

Appendix 5K

Aquatic Ecology Survey Reports

October 2024

Revision 1

Volume 0001

Document ref. 852552-WSPE-IA-ES-RP-B8-501090

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1. Overview

- 1.1.1 This appendix accompanies **Chapter 5: Biodiversity** of the Draft Environmental Statement (ES) for the HyNet North West Hydrogen Pipeline Project ('the Project').
- 1.1.2 The appendix should also be read in conjunction with the full description of the Project provided in **Chapter 2: The Project**.
- 1.1.3 The Project is a Nationally Significant Infrastructure Project (NSIP) under the Planning Act 2008 (the 'Act')¹. Under Section 31 of the Act, development consent is required for development to the extent that it is or forms part of an NSIP. Development consent is granted by the making of a Development Consent Order (DCO) for which an application may be made under Section 37 of the Act to the Secretary of State (delegated to the Planning Inspectorate (PINS)).
- 1.1.4 A number of surveys were undertaken to identify the baseline aquatic ecology in relation to the Project. These are reported in the following annexes which make up this appendix:
- **Annex 5K1: Macroinvertebrates surveys 2023 sites**
 - **Annex 5K2: Macrophyte surveys**
 - **Annex 5K3: eDNA survey**
 - **Annex 5K4: River condition assessment survey**
 - **Annex 5K5: Drone surveys**

¹ UK Government (2008) The Planning Act 2008. (online) Available at: <https://www.legislation.gov.uk/ukpga/2008/29/contents> (Accessed September 2024).

Annex 5K1

Aquatic Ecology Survey Report Macroinvertebrates Surveys 2023 Sites

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1. Methodology

1.1 Desk Study

- 1.1.1 A desk study was undertaken in Spring 2022 and the methodology for this is set out in **Section 5.5** and **Table 5.8** of the Preliminary Environmental Information Report (PEIR) published in 2022. The desk study recorded the presence of statutory designated sites within up to 20km ^[1] of the Preliminary Order Limits (**Section 5.6.1**, **Table 5.10**, and **Figure 5.1** of the PEIR) and non-statutory designated sites within 2km (**Section 5.6.2**, **Table 5.11**, and **Figure 5.2** of the PEIR). The desk study also recorded the presence of Habitats of Principal Importance (HPI) within 2km of the Preliminary Order Limits (**section 5.6.3**, **Table 5.12** and **Figure 5.3** of the PEIR). Records of protected and notable species within 2km of the Preliminary Order Limits are discussed within **section 5.6.12-5.6.41** of the PEIR.
- 1.1.2 The desk study information from the PEIR is not repeated in this report or discussed further. The desk study will be updated for the Final Environmental Statement following design freeze for the Project.

1.2 Survey Area

- 1.2.1 Please note that as part of the design process, the order limits have undergone a number of iterations (as described in **Appendix 2A: Design evolution** of the Draft ES) and this report is based on the Preliminary Order Limits as they stood in early 2023.
- 1.2.2 The study area for macroinvertebrates surveys includes a total of 12 watercourse crossings as shown in **Figure 5K1 1.1**. The locations cover the extent of the Project.
- 1.2.3 A total of 12 sites were surveyed on one occasion, for river macroinvertebrates using the industry standard River Invertebrate Classification Tool (RICT) methodology², in accordance with the requirements of the WFD. Of these 12 sites two were deemed unsuitable for macroinvertebrate surveys due to steep banks and deep water. Surveys were undertaken in August and September 2023. Survey locations are provided in **Table 5K1 1.1** and **Figure 5K1 1.1** and photographs in **Graphic 5K1 2.1** to **Graphic 5K1 2.11** in **Annex 2**.

¹ Dependent on reasons for designations; within two kilometres for habitats, extending to 10 kilometres for bats and up to 20 kilometres for all the ornithological interests for international sites.

² UKTAG (2014) UKTAG River Assessment Method Benthic Invertebrate Fauna; River Invertebrates Classification Tool (RICT). December 2008.

1.3 Field Surveys

Approach to field survey design

- 1.3.1 Macroinvertebrate surveys were conducted along watercourse crossing points detailed in **Table 5K1 1.1** during August and September 2023. The table references watercourse crossing codes that have since been updated during design refinement. While the Draft ES incorporates these updated codes (as detailed in **Chapter 2: The Project** and **Appendix 2B**), the survey report currently reflects the previous codes. All survey reports will be revised to align with the finalised watercourse crossing codes in the Final ES.
- 1.3.2 The study area considers seven watercourse crossings chosen based on WFD waterbody classification or chosen as a representative watercourses within each geographical area/ watercourse type (Canal, River or Stream/Ditch) to provide an indication of the community structures present. One representative watercourse identified by the Environment Agency as a main river was surveyed per catchment.

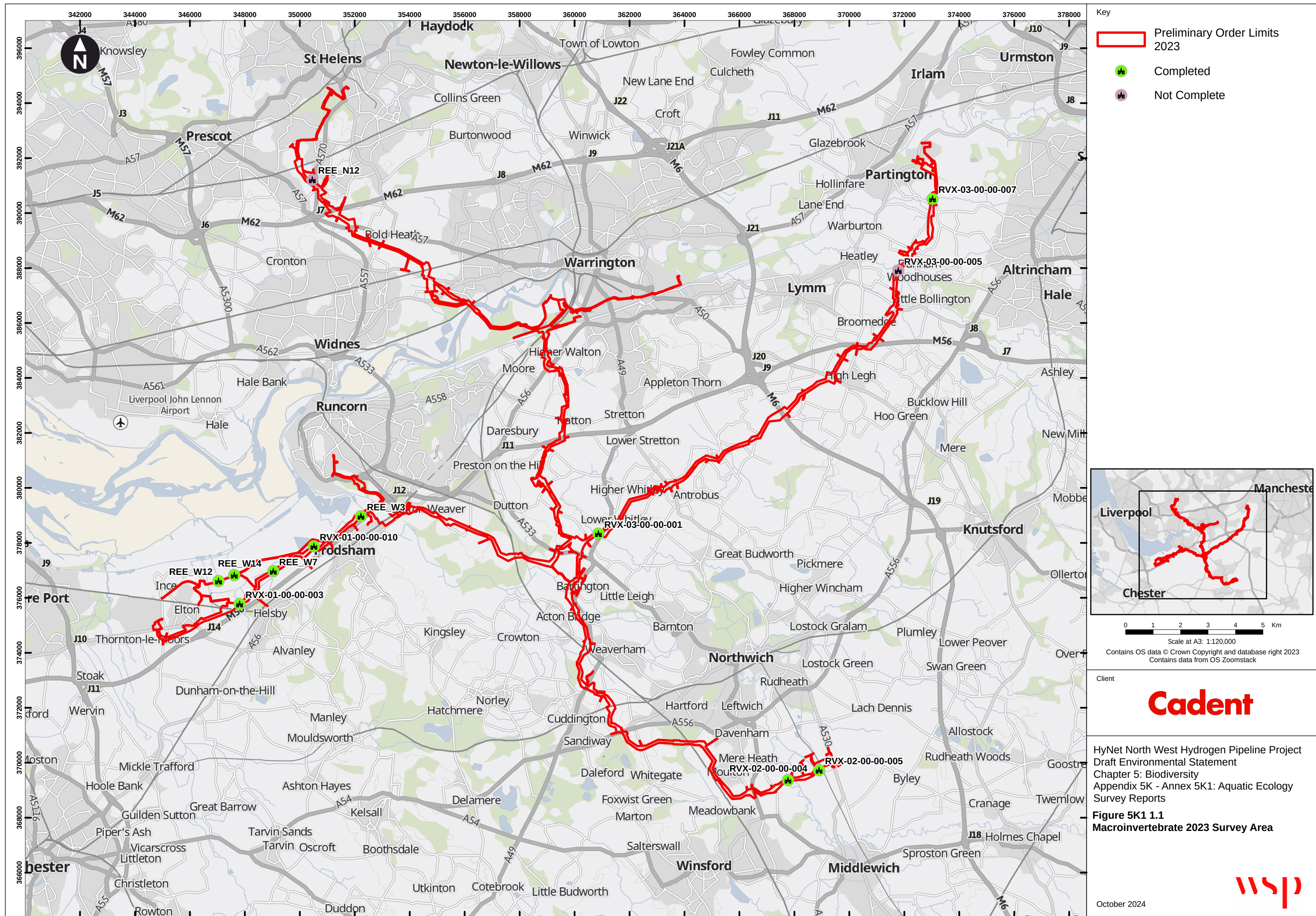


Table 5K1 1.1 Macroinvertebrate Survey Sites

River Crossing Name	X	Y	Watercourse Type	Watercourse name	Watercourse Status (WFD / Main River / Ordinary watercourse)	Hydro- morphological designation	WFD waterbody	Ecological Classification	Macroinverteb rate Classification
RVX-03-00-00-005	371779	387909	River	Agden Brook	WFD	not designated artificial or heavily modified	GB112069061382 Bollin (Ashley Mill to Manchester Ship Canal)	Moderate	Moderate
RVX-03-00-00-007	373027	390517	River	Caldwell Brook	Main River	not designated artificial or heavily modified	GB112069060980 Sinderland Brook	Poor	Poor
REE_N12	350454	391212	River	Unnamed River / Main Drain	WFD	heavily modified	GB112069061170 Sutton Brook	Moderate	Moderate
RVX-03-00-00-001	360867	378336	River	Whitely Brook	Main River	not designated artificial or heavily modified	GB112068060510 Cogshall Brook	Moderate	High
RVX-02-00-00-005	368897	369728	River	Puddinglake Brook	WFD	not designated artificial or heavily modified	GB112068060220 Puddinglake Brook	Poor	Moderate
RVX-02-00-00-004	367766	369366	Stream / Ditch	River Dane	WFD	not designated artificial or heavily modified	GB112068060470 Dane (Wheelock to Weaver)	Moderate	Moderate
REE_W3	352225	378969	Stream / Ditch	-	Ordinary watercourse	heavily modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate	Bad
RVX-01-00-00-010	350511	377876	Stream / Ditch	-	Ordinary watercourse	heavily modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate	Bad
REE_W7	349035	376970	River	-	Ordinary watercourse	heavily modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate	Bad
RVX-01-00-00-003	347808	375776	River	-	Main River	not designated artificial or heavily modified	GB112068060330 Peckmill Brook, Hoolpool Gutter at Ince Marshes	Moderate	-
REE_W12	347041	376611	River	-	Main River	not designated artificial or heavily modified	GB112068060330 Peckmill Brook, Hoolpool Gutter at Ince Marshes	Moderate	-
REE_W14	347614	376825	River	-	Main River	not designated artificial or heavily modified	GB112068060330 Peckmill Brook, Hoolpool Gutter at Ince Marshes.	Moderate	-

- 1.3.3 Macroinvertebrate samples were collected using standard three-minute kick sampling of all in-channel habitats in proportion to their occurrence. This was carried out using a standard sampling net (1mm mesh), with a one-minute timed hand search following the Environment Agency (2017) procedure³. This sampling method conforms to BS EN ISO 10870:2012 Water Quality – Guidelines for the selection of sampling methods and devices for benthic macroinvertebrates in fresh waters⁴.
- 1.3.4 A standardised field sheet was completed that captures details of channel and bank physical habitat (material of banks and substrates, flow types, physical processes, bank structure), riparian land use and potential sources of anthropogenic stress.
- 1.3.5 Samples were placed in one-litre sample pots, preserved in Industrial Methylated Spirits (IMS) on site and transported to the laboratory for sorting and identification to Taxonomic Level 5, in adherence with Environment Agency (2014) procedures⁵.

1.4 Biological Metrics

- 1.4.1 The use of biological metrics allowed the assignation of ecological values to the macroinvertebrate communities observed and an assessment of pressures on those communities to be made.

River invertebrate classification tool

- 1.4.2 The River Invertebrate Classification Tool (RICT) determines the ecological condition of a given location based on a comparison of macroinvertebrate communities observed at each study site, with macroinvertebrate communities observed at reference sites⁵. RICT reference sites are deemed to be as close as possible to pristine conditions and not impacted by environmental stressors such as pollution, habitat modification or flow stress. Reference sites provide an expected macroinvertebrate community score for that particular river type. The observed macroinvertebrate community score at a given study site is divided by the expected community score. Reference and bias adjustments are then applied to obtain the Ecological Quality Ratio (EQR). RICT can derive EQR scores for a number of biological metrics. These metrics are discussed further below.

³ Environment Agency (2012). Hydroecological validation using macroinvertebrate data: Operational Instruction 318_10. Environment Agency, Bristol.

⁴ ISO. ISO 1087 (2012). Water Quality—Guidelines for the Selection of Sampling Methods and Devices for Benthic Macroinvertebrates in Freshwaters; International Organization for Standardization: Geneva, Switzerland; pp. 1–26.

⁵ Water Framework Directive – United Kingdom Technical Advisory Group (2014). River Assessment Method Benthic Invertebrate Fauna Invertebrates (General Degradation): Whalley, Hawkes, Paisley & Trigg (WHPT) metric in River Invertebrate Classification Tool (RICT).

⁵ Davy-Bowker, J., Clarke, R.T., Corbin, T.A., Vincent, H., Pretty, J.L., Hawczak, A., Murphy, J., Jones, J.I. (2008). River invertebrate classification tool: Final Report. Scottish and Northern Ireland Forum for Environmental Research (SNIFFER Project WFD72c). Edinburgh, UK.

Whalley, Hawkes, Paisley and Trigg

- 1.4.3 The Whalley, Hawkes, Paisley and Trigg (WHPT) metric is based on the tolerance of different macroinvertebrates to organic pollution. Each macroinvertebrate family is assigned a score from -1.6 to 13, depending on their tolerance to pollution and abundance category (on a continuous scale, -1.6 is for highly abundant pollution-tolerant taxa, 13 is for highly abundant pollution-intolerant taxa) and an overall score is produced from the total. The WHPT index is widely used to determine the ecological water quality of running waters and specifically the detection of organic pollution. As such, any extrapolation of other water quality pressures should be undertaken with caution.
- 1.4.4 The Average Score Per Taxon (ASPT) is derived from the WHPT index. By dividing the total WHPT score by the number of scoring taxa present (NTAXA), the average score per taxon can be calculated. This metric is more easily comparable with other sites and permits an assessment of biological water quality that is less influenced by the presence of a greater proportion of low scoring taxa or sampling effort than the overall WHPT score. In both the case of WHPT score and ASPT, higher scores indicate better ecological quality.

Lotic-invertebrate index for flow evaluation

- 1.4.5 Macroinvertebrates have specific requirements for flow conditions and can be used to determine not only predominant flow types⁶, but also changes in flow character. The Lotic-invertebrate Index for Flow Evaluation (LIFE) metric uses abundance data to assign a flow preference score to macroinvertebrate families present in a sample and an overall score for the site can be interpreted as an abundance-weighted average score per taxon metric. The family-level LIFE score is calculated in RICT as a ratio of the observed/expected at reference sites (O/E) for the sample.
- 1.4.6 There are currently no WFD-related class boundaries for LIFE EQRs, but a threshold of 0.94 is used to indicate the presence of flow stressed macroinvertebrate communities². A LIFE score of less than 0.94 may indicate that flow is a possible pressure acting on an ecological community at a site.

Proportion of sediment-sensitive invertebrates

- 1.4.7 The Proportion of Sediment-sensitive Invertebrates (PSI) metric aims to act as a proxy for the quantity of fine sediment at a site⁷. Macroinvertebrate species are assigned a fine sediment sensitivity rating that ranges from highly insensitive to highly sensitive to fine sediment. The PSI score is calculated as the percentage of sensitive taxa in the sample and used to indicate how sedimented a watercourse is, from minimally sedimented/un-sedimented to heavily sedimented.

⁶ Extence, C.A., Chadd, R., England, J., Wood, P.J. and Taylor, E. (2011). The assessment of fine sediment accumulation in rivers using macro-invertebrate community response. *River Research and Applications*, 29(1), 17-55.

⁷ Extence, C.A., Balbi, D.M., and Chadd, R.P. (1999). River flow indexing using British benthic macroinvertebrates: a framework for setting hydroecological objectives. *Regulated Rivers: Research and Management*, 15, 543-574.

1.4.8 Table 5K1 1.2. Proportion of Sediment-sensitive Invertebrates (PSI) scores and interpretation.

Table 5K1 1.2 Proportion of Sediment-sensitive Invertebrates (PSI) scores and interpretation

PSI Score	Riverbed condition
81 – 100	Minimally sedimented / un-sedimented
61 – 80	Slightly sedimented
41 – 60	Moderately sedimented
21 – 40	Sedimented
0 – 20	Heavily sedimented

1.4.9 There are currently no WFD-related class boundaries for PSI EQRs, but a threshold of 0.70 is used to indicate the presence of low stressed macroinvertebrate communities⁸.

Community conservation index

1.4.10 The diversity and conservation interest of a macroinvertebrate community at each site can be represented by analysing species level data through the Community Conservation Index (CCI). The CCI incorporates elements of taxon rarity and richness to summarise the conservation value of macroinvertebrate communities⁹. Scores defined within Chadd and Extence (2004) are assigned to species within the sample to derive a total sample conservation score which infers a conservation value from the criteria listed in **Table 5K1 1.2**.

Table 5K1 1.3 Proportion of Sediment-sensitive Invertebrates (PSI) scores and interpretation

Conservation Score	Conservation Classification	Description
0 ≤ 5	Low	Sites supporting only common species and/or a community of low taxon richness.
5 ≤ 10	Moderate	Sites supporting at least one species of restricted distribution and/or a community of moderate taxon richness.

⁸ Turley, M. (2017). A biomonitoring tool to identify and quantify the impacts of fine sediment in river and stream ecosystems (Doctoral dissertation, University of Brighton).

⁹ Chadd, R. and Extence, C. (2004). The conservation of freshwater macroinvertebrate populations: a community-based classification scheme. *Aquatic Conservation: Marine and Freshwater Ecosystems*, 14(6), pp.597-624.

Conservation Score	Conservation Classification	Description
10 ≤ 15	Fairly high	Sites supporting at least one uncommon species, or several species of restricted distribution and/or a community of high taxon richness.
15 ≤ 20	High	Sites supporting several uncommon species, at least one of which may be nationally rare and/or a community of high taxon richness.
> 20	Very high	Sites supporting several rarities, including species of national importance, or at least one extreme rarity (such as taxa included in the British RDBs) and/or a community of very high taxon richness (potentially of national significance and may merit statutory protection).

Water framework directive macroinvertebrate classification

- 1.4.11 The WFD uses the pollution sensitivity (WHPT ASPT) and macroinvertebrate richness (WHPT NTAXA) EQR scores to determine whether a watercourse meets Good Ecological Status, as required under the Directive.
- 1.4.12 There are five ecological status classes: 'Bad', 'Poor', 'Moderate', 'Good' and 'High'.
- 1.4.13 Where a macroinvertebrate community is recorded at, or above Good Ecological Status, then biological or physical pressures including flow and anthropogenic pollution are not assumed to be affecting the aquatic ecology.
- 1.4.14 Watercourses failing to meet Good Ecological Status for macroinvertebrates may be influenced by a variety of stressors. EQRs can be interrogated to determine the likely cause of failure to meet Good Ecological Status.
- 1.4.15 For WFD classification the lower scoring of these EQR scores determines the macroinvertebrate classification of a given site.

1.5 Constraints

Access limitations

- 1.5.1 Surveys were limited to locations where landowner permission had been obtained within the survey season.
- 1.5.2 Macroinvertebrate surveys require physical access to the river channel, so health and safety concerns or other physical restrictions can constrain river macroinvertebrate surveys. Heavy bank-side vegetation and steep banks constrained physical access to the channel.

- 1.5.3 Access was obtained for all 12 sites, on one occasion (Autumn 2023). Of these, two sites were deemed unsuitable to survey due to the steep banks and deep nature of the channel and no data was collected, these were sites RVX-03-00-00-005 and REE_N12. Survey locations are provided in **Table 5K1 1.1** and photographs in **Graphic 5K1 2.1** to **Graphic 5K1 2.11** in **Appendix B**.

Ecological considerations

- 1.5.4 To assess a site for ecological status, it is recommended that a minimum of two survey per year (one survey in spring and one in autumn) for three years should be undertaken, with the surveys being carried out at the same time of the season each year.
- 1.5.5 Although a minimum of three twice-a-year surveys is recommended, to enable any inter-year variation to be taken into account, assessments of ecological status may be undertaken on the basis of a single survey in a single year. This is seen as appropriate for studies such as the Project, where the aim is to gain an overview of the ecological status of the catchments in order to identify those areas which would most benefit from further investigation.
- 1.5.6 Ecological survey data is typically valid for up to 18 months unless otherwise specified. The likelihood of surveys needing to be updated increases with time and is greater in circumstances where the habitat or its management has changed significantly since the surveys were undertaken.
- 1.5.7 Whilst RICT3 metrics are automatically calculated for ditches and impoverished watercourses with very low numbers of taxa, they should not be used in the calculation of WFD classes.
- 1.5.8 Where a watercourse is not suitable (ditches) for the RICT3 classification method, a quality assessment was made based on professional judgement and presence of species of conservation interest.

1.6 Personnel

- 1.6.1 The programme of surveys was led by Paul Cronje. The survey lead was assisted by suitably qualified and experienced Ricardo Personnel; details of whom are provided in **Table 5K1 1.4**

Table 5K1 1.4 Survey personnel

Name	Experience
Paul Cronje	Btech, NDip, AMIEnvSc, over six years of experience in ecological consultancy. Licence holder: WML-CL11 - Surveying white-clawed crayfish
Katie Clarke	BSc. (Hons), MSc. Over three years of experience in ecological consultancy.

Name	Experience
Esther Kendall	BSc. (Hons), MSc. Over four years of experience in ecological consultancy.
Morgan Hannah	BSc. (Hons), MSc. One year of experience in ecological consultancy,

2. Results

2.1 Field Survey

- 2.1.1 A total of ten of the 12 sites were surveyed, on one occasion, for river macroinvertebrates using the RICT3 methodology, in accordance with the requirements of the WFD. Surveys were undertaken in August and September 2023.
- 2.1.2 The full macroinvertebrate taxon list is presented in **Appendix A**. Images of sampling locations are displayed in **Appendix B**.
- 2.1.3 The biological metrics calculated for each site based on the macroinvertebrate communities present are displayed in **Table 5K1 2.1**.

