



**JBA**  
consulting

## Dowie's Mill Weir

Specification

December 2016



**RAFTS**

RAFTS  
11 Rutland Square  
Edinburgh  
EH1 2AS

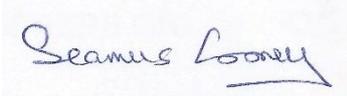
## JBA Project Manager

Amanda Kitchen  
South Barn  
Broughton Hall  
SKIPTON  
North Yorkshire  
BD23 3AE  
United Kingdom

## Revision History

Revision Ref / Date Issued	Amendments	Issued to
P1.0 / 20 June 2016		RAFTS
V1.0 / December 2016	Minor amendments	

Prepared by  ..... Lachlan Attard BEng  
Engineer

Reviewed by  ..... Seamus Cooney BEngTech (Ord) BEng CEng MIEI  
Engineer

## Purpose

This document has been prepared as a Technical Specifications for RAFTS. JBA Consulting accepts no responsibility or liability for any use that is made of this document other than by the Client for the purposes for which it was originally commissioned and prepared.

JBA Consulting has no liability regarding the use of this report except to RAFTS.

## Copyright

© Jeremy Benn Associates Limited 2016

## Carbon Footprint

A printed copy of the main text in this document will result in a carbon footprint of 82g if 100% post-consumer recycled paper is used and 105g if primary-source paper is used. These figures assume the report is printed in black and white on A4 paper and in duplex.

JBA is aiming to reduce its per capita carbon emissions.

## Contents

Specification .....	1
Supplementary Clauses to the Specification	
Section 1: General.....	1
Section 2: Materials.....	5
Section 3: Excavation, Backfilling & Restoration.....	12
References.....	15

## List of Tables

Table 1: Riprap Gradings.....	5
Table 2: BS EN 13383-1:2002 (Table 2).....	5
Table 3: River Gravel Mix Specification.....	8
Table 4: Type 3 Stony Cohesive Fill Specification.....	8
Table 5: Sealing Substrate Specification.....	8
Table 6: Specification for Non-woven Geotextile.....	10

# 1 Specification

The Specification referred to shall be the 'Civil Engineering Specification for the Water Industry (7th Edition)', published by UK Water Industry Research Ltd in March 2011, augmented by supplementary Specification Clauses.

In so far as any Supplementary Clause may conflict, or be inconsistent with any provision of the 'Civil Engineering Specification for the Water Industry (7th Edition)', the Supplementary Clause shall always prevail.

Where other specifications are referred to on the Contract Drawings e.g. the Highways Agency's 'Specification for Highway Works' these shall always prevail.

## Supplementary Clauses to the Specification

### SECTION 1 - GENERAL

#### 1.2 ACCOMODATION FOR THE CONTRACT

5. No accommodation is required by the Client for the duration of the Contract.
6. The space available for the Contractor's accommodation shall be within the site boundary as noted on drawing 2015s3628-S-D400 Site Location Plan. The contractor may extend the working area with agreement of the Client and in accordance with the Conditions of Contract.
7. The Contractor is to make his own arrangements for his accommodation and servicing.

#### 1.3 BILLPOSTING AND ADVERTISING

2. No advertising boards will be permitted.
3. Requirements for notice boards during the contract for purposes of Site Health and Safety will be agreed with the Client upon awarding of the Contract.

#### 1.6 ENTRY ONTO SITE

6. Site working Hours shall be:
  - 7:30 to 18:00 (Mon-Fri)
  - 7:30 to 14:00 (Sat)
 Agreement should be obtained from the Client to extend these hours.
7. Noisy operations shall not be permitted outside the following hours without consent of the Local Environmental Health Officer:
  - 8:00 to 18:00 (Mon-Fri)
  - 8:00 to 14:00 (Sat)

#### 1.7 SURVEY OF HIGHWAYS, PROPERTIES AND LAND

5. A photographic survey of all structures and pavements within the site that are to be retained should be undertaken with the Client prior to the commencement of works. This shall also include the several historical sites in close proximity to the works. This survey should include all existing defects, such as cracks, bulges and depressions, and the photographs should include an appropriate scale, and be of sufficient size to show the extent and nature of the defect. A factual report with photograph locations should be presented in .pdf format (2 photos/A4 sheet). A CCTV survey of the portion of the Scottish Water sewer buried in the channel shall be undertaken prior to start of construction works and again post construction.

#### 1.8 LEVELS AND REFERENCE POINTS

2. The Contactor is to check the existing weir levels and coordinates before commencing construction to ensure that the new works will tie in with existing. Horizontal setting out will be given using coordinates relating to setting out points, which relate to the National Grid, but may differ

depending on the accuracy of the original survey. All levels and coordinates refer to Ordnance Datum Newlyn (ODN).

