Westnewton Bridge

Water Framework Directive Compliance Assessment Report

May 2015

Final Report

Report Prepared For:

Mr Peter Brewis
Northumberland County Council
County Hall
Morpeth
Northumberland
NE61 2EF

Project Ref: ECN14 189

Prepared By: John Thompson MCIEEM

Reviewed By: Mark Middleton

Approved By: Vicki Sixsmith MIoD

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NORTH
Ecological Consultants

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EcoNorth Ltd
Garden House
St Nicholas Park
Gosforth
Newcastle upon Tyne
NE3 3XT

E: enquiries@EcoNorth.co.uk
Tel: 0191 285 4412
Fax: 0191 284 6794
Web: www.econorth.co.uk

Non-Technical Summary

EcoNorth Ltd was commissioned by Northumberland County Council to undertake the ecological elements of a Water Framework Directive Compliance Assessment of a proposal for engineering works to strengthen and protect a road bridge (known as Westnewton Bridge) on the B6531 at Westnewton, north of Wooler, Northumberland (NGR NT 90782 30384) where the road crosses the College Burn.

The College Burn at Westnewton Bridge is currently classified as 'moderate ecological status.' The factor preventing this reaching the target 'good ecological status' is considered to be aquatic macrophytes as identified within the 2014 assessment as a reason for 'failure'. In accordance with compliance with the Water Framework Directive, proposals such as this one, that have the potential to effect rivers are required to demonstrate that actions would not result in a deterioration in ecological status and would not result in the relevant waterbodies being unable to achieve 'good ecological status'.

To avoid any adverse effects on the ecological status of the College Burn and further waterbodies including the Rivers Glen, River Till and River Tweed, a range of avoidance and mitigating measures have been devised by Northumberland County Council and are incorporated into the design philosophy, with features of the design and working methods proposed.

Following inclusion of mitigating measures the evidence presented in this report indicates that the proposal will not adversely affect the ecological status of the relevant waterbodies identified both upstream and downstream of the proposal. Further to this the proposal will not prevent the waterbody achieving good ecological status.

Northumberland County Council proposes to employ an Ecological Clerk of Works (ECoW) to oversee mitigation measures and works on site to ensure compliance with the details of the method statement proposed.

Contents

1. Introduction

EcoNorth Ltd was commissioned by Northumberland County Council to undertake a Habitats Regulations Assessment (HRA) of a proposal to strengthen and protect a road bridge on the B6531 at Westnewton, north of Wooler, Northumberland (National Grid Reference NT 90782 30384) where the road crosses the College Burn.

The assessment of likely significant effects and appropriate assessment of any such effects is required under the Habitats Regulations (2010) as part of the UK's responsibilities under the EC Habitats Directive 92//43/EEC

1.1 Background

Following a near catastrophic event at the bridge under flood conditions in 2012, Northumberland County Council has developed a detailed proposal to protect the bridge at Westnewton from further structural damage. Immediately following the flooding and damage which occurred in 2012, Northumberland County Council undertook some remedial works under emergency powers which comprised of remedial works to the bridge and some channel realignment to channel the flow of the river under the main arch of the bridge.

Following the emergency works Northumberland County Council (in conjunction with CBEC Eco-Engineering UK Ltd) have proposed a series of longer term measures to protect the bridge. This report aims to assess the proposed works against the requirements of the Habitat Regulations (2010).

This report is also informed by an ecological survey undertaken by EcoNorth (2014) to examine the overall ecological effect of the scheme, but also with particular reference to Special Area of Conservation (SAC) features, of which the River Tweed SAC is included, and key habitats which could support sensitive features or life stages of those species. The EcoNorth Report identified that the habitats in the vicinity of the bridge where works are proposed are not suitable habitats for the most sensitive stages of either the Atlantic salmon (*Salmo salar*) or European river lamprey (*Lampetra fluviatilis*) lifecycle (i.e. spawning grounds). The survey has also identified that no aquatic plant communities will be directly affected by the footprint of the works.

A thorough survey for otter (*Lutra lutra)* as part of the EcoNorth survey confirmed their presence in the area, though did not identify any holts, couches or dens in the vicinity of the works. Due to the mobility of this species and the time between the EcoNorth survey and the proposed development, this aspect of the survey will need to be updated in advance of the works to ensure that European legislation with respect to species protection is adhered to throughout the works.

This assessment document is set out taking into account available guidelines from the Environmental Agency, which provided a checklist for assessing compliance with the Water Framework Directive.

1.2 Site Context

Figure 1.1 Indicative Site Boundary and Working Areas

(Boundaries outlined in red)