Table 5K1 2.1 Survey Metrics results

Site name		RVX-03-00-00-005	RVX-03-00-00-007	REE_N12	RVX-03-00-00-001	RVX-02-00-00-005	RVX-02-00-00-004	REE_W3	RVX-01-00-00-010	REE_W7	RVX-01-00-00-003	REE_W12	REE_W14
Metrics	WHPT NTAXA	NA	15	NA	19	9	15	10	19	14	10	7	19
	WHPT Total		52		100	29	68.2	31.3	67	46.7	33.1	20.4	67.3
	WHPT ASPT		3.47		5.27	3.22	4.55	3.13	3.53	3.34	3.31	2.91	3.54
	Family LIFE Score		6		7.41	6	6.5	5.56	5.94	5.67	5.88	5.5	5.63
	Species LIFE Score		5.88		7.5	6.5	6.7	5.67	5.89	5.62	5.57	5.33	5.75
	CCI		11.8		3.43	1.17	8	5.4	13	17	5.63	1.33	5.06
	PSI Mixed		15.7		53.3	10	20	0	5.56	0	0	0	4.76

Table 5K1 2.2 Macroinvertebrate EQR classification boundaries

WHPT Classification	WHPT ASPT EQR	WHPT NTAXA EQR	LIFE EQR (Non-WFD)	PSI EQR (Non-WFD)
High	>0.97	>0.8	>0.97	>0.8
Good	0.86 - 0.97	0.68 - 0.8	0.94 - 0.97	0.7 - 0.8
Moderate	0.72 - 0.86	0.56 - 0.68	0.88 - 0.94	0.6 - 0.7
Poor	0.59 - 0.72	0.47 - 0.56	0.83 - 0.88	0.5 - 0.6
Bad	<0.59	<0.47	<0.83	<0.5

Table 5K1 2.3 Biological metrics for the 10 surveyed macroinvertebrate sites in autumn 2023

Site	Survey Date	LIFE (Family) (O)	LIFE (Family) (E)	LIFE (Family) EQR	WHPT ASPT (O)	WHPT ASPT (E)	WHPT ASPT EQR	WHPT NTAXA (O)	WHPT NTAXA (E)	WHPT NTAXA EQR	PSI (Family) (O)	PSI (Family) (E)	PSI (Family) EQR
RVX-03-00-00-001	9/2023	7.41	6.927	1.070	5.27	5.335	0.989	19	27.861	0.682	53.33	45.690	1.167
RVX-02-00-00-005	9/2023	6	6.923	0.867	3.22	5.490	0.587	9	27.873	0.323	10	45.874	0.218
RVX-02-00-00-004	9/2023	6.5	6.503	1.000	4.55	4.897	0.928	15	27.224	0.551	20	33.504	0.597
RVX-03-00-00-007	9/2023	6	6.200	0.968	3.47	4.435	0.782	15	25.873	0.580	15.69	25.508	0.615
REE W3	9/2023	5.56	6.650	0.835	3.13	4.957	0.631	10	26.774	0.373	N/A	37.994	N/A
RVX-01-00-00-010	9/2023	5.94	5.686	1.045	3.53	3.992	0.883	19	26.115	0.728	5.556	14.705	0.378
REE W7	9/2023	5.67	5.810	0.975	3.34	4.113	0.811	14	25.929	0.540	N/A	17.651	N/A
RVX-01-00-00-003	9/2023	5.88	6.114	0.961	3.31	4.377	0.756	10	25.682	0.389	N/A	24.361	N/A
REE W12	8/2023	5.5	7.229	0.761	2.91	5.948	0.490	7	17.147	0.408	N/A	61.062	N/A
REE W14	8/2023	5.63	5.654	0.995	3.54	3.967	0.893	19	26.154	0.726	4.762	14.053	0.339

(O) = Observed, (E) = Expected

- 2.1.4 Macroinvertebrates were completed at ten Sites (Detailed in **Table 5K1 2.3** in 2023. The indicative WFD classification for these sites is based on the worst classification between WHPT ASPT and NTAXA, these ranged between 'Bad' on 4 occurrences to 'Good' on 3 occurrences.
- 2.1.5 WHPT ASPT scores ranged between 2.91 - 5.27 (3.63) with the lowest WHPT ASPT score of 2.91 at Site REE W12, and the highest score of 5.27 at Site RVX-03-00-00-001. The WHPT ASPT expected scores for ranged between 3.97 to 5.95 across the sites, with six of the ten samples below the 'Good/Moderate' boundary. WHPT ASPT EQR scores ranged between 0.49 - 0.99 (0.78) with the lowest WHPT ASPT EQR of 0.49 at Site REE W12, and the highest EQR of 0.99 at Site RVX-03-00-00-001.
- 2.1.6 WHPT NTAXA scores ranged between 7 - 19 (13.7) with the lowest WHPT NTAXA score of 7 at Site REE W12 and the highest score of 19 at Sites RVX-03-00-00-001, RVX-01-00-00-010 and REE W14. The WHPT NTAXA expected scores ranged between 17.15 to 27.87 across the sites, with seven of the ten samples below the 'Good/Moderate' boundary. WHPT NTAXA EQR scores ranged between 0.32 - 0.73 (0.53) with the lowest WHPT NTAXA EQR of 0.32 at Site RVX-02-00-00-005 and the highest EQR of 0.73 at Site RVX-01-00-00-010.
- 2.1.7 LIFE (family) EQRs are not used to determine WFD classification but provides an indication of the flow preferences of the macroinvertebrate communities at the sites. LIFE (family) scores ranged between 5.5 - 7.41 (6.01) with the lowest LIFE (family) score of 5.5 at Site REE W12, and the highest score of 7.41 at Site RVX-03-00-00-001. The LIFE (family) expected scores ranged between 5.65 to 7.23 across the sites, with three of the ten samples below the 'Good/Moderate' boundary. LIFE (family) EQR scores ranged between 0.76 - 1.07 (0.95) with the lowest LIFE (family) EQR of 0.76 at Site REE W12 and the highest EQR of 1.07 at Site RVX-03-00-00-001.
- 2.1.8 Similarly, PSI EQRs are not used to determine WFD classification but provides an indication of the level of sedimentation and eutrophication at the sites. PSI (family) scores ranged between 4.76 - 53.33 (18.22) with the lowest PSI (family) score of 4.76 at Site REE W14 and the highest score of 53.33 at Site RVX-03-00-00-001. The PSI (family) expected scores ranged between 14.05 to 61.06 across the sites, with five of the ten samples below the 'Good/Moderate' boundary. PSI (family) EQR scores ranged between 0.22 - 1.17 (0.55) with the lowest PSI (fam) EQR of 0.22 at Site RVX-02-00-00-005 and the highest EQR of 1.17 at Site RVX-03-00-00-001.
- 2.1.9 A total of two INNS species, including New Zealand Mud Snail *Potamopyrgus antipodarum* and Demon Shrimp *Dikerogammarus haemobaphes* were recorded as present at three sites (detailed in **Table 5K1 2.6**).

River invertebrate classification tool

- 2.1.10 River Invertebrate Classification Tool analysis was performed to produce WFD status classifications for macroinvertebrates; outputs are summarised in **Table 5K1 2.4**.

2.1.11 RICT3 classification was performed on ten sites, listed below:

- RVX-03-00-00-001
- RVX-02-00-00-005
- RVX-02-00-00-004
- RVX-03-00-00-007
- REE W3
- RVX-01-00-00-010
- REE W7
- RVX-01-00-00-003
- REE W12
- REE W14

2.1.12 The RICT3 Classifications for the ten sites are listed in **Table 5K1 2.4**. Where alkalinity readings were taken from the Environment Agency Water Quality Archive.

Table 5K1 2.4 Results of RICT3 Classification

Site ID	WHPT ASPT EQR	WHPT NTAXA EQR	Indicative WFD Classification
RVX-03-00-00-001	0.989	0.682	Good
RVX-02-00-00-005	0.587	0.323	Bad
RVX-02-00-00-004	0.928	0.551	Poor
RVX-03-00-00-007	0.781	0.580	Moderate
REE W3	0.631	0.373	Bad
RVX-01-00-00-010	0.883	0.728	Good
REE W7	0.811	0.540	Poor

Site ID	WHPT ASPT EQR	WHPT NTAXA EQR	Indicative WFD Classification
RVX-01-00-00-003	0.757	0.389	Bad
REE W12	0.490	0.408	Bad
REE W14	0.893	0.726	Good

- 2.1.13 Sites RVX-03-00-00-001, RVX-01-00-00-010 and REE W14 all achieved indicative classification of 'Good' status, with site RVX-03-00-00-007 indicative of 'Moderate' and all other sites indicative of 'Bad' and 'Poor' WFD status.
- 2.1.14 The results indicate in the majority of sites that the macroinvertebrate assemblages are likely adversely affected by stressors such as pollution, flow pressures and anthropogenic activities. This is reflected in the WHPT NTAXA and WHPT ASPT EQR scores, which were below what would be expected under reference conditions as shown in **Table 5K1 2.4.** above.
- 2.1.15 The PSI scores indicated that there is a slight degree of nutrient enrichment throughout all sites, with all one site (RVX-03-00-00-001) indicative of heavily sedimented conditions. This would be expected given the connectivity between agricultural land use and the riverine environment.

Macroinvertebrate assemblage and conservation status

- 2.1.16 The samples contained large numbers of water slater *Asellus aquaticus*, non-biting midge (Chironomidae) and the Oligochaeta across all the samples.
- 2.1.17 The RVX-03-00-00-001, RVX-01-00-00-010 and REE_W14 displayed the greatest diversity of taxa and contained more species and larger numbers compared to the other sites at 19 taxa respectively.
- 2.1.18 The most abundant taxa included water slater *Asellus aquaticus*, non-biting midge (Chironomidae) and the Oligochaeta.
- 2.1.19 REE_W12 contained the lowest diversity of taxa with the assemblage dominated by the water slater *Asellus aquaticus*, with limited numbers of other taxa.
- 2.1.20 Two species of note under Community Conservation Index scoring, the Grannom Caddisfly *Brachycentrus subnubilus* and Scarce Olive *Baetis buceratus* were identified in the samples, detailed in **Table 5K1 2.5** A total of four *B.subnubilus* individuals were recorded in the RVX-03-00-00-001 sample, and a single *B.buceratus* individual was found in the REE_N12 sample. The species have conservation scores of six and as such are Regionally Notable (uncommon in some parts of the country).

Table 5K1 2.5 Macroinvertebrates identified with a Conservation Score of six or greater.

Latin name	Common name	Conservation Score	Status
<i>Baetis buceratus</i>	Scarce Olive	6	Regionally Notable
<i>Brachycentrus subnubilus</i>	Grannom Caddisfly	6	Regionally Notable

2.1.21 The invasive New Zealand Mud Snail *Potamopyrgus antipodarum* was recorded at sites RVX-03-00-00-001, RVX-02-00-00-004 and REE_W14, being most abundant at site RVX-02-00-00-004 where 983 individuals were found. In addition, Demon Shrimp *Dikerogammarus haemobaphes* were found to be present within site RVX-02-00-00-004 with four individuals present as detailed in **Table 5K1 2.6**.

Table 5K1 2.6 Invasive Macroinvertebrate species present within Autumn 2023 surveys

Site ID	Waterbody	Taxa Name	Common Name	Survey abundance
RVX-03-00-00-001	GB112068060510	<i>Potamopyrgus antipodarum</i>	New Zealand Mudsnaill	4
RVX-02-00-00-004	GB112068060470	<i>Potamopyrgus antipodarum</i>	New Zealand Mudsnaill	983
RVX-02-00-00-004	GB112068060470	<i>Dikerogammarus haemobaphes</i>	Demon Shrimp	4
REE W14	GB112068060330	<i>Potamopyrgus antipodarum</i>	New Zealand Mudsnaill	41

Sites by WFD waterbody

2.1.22 The sites surveyed are located within ten distinct WFD waterbodies which are included in the Preliminary Order Limits of the Project. Each WFD water body is detailed below with a summary of the results for each watercourse crossing survey site. These site summaries highlight the number of taxa present and any recorded occurrences of INNS or designated species.

Bollin (Ashley Mill to Manchester Ship Canal) - GB112069061382

RVX-03-00-00-005

2.1.23 No survey completed - unsuitable for macroinvertebrate surveys due to steep banks and deep water.

Sinderland Brook – GB112069060980

RVX-03-00-00-007

2.1.24 The macroinvertebrate assemblage at Site RVX-03-00-00-007, in September 2023, comprised of 15 scoring taxa. No INNS species were recorded at the site.

Sutton Brook - GB112069061170

REE_N12

2.1.25 No survey completed - unsuitable for macroinvertebrate surveys due to steep banks and deep water.

Cogshall Brook - GB112068060510

RVX-03-00-00-001

2.1.26 The macroinvertebrate assemblage at Site RVX-03-00-00-001, in September 2023, comprised of 19 scoring taxa. One INNS species was recorded at the site: *Potamopyrgus antipodarum* (New Zealand Mud Snail).

Puddinglake Brook - GB112068060220

RVX-02-00-00-005

2.1.27 The macroinvertebrate assemblage at Site RVX-02-00-00-005, in September 2023, comprised of 9 scoring taxa. No INNS species were recorded at the site.

Dane (Wheelock to Weaver) - GB112068060470

RVX-02-00-00-004

2.1.28 The macroinvertebrate assemblage at Site RVX-03-00-00-007, in September 2023, comprised of 15 scoring taxa. Two INNS species was recorded at the site: *Potamopyrgus antipodarum* (New Zealand Mud Snail) and *Dikerogammarus haemobaphes* (Demon Shrimp).

Weaver (Dane to Frodsham) - GB112068060500

REE_W3, RVX-01-00-00-010 and REE_W7

- 2.1.29 The macroinvertebrate assemblage at Site RVX-01-00-00-010 recorded the highest number of scoring taxa with 19 and Site REE_W3 recorded the least with ten. No INNS species were recorded at all sites.

Peckmill Brook, Hoolpool Gutter at Ince Marshes - GB112068060330

RVX-01-00-00-003, REE_W12 and REE_W14

- 2.1.30 The macroinvertebrate assemblage at Site REE_W14 recorded the highest number of scoring taxa with 19 and Site REE_W12 recorded the least with seven. One INNS species was recorded at Site REE_W14: *Potamopyrgus antipodarum* (New Zealand Mud Snail).

2.2 Overview

- 2.2.1 Ten of the twelve sites were successfully surveyed in 2023 and were assessed with WFD RICT3 methodology. These sites indicated a range of indicative WFD classifications from 'Good' to 'Bad' with three sites classed as 'Good', one 'Moderate', two 'Poor' and four 'Bad'. Invasive species of *Potamopyrgus antipodarum* and *Dikerogammarus haemobaphes* were recorded at three sites during the surveys. Two Species of Conservation Interest, Grannom Caddisfly *Brachycentrus subnubilus* and Scarce Olive *Baetis buceratus* were identified in the samples, RVX-03-00-00-001 and REE_N12.

2.3 Next Steps

- 2.3.1 Should further changes to the Project be outside the Preliminary Order Limits at the time of reporting, further surveys may be required to provide a baseline of the macroinvertebrate community present within any additional watercourses.
- 2.3.2 Should the survey data within this report become older than 18 months before the planning application for the Project is submitted, it is advised that the macroinvertebrate surveys be repeated. Eighteen months is the time for which ecological survey data is likely to remain valid.

Annex 1 Macroinvertebrate Taxon List

Table 5K1 1.1 Macroinvertebrate taxon list

Site Description	RVX-03-00-00-001	RVX-02-00-00-005	RVX-02-00-00-004	RVX-03-00-00-007	REE W3	RVX-01-00-00-010	REE W7	RVX-01-00-00-003	REE W12	REE W14
<i>Tricladida</i>										4
<i>Gastropoda</i>		1	2			1				1
<i>Valvata piscinalis</i>					33	1				
<i>Potamopyrgus antipodarum</i>	4		983							41
<i>Bithynia tentaculata</i>			45		4	1	3			
<i>Physella</i>				4		2			7	183
<i>Lymnaeidae</i>	2						1			
<i>Stagnicola palustris</i>				2		1				
<i>Radix balthica</i>		1	1			1	23	1		8
<i>Planorbidae</i>				1		1				
<i>Planorbis carinatus</i>				13						
<i>Planorbis planorbis</i>						1	3			1
<i>Anisus vortex</i>		2		26		34				
<i>Gyraulus albus</i>				1	8	8				
<i>Gyraulus crista</i>					3					
<i>Hippeutis complanatus</i>				1						
<i>Planorbarius corneus</i>				1	1	1	1	1		2
<i>Ancylus fluviatilis</i>	4									
<i>Acroloxus lacustris</i>				4						

Site Description

	RVX-03-00-00-001	RVX-02-00-00-005	RVX-02-00-00-004	RVX-03-00-00-007	REE W3	RVX-01-00-00-010	REE W7	RVX-01-00-00-003	REE W12	REE W14
<i>Succineidae</i>				3						
<i>Sphaeriidae</i>			3							
<i>Sphaerium</i>	17		1	4						
<i>Pisidium</i>	24		4	2						
<i>Oligochaeta</i>	7	4	4	2				6	1	3
<i>Theromyzon tessulatum</i>				2						3
<i>Glossiphonia complanata</i>	2	1	1		5	3				
<i>Glossiphonia paludosa</i>						1	1			
<i>Helobdella stagnalis</i>				23			29			
<i>Alboglossiphonia heteroclita</i>						1				1
<i>Erpobdellidae</i>				15						
<i>Erpobdella octoculata</i>							1	2		
<i>Erpobdella testacea</i>				8						
<i>Hydracarina</i>					1					6
<i>Cladocera</i>										5
<i>Ostracoda</i>										44
<i>Asellus aquaticus</i>	89	14	1	2263	25	48	313	41	239	419
<i>Gammarus pulex</i>	71	3		27		1				
<i>Collembola</i>		1								
<i>Baetidae</i>						1				2
<i>Baetis</i>	2			43						
<i>Baetis buceratus</i>				4						

Site Description

	RVX-03-00-00-001	RVX-02-00-00-005	RVX-02-00-00-004	RVX-03-00-00-007	REE W3	RVX-01-00-00-010	REE W7	RVX-01-00-00-003	REE W12	REE W14
<i>Baetis fuscatus</i>				6						
<i>Baetis rhodani</i>	4									
<i>Cloeon dipterum</i>										5
<i>Ephemera</i>	1									
<i>Ephemera danica</i>	1									
<i>Serratella ignita</i>	2									
<i>Coenagrionidae</i>						7	1			12
<i>Pyrrhosoma nymphula</i>						4				
<i>Ischnura elegans</i>						1				7
<i>Calopteryx splendens</i>			6	11						
<i>Aeshna cyanea</i>										1
<i>Nepa cinerea</i>						1				
<i>Ilyocoris cimicoides</i>							5			
<i>Notonecta glauca</i>					1					
<i>Callicorixa praeusta</i>					3					2
<i>Hesperocorixa linnaei</i>								1		
<i>Hesperocorixa sahlbergi</i>					1	2				
<i>Sigara dorsalis</i>					15	1		1		13
<i>Sigara falleni</i>					2					2
<i>Haliplidae</i>								1		
<i>Haliplus</i>				13	1	6				1
<i>Haliplus lineatocollis</i>						1				
<i>Haliplus sibiricus</i>				2	1					

Site Description

	RVX-03-00-00-001	RVX-02-00-00-005	RVX-02-00-00-004	RVX-03-00-00-007	REE W3	RVX-01-00-00-010	REE W7	RVX-01-00-00-003	REE W12	REE W14
<i>Haliphus flavicollis</i>					1					
<i>Noterus clavicornis</i>										1
<i>Dytiscidae</i>		2								
<i>Hyphydrus ovatus</i>							1			
<i>Hygrotus inaequalis</i>						1	1		1	
<i>Hydroporus planus</i>								1		
<i>Platambus maculatus</i>		4								
<i>Agabus sturmii</i>						1				
<i>Ilybius</i>		11								
<i>Ilybius quadriguttatus</i>						1				
<i>Helophorus</i>							1			
<i>Helophorus brevipalpis</i>	1					2	1			1
<i>Hydrophilidae</i>										1
<i>Anacaena globulus</i>						3				
<i>Anacaena limbata</i>						1				
<i>Helochares lividus</i>							1			
<i>Elmis aenea</i>	117		1							
<i>Limnius volckmari</i>	4									
<i>Oulimnius</i>	1									
<i>Oulimnius tuberculatus</i>	1									
<i>Sialis lutaria</i>			1			1			4	
<i>Rhyacophila dorsalis</i>	1									
<i>Agapetus</i>	4									

Site Description

	RVX-03-00-00-001	RVX-02-00-00-005	RVX-02-00-00-004	RVX-03-00-00-007	REE W3	RVX-01-00-00-010	REE W7	RVX-01-00-00-003	REE W12	REE W14
<i>Hydropsyche siltalai</i>	2		1							
<i>Brachycentrus subnubilus</i>			1							
<i>Cataclysta lemnata</i>						6	1			
<i>Diptera</i>		2		2						1
<i>Psychodidae</i>		13	1							
<i>Ceratopogonidae</i>										1
<i>Simuliidae</i>	5									
<i>Chironomidae</i>	1	1215	14	1	2	7	1	3	2	48
<i>Sciomyzidae</i>									1	
<i>Ephydridae</i>							1			
<i>Corixinae</i>					13					18
<i>Halipus ruficollis group</i>				1		1				
<i>Hydroporinae</i>										1
<i>Polycelis nigra/tenuis</i>	1									2
<i>Dikerogammarus haemobaphes</i>			4							
<i>Sigara dorsalis/striata</i>					1					86
<i>Gammarus pulex/fossarum</i>	155	2	1	14						
<i>Baetis rhodani/atlanticus</i>	18									
<i>Corixa punctata/iberica</i>							1			
<i>Crangonyx pseudogracilis/floridianus</i>				2	1	10	8	2		6
<i>Odontomyia/Oplodontha</i>						2				

