28/04/2026

Applecross Remedial Designs

Marine Licence – Reduced Design Method Statement

Background

This reduced design method statement (RDMS), is provided in support of the Marine Licence application (00011588 - Bakkafrost Scotland Ltd - Remedial Works - Russel Burn, Kishorn). This has been requested by MD-Lot to outline only the works that are proposed below Mean High Water Spring levels. For wider context, it may be useful to be read in conjunction with the full, original Design Method Statement (DMS) produced by cbec eco-engineering UK Ltd, also provided as part of the application. The relevant text from the DMS have been extracted to provide detail only on the proposed works below MHWS, outlined below.

1. INTRODUCTION

cbec eco-engineering UK Ltd was commissioned by Bakkafrost to develop detailed designs for remedial works to the Russel Burn, Kishorn. The aim of the project is to remediate the existing river engineering works to comply with conditions set out by SEPA in March 2024, under the Controlled Activities Regulations (CAR). The design is based on cbec's evaluation of hydraulic, geomorphic and ecological performance, whilst ensuring that there is no increased erosion or flood risk to the development on the river right (west) floodplain and the existing infrastructure that interacts with the channel and the immediate vicinity (i.e. pipe crossing, concrete bed protection, inspection chamber and bridges).

The design site is situated along the lower course of the Russel Burn, where the bedrock channel transitions to a naturally unconfined alluvial fan environment before discharging into Loch Kishorn. Prior to modification, this unconfined ~300 m long alluvial fan would have been dominated by sediment deposition and a dynamic channel that adjusted continuously. Engineering practices have since altered the character and function of the design site, including:

- the dam installed in Loch Coire nan Arr, controlling the flow through the Russel Burn and impacting sediment supply;
- and a history of channel straightening, embankment construction and bank/ bed reinforcements along the design site, responsible for channel instability due to the steepened gradient and erodible bank material.

Prior to the commencement of any physical works, an initial on-site start-up meeting is required to ensure that all parties involved agree with the proposed construction process.

Assumptions

As with any construction that involves working in the natural environment, complete and spatially continuous supporting data sets are not always available. It is therefore not uncommon for unexpected issues to arise once the construction phase has begun. Under such circumstances, it is required to make decisions at short notice as to how designs need to be modified to solve these issues. This process is known as 'field-fitting', with this term used throughout this document where necessary.

CBEC, as the designer, requires representation to supervise all phases of construction to oversee the appropriate execution of the designs and ensure that any 'field-fitting' can be undertaken appropriately when it is determined necessary.

Accurate hydrology data could not be obtained to represent the flow controlled by the dam at Loch Coire nan Arr. Therefore, hydrology was estimated using FEH analysis, using flows that do not account for the impact of the dam or any abstraction. This decision was taken as a conservative approach which aids the development of a stable design. However, the design was modelled under overestimated flows.

2. DETAILED DESIGN

The final design components are summarised below.

- Construction of a 'step-pool' channel morphology along 56 m of the downstream section of the Russel Burn channel.
- Removal of the existing bed level control boulder 'weir' structure, to be incorporated into the step-pool design channel.
- Construction of a total of ~30 m of rock armour bank protection (comprising three sections) with rock roll pyramids, rock mattresses and gripples and coir rolls, tying into the downstream bridge. Extents of exiting bank protection to be replaced with this method are as follows:
    - ~15 m of rock armour bank protection on the river right bank between NG 82252 40369 and NG 82265 40361. The existing bank protection will be removed for the installation of the rock roll pyramid and rock mattress design.
    - ~10 m of rock armour bank protection on the river left bank between NG 82259 40373 and NG 82268 40370. The existing bank protection will be removed for the installation of the rock roll pyramid and rock mattress design.

It is assumed that material excavated for the construction of the Russel Burn plane bed channel and the reprofiling of banks will be reused as part of the design on site, if appropriate.

Design details are site-specific and informed through desk- and field-based investigations and CBEC's experience in the design of green bank protection and sustainable river management methods, with precise design details having been specified by the support of hydraulic modelling.

The constructed plane bed channel is designed to be stable, but accommodate minor channel adjustments over time within a discrete inset floodplain area. Buried erosion protection is set back from the channel to limit the extent of lateral channel adjustment and prevent erosion into existing assets.

