

Biosecurity Plan Template

Marine Maintenance Dredging

This Biosecurity Plan Template is intended to be used by marine maintenance dredging operators and contractors in order to minimise the risks posed by marine invasive non-native species (INNS), particularly related to minimising spread to new areas. It is difficult to directly manage INNS in the marine environment once they are present, therefore, prevention is key which is recognised in the GB Invasive Non-native Species Strategy (2015)

“Where direct management is not feasible, as is often the case in the marine environment, we will seek to reduce the spread of species by improved and targeted biosecurity”.

There are a number of legislative drivers for this work including the Marine Strategy Framework directive (MSFD); EU IAS (Invasive Alien Species) Regulation and the Wildlife and Countryside Act (W&CA) 1981, Schedule 9. Section 14 of the W&CA states that it is an offence to ‘release or allow to escape into the wild any animal which is not ordinarily resident in Great Britain or any species listed in Schedule 9 of the Act’. Schedule 9 of the act lists a number of marine INNS particularly relevant to marine dredging activities, these include the Chinese mitten crab (*Eriocheir sinensis*), American Oyster Drill (*Urosalpinx cinerea*) and the American Slipper Limpet (*Crepidula fornicata*).

With respect to maintenance dredging activities in Wales and in order for the potential risks posed by these species to be managed in the most effective way it is important that NRW obtain as much information as possible. In certain circumstances where the activity is deemed not to contribute to the further geographic spread of those species on Schedule 9 (W&CA), NRW may issue an exemption in the form of a ‘General Species Licence’, however, this will be assessed as part of the licensing process.

1. Introduction

Please provide a brief background/overview about the maintenance dredging activity

There is no requirement for dredging within this contract, however the form has been completed to list the plant and equipment that will be used for the construction works and in order to comply with Marine Licence CML2133.

The purpose of this contract is to undertake construction works for the Aberaeron Coastal Defence Scheme as detailed below:

Aberaeron Coastal Defence scheme is required in order to reduce the risks associated with coastal flooding within the town, to provide protection against predicted sea level rise, and to maintain the South Beach defences and Grade II Listed South Pier for the future. The seaward end (head) of South Pier is currently fenced off due to it being unsafe for use and is in need of reconstruction as this is a critical flood defence feature which maintains the shingle

on the South Beach. The existing harbour flood walls are too low and need to be raised to provide protection from flooding now and in the future. The proposed scheme is made up of five key elements which are interlinked as integral parts to the flood defence scheme. These are as follows:

1. **South Pier** - Partial reconstruction of the seaward head of the South Pier and improving the durability of the remaining structure by grouting.
2. **Breakwater** - Construction of a rock breakwater extending out from the North Pier
3. **Harbour flood walls** - Raising parts of the set-back flood walls at Quay Parade and Pwll Cam with masonry and glass panels. Incorporating tilt barriers (flood gates) within these walls to maintain access. Improving durability of existing harbour walls by grouting. Raising the existing River Aeron wall with glass panels. Extending and constructing a new wall between the footbridge up to the rear of the Monachty Hotel. Biodiversity enhancements and amenity improvements are also provided.
4. **Pwll Cam gate** - Construction of a flood gate and control kiosk at Pwll Cam to maintain use of the inner harbour area.
5. **South Beach** - Improvements to South Beach in the form of removal and replacement of the existing timber groynes. Replacing and extending the existing rock revetment and placement shingle nourishment.

Refer to general arrangement drawing 5182114-ATK-MAR-GEN-DR-C-1000 indicating the main scheme structures proposed.

- 1.1. **Applicant Name:** Contractor – BAM Nuttall
- 1.2. **Marine Licence reference number:** CML2133
- 1.3. **Description of Operation:** Aberaeron Coastal Defence Scheme – Construction works as detailed in section 1.0 above.
- 1.4. **Dredge and disposal Site Location(s):** Not applicable as no dredging and disposal required
- 1.5. **Activity period:** Site works September 2022 to December 2023
- 1.6. **Biosecurity Manager/Officer:** Emyr Thomas (BAM Nuttall)
- 1.7. **Approval Date:** 03 January 2023
- 1.8. **Document version number:** Version 2_15/12/23

2. Information related to the Environmental conditions affecting biosecurity

	Source environment/location	Receiving environment/location
Marine Non-native species known to be present		No records of invasive species are found local to Aberaeron harbour area or within the boundary shown on drawing 5182114-ATK-MAR-GEN-DR-C-1000 where the works are to take place. Japanese wireweed (Sargassum) has been recorded in the Cardigan Bay SAC. There does not appear to be any recordings at Aberaeron harbour where the works will take place, although it has been identified offshore, and further up and down the coast (based on NBN Gateway data) as detailed below.

