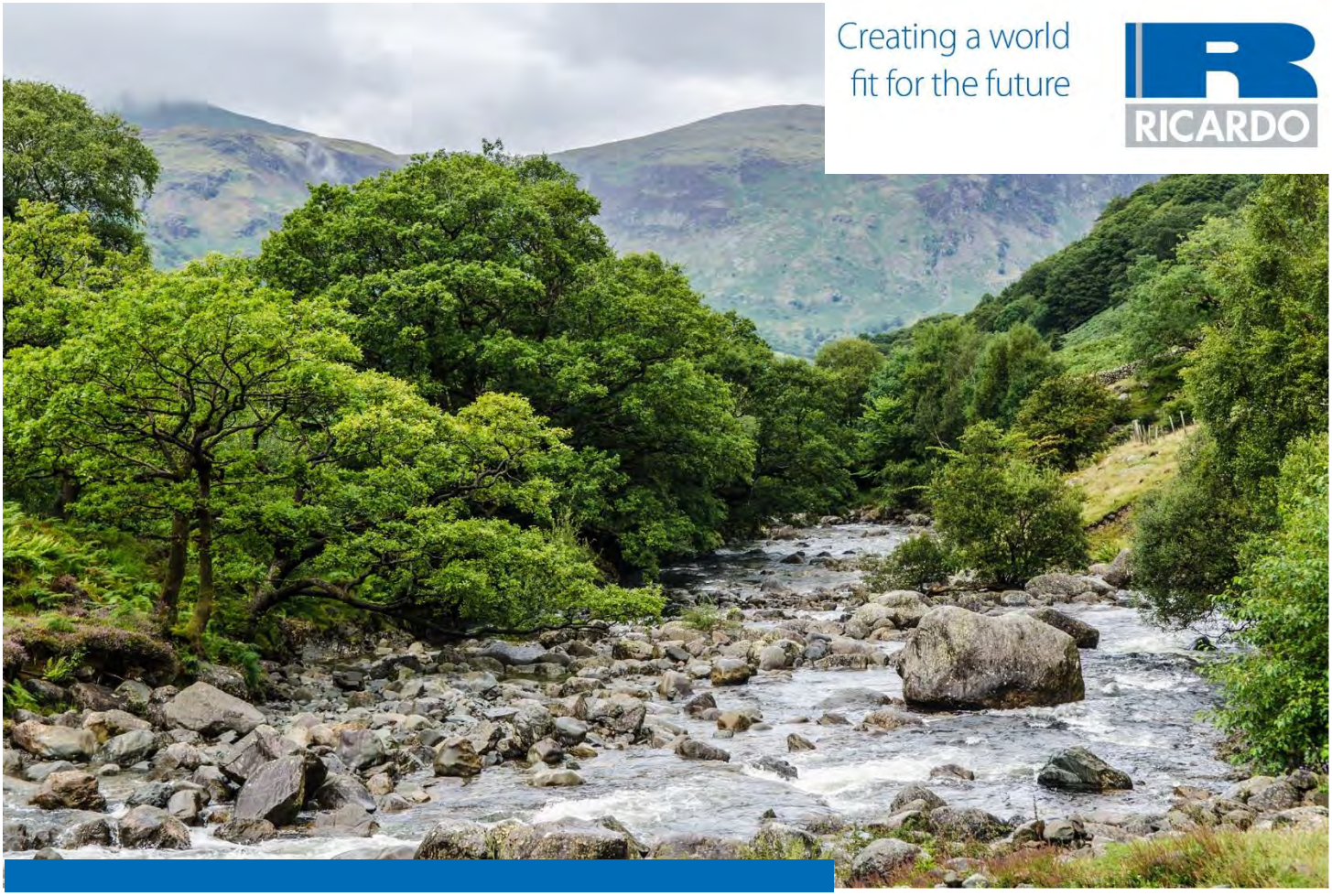


Haweswater Aqueduct Resilience Programme

Proposed Marl Hill Section, Volume 6, Proposed Ribble Crossing

Aquatic Ecology Baseline

Technical Appendix 9B.1

RVBC-MH-RC-TA-009-02-001

ED13654 | Issue number 1 | Date 30/03/21

Customer:

United Utilities

Customer reference:

3500183975

Contact:

Anne Fairhead
Ricardo Energy & Environment
Bright Building, First Floor
Manchester Science Park
Manchester, M15 6GZ
United Kingdom

T: +44 (0) 1235 753 488

E: anne.fairhead@ricardo.com

Author(s):

Tom Priestley, Ryan Hale, Martin Ferreira

Approved by:

Anne Fairhead

Date:

30 March 2021

Ref: ED13654

Ricardo is certified to ISO9001, ISO14001, ISO27001 and ISO45001

Table of Contents

Annex 1: Walkover survey results

1 Introduction

This report is a technical appendix to Chapter 9B Aquatic Ecology of the HARP Proposed Ribble Crossing Environmental Statement. The purpose of the report is to identify within the Proposed Ribble Crossing study area the presence of designated sites, the baseline condition of the aquatic ecology communities which inform the Water Framework Directive (WFD) status of the watercourses in the study area, and the presence of protected or notable species to inform the Ecological Impact Assessment (EcIA) and the associated mitigation strategy presented in Chapter 9B Aquatic Ecology.

This report presents baseline ecological data collated from a desk study of existing ecological data, walkover surveys, and white clawed crayfish surveys of watercourses within the Proposed Ribble Crossing Section study area.

2 Methodology

2.1 Desk study

The MAGIC website mapping tool was used to help identify any statutory or non-statutory designated sites for freshwater fish, macrophyte and aquatic macroinvertebrate species within the Proposed Ribble Crossing Section study area.

In addition, ecological datasets for the period 2010 – 2020 were obtained via the Environment Agency Ecology and Fish Data Explorer website[1], this data included:

- National Fish Populations Database (NFPD): Freshwater Fish Counts for all Species for all Areas and all years. NFPD consists of information collected from fisheries monitoring work on rivers and lakes. This monitoring work is undertaken by the Environment Agency.
- Data for freshwater and marine biological surveys for macroinvertebrates, diatoms and macrophytes in England. The Environment Agency undertakes freshwater and marine biological monitoring in England. Freshwater and Marine Biological Surveys England is a large dataset containing taxonomic level species data for biological surveys carried out in freshwater and marine environments. This archive is more commonly known as BIOSYS.

These data were analysed in order to

- Identify important migratory pathways for diadromous fish species;
- Identify important spawning and nursery habitat for protected and notable species;
- Identify the location of protected and notable macrophyte and macroinvertebrate species in relation to the proposed development; and
- Identify important habitats that support key macrophyte and macroinvertebrate communities.

