

Appendix B6: Ecology Assessment -Ribble Crossing

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Haweswater Aqueduct Resilience Programme -Proposed Bowland Section

Supplementary Environmental Information

Appendix B6: Ecology Assessment - Ribble Crossing

February 2022







Haweswater Aqueduct Resilience Programme - Proposed Bowland Section

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1. Ecology Assessment of Ribble Crossing SEI

1.1 Introduction

- 1) United Utilities plc is seeking planning consent for the Haweswater Aqueduct Resilience Programme (HARP), which is a proposal to replace the underground tunnel sections of the existing 110 km Haweswater Aqueduct.
- 2) This is Appendix B6 Ecology Ribble Crossing and is a technical appendix of the Main Bowland Supplementary Environmental Information (SEI) report. Further SEI ecology information can be found in the following documents:
 - SEI technical appendix B5, Ecology Bowland
 - SEI technical appendix B7, Ecology Off-Site Highways Works
 - Bowland HRA addendum
 - Bowland SSSI addendum
 - Bowland BNG On-Site Habitat Compensation revised report
 - Bowland BNG Off-Site Habitat Compensation revised report
- 3) This SEI technical appendix B6 provides information to be read in conjunction with the Environmental Statement (ES) and associated planning application for the Bowland Section of the Haweswater Aqueduct Resilience Programme (HARP), which were submitted to Lancaster City Council and Ribble Valley Borough Council in June 2021. Specifically technical appendix B6 relates to and should be read in conjunction with ES Volume 6 Proposed Ribble Crossing (Chapter 9A and 9B and supporting figures and appendices cover the terrestrial and aquatic ecology assessments). This SEI technical appendix B6 specifically relates to :
 - Review of confirmed construction traffic access proposals
 - Review of environmental data not available at submission of the ES in June 2021
 - Review of consultation responses

1.2 Confirmed Construction Traffic Access

- 4) The June 2021 Environmental Statement (Volume 4 Appendix 3.1) made reference to two transport route options to serve the main construction compounds on the Proposed Bowland Section. It was confirmed in the June 2021 Environmental Statement that one of the two options would be selected prior to determination of the Proposed Bowland Section planning application. It is now possible to confirm that Route Option 2 (referred to in the June 2021 Environmental Statement as the Ribble Crossing) has been adopted in preference to Route Option 1, albeit with a need to use local roads for a short period of approximately nine months to enable construction of the temporary crossing.
- 5) Because the Ribble Crossing option was included and fully assessed in the June 2021 ES, the confirmation of this option being taking forward does not require and additional assessment.

1.3 Review of Additional Data

- 6) The following additional technical reports have become available after the June 2021 submission:
 - B6 Annex 1: Ribble Crossing Breeding Bird Survey Report
 - B6 Annex 2: Ribble Crossing Post Submission Aquatic Ecology Surveys

Breeding Bird Survey

7) Since the June 2021 submission a breeding bird survey of the Proposed Ribble Crossing has been completed. A provisional assessment of likely impacts on birds was made in the June 2021 submission



pending review of the completed survey. The breeding bird survey report is provided in Annex 1 of this SEI Appendix B6 and the following paragraphs confirm whether or not the findings change the previously submitted assessment.

8) The June 2021 ES description of the breeding bird baseline stated:

A review of habitats found that the section of the river that the proposals cross and run alongside does not contain suitable banks for nesting kingfisher or sand martin, nor do they contain suitable shingle banks for nesting waders such as common sandpiper, little ringed plover and ringed plover. Adjacent fields are enclosed by hedges and trees and contain improved grassland, sub-optimal for wader species such as curlew.

The grassland within or near to the site could potentially support small numbers of breeding oystercatcher. A range of common passerine species are likely to nest within the trees and hedgerows present, including SPI and BoCC species such as dunnock, house sparrow, song thrush and tree sparrow

- 9) This description remains largely correct following the 2021 breeding bird survey, however common sandpiper, curlew and oystercatcher have all been classed as 'possible' breeders within 100m of the site. It is likely that each of these species nested further than 100m from the site but used this area for feeding.
- 10) The June 2021 ES valued the breeding bird community at the Ribble Crossing at the Local level stating:

Due to the low suitability of the habitats present there are unlikely to be significant numbers of ground nesting species such as lapwing, oystercatcher or skylark present within the site. The trees and hedgerows are likely to support a range of nesting passerine species, including SPI and BoCC species, however it is highly unlikely that these would be present in numbers notable at County level.

- 11) This valuation remains correct. The survey recorded 43no. species, with 35 confirmed, probable or possible breeders (County level threshold is 49no. confirmed, probable or possible breeding species). Five BoCC species were confirmed to breed within 100m and nine BoCC species were possible breeders within 100m.
- 12) The June 2021 ES identified the following pre mitigation effects on breeding birds:

Feature	Value	Description of Effects	Significance of effect
Breeding birds	Local	Local It is likely that small numbers of common bird species nest within Sinther scattered trees, scrub and short sections of hedgerow within the site, and it is possible that a pair of oystercatcher may nest within open grassland within the site. Vegetation clearance could result in disturbance of nests and while the destruction of active nests would be avoided through embedded mitigation the clearance works would result in the loss of some potential nesting habitat, although this is not extensive in the context of the wider landscape (reversible with intervention). Reducing to Not significant in the long term following reinstatement.	Significant Adverse Less than local Reducing to Not significant
		Species nesting in retained habitats offsite, or utilising habitats within or surrounding the compounds to support nesting, may be subject to disturbance from noise, visual or vibration effects, resulting in possible localised displacement. Reversible (with intervention). Disturbance events may result in needless expenditure of energy and may expose species to increased risk of predation, resulting in increased mortality of individuals. Although the extent and	Significant Adverse Less than local

Table 1: June 2021 ES Breeding Bird Assessment of Effects Extract



Feature	Value	Description of Effects	Significance of effect
		duration of disturbance is not significant. Irreversible (loss of individuals).	
		Small additional loss of improved grassland habitat (along the road route) during the construction phase, although some improved grassland will be reinstated (at the construction compounds) on completion of this phase (effects not significant). Disturbance / displacement effects commenced during the enabling phase will continue.	Significant Adverse Less than local

- 13) The only change required is that the description "*it is possible that a pair of oystercatcher may nest within open grassland within the site*" should now read "*it is possible that a pair of oystercatcher and curlew nest within open grassland within 100m of the site*". The significance of effects are unchanged by this minor update.
- 14) The description of mitigation requirements stated in the June 2021 ES are unchanged by the breeding bird survey. Similarly, the assessment of residual effects in the June 2021 ES are also unchanged by the breeding bird survey. The survey findings confirm the conclusions made in the original assessment that residual effects on the breeding bird community associated with the Proposed Ribble Crossing are Not Significant.

Otter Survey

- 15) Since the June 2021 submission a repeat otter survey of the Proposed Ribble Crossing has been undertaken to add to the information obtained during the initial survey. An assessment of likely impacts on otter was made in the June 2021submission where features with potential to be used by otter for shelter were identified along the banks of the Ribble River in the vicinity of the proposed bridge crossing. Otters are a highly mobile species and the additional otter survey (report provided within Annex 1 of this SEI Appendix B6) builds upon the findings of the previous survey.
- 16) As with the original survey, the repeat otter survey confirmed the presence of otter activity (prints and spraints) along with multiple features amongst tree roots along the riverbank with potential to be used by otter for shelter. The location of otter signs and potential holts are shown on Figure 1 in Appendix D of Annex 2. In addition, one location had evidence of activity and therefore is classed as a confirmed holt. This is located under the roots of a twin stemmed mature sycamore tree T68, on the riverbank approximately 15 m northeast of the proposed Ribble Crossing location. T68 will be retained as will the other trees identified as providing features with potential to be used by otter. One potential holt location is beneath the proposed bridge alignment, however, this a tree stump and is over sailed by the bridge.
- 17) The Ribble crossing location has been selected following a review of the potential options taking into account geography of the land/river, routes for traffic, engineering, flood risk, and environmental considerations. Further information on the choice of crossing location can be found in the planning application and associated documents including the Environmental Statement.
- 18) The location of the potential and confirmed holts is already subject to some degree of disturbance with an existing road bridge adjacent to the northern edge of the red line boundary and a well-used footpath running along the river immediately adjacent to them (it was noted that dog prints were abundant in the sand of the riverbank during site visits). The potential for disturbance from construction activity will be reduced by the need to minimise activities within the floodplain and will be limited to construction and removal of the bridge. Operation of the temporary bridge is unlikely to have significant disturbing effects and the open span construction (which allows the footpath along the riverbank to remain in place except for a temporary diversion during construction) will ensure otters can move along the riverbank and are not forced to come inland and cross the haul road. This confirms the findings of the previous survey undertaken in February 2021 (presented in Appendix B) and the mitigation and licencing requirements identified in the Environmental Statement Chapter 9B.



- 19) Although there is potential for disturbance to an otter resting place the proposed crossing place has been chosen and designed to reduce the potential for impacts to the habitats and aquatic communities in the River Ribble, maintain connectivity along the river, minimise flood risk, and minimise impacts on local residents. Thereby reducing the potential for impacts to the otters supporting habitat and reducing the overall impact to otters within the catchment.
- 20) Due to the delay between the application and the proposed commencement of works at the site it is not possible to fully confirm if a licence would be required for the works. As identified in the Environmental Statement (ES) Chapter 9B otters are highly mobile and utilise a range of resting places and holts across their home range. Therefore, it is not known if the potential holts and confirmed holt identified will be present (could be naturally altered during high flow) or in use when the enabling works start, additionally new otter holts may be present and need accounting for. For this reason the June 2021 ES proposed additional pre commencement monitoring work to support a licence application if required. The survey findings do not change the valuation of the otter population nor the otter impact assessment made in the June 2021 ES. Potential mitigation requirements to reduce disturbance to otter are still relevant and deliverable within the planning boundary and therefore the conclusions made in the original assessment remain valid.

1.4 Clarification on Bat Roost Potential Trees

21) A query was raised in the consultation response regarding potentially conflicting statements, Table 2 clarifies the position and confirm the statements are not in conflict.

Extract	Clarification
Vol 6 Chapter 9A, Table 9A.7	This is true, within the proposed footprint of the
"There are no trees with high, moderate or low bat	haul road there are no trees with bat potential.
roost suitability present within the construction route	There are trees with bat potential within the red
for the temporary haul road".	line boundary however.
Vol 6 Chapter 9A, Table 9A.4	This is referring to trees within the red line
"Several trees with bat roosting potential are present	boundary for the Ribble Crossing (i.e. not just
within the Proposed Ribble Crossing"	within the proposed route of the haul road).
Vol 6 Chapter 9A, Section 9.7.4 Para 76 "Suitable bat roost habitat features have been identified in numerous trees within and adjacent to the proposed Ribble crossing, some of which would require removal during the enabling and construction works phases".	This is referring to trees within the red line boundary for the Ribble Crossing (i.e. not just within the proposed route of the haul road). This time it is referring to the red line boundary and 20m buffer.
Vol 6 Appendix 9A.3: Bats, Section 3.1 Para 8	This is referring to trees within the red line
"Mature Trees are peppered across the site with	boundary for the Ribble Crossing (i.e. not just
various levels of suitability for roosting bats".	within the proposed route of the haul road).

Table 2: Clarification on Bat Text Within the June 2021 ES



Haweswater Aqueduct Resilience Programme -Proposed Marl Hill Section Supplementary Environmental Information

Appendix B6: Annex 1

Ribble Crossing – Breeding Bird Survey 2021 Report

January 2022







Haweswater Aqueduct Resilience Programme - Proposed Bowland Section

Project No:	B27070CT
Document Title:	Proposed Bowland Section Supplementary Environmental Information (SEI) Appendix B6 Annex 1: Ribble Crossing – Breeding Bird Survey 2021 Report
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Date:	January 2022
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Appendix A. Bowland Ecology Breeding Bird Report



1. Birds Technical Appendix

1.1 Introduction

- TEP was appointed by United Utilities to complete an Ecological Impact Assessment (EcIA) for the Haweswater Aqueduct Resilience Programme - Proposed Bowland Section. The EcIA is required to inform an Environmental Impact Assessment (EIA) and support production of the Environmental Statement (ES).
- 2) A series of ecological surveys was undertaken to complete the EcIA. This Appendix is one of a series of Ecological Technical Reports (ETRs) produced to support the EcIA. This ETR documents the methods and findings of the Breeding Bird and Wintering Bird surveys undertaken by Bowland Ecology.

1.2 Summary of Findings

1.2.1 Breeding Birds

- 3) The breeding bird survey was carried out between April and June 2021 using a transect survey method. A wider area was surveyed than will be potentially impacted by the proposed works at the Ribble Crossing. Consequently only parts of the overall area surveyed by Bowland Ecology and presented within the following Technical Appendix will be used to inform the breeding bird assessment within the EcIA.
- 4) Within 100m of the proposed Ribble Crossing access route, a total of 43 no. species were recorded during surveys, with 35 species recorded as confirmed, probable or possible nesting species in this area. Sixteen of these are BoCC, including black-headed gull (Amber), common sandpiper (Amber), curlew (SPI, Red), dunnock (SPI, Amber), grey wagtail (Amber), house sparrow (SPI, Red), lesser black-backed gull (Amber), mallard (Amber), oystercatcher (Amber), song thrush (SPI, Red), starling (SPI, Red), stock dove (Amber), swift (Amber), tawny owl (Amber), tree sparrow (SPI, Red) and willow warbler (amber). Of these 5 no. species were confirmed or probable breeders within the compound and buffer (dunnock, song thrush, swallow, tree sparrow and willow warbler) and 9 no. were possible breeders (common sandpiper, curlew, grey wagtail, house sparrow, mallard, oystercatcher, starling, stock dove and tawny owl).

Ribble Crossing – Breeding Birds				
Species	Conservation Status	Likely Breeding Status		
		Site	Site + 100 m buffer	
Blackbird		Ро	C (1) Pr (4)	
Blackcap		Ро	Ро	
Black-headed gull	BAm	N	Ν	
Blue tit		Ро	Pr (1)	
Canada goose		N	Ν	
Carrion crow		Ро	C (4)	
Chaffinch		Ро	Pr (3)	

Table 1. Breeding birds recorded at the Ribble Crossing Area



Ribble Crossing – Breeding Birds					
Species	Conservation Status	Likely Breeding Status			
		Site	Site + 100 m buffer		
Chiffchaff		Po	Ро		
Common sandpiper	BAm	Po	Ро		
Curlew	S41 BRd	Po	Ро		
Dunnock	S41 BAm	Po	Pr (3)		
Goldcrest		Po	Ро		
Goldfinch		Ро	Pr (3)		
Goosander		N	Ро		
Great spotted woodpecker		Po	Ро		
Great tit		Ро	Pr (2)		
Greenfinch		Po	Ро		
Grey wagtail	BRd	Po	Ро		
Greylag goose	WCA1*	N	Ν		
House martin		N	Ν		
House sparrow	S41 BRd	N	Ро		
Jackdaw		N	Ро		
Kestrel		N	Ν		
Lesser black-backed gull	BAm	N	Ν		
Long-tailed tit		Ро	C (1)		
Magpie		Po	Ро		
Mallard	BAm	Ро	Ро		
Nuthatch		Ро	Ро		
Oystercatcher	BAm	Ро	Ро		
Pheasant		Po	Ро		
Pied wagtail		Ро	Ро		
Robin		Po	Pr (3)		
Siskin		N	Ν		
Song thrush	S41 BRd	Po	Pr (1)		



Ribble Crossing – Breeding Birds					
Species	Conservation Status	Likely Breeding Status			
		Site	Site + 100 m buffer		
Starling	S41 BRd	Ν	Ро		
Stock dove	BAm	Ν	Ро		
Swallow		N	Pr (1 col)		
Swift	BAm	N	N		
Tawny owl	BAm	N	Ро		
Tree sparrow	S41 BRd	Ро	C (2)		
Willow warbler	BAm	Ро	Pr (2)		
Woodpigeon		Ро	Pr (4)		
Wren		Ро	Pr (7)		

C = confirmed breeding, Pr = Probable breeding, Po = Possible breeding, N = Not breeding

*This species is only protected under Part 2 of the WCA1981 in certain parts of Scotland



Appendix A. Bowland Ecology Breeding Bird Report





1 Project Details				
Project Name:	Haweswater Aqueduct Resilience Programme	Project Number:	80061155	
Written:	Mark Breaks, Ecologist	Approved:	Alice Helyar, Principal	
	Eve Loxham, <i>Ecologist</i>		Ecologist	
Report reference:	Ribble Crossing Breeding Bird Survey Report 2021	Date:	14/07/2021	
2 Project Drawings				
Ribble Crossing Birc	l Survey Plans – April 2021	Sheet 1 of 1		
Ribble Crossing Birc	l Survey Plans – May 2021	Sheet 1 of 1		
Ribble Crossing Birc	l Survey Plans – June 2021	Sheet 1 of 1		
3 Ecology Surveys				
Surveyors:	Mark Breaks BSc (Hons)			
Survey Visits:	Visit 1: Date 27/04/2021 Start time 07:10 End time	09:20		
	Visit 2: Date 11/05/2021 Start time 07:00 End time	09:40		
Survey Method:	Survey Method: A modified breeding bird survey was conducted in line with the specifications detailed by the British Trust for Ornithology (Gilbert <i>et al.</i> 1998). This methodology follows that stated by Gilbert for the Breeding Bird Survey (BBS) where a transect is walked encompassing the whole ecological survey area. The survey frequency comprised three visits throughout the breeding season. Mapping methodology comprised plotting the identity and activity of birds recorded within the survey area as the Common Bird Census (CBC) approach defined in Gilbert <i>et al.</i> (1998). The surveys were undertaken under appropriate weather conditions (avoiding heavy rain or strong wind). During the surveys, all birds showing signs of 'confirmed' or 'probable' breeding within the site boundary are mapped showing their location along with 'possible' breeders and other birds that showed no signs of breeding being recorded. The survey area at the time of scoping comprised one transect that covered the entire site within the development envelope			
Weather Conditions:	Visit 1: 8/8 cloud, F1 westerly wind, light rain, approximately 8°C. Visit 2: 1-3/8 cloud, F1-2 southerly wind, dry, approximately 7°C. Visit 3: 8/8 cloud, F2 south westerly wind, drizzle, approximately 14°C.			
Limitations to the survey:	itations to the Ecological surveys are limited by factors that affect the presence of birds, such as the time of year and weather conditions. Therefore, the list of species that may potentially use the site may not be complete, though the survey provides a good indication of the species present and a confident way of identifying the value of the area for birds.			
4 Existing data				
No historic bird reco	ords were available at the time of writing this report.			