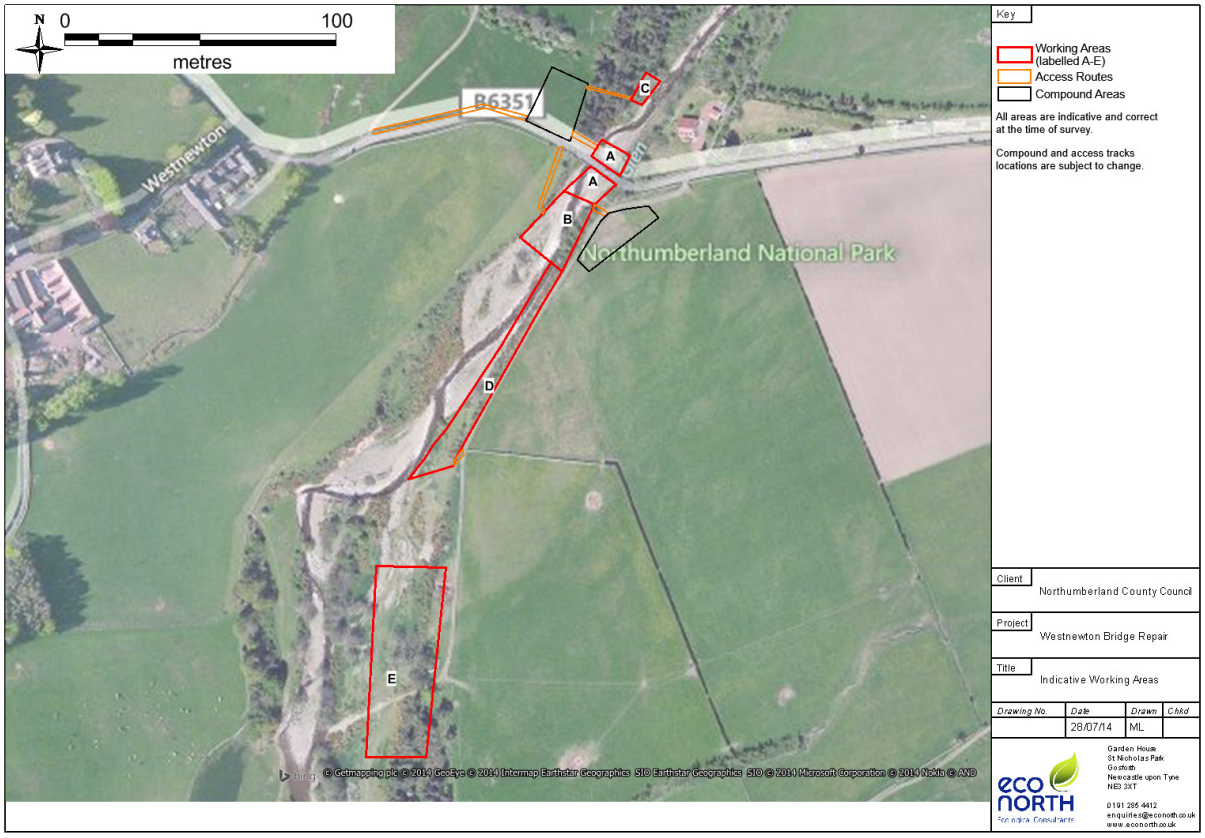
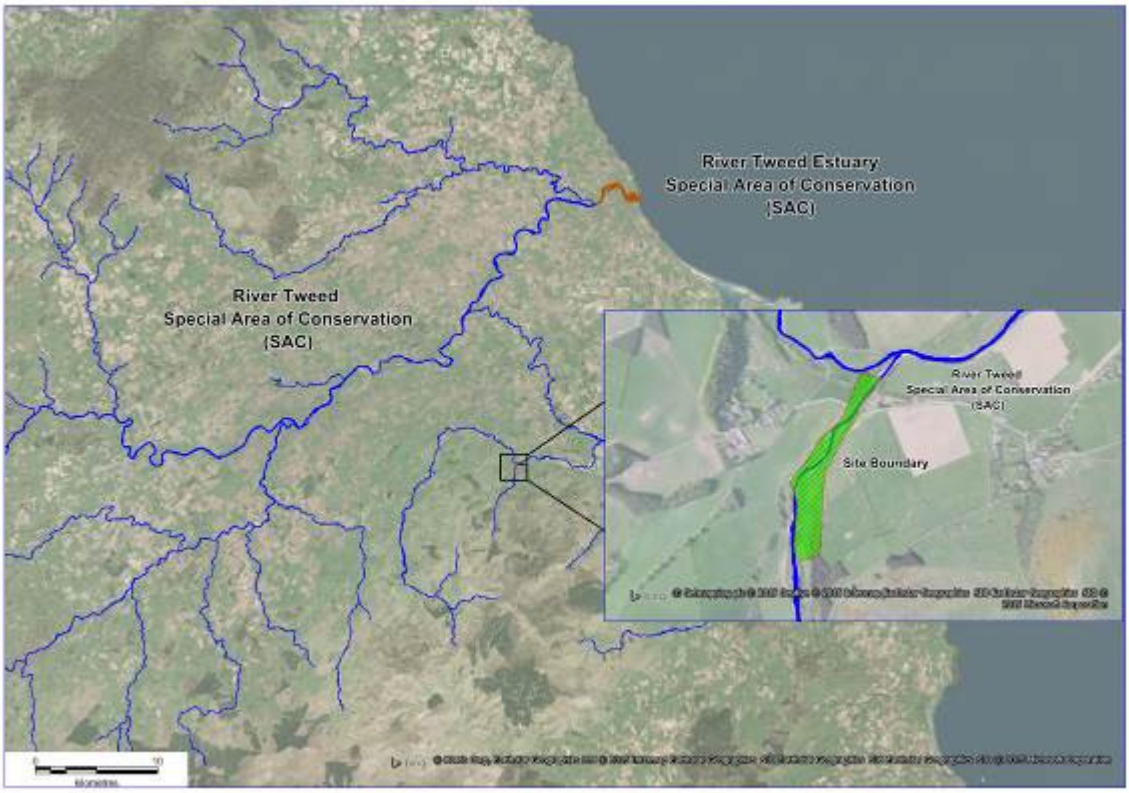


Figure 1.2 Site Location in Relation to Overall Distribution of Tweed Catchment Rivers SAC -illustrating the wider Tweed Catchment Area



1.3 Legislation

In October 2000 the 'Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for community action in the field of water policy' (Water Framework Directive or WFD) was adopted and came into force in December 2000. The purpose of the Directive is to establish a framework for the protection of inland surface waters (rivers and lakes), transitional waters (estuaries), coastal waters and groundwater. It will ensure that all aquatic ecosystems and, with regard to their water needs, terrestrial ecosystems and wetlands meet 'good status' by 2015.

Transposition into national law in the UK occurred through the following regulations: The Water Environment (Water Framework Directive) (England and Wales) Regulations 2003 (Statutory Instrument 2003 No. 3242) for England and Wales; the Water Environment and Water Services (Scotland) Act 2003 (WEWS Act).

The Directive and associated Regulations target achieving 'good ecological status', which is measured over a wide range of parameters for each water body identified within the relevant River Basin Management Plan (RBMP).

1.4 Policy

River work operations are a key focus of the Tweed Catchment Management Plan. A strategic aim of the Tweed Catchment Management Plan is that 'all river work operations respect the physical, ecological and aesthetic integrity of the river system', Tweed Forum (2010).