		According to the NRW <i>Sargassum muticum</i> dataset, there are 2 records of the species at the beach south of Aberaeron. It should be noted that the <i>Sargassum muticum</i> records along the coast are outside of the limit of the works. However, prior to the start of the works, these locations will be added to our drawings so that the contractor is aware of its location and so that they will not operate within this area which is outside of the works extent.
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3. Vessels & equipment involved in the operation¹ *(please list all vessels, barges and equipment to be used as part of the maintenance dredging operation – insert additional rows as necessary)*

Vessel name	Photo reference <i>(Please insert images in the appendix)</i>	Vessel type	Details, Risk factors & Justification <i>e.g. Pathway, vessel speed, biofouling control, Inspection history, Internal treatment history etc..</i>	Risk: <i>(High/Medium/Low)</i>
Dredging - not applicable as no dredge and disposal activities taking place. Rock delivery vessels detailed below.	<i>Insert image reference numbers</i>	<i>e.g. Suction dredge</i>	<i>See IMO Biofouling Guidance</i>	<i>e.g. Medium</i>
Tracked excavator with bucket for excavation	Image 1 (refer to appendix)	Tracked Excavator (35-90 tonne tracker excavator)	Used for intertidal works - to be deployed on the South beach, South Pier, Breakwater and in the harbour at low tide (i.e. dry) for excavation works of foundation details of new structures. Vehicles and equipment will be cleaned thoroughly in freshwater prior to and	Low

¹ The licence holder should update and submit a revised plan as a result of any amendments to the list of vessels and/or equipment to be utilised as part of current licence.

			and prior to leaving site (at the end of the project) and any material will be disposed of in the correct manner to a licensed tip.	
Tracked excavator placing geotextile	Image 2 (refer to appendix)	Tracked Excavator (35-90 tonne)	Used for intertidal works - to be deployed on the South beach, South Pier, Breakwater and in the harbour at low tide (i.e. dry) for placing geotextile at the base of new structures. Vehicles and equipment will be cleaned thoroughly in freshwater prior to arrival and prior to leaving site (at the end of the project) and any material will be disposed of in the correct manner to a licensed tip.	Low
Tracked excavator with a grapple or bucket to pick up and place rock	Image 3 (refer to appendix)	Tracked Excavator (35-90 tonne)	Used for land based and intertidal works - to be deployed on the South beach, South Pier, Breakwater and in the harbour at low tide (i.e. dry) for placing of rock for new structures. Vehicles and equipment will be cleaned thoroughly in freshwater prior to arrival and prior to leaving site (at the end of the project) and any material will be disposed of in the correct manner to a licensed tip.	Low
Wheeled Dump truck transporting rock	Image 4 (refer to appendix)	Wheeled Dump truck (25 - 40 tonne)	Used for land based and intertidal works - to be deployed on the south beach at low tide (i.e. dry) for the transport of rock between the rock stockpile and	Low

			breakwater/revetment structures. Vehicles and equipment will be cleaned thoroughly in freshwater prior to arrival and prior to leaving site (at the end of the project) and any material will be disposed of in the correct manner to a licensed tip.	
Dozer to spread out the shingle	Image 5 (refer to appendix)	Tracked Dozer	Used for intertidal works - to be deployed on the south beach at low tide (i.e. dry) in order to spread out and profile imported shingle on the beach. Vehicles and equipment will be cleaned thoroughly in freshwater prior to arrival and prior to leaving site (at the end of the project) and any material will be disposed of in the correct manner to a licensed tip.	Low
Piling Rig	Image 6 (refer to appendix)	Piling rig or tracked excavator with pile driver (movax)	Used for land based and intertidal works - to drill piles into the sea bed when the tide is receded (i.e. dry) for the new timber groynes. Also piling of the sheet piles wall adjacent to the River Aeron about MHWS on a temporary access platform. Vehicles and equipment will be cleaned thoroughly in freshwater prior to arrival and prior to leaving site (at the end of the project) and any material will be disposed of in the	Low

			correct manner to a licensed tip.	
Scaffolding for south pier and wall repairs	Image 7 (refer to appendix)	Scaffolding platform off harbour walls	To be positioned on harbour walls and south pier above MHWS to undertake drilling, grouting and wall repairs. The scaffold platform will be above high water, therefore, it does not have any interaction with the water. Vehicles and equipment will be cleaned thoroughly in freshwater prior to arrival and prior to leaving site (at the end of the project) and any material will be disposed of in the correct manner to a licensed tip.	Low
Negative Mobile Elevated Working Platforms (MEWP's) to repair walls from above high water	Image 8 (refer to appendix)	MEWP off harbour walls	To be positioned on harbour walls and south pier above MHWS to undertake drilling, grouting and wall repairs. The MEWP will be positioned above high water, therefore, it does not have any interaction with the water. Vehicles and equipment will be cleaned thoroughly in freshwater prior to arrival and prior to leaving site (at the end of the project) and any material will be disposed of in the correct manner to a licensed tip.	Low
Crane and basket to carry operatives for wall repairs	Image 9 (refer to appendix)	Crane and basket	To be positioned on harbour walls and south pier above MHWS to undertake drilling, grouting and wall repairs. The Crane and basket will be positioned above	Low