5 Habitat Description



Farmland comprising improved and semi-improved grassland, river, small watercourses, hedgerows, scattered trees/scrub and woodland.

Ribble Crossing Breeding Bird Survey Report_2021





6 Breeding bird survey results – number of territories (number of individuals)							
Species	Visit 1	Visit 2	Visit 3	Cons. status	Breeding status		
blackbird (B.)	18	10	7	None	С		
blackcap (BC)	4	3	2	None	Pr		
black-headed gull (BH)	(5 birds)		(3 birds)	А	N		
blue tit (BT)	6	5	3	None	С		
bullfinch (BF)			1	S41, A	Ро		
Canada goose (CG)	(11 birds)	(8 birds)	(6 birds)	None	N		
carrion crow (C.)	3 nests (23 birds)	4 nests (15 birds)	(12 birds)	None	С		
chaffinch (CH)	9	9	7	None	Pr		
chiffchaff (CC)	2	1		None	Pr		
collared dove (CD)			1	None	Ро		
common sandpiper (CS)	1			А	Ро		
curlew (CU)	1 (5 birds)		2 (4 birds)	S41, R	С		
dunnock (D.)	7	6	1	S41, A	Pr		
goldcrest (GC)		1		None	Ро		
goldfinch (GO)	9	7	5	None	Pr		
goosander (GD)	(1 bird)	(3 birds)	(1 bird)	None	Ро		
great spotted woodpecker (GS)		1		None	Ро		
great tit (GT)	3	2	3	None	С		
greenfinch (GR)		2		None	Ро		
grey heron (H.)	(1 bird)	(1 bird)	(1 bird)	None	N		
grey wagtail (GL)	1	1	1	R	Pr		
greylag goose (GJ)	(8 birds)			А	N		
herring gull (HG)	(2 birds)			S41, R	N		
house martin (HM)	(3 birds)		(3 birds)	А	N		
house sparrow (HS)	3	2	6	S41, R	Pr		
jackdaw (JD)	2	2 (6 birds)	2	None	Pr		
kestrel (K.)		1		А	Ро		
lapwing (L.)	1	1		S41, R	С		
lesser black-backed gull (LB)	(44 birds)	(3 birds)	(4 birds)	А	N		
long-tailed tit (LT)	2	2	2	None	С		
magpie (MG)	2	2	1	None	Pr		
mallard (MA)	(11 birds)	(5 birds)	(9 birds)	А	Ро		
moorhen (MH)	1			None	Ро		
Species	Visit 1	Visit 2	Visit 3	Cons. status	Breeding status		
nuthatch (NH)	2	1	1	None	Pr		
oystercatcher (OC)	1 (3 birds)	1	(10 birds)	Α	Ро		
pheasant (PH)	1	1		None	Ро		
pied wagtail (PW)	4		1	None	Ро		
reed bunting (RB)	1		1	S41, A	Ро		
robin (R.)	11	11	7	None	Pr		
sand martin (SM)	8 nests	8 nests	(6 birds)	None	С		
siskin (SK)	(1 bird)			None	N		





song thrush (ST)	1	6	5	S41, R	Pr
starling (SG)	1 (13 birds)	(8 birds)	(10 birds)	S41, R	C
stock dove (SD)	1	2	1	А	Pr
swallow (SL)	3	2	3	None	Pr
swift (SI)		(2 birds)	(2 birds)	А	N
tawny owl (TO)		1		А	Ро
tree sparrow (TS)	2	2	1	S41, R	С
willow warbler (WW)	5	3	3	А	Pr
wood pigeon (WP)	6 (16 birds)	1 (29 birds)	3 (17 birds)	None	C
wren (WR)	18	19	14	None	Pr

Key: C = Confirmed; Pr = Probable; Po = Possible; N = Not; R = Red List; A = Amber List;

Sch 1 = Schedule 1; S41 = NERC Act conservation priority species; Cons. = Conservation

7 Summary

A total of 51 bird species were recorded using the survey area:

- 11 species were confirmed breeding as follows: blackbird, blue tit, carrion crow, curlew (S41, Red listed), great tit, lapwing (S41, Red listed), long-tailed tit, sand martin, starling (S41, Red listed), tree sparrow (S41, Red listed) and wood pigeon;
- 16 species were identified to be probable breeding on site including: blackcap, chaffinch, chiffchaff, dunnock (S41, Amber listed), goldfinch, grey wagtail (Red listed), house sparrow (S41, Red listed), jackdaw, magpie, nuthatch, robin, song thrush (S41, Red listed), stock dove (Amber listed), swallow, willow warbler (Amber listed) and wren:
- 15 species were recorded as possible breeders on site including: bullfinch (S41, Amber listed), collared dove, common sandpiper (Amber listed), goldcrest, goosander, great spotted woodpecker, greenfinch, kestrel (Amber listed), mallard (Amber listed), moorhen, oystercatcher (Amber listed), pheasant, pied wagtail, reed bunting (S41, Amber listed) and tawny owl (Amber listed); and
- Nine species were sighted using the survey area, however, they were considered to be non-breeding, including, herring gull (S41, Red listed) and the following Amber listed species, black-headed gull, greylag goose, house martin, lesser black-backed gull and swift were recorded using the habitat for foraging.

8 Evaluation

Fuller (1980) devised a method of classifying the ornithological interest of sites for conservation based on three site attributes: population size, rarity and diversity. These criteria were followed in the evaluation of the results.

The total number of confirmed, probable and possible breeding bird species recorded within a site also indicates its significance. Table 1 includes the breeding diversity criteria devised by Fuller (1980).

Table 1: Significance of the total number of breeding species recorded at a site

Local	County	Regional	National
25-49	50-69	70-84	85+

No significant breeding bird concentrations (i.e. 1% or more of the national breeding population) or nationally rare breeding bird species (i.e. between 1 and 1,000 breeding pairs; Musgrove et al., 2013) were recorded during the survey.

Based on Fuller's criteria, the 42 confirmed, probable and possible breeding bird species recorded within the survey area indicates that it is of local significance for breeding birds. Weight is added to this evaluation by the presence of seven species of high (Red listed) conservation concern and ten species of medium (Amber listed) conservation concern within the site. This site and surrounding area has great importance with confirmed presence of two breeding pairs of curlew and one breeding pair of lapwing, which are S41 priority species (NERC Act, 2006) and Red listed conservation concern





Species. These species nest in open grassland areas in the western half of the site. In addition, two breeding pair of tree sparrow and a minimum of one breeding pair of starling that inhabit areas of broad-leaved trees/hedgerows and farm buildings were also recorded; these species are S41 priority species (NERC Act, 2006) and Red listed conservation concern species. In addition, up to six probable breeding pairs of both house sparrow and song thrush (S41 priority species and Red listed conservation concern species) were recorded.

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Species listed under section 41 (England) of the NERC Act (2006) https://webarchive.nationalarchives.gov.uk/20140605093420tf_/http://www.naturalengland.org.uk/ourwork/conservat ion/biodiversity/protectandmanage/habsandspeciesimportance.aspx

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	С	A bird in song						
	*	A nest occupied	with eggs/brood					
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- 6	CG	Canada goose	-	Lesser black-	SM	Sand martin		
	СН	Chaffinch	LD	backed gull	ST	Song thrush		
1	CS	Common sandpiper	LT	Long-tailed tit	TS	Tree sparrow		
Ó	CU	Curlew	MG	Magpie	WR	Wren		

MH Moorhen

NH Nuthatch

PH Pheasant

OC Oystercatcher

WW Willow warbler



Q

D

B

Dunnock

GJ Greylag goose

GL Grey wagtail

GD Goosander



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ma	A bird carrying nesting material					
C	A bird in song					
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BH	Black-headed LT Long-tailed tit					
вт	Blue tit MG Magpie					
C	Carrion crow NH Nuthatch					
CH	Chaffinch PW Pied wagtail					
CU	Curlew R Robin					
D GD	Dunnock SD Stock dove Goosander SG Starling					
GL	Grey wagtail SI Swift					
GO GT	Goldfinch SL Swallow Great tit SM Sand martin					
H	Grey heron ST Song thrush					
HM HS	House martin TS Tree sparrow					
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Water for the North West

UNITED UTILITIES WATER LIMITED HAWESWATER AQUEDUCT RESILIENCE PROGRAMME BREEDING BIRD SURVEY - VISIT 3 - JUNE 2021 RIBBLE CROSSING

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Creating a world fit for the future



Haweswater Aqueduct Resilience Programme -Proposed Bowland Section Supplementary Environmental Information

Appendix B6: Annex 2

Ribble Crossing – Post Submission Aquatic Ecology Surveys

January 2022







Haweswater Aqueduct Resilience Programme - Proposed Bowland Section

Project No:	B27070CT
Document Title:	Proposed Bowland Section Supplementary Environmental Information (SEI)
	Appendix B6 Annex 2: Ribble Crossing – Post Submission Aquatic Ecology Surveys
Document ID:	LCC_RVBC-BO_SEI-Appendix B6 Annex 2
Revision:	0
Date:	January 2022
Client Name:	United Utilities
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Manchester, M15 6GZ	
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Document history and status

Revision	Date	Description	Author	Checked	Reviewed	Approved



Post Submission Aquatic Ecology Surveys - Review of Implications for Impact Assessment

A number of aquatic ecology surveys were undertaken in September 2021 and December 2021 in order to complete the baseline surveys required for the Haweswater Aqueduct Resilience Programme. These surveys were not able to be completed prior to the submission of the planning application due to seasonal constraints. The survey reports are provided in **Appendix A** (Aquatic Walkover Results), **Appendix B** (Otter and Water Vole Surveys), **Appendix C** (White clawed Crayfish Surveys), and **Appendix D** (River Ribble Otter Survey Update).

The following table presents a review by Ricardo Energy and Environment of the potential implications on the conclusions within Chapter 9B Aquatic Ecology of the Haweswater Aqueduct Resilience Programme – Proposed Ribble Crossing Environmental Statement, which was submitted in June 2021.

Watercourse	Relevant	Environmental Statement Baseline	Additional	Summary of Findings	Implications
	Scheme	(Importance of Aquatic Receptors)	Surveys		for
	Component		Completed		Assessment
Greg Sike	Ribble Crossing	Macrophytes – Local	White clawed	No evidence of white-clawed crayfish was	None
(W2321)	- Temporary	Fish - Local	crayfish survey	identified during the stone turning survey.	
	road crossing,	Macro-invertebrates – Local		The watercourse has potential to support	
	within 5 m of	White clawed crayfish -Local		white-clawed crayfish. Suitable refuges which	
	temporary	Otter – Intermediate		could provide habitat for crayfish (e.g.	
	road at several	Water vole – Not applicable (not		boulders and undercut banks) were observed	
	locations,	present)		in low abundance.	
	within 10 m of			The survey findings have not led to any	
	two			changes to the assigned importance of	
	construction			aquatic receptors within the watercourse.	
	laydown areas				
River Ribble	Ribble Crossing	Macrophytes – River Basin District	White clawed	No evidence of white-clawed crayfish was	None
(W2325)	- Temporary	Fish - River Basin District	crayfish survey	identified during the stone turning survey.	
	road crossing,	Macro-invertebrates – River Basin	Otter	The watercourse has potential to support	
	within 10 m of	District		white-clawed crayfish. Suitable refuges which	
	two	White clawed crayfish -Local		could provide habitat for crayfish (e.g.	
	construction	Otter – Local		boulders) were observed.	
	laydown areas.	Water vole – Not applicable (not			
	Receiving	present)			

In summary, no changes to the submitted assessment have been identified.



Implications

Scheme	(Importance of Aquatic Receptors)	Surveys		for
Component		Completed		Assessment
discharge from			Evidence of otter identified including a holt,	
emporary			multiple prints, and spraints throughout the	
oads, through			surveyed reach of the River Ribble adjacent to	
our outfalls			the Ribble Crossing. The location of otter signs	
			and hots and potential holts are shown on	
			Figure 1 in Appendix D. There were multiple	
			potential holt locations under tree roots	
			adjacent to the compound area and proposed	
			bridge location including one with confirmed	
			activity. The otter holt with evidence of	
			activity was identified under the roots of two	
			joined mature sycamore trees on the	
			riverbank approximately 15 m north east of	
			the proposed Ribble Crossing location.	
			Evidence of otter activity was recorded	
			regularly along the surveyed reach of the	
			River Ribble (500m downstream form the	
			existing West Bradford road bridge). This	
			confirms the findings of the previous survey	
			undertaken in February 2021 (presented in	
			Appendix B) and the mitigation and licencing	

Additional

Summary of Findings

requirements identified in the Environmental

The survey findings have not led to any changes to the assigned importance of aquatic receptors within the watercourse.

Statement Chapter 9B.

Watercourse

Relevant

Environmental Statement Baseline



	RICARDO
ngs	Implications for
	Assessment

Watercourse	Relevant	Environmental Statement Baseline	Additional	Summary of Findings	Implications
	Scheme	(Importance of Aquatic Receptors)	Surveys		for
	Component		Completed		Assessment
Unnamed	Ribble Crossing	Macrophytes – Local	Aquatic habitat	The majority of the watercourse way dry	None
Watercourse	- Temporary	Fish - Local	walkover, white	during the walkover survey with occasional	
2097	road crossing.	Macro-invertebrates – Local	clawed crayfish	areas with no perceptible flow. This indicates	
(W2348)		White clawed crayfish - Local	survey and otter	the watercourse dries periodically but the	
		Otter – Immediate site Water vole – Not applicable (not present)	survey	 drying frequency is not known. One potential obstacle to fish passage was recorded in the surveyed reach which along with temporary drying limits the suitability for migratory fish species. No evidence of white-clawed crayfish was identified during the stone turning survey. This watercourse is not considered to provide suitable habitat for crayfish. No holts or resting places identified. Limited suitable habitat for holts and resting places. The survey findings have not led to any 	
				changes to the assigned importance of	
				aquatic receptors within the watercourse.	