A River Restoration Strategy has been prepared for the River Till (TRRS) 2013. This report also considers the content of this report.

2. Proposed Works

2.1.1 Defining the Proposal:

Northumberland County Council has developed a detailed proposal to protect the bridge at Westnewton from further structural damage following flooding and associated damage which occurred during winter 2012. Immediately following this event Northumberland County Council undertook some works under emergency powers which comprised of remedial works to the bridge and some channel realignment to channel the flow of the river under the main arch of the bridge.

Following the emergency works Northumberland County Council have developed, in conjunction with CBEC Eco-Engineering UK Ltd, a proposed series of longer term measures to protect the bridge. The measures proposed are outlined below and are described in more technical detail in the 2014 CBEC report for the scheme. The scheme has been devised taking into account general aims of both The Tweed Catchment Management Plan and Till Restoration Strategy in terms of deploying 'soft' engineering approaches where practicable. The areas referred to relate to those areas illustrated on the proposed works plan prepared by Northumberland County Council. A detailed method statement to undertake the works has been prepared by Northumberland County Council (2014) and this should be referred to for full comprehensive details of the proposal. Full details of works areas are illustrated on NCC drawing HB127276/B/B6531/06/23.

Area 1 - (Marked area A on Figure 1.1). Works in area 1 relate specifically to structurally strengthening the bridge and taking measures to reduce scour through the main central archway and surrounding the aprons of the bridge. The works will require installation of a reinforced concrete invert to current invert levels and will require sheet piling upstream and downstream of the bridge to facilitate this.

Area 2 - (Marked area C on Figure 1.1). Area 2 refers to an old rail crossing bridge abutment. Modeling has shown that this feature has some adverse effects on the flow of the river and this will be removed as part of the works on the site.

Log Arrays - (Works in area B illustrated on Figure 1.1). Works will guide the main flow of water through the central archway of the bridge thus reducing impacts on the supporting

structures of the bridge during periods of high flow. This will be achieved using pairs of logs positioned on either side of the river to train the flow of water.

Area 3 –Material arising from emergency works undertaken to protect the bridge in 2012.

Area 4 - (Marked area E on Figure 1.1). Comprises an area which will be elevated by 300mm using material arising from emergency works currently stored in area 3, undertaken to protect the bridge in 2012. This will be carried out to prevent the existing flood bank breaching.

Area 5 – (Working area D on Figure 1.1) Soft engineered timber stockades will be installed in the ground in this area to prevent cut back scour during flood events.

2.1.2 Water Bodies Potentially Affected

The proposal lies within the following waterbody:

- College Burn: Lamden Burn - River Glen

The proposal is within the lower reach of this water body close to the River Glen.

Further water bodies which may potentially be affected are detailed below:

Downstream

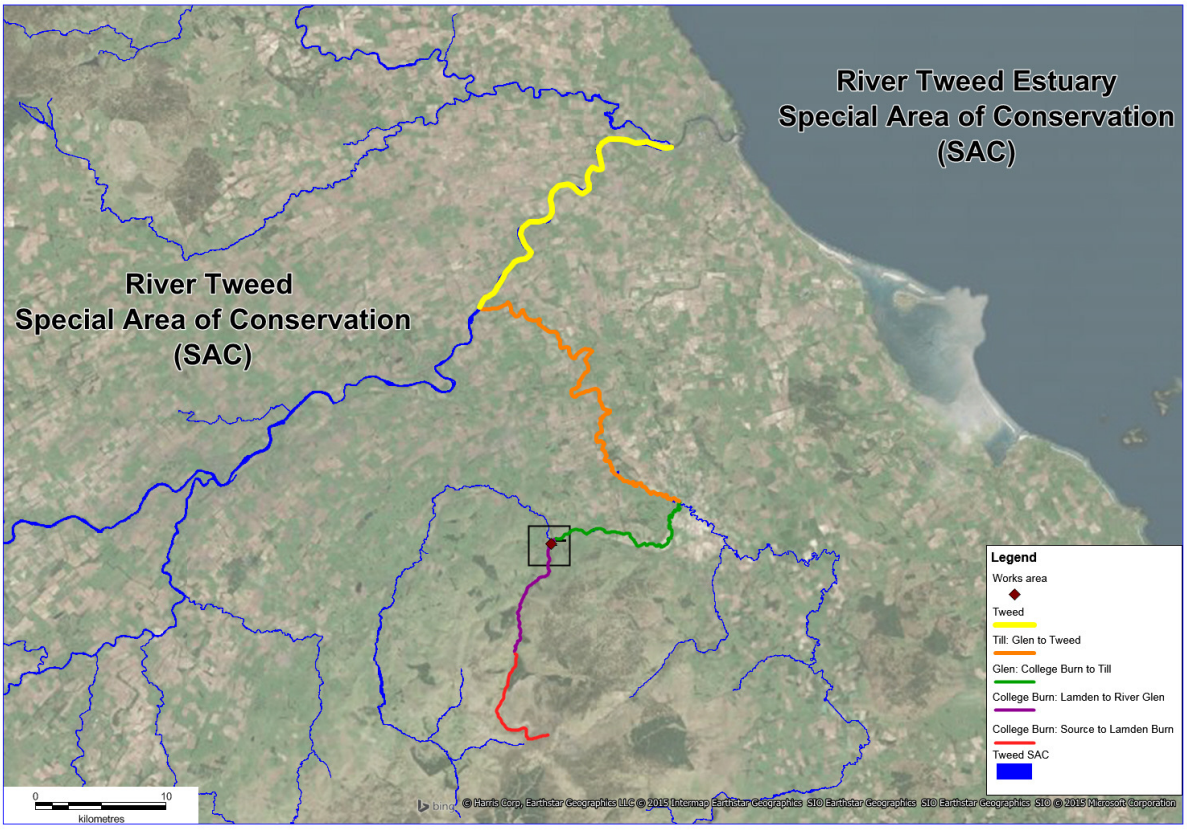
- River Glen: College Burn - River Till
- River Till : River Glen River -Tweed
- River Tweed

Upstream

- College Burn: Source - Lamden Burn

The location of the waterbodies described in relation to the works area is illustrated on Figure 2.1 below.