			high water, therefore, it does not have any interaction with the water. Equipment will be cleaned thoroughly in freshwater prior to arrival and prior to leaving site (at the end of the project) and any material will be disposed of in the correct manner to a licensed tip.	
Rope access for repointing and wall repairs	Image 10 (refer to appendix)	Rope access	To be positioned on harbour walls and south pier above MHWS to undertake drilling, grouting and wall repairs. The rope access will be positioned above high water, therefore, it does not have any interaction with the water. Equipment will be cleaned thoroughly in freshwater prior to arrival and prior to leaving site (at the end of the project) and any material will be disposed of in the correct manner to a licensed tip.	Low
Barge, Tug, Crane and Gate TBC – may be delivered by road	Image 11 example at Milford Marina (refer to appendix) TBC	Barge and Crane	To be positioned in the harbour above water (i.e. in the wet) to allow the Pwll Cam gate to be floated and lifted into place. Vehicles and equipment will be cleaned thoroughly in freshwater prior to and after leaving site and any material will be disposed of in the correct manner to a licensed tip. Ballast water management to follow IMO guidelines / best	Low

			practice – no ballast water exchange at least 200nm from land and in water 200m deep. A hull fouling risk assessment shall be undertaken following IMO guidance, including a visual estimate of biofouling to ensure fouling no worse than light fouling (1-5% of submerged surfaces fouled) of any vessel	
Main barge (out at sea) to transports rock from the quarry. Rocks lifted by excavator onto smaller barge in next section	Image 13 (refer to appendix)	Barge	To be positioned out at sea above water. The barge will contain rocks for the breakwater and revetments. These will be lifted from the barge by and excavator (placed on the barge) and offloaded onto smaller boats for transport to Aberaeron. Barge and equipment will be cleaned thoroughly in freshwater prior to and after leaving site and any material will be disposed of in the correct manner to a licensed tip. Ballast water management to follow IMO guidelines / best practice – no ballast water exchange at least 200nm from land and in water 200m deep. A hull fouling risk assessment shall be undertaken following IMO guidance, including a visual estimate of biofouling to ensure fouling no worse than light fouling (1-5% of submerged surfaces fouled) of any vessel.	Low

Transfer barges from main barge to beach	Image 14 (refer to appendix)	Barge	The smaller barges will transport rock from the main barge to Aberaeron south beach. A hull fouling risk assessment shall be undertaken following IMO guidance, including a visual estimate of biofouling to ensure fouling no worse than light fouling (1-5% of submerged surfaces fouled) of any vessel.	Low
Rock Delivered by Road	Image 15 (refer to appendix)	Articulated lorry	Used for land based works - to be deployed from the land based quarry and delivered to the site compound above MHWS.	Low

3.1. Vessel & Disposal site Proposed activity log

In relation to maintenance dredging activities, marine invasive non-native species typically have three main vectors by which spread can potentially occur from one location to another. These are hull fouling, transfer in vessel ballast water and transfer within marine sediments. In order to better understand the potential risks associated to the current operation it is important to outline a brief history of vessel/equipment movements. This includes information such as vessel/equipment recent activity history (including any periods of inactivity) as well as information on ports visited and dredge/disposal site locations associated to the current licensable activity.

(Please note: a separate row should be inserted for changes in vessel and/or disposal site)

Vessel name	Brief description of vessel activity over the last 12 months	Transit ports (list all ports to be visited on route to the current dredge activity if applicable)	Transit ports arrival and departures		Disposal site name & reference
			Arrival date	Departure date	
TBC	Insert name of all ports and dredge/disposal sites visited in the last 12 months	Port name	Date	Date	Disposal site name and reference no. N/A
		TBC	TBC	TBC	

4. Activities which have a significant risk of introducing or spreading marine invasive non-native species *(Please provide as much detail as possible of how each of the activities have the potential to increase the risk of introduction or onward spread of marine invasive non-native species – insert additional rows as necessary)*

Activity and brief description	Details of how this could potentially increase the risk of introducing and/or spreading MINNS	Mitigation and Biosecurity measures to be implemented
Movement of equipment from one location to another to undertake works.	Inadequate cleaning / anti-fouling may transfer some MINNS between areas	- Equipment to be thoroughly flushed /washed before moving off site in order to minimise the risk of transporting MINNS between sites/ports. - All the works will require plant (excavators, dumpers, dozer piling rig, barge and boats) to move between works as detailed below:
Movement of barges from one site to another site.	Inadequate cleaning / anti-fouling may transfer some MINNS between areas.	A hull fouling risk assessment shall be undertaken following IMO guidance, including a visual estimate of biofouling to ensure fouling no worse than light fouling (1-5% of submerged surfaces fouled) of any vessel. Ballast water management to follow IMO guidelines / best practice – no ballast water exchange at least 200nm from land and in water 200m deep.
Movement of the excavators, dumpers and dozer	Inadequate cleaning may transfer some MINNS between areas.	The excavators, dumpers and dozer will only move from the site compound, along the beach and to the breakwater and revetment locations. A maximum distance of 400m between the compound and breakwater and 300m from the compound to the furthest groyne.

