Specifications and Tender Document

Dunston Beck Floodplain Reconnection Project

WILD TROUT TRUST

wildtrout.org

Location: Dunston Fen Lane, near Dunston Village, Lincolnshire

November 2020

Contents

Invitation to tender for the Dunston Beck Floodplain Reconnection Project

Wild Trout Trust PO Box 120 Waterlooville Hants PO8 0WZ

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Project Title: Dunston Beck Floodplain Reconnection Project

Authors: Tim Jacklin and Joanna Knight

1. Description of work

Background information

The 3-hectare site consists of fallow arable land to the north and west of the Dunston Beck at the junction of Dunston Fen Lane and Prior Lane, near Dunston, Lincolnshire. The site is situated on private land owned by Beeswax Dyson Farming Ltd.

The primary aim of the project is to improve biodiversity by creating a lowered floodplain area with a variety of habitat types including wetlands, backwaters and ponds, as per the design note and drawings in Appendices 1 and 2. The works will be supervised on site by the designer, AquaUoS Environmental Consultancy.

The project is being carried out by a partnership consisting of The Wild Trout Trust (WTT), Beeswax Dyson Farming Ltd (BDFL, the landowner) and the Environment Agency (EA). The project is being project managed by the Wild Trout Trust on behalf of the partnership.

The project site is not located within any international or national nature conservation designations, nor any non-statutory local conservation designations.

There are no Public Rights of Way on the site, although it is accessible from public roads which are regularly used by cyclists and pedestrians as well as vehicle traffic.

2. Definitions

The following terms have the meaning described below unless otherwise stated in the document, or required by the context:

'Wild Trout Trust' shall mean Wild Trout Trust (Registered Charity 1077041), PO Box 120, Waterlooville PO8 0WZ, Tel. 023 9257 0985.

'Nominated officer' shall mean Tim Jacklin of Wild Trout Trust or such other officer as Wild Trout Trust may nominate.

'Project Site' shall mean the site alongside the Dunston Beck where the construction of the floodplain and associated structures is to take place, as identified in the maps in this and appended documents.

'Tenderer' shall mean the person submitting a Tender and where a Tenderer consists of more than one person, obligations and submissions shall be deemed to have been made jointly and severally and the masculine gender shall include all other genders.

'Contractor' shall mean the successful Tenderer.

'Method statement' shall mean the method statement forming part of the tender.

'Works' shall mean the work to be undertaken and the services to be provided as described in the Tender Documentation for the construction of the floodplain and associated structures, together with any alteration and amendments that are made in accordance with these conditions.

'Landowner' shall mean Beeswax Dyson Farming Ltd, The Estate Office, Cyclone Way, Nocton, Lincoln LN4 2GR.

3. Description of works

A lowered floodplain area is to be excavated within the field to the north and west of the Dunston Beck channel (to the south of Dunston Fen Lane and east of Prior Lane). Some meanders are to be created within the course of the beck and three gravel riffles installed (using riddled gravel arising on site if possible, or imported gravel).

The spoil from the excavation will be used to form low embankments and meadow habitat within the site, to the north and west of the field. Further details on the design of habitats to be created through the spoil spreading are pending.

A detailed design and bill of quantities is provided in the Appendices. The designer (AquaUoS Environmental Consultancy) will supervise the works on site.

Management and minimisation of fine sediment input to the Dunston Beck is a key consideration and should be addressed in the method statement.

There is good access to the site from public roads.

It is anticipated that the works would be completed within 4-6 weeks of the start date. The works must be completed by 31st March 2021.

Planning permission for the works is pending and a decision due no later than 19th January 2021. Some conditions relating to planning permission may arise, such as archaeological watching brief and/or additional biodiversity survey requirements. The cost of these will be met by Wild Trout Trust through the project partnership, but it should be noted they may cause delays to groundworks.

All technical enquiries regarding the Works can be directed to Tim Jacklin on 07876 525457.

4. Specifications of required works

4.1. Preliminaries

It is essential that there is no waste of materials, the Tenderer will be expected to manage operations to minimise waste.

The Project Site is unsecured with access possible from the public highway. Equipment and fuel left unattended or remaining at the Delivery Site overnight is left so at the Tenderer's risk. Tenderers are responsible for sourcing appropriate locations to accommodate their equipment and operatives whilst the Works are not being undertaken.

All fuels or flammable substances, which are to remain at the Project Site while the Works are not being undertaken, must be adequately secured to prevent accidental fires.

The contractor must hold and provide evidence of Employers and Public liability insurance to the value of £10,000,000. Copies of these must be submitted with this tender.

Certificates of competence and appropriate construction insurances should also be supplied.

The contractor must be SIPP accredited (SAFE Contractor, CHAS, Worksafe/SMAS).

A pre-construction phase plan including method statement, risk assessments, CoSSH assessment and waste management must be provided with the application.

All waste resulting from the Works is the responsibility of the Tenderer. This waste must be collected and removed from the delivery Site and disposed of appropriately off site. This is to ensure that no waste material remains on the Delivery Site when the Works are completed.

All/any hazardous waste must be handled in accordance with the Hazardous Waste Regulations 2005.

4.2. Health and safety

The Tenderer will be responsible for the health and safety implications of all operations to complete the Works. A Method Statement, including information referring to Construction (Design and Management) Regulations 2015, to cover all of the operations including operational risk assessments must be included with the tender, detailing safe working practices, training requirements and health and safety procedures, that will be used at all states of the contract.

Copies of Site Risk Assessments for the Project Site will be required prior to commencement of the Works.

Failure to adhere to the agreed Method Statement will result in termination of the contract.

The Tenderer must take the lead in ensuring the health and safety of all those involved in the contract, including the use of correct PPE by all operatives or others involved in the contract.

The Tenderer must have a plan in place to safely remove an injured colleague from the site in the event of an accident. The Nominated Officer will need to see evidence of this.

The tenderer must maintain an accident book and will report all accidents to the Nominated Officer. The Tenderer is responsible for reporting incidents to the Health and Safety Executive (HSE) in respect of RIDDOR reportable incidents/accidents.

The Tenderer will be required to ensure that the equipment is fully maintained and serviced. The Tenderer is required to keep all equipment operational and to pay for all repairs during the period of the contract.

The Tenderer must be aware that there is potential public access to the Project Site at all times and as such, they may encounter members of the public at any time.

4.3. Specification

The Nominated officer will identify the Project Site so that the Tenderer can visit the site and satisfy himself on the location and requirements, before a Tender is submitted (see Appendices).

Neither the invitation to tender nor an acceptance constitutes a permission or consent to construct the new river channel and associated structures. The permanent Ordinary Watercourse Consent has been obtained for the project, however the Contractor will be responsible and liable for obtaining any temporary consents if required, via the method statement and the Nominated Officer.

Access to the site has been provisionally agreed with the landowner. The contractor will need to provide details of their public liability insurance to the landowner and agree access and site compound location.

The Tenderer agrees to comply with and abide by any conditions or instructions that may be imposed or required by such consents.

The works must be completed by 31st March, 2021.

5. Environmental Considerations

The mobilisation and input of fine sediment to the Dunston Beck is a key consideration as it has the potential to damage aquatic life and impact upon the Car Dyke a short distance downstream (a Scheduled Ancient Monument). Fine sediment input must be kept to a minimum by agreeing working practices and mitigation measures (for example, sedimats) in advance with the Nominated Officer and documenting them in the method statement.

Work on the Dunston Beck channel itself has potential to damage trout spawning areas. No such work must take place before immediate prior inspection by the Nominated Officer.

All substances subject to the Control of Substances Hazardous to Health Regulations 1992 (COSHH) will need to fully comply with these regulations, evidence of this will be included as part of the Tender.

All fuel storage must comply with the Control of Pollution (Oil Storage) Regulations 2001.

Plants and animals protected under the Schedules of the Wildlife and Countryside Act 1981 and other Acts are not to be harmed or their habitat damaged.

No mature trees (>10cm trunk diameter) are to be removed (there are none on site).

Nesting birds are not to be disturbed and are to be reported immediately to the Nominated Officer. It is a criminal offence to recklessly destroy a bird's nest.

No works are to commence on the river channel or banks prior to a final inspection for water voles.

Any public complaints must be immediately reported to the Nominated Officer.

The Project Site must be left clean and tidy at all times.

Dogs are not permitted on the Project Site.

All gates to be closed on the Project Site where necessary to ensure security.

6. Utilities searches

The site is affected by high voltage overhead electricity wires on the north and western sides. The Tenderer must make provision for safe working practices in the vicinity of these and document such in the method statement.

The finished works must not increase the risk posed by the presence of the overhead electricity wires (for example, raised ground levels beneath the wires).

Utilities searches were carried out in September 2019 and are shown in Sheet 1 of the design drawings. It is the Tenderer's responsibility to ensure the utility searches are complete and up to date.

7. Information and instructions for tendering

- Tenders must be submitted in accordance with the following instructions. Any tenders not complying with these instructions may be rejected by Wild Trout Trust whose decision is final.
- Wild Trout Trust is inviting tenders from suitably experienced contractors and those who can demonstrate an ability to professionally undertake the construction of a new river channel and associated structures at the project site, as described above ("Works").
- Tenders are being invited on the basis of undertaking the whole of the Works
- Tenders are invited for a period of a single task. All works must be completed before 30th March, 2020. All invoices must be delivered to the Wild Trout Trust, PO Box 120 Waterlooville, Hants, PO8 0WZ before 31st March 2020.
- Tenderers are invited to visit the Delivery Site to establish all relevant conditions and to thoroughly appraise the extent and nature of the proposed Works. If you require a site visit, please contact the Nominated officer who will arrange access to the site.
- Tenderers are advised to study all documentation provided by Wild Trout Trust and their true intent and meaning ascertained before submitting a tender. Tenderers should seek to clarify any points of doubt, including any ambiguities, errors and omissions in the tender documents with Wild Trout Trust through its Nominated Officer prior to submitting a tender. Please contact the Nominated Officer on: 07876 525457
- Where examination of a tender reveals arithmetical errors these will be corrected and the Tenderer will be afforded the opportunity of confirming the revised totals (in writing) or withdrawing its tender within 7 days.
- Tenderers are required to keep Tenders valid for acceptance for a period of 30 working days from the closing date for receipt of tenders.
- Tenderers are required to submit a written proposal by the deadline. All proposals should include the following:
  - Organisation and Method of Working, including Method Statements, risk assessments and CDM information.
  - Costings – including breakdown
  - An estimation of timescale and outline programme
  - Capability Statement and/or previous experience including biodiversity and river work in the last 2 years and name of contact for whom the work was carried out; details of proposed sub-contractors (if needed); copies of all Insurance Certificates, for the supplier and any sub-contractors
- Any assumptions used in preparing responses should be clearly stated. Any appropriate supporting documents should be included.
- The Tender must be signed, where the Tenderer is an individual, by that individual. Where the Tenderer is a partnership, by two duly authorised partners. Where the Tenderer is a company, by two directors or by a director and a company secretary, such persons to be duly authorised for the purpose. To nominate another individual please confirm with the Nominated Officer.

- Tenders must be sent to the address detailed below in 'Full Contact Details' or via email to tjacklin@wildtrout.org .
- The deadline for receipt of tenders is 31st December 2020.
- All queries must be made my email or telephone.
- Late tenders, received after the closing date and time stated above will not be considered unless by prior arrangement.
- Proof of posting will not be accepted as proof of delivery if the tender fails to arrive at the stipulated address before the specified time.

8. Timescale

All physical works must be completed before the end of March 2021.

Invitation to Tender (ITT) released: 7th December, 2020

Tender submission deadline: 31st December, 2020

Contractor appointment: 6th January, 2021

31st March 2021: Works to be completed and all operators off the Project Site

9. Full Contact Details

Tenders must be delivered to the following address:

Contact name: Tim Jacklin

Email address: tjacklin@wildtrout.org

Full address: Wild Trout Trust PO Box 120 Watelooville PO8 0WZ

Telephone: 07876 525457

10. Tender Evaluation and process

Wild Trout Trust will be conducting a full financial and technical evaluation of all tenders as well as evaluating the ability to commence and complete the Works to the timescale.

Tenders will be evaluated on a 50% cost 50% quality basis

Tenders will be evaluated in accordance with the following:

- Products and services shall be competitively priced, readily available and fit for their intended purposes, bearing in mind health and safety or other legislative requirements.
- When purchasing products or services, preference will be given to those: a) from suppliers with accredited environmental practices; b) that are produced and distributed using resources responsibly, with a minimum of hazardous substances; c) that minimise waste, energy consumption or other adverse environmental impacts in their use and disposal.

In the evaluation of tenders the following will apply: a) Method Statements and Resources b) Other Items c) Written technical and financial references may be requested and considered as a part of the evaluation procedure.

Wild Trout Trust may also seek clarification in respect of the Method Statement and other documentation in various ways including but not limited to: a) Site visits b) Interviews with key personnel who would be assigned to the Contract and appropriate Senior Managers of the Company.

11. Basis of Tender

The tenderer shall show the Tender sum for the actual Works and the VAT separately.

The Tender must include value of all the Works and must cover all costs and expenses which may be incurred in order to complete the Works in accordance with the Conditions, the Specification and all other documents forming part of the Tender documentation.

The Tenderer shall be deemed to have satisfied itself before submitting its Tender as to the correctness and sufficiency of its rates and prices.

12. Sub-contracting

When submitting its Tender, the Tenderer must notify Wild Trout Trust of any parts of the Works that it proposes to sub-contract. Failure to do so will invalidate any such tender.

Wild Trout Trust's prior written approval must be obtained before any part of the Work is sub-contracted. Wild Trout Trust reserves the right to refuse such approval as its absolute discretion.

An approved sub-contractor must give a direct warranty and undertaking to Wild Trout Trust but the Tenderer will remain primarily liable for carrying out and completing the Works.

13. Award of Contract

Wild Trout Trust expects to award the Contract within 10 working days of accepting a tender but reserves the right to delay awarding the Contract to a later date for any reason.

The successful Tenderer will be required to execute a formal contract incorporating the Conditions and until such execution, the successful Tender together with Wild Trout Trust's written acceptance shall constitute the contract.

14. Health and Safety

Tenderers will be required to comply with the Health and Safety at Work Act 1974 and all other regulations made under and after the Act, in addition to all other relevant legislation and regulations.

15. Obligations & Accuracy

Tenderers submitting a Tender must be familiar with the nature and extent of their obligations if their tender is accepted. Information supplied by Wild Trout Trust in this tender document, and all other sources, is supplied for general guidance for tender preparation. The tenderers must satisfy themselves by their own investigations with regard to accuracy of any such information and no responsibility is accepted by Wild Trout Trust for any inaccurate information obtained by Tenderers.

16. Confidentiality

By submitting a tender, you are committing to an understanding of the requirements of the work and have sufficiently addressed all aspects of the tender. All information you have provided has been checked to be correct and as intended.

All information supplied by Wild Trout Trust in connection with this tender to date, and any further information supplied during the tender process shall be regarded as confidential and must not be shared with any other organisation without written permission of Wild Trout Trust.

17. Canvassing

Tenderers face automatic disqualification if they canvass for the Contract by approaching Wild Trout Trust with a view to gaining more favourable consideration of their Tender.

18. Appendices

Appendix 1 – Design Technical Note

Appendix 2 – Design Drawings

Appendix 3 – Designer's Method Statement

Appendix 4 – Bill of Quantities

AquaUoS
Redefining Environmental Consultancy

Dunston Restoration

Technical Note DRAFT

Wild Trout Trust

Quality information

Document name	Prepared by	Date	Reviewed by	Approved By
Dunston Restoration Technical Note DRAFT v1.0	Seb Bentley and George Heritage	15th October 2019	George Heritage	Neil Entwistle

1. Introduction and Methodology

1.1 Background and Objectives

The Wild Trout Trust commissioned AquaUoS to undertake optioneering and a detailed design to provide a restoration design for an area of floodplain on the Dunston Beck. The primary objective for the project is to develop a design that encourages floodplain connectivity to create improved wetland across the site.

Figure 1.1 Study area of the Dunston Beck.

1.2 Proposed Approach

We have gained a detailed understanding of the state, activity and sensitivity of the Dunston Beck, through the review of archival maps and aerial photography illustrating system functioning over both historical and recent time. Changes have been related to river and catchment management and diffuse sediment delivery processes to ensure that these are all treated as a single functional system.

The targeted walkover helped confirm the landscape features identified during the desk study identifying sediment sources and sinks, geomorphological units and identifying and recording geomorphological processes linked to the sediment transport and channel change regime. All data were reviewed against the hydraulic modelling outputs.

We have reviewed potential natural and artificial constraints on the proposed floodplain reconnection and restoration works (including full utilities service searches that have been used to inform the design) developing a list of opportunities that balances system gains with difficulties and risks compared to the 'do nothing' scenario. The walkover and desk study findings have been used to assess the key options for the floodplain at this location.

We have quantified the geomorphological and flood risk impacts of the preferred concept option (following the optioneering). We have developed a 2D hydraulic model (TUFLOW) for the river, utilising information Environment Agency LIDAR and new survey data. The 2D modelling approach has been applied across both the river and valley bottom allowing inundation areas to be mapped. In all scenarios it is vital that the predicted hydraulic regime is linked to the likelihood of channel change through prediction of sediment movement and bank erosion. Data from the flow modelling across the flow regime was used to confirm impacts to the flow and sediment regime and to ensure they are appropriate for a naturally functioning watercourse of this type and to determine the potential impacts on phosphorous storage across the reconnected floodplain. The model was also used to determine impacts on the flood hydrograph downstream by monitoring the flow at the downstream end of the model and comparing it to the baseline outputs.

We have produced a concept design for the preferred option including concept overview diagrams in Section 3. Following review of this report and concept drawings by the Wild Trout Trust and Environment Agency, a preferred concept design was chosen and a detailed design has been developed.

2. Data Review and Fluvial Audit

2.1 Desk Study

The Dunston Beck study site is underlain by a variety of clays and limestones, however this does not outcrop at the surface (Figure 2.1). Instead the watercourse flows through river alluvium reworked from fluvioglacial mixed sands, gravels, clays and silts and tidal flat deposits (Figure 2.2), this is the current control on current processes within the channel and floodplain.

