Climate Adaptation Scilly
Porthmellon Enterprise Centre
St Mary's
Isles of Scilly TR21 0LW

Olivia Rickman
Council of the Isles of Scilly
Planning & Development Department
Old Wesleyan Chapel Garrison Lane
St Mary's
Isles of Scilly TR21 0JD

Our ref: CAS-EA1
Your ref: P/22/077/FUL

23 January 2023

Dear Olivia

APPLICATION FOR THE INSTALLATION OF GEOBAGS AT PERIGLIS TO REPLACE THE CORE OF EXISTING DUNES, WRAPPED IN GEOTEXTILE AND COVERED WITH EXCAVATED MATERIAL AND TO STABLILISE THE DUNE CREST WITH GEOMAT TO ENCOURAGE RE-VEGETATION. INSTALLATION OF ROCK BAGS AT PORTH COOSE TO HEIGHTEN THE EXISTING PROTECTION, BACKED BY EARTH BUND AND INSTALLING ROCK ARMOUR AT THE BOTTOM OF THE EXISTING SEA WALL AT PORTH KILLIER. TO REDUCE THE RISK OF COASTAL FLOODING ON ST AGNES. (EIA DEVELOPMENT) (MAJOR DEVELOPMENT) LAND ADJ TO WASTE SITE, THE QUAY, ST AGNES, ISLES OF SCILLY

Thank you for providing the objection raised by the Environment Agency (EA) on 19 December 2022, their reference DC/2022/122897/01-L01.

In the following response, I deal with the individual points raised in the same order as those raised by the EA. I quote their objection in italics and provide the project's response underneath. Accompanying the project's response is a detailed response from the design engineers for the project, HR Wallingford in the form of a memo. I refer to the memo in my response.

EA Objection 1 (Periglis)

1) *We have concerns that the design of the Periglis coast protection works will not provide the intended protection for the drinking water supply and will be prone to undermining and failure in the future. An alternative design whereby the geo-bags are constructed into the rear of the dune ridge (4-5m landward of proposed location), rather than towards the seaward face, would avoid disturbance of the shingle ridge frontage and avoid the risk of undermining within the intended design life of the structure.*

   The Environmental Statement indicates that the dune ridge appears to be in a long-term erosional trend, with evidence of erosion and steepening in some locations. As the long-term trend of the existing dune crest is predominantly erosional, it can be inferred that both advancing the alignment of the dune crest

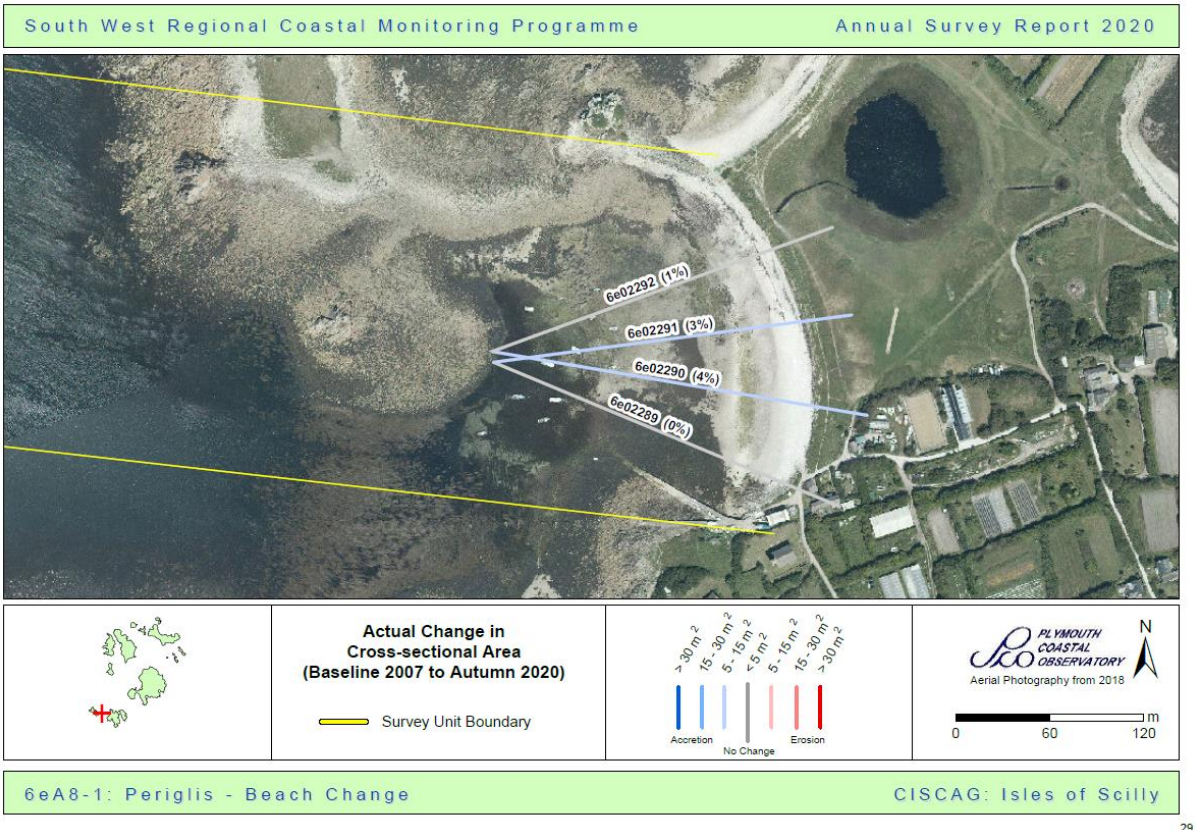
seaward and raising the elevation of the dune crest within the proposed design is likely to exacerbate the erosion of the dune face during storm events. As the defence prevents natural rollback, the dune face will become sacrificial, and exposure and undermining of the geo-bags will occur, as has been observed on other wave-exposed sites where the net dune sediment budget is negative. On exposure to the more vertical, resistant surface of the geo-bags, wave reflection is likely to occur, which could subsequently erode and steepen the beach face. The strandline as viewed in Figure 15 of the non-technical summary is overlapping with the toe of the proposed defence; therefore, it would be anticipated that this sensitive area would be subject to erosion following the construction of the defence.