Appendix A : Watercourse walkover survey results



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	Salmonid habitat										
	Dry										
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## Table 1: Habitat classifications and abbreviations

	Flow Type		Depth		Velocity		Substrate		Notable/species specific habitat		Macrophyte (% cover)		
GL	Glide	А	0.05 - 0.1 m	0	0.01 - 0.05 m/s	BE	Bedrock	Pr	Salmonid parr habitat	SFL	Submerged fine-leaved	Obstruction	
R	Run	В	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	С	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		
Р	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	Е	> 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)		



Other features

Potential obstacle/obstruction to fish passage

## Table 2: HARP Marl Hill (TR4) walkover data

Target Note	Flow Type	Water depth	Water velocity	Dominant substrate	Vegetation type and % coverage	Habitat type
1	Riffle	A	2	BO/CO/GR		
2	Glide	В	2	BO/CO/GR	FL 40%	
3	Riffle	A	3	BO/CO/GR		
4	Pool	С	1	BO/CO/GR		
5	Pool	С	1	BO/CO/GR		
6	Riffle	A	3	BO/CO/GR		
7	Pool	D	1	BO/CO/GR		
8	Run	В	3	BO/CO/GR	FL 10%	
9	Riffle	A	3	BO/CO/GR		
10	Glide	В	2	BO/CO/GR	FL 10%	
11	Pool	С	1	BO/CO/GR		
12	Riffle	A	3	BO/CO/GR	FL 10%	
13	Run	В	2	BO/CO/GR	FL 30%	
14	Riffle	A	3	BO/CO/GR	FL 5%	
15	Riffle	A	3	BO/CO/GR	FL 10%	
16	Pool	С	1	BO/CO/GR	FL 40%	
17	Riffle	В	3	BO/CO/GR		
18	Riffle	A	3	BO/CO/GR		
19	Riffle	A	3	BO/CO/GR	FL 10%	
20	Glide	В	1	CO/BO/BE	FL 10%	
21	Riffle	A	2	BO/CO/GR	FL 10%	
22	Run	В	2	BO/CO/GR	FL 10%	
23	Riffle	A	3	BO/CO/GR		
24	Run	В	2	BO/CO/GR	FL 10%	
25	Riffle	A	3	BO/CO/GR		
26	Pool	С	1	BO/CO/GR	FL 10%	
27	Pool	С	1	BO/CO/GR	FL 10%	
28	Riffle	Α	3	BO/CO/GR	FL 10%	
29	Pool	D	1	BO/CO/GR	FL 20%	
30	Riffle	Α	3	BO/CO/GR	FL 20%	
31	Run	В	2	BO/CO/GR	FL 20%	
32	Riffle	A	3	BO/CO/GR	FL 10%	
33	Glide	В	2	CO/BO/BE	FL 40%	
34	Run	В	2	BO/CO/GR		
35	Riffle	A	2	BO/CO/GR	FL 10%	
36	Pool	С	1	BO/CO/GR		
37	Potential obstacle/obstruction to fish passage					
38	Riffle	Α	2	BO/CO/GR	FL 10%	
39	Run	В	2	BO/CO/GR		
40	Riffle	Α	2	BO/CO/GR	FL 10%	
41	Glide	В	1	BO/CO/GR		
42	Potential obstacle/obstruction to fish passage					
43	Pool	С	1	BO/CO/GR		
44	Glide	В	2	BO/CO/GR	FL 10%	
45	Riffle	A	2	BO/CO/GR		
46	Glide	В	2	BO/CO/GR		
47	Run	A	2	BO/CO/GR		
48	Riffle	A	2	BO/CO/GR		
49	Glide	В	2	BO/CO/GR		



Target Note	Flow Type	Water depth	Water velocity	Dominant substrate	Vegetation type and % coverage	Habitat type
50	Run	В	2	BO/CO/GR		
51	Riffle	A	2	BO/CO/GR		
52	Run	В	2	BO/CO/GR	FL 10%	
53	Riffle	A	2	BO/CO/GR		
54	Pool	С	1	BO/CO/GR	FL 10%	
55	Riffle	A	2	BO/CO/GR		
56	Glide	В	2	BO/CO/GR		
57	Riffle	Α	2	BO/CO/GR		
58	Run	B	2	BO/CO/GR		
59	Run	B	2	BO/CO/GR		
60	Riffle	A	2	BO/CO/GR		
61	Glide	B	2	BO/CO/GR		
62	Run	B	2	BO/CO/GR		
63	Glide	В	2	BO/CO/GR		
64	Run	B	2	BO/CO/GR		
65	Pool	B	1	BO/CO/GR	FL 10%	
66	No perceptible flow	A	0	BO/CO/GR	FL 20%	
67	No perceptible flow	A	0	GR/CO/SI	122070	
68	No perceptible flow	A	0	GR/CO/SI		
69	Potential obstacle/obstruction to fish passage					
70	No perceptible flow	Α	0	SA/SI/GR		
71	Pool	B	1	SA/SI/GR		
72	Potential obstacle/obstruction to fish passage					
73	Pool	B	1	GR/CO/SI		
70	No perceptible flow	Δ	0	GR/CO/SI		
75	Run	Δ	1	SI/BO/CO		
76	No perceptible flow	Α	0	GR/CO/SI		
77	Pool	B	0	SI		
78	Pool	B	0	<u>si</u>		
79	Pool	B	0	SI/BO/CO		
80	No perceptible flow	Δ	0	SI/BO/CO		
81	Pool	B	1	SI/BO/CO		
82	Pool	B	1	SI/BO/CO		
83	Potential obstacle/obstruction to fish passage					
84	Pool	C	0	BO/CO/GR		
85	No perceptible flow	Δ	0	BO/CO/GR		
86	Run	Δ	1	BO/CO/GR		
87	Riffle	Δ	2	SA/BO/CO		
88	Glide	B	1	SA/BO/CO		
89	Bun	Δ	2	SA/BO/CO		
90	Riffle	Δ	2	SA/BO/CO		
91	Run	Δ	2	SA/BO/CO		
92	Pool	C.	0	SA/BO/CO		
03	Potential obstacle/obstruction to fish passage			0,400,000		
94	Run	R	2	SI/BO/CO		
95	Pool	<u> </u>	1	SA/RO/CR		
96	Cascade	Δ	2	BO/CO		
97	Run	R	2	BO/CO/GR		
97	Pool	<u> </u>	1	SA/RO/CO		
90	Run	R	2	SA/BO/CO		
55			L 2			



Target Note	Flow Type	Water depth	Water velocity	Dominant substrate	Vegetation type and % coverage	Habitat type
100	Glide	В	1	SA/BO/CO		
101	Run	A	2	BO/CO/GR		
102	Potential obstacle/obstruction to fish passage					
103	Pool	С	1	BO/CO/GR		
104	Run	A	2	BO/CO/GR		
105	Glide	В	1	BO/CO/GR		
106	Riffle	A	2	SA/BO/CO		
107	Run	В	2	BO/CO/GR		
108	Riffle	A	2	SA/BO/CO		
109	Potential obstacle/obstruction to fish passage					
110	Pool	С	1	SA/BO/CO		
111	Riffle	A	2	BO/CO/GR		
112	Glide	В	1	BO/CO/GR		
113	Cascade	A	1	BO/CO		
114	Cascade	A	1	BO/CO		
115	Riffle	A	2	BO/CO/GR		
116	Pool	С	1	SA/BO/CO		
117	Cascade	A	1	BO/CO		
118	No perceptible flow	A	0	BO/CO/GR		
119	No perceptible flow	A	0	BO/CO/GR		
120	Potential obstacle/obstruction to fish passage					
121	Pool	С	1	SI		
122	Pool	В	1	CL/CO		
123	No perceptible flow	A	0	BO/CO/GR		
124	Pool	A	0	BO/CO/GR		
125	Cascade	A	2	BO/CO		
126	No perceptible flow	A	0	BO/CO/GR		
127	Pool	A	1	BO/CO/GR		
128	Pool	В	1	BO/CO/GR		
129	Pool	A	1	BO/CO/GR		
130	Pool	A	1	BO/CO/GR		
131	Pool	С	1	BO/CO/GR		
132	Pool	С	1	BO/CO/GR		
133	Potential obstacle/obstruction to fish passage					
134	No perceptible flow	В	0	BO/CO/GR		
135	Waterfall	A	2	BO/CO		
136	Pool	В	0	BO/CO/GR		
137	No perceptible flow	A	0	BO/CO/GR		
138	Potential obstacle/obstruction to fish passage					
139	No perceptible flow	A	0	BO/CO/GR		
140	Pool	A	0	BO/CO/GR		
141	No perceptible flow	A	0	BO/CO/GR		
142	Run	A	1	BO/CO/GR		
143	No perceptible flow	A	0	BO/CO/GR		
144	Pool	В	1	BO/CO/GR		
145	Run	A	1	BO/CO/GR		
146	Waterfall	A	2	BO/CO		
147	Pool	С	1	CL/GR/BO		
148	Potential obstacle/obstruction to fish passage					
149	Glide	В	1	BO/CO/GR		



Target Note	Flow Type	Water depth	Water velocity	Dominant substrate	Vegetation type and % coverage	Habitat type
150	Run	A	2	BO/CO/GR		
151	Pool	В	1	BO/CO/GR		
152	Potential obstacle/obstruction to fish passage					
153	Pool	В	1	BO/CO/GR		
154	Run	A	1	BO/CO/GR		
155	No perceptible flow	A	0	CL/BO/SA		
156	No perceptible flow	A	0	CL/BO/SA		
157	No perceptible flow	A	0	BO/CO/GR		
158	No perceptible flow	A	0	BO/CO/GR		
159	No perceptible flow	A	0	BO/CO/GR		
160	Pool	В	1	BO/CO		
161	Run	A	1	BO/CO/GR		
162	No perceptible flow	A	0	CL/BO		
163	Potential obstacle/obstruction to fish passage					
164	Pool	C	1	CL		
165	No perceptible flow	A	0	BO/CO/GR		
166	Run	A	1	BO/CO/GR		
167	No perceptible flow	С	0	BO/GR/SA		
168	Potential obstacle/obstruction to fish passage					
169	Glide	A	1	BO/CO/GR		
170	Run	A	1	BO/CO/GR		
171	No perceptible flow	A	0	BO/CO/GR		
172	Run	A	1	BO/CO/GR		
173	No perceptible flow	A	0	BO/CO/GR		
174	No perceptible flow	D	0	SI		
175	No perceptible flow	В	0	SI		
176	Run	В	2	SI		
177	No perceptible flow	В	0	BO/CO/GR		
178	Run	A	1	BO/CO/GR		
179	No perceptible flow	A	0	BO/CO/GR		
180	No perceptible flow	В	0	BO/CO/GR		
181	No perceptible flow	A	0	BO/CO/GR		
182	No perceptible flow	В	0	BO/CO/GR		
183	No perceptible flow	С	0	BO/CO/GR		
184	No perceptible flow	В	0	BO/CO/GR		
185	Potential obstacle/obstruction to fish passage					
186	Potential obstacle/obstruction to fish passage					
187	No perceptible flow	В	0	BO/CO/SA		
188	No perceptible flow	В	0	BO/CO/GR		
189	Potential obstacle/obstruction to fish passage					
190	No perceptible flow	В	0	BO/CO/GR		
191	No perceptible flow	В	0	BO/CO/GR		
192	No perceptible flow	В	0	BO/CO/GR		
193	No perceptible flow	В	0	BO/CO/GR		
194	No perceptible flow	В	0	BO/CO/GR		
195	No perceptible flow	С	0	BO/CO/GR		
196	No perceptible flow	В	0	BO/CO/GR		
197	Run	A	2	BO/CO/GR		
198	No perceptible flow	В	0	BO/CO/GR		
199	Run	A	1	BO/CO/GR		



Target Note	Flow Type	Water depth	Water velocity	Dominant substrate	Vegetation type and % coverage	Habitat type
200	No perceptible flow	В	0	BO/CO/GR		
201	No perceptible flow	В	0	BO/CO/GR		
202	Run	A	1	BO/CO/GR		
203	No perceptible flow	В	0	BO/CO/GR		
204	Run	A	1	BO/CO/GR		
205	No perceptible flow	В	0	BO/CO/GR		
206	No perceptible flow	В	0	BO/CO/GR		
207	No perceptible flow	В	0	BO/CO/GR		
208	Potential obstacle/obstruction to fish passage					
209	Potential obstacle/obstruction to fish passage					
210	No perceptible flow	В	0	BO/CL		
211	No perceptible flow	A	0	BO/GR/SA		
212	No perceptible flow	A	0	BO/GR/SA		
213	Pool	С	1	BO/CO/GR		
214	No perceptible flow	A	0	BO/CO/GR		
215	Run	A	1	BO/CO/GR		
216	Potential obstacle/obstruction to fish passage					
217	Pool	С	1	BO/CL		
218	Potential obstacle/obstruction to fish passage					
219	No perceptible flow	В	0	BO/CO/GR		
220	No perceptible flow	С	0	BO/CO/GR		
221	No perceptible flow	В	0	BO/CO/GR		
222	Potential obstacle/obstruction to fish passage					
223	No perceptible flow	С	0	BO/GR		
224	No perceptible flow	B	0	BO/CL		
225	No perceptible flow	С	0	BO/CL		
226	No perceptible flow	В	0	BO/CL		
227	No perceptible flow	В	0	BO/CL		
228	Run	В	2	BO/CO/GR		
229	Pool	С	1	GR/SA/BO		
230	Glide	В	1	GR/BO/SI		
231	Pool	С	1	SA/CO/BO		
232	Glide	A	1	GR/SA/BO		
233	Pool	С	1	GR/SA		
234	Potential obstacle/obstruction to fish passage					
235	Pool	С	1	GR/SA		
236	Run	A	2	GR/SA/BO		
237	Potential obstacle/obstruction to fish passage					
238	Run	В	2	BO/GR/SA		
239	Pool	В	1	SA/BO		
240	Run	В	2	BO/GR/SA		
241	Pool	В	1	SA/BO		
242	Run	В	2	BO/GR/SA		
243	Potential obstacle/obstruction to fish passage					
244	Glide	В	1	BO/GR/SA		
245	Potential obstacle/obstruction to fish passage					
246	Pool	D	1	BE/BO/SA		
247	Potential obstacle/obstruction to fish passage					
248	Glide	В	1	BE/SA		
249	Potential obstacle/obstruction to fish passage					
						· · · · · · · · · · · · · · · · · · ·


Target Note	Flow Type	Water depth	Water velocity	Dominant substrate	Vegetation type and % coverage	Habitat type
250	Glide	В	1	BO/CO/SI		
251	Run	В	2	CO/BO/GR		
252	Pool	С	1	BO/CO/SA		
253	Run	В	2	BO/CO/GR		
254	Potential obstacle/obstruction to fish passage					
255	Glide	В	1	BO/CO/GR		
256	Run	В	2	BO/CO/GR		
257	Pool	С	1	BO/CO/GR		
258	Run	В	2	BO/CO/GR		
259	Glide	C	1	GR/BO/SA		
260	Run	В	2	CO/BO/SA		
261	Potential obstacle/obstruction to fish passage					
262	Pool	С	1	BO/SA		
263	Glide	В	1	BO/SA		
264	Run	В	2	BO/GR/SA		
265	Pool	С	1	BO/SA/CO		
266	Potential obstacle/obstruction to fish passage					
267	Glide	В	1	BO/SA		
268	Run	В	2	BO/CO/SA		
269	Run	В	2	SI/CO/BO		
270	Glide	В	1	SI/CO/BO		
271	Riffle	A	2	BO/CO/GR		
272	Pool	С	1	CL/BO		
273	Pool	С	1	CL/BO		
274	Run	В	2	CL/BO/GR		
275	Glide	В	1	CL/BO/GR		
276	Cascade	A	2	BO/CO		
277	Run	В	2	GR/SI/BO		
278	Cascade	A	2	BO/CO		
279	Cascade	A	3	BO/CO		
280	Glide	В	1	BO/SI	FL 60%	
281	Cascade	A	2	BO/CO		
282	Run	В	2	CO/BO/SI		
283	Riffle	A	2	CO/BO/SI		
284	Run	В	2	BO/GR/SI		
285	Riffle	A	2	CO/BO/SI		
286	Run	A	2	CO/BO/SI		
287	Cascade	A	2	BO/CO		
288	Glide	В	1	GR/SI/BO		
289	Cascade	A	2	BO/CO		
290	Glide	В	1	GR/SI/BO		
291	Riffle	В	2	GR/SI/BO		
292	Run	В	2	CO/BO/SI		
293	Glide	В	1	GR/SI/BO		
294	Riffle	В	2	BO/CO/GR		
295	Glide	B	1	BO/CO/SI		
296	Run	B	2	BO/CO/GR		
297	Pool	C	1	BO/CO/GR		
298	Cascade	A	3	BO/CO		
299	Riffle	В	2	BO/GR/BE		



Target Note	Flow Type	Water depth	Water velocity	Dominant substrate	Vegetation type and % coverage	Habitat type
300	Run	В	2	BE		
301	Cascade	A	3	BE		
302	Glide	С	1	BO/CO/SI		
303	Run	В	2	BO/GR/SA		
304	Glide	В	1	BO/CO/SI		
305	Cascade	A	3	BO/CO		
306	Pool	C	1	BO/GR/SI		
307	Cascade	A	3	BO/CO		
308	Pool	В	1	BE/BO		
309	Run	A	2	BE		
310	No perceptible flow	A	0	BE		
311	Riffle	A	2	BE/BO/GR		
312	Potential obstacle/obstruction to fish passage					
313	Riffle	A	2	BO/CO/GR		
314	Potential obstacle/obstruction to fish passage					
315	Pool	В	1	BO/GR/CO		
316	Riffle	A	2	BO/CO/GR		
317	Glide	В	1	BO/GR/SA		
318	Riffle	A	2	BO/SA/GR		
319	Glide	В	1	BO/GR/SA		
320	Cascade	A	3	BO		
321	Run	A	2	BE/BO		
322	Cascade	A	2	BE/BO		
323	Glide	В	1	BO/GR/SA		
324	Riffle	A	2	BO/SA/GR		
325	Cascade	A	3	BO/CO		
326	Glide	В	1	BO/GR/SA		
327	Cascade	A	3	BO/CO		
328	Glide	В	1	BO/GR/SA		
329	Run	В	2	BO/GR/SA		
330	Potential obstacle/obstruction to fish passage					
331	Riffle	A	2	BO/SA/GR		
332	Cascade	A	3	BO/CO		
333	Riffle	A	2	BO/SA/GR		
334	Cascade	A	3	BO		
335	Riffle	A	2	BO/SA/GR		
336	Potential obstacle/obstruction to fish passage					
337	Riffle	A	2	BO/SA/GR		
338	Potential obstacle/obstruction to fish passage					
339	Pool	С	1	BO/SA		
340	Run	В	2	BO/GR/SA		
341	Potential obstacle/obstruction to fish passage					
342	Run	В	2	BO/GR/SA		
343	Cascade	A	2	BO		
344	Riffle	A	2	BO/SA/GR		
345	Pool	С	1	BO/SA/GR		
346	Riffle	A	2	BO/SA/GR		
347	Pool	С	1	BO/SA/GR		
348	Riffle	A	2	BO/SA/GR		
349	Glide	В	1	BO/GR/SA		