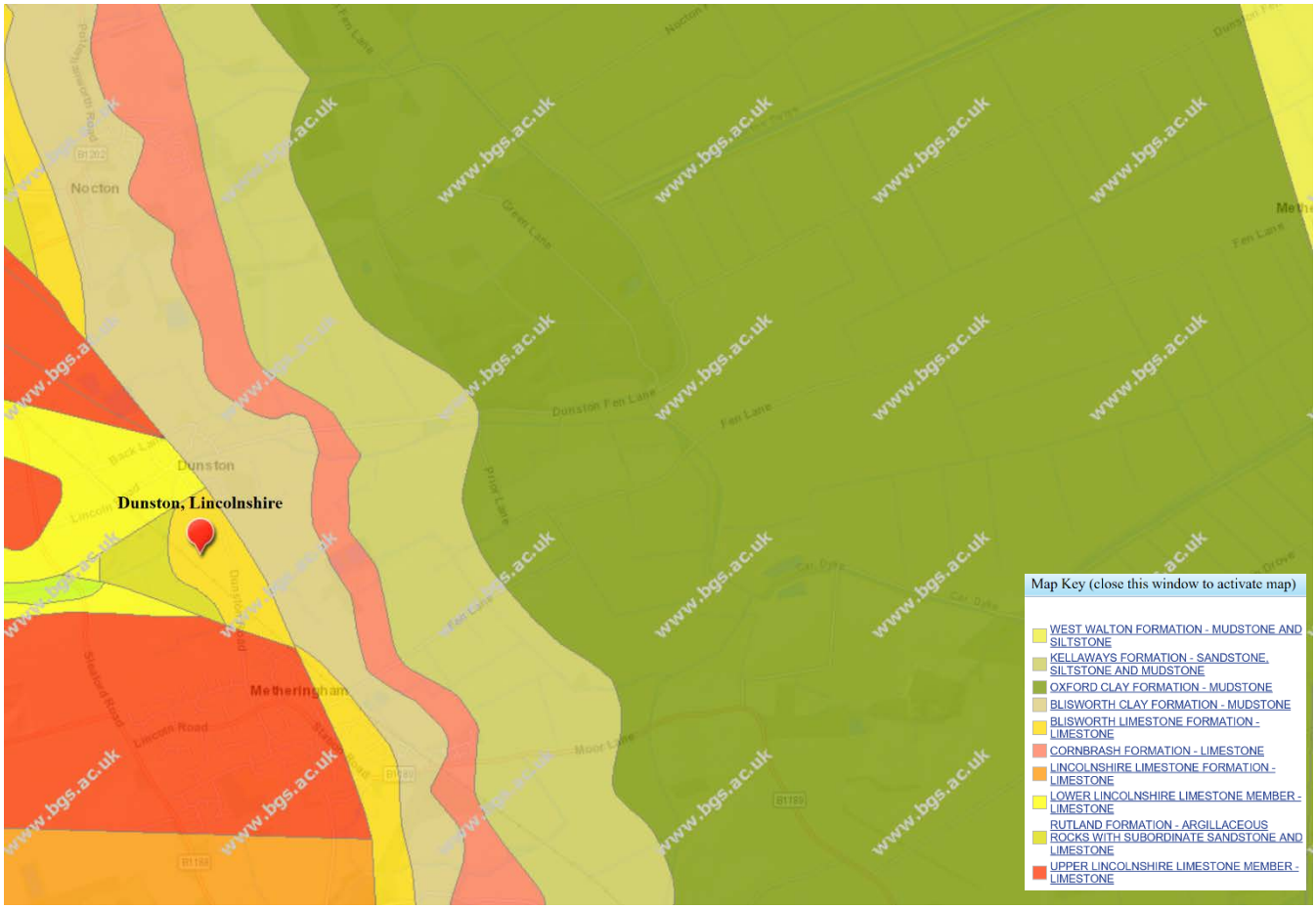


Figure 2.1 Bedrock geology of Dunston Beck

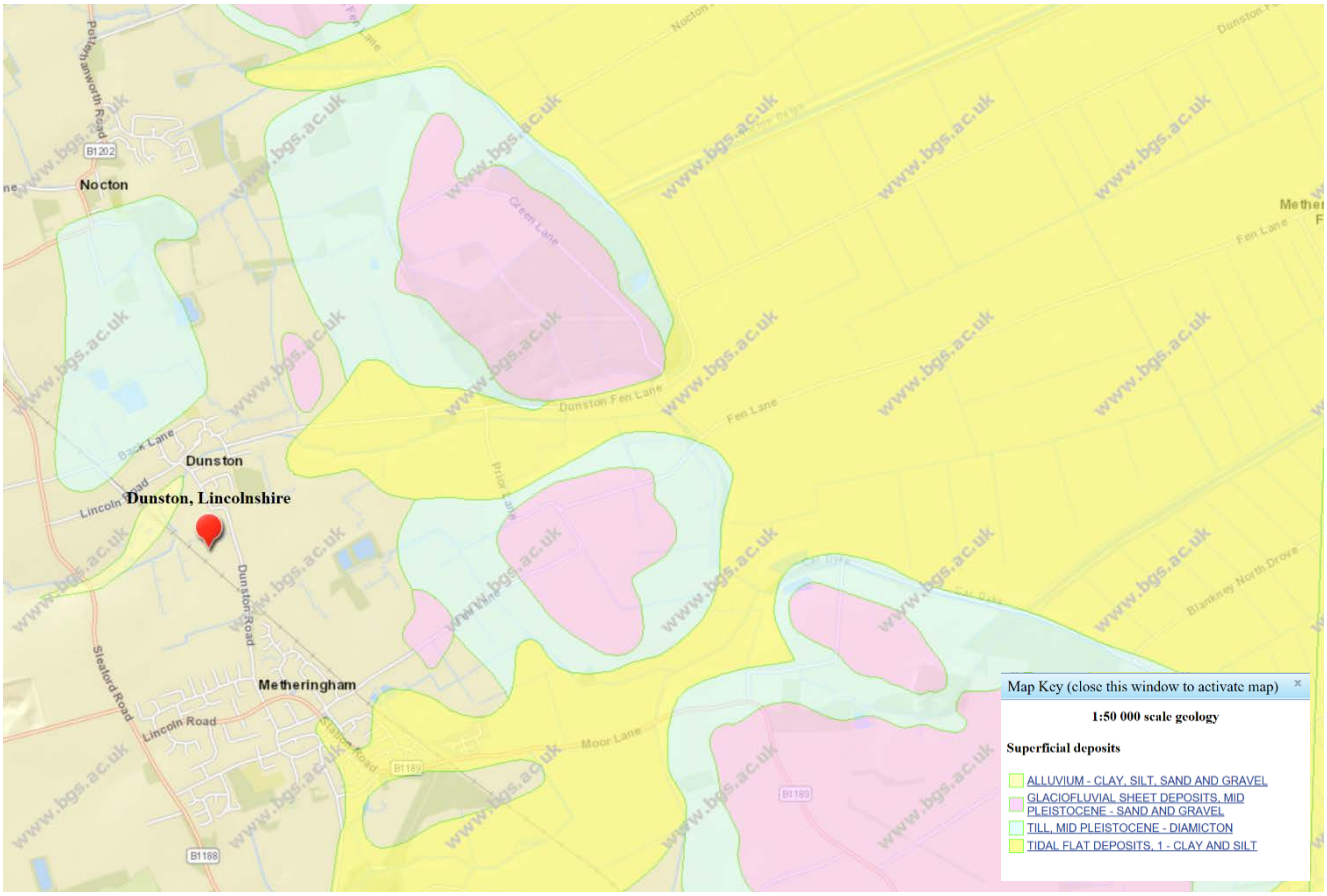


Figure 2.2 Drift geology of Dunston Beck

The watercourse flows over a subdued topography with higher ground to the north west that is the proposed spreading area for excavated material for the scheme. The floodplain is best connected to the east but even here the channel is strongly inset, and connectivity is poor (Figure 2.3). The gradient of the Dunston Beck is low at around 0.004. Such low gradients would normally suggest an aggradational environment but it would appear that the strongly inset nature of the channels concentrates flow energy preventing severe in-channel fine sediment build up.

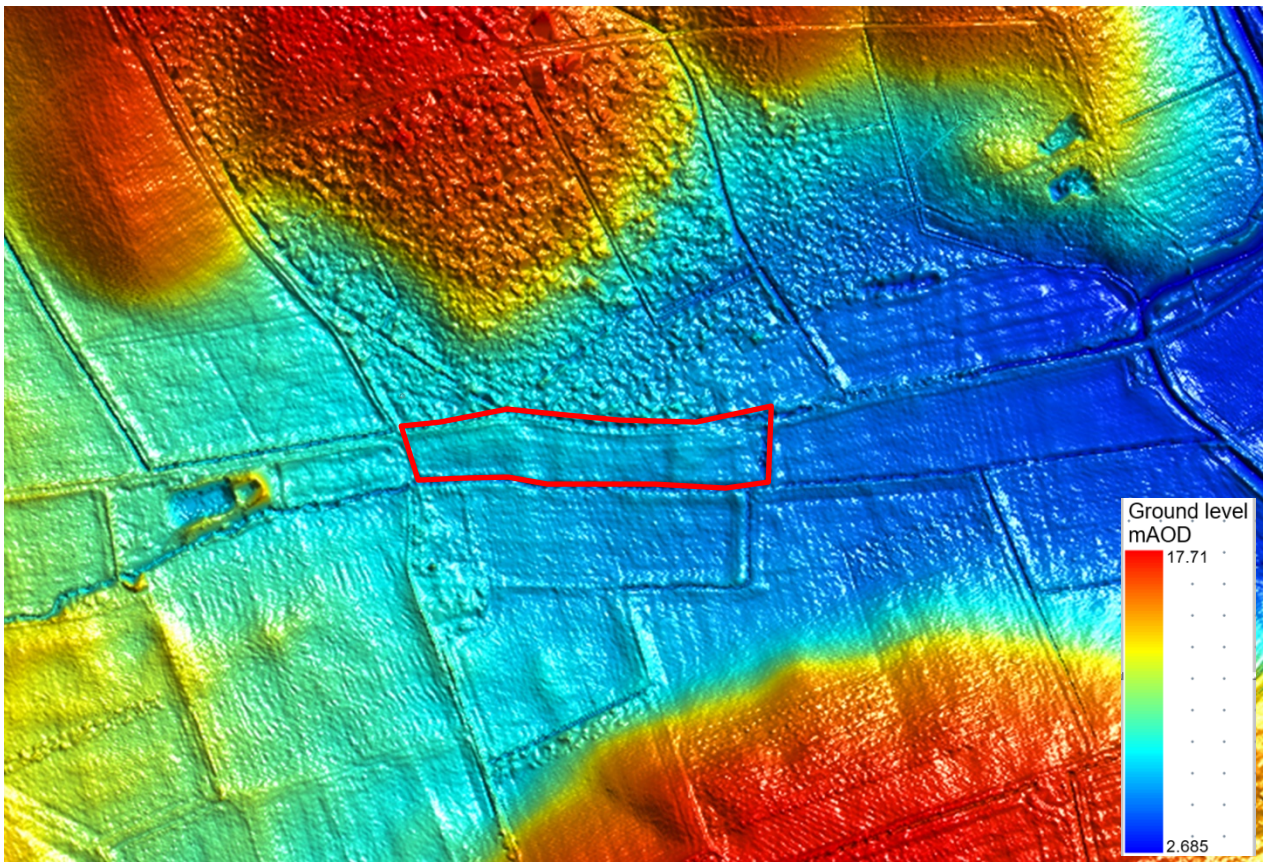


Figure 2.3 General topography in the vicinity of the Dunston Beck site

Dunston Beck is artificially straight (Figure 2.5), with straightening pre-dating the earliest available maps in 1887 (Figure 2.6) and is likely to have been undertaken to better drain surrounding agricultural land. There has been very little change to the planform over the last 30-135 years based on analysis of the current and the first epoch Ordnance Survey Map (Figures 2.5 and 2.6).

Figure 2.5 Current river course across the study site.

Figure 2.6 Historic mapping of Dunston Beck.

Aerial photography suggests that the watercourse is relatively low energy with some in-channel marginal berms and vegetated bar deposits. It is likely there are high levels of diffuse fine sediment input from farming practices both locally and upstream that will encourage the development of these fine sediment features. This has encouraged channel narrowing in places and bed gravels are often exposed here.

Analysis of the LIDAR data for the site (Figure 2.3) suggests that the watercourse is significantly over-deep (with an approximate river bed to top of bank depth of around 1.5m despite the river being only 1.5 to 2 m wide). The watercourse is likely to have been dredged that has exacerbated the dysconnectivity to the floodplain. The restoration site displays subtle topographic variation with land rising to the north west. No palaeo-channel features are discernible across the site, instead the central and eastern zones form lower areas representing the best opportunity zones for floodplain lowering and wetland development.

2.3 Field studies

A field audit was conducted along the study reach of the Dunston Beck in Summer 2019. The floodplain zone was found to be ungrazed and vegetation growth made observation difficult. The species mix was dominated by ruderals many of which are characteristic of dryer environments.

The watercourse was found to be grossly over-deep, displaying width depth ratios <1. The channel is obscured by vegetation with strong growth of marginal plants dominated by wetland species especially where low berms are present and areas of aquatic vegetation growing mostly across the bed of the channel where fines dominate but also seen in more gravelly reaches. Despite being grossly over-deep the bed of the channels displays some morphologic variation. Gravels are partially covered in a veneer of silt but it is likely that this is flushed during higher winter flows.

The presence of areas of gravels suggests that the watercourse is occasionally energetic despite flowing over low slopes. This is partially influenced by the shape of the inset channel which concentrates flood flows within the channel and this morphology could be subject to change if the floodplain is extensively reconnected. Change would be due to deposition and to a degree this will be offset by flow splitting across the floodplain moving some suspended sediment away from the main channel.

3. Model and Audit Driven Optioneering

3.1 Flow Model Construction

To assess potential opportunities for improved floodplain connection and to improve the functioning of this reach of the Dunston Beck, a 2D TUFLOW model of the reaches has been developed using available Environment Agency 2 m cell size LIDAR. The model was developed at a 2 m cell size to enable accurate representation of the channel and floodplain, that were of significant importance for the opportunity identification for this project. In-channel information was ground-truthed on site and adjusted where necessary, and the hydrology was developed using catchment descriptors and used as flow inputs to the 2D model.

The purpose of the modelling was to identify potential floodplain reconnection and restoration opportunities for this reach of the Dunston Beck, with the primary aim to identify an option that best restores floodplain connectivity across the site. This enabled assessment of the impacts to in-channel processes and the hydrological regime across the floodplain. The model has also assessed the impact on flood risk both locally and downstream through use of a monitoring line at the downstream extent of the model.

The models have been built using a Digital Elevation Model (DEM) across the model domain that provides a ground elevation value for each 2 m grid cell. The model extents are shown in Figure 3.1 below.

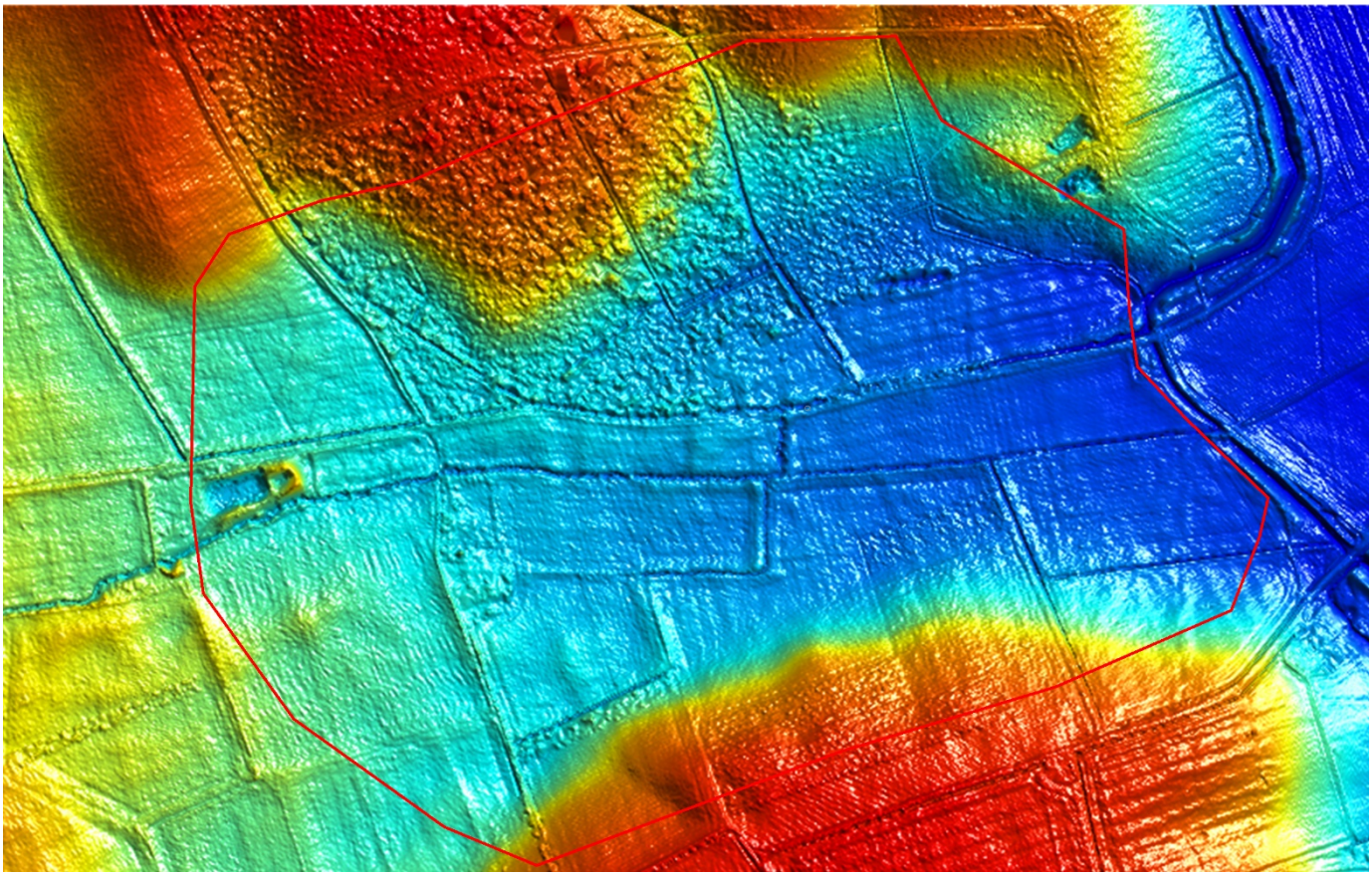


Figure 3.1 Model extent (Environment Agency LiDAR base map)

Hydrology

Flow inputs to the upstream end of the 2D model domain were developed using catchment descriptors. For the purposes of this design assessment, a flow of 10m^3/s was run through the model to represent a 1 in 100yr plus allowances for climate change event. Intermediate flows were also assessed. A Q95 flow was

estimated at 0.3 m^3/s and a Q10 flow at 0.5 m^3/s for the purposes of assessing low flow hydraulics in the channel and across the floodplain.

Model Run Parameters

Simulated depths, velocities, water level, bed shear stress, flow and mass balance were output to assess flood extents across the model domain. PO monitoring lines were used at the downstream end of the models to determine likely downstream flood risk impacts. Model outputs were sensibility checked by AquaUoS to ensure these reflected information gathered during the Fluvial Audit undertaken prior to the modelling and model results were deemed to be appropriate and sensible. Once a restoration design is agreed, bed shear stress and velocity information extracted from the model will be used to determine the potential for phosphorous storage across the floodplain.

Initial outputs from the baseline hydraulic model run from the 100 year plus allowances for climate change return period event are shown below in Figure 3.2. This was initially used to identify preferential floodplain reconnection areas for the site. Figure 3.2 shows the severe disconnection across the majority of the site, with the lower eastern areas suffering severe disconnection.

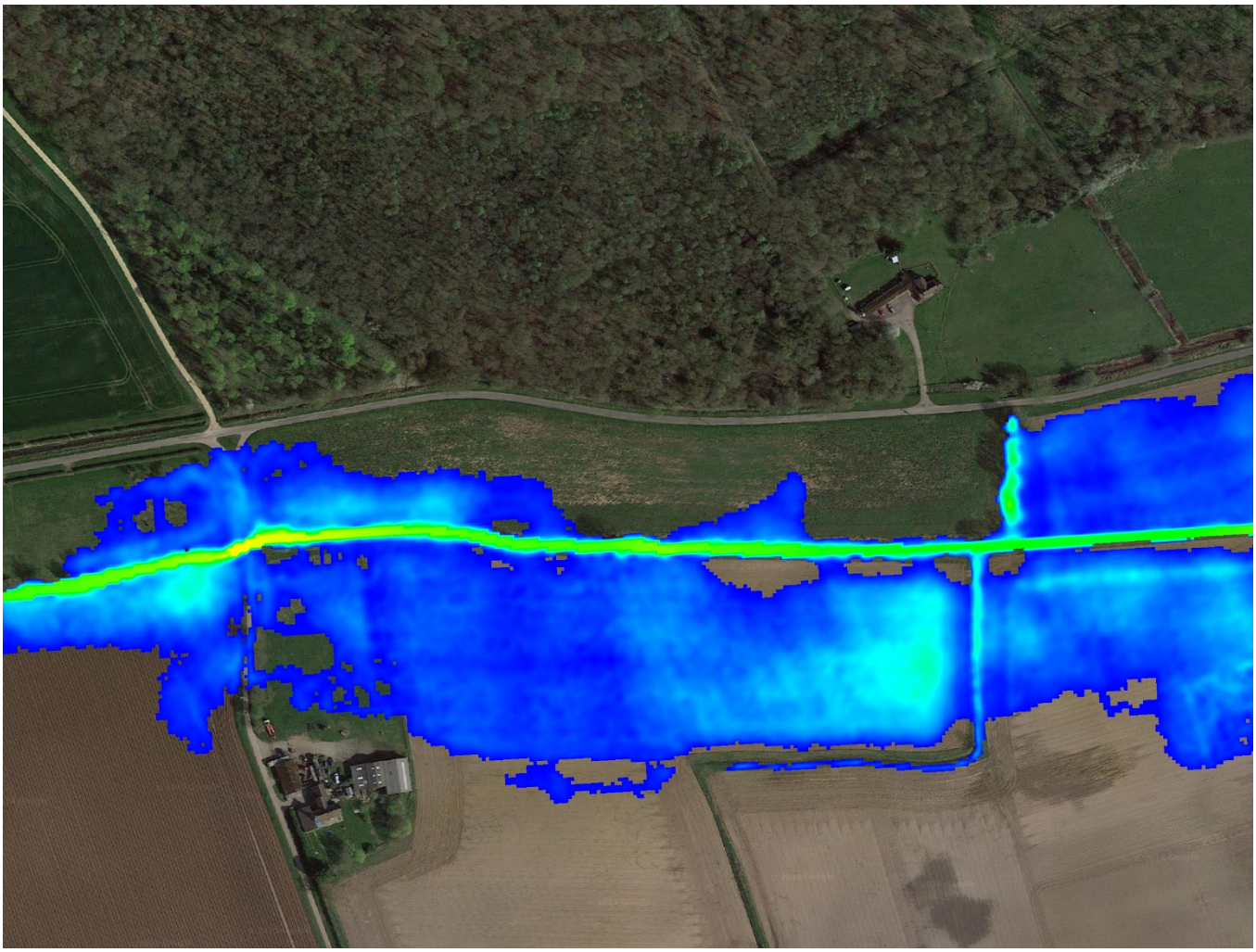


Figure 3.2 Baseline model flood levels, (blue-shallow, green-deep) at the study site

3.3 Optioneering

The high levels of floodplain disconnection offer a strong justification for developing a floodplain reconnection scheme within the study area. The options developed below consider impacts on channel processes, flood risk impact and local land use.