Response to objection 1)

The EA suggest that the coast protection works will be "prone to undermining and failure in the future" because the "dune ridge appears to be in a long-term erosional trend". Although the EA rely on the Environmental Statement (ES) for this information, the ES is inaccurate.

The independent Plymouth Coastal Observatory annual surveys for this beach from 2007 to 2020 shows that the trend for Periglis is actually accretional (Figure 1). These data include observations both before the 2014 storm and after the 2014 storm.

Figure 1: Actual changes in cross-sectional area at Periglis beach, from autumn 2007 to autumn 2020. Positive percentages would indicate accretion, while negative percentages would indicate erosion. All cross sections at Periglis show no change or up to 4% accretion over this period (PCO 2020).



Despite this actual positive trend to accretion at Periglis over this period, Council proposes to move the geobags further back within the dune in response to the objection. Shifting the geobags rearward will increase the volume of material excavated. In the northern part of the dune, this is likely to remove the dune entirely before reconstruction is undertaken. Council proposes to move the bags back 3 m laterally compared to the originally submitted designs towards the back of the dunes, to minimise the volume of additional material to be excavated and associated increased costs.

This design modification is not likely to change the environmental impact of the proposed works, but it is likely to require working more frequently from behind the dunes at Periglis, rather than from the beach. The existing red line diagram provides adequate space in which this form of working can take place.

EA Objection 2 (Porth Coose)

2) *We have further concerns with regard to the design of the Porth Coose coast protection works. Currently, the Armourflex concrete mattress is covered by shingle, although this was partially exposed in the 2014 storms. The proposed rock bag wall, some 1.2m high, along the crest of the dune will impact wave energy by preventing regular overwash and introducing a hard reflective structure within the wave impact zone. Not only is this liable to lead to increased exposure of the concrete mattress, but also has the potential to damage the structure. Should the concrete mattress be damaged, subside or fail, then the rock bag coast protection wall will be prone to undermining and failure itself.*

   This should be considered within the Environmental Statement by providing information on the standard of protection, design life, wave energy impacts on the concrete mattress, and management responses in event of failure of any element of these combined works.

   On review of this information, the rock bag design may need to be amended to provide sufficient resilience over the design life. This might include, setting the base of the rock bags below the level of the concrete mattress, designing a sloping face to reduce wave energy reflection, and redesigning the toe protection provided by the concrete mattress.

Response to objection 2)

The proposed rock bags at the crest of the existing concrete mattress are not a solid vertical structure and will dissipate energy when waves impinge on the bags (see section 3.1 in the attached memo from HR Wallingford, the design engineers).

It is unlikely that the potential increase in run down induced by the presence of the rock bags will lead to loss of cobbles from the system and expose the concrete mattress to such an extent to cause its failure, during the 25 years design life (see attached memo).