Several macrophyte species are known to be good indicators of water chemistry, habitat disturbance and seasonal changes in flow and have been used as a biological method to assess the trophic status of rivers and streams in the UK, including the impact of eutrophication and flow. They were selected for this method because:

- their species composition can change with increased nutrient concentrations;
- the changes in macrophyte community can be highly visible and may be deemed ‘undesirable’;
- most species recorded for the surveys are readily identifiable with the naked eye; and
- the rooted nature of many species means that any absence or presence of species is significant.

The UKTAG Fisheries Classification Scheme 2 (FCS2)[2] is used to assess the status of fish fauna (the WFD ‘Fish’ element) in rivers in England and Wales. Electric fishing data is inputted into a model which compares this observed data with the predicted fish assemblage for the river type given site location and four environmental variables (altitude, distance to tidal limit, mean wetted width and survey area). The site is then classified based on how the site performs against the predicted fish assemblage.

[1] Environment Agency Ecology and Fish Data Explorer website https://environment.data.gov.uk/ecology-fish/. Accessed 17 April 2020
[2] Available from: http://www.wfduk.org/sites/default/files/Media/Characterisation%20of%20the%20water%20environment/Biological%20Method%20Statements/river%20fish.pdf

Records of white clawed crayfish (*Austropotamobius pallipes*) supplied by the Cumbria Biodiversity Data Centre (CBDC) and Lancashire Environmental Records Network (LERN) were reviewed for within 2 km of the proposed scheme.

2.2 Watercourse walkover surveys

Walk-over habitat surveys were undertaken in February 2021 for watercourses within 500m of the Proposed Ribble Crossing which contain an access track, bridge, and lay down area.

The walk-over habitat survey methodology was based on the Environment Agency's 'Restoration of Riverine Salmon Habitats' guidance manual[3]. The 'Hendry & Cragg-Hine' method was developed to be used to inform habitat restoration, fish survey site selection, and fish population studies.

The main objective walk-over survey was to obtain a detailed representation of the location, extent, and condition of habitat features along and surrounding a watercourse. This was done by walking the riverbank of the selected survey stretch and entering the river when necessary. The habitats and features were mapped using Esri ARC GIS and are presented in **Annex 1** to this appendix. The habitats and features recorded during the walk-over surveys included:

- Flow type
- Water depth
- Flow velocity (estimate of surface velocity)
- Substrate composition
- Species specific habitats
- Obstructions
- Macrophytes – estimated percentage cover for:
    - submerged macrophytes
    - emergent macrophytes
    - filamentous algae
    - Macrophyte choked channel
- Other features:
    - Coarse woody material
    - Debris dam
    - Bankside roots (target note)
    - Undercut bank (line along bank)
    - Overhanging terrestrial vegetation
    - Shading.

Incidental findings were also recorded during the walk-over surveys including Invasive Non-native Species (INNS), pollution sources, field boundaries, land use, and bank modifications.

2.3 White clawed-crayfish surveys

In order to establish if white-clawed crayfish (*Austropotamobius pallipes*) could be present in waterbodies within the zone of influence surveys were undertaken in 2020.

Due to the timing of the surveys (during winter outside of the required survey period) surveys for white clawed crayfish were restricted to habitat suitability surveys. Where required instream habitat was assessed for its suitability to support white-clawed crayfish. The suitability of the habitat for white-clawed crayfish was assessed using the following criteria:

- Abundance and distribution of submerged refuges;
- Evidence of poor water quality i.e. sewage fungus;

[3] Hendry & Cragg-Hine (1997) http://www.apemltd.co.uk/wp-content/uploads/2016/08/Restoration-of-Riverine-Salmon-Habitats-A-Guidance-Manual.pdf

- River flow velocity;
- Quantities of fine sediment;
- Abundance of potential food sources i.e. macroinvertebrates; and
- Evidence of invasive non-native crayfish species.Water courses with suitable habitat to support white clawed crayfish were subject to surveys to determine presence/likely absence in 2020 by Ricardo Energy & Environment. The results of the white clawed crayfish surveys are presented in Section 3.2.

Water courses surveyed for white clawed crayfish habitat suitability in February 2021 for the Proposed Ribble Crossing included:

- River Ribble
- Greg Sike
- Waddington Brook

2.3.1 Weather conditions and survey dates

The weather conditions and survey dates for the white clawed crayfish habitat suitability surveys are shown below in **Table 2.1**.

Table 2.1: Surveys dates and weather conditions for white clawed crayfish

Survey Date	Weather conditions
01/02/2021	Surveys were undertaken during dry weather with no constraints due to weather conditions

2.4 Study Limitations

The absence of desk study records cannot be relied upon to infer absence of a species/habitat. Often, the absence of records is a result of under-recording within the given search area.

Due to the timing of the surveys in winter 2021 it was not possible to undertake presence/absence surveys for white clawed crayfish to inform the ecological impact assessment.

3 Baseline Conditions

3.1 Water Framework Directive (WFD) communities and status

3.1.1 Macrophytes and Phytobenthos

3.1.1.1 Macrophytes

Available Environment Agency macrophyte monitoring data (2010-2020) have been reviewed for the relevant reaches of the Ribble Downstream Stock Beck (GB112071065612) WFD waterbody was classified as 'Good' for combined macrophytes and diatoms in 2019, Cycle 2.

Table 3.1: Details of Macrophyte monitoring sites: Ribble Downstream Stock Beck

Monitoring site	NGR	Number of surveys	Survey period	WFD Waterbody
Ribble Downstream Stock Beck				
River Ribble - 92333	SD7220040300	2	2010 – 2013	GB112071065612
River Ribble - 92334	SD7260040000	2	2010 – 2013	
River Ribble - 92335	SD7150038400	3	2010 – 2014	
River Ribble at West Bradford Road - 159587	SD7448443950	2	2013 – 2014	

The biological indices for the macrophyte communities identified at the four monitoring sites in the waterbody Ribble Downstream Stock Beck are summarised in **Table 3.2**.

The average RMHI of 6.58 indicates that the communities present in the waterbody have a preference for faster flowing conditions, and the RMNI of 6.85 is indicative of macrophyte communities which are subject to a slight degree of nutrient enrichment

NTAXA was low, but above the minimum of three required for LEAFPACS2 methodology[4]. The number of functional groups, ranging from 6 to 11 taxa indicate the presence of low to moderately diverse macrophyte communities. The percentage cover of filamentous algae was highly variable with a range from 3.85% to 87.55% cover, showing that nutrient enrichment is variable between years and seasons with the highest percentage cover recorded in June 2013.