Table 5K1 1.2 Macroinvertebrate metric scores

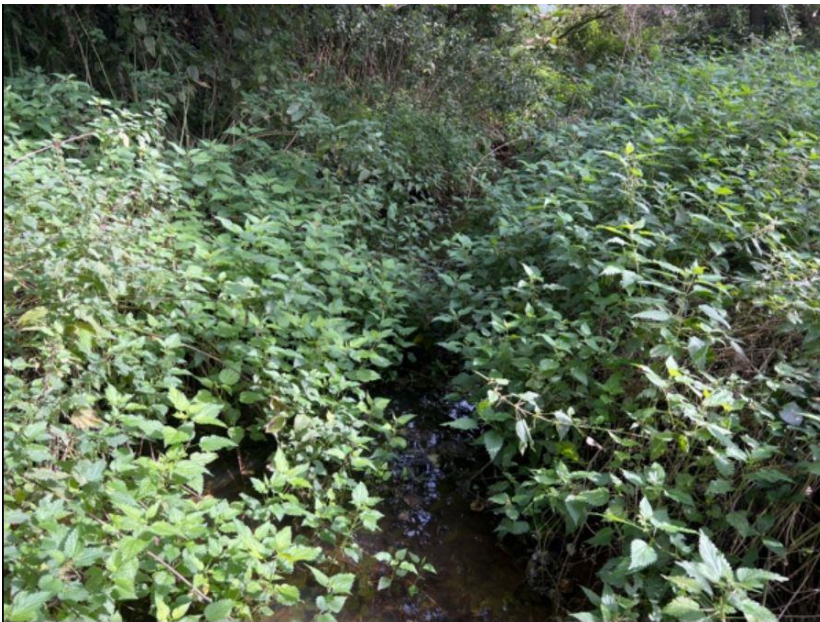
Site Description	RVX-03-00-00-001	RVX-02-00-00-005	RVX-02-00-00-004	RVX-03-00-00-007	REE W3	RVX-01-00-00-010	REE W7	RVX-01-00-00-003	REE W12	REE W14
WHPT N-Taxa	19	9	15	15	10	19	14	10	7	19
WHPT Total	100.2	29	68.2	52	31.3	67	46.7	33.1	20.4	67.3
WHPT ASPT	5.27	3.22	4.55	3.47	3.13	3.53	3.34	3.31	2.91	3.54
Family LIFE Score	7.41	6.00	6.50	6.00	5.56	5.94	5.67	5.88	5.50	5.63
Species LIFE Score	7.50	6.50	6.70	5.88	5.67	5.89	5.62	5.57	5.33	5.75
CCI	3.43	1.17	8.00	11.76	5.40	12.96	17.00	5.63	1.33	5.06
PSI Mixed	53.33	10.00	20.00	15.69	0.00	5.56	0.00	0.00	0.00	4.76
PSI Mixed-assessment	Moderately Sedimented	Heavily Sedimented	Heavily Sedimented	Heavily Sedimented	Heavily Sedimented	Heavily Sedimented	Heavily Sedimented	Heavily Sedimented	Heavily Sedimented	Heavily Sedimented

Annex 2 Site Photographs

Graphic 5K1 2.1 RVX-03-00-00-001 Survey Area



Graphic 5K1 2.2 RVX-02-00-00-005 Survey Area



Graphic 5K1 2.3 RVX-02-00-00-004 Survey Area



Graphic 5K1 2.4 RVX-03-00-00-007 Survey Area



Graphic 5K1 2.5 REE W3 Survey Area



Graphic 5K1 2.6 RVX-01-00-00-010 Survey Area



Graphic 5K1 2.7 REE W7 Survey Area



Graphic 5K1 2.8 RVX-01-00-00-003 Survey Area



Graphic 5K1 2.9 REE_W12 Survey Area



Graphic 5K1 2.10 REE_W14 Survey Area



Graphic 5K1 2.11 RVX-03-00-00-005 Survey Area



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Annex 5K2

Aquatic Ecology Survey Report – Macrophyte Surveys

October 2024

Revision	1
Volume	0001
Document ref.	0001

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1. Methodology

1.1 Desk Study

- 1.1.1 A desk study was undertaken in Spring 2022 and the methodology for this is set out in **Section 5.5** and **Table 5.8** of the Preliminary Environmental Information Report (PEIR). The desk study recorded the presence of statutory designated sites within up to 20km ^[1] of the Preliminary Order Limits (**Section 5.6.1**, **Table 5.10**, and **Figure 5.1** of the PEIR) and non-statutory designated sites within 2km (**Section 5.6.2**, **Table 5.11**, and **Figure 5.2** of the PEIR). The desk study also recorded the presence of Habitats of Principal Importance (HPI) within 2km of the Preliminary Order Limits (**section 5.6.3**, **Table 5.12** and **Figure 5.3** of the PEIR). Records of protected and notable species within 2km of the Preliminary Order Limits are discussed within **section 5.6.12-5.6.41** of the PEIR.
- 1.1.2 The desk study information from the PEIR is not repeated in this report or discussed further. The desk study will be updated for the Final Environmental Statement following design freeze for the Project.

1.2 Survey Area

- 1.2.1 Please note that as part of the design process, the order limits have undergone a number of iterations (as described in **Appendix 2A: Design evolution** of the Draft ES) and this report is based on the Preliminary Order Limits as they stood in early 2023.
- 1.2.2 The study area for Macrophyte surveys includes a total of 31 watercourse crossings as shown in **Figure 5K2 1.1**. Of these, 24 watercourse crossings were completed in July 2022 to cover a representative sample of watercourse crossings within the redline boundary as updated in June 2022. A further seven watercourse crossings were completed in August and September 2023 to cover the updated redline boundary as of April 2023.
- 1.2.3 A total of 25 sites were surveyed on one occasion, for river macrophytes using the LEAFPACS2 methodology², in accordance with the requirements of the WFD. Of these 25 sites six sites were dry at the time of survey and no macrophyte data was collected. Surveys were undertaken in July 2022 and August/September 2023. Survey locations are provided in **Table 5K2 1.1** and **Table 5K2 2.1** and photographs in **Graphic 5K2 2.1** to **Graphic 5K2 2.20** in **Annex 2**.

¹ Dependent on reasons for designations; within two kilometres for habitats, extending to 10 kilometres for bats and up to 20 kilometres for all the ornithological interests for international sites.

² UKTAG (2014) UKTAG River Assessment Method. Macrophytes and Phytobenthos; Macrophytes (River LEAFPACS2). July 2014

1.3 Field Surveys

Approach to field survey design

- 1.3.1 Macrophyte surveys were conducted along watercourse crossing points detailed in **Table 5K2 1.1** below, in July 2022 and August/September 2023.
- 1.3.2 The study area considers 31 watercourse crossings. Survey locations were chosen based on Water Framework Directive (WFD) waterbody classification or chosen as a representative watercourse within each geographical area/ watercourse type (Canal, River or Stream/Ditch) to provide an indication of the community structures present. One representative watercourse identified by the Environment Agency as a main river, which is crossed by the route of the Project, was included for each WFD waterbody classified for Macrophytes and Phytobenthos.

Table 5K2 1.1 Macrophyte Survey sites

River Crossing Name	X	Y	Watercourse Type	Watercourse name	Watercourse Status (WFD / Main River/ Ordinary watercourse)	Hydro-morphological designation	WFD waterbody	Ecological Classification	Macrophytes and Phytobenthos Combined	Macrophytes Sub Element	Phytobenthos Sub Element
STRX-01-00-00-001	346742	375265	Stream/ditch		Main River	not designated artificial or heavily modified	GB112068060330 Peckmill Brook, Hoolpool Gutter at Ince Marshes	Moderate	Moderate	Moderate	-
STRX-01-00-00-009	348074	375992	Stream/ditch		Main River	not designated artificial or heavily modified	GB112068060330 Peckmill Brook, Hoolpool Gutter at Ince Marshes	Moderate	Moderate	Moderate	-
STRX-01-00-00-027	351268	378248	Stream/ditch	-	Main River	Heavily Modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate	Good	Poor	Good
RVX-01-00-00-015	352471	379128	River	River Weaver	WFD	Heavily Modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate	Good	Poor	Good
STRX-01-00-00-031	355181	378914	Stream/ditch	-	Ordinary watercourse	Heavily Modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate	Good	Poor	Good

River Crossing Name	X	Y	Watercourse Type	Watercourse name	Watercourse Status (WFD / Main River/ Ordinary watercourse)	Hydro-morphological designation	WFD waterbody	Ecological Classification	Macrophytes and Phytobenthos Combined	Macrophytes Sub Element	Phytobenthos Sub Element
RVX-02-00-00-001	359816	376175	River	River Weaver	WFD	Heavily Modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate	Good	Poor	Good
STRX-02-00-00-002	359913	375821	Stream/ ditch	-	Ordinary watercourse	Heavily Modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate	Good	Poor	Good
RVX-02-00-00-003	363957	370272	River	River Weaver	WFD	Heavily Modified	GB112068060463 Weaver (Winsford Flashes to Dane)	Moderate	-	Poor	-
RVX-02-00-00-004	367766	369366	River	River Dane	WFD	not designated artificial or heavily modified	GB112068060470 Dane (Wheelock to Weaver)	Moderate	Moderate	Moderate	Moderate
CLX-02-01-00-002	365066	374990	Canal	Weaver Navigation	WFD	Heavily Modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate	Good	Poor	Good
RVX-03-00-00-002	365417	381247	River	Gale Brook	WFD	not designated artificial or heavily modified	GB112068060420 Arley Brook (Source to Gale Brook)	Moderate	Moderate	Moderate	-

River Crossing Name	X	Y	Watercourse Type	Watercourse name	Watercourse Status (WFD / Main River/ Ordinary watercourse)	Hydro-morphological designation	WFD waterbody	Ecological Classification	Macrophytes and Phytobenthos Combined	Macrophytes Sub Element	Phytobenthos Sub Element
STRX-03-00-005	365826	381479	Stream/ ditch	-	Ordinary watercourse	not designated artificial or heavily modified	GB112068060420 Arley Brook (Source to Gale Brook)	Moderate	Moderate	Moderate	-
RVX-03-00-005	371779	387909	River	River Bollin	WFD	not designated artificial or heavily modified	GB112069061382 Bollin (Ashley Mill to Manchester Ship Canal)	Poor	Poor	Poor	-
STRX-03-00-00-013	372043	388197	Stream/ ditch	-	Main River	not designated artificial or heavily modified	GB112069061382 Bollin (Ashley Mill to Manchester Ship Canal)	Poor	Poor	Poor	-
RVX-03-00-00-007	373027	390517	River	Sinderl and Brook	WFD		GB112069060980 Sinderland Brook	Poor	Moderate	Moderate	-
STRX-04-00-00-008	357474	385837	Stream/ ditch	-	Ordinary watercourse	-	-	-	-	-	-

River Crossing Name	X	Y	Watercourse Type	Watercourse name	Watercourse Status (WFD / Main River/ Ordinary watercourse)	Hydro- morphological designation	WFD waterbody	Ecological Classification	Macrophytes and Phytobenthos Combined	Macrophytes Sub Element	Phytobenthos Sub Element
STRX-04-00-00-009	356659	385903	Stream/ ditch	-	Ordinary watercourse	-	-	-	-	-	-
STRX-04-03-01-001	350834	390216	Stream/ ditch	-	Ordinary watercourse	Heavily Modified	GB112069061170 Sutton Brook	Moderate	Moderate	Poor	Moderate
RVX-04-03-01-001	350837	390977	River	Unnam ed River / Main Drain	WFD	Heavily Modified	GB112069061170 Sutton Brook	Moderate	Moderate	Poor	Moderate
REE_N1	356256	386653	Canal	Sankey Canal	WFD	Artificial	GB71210055	Moderate	-	-	-
REE_SA 12	359881	376610	Canal	Trent and Mersey Canal	WFD	Artificial	GB71210247	Moderate	-	-	-

River Crossing Name	X	Y	Watercourse Type	Watercourse name	Watercourse Status (WFD / Main River/ Ordinary watercourse)	Hydro- morphological designation	WFD waterbody	Ecological Classification	Macrophytes and Phytobenthos Combined	Macrophytes Sub Element	Phytobenthos Sub Element
REE_W 14	347566	376858	River	Hornsm ill Brook	WFD	not designated artificial or heavily modified	GB112068060330 Peckmill Brook, Hoolpool Gutter at Ince Marshes	Moderate	Moderate	Moderate	-
REE_SA 3	364272	370730	River	Weaver	WFD	Heavily Modified	GB112068060463 Weaver (Winsford Flashes to Dane)	Moderate	-	Poor	-
REE_N1 4	356982	385863	Stream/ ditch	Unnam ed ditch	Ordinary watercourse	-	-	-	-	-	-
REE_SA 4	364079	370722	Stream/ ditch	Unnam ed stream	WFD	Heavily Modified	GB112068060463 Weaver (Winsford Flashes to Dane)	Moderate	-	Poor	-
REE_N1 2	350456	391219	River	Sutton Brook	WFD	Heavily Modified	GB112069061170 Sutton Brook	Moderate	Moderate	Poor	Moderate

- 1.3.3 The macrophyte survey was carried out using the Water Framework Directive UK Technical Advisory Group's methodology for assessing macrophytes in rivers (WFDUKTAG)². This method conforms with CEN 14184: 2003 Water Quality – Guidance standard for the surveying of aquatic macrophytes in running waters.
- 1.3.4 The methodology specifies that a 100m reach of the watercourse should be sampled between 1st June and 30th September and that sampling should not be completed during or immediately after high flows.
- 1.3.5 Survey recorded the presence of all macrophyte taxa present with the Survey Area to species level where possible. Where this was not possible, taxa were recorded to genus or other aggregate taxon level.
- 1.3.6 The percentage of the river channel (up to the height of bank that would typically be inundated for >50% of the year) covered by each species was estimated by assigning it an appropriate taxon cover value, as detailed in **Table 5K2 1.2**.

Table 5K2 1.2 Cover values for lotic macrophyte surveys

Percentage cover range (% of channel area)	Mid-point percentage	Taxon cover level
<0.1	0.05	1
0.1<1	0.5	2
1<2.5	1.7	3
2.5<5	3.8	4
5<10	7.5	5
10<25	17.5	6
25<50	37.5	7
50<75	62.5	8
>75	87.5	9

1.4 Biological Indices

- 1.4.1 The condition of the macrophyte communities within the Survey Area was assessed by calculating various indices using data recorded during the field survey. These indices are detailed in the following paragraphs within this section.

River Macrophyte Nutrient Index (RMNI)

- 1.4.2 The RMNI is a measure of the plants that grow in the river and their association with high nutrient levels; it is measured on a scale from 1-10.

- 1.4.3 Each scoring macrophyte taxon was assigned its corresponding RMNI species score. RMNI was then calculated using the equation:

$$RMNI = \frac{\sum_{j=1}^n (C_j \times R_j)}{\sum_{j=1}^n C_j}$$

- 1.4.4 Where:

- 'R_j' is the river macrophyte nutrient index score for taxon 'j';
- 'j' represents a scoring taxon and has a value of 1 to 'n' indicating which taxon it represents; and
- 'C_j' is the taxon cover value for taxon 'j'.

Number of Macrophyte Taxa (NTAXA)

- 1.4.5 NTAXA is the number of truly aquatic (non-helophyte) scoring taxa recorded in the field survey, which is used as a measure of diversity.

Number of Functional Groups (NFG)

- 1.4.6 NFG is a diversity metric calculated by assigning all truly aquatic (non-helophyte) scoring taxa to one of 24 'functional groups'. The NFG value is given by the sum of the number of different functional groups of taxa that were identified as being present in the river.

Cover of Green Filamentous Algae (ALG)

- 1.4.7 ALG is the percentage cover of green filamentous algae over the whole survey section. This was calculated by adding up the mid-point percentage cover values (**Table 5K2 1.2**) for all algae species identified as being present.
- 1.4.8 The value for the parameter ALG represents the total coverage of the riverbed by green filamentous algae and will range from 0-100. This metric is used as a measure of nutrient enrichment.

1.5 River Predictions and Classification Systems for Macrophytes (LEAFPACS2)

- 1.5.1 The River LEAFPACS2 classification tool was used to contextualise RMNI, NTAXA, NFG, and ALG metric scores. Ecological Quality Ratios (EQRs) are derived from these metrics based on observed data and site-specific predicted reference values derived from the physical and chemical parameters listed in **Table 5K2 1.3**.

Table 5K2 1.3 Predictive reference parameters for LEAFPACS2

Invariant data	Variant data
National Grid Reference (NGR)	Alkalinity
Slope	-
Distance from source	-
Altitude at source	-

- 1.5.2 EQRs are normalised so they fit the same scale and combined to provide an overall EQR representing an ecological status class as defined by the WFD ('High', 'Good', 'Moderate', 'Poor' and 'Bad'). The class boundaries are outlined in **Table 5K2 1.4** below.

Table 5K2 1.4 River LEAFPACS2 class boundaries

Status class boundary	EQR
High/Good	0.8
Good/Moderate	0.6
Moderate/Poor	0.4
Poor/Bad	0.2

1.6 Constraints

Access limitations

- 1.6.1 Surveys were limited to locations where landowner permission had been obtained within the survey season.
- 1.6.2 Macrophyte surveys require physical access to the river channel, so health and safety concerns or other physical restrictions constrained macrophyte surveys. Heavy bank-side vegetation and steep banks constrained physical access to the channel.
- 1.6.3 Of the 31 sites identified as requiring macrophyte surveys 26 sites were accessed, five sites were did not have physical access to the watercourse. A summary of locations where the requirement for river macrophyte survey was identified, but where surveys were not conducted due to inadequate access, is provided below:
- RVX-02-00-00-004
 - RVX-03-00-00-005
 - RVX-03-00-00-007

- CLX-04-00-00-002
- RVX-04-00-00-005

1.6.4 Access was obtained for a total of 26 sites, 19 sites in 2022 and seven sites in 2023, of these six sites were dry at the time of survey and no macrophyte data was collected. Survey locations are provided in **Table 5K2 2.1** and photographs in **Graphic 5K2 2.1** to **Graphic 5K2 2.20** in **Annex 2**.

1.6.5 Macrophyte surveys were limited to watercourses which were not dry during the survey season. A summary of locations where the requirement for river macrophyte survey was identified, but where no data was collected due to dry watercourses, is provided below:

- STRX-01-00-00-031
- STRX-02-00-00-002
- STRX-03-00-00-013
- STRX-04-00-00-008
- STRX-04-00-00-009
- STRX-04-03-01-001

1.6.6 Seven sites were surveyed in 2023, of these one site was deemed unsuitable to survey due to the artificial nature of the channel substrate; this was REE_N12.

Ecological considerations

1.6.7 Any specimens that could not be identified with confidence in the field were retained for later identification in the laboratory. Where it was not possible to identify a macrophyte to species level (for example due to the lack of flowering or fruiting bodies), it was recorded under its genus or other aggregate taxon level if such was listed in the guidelines.

1.6.8 To assess a site for ecological status, it is recommended that a minimum of one survey per year for three years should be undertaken, with the surveys being carried out at the same time of the season each year.

1.6.9 Although a minimum of three once-a-year surveys is recommended, to enable any inter-year variation to be taken into account, assessments of ecological status may be undertaken on the basis of a single survey in a single year. This is seen as appropriate for studies such as the Project, where the aim is to gain an overview of the ecological status of the catchments in order to identify those areas which would most benefit from further investigation.

1.6.10 Ecological survey data is typically valid for up to 18 months unless otherwise specified³. The likelihood of surveys needing to be updated increases with time and is greater in circumstances where the habitat or its management has changed significantly since the surveys were undertaken.

³ CIEEM. (2019). *Advice note on the lifespan of ecological reports and surveys*. Available at: <https://cieem.net/wp-content/uploads/2019/04/Advice-Note.pdf>

- 1.6.11 In addition to the metrics above, non-scoring taxa (on the LEAFPACS2 list of taxa) and additional taxa not on the list were used to aid interpretation.
- 1.6.12 Whilst LEAFPACS2 metrics are automatically calculated for ditches and impoverished watercourses with very low numbers of taxa, they should not be used in the calculation of WFD macrophyte status.
- 1.6.13 Where a watercourse is not suitable (ditches) for the LEAFPACS2 classification method, a quality assessment was made based on professional judgement and presence of species of conservation interest.

1.7 Personnel

- 1.7.1 The programme of surveys was led by Pete Sibley. The survey lead was assisted by suitably qualified and experienced Ricardo Personnel; details of whom are provided in **Table 5K2 1.5**.

Table 5K2 1.5 Survey personnel

Name	Experience
Pete Sibley	BSc (Hons) Applied Biology, Diploma in Water & Environmental Management, Diploma in Fisheries Management. Over 30 years of experience in ecological consultancy. Fellow of the Linnean Society (FLS), Chartered Environmentalist (CEnv), Member of the Chartered Institute of Ecology & Environmental Management (MCIEEM), Member of the Institute of Fisheries Management (MIFM). Licence holder: WML-CL11 - Surveying white-clawed crayfish
Esther Kendall	BSc. (Hons), MSc. Over four years of experience in ecological consultancy.
Oliver Parr	BSc. (Hons), MSc. Over two years of experience in ecological consultancy.
Curt Williams	BSc. (Hons), MSc. Over four years of experience in ecological consultancy.

2. Results

2.1 Field Survey

- 2.1.1 A total of 25 sites were surveyed on one occasion in either 2022 or 2023, with 18 sites completed in July 2022 as part of the original survey scope and seven additional survey sites completed in August/September 2023. All river macrophytes surveys were completed using the LEAFPACS2 methodology², in accordance with the requirements of the WFD⁴. Of these 25 sites, six sites were dry at the time of survey and no macrophyte data was collected.
- 2.1.2 The macrophyte flora and physical character of the survey length were surveyed by wading, boat, or walking along the bank using a grapnel to retrieve samples for identification as required. **Table 5K2 2.1** provides a list of the sites completed within the study area and includes start and end locations and surveyor comments.
- 2.1.3 All macrophytes present were recorded, together with the estimated percentage cover of each taxon (recorded as abundance classes) and the estimated percentage cover of overall macrophyte growth. Representative samples (algae, *Ranunculus*, *Callitriche*, and *Potamogeton* species) and species which were uncertain were taken for laboratory identification. Physical parameters of the survey length were estimated, and a photograph taken. **Table 5K2 2.2** contains the environment variables of the sites completed within the study area and includes any visual observations.

⁴ The Water Environment (Water Framework Directive) (England and Wales) Regulations 2003

Table 5K2 2.1 Macrophyte survey site list

Site name	Surveyor	Start time	NGR start	NGR end	% Wadeable	Notes
STRX-01-00-00-001	PJS	10:20	SJ 46761 75217	SJ 46722 75300	10	Ditch choked with dense <i>Phragmites</i> and <i>Sparganium</i> reeds, making observation of the water surface & submerged species difficult. Grapnel pole used. Access to both banks via crossing point at d/s end. Clearer view of marginal vegetation from far (right) bank.
STRX-01-00-00-009	PJS	12:00	SJ 48084 75978	SJ 48033 76061	0	Channel completely covered by duckweed or emergent vegetation. Grapnel pole used.
STRX-01-00-00-027	PJS	13:50	SJ 51307 78220	SJ 51223 78278	10	Ditch contains shallow standing water occupying a fraction of the channel throughout - close to drying out. Vegetation almost entirely composed of reeds.
RVX-01-00-00-015	PJS	10:25	SJ 52442 79192	SJ 52538 79149	20	Surveyed 5 m strip along right bank, mainly from boat but wading possible in margins at either end of survey length. Grapnel and grapnel pole used - too cloudy for bathyscope.
STRX-01-00-00-031	PJS	14:40	SJ 55172 78906		DRY	Dry ditch not surveyed - occasional standing puddles of water but not continuous. No aquatic vegetation seen. Heavily overgrown with bindweed, nettle, bramble and willowherb.