This will be true provided that the installed crest continues to be monitored and repaired where damaged and that the front of the beach continues to have boulders protecting the toe.

In addition, cobbles currently are overwashed by storms (photograph 5 in the accompanying memo), which means they can no longer dissipate energy on the seaward side of the existing Porth Coose coastal protection works. The proposed protection works would reduce the likelihood that more cobbles were lost from the beach system in future, thereby reducing the impact of waves on the structures.

The boulder layer currently extends to an elevation of approximately 5 to 5.5 m Ordnance Datum (OD) (existing crest is on average at approximately 6m OD). Cobbles mainly are located below the toe of the proposed structure, where cross sections have increased in area by 1% to 4% between 2007 and 2020 (PCO 2020) as sediment (including cobbles) has accumulated.

Any failure of the existing concrete mattress slope will potentially cause a failure of the crest. The rock bags are however a more flexible element than a solid structure. Thus, it is likely that they will adjust to any minor modification of the crest, without failing. The crest stability has been assessed considering the hydraulic loading during a storm and requirements for ground investigation prior to construction have been incorporated in the tender package.

Monitoring and maintenance of the structure should continue to be carried out to ensure that any damage is promptly repaired.

The alternative design solution proposed in the Environment Agency's objection results, substantially, in a new embankment with reinforced core and a protected sea face. This solution would imply the excavation of the existing ridge, with removal of the Armourflex mattress and the reconstruction of a new armouring system on the front face and resultant increase in the works footprint. This would result in constructing a completely new protection system, with a considerable increase in costs and construction schedule and would be a greater change compared to the existing.

This is not likely to be feasible under existing available funding. In addition, Natural England have expressed concerns in their objection of 12 January 2023 about the impact excavation of the dune crest within this Site of Special Scientific Interest will have on vegetation. Minimising excavation and disturbance would help to avoid increasing the impacts that Natural England are concerned about.

EA Objection 3 (All sites)

3) *We would request an assessment as to how the applicant will ensure no adverse impact on surface water quality in general, especially as:*

   The Isles of Scilly lie within the WFD TrAC waterbody Scilly Isles (GB620807080000). (The Isles of Scilly are also covered by the WFD groundwater waterbody Isles of Scilly (GB40802G081200)).

The Isles of Scilly are covered by SAC and MCZ designations and include interest features such as Zostera (sea-grass) which are known to be sensitive to siltation i.e. suspended solids in the water column can settle out and smother sea-grass.

Response to objection 3)

There are no flowing streams on the off-islands of the Isles of Scilly. Surface water quality therefore refers to the potential impacts of the works on freshwater and saline lakes such as Big Pool on St Agnes and Pool of Bryher. No works are taking place directly within any surface water features, so potential impacts relate to discharges of sediment to the marine environment during construction of the works, or of fuels or lubricants from machines or from processes associated with the works on dry land, or in the marine setting. Discharge of fuels or lubricants also has the potential to affect groundwater bodies.

The potential impacts on surface water quality in general are identified in various sections of the ES, including:

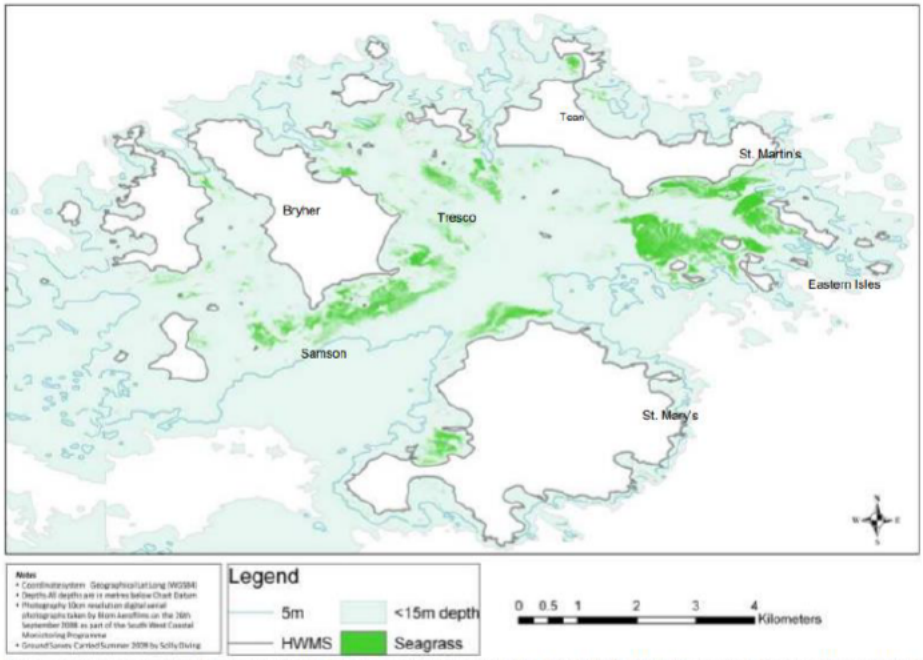
1) Section 5, at pages 185, 198 and summarised in section 10.8 at page 358, where the potential impact of refuelling vehicles on water quality is discussed and mitigation measures are proposed
2) Section 4 deals widely with the potential impacts of the works on sediment in the marine zone. In particular, section 4.2 deals with the expected impacts of sediment released during construction and operation of the various flood defences. The ES concludes (section 4.3) that there will be no significant residual effect on coastal processes, including sediment generated by the works.