Bit         Casade         A         2         BOCO           351         Casade         A         3         BOCO           352         Potential obstact/obstaction to fish passage         A         2         BOSAGR           353         Potential obstact/obstaction to fish passage         C         BOSAGR         A           356         Ginda         B         1         BOGRAR         A           357         Rifle         A         2         BOSAGR         A           358         Ginda         B         1         BOGRAR         A           359         Rifle         A         2         BOSAGR         A           359         Rifle         A         2         BOGRAR         A           360         Run         B         2         BOGRAR         A           361         Cascade         A         3         BO         A           363         Cascade         A         3         BO         A           364         Potal         C         1         BORA         A           37         Run         B         2         BOGRAR         A           386         <	Target Note	Flow Type	Water depth	Water velocity	Dominant substrate	Vegetation type and % coverage	Habitat type
351         Cacade         A         3         BOCO           352         Pool         C         1         BOISA           353         Riffe         A         2         BOISA           354         Potental distriction to fish passage         -         -         BOISA           358         Potental distriction to fish passage         -         BOISA         -           359         Potental distriction to fish passage         -         BOISA         -           359         Riffle         A         2         BOORAGR         -           359         Riffle         A         2         BOORAGR         -           350         Riffle         A         2         BOORAGR         -           361         Cascade         A         3         BO         -           362         Pool         C         1         BOSA         -           363         Cascade         A         2         BO         -           364         Pool         C         1         BOSAGR         -           365         Grun         B         1         BOORAGR         -           370         Cascade	350	Riffle	A	2	BO/SA/GR		
BS2         Pod         C         1         BOSA           383         Federatial obstact/obstruction to fair passage         -         -         -           384         Federatial obstact/obstruction to fair passage         -         -         -           385         Grin         S         1         BOCRA         -           386         Grin         S         1         BOCRA         -           387         Grin         S         1         BOCRA         -           389         Grin         B         1         BOCRA         -           389         Grin         B         1         BOCRAS         -           380         Run         B         2         BOCRAS         -         -           381         Carcade         A         2         BOCRAS         -         -           383         Carcade         A         2         BOCRAS         -         -           386         Gride         B         1         BOCRAS         -         -           386         Gride         B         1         BOCRAS         -         -           387         Run         B	351	Cascade	Α	3	BO/CO		
B33         Rnfle         A         2         BOSACR           354         Potental obtacheobstruction to fish passage         -         -         -           366         Ocide         B         1         BOCRNSA         -           367         Oride         B         1         BOCRNSA         -           368         Oride         A         2         BOSACR         -           369         Rrifin         A         2         BOSACR         -           369         Rrifin         A         2         BOSACR         -           361         Cascade         A         3         BO         -           362         Pool         C         1         BOSA         -           364         Pool         C         1         BOSA         -           365         Run         B         1         BOSACR         -           366         Run         B         2         BOGRAS         -           371         Pool         C         1         BOSACOR         -           371         Pool         C         1         BOCCORR         -           374 <td< td=""><td>352</td><td>Pool</td><td>С</td><td>1</td><td>BO/SA</td><td></td><td></td></td<>	352	Pool	С	1	BO/SA		
354         Petertial obtaicalobatucion to fish passage	353	Riffle	A	2	BO/SA/GR		
385         Pool         C         1         BOKA           386         Glide         B         1         BOKRSA           387         Rille         A         2         BOKRSA           388         Glide         B         1         BOKRSA           389         Riffle         A         2         BOKRSA           380         Run         B         2         DOKRSA           381         Cascade         A         3         BO           382         Pool         C         1         BOKSA           383         Glide         B         2         BOKRSA           384         Cascade         A         2         BOKRSA           385         Run         B         2         BOKRSA           386         Glide         B         1         BOKRSA           386         Olide         B         1         BOKRSA           386         Olide         B         1         BOKRSA           389         Potenial abbade/babructon to fan passage	354	Potential obstacle/obstruction to fish passage					
386         Glide         B         1         BOGRSA           387         Riffe         A         2         BOSAGR           388         Glide         B         1         BOGRSA           389         Riffe         A         2         BOSAGR           380         Roman         B         2         BOGRSA           380         Calcade         A         3         BO           381         Calcade         A         3         BO           383         Calcade         A         3         BO           384         Pool         C         1         BOSA           385         Run         B         2         BOGRSA           386         Glide         B         1         BOSAGR           386         Glide         B         1         BOSAGR           387         Run         B         2         BOGRSA           388         Potentia destaclobotructon to fan passago	355	Pool	С	1	BO/SA		
367         Rifie         A         2         BOSAGR           388         Gildo         B         1         BOGRAG           389         Rifie         A         2         BOGRAG           380         Run         B         2         BOGRAG           381         Cascade         A         3         BO           382         Pool         C         1         BOSAGR           383         Cascade         A         3         BO           383         Cascade         A         2         BOGRAG           386         Pool         C         1         BOSAGR           386         Run         B         2         BOGRAG           386         Run         B         1         BOGRAG           386         Gilde         B         1         BOGRAG           389         Potential obstocobstruction to fits passage	356	Glide	В	1	BO/GR/SA		
388         Glide         B         1         BOGRSA           399         Riffle         A         2         BOSAGR           300         Run         B         2         BOGRSA           301         Cascade         A         3         BO           302         Pool         C         1         BOSA           303         Cascade         A         2         BO           304         Pool         C         1         BOSA           305         Run         B         2         BOGRSA           306         Glide         B         1         BOSAGR           306         Glide         B         1         BOSAGR           306         Glide         B         1         BOSAGR           307         Run         B         2         BOGOGR           310         Potential obstate/obstruction to fin passage	357	Riffle	A	2	BO/SA/GR		
369         Rtifle         A         2         BO/SNGR           360         Run         B         2         BO/SNA           361         Cascade         A         3         BO           362         Pool         C         1         BO/SA           363         Cascade         A         2         BO           364         Pool         C         1         BO/SA           365         Run         B         2         BO/GR/SA           366         Glide         B         1         BO/SA/GR           367         Run         B         2         BO/CR/SA           368         Glide         B         1         BO/SA/GR           370         Ruff         A         2         BO/CO/GR           371         Pool         C         1         BO/CO/GR           373         Run         B         2         BO/CO/GR           373         Ruff         A         2         BO/CO/GR           374         Ruff         A         2         BO/CO/GR           375         Glide         B         1         BO/SA/A           376         C	358	Glide	В	1	BO/GR/SA		
360         Run         B         2         BOGRISA           361         Cascade         A         3         BO           362         Pool         C         1         BO/SA           363         Cascade         A         2         BO           364         Pool         C         1         BO/SA           366         Glide         B         1         BO/SA/GR           366         Glide         B         1         BO/SA/GR           366         Glide         B         1         BO/SA/GR           368         Glide         B         1         BO/SA/GR           370         Riffle         A         2         BO/CO/GR           371         Pool         C         1         BO/CO/GR           372         Riffle         A         2         BO/CO/GR           373         Run         B         2         BO/CO/GR           374         Riffle         A         2         BO/CO/GR           376         Glido         B         1         BO/CO/GR           377         Glido         B         1         BO/CO/GR           377	359	Riffle	A	2	BO/SA/GR		
361         Cascade         A         3         BO           362         Pool         C         1         BOSA           363         Cascade         A         2         BO           364         Pool         C         1         BOSA           365         Run         B         2         BOGRNSA           366         Glide         B         1         BOSACR           367         Run         B         2         BOGRNSA           368         Glide         B         1         BOSACR           369         Potential obstack/obstruction to fish passage	360	Run	В	2	BO/GR/SA		
Big2         Pool         C         1         BO/SA           363         Gescade         A         2         BO           364         Pool         C         1         BO/SA           366         Run         B         2         BO/SA/GR           366         Gide         B         1         BO/SA/GR           366         Gide         B         1         BO/SA/GR           366         Gide         B         1         BO/SA/GR           366         Potential obstacle/obstruction to fish passage         B         1         BO/CO/GR           370         Riffle         A         2         BO/CO/GR         Image: State St	361	Cascade	Α	3	BO		
363         Cascade         A         2         BO           364         Pool         C         1         BOSA           365         Run         B         2         BO(RKGA           366         Gide         B         1         BOSA/GR           367         Run         B         2         BO(RKGA           368         Gide         B         1         BOSA/GR           369         Potential obstacle/obstruction to fish passage             371         Pool         C         1         BO/CO/GR           371         Pool         C         1         BO/CO/GR           372         Rtifie         A         2         BO/CO/GR           373         Run         B         1         BO/CO/GR           374         Gide         B         1         BO/CO/GR           375         Gilde         B         1         BO/CO/GR           376         Cascade         A         3         BO           377         Gilde         B         1         BO/GR/GA           378         Rtifie         A         2         BO/CO/GR           379<	362	Pool	С	1	BO/SA		
364         Pool         C         1         BO/SR $366$ Run         B         2         BO/GR/SA	363	Cascade	Α	2	BO		
365         Run         B         2         BO/GR/SA           366         Glide         B         1         BO/SA/GR	364	Pool	С	1	BO/SA		
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	365	Run	В	2	BO/GR/SA		
967         Run         B         2         BO(RNSA           368         Gilde         B         1         BO(SA/GR           370         Riffie         A         2         BO(CO/GR           371         Pool         C         1         BO/CO/GR           372         Riffie         A         2         BO/CO/GR           373         Run         B         2         BO/CO/GR           374         Riffie         A         2         BO/CO/GR           375         Gilde         B         1         BO/CO/GR           376         Cascade         A         2         BO/CO/GR           377         Gilde         B         1         BO/CN/SA           377         Gilde         B         1         BO/CN/SA           377         Gilde         B         1         BO/CN/SA           378         Riffie         A         2         BO/CO/GR           379         Run         B         2         BO/CO/GR           380         Riffie         A         2         BO/CO/GR           381         Gilde         B         1         BO/CO/GR	366	Glide	В	1	BO/SA/GR		
388         Glide         B         1         BO/SA/GR         Image: Constraint of the passage           370         Riffle         A         2         BO/CO/GR         Image: Constraint of the passage           371         Pool         C         1         BO/CO/GR         Image: Constraint of the passage           371         Pool         C         1         BO/CO/GR         Image: Constraint of the passage           372         Riffle         A         2         BO/CO/GR         Image: Constraint of the passage           373         Ran         B         2         BO/CO/GR         Image: Constraint of the passage           374         Riffle         A         2         BO/CO/GR         Image: Constraint of the passage           376         Glide         B         1         BO/GR/SA         Image: Constraint of the passage           377         Glide         B         1         BO/GR/SA         Image: Constraint of the passage           378         Ruffle         A         2         BO/GR/SA         Image: Constraint of the passage           380         Ruffle         A         2         BO/GR/SA         Image: Constraint of the passage           381         Glide         B         1	367	Run	В	2	BO/GR/SA		
369         Potential obstacle/obstruction to fish passage              370         Riffle         A         2         BO/CO/GR            371         Pod         C         1         BO/CO/GR            372         Riffle         A         2         BO/CO/GR            373         Run         B         2         BO/CO/GR            374         Riffle         A         2         BO/CO/GR            375         Glide         B         1         BO/GR/SA            376         Cascade         A         3         BO            377         Glide         B         1         BO/CO/GR            378         Riffle         A         2         BO/CO/GR            380         Riffle         A         2         BO/CO/GR            381         Glide         B         1         BO/CO/GR            382         Pool         B         1         BO/CO/GR            384         Glide         A         2         BO/CO/GR       <	368	Glide	В	1	BO/SA/GR		
370         Riffle         A         2         BO/CO/GR           371         Pool         C         1         BO/CO/GR           372         Rifle         A         2         BO/CO/GR           373         Run         B         2         BO/CO/GR           374         Rufle         A         2         BO/CO/GR           374         Rufle         A         2         BO/CO/GR           375         Glide         B         1         BO/GR/SA           376         Cascade         A         3         BO           377         Glide         B         1         BO/GR/SA           378         Rufle         A         2         BO/CO/GR           379         Run         B         2         BO/CO/GR           380         Rufle         A         2         BO/CO/GR           381         Glide         B         1         BO/CO/GR           382         Pool         B         1         BO/CO/GR           383         Run         B         2         BO/CO/GR           384         Pool         C         1         BO/CO/GR           385	369	Potential obstacle/obstruction to fish passage					
371         Pool         C         1         BO/CO/GR $372$ Riffle         A         2         BO/CO/GR $373$ Run         B         2         BO/CO/GR $374$ Riffle         A         2         BO/CO/GR $375$ Glide         B         1         BO/GR/SA $376$ Cascade         A         3         BO $377$ Glide         B         1         BO/GR/SA $378$ Riffle         A         2         BO/CO/GR $379$ Run         B         2         BO/CO/GR $380$ Riffle         A         2         BO/CO/GR $381$ Glide         B         1         BO/CO/GR $382$ Pool         B         1         BO/CO/GR $383$ Run         B         2         BO/GR/SA $384$ Pool         C         1         BO/GR/SA $384$ Pool         C         1         BO/GR/SA $386$ Riffle         A         2         BO/CO/GR <td>370</td> <td>Riffle</td> <td>A</td> <td>2</td> <td>BO/CO/GR</td> <td></td> <td></td>	370	Riffle	A	2	BO/CO/GR		
372         Riffle         A         2 $60/CP/SA$ $373$ Run         B         2 $60/CP/SA$ $374$ Riffle         A         2 $B0/CP/SA$ $375$ Gilde         B         1 $B0/CP/SA$ $376$ Cascade         A         3         BO $377$ Gilde         B         1 $B0/CP/SA$ $378$ Riffle         A         2 $B0/CO/GR$ $378$ Riffle         A         2 $B0/CO/GR$ $379$ Run         B         2 $B0/CO/GR$ $380$ Riffle         A         2 $B0/CO/GR$ $381$ Gilde         B         1 $B0/GR/SA$ $382$ Pool         C         1 $B0/GR/SA$ $384$ Pool         C         1 $B0/GR/SA$ $386$ Run         B         2 $B0/CO/GR$ $386$ Run         B         1 $B0/GR/SA$ $386$ Run         B         1 <td>371</td> <td>Pool</td> <td>С</td> <td>1</td> <td>BO/CO/GR</td> <td></td> <td></td>	371	Pool	С	1	BO/CO/GR		
373         Run         B         2         BO/GR/SA $374$ Riffle         A         2         BO/CO/GR $375$ Gilde         B         1         BO/GR/SA $376$ Cascade         A         3         BO $377$ Gilde         B         1         BO/GR/SA $377$ Gilde         B         1         BO/CO/GR $379$ Ruffle         A         2         BO/CO/GR $380$ Riffle         A         2         BO/CO/GR $381$ Gilde         B         1         BO/GR/SA $382$ Pool         B         1         BO/CO/GR $383$ Run         B         2         BO/CO/GR $384$ Pool         C         1         BO/GR/SA $385$ Riffle         A         2         BO/CO/GR $386$ Run         B         2         BO/CO/GR $386$ Run         B         1         BO/CO/GR	372	Riffle	A	2	BO/CO/GR		
374         Rifie         A         2         BO/CO/GR           375         Glide         B         1         BO/GR/SA           376         Cascade         A         3         BO           377         Glide         B         1         BO/GR/SA           378         Riffle         A         2         BO/CO/GR           379         Run         B         2         BO/GR/SA           380         Riffle         A         2         BO/CO/GR           381         Glide         B         1         BO/GR/SA           382         Pool         B         1         BO/CO/GR           383         Run         B         2         BO/GR/SA           384         Pool         C         1         BO/GR/SA           385         Riffle         A         2         BO/CO/GR           386         Run         B         2         BO/GR/SA           386         Run         B         2         BO/CO/GR           386         Run         B         2         BO/CO/GR           387         Riffle         A         2         BO/CO/GR           388	373	Run	В	2	BO/GR/SA		
375         Glide         B         1         BO/GR/SA           376         Cascade         A         3         BO           377         Glide         B         1         BO/GR/SA	374	Riffle	А	2	BO/CO/GR		
376         Cascade         A         3         BO           377         Glide         B         1         BO/GR/SA	375	Glide	В	1	BO/GR/SA		
377         Gilde         B         1         BO/GR/SA           378         Rffle         A         2         BO/CO/GR           379         Run         B         2         BO/GR/SA           380         Riffle         A         2         BO/CO/GR           381         Gilde         B         1         BO/GR/SA           382         Pool         B         1         BO/CO/GR           383         Run         B         2         BO/GR/SA           384         Pool         C         1         BO/CO/SA           384         Pool         C         1         BO/GR/SA           385         Riffle         A         2         BO/CO/GR           386         Run         B         2         BO/CO/GR           386         Run         B         1         BO/GR/SA           387         Riffle         A         2         BO/CO/GR           388         Gilde         B         1         BO/GR/SA           390         Gilde         B         1         BO/CO/GR           391         Riffle         A         2         BO/CO/GR <t< td=""><td>376</td><td>Cascade</td><td>A</td><td>3</td><td>BO</td><td></td><td></td></t<>	376	Cascade	A	3	BO		
378         Riffie         A         2         BO/CO/GR           379         Run         B         2         BO/CO/GR           380         Riffle         A         2         BO/CO/GR           381         Glide         B         1         BO/CO/GR           382         Pool         B         1         BO/CO/SA           383         Run         B         2         BO/GR/SA           384         Pool         C         1         BO/GR/SA           385         Run         B         2         BO/GR/SA           386         Riffle         A         2         BO/GR/SA           386         Run         B         2         BO/GR/SA           386         Run         B         2         BO/CO/GR           387         Riffle         A         2         BO/CO/GR           388         Glide         B         1         BO/GR/SA           389         Riffle         A         2         BO/CO/GR           390         Glide         B         1         BO/GR/SA           391         Riffle         A         2         BO/CO/GR           <	377	Glide	В	1	BO/GR/SA		
379         Run         B         2         BO/GR/SA           380         Riffle         A         2         BO/CO/GR           381         Glide         B         1         BO/CR/SA           382         Pool         B         1         BO/CR/SA           383         Run         B         2         BO/GR/SA           383         Run         B         2         BO/GR/SA           384         Pool         C         1         BO/GR/SA           385         Riffle         A         2         BO/CO/GR           386         Run         B         2         BO/CO/GR           387         Riffle         A         2         BO/CO/GR           388         Glide         B         1         BO/GR/SA           389         Riffle         A         2         BO/CO/GR           390         Glide         B         1         BO/GR/SA           391         Riffle         A         2         BO/CO/GR           392         Glide         B         1         BO/GR/SA           393         Riffle         A         2         BO/CO/GR	378	Riffle	А	2	BO/CO/GR		
380         Riffle         A         2         BO/CO/GR           381         Glide         B         1         BO/CR/SA           382         Pool         B         1         BO/CR/SA           383         Run         B         2         BO/GR/SA           384         Pool         C         1         BO/CO/SA           385         Riffle         A         2         BO/CO/GR           386         Run         B         2         BO/CO/GR           387         Riffle         A         2         BO/CO/GR           388         Glide         B         1         BO/CO/GR           388         Glide         B         1         BO/CO/GR           389         Riffle         A         2         BO/CO/GR           390         Glide         B         1         BO/CO/GR           391         Riffle         A         2         BO/CO/GR           392         Glide         B         1         BO/CO/GR           393         Riffle         A         2         BO/CO/GR           393         Riffle         A         2         BO/CO/GR	379	Run	В	2	BO/GR/SA		
381         Glide         B         1         BO/GR/SA           382         Pool         B         1         BO/CO/SA           383         Run         B         2         BO/GR/SA           384         Pool         C         1         BO/GR/SA           385         Riffle         A         2         BO/GR/SA           386         Run         B         2         BO/CO/GR           387         Riffle         A         2         BO/CO/GR           388         Glide         B         1         BO/GR/SA           389         Riffle         A         2         BO/CO/GR           389         Riffle         A         2         BO/CO/GR           390         Glide         B         1         BO/GR/SA           391         Riffle         A         2         BO/CO/GR           392         Glide         B         1         BO/GR/SA           393         Riffle         A         2         BO/CO/GR           393         Riffle         A         2         BO/CO/GR           393         Riffle         A         2         BO/CO/GR	380	Riffle	Α	2	BO/CO/GR		
382         Pool         B         1         BO/CO/SA           383         Run         B         2         BO/GR/SA           384         Pool         C         1         BO/GR/SA           385         Riffle         A         2         BO/CO/GR           386         Run         B         2         BO/CO/GR           386         Run         B         2         BO/GR/SA           387         Riffle         A         2         BO/CO/GR           388         Glide         B         1         BO/GR/SA           389         Riffle         A         2         BO/CO/GR           389         Riffle         A         2         BO/CO/GR           390         Glide         B         1         BO/GR/SA           391         Riffle         A         2         BO/CO/GR           392         Glide         B         1         BO/GR/SA           393         Riffle         A         2         BO/CO/GR           393         Riffle         A         2         BO/CO/GR           393         Riffle         A         2         BO/CO/GR	381	Glide	В	1	BO/GR/SA		
383         Run         B         2         BO/GR/SA           384         Pool         C         1         BO/GR/SA           385         Riffle         A         2         BO/CO/GR           386         Run         B         2         BO/CO/GR           387         Riffle         A         2         BO/CO/GR           388         Glide         B         1         BO/CO/GR           389         Riffle         A         2         BO/CO/GR           389         Riffle         A         2         BO/CO/GR           390         Glide         B         1         BO/CO/GR           391         Riffle         A         2         BO/CO/GR           392         Glide         B         1         BO/GR/SA           393         Riffle         A         2         BO/CO/GR           394         Run         B         2         BO/CO/GR	382	Pool	В	1	BO/CO/SA		
384         Pool         C         1         BO/GR/SA           385         Riffle         A         2         BO/CO/GR           386         Run         B         2         BO/CO/GR           387         Riffle         A         2         BO/CO/GR           388         Glide         B         1         BO/CO/GR           389         Riffle         A         2         BO/CO/GR           390         Glide         B         1         BO/GR/SA           391         Riffle         A         2         BO/CO/GR           392         Glide         B         1         BO/GR/SA           393         Riffle         A         2         BO/CO/GR           394         Run         B         2         BO/CO/GR           395         Potential obstacle/obstruction to fish passage	383	Run	В	2	BO/GR/SA		
385         Riffle         A         2         BO/CO/GR           386         Run         B         2         BO/GR/SA           387         Riffle         A         2         BO/CO/GR           388         Glide         B         1         BO/CO/GR           389         Riffle         A         2         BO/CO/GR           389         Riffle         A         2         BO/CO/GR           390         Glide         B         1         BO/CO/GR           391         Riffle         A         2         BO/CO/GR           392         Glide         B         1         BO/GR/SA           393         Riffle         A         2         BO/CO/GR           394         Run         B         2         BO/GR/SA           396         Glide         B         1         BO/GR/SA <t< td=""><td>384</td><td>Pool</td><td>С</td><td>1</td><td>BO/GR/SA</td><td></td><td></td></t<>	384	Pool	С	1	BO/GR/SA		
386         Run         B         2         BO/GR/SA           387         Riffle         A         2         BO/CO/GR           388         Glide         B         1         BO/GR/SA           389         Riffle         A         2         BO/CO/GR           390         Glide         B         1         BO/CO/GR           390         Glide         B         1         BO/CO/GR           391         Riffle         A         2         BO/CO/GR           392         Glide         B         1         BO/GR/SA           393         Riffle         A         2         BO/CO/GR           394         Run         B         2         BO/CO/GR           395         Potential obstacle/obstruction to fish passage	385	Riffle	Α	2	BO/CO/GR		
387         Riffle         A         2         BO/CO/GR           388         Glide         B         1         BO/GR/SA           389         Riffle         A         2         BO/CO/GR           390         Glide         B         1         BO/GR/SA           391         Riffle         A         2         BO/CO/GR           391         Riffle         A         2         BO/CO/GR           392         Glide         B         1         BO/GR/SA           393         Riffle         A         2         BO/CO/GR           394         Run         B         2         BO/GR/SA           395         Potential obstacle/obstruction to fish passage	386	Run	В	2	BO/GR/SA		
388GlideB1BO/GR/SA389RiffleA2BO/CO/GR390GlideB1BO/GR/SA391RiffleA2BO/CO/GR392GlideB1BO/GR/SA393RiffleA2BO/CO/GR394RunB2BO/GR/SA395Potential obstacle/obstruction to fish passage	387	Riffle	Α	2	BO/CO/GR		
389RiffleA2BO/CO/GR390GlideB1BO/GR/SA391RiffleA2BO/CO/GR392GlideB1BO/GR/SA393RiffleA2BO/CO/GR394RunB2BO/CO/GR395Potential obstacle/obstruction to fish passage	388	Glide	В	1	BO/GR/SA		
390GlideB1BO/GR/SA391RiffleA2BO/CO/GR392GlideB1BO/GR/SA393RiffleA2BO/CO/GR394RunB2BO/GR/SA395Potential obstacle/obstruction to fish passage	389	Riffle	A	2	BO/CO/GR		
391RiffleA2BO/CO/GR392GlideB1BO/GR/SA393RiffleA2BO/CO/GR394RunB2BO/CO/GR395Potential obstacle/obstruction to fish passage	390	Glide	B	1	BO/GR/SA		
392GlideB1BO/GR/SA393RiffleA2BO/CO/GR394RunB2BO/GR/SA395Potential obstacle/obstruction to fish passage	391	Riffle	A	2	BO/CO/GR		
393RiffleA2BO/CO/GR394RunB2BO/GR/SA395Potential obstacle/obstruction to fish passage	392	Glide	B	1	BO/GR/SA		
394RunB2BO/GR/SA395Potential obstacle/obstruction to fish passage396GlideB1BO/GR/SA397RiffleA2BO/CO/GR398GlideB1BO/GR/SA399RunB2BO/GR/SA	393	Riffle	A	2	BO/CO/GR		
395Potential obstacle/obstruction to fish passageDefendence396GlideB1BO/GR/SA397RiffleA2BO/CO/GR398GlideB1BO/GR/SA399RunB2BO/GR/SA	394	Run	B	2	BO/GR/SA		
396GlideB1BO/GR/SA397RiffleA2BO/CO/GR398GlideB1BO/GR/SA399RunB2BO/GR/SA	395	Potential obstacle/obstruction to fish passage		<u> </u>			
397RifleA2BO/CO/GR398GlideB1BO/GR/SA399RunB2BO/GR/SA	396	Glide	B	1	BO/GR/SA		
398         Glide         B         1         BO/GR/SA           399         Run         B         2         BO/GR/SA	397	Riffle	A	2	BO/CO/GR		
399 Run B 2 BO/GR/SA	398	Glide	B	1	BO/GR/SA		
	399	Run	B	2	BO/GR/SA		