Site name	Surveyor	Start time	NGR start	NGR end	% Wadeable	Notes
RVX-02-00-00-001	PJS	16:40	SJ 59738 76217	SJ 59849 76176	0	Surveyed 5 m strip along right bank from boat. Grapnel and pole grapnel used, too cloudy for bathyscope, substrate felt firm. Channel edge was artificial concrete lip - <i>Phragmites</i> was abundant along the bank on the landward side of this lip and all of the additional taxa recorded above were found here (not counted as within the wetted channel).
STRX-02-00-00-002	PJS	15:25	SJ 59941 75850		DRY	Dry ditch not surveyed - occasional standing puddles of water but not continuous. No aquatic vegetation seen. Hawthorn hedge adjacent with <i>Phalaris</i> , thistles, bramble and willowherb in channel.
RVX-02-00-00-003	PJS	13:00	SJ 63963 70234	SJ 63943 70320	0	Surveyed full channel width from boat. Grapnel and grapnel pole used, too cloudy for bathyscope. No submerged macrophytes found. Note occurrence of several INNS species in additional taxa.
RVX-02-00-00-004	PJS	14:30	SJ 66697 71889	SJ 66769 71811	90	Waded up river, except for occasional deep areas including immediately d/s weir at the upstream end.
CLX-02-01-00-002	PJS	15:35	SJ 65079 75001	SJ 65031 75088	1	No boat access. Surveyed 5 m strip from right bank. Grapnel and pole grapnel used, too deep/cloudy for bathyscope. Most of bank was reinforced piling, some gaps in this provided habitat for vegetation. Stand of <i>Phragmites</i> at u/s end.
RVX-03-00-00-002	PJS	15:00	SJ 65466 81268	SJ 65383 81256	100	Channel entirely wadeable but with some difficulty due to very dense growth of balsam, nettles and brambles. This effectively shades most of the water surface.

Site name	Surveyor	Start time	NGR start	NGR end	% Wadeable	Notes
STRX-03-00-00-005	PJS	13:50	SJ 65835 81433	SJ 65819 81531	100	Narrow and shallow, slow flowing ditch entirely wadeable. Much leaf litter in channel from recent hedge trim.
RVX-03-00-00-005	PJS	10:20	SJ 70907 88402	SJ 70928 88325	20	Section too deep to wade at d/s end, grapnel and grapnel pole used from right bank. Possible to safely wade sandy shelf at u/s end - see photos. Note presence of invasive species including Giant hogweed.
STRX-03-00-00-013	PJS	09:00	SJ 72081	88157	DRY	Dry ditch not surveyed - occasional stagnant puddles but mostly dry. Dense growth of water horsetail (<i>Equisetum fluviatile</i>), <i>Phalaris</i> , nettles, bramble and other terrestrial vegetation along length of channel.
RVX-03-00-00-007	PJS	12:30	SJ 73990 90550	SJ 74056 90541	60	Access at d/s end where brook is wadeable for approx. half its length (chest waders would be preferable here). Otherwise use binoculars and grapnel pole. Livestock poaching at d/s and u/s end, some manure in channel. Dense growth of <i>Potamogeton natans</i> along much of the channel.
STRX-04-00-00-008	PJS	13:00	SJ 57341	85833	DRY	Dry ditch not surveyed - Himalayan balsam abundant along channel and banks, also growth of <i>Phragmites</i> , nettles, grasses etc.
STRX-04-00-00-009	PJS	12:15	SJ 56652	85885	DRY	Dry ditch not surveyed - dense growth of <i>Phragmites</i> , bramble, nettles etc along length of ditch.

Site name	Surveyor	Start time	NGR start	NGR end	% Wadeable	Notes
STRX-04-03-01-001	PJS	11:10	SJ 50808	90166	DRY	Dry grassy ditch not surveyed - occasional <i>Juncus effusus</i> but no standing water. Long section of this ditch has been filled in d/s of intended survey length.
RVX-04-03-01-001	PJS	09:50	SJ 50851 90966	SJ 50766 90999	0	Overgrown ditch with tall herbs growing along banks. Not possible to wade due to sinking sediment, surveyed from right bank with use of grapnel pole.
REE_N1	EK	10:00	SJ 56300 86682	SJ 56212 86625	0	Regularly used canal, with boat traffic. Survey conducted using a grapnel. Channel was mostly clear of vegetation, it's possible the reach has been recently cleared of vegetation. Channel choked with vegetation towards the road bridge. Both banks were artificial walls, with the occasional marginal species growing on the walls but not in the water.
REE_SA1 2	EK	14:20	SJ 59927 76597	SJ 59836 76634	0	Regularly used canal, with lots of boat traffic. RHB is 100% artificial, LHB is more natural. Survey undertaken using grapnel from RHB> Site was moved slightly due to the presence of moored boats along most of the RHB. Common Reed and <i>Glyceria maxima</i> are dominant along LHB. Mid channel lacked any vegetation, likely due to disturbance from boats.

Site name	Surveyor	Start time	NGR start	NGR end	% Wadeable	Notes
REE_W14	EK	09:30	S J47609 76825	SJ 47538 76901	0	Embanked modified watercourse, lacking any perceivable flow. Survey undertaken using grapnel from LHB. Water was a dark colour and turbid. The first ~30m of the reach were choked with plants, mostly <i>Elodea</i> and hornwort. The rest of the channel was mostly clear of vegetation, this may be because it was cleared or the influence of the road bridge. Common reed and canary grass are dominant along the water's edge.
REE_SA3	EK	16:10	SJ 64299 70772	SJ 64248 70684	0	Survey conducted from bankside on the LHB using visual observation. Could not use a grapnel in most of the reach due to thick beds of floating pennywort at the water margin and thick terrestrial vegetation on the bank. For a more suitable survey this reach would likely need to be surveyed by boat. River is highly modified and navigable, boat traffic is a likely influence on plant species presence.
REE_N14	EK	14:00	SJ 56965 85814	SJ 56995 85912	0	Deep narrow ditch. Survey undertaken from bank, as banks were too steep to be able to enter the channel. The channel was choked by common reed and nettle meaning the grapnel was not used and there was difficulty seeing into the channel. Part of the channel could be seen, in these areas only duckweed was seen.
REE_SA4	EK	15:40	SJ 64037 70748	SJ 64096 70695	100	Small shaded sandy stream (mostly sand substrate with small amount of gravel), situated in broadleaf woodland. Nothing present within channel or on banks. Ground canopy vegetation cover dominated by Himalayan balsam. Rhododendron is also present.

Site name	Surveyor	Start time	NGR start	NGR end	% Wadeable	Notes
REE_N12	EK	10:00	SJ 50454 91212		100	Culverted ditch with artificial brick lower bank and bottom. At SJ 50419 91213 the stream comes out the culvert and flows into another culvert at the end of the field near the A road. Upstream of this point the ditch is more natural but appears to be dry/ not flowing water. Due to the artificial nature of the stream it was deemed unsuitable for a macrophyte survey.

Table 5K2 2.2 Macrophyte Site Survey Conditions and Visual Observations

Site name		STRX-01-00-00-001	STRX-01-00-00-009	STRX-01-00-00-027	RVX-01-00-00-015	STRX-01-00-00-031	RVX-02-00-00-001	STRX-02-00-00-002	RVX-02-00-00-003	RVX-02-00-00-004	CLX-02-01-00-002	RVX-03-00-00-002	STRX-03-00-00-005	RVX-03-00-00-005	STRX-03-00-00-013
% Wadeable		10	0	10	20	Dry	0	Dry	0	90	1	100	100	20	Dry
Total % cover of macrophytes		99	100	100	50		<1		4	5	7	2	20	10	
% cover of filamentous algae					<1		<1		<1		<1			3	
Width (m) %	<1			100									100		
	1 - 5	100	100		100		100				100	100			
	5 -10									5					
	10-20									95				100	
	> 20								100						
Depth (m) %	< 0.25			100					2	20		95	100	10	
	0.25 - 0.5	30			30				3	70	10	5		20	
	0.5 - 1	70	100		70				5	10	10			10	

Site name		STRX-01-00-00-001	STRX-01-00-00-009	STRX-01-00-00-027	RVX-01-00-00-015	STRX-01-00-00-031	RVX-02-00-00-001	STRX-02-00-00-002	RVX-02-00-00-003	RVX-02-00-00-004	CLX-02-01-00-002	RVX-03-00-00-002	STRX-03-00-00-005	RVX-03-00-00-005	STRX-03-00-00-013
	> 1						100		90		80			60	
Substrate %	Peat														
	Silt/clay	98	100	100	95		100?		95	30	90	70	75	20	
	Sand								1	40	5	10	5	30	
	Pebbles/gravel				4				2	20	4	15	20	10	
	Boulder/cobbles	2			1				2	10	1	5		40	
Habitat %	Pool														
	Riffle									5					
	Run									95				100	
	Slack	100	100	100	100		100		100		100	100	100		
Shading %	LB	None	100	100	100	100	100		95	70	100	70	100	50	
		Broken							3	20		10		20	

Site name		STRX-01-00-00-001	STRX-01-00-00-009	STRX-01-00-00-027	RVX-01-00-00-015	STRX-01-00-00-031	RVX-02-00-00-001	STRX-02-00-00-002	RVX-02-00-00-003	RVX-02-00-00-004	CLX-02-01-00-002	RVX-03-00-00-002	STRX-03-00-00-005	RVX-03-00-00-005	STRX-03-00-00-013
	Dense								2	10		20		30	
	RB	None	100	100	100	100	100		95	60	100	100		100	
		Broken							2	20			100		
		Dense							3	20					
Clarity %	Clear	100	100	100						60		80	100	30	
	Turbid								100						
	Cloudy				100		100			40	100	20		70	
Bed stability %	Solid/firm			100	20		100		95		100				
	Unstable									60		100	100	50	
	Stable	2								10				40	
	Soft/sinking	98	100		80				5	30				10	

Table 5K2 2.3 Macrophyte Site Survey Conditions and Visual Observations (Continued)

Site name		REE_N1	REE_SA12	REE_W14	REE_SA3	REE_N14	REE_SA4	REE_N12	RVX-03-00-00-007	STRX-04-00-00-008	STRX-04-00-00-009	STRX-04-03-01-001	RVX-04-03-01-001
% Wadeable		0	0	0	0	0	100	NA	60	Dry	Dry	Dry	0
Total % cover of macrophytes		1	20	50	11	80	1.2		70				<1
% cover of filamentous algae		1		6					3				
Width (m) %	<1												
	1 - 5					100		95			100		
	5 -10		94	100				5					
	10-20	100	6										
	> 20				100								
Depth (m) %	< 0.25						5		70				
	0.25 - 0.5					100		60			30		
	0.5 - 1		100	100	6			25					

Site name

			REE_N1	REE_SA12	REE_W14	REE_SA3	REE_N14	REE_SA4	REE_N12	RVX-03-00-00-007	STRX-04-00-00-008	STRX-04-00-00-009	STRX-04-03-01-001	RVX-04-03-01-001
	> 1		100			94		10						
Substrate %	Peat													
	Silt/clay		100		100	56	100		35			100		
	Sand							90	60					
	Pebbles/gravel					40		10	5					
	Boulder/cobbles			100		4								
Habitat %	Pool							2	10					
	Riffle							30						
	Run								60					
	Slack		100	100	100	100	100	68	30			100		
Shading %	LB	None	99	98	100	90	10	50		40				
		Broken	1	2		5		30		30				

Site name

			REE_N1	REE_SA12	REE_W14	REE_SA3	REE_N14	REE_SA4	REE_N12	RVX-03-00-00-007	STRX-04-00-00-008	STRX-04-00-00-009	STRX-04-03-01-001	RVX-04-03-01-001
		Dense				5	90			30				
	RB	None	100	95	100	93	10	75		20				
		Broken		5		5		25		40				
		Dense		0		2	90			40				
Clarity %	Clear						100	100	50			40		
	Turbid			100		100								
	Cloudy		100		100				50			60		
Bed stability %	Solid/firm													
	Unstable					44			50					
	Stable			100										
	Soft/sinking		100		100	56	100	100	50			100		

Calculation of Biological Indices and LEAFPACS2

- 2.1.4 The observed RMNI, NTAXA and NFG are outlined in **Table 5K2 2.4**.
- 2.1.5 The RMNI scores indicated that there is a slight degree of nutrient enrichment throughout all sites. This would be expected given the connectivity between agricultural land use and the riverine environment.
- 2.1.6 The NTAXA gives an indication of diversity of true aquatic plants within the macrophyte community, with RVX-02-00-00-004, RVX-03-00-00-007 and REE_W14 having the highest (nine and eight respectively) of the surveyed watercourses.
- 2.1.7 LEAFPACS2 classification was performed on the 12 sites, listed below:
- RVX-01-00-00-015
 - RVX-02-00-00-001
 - RVX-02-00-00-003
 - RVX-02-00-00-004
 - CLX-02-01-00-002
 - RVX-03-00-00-002
 - RVX-03-00-00-005
 - RVX-03-00-00-007
 - REE_N1
 - REE_SA12
 - REE_W14
 - REE_N14

Table 5K2 2.4 LEAFPACS2 Metric Calculator results

Site name		STRX-01-00-00-001	STRX-01-00-00-009	STRX-01-00-00-027	RVX-01-00-00-015	STRX-01-00-00-031	RVX-02-00-00-001	STRX-02-00-00-002	RVX-02-00-00-003	RVX-02-00-00-004	CLX-02-01-00-002	RVX-03-00-00-002	STRX-03-00-00-005	RVX-03-00-00-005	STRX-03-00-00-013	RVX-03-00-00-007	STRX-04-00-00-008	STRX-04-00-00-009	STRX-04-03-01-001	RVX-04-03-01-001	REE_N1	REE_SA12	REE_W14	REE_SA3	REE_N14	REE_SA4	REE_N12
Metrics	RMNI	7.95	8.93	7.64	8.20	Dry	8.18	Dry	7.93	8.07	8.15	8.12	7.38	8.11	Dry	7.42	Dry	Dry	Dry	6.47	8.68	8.33	8.69	7.93	8.27	3.92	NA
	NTAXA	4	3	0	3		1		2	9	4	2	2	6		8				1	5	1	8	0	1	0	
	NFG	4	3	0	3		1		2	7	4	2	2	5		7				1	4	1	4	0	1	0	
	ALG	0	0	0	0.05		0.05		0.5	4.3	0.5	0	0	3.4		3.85				0	0.5	0	8	0	0	0	

2.1.8 The LEAFPAC2 Classifications for the 12 sites are listed in **Table 5K2 2.5**. Where alkalinity readings were not available for the watercourses 180 CaCO₃ mg/l was used as a proxy value.

Table 5K2 2.5 Results of LEAFPAC2 Classification

Watercourse Crossing	RMNI EQR	NTAXA EQR	NFG EQR	ALG EQR	LEAFPACS EQR	CLASS
RVX-01-00-00-015	0.556	0.305	0.182	1.000	0.431	Moderate
RVX-02-00-00-001	0.557	0.102	0	1.000	0.352	Poor
RVX-02-00-00-003	0.652	0.203	0.062	0.964	0.456	Moderate
RVX-02-00-00-004	0.487	0.968	0.962	0.730	0.487	Moderate
CLX-02-01-00-002	0.561	0.406	0.301	0.964	0.474	Moderate
RVX-03-00-00-002	0.367	0.235	0.099	1.000	0.278	Poor
RVX-03-00-00-005	0.405	0.680	0.624	0.766	0.405	Moderate
RVX-03-00-00-007	0.718	0.978	0.974	0.748	0.718	Good
REE_N1	0.373	0.620	0.553	0.964	0.373	Poor
REE_SA12	0.239	0.124	-0.031	1.000	0.149	Bad
REE_W14	0.263	0.699	0.645	0.591	0.263	Poor
REE_N14	0.496	0.132	-0.021	1.000	0.288	Poor

2.1.9 The remaining seven sites were not compatible with the classification software. Of the seven sites surveyed, no species of conservation interest were noted. The number of taxa recorded ranged from three to 15 across the five sites.

Table 5K2 2.6 Quality Assessment of Non-LEAFPACS2 Sites

Watercourse Crossing	Species of Conservation Interest	Number of Taxa
STRX-01-00-00-001	X	15
STRX-01-00-00-009	X	10
STRX-01-00-00-027	X	8
STRX-03-00-00-005	X	15
RVX-04-03-01-001	X	7
REE_SA3	X	2
REE_SA4	X	1

Sites by WFD waterbody

2.1.10 The sites surveyed are located within ten distinct WFD waterbodies which are included in the Preliminary Order Limits of the Project. Each WFD water body is detailed below with a summary of the results for each watercourse crossing survey site. These site summaries highlight the number of taxa present and any recorded occurrences of INNS or designated species.

Peckmill Brook, Hoolpool Gutter at Ince Marshes – WFD GB112068060330

STRX-01-00-00-001

2.1.11 The macrophyte assemblage in STRX-01-00-00-001, in September 2022, comprised four scoring taxa and 11 non-scoring taxa. No INNS were recorded for this site.

STRX-01-00-00-009

2.1.12 The macrophyte assemblage in STRX-01-00-00-009, in September 2022, comprised three scoring taxa and eight non-scoring taxa. No INNS were recorded for this site.

REE_W14

2.1.13 The macrophyte assemblage at REE_W14 in August 2023, comprised of eight scoring taxa and three non-scoring taxa. Two INNS species were recorded at the site: *Elodea nuttallii* (Nuttalls waterweed) and *Lemna minuta* (least duckweed).

Weaver (Dane to Frodsham) – WFD GB112068060500

STRX-01-00-00-027

2.1.14 The macrophyte assemblage in STRX-01-00-00-027, in September 2022, comprised no scoring taxa and nine non-scoring taxa. No INNS were recorded for this site.

RVX-01-00-00-015

2.1.15 The macrophyte assemblage in RVX-01-00-00-015, in September 2022, comprised three scoring taxa and eight non-scoring taxa. No INNS were recorded for this site.

RVX-02-00-00-001

2.1.16 The macrophyte assemblage in RVX-02-00-00-001, in September 2022, comprised one scoring taxa and eight non-scoring taxa. One INNS was recorded for this site, *Impatiens glandulifera* (Himalayan balsam).

CLX-02-01-00-002

2.1.17 The macrophyte assemblage in CLX-02-01-00-002, in September 2022, comprised four scoring taxa and 15 non-scoring taxa. Three INNS were recorded for this site: *Impatiens glandulifera*, *Hydrocotyle ranunculoides* (floating pennywort) and *Impatiens capensis* (Spotted touch-me-not).

Weaver (Winsford Flashes to Dane) – WFD GB112068060463

RVX-02-00-00-003

2.1.18 The macrophyte assemblage in RVX-02-00-00-003, in September 2022, comprised two scoring taxa and 16 non-scoring taxa. Four INNS were recorded for this site: *Impatiens glandulifera*, *Hydrocotyle ranunculoides*, *Impatiens capensis* and *Fallopia japonica* (Japanese knotweed).

REE_SA4

2.1.19 The macrophyte assemblage at REE_SA4, in September 2023, comprised of no scoring taxa and one non-scoring taxa. Two INNS species were recorded at this site: *Impatiens glandulifera* and *Rhododendron*.

REE_SA3

2.1.20 The macrophyte assemblage at REE_SA3 in August 2023 comprised of no scoring taxa and two non-scoring taxa. Two INNS species were recorded at this site: *Hydrocotyle ranunculoides* and *Impatiens glandulifera*.

Dane (Wheelock to Weaver) – WFD GB112068060470

RVX-02-00-00-004

2.1.21 The macrophyte assemblage in RVX-02-00-00-004, in September 2022, comprised nine scoring taxa and eight non-scoring taxa. Two INNS were recorded for this site: *Elodea nuttallii* and *Impatiens glandulifera*.

Arley Brook (Source to Gale Brook) – WFD GB112068060420

RVX-03-00-00-002

2.1.22 The macrophyte assemblage in RVX-03-00-00-002, in September 2022, comprised two scoring taxa and seven non-scoring taxa. One INNS was recorded for this site: *Impatiens glandulifera*.

Bollin (Ashley Mill to Manchester Ship Canal) – WFD GB112069061382

RVX-03-00-00-005

2.1.23 The macrophyte assemblage in RVX-03-00-00-005, in September 2022, comprised six scoring taxa and ten non-scoring taxa. Two INNS were recorded for this site: *Impatiens glandulifera* and *Heracleum mantegazzianum* (Giant hogweed).

Sinderland Brook – WFD GB112069060980

RVX-03-00-00-007

2.1.24 The macrophyte assemblage in RVX-03-00-00-007, in September 2022, comprised eight scoring taxa and four non-scoring taxa. Two INNS were recorded for this site. Two INNS were recorded for this site: *Elodea nuttallii* and *Impatiens glandulifera*.

Sutton Brook – WFD GB112069061170

RVX-04-03-01-001

2.1.25 The macrophyte assemblage in RVX-04-03-01-001, in September 2022, comprised one scoring taxa and eight non-scoring taxa. One INNS was recorded for this site: *Impatiens glandulifera*.

Sankey Canal – WFD GB71210055

REE_N1

2.1.26 The macrophyte assemblage at REE_N1, in August 2023 comprised of five scoring taxa and no non-scoring taxa. No INNS species were recorded at this site.

Trent and Mersey Canal, summit to Preston Brook Tunnel – WFD GB71210247

REE_SA12

2.1.27 The macrophyte assemblage at REE_SA12, in August 2023 comprised of one scoring taxa and two non-scoring taxa. No INNS were recorded at this site.

2.2 Overview

2.2.1 Of the 13 sites successfully surveyed in 2022 and the six surveyed in 2023, 12 were assessed with WFD LEAFACS2 methodology⁴. These sites indicated a range of indicative WFD classifications from 'Bad' to 'Good', with majority (five) of the sites classified as 'Moderate' or 'Poor'. Those sites not compatible with the WFD LEAFACS2 methodology, notably the ditch watercourses recorded no Species of Conservation Interest.

2.3 Next Steps

- 2.3.1 Should further changes to the Project be outside the Preliminary Order Limits at the time of reporting, further surveys may be required to provide a baseline of the macrophyte community present within any additional watercourses.
- 2.3.2 Should the survey data within this report become older than 18 months before the planning application for the Project is submitted, it is advised that the macrophyte surveys be repeated. Eighteen months is the time for which ecological survey data is likely to remain valid³.

