

Specification - Description of Works

1. Introduction

Project Location

Dalgety Bay is situated on the south coast of Fife on the Forth estuary approximately 4km east of the Forth Bridge. The sandy bay is formed between the Headland near the Ross Plantation to the west and Braefoot Point to the east. Various housing developments surround the Bay, with Dalgety Bay Sailing Club situated at the Headland area.

Purpose of Works

Radium potentially hazardous to health is present on parts of the foreshore and coastal land around the Headland area of Dalgety Bay. A strategy has been established to manage this problem which involves removal of critical particles, above certain level of radioactivity, and providing a cover system to isolate the remaining particles from the public. The system is to extend over defined areas of the foreshore and be able to resist the effects of the sea over the long term. The system is to comprise a geotextile membrane, capable of retaining small particles (down to 1mm), secured in place by layers of rock armour stone. As well as protecting the membrane, the new rock armour will also protect against future erosion of shore. This system will prevent further loss of potentially contaminated particles and their subsequent deposition on adjacent beach areas. The slipways and jetty structures at the sailing club will be removed to allow placing of membrane and replaced with new concrete structures.

Sites Area

The site consists of the coastal strip and foreshore areas extending from the west side of the headland, near the New Harbour, at the south end, round to the Ross Plantation in the north, including the jetty and slipway area used by the Dalgety Bay Sailing Club.

Specification - Description of Works

2. Management Strategy

The strategy to manage the contamination has been previously established and set out in a Management Strategy report prepared by AMEC on behalf of DIO.

The site has been divided into four main areas comprising the Headland Area, Slipway Area, Boat Yard Area South and Boat Yard Area North. The Management Strategy sets out the use of geotextile and rock armour as the system to be used to protect and cover these areas.

The strategy for the **Headland Area** is to re-profile the existing armour stone revetment and provide a geotextile membrane with rock armour protection from the top of the revetment slope down across the foreshore to mean low water springs. Radium contamination in excess of the threshold set out in the associated radiological management document encountered during the construction process will be removed from this area.

The strategy for the **Slipway Area** is to remove the slipway and jetty structures then excavate the foreshore in a series of cells (see associated radiological management document for details), screen the material to remove radium contamination above threshold levels and replace the material. New slipway and jetty structures will be constructed extending down to around the mean low water springs tide line with geotextile membrane provided over the whole area beneath the structures.

The strategy for the **Boat Park Area** is to reinforce or replace the existing armour stone and extend the armour, with a geotextile membrane beneath, down across the upper sandy part of the foreshore. Prior to placing the geotextile and rock armour, the sandy upper part of the foreshore would be excavated, screened and replaced as per the Slipway area. Existing armour stones will be screened at their current location and set aside for re-use. The unprotected shore in Area BN-Z at the north of this area will also be excavated, screened and replaced with a new armour slope provided.

Specification - Description of Works

3. Works Overview

An overview of the anticipated construction work required for each area is as follows.

The cover system comprising a geotextile membrane and rock armouring will be capable of preventing migration of sediment particles greater than or equal to 1mm diameter and be of sufficient robustness to last and remain in place for the required 25 year design life.

The revetment to the slope at the Headland will comprise two layers of primary armour stone with an underlayer of smaller armour stones and a bedding layer, placed on top of a heavy grade geotextile. For the foreshore cover system the primary armour will be of similar size to the underlayer on the revetment. The bedding layers will be required to protect the geotextile from being ruptured by the larger armour stones. This geotextile will be placed directly on the foreshore with any larger stones/rocks removed or covered by bedding material. The surface of the existing armour slopes will need to be prepared by spreading granular material to fill the void spaces and provide a more even surface over which to place the geotextile.

Headland Area – Oversized armour stone from the existing revetment will be set aside for reuse in the new revetment. The existing armour stone slope and crest will be reprofiled to new lines, where required. The new armour stone, which will be transported to site by sea, will be stockpiled on the beach for later use in the works. Any radium sources above the threshold encountered during the works will be removed. Works will progress along the length of the coast in strips corresponding to the width of the geotextile. The geotextile will be anchored at the top of the revetment in a trench below a precast concrete crest beam and in a trench excavated in the foreshore at the toe of the cover system. The geotextile will be anchored by being folded back on itself around a bedding layer of stones placed in the toe trench and beneath the concrete beam at the crest. It is envisaged that the geotextile will be placed working from the toe of the slope up the beach to top. Work on the foreshore will be progressed between high tides.