Under completely unconstrained conditions it is suggested that restoration of the site should create a significantly lowered floodplain zones with a sub-network of channels and potential for isolated ponds. This would be more characteristic of unimpacted lowland channels i.e. a part anastomosed network that could develop further over time, (Figure 3.3). Given the generally poor natural functioning of much of the watercourse and floodplain it is concluded that there is strong justification to explore the possibility of significant restoration effort along the river. Natural processes should be left unhindered wherever practicable and intervention through minor works that encourage naturalisation should be favoured. However, process-driven change is slow on this system and the river-floodplain connectivity is severely impacted. Hence several more substantial restoration opportunities are discussed below alongside the option to naturalise and 'do nothing' on the watercourse.

Figure 3.3 Example of functioning anastomosed wetland.

Do nothing

Under a do-nothing scenario, the channel bed will narrow principally as a result of vegetative growth into the channel. Vegetation growth is already significant and is trapping finer inorganic material delivered to the watercourse through diffuse agricultural inputs. This has resulted in a mixed sediment bed with patches of winnowed gravel where the vegetation has narrowed the channel and bathymetric variability. Vegetation growth will eventually proceed to cover the majority of the channel and progressive bed aggradation will occur from the deposition of organics and silts.

Encourage naturalisation

The desk and field audit reviewed the system in terms of current form and function, identifying options for system restoration. It was clear that the watercourse has been very significantly altered from natural and that this has resulted in a floodplain that is disconnected and non-functional. The dominant processes are depositional, most strongly linked to plant growth and organic build-up. This process is slow and spatially limited, due to the highly inset nature of the channel. This has allowed a dry grassland community to develop across the former floodplain. Progressive alluviation and associated floodplain hydrological reconnection will be slow during which time scrub encroachment will continue across the floodplain area.

Active restoration

Active restoration across the site should aim to restore the connectivity between the over-deep watercourse and the floodplain. This may be achieved through bed level raising and floodplain level lowering (which will act to store floodwater and sediment and create wetland habitat). Watercourses flowing across such low gradient terrain tend to anastomose under natural conditions or flow as inactive single-thread channels where they are more constrained. Table 3.1 considers the various options for restoration of the watercourse and floodplain across the site based on these options. It is clear that whilst many of the options are more suited to larger restoration sites and others require significant intervention to current system form, many would generate significant and rapid ecological gains and should be considered further.

Table 3.1 Unconstrained restoration approaches for Dunston Beck.

Option	Comment	Action
Limited floodplain lowering and open water creation across the restoration site.	Moderate ecological gains, water retained across some of the site to allow sediment to deposit and lock up nutrients. Spoil volumes will be large. Retention of current channel morphology.	Consider further if restoration is constrained
Extensive floodplain lowering, backwater and open water creation across the restoration site.	Good ecological gains. Spoil volumes will be very large. Retention of current channel morphology.	Reject
Extensive floodplain lowering, backwater and open water creation with riffles across the restoration site.	Strong ecological gains, water retained across some of the site to allow sediment to deposit and lock up nutrients. Spoil volumes will be moderate. Current channel morphology improved.	Take Forward
Inset anastomosed channel creation across the restoration site.	Limited ecological gains. Anastomosing channels remain disconnected from the floodplain. Space is limited for extensive anastomosis. Spoil volumes will be moderate. Retention of current channel morphology.	Reject
Extensive floodplain lowering and anastomosed channel creation across the restoration site.	Very good ecological gains. Space is limited for extensive anastomosis. Spoil volumes will be very large. Retention of current channel morphology.	Reject
Extensive floodplain lowering and anastomosed channel creation with riffles across the restoration site.	Very good ecological gains. Space is limited for extensive anastomosis. Spoil volumes will be moderate. Retention of current channel morphology.	Reject

3.3 Preferred option

Floodplain lowering with limited channel bifurcation/open water creation together with the inclusion of riffle features will providing the biggest gains with respect to floodplain reconnection, functional wetland creation and in-channel morphological diversity (Figure 3.4). A slightly more sinuous planform with inset berms in the current main channel would add further morphologic and hydraulic diversity to the main channel. Under the proposed restoration the wet area of the channel will increase markedly and hydraulic habitat extent and diversity will be improved. This is illustrated in Figure 3.5.

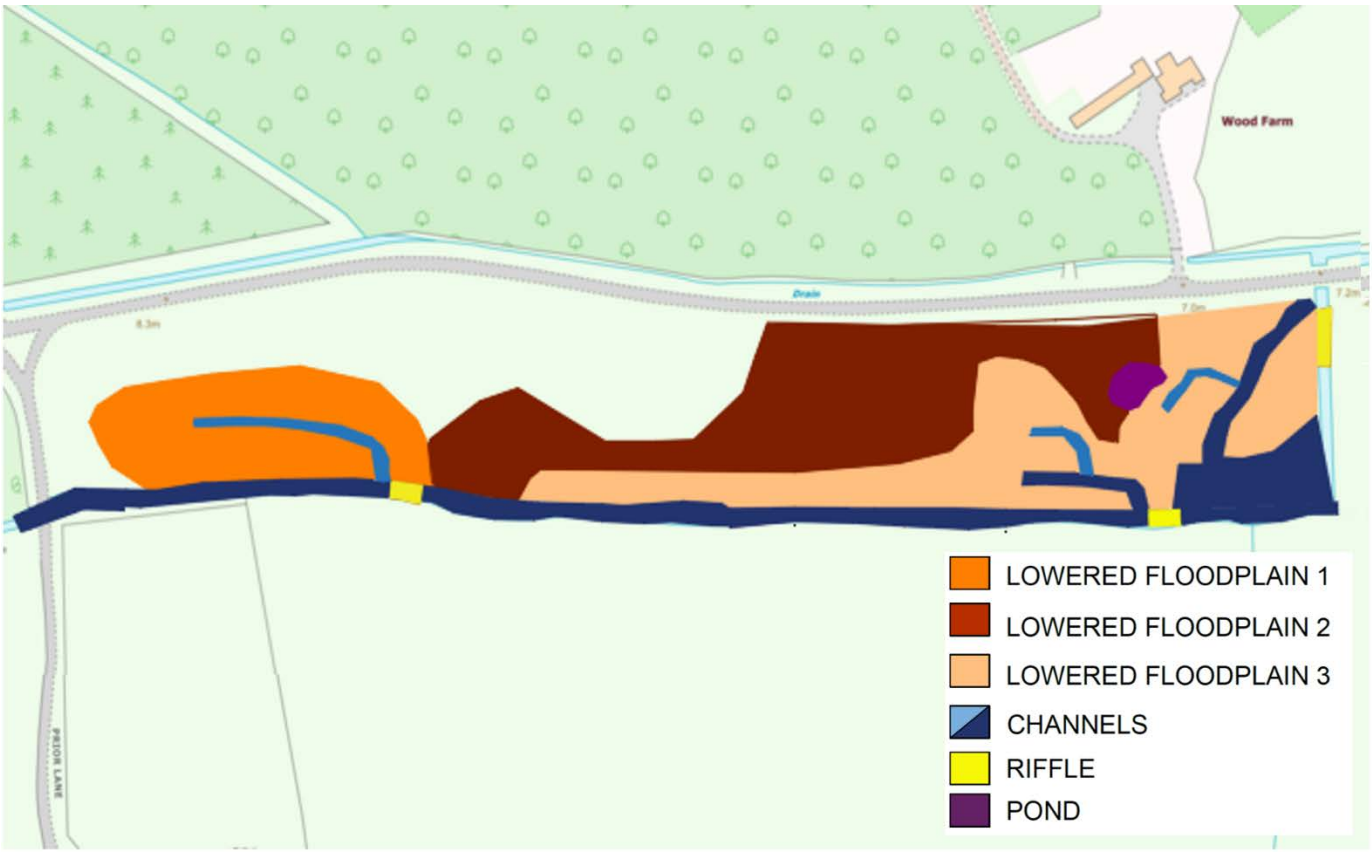


Figure 3.4 Preferred restoration option for the study site: extensive floodplain lowering and anastomosed channel creation with berms.

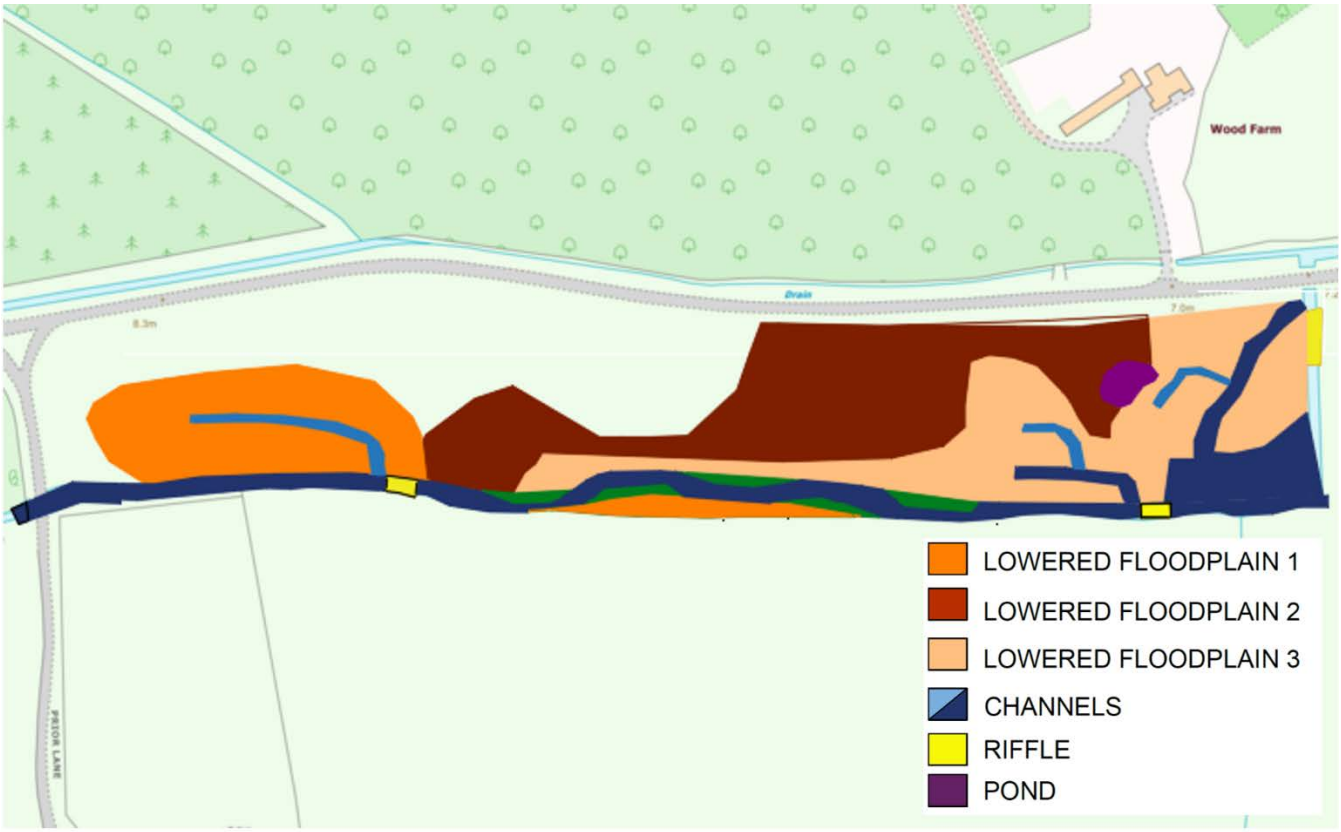


Figure 3.5 Preferred restoration option for the study site: extensive floodplain lowering and anastomosed channel creation with berms and increased in-channel sinuosity.

4. Restoration Design and Flood Risk

Services

A services search has been conducted for the site (Figure 4.1). This revealed an overhead cable that may be passed under to access the proposed site area and during the works but will not be directly impacted as material spreading is mainly proposed in the vicinity of the small pylon, and water mains (underground) that might be crossed to access the site. The works themselves will not directly impact any services but the contractor should be aware of the presence of services as mapped below.

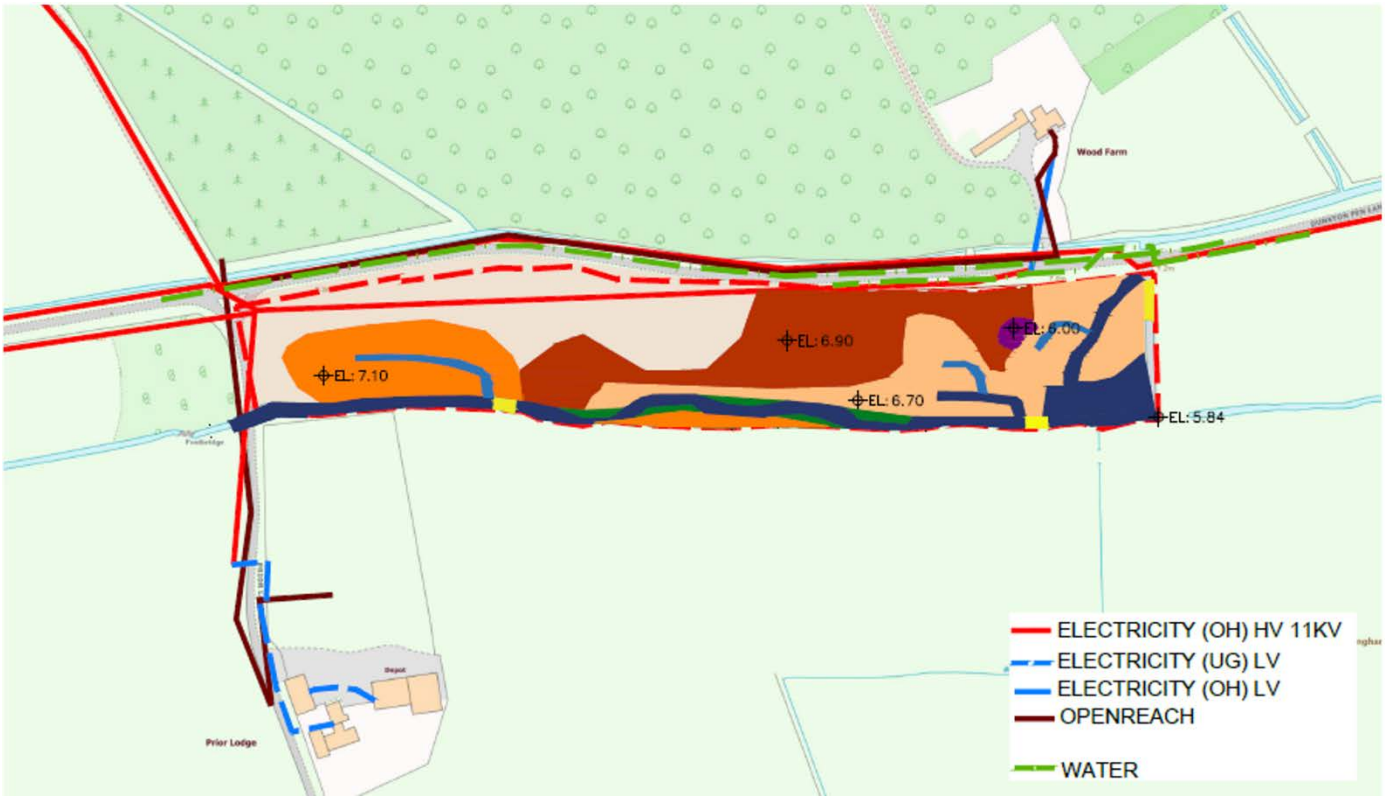


Figure 4.1 Services present at the restoration site

Design

The preferred restoration design option is shown as a concept drawing in Figure 3.4 above. Detailed design drawings have been produced alongside a Method Statement that outline how a contractor might safely deliver the works, a Designers Risk Register that highlights all risks related to the project and a Bill of Quantities. The below sections outline the hydraulic habitat gains linked to the preferred restoration scheme, review of shear stress and associated sediment impacts and the flood risk impacts as a result of the preferred scheme design.

Hydraulic Habitat

Figure 4.2 shows the hydraulic habitat change, compared to baseline, under good summer flow conditions as a result of the floodplain reconnection, pond creation and riffle instalment at the Dunston Beck site.

The hydraulic habitat area under the same flow conditions is more than trebled (to 43,392m^2 from 13,236m^2) under the restored conditions compared to baseline providing significant increase in habitat and flow diversity locally. There are percentage increases in glide, pool and riffle type habitat compared to baseline, reflecting the low energy conditions created across the lowered floodplain area and ponds (this will allow capture of fine sediment carried in suspension during higher flows). Riffle habitat is created where the riffles have been installed within the current main channel to connect the floodplain.

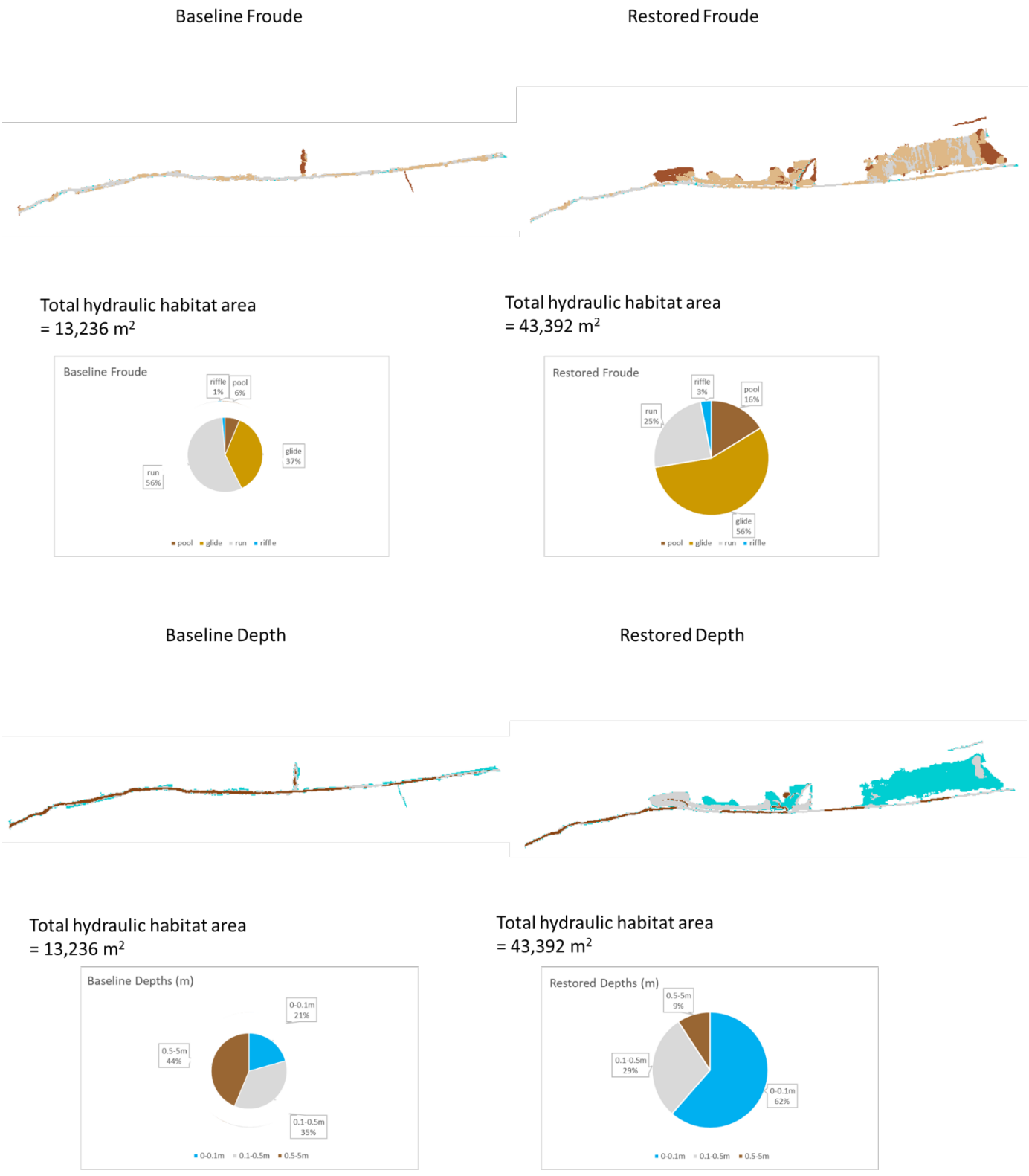


Figure 4.2 Good summer flow hydraulic habitat / biotope and depth change compared to baseline (pie chart size scaled to show area change).