Figure 2.1 Locations of Relevant WaterBodies



2.1.3 Current Status of Waterbodies

Table 2.1 below details the current condition of the relevant waterbodies. This details an assessment undertaken in 2012 and 2014 with more detailed assessment results for 2014. The detail included within this section focuses on the water bodies most likely to be affected by the scheme, these are considered to be the College Burn from Lamden Burn to River Glen in which the scheme is located and the College Burn from source to Lamden Burn upstream of the works. This upper section is included, as the scheme without careful design has potential to affect the distribution of fish species within the catchment through creating a barrier to upstream movement.

Table 2.1 Current Ecological Status of Waterbodies

Overall Assessment				
Water Body		**2012**	**2014**	**Reasons for failing**
College Burn: Lamden Burn - River Glen		Poor	Moderate	Macrophytes
College Burn: Source - Lamden Burn		Good	Good	
River Glen: College Burn – River Till		Moderate	Moderate	Flood protection
River Till: Glen to River Tweed		Moderate	Good	Mixed agricultural run off
River Tweed		Moderate	Moderate	TBC

Detailed Assessment applied using 2014 Data (elements which are below good ecological status are highlighted in red)		
Element	**College Burn from Lamden Burn to Glen**	**College Burn from Source to Lamden Burn**
Fish	Moderate	-
Invertebrates	High	High
Macrophytes and phytobenthos combined	Moderate	-
Priority hazardous substances	Good	Good
Priority Substances	Good	Good
Other pollutants	Good	-
Biological quality elements	Moderate	High
Hydromorphological supporting quality elements	Not High	Not High
Physico-chemical quality elements	High	High
Specific pollutants	High	High
Morphology	Supports good	Supports good
Hydrological regime	Moderate	High
Macrophytes (sub element)	Moderate	-
Phytobenthos (sub element)	High	
Carbon tetrachloride	Good	
DDT total	Good	
Para para DDT	Good	
Ammonia (Phys-chem)	High	High
Dissolved oxygen	High	High
pH	High	High
Phosphate	High	High
Temperature	High	High
Cadmium and its compounds	Good	Good
Di (2-ethylhexyl)phthalate	Good	Good
Nonylphenol	Good	Good
Tributylin compounds	Good	Good
1,2 - dichloroethane	Good	

Benzene	Good	
Dicloromethane	Good	
Lead and its compounds	Good	Good
Nickel and its compounds	Good	Good
Trichloromethane	Good	
Copper	High	High
Zinc	High	High
Triclosan	High	High

Table 2.1 above illustrates the overall status of the College Burn and breaks the status down into ecological, biological and chemical components and shows that in most cases the various elements are good or high. Those elements which are not achieving 'Good' status and are therefore considered the likely reasons for an overall assessment of 'moderate' (i.e. not achieving good ecological status) on the College Burn from Lambton Burn to Glens are fish, macrophytes and phytobenthos combined, macrophytes and hydrological regime.

All of the Till Catchment Rivers have experienced a long history of modification as a result of changes in river and floodplain use. The College Burn from the Glen confluence to Hethpool has flood banks on around 5% of its length, local hard and soft bank protection and former bridge abutments. Higher up, the stream energy and gradient create issues with rapid run-off and extreme sediment transport. The exact reasons for the College Burn's failure to achieve good ecological status are unclear; however these modifications are considered a contributing factor to its current status. The current condition and previous modifications are considered in the design for the proposed works, in order to avoid further deterioration or failure of the water body to achieve good ecological status.

2.1.4 Measures Required to Achieve Good Ecological Status (GES)

The College Burn's (between Lambden Burn and its confluence with the River Glen) current status is moderate. This is considered to be due to the quality of macrophytes (Claire Pattison, Environment Agency pers. comm), which are an important component of freshwater ecosystems, table 2.1also however highlights that fish and hydrological regime are noted as being of moderate status. For this reason it is imperative that the proposals do not inhibit macrophyte growth in any way and thus prevent the College Burn from achieving GES due to this, or any other biological element. Equally the proposals need to avoid deterioration of fish populations and the hydrological regime.

Factors that can affect the development of macrophytes in terms of species composition, distribution, abundance and diversity (and which must therefore be considered so that that this water body can achieve GES) include light, water temperature, water quality, nutrient enrichment, sediment composition, fluctuations in water levels, as well as land use and land cover changes, competition and grazing.

The proposed scheme considers the likelihood of impact on factors which affect macrophyte development such as possibilities of sediment smothering, impacts to rock areas where macrophytes may develop, periods of inundation or flooding and water quality impacts of agricultural run-off and eutrophication. The scheme will avoid and/or seek to mitigate negative impacts on macrophytes and other elements that contribute to GES

2.1.5 Considerations of Alternatives

As part of the engineering process for the scheme a number of options to achieve the same objective of safeguarding the structural integrity of the bridge have been considered. The details of this process are considered in Appendix A and B of this report.

Following a review of other possible structural repair options the only possible solution identified relates to the combination of the provision of a reinforced invert across the river, soft engineering measures to train the flow of the river to a short distance upstream of the bridge and scour protection further upstream to approximately 100m of the bridge. These measures are less restrictive than the training measures immediately upstream of the bridge and allow for some meandering of the watercourse within the existing channel. During the continuing design process further measures to prevent back scour a distance further upstream have been dropped from the proposals in part to reduce the level of influence held over the Burn in this area.