3. The original survey is orientated to the Ordnance Survey National Grid and Datum.

#### 1.10 INTERFERENCE WITH LAND INTERESTS

4. Should the Contractor subsequently require a working area greater in extent than that originally agreed, he shall make his own arrangements with the appropriate land owners. In making such arrangements the Contractor shall expressly inform them by letter of the basis of the arrangement, namely that it is made in the Contractor's own name and not on behalf of the Employer and that any claim whatsoever shall be against the Contractor and not against the Client. The Contractor shall provide the Client with copies of all correspondence regarding such arrangements.

#### 1.12 PROCEDURE FOR COMPLAINTS AND CLAIMS

4. Details of all complaints, claims, damages or injuries should be logged immediately. Where possible action should be taken immediately to deal with the complaint. Written correspondence should be actioned within 48hrs, and the complainant kept informed of the progress or developments involving any claim.

#### 1.13 PROTECTION AGAINST DAMAGE

4. The Contractor's temporary works are not to increase flood risk to adjoining properties. The Contractor is to maintain the existing level of flood protection provided to the site by the river banks. Procedures to safely remove works blocking river channel at short notice should be in place to avoid increasing the flood risk.

5. Any damage to roads and surrounding structures is to be repaired to match their original condition.

#### 1.14 USE OF HERBICIDES AND PESTICIDES/PROTECTION OF AGRICULTURAL LAND

3. Any Herbicides used are not to be harmful to the aquatic environment.
4. Pesticides are not to be used.

#### 1.15 WORKS AFFECTING WATERCOURSES

6. The Contractor is to comply with the conditions contained within all the appropriate statutory consents including:

- a. CAR licencing requirements;
- b. Listed Building consent for any works at Cramond Brig;
- c. Planning Permission.

7. Works within the river channel should be conducted outside the fish spawning season identified in the conditions associated with the statutory consents. If this is not determined before the tender period, upon receipt of this information, the Contractor is to determine the effect on programme and costs, and if necessary submit details in accordance with the Contract.

#### 1.19 EMERGENCY ARRANGEMENTS

3. The Contractor is to ensure he is in receipt of all of SEPA's flood warnings, and is to take the necessary precautions to secure and evacuate the works if a flood warning is issued. Formal flood warning arrangements as provided by SEPA may be inadequate as river levels are known to rise rapidly. Independent on-site monitoring shall be undertaken and a pre-determined evacuation procedure shall be prepared. This shall include maintenance or reinstatement of the existing impoundment until the necessary protection works to upstream banks and services are complete.

4. The Contractor is responsible for site security for the duration of the works.

## 1.21 ENVIRONMENT AND SUSTAINABILITY

4. Only FSC timber shall be used. The Contractor must submit details of proposed timber products for both temporary works and permanent construction prior to ordering, and produce FSC certification on delivery.

## 1.23 ASSET RECORDS

2. The Contract drawings will be made available to the Contractor in AutoCad 2008.dwg format. On completion of construction activities the Contractor shall provide the Client with 'As-Built drawings', presented to the Client both in AutoCad 2008.dwg format and as full size and A3 paper copies. All files should be editable.

3. The Health and Safety File will highlight all the safety critical elements of the remaining structures and maintenance. It will show:

- a. Residual hazards and hazardous materials used in the structure;
- b. As-built drawings recording details of construction, annotated where significant or difficult to manage issues for the future are identified;
- c. Safe methods of working; and
- d. Copies of manufacturer's technical literature and COSHH data sheets (only where these highlight potential hazards associated with maintaining or carrying out further work or demolition).

## 1.25 CONSTRAINTS ON HOW THE CONTRACTOR PROVIDES THE WORKS

1. Works in the river channel will be carried out in accordance with the statutory consents, as described in Clause 1.15, and the methodology described in the Contract Drawings.

2. Works may only proceed after detailed method statements have been received and accepted by the Client for the operations listed below. A minimum time of two weeks is required for the Client to review and accept these method statements.

- a. Managing deliveries to site;
- b. Operations on or near river;
- c. Demolition of weir
- d. Protection to services and protection to the right bank.
- e. Other works in the channel;
- f. Access arrangements;
- g. Temporary works.

3. The draft Health & Safety File will be submitted one week before the Completion date. Completion requires a complete submission of the Health & Safety File.

## 1.26 REQUIREMENTS OF THE PROGRAMME

1. The Contractor shall provide a programme in the form of a network diagram produced as a result of a 'critical path analysis', and must abide by the constraints below. It shall show the level of detail appropriate to each stage of the Works and all activities and restraints, and each shall be given a short title. All events shall be numbered and annotated with earliest and latest event dates. The programme shall include all items and its effect on the overall programme.

2. The time units quoted in the network shall be working days and the Contractor shall provide the Client with a preliminary indication of the anticipated non-working days over the duration of the contract period.

3. Allowance should be made for bank holidays, and local trade holidays/site shut downs over the Christmas and Easter periods as required.

4. A schedule of output and resources to support all activities shown in the programme is required at the time of presentation.