Bed Shear Stress

Figures 4.3 and 4.4 show the variation in bed shear stress across the local model domain during an extreme flood (1 in 100yr plus allowances for climate change). There are no significant differences in the current main channel, except for higher bed shear stress across the constructed riffles with shears up to around 60 Nm^2. This has been used for the sizing of the gravel material for creation of these features, as shown in the accompanying design drawings and Bill of Quantities. Bed shear stresses in general are slightly lower in the main channel compared to baseline as a result of the improved floodplain connectivity. At the peak of the event, shear stresses across the floodplain may reach up to 30Nm^2 in some of the constructed channels that may allow for some minor erosion and limited transport of small gravel onto the floodplain. This would be infrequent, however, as this is an extreme event and gravel supply from upstream is low. During lower flows, this environment will generally be depositional with fine sediment depositing particularly during the receding limb of the flood hydrograph. This will reduce deposition of fine sediment in the current main channel and reduce delivery of this sediment downstream.

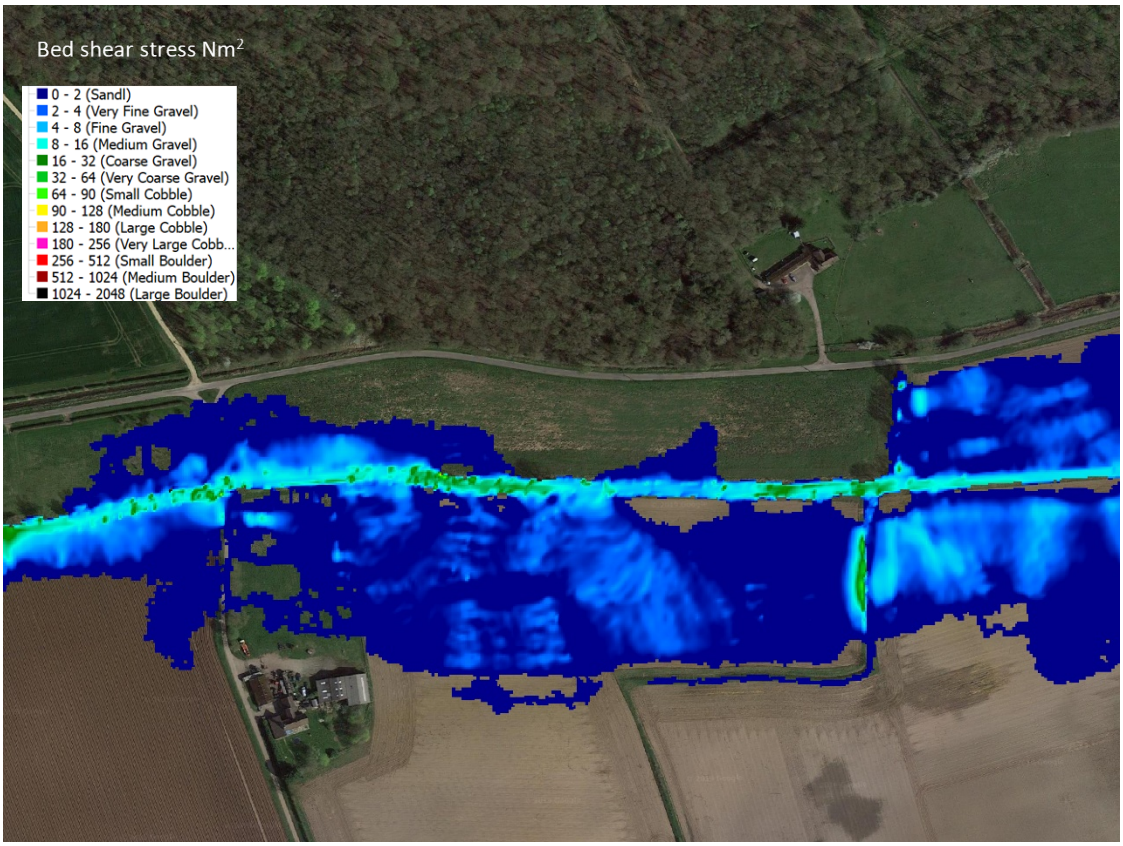


Figure 4.3 Bed shear stress during extreme flood under current conditions (key shows indicative sediment sizes being moved if available).

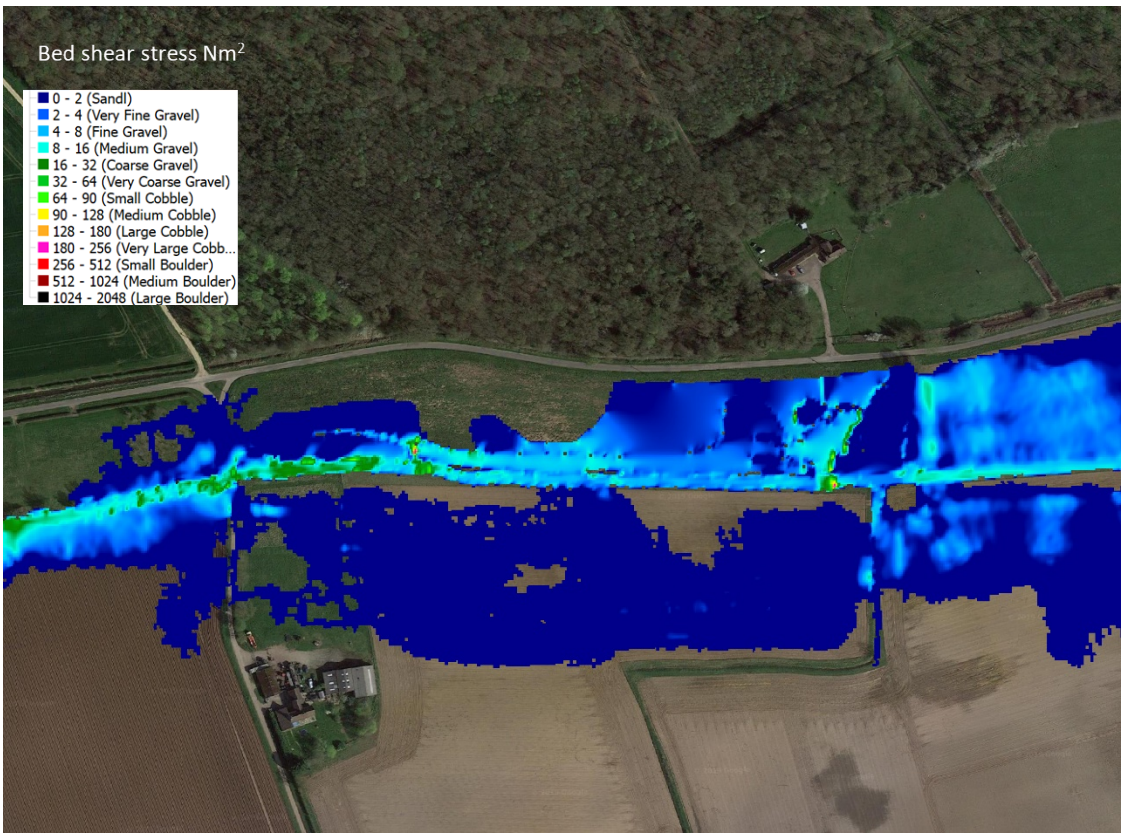


Figure 4.4 Bed shear stress during extreme flood under restored conditions (key shows indicative sediment sizes being moved if available).

Flood Risk

Model Flood Outputs

Flood modelling for the current and restored site scenario has been undertaken to determine the fluvial flood risk impacts as a result of the proposed scheme. This has been undertaken for the 100yr plus allowances for climate change, 20yr and 5yr event. Low flows and associated restoration impacts are discussed in the section above with regards to habitat changes.

Figures 4.5 to 4.7 demonstrate the flood extent changes for each of the flood return periods listed above, with baseline shown in blue and the restored scenario shown in red. The ‘a’ figures show flood extent increases as a result of the restored option for each return period modelled (visible red areas) and the ‘b’ figures show flood extent decreases as a result of the restored option (visible blue areas). For all of the flood events modelled, there are increases in flood extent through the lowered floodplain area where restoration works are being undertaken. This is to be expected since floodplain lowering is being undertaken to reconnect the floodplain to the river. Otherwise there are no other increases in flood extent outside of the works area. There are minor flood extent reductions over the left and right banks local to the scheme that are a result of increased flooding of the restored zone.

Figure 4.5a 1 in 100yrCC flood extent change, blue = baseline, red = restored (where red is visible indicates flood extent increase).

Figure 4.5b 1 in 100yrCC flood extent change, blue = baseline, red = restored (where blue is visible indicates flood extent decrease).

Figure 4.6a 1 in 20yr flood extent change, blue = baseline, red = restored (where red is visible indicates flood extent increase).

Figure 4.6b 1 in 20yr flood extent change, blue = baseline, red = restored (where blue is visible indicates flood extent decrease).

Figure 4.7a 1 in 5yr flood extent change, blue = baseline, red = restored (where red is visible indicates flood extent increase).

Figure 4.7b 1 in 5yr flood extent change, blue = baseline, red = restored (where blue is visible indicates flood extent decrease).

Downstream, the impact of the extreme flood (1 in 100yrCC) is not significantly impacted by the proposed works under current conditions for extreme events (Figure 4.8). This is similarly true for the 5yr event (Figure 4.9). There is no increase in flood risk downstream as a result of the proposed works.

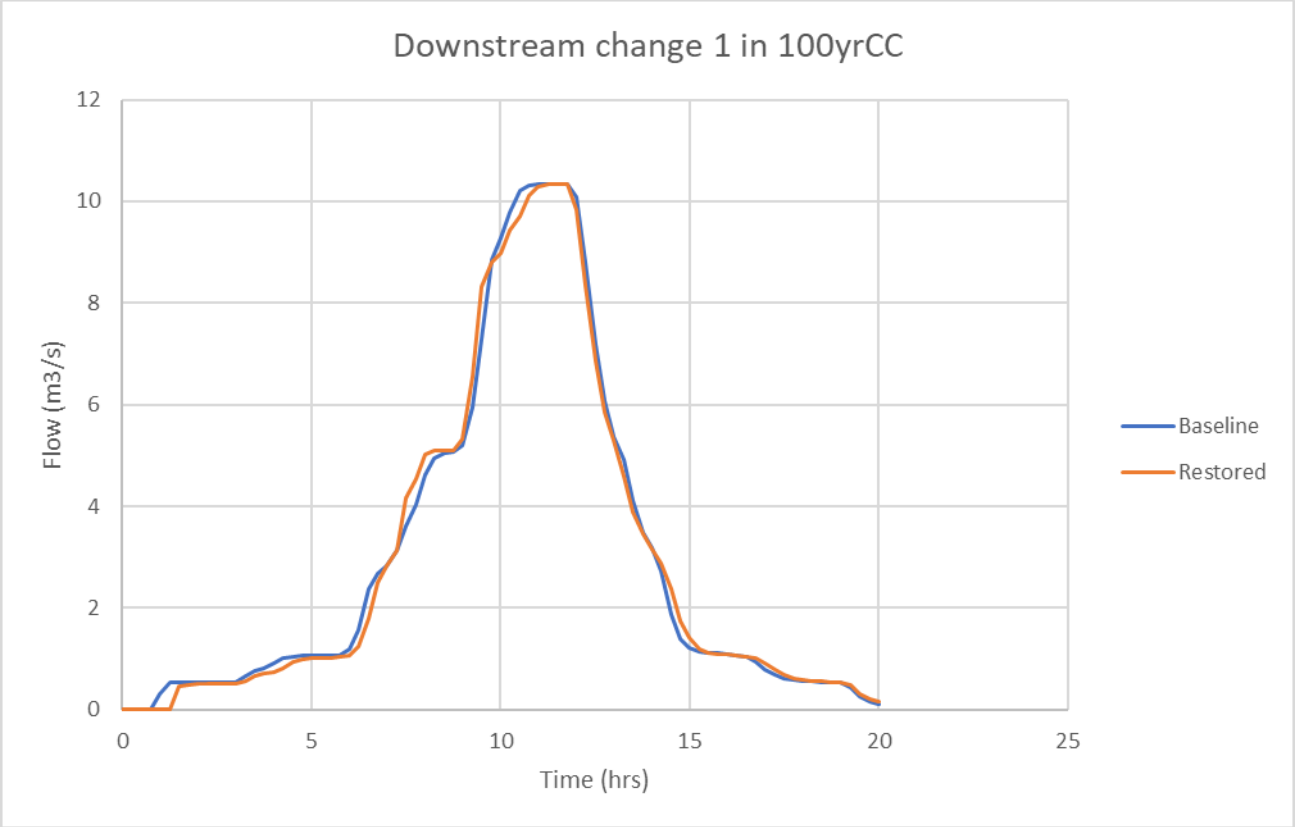


Figure 4.8 1 in 100yrCC flood downstream flood hydrograph change.

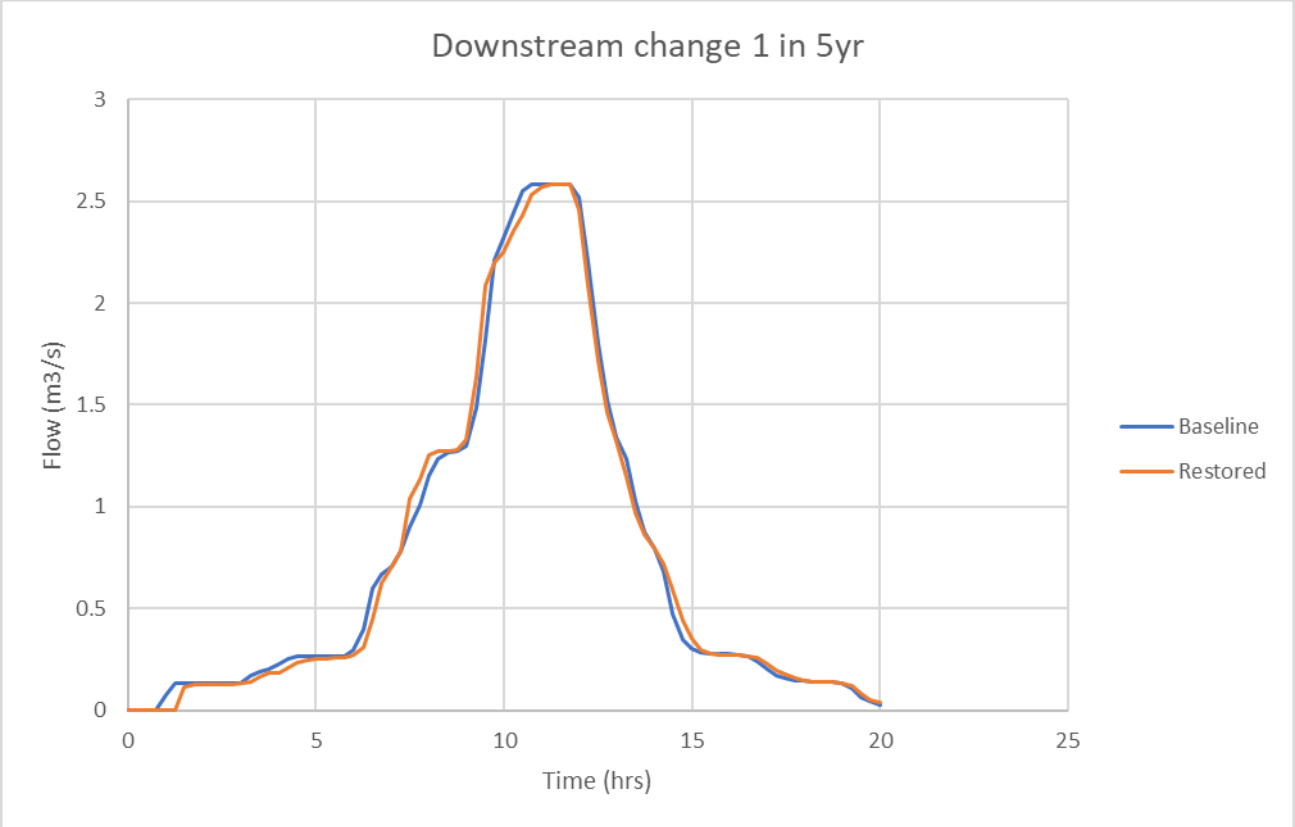


Figure 4.9 1 in 5yr flood downstream flood hydrograph change.

5. Conclusions and Recommendations

- The Dunston Beck is in a degraded state as a result of historic modification, straightening and dredging to drain surrounding agricultural land;
- Aerial photography suggests that the watercourse is relatively low energy with some in-channel marginal berms and vegetated bar deposits present. Diffuse fine sediment input from farming practices locally and upstream will be encouraging the development of such features and impacting the bed of the channels;
- Wetland habitats and floodplain connectivity in general, is currently mostly non-functional across the site as a result of historic modification and overdeepening linked to dredging;
- Floodplain reconnection of the left bank of the Dunston Beck at the study site offers the best option for restoration of this area that will improve the hydrological and geomorphological functioning as well as capturing fine sediments being delivered from upstream;
- Hydraulic modelling has demonstrated the ability of this restored area to capture fine sediments across the lowered floodplain area and outputs have been used to size gravel material for the creation of the riffle features in the main channel (designed to restore connectivity to the lowered floodplain area);
- Modelling has also shown that there are no negative flood risk impacts associated to the scheme with flood extent increases contained within the restored area;
- Hydraulic habitat mapping also shows the significant areal increase in available hydraulic habitat at frequent flows (more than trebled compared to baseline for the same flow) as a result of the scheme;
- It is recommended that a geomorphologist supervises the site works during construction, as detailed in the accompanying Method Statement.

Dunston Restoration - Outline Method Statement

Project name: Dunston Restoration									
Project location: Dunston									
Client: Wild Trout Trust									
	Initial	Rev1	Rev2	Rev3	Rev4	Rev5	Rev6	Rev7	**Rev8**
Date	02-10-19	02-10-19							
By	SB	SB							
Checked	GH	GH							
Approved	**GH**	**GH**							

Summary of key works

1. Excavate floodplain, channels and ponds
2. Excavate current channel, install berms to create sinuosity and install gravel riffles
3. Connect channels and modify features / channels as required. Reinstate works area.

Pre-construction & construction procedure

Construction of site compounds, lay-down areas, delivery of machinery and any other initial preparatory works to be undertaken in-line with specific site work activity. All works on site will be carried out in accordance with the appropriate British Standards and industry Codes of Practice. A qualified and experienced Geomorphologist must attend the site to advise on construction procedure at certain points during the works, this includes setting out on site.

Biosecurity measures outlined in the following two documents should be followed by all personnel and machinery on site:

https://secure.fera.defra.gov.uk/nonnativespecies/checkcleandry/documents/check-clean-dry-england.pdf

http://www.nonnativespecies.org/checkcleandry/

Construction period

The construction period is expected to take 4-6 weeks, ensuring cost effective delivery and minimal environmental disturbance as a result of the work on site. However, it is possible that adverse weather conditions such as periods of high rainfall (and associated river level rise), will lead to temporary cessation of some construction. Liaison should be undertaken by the client and contractor with the Environment Agency to determine an appropriate time of year for the contractor to deliver the works as whilst wet working has been minimized as far as possible, some will be required to complete the works.

Public Access during the works

During the construction period, public access to the site should be restricted and fenced off. Shrub removal may be required to facilitate access and to construct the works and to deliver some elements of the design. This is to be marked out during the setting out phase of construction.

The contractor will ensure appropriate signage and fencing off of the construction compound area and work area, and it is the responsibility of the contractor to ensure safe access for the workforce and appropriate restriction of access to the public.

No historic sites have been identified during pre-project surveys (including a geophysical ground scan), but Planning Consent may require an archaeological watching brief and avoidance of certain areas, which should be fenced to ensure no damage is caused by machinery access, etc.

Species surveys

A Preliminary Ecological Assessment has been carried out, separately to this design work, on the site which concluded:

- No internationally or national designated wildlife sites will be affected by the proposals.
- The potential impact on the Nocton Delph Local Wildlife Site, caused by the mobilisation of fine sediment, can be mitigated effectively.
- No priority habitats will be affected by the proposals.
- No protected species will be affected by the proposals.

Any potential ecological impacts can be effectively avoided or mitigated as follows:

- Undertake the works when flows are low.
- Install silt traps/fine sediment control measures, e.g. straw bales, fine sediment control mats and/or silt curtains downstream of the works prior commencement.
- Undertake works after the plants in the uncultivated arable area have finished flowering and set seed to extend the value of the nectar and pollen source to the end of the growing season.
- Sow the lowered 'floodplain areas' with a low maintenance, inundation tolerant grass/flower seed mix, e.g. Emorsgate EM8 (https://wildseed.co.uk/mixtures/view/9/meadow-mixture-forwetlands), to control fine sediment run-off into the Beck and head-start naturalization of the site.
- A flower-rich seed mix will complement the pollen/nectar source seed mix sown on the adjacent drier parts of the site.
- Restore the higher, dry areas of the site to pollinator/nectar source habitat to provide habitat continuity in future years. Although the topsoil will contain a significant quantity of pollen/nectar source plant seed, the area/s where the excavated soils are deposited should be sown with a suitable pollen/nectar source seed mix to augment the seedbank.
- Notwithstanding the current absence of Water Voles, as a precaution further checks for Water Voles should be made immediately prior to the commencement of works. If they are found to be present works should not proceed until effective safeguarding and mitigation has been agreed.
- To avoid impacts on nesting birds the works should take place after the conclusion of the main breeding season (March to July inclusive). Commencement in August should be preceded by a walkover survey to check for the presence of late breeding birds.
- Scheme design should avoid the need to remove or manage any mature and semi-mature trees ensuring that that potential bat roosts and nest sites for tree-nesting birds are retained.