Annex 1 LEAFPACS2 Taxa List

Table 5K2 1.1 LEAFPACS2 taxon list and metric scores

Species	RMNI score	Aquatic taxa	Functional group	Filamentous alga
<i>Apium nodiflorum</i>	8.64	1	8	-
<i>Callitriche brutia</i>	4.51	1	6	-
<i>var hamulata</i>	-	-	-	-
<i>Callitriche obtusangula</i>	8.04	1	6	-
<i>Callitriche spp.</i>	6.67	1	6	-
<i>Elodea nuttallii</i>	9.44	1	5	-
<i>Fontinalis antipyretica</i>	5.4	1	21	-
<i>Glyceria maxima</i>	9.64	-	-	-
<i>Lemanea spp.</i>	4.53	1	19	-
<i>Lemna minor</i>	8.8	1	1	-
<i>Lemna trisulca</i>	8.21	1	1	-
<i>Leptodictyon riparium</i>	7.57	1	21	-
<i>Mentha aquatica</i>	6.27	-	-	-
<i>Myosotis scorpioides</i>	6.83	-	-	-
<i>Myriophyllum spicatum</i>	8.26	1	7	-
<i>Nuphar lutea</i>	8.42	1	12	-
<i>Nymphaea alba</i>	5.69	1	12	-
<i>Pellia endiviifolia</i>	6.5	-	-	-
<i>Phalaris arundinacea</i>	7.52	-	-	-
<i>Phragmites australis</i>	7.7	-	-	-
<i>Platyhypnidium riparioides</i>	5.16	1	21	-

Species	RMNI score	Aquatic taxa	Functional group	Filamentous alga
<i>Potamogeton crispus</i>	8.02	1	17	-
<i>Potamogeton pectinatus</i>	9.59	1	15	-
<i>Potamogeton perfoliatus</i>	8.16	1	17	-
<i>Ranunculus penicillatus</i> subsp. <i>pseudofluitans</i> var <i>pseudofluitans</i>	7.92	1	18	-
<i>Rorippa amphibia</i>	9.2	-	-	-
<i>Rorippa nasturtium- aquaticum</i> agg.	8.42	-	-	-
<i>Sagittaria sagittifolia</i>	9.24	1	12	-
<i>Sparganium erectum</i>	8.34	-	-	-
<i>Ulva flexuosa</i>	9.52	1	19	1
<i>Veronica anagallis-aquatica</i>	8.45	-	-	-
<i>Veronica beccabunga</i>	7.31	-	-	-
<i>Enteromorpha Spp.</i>	-	-	-	-
<i>Epilobium hirsutum</i>	-	-	-	-
<i>Filamentous algae</i>	-	-	-	-
<i>Filipendula ulmaria</i>	-	-	-	-
<i>Impatiens glandulifera</i>	-	-	-	-
<i>Solanum dulcamara</i>	-	-	-	-
<i>Spirodela polyrhiza</i>	8.99	1	1	-
<i>Ceratophyllum demersum</i>	9.73	1	5	-
<i>Cladophora glomerata</i>	7.5	1	19	1
<i>Oenanthe crocata</i>	6.22	1	8	-
<i>Alnus glutinosa</i>	-	-	-	-
<i>Lycopus europaeus</i>	-	-	-	-
<i>Urtica dioica</i>	-	-	-	-

Species	RMNI score	Aquatic taxa	Functional group	Filamentous alga
<i>Marchantia polymorpha</i>	-	-	-	-
<i>Potamogeton filiformis</i>	6	1	15	-
<i>Stachys palustris</i>	-	-	-	-
<i>Rumex</i>	-	-	-	-
<i>Cladophora glomerata/Rhizoclonium hieroglyphicum</i>	8.66	1	19	1
<i>Lemna minuta</i>	9.21	1	1	-
<i>Vaucheria</i>	8.41	1	19	1
<i>Hydrocotyle ranunculoides</i>	-	-	-	-
<i>Carex remota</i>	-	-	-	-
<i>Salix</i>	-	-	-	-
<i>Carex pendula</i>	-	-	-	-
<i>Angelica archangelica</i>	-	-	-	-
<i>Symphytum officinale</i>	-	-	-	-
<i>Equisetum fluviatile</i>	3.92	-	-	-
<i>Cardamine</i>	-	-	-	-

Annex 2 Site Photographs

Graphic 5K2 2.1 STRX-01-00-00-001 Survey Area



Graphic 5K2 2.2 STRX-01-00-00-009 Survey Area



Graphic 5K2 2.3 STRX-01-00-00-027 Survey Area



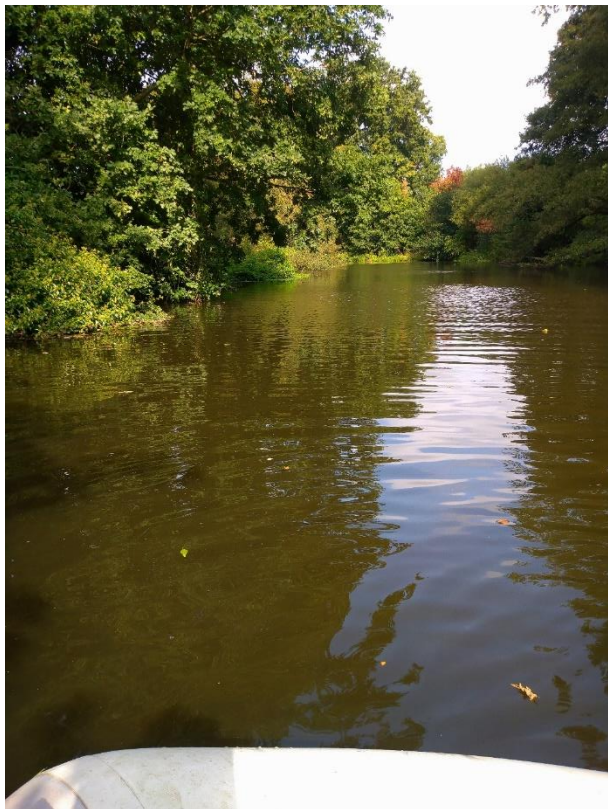
Graphic 5K2 2.4 RVX-01-00-00-015 Survey Area



Graphic 5K2 2.5 RVX-02-00-00-001 Survey Area



Graphic 5K2 2.6 RVX-02-00-00-003 Survey Area



Graphic 5K2 2.7 RVX-02-00-00-004 Survey Area



Graphic 5K2 2.8 CLX-02-01-00-002 Survey Area



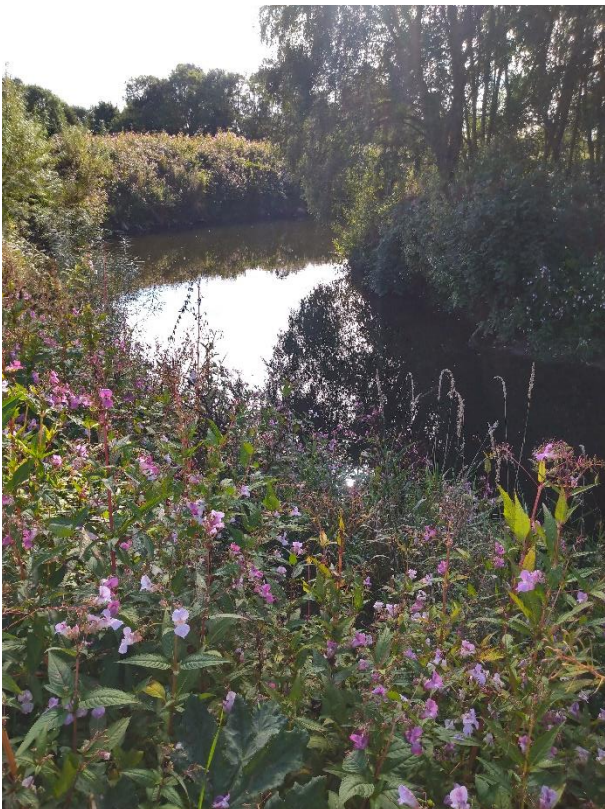
Graphic 5K2 2.9 RVX-03-00-00-002 Survey Area



Graphic 5K2 2.10 STRX-03-00-00-005 Survey Area



Graphic 5K2 2.11 RVX-03-00-00-005 Survey Area



Graphic 5K2 2.12 RVX-03-00-00-007 Survey Area



Graphic 5K2 2.13 RVX-04-03-01-001 Survey Area



Graphic 5K2 2.14 REE_SA4 Survey Area



Graphic 5K2 2.15 REE_SA3 Survey Area



Graphic 5K2 2.16 REE_SA12



Graphic 5K2 2.17 REE_W14



Graphic 5K2 2.18 REE_N14



Graphic 5K2 2.19 REE_N1



Graphic 5K2 2.20 REE_N12



HyNet North West Hydrogen Pipeline

Delivering clean growth

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Annex 5K3

Aquatic Ecology Survey Report – eDNA Survey

October 2024

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Volume	0001
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1. Methodology

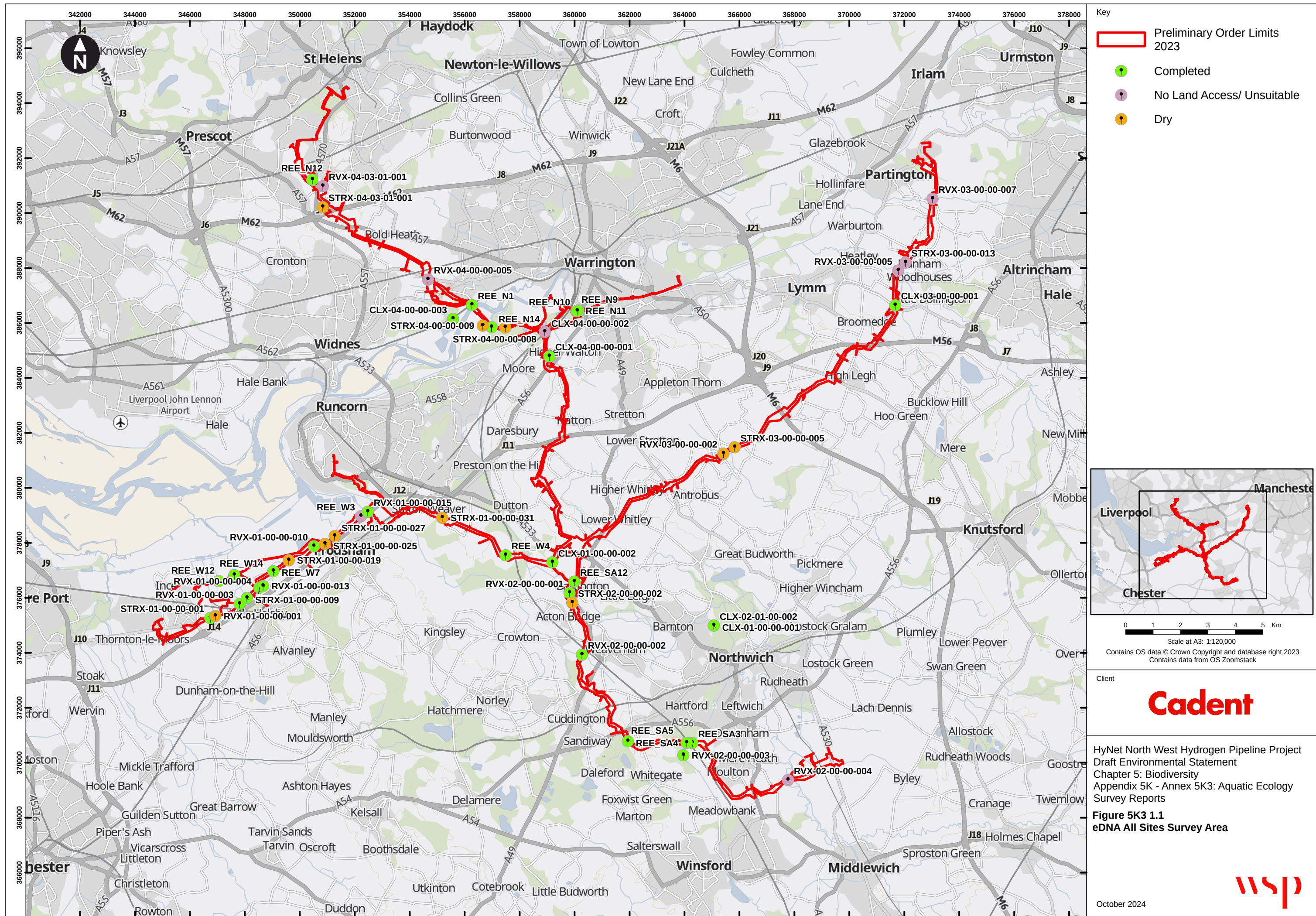
1.1 Desk Study

- 1.1.1 A desk study was undertaken in Spring 2022 and the methodology for this is set out in **Section 5.5** and **Table 5.8** of the Preliminary Environmental Information Report (PEIR). The desk study recorded the presence of statutory designated sites within up to 20km^[1] of the Preliminary Order Limits (**Section 5.6.1**, **Table 5.10**, and **Figure 5.1** of the PEIR) and non-statutory designated sites within 2km (**Section 5.6.2**, **Table 5.11**, and **Figure 5.2** of the PEIR). The desk study also recorded the presence of Habitats of Principal Importance (HPI) within 2km of the Preliminary Order Limits (**section 5.6.3**, **Table 5.12** and **Figure 5.3** of the PEIR). Records of protected and notable species within 2km of the Preliminary Order Limits are discussed within **section 5.6.12-5.6.41** of the PEIR.
- 1.1.2 The desk study information from the PEIR is not repeated in this report or discussed further. The desk study will be updated for the Final Environmental Statement following design freeze for the Project.

1.2 Survey Area

- 1.2.1 Please note that as part of the design process, the order limits have undergone a number of iterations (as described in **Appendix 2A: Design evolution** of the Draft ES) and this report is based on the Preliminary Order Limits as they stood in early 2023.
- 1.2.2 The study area for eDNA sampling and analysis includes a total of 49 watercourse crossings as shown in **Figure 5K3 1.1**. The locations are concentrated between Helsby and Frodsham, but also cover watercourses close to Northwich and Warrington. These sites cover the extent of the Project.
- 1.2.3 Survey locations were chosen based on WFD waterbody classification or chosen as representative watercourses within each geographical area/ watercourse type (Canal, River or Stream/Ditch) to provide an indication of the community structures present. One representative watercourse identified by the Environment Agency (EA) as a main river was surveyed per catchment.
- 1.2.4 A total of 41 sites were surveyed, on one occasion, of these 11 sites six sites were dry at the time of survey and no eDNA data was collected. Surveys were undertaken between July 2022 and October 2023. Survey locations are provided in **Table 5K3 1.1**.

¹ Dependent on reasons for designations; within two kilometres for habitats, extending to 10 kilometres for bats and up to 20 kilometres for all the ornithological interests for international sites.



1.3 eDNA Water Sampling

- 1.3.1 All water bodies found to provide suitable habitat, and to which an eDNA survey was possible, were subject to eDNA water sampling. The sampling methodology followed the filtration sample collection guide for ponds, lakes and rivers provided by NatureMetrics and was carried out over a total of 30 sites in the study area.

eDNA sampling methodology

- 1.3.2 A guide to the sampling methodology undertaken at each site by qualified and trained staff has been provided in the NatureMetrics filtration sample collection guide for ponds, lakes and rivers. A summary of the guidance is provided below.

Part 1 – Collecting the Water

- The provided collection bag was filled with river water, standing downstream of the bag to minimise collection of samplers DNA.
- Bag emptied into a bucket lined with a plastic bag and refilled about 5 times with river water following the step above, capturing different parts of the flow if possible. Subsamples are well mixed in the bucket.

Part 2 – Filtering the Water

- 50 mL of water was drawn from the bag into a large syringe;
- Water was pushed from syringe through a filter and repeated until filter is clogged;
- Syringe was detached from the filter, and syringe plunger pulled back to fill the syringe with air. Filter reattached and air pushed through to expel any water trapped inside the filter;
- A separate small syringe was uncapped (already filled with preservative solution) and twisted onto a filter inlet away from water's edge, with syringe facing upwards;
- Plunger was squeezed to push the preservative into the filter until the first drop can be seen emerging from the filter outlet. Filter outlet was capped;
- Syringe turned so that the filter points down, and plunger pressed to ensure that the filter is filled with preservative. Syringe is detached and filter inlet capped; and
- The filter was then bagged and shipped along with a completed field data sheet.

eDNA laboratory analyses methodology

- 1.3.3 Samples collected as part of the initial 2022 survey scope were analysed for the below metabarcoding suite:
- Freshwater Fish (excl. sharks & rays);

- Freshwater Unionid mussels;
- Freshwater bivalves (excl. Unionid mussels);
- Signal Crayfish (*Pacifastacus leniusculus*); and
- Aquatic Invertebrates (Freshwater eDNA).

1.3.4 Samples collected as part of the updated 2023 survey scope were analysed for the below metabarcoding suite:

- Freshwater Fish (excl. sharks & rays);
- Freshwater Unionid mussels;
- Freshwater bivalves (excl. Unionid mussels); and
- Signal Crayfish (*Pacifastacus leniusculus*).

1.3.5 Samples were analysed in the NatureMetrics laboratory. The methodology provided to Ricardo has been detailed below.

- DNA from each filter was extracted using a commercial DNA extraction kit with a protocol modified to increase DNA yields. An extraction blank was also processed for the extraction batch. DNA was purified to remove Polymerase Chain Reaction (PCR) inhibitors using a commercial purification kit.
- Purified DNAs were amplified with PCR to target specific species.
 - ▶ hypervariable region of the 12S rRNA gene to target fish;
 - ▶ hypervariable region of the 16S ribosomal RNA (rRNA) gene to target venerid and unionid mussels;
 - ▶ hypervariable region of the cytochrome c oxidase subunit 1 (COI) rRNA gene to target macroinvertebrates; and
 - ▶ Mammals and birds were detected as 'non-target vertebrate taxa' within the fish eDNA analyses.
- Standard analysis includes 12 replicate PCRs per sample. All PCRs were performed in the presence of both a negative control and a positive control sample. Amplification success was determined by gel electrophoresis.
- Amplicons were purified and checked by gel electrophoresis; these were then quantified using a Qubit high sensitivity kit according to the manufacturer's protocol.
- All purified index PCRs were pooled into a final library with equal concentrations. The final library was sequenced using an Illumina MiSeq V3 kit at 10.5 pM with a 20% PhiX spike in.
- Sequence data were processed using a custom bioinformatics pipeline for quality filtering, Operational Taxonomic Unit (OTU) clustering, and taxonomic assignment.

- 1.3.6 Consensus taxonomic assignments were made for each OTU using sequence similarity searches against the NCBI nt (GenBank) reference database. Assignments were made to the lowest possible taxonomic level where there was consistency in the matches. Conflicts were flagged and resolved manually. Minimum similarity thresholds of 98%, 95%, and 92% were used for species-, genus- and higher-level assignments respectively. In cases where there were equally good matches to multiple species, public records from Global Biodiversity Information Facility (GBIF) were used to assess which were most likely to be present in the United Kingdom. Higher-level taxonomic identifications or multiple potential identifications were reported in cases that could not be resolved in this way.
- 1.3.7 The OTU table was then filtered to remove low abundance OTUs from each sample (<0.05% or <10 reads, whichever is the greater threshold for the sample). Unidentified, non-target, and common contaminant sequences were then removed.
- 1.3.8 Note that unidentified or misidentified taxa can result from incomplete or incorrect reference databases, and taxa may be missed due to low quality DNA, environmental contaminants, or the dominance of other species in the sample.
- 1.3.9 Please note that the abundance of taxa cannot be directly inferred from the proportion of total sequence reads. While the proportion of sequence reads is a consequence of abundance, it is also impacted by biomass, activity, surface area, condition, distance from the physical sample, primer bias, and species-specific variation in the genome.

Table 5K3 1.1 Sites requiring eDNA surveys in 2022

River Crossing Name	X	Y	Survey status	Water-course Type	Water-course name	Watercourse Status (WFD/Main River/ Ordinary watercourse)	Hydro-morphological designation	WFD Waterbody	Ecological Classification	Fish	Invertebrates
RVX-01-00-00-003	347808	375776	Completed	River	-	Main River	not designated artificial or heavily modified	GB11206806 0330 Peckmill Brook, Hoolpool Gutter at Ince Marshes	Moderate	Moderate	Moderate
STRX-01-00-00-001	346742	375265	Completed	Stream/ ditch	-	Main River	not designated artificial or heavily modified	GB11206806 0330 Peckmill Brook, Hoolpool Gutter at Ince Marshes	Moderate	Moderate	Moderate
STRX-01-00-00-009	348074	375992	Completed	Stream/ ditch	-	Main River	not designated artificial or heavily modified	GB11206806 0330 Peckmill Brook, Hoolpool Gutter at Ince Marshes	Moderate	Moderate	Moderate

River Crossing Name	X	Y	Survey status	Water-course Type	Water-course name	Watercourse Status (WFD/Main River/ Ordinary watercourse)	Hydro-morphological designation	WFD Waterbody	Ecological Classification	Fish	Invertebrates
RVX-02-00-00-003	363957	370272	Completed	River	River Weaver	WFD	Heavily Modified	GB11206806 0463 Weaver (Winsford Flashes to Dane)	Moderate	Poor	Poor
RVX-02-00-00-002	360267	373928	Completed	River	Grange Brook	Main River	not designated artificial or heavily modified	GB11206806 0480 Cuddington Brook (Source to Crowton Brook)	Moderate	-	Moderate
CLX-02-01-00-002	365066	374990	Completed	River	River Weaver	WFD	Heavily Modified	GB11206806 0500 Weaver (Dane to Frodsham)	Moderate	-	Bad
RVX-01-00-00-004	348528	376368	Completed	River	River Weaver	WFD	Heavily Modified	GB11206806 0500 Weaver (Dane to Frodsham)	Moderate	-	Bad

River Crossing Name	X	Y	Survey status	Water-course Type	Water-course name	Watercourse Status (WFD/Main River/ Ordinary watercourse)	Hydro-morphological designation	WFD Waterbody	Ecological Classification	Fish	Invertebrates
RVX-01-00-00-010	350511	377876	Completed	Stream/ditch	-	Main River	Heavily Modified	GB11206806 0500 Weaver (Dane to Frodsham)	Moderate	-	Bad
RVX-01-00-00-013	348661	376427	Completed	River	Unnamed River / Main Drain	WFD	Heavily Modified	GB11206806 0500 Weaver (Dane to Frodsham)	Moderate	-	Bad
RVX-01-00-00-015	352471	379128	Completed	River	River Weaver	WFD	Heavily Modified	GB11206806 0500 Weaver (Dane to Frodsham)	Moderate	-	Bad
RVX-02-00-00-001	359816	376175	Completed	River	River Weaver	WFD	Heavily Modified	GB11206806 0500 Weaver (Dane to Frodsham)	Moderate	-	Bad
CLX-03-00-00-001	371666	386642	Completed	Canal	Bridgewater Canal	WFD	Artificial	GB71210001 Bridgewater Canal	Moderate	-	-