5. The Client shall require the Contractor to produce a programme provided in accordance with the Conditions of Contract, along with a corresponding revised programme on the first day of

every month showing the actual events as they have occurred and the programme required to complete the works.

6. The Contractor shall include all measures necessary for the safe and efficient execution of all Works necessary for protecting privately and publicly owned services and supplies.

7. The level of detail in the Programme should be not less than the following:

**Level 1**

- Mobilisation;
- Preparation of Health and Safety Plan, and review by Principal Designer;
- Provisions for control of Invasive Non-Native Species (INNS);
- Construction of access tracks and any crane pad;
- Excavation, screening and dewatering of sediment;
- Breaching existing weir, draining of impoundment and construction of temporary dam arrangement;
- In-channel and bank protection works;
- Demolition of existing weir, separation of concrete and natural material and reuse of rubble as infill where required (including in boulder rapid where suitable);
- Removal of temporary works for access and reinstatement;
- Submission of H&S File;
- Demobilisation.

**Level 2**

Further breakdown of items and other details as required.

**SECTION 2 - MATERIALS**

**2.143 RIPRAP SPECIFICATION (as per Appendix A1 of CIRIA C683 'The Rock Manual')**

1. Natural stone shall be of durable quality, uniform in texture, and free from iron bands, spots, sandholes, flaws, shakes or other imperfections which would adversely affect its strength or appearance. The stone shall be free from laminations, weak cleavage planes and cracks. It shall be durable in that it shall not disintegrate from the action of air, water, wetting and drying, freezing and thawing and impact due to river flows. It shall be capable of being handled and placed without fracture or damage. It shall comprise of fresh quarried un-weathered material.
2. Argillaceous metamorphic or sedimentary rocks (including all slates, phylites, schists, shales, siltstones and mudstones) shall not be used as rock armour or filter layer rocks.
3. For Source Approval by the Supervisor, the Contractor shall:
  - a. State the source (quarry) of rock he proposes to use in the Tender Document. He shall afford the Supervisor all facilities for inspecting the source and shall provide a sample of at least 15 tonnes either at the source or at the Works site as agreed with the Supervisor. The Supervisor shall agree with the Contractor those parts of the source or quarry which are acceptable. Samples submitted for acceptance shall be truly representative of the source from which they have been obtained.
  - b. Provide detailed petrological descriptions of all rock types to be used and shall submit to the Supervisor for acceptance test results from an Approved Laboratory demonstrating the proposed source complies with the following criteria when tested in accordance with BS EN 13383-1:2002.

**4. Table 1: Riprap Gradings**

Property	Category to BS EN 13383-1:2002	
Nominal Diameter Dn <sub>50</sub>	550mm	160mm
Grading	Non-standard grading, average mass 400 - 1200 kg (may be substituted for a larger grading, subject to approval)	LMA <sub>5/40</sub>

**5. Table 2: BS EN 13383-1:2002 (Table 2)**

**Table 2 — Requirements for average mass (excluding fragments) and mass distribution of category A standard light gradings**

Grading kg	5 to 40	10 to 60	40 to 200	60 to 300	15 to 300
Category	LMA <sub>5/40</sub>	LMA <sub>10/60</sub>	LMA <sub>40/200</sub>	LMA <sub>60/300</sub>	LMA <sub>15/300</sub>
Average mass kg	10 to 20	20 to 35	80 to 120	120 to 190	45 to 135
Mass kg	Percentage (by mass) less than particle mass				
450	-	-	-	97 to 100	97 to 100
300	-	-	97 to 100	70 to 100	70 to 100
200	-	-	70 to 100	-	-
120	-	97 to 100	-	-	-
80	97 to 100	-	-	-	-
60	-	70 to 100	-	0 to 10	-
40	70 to 100	-	0 to 10	-	-
30	-	-	-	0 to 2 <sup>a</sup>	-
15	-	-	0 to 2 <sup>a</sup>	-	0 to 10
10	-	0 to 10	-	-	-
5	0 to 10	-	-	-	-
3	-	-	-	-	0 to 2 <sup>a</sup>
2	-	0 to 2 <sup>a</sup>	-	-	-
1,5	0 to 2 <sup>a</sup>	-	-	-	-

<sup>a</sup> Fragments.

## TRANSPORTATION AND STOCKPILING OF ROCK

6. The procedure for transportation and handling of rock for use as riprap shall be agreed with the Supervisor prior to commencement of construction and the following general points shall apply. Rock shall be transported to the site of the permanent works along an approved route. Trucks used to transport rock for this project shall be of a type specifically constructed for hauling rock and shall have tail boards or scow-ends. If transporting heavy rock on flat top wagons, adequate chains and slings shall be used and verified before it leaves the quarry to ensure optimum security. No other mode of rock transportation may be employed unless first accepted by the Supervisor and the relevant Authorities.