Target Note	Flow Type	Water depth	Water velocity	Dominant substrate	Vegetation type and 9
400	Pool	С	1	BO/CO/GR	
401	Run	В	2	BO/GR/SA	
402	Potential obstacle/obstruction to fish passage				
403	Pool	С	1	BO/CO/GR	
404	Run	В	2	BO/GR/SA	
405	Glide	В	1	BO/CO/GR	
406	Riffle	A	2	BO/CO/GR	
407	Pool	С	1	BO/CO/GR	
408	Glide	В	1	BO/CO/GR	
409	Riffle	В	2	BO/CO/GR	
410	Pool	С	1	BO/CO/GR	
411	Run	В	2	BO/CO/GR	
412	Riffle	В	2	BO/CO/GR	
413	Run	В	2	BO/CO/GR	
414	Pool	С	1	BO/CO/GR	
415	Run	В	2	BO/CO/GR	
416	Riffle	В	2	BO/CO/GR	
417	Run	В	2	BO/CO/GR	
418	Riffle	В	2	BO/CO/GR	
419	Run	В	2	BO/CO/GR	
420	Riffle	В	2	BO/CO/GR	
421	Run	В	2	BO/CO/GR	
422	Potential obstacle/obstruction to fish passage				
423	Run	С	3	BO/CO/GR	
424	Run	В	3	BO/CO/GR	
425	Run	С	3	BO/CO/GR	
426	Glide	В	1	BO/CO/GR	
427	Salmonid	В	4	BO/CO/GR	
428	Salmonid	С	4	BO/CO/GR	
429	Salmonid	D	3	BO/CO/GR	
430	Glide	В	1	BO/CO/GR	
431	Glide	С	1	BO/CO/GR	
432	Glide	В	1	BO/CO/GR	
433	Glide	D	1	BO/CO/GR	
434	Glide	E	1	BO/CO/GR	
435	Lamprey	С	1	SI/SA/GR	
436	Lamprey	С	1	SI/SA/GR	
437	Pool	E	1	BO/CO/GR	
438	Eddy	С	0	BO/CO/SA	EFL-10
439	Run	В	2	BO/CO/GR	
440	Run	D	2	BO/CO/GR	
441	Run	E	3	BO/CO/GR	
442	Run	С	4	BO/CO/GR	
443	Run	В	3	BO/CO/GR	
444	Eddy	D	0	BO/CO/GR	
445	Glide	В	2	BO/CO/GR	
446	Salmonid	С	2	BO/CO/GR	
447	Glide	E	3	BO/CO/GR	
448	Glide	E	2	BO/CO/GR	
449	Glide	D	2	BO/CO/GR	



6 coverage	Habitat type
	Fry
	Parr
	Sub optimal spawning
	Sub optimal
	Sub optimal
	Sub optimal spawning

Target Note	Flow Type	Water depth	Water velocity	Dominant substrate	Vegetation type and 9
450	Glide	E	1	BO/CO/GR	
451	Glide	D	1	BO/CO/GR	
452	Glide	C	1	BO/CO/GR	
453	Run	C	2	BO/CO/GR	
454	Run	E	2	BO/CO/GR	
455	Eddy	E	0	BO/CO/GR	
456	Run	E	3	BO/CO/GR	
457	Glide	C	2	GR/CO/SA	
458	Run	E	4	BO/CO/GR	
459	Glide	В	2	GR/CO/SA	
460	Run	D	4	BO/CO/GR	
461	Run	С	4	BO/CO/GR	
462	Eddy	C	0	BO/CO/SA	
463	Torrent	C	5	BO/CO/GR	
464	Salmonid	В	3	BO/CO/GR	
465	Run	A	3	BO/CO/GR	
466	Run	D	3	BO/CO/GR	
467	Riffle	A	2	BO/CO	
468	Glide	C	2	BO/CO/SA	
469	Run	C	3	BO/CO/SA	
470	Eddy	C	0	BO/CO/SA	
471	Run	D	4	BO/CO/GR	
472	Salmonid	C	4	BO/CO/GR	
473	Run	A	2	CO/GR/SA	
474	Riffle	A	2	CO/GR/SA	
475	Run	A	2	CO/GR/SA	
476	Potential obstacle/obstruction to fish passage				
477	Potential obstacle/obstruction to fish passage				
478	Run	В	2	BO/SA/GR	
479	Riffle	A	2	BO/SA/GR	
480	Run	В	2	BO/SA/GR	
481	Riffle	A	2	BO/SA/GR	
482	Run	В	2	BO/SA/GR	
483	Run	В	3	BO/SA/GR	
484	Potential obstacle/obstruction to fish passage				
485	Run	В	2	BO/SA/GR	
486	Pool	С	1	BO/SA/GR	
487	Riffle	В	3	BO/CO/SA	
488	Run	В	3	BO/CO/SA	
489	Pool	С	1	BO/SA/SI	
490	Run	В	3	BO/CO/SA	
491	Potential obstacle/obstruction to fish passage				
492	Run	В	3	BO/CO/SA	
493	Pool	C	1	BO/SA/SI	
494	Potential obstacle/obstruction to fish passage				
495	Run	В	3	BO/CO/GR	
496	Riffle	В	3	BO/SA/GR	
497	Glide	С	1	BO/SA/CO	
498	Run	В	3	BO/SA/CO	
499	Riffle	B	3	BO/CO/GR	