Table 3.2: Biological indices for macrophyte sites in Ribble Downstream Stock Beck

	RMHI	RMNI	Number of TAXA (RMNI)	Number of river macrophyte functional groups	percentage cover of Filamentous algae
Mean	6.58	6.85	8.33	5.67	46.29
Min	6.29	6.1	6	5	3.85
Max	6.95	7.29	11	7	87.55

3.1.1.2 Diatoms

Available Environment Agency diatom monitoring data (2010-2020) have been reviewed for the relevant reaches of the Ribble Downstream Stock Beck (GB112071065612) WFD waterbody was classified as 'Good' for combined macrophytes and diatoms in 2019, Cycle 2. The location of the diatom monitoring sites in the relevant WFD waterbodies are shown in **Table 3.3**.

[4] WFD-UKTAG (2014) River Assessment Method Macrophytes and Phytobenthos. Macrophytes (River LEAFPACS2).

Table 3.3: Details of Diatom monitoring sites: Ribble Downstream Stock Beck

Monitoring site	NGR	Number of surveys	Survey period	WFD Waterbody
Ribble Downstream Stock Beck				
River Ribble - 92333	SD7220040300	2	2014 – 2014	GB112071065612
River Ribble - 92334	SD7260040000	2	2011 – 2013	
River Ribble - 92335	SD7150038400	2	2011 – 2013	
River Ribble - 66106	SD7261741439	2	2011 – 2013	

The assessment of diatoms (phytobenthos) in rivers according to the requirements of the WFD is completed using a tool called DARLEQ2 (Diatoms for Assessing River and Lake Ecological Quality), based on a metric called the Trophic Diatom Index (TDI). The TDI describes the nutrient preferences of a diatom community. It ranges from 1 (preference for extremely low nutrient levels) to 100 (preference for extremely high nutrient levels). The TDI4 scores were used by the Environment Agency in the assessment of WFD status of the Cycle 2 assessments.

Percentage Motile Taxa data are also provided which gives the relative proportions of phytobenthos taxa within the community that are motile. A high proportion of motile taxa (>50%) can indicate that light availability is influencing the community, which can be brought about by pressures such as siltation and high covers of filamentous algae. The available baseline TDI scores for the sites associated with the Ribble Downstream Stock Beck waterbody (**Table 3.4**) are indicative of moderate to high nutrient conditions, while the moderate percentage motile taxa are indicative of siltation and disturbed waters.

Table 3.4: Biological indices for diatom sites in Ribble Downstream Stock Beck

	TDI Score	Motile %
Mean	63.16	32.56
Min	57.15	24.01
Max	67.11	57.23

3.1.2 Macroinvertebrates

Available Environment Agency diatom monitoring data (2010-2020) have been reviewed for the relevant reaches of the Ribble Downstream Stock Beck (GB112071065612) WFD waterbody was classified as 'High' for macroinvertebrates in 2019, Cycle 2.

Table 3.5 Details of macroinvertebrate monitoring in Ribble Downstream Stock Beck

Monitoring site	NGR	Number of surveys	Survey period	WFD Waterbody
Ribble - 66106	SD7261741439	4	2013 - 2014	GB112071065612

Over 180 invertebrate taxa have been recorded from the monitoring site on the Hodder - conf Easington Bk to conf Ribble.

The Whalley Hawkes Paisley Trigg (WHPT) metric is primarily used to monitor the impact of organic enrichment, but also responds to toxic pollution, siltation, habitat reduction and reduced flows. High WHPT scores are associated with good water quality and high habitat quality. The WHPT scores for sites in the Ribble Downstream Stock Beck waterbody were very high on all sampling occasions ranging from 181.2 to 217.7 with an average of 203.83 (see **Table 3.6**). The $WHPT_{ASPT}$ provides an indication of the tolerance of macroinvertebrates to pollution or adverse water quality. The $WHPT_{ASPT}$ scores for the Ribble Downstream Stock Beck waterbody ranged from 6.25 to 7.02 with an average of 6.53. The WHPT and $WHPT_{ASPT}$ data indicate that, in general, the

macroinvertebrate community supported by the River Ribble (Downstream Stock Beck) are associate with representative of good to very good water quality with a high proportion of pollution sensitive taxa present. The macroinvertebrate community is considered to be highly sensitive to reductions in water quality from pollution and reductions in dissolved oxygen.

$WHPT_{NTAXA}$ is a species richness index. It is simply the number of scoring taxa (families) that contributed to the WHPT score. Habitat-rich rivers, such as lowland chalk streams will often have $WHPT_{NTAXA}$ scores exceeding 30. Upland systems with restricted habitats tend to have lower values. River reaches with impoverished habitat quality; siltation issues or reduced water quality will typically have reduced $WHPT_{NTAXA}$ scores compared with less impacted reaches in similar river types. The $WHPT_{NTAXA}$ from the Ribble Downstream Stock Beck ranged from 28 to 33 with an average of 31.25. showing the waterbody supports a highly adverse macroinvertebrate community.

The Lotic-invertebrate Index for Flow Evaluation (LIFE) was developed as a means of assessing flow as a stressor of the macroinvertebrate community of flowing watercourses. Individual species and family groups are assigned to a flow group depending on their documented flow preferences (current velocity) ranging from I (Rapid) to VI (Drought Resistant). Species LIFE (S) provides a more precise measure than Family LIFE (F) as a number of aquatic invertebrate families contain species with wide-ranging flow requirements however this is not always calculated or available from EA monitoring sites. The community LIFE score can be broadly interpreted according to published thresholds, ranging from 6.5 and below (Low sensitivity to reduced flows) to 7.26 and above (high sensitivity to reduced flows). The LIFE scores indicate that the macroinvertebrate community of the River Ribble Downstream Stock Beck water body, ranging from 7.43 to 7.67 are indicative of communities that are associated with high flow velocities and a high sensitivity to reductions in flow velocity.

The Proportion of Sediment-sensitive Invertebrates (PSI) index measures the abundance-weighted proportional frequency of taxa which are sensitive to fine sediment deposition (Extence *et al* 2011). The PSI scores for the sites in the Ribble D Stock Beck, ranging from 67.27 to 76.47, are indicative of 'Slightly sedimented' conditions.

Table 3.6 Macroinvertebrate Indices for monitoring sites in the Ribble Downstream Stock Beck waterbody

	WHPT ASPT	WHPT	NTAXA	PSI (Family)	LIFE (Family)
MEAN	6.53	203.83	31.25	70.90	7.55
MIN	6.25	181.2	28	67.27	7.43
MAX	7.02	217.7	33	76.47	7.67

3.1.3 Freshwater fish

Available fish data from Environment Agency monitoring sites for the period 2010-2020 were collated for the Ribble Downstream Stock Brook Waterbody. The Ribble Downstream Stock Beck (GB112071065612) was not assessed for th fish component in Cycle 2however the overall biological quality element was classified as 'Good' in 2019.