## ON-SITE INSPECTION

7. Subject to the acceptance of the Supervisor, the Contractor may be permitted to stockpile rock at or near the site of the permanent works. Stored materials shall not obstruct normal access to public footpaths by pedestrians, and for emergency access. The stockpiles shall be formed so that they do not constitute a hazard; the locations, side slopes and heights and other factors affecting safety shall be as approved by the Supervisor.

8. The Contractor shall provide all necessary facilities for any on-site inspection, categorisation and acceptance/rejection activities on materials.

## PLACING RIPRAP - GENERAL

9. At least 10 days before commencement of the construction work the Contractor shall submit to the Supervisor for his acceptance full details of his proposed method of forming the Works to the profiles indicated on the Drawings.

10. The Contractor shall not commence any Permanent Works until the Supervisor has accepted in writing the Contractors working method for forming the Works. During the course of the Works, the sequential placing of filter layer and armourstone shall proceed as closely-spaced defined fronts in only one grade of material as required at each front location. At each location, construction with material associated with the placing of the next front is only permitted to proceed upon acceptance by the Supervisor of the previous front. The maximum spacing of working fronts is specified below.

11. Placing of materials shall be one continuous operation, to ensure that none of the underlying layers is left unprotected over a distance greater than agreed or for a duration greater than agreed between the Contractor and the Supervisor. If the operation has to be interrupted temporary protection of the underlying layers shall be provided with the same material as to be used for the final construction.

## SURVEY FOR ROCK PLACEMENT

12. Before placing rock or geotextile the Contractor shall submit to the Supervisor for acceptance, details of the survey methods to be adopted to ensure accurate setting out, alignment, level and cross-sectional control during construction of all parts of the Works. NOTE: Table 9.9 of the Rock Manual (CIRIA C683) provides recommended factors for orthogonal thickness corrections using two alternative survey systems for double armourstone layers. For a land-based survey the probe will generally be connected to a staff or EDM target.

13. In this specification,  $D_{n50}$  is the nominal stone diameter for the median rock size for the grading (m), and shall be calculated as the cube root of the total volume of the stone.  $\sqrt[3]{V}$  (m<sup>3</sup>). The volume shall be calculated by dividing the mass of the median stone,  $M_{50}$  (kg) by the apparent mass density of the stone,  $\rho_{app}$  (kg/m<sup>3</sup>). For the purposes of calculations in this construction specification only, the mass of the median stone may be assumed to be close to the average of the nominal upper and lower limits of the grading:  $M_{50} = (NUL + NLL)/2$ . Stone density values for zero saturation are applicable for such mass values.

14. When above water survey measurements are based on fixed interval methods, measurements shall be carried out at the following intervals across the measurement profile:

- a. Coarse and light grading: 1 to 2m;
- b. Heavy grading river gravel: 1 to 2m;
- c. Heavy grading: 0.75  $D_{n50}$ .

15. Measurement profiles shall be at intervals along the length of river section to be armoured and shall be accepted by the Supervisor. These will generally be every 5m, but may need to be more frequent where the profile is changing rapidly. The Contractor shall provide and maintain chainage markers at the approved measurement intervals along the lines of the parts of the Works

that involve armourstone or rock. Surveyed sections shall extend to a distance of 2m beyond the as-constructed edges.

16. No layer shall be covered by a subsequent layer until the profile of the former layer has been approved by the Supervisor. The Contractor shall give an agreed minimum period prior notice of survey to the Supervisor and shall provide facilities for his attendance during surveys. The minimum period shall take into account the working method, river level and current conditions.

#### WORKING IN THE WATER ENVIRONMENT

17. Subject to complying with the general survey requirements above, each placed layer shall be protected by the subsequent layer (as indicated on the drawings) as soon as possible after placement. No part of the unfinished Works shall be left unprotected in order to minimise damage in the event of storms during the construction period.

18. The Contractor shall make good any location where material has been eroded or removed by other cause before placing the appropriate material for the overlying (protective) layer. However, in respect of general fill material, the Contractor may if authorised in writing by the Supervisor, build up the general fill to the dimensions shown on the drawings with the material specified for the layer next overlying the core and in accordance with the method for this overlying layer.

19. Notwithstanding the above, the Contractor shall take all reasonable care to avoid disturbing a previously placed layer by avoiding dropping rock or any other potentially disturbing placing methods.

20. Preference will be given by the Supervisor to methods of working that progress from downstream to upstream and thereby reduce undesirable siltation in the work area prior to stone dumping/placing.

21. Sufficient fine material on the surface of already placed stones (including stones within the layer being placed) shall be removed from those areas where surface contact will arise between the stone being placed and those already placed to ensure sound bearing and interlock between stones. The Contractor shall make due allowance for the removal of such fine material.