Seagrass beds around the Isles of Scilly were mapped by Natural England (2011). Figure 12 of that study (included as Figure 2 here, note island name labels are mis-placed in the original figure) identified where seagrass was likely to be found around the islands. No seagrass is expected to be present near works on St Agnes, nor Bryher (except Kitchen Porth). No seagrass present near the works on St Martin's is likely to be affected since all these works occur on land or above MHWS.

All construction work at Kitchen Porth will occur above MHWS and requires minimal removal of materials first. No excavation of the beach is proposed at this site. The works will be constructed against the existing bank without disturbing it. The delivery of materials to the sandy, rocky beach at Kitchen Porth is unlikely to release fine-grained sediment that will affect local seagrass beds.

On all islands, disturbance of the seabed during storms is likely to produce more suspended sediment in the water column than the proposed activities of the project.

Figure 2: Final map of seagrass distribution for the Isles of Scilly, from Natural England (2011), page 25.



Please note bathymetric data is derived from © British Crown and SeaZone Solutions Limited, 2009. All Rights Reserved. Products Licence No. 062006.004. This product has been derived in part from material obtained from the UK Hydrographic Office with the permission of the Controller of Her Majesty's Stationery Office and UK Hydrographic Office (www.ukho.gov.uk). NOT TO BE USED FOR NAVIGATION.

Figure 12 Final map of seagrass distribution post knowledge editing

Isles of Scilly Seagrass Mapping 25

Yours sincerely,

[redacted]

Stephen Swabey
Project Director, Climate Adaptation Scilly

References

Natural England (2011) "Isles of Scilly seagrass mapping (NECR087)" http://publications.naturalengland.org.uk/file/82006

Plymouth Coastal Observatory [PCO] (2020) "South West Regional Coastal Monitoring Programme – Annual Survey Report Isles of Scilly 2020", 219 pp. https://www.coastalmonitoring.org/pdf_download/?metadata_id=557900

HR Wallingford

Memo

To:	Stephen Swabey
cc:	Andy Campbell; Tim Pullen
From:	Aurora Orsini
Date:	13/01/2023

Subject: EA Objection to scheme at Port Coose and need for design changes

1. Introduction

The Environment Agency has sent an objection to the current proposed flood defence design scheme at Periglis with the following motivation:

"Advice regarding proposals for Porth Coose frontage of the St Agnes application.

We have further concerns with regard to the design of the Porth Coose coast protection works. Currently, the Armourflex concrete mattress is covered by shingle, although this was partially exposed in the 2014 storms. The proposed rock bag wall, some 1.2m high, along the crest of the dune will impact wave energy by preventing regular overwash and introducing a hard reflective structure within the wave impact zone. Not only is this liable to lead to increased exposure of the concrete mattress, but also has the potential to damage the structure. Should the concrete mattress be damaged, subside or fail, then the rock bag coast protection wall will be prone to undermining and failure itself.

This should be considered within the Environmental Statement by providing information on the standard of protection, design life, wave energy impacts on the concrete mattress, and management responses in event of failure of any element of these combined works.

On review of this information, the rock bag design may need to be amended to provide sufficient resilience over the design life. This might include, setting the base of the rock bags below the level of the concrete mattress, designing a sloping face to reduce wave energy reflection, and redesigning the toe protection provided by the concrete mattress."

2. Current proposed design option

At Porth Coose the ridge is protected by an Armourflex concrete mattress slope, which with time has been covered at sections by sand and vegetation. A cobble layer covers the upper beach where the toe of the revetment is located, providing protection and a dissipating layer for wave energy.