3. Potential Effects of The Scheme on the Ecological Status of the Relevant Waterbodies

3.1 Hydromorphology

3.1.1 Quantity and Dynamics of Flow

There will be no change to the quantity of flow within the channel in the short term during construction or in the longer term through the operation of the bridge. The dynamics of the flow under the bridge will be modified slightly during the construction phase of the repair through a series of minor river diversions required to install the apron around the bridge foundations in a phased operation. Details of the series of diversions required are detailed in the method statement for construction prepared by Northumberland County Council. This minor temporary change (c. 6 weeks) to the dynamics of flow under the bridge are not considered to be of a magnitude or timeframe which would result in the failure of the Burn to reach GES.

Some training of the flow under the bridge is targeted by the installation of pairs of logs upstream of the bridge. The aim of this is to allow the main flow to pass through the large central arch of the bridge avoiding large build-up of materials at the peripheral arches of the bridge and associated flooding and structural risks to the bridge. This modification to the dynamics of the flow will occur over a range of approximately 40m and will be

relevant on elevated river levels. This minor effect on the flow dynamic is not anticipated to be of a magnitude which would prevent the ability of the Burn to achieve GES. Furthermore, the works will not result in deterioration of the current status of 'moderate' (2014) as the watercourse in its current state s modified due to straightening during emergency works in 2012.

Further measures up to 100m upstream of the bridge include measurers for scour protection to the Southern bank during flood events. This will comprise of 'soft engineering' timber stockades in this area. This will reduce the energy in this section of the river in high water periods and will ultimately influence the dynamics of the flow (and sediment transport) to some degree under flood conditions. The use of timber stockades allows for some natural channel meandering however this section of the waterbody is, and has been, constrained by embankments for a long period of time. This measure is not therefore considered to be of a magnitude where it would cause deterioration to the ecological status of the Burn and would not constrain it from achieving GES. Further to this, the removal of the former rail bridge abutment downstream of the bridge is in accordance with the Till Rivers Restoration Strategy and goes some way toward naturalizing the channel dynamics downstream of the bridge.

3.1.2 Connection to Ground Waters

The proposed works are not anticipated to have any adverse effect on connection to ground waters.

3.1.3 River Continuity

As detailed above and within the construction method statement, a slightly modified, though continuous river channel will be maintained throughout construction allowing any relevant downstream migration of fish during this period (or upstream migration of fish as may be the case for sea trout (*Salmo trutta*)). In the permanent state the permeability of the bridge structure to migratory fish has been one of the key design requirements and the Apron has been designed in a way which will allow fish passage.

3.1.4 River Depth and Width Variation

The works within the footprint of the bridge will influence the depth and width of the College Burn as a fixed Apron will be in place. The depth and width will also be influenced a short distance upstream by the installation of logs to train the Burn under the central arch of the bridge. These minor constraints of depth and width variation are not considered of a magnitude which would cause deterioration in the ecological status or prevent the Burn or adjacent waterbodies achieving GES.

3.1.5 Structure and Substrate of the River Bed

A design to protect the bridge has been developed which will allow the most natural river management practicable maintaining the relevant structure and substrates to those currently occurring. The exception to this is within the bridge apron itself which will be a concrete structure. The concrete structure will however have inset cobbles sourced from the local inset, set into the concrete to 'mirror' the existing river bed.

3.1.6 Structure of the Riparian Zone

The structure of the riparian zone is modified in the vicinity of the bridge and associated works by the presence of flood banks. The proposed works will not cause deterioration in the riparian zone. In the case of works area C (removal of downstream bridge abutment) the works will result in a more naturalized riparian zone. No effect on the riparian zone is predicted which will result in a deterioration of the Burn's ecological status and no effects on the riparian zone will inhibit the ability of the Burn to reach GES.

3.2 Physico-Chemical

3.2.1 Thermal Conditions

No changes to thermal conditions can be expected throughout construction or during operation. Any settlement system applied to reduce sediment arising from construction activities will return any filtered water to the Burn at a temperature consistent with the Burn.

3.2.2 Oxygenation Conditions

Oxygenation conditions are not expected to be affected by the engineering works. Strict controls will be in place during construction to prevent the emissions of any pollutants including any which may result in deterioration of oxygenation conditions.

3.2.3 Salinity

No effect on salinity is predicted throughout construction. For this reason no deterioration in the ecological status is predicted.

3.2.4 Acidification

No acidification of the waterbody is predicted as a result of the construction or operation of the proposed bridge works. A more relevant risk without suitable mitigation is the release of cement into the watercourse when constructing the bridge Apron and the associated increase in the alkalinity of the watercourse. This type of event could have a highly toxic effect on fish and other freshwater fauna in the vicinity of the release and

potentially for a distance downstream of the works within additional waterbodies. A significant event of this nature could result in the deterioration of the ecological status of the watercourse. For this reason this has been considered at different stages of the project development and strict protocol and mitigation measures will be in place during the construction phase of the project to prevent such occurrences. The specific construction detail can be located within the construction method statement and associated drawings. Northumberland County Council (September 2014). Mitigation measures for the scheme are also summarised in Table 3.5.

3.2.5 Nutrient Conditions

The proposed works are not expected to result in any deterioration of the ecological status of the Burn as a result in changing nutrient conditions. Changes in nutrient status are typically more closely related to surrounding agricultural uses which will not change as a result of the proposed works. Increasing the height of flood bunds by 300mm as described in the C-BEC Report (2013) will minimize the occurrence of the river overflowing to adjacent agricultural fields and thus possibly minimizing occurrence of increased nutrient input as a result of such events.

3.2.6 Specific Pollutants

During construction works there is potential for a range of specific pollutants to enter the watercourse, most notably this includes cement detailed in Section 3.2.4 above as a number of construction plant crossings across the river are required. Without strict controls this could result in the release of fuels/oils associated with the construction plant. These controls will be put in place as indicated in 3.2.4 above.

3.3 Biological

3.3.1 Fish (Composition, Abundance and Age of the Fauna)

Without mitigation the scheme has some potential to adversely affect the composition, abundance and age of the fish fauna of the College Burn. The fish fauna of the Burn could be affected by temporary and permanent barriers to movement up or down the Burn, potentially affecting the distribution of fish on the River system in the long term. Both the construction process and permanent design focus on achieving a solution which is permeable to all species of fish associated with the Burn, most notably the Special Area of Conservation qualifying species of Atlantic salmon, European river lamprey and brook lamprey (*Lampetra planeri*) but also including sea trout for which the College Burn is noted as supporting a genetically distinct population. The construction timing avoids the breeding and migratory periods for SAC species.