Slipway Area – The existing slipways and jetty will be removed in two phases to allow the Dalgety Bay Sailing Club to continue to use one slipway whilst a new jetty structure and part of the new slipway are constructed. The new jetty and slipway will be formed in precast concrete blocks bedded on granular material with the geotextile beneath. Precast concrete will be delivered to site by sea. In advance of building the new structures, foreshore arisings below and to the east of the existing jetty will be excavated to the full depth of known contamination, i.e. down to rockhead, and screened to remove particles with radioactivity above the threshold, as described in the associated radiological management document. It is envisaged that this will be achieved by dividing the foreshore into cells and removing the material within each cell for screening at the site compound and replacing it with either screened or imported material.

Boat Park Area – The foreshore in this area will be turned over and screened in a similar manner to the slipway area, with the existing rock armour stone also screened and set aside for reuse. A cover system comprising a geotextile membrane with rock armour protection will then be installed as described for the Headland Area. At the north end of the Boat Park Area, adjacent to the Ross Plantation, there is an area approximately 5m wide by 35m long on the landward side of the top of the beach which will be excavated, screened and replaced.

Specification - Description of Works

4. Delivery of Construction Materials

The construction of the rock armoured revetment and slipway will require delivery to site of large 'primary' rock armour stones, smaller 'secondary' rock armour stones, granular bedding materials, geotextile membrane and concrete.

Road access to the site is via small roads through the village of Dalgety Bay and so it is desirable for the bulk of the materials to be delivered to site without using the local road network. Where practicable delivery of the materials required for the works should therefore be by sea. Concrete elements of the works have been designed to be predominantly precast to facilitate transport by sea.

It is envisaged that most of these materials could be transported to site by barges which could be loaded at the dock at Burntisland, which is approximately 8km from the site, and towed to site by tug. Although the same number of vehicle movements would be required for transport of materials to Burntisland for delivery to site by barge, these movements would be on roads more suitable to HGVs and would not be through the village of Dalgety Bay.

A 200m wide navigation channel is provided to allow access from the Firth of Forth to the site, as shown on the Drawings. Dalgety Bay Sailing Club moorings in this navigation channel will be removed prior to commencement of the Works and the area made available for Contractor use.

All vessel movements to and from the site shall be via the navigation channel. At low tides the channel will not be fully useable due to water depth limitations and also because the 300m exclusion zone around the rocks to the west of the channel will come into effect whenever the rocks are exposed (when they could be used as perching positions by seabirds). These exclusion zones are fully defined in the Planning Permission documents.

Specification - Description of Works

5. Off-loading and Storing at Site

For deliveries of primary and secondary rock armour it is envisaged that barges will arrive at high tide to allow the barge to be positioned adjacent to a designated stockpile area. The barge could either be held in position until the tide level drops so that it beaches on the foreshore for offloading, or the armour stone could be offloaded at high tide into the water. Excavators working on the deck of the barge and on the shore would unload the rock into stockpiles. The excavators and dumper trucks will then distribute the materials to the various work areas as required. Any material left in the stockpile and submerged should be sized to prevent dispersion due to wave and tidal action.

Granular bedding for the revetment will consist of smaller sized stones than the rock armour and this would be liable to dispersion by wave and current action if submerged in the stockpile area. To prevent this, bedding material could be delivered and offloaded from barge in closed top bulk bags or this smaller sized material moved directly from the barge and stockpiled on dry land.

Concrete will, wherever possible, be precast off site and brought to the site by barge in batches to suit phasing of head beam, slipway and jetty construction. The precast units would be offloaded from the barge by crane.

The delivery of these materials will be ongoing throughout the construction and the composition of each delivery will depend on the construction sequence. With the exception of larger rock armour stones, material in closed bulk bags and the precast concrete elements, materials transported to site and deposited on the foreshore shall either be removed from the foreshore to the site compound or incorporated in the Works prior to the next high tide.

Specification - Description of Works

6. Construction of Revetment

The revetment will be constructed with machinery operating on the foreshore and working between tides. The general sequence of construction could be as follows, working in sections from toe to the head of the revetment. Further sequencing description for the individual work areas is also provided in the following sections.

1. In the Boat Yard Areas only, set aside existing armour stone for reuse, excavate the foreshore material, screen to remove contamination above defined threshold and replace.
2. Prepare the existing surface, ie excavate toe trench, blind/fill voids in existing revetment with bedding or toe trench material and set aside existing armour stone for reused where appropriate.
3. Place the geotextile by rolling out it over the foreshore and anchoring it at the toe with bedding material.
4. Cover the geotextile with the bedding material.
5. Place secondary rock armour over the bedding material.
6. Place concrete head beam to anchor the geotextile at the top of the slope.
7. Place primary rock armour over the secondary armour on revetment slope.