6 coverage	Habitat type
	Parr/Fry
	Parr

Target Note	Flow Type	Water depth	Water velocity	Dominant substrate	Vegetation type and % coverage	Habitat type
500	Run	В	3	BO/SA/CO		
501	Riffle	В	3	BO/CO/GR		
502	Run	В	3	BO/SA/CO		
503	Potential obstacle/obstruction to fish passage					
504	Pool	В	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	В	3	BO/CO/GR		
510	Potential obstacle/obstruction to fish passage					
511	Pool	С	1	BO/CO/SA		
512	Run	В	2	BO/CO/GR		
513	Potential obstacle/obstruction to fish passage					
514	Run	В	2	BO/CO/GR		
515	Glide	В	1	BO/CO/GR		
516	Run	В	2	BO/CO/GR		
517	Run	В	3	BO/CO/GR		
518	Glide	В	2	BO/CO/GR		
519	Run	В	2	BO/CO/GR		
520	Glide	В	1	CO/GR/SA		
521	Riffle	В	2	BO/CO/GR		
522	Run	В	2	BO/CO/GR		
523	Pool	С	1	BO/CO/GR		
524	Run	В	2	BO/CO/GR		
525	Glide	В	2	CO/GR/SA		
526	Run	В	2	CO/GR/SA		
527	Run	В	3	BO/CO/GR		
528	Riffle	В	3	BO/CO/GR		
529	Run	В	3	BO/CO/GR		
530	Pool	С	1	CO/GR/SA		
531	Run	В	2	CO/GR/SA		
532	Riffle	В	2	BO/CO/GR		
533	Glide	С	1	BO/CO/GR		
534	Riffle	В	2	BO/CO/GR		
535	Run	В	2	BO/CO/GR		
536	Glide	С	2	CO/GR/SA		
537	Run	В	2	BO/CO/GR		
538	Glide	В	3	BO/CO/GR		
539	Riffle	В	3	BO/CO/GR		
540	Glide	В	2	BO/CO/GR		
541	Run	В	2	BO/CO/GR		
542	Riffle	В	3	BO/CO/GR		
543	Glide	В	2	BO/CO/GR		
544	Pool	D	1	BO/CO/GR		
545	Riffle	В	1	BO/CO/GR		
546	Riffle	В	3	BO/CO/GR		
547	Run	С	3	BO/CO/GR		
548	Riffle	В	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	В	3	BO/CO/GR		
551	Glide	С	2	CO/GR/SI		
552	Riffle	В	3	CO/GR/SA		
553	Glide	С	2	CO/GR/SA		
554	Riffle	В	2	BO/CO/GR		
555	Pool	D	1	CO/GR/SA		
556	Glide	С	2	CO/GR/SA		
557	Riffle	В	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	В	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/CI		
571	Glide	B	1	CO/GR/SI		
572	Glide	C	1	CO/GR/SI		
573	Bun	Δ	2	CO/GR/SI		
574	Bun	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			00/01/0/		
581	Glide	B	1	CO/GR/SA		
582	Bun	B	2	CO/GR/SA		
583	Bun	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		1	00/01/0/		
587	Rin	R	2	BO/CO/GR		
588	Glide	B	2	BO/CO/GR		
589	Bun	B	3	BO/CO/GR		
590	Glide	C C	2	BO/CO/GR		
591	Bun	B	2	CO/GR/SA		
502	Glide	R	2	CO/CR/SA		
502	Glide	R	2	GR/SA/SI		
594	Potential obstacle/obstruction to fish passage					
505	Run	R	2	GR/SV/SI		
506	Glide	С С	2	GR/SA/SI		
507	Run	R	2			
508	Run	R	2	CO/CR/SA		
500	Glide	R	2	GR/SA/SI		
000	Cide		<b>4</b>			



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	В	3	BO/CO/GR		
602	Run	В	2	BO/CO/GR		
603	Riffle	В	3	BO/CO/GR		
604	Run	В	2	BO/CO/GR		
605	Glide	В	1	BO/CO/GR		
606	Riffle	В	2	BO/CO/GR		
607	Potential obstacle/obstruction to fish passage					
608	Run	В	2	BO/CO/GR		
609	Glide	С	2	CO/GR/SA		
610	Potential obstacle/obstruction to fish passage					
611	Run	В	2	BO/CO/GR		
612	Glide	В	1	GR/SA/SI		
613	Glide	С	1	GR/SA/SI		
614	Glide	В	1	GR/SA/SI		
615	Potential obstacle/obstruction to fish passage					
616	Run	В	2	CO/GR/CL		
617	Riffle	В	3	CO/GR/SA		
618	Pool	С	1	CO/GR/SA		
619	Run	В	2	CO/GR/SA		
620	Glide	В	3	CO/GR/SA		
621	Glide	В	2	CO/GR/SA		
622	Riffle	A	1	CO/GR/SA		
623	Glide	В	2	CO/GR/SA		
624	Run	В	2	CO/GR/SA		
625	Glide	С	2	CO/GR/SA		
626	Run	В	2	CO/GR/SA		
627	Glide	В	2	CO/GR/SA		
628	Glide	C	1	SA/SI		
629	Potential obstacle/obstruction to fish passage					
630	Run	В	2	CO/GR/SA		
631	Run	С	2	CO/GR/SA		
632	Pool	C	1	CO/GR/SA		
633	Run	В	2	CO/GR/SA		
634	Run	С	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	С	2	BE/CO/GR		
643	Run	D	3	BO/CO/GR		
644	Run	В	2	BO/CO/GR		
645	Lamprey	С	0	SA/SI/GR	Sub-optimal	
646	Riffle	В	3	BO/CO/GR		
647	Lamprey	В	1	SA/SI/GR	Sub-optimal	
648	Lamprey	В	1	SA/SI	Optimal	
649	Run	С	3	BO/CO/GR		



Target Note	Flow Type	Water depth	Water velocity	Dominant substrate	Vegetation type and % coverage	Habitat type
650	Glide	В	2	BO/CO/GR		
651	Salmonid	В	3	BO/CO/GR		Fry
652	Lamprey	С	1	SI/SA/GR		Sub-optimal
653	Run	С	3	BO/CO/GR		
654	Salmonid	С	4	BO/CO/GR		Parr
655	Lamprey	В	0	SI/SA/GR		Sub-optimal
656	Run	С	3	BO/CO/BE		·
657	Run	С	3	BO/CO/GR		
658	Run	С	3	BO/CO/BE		
659	Run	D	4	BO/CO/GR		
660	Salmonid	С	4	BO/CO/GR		Parr
661	Run	D	4	CO/GR/SA		
662	Run	В	2	CO/GR/SA		
663	Run	С	2	CO/GR/SA		
664	Run	С	3	CO/GR/SA		
665	Eddy	D	0	BO/CO/GR		
666	Lamprey	С	1	SI/SA/GR		Sub-optimal
667	Run	D	3	CO/GR/SA		
668	Run	С	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	Lamprev	С	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	С	0	BO/CO/GR		
679	Pool	С	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	С	3	BO/CO/GR		
684	Salmonid	В	3	BO/CO/GR		Fry
685	Glide	С	2	BO/CO/GR		<b>,</b>
686	Glide	С	3	BO/CO/GR		
687	Salmonid	С	3	BO/CO/GR		Sub-optimal spawning
688	Run	С	4	BO/CO/GR		
689	Eddy	D	0	BO/CO/GR		
690	Salmonid	В	4	BO/CO/GR		Fry
691	Lamprey	С	1	SI/SA		Optimal
692	Eddy	С	0	BO/CO/GR		I
693	Glide	D	2	BO/GR/CO		
694	Run	С	3	BO/CO/GR		
695	Pool	E	1	BO/GR/CO		
696	Lamprey	С	1	SI/SA/GR		Sub-optimal
697	Drv	N/A	N/A	N/A		1
698	Potential obstacle/obstruction to fish passage					
699	Dry	N/A	N/A	N/A		
<u>.</u>	*		•	•		



Target Note	Flow Type	Water depth	Water velocity	Dominant substrate	Vegetation type and % coverage	Habitat type
700	Dry	N/A	N/A	N/A		
701	Potential obstacle/obstruction to fish passage					
702	No perceptible flow	В	0	SI/GR		
703	No perceptible flow	В	0	BO/CO/GR		
704	No perceptible flow	С	0	BO/CO/GR		
705	No perceptible flow	В	0	BO/CO/GR		
706	No perceptible flow	C	0	BO/CO/GR		
707	No perceptible flow	В	0	BO/CO/GR		
708	No perceptible flow	A	0	BO/CO/GR		
709	Potential obstruction to fish passage					
710	No perceptible flow	С	0	BO/CO/GR		
711	No perceptible flow	В	0	BO/CO/GR		
712	No perceptible flow	С	0	BO/CO/GR		
713	No perceptible flow	A	0	BO/CO/GR		
714	No perceptible flow	В	0	BO/CO/GR		
715	Run	A	2	BO/CO/GR		
716	Glide	В	1	BO/CO/GR/SI		
717	Glide	A	1	BO/CO/GR		
718	Run	A	2	BO/CO/GR/SA		
719	Glide	A	1	BO/CO/GR/SA		
720	Riffle	A	2	BO/CO/GR		
721	Glide	С	1	BO/CO/GR		





# Appendix B: Otter and Water vole survey results



# Haweswater Aqueduct Resilience Programme

Otter and Water Vole Survey Report – TR4 Marl Hill

Project No. 2480524



**SEPTEMBER 2021** 



# **RSK GENERAL NOTES**

#### **Project No.:** 2480524

- Title:
   Haweswater Aqueduct Resilience Programme: Otter and Water Vole Survey

   Report TR4 Marl Hill
- Client: Ricardo Energy and Environment
- Date: September 2021
- Office: Helsby
- Status: REV4

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Where field investigations have been carried out, these have been restricted to a level of detail required to achieve the stated objectives of the work.

This work has been undertaken in accordance with the quality management system of RSK Bio census Ltd.



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# **1** INTRODUCTION

# 1.1 Purpose of this report

RSK Biocensus (RSK) was commissioned by Ricardo Environment and Energy (Ricardo) to provide specialist aquatic ecological support in relation to the Haweswater Aqueduct Resilience Programme (HARP). Otter (*Lutra lutra*) and water vole (*Arvicola amphibius*)) surveys are required to inform a Water Framework Directive (WFD) assessment, Environmental Impact Assessment (EIA) and mitigation strategy for the scheme.

As part of the scheme United Utilities propose to replace several sections of the existing single line aqueduct. The replacement sections are proposed to be delivered over five distinct sections. From north to south these sections are named as follows:

- Docker (TR1);
- Swarther (TR2);
- Bowland (TR3);
- Marl Hill (TR4); and
- Haslingden to Walmersley (TR5/6).

Nine planning applications are required to cover all five sections. These will be accompanied by an Environmental Statement (ES) for each section and a Habitat Regulations Assessment (HRA) as required for each section.

This report details surveys undertaken on watercourses within the Marl Hill (TR4) section which will likely be impacted by the proposed works.

## **1.2** Site information

*Figure 1* shows the location of the survey reaches and the survey extents for each watercourse identified that will be impacted by the works for section TR4 of the scheme. *Table 1* summarises the survey requirements at each watercourse which were specified by Ricardo.



#### Table 1. Site information and survey requirements, TR4 Marl Hill

			Eastings and Northings				
Name	Watercourse ID	Section	Upstream	Downstream	Date of survey	Water Vole	Otter
Bashall Brook	W512	T04	X: 369928 Y: 444567	X: 370018 Y: 444057	24/04/2020	-	Yes
Unnamed Watercourse 430	W520	T04	X: 371521 Y: 444978	X: 371527 Y: 444907	24/04/2020	Yes (x2)	Yes
Unnamed Watercourse 431	W521	T04	X: 371727 Y: 445030	X: 371737 Y: 444952	24/04/2020	-	Yes
Unnamed Watercourse 433	W523	T04	X: 371960 Y: 445103	X: 371975 Y: 445019	24/04/2020	-	Yes
Unnamed Watercourse 442	W533	T04	X: 370293 Y: 444498	X: 370454 Y: 444396	24/04/2020	-	Yes
Unnamed Watercourse 463	W557	T04	X: 371799 Y: 445413	X: 371919 Y: 444809	24/04/2020	-	Yes
Waddington Brook	W506	T04	X: 372043 Y: 447548	X: 372137 Y: 446634	05/06/2020	Yes	Yes
Coplow Brook	W506	T04	X: 373521 Y: 443840	X: 373924 Y: 443617	01/02/2021	Yes (survey timing sub optimal - habitat suitability assessment only)	Yes
Unnamed Watercourse 430 (downstream)	W520	T04	X: 371578 Y: 444453	X: 371684 Y: 444111	05/06/2020	Yes	Yes
Unnamed Watercourse 446	W538	T04	X: 371373 Y: 444791	X: 371177 Y: 444010	09/06/2020	Yes	Yes
Unnamed Watercourse 445	W537	T04	X: 371255 Y: 444749	X: 371200 Y: 444302	05/06/2020	Yes	Yes
Sandy Ford Brook	W530	T04	X: 371051 Y: 445379	X: 371183 Y; 444306	09/06/2020	Yes	Yes
Greg Sike	W2321	T04	X: 373964 Y: 443939	X: 374095 Y: 443580	01/02/2021	Yes (survey timing sub optimal - habitat suitability assessment only)	Yes
River Ribble	RW03-05	T04	X: 372037 Y: 446276	X: 372261 Y: 445877	24/11/2020	Yes (survey timing sub optimal - habitat suitability assessment only)	Yes
River Ribble	W2325	T04	X: 374488 Y: 443947	X: 374020 Y: 443440	01/02/2021	Yes (survey timing sub optimal - habitat suitability assessment only)	Yes
Waddington Brook	RW17	T04	X: 372037 Y: 446276	X: 372261 Y: 445877	01/02/2021	Yes (survey timing sub optimal - habitat suitability assessment only)	Yes
Coplow Brook	W2349	T04	X: 373624 Y: 443620	X: 373466 Y: 444014	31/08/2021	No	Yes
Unnamed watercourse 2097	W2348	T04	X: 374169 Y: 443996	X: 374236 Y: 443779	31/08/2021	No	Yes



# 2 METHOD

# 2.1 Survey timings

Surveys were undertaken by two experienced aquatic ecologists. All presence absence surveys were undertaken during optimal seasons and in the weeks preceding each of the presence absence surveys no significant rainfall was recorded.

## 2.2 Otter surveys

Otter surveys followed an amended methodology derived from that detailed within Chanin 2003¹. Where access permitted, both banks of each watercourse were surveyed to look for and record signs of otter. Emphasis was given to investigating prominent features such as bridge arches, fallen trees and root systems as well as rocks and ledges along the banks where spraints, footprints, evidence of resting or breeding sites and feeding remains were most likely to be present. Presence of access points, such as slides or runs, were also recorded. The location of any evidence was marked using a hand-held tablet device allowing the data to be mapped using GIS software. Photographs were taken to evidence sign of otter as well as the habitat present on the site.

## 2.3 Water vole surveys and habitat suitability assessment

The water vole surveys followed the standard methods outlined within Strachan  $(2011)^2$  and Dean *et al.*  $(2016)^3$  respectively. Where accessible, surveyors searched both banks of each watercourse for evidence of water voles including burrows, feeding platforms, grazing (including food remains), latrines and footprints.

The location of any water vole evidence was recorded using a hand-held tablet device allowing the data to be mapped using GIS software. Photographs were also taken to evidence water vole activity as well as the habitat present on site.

Where surveys were undertaken outside the survey season for water vole (April – September) the suitability of the habitat for water voles was assessed using the following criteria (Dean *et al.*,  $2016^4$ ):

- Bank profile;
- Bank substrate, specifically its suitability for burrowing;
- Water depth;
- Likely frequency and height of water level changes, relative to bank height;
- Amount of shading from trees/shrubs;

¹ Chanin, P. 2003. Ecology of the European Otter. Conserving Natura 2000 Rivers Ecology Series No. 10. English Nature, Peterborough.

² Strachan, R. (2011). Water Vole Conservation Handbook – The Third Edition. Wildlife Conservation Research Unit, Oxford

 ³ Dean, M., Strachan, R., Gow, D. and Andrews, R. (2016). The Water Vole Mitigation Handbook (The Mammal Society Mitigation Guidance Series). Eds Fiona Mathews and Paul Chanin. The Mammal Society, London
 ⁴ Dean, M., Strachan, R., Gow, D. and Andrews, R. (2016). *The Water Vole Mitigation Handbook (The Mammal Society Mitigation Guidance Series)*. Eds Fiona Mathews and Paul Chanin. The Mammal Society, London.



- Bankside herbaceous vegetation type (tall tussocky grass, mown grass etc.);
- Bankside herbaceous vegetation density;
- In-channel herbaceous vegetation type;
- In-channel herbaceous vegetation width (from toe of bank to the point at which the Bank meets water level);
- In-channel herbaceous vegetation density;
- Percentage of the channel with in-channel herbaceous vegetation;
- Evidence of current or recent management, and the likely effects of management; and
- Any other relevant factors.

Classification of habitat suitability was made as follows:

- **Excellent** optimal habitat with good cover, food sources and other features that would allow water vole populations to thrive throughout the year.
- **Suitable** habitat that has all the elements required by water vole, certainly in the summer, and probably through most winters.
- *Moderate* habitat that has some of the features that are suitable for water vole, but with some constraints so that suitability throughout the year is not certain.
- **Unsuitable** habitat lacking one or more crucial element for use by water voles. This category does not necessarily preclude the habitat being used by water voles, but it would not be able to support a resident population.