An inevitable reality of implementing river restoration designs is the requisite stabilisation period following the initial completion of design works, which may be three to five years depending on the flow regime over this period. During the stabilisation period, the site is more susceptible to adjustment as a result of high flows and, therefore, monitoring of the design channel's performance should be conducted following any such event. Monitoring will determine if remedial 'adaptive management' work is required to mitigate any issues should they arise.

Site Location

The site encompasses the lower, tidal section of the Russel Burn where the channel discharges into Loch Kishorn from grid references NG 82228 40409 and NG 82234 40415 to NG 82268 40368 and NG 82265 40360.

METHOD STATEMENT OF DESIGN IMPLEMENTATION

Site access and preparation

Site access and welfare location is to be discussed and agreed with the client and appointed contractor. The Principal Contractor's Site Manager should co-ordinate all deliveries of materials and plant, to be planned and timed under liaison with the client (i.e. the person responsible for project liaison and site supervision). Any specific times to avoid vehicular access should be adhered to.

Location of existing services

Previous site visits and information provided by the client have identified a number of assets and services on the design site. Those identified and considered in the RDMS are as follows:

- Bridge at the downstream extent of the site, located at NG 8227 4036; to be retained and not impacted by the design. Replacement of the existing bank protection at the upstream extent of the bridge is proposed.

Riparian management

No removal of trees is required for construction. After construction, native riparian trees should be planted throughout the floodplain along the Russel Burn design area (i.e. to provide natural stabilisation of the bank areas to resist erosive forces). Due to the high presence of deer in the area, Tree guards are proposed to be installed with each planted tree to protect from grazing.

Ecological considerations

It is important to note that no ecological surveys have been undertaken by CBEC as part of this design project. Therefore, it is recommended that a pre-construction ecological assessment is undertaken by the client to mitigate against any potential issues. Construction should be scheduled for when ecological sensitivity to disturbance is relatively low and there is a reduced risk of wet conditions impacting the

works programme. Advice should be sought from the local Salmon Fishery Board as to whether fish rescue is required prior to the connection of the design channel to the existing channel.

Invasive Non-Native Species (INNS)

No INNS were identified during site visits. However, it is recommended that an INNS survey is undertaken prior to the commencement of any construction works. The Principal Contractor should provide a method statement that details the proposed methods for dealing with INNS on the site. However, as a minimum, the following mitigation measures are recommended to control the spread of any INNS found on site:

- Prior to construction the invasive species should be removed, treated and disposed of in line with biosecurity guidelines.
- During construction, if any additional invasive species are identified, they should be removed and disposed of in line with biosecurity guidelines before works continue.
- All earth-moving equipment should be cleaned before coming on site and washed down prior to leaving each site. This cleaning protocol is to prevent the spread of any invasive species that might be transported by the machinery.
- Proactive monitoring and management of INNS is essential in the first 3 years following construction to ensure that native vegetation is able to colonies the riverbank and stabilise the substrate.

Vulnerability to INNS is greatest in the growing season immediately following construction when recently disturbed surfaces are exposed and free of mature vegetation. This can be the spring following a late autumn build. Frequent monitoring and timely management of INNS on the design site post-construction will support the development of native vegetation that provides natural stability to riverbanks and resilience against the future risk of INNS.

Temporary storage of excavated materials

During construction, material will be excavated from the following components of the design:

- Excavation of river bank material for the construction of the realigned Russel Burn channel and inset floodplain.
- Removal of rock armour bank protection throughout the Russel Burn design reach.

The excavated material will be stored in a ‘live’ stockpile within the floodplain (location to be agreed with the client and landowner(s) ahead of the works).

Excavated material will be reused on site where possible, if appropriate.

The Principle Contractor will be responsible for ensuring that appropriate silt management measures are implemented to avoid contamination to the watercourse with excess fine sediment.

Flow diversion

Flow diversions will be required throughout the construction phase to minimise risk of sediment release and improve machinery access for ease of construction. Ultimately, it will be the responsibility of the Principal Contractor to propose a specific method for flow diversion, accounting for construction-specific constraints, including Health and Safety considerations. However, options for flow diversion are likely to include (i) a temporary diversion channel, where constraints allow; (ii) over-pumping of the works area; and/or (iii) construction of a moving cofferdam that can be repositioned as construction proceeds.

Silt management

Silt management is undertaken to prevent eroded soil/ sediment entering the watercourse and becoming suspended sediment load. High inputs of fine sediment, mobilised during construction works for example, could cause pollution or further sedimentation in sensitive areas downstream.