The revetment will be constructed in strips to suit the geotextile roll width. To avoid leaving unprotected bedding material exposed at the end of each working window, temporary protection with secondary armour will be required.

It is anticipated that tracked excavators and four wheel drive dumper trucks will be used to move materials from the stockpile areas on the foreshore to the working area.

Formation of temporary access ramps onto the shore will be required to assist with construction.

A permanent access way for future maintenance on to the shore will be provided, as shown on the Drawings.

Specification - Description of Works

7. Construction of Slipway and Jetty

The slipway and jetty will also be constructed with machinery operating from the foreshore and working between tides. The general sequence of construction is likely to be as follows, with the work undertaken in two phases to allow continued use by Dalgety Bay Sailing Club of slipway and jetty facilities throughout the period of the Works, as discussed further in the following section.

1. Formation of a temporary berthing face for smaller boats at the east side of the existing east slipway. This berthing face must be completed and the slipway handed back to the Employer/Dalgety Bay Sailing Club before the existing jetty is taken out of commission and any work starts in that area.
2. Demolition of the existing west slip and jetty. The existing concrete and stone blockwork will be set aside for screening and, where suitable, reused as filling below the new slipway surface. Large individual stones from the jetty may be screened at source, but concrete must be removed to the site compound and crushed or broken up into small elements for screening.
3. Excavation, screening and replacement of foreshore material in Area 2, the western part of the Slipway Area, in advance of construction of the new jetty, slipway and retaining walls.
4. Formation of intermediate retaining wall dividing the Slipway Area into west and east areas with geotextile placed below the wall foundation.
5. Excavation and foundation preparation for the new jetty, including placing geotextile below foundation.
6. Placing precast concrete blocks for the new jetty, starting at the bottom and working up the jetty in a landward direction.
7. Grading the formation beside the jetty to form the new slipway slope, incorporating screened excavated material and processed demolition materials where suitable.
8. Placing precast concrete toe beam, edge wall and slipway slabs on regulating material over geotextile working from toe of the slipway up the slope.
9. Commission new jetty and slipway slabs in Area 2, west of the intermediate wall, and hand back to the Employer/Dalgety Bay Sailing Club.
10. Remove existing east slipway and construct the east part of the slipway, in Area 3, in a similar manner to that described above for the west part.

Specification - Description of Works

8. Works Phasing and Sequencing Requirements

Works Phasing

The Works shall be carried out in two separate phases. Phase 1 is to be completed and handed back for use by the Employer/Dalgety Bay Sailing Club before the work on site for Phase 2 is started. Off-site fabrications for Phase 2 work, materials transport to site and on-site storage of that material for the Phase 2 work would be possible subject to approval by the Project Manager of the proposed arrangements.

- Phase 1 shall include work in Work Area 1 (Headland), Work Area 2 (Slipway west) and Work Area 5 (Boat Park BN-Z area).
- Phase 2 shall include work in Work Area 3 (Slipway east) and Work Area 4 (Boat Park Area remainder).

Works on site will only be permitted between 1st April and 30th September each year. It is anticipated that Phase 1 will be progressed in the first summer season (2019) and Phase 2 will be progressed in the second summer season (2020).

At the end of the first season if any elements of the Phase 1 works are incomplete they shall be protected and made safe to leave over the winter and shall be completed in the following season. If all Phase 1 work is completed in the first season then Phase 2 work may start within the first season, with any incomplete work protected and made safe at the end of the first season.

At the start of the second season any degradation of the work undertaken during the previous season shall be rectified before new work is progressed.

The principal driver for the work being split over two phases is to allow continued operation of Dalgety Bay Sailing Club. In the first phase Dalgety Bay Sailing Club would use the east slipway whilst the removal of the existing jetty and the construction of the new jetty and western part of the new slipway is carried out. In the second phase Dalgety Bay Sailing Club would then use the new jetty and western part of the slipway whilst the construction in the eastern part is progressed. Prior to removal of the existing jetty the eastern edge of the eastern slipway is to be refurbished to form a safe edge for Dalgety Bay Sailing Club to use for berthing of small boats.

The work at the Headland Area is to be progressed in the first phase to allow the option for Contractor access along the shore line at low water before this access option is prevented by the construction of the new slipway and jetty. The work in the BN-Z area is to be progressed in the first phase to remediate the area of unprotected coast at the north of the site.