River Crossing Name	X	Y	Survey status	Water-course Type	Water-course name	Watercourse Status (WFD/Main River/ Ordinary watercourse)	Hydro-morphological designation	WFD Waterbody	Ecological Classification	Fish	Invertebrates
CLX-04-00-00-001	359080	384785	Completed	Canal	Bridgewater Canal	WFD	Artificial	GB71210001 Bridgewater Canal	Moderate	-	-
CLX-04-00-00-003	355575	386148	Completed	Canal	Sankey Canal	WFD	Artificial	GB71210055 Sankey Canal	Moderate	-	-
CLX-01-00-00-001	365066	374990	Completed	Canal	Weaver Navigation	WFD	Artificial	GB71210545 Weaver Navigation (canal section Frodsham to Weston Point Docks)	Moderate	-	-
CLX-01-00-00-002	359191	377291	Completed	Canal	Weaver Navigation	WFD	Artificial	GB71210545 Weaver Navigation (canal section Frodsham to Weston Point Docks)	Moderate	-	-
RVX-04-00-00-005	354664	387580	No Land Access	River	Unnamed River / Main Ditch	Ordinary watercourse	-	-	-	-	-

River Crossing Name	X	Y	Survey status	Water-course Type	Water-course name	Watercourse Status (WFD/Main River/ Ordinary watercourse)	Hydro-morphological designation	WFD Waterbody	Ecological Classification	Fish	Invertebrates
RVX-02-00-00-004	367766	369366	No Land Access	River	River Dane	WFD	not designated artificial or heavily modified	GB11206806 0470 Dane (Wheelock to Weaver)	Moderate	Moderate	Good
RVX-03-00-00-007	373027	390517	No Land Access	River	Sinderland Brook	WFD	not designated artificial or heavily modified	GB11206906 0980 Sinderland Brook	Poor	Moderate	Poor
RVX-04-03-01-001	350837	390977	No Land Access	River	Unnamed River / Main Drain	WFD	Heavily Modified	GB11206906 1170 Sutton Brook	Moderate	-	Moderate
RVX-03-00-00-005	371779	387909	No Land Access	River	River Bollin	WFD	not designated artificial or heavily modified	GB11206906 1382 Bollin (Ashley Mill to Manchester Ship Canal)	Poor	Poor	Good

River Crossing Name	X	Y	Survey status	Water-course Type	Water-course name	Watercourse Status (WFD/Main River/ Ordinary watercourse)	Hydro-morphological designation	WFD Waterbody	Ecological Classification	Fish	Invertebrates
STRX-03-00-00-013	372043	388197	No Land Access	Stream/ ditch	-	Main River	not designated artificial or heavily modified	GB11206906 1382 Bollin (Ashley Mill to Manchester Ship Canal)	Poor	Poor	Good
CLX-04-00-00-002	358914	385677	No Land Access	Canal	Manchester Ship Canal	WFD	Artificial	GB71210004 Manchester Ship Canal Water Body	Moderate	-	-
STRX-04-00-00-008	357474	385837	Dry	Stream/ ditch	-	Ordinary watercourse	-	-	-	-	-
STRX-04-00-00-009	356659	385903	Dry	Stream/ ditch	-	Ordinary watercourse	-	-	-	-	-
RVX-03-00-00-002	365417	381247	Dry	River	Gale Brook	WFD	not designated artificial or heavily modified	GB11206806 0420 Arley Brook (Source to Gale Brook)	Moderate	-	High

River Crossing Name	X	Y	Survey status	Water-course Type	Water-course name	Watercourse Status (WFD/Main River/ Ordinary watercourse)	Hydro-morphological designation	WFD Waterbody	Ecological Classification	Fish	Invertebrates
STRX-03-00-00-005	365826	381479	Dry	Stream/ ditch	-	Ordinary watercourse	not designated artificial or heavily modified	GB11206806 0420 Arley Brook (Source to Gale Brook)	Moderate	-	High
RVX-01-00-00-001	346924	375338	Dry	River	Unnamed River / Main Drain	WFD	Heavily Modified	GB11206806 0500 Weaver (Dane to Frodsham)	Moderate	-	Bad
STRX-01-00-00-019	349595	377364	Dry	Stream/ ditch	-	Main River	Heavily Modified	GB11206806 0500 Weaver (Dane to Frodsham)	Moderate	-	Bad
STRX-01-00-00-025	350913	377962	Dry	Stream/ ditch	-	Main River	Heavily Modified	GB11206806 0500 Weaver (Dane to Frodsham)	Moderate	-	Bad

River Crossing Name	X	Y	Survey status	Water-course Type	Water-course name	Watercourse Status (WFD/Main River/ Ordinary watercourse)	Hydro-morphological designation	WFD Waterbody	Ecological Classifi-cation	Fish	Inverte-brates
STRX-01-00-00-027	351268	378248	Dry	Stream/ ditch	-	Main River	Heavily Modified	GB11206806 0500 Weaver (Dane to Frodsham)	Moderate	-	Bad
STRX-01-00-00-031	355181	378914	Dry	Stream/ ditch	-	Ordinary watercourse	Heavily Modified	GB11206806 0500 Weaver (Dane to Frodsham)	Moderate	-	Bad
STRX-02-00-00-002	359913	375821	Dry	Stream/ ditch	-	Ordinary watercourse	Heavily Modified	GB11206806 0500 Weaver (Dane to Frodsham)	Moderate	-	Bad
STRX-04-03-01-001	350834	390216	Dry	Stream/ ditch	-	Ordinary watercourse	Heavily Modified	GB11206906 1170 Sutton Brook	Moderate	-	Moderate

Table 5K3 1.2 Sites requiring eDNA surveys in 2023

River Crossing Name	X	Y	Survey status	Water-course Type	Water-course name	Water-course Status (WFD/ Main River/ Ordinary watercourse)	Hydro-morphological designation	WFD Waterbody	Ecological Classification	Fish	Invertebrates
REE_W1 2	347041	376611	Completed	Stream/ditch	Unnamed trib	Main River	not designated artificial or heavily modified	GB1120680603 30 Peckmill Brook, Hoolpool Gutter at Ince Marshes	Moderate	Moderate	Moderate
REE_W1 4	347614	376825	Completed	River	Hoolpool Gutter	WFD	not designated artificial or heavily modified	GB1120680603 30 Peckmill Brook, Hoolpool Gutter at Ince Marshes	Moderate	Moderate	Moderate
REE_SA3	364283	370719	Completed	River	River Weaver	WFD	Heavily Modified	GB1120680604 63 Weaver (Winsford Flashes to Dane)	Moderate	Poor	Poor

River Crossing Name	X	Y	Survey status	Water-course Type	Water-course name	Water-course Status (WFD/ Main River/ Ordinary watercourse)	Hydro-morphological designation	WFD Waterbody	Ecological Classification	Fish	Invertebrates
REE_SA4	364079	370722	Completed	Stream/ditch	Unnamed trib	Ordinary watercourse	Heavily Modified	GB1120680604 63 Weaver (Winsford Flashes to Dane)	Moderate	Poor	Poor
REE_W3	352225	378969	Not Suitable	Stream/ditch	Unnamed trib	Ordinary watercourse	Heavily Modified	GB1120680605 00 Weaver (Dane to Frodsham)	Moderate	-	Bad
REE_W4	357489	377548	Completed	Stream/ditch	Unnamed trib	Ordinary watercourse	Heavily Modified	GB1120680605 00 Weaver (Dane to Frodsham)	Moderate	-	Bad
REE_W7	349035	376970	Completed	Stream/ditch	Unnamed trib	Ordinary watercourse	Heavily Modified	GB1120680605 00 Weaver (Dane to Frodsham)	Moderate	-	Bad
REE_SA5	361939	370779	Completed	Stream/ditch	Unnamed trib	Ordinary watercourse	not designated artificial or heavily modified	GB1120680605 40 Bogart Brook	Moderate	High	Good
REE_N12	350454	391212	Completed	Stream/ditch	Sutton Brook	WFD	Heavily Modified	GB1120690611 70	Moderate	-	Moderate

River Crossing Name	X	Y	Survey status	Water-course Type	Water-course name	Water-course Status (WFD/ Main River/ Ordinary watercourse)	Hydro-morphological designation	WFD Waterbody	Ecological Classification	Fish	Invertebrates
								Sutton Brook			
REE_N1	356261	386654	Completed	Canal	Sankey Canal	WFD	Artificial	GB71210055 Sankey Canal	Moderate	-	-
REE_SA1 2	359987	376589	Completed	Canal	Trent and Mersey Canal	WFD	Artificial	GB71210247 Trent and Mersey Canal	Moderate	-	-
REE_N9	360136	386461	Completed	Transitional Water	Unnamed trib	WFD	Heavily Modified	GB5312069081 00 Mersey	Moderate	Moderate	-
REE_N10	360058	386429	Completed	Canal	Runcorn and Latchford Canal	Ordinary watercourse	Artificial	N/A	N/A	N/A	N/A
REE_N11	360095	386439	Completed	Stream/ditch	Unnamed trib	Ordinary watercourse	not designated artificial or heavily modified	N/A	N/A	N/A	N/A
REE_N14	356978	385846	Completed	River	Unnamed trib	Main River	not designated artificial or heavily modified	N/A	N/A	N/A	N/A

1.4 Constraints and Considerations

Access limitations

- 1.4.1 Surveys were limited to locations where landowner permission had been obtained within the survey season.
- 1.4.2 eDNA surveys require physical access to the river channel, so health and safety concerns or other physical restrictions such as heavy bank-side vegetation and steep banks constrained the surveys.
- 1.4.3 Of the 49 sites identified as requiring eDNA surveys 45 sites were accessed, the remaining seven sites were not granted land access at the time of surveys. A summary of locations where the requirement for eDNA survey was identified, but where surveys were not conducted due to inadequate access, is provided below:
- RVX-04-00-00-005
 - RVX-02-00-00-004
 - RVX-03-00-00-007
 - RVX-04-03-01-001
 - RVX-03-00-00-005
 - STRX-03-00-00-013
 - CLX-04-00-00-002
 - REE_W3
- 1.4.4 eDNA surveys are limited to watercourses which are not dry during the survey season. A summary of locations where the requirement for eDNA survey was identified, but where no data was collected due to dry watercourses, is provided below:
- STRX-04-00-00-008
 - STRX-04-00-00-009
 - RVX-03-00-00-002
 - STRX-03-00-00-005
 - RVX-01-00-00-001
 - STRX-01-00-00-019
 - STRX-01-00-00-025
 - STRX-01-00-00-027
 - STRX-01-00-00-031
 - STRX-02-00-00-002
 - STRX-04-03-01-001

Ecological considerations

- 1.4.5 Ecological survey data is typically valid for up to 18 months unless otherwise specified. The likelihood of surveys needing to be updated increases with time and is greater in circumstances where the habitat or its management has changed significantly since the surveys were undertaken.

Technical considerations

- 1.4.6 Unionid mussel records have identified the presence of *Pisidium dorbignyi*. This is not to be confused with the Latin American species of the same taxonomic name. Records of *Pisidium dorbignyi* as referred to in the eDNA records, are identifying the UK native iridescent pea mussel. The iridescent pea mussel is also known by the taxonomic synonym *Pisidium pulchellum*.

1.5 Personnel

- 1.5.1 The programme of surveys was led by Eve Loxham, Esther Kendall, Katie Clarke and Bruce Munroe. The survey lead was assisted by suitably qualified and experienced Ricardo Personnel, details of whom are provided in **Table 5K3 1.3** below.

Table 5K3 1.3 Survey personnel

Name	Experience
Eve Loxham	MBiolSci (Hons). Over 7 years of experience in ecological consultancy. Natural England bat survey licence holder for 6 years, Class level 1 licence registration no. 2017-28371-CLS-CLS. Natural England great crested newt survey licence holder for years, Class level 1 licence registration no. 2017-27825-CLS-CLS. Natural England white-clawed crayfish survey licence holder, Class level licence registration no. .CL11-2019-39003-CLS-CLS
Esther Kendal	BSc (Hons), MSc. Over five years of experience in ecological consultancy. Modular River Survey River Condition Assessment certified.
Katie Clarke	BSc. (Hons), MSc. Over four years of experience in ecological consultancy. Modular River Survey River Condition Assessment certified.
Bruce Munroe	BSc (Hons) Environmental Science, MSc Environmental Monitoring, Modelling, and Reconstruction. 2 years of experience in water resource consulting. Remote Pilot Certificate of Competence (A2CofC) holder. Modular River Survey River Condition Assessment certified.

2. Results

2.1.1 The following sections present a detailed assessment of the taxonomic composition of the eDNA samples. Species of note and INNS have been highlighted where applicable. The results have been presented in four groups; fish; bivalves; macroinvertebrates and crayfish; and mammals and birds. The assessment is followed by a summary of the key findings. The summary of key findings provides a general overview of the findings within the group across all 31 sample sites and includes a summary of key species identified within the main assessment.

2.2 Detailed eDNA Assessment

Fish

- 2.2.1 A total of 28 taxa were detected. 82.1% (23 taxa) were at least 99% similar to a species in the global reference databases, and species names are suggested. The remaining taxa were identified to the lowest possible taxonomic level: 10.7% to genus (3 taxa), and the remainder to family (2 taxa). The taxa belong to 9 orders, 10 families, and 23 genera. The average taxon richness was 5.24 and ranged from 1 ('CLX-01-00-00-001, RVX-001-00-00-013, RVX-02-00-00-002') to 15 ('REE_SA3'). The proportion of the sequencing output allocated to different taxa for each sample site has been presented below in **Figure 5K3 2.1** and **Figure 5K3 2.2**. Full taxa records are available in **HyNet_eDNA-Survey-DataFile.csv**.
- 2.2.2 Species of note include the European eel (*Anguilla anguilla* - Critically Endangered), which was identified at 8 sites: CLX-04-00-00-003, RVX-01-00-00-003, RVX-01-00-00-015, RVX-02-00-00-001, REE_SA3, REE_N9, REE_N1 and REE_W7).
- 2.2.3 Invasive Non-Native Species (INNS) records include Bitterling/Amur bitterling (*Rhodeus amarus/Rhodeus sericeus*) or Bitterling sp. (*Rhodeus sp.*) recorded at two sites: RVX-02-00-00-003 and REE_SA3 on the River Weaver, and sunbleak (*Leucaspius delineatus*) identified at three sites: CLX-02-01-00-002, RVX-02-00-00-003 and REE_SA3 on the River Weaver.
- 2.2.4 Bitterling has been recorded previously in the north-west of England, with eight confirmed sightings highlighted on the NBN atlas² between 2000 – 2009. Although no historic records are located in the watercourses surveyed as part of this assessment, it is noted that records exist in the wider catchment area and therefore this record is not considered to be unexpected within the eDNA results.
- 2.2.5 However, sunbleak, has not previously been recorded in the north-west of England outside of the HyNet aquatic monitoring and is therefore considered a new and unexpected INNS record within the study area and wider catchment.

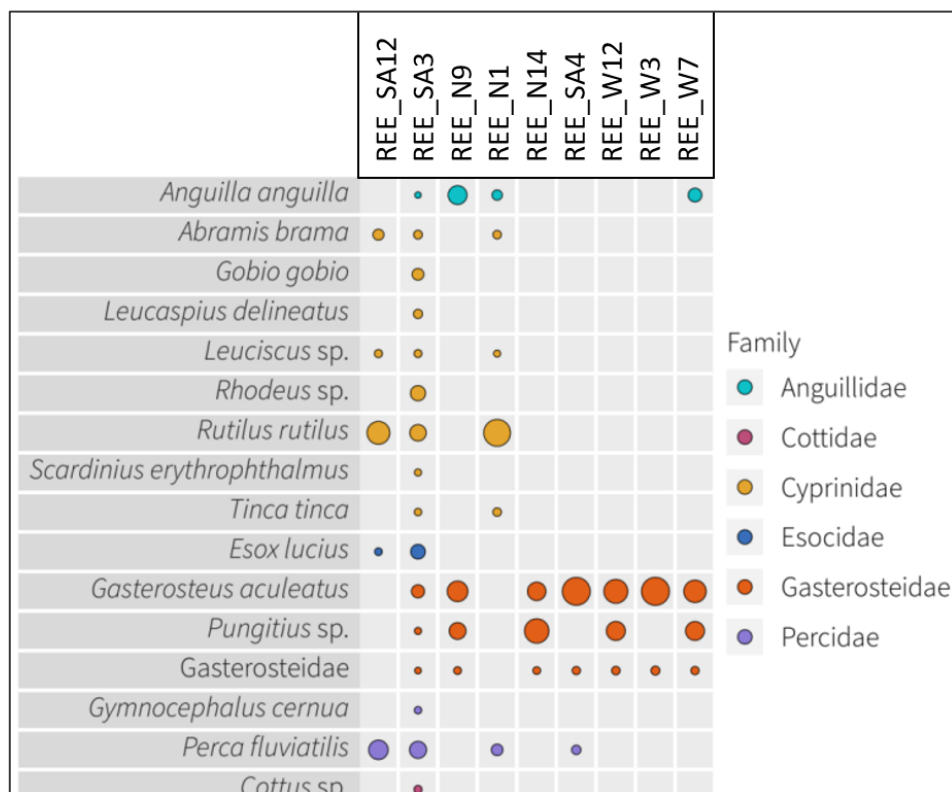
² © NBN Atlas Partnership 2021. Available at: [Species search | NBN Atlas](#). Accessed 16th March 2024.

- 2.2.6 The three-spined stickleback (*Gasterosteus aculeatus*), which accounted for 33.09% of the total sequence reads, was among the most abundant in terms of sequences. Among the most commonly detected species were Three-spined stickleback (*Gasterosteus aculeatus*), roach (*Rutilus rutilus*) and European perch (*Perca fluviatilis*) which were detected in 18, 13 and 13 samples, respectively.
- 2.2.7 High-quality fish sequence data were obtained for 25 of the 30 eDNA samples.
- 2.2.8 'CLX-01-00-00-001', 'CLX-01-00-00-002' and 'RVX-001-00-00-013' produced fewer than expected target reads; results for these samples are therefore considered tentative. Samples REE_N10 and REE_N12 observed no amplifiable fish DNA and no species recorded, while REE_SA5, REE_W4 and REE_W14 passed all QC tests but no species were recorded. All laboratory controls behaved as expected.

Figure 5K3 2.1 The proportion of the sequencing output allocated to the different Fish taxa (rows) within each sample (columns) for sites surveyed in 2022



Figure 5K3 2.2 The proportion of the sequencing output allocated to the different Fish taxa (rows) within each sample (columns) for sites surveyed in 2023



Bivalves

- 2.2.9 A total of 16 Bivalve (Veneridae, Sphaeriidae and Myida) taxa were detected. 93.8% (15 taxa) were at least 99% similar to a species in the global reference databases, and species names are suggested. The remaining taxa were identified to the lowest possible taxonomic level: 6.3% to genus (1 taxon). The taxa belong to 4 orders, 4 families, and 8 genera.
- 2.2.10 Species of note identified during the eDNA analysis include the River orb mussel (*Sphaerium rivicola* - Vulnerable). The River orb mussel was recorded at two sites: CLX-01-00-00-002 and REE_SA3.
- 2.2.11 The average Bivalve (Veneridae, Sphaeriidae and Myida) taxon richness was 3.17 and ranged from 1 ('REE_N14', 'CLX-04-00-00-003', 'RVX-01-00-00-015', 'RVX-02-00-00-003', and 'STRX-01-00-00-009') to 6 ('CLX-01-00-00-002', 'CLX-04-00-00-001' and 'RVX-02-00-00-002'). Zebra mussel (*Dreissena polymorpha*), which accounted for 52.2% of the total sequence reads, was the most abundant in terms of sequences. The relative proportion of the sequences found in each of the samples for each taxa is shown in **Figure 5K3 2.2** and **Figure 5K3 2.3**. Full taxa records are available in **HyNet_eDNA-Survey-DataFile.csv**.
- 2.2.12 INNS records include the Zebra mussel (*Dreissena polymorpha*), Dark false mussel (*Mytilopsis leucophaeata*), Caserta pea mussel (*Euglesa casertana*), Long fingernail clam (*Musculium transversum*) and Asian clam (*Corbicula fluminea*).

- 2.2.13 Zebra Mussel was recorded at 11 sites: CLX-01-00-00-001, CLX-01-00-00-002, CLX-02-01-00-002, LX-03-00-00-001, CLX-04-00-00-001, CLX-04-00-00-003, RVX-02-00-00-001, RVX-02-00-00-003, STRX-01-00-00-001, REE_SA12 and REE_SA3. Species records accessed from NBN Atlas indicate that the Zebra mussel has previously been recorded within the study area and throughout wider catchment as recently as 2019, with records dating back to pre-2000. These records within the eDNA data are therefore not considered unexpected.
- 2.2.14 Asian clam was recorded at seven sites: REE_SA12, CLX-01-00-00-002, CLX-02-01-00-002, CLX-03-00-00-001, CLX-04-00-00-001, RVX-02-00-00-001 and STRX-01-00-00-001. Asian clam has previously been recorded within the northwest of England at two sites, between 2017-2018. Although no historic records are located in the watercourses surveyed as part of this assessment, species records accessed from NBN Atlas that records exist in the wider catchment area and therefore this record is not unexpected within the eDNA results.
- 2.2.15 Dark false mussel, Caserta pea mussel and Long fingernail clam were each recorded at one site throughout the study area. There are no previous records of these species being present in the northwest of England. These are therefore considered new and unexpected INNS records within the study area and wider catchment.
- 2.2.16 Among the most commonly detected Bivalve (Veneridae, Sphaeriidae and Myida) species were Zebra mussel (*Dreissena polymorpha*), Asian clam (*Corbicula fluminea*) and European fingernail clam (*Sphaerium corneum*) which was detected in 9, 6 and 5 samples respectively. Among the most commonly detected Bivalve (Unionidae) species were duck mussel (*Anodonta anatina*) and swollen river mussel (*Unio tumidus*), which were detected in 8 and 6 samples, respectively.
- 2.2.17 High quality Bivalve (Veneridae, Sphaeriidae and Myida) sequence data were obtained for 17 of the 30 eDNA samples. eDNA metabarcoding of bivalves was not successful for 'RVX-01-00-00-010', which failed to amplify despite troubleshooting. Sample 'RVX-01-00-00-015' produced fewer than expected target reads; results for this sample are therefore considered tentative. The remaining 3 samples, 'RVX-001-00-00-013', 'RVX-01-00-00-003' and 'RVX-01-00-00-004', did not produce any target reads, only non-target sequences were detected. Samples REE_SA5, REE_W4, REE_W3, REE_W7, REE_W14, REE_SA4 and REE_W12 observed no amplifiable fish DNA and no species recorded, while REE_N10 and REE_N1 passed all QC tests but no species were recorded. All laboratory controls behaved as expected.
- 2.2.18 A total of 4 Bivalve (Veneridae, Sphaeriidae and Myida) taxa were detected. All taxa were at least 99% similar to a species in the global reference databases, and species names are suggested. The taxa belong to 2 genera.
- 2.2.19 For bivalves (Unionidae) data were obtained for 10 of the 16 eDNA samples. eDNA metabarcoding of Unionide mussels was not successful for 'CLX-01-00-00-001', 'RVX-001-00-00-013', 'RVX-01-00-00-010', and 'STRX-01-00-00-009', which failed to amplify despite troubleshooting. The remaining 4 samples, 'CLX-04-00-00-003', 'RVX-01-00-00-003', 'RVX-01-00-00-004', and 'RVX-02-00-00-002', did not produce any target reads.