		At the end of each shift the excavator, dumpers and dozer will move onto land (above MHWS) using the temporary access ramp from the site compound. The excavator will park at the site compound and then resume operations when the shift or tides allow. A tidal period of work of over a period of 6 to 9 months is expected. The equipment will be cleaned and dried prior to arriving to site, once the works have been completed and before it is transported to the next location.
Movement of the piling rig	Inadequate cleaning may transfer some MINNS between areas.	The piling rig will only move from the site compound and along the south beach. A maximum distance of 500m from the south pier to the furthest timber groyne. At the end of each shift the rig will move onto land (above MHWS) using the temporary access ramp from the site compound. The rig will park at the site compound and then resume operations when the shift or tides allow. A tidal working period of 2 weeks is expected to drive the new groyne piles. This plant will not be moving significant distances when at Aberaeron as detailed above and deemed low risk. The equipment will be cleaned and dried prior to arriving to site, once the works have been completed and before it is transported to the next location.
Unusual/unknown species carried with rock cargo	Transfer of MINNS or unknown/unusual species between areas.	Predeparture inspection to ensure no vegetative / organic matter transferred with rock.

5. Mitigation & Biosecurity Control Measures – Instructions for staff/contractors/site users *(insert additional rows as necessary)*

Who	What	Where	When
Contractor – site foreman / person in charge	Equipment is thoroughly flushed /washed before arriving to site and moving off site in order to minimise the risk of transporting MINNS between sites/ports.	Site management plan	Before / after accessing site
Contractor – site foreman / person in charge	Ensure Check, Clean, Dry protocol is included in site induction / pre-site information for site staff	Site management plan	Before site is operational / pre-site information to staff
All site staff / visitors	INNS toolbox talk / site induction	Site induction	Before accessing site
Contractors excavator operator, piling rig operator, dumper operator, dozer operator	The equipment will be cleaned and dried prior to arriving to site, once the works have been completed and before it is transported to the next location.	Site Management plan	Before arriving to site and prior to leaving site
Contractors barge and boat operator	INNS is found.	Log the incident in the Biosecurity log. Alert the relevant authority based on whether local INNS or high risk INNS and seek specialist advice.	During works

6. Operational surveillance and reporting procedure

Identification of INNS - On day one of the contract an ecological briefing/toolbox talk will be presented to the contractors and their staff. This will highlight the potential species at the site with regards to marine ecology and in respect of INNS. This will be presented to the contractor by an ecologist from Ceredigion County Council. The toolbox talk will take place at low tide to allow the ecologist to show the contractor what they need to look out for during the works. What will happen if INNS are found - If INNS are located then these will be recorded in terms of their actual co-ordinates and with photos, if possible.
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- Any records of NNS will be recorded on the UK NNSS database, using the reporting database. This should allow photos to be uploaded – [Enter non-native species records | iRecord \(brc.ac.uk\)](#)
- This will also be recorded on NRW website - [Natural Resources Wales / Report an incident \(naturalresources.wales\)](#)
- If the database does not work for any reason, records, including photos if possible, will be notified by email to - alertnonnative@ceh.ac.uk
- Have procedure in place for recording specimen and marine biologist to identify species.
- Log the incident in the Biosecurity logbook.
- Alert the relevant authority based on whether local INNS or high risk INNS.

7. Contingency Plan (*i.e. when changes to the plan necessary and have been identified - insert additional rows as necessary*)

Action	Responsibility	Location of Equipment
Use of alternative staff	Contractor – site foreman / person in charge	Ensure measures in section 5 have been applied and staff have received training.

8. Location of biosecurity logbook

Administrative office to be located in the site compound.

9. Annual Review Date

The annual review will be undertaken 1 year from the commencement date on site. Currently, 1 year will be in December 2023.

Useful reference documents

IMO Guidelines for the control and management of ships biofouling to minimize the transfer of invasive aquatic species

http://www.imo.org/blast/blastDataHelper.asp?data_id=30766

Shetland Biosecurity Plan

<http://www.nafc.uhi.ac.uk/departments/marine-science-and-technology/BiosecurityPlan.pdf>

Marine Biosecurity Planning Guidance (England & Wales November 2015 – adapted from SNH, Payne, Cook Macleod February 2014)

<https://secure.fera.defra.gov.uk/nonnativespecies/downloadDocument.cfm?id=1401>

GB non-natives species secretariat

Marine biosecurity - key guidance documents and websites

Non - native species records can be accessed via the local record centres

<http://www.lrcwales.org.uk/?AspxAutoDetectCookieSupport=1>

or the National Biodiversity Network

<http://www.nbn.org.uk/>

or the marine biological Association

<http://www.mba.ac.uk/>

NRW marine experts can also give advice on Non-native species records.

Appendix

Additional supporting material to be added here e.g. vessel/equipment photographs

Section 10 – Additional detailed method statement and photographs of plant, equipment and vessels to be used.

The section below provides a detailed method statement of the works required at each structure.

North Pier Breakwater

Before the breakwater is constructed, some excavation of the shingle seabed is required to 'toe-in' the outer perimeter of the breakwater below the sea-bed. This will enable the breakwater to be protected from any scour which may arise from large storm waves which might wash out some shingle and undermine the base of the breakwater and to prevent movement from future settlement. The excavation will be carried out using a number of 360 degree **tracked excavators (see photo 1)** positioned on the beach at low tide. Excavation will be carried out at low tide for the sections of breakwater that will be above MLWS. For sections of the breakwater below MLWS, excavation will take place under water. The shingle material removed will be stockpiled above MHWS on South Beach with some of it being re-used in the core of the breakwater and some as shingle recharge on South Beach. The total amount of material excavated is estimated to be 12,916m³ (8,000m³) is estimated to be used on South Beach as shingle nourishment, and 4,916m³ in the breakwater core).