The proposed design does take into account that Porth Coose has previously had Armourflex concrete mattress slope protection installed to protect against erosion, though further protection against overtopping is required to meet the requirement for flood protection at this location.

Over the full extent of the beach the Armourflex concrete mattress slope will be retained, as a walk over survey indicated that it is in reasonable condition, and to enhance protection against overtopping, the crest level will be increased through the placement of rock bags with the rear filled, which aim to provide protection from overtopping. The bags will be placed on a prepared surface at the top of the armourflex concrete mattress slope, which will provide protection of the crest of the ridge which is currently eroded at some locations. Fill material is to be placed behind to tie in the top of the bags to the ground behind and to strengthening the ridge where damaged by erosion. A geomat will be placed to stabilise this slope and encourage establishment of vegetation. Sand fill will also be placed on top of the bags to cover and encourage plant colonisation. The general arrangement of the works are shown in drawing DKR6499/D110/111, and the typical cross section for the proposed works is shown in drawing DKR6499/D110/320, Figure 1 below shows an example of a typical section.

The standard of protection to be provided by this option is 1 in 150 years, with a design life of 25 years.

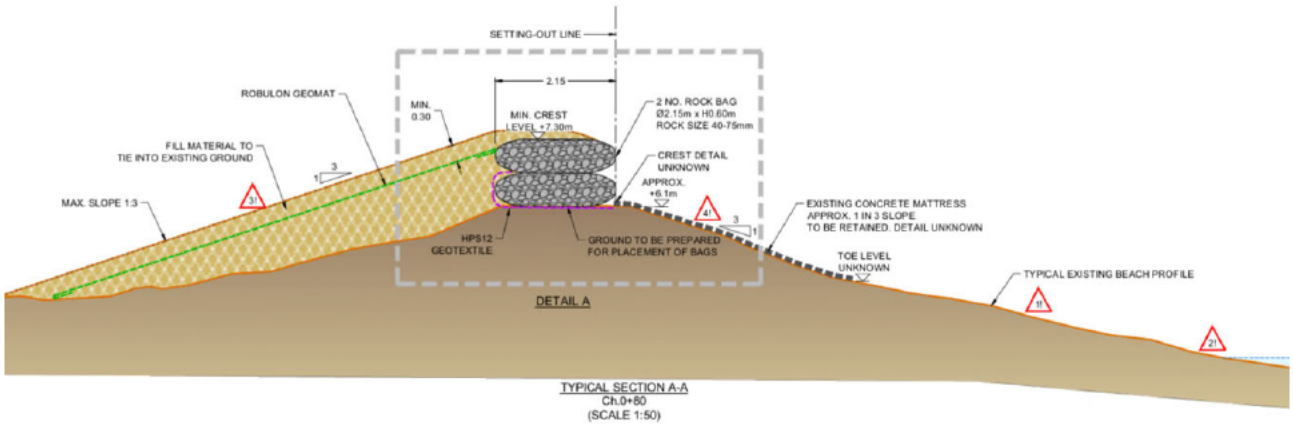


Figure 1: Site 50 – Typical section

3. Discussion

3.1 Purpose of the works and description of ridge

The purpose of the works is, as described above, to enhance the flood protection at this location. This is particularly important given the presence of Big Pool behind and the risk to fresh water habitat and supply represented by salt water flooding. The rock bags at the top of the ridge aim therefore to reduce the risk of overwashing and flooding. The rock bags are not a solid vertical structure and they will still provide some level of energy dissipation in addition they can be, in time, naturally populated by local vegetation.

Presently the ridge is protected by an Armourflex concrete mattress, as shown in Photograph 1 and 2 below, which is fronted by a layer of boulders and cobbles. As built drawing or any design information was not available, to be incorporated in the design. Therefore assumptions on the condition, and toe elevations were

made based on a walk over inspection carried out in June 2021 and it is proposed to retain the existing mattress.

Photograph 1 – View of the ridge armoured with the Armouflex concrete mattress, fronted by boulders, at its toe, and a layer of cobbles and gravel over the beach

Photograph 2 – Armourflex concrete mattress fronted by large boulders

Photograph 3 – Ridge crest artially vegetated with cobbles washed over during storms

Photograph 4 – Looking towards South-West, with evidence of presence of boulders and cobbles along the upper beach

The condition of the concrete mattress appeared fair during that inspection, though at some specific locations along the front, rear and along the crest will require some local repairs as also discussed in the section below.