Some use of plant within the river and plant crossings of the river bed are required to undertake the works. Habitat suitability studies (EcoNorth 2014) however show that those areas subject to in-stream works are not suitable breeding areas for any of the key fish species detailed above and so no damage to spawning fish (potentially affecting both

abundance and age structures of the fish) is likely. Additionally works will be timed to avoid spawning seasons for key species when eggs and immobile larvae are present within gravel / sediment beds.

The works will involve the use of a piling rig to install sheet piles in order to cast the concrete apron around the bridge supports. This will involve some noise and vibration with potential associated disturbance or even injury to fish (Hawkins, 2010). The piling work will apply a 'soft start' method to displace fish temporarily without risk of injury while piling work occurs. Additionally an Ecological Clerk of Works will be appointed and such works will not occur if there is an obvious 'run' of sea trout in evidence.

Given the considerations applied to the scheme through construction and operation, there is no anticipation of any adverse effects on fish that would result in a deterioration of GES, or alternatively affect the ability of the watercourse to achieve GES for fish.

3.3.2 Benthic Invertebrates (Composition and Abundance of the Fauna)

The status of invertebrates within the College Burn is recorded as high (2014). The only consideration which is likely to result in a risk to the ecological status of invertebrates is through incidental pollution on site. Given the designated status of the Burn and wider Tweed catchment strict protocols for avoiding pollution incidents on site will be applied for the six week construction phase of the project. With this risk highly managed no deterioration of the ecological status of the Burn in relation to invertebrates is predicted.

3.3.3 Aquatic flora (Macrophytes - Composition and Abundance of the Flora)

While there is no documented certainty relating to current reasons for the College Burn failing (eg 'moderate' classification), it is perceived that this is in relation to aquatic Macrophytes. This compliance assessment is therefore required to carefully consider effects on aquatic Macrophytes. Dar *et al* (2014) describe the factors affecting the distribution and abundance of Macrophytes and these factors are detailed below in Table 3.1 and any relevant effects of the proposal are discussed in the same table.

Table 3.1 Factors Affecting Aquatic Macrophyte Abundance and Distribution

Factor	Relevance to the Scheme
Light	No change in existing light levels
Water Temperature	No predicted change in water temperature
Water Quality	Strict controls to be in place to avoid reduction in water quality due to pollution
Nutrient Enrichment	No predicted change in nutrient status of the Burn as a result of the proposal
Sediment Composition	Construction operations without mitigation may result in increased sediment levels within the water column and potential downstream 'smothering of vegetation'. The scheme in the longer term will influence the sediment distribution in the immediate vicinity of the bridge. This may result in some increased stability which may benefit establishment of aquatic macrophytes on stream bed cobbles in this area.
Fluctuations in Water Levels	The scheme will have little effect on the fluctuations in water levels along the Burn

The one element Dar *et al* don't consider, which is included in this assessment, is the potential effect on macrophytes of pollutants emitted to the watercourse in incidental events throughout the course of construction. The exact nature of these effects and toxicity on plants is not considered in detail, however it is assumed that cement fuel and hydraulic oils could be toxic to macrophytes to the point where this resulted in a deterioration of the ecological status or prevented the water body achieving GES. For this reason strict controls will be required to prevent incidental pollution incidents.

3.3.4 Phytoplankton (diatoms)

The effects on phytoplankton are likely to relate primarily to continuity of the water course and water quality. If any potential pollution risk can be managed out of the scheme through careful mitigation during construction no deterioration of phytoplankton communities are anticipated as a result of the works.

3.4 Consideration of Critical Sensitive Habitats

The College Burn forms part of the Tweed Catchment Rivers Special Area of Conservation (SAC). This classification comes about through supporting the Annexe 1 Habitat *Water Course of Plain to Montane level supporting Ranunculion fluitantis and Calitrichio – Batrachion vegetation.* The effects on all the relevant interest features of the SAC are considered separately in detail within a separate Habitats Regulations Assessment Report,(EcoNorth 2015). The Habitat Regulations Assessment Report should be read in conjunction with this report.

3.5 Mitigation Measures

A range of mitigation measures have been introduced in Section 3.4 above when assessing the effects on the ecological status of the various attributes listed. Table 3.5 below provides an overview of the mitigation measures included within the scheme to ensure no deterioration to the ecological status of the relevant waterbodies occurs as a result of the proposal and that the proposal does not adversely affect the ability of the waterbody to achieve GES.

Table 3.5 Mitigation Measures

Feature		Mitigation Measures
Hydromorphology 3.1.1 Quantity and Dynamics of Flow		Minor modifications applying 'soft engineering' techniques upstream of the bridge will be offset by naturalizing flow downstream of the bridge through the removal of rail abutment. The scheme aims to reduce the requirement for mechanical intervention which has historically been required to manage sediment build up at West Newton Bridge.
3.1.3 River Connectivity/Continuity		The installation of an Apron at the bridge introduces a risk of a barrier to fish migration. The design process has held the permeability to fish species a key requirement throughout the process and the bed of the apron will be naturalised to mirror the existing river bed in this area through setting cobbles into the base. The permeability of the river to fish will be retained through applying only partial diversions through the construction phase which has been timed to avoid SAC species but may coincide with sea trout migration or more general movements of other species.
3.1.5 Structure and Substrate of River Bed		Some sediment may be mobilised during construction where required water bearing mobilised sediment will be filtered through settlement tanks and / or a siltbuster system where appropriate and therefore no ' smothering ' of downstream stream bed or vegetation will occur. The steam bed under the bridge will use a natural finish for the invert by setting cobbles into the concrete invert.
3.1.6 Structure of the Riparian Zone		No adverse effects on the structure of the riparian zone are predicted access will be from existing access points only through riparian habitats. The removal of the rail abutment downstream of the bridge will result in a more naturalised riparian zone in this area.
Physico – Chemical 3.2.1 – 3.2.6		Strict measures to control incidental pollution during the construction phase of the proposal will be undertaken. Where appropriate pumped water from within sheet piles will be filtered through a siltbuster type system to carefully manage water where cement may be present to control the pH of water returned to the watercourse. Use ECoW to monitor works and ensure relevant method statements and measures are implements/adhered to.
Biological 3.3.1 Fish		Timing of works will be undertaken to avoid sensitive periods for key species.