- 2.2.20 A total of four Bivalve (Unionidae) taxa were detected, all of which were at least 99% similar to a species in the global reference databases, and species names are suggested. The taxa belong to 3 orders, 3 families, and 7 genera.
- 2.2.21 The average Bivalve (Unionidae) taxon richness was 2.6 and ranged from 1 ('RVX-01-00-00-015' and 'RVX-02-00-00-001') to 4 ('CLX-01-00-00-002'). The relative proportion of the sequences found in each of the samples for each taxa is shown in **Figure 5K3 2.2** and **Figure 5K3 2.3**. Full taxa records are available in **HyNet_eDNA-Survey-DataFile.csv**.

Figure 5K3 2.3 The proportion of the sequencing output allocated to the different Bivalve (Venerida, Sphaeriida and Myida) taxa (rows) within each sample (columns) in 2022

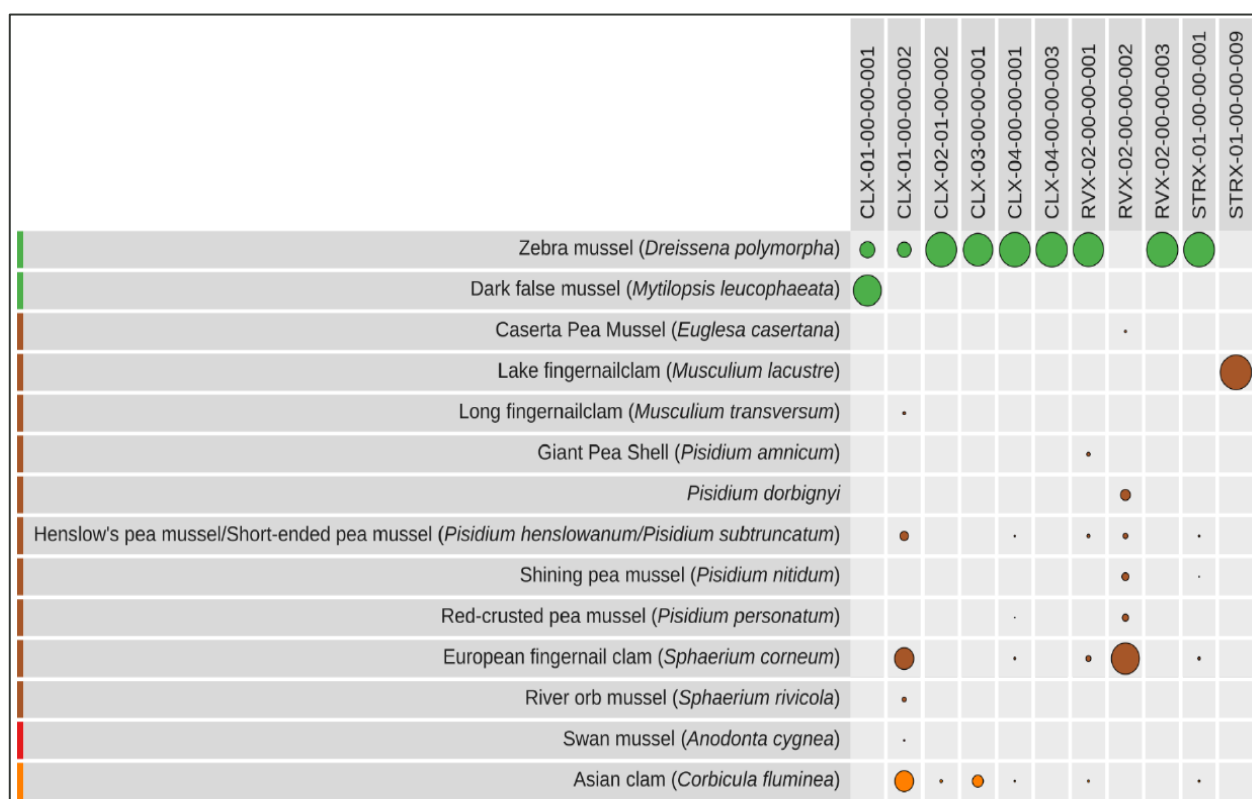


Figure 5K3 2.4 The proportion of the sequencing output allocated to the different Bivalve (Venerida, Sphaeriida and Myida) taxa (rows) within each sample (columns) in 2023

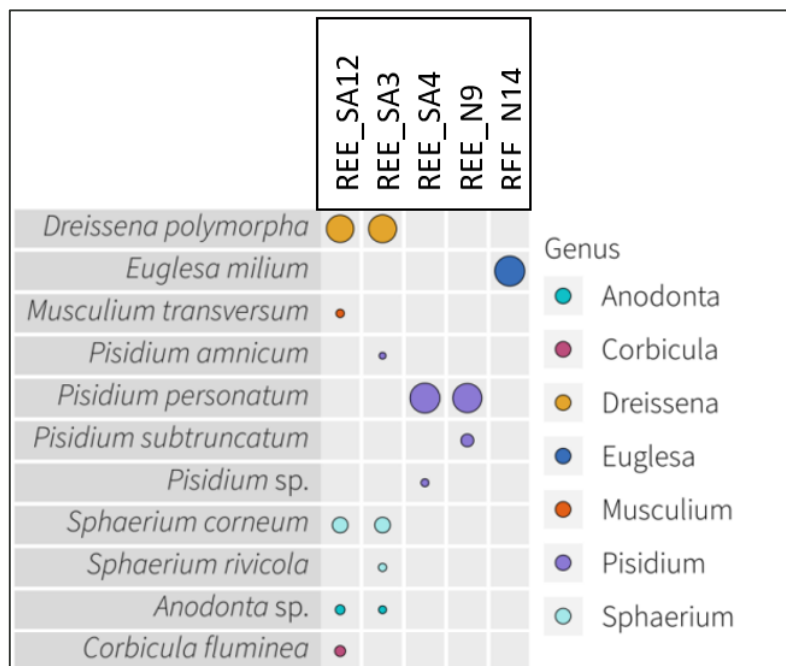


Figure 5K3 2.5 The proportion of the sequencing output allocated to the different Bivalve (Unionid) taxa (rows) within each sample (columns) in 2022

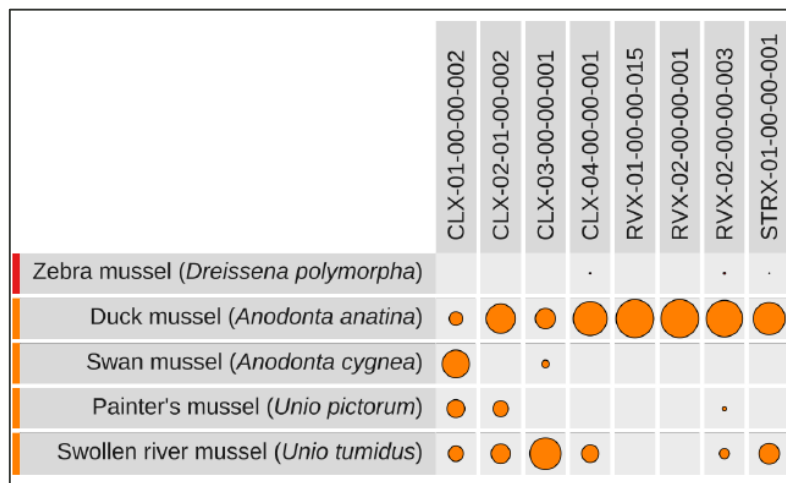
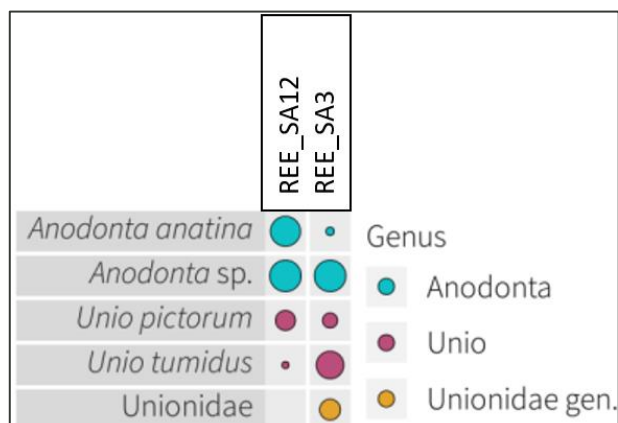


Figure 5K3 2.6 The proportion of the sequencing output allocated to the different Bivalve (Unionid) taxa (rows) within each sample (columns) in 2023

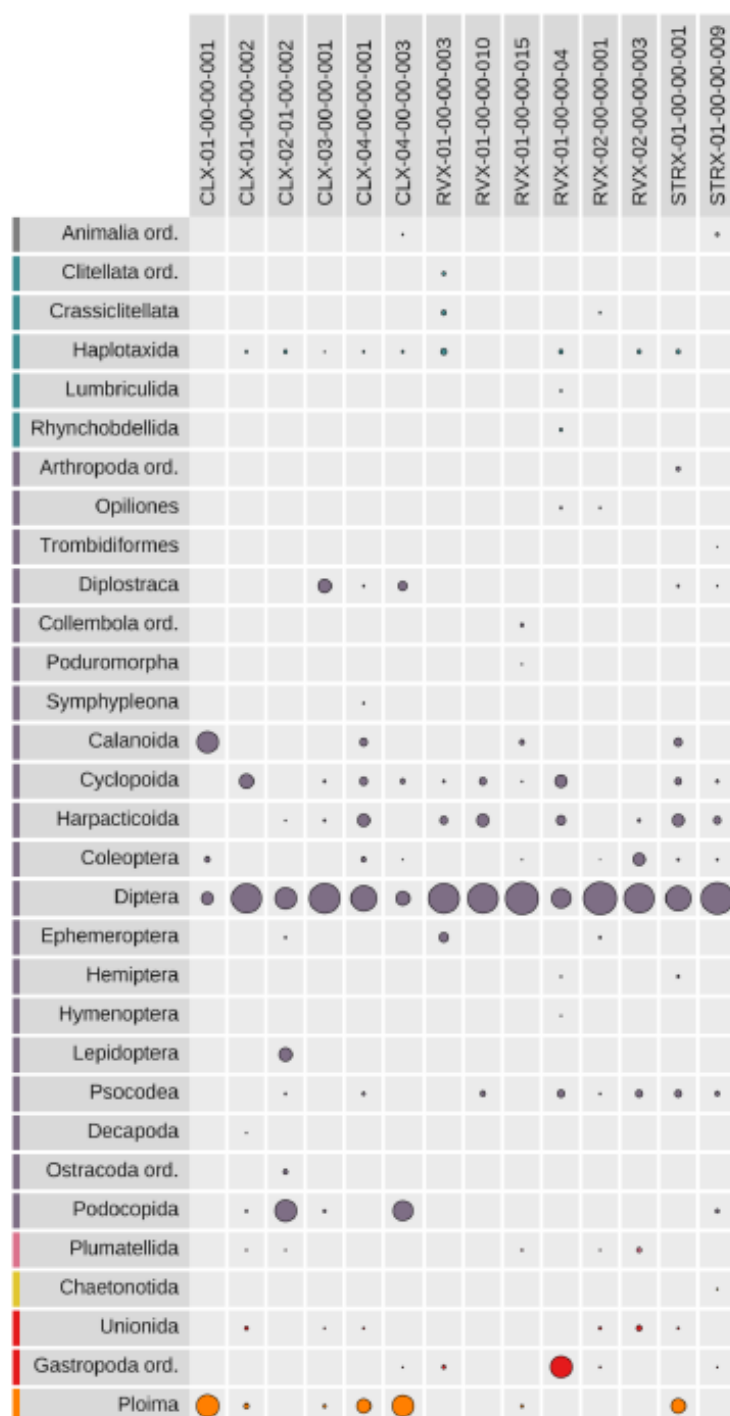


Macroinvertebrates

- 2.2.22 eDNA analysis for macroinvertebrates was only completed as part of the original 2022 aquatic monitoring scope, therefore no surveys completed in 2023 includes any macroinvertebrate community data.
- 2.2.23 A total of 240 taxa were detected. 43.8% (105 taxa) were at least 99% similar to a species in the global reference databases, and species names are suggested. The remaining taxa were identified to the lowest possible taxonomic level: 28.7% to genus (69 taxa), 22.9% to family (55 taxa), 2.9% to order (7 taxa), 0.8% to class (2 taxa), 0.4% to family (1 taxon), and the remainder to kingdom (1 taxon). The taxa belong to 27 orders, 64 families, and 112 genera.
- 2.2.24 The average taxon richness was 31.5 and ranged from 14 ('CLX-01-00-00-001', 'RVX-01-00-00-010') to 51 ('CLX-04-00-00-001'). The relative proportion of the sequences found in each of the samples is shown in **Figure 5K3 2.3**. *Glyptotendipes barbipes*, which accounted for 11.6% of the total sequence reads, was among the most abundant in terms of sequences. Among the most commonly detected species were *Acanthocyclops americanus*, *Parachironomus arcuatus* and *Kiefferulus tendipediformis*, each of which were detected in 6 samples.
- 2.2.25 The relative proportion of the sequences found in each of the samples for each order is shown in **Figure 5K3 2.4**. Full taxa records are available in **HyNet_eDNA-Survey-DataFile.csv**.
- 2.2.26 The macroinvertebrate family list includes several high scoring biological monitoring working party (BMWP) taxa: including but not limited to Unionidae (*Anodonta anatina*), Chrysomelidae (*Agelastica alni*, *Longitarsus luridus*, *Longitarsus rubiginosus*, *Psylliodes chrysocephalus*), Dytiscidae (*Dytiscus marginalis*, *Ilybius fuliginosus*, *Ilybius quadriguttatus*), Simuliidae (*Simulium angustipes*, *Simulium velutinum*), and Tipulidae (*Tipula oleracea*, *Tipula paludosa*).

2.2.27 High-quality macroinvertebrate sequence data were obtained for 11 of the 16 eDNA samples. Samples 'CLX-01-00-00-001', 'RVX-01-00-00-003' and 'RVX-02-00-00-003' produced fewer than expected target reads; results for these samples are therefore considered tentative. The total number of target sequences in samples 'RVX-001-00-00-013' and 'RVX-02-00-00-002' are below our threshold for reporting and the corresponding detections are not reported. All laboratory controls behaved as expected.

Figure 5K3 2.7 The proportion of the sequencing output allocated to the different macroinvertebrate order (rows) within each sample (column)



Crayfish

2.2.28 INNS records highlight American signal crayfish (*Pacifastacus leniusculus*), identified in two samples: CLX-01-00-00-002 and REE_SA3. Species records accessed from NBN Atlas indicate Signal crayfish have previously been recorded within the study area and throughout wider catchment as recently as 2020, with records dating back to pre-2000. These records within the eDNA data are therefore not considered unexpected. No white-clawed crayfish (*Austropotamobius pallipes* - endangered) were identified in the samples.

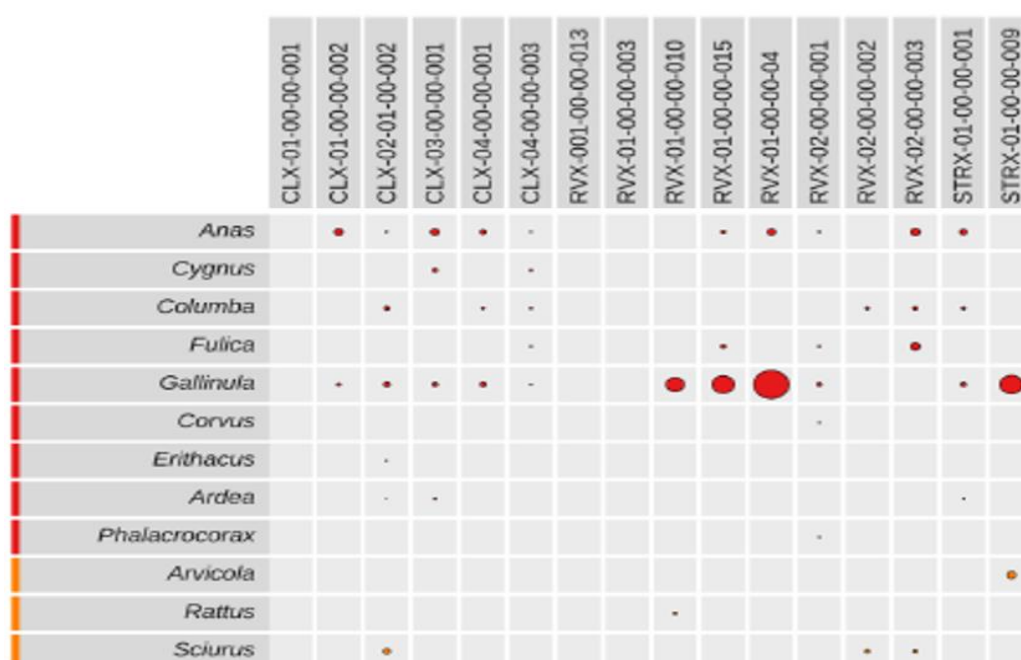
Mammals and Birds

2.2.29 Mammals and birds were detected as 'non-target vertebrate taxa' within the fish eDNA analyses. These non-target detections should be treated with some caution as the fish analysis may not fully capture the non-fish vertebrate community present in the samples. Common environmental contaminants such as human and livestock sequences are excluded.

2.2.30 Mammals and birds were detected in 14 of the samples. Moorhen (*Gallinula sp.*) was the most abundant in terms of sequences and accounted for the highest proportion of the sampled DNA. Species of note include the European water vole (*Arvicola amphibius* - protected under the Wildlife and Countryside Act 1981). European water vole was identified at one sample site - STRX-01-00-00-009. Historic species records accessed from NBN Atlas have previously identified this species at or around the study area.

2.2.31 The relative proportion of the sequences found in each of the samples is shown in **Figure 5K3 2.8** below.

Figure 5K3 2.8 The proportion of the sequencing output allocated to the different mammalian and bird taxa (rows) within each sample (columns)



2.3 Overview

Fish

- A total of 28 taxa were detected;
- Average taxon richness was 5.24 and ranged from 1 to 15;
- Most abundant sequences: Three-spined stickleback (*Gasterosteus aculeatus*);
- Most commonly detected taxa: Three-spined stickleback (*Gasterosteus aculeatus*), roach (*Rutilus rutilus*) and; European perch (*Perca fluviatilis*);
- Species of note: European eel (*Anguilla anguilla* - Critically Endangered);
- INNS records: Sunbleak (*Leucaspis delineatus*) Bitterling / Amur Bitterling (*Rhodeus amarus/Rhodeus sericeus*) or Bitterling sp. (*Rhodeus sp.*); and
- Fish sequence data was obtained from 25 of 30 samples.

Bivalves

2.3.1 Veneridae, Sphaeriidae and Myida:

- A total of 16 taxa were detected;
- Average taxon richness was 3.17 and ranged from 1 to 6;
- Most abundant sequences: zebra mussel (*Dreissena polymorpha*);
- Most commonly detected taxa: zebra mussel (*Dreissena polymorpha*), Red-crusted pea mussel (*Pisidium personatum*) and European fingernail clam (*Sphaerium corneum*);
- Species of note: river orb mussel (*Sphaerium rivicola* - Vulnerable);
- INNS records: Zebra mussel (*Dreissena polymorpha*), Dark false mussel (*Mytilopsis leucophaeata*), Caserta pea mussel (*Euglesa casertana*), Long fingernail clam (*Musculium transversum*) and Asian clam (*Corbicula fluminea*); and
- Bivalve sequence data was obtained from 17 of 30 eDNA.

2.3.2 Unionidae:

- A total of 4 taxa were detected;
- Average taxon richness was 2.6 and ranged from 1 to 4;
- Most abundant sequence: duck mussel (*Anodonta anatina*);
- Most commonly detected taxa: duck mussel (*Anodonta anatina*) and swollen river mussel (*Unio tumidus*); and
- Unionidae bivalve sequence data was obtained from 10 of 30 eDNA samples.

Macroinvertebrates

- A total of 240 taxa were detected;
- Average taxon richness was 31.5 and ranged from 14 to 51;
- Most abundant sequences: *Glyptotendipes barbipes*;
- Most commonly detected taxa: *Acanthocyclops americanus*, *Parachironomus arcuatus* and *Kiefferulus tendipediformis*;
- No INNS recorded; and
- Macroinvertebrate sequence data were obtained for 14 of 16 eDNA samples (11 high quality and three tentative).

Crayfish

- INNS records: American signal crayfish (*Pacifastacus leniusculus*) was present in two sample of 30; and
- All laboratory controls behaved as expected.

Mammals and Birds

- A total of 14 mammalian and bird taxa were identified; and
- Species of note: Eurasian water vole (*Arvicola amphibius*- protected under the Wildlife and Countryside Act 1981) was present in one out of 16 samples.

2.4 Next Steps

- 2.4.1 It is recommended that those sites not successfully surveyed should be re-surveyed to provide a baseline of the community present.
- 2.4.2 Should further changes to the Project be outside the Preliminary Order Limits at the time of reported further surveys may be required to provide a baseline of the macrophyte community present within any additional watercourses.
- 2.4.3 Those INNS species recorded as not previously present within the catchment should be reported to the EA as potential new species within the catchment. Further INNS specific surveys should be completed to understand the risk of spread as a result of the Project.

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Annex 5K4

Aquatic Ecology Survey Report River Condition Assessment Surveys

October 2024

Revision	1
Volume	0001
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1. Methodology

1.1 Desk Study

- 1.1.1 A desk study was undertaken in Spring 2022 and the methodology for this is set out in **Section 5.5** and **Table 5.8** of the Preliminary Environmental Information Report (PEIR). The desk study recorded the presence of statutory designated sites within up to 20km ^[1] of the Preliminary Order Limits (**Section 5.6.1**, **Table 5.10**, and **Figure 5.1** of the PEIR) and non-statutory designated sites within 2km (**Section 5.6.2**, **Table 5.11**, and **Figure 5.2** of the PEIR). The desk study also recorded the presence of Habitats of Principal Importance (HPI) within 2km of the Preliminary Order Limits (**section 5.6.3**, **Table 5.12** and **Figure 5.3** of the PEIR). Records of protected and notable species within 2km of the Preliminary Order Limits are discussed within **section 5.6.12-5.6.41** of the PEIR.
- 1.1.2 The desk study information from the PEIR is not repeated in this report or discussed further. The desk study will be updated for the Final Environmental Statement following design freeze for the Project.