Photograph 5 below show a pile of cobbles along the back of the ridge, which are assumed to have been overwashed during storms. At present, these cobbles are no longer available along the front face of the beach to naturally dissipate wave energy.

Photograph 5 – Cobbles thrown over the ridge or overwashed by severe storms and overwashing events.

3.2 Structure condition

We are aware that the condition of the beach defence was described as 'poor' in the September 2021 asset inspection undertaken by the CCO. Full details of the inspection are not yet available as to what specifically determined the classification of this asset as 'poor', which from the definitions above, would suggest that the defects are such that they would significantly reduce the performance of the asset. An in depth analysis of the information provided showed however that the concrete revetment was scored as 3, "Fair", though the crest and the rear side did score as 4, "Poor". Therefore the overall score was considered as 4, "Poor".

A detailed condition survey was not undertaken as part of the present design, but, as identified in a visual inspection carried out during the walkover survey in the summer 2021, overall the slope appeared in fair condition, rather than poor; although along some sections parts of the mesh at the crest and along the rear side had been exposed.

Left unprotected and unrepaired the crest of the ridge will continue to erode causing eventually the failure of the concrete mattress protection, see Photograph 6.

Therefore, as part of the proposed design, a surface preparation for the placement of the rock bags will be carried out with localised repair/preparation works, ahead of placing and the rear side will be buried by the fill as shown above.

These measures will provide some level of repair, which would improve the current structure's conditions to re-establish a "Fair" overall condition and extend its present residual life.

The residual life of this structure is currently probably between 10 and 15 year; the repair works would likely increase the residual life to 25 years, in line with the required design life of the proposed works.

Photograph 6 – Exposed mesh on the ridge

3.3 Impact of the rock bags

We do not believe that the presence of the proposed bags will particularly worsen the existing situation in the life of the scheme, to the point of causing failure of the protection. The concrete mattress is already a reflective structure, possibly, with the large boulders, more reflective than the proposed rock bags, which will also be located at a higher level. Most of the time the cobbles will not feel the presence of the rock bags, since wave action will not routinely push the cobbles up to the rock bags. During severe storms, wave run

up will reach the bags. It is expected that, for specific conditions, the crest will still be partially overtopped, though with tolerable discharges, though the overwashing of cobbles will be minimised.

This is not a natural ridge which is meant to roll back, because it is engineered, therefore there is no benefit in relation to natural sediment transport, from the rolling backwards of the cobbles over the crest of the ridge. On the contrary this allows valuable volumes of cobbles to be lost from the foreshore.

There is no evidence that would suggest that the presence of the bags can create an offshore movement of cobbles, capable of leaving the system. It is more likely that the cobbles will be moved across and along the shore during a storm, and then will be moving back to the upper beach/toe of the ridge during calmer sea conditions, see Figures 2 and 3 below.

Embankment reinforced with concrete mattresses are not generally designed to be overwashed, though some overtopping may be tolerated. Overwashing would lead to the erosion of the crest and the rear side and then failure, as also shown in Figure 2, and as it is currently happening along some sections. The protection from overwashing, the repairs and the further protection of the rear slope will improve the overall stability and extend the life of the protected ridge to meet the 25 years design requirement.

It is acknowledged that run down during severe storms will be likely greater than at present, given that overtopping and overwashing is reduced by the increased crest level, though how much greater can not be estimated with accuracy, unless a physical model test is carried out. The rock bags will provide some level of permeability, therefore absorbing some of the energy, and therefore the option should not be compared to a situation such as a seawall backing a gravel beach.

The requirement at this location was the enhancement of the existing defence by retrofitting a design solution which would mitigate the risk of overtopping and flooding and any proposed option needed to be affordable. The proposed retrofit of rock bags over the ridge aims to provide an economic though still viable protection, which during the design storm will allow the system to reduce the risk of overwashing and flooding for the duration of the storm. It is envisaged that the system will need repairs following such a storm with some material recharge on and behind the crest. The relatively narrow ridge footprint means that new revetments or engineered embankments would require large volumes of material and would encroach the Big Pool to a greater extent than already proposed and so is not recommended.

The findings of the site visit suggested that the ground conditions are suitable to accommodate the proposed coastal protection works. However, due to the lack of geotechnical information, no assessment was carried out to verify this assumption. The suitability of the ground will to need to be confirmed prior to construction as recommended. Specification for GI were part of the deliverable and tender package.

The presence of local boulders at the toe of the ridge will be maintained along the whole frontage as part of the present design.

