rural Communities Act 2006 places a duty on public authorities with regard the conservation of biological diversity. This duty is as follows:

'Every public authority must, in exercising its functions, have regard, so far as is consistent with the proper exercise of those functions, to the purpose of conserving biodiversity.'

The detailed scheme should show how this duty is being discharged.

7.5 Coastal Protection Act 1949

The Coast Protection Act 1949 (part I) empowers Local Authorities with coastlines (termed 'Coast Protection Authorities' in the Act) to carry out coast protection work inside and outside their area as necessary, subject to the approval of the Secretary of State. The project will be carried out under the powers of this Act.

7.6 Land Drainage Act 1991 and Water Resources Act 1991 and associated byelaws

Prior written consent from the Environment Agency is required for any works in, under or near a watercourse or flood defence structure on any main river. Newholme Beck is not classified as a main river by the Environment Agency; therefore, it is considered that an application for 'Consent for Works affecting watercourses and / or flood defences' would not be required.

It is considered that a discharge consent from the Environment Agency may be required to allow the drainage water collected from the coastal slope to be discharged onto the beach from the proposed outfall pipe underneath the A174.

7.7 Habitats Regulations Assessment

The Conservation of Species and Habitats Regulations 2010 (the Habitats Regulations) implement EC Directive 92/43/EEC on the conservation of natural habitats and of wild flora and fauna (the Habitats Directive). In accordance with Section 61 of the Habitats Regulations, Appropriate Assessment (AA) is required for any plan or project, not connected with the management of a European site, which is likely to have a significant effect on the site either alone or in combination with other plans and projects. European sites comprise Special Protection Area (SPA), as designated under Council Directive 79/409/EEC (the Wild Birds Directive), or a Special Area of Conservation (SAC), as designated under the Habitats Directive. AA is also required as a matter of government policy for potential SPAs, candidate SACs and listed Ramsar sites for the purpose of considering development proposals affecting them (ODPM, 2005).

The site of the proposed works does not contain or lie adjacent to any European designated sites. As such, AA is considered unlikely to be required.

7.8 Water Framework Directive

The WFD establishes a legal framework to protect and restore clean water across Europe to ensure its long-term, sustainable use. One of the aims of the WFD is to ensure that all European waterbodies are of Good Ecological Status/Potential by 2015 by the setting of Environmental Quality Objectives (EQO's), including water chemistry, ecological and hydromorphological quality needs. The Environment Agency has a duty to consider the implications of proposals under the WFD. Consideration of the implications of the proposed scheme under the WFD will be provided by undertaking a WFD assessment.

7.9 Requirement for Environmental Impact Assessment

The requirement for Environmental Impact Assessment (EIA) is established by the European Directive 85/33/EEC, as amended by 97/11/EC and 2003/35/EC, on the assessment of the effects of certain public and private projects on the environment (the EIA Directive). The EIA

Directive, as amended, is implemented via various Regulations; the following are applicable to the proposed scheme.

Marine Works (EIA) Regulations 2007

The Marine Works (EIA) Regulations 2007, as amended[3], transpose the EIA Directive in relation to activities which are regulated under the MCAA 2009. The MCAA provides a framework for the current marine licensing system for works below the level of mean high water spring (MHWS) mark.

Town and Country Planning (EIA)(England and Wales) Regulations 1999

The Town and Country Planning (EIA)(England and Wales) Regulations 1999, as amended[4], transpose the EIA Directive for some schemes that require planning permission under the Town and Country Planning Act 1990. Generally, EIA can be required for the following categories of development:

1. Major developments that are of more than local importance.
2. Other developments that are proposed for particularly sensitive and vulnerable locations.
3. Developments with unusually complex and potentially adverse environmental effects.

A screening opinion has been sought from both Scarborough Borough Council, under the Town and Country Planning (EIA)(England and Wales) Regulations 1999 as amended, and the Marine Management Organisation, under the Marine Works (EIA) Regulations 2007 as amended. Both opinions confirm that an EIA is not required.

8 References

Environment Agency, 2011. What's in Your Backyard: Groundwater. Available at: http://maps.environment-agency.gov.uk/

Natural England, 2011. National Character Area 25: North Yorkshire Moors and Cleveland Hills. Available at: http://www.naturalengland.org.uk/ourwork/landscape/englands/character/areas/north_yorkshire_moors_and_cleveland_hills.aspx

Natural England, 2010. Natural Areas: 17 North York Moors and Hills. Available at: http://www.naturalareas.naturalengland.org.uk/Science/natural/NA_Details.asp?NA_ID=17&S=17&R=0

Scarborough Borough Council, 2002. Whitby Coastal Strategy, Sandsend to Abbey Cliff.