Further details of the sequencing requirements in each of the Work Areas are set out below.

Phase 1 (season 1)

Work Area 1

It is envisaged that the work to construct the revetment and cover system would start at one end of the Headland Area and progress to the other end in manageable strips. The work in this area could be further divided into construction of the main revetment slope, which would be less dependent on low tides, and the blanket covering the foreshore, which would need to be progressed during more favourable low tides.

To minimise the duration the unprotected embankment is exposed to erosion and therefore minimising the risk of release of point sources, the Contractor shall only remove rock armour from a section of the existing embankment immediately prior to construction commencing on that section.

The Contractor's plant shall not be permitted access on to any section of the completed cover system, including those areas formed for future maintenance access.

Specification - Description of Works

Work Area 2

As noted above, refurbishment of the eastern edge of the east slipway shall be completed to provide a safe berthing face, as shown on the Drawings, prior to any works commencing in Work Area 2. The east slipway is in Work Area 3 and may only be accessed by the Contractor for this enabling work before the main Phase 1 work commences.

The existing jetty and west slipway structures will be dismantled and the materials set aside for reuse following screening to remove any material with radioactivity above the defined threshold. Screened material below this threshold can be reused as fill below the geotextile membrane. Large individual stones from the jetty may be screened at source and stockpiled in the upper part of the Slipway area, but concrete must be removed to the site compound and crushed or broken up into small elements for screening.

The area of foreshore to the east of the existing jetty and the area below the footprint of the existing jetty will be excavated, screened and replaced in advance of constructing the intermediate retaining wall, new jetty and slipway, using the procedures stated in the associated radiological management document. The excavations associated with this activity must not endanger the stability of the existing east slipway or any other structure and temporary support to the edges of the excavation must be provided where necessary. Any material which is removed from the foreshore to the west of the existing jetty for construction of the new jetty foundations must also be screened.

Construction of the new intermediate retaining wall dividing Working Areas 2 and 3 will be progressed working from the bottom of the slipway up the foreshore with the geotextile membrane installed below the wall foundation. This work shall not interfere with the use of the existing eastern slipway by Dalgety Bay Sailing Club.

The new jetty structure will be formed by placing suitable granular material over the rockhead followed by the geotextile membrane and bedding layers before placing the precast concrete blocks onto the foundation, starting at the seaward end of the jetty and working landward.

The new western retaining wall and slipway edge beam will be constructed in a similar manner to the jetty.

The trench for the slipway toe beam will be excavated on either side of the jetty and the lower end of the geotextile membrane anchored in the trench with bedding material prior to placing the precast toe beam elements on a further layer of bedding material. Screened material or imported granular filling will be placed over the slipway area up to the level of the geotextile, which will then be installed ahead of placing the bedding layers and slipway slabs, working from the toe up the slipway. The geotextile must be continuous over the whole footprint of the works to contain the existing foreshore material below.

Work Area 5

The revetment cover system works shall not commence until a) the foreshore excavation, screening and replacement operation in Area 5 has been completed and b) the excavation, screening and replacement operation has been completed in Boat Park North area BN-Z.

The works in this area could be split in to smaller sections to allow a rolling sequence of work of excavation/screening/replacement and construction operation, subject to agreement.

Specification - Description of Works

Phase 2 (season 2)

Work Area 3

Work in Area 3 must not commence until Area 2 is complete and has been handed back for use by Dalgety Bay Sailing Club. Demolition of the existing (modified) slipway will be followed by the foreshore excavation/screening/replacement operation in Area 3, which must be done in advance of construction of the new slipway in this area.

Construction of the new slipway shall be carried out as described above for Area 2, commencing with the toe beam at the bottom of the slipway and working landward.

The new slipway edge beam at the north east edge of the new slipway shall be constructed ahead of the slipway itself and prior to placement of rock in the adjacent revetment/cover system.

Works to construct the area of cover system adjacent to the slipway shall start at the eastern slipway edge beam and progress north east.

The Contractor's plant shall not be permitted access onto any section of completed cover system, including those areas formed for maintenance access.

Work Area 4

Existing rock armour will be screened and set aside on the foreshore for reuse in advance of excavation/screening/replacement of the beach material, as described in the associated radiological management document.

It is anticipated that the beach cover system will be constructed from the south end of the area and work northwards, with the geotextile membrane anchored in the toe trench, protected by the bedding layer and the concrete head wall placed, followed by the new armour stone.