These waterbodies comprise a mix of salmonid and coarse fish species, including several internationally and/or nationally designated species including Atlantic salmon (*Salmo salar*), brown trout (*Salmo trutta*), bullhead (*Cottus gobio*), and European eel (*Anguilla anguilla*). The D/S Edisford Bridge and West Bradford Bridge Sites also support high numbers of minor species such as minnow (*Phoxinus phoxinus*) and stone loach (Barbatula *barbatula*)

Table 3.7 Details of freshwater fish monitoring sites in the Ribble Downstream Stock Beck

Monitoring site	NGR	Number of surveys	Survey period	WFD Waterbody
D/S Edisford Bridge (35393)	SD7255941339	5	2010 – 2018	GB112071065612
West Bradford Bridge (42583)	SD6987250313	3	2014 – 2018	
Waddow Weir (45721)	SD6902349885	10	2012 – 2012	

Species presence and distribution data from the fish monitoring sites can be used to provide an indicative reach-based classification of community environmental preferences and therefore sensitivity to potential environmental

pressures associated with the proposed development. This is determined using the WFD Fisheries Classification Scheme Version 2 (FCS2). FCS2 uses a range of complex statistical models and geographical data to predict the fish community at any given location under natural conditions. The system then compares this with the actual survey catch at individual sites and provides a score (Ecological Quality Ratio, EQR) that reflects whether or not the two are similar. Scores determine the formal WFD status classification.

The Environment Agency collects data on the fish species and numbers present in the water bodies through a number of mechanisms including electric fishing survey data, fish counter data, fishery catch records and various other observations. Reach sensitivity can broadly be defined by the most sensitive of the fish taxa present (i.e. those with the lowest tolerance of environmental disturbance).

Table 3.6: Environment Agency fish monitoring sites: summary of species distribution from sites in the Ribble Downstream Stock Beck (GB112071065612) Waterbody (species tolerance of environmental disturbance as defined by the Fisheries Classification Scheme (FCS2)[5]

Site	Date	Low Tolerance						Medium Tolerance						High tolerance					
		Brown / sea trout	Grayling	Bullhead	Atlantic salmon	Lamprey sp. ammocoetes	Brook Lamprey	Minnow	Stone loach	Pike	Gudgeon	Chub	Dace	Tench	European eel	European eels > elvers	Roach	3-spined stickleback	Perch
PDC electric fishing - catch depletion sample																			
D/S Edisford Bridge	06/07/2010			100-999	3			10-99	10-99						42				
	22/05/2012	1		10-99				10-99	1-9						8				
	18/07/2014	2		10-99	94			10-99	1-9						19				
	06/06/2016	1		10-99	3		1	100-999	10-99						16				
	09/08/2018	3	5	100-999	43			100-999	10-99			18			25				
West Bradford Bridge	24/07/2014	51	1		72			10-99	1-9			2			28				
	06/06/2016	17	1		2			1000-9999	100-999						15				
	09/08/2018	64			16			1000-9999	100-999		1	20			9		1-9		
Fixed trap fishing monitoring data – Single catch samples																			
Wadow Weir	12/04/2012				5														
	13/04/2012				1														
	14/04/2012				5														
	27/04/2012				1														
	28/04/2012				1														
	11/05/2012				5														
	12/05/2012				2										2				

[5] UKTAG (2008) Rivers Assessment Methods Fish Fauna (Fisheries Classification Scheme 2 (FCS2)) ISBN: 978-1-906934-09-5

Site	Date	Low Tolerance						Medium Tolerance						High tolerance					
		Brown / sea trout	Grayling	Bullhead	Atlantic salmon	Lamprey sp. ammocoetes	Brook Lamprey	Minnow	Stone loach	Pike	Gudgeon	Chub	Dace	Tench	European eel	European eels > elvers	Roach	3-spined stickleback	Perch
	13/05/2012				3														
	14/05/2012				1														

3.2 Protected and notable species

3.2.1 White clawed crayfish

3.2.1.1 Desk study

No records of white clawed crayfish were received from LERN for within 2 km of the proposed scheme in the period 2010 to 2020. White clawed crayfish were not present in macroinvertebrate monitoring data recorded at sites in the Ribble Downstream Stock Beck waterbody during the period 2010 to 2020.

3.2.1.2 White clawed crayfish surveys

The results of the surveys of watercourses for white clawed crayfish habitat suitability undertaken in 2021 are summarised in **Table 3.8**.

Three watercourses were surveyed in the Ribble Downstream Stock beck catchment adjacent to the Proposed Ribble Crossing. All three watercourses were identified as having suitable habitats to support white clawed crayfish.

The River Ribble at the proposed crossing point contains suitable habitats to support white clawed crayfish with plenty of suitable refuges present in the form of coarse substrate, boulders, and tree roots. No incidental evidence of crayfish was recorded during the habitat suitability survey and no remains were observed within the otter (*Lutra lutra*) spraint. The River Ribble at the survey location was approximately 35 m and, at the time of survey, the water depth was 30 – 40 cm. The substrate was predominantly coarse comprising boulders, large cobbles, and gravel.

Greg Sike is a small watercourse with a channel width of approximately 1 m, and, at the time of survey, the water depth was *c.* 10 cm, although both of these were variable throughout the surveyed reach. The substrate comprised mostly of cobble, gravel, and sand with boulders in some sections. The downstream end of the surveyed reach comprised finer sediment with a substrate dominated by sand and silt. Greg sike contains suitable habitats for supporting white clawed crayfish in areas with coarse sediments where there are sufficient available refuges. No incidental evidence of white clawed crayfish was identified at Greg sike during the habitat suitability survey.

Waddington Brook (upstream of the Ribble confluence) is a small watercourse with a channel width of approximately 1.25 m, and, at the time of survey, a water depth was of approximately 10 cm, although both of these were variable throughout the survey reach. The watercourse had a coarse substrate predominantly comprising boulder, cobble, gravel, and sand, with some silt at the downstream end of the survey reach. Waddington brook contains suitable habitat for white-clawed crayfish, due to the presence of boulders and large cobbles that can serve as potential refuges. However, sewage fungus was recorded over a large stretch of the reach indicating a water quality issues may be a problem within the watercourse. The potential water quality issues as indicated by the presence of sewage fungus would reduce the likelihood of white-clawed crayfish being present here. No incidental evidence of white clawed crayfish was recorded during the survey and no remains were observed within the otter spraint identified at the watercourse.