### 2.4 Survey constraints

There were no obvious constraints to undertaking the surveys. Where presence absence surveys were undertaken, the timings were considered suitable for water vole and otter and the surveys were not compromised by poor weather. Surveyors were also able to access the full extent of each watercourse.

### 2.5 Biosecurity

All RSK ecologists have undertaken internal training on biosecurity practices, which are in accordance with those described by the Great Britain Non-Native Species Secretariat's (GB NNSS) check-clean-dry policy. Furthermore, they have all completed, as a minimum, modules 1 and 3 of the GB NNSS e-learning modules on biosecurity. In addition to adhering to this procedure, surveyors worked in a downstream direction in flowing watercourses to further minimise risk. All equipment was thoroughly checked, cleaned (and disinfected) and dried before it was used in a different watercourse.



# 3 **RESULTS**

Table 2 summarises the results of the surveys at each respective site.

#### Table 2. Otter and water vole survey results – TR4 Marl Hill

#### T04: W512 Bashall Brook



#### **Eastings and Northings**

Upstream: X: 369928 Y: 444567 Downstream: X: 370018 Y: 444057

• Evidence of otter, suitable habitat at W512.

Evidence of otter was recorded at W512; four spraints were recorded (*Figure* 2 - W512). W512 is considered suitable habitat for otter.

W512 was a moderately flowing stream with varying flow types and pools. The channel substrate was predominantly comprised of bedrock, boulder, cobble, and gravel. Filamentous algae was occasionally present throughout the surveyed reach. The width of the channel was variable ranging from c. 2.4 - 4.5 m. Similarly, the depth was also variable ranging from c. 0.03 - 0.45 m. Large woody debris and side bars were present throughout the watercourse providing heterogeneous flow and aquatic habitat.

The majority of W512 was comprised of steep, wooded, channel sides with bankside herbs.

W512 had a section of artificial substrate and vertical embankment with a culvert present immediately upstream of the bridge. Downstream of the bridge a large man-made cascade was present. A fish ladder was adjacent to this obstruction but was blocked by boulders and cobbles at the time of the survey.



#### T04: W520 Unnamed Watercourse 430 (Upstream reach)

	<b>Eastings and Northings</b> Upstream: X: 371521 Y: 444978 Downstream: X: 371527 Y: 444907
	<ul> <li>No evidence of otter and moderate habitat suitability at W520.</li> <li>Potential water vole evidence but low</li> </ul>
	habitat suitability. No evidence of otter was observed.
	Three burrows were recorded ( <i>Figure 2</i> – W520). Notwithstanding this, most of the site is considered of low suitability for water voles due to the extensive tree cover throughout the section surveyed and limited food resources.
	Despite the burrows being found, in the absence of definitive evidence i.e. latrines, it is considered unlikely that water vole are present at the site.
	The watercourse was a shallow, slow-flowing stream with steep earth and rock banks. Abundant tree cover and woody debris was present throughout with ground flora consisting of grass, herbs and <i>Juncus</i> sp. (a Rush).
	The channel substrate was a mix of boulder, cobble, sand and gravel. The stream was bordered by sheep-grazed pasture. The width of the channel was <i>c</i> . 0.5 m and the water depth was <i>c</i> . 2 cm.
T04: W520 Unnamed Watercourse 430 (	Downstream reach)
	Eastings and Northings
	Upstream: X: 371578 Y: 444453
ST AND A PARTY AND	Downstream: X: 371684 Y: 444111
A CARLES AND	<ul> <li>No evidence of otter or water vole.</li> <li>W520 is unsuitable for water vole, but of</li> </ul>
	low to moderate suitability for otter.
	No evidence of water vole was found during surveys. Due to heavy shading throughout and lack of available foraging resources, the reach was considered unsuitable for water vole.



	No evidence of otter was recorded on W520, however, the watercourse possessed suitable resting sites (exposed tree roots and cavities below large boulders) and commuting potential for otters.
	The watercourse was a steep sided, shallow flowing stream, shaded throughout with both native deciduous and non-native ever green canopy ( <i>rhododendron</i> sp.). The in-channel substrate was comprised of boulder, cobble, and gravel with occasional coarse woody debris.
	A small section of W520 had artificially reinforced banks, stone walls, and a weir was present in the upstream section.
	The width of the channel was <i>c.</i> 2.5 m and the water depth was <i>c.</i> 10 cm.
T04: W521 Unnamed Watercourse 431	
	Eastings and Northings
	Upstream: X: 371727 Y: 445030
	Downstream: X: 371737 Y: 444952
	<ul> <li>No otter evidence, low habitat suitability at W521.</li> </ul>
Contraction of the second	No evidence of otter was recorded at W521 during the surveys ( <i>Figure 2</i> – W521).
	W521 was predominantly dry with areas of shallow standing water. The width of the channel was <i>c</i> . 0.3 m and the water depth was <i>c</i> . 1 cm, where water was present.
	W521 was predominantly dry with areas of shallow standing water. The width of the channel was <i>c</i> . 0.3 m and the water depth was <i>c</i> . 1 cm, where water was present. The shallow sloping banks were vegetated with grasses and trees with occasional <i>Juncus</i> sp., herbs and scrub. The ditch was bordered by sheep-grazed pasture. The in-channel substrate was comprised of boulder, cobble and gravel.
	W521 was predominantly dry with areas of shallow standing water. The width of the channel was <i>c</i> . 0.3 m and the water depth was <i>c</i> . 1 cm, where water was present. The shallow sloping banks were vegetated with grasses and trees with occasional <i>Juncus</i> sp., herbs and scrub. The ditch was bordered by sheep- grazed pasture. The in-channel substrate was comprised of boulder, cobble and gravel.
	W521 was predominantly dry with areas of shallow standing water. The width of the channel was <i>c</i> . 0.3 m and the water depth was <i>c</i> . 1 cm, where water was present. The shallow sloping banks were vegetated with grasses and trees with occasional <i>Juncus</i> sp., herbs and scrub. The ditch was bordered by sheep- grazed pasture. The in-channel substrate was comprised of boulder, cobble and gravel.



T04: W523 Unnamed Watercourse 433	
	Eastings and Northings
	Upstream: X: 371960 Y: 445103
	Downstream: X: 371975 Y: 445019
	<ul> <li>No evidence of otter at W523, habitat of moderate suitability.</li> </ul>
	No evidence of otter was recorded during the surveys ( <i>Figure 2</i> – W523).
	The watercourse was a shallow, slow flowing stream with no in-channel vegetation. The width of the channel was $c$ . 0.5 m and the water depth was $c$ . 2 cm.
	The channel substrate was a mix of boulder, cobble, and gravel with occasional mud. The banks were steep and principally bare earth or grass. The bordering vegetation was comprised of grass, <i>Juncus</i> sp., scrub and trees.
104: W533 Unnamed Watercourse 442	Eastings and Northings
	Linstream: X: 370203 V: 444408
	Downstream: X: 370454 Y: 444396
	<ul> <li>No evidence of otter at W533, habitat of low suitability.</li> </ul>
	·····
	No evidence of otter was recorded during the surveys ( <i>Figure 2</i> – W533).
	W533 was predominantly dry with occasional standing water and some filamentous algae present. The substrate was boulder, cobble, and gravel. The width of the channel was $c$ . 0.3 m and the water depth was $c$ . 1 cm.
	The channel cuts through grazed pasture and follows a line of trees. Bank growth mainly consists of trees, grass and <i>Juncus</i> sp. with occasional scrub and herbs (dominated by nettles).



#### T04: W557 Unnamed Watercourse 463



#### **Eastings and Northings**

Upstream: X: 371799 Y: 445413 Downstream: X: 371919 Y: 444809

No evidence of otter at W557, habitat of moderate suitability.

No evidence of otter was recorded during the surveys at W557 (*Figure 2* – W557).

W557 was a wooded, shallow ditch with intermittent reaches of ponded water or water with no perceivable flow. The substrate consisted of boulder, cobble, and gravel. The width of the channel was c. 0.4 m and the water depth was c. 3 cm where water was present.

Bankside vegetation was comprised mostly of grasses and *Juncus* sp. with areas of bare ground and occasional scrub or tree cover. The stream was bordered by sheep grazed pasture. No in-channel vegetation was observed and there was evidence of trampling and poaching on the banks.

T04: W506 Waddington Brook	
	Eastings and Northings
	Upstream: X: 372043 Y: 447548
	Downstream: X: 372137 Y: 446634
	<ul> <li>No evidence of water vole recorded on W506.</li> </ul>
	• Two otter spraints were recorded at the upstream extent of the reach.
	<ul> <li>Habitat within the survey reach was generally unsuitable for both species.</li> </ul>
	No evidence of water vole was recorded on W506. The brook does however provide some suitable foraging and burrowing habitat.
	The watercourse was generally, a moderately flowing, shallow brook with a substrate comprised predominantly from boulders, cobble, gravel, silt, and bedrock. Bedrock cascades and pools were



also frequent. Although variable, the width of the channel was 1 - 3.5 m and the water depth was *c*. 20 cm.

Vegetation on the steep, sheep-grazed banks was comprised of herbs, *Juncus* sp. and ferns. No in-channel vegetation was recorded.

### T04: W506 Coplow Brook



#### **Eastings and Northings**

Upstream: X: 373521 Y: 443840 Downstream: X: 373924 Y: 443617

- Evidence of otter at W506, some suitable habitat present.
- No evidence of water vole, habitat of low suitability.

The channel width was c. 1.25 m, and, at the time of survey, the water depth was c. 10 cm, although both of these were variable. The substrate comprised mostly of boulder, cobble, gravel, and sand, with some silt at the downstream end.

Sewage fungus was recorded over a large stretch of the reach indicating a water quality issues may be a problem within the watercourse.

Evidence of otter was recorded in the form of spraint and footprints (*Figure 2 – W506*). Habitat was not considered to be of high suitability for otter, but there were sections of woody and anthropogenic debris on the bank which otters may choose to use for refuge.

No evidence of water vole was recorded during the survey and habitat was largely unsuitable at W506.



T04: W538 Unnamed Watercourse 446	
	Eastings and Northings
A CONTRACTOR OF	Upstream: X: 371373 Y: 444791
	Downstream: X: 371177 Y: 444010
and the second	
	<ul> <li>No evidence of otter or water vole on W538.</li> </ul>
	W538 was largely unsuitable for water vole with no definitive water vole evidence recorded during the survey i.e. latrines.
	No evidence of otter was recorded on W538. Although the habitat was regarded as being largely unsuitable for otter with few foraging and resting opportunities at this location, the watercourse could still be used for commuting.
	The channel width was <i>c.</i> 2 m and the water depth was <i>c.</i> 5 cm.
	The upstream section of W538 was a dry, tree- bordered ditch between cattle-grazed, improved / semi-improved pasture. The substrate was predominantly boulder, cobble, gravel, and clay.
	The channel passed under a road into a rhododendron dominated plantation. Areas of shallow ponded water were present within the channel at this location.
	W538 passed under another road and entered another cattle-grazed, semi-improved / improved pasture. The bank was poached through trampling.
T04: W537 Unnamed Watercourse 445	
	Eastings and Northings
	Upstream: X: 371255 Y: 444749
	Downstream: X: 371200 Y: 444302
	No evidence of otter or water vole on W537
	<ul> <li>Habitat largely unsuitable for both species.</li> </ul>
	The channel width was <i>c</i> . 1.0 m, and, at the time of survey, the channel was predominantly dry with some ponded areas with no flow.





No evidence of water vole was found during surveys. Due to heavy shading throughout and a lack of suitable foraging resources, the reach is considered largely unsuitable for water vole. A small section of channel is unshaded providing suitable bankside habitat for water vole (pictured). This is located towards the downstream extent of the survey reach and was dry at the time of the survey.

No evidence of otter was recorded on W537. Due to the lack of available foraging and resting opportunities, the habitat was regarded as being unsuitable for otter.

W537 was a predominantly shaded channel with trees growing along both banks. A short section of the channel entered a meadow where herbs, grass and *Juncus* sp. dominate the banks. The channel was dry with a few sections of ponded water. The substrate was boulder, cobble, and gravel.

#### T04: W530 Sandy Ford Brook



#### Eastings and Northings

Upstream: X: 371051 Y: 445379

Downstream: X: 371183 Y: 444306

- No evidence of otter or water vole at W530.
- Habitat generally unsuitable for both species.

No evidence of otter was found at W530. The habitat was generally unsuitable for otter because, although suitable resting areas were identified (cavities under bankside trees), low flows currently limit aquatic foraging opportunities.

The upper section of W530 was potentially suitable for water vole with lush bankside vegetation present and bankside substrate for burrowing. Small mammal activity was observed in the form of burrows and feeding evidence (pictured) but this was characteristic of bank voles (*Myodes glareolus*).

The channel width ranged from 2 - 5 m and the water depth remained shallow throughout at *c*. 3 cm.

The upper reaches of the stream bisect pasture and at this point there was little, or no flow observed.



The gently sloping banks were vegetated with herbs, grasses and <i>Juncus</i> sp The in-channel substrate was comprised of boulder, cobble, gravel, silt, and clay.
As the watercourse flows downstream, the gently sloping banks are replaced by steep forested banks which have minimal herbaceous vegetation. The substrate was boulder, cobble, and gravel, with frequent coarse woody debris.

#### T04: W2321 Greg Sike



#### **Eastings and Northings**

Upstream: X: 373964 Y: 443939 Downstream: X: 374095 Y: 443580

- Evidence of otter present at W2321.
- No evidence of water vole and habitat largely unsuitable.

The channel width was c. 1 m, and, at the time of survey, the water depth was c. 10 cm, although both of these were variable. The substrate comprised mostly of cobble, gravel, and sand with boulders in some sections. The downstream reach comprised of finer sediment and was composed mostly of sand and silt.

No holts, couches or spraint were recorded at W2321. A single otter footprint (pictured) was however recorded in an area of sand adjacent to the watercourse (*Figure 2 – W2321*). Although the watercourse provides limited opportunities for refuge this evidence suggests that otter could use the watercourse for foraging.

As the banks of the watercourse were mostly shallow, heavily shaded and lacking herbaceous vegetation the habitat was assessed to be largely unsuitable for water vole.



#### T04: W2325 River Ribble



#### **Eastings and Northings**

Upstream: X: 374488 Y: 443947 Downstream: X: 374020, Y: 443440

- Evidence of otter at W2325, suitable habitat present.
- No evidence of water vole, habitat of moderate suitability.

The channel width at W2325 was c. 35 m and, at the time of survey, the water depth was mostly c. 30 - 40 cm. The substrate comprised mainly of boulders, large cobbles, and gravel.

On the left-hand bank of the watercourse a wellused public footpath was present that encompassed the entire survey reach. During the survey several members of the public, including dog walkers, were observed using this right of way.

Evidence of otter was present in the form of spraint (5 separate locations), two suspected couches and 3 potential holts (*Figure 2 – W2325*). Otter footprints were observed that lead from beneath one of the potential holts (cavity beneath tree roots – pictured left), heading towards the watercourse (*Figure 2 – W2325*).

Although habitat is largely unsuitable for water vole a densely vegetated area (pictured) is present on the right-hand bank of the watercourse (immediately downstream of the road bridge). This area could provide suitable burrowing and foraging habitat for water vole. As this area is likely to be inundated when the river is in spate, it is not optimal habitat for water voles.

There were several marginal sections where the substrate was comprised of sand and silt and provided either optimal or sub-optimal habitat for lamprey.



#### T04: RW03-RW05



#### **Eastings and Northings**

Upstream: X: 372037 Y: 446276 Downstream: X: 372261 Y: 445877

- Evidence of otter, suitable habitat present at RW03-RW05.
- No evidence of water vole, habitat of moderate suitability.

Evidence of otter was observed on the river Ribble at RW03-RW05 in the form of spraint and footprints (both pictured). No otter holts or resting areas (couches) were recorded (*Figure 2 – RW03-RW05*). A cavity was present beneath some tree roots at the upstream extent of the reach (left bank) but there was no evidence to suggest it was being used by otters as refuge.

Habitat within the reach was assessed to be of moderate suitability for water voles. The site contains steep banks suitable for burrowing, however certain sections of the reach have bank reinforcements in place which inhibit burrowing.

At the time of survey, the bankside and emergent vegetation was sparse (partly owing to the timings of the survey). A small area of emergent reeds was present downstream of the road bridge (right bank), which could provide foraging habitat for water vole.

#### T04: RW17



### Eastings and Northings

Upstream: X: 372037 Y: 446276 Downstream: X: 372261 Y: 445877

- Evidence of otter, suitable habitat present at RW17.
- No evidence of water vole, habitat of moderate suitability.

Three otter spraints were observed during the survey and one potential couch was recorded at the base of a tree trunk (*Figure 2 – RW17*). Habitat within the survey extent is suitable for otter but due to the size of the watercourse foraging opportunities could be limited.