#### PLACING OF RIPRAP ON RIGHT HAND BANK

22. Riprap will be placed on those areas of bank in front of existing retaining walls. Riprap shall be individually placed to achieve a dense, fully interlocked armoured slope so that each stone is securely held in place by its neighbours. Placing shall commence at the toe and proceed upwards towards the crest. Stones shall be lowered into place individually. Stones shall be placed in such a way that they obtain their stability from interlocking and frictional resistance, and not from friction on one plane alone. Adequate support to the retaining walls is to be provided during construction by either propping or using a hit and miss construction pattern, or a combination of both.

23. Tipping of stones from vehicles, or bulldozing into final position shall not be permitted.

24. Unless otherwise stated, the surface of the armoured slope shall present an angular uneven face to the water to achieve the desired energy dissipation of flood waters. Pieces of stone smaller than the equivalent of the ELL value of the grading shall not be used to fill interstices, or to prop larger stones in order to achieve the required profile.

25. Pieces of riprap broken during handling or placing shall be removed immediately at the Contractor's expense. Subject to the Supervisor's acceptance, broken pieces of riprap may be included in smaller gradings.

26. Any void below the finished profile level as shown on the drawings in excess of  $0.75D_{N50}$  shall be filled with an appropriate stone or stones. Determination of the acceptability of any void shall be by means of use of the survey probe or other a test sphere or cage of diameter  $0.75D_{N50}$ .

#### PLACING GEOTEXTILE AND GENERAL FILL

27. General fill material shall be placed to the positions and slopes indicated on the drawings and in accordance with the method and sequence of construction accepted by the Supervisor.

28. Geotextile will be placed to the satisfaction of the Supervisor.

2.144 SUBSTRATES

RIVER GRAVEL MIX (UPPER SUBSTRATE)

1. **Table 3: River Gravel Mix Specification**

Class & Description	Permitted Constituents	Property	PSD Limits
Well graded heavy river gravel (200mm nominal diameter)	Well rounded, natural cobbles and gravel mix	Particle size distribution (PSD)	100% passing 200mm screen; 5% passing 10mm screen

2. The river gravel mix is intended to form part of the transported sediment in the channel, and will be layered over the permanent fill layer and elsewhere as indicated on the Contract drawings.

TYPE 3 STONY COHESIVE FILL (LOWER SUBSTRATE)

3. **Table 4: Type 3 Stony Cohesive Fill Specification**

Class & Description	Permitted Constituents	Property	Grading	
			PSD Lower Limit	PSD Upper Limit
Granular Sodium Bentonite	Natural clay montmorillonite minerals	Granules	2mm	6mm
Well graded angular material (180-300mm nominal diameter)	Angular, natural gravel and sand	Particle size distribution (PSD)	98-100% passing 360mm screen; 90-100% passing 250mm; 0-50% passing 125mm screen; 0-15% passing 90mm screen; 0-5% passing 45mm screen	

4. The Type 3 stony cohesive mix shall be used to bring areas underneath the riffles up to the required levels. The final form of the mix shall be a dense stony cohesive mass comprising 70% well graded angular material (180-300mm nominal diameter heavy grading), 20% Class 6L material and 10% dry granular (2-6mm) sodium bentonite by volume. The lower substrate shall be placed in a single layer in its dry state to the line and level shown on the Contract drawings. It shall be evenly sprayed with water at a ratio of 1.5:1 volume of water to applied volume of bentonite in an upstream to downstream direction. The contractor shall allow 60 minutes after the application of water for the bentonite to swell. The Contractor shall obtain acceptance of the layer prior to reconnecting the area to the main flow of the watercourse and shall make any adjustments necessary to obtain the Supervisor's acceptance.

SEALING SUBSTRATE

5. **Table 5: Sealing Substrate Specification**

Class & Description	Permitted Constituents	Property	Grading	
			Lower Limit	Upper Limit
Granular Sodium Bentonite	Natural clay montmorillonite minerals	Granules	2mm	6mm
Angular gravel mix (10-2mm)	Angular, natural gravel	Particle size distribution (PSD)	100% passing 10mm screen; 0% passing 2mm screen	

6. The sealing substrate shall be used to seal the overlap between boulders in the boulder bar. The final form of the sealing substrate shall be a cohesive mass comprising of a 10-2mm angular gravel mix with 10% dry granular (2-6mm) sodium bentonite by volume. The sealing substrate shall be placed in a single layer in its dry state to the line and level shown on the drawings. It shall be evenly sprayed with water at a ratio of 1.5:1 volume of water to applied volume of bentonite in an upstream to downstream direction. The contractor shall allow 60 minutes after the application of water for the bentonite to swell. The Contractor shall obtain acceptance of the layer prior to reconnecting the area to the main flow of the watercourse and shall make any adjustments necessary to obtain the Supervisor's acceptance.

#### 2.145 CLASS 4 MATERIAL

1. Two types of Class 4 material shall be used as fill material, designated Type 1 and Type 2, as specified below:

- Class 4 Type 1 shall consist of as-dug river bed material, compacted using a method approved by way of a site trial, see Standards for Highways (Specification for Highway Works Clause 612.5);
- Class 4 Type 2 shall consist of excavated river bed material with 100% of material passing the 100mm sieve, which shall be used to fill the gaps in the riprap bank faces.