A detailed silt management plan should be provided by the Principal Contractor. However, as a minimum, silt fences or mats should be laid out around any watercourses affected by the works. The placement should be determined based on channel bed profile and water depth. The fences/ mats should cover the entire circumference around the sites to avoid silt reaching waterbodies from any direction.

To slow the water flow and remove more of the suspended material, a silt wattle should be positioned on the downstream end of the silt mat. It is critical that there is some exposed mat beyond the wattle to take the abrasive impact of any water that may cascade over the silt wattle in high flow conditions.

Installation should start with a double row of mats, fences and wattles. Should the proposed interventions not be sufficient, more rows should be added, although it should be noted that very fine sediment particles such as clay will be extremely challenging to remove without the use of chemicals. However, no chemical flocculants should be used in the river without the consent of SEPA.

Construction sequence

The Principal Contractor’s Construction Method Statement should include a detailed proposal for the sequence of works. Specifically, the step-pool section of the Russel Burn should be constructed prior to the plane bed section so that the bed level control structure (incorporated into step crest no. 1) is in place before the plane bed channel is constructed (i.e. since the downstream limit of the plane bed section will tie into this

base level/ hydraulic control). Similarly, the construction of steps no. 8 and no. 9 should be completed prior to the construction of the tributary confluence that joins from the river right. This is because step crest no. 9 acts as a bed/ base level control for the tributary channel. Overall, it is recommended that construction be progressed broadly from downstream to upstream to ensure the necessary bend level controls are in place in and to minimise the tracking of machinery along the river corridor.

It is recommended that a suitably qualified geomorphologist/ restoration specialist who is familiar with the design should be on site at key stages of the construction process to ensure that implementation is conducted as intended. This will enable field-fitting of the design, as required, to maximise design stability and post-construction function.

Construction of step-pool channel

All existing rock armour bank protection is to be completely removed from the bank toe and bank surface. These boulders can be reused in the construction of the step pool channel if rounded and of the appropriate size. Alternately, they can be buried beneath the surface of the designed floodplain, where rock roll pyramids separate the buried rocks from the channel to avoid them becoming exposed if the channel adjusts. Where raised embankments form the banks of the channel, the bank slope is to be smoothed to an even surface, reflective of the existing slope. Where there are no raised embankments, banks are to be reprofiled to a gradient of 1V:2H.

- The design prescribes a series of 12 steps with pool features in between. The hight of the steps shall be 300 mm (step nos. 1 - 9) or 150 mm (step nos. 10 - 12) and their spacing 5 m (step nos. 1 - 11) or 6 m (step no. 12). Further details and specifications are provided in detailed design drawings no. 02 and 09.
- The step-pool structure will incorporate larger ‘anchor’ boulders located at the ends of each step, anchored into the adjacent river banks. The anchor boulders will be the largest clast size in the channel at the outer margins of the step and also form part of the bank toe protection (typically 500 mm in diameter). The boulder sizes for the bank toe protection are specified as 300 to 500 mm. Boulders won from the removal of existing bank protection can be used for this purpose if they are rounded and of the appropriate size.
- The keystones within the steps should be implanted to at least 1/3 of their diameter into the channel bed. Given a step height of 300 mm, the keystone boulders will therefore need to have a minimum diameter of 500 mm. Specifications are also shown on the design drawings.
- The axis of the step perpendicular to the flow direction will be concave upstream, thereby focusing the flow of water into the centre of the downstream pool. This process is accentuated by the central third of the step being slightly lower in elevation than the margins. The position of these lowered sections are slightly off set from one another in the following sequence: slightly left of centre,

centre, slightly right of centre, centre, slightly left of centre etc. This process will be guided through field-fitting.

- Any rock required for construction should be imported from a local quarry. The rock type should be granite and/or a hard metamorphic rock type such (e.g. schist, gneiss).
- Due to the complexity of construction and to ensure long-term stability, an appropriately qualified geomorphologist/ restoration specialist who has experience in the design and implementation of step-pool channels must be present during key phases of the construction process.
- Between the step structures (i.e. the pools), the bed material is to comprise a mix of cobble (64 to 256 mm) and coarse gravel (2 to 64 mm) sized sediments to produce a general grade of D50 ~120 mm. The precise mix of sediment is to be determined based on the size classes available from the suppling quarry, therefore the ratio of the sediment mix will be confirmed by the designers once a quarry has been selected. This material should be rounded, of fluvial or glacio-fluvial origin.
- The remaining bank surfaces, smoothed and/or reprofiled after the removal of bank protection, should be seeded with an appropriate native seed mix to establish vegetation cover. A native seed mix comprising approximately 80% grasses and 20% coastal species is recommended for this site.