Two watercourses present in the updated red line boundary for the Proposed Ribble Crossing were not surveyed for suitability to support white clawed crayfish: Coplow Brook (W2349 and Unnamed Watercourse 2097 (W2348). Both watercourses are small with some modifications including culverts and bridges. However due to the suitability of the other nearby tributaries of the River Ribble using a precautionary approach both watercourses are assumed to contain suitable habitats for white clawed crayfish.

Table 3.8 White clawed crayfish survey results summary

Watercourse name	WFD catchment	Upstream NGR	Downstream NGR	Suitability	Survey results
River Ribble	Ribble Downstream Stock Beck	SD 7448 43947	SD 74020 443440	Suitable habitats present	Large main river with Coase substrate and suitable refuges including boulders and tree roots. No incidental evidence of crayfish was recorded during the habitat suitability survey and no remains were observed within the otter (*Lutra lutra*) spraint.
Greg Sike	Ribble Downstream Stock Beck	SD 73964 43939	SD 74095 43580	Suitable habitats present	Greg sike contains suitable habitats for supporting white clawed crayfish in areas with coarse sediments where there are sufficient available refuges. The downstream end of the surveyed reach comprised finer sediment with a substrate dominated by sand and silt. No incidental evidence of white clawed crayfish was identified at Greg sike during the habitat suitability survey.
Waddington Brook (Upstream Ribble confluence).	Ribble Downstream Stock Beck	SD 73521 43840	SD 73924 43617	Suitable habitats present	The watercourse had a coarse substrate predominantly comprising boulder, cobble, gravel, and sand, with some silt at the downstream end of the survey reach. Waddington brook contains suitable habitat for white-clawed crayfish, due to the presence of boulders and large cobbles that can serve as potential refuges. However, sewage fungus was recorded over a large stretch of the reach indicating a water quality issues may be a problem within the watercourse. The potential water quality issues as indicated by the presence of sewage fungus would reduce the likelihood of white-clawed crayfish being present here. No incidental evidence of white clawed crayfish was recorded during the survey and no remains were observed within the otter spraint identified at the watercourse

3.3 Invasive species

3.3.1.1 Desk study

Environment Agency records from monitoring sites in the Ribble Downstream Stock Beck waterbody in the period 2010 to 2020 are presented in **Table 3.9**.

The Environment Agency data also included two records of a non-native aquatic macroinvertebrate species; Jenkin's spire snail (*Potamopyrgus antipodarum*) in the River Ribble Downstream Stock Beck Waterbody. These records were on on the River Ribble downstream of the Proposed Ribble Crossing works. Jenkins' spire snail is naturalised and widely distributed throughout the country it is not listed although it is non-native it is not listed as an invasive species under the Wildlife and Countryside act 1981 (as amended) and is therefore scoped out of any assessments for invasive non-native species.

One record of an invasive non-native species was present in EA monitoring data from sites on the River Ribble Downstream Stock Beck waterbody. Low (<0.1%) cover from Himalayan balsam (*Impatians glandulifera*) was recorded from Site 92333 in 2010. Himalayan balsam is listed on Schedule 9 of the Wildlife and Countryside act 1981 which makes it an offence to cause it to grow in the wild. Due to the age of the record and presence of the species in the wider catchment during walkover surveys (see Section 3.3.1.2) as a precautionary approach Himalayan balsam is assumed to be present in low abundances throughout the catchment and potentially affected watercourses.

Table 3.9: : Environment Agency invasive and non-native species records from Macrophyte monitoring sites in the Ribble Downstream Stock Beck Waterbody

Common name	Scientific Name	Sample date	Site ID	NGR	Abundance
Himalayan balsam	*Impatiens glandulifera*	01/09/2010	92333	SD7220040300	<0.1% cover
Jenkins' Spire Snail	*Potamopyrgus antipodarum*	25/04/2014	66106	SD7261741439	7
		16/09/2014	66106	SD7261741439	9

3.3.1.2 Survey results

Incidental observations of Himalayan balsam (*Impatians glandulifera*) were recorded during the walkover survey of Waddington Brook in December 2020, no invasive non-native species were identified at either the River Ribble or Greg Sike during the walkover surveys. However, the surveys were undertaken outside of the optimal period for identifying plants so absence of records during these surveys does not provide confirmation of absence of invasive non-native species form these watercourses.

Table 3.10: Watercourses subject to walkover surveys in 2020

Name	WC_ID	U/S Grid Ref	D/S Grid Ref	Biological
River Ribble	W2325	SD 74488 43937	SD 74020 43440	No evidence of INNS
Greg Sike	W2321	SD 73964 43939	SD 74095 43580	No evidence of INNS
Waddington Brook	W506	SD 73521 43840	SD 73924 43617	Himalayan Balsam present (< 5% of channel length).

4 Summary

4.1 Baseline Summary

A summary of the baseline conditions as identified through the desk study and surveys undertaken for the watercourses in the River Ribble (Downstream Stock Beck) WFD waterbody are in **Table 4.1**.

Table 4.1: Summary of Baseline conditions of watercourses within the Ribble – Downstream Stock Beck WFD waterbody

Watercourse	River Ribble (W2325)	Greg Sike (W2321)	Coplow Brook (W2349)	Unnamed Watercourse 2097 (W2348)
WFD waterbody	Ribble – Downstream Stock Beck (GB112071065612)	Ribble – Downstream Stock Beck (GB112071065612)	Ribble – Downstream Stock Beck (GB112071065612)	Ribble – Downstream Stock Beck (GB112071065612)
Macrophytes and phytobenthos	The available macrophyte and diatom data available from site in the River Ribble (Downstream Stock Beck) catchment indicates the watercourse supports communities associated with faster flow velocities, but with moderate nutrient enrichment. The macrophyte and diatom communities are considered to be sensitive to reductions in water quality and increased fine sediment.			
Fish	The River Ribble (Downstream Stock Beck) catchment supports populations of Atlantic salmon, brown trout, bullhead, brook lamprey, and European eel. Due to the high proportion of the fish community comprising Atlantic salmon, bullhead, and brown trout the fish community of watercourses within the catchment are considered to be highly sensitive to reductions in water quality, barriers to movement, and increases in fine sediments. The watercourse at the proposed crossing location also supports high abundances European eel and minor species such as minnows and stone loach.			
Macroinvertebrates	Macroinvertebrate communities in the River Ribble (Downstream Stock Beck) catchment are associated with good to high water quality with moderate to high flows. The macroinvertebrate baseline data indicates the watercourse is 'slightly sedimented'. The macroinvertebrates present are considered to be sensitive to reductions in flow velocity or water quality and increases in fine sediment.			
White clawed crayfish	Watercourse contains suitable to support white clawed crayfish	Watercourse contains suitable to support white clawed crayfish	Precautionary approach – assumed to contain suitable habitats to support white clawed crayfish	Precautionary approach – assumed to contain suitable habitats to support white clawed crayfish
Invasive Non-native Species	Historic records of Himalayan balsam downstream of the proposed works and low proportion of cover on tributary (Waddington Brook) adjacent tot the proposed crossing works	No INNS identified in baseline data	No INNS identified in baseline data	No INNS identified in baseline data