#### 2.146 GEOTEXTILE SPECIFICATION

1. Geotextile is to be placed below all riprap layers, as per locations specified on the contract drawings.

2. Geotextile fabrics are to be manufactured from synthetic polymer fibres in the form of woven or non-woven thin permeable membrane.

- a. Woven fabric shall be manufactured from either flat-tape, monofilament, multifilament, split film yarn or any combination of these types;
- b. Non-woven fabric shall be manufactured from staple fibres needle punched or similar product.

3. The fabric shall have ultra violet and long life protection and where specified be available with loops for additional securing.

4. The life period required for the fabric in place is to be 25 years.

5. Before laying the geotextile fabric any stumps or stones protruding more than 50mm above the general surrounding ground level shall be uplifted and removed.

6. The edges of the geotextile fabric shall be secured by retaining between the riprap layers for a length of 1m. All joints shall be overlapped by a minimum of 1000mm, as shall patches to areas damaged during installation. Laps shall be formed such that the upstream lap lays over the downstream lap to prevent ingress of water.

7. The Contractor shall not run plant directly on the geotextile fabric.

8. The Contractor shall submit to the Supervisor for acceptance, detailed specification sheets for the proposed geotextile products to be incorporated in the Works, 2 weeks prior to the starting date.

9. The geotextile shall be a non-woven fabric manufactured by needle-punching virgin staple fibres of polypropylene incorporating a minimum of 1 per cent by mass of active carbon black. Geotextiles manufactured from fibres of more than one polymer will not be permitted. The geotextile shall have the properties given in the table below.

10. **Table 6: Specification for Non-woven Geotextile**

Test description	Approved test method	Units	Typical value	Allowable tolerance for typical value
Water flow normal to the plane of the geotextile @50mm head	EN ISO 11058	l/s/m <sup>2</sup>	45	-10%
Coefficient of permeability	EN ISO 11058	m/s	0.04	-10%
Apparent pore size - 90% finer [O90]	EN ISO 12956	µm	70	+10%
Tensile extension	EN ISO 10319	%	80	-10%
Tensile strength	EN ISO 10319	kN/m	25	-10%
Cone drop perforation hole diameter	BS EN 13433	mm	9	-10%
Static puncture strength (CBR)	EN ISO 12236	kN	5	-10%
Push-through displacement	EN ISO 12236	mm	-	-
Thickness reduction for pressure increase from 2kPa to 200kPa	BS EN 964	%	-	-
Thickness @2kPa	EN ISO 964-1	mm	3.2	-10%

11. The geotextile filters shall be laid on prepared surfaces in accordance with the manufacturer's recommendations. On sloping surfaces, the fabric shall be laid with its longitudinal axis down the slope. The geotextile shall be installed in the positions and to the lines and levels described on the drawings. Folds shall be avoided to obtain the best contact between the geotextile and the material beneath to be filtered. Material that may be in contact with the geotextile shall not have protrusions, which are likely to damage the geotextile during installation or in service.

12. Riprap shall be placed on the geotextile filter from the bottom to the top of the slope. The Contractor shall adopt such placing method that moving of stones over the geotextile filter is prevented.

13. The geotextile fabric and filter layer shall be protected against loss of material as the construction proceeds. Any loss of material or draw down of the slopes shall be rectified at the Contractor's expense. Any temporary protection to the open ends of the under layer is to be allowed for in the rates.

14. Geotextile shall be delivered to site in packaging that will protect the rolls from ultra violet light degradation. The labelling of the rolls shall clearly identify the product supplied in accordance with EN 10320:1999. Geotextiles shall be protected at all times against physical or chemical damage. The geotextile fabric shall at all times prior to placement be stored under cover and protected from all liquids and direct sunlight, and shall be kept in the protective wrappings provided by the manufacturer until required for use in the Works. The rolls of geotextile shall be stored on level ground and stacked not more than five rolls high and no other materials shall be stacked on top of the geotextiles. The Contractor shall ensure that fabric is not exposed to direct sunlight for more than the number of days written in the geotextile CE certificate in accordance with EN 13253:2000 Annex B or a maximum of one day if not tested.

15. The Contractor shall state in his method statement the geotextile fabric which he proposes to use in the Works. The Contractor shall ensure that the geotextile complies with the requirements set out in the Specification, in particular regarding the appropriate functional characteristics, that the geotextile is sufficiently robust to withstand, without being damaged, the working method of placing the geotextile and the subsequent placing of the filter layer and armour on top, and that it is durable for the lifetime of the project, specified elsewhere in the Specification.

2.147 COIR MATTING

1. Coir matting is to be placed over those areas of bank requiring riprap protection and the area of infill on the right hand bank as indicated on the drawings.