Timing of vegetation clearance and temporary disturbance to river bed as part of works

Trimming / pollarding of trees and clearance of any ground vegetation is unlikely at the site but may be required to facilitate the works. Only those areas specifically identified for site clearance (to be marked out by the client and contractor prior to commencement of construction, with supervision from AquaUoS) shall be cleared of existing tree and vegetation cover. Contractor to use tracking mats for river banks when entering and exiting the channel when required.

If any vegetation clearance is required during the bird nesting season (March - August), these works will only be undertaken immediately after inspection and deemed free of nesting birds by a qualified ecologist.

Any works to the river channel must not take place until after immediate prior inspection by the Wild Trout Trust for trout spawning activity, during the period October - April.

Note: There may be some changes to the outlined method statement as more knowledge of site conditions are gained in the pre-construction and construction phases of the project to be determined by the contractor.

Activity: Excavate floodplain, channels and ponds	Method Statement 1

Risks: Overturning of plant machinery, crush injuries, collapse of earth banks, falling trees and branches, collision with other plant machines, pollution to watercourse, machine strike to persons, machine strike of services, insect bites and allergic reactions, snake bites, leptospirosis, manual handling, drowning.

Proposed working method overview:

- Machinery to access site as advised by the client. The site is bounded by a road to the north and west and higher ground exists in the site towards the northwest. Track mats should be used as appropriate dependent on landowner requests and ground conditions at time of construction.
- Temporary watercourse crossings may be required dependent on track routes and plant, this is to be agreed between affected landowners, contractor and the client.
- Silt control measures to be in place downstream during works and inspected daily (replace / repair as necessary).
- Banks to be monitored during the works. No personnel to be in the channel during works.
- Environment Agency wet working approval will need to be obtained prior to works (despite most works being undertaken in the dry), this will include setting up of suitable fine sediment mitigation downstream.
- Channels and ponds should be surveyed in on site prior to excavation beginning using coordinates provided with the design drawings, this should also be undertaken with supervision from AquaUoS as the designer.
- Excavate the channels, wetland and floodplain area, followed by the ponds, following levels provided within the design drawings and under supervision of the geomorphologist. Minimise tree disturbance wherever possible.
- Leave a 5m buffer at the up and downstream connection points to the main channels to minimise the risk of works being flooded out during excavation. These will be removed once the riffles are created.
- Transport excavated material straight to agreed spreading point to the north-west of the site boundary, spreading to a depth of not greater than 0.9m, according to design/supervision by ecologist and avoiding raising ground levels beneath overhead services.
- Separate out and stockpile any clay/highly cohesive material for use in berm construction. Material could also be riddled for gravels should these be evident during excavation and gravels can be utilised in riffle feature creation.
- Remove any tracks into watercourse and across the working area and make good any damage. Utilise bog mats along track routes if ground becomes wet.
- Seed exposed floodplain and top of bank areas with agreed seed mix at 5g/m^2 spreading rate (see design drawings and BoQ).

General Method of Work:

- Client and Principal Contractor to reconfirm area of works and mark up extent of site works.
- Ecologists to undertake final water vole and trout spawning checks in/alongside the beck channel.
- Check line of works for any trees to be cut back, vegetation clearance etc. to ensure safe passage for machinery.
- Erect temporary fencing to restrict public access to the site and to fence off historic sites (if present).
- Mark location of and install temporary protection measures to utilities, e.g. excavator mats to buried services at crossing points, goal posts for overhead cables.
- Silt traps to be installed downstream of excavation locations when features are being created, floodplain excavated etc and when machinery accesses the bank top or channel to prevent silt-run off from exposed banksides and from disturbed fine sediment when working in the channel.
- Install appropriate fine sediment control measure downstream of works area e.g. straw bales, fine sediment control mats, silt curtains.

Control Measures or Modifications

- No smoking in works area.
- No works to be undertaken during the hours of darkness.
- Ensure staff are aware of risk of drowning associated with working in or near water and the health and safety requirements (as detailed in the site risk assessment by the contractor).

- If any tree felling/vegetation clearance is required, site manager to contact ordnance contractor.
- All re-fuelling will take place at least 20m away from the watercourse, next to the fuel bowser.
- Be vigilant for members of public / pets / stock / wild animals entering works area.
- Be aware of the risk of Leptospirosis in and around the watercourse.
- Ensure bucket is lowered to the ground when machine is not in use.
- When visitors are on site, stop work & lower bucket to ground if they enter the works safety area.
- If working with a Banksman ensure that they are in a position where you can see them.
- Beware of machine blind spots when slewing and turning, especially with regard to tree branches.
- Be aware of any taped off areas/sites that will be of conservation, archaeological or other special interest. Do not enter these areas with any machinery.
- As a minimum use heather bale dams / silt curtains at strategic intervals in the watercourse to filter coarse sediments. Pollution booms and silt reduction measures booms to be erected at the downstream end of the works.
- All operators to be competent and certificated on the machines they operate.
- All incidents relating to safety or pollution of any kind are to be reported as soon as it is safe to do so.
- All staff and visitors to undertake induction and wear the appropriate PPE for the site conditions they encounter.

Activity: Excavate current channel, install berms to create sinuosity and install gravel riffles	Method Statement 2

Risks: Overturning of plant machinery, crush injuries, collapse of earth banks, falling trees and branches, collision with other plant machines, pollution to watercourse, machine strike to persons, machine strike of services, insect bites and allergic reactions, snake bites, leptospirosis, manual handling, drowning.

Proposed working method overview:

- Machinery to access site as advised by the client. The site is bounded by a road to the north and west and higher ground exists in the site towards the northwest. Track mats should be used as appropriate dependent on landowner requests and ground conditions at time of construction.
- Temporary watercourse crossings may be required dependent on track routes and plant, this is to be agreed between affected landowners, contractor and the client.
- Silt control measures to be in place downstream during works and inspected daily (replace / repair as necessary).
- Banks to be monitored during the works. No personnel to be in the channel during works.
- Environment Agency wet working approval will need to be obtained prior to works (despite most works being undertaken in the dry), this will include setting up of suitable fine sediment mitigation downstream.
- Excavate the current channel and install the berms using excavated cohesive arisings to create mild sinuosity as shown in the design drawings (cover with pinned jute matting if geomorphologist determines that this material is erodible).
- Install each gravel riffle working from downstream to upstream. Ensure the gravel specification is well mixed prior to placement and ensure adequate compaction provided to the placed gravel material. Construct features under the guidance of the geomorphologist, hand rake where required to stated heights in design drawings with final heights to be confirmed by geomorphologist to ensure appropriate functioning.
- Remove any tracks into watercourse and across the working area and make good any damage. Utilise bog mats along track routes if ground becomes wet.
- Seed disturbed areas with agreed seed mix at 5g/m^2 spreading rate (see design drawings and BoQ).

General Method of Work:

- Client and Principal Contractor to reconfirm area of works and mark up extent of site works.
- Ecologists to undertake final water vole and trout spawning checks in/alongside the beck channel.
- Check line of works for any trees to be cut back, vegetation clearance etc. to ensure safe passage for machinery.
- Erect temporary fencing to restrict public access to the site and to fence off historic sites (if present).
- Mark location of and install temporary protection measures to utilities, e.g. excavator mats to buried services at crossing points, goal posts for overhead cables.
- Silt traps to be installed downstream of excavation locations when features are being created, floodplain excavated etc and when machinery accesses the bank top or channel to prevent silt-run off from exposed banksides and from disturbed fine sediment when working in the channel.
- Install appropriate fine sediment control measure downstream of works area e.g. straw bales, fine sediment control mats, silt curtains.

Control Measures or Modifications

- No smoking in works area.
- No works to be undertaken during the hours of darkness.
- Ensure staff are aware of risk of drowning associated with working in or near water and the health and safety requirements (as detailed in the site risk assessment by the contractor).
- If any tree felling/vegetation clearance is required, site manager to contact ordnance contractor.
- All re-fuelling will take place at least 20m away from the watercourse, next to the fuel bowser.
- Be vigilant for members of public / pets / stock / wild animals entering works area.
- Be aware of the risk of Leptospirosis in and around the watercourse.
- Ensure bucket is lowered to the ground when machine is not in use.

- When visitors are on site, stop work & lower bucket to ground if they enter the works safety area.
- If working with a Banksman ensure that they are in a position where you can see them.
- Beware of machine blind spots when slewing and turning, especially with regard to tree branches.
- Be aware of any taped off areas/sites that will be of conservation, archaeological or other special interest. Do not enter these areas with any machinery.
- As a minimum use heather bale dams / silt curtains at strategic intervals in the watercourse to filter coarse sediments. Pollution booms and silt reduction measures booms to be erected at the downstream end of the works.
- All operators to be competent and certificated on the machines they operate.
- All incidents relating to safety or pollution of any kind are to be reported as soon as it is safe to do so.
- All staff and visitors to undertake induction and wear the appropriate PPE for the site conditions they encounter.

Activity: Connect channels and modify features / channels as required. Reinstate works area.	Method Statement 3

Risks: Overturning of plant machinery, crush injuries, collapse of earth banks, falling trees and branches, collision with other plant machines, pollution to watercourse, machine strike to persons, machine strike of services, insect bites and allergic reactions, snake bites, leptospirosis, manual handling, drowning.

Proposed working method overview:

- Machinery to access site as advised by the client. The site is bounded by a road to the north and west and higher ground exists in the site towards the northwest. Track mats should be used as appropriate dependent on landowner requests and ground conditions at time of construction.
- Temporary watercourse crossings may be required dependent on track routes and plant, this is to be agreed between affected landowners, contractor and the client.
- Silt control measures to be in place downstream during works and inspected daily (replace / repair as necessary).
- Banks to be monitored during the works. No personnel to be in the channel during works.
- Environment Agency wet working approval will need to be obtained prior to works (despite most works being undertaken in the dry), this will include setting up of suitable fine sediment mitigation downstream.
- Remove the downstream 5m buffers from each channel connection point and dispose of material to the proposed spreading area.
- Remove the upstream 5m buffers from each channel connection point and dispose of material to the proposed spreading area.
- Once flow has entered all channels etc and the channels are seen to be flowing clear, adjust any channels as necessary and finalise riffle heights with a hand rake to ensure they are functioning correctly under the guidance of the geomorphologist.
- Remove any tracks into watercourse and across the working area and make good any damage. Utilise bog mats along track routes if ground becomes wet.
- Seed disturbed areas with agreed seed mix at 5g/m^2 spreading rate (see design drawings and BoQ).

General Method of Work:

- Client and Principal Contractor to reconfirm area of works and mark up extent of site works.
- Ecologists to undertake final water vole and trout spawning checks in/alongside the beck channel.
- Check line of works for any trees to be cut back, vegetation clearance etc. to ensure safe passage for machinery.
- Erect temporary fencing to restrict public access to the site and to fence off historic sites (if present).
- Mark location of and install temporary protection measures to utilities, e.g. excavator mats to buried services at crossing points, goal posts for overhead cables.
- Silt traps to be installed downstream of excavation locations when features are being created, floodplain excavated etc and when machinery accesses the bank top or channel to prevent silt-run off from exposed banksides and from disturbed fine sediment when working in the channel.
- Install appropriate fine sediment control measure downstream of works area e.g. straw bales, fine sediment control mats, silt curtains.

Control Measures or Modifications

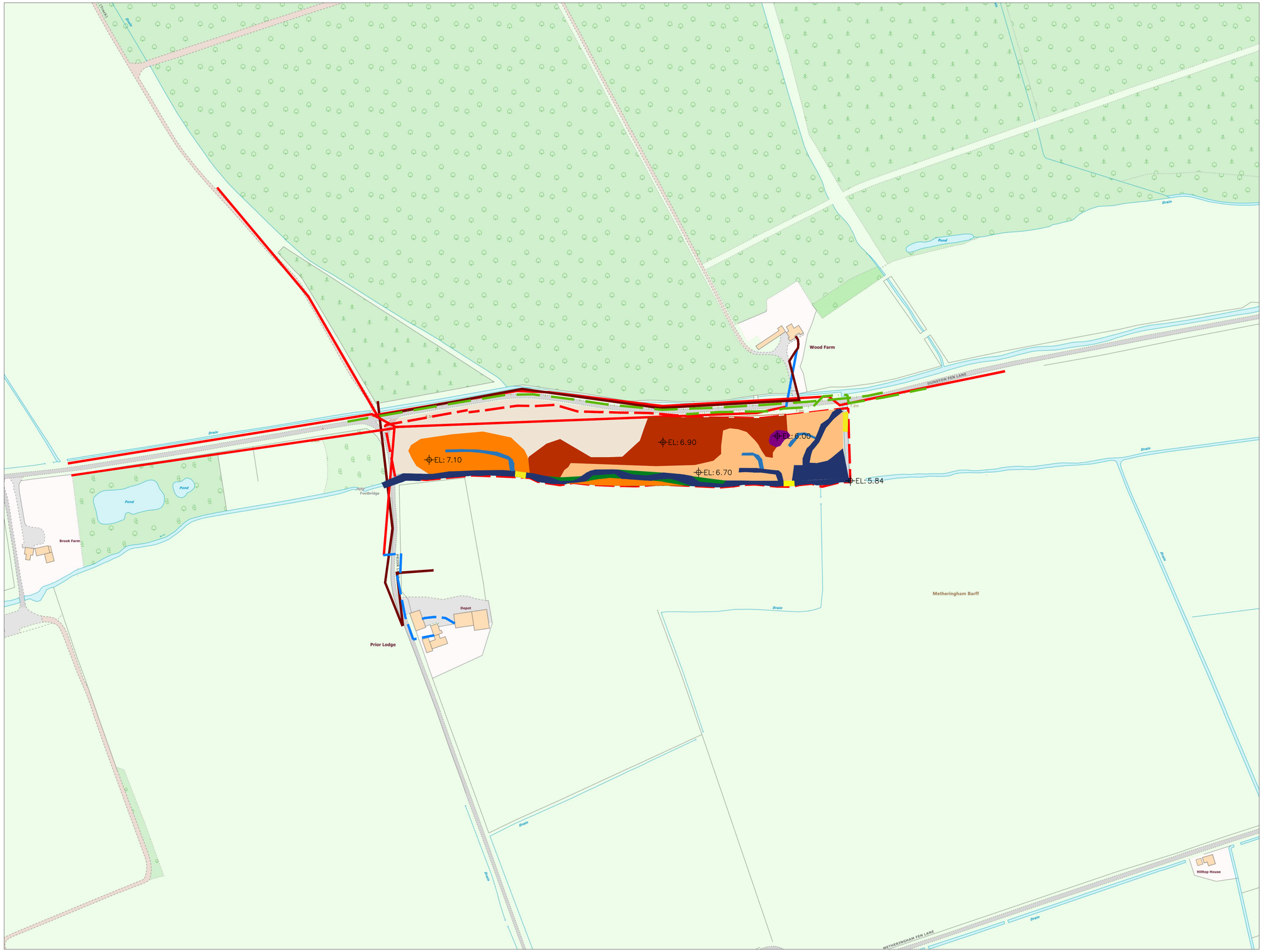
- No smoking in works area.
- No works to be undertaken during the hours of darkness.
- Ensure staff are aware of risk of drowning associated with working in or near water and the health and safety requirements (as detailed in the site risk assessment by the contractor).
- If any tree felling/vegetation clearance is required, site manager to contact ordnance contractor.
- All re-fuelling will take place at least 20m away from the watercourse, next to the fuel bowser.
- Be vigilant for members of public / pets / stock / wild animals entering works area.
- Be aware of the risk of Leptospirosis in and around the watercourse.
- Ensure bucket is lowered to the ground when machine is not in use.

- When visitors are on site, stop work & lower bucket to ground if they enter the works safety area.
- If working with a Banksman ensure that they are in a position where you can see them.
- Beware of machine blind spots when slewing and turning, especially with regard to tree branches.
- Be aware of any taped off areas/sites that will be of conservation, archaeological or other special interest. Do not enter these areas with any machinery.
- As a minimum use heather bale dams / silt curtains at strategic intervals in the watercourse to filter coarse sediments. Pollution booms and silt reduction measures booms to be erected at the downstream end of the works.
- All operators to be competent and certificated on the machines they operate.
- All incidents relating to safety or pollution of any kind are to be reported as soon as it is safe to do so.
- All staff and visitors to undertake induction and wear the appropriate PPE for the site conditions they encounter.

General mitigation of construction impacts on habitats / species

A site Operational Management plan shall be developed by the contractor with reference to the following elements:

Element	Suggested action	Required
Water quality	Control of silt run-off and potential for machinery pollution source	YES
River crossing	Control of disturbance, contamination, silt release, noise, vibration, debris, flooding	TBD
Site waste recycling plan	Re-use on site where possible	YES
Noise and dust	Timing of works; selection of plant	YES
Protected species Protection Plans	Follow species protection plans if applicable	TBD
Invasive plant species, pests & diseases	Fence giant hogweed, remove other invasives during site preparation where necessary	TBD



AquaUoS
Redefining Environmental Consultancy

PROJECT NAME
DUNSTON AND GRANTHAM

PROJECT NUMBER
ELCI0135

CONSULTANT ADDRESS
AquaUoS
Peel Building
The Crescent
Salford
M5 4WT

CLIENT NAME/ADDRESS
WILD TROUT TRUST
17 WESTSIDE VIEW
WATERLOOVILLE
PO8 0WZ

NOTES
ALL LEVELS ARE GIVEN IN M A.O.D (METERS ABOVE ORDNANCE DATUM)

PROPOSED LEVELS MAY VARY +/- 75 mm TO GENERATE BED VARIATION

CHAINAGE MEASUREMENTS ARE IN METERS

FEATURES ARE NOT TO SCALE DO NOT MEASURE OFF THIS

REVISIONS

3	REVISIONS	23/09
2	SECOND DRAFT	16/09
1	DRAFT FOR REVIEW	06/09

TITLE
PROJECT OVERVIEW: SERVICES

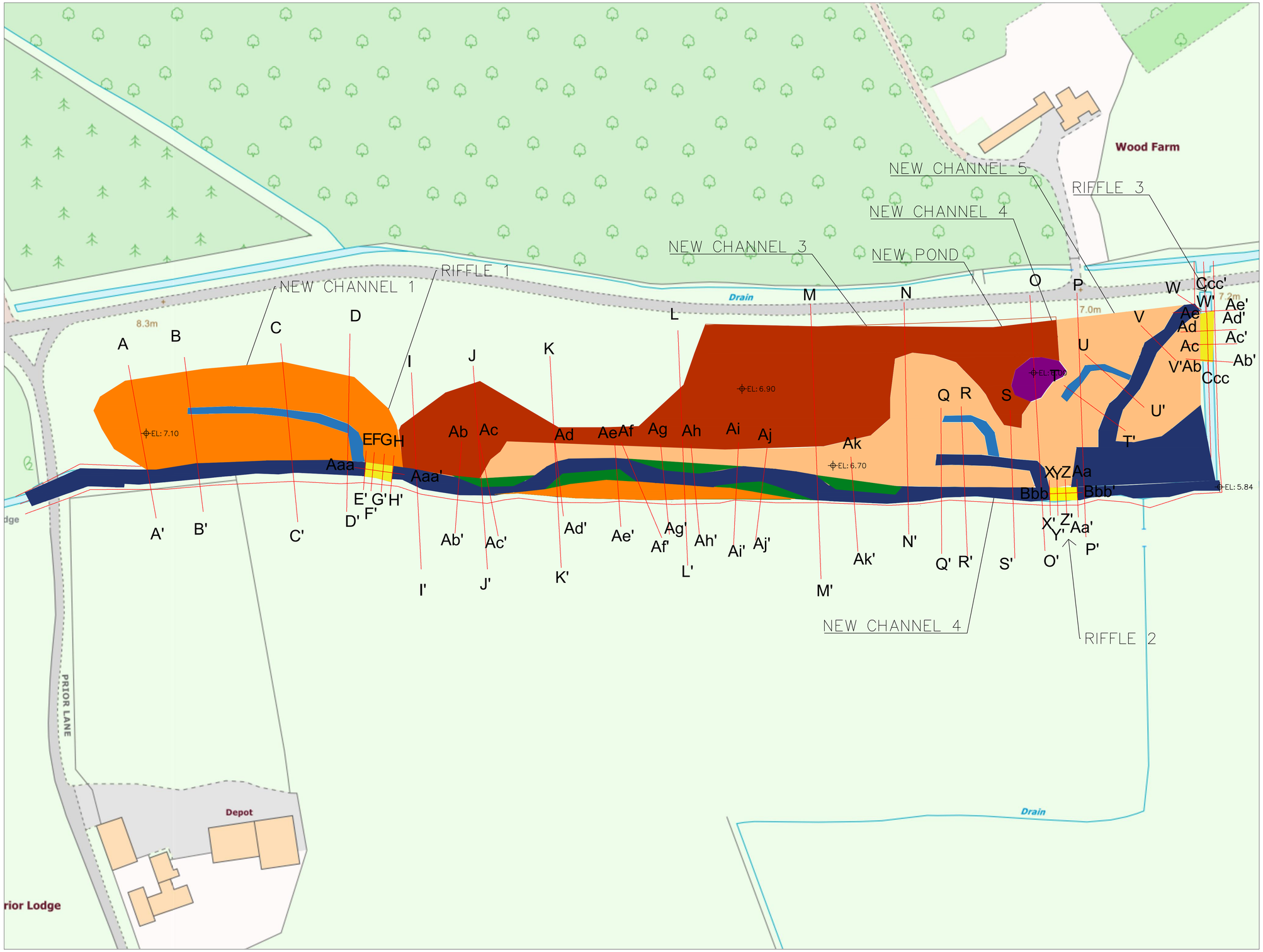
LEGEND
- ELECTRICITY (OH) HV 11KV
- ELECTRICITY (UG) LV
- ELECTRICITY (OH) LV
- OPENREACH
- WATER
- SITE BOUNDARY