Prior to the placement of the breakwater rocks, a geofabric mat will be positioned onto the seabed in the excavated footprint of the breakwater. In addition to helping reduce settlement once the breakwater is constructed, it will also help reduce the washout of bed material beneath the rocks and reduce scour in the future. The mat will be laid on the seabed by a **tracked excavator (see photo 2)**, with rocks placed onto the mat to hold it into position before the rest of the breakwater construction commences.

The rock for the breakwater will be sourced from a quarry or number of different quarries, depending on the quantities available and to ensure a constant supply of rock for the scheme. The larger rock will be transported to site by sea from Norway. For delivery by road, the rock would be sourced from a local Welsh quarry, with more than one quarry required due to the volume of rock needed. The rock would be transported to the site compound via the A487 using **articulated lorries (photo 15)** for the larger 6 -10 t rock and tipper lorries for the 0.3 to 1t rock. In between each rock delivery to the site compound, **30-40t dump trucks (see photo 4)** will transport the rock from the stockpile in the site compound to the breakwater location, thus maintaining space in the compound for more rock to be delivered. There will be stockpiles of rock temporarily placed on the beach to organise the rock into sizes and due to tidal working.

The rock will be transported from the site compound to South Beach by dump trucks which will use a temporary access ramp formed out of rocks leading from the site compound onto the beach. These

dump trucks will then transport the rock along South Beach to the breakwater. The transportation of rock from the site compound to the stockpile areas will continue for approximately 6 - 9 months. The dumpers will reduce their footprint on the beach by keeping vehicle movements to the upper beach area and avoiding the intertidal area as much as possible to reduce sediment becoming mobilised into the water and increasing turbidity. Although South Beach forms part of the SSSI and there is a high presence of *Sabellaria alveolata* along the coastline, generally this habitat is absent from the intertidal area at South Beach.

The rocks will be picked up from the stockpile area by **360 excavator (35-90t) by excavator bucket or with a grapple (see photo 3)** attachment to carefully pick up and place the rock. These will be located on the beach for the breakwater construction. For the smaller core rock, dump trucks will be used to tip the rock on top of the geofabric layer and assisted by excavators to spread the rock material. The breakwater will be constructed starting from the landward end and progressing seaward. This will allow machinery constructing the parts of the breakwater in the subtidal zone to work from the top of the newly constructed portions of the breakwater.

For delivery by sea, the rock is to be sourced from a Norwegian quarry. The rock supplied will be transported to the quayside where approximately 25,000t of rock will be loaded onto a **barge (photo 13)**. The barge vessel will set sail to the site where it will anchor offshore of Aberaeron for around 1 to 2 weeks before setting sail for another load.

A shallow draught **smaller barge of capacity (photo 14)** 1,000-3,000t will travel with the main vessel and the rock armour will be transferred individually from the main ship onto the transfer barge using an on-board excavator equipped with a hydraulically operated grapple. The smaller barge will transport the rock to the site of the breakwater or South Beach at high tide and tip the rock onto the seabed. At low tide this will be sorted into sizes and placed in the breakwater footprint using the excavator and grapple.

At no time will there be any beaching of boats on the beach. The transfer barge will shuttle to and from the main ship transferring rock to the breakwater site. Once the main barge has been unloaded, it will return to collect more rock from the quarry. A total of up to 4 return trips are estimated to be required to transport the rock.

At the end of the existing North Pier, the existing concrete wave wall will be removed to enable access for construction machinery onto the pier. Demolition of the wall will be carried out using a back-hoe excavator and breaker to break out the concrete, with the material removed off site to a licenced tip. The material will be removed via Quay Parade.

Before completing the breakwater construction, a concrete walkway will be constructed along the full length. Pre-cast concrete 'u'-shaped units will be manufactured in a factory offsite and transported directly to North Pier via Quay Parade by road.

The concrete 'u'-shaped units will be positioned on the top of the breakwater with a mobile crane or excavator. Concrete will be poured into the precast units using a concrete pump and concrete delivery lorries. Rock armour will be placed around the precast units to secure them in place. The surface of the concrete blocks will be left exposed to form a concrete footpath on top of the breakwater. This footpath will provide access for recreation as well as for future maintenance of the structure.

Repair work to the surface slab will be undertaken at the end of the existing North Pier. This will involve vertical drilling and grouting which will take place from the surface of the pier. Holes (nominally 50mm dia.) will be drilled down into the top surface of the pier to a depth of 5m. The holes will be drilled in a staggered diamond shape pattern at a distance of 1m north to south and 2m east to west. The holes will be injected with a combination of lime and cement grout to stabilise the loose ground beneath the surface slab.

Signage and navigation markers (including electricity cables for navigation lights) will also be installed. Existing life rings are present on North Pier and the need for any additional life rings/buoys will be determined by CCC.