		The structure is designed to ensure the bridge is permeable to all fish during both construction and operation. A 'soft start' approach to works during piling works will be applied to reduce disturbance / avoid injury to fish. Strict pollution avoidance overseen by an ecological clerk of works ECoW.
3.3.2 Invertebrates		Strict pollution avoidance measures overseen by an ECoW
3.3.3 Macrophytes		Habitat assessment have identified that in-stream works will not affect high quality areas for macrophytes. The proposal aims to reduce any requirement for future in stream works to remove sediment (cobble build up) surrounding the bridge structure. This slight increase in stability is likely to result in more stable conditions suitable for the establishment of macrophytes. Strict pollution control measure to avoid chemical pollution or increased sediment load which could result in smothering of vegetation.
3.3.4 Phytoplankton		Strict pollution avoidance measures overseen by an ECoW during construction.

3.6 In Combination Considerations

The following projects plans have been identified through the consultation process outlined above and also through undertaking a trawl of planning applications using the Scottish Borders Council website. Broadly the approach to In Combination Considerations has been to identify:-

- All accessible proposals on or in the vicinity of the College Burn
- All accessible proposals comprising of river works on the Tweed Catchment

The proposals and projects identified through consultation and desk based searches are included in Table 3.6

Table 3.6 Proposals Currently Considered in Relation to In Combination Affects

Site and Project	Information Source	Comments
Redundant Weir Structure downstream of the site on River Glen	E-Mail correspondence with Tweed Foundation	Initial studies are underway to investigate options for managing a redundant weir structure. No HRA undertaken to date and unlikely as it is likely to be considered to be part of conservation management of the site however this is likely to have a positive effect on the river system in relation to restoring natural river processes.
Sand and Gravel Extraction on flood plain of River Tweed catchment	Northumberland Local Development Plan. Core Strategy Habitats Regulations Assessment Scoping Report	Plan identifies potential releases of silt or other pollutants into Tweed Catchment as a potential threat to the integrity of the SPA.
Forestry felling works in the College Valley	Verbal Report from NNPA	NNPA reported that some forestry felling was due to be undertaken in the College Valley and that this may lead to an increase in sedimentation in the College Burn. At this stage it is unlikely that the two operations will be undertaken simultaneously as forestry works are best undertaken during the winter period however no detailed plans of felling are available on the forestry commission register of cases (accessed 4th Feb 2015) and therefore the risk of interaction between the two is considered to be minimal particularly when mitigation measures are considered along with the coarse nature of sediment on site which is not easily suspended.

A search of available information on plans and projects has not identified any evidence of plans or projects where significant effects are predicted or are likely to interact with the proposals being assessed within this document to result in elevated levels of adverse effects on the Tweed Catchment Rivers SAC.

4. Conclusions

This assessment identifies five water bodies relevant to the scheme; the scheme is situated within one of these; another is upstream, and a further three lie downstream of the proposed works.

Table 4.1 below illustrates the current assessment of ecological status of each of the waterbodies and includes a summary of the predicted effect of the proposed works. The table concludes that with effective implementation of mitigation measures in design and working practices no deterioration in the ecological status of the relevant water bodies is predicted as a result of the proposal. Equally, the works in their own right are not considered to prevent the relevant waterbodies achieving good ecological status.

Table 4.1 Summary of Assessment

Water Body	Location	2012	2014	Reasons for failing	Comments
College Burn from Lamden Burn to River Glen	Works located within	Poor	Moderate	Macrophytes	Following application of mitigation measures no deterioration of ecological status is predicted
College Burn from Source to Lamden Burn	Upstream	Good	Good	n/a	Only possible effect upstream relates to the distribution of fish species. Following mitigation measures in design and a construction process no deterioration is predicted.
River Glen from College Burn to River Till:	Downstream	Moderate	Moderate	Flood protection	No additional flood protection is proposed as part of this scheme. Pollution control measures will prevent deterioration of other aspects of ecological status.
River Till from River Glen to River Tweed	Downstream	Moderate	Good	Mixed agricultural run off	Possible reduction in agricultural run-off through reduction in inundation to agricultural fields around works areas. With implementation of pollution control no deterioration in ecological status is predicted.
River Tweed	Downstream	Moderate	Moderate	TBC	With implementation of pollution control no deterioration in ecological status is predicted.

5. References

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Appendix A – Consideration of Alternatives

Westnewton Bridge – Scour protection measures

A Feasibility study for provision of hardened invert around bridge footings

The flood event of 25th September 2012 caused damage to one the piers of Westnewton Bridge and emergency works have been carried out to temporarily reinstate the foundations.

There remains a substantial risk to the bridge from flood events and, to permanently safeguard the integrity of the bridge foundations, the County Council envisages submitting a detailed scheme for consent with a view to construction in summer 2015.

Furthermore, to minimise scour of the RH bank upstream of the bridge and limit deposition that may block the available waterway through the arches, it is considered that keeping the river on a straight alignment up to and through the bridge would be beneficial. Please see options considered at the bottom of the page.