SCALE
NTS

DATE
23/09/2019

SHEET
1

Author: RW Checked: SB Approved: GH



AquaUoS
Redefining Environmental Consultancy

PROJECT NAME
DUNSTON AND GRANTHAM

PROJECT NUMBER
ELCI0135

CONSULTANT ADDRESS
AquaUoS
Peel Building
The Crescent
Salford
M5 4WT

CLIENT NAME/ADDRESS
WILD TROUT TRUST
17 WESTSIDE VIEW
WATERLOOVILLE
PO8 0WZ

NOTES
ALL LEVELS ARE GIVEN IN M A.O.D (METERS ABOVE ORDNANCE DATUM)

PROPOSED LEVELS MAY VARY +/- 75 mm TO GENERATE BED VARIATION

CHAINAGE MEASUREMENTS ARE IN METERS

FEATURES ARE NOT TO SCALE DO NOT MEASURE OFF THIS

REVISIONS

3	REVISIONS	23/09
2	SECOND DRAFT	16/09
1	DRAFT FOR REVIEW	06/09

TITLE
PROJECT OVERVIEW: FEATURE DETAIL

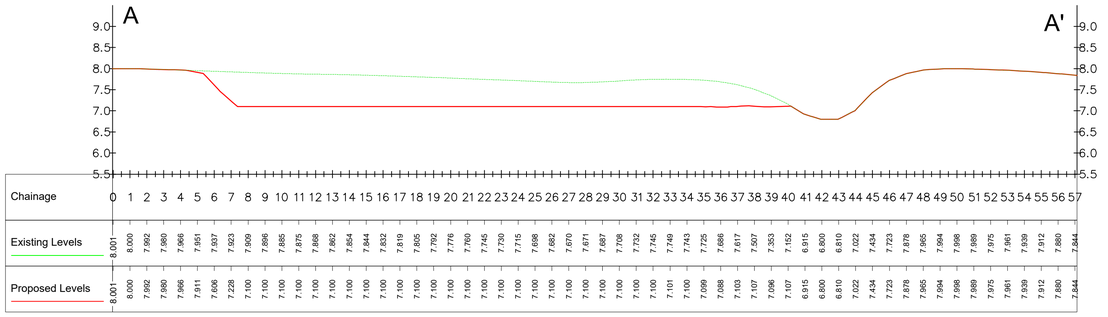
LEGEND
- LOWERED FLOODPLAIN 1
- LOWERED FLOODPLAIN 2
- LOWERED FLOODPLAIN 3
- CHANNELS
- BERM
- RIFFLE
- POND

SCALE
NTS

DATE
23/09/2019

SHEET
2

Author: RW Checked: SB Approved: GH



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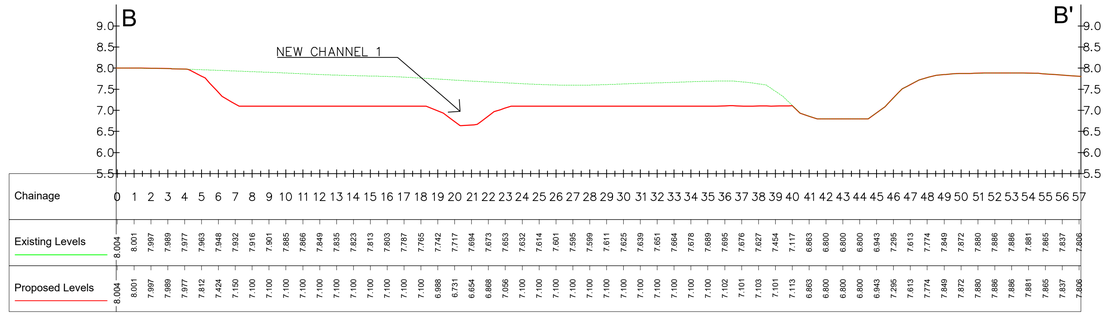

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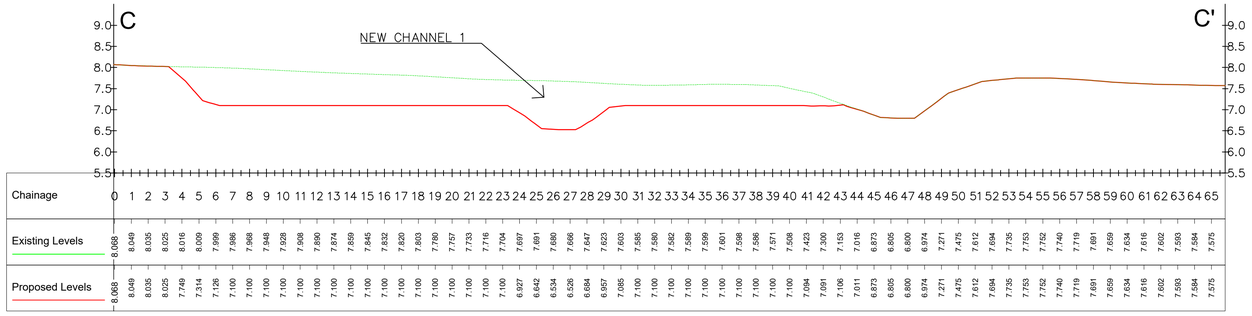

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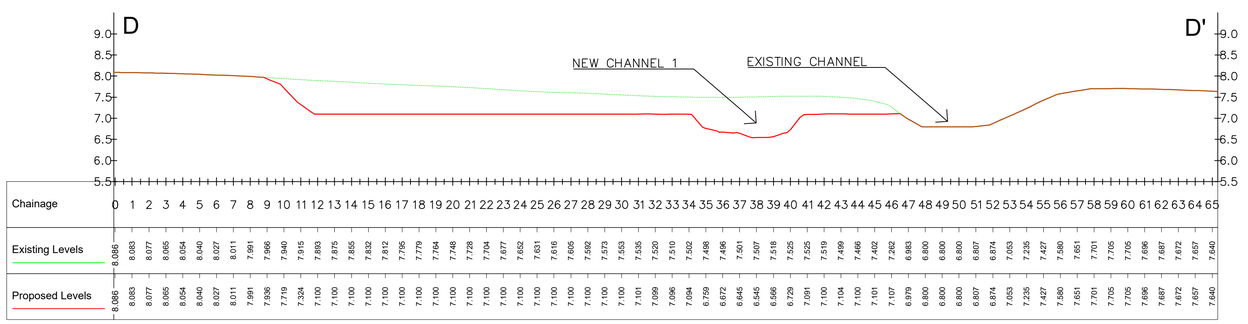

FLOODPLAIN LOWERING 1 SECTION 4

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TITLE
SECTIONS A-D

LEGEND

SCALE
NTS

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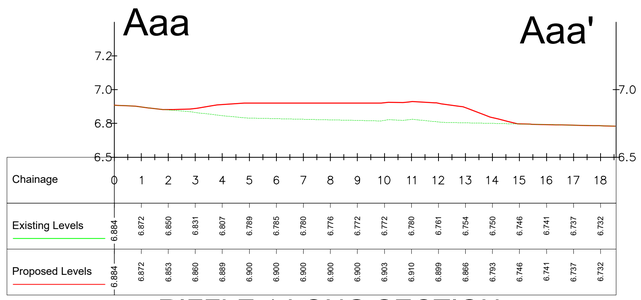
23/09/2019

SHEET
3

Author: RW Checked: SB Approved: GH



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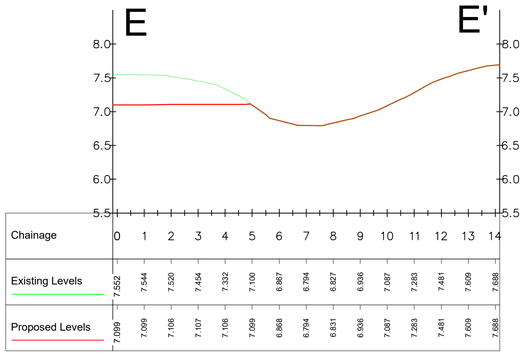
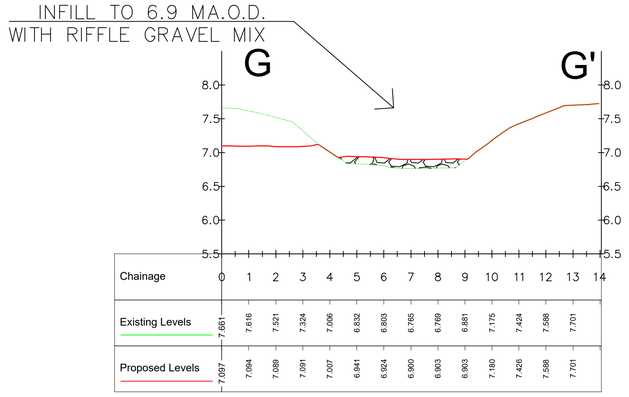


RIFFLE 1 SECTION 1



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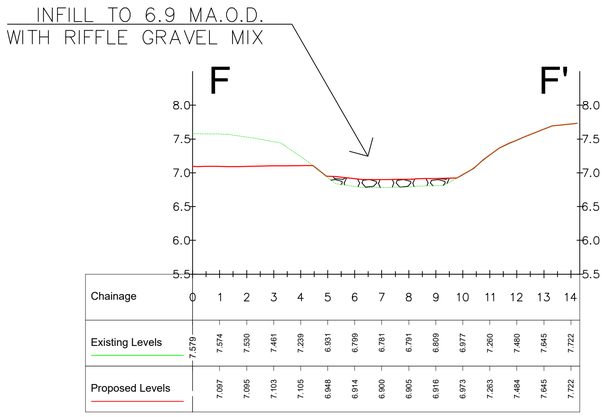

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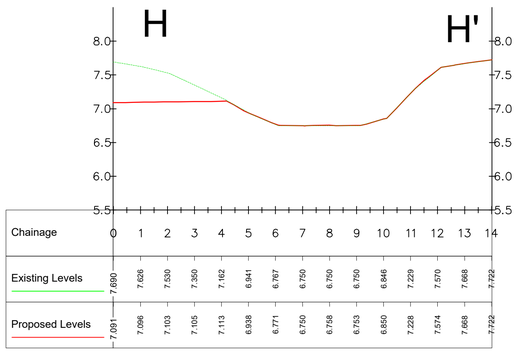

RIFFLE 1 SECTION 4

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REVISIONS

3	REVISIONS	23/09
2	SECOND DRAFT	16/09
1	DRAFT FOR REVIEW	06/09

TITLE
SECTIONS E-H

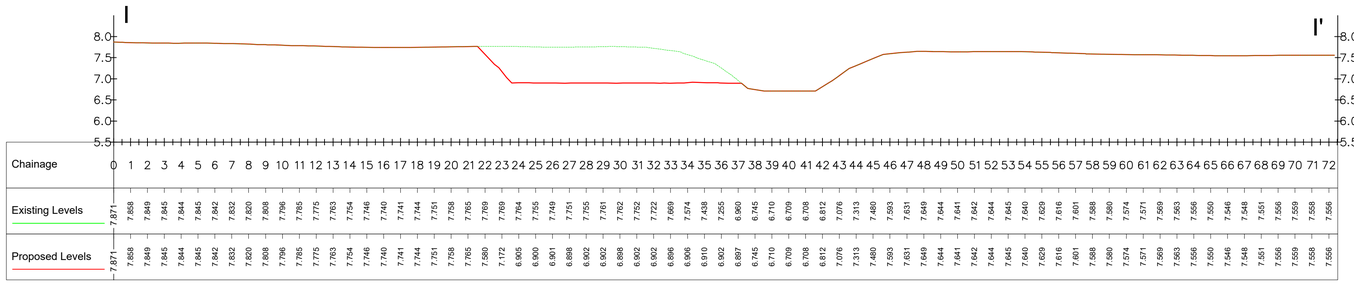
LEGEND
RIFFLE GRAVEL MIX:
10%: 50-70 mm
10%: 30-50 mm
60%: 20-30 mm
20%: <20 mm

SCALE
NTS

DATE
23/09/2019

SHEET
4

Author: RW Checked: SB Approved: GH



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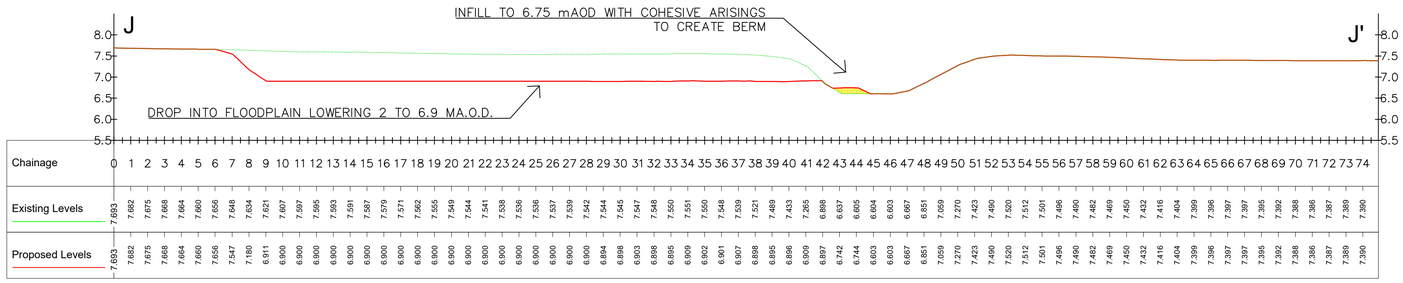

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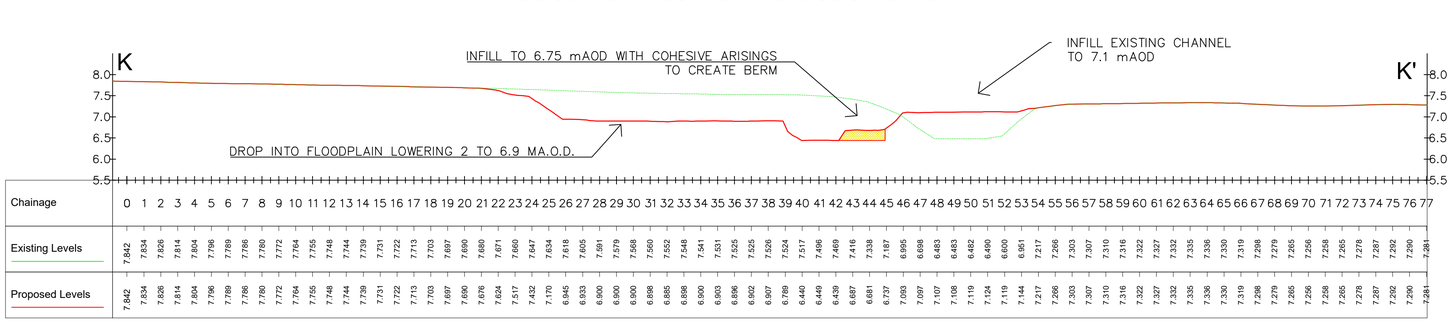

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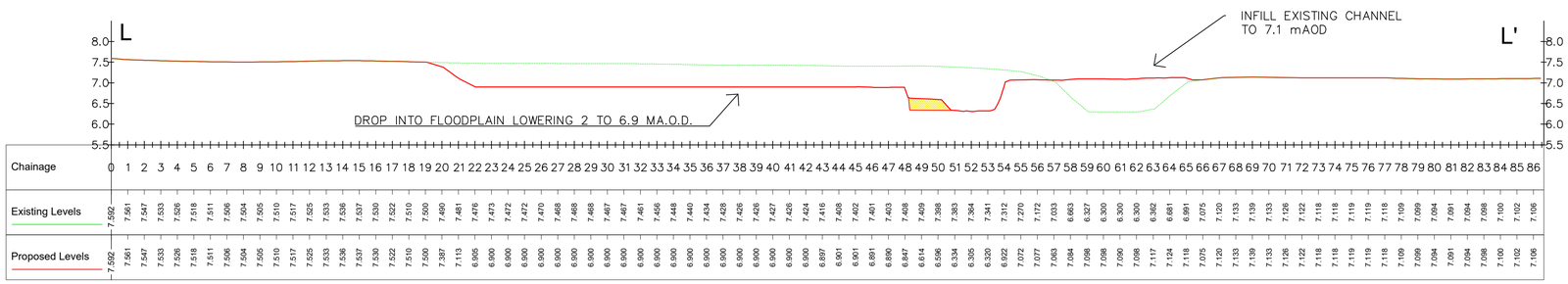

FLOODPLAIN LOWERING 2 SECTION 4

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REVISIONS

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TITLE
SECTIONS I-L

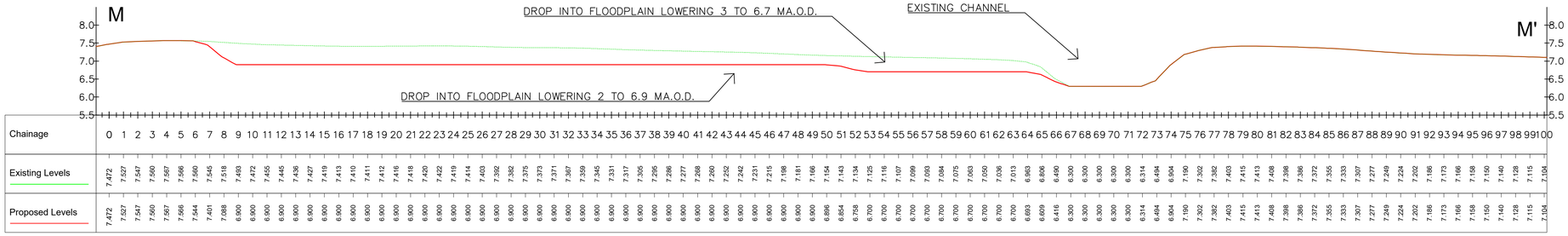
LEGEND

SCALE
NTS

DATE
23/09/2019

SHEET
5

Author: RW Checked: SB Approved: GH



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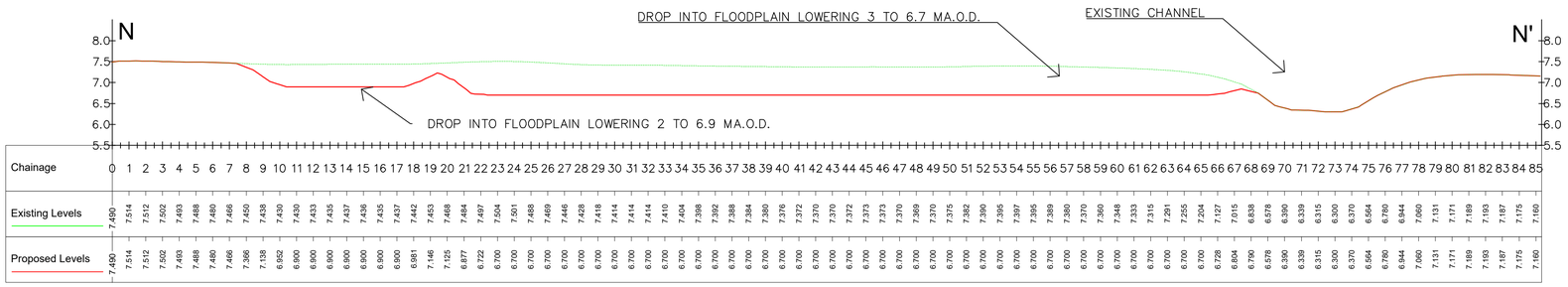