Annexes

Annex 1: 2021 Watercourse walkover survey results

373500 373600 373700

443800 443700 443600

Waddington Brook

514 515 516 517 518 519 520 521 522 523 524 525 526 527 528 529 530 531 532 533 534 535 536 537 538 539 540 541 542 543 544 545 546 547 548 549 550 551

Coplow Hill

Legend:

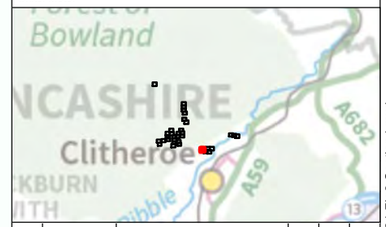
Walkover extents

- Start Point
- End Point

Flow Type

- Waterfall
- Torrent
- Cascade
- Run
- Glide
- Riffle
- No perceptible flow
- Pool
- Eddy
- Juvenile Lamprey habitat
- Salmonid habitat
- Dry
- Exposed Sediment
- Potential obstacle / obstruction to fish passage
- Overhanging Vegetation
- Coarse Woody Debris

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter



Rev	Date	Description	Drn	Chk	App
00	16/02/2021	2480524	SP	RG	BF

HARP Aquatics

Ricardo Energy & Environment

RSK biocensus EXPERTS IN ECOLOGY

TITLE: Figure 2:
Marl Hill TR4
Walkover Survey
Map 30 of 34

0 20 40
Meters
SCALE: 1:1,000 @ A3

N W E S

REV 00

Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-Fig2-Section4.mxd

373700 373800 373900

443700 443600 443500

oplow Hill

536 537 538 539 540 541 542 543 544 545 546 547 548 549 550 551 552 553 554 555 556 557 558 559 560 561 562 563 564 565 566 567 568 569 570 571 572 573

Waddington Brook

Legend:

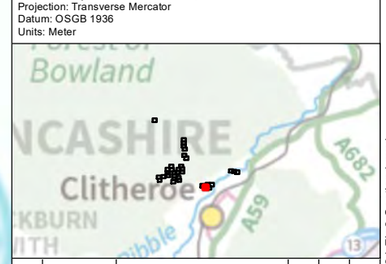
Walkover extents

- Start Point
- End Point

Flow Type

- Waterfall
- Torrent
- Cascade
- Run
- Glide
- Riffle
- No perceptible flow
- Pool
- Eddy
- Juvenile Lamprey habitat
- Salmonid habitat
- Dry
- Exposed Sediment
- Potential obstacle / obstruction to fish passage
- Overhanging Vegetation
- Coarse Woody Debris

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter



Rev	Date	Description	Drn	Chk	App
00	16/02/2021	2480524	SP	RG	BF

HARP Aquatics

Ricardo Energy & Environment

RSK biocensus
EXPERTS IN ECOLOGY

TITLE: Figure 2:
Marl Hill TR4
Walkover Survey
Map 31 of 34

0 20 40
Meters
SCALE: 1:1,000 @ A3

N W E S

REV 00

Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-Fig2-Section4.mxd

373900 374000 374100

443900 443800 443700

Greg Sike

574 575 576 577 578 579 580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595 596 597 598 599 600 601 602 603 604 605 606 607 608 609 610 611 612 613 614 615 616 617 618 619 620 621

Legend:

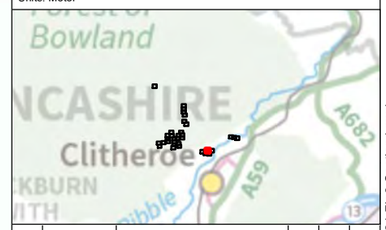
Walkover extents

- Start Point
- End Point

Flow Type

- Waterfall
- Torrent
- Cascade
- Run
- Glide
- Riffle
- No perceptible flow
- Pool
- Eddy
- Juvenile Lamprey habitat
- Salmonid habitat
- Dry
- Exposed Sediment
- Potential obstacle / obstruction to fish passage
- Overhanging Vegetation
- Coarse Woody Debris

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter



Rev	Date	Description	Drn	Chk	App
00	16/02/2021	2480524	SP	RG	BF

HARP Aquatics

RSK biocensus
EXPERTS IN ECOLOGY

TITLE: Figure 2:
Marl Hill TR4
Walkover Survey
Map 32 of 34

0 20 40
Meters
SCALE: 1:1,000 @ A3

N W E S

REV 00

Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-Fig2-Section4.mxd

374000
374100
374200
443600
443500
620
621
622
623
624
625
626
627
628
629
630
631
632
633
Greg Sike
671
672
670
668
673
675
674
678
676
679
677
680
683
681
682
685
684
687
686
688
690
689
694
691
692
693
695
River Ribble

Legend:

Walkover extents

- Start Point
- End Point

Flow Type

- Waterfall
- Torrent
- Cascade
- Run
- Glide
- Riffle
- No perceptible flow
- Pool
- Eddy
- Juvenile Lamprey habitat
- Salmonid habitat
- Dry
- Exposed Sediment
- Potential obstacle / obstruction to fish passage
- Overhanging Vegetation
- Coarse Woody Debris

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter

Rev	Date	Description	Drn	Chk	App
00	16/02/2021	2480524	SP	RG	BF

HARP Aquatics

Ricardo Energy & Environment

RSK biocensus
EXPERTS IN ECOLOGY

TITLE: Figure 2:
Marl Hill TR4
Walkover Survey
Map 33 of 34

0 20 40
Meters
SCALE: 1:1,000 @ A3

N
W E
S

REV 00

Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-Fig2-Section4.mxd

374200 374300 374400 374500

443900 443800 443700

River Ribble

634 635 636 637 638 639 640 641 642 643 644 645 646 647 648 649 650 651 652 653 654 655 656 657 658 659 660 661 662 663 664 665 666 667 668 669 670 671 672 696

Horrocksford

Legend:

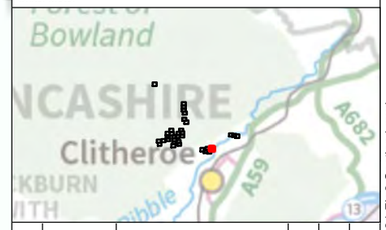
Walkover extents

- Start Point
- End Point

Flow Type

- Waterfall
- Torrent
- Cascade
- Run
- Glide
- Riffle
- No perceptible flow
- Pool
- Eddy
- Juvenile Lamprey habitat
- Salmonid habitat
- Dry
- Exposed Sediment
- Potential obstacle / obstruction to fish passage
- Overhanging Vegetation
- Coarse Woody Debris

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter



Rev	Date	Description	Drn	Chk	App
00	16/02/2021	2480524	SP	RG	BF

HARP Aquatics

Ricardo Energy & Environment

RSK biocensus EXPERTS IN ECOLOGY

TITLE: Figure 2:
Marl Hill TR4
Walkover Survey
Map 34 of 34

0 20 40
Meters
SCALE: 1:1,000 @ A3

N W E S

REV 00

Document Path: \\to-dc0\GIS\Ecology\2480000s\2480500s\2480524 - HARP Aquatics\07 GIS\2480524-Fig2-Section4.mxd

Table 1: Habitat classifications and abbreviations

	Flow Type		Depth		Velocity		Substrate		Notable/species specific habitat		Macrophyte (% cover)		Other features
GL	Glide	A	0.05 - 0.1 m	0	0.01 - 0.05 m/s	BE	Bedrock	Pr	Salmonid parr habitat	SFL	Submerged fine-leaved	Obstruction	Potential obstacle/obstruction to fish passage
R	Run	B	0.1 - 0.2 m	1	0.05 - 0.15 m/s	BO	Boulder (> 256 mm)	Fr	Salmonid fry habitat	SLL	Submerged linear-leaved		
RI	Riffle	C	0.2 - 0.4 m	2	0.15 - 0.3 m/s	CO	Cobble (64 - 256 mm)	Pr/Fr	Mixed juvenile salmonid habitat	SBL	Submerged broad-leaved		
P	Pool	D	0.4 - 1.0 m	3	0.3 - 0.5 m/s	GR	Gravel (2 - 64 mm)	SPO	Optimal salmonid spawning habitat	ELL	Emergent linear-leaved		
CAS	Cascade	E	> 1.0 m	4	0.5 - 0.7 m/s	SA	Sand (< 2 mm)	SPSO	Sub optimal salmonid spawning habitat	EBL	Emergent broad-leaved		
ED	Eddy			5	> 0.7 m/s	SI	Silt	LO	Optimal juvenile lamprey habitat	FL	Filamentous algae		
TOR	Torrent					CL	Clay	LSO	Sub optimal juvenile lamprey habitat	FLO	Floating		
NP	No perceptible flow					AR	Artificial			FLR	Floating-leaved rooted		
DRY	Dry					NV	Not visible			CHOKED	Channel choked (veg)		

Target Note	Flow Type	Water depth	Water velocity	Dominant substrate	Vegetation type and % coverage	Habitat type
500	Run	B	3	BO/SA/CO		
501	Riffle	B	3	BO/CO/GR		
502	Run	B	3	BO/SA/CO		
503	Potential obstacle/obstruction to fish passage					
504	Pool	B	1	BO/SA/CO		
505	Run	A	2	BO/CO/GR		
506	Potential obstacle/obstruction to fish passage					
507	Run	A	2	BO/CO/GR		
508	Potential obstacle/obstruction to fish passage					
509	Run	B	3	BO/CO/GR		
510	Potential obstacle/obstruction to fish passage					
511	Pool	C	1	BO/CO/SA		
512	Run	B	2	BO/CO/GR		
513	Potential obstacle/obstruction to fish passage					
514	Run	B	2	BO/CO/GR		
515	Glide	B	1	BO/CO/GR		
516	Run	B	2	BO/CO/GR		
517	Run	B	3	BO/CO/GR		
518	Glide	B	2	BO/CO/GR		
519	Run	B	2	BO/CO/GR		
520	Glide	B	1	CO/GR/SA		
521	Riffle	B	2	BO/CO/GR		
522	Run	B	2	BO/CO/GR		
523	Pool	C	1	BO/CO/GR		
524	Run	B	2	BO/CO/GR		
525	Glide	B	2	CO/GR/SA		
526	Run	B	2	CO/GR/SA		
527	Run	B	3	BO/CO/GR		
528	Riffle	B	3	BO/CO/GR		
529	Run	B	3	BO/CO/GR		
530	Pool	C	1	CO/GR/SA		
531	Run	B	2	CO/GR/SA		
532	Riffle	B	2	BO/CO/GR		
533	Glide	C	1	BO/CO/GR		
534	Riffle	B	2	BO/CO/GR		
535	Run	B	2	BO/CO/GR		
536	Glide	C	2	CO/GR/SA		
537	Run	B	2	BO/CO/GR		
538	Glide	B	3	BO/CO/GR		
539	Riffle	B	3	BO/CO/GR		
540	Glide	B	2	BO/CO/GR		
541	Run	B	2	BO/CO/GR		
542	Riffle	B	3	BO/CO/GR		
543	Glide	B	2	BO/CO/GR		
544	Pool	D	1	BO/CO/GR		
545	Riffle	B	1	BO/CO/GR		
546	Riffle	B	3	BO/CO/GR		
547	Run	C	3	BO/CO/GR		
548	Riffle	B	3	BO/CO/GR		
549	Glide	C	2	BO/CO/GR		

Target Note	Flow Type	Water depth	Water velocity	Dominant substrate	Vegetation type and % coverage	Habitat type
550	Riffle	B	3	BO/CO/GR		
551	Glide	C	2	CO/GR/SI		
552	Riffle	B	3	CO/GR/SA		
553	Glide	C	2	CO/GR/SA		
554	Riffle	B	2	BO/CO/GR		
555	Pool	D	1	CO/GR/SA		
556	Glide	C	2	CO/GR/SA		
557	Riffle	B	2	CO/GR/SA		
558	Glide	C	2	CO/GR/SA		
559	Pool	C	1	CO/GR/SA		
560	Glide	C	2	CO/GR/SA		
561	Riffle	B	3	CO/GR/SA		
562	Glide	B	2	CO/GR/SA		
563	Riffle	B	3	CO/GR/SA		
564	Glide	B	2	CO/GR/SA		
565	Riffle	B	3	CO/GR/SA		
566	Run	B	2	CO/GR/SA		
567	Glide	B	2	CO/GR/SA		
568	Run	B	2	CO/GR/SI		
569	Riffle	B	2	CO/GR/SI		
570	Run	B	2	CO/GR/CL		
571	Glide	B	1	CO/GR/SI		
572	Glide	C	1	CO/GR/SI		
573	Run	A	2	CO/GR/SI		
574	Run	B	2	CO/GR/SA		
575	Glide	B	2	CO/GR/SA		
576	Pool	C	1	GR/SA/SI		
577	Potential obstacle/obstruction to fish passage					
578	Pool	C	1	GR/SA/SI		
579	Glide	B		CO/GR/SA		
580	Potential obstacle/obstruction to fish passage					
581	Glide	B	1	CO/GR/SA		
582	Run	B	2	CO/GR/SA		
583	Run	B	3	CO/GR/SA		
584	Glide	C	1	BO/CO/GR		
585	Glide	B	1	CO/GR/SA		
586	Potential obstacle/obstruction to fish passage					
587	Run	B	2	BO/CO/GR		
588	Glide	B	2	BO/CO/GR		
589	Run	B	3	BO/CO/GR		
590	Glide	C	2	BO/CO/GR		
591	Run	B	2	CO/GR/SA		
592	Glide	B	2	CO/GR/SA		
593	Glide	B	2	GR/SA/SI		
594	Potential obstacle/obstruction to fish passage					
595	Run	B	2	GR/SA/SI		
596	Glide	C	2	GR/SA/SI		
597	Run	B	2	CO/GR/SA		
598	Run	B	3	CO/GR/SA		
599	Glide	B	2	GR/SA/SI		