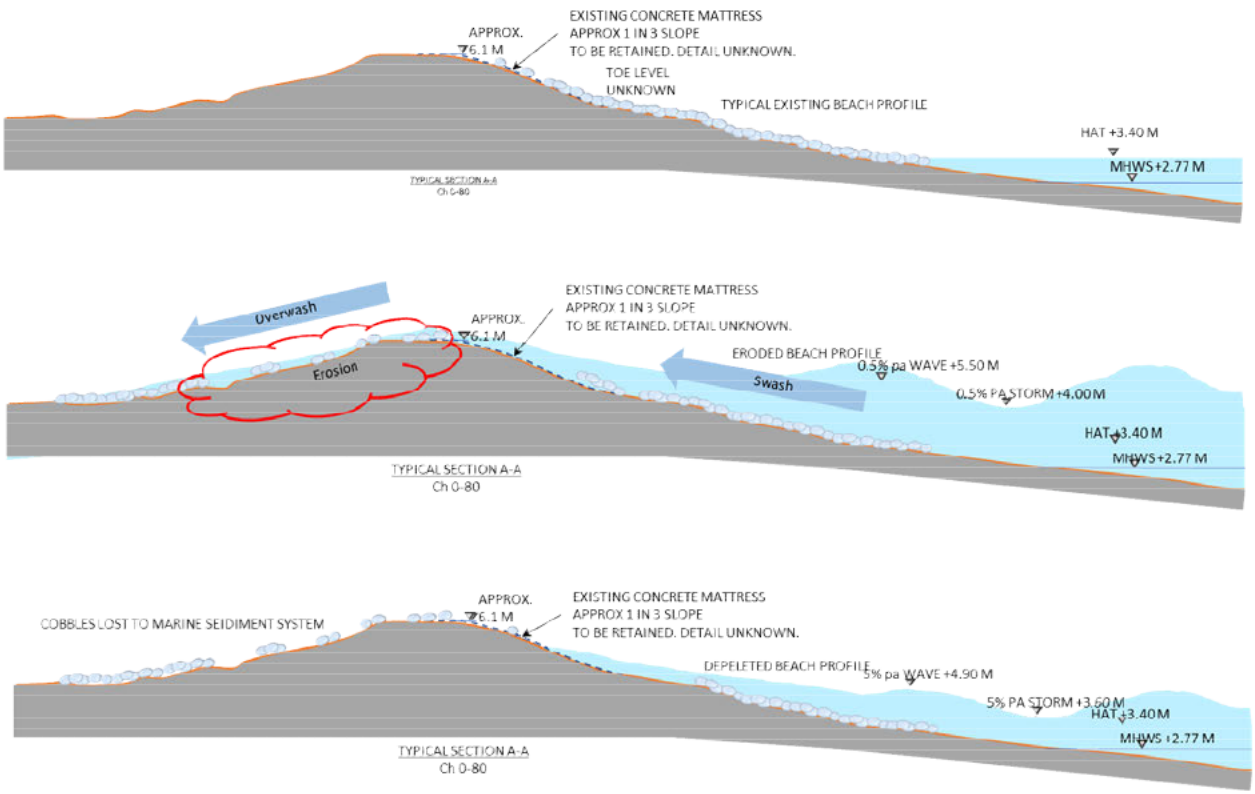


Figure 2 Present schematic representation of the movement of cobbles during storms