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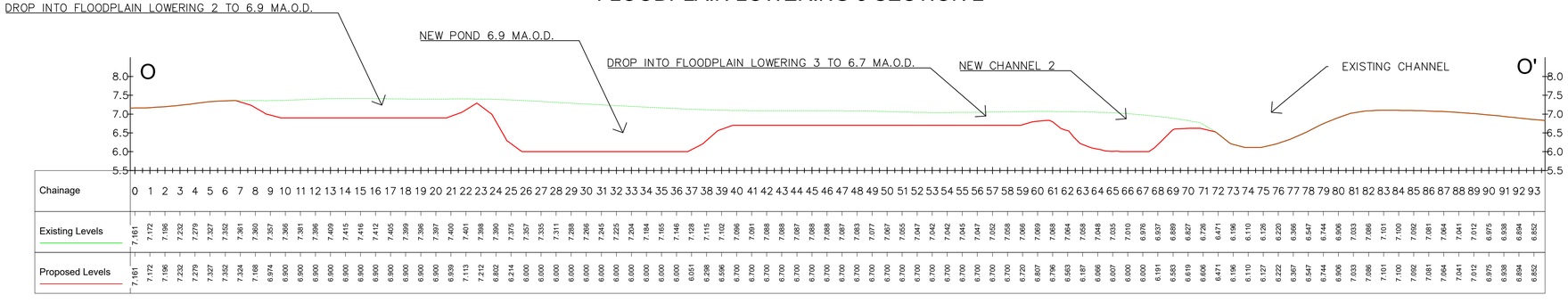

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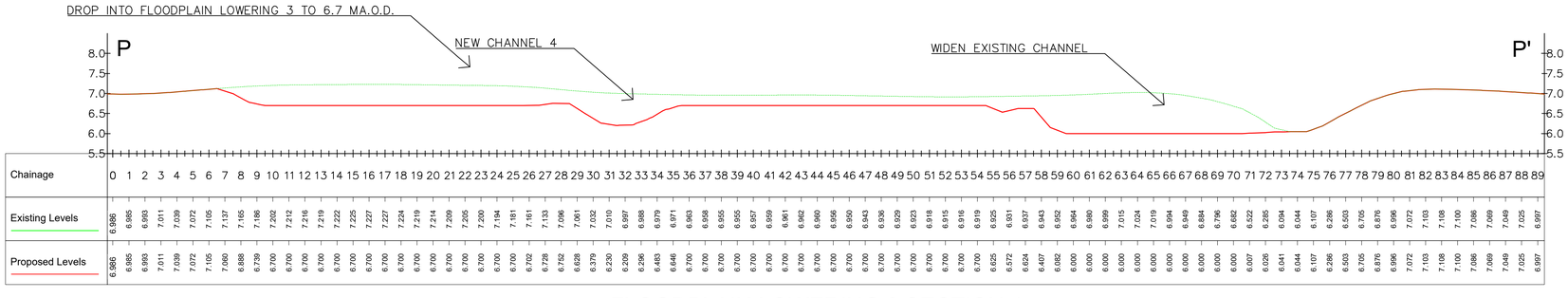

FLOODPLAIN LOWERING 3 SECTION 4

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REVISIONS

3	REVISIONS	23/09
2	SECOND DRAFT	16/09
1	DRAFT FOR REVIEW	06/09

TITLE
SECTIONS M-P

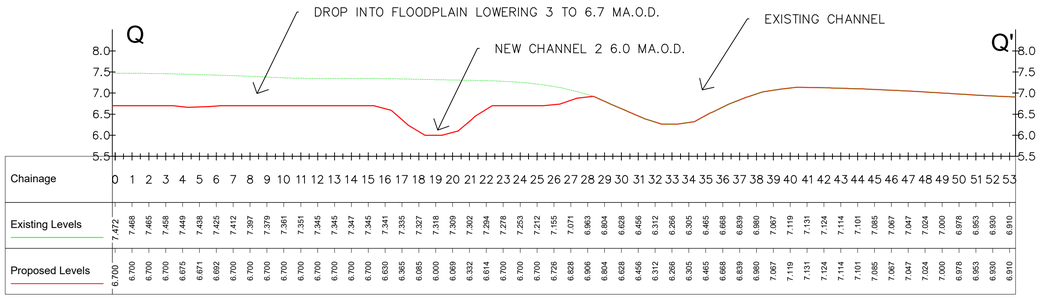
LEGEND

SCALE
NTS

DATE
23/09/2019

SHEET
6

Author: RW Checked: SB Approved: GH



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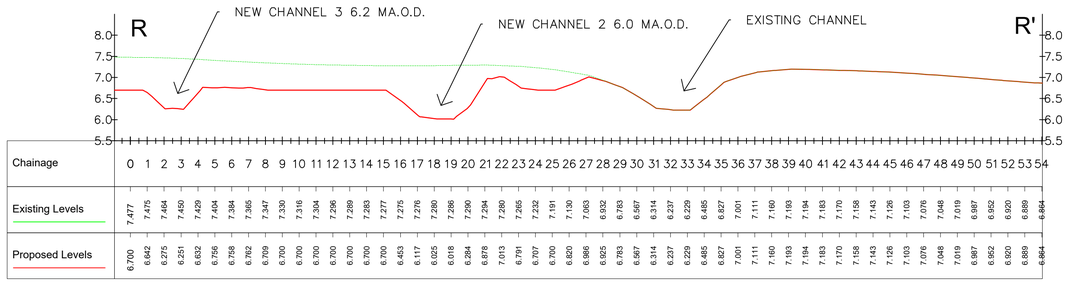

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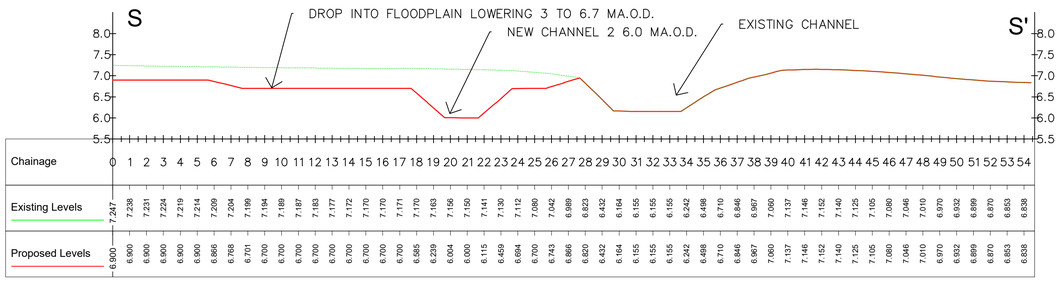

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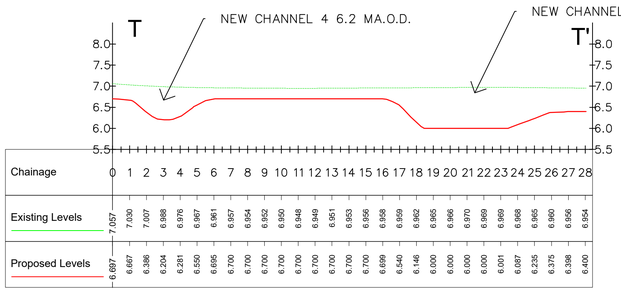

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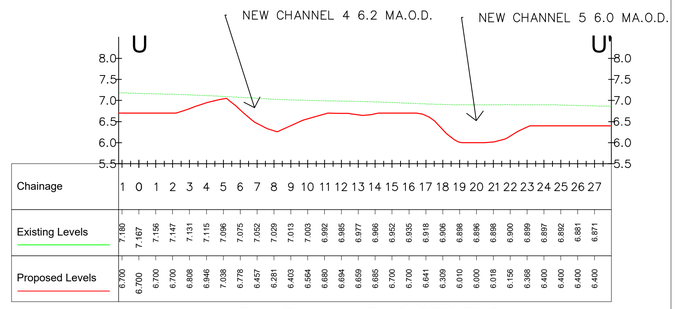

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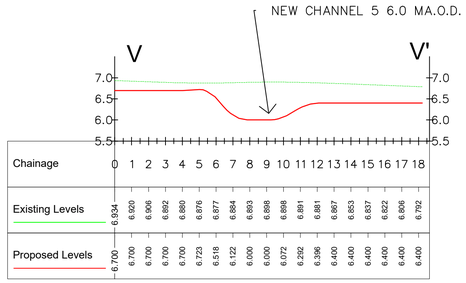

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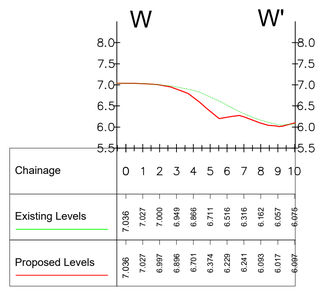

NEW CHANNELS SECTION 7

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ELCI0135

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Peel Building
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Salford
M5 4WT

CLIENT NAME/ADDRESS
WILD TROUT TRUST

17 WESTSIDE VIEW
WATERLOOVILLE
PO8 0WZ

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REVISIONS

3	REVISIONS	23/09
2	SECOND DRAFT	16/09
1	DRAFT FOR REVIEW	06/09

TITLE
SECTIONS Q-W

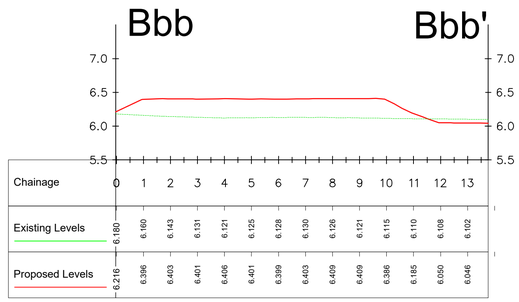
LEGEND

SCALE
NTS

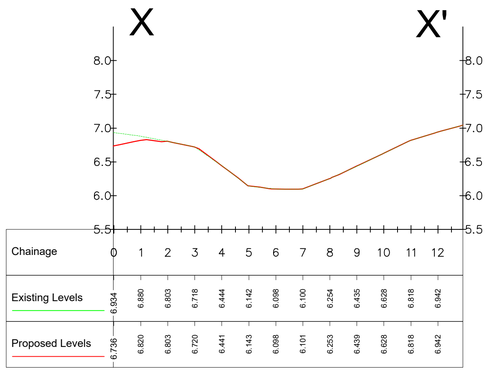
DATE
23/09/2019

SHEET
7

Author: RW Checked: SB Approved: GH



RIFFLE 2 LONG SECTION



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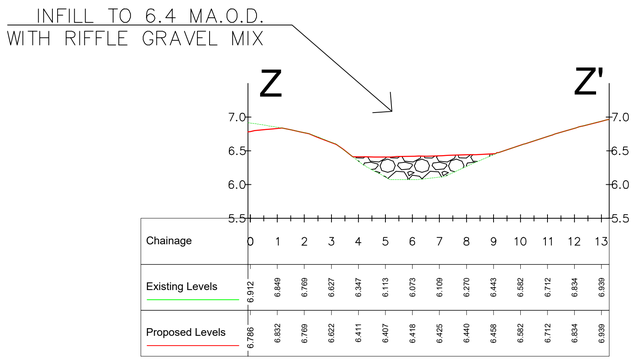

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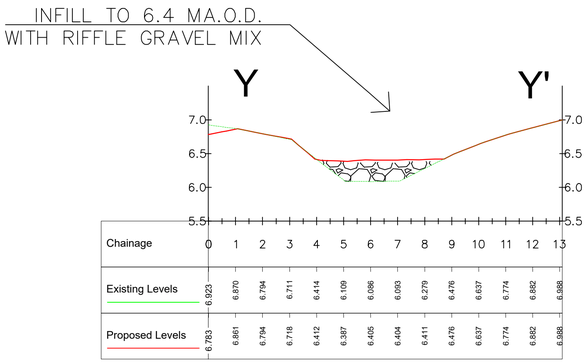

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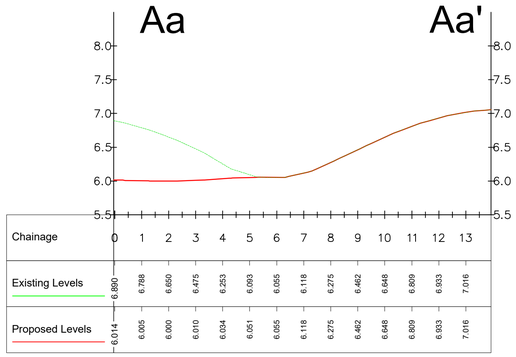

RIFFLE 2 SECTION 4

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REVISIONS

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TITLE
SECTIONS X-Aa

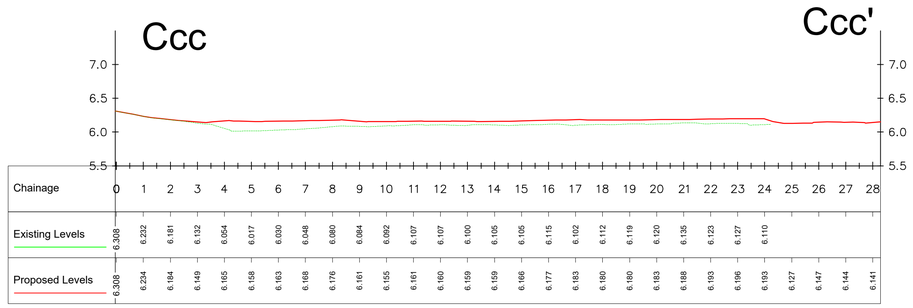
LEGEND
RIFFLE GRAVEL MIX:
10%: 50-70 mm
10%: 30-50 mm
60%: 20-30 mm
20%: <20 mm

SCALE
NTS

DATE
23/09/2019

SHEET
8

Author: RW Checked: SB Approved: GH



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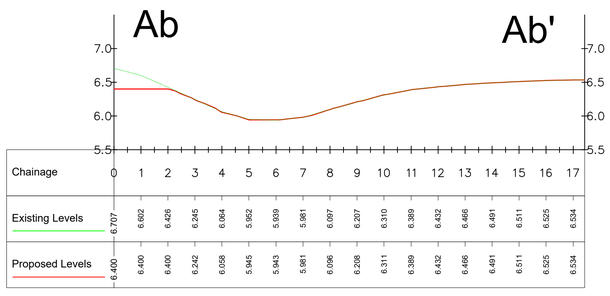

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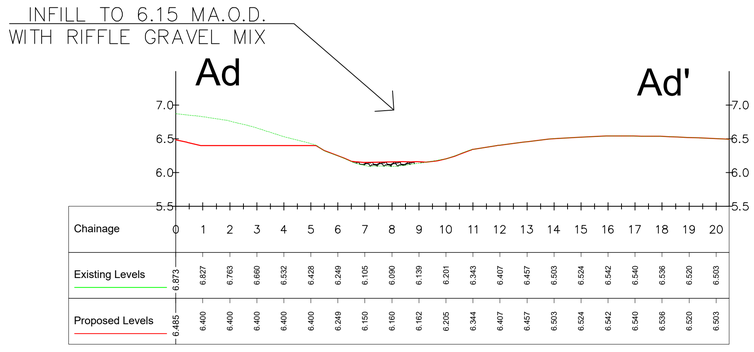

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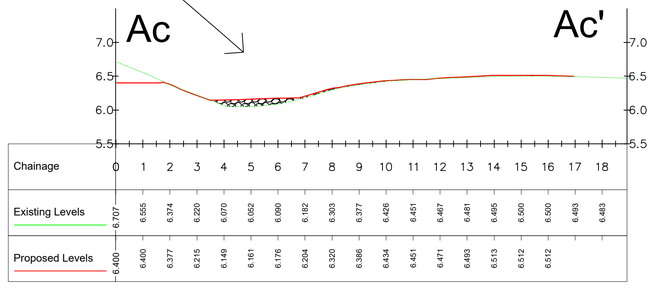

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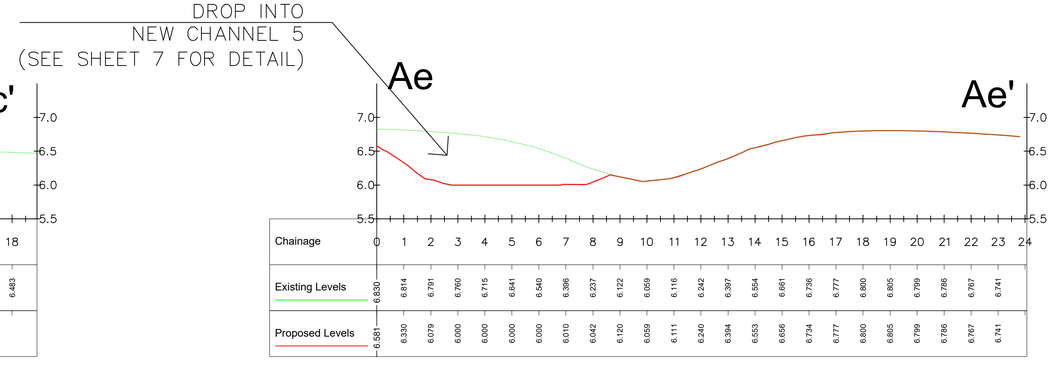

RIFFLE 3 SECTION 4

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TITLE
SECTIONS Ab-Ae

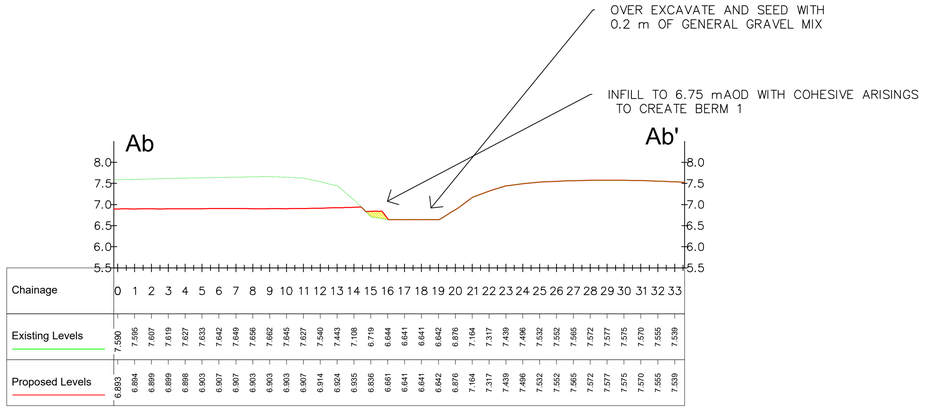
LEGEND
RIFFLE GRAVEL MIX:
10%: 50-70 mm
10%: 30-50 mm
60%: 20-30 mm
20%: <20 mm

SCALE
NTS

DATE
23/09/2019

SHEET
9

Author: RW Checked: SB Approved: GH



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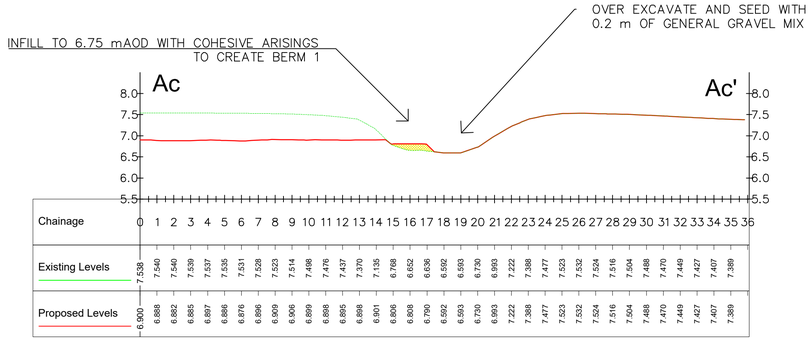
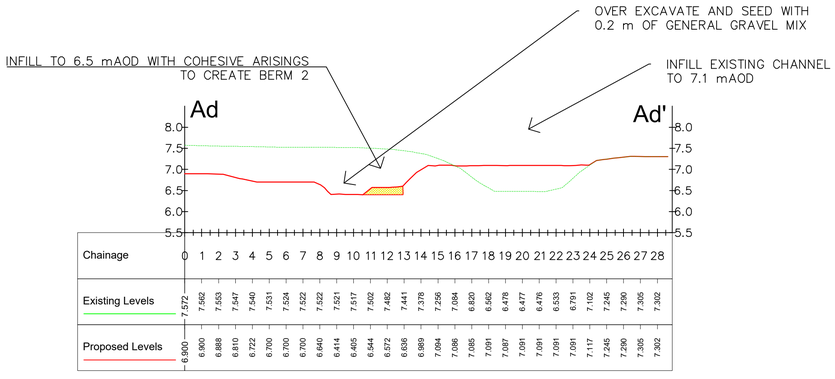
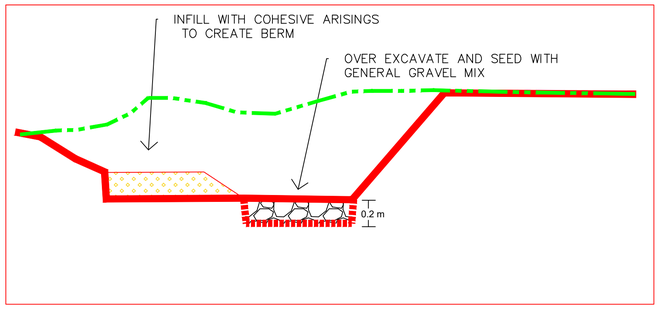
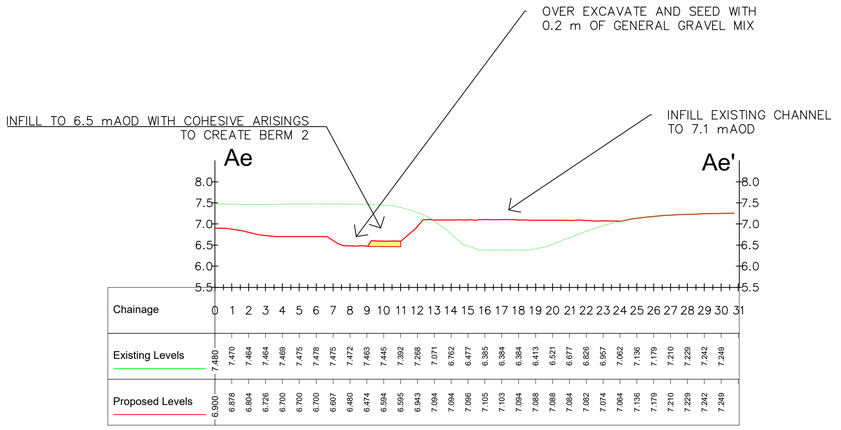