Habitat was largely unsuitable for water vole as large sections of the channel were shaded by tree cover, inhibiting the growth of low-lying herbaceous plants. Bank substrate was also primarily large boulders and therefore often unsuitable for burrowing.

Upstream of the main confluence on the reach the watercourse flows adjacent to an area of open grassland for approximately 100 m (pictured). The left-hand bank is reasonably steep at this point and is comprised of earth making it suitable for burrowing. Juncus sp. is abundant in this location, which does provide potential foraging habitat.

At this location with the watercourse averages just 0.4 m in width and 0.15 m in water depth. No areas of deep open water (which water vole could use to evade predation) were recorded adjacent to the suitable burrowing habitat.





### **Eastings and Northings** Upstream: X:373624 Y:443620

Downstream: X:373466 Y:444014

• No evidence of otter at W2349, some suitable habitat present.

The channel width was c. 1.25 m, and, at the time of survey, the water depth was c. 0.05 cm. The substrate comprised mostly of boulder, cobble, gravel, and sand, with some silt at the downstream end. The survey reach at W2349 is situated immediately upstream of reach W506.

No evidence of otter was recorded during the surveys. Habitat was not considered to be of high suitability for otter, but there were sections of woody and anthropogenic debris on the bank which otters may choose to use for refuge. Minnows were abundant throughout the survey extent providing a potential source of food for otters.

The invasive species Himalayan Balsam (*Impatiens glandulifera*) and Japanese Knotweed (*Fallopia japonica*) were both recorded within the survey extent.







# **4** APPENDICES – SURVEY MAPS



#### 377000



cument Path: \lto-dc0\GIS\Ecology/2480000s/2480500s\2480524 - HARP Aquatics\07 GIS\2480524-TR4-Otter&WV Overview Ma



#### Legend:



- O Upstream Survey Extent
- O Downstream Survey Extent

Otter Evidence

△ Otter Spraint

Potential Water Vole Evidence

Burrow

▲ Feeding Signs





Meters SCALE: 1:4,000 @ A3

REV 00





14

Contains Ordnance Survey data © Crown copyright and database right 2020 Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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W521 Upstream

W521

0

Downstream








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### Legend:



- O Upstream Survey Extent
- O Downstream Survey Extent

Potential Water Vole Evidence

- Burrow
- ▲ Feeding Signs







SCALE: 1:3,000 @ A3

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REV 00









 Waterbody	



















# Appendix C: White clawed crayfish survey results



# Haweswater Aqueduct Resilience Programme

White-Clawed Crayfish Survey Report – TR4 Marl Hill

Project No. 2480524



**SEPTEMBER 2021** 



# **RSK GENERAL NOTES**

Project No.: 2480524
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- Title: Haweswater Aqueduct Resilience Programme: White-Clawed Crayfish Surveys TR4 Marl Hill
- Client: Ricardo Energy and Environment
- Date: September 2021
- Office: Helsby
- Status: REV00

Author	Ben Faulkner	Technical and quality reviewer	Matthew Davison
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Date:	21 September 2021	 Date:	22 September 2021

**Project manager** 

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Signature Date:

21 September 2021

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Where any data supplied by the client or from other sources have been used, it has been assumed that the information is correct. No responsibility can be accepted by RSK for in accuracies in the data supplied by any other party. The conclusions and recommendations in this report are based on the assumption that all relevant information has been supplied by those bodies from whom it was requested.

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Where field investigations have been carried out, these have been restricted to a level of detail required to achieve the stated objectives of the work.

This work has been undertaken in accordance with the quality management system of RSK Bio census Ltd.



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	1.2 Site information	1
2	METHOD	3
	2.1 Survey timings	3
	2.2 Crayfish surveys	3
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# **1** INTRODUCTION

### 1.1 Purpose of this report

RSK Biocensus (RSK) was commissioned by Ricardo Environment and Energy (Ricardo) to provide specialist aquatic ecological support in relation to the Haweswater Aqueduct Resilience Programme (HARP). White-clawed crayfish (*Austropotamobius pallipes*) surveys are required to inform a water framework directive (WFD) assessment, environmental impact assessment (EIA) and mitigation strategy for the scheme.

As part of the scheme, United Utilities propose to replace several sections of the existing single line aqueduct. The replacement sections are proposed to be delivered over five distinct sections. From north to south these sections are named as follows:

- Docker (TR1)
- Swarther (TR2)
- Bowland (TR3)
- Marl Hill (TR4)
- Haslingden to Walmersley (TR5/6)

Nine planning applications are required to cover all five sections. These will be accompanied by an environmental statement (ES) for each section and a habitat regulations assessment (HRA), as necessary, for each section.

This report details surveys undertaken on watercourses within the Marl Hill (TR4) section of the scheme.

### **1.2** Site information

*Table 1* summarises the site information for each watercourse which was provided by Ricardo.



Table 1. Site information and survey requirements, TR4 Marl Hill

Name	Watercourse ID	Section	Date	Upstream Grid Ref	Downstream Grid Ref
Bonstone Brook	W498	T04	02/09/2021	369186 448740	369719 448561
Coplow Brook	W2349	T04	31/08/2021	373624 443620	373466 444014
Greg Sike	W2321	T04	31/08/2021	373964 443939	374095 443580
River Ribble	W2325	T04	31/08/2021	374488 443947	374020 443440
Unnamed watercourse 2097	W2348	T04	31/08/2021	374169 443996	374236 443779



# 2 METHOD

### 2.1 Survey timings

Surveys were undertaken by two experienced aquatic ecologists including a Natural England licenced (NE), white-clawed crayfish surveyor. At the time of the September surveys the weather was fair with ambient air temperature of c.22 degrees Celsius. In the week preceding the surveys no rainfall was recorded.

### 2.2 Crayfish surveys

The surveys followed the methodology within Survey and Monitoring Protocol for whiteclawed crayfish (Peay, 2003)¹. This comprised manual searching: carefully lifting suitable stones and debris on the channel bed which crayfish may use as refuge sites. Initially 100 refugia were searched within a 50 m stretch of riverbed. If five or more crayfish were observed (and captured) searching ceased. If fewer than five crayfish were observed, searching continued to 250 refugia.

Refuge searching took place in an upstream direction to avoid poor visibility caused by disturbing silt/sediment. All crayfish captured were identified to species level, sexed, checked for signs of disease or injury and their carapace length (mm) recorded. A record of the approximate size/age class of crayfish observed but not captured was also made. Photographs were taken to document crayfish evidence as well as habitat presence on site. Evidence of invasive crayfish species was also recorded.

### 2.3 Survey constraints

The recommended survey period for white-clawed crayfish is May-October inclusive with July to September considered to be the optimal months for surveying¹. Survey timings were therefore considered optimal for white-clawed crayfish.

At the time of the survey turbidity was low at all of the surveyed watercourses providing good visibility for observation.

At the River Ribble (W2325) it was not possible to survey the full array of aquatic habitats present using manual searching due to water depths in excess of 0.5 m. An abundance of suitable crayfish habitat was however present within the reach, including in shallower marginal habitat where manual searching could safely be undertaken, therefore this is not considered to have impacted the results of the survey.

### 2.4 Biosecurity

All RSK ecologists have undertaken internal training on biosecurity practices, which are in accordance with those described by the Great Britain non-native species secretariat's (GB NNSS) check-clean-dry policy. Furthermore, they have all completed, as a minimum, modules 1 and 3 of the GB NNSS e-learning modules on biosecurity. In addition to

¹ Peay S (2003). Monitoring the White-Clawed Crayfish Austropotamobius pallipes. Conserving Natura 2000 Rivers Monitoring Series No. 1, English Nature, Peterborough.



adhering to this procedure, surveyors worked in an upstream to downstream direction in flowing watercourses to further minimise risks. All equipment was thoroughly checked, cleaned (and disinfected) and dried before it was used in a different watercourse.



# 3 **RESULTS**

Table 2 summarises the results of the surveys at each respective site.

### Table 2. Crayfish survey results, TR4 Marl Hill

T04: W498 Bonstone Brook	
	Upstream: 369186 448740
	Downstream: 369719 448561
	No crayfish captured or observed. Suitable habitat present.
	Suitable refuges were observed throughout the survey extent including boulders, undercut banks and coarse woody debris. During the surveys more than 250 refuges were searched but no crayfish were recorded at W498. Several otter spraints were also observed during the survey of which none contained remains of crayfish.
	Within the survey extent the width of the channel is <i>c</i> . 4 m and at the time of the survey the depth was <i>c</i> . 0.2 m. Instream habitats included run, riffle, cascade, pool and glide. Dominant substrate types included boulder, cobble, gravel and bedrock,
	The survey extent is bordered by grazed pasture and woodland.
T04: W2349 Coplow Brook	
	Upstream: 373624 443620
	Downstream: 373466 444014
	No crayfish captured or observed. Habitat of moderate suitability at W2349.
	Suitable refuges which could provide habitat for crayfish (e.g. boulders) were observed in low abundance. No crayfish were recorded during the surveys at W2349.
	Within the survey extent the width of the channel is <i>c</i> . 1.5 m and at the time of the survey the depth was <i>c</i> . 0.05 m. The survey extent is bordered on both banks by grazed pasture.
	Cattle have direct access to the channel at multiple locations within the survey extent and during the





survey cattle faeces was observed in the channel at two locations. This is likely to reduce the sites suitability to support white-clawed crayfish which prefer to inhabit streams with good water quality.

T04: W2321 Greg Sike



Upstream: 373964 443939 Downstream: 374095 443580

# No crayfish captured or observed. Habitat of moderate suitability at W2321.

Although suitable refuges were recorded (boulders and undercut banks) they were infrequent. More than 25 refuges were searched during the survey but no evidence of crayfish was found on W104. Food sources such as macroinvertebrates however were readily available providing suitable foraging for crayfish.

Within the survey extent the width of the channel is c. 1.0 m and at the time of the survey the depth was c. 0.1 m. The survey extent is bordered on both banks by grazed pasture. A narrow strip of riparian vegetation comprising trees, bushes and low-lying herbaceous plants is however retained on both banks.

### T04: W2325 River Ribble



Upstream: 374488 443947 Downstream: 374020 443440

# No crayfish captured or observed. Suitable habitat present at W2321.

Suitable refuges were observed, predominantly boulders but no crayfish were recorded at W498. Otter spraint also was observed during the survey, none of which contained crayfish remains.



It was not possible to survey certain sections of channel (using manual searching) as water depths frequently exceeded 0.5 m. As suitable refuges were also present in shallower marginal areas this is not considered to have impacted the survey.
Within the survey extent the channel is $c$ . 30 m in width and the depth is $c$ . 0.75 m. The channel substrate comprises a mixture of boulder, cobble, gravel and bedrock. Instream habitats included run, riffle, glide and pool.
7
<b>7</b> Upstream: 374169 443996
<b>7</b> Upstream: 374169 443996 Downstream: 374236 443779
7 Upstream: 374169 443996 Downstream: 374236 443779 No crayfish captured or observed. Habitat unsuitable at W2348.



# Appendix D: River Ribble Otter Surveys Update



Haweswater Aqueduct Resilience Programme River Ribble – Otter Survey Update

ED13654 | Issue number 2 | Date 20/01/2022

#### Customer:

**United Utilities** 

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20 January 2022

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Ricardo is certified to ISO9001, ISO14001, ISO27001 and ISO45001



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# 1 Introduction

### 1.1 Purpose of this report

Ricardo was commissioned by United Utilities to undertake a walkover survey of the River Ribble in relation to the Haweswater Aqueduct Resilience Programme (HARP) Proposed Ribble Crossing. Consultation with the local authority following submission of the planning application for the Proposed Ribble Crossing identified the requirement for an update to the otter *Lutra lutra* survey undertaken at the River Ribble in February 2021 to inform the conclusions and recommendation identified in Chapter 9B of the Environmental Statement for the Proposed Ribble Crossing (Volume 6 Proposed Ribble Crossing Chapter 9B: Aquatic Ecology Document Ref.: LCC_RVBC-BO-RC-ES-009-02)

This report details a repeat otter survey undertaken on the River Ribble relating to the Proposed Ribble Crossing. The aim of the survey was to determine the presence and or status of otter holts/resting places or the presence/absence of potential resting places or suitable features in areas which would be subject to vegetation removal and or disturbance from the proposed scheme. The presence of otter activity in these areas of the River Ribble was identified by the previous surveys undertaken in February 2021.

### 1.2 Site information

The map in **Appendix 1** shows the location of the survey extent.. The watercourse details are shown in **Table 1.1** below.

### Table 1.1: Watercourse information

Watercourse name	Watercourse ID	Survey area	NGR
<b>River Ribble</b>	W2325	Ribble crossing	SD 74383 43862

## 2 Methodology

### 2.1 Otter survey and habitat suitability assessment

The methodology for surveying otters broadly follows the guidance set out by Chanin (2003)¹ and includes an assessment of the (relative) suitability of the habitat for otters and a search for field signs indicating the presence, or possible presence.

Searches were undertaken for field signs as described by Chanin (2003). Surveys were carried out where possible during periods of low rainfall. The presence of Otter may be indicated by the following signs:

- Potential and actual holt locations
- Potential and actual couch locations
- Spraints (droppings)
- Footprints/ tracks
- Slides
- Evidence of feeding (fish carcasses)
- Direct observation of otter

Photographs were taken to document otter evidence as well as the habitats present on site.

### 2.2 Survey Meta data

The survey was undertaken on 20 December 2021 by experienced ecologists Tom Priestley and Eve Loxham. Weather conditions are detailed in **Table 2.1** below.

¹ Chanin P. (2003) *Monitoring the Otter, Lutra lutra*. Conserving Natura 2000 Rivers Monitoring Series 10.



### Table 2.1: Surveys dates and weather conditions for the 2021 otter surveys

Watercourse	Cloud cover	Wind speed (Beaufort scale)	Temperature (°C)	Precipitation
River Ribble – Ribble crossing (W2325)	6/8	F2	4°C	No precipitation

### 2.3 Limitations

Surveyors were not able to access the north bank of the River Ribble at the Proposed Ribble Crossing; this is not considered to be a constraint as the aim of the survey was to update the finding of the previous otter survey and monitor the status of the potential otter holts identified during the initial otter survey conducted on the 1 February 2021² rather than identify if otter activity was present on the river. No potential otter holts were identified on the north bank and there is an absence of suitable features on this bank at or immediately adjacent to the crossing and lay down areas.

² Ricardo Energy and Environment (2021) Haweswater Aqueduct Resilience Programme Proposed Marl Hill Section, Volume 6, Proposed Ribble Crossing Protected Species Survey Report Technical Appendix 9B.2 Report reference: RVBC-MH-RC-TA-009-02-002.



# 3 Survey Results

The results of the otter survey undertaken at the River Ribble on 20 December 2021 are presented in **Table 3.1** and Figure 1 in Annex 1. Site photographs are presented in Annex 2.

Table 3.1	Otter	surveys	results
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Survey Site	Survey Results
River Ribble (W2325) –	Eastings and Northings:
Proposed Ribble Crossing	Upstream: X: 374488 Y: 443947
g	Downstream: X: 374020 Y: 443440
	<ul> <li>Evidence of otter identified including a holt, multiple prints, and spraints throughout the surveyed reach of the River Ribble.</li> </ul>
	The location of otter signs and hots and potential holts are shown on Figure 1 in Annex 1, photographs of the site are presented in Annex 2 Photos 1 to 7. As with the previous survey undertaken in February 2021 ² there were multiple potential (eight in total) holt locations under tree roots adjacent to the compound area and proposed bridge location including one with confirmed activity. The otter holt with evidence of activity was identified under the roots of two joined mature sycamore trees on the riverbank approximately 15 m north east of the proposed bridge location. The main cavity under the tree roots was approximately 2 m by 3 m. The was evidence of recent use by an otter including prints in the main cavity under the roots and a fresh spraint in entrance to main cavity. In addition to otter prints inside another smaller entrance (potentially to a separate cavity) on north-east side of trees.
	A suitable location for an otter resting place was identified under a large tree stump (diameter approximately 1.5 m) with exposed roots on the riverbank at the proposed crossing point. No evidence of otter activity was identified within the spaces under the tree stump and a hole in stump limited the amount of cover provided above. However, prints were present on riverbank with 2-5 m of the tree stump.
	River Ribble (500m downstream form the existing West Bradford road bridge) including prints and another spraint under the undercut bank approximately 70 m downstream of the proposed Ribble Crossing.



# Annex 1: Survey map



River Ribble Otter Survey December 2021 Ref: ED13654110 | Issue number 2 | 20/01/2022

Figure 1 River Ribble – Proposed Ribble Crossing otter survey results 20 December 2021





# Annex 2: Site Photographs

Description	Photograph
Photo 1.	
River Ribble (Ribble crossing) at upstream survey extent	
Photo 2. Joined sycamore ( <i>Acer</i> <i>pseudoplatanus</i> ) trees with confirmed otter holt in cavities below roots immediately upstream of Ribble crossing location.	
















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