South Pier Refurbishment

The South pier will be drilled and grouted in a similar manner to the North pier prior to the demolition and reconstruction works to the pier head to ensure it is stable whilst the works are carried out. The horizontal and vertical grouting will require hand-held drills being used to drill into the wall face and top of the structure into any voids present. These holes will then be filled with temporary plastic pipes which will be used to pump lime and cement grout into the voids. Localised masonry repairs and repointing works will be required to the masonry face of the structure. These works will require the use of **scaffolding (see photo 7)** and **negative mobile elevated working platforms (see photo 8)** to undertake the repairs.

The seaward end of the South Pier will be demolished using machine mounted breakers. Machinery and equipment will be located on the beach. Sections of concrete, masonry and other arisings will be removed from site by dumpers. Some of the masonry to be salvaged and reused to clad the pier. The demolition work will take place during low tides for ease of access by the contractor. Working at low tide will help to reduce the amount of debris falling into the water. To further reduce this, a geotextile layer, or similar, may be placed on the seabed to help capture falling debris for removal from site before the tide rises. A temporary working platform will be built at the base of the pierhead out of imported rock materials that will be eventually used for the rock breakwater. In this scenario geotextile will be used to ensure separation between imported and indigenous materials so that total removal of the working platform can take place on completion.

Once the collapsing degraded pier head has been removed, there will be a need for rock armour to be placed temporarily adjacent to its existing footprint whilst it is being removed in order to act as a temporary flood defence. Steel sheet piles will be driven into the ground around the toe of the new pier head base using a **piling rig (see photo 6)** positioned on a rock platform on the beach. Steel sheet piles will be driven around the end of South pier along the base of the wall below the level of the shingle bank to protect the southern side of the pier from the effects of scour and abrasion which result from shingle moved around by strong waves. These piles will initially be set with the top above HWL to provide temporary protection to the construction works.

A new reinforced concrete base will then be constructed within the sheet piles to support the new pier head. Precast concrete wall units will be manufactured in a factory and will be transported to South Pier. These will be built up in sections to form the shape of the pier. Once the external precast concrete shell is constructed, concrete pumps will be used to pump wet concrete into the pre-cast shell units to infill the units.

The relatively small amount of rock required at the end of the pier head will be constructed in a similar method to the breakwater and using the same source with the rock brought to site from either a Welsh or European quarry and transported to site by road or sea respectively.

South Beach Improvements

Groynes

The timber planks for the groynes will be removed using hand cutting tools and saws. The existing groyne piles will be removed by using an excavator with a grapple or lifting accessories. This plant will dig the piles out of the ground and place them into the wheeled dumpers for onward disposal. There are existing concrete steps present at the end of the existing timber groynes and these will be

broken out with an excavator and a breaker. The material will then be placed into dumpers and removed from the beach for onward disposal of at an off-site tip.

The groyne piles and timber planks will be brought onto the beach from the site compound on dump trucks. The timber posts will be inserted into the ground using a piling rig to drive the piles into the ground by a percussion and vibration piling technique. Hand tools will be used to attach the horizontal panels to the timber piles. The groyne works will take approximately two weeks to remove the existing groynes, two weeks to drive in the new piles and a further four weeks to attach the planks. Work will have to take place at low tide to gain access and this has the benefit of avoiding sediment disturbance.

Revetment

To construct the new revetment, the existing rock revetment will be removed using an excavator (35t-40t) with rocks loaded onto dump trucks. The existing rocks will be stockpiled for re-use, with the existing 1-4t rocks to be re-used for the making up for low spots in the ground along the location of the proposed defence. Some of the existing shingle around the existing structure will be temporarily removed to construct the new revetment and will then be reinstated around the completed revetment on completion. Reclaimed rock and shingle will be reused within the South Beach works. Non-indigenous material which may include hitherto undiscovered concrete, steel or other non-natural debris will be removed to an off-site tip.

An excavator on the beach will excavate the area where the new revetment will be placed. Approximately 8,848m³ (5,550t) of shingle will be excavated, with all excavated material reused as nourishment. The excavated shingle material will be stockpiled within the beach above MHWS before it is needed for re-use, although this is not critical and shingle can be temporarily located immediately seaward of completed sections of revetment, before being relocated to its final position.

A geofabric separation membrane will then be laid onto the excavated surface prior to the placement of new rock for the revetment. The rock will then be transported to the beach by dumpers and tipped onto the beach. At this point the excavator with the grapple will sort the rock into stockpiles for temporary storage on the beach before placing into the revetment. Rock will be placed to form the revetment using an excavator with a grab one rock at a time. This work will be undertaken at low tides. The volume of imported rock required for the revetment is estimated to be 14,534m³.

Beach Renourishment

As described in the above sections, the material for the beach nourishment will be stockpiled on the beach following the breakwater and revetment excavation work, ready for re-use on the beach. It is unlikely that shingle material will need to be imported, but if required, this would be brought from the site compound via dump trucks. A bulldozer (see photo 5) will spread the material to the required beach profile at low tide.

Flood wall: Quay Parade

The removal of the existing flood wall and construction of the new raised wall will take place in sections to allow the existing flood wall to maintain its current function during the construction phase of the new works. This also allows parking to be maintained alongside the wall where work is not taking place and to maintain access along the road. Residents along Quay Parade have parking at the rear of their properties. The existing wall will be removed and replaced in approximately 30m sections.