BERM 1 SECTION 2

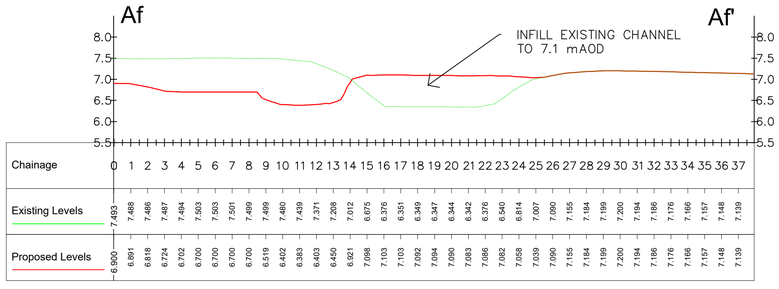


BERM 2 SECTION 1





BERM 2 SECTION 2



BERM 2 SECTION 3

AquaUoS
Redefining Environmental Consultancy

PROJECT NAME
DUNSTON AND GRANTHAM

PROJECT NUMBER
ELCI0135

CONSULTANT ADDRESS
AquaUoS
Peel Building
The Crescent
Salford
M5 4WT

CLIENT NAME/ADDRESS
WILD TROUT TRUST

17 WESTSIDE VIEW
WATERLOOVILLE
PO8 0WZ

NOTES
ALL LEVELS ARE GIVEN IN M A.O.D (METERS ABOVE ORDNANCE DATUM)

PROPOSED LEVELS MAY VARY +/- 75 mm TO GENERATE BED VARIATION

CHAINAGE MEASUREMENTS ARE IN METERS

REVISIONS

3	REVISIONS	23/09
2	SECOND DRAFT	16/09
1	DRAFT FOR REVIEW	06/09

TITLE
SECTIONS I-L

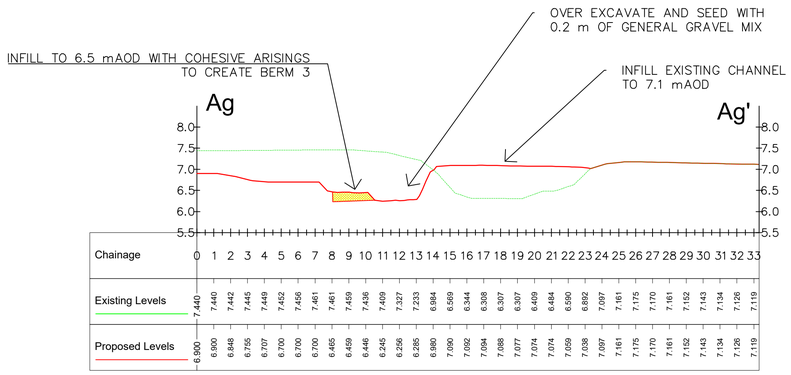
LEGEND
GENERAL GRAVEL MIX:
10%: 50-70 mm
10%: 30-50 mm
60%: 20-30 mm
20%: <20 mm

SCALE
NTS

DATE
23/09/2019

SHEET
10

Author: RW Checked: SB Approved: GH



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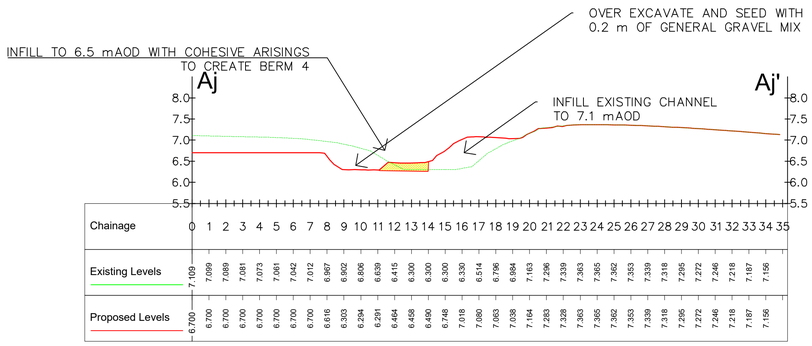

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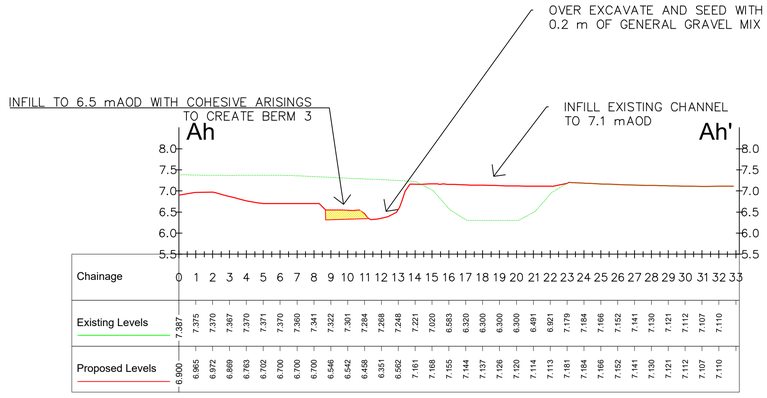

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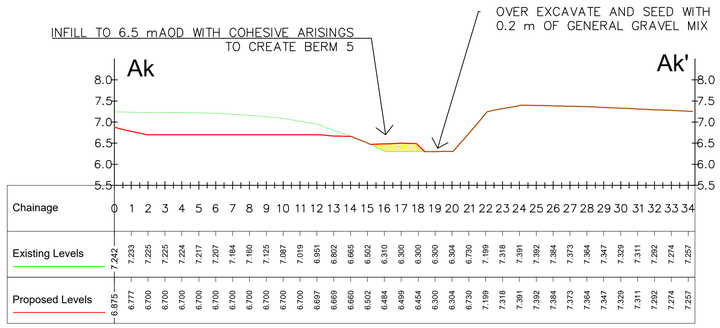

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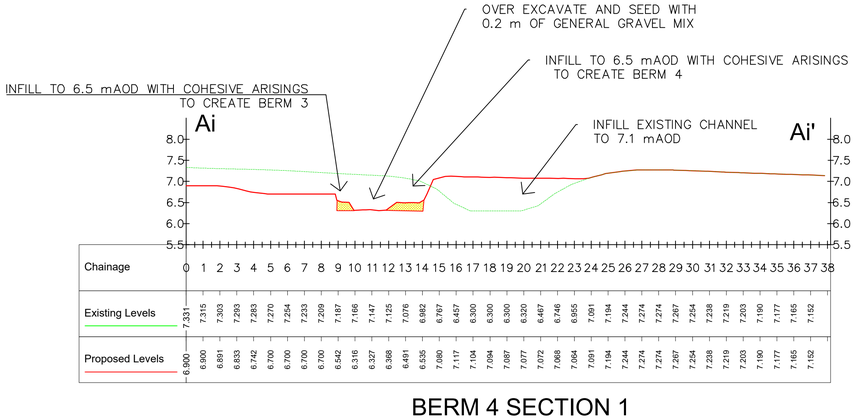

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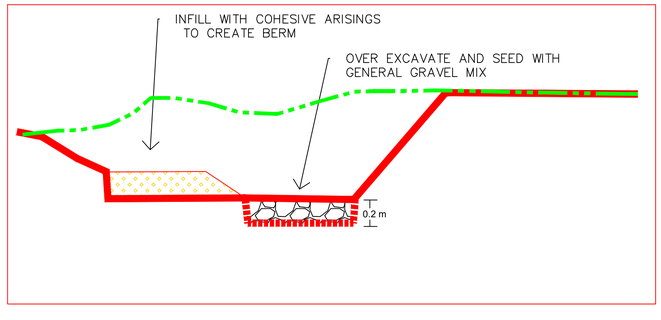

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GENERAL GRAVEL MIX:
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SCALE
NTS

DATE
23/09/2019

SHEET
11

Author: RW Checked: SB Approved: GH

Designer's Risk Register Form

Project name: Dunston Restoration									
Project location: Dunston									
Client: Wild Trout Trust									
	Initial	Rev1	Rev2	Rev3	Rev4	Rev5	Rev6	Rev7	**Rev8**
Date	02-10-19	02-10-19							
By	SB	SB							
Checked	GH	GH							
Approved	**GH**	**GH**							

1. In accordance with the Construction (Design and Management) Regulations, Regulation 9, the hazards associated with the work activity have been considered and eliminated, where possible.
2. The residual hazards and the provision made in the design solution to manage them, thus reducing the risks from the hazard are shown below. In accordance with HSE advice only the significant hazards are recorded on this form.
3. In order to put these provisions in context, assumptions about the method of construction have been stated. However, this does not restrict the contractor to the construction methods implied by this.
4. It is understood that a competent contractor will carry out the construction, maintenance and demolition work in accordance with relevant regulations and recognised good industry practice.
5. It is recommended and assumed that the works are overseen by a competent geomorphologist who is familiar with the design.

Designer's Risk Register Form

Ref.	Feature, element, process or work activity e.g. construction of retaining walls, installing dry risers, constructing manholes	Description of constraints, hazards and associated risks	Designer's interventions to eliminate or reduce risk	Significant residual risks remaining i.e. • Not obvious to a competent contractor or other designer, or • Unusual, or • Likely to be difficult to manage	Information to be provided to enable project partners to manage the risk
1	General work on site	The site is located on a floodplain and is therefore at risk of flooding. Working near water around the restoration site. There is a risk of drowning, flooding, high velocity flows and associated hazards such as hypothermia and environmental pollution.	Specified that all works to be carried out under low flow. In river and floodplain works to stop if flooding into the floodplain and high flows in the channel. All equipment should be moved out of the floodplain. Works schedule should be for spring /summer period when risk of flooding is reduced. Compound / plant to be located / stored outside of known flood event extents.	Drowning. Flooding. Associated hazards such as hypothermia and environmental pollution.	Contractor to be informed of perceived residual hazards. Contractor to consider construction sequence produced for contractor's reference. Contractor to design temporary works and put in place appropriate precautions to deal with flood risk during construction (monitor weather conditions and water levels). Contractor to sign up to EA flood alerts. Works to be programmed such that no critical sections are left open at the end of the working day, or over a weekend, in case a flood event occurs.

Designer's Risk Register Form

Ref.	Feature, element, process or work activity e.g. construction of retaining walls, installing dry risers, constructing manholes	Description of constraints, hazards and associated risks	Designer's interventions to eliminate or reduce risk	Significant residual risks remaining i.e. • Not obvious to a competent contractor or other designer, or • Unusual, or • Likely to be difficult to manage	Information to be provided to enable project partners to manage the risk
2	Working in vicinity of services.	Construction works will not directly impact any services (see drawings) but plant may cross underneath overhead power lines when spreading the excavated material to the north-west of the site boundary, and across the water mains just outside of the site boundary when accessing the site. Plant operators should be aware of the presence of the overhead lines (goalposts should be erected where necessary) and track matting may be required across the water main depending on the service provider requirements. Spreading of excavated material should not occur directly underneath overhead power lines. Other private services, such as land drains, that are not picked up by utilities service searches, could be encountered during the works. This should be monitored by the contractor and client on site.	Service searches have been undertaken and have been provided with the design pack.	None Encountering private services, e.g. land drains that will need to be dealt with on site by the contractor with agreement by the landowner and client.	Contractor to be informed of perceived residual hazards. Location of services and control measures outlined in supplied services search. Contractor to undertake another services search prior to works.

Designer's Risk Register Form

Ref.	Feature, element, process or work activity e.g. construction of retaining walls, installing dry risers, constructing manholes	Description of constraints, hazards and associated risks	Designer's interventions to eliminate or reduce risk	Significant residual risks remaining i.e. • Not obvious to a competent contractor or other designer, or • Unusual, or • Likely to be difficult to manage	Information to be provided to enable project partners to manage the risk
3	Movement of gravel material for feature creation and excavated soil, and for temporary works (e.g. gravel filled dumpy bags).	The works involve the movement of gravel and excavated soil material potentially weighing several hundred kg. There is a risk of dropping material.	None.	Injury from falling material etc.	Contractor to be informed of perceived residual hazards. Contractor to consider construction sequence produced for contractor's reference. Safe working zones to be established between operative and plant.

Designer's Risk Register Form

Ref.	Feature, element, process or work activity e.g. construction of retaining walls, installing dry risers, constructing manholes	Description of constraints, hazards and associated risks	Designer's interventions to eliminate or reduce risk	Significant residual risks remaining i.e. • Not obvious to a competent contractor or other designer, or • Unusual, or • Likely to be difficult to manage	Information to be provided to enable project partners to manage the risk
4	Construction impact on bank stability and impact on natural processes.	The stability of the banks in the vicinity of the works of the existing channel should be monitored during the works particularly when the bank is loaded or damaged during construction or otherwise disturbed e.g. during excavation of the floodplain, channels and ponds. This is particularly the case following wet weather. The design is promoting natural processes associated to a low activity single thread river system through this reach, therefore erosion and deposition is to be expected into the future throughout the restored reach but at a rate to be expected for a river system of this type as it naturalises. In particular, the deposition of fine sediment is to be expected across the reconnected floodplain.	Any signs of damage during and post construction should be monitored and mitigated. Care must be taken to avoid damage to the river bank opposite the site which is under different ownership.	Collapse of bank and fall from height. Persons being buried. Collapse / erosion of bank due to loading during works.	Contractor to be informed of perceived residual hazards. Condition of banks and margins to be monitored during works (operatives with binoculars if required). All plant to be set back from the edge of the river.

Designer's Risk Register Form

Ref.	Feature, element, process or work activity e.g. construction of retaining walls, installing dry risers, constructing manholes	Description of constraints, hazards and associated risks	Designer's interventions to eliminate or reduce risk	Significant residual risks remaining i.e. • Not obvious to a competent contractor or other designer, or • Unusual, or • Likely to be difficult to manage	Information to be provided to enable project partners to manage the risk
5	Construction impact on floodplain function.	The design is promoting natural processes associated to an active tributary system through this reach, and the morphology included intends to improve floodplain connectivity over the left hand bank, this area will therefore flood more frequently than at present.	Any signs of damage during and post construction should be monitored and mitigated.	Collapse of bank and fall from height. Persons being buried. Collapse / erosion of bank due to loading during works.	Contractor to be informed of perceived residual hazards. Condition of banks and margins to be monitored during works (operatives with binoculars if required). All plant to be set back from the edge of the river.
6	Access to and from site.	Risk to members of public from plant movements. Access routes are to be confirmed with the client and landowner. If crossing of the watercourse is required to access the site, a temporary bridge will be required that will be specified by the contractor.	Public access route closure/fencing. Works area to be fenced off from members of the public.	Injury / death from collision with vehicles. Contractor will need to specify temporary access bridge requirements if these are required to access the site. Once on site, no crossing of the watercourse is envisaged.	Contractor to be informed of perceived residual hazards. Access route to site to be defined and all delivery drivers made aware of risks.

Designer's Risk Register Form

Ref.	Feature, element, process or work activity e.g. construction of retaining walls, installing dry risers, constructing manholes	Description of constraints, hazards and associated risks	Designer's interventions to eliminate or reduce risk	Significant residual risks remaining i.e. • Not obvious to a competent contractor or other designer, or • Unusual, or • Likely to be difficult to manage	Information to be provided to enable project partners to manage the risk
7	Increased flood risk.	Works do not cause an increase to out of bank flooding that increases risk to property or people. The area of the floodplain being lowered will be flooded more frequently compared to current conditions. Temporary works (dependent on contractor approach) may partly block the channel reducing its capacity. If an event occurs, this could result in out of bank flows and premature flooding. Risk of flooding to adjacent land and areas adjacent to and upstream of works.	Recommended that contractor places a limit on height and extent of temporary works, such that if a large event occurs the temporary works will over top and not reduce channel capacity. Limit width of channel which is closed off at any one time where possible (if this is deemed required by the contractor).	Minor raising of river level upstream but does not increase out of bank flooding anywhere except at the restored site. Drowning.	Contractor to be informed of perceived residual hazards. Construction to consider temporary works approach and sequence.
8	Spreading of non-native species / biosecurity	Spreading of non-native species during works by moving machinery/ equipment and by boots. All plant and equipment including boots and waders to be disinfected prior to use in the river.	None – no non-native species surveys carried out as part of the project.	Increased area of non-native species. Damage, injury, death to protected species and habitats.	Comply with the Environment Agencies requirements to prevent the spread of invasive species. Contractor responsible for suitable biosecurity measures on site.

9	Future channel change linked to naturalisation of an active single thread river system.	Natural processes associated to active single thread river systems are low levels of erosion and moderate levels of deposition. This should be anticipated at the site following construction, with fine sediments likely to be deposited across the lowered floodplain area in the long term.	Naturalisation is part of project objectives and deposition within the inset floodplain section will occur. Design has aimed to reduce the risk of excessive erosion through suitable floodplain connectivity achieved through creation of the proposed in-channel features.	Natural processes linked to low/moderate bank erosion and in-channel deposition.	Recommend discussions with all parties, stakeholders and landowners with regards to these ongoing processes.
10	Tree works.	Some tree works may be required for machinery access purposes to deliver the works. It is envisaged this will only be trimming / pollarding rather than full removal but to be confirmed with the contractor.	None.	Unknown number of trees requiring works. Tree surveys and protected species habitat surveys may be required.	Contractor to be informed of perceived residual hazards. Site walkover to be undertaken by client with the contractor to determine any required tree works

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					following marking out of the works.
11	Material quantities.	Increased expenditure due to minor design changes during construction based on local conditions encountered during the works (particularly anticipated volume of sediment for removal). Design is based on survey and LiDAR available. Formation levels may change based on encountered ground conditions.	Survey and LiDAR data has been checked as far as possible.	Adjusted material quantities.	Client should have suitable contingency funds. Contractor should be made aware of associated risks and can account for them in advance.
12	Inadequate compaction of features and use of incorrect materials results in washout of placed features.	Created features at risk of washout if contractor does not ensure suitable compaction of features and use of stated material sizes, mixes and types as described on the design drawings.	Geomorphologist to review materials delivered to site for use in creating the features and to supervise the contractor during creation and compaction of features.	None if designer's interventions followed.	Contractor to carefully review design drawings and material requirements and to follow guidance provided by on site geomorphologist during feature creation.

Dunston Restoration – Bill of Quantities

Project name: Dunston Restoration									
Project location: Dunston									
Client: Wild Trout Trust									
	Initial	Rev1	Rev2	Rev3	Rev4	Rev5	Rev6	Rev7	**Rev8**
Date	02-10-19	02-10-19							
By	SB	SB							
Checked	GH	GH							
Approved	**GH**	**GH**							

Excavation and Fill Volumes – ALL WORKS

Volumes of infill material for channel features		
Feature	**Infill volume (m^3)**	**Material type / comments**
Riffle 1	12	Washed river gravels: 10% 50-70 mm 10% 30-50 mm 60% 20-30 mm 20% <20 mm
Riffle 2	15	Washed river gravels: 10% 50-70 mm 10% 30-50 mm 60% 20-30 mm 20% <20 mm
Riffle 3	12	Washed river gravels: 10% 50-70 mm 10% 30-50 mm 60% 20-30 mm 20% <20 mm
Channel infill	320	For sinuous design only – excavated arising
Berm creation	55	For sinuous design only - excavated cohesive arisings

Volumes of excavation		
Feature	**Excavation volume (m^3)**	**Material type / comments**
Channel cutting excavation of main	180	Excavated floodplain sediment.

Volumes of excavation		
Feature	**Excavation volume (m^3)**	**Material type / comments**
channel (for sinuous design only)		Excavated gravel to be riddled / sieved and re-used for creation of riffles.
Channel cutting excavation	1400	Excavated floodplain sediment. Excavated gravel to be riddled / sieved and re-used for creation of riffles.
Floodplain / wetland excavation	9000	Excavated floodplain sediment. Excavated gravel to be riddled / sieved and re-used for creation of riffles.
Pond excavation	270	Excavated floodplain sediment. Excavated gravel to be riddled / sieved and re-used for creation of riffles.

Seed Mixes

Naturescape's N7: https://www.naturescape.co.uk/product/n7-wetland-meadow-mixture/

or

Emorsgate's EM8: https://wildseed.co.uk/mixtures/view/9

Sown at 5g per square metre.