Target Note	Flow Type	Water depth	Water velocity	Dominant substrate	Vegetation type and % coverage	Habitat type
600	Pool	C	1	GR/SA/SI		
601	Run	B	3	BO/CO/GR		
602	Run	B	2	BO/CO/GR		
603	Riffle	B	3	BO/CO/GR		
604	Run	B	2	BO/CO/GR		
605	Glide	B	1	BO/CO/GR		
606	Riffle	B	2	BO/CO/GR		
607	Potential obstacle/obstruction to fish passage					
608	Run	B	2	BO/CO/GR		
609	Glide	C	2	CO/GR/SA		
610	Potential obstacle/obstruction to fish passage					
611	Run	B	2	BO/CO/GR		
612	Glide	B	1	GR/SA/SI		
613	Glide	C	1	GR/SA/SI		
614	Glide	B	1	GR/SA/SI		
615	Potential obstacle/obstruction to fish passage					
616	Run	B	2	CO/GR/CL		
617	Riffle	B	3	CO/GR/SA		
618	Pool	C	1	CO/GR/SA		
619	Run	B	2	CO/GR/SA		
620	Glide	B	3	CO/GR/SA		
621	Glide	B	2	CO/GR/SA		
622	Riffle	A	1	CO/GR/SA		
623	Glide	B	2	CO/GR/SA		
624	Run	B	2	CO/GR/SA		
625	Glide	C	2	CO/GR/SA		
626	Run	B	2	CO/GR/SA		
627	Glide	B	2	CO/GR/SA		
628	Glide	C	1	SA/SI		
629	Potential obstacle/obstruction to fish passage					
630	Run	B	2	CO/GR/SA		
631	Run	C	2	CO/GR/SA		
632	Pool	C	1	CO/GR/SA		
633	Run	B	2	CO/GR/SA		
634	Run	C	3	BO/CO/GR		
635	Run	E	3	BO/CO/GR		
636	Glide	D	2	BO/CO/BE		
637	Potential obstacle/obstruction to fish passage					
638	Torrent			BO/CO		
639	Run	D	3	BE/CO/BO		
640	Run	D	4	BO/CO/GR		
641	Run	E	3	BE/CO/BO		
642	Run	C	2	BE/CO/GR		
643	Run	D	3	BO/CO/GR		
644	Run	B	2	BO/CO/GR		
645	Lamprey	C	0	SA/SI/GR	Sub-optimal	
646	Riffle	B	3	BO/CO/GR		
647	Lamprey	B	1	SA/SI/GR	Sub-optimal	
648	Lamprey	B	1	SA/SI	Optimal	
649	Run	C	3	BO/CO/GR		

Target Note	Flow Type	Water depth	Water velocity	Dominant substrate	Vegetation type and % coverage	Habitat type
650	Glide	B	2	BO/CO/GR		
651	Salmonid	B	3	BO/CO/GR		Fry
652	Lamprey	C	1	SI/SA/GR		Sub-optimal
653	Run	C	3	BO/CO/GR		
654	Salmonid	C	4	BO/CO/GR		Parr
655	Lamprey	B	0	SI/SA/GR		Sub-optimal
656	Run	C	3	BO/CO/BE		
657	Run	C	3	BO/CO/GR		
658	Run	C	3	BO/CO/BE		
659	Run	D	4	BO/CO/GR		
660	Salmonid	C	4	BO/CO/GR		Parr
661	Run	D	4	CO/GR/SA		
662	Run	B	2	CO/GR/SA		
663	Run	C	2	CO/GR/SA		
664	Run	C	3	CO/GR/SA		
665	Eddy	D	0	BO/CO/GR		
666	Lamprey	C	1	SI/SA/GR		Sub-optimal
667	Run	D	3	CO/GR/SA		
668	Run	C	3	BO/CO/GR		
669	Eddy	E	0	BO/CO/GR		
670	Pool	D	3	BO/CO/GR		
671	Run	D	3	BO/CO/GR		
672	Glide	D	3	BO/CO/GR		
673	Lamprey	C	1	SI/SA/GR		Sub-optimal
674	Glide	C	2	BO/CO/GR		
675	Glide	C	3	BO/CO/GR		
676	Glide	D	2	BO/CO/GR		
677	Run	D	1	BO/CO/GR		
678	Eddy	C	0	BO/CO/GR		
679	Pool	C	1	BO/CO/GR		
680	Pool	E	1	BO/CO/GR		
681	Glide	D	2	BO/CO/GR		
682	Pool	D	1	BO/CO/GR		
683	Glide	C	3	BO/CO/GR		
684	Salmonid	B	3	BO/CO/GR		Fry
685	Glide	C	2	BO/CO/GR		
686	Glide	C	3	BO/CO/GR		
687	Salmonid	C	3	BO/CO/GR		Sub-optimal spawning
688	Run	C	4	BO/CO/GR		
689	Eddy	D	0	BO/CO/GR		
690	Salmonid	B	4	BO/CO/GR		Fry
691	Lamprey	C	1	SI/SA		Optimal
692	Eddy	C	0	BO/CO/GR		
693	Glide	D	2	BO/GR/CO		
694	Run	C	3	BO/CO/GR		
695	Pool	E	1	BO/GR/CO		
696	Lamprey	C	1	SI/SA/GR		Sub-optimal

T: +44 (0) 1235 753000
E: enquiry@ricardo.com
W: ee.ricardo.com