The permanent options to protect the invert around the bridge from scour are considered as described below:

Option	Advantages	Disadvantages	Conclusion
1. Do not provide invert.	Minimal intervention. No short term cost	Bridge foundations would remain at risk from scour. Potential loss of Highway and large cost to reinstate.	Cannot secure safety of travelling public therefore **disregard**
2. Sheet piled invert with concrete apron around individual abutments and piers.	Will provide permanent protection to bridge foundations. Would leave invert at centre of spans in natural condition. Good for fish passage.	Local scour effects around sheet piling would be significant. Very difficult to install sheet piling in confined head room, probably impossible. Significant works in the river environment.	Probably impossible to carry out therefore **disregard**
3. Underpin	Will provide permanent	Deep excavations required with	Cannot be carried out safely therefore

abutments and piers with concrete footings.	protection to bridge foundations. Would leave invert under bridge spans in natural condition. Good for fish passage.	severe concerns over provision of safe working area. Probably impossible to keep water out of excavation. Significant works in the river environment.	**disregard**
4. Installation of inclined steel piles through masonry to provide support against scour.	Will provide permanent protection to bridge foundations. Would leave invert under bridge spans in natural condition. Good for fish passage.	Very difficult to install sheet piling in confined head room, probably impossible. Major intervention into Listed Building because piles would be cored through masonry. Significant works in the river environment.	Major intervention into Listed Building but probably impossible to carry out therefore **disregard**
5. Manage river by frequent intervention	Used to be carried out on a regular basis by Environment Agency prior to current environmental legislation. Concrete and/or steel installations not required in water course.	Difficult to react in a timely manner to build up of gravels and changes in river alignment. Many consultations/surveys and studies required for every intervention. Significant works in the river environment.	Continual intervention in river corridor needing extensive consultation to achieve consent on each occasion. Not considered realistic therefore **disregard**
6. Concrete Invert provided across whole width of river.	Will provide permanent protection to bridge foundations.	Significant works in the river environment. Risk of step forming in invert that would be a risk to fish passage.	Major scheme – much study and justification required – **possible solution**
7. Soft engineering only	Concrete and/or steel installations not required in water course.	Soft engineering measures around the bridge foundations are not robust enough to resist the extreme turbulence that occurs in this location. Measures have only a short term life spa and would have to be	Expert geomorphologist considers soft engineering to be inappropriate to resist scour forces through the bridge therefore **disregard**

		repeated to maintain protection.	
Conclusion – carry out study of option 6 to include hydrological, geomorphological and ecological issues.			

B Feasibility study for options to maintain river alignment through centre arch of bridge arch

When the river moves laterally it promotes scour on the outside of bends but deposition on the inside. This deposition leads to a reduction of the available waterway through the bridge arches leaving them at greater risk to blockage from debris during flood events. This issue was shown to be a concern after the near catastrophic scour events of September 2012. The deposition used to be removed as it occurred by the Environment Agency and its predecessors but recent environmental legislation prevents this course of action without extensive study and justification. It is proposed to limit the rivers potential for meandering by studying the hydrological and geomorphological characteristics and providing bank protection where needed. The ideal for this aim is to ensure that the river is aligned with the centre arch of the bridge so reducing the propensity for deposition.

Option	Advantages	Disadvantages	Conclusion
A. Do nothing	No intervention into river environment	High potential for deposition and risk of debris blocking available arches for flood water as evidenced on previous occasions	Significant risk of blockage of bridge without intervention to remove deposition. Not a realistic long term solution therefore **disregard**
B. Manage river by frequent intervention	Used to be carried out on a regular basis by Environment Agency prior to current environmental legislation.	Difficult to react in a timely manner to build up of gravels and changes in river alignment. Many consultations/surveys and studies required for every intervention. Significant works in the river environment.	Continual intervention in river corridor needing extensive consultation to achieve consent on each occasion. Not considered realistic therefore **disregard**
C. Protect existing RH bank with hard engineering	RH bank protected against scour and failure	Unlikely to gain approval because of ecological designation	Probably unlikely to gain assent/consent therefore **disregard**
D. Protect existing RH bank with soft engineering	RH bank protected against scour and failure	Soft engineering has a limited lifespan and therefore maintenance likely to be required.	Probably only option that is likely to be acceptable to the consenting bodies. – **Possible solution**

E. Maintain river on straight alignment with hard engineering	River straightened and deposition minimised	Unlikely to gain approval because of ecological designation	Probably unlikely to gain assent/consent therefore **disregard**
F. Maintain river on straight alignment with soft engineering	River straightened and deposition minimised	Soft engineering has a limited lifespan and therefore maintenance likely to be required.	Probably only option that is likely to be acceptable to the consenting bodies. . – **Possible solution**
Conclusion – carry out study of options D and F to include hydrological, geomorphological and ecological issues.			

Addendum to feasibility study to provide soft engineering options to maintain river alignment through centre arch of bridge arch

Option	Advantages	Disadvantages	Conclusion
I. Willow spiling to RH bank	Soft engineering option that promotes ecological values	Existing bank has log soldiers along bulk of length. 30 metre length to be reinstated. Willow spiling would not have the inherent protection below invert level in this high energy location	Not suitable for a high energy scour location therefore **disregard**.
II. Combined solution with willow spiling and armoured rock toe facility	Softer engineering option that can resist some scour at base level.	The use of armoured stones would be unlikely to be accepted by the heritage bodies. Would also be expensive and would require deep excavation to install.	Expensive with large excavations therefore **disregard**
III. Combined solution with willow spiling and toe protection provided by logs spiked to subgrade and laid longitudinally	Softer engineering option that can resist some scour at base level.	Very expensive and time consuming operation. Would require deep excavation to install.	Expensive with large excavations therefore **disregard**
IV. Log soldiers driven in as piles to depth as toe protection.	Quick to install with minimal excavation. Would tie into existing installation.	Existing installation failed due to lack of toe embedment. Proposed installation to have deeper installation.	Potential solution but could require maintenance **– Possible solution**
V. Log soldiers driven in as piled protection against 'cut back'	Quick to install with minimal excavation. Would be hidden by	Limited life span for wood at surface levels therefore adopt hardwood materials to improve resistance against abrasion and rotting	Potential solution but could require maintenance **– Possible solution**

scour	vegetation and be mostly below ground.		
Conclusion – carry out study of options (IV) and (V) to cater for abrasion characteristics of environment and deeper embedment depth			