Work will commence with the removal of street furniture, lighting and signage. This will be carried out using hand tools, with the items set aside for re-installment following construction. Currently, the lighting is located on the seaward side of the flood wall. Benches will be reinstated to their existing

location on the seaward side of the wall with the potential for additional new seating to be provided. Options are also being considered to fix seating directly onto the walls.

The existing inland concrete flood wall will be removed in sections, including its foundation to a depth of 1.5m using an angle grinder, pneumatic breaker, excavator and dumper. Material will be removed from site by loading the material onto small 3 to 5T wheeled dump trucks.

Excavation will be carried out to a depth of 1m into the footway for the wall using disc cutters, breakers and excavators to construct the footings for the new wall. The lower concrete and masonry-clad portion of the wall will be constructed by erecting steel reinforcement and pouring concrete into temporary timber formwork (moulds) to form the wall and foundations. The temporary formwork is needed to keep the concrete in place while it is setting and is then removed once concrete is set. The concrete wall will be clad with stone masonry to provide a finish that is similar to the existing quay wall.

The glass panels will be manufactured in a factory and transported to Quay Parade. The glass panels will be inserted into pre-determined fixing points cast in the reinforced concrete wall, secured and sealed accordingly. The panels will be supported by steel posts on each side of the glass panel and fixed to the top of the wall.

Flood Wall: Pwll Cam to Monachty Hotel

The construction of this section of wall will follow a similar methodology to that at Quay Parade. Once concrete is set the temporary formwork will be removed leaving the shape of the new wall. The wall will be clad with the same stone masonry as the new wall at Quay Parade, to provide a finish that is similar to existing quay walls, and that will be in keeping with the existing surrounds. The glass panels, will be transported to site from a factory, and will be fixed to the top of the wall with mechanical fixings.

To the west of the entrance to Pwll Cam, and adjacent to The Hive, a short 10m long section of wall will also be raised with concrete and masonry cladding to 5.2mOD with glass panels.

A flood gate will be constructed at the entrance to the footbridge over the River Aeron. The barriers will be manufactured off site for installation. The installation of the barrier should take approximately 1 week.

Biodiversity enhancements are being implemented which include improving connectivity for otters from the river to the marine environment as it provides an important foraging area for them. This will be done through modifying / extending the existing ledge on the river revetment between the A487 road bridge and the Pwll Cam harbour entrance. Additional ledges will be constructed at a higher level and fixed to the walls to provide access for otters at all flood levels.

Flood Wall: Monachty Hotel to A487

To undertake the works from the footbridge to the property adjacent to the Monachty Hotel the existing rock revetment in front of the wall will need to be temporarily moved and placed alongside the river channel to create a working area/access track, so that the existing wall can be removed and the new wall constructed. It will also be necessary to remove part of the existing boundary wall at the rear corner of the Monachty Hotel to create an access route. The rock from the revetment will be shaped to retain a temporary working platform for the works in this area. This will be undertaken using excavators with a grapple attachment working in the river when the tide is low. The excavators will be able to move into the harbour using the slipway at Doc Bach (near Beach Parade).

The new wall construction at Toad Hall will be constructed with a steel piled foundation driven into the hard ground using a **piling rig** (see photo 6). Attached landward of the piles will be a (steel)

reinforced concrete base for the wall. To construct this, there will be a need for a portable pump to pump out water at the bottom of the excavation (as a result of tidal ingress). On top of the concrete base a new vertical concrete wall will be constructed which will be clad with masonry. The top level of the wall will house glass panels to the same 5.2m AOD crest height as the other flood walls being constructed for this Scheme. On completion of these works the existing rock revetment will be relocated in its original position but placed against the new wall so that it matches its existing appearance and continues to provide scour protection along the river frontage.

The existing wall from the A487 road bridge will be connected to the new wall constructed between Pwll Cam and the Monachty Hotel as described above. Work to raise this stretch of existing wall will involve constructing a reinforced concrete capping beam onto the top of the wall which will be anchored into the existing wall using steel dowels and resin grouting. The small scale of work and limited access will necessitate using hand tools for the most part. The glass panels will be fixed to the top of the new capping beam between the new steel columns on top of the wall.

Construction access to carry out these works is very limited in this location due to the proximity of residential properties behind the wall. A temporary scaffolding platform will be erected in the river channel next to the wall. Work to raise the wall would take place from this platform, thus avoiding the need to access the site from property gardens. Materials would be brought onto the working scaffold area via the temporary working area/access track to the rear of the Monachty Hotel. The scaffolding platforms would be screened to enable much of the debris from the works to land on the platform rather than falling into the water.

Pwll Cam Flood gate

A temporary sheet pile cofferdam will be installed at the entrance of Pwll Cam (dock) to construct the new gate. Following the cofferdam construction, the working area along with Pwll Cam will be dry and pumps will be required to remove any groundwater or rainwater inflows. Prior to dewatering the cofferdam, a fish rescue will be undertaken in the dock. The cofferdam will be constructed at low tide.