NAA, 2011. Historic Environment Desk Based Assessment. Whitby Coastal Strategy, Whitby, North Yorkshire.

[3] as amended by Marine Works (Environmental Impact Assessment) (Amendment) Regulations 2011

[4] as amended by the Town & Country Planning (Environmental Impact Assessment)(Amendment) Regulations 2006 (SI 2006 No. 3295) and the Town & Country (Environmental Impact Assessment)(Amendment) (England) Regulations 2008 (SI 2008 No. 2093).

Royal Haskoning, 2011a. Whitby Coastal Strategy Sandsend Road PAR Geotechnical Desk Study.

Royal Haskoning 2011b. Sandsend Desk Study Addendum.

ROYAL HASKONING

APPENDIX A

Short-listed Options

Option 1 - Do Nothing

No active intervention would be taken, with no further maintenance or capital works carried out on existing revetment or upper coastal slopes. The revetment will fail in large sections and quickly unravel laterally, and erosion of lower coastal slope will commence. Erosion in the eastern section of the study area will continue as currently where the defences are virtually obsolete. The A174 will be compromised and become unusable by year 20. This is the baseline against which the options are assessed.

Option 2 - Do Minimum

Maintenance of the existing revetment would continue until the end of its residual life, estimated to be approximately 5 years. At this point the failures of the surface of the existing revetment would be on too large a scale to patch repair. No new capital works would be carried out and Do Nothing would then commence with the revetment failing in large sections, and erosion of lower coastal slope starting. The eastern sections (MUs 6 and 7) would continue to erode as currently, the A174 would therefore be lost as under the Do Nothing scenario by year 20.

Option 3a - Stabilise the coastal slope and new outfall beneath the road

Upper coastal slope would be trimmed back to 22°, with excavated material placed in Raithwaite Ravine to provide erosion protection to the 1920's road embankment; this will require the outfall culvert to be extended by approximately 40m. Installation of drainage (vertical drains at 10m centres, toe drain, and French drain at top of slope to collect surface water), and planting of reprofiled slope.

Maintenance of this option would be limited to vegetation management and routine maintenance of the drainage system.

Option 3b - Construction of a catch wall and new outfall beneath the road

Installation of 12m 'H' section steel piles at 2 m centres with precast concrete panels to a height of 4m between the piles. The 'H' piles would be anchored into bed rock to a distance of 5m. Initial trimming of the slope will be required to remove the most unstable sections and drainage at the toe, mid slope and upper slope will be required. The option would work by allowing the upper coastal slope to continue to fail and 'catching' the material behind the wall preventing it reaching the road. The drainage would collect surface and ground water and discharge it safely through the revetment preventing damage to the revetment.

This slope option would require relatively high levels of maintenance, including clearance of fallen material from behind the catch wall, and maintenance of the wall itself and the slope drainage. The design life of the catch wall would be limited to 50 years and would require replacement at that point.

Option 4a - Construction of a reinforced concrete stepped revetment with rock armour extension

A reinforced concrete stepped revetment would be constructed on top of the existing revetment, after the concrete surface had been broken out and the fill material reprofiled to a suitable profile. The revetment would be constructed to approximately the same height as the existing revetment.

The concrete revetment would end at the edge of Raithwaite Ravine and tie into a new rock armour revetment across the front of the fill material placed in Raithwaite Ravine (either in-filled with new fill material or excavated material from slope Option AC).

The bedrock would be excavated to a depth of approximately 2m and the toe of the concrete revetment tied in to prevent undercutting.

Improvements to drainage outfalls from the road gullies would be made, and new outfalls incorporated for Newholme Beck at Raithwaite Ravine and the unnamed watercourse close to Raven Hill Farm. Additional drainage through the concrete revetment would be installed to allow discharge of ground water and ingressed seawater without damaging the revetment.

Maintenance for this option would include concrete repairs following storms, maintenance of the drainage systems and joints. Additionally for the rock armour section maintenance would be required including replacement of rocks and maintenance of the profile of the revetment following storms.

Option 4b - Construction of a rock armour revetment

A rock armour revetment would be constructed on top of the existing revetment, after the concrete surface had been broken out. The revetment would be constructed to approximately the same height as the existing revetment and would continue across the front of Raithwaite Ravine (either in-filled with new fill material or excavated material from slope Option AC).

The bedrock would be excavated to a depth of approximately 2m and the toe of the rock armour revetment tied in to prevent undercutting.

Improvements to drainage outfalls from the road gullies would be made, and new outfalls incorporated for Newholme Beck at Raithwaite Ravine and the unnamed watercourse close to Raven Hill Farm.

Maintenance for this option would include replacement of rocks and maintenance of the profile of the revetment following storms, and maintenance of the drainage systems.