MANUFACTURE

2. Coir rolls shall be manufactured in the UK using virgin mattress type coir fibre.

COMPONENTS

3. Coir roll netting is to be manufactured from UV stabilised polypropylene multi filament net in a diamond mesh pattern 50mm x 50mm aperture. Each yarn should be 2.5mm diameter with a minimum tensile strength of 0.84kN. Each end of the roll shall be closed by stitching with a 3mm

diameter multi-filament braided UV stabilised polypropylene yarn. Breaking strength of individual yarn to be no less than 102kg.

4. Coir rolls are to be machine filled in order to maintain constant density of coir fibre. Coir fibre is to be virgin mattress fibre with dust content removed at manufacture stage. Each fibre is to be of no less than 50mm long and be typically 100mm to 150mm long. Coir fibre shall have a compressed density of 8kg/metre (based on 300mm diameter coir roll) and shall not compress more than 15% when an 80kg weight is applied.

5. Pins are to be 300mm long chestnut.

#### INSTALLATION

6. Mats are to be rolled out starting at the invert and working towards the crest. Work is to begin at the downstream end and progress upstream, in order to achieve the correct lap configuration (upstream over downstream). At joins, mats should be overlapped by a minimum of 100mm and pinned at 150mm centres. At the crest, mats are to be secured in a 300x300mm trench, which should be spaced a minimum of 300mm from the edge of the riprap. The remainder of the mat area is to be pinned at 450mm centres.

#### 2.147 ROCK ROLLS

1. Rock rolls are a tubular revetment consisting of small stones retained within a high strength polyethylene net. They should be designed to provide invertebrate habitat and to enable vegetation establishment within the rock roll.

## SECTION 3 - EXCAVATION, BACKFILLING AND RESTORATION

### 3.1 EXCAVATION

9. Prior to commencing any Works, the Contractor is to establish contact with the relevant owners of services (including, but not limited to, the gas and sewer pipelines) and obtain the appropriate permissions to begin excavation and protection works to the in-channel services. Conditions of permission may include provisions for hand excavation to avoid damage, and site supervision by each party during the duration of the works.

### 3.3 TOPSOIL FOR RE-USE

5. Topsoil is to be retained for re-use as a layer over rock armour areas, and the infill area placed on the right hand bank, as shown on the contract drawings.

### 3.4 DEALING WITH WATER

5. Prior to commencement of the Works, the necessary cofferdams are to be satisfactorily hydraulically modelled to ensure they do not inadvertently increase flood risk to adjacent properties at any stage during the works. Optimum cofferdam levels are to be obtained to ensure that flood flows are unaffected by the temporary works. In channel works are to be carried out in the April to September period to minimise risk from high flows.

### 3.6 BACKFILLING

6. Backfilling is to occur in the area upstream of the 12m section of weir to be retained in order to straighten the channel. Class 4 Type 1 materials are to be used (once the existing fines have been removed).

### 3.16 DEMOLITION

1. Demolition works shall be carried out in accordance with BS 6187:2011 'Code of Practice for Full and Partial Demolition, published by the BSI.

2. Material containing concrete is to be recycled for off-site use. Natural material including soft bed material is to be reused in the Works to form a component of the river gravel or of the fill to right bank subject to accept by the engineer.

### 3.17 WILLOW SPILING

1. The new right hand bank (excluding the areas requiring riprap protection) shall be formed in the following sequence:

- A Rock Roll shall be placed at the new toe line and level shown on the contract drawings;
- A Coir Roll shall be placed on top of the Rock Roll to line and level shown on contract drawings;
- Rock Roll and Coir Roll shall be held in place by chestnut stakes on both sides. Chestnut fixing stakes shall be full round and have FSC full chain of custody. Stakes diameter to be between 60 to 100mm with bark still attached. Length as shown on contract drawings. All stakes should be pointed at one end;
- Terraces shall be formed by live willow stakes at 0.5m centres 80 to 120mm diameter and 2.0m long. Stakes shall be pointed at one end and any stakes with damaged bark shall be discarded. A pilot hole shall be created prior to installing the live willow stakes in order to prevent the stake bark being damaged by existing gravel/cobble bed. All willow stakes shall be *Salix cineria* (Grey Willow), *Salix fragilis* (Crack Willow) and *Salix alba* (White Willow) and shall be sourced locally;
- Willow spiling on each terrace is formed using live willow cuttings woven around the stakes and shall allow for a 500mm vertical willow weaving face;
- Class 4 Type 2 fill material shall be used to backfill the formed terraces, where indicated on the contract drawings.

### WILLOW CUTTINGS

2. The top of each willow cutting shall be cut square above a leaf bud, and the base of each willow cutting shall be cut below a leaf bud at an angle of approximately 45 degrees. Willow cuttings shall have leaves and branches trimmed off flush with the stem. Pruned branches and trimmings shall be spread in the designated willow cutting areas so that no areas are left unsightly.