A concrete structure will be constructed to which the flood gate will be attached. Due to the access limitations at Pwll Cam, consideration of options for this aspect of the construction will be a key part of the contractor procurement process. The wall will be constructed in reinforced concrete. Formwork (moulds) will be erected to form the shape of the wall, with concrete then poured into the formwork before setting and then the formwork removed. The wall will be clad with stone masonry to provide a finish that is similar to the existing quay wall.

Drilling and grouting of walls will also take place to consolidate existing masonry and repair cracks and holes in the entrance channel walls alongside the Hive. The existing sill at the entrance to Pwll Cam will be removed by excavation using a saw cutter and excavator to remove existing concrete. A new concrete sill would then be cast onto the prepared ground.

For all of the wall grouting, drilling and lowering of the cill, this work would be done behind the cofferdam in the dry.

The flood gate will be manufactured off-site and may be brought to site via a barge due to its size and the limited quayside access. A tug-boat will guide the barge (see photos 11 and 12) into the harbour, with a crane positioned on the barge used to lift the gate into position. Depending on the time taken to offload the gate from the barge, the barge may need to rest on the harbour bed until it can leave on the next high tide. There will be a smaller crane located either in the car park (photo 11) or adjacent to the slipway which will be used for ancillary activities.

There is a possibility that the gate might be installed from land and the gate brought in by road. A temporary access road formed of crushed stone materials will be constructed from the slipway and along the eastern dock wall on the dock seabed to the gate location. This temporary structure would be installed after construction of the cofferdam and would provide a working platform to construct the gate structure and provide a location for a heavy-duty crane to position itself for lifting the gate.

Installation of the gate is the only aspect of the Scheme that may require some night-time working. This is because the installation is a continuous operation likely to take more than 12 hours to complete. The contractor would follow best practice procedures for work at night, including measures to minimise noise and directional lighting.

The construction of the gate will also require some digging of service trenches using saw cutters and excavators or similar to bury electrical cables for the gate operation which will connect to mains services in Market Street. A control kiosk to house the gate operating equipment will be constructed East of the entrance to Pwll Cam adjacent to the gate. The design of this structure is not yet confirmed, but could be housed within a small compound comprised of masonry walls to blend with the existing abutment and flood defence walls.

Photographs of the plant described above

Photo 1 - Tracked excavator with bucket for excavation



Photo 2 – Tracked excavator placing geotextile



Photo 3 – Tracked excavator with a grab to pick up and place rock



Photo 4 - Wheeled Dump truck transporting rock



Photo 5 - Dozer to spread out the shingle



Photo 6 - Piling Rig



Photo 7 - Scaffolding for south pier and wall repairs

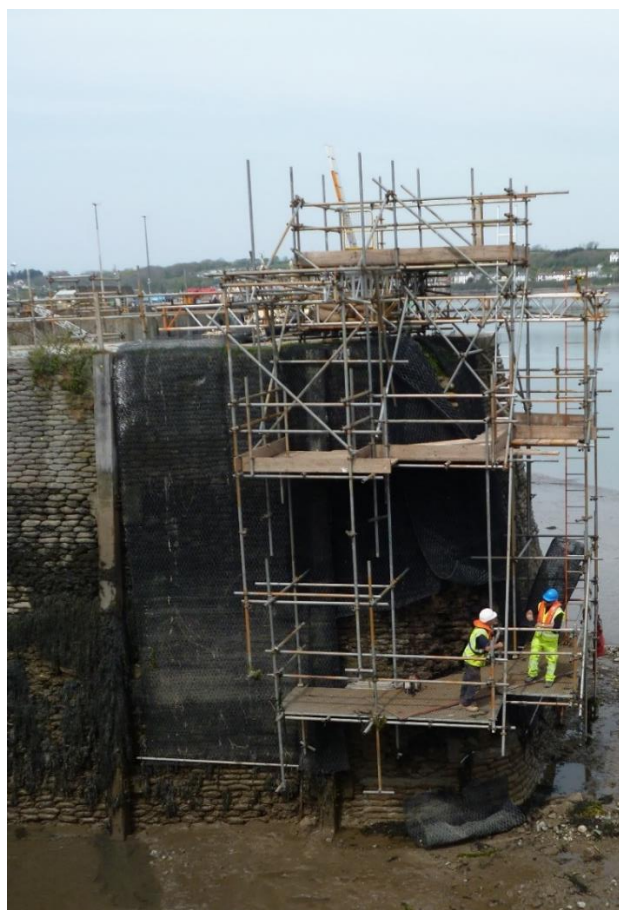


Photo 8 - Negative Mobile Elevated Working Platforms (MEWP's) to repair walls from above high water



Photo 9 - Crane and basket to carry operatives for wall repairs



Photo 10 - Repointing and wall repairs by rope access



Photo 11 – Barge, Tug, Crane and Gate at Milford Marina



Photo 12 – Barge, Crane and Gate at Milford Marina



Photos 13 – Main barge (out at sea) Rocks lifted by excavator onto smaller barge in next photo



Photo 14 – Smaller barge used to place rocks on the beach



Photo 15 - Rock Delivered by Road