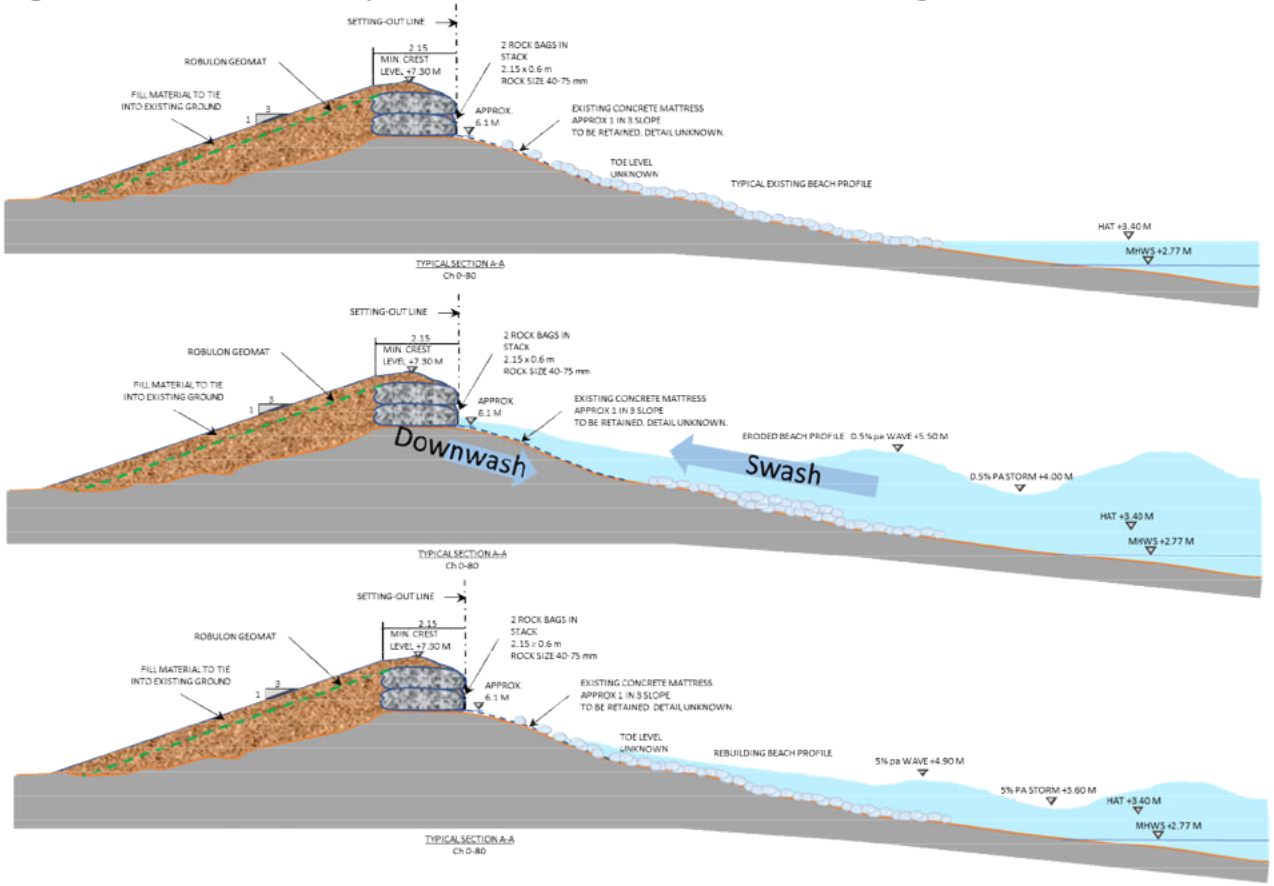


Figure 3 Schematic representation of the movement of cobbles with the proposed design

Conclusions

The present design should be considered as a retrofit, to extend the life of the existing structures and enhance the standard of protection from flooding. An economical though viable design solution has been proposed, which could be constructed with minimum disturbance of the site, reducing the need to transporting large rocks and working above the tidal foreshore.

GI were not available prior to design, therefore the site conditions have been assessed through a visual inspection only. A specification for GI have been included in the tender package and recommendations to carry out these investigation prior construction have been given.

Given the discussion and the evidence described in the sections above, it is unlikely that the potential increase in run down induced by the presence of the rock bags will lead to loss of cobbles from the system and expose the concrete mattress to such an extent to cause its failure, during the 25 years design life. This is true provided that the installed crest continues to be monitored and repaired where damaged and that the front of the beach continues to have boulders protecting the toe. The boulder layer currently extent to an elevation of approximately 5 to 5.5 m OD (existing crest is on average at approximately 6m OD). Cobbles are mainly located below the toe of the structure, as described also in the CCO surveys.

We are aware that any failure of the slope will cause a failure of the crest. The rock bags are however a more flexible element than a solid structure , thus it likely that they will adjust to any minor modification of the crest, without failing. The crest stability has been assessed considering the hydraulic loading during a storm and requirements for GI prior construction have been incorporated in the tender package.

Monitoring and maintenance of the structure should continue to be carried out to ensure that any damage is promptly repaired.

The alternative design solution propose substantially a new embankment with reinforced core and a protected sea face. This solution would imply the excavation of the existing ridge, with removal of the armourflex mattress and the reconstruction of a new armouring system of the front face and resultant footprint. This would result in the construction of a completely new protection with a considerable increase in costs and construction schedule and would be a larger change compared to the existing..

A staggered layout of the bags could still be achieved, without the removal of the existing armourflex concrete slope, increasing the number of bags from two to three and maintaining 1 bag over the crest. This could reduce the vertical effect, though it will increase the volume of the fill required at the rear and the number of bags required, thus costs and construction time.