## PLANTING

3. Willow cuttings shall be planted within 48 hours after cutting and shall be kept wet until planted. Willow cuttings not planted within 48 hours after cutting, or allowed to dry out, shall not be used. Willow cuttings not used shall be disposed of at an appropriate waste management facility.
4. Planting holes shall be made perpendicular to the ground line and shall be formed with a steel bar or excavated by use of an auger, post-hole digger or similar tools. Plant holes shall be large enough to receive the willow cuttings in order that the willow cuttings may be planted to the proper depths without damage to the bark. Where rock or other hard material prohibits holes from being excavated as specified, new holes shall be excavated and the abandoned holes backfilled.
5. If the soil in and around the plant hole is not wet prior to planting, the soil shall be watered and maintained in a wet state until the willow cuttings are planted.
6. Cuttings shall be watered and maintained in a healthy condition from the time the cuttings are planted until acceptance of the contract. Cuttings that die shall be replaced at the Contractor's expense. The method of planting replacement cuttings shall be as specified in this section for willow cuttings.
7. The quantity of willow cuttings shall be measured as units determined from actual count in place, excluding additional willow cuttings required for replacement cuttings. A 0.5m spacing shall be applied in planting the willow cuttings.

### 3.18 SEEDING

1. Seeding operations shall be planned for sowing in suitable weather and ground conditions, from April to mid-June or in autumn from August to late-September.
2. The Contractor shall cultivate placed topsoil to produce a tilth up to 25mm suitable for seeding or turfing. The bed shall be fine, smooth and evenly firmed, but not over consolidated.
3. Pond Edge Mix. Seed mix shall comprise of known Scottish provenance as follows:

<i>Achillea ptarmica</i> Sneezewort	10%
<i>Alisima plantago-aquatica</i> Water Plantain	0.5%
<i>Angelica sylvestris</i> Angelica	2%
<i>Caltha palustris</i> Marsh Marigold	5%
<i>Cardamine pratensis</i> Cuckoo Flower	0.2%
<i>Comarum palustre</i> Marsh Cinquefoil	0.5%
<i>Filipendula ulmaria</i> Meadowsweet	23%
<i>Galium palustre</i> Marsh Bedstraw	0.5%
<i>Geum rivale</i> Water Avens	5%
<i>Hypericum tetrapterum</i> Square stemmed St John's wort	0.5%
<i>Iris pseudacorus</i> Yellow Flag Iris	34%
<i>Lythrum salicaria</i> Purple Loosestrife	1%
<i>Mentha aquatica</i> Water Mint	0.5%
<i>Myosotis scorpioides</i> Water Forget me not	0.5%
<i>Silene flos-cuculi</i> Ragged Robin	4%
<i>Stachys palustris</i> Marsh Woundwort	3%
<i>Valeriana officinalis</i> Valerian	4.5%
<i>Veronica beccabunga</i> Brooklime	5.3%

4. No seed is to be sown until the cultivation and preparatory work have been accepted by the Supervisor. Pond edge mix shall be sown at a rate of 3g/m<sup>2</sup>.
5. After sowing, the ground shall be chain-harrowed or hand raked; on light soils. If deemed required by the Supervisor, the surface shall be rolled and cross-rolled with a lightweight flat roller.

### 3.19 NATURALISATION OF RIPRAP BANKS

1. Bank sections requiring riprap (i.e. in front of retaining walls) are to be 'naturalised' using the following steps:

- Class 4 Type 2 material (refer to 2.145-1) shall be compacted into the gaps between the stones, using excavated mounted vibrating plate and built up to form a layer 150mm above the riprap;
- Class 4 Type 2 layer is to be scarified using a suitable technique (e.g. excavator bucket) to allow placement of topsoil layer;
- 100mm layer of topsoil is to be placed over the Class 4 Type 2 layer;
- Bank is to be seeded (refer to 3.18);
- Coir matting is to be placed over the top (refer to 2.147).

## References

- CIRIA C742 Manual on scour at bridges and other hydraulic structures (2nd edition)
- CIRIA C683 The Rock Manual - The use of rock in hydraulic engineering (2nd edition)
- Design Manual for Roads and Bridges (DMRB)
- British Standard EN 13383-1 2002 Armourstone Part 1: Specification

**JBA**  
consulting

Offices at

Coleshill  
Doncaster  
Dublin  
Edinburgh  
Exeter  
Glasgow  
Haywards Heath  
Isle of Man  
Limerick  
Newcastle upon Tyne  
Newport  
Peterborough  
Saltaire  
Skipton  
Tadcaster  
Thirsk  
Wallingford  
Warrington

Registered Office

South Barn  
Broughton Hall  
SKIPTON  
North Yorkshire  
BD23 3AE  
United Kingdom

t:+44(0)1756 799919  
e:info@jbaconsulting.com

Jeremy Benn Associates Ltd

Registered in England  
3246693

Visit our website

[www.jbaconsulting.com](http://www.jbaconsulting.com)