Replacement of bank protection at downstream bridge (rock roll pyramid, rock mattress and gripples, coir roll and seeding)

- Installation of the rock roll pyramid, rock mattress and Gripple ground anchors should be undertaken offline as far as is feasible, or under low flow conditions, to minimise the risk of sediment release downstream and provide suitable working conditions.

- The bank protection structure will extend along both sides of the bank along the Russel Burn directly upstream of the bridge at the downstream extent off the site; (1) a total of 14 m along the river right bank between NG 82252 40369 and NG 82264 40360, (2) a total of 10 m along the river left bank between NG 82259 40373 and NG 82268 40370. A third section of bank protection will extend (3) a total of 6 m perpendicular to the channel along the toe of the road embankment between NG 82262 40378 and NG 82262 40372.

- The existing rock armour bank protection should be completely removed from the bank toe and bank surface.

- The design comprises rock rolls (each 300 mm diameter and 2 m length) installed within the toe of the bank, rock mattresses (3 rock rolls attached side by side (1 m width, 2 m length, 300 mm thickness)) installed into the bank surface. The rock rolls will be used to construct a three-tier pyramid consisting

of 6 no. rock rolls (i.e. 3 in the lower tier, 2 in the middle tier and 1 on the top tier). See design drawing no. 08 for details.

- A trench approximately 400 mm deep below the adjacent channel bed level should be dug at the toe of the bank, to allow the bottom two tiers of the pyramid to be installed. The lower tier being completely buried below the bed, the middle tier installed at the bank toe and the upper tier slightly below the water level (under normal flows).
- Chestnut stakes (~100 mm diameter, 1.2-1.4 m length) should be placed at 400 mm centres along the front edge (i.e. river side) of the bottom tier of the rock roll to secure. Each roll should be secured to the next at its upstream and downstream extents using 3 mm fixing twine, or as per the supplier's installation guidance.
- The rock mattress will be installed into the bank surface directly above the rock roll pyramid. The bank surface should be prepared by infilling voids left after the removal of the rock armour and levelling the surface so that, when installed, the rock mattress should sit flush with the surrounding bank surface.
- Gripple Terra-LockTM ground anchors (Type: TL406-TLA3-4MM-2M-Z) should be installed across the surface of the rock roll pyramid and rock mattress to secure the structure to the bank surface. Anchors should be spaced 1 anchor per 0.9m2 in a grid pattern (2 anchors per mattress). Anchors should be installed as per the suppliers guidelines.
- The remaining bank profile should be smoothed to an even surface, retaining the existing slope of 1V:1.65H.
- At the upstream limits of the design, the height of the rock mattress should be reduced, tapering into the step-pool channel section over a length of 4 m by constructing the mattress from fewer rock rolls: 2 rock rolls for 2 m length, then 1 rock roll for 2 m length. The final section of rock roll and rock mattress will be buried completely into the bank, to tie into the more stable bank of the step-pool channel (as shown in the accompanying design drawing plan view). The rock mattress tapering sections continue further upstream than the rock roll pyramid along the bank toe; these sections will tie into the rock comprising the lower banks of the step-pool channel.
- At the downstream limits of the design, the rock rolls will be installed flush to the bridge abutments along the bank toe, slightly set back to reduce risk of scour behind the bank protection. The rock mattress and coir roll will butt up against the bridge abutment, following the bank profile.
- A single row of coir roll will be installed immediately behind the top of the rock mattress to provide additional stability and improve the rate of vegetation re-

establishment along the bank. The roll should be buried into the bank with only the top section of the coir roll exposed.

- As with the rock roll, at the upstream limits of the design, the final section of coir roll will be buried completely into the bank, to tie into a more stable section of adjacent bank.
- The remaining section of bank between the bank top and the coir roll, and ~2 m of the adjacent floodplain should be seeded to establish vegetation cover. A native seed mix comprising approximately 80% grasses and 20% coastal species is recommended for this site.