1.2 Survey Area

- 1.2.1 Please note that as part of the design process, the order limits have undergone a number of iterations (as described in **Appendix 2A: Design evolution** of the Draft ES) and this report is based on the Preliminary Order Limits as they stood in early 2023.
- 1.2.2 The study area for MoRPh surveys includes a total of 49 watercourse crossings as shown in **Figure 5K4 1.1**. The locations are concentrated between Helsby and Frodsham, but also cover watercourses close to Northwich, Warrington and Dunham Massey. These sites cover the extent of the Project.
- 1.2.3 Survey locations were chosen based on WFD waterbody classification or chosen as representative watercourses within each geographical area/ watercourse type (Canal, River or Stream/Ditch) to provide an indication of the community structures present. One representative watercourse identified by the Environment Agency as a main river was surveyed per catchment.
- 1.2.4 A total of 41 sites were surveyed, on one occasion, using the Modular River Physical Survey (MoRPh) methodology². Surveys were undertaken between July 2022 and October 2023. Survey locations are provided in **Table 5K4 1.1** and

¹ Dependent on reasons for designations; within two kilometres for habitats, extending to 10 kilometres for bats and up to 20 kilometres for all the ornithological interests for international sites.

² Gurnell, A. M., & Shuker, L. J. (2022). The MoRPh Survey. Technical Reference Manual 2022 version 14. Available at <https://modularriversurvey.org/professional-help/>. (Accessed 07 August 2023).

Table 5K4 2.1 and photographs in **Graphic 5K4 1.1** to **Graphic 5K4 1.41** in Annex 1.

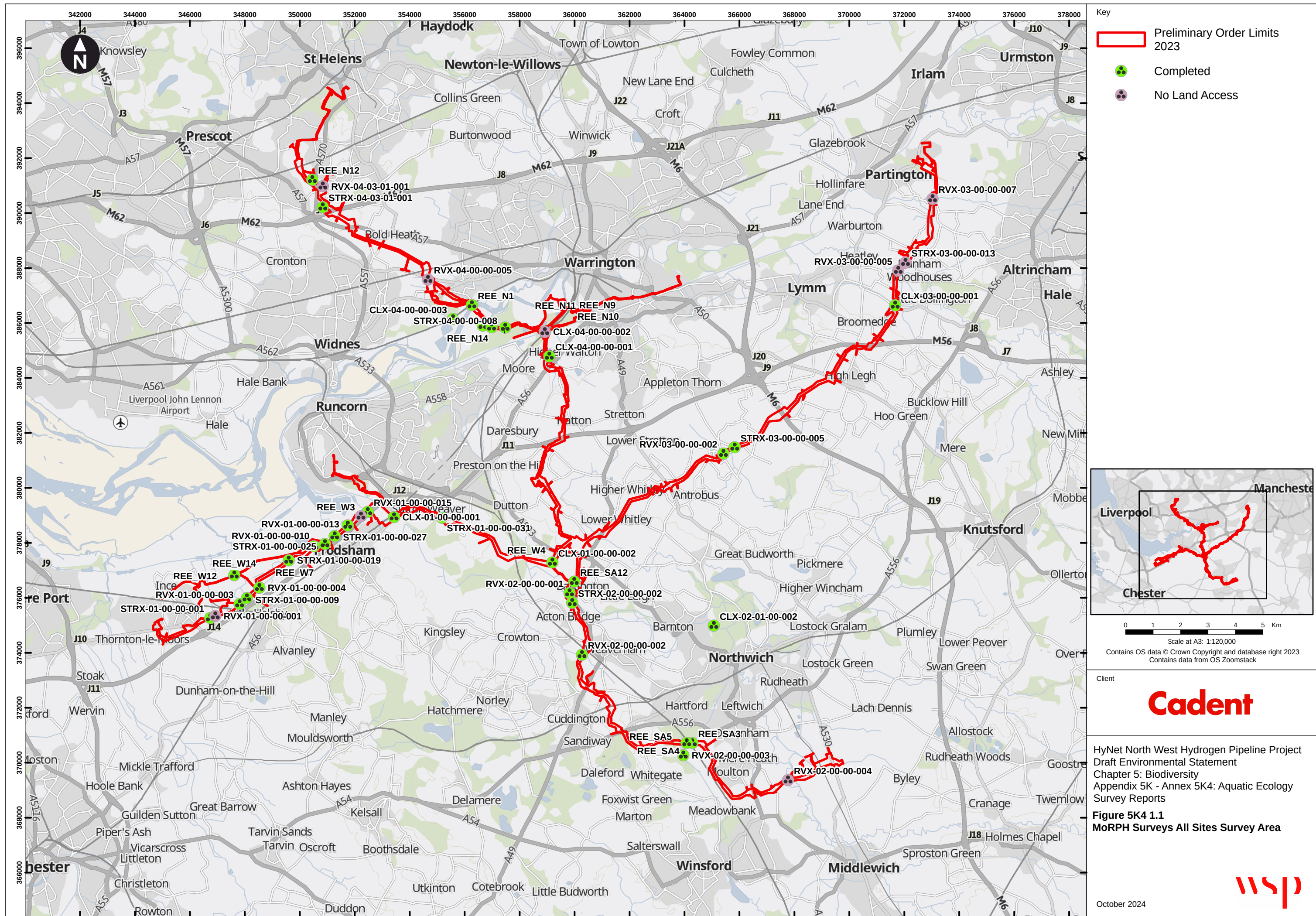
1.3 Field Surveys

Approach to field survey design

Overview

- 1.3.1 River Condition Assessments³ (RCA) are comprised of two components, 1) a field-based assessment; Modular River Physical Survey² MoRPh) which determines a preliminary river condition based on indicators automatically extracted from the field surveys, and 2) a desk-based assessment which determines the river type. The final river condition score is determined using the preliminary condition score and river type.
- 1.3.2 MoRPh field surveys involve visual assessments of short sections of the river (modules) to capture information on the bank top, bank face, channel-water margin, and riverbed. Five contiguous modules, a MoRPh5 subreach are required to evaluate the river condition indicator scores. There are 32 river condition indicators that are automatically calculated from records taken during the MoRPh5 field surveys and given a score (0 to 4 for positive type indicators, and -4 to 0 for negative type indicators), these are presented in **Table 5K4 1.1**. The average of all negative condition scores plus the average of all positive condition scores determines the preliminary condition score of the watercourse.

³ Gurnell, A. M., England, J., Scott, S. J. & Shuker, L. J. (2022). A guide to assessing river condition. Part of the rivers and streams component of the biodiversity net gain metric BM3.1 version. Available at <https://modularriversurvey.org/professional-help/>. (Accessed 07 August 2023).



- Key
- Preliminary Order Limits 2023
 - Completed
 - No Land Access



Scale at A3: 1:120,000
Contains OS data © Crown Copyright and database right 2023
Contains data from OS Zoomstack

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HyNet North West Hydrogen Pipeline Project
Draft Environmental Statement
Chapter 5: Biodiversity
Appendix 5K - Annex 5K4: Aquatic Ecology
Survey Reports

Figure 5K4 1.1
MORPH Surveys All Sites Survey Area



Table 5K4 1.1 River condition indicators used to determine preliminary condition score

Indicator code	Name	Positive / Negative type
B1	Bank top vegetation structure	Positive
B2	Bank top tree feature richness	Positive
B3	Bank top water-related features	Positive
B4	Bank top NNIPS* cover	Negative
B5	Bank top managed ground cover	Negative
C1	Bank face riparian vegetation structure	Positive
C2	Bank face tree feature richness	Positive
C3	Bank face natural bank profile extent	Positive
C4	Bank face natural bank profile richness	Positive
C5	Bank face natural bank material richness	Positive
C6	Bank face bare sediment extent	Positive
C7	Bank face artificial bank profile extent	Negative
C8	Bank face reinforcement extent	Negative
C9	Bank face reinforcement material severity	Negative
C10	Bank face NNIPS cover	Negative
D1	Channel margin aquatic vegetation extent	Positive
D2	Channel margin aquatic morphotype richness	Positive
D3	Channel margin physical feature extent	Positive
D4	Channel margin physical feature richness	Positive
D5	Channel margin artificial features	Negative
E1	Channel aquatic morphotype richness	Positive
E2	Channel bed tree features richness	Positive
E3	Channel bed hydraulic features richness	Positive

Indicator code	Name	Positive / Negative type
E4	Channel bed natural features extent	Positive
E5	Channel bed natural features richness	Positive
E6	Channel bed material richness	Positive
E7	Channel bed siltation	Negative
E8	Channel bed reinforcement extent	Negative
E9	Channel bed reinforcement severity	Negative
E10	Channel bed artificial features severity	Negative
E11	Channel bed NNIPS extent	Negative
E12	Channel bed filamentous algae extent	Negative

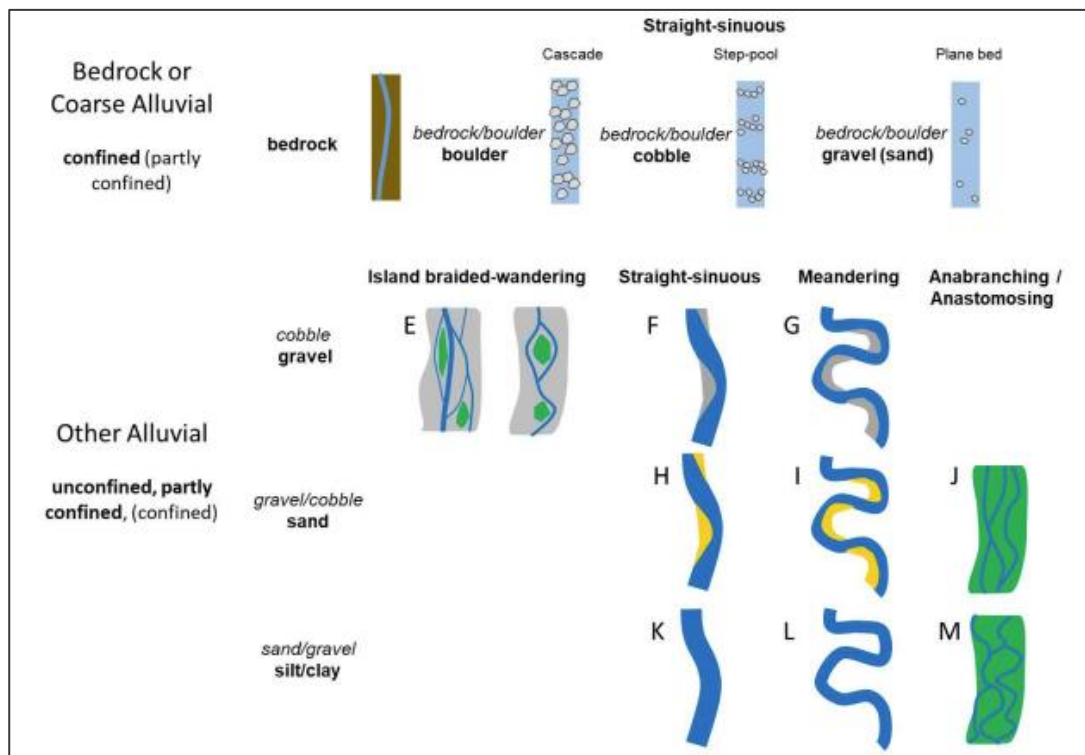
*NNIPS = non-native invasive plant species

- 1.3.3 Eight indicators are used to determine the river type, as detailed in **Table 5K4 1.2** below. The values of the indicators are assigned based on assessed information on planform and bed material and supported by their degree of confinement and valley gradient. Indicators A1 to A5 are determined using aerial imagery and maps. Indicators A6 to A8 are derived from the MoRPh5 sub reach field surveys.

Table 5K4 1.2 Indicators used to determine the indicative river type for River Condition Assessments

Indicator code	Name
A1	Braiding index
A2	Sinuosity index
A3	Anabranching index
A4	Level of confinement
A5	Valley gradient
A6	Bedrock reaches
A7	Coarsest bed material size class
A8	Average alluvial bed material size class

1.3.4 The indicator values determine an indicative river type. A total of 15 indicative river types are incorporated into the assessment which include: canals and navigable rivers, large rivers (where the bed material and submerged bed features are not visible) and 13 river planform-bed material types as shown in **Figure 5K4 1.2**.

Figure 5K4 1.2 River types A to M for River Condition Assessment³

1.3.5 The preliminary condition score and indicative river type are then assessed in accordance with thresholds to determine the final condition score, as shown in **Table 5K4 1.3**.

Table 5K4 1.3 Thresholds for final condition scores for each river type³

River Type	Canals / Navigable	Large	A	B	C	D	E	F	G	H	I	J	K	L	M
Likely best average condition score	1.8	2.5	2.4	2.7	2.7	2.7	2.7	2.8	3	2.9	3.1	2.8	2.4	2.4	2.4
Lower threshold for GOOD	>1.4	>2.0	>1.9	>2.2	>2.2	>2.2	>2.2	>2.3	>2.5	>2.4	>2.5	>2.3	>1.9	>1.9	>1.9
Lower threshold for FAIRLY GOOD	>0.7	>1.3	>1.2	>1.4	>1.4	>1.4	>1.4	>1.5	>1.6	>1.6	>1.7	>1.5	>1.2	>1.2	>1.2
Lower threshold for MODERATE	>-0.1	>0.3	>0.2	>0.2	>0.2	>0.2	>0.2	>0.4	>0.5	>0.5	>0.6	>0.4	>0.2	>0.2	>0.2
Lower threshold for FAIRLY POOR	>-1.2	>-1.0	>-1.0	>-0.9	>-0.9	>-0.9	>-0.9	>-0.9	>-0.9	>-0.9	>-0.8	>-0.9	>-1.0	>-1.0	>-1.0
Likely worst average condition score	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5

1.4 Constraints

Access limitations

1.4.1 Of the 49 sites identified as requiring MoRPh assessments 41 sites were accessed, the remaining eight sites were not granted land access at the time of surveys. A summary of locations where the requirement for MoRPh assessments were identified, but where surveys were not conducted due to inadequate access, is provided below:

- RVX-04-00-00-005
- RVX-01-00-00-001
- RVX-02-00-00-004
- RVX-03-00-00-007
- RVX-04-03-01-001
- RVX-03-00-00-005
- STRX-03-00-00-013
- CLX-04-00-00-002

Ecological considerations

1.4.2 Surveyors undertook MoRPh assessments from the embankments and did not enter the watercourses. Dense vegetation or steep embankments can limit visibility of the watercourse and opposite banks. Where possible, surveyors moved location, temporarily moved vegetation and used vantage points to view the watercourse features and opposite banks. Where a clear view of the watercourse was not possible, and specifically the bed materials could not be viewed, the MoRPh survey was moved up or downstream and the length of the MoRPh survey was increased to the maximum length (50m). Therefore, limited visibility is not considered to be a major limitation.

1.4.3 MoRPh surveys are ordinarily conducted during periods of low flow, during spring or early summer; this enables the recording of information on both vegetation and physical properties of the river and its margins. Although the surveys were undertaken between mid-summer and autumn, care was given to accurately identify and quantify physical features that may have been obscured by vegetation and therefore the timing of the surveys was not considered to be a significant limitation to the survey findings.

1.5 Personnel

1.5.1 The programme of surveys was led by Eve Loxham and Esther Kendall. The survey lead was assisted by suitably qualified and experienced Ricardo Personnel; details of whom are provided in **Table 5K4 1.4**.

Table 5K4 1.4 Survey personnel

Name	Experience
Eve Loxham	MBiolSci (Hons). Over seven years of experience in ecological consultancy. Licence holder: WML-CL11 - Surveying white-clawed crayfish. Modular River Survey River Condition Assessment for The Biodiversity Metric accredited.
Esther Kendal	BSc (Hons), MSc. Over four years of experience in ecological consultancy. Modular River Survey River Condition Assessment for The Biodiversity Metric accredited.
Paul Cronje	Btech, NDip, AMIEnvSc, over seven years of experience in ecological consultancy. Licence holder: WML-CL11 - Surveying white-clawed crayfish
Joe Salkeld	BSc (Hons), MSc, MCIEEM over seven years of experience in ecological consultancy. Modular River Survey River Condition Assessment for The Biodiversity Metric accredited.
Bruce Monroe	BSc (Hons), MSc, two years of experience in ecological consultancy. Modular River Survey River Condition Assessment for The Biodiversity Metric accredited.
Katie Clarke	BSc (Hons), MSc. Over four years of experience in ecological consultancy. Modular River Survey River Condition Assessment for The Biodiversity Metric accredited.
Sean Herd-Hoare	BSc (Hons). Over 2 years of experience in ecological consultancy. Modular River Survey River Condition Assessment for The Biodiversity Metric accredited.

2. Results

2.1 Field Survey

Baseline ecological conditions & assessment

Preliminary river condition results

- 2.1.1 **Table 5K4 2.1** contains the river condition indicator scores and preliminary condition scores of each crossing. **Annex 2** is the raw Cartographer outputs provided in excel format 'HyNet_Morph-Survey-DataFile_All Sites_Appendix B'. **Annex 1** is site photographs.

Table 5K4 2.1 River condition indicator scores and determined preliminary condition scores. Scores are shaded red if scoring the lowest in that indicatory category and green if scoring the highest.

Map reference	River condition indicator score																								Preliminary condition Score								
	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	D1	D2	D3	D4	D5	E1	E2	E3	E4		E5	E6	E7	E8	E9	E10	E11	E12
STRX-01-00-00-001	1	0	0	0	-2	1	0	3	2	1	0	0	0	0	0	2	1	0	0	0	2	0	0	0	0	1	-4	0	0	0	0	0	0.28
RVX-01-00-00-003	1	0	0	0	-3	1	1	2	1	2	0	0	0	0	0	3	1	1	1	0	2	0	0	0	0	1	-4	0	0	0	0	0	0.36
STRX-01-00-00-009	1	0	0	0	-2	2	0	2	1	2	1	0	0	0	0	3	1	0	0	0	2	0	0	0	0	3	0	0	0	0	0	0	0.79
RVX-01-00-00-004	1	0	0	0	-4	2	0	2	1	1	1	0	0	0	0	2	2	0	0	0	2	0	0	0	0	1	0	0	0	0	0	0	0.48
STRX-01-00-00-019	2	0	0	0	-3	3	2	2	1	1	3	0	0	0	0	4	2	2	1	0	1	1	0	1	0	2	0	0	0	0	0	0	1.24
RVX-01-00-00-010	1	0	0	0	-3	2	0	2	1	1	0	0	0	0	0	3	1	0	0	0	2	2	0	0	0	2	0	0	0	0	0	0	0.66
STRX-01-00-00-025	1	0	4	0	-2	2	1	2	1	1	0	0	0	0	0	3	1	0	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0.9
STRX-01-00-00-027	2	0	0	0	-2	1	0	2	1	1	0	0	0	0	0	3	1	0	0	0	1	0	0	0	0	1	-2	0	0	0	0	0	0.38
RVX-01-00-00-013	2	0	0	0	-4	1	0	2	1	1	0	0	0	0	0	3	1	0	0	0	1	1	0	0	0	2	0	0	0	0	0	0	0.48

	River condition indicator score																								Preliminary condition Score								
Map reference	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	D1	D2	D3	D4	D5	E1	E2	E3	E4		E5	E6	E7	E8	E9	E10	E11	E12
RVX-01-00-00-015	2	0	0	0	-2	1	0	2	1	1	0	-2	-2	-2	0	2	1	1	1	-1	1	0	0	0	0	1	0	0	0	-3	0	0	-0.19
CLX-01-00-00-001	2	0	0	0	-4	2	0	0	0	1	0	-4	-3	-4	0	2	1	0	0	-2	0	1	0	0	0	1	0	0	0	-3	0	0	-1.01
STRX-01-00-00-031	1	0	0	0	-3	1	1	2	1	1	0	0	0	0	0	3	1	0	0	0	1	1	0	0	0	1	-4	0	0	0	0	0	0.2
CLX-01-00-00-002	1	0	2	0	-3	1	1	3	2	1	0	0	-4	-4	0	3	2	0	0	-1	0	1	0	0	0	1	-2	0	0	0	0	-1	-0.21
RVX-02-00-00-001	2	0	0	0	-4	2	0	2	1	1	0	0	-3	-4	0	2	1	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	-0.16
STRX-02-00-00-002	1	0	0	0	-2	1	0	2	1	1	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0	2	0	0	0	0	0	0	0.43
RVX-02-00-00-002	3	3	1	0	-2	2	3	3	4	1	4	-3	0	0	0	1	2	1	2	-1	1	3	2	0	0	3	-2	0	0	0	0	0	1.44
RVX-02-00-00-003	2	0	1	-3	-2	2	2	2	1	1	1	-1	0	0	-4	1	0	0	0	0	2	2	0	0	0	1	-4	0	0	0	-3	0	-0.36
CLX-02-01-00-002	3	1	0	-3	0	1	0	2	1	0	1	0	-4	-4	-4	2	1	4	1	0	2	0	0	0	0	1	0	0	0	0	-3	0	-0.33
RVX-03-00-00-002	3	0	0	-3	-3	2	1	3	2	1	2	0	0	0	-3	0	0	1	1	0	1	1	2	0	0	3	0	0	0	0	-4	0	0.21
STRX-03-00-00-005	2	0	0	0	-2	1	1	2	1	1	1	0	0	0	0	2	1	0	0	0	1	2	0	0	0	2	0	0	0	0	0	0	0.74

	River condition indicator score																														Preliminary condition Score		
Map reference	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	D1	D2	D3	D4	D5	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10		E11	E12
CLX-03-00-00-001	1	0	0	0	-3	1	0	2	1	0	0	0	-4	-4	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	-0.48
CLX-04-00-00-001	2	1	0	0	-4	1	1	1	2	1	0	0	-4	-4	0	0	0	0	0	0	0	0	2	0	0	1	0	0	0	0	0	0	-0.29
STRX-04-00-00-008	1	2	0	0	-4	2	4	2	2	1	1	0	0	0	0	0	0	0	0	0	0	3	0	0	0	2	0	0	0	0	0	0	0.74
STRX-04-00-00-009	3	2	1	-2	-3	2	1	2	3	1	4	-2	0	0	-2	1	0	0	0	0	1	2	0	0	0	2	0	0	0	0	-4	0	0.32
CLX-04-00-00-003	3	0	0	-3	-4	0	0	2	1	0	0	0	-4	-4	0	3	1	0	0	0	1	1	0	0	0	1	-4	-4	-3	0	0	0	-1.32
STRX-04-03-01-001	1	0	0	0	-2	2	1	0	0	1	0	0	0	0	0	1	0	0	0	0	0	2	0	0	0	2	0	0	0	-4	0	0	0.065
REE_W12	1	0	0	0	0	1	2	2	1	1	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	1	0	0	0	0	0	0	0.578
REE_W14	1	0	1	0	-2	1	0	1	2	1	0	-4	0	0	0	2	1	1	1	-1	3	0	0	0	0	1	0	0	0	0	0	-3	0.073
REE_SA3	2	0	0	-3	-2	2	1	2	2	1	2	0	-1	0	-4	1	0	0	0	-1	0	1	0	0	0	3	0	0	0	-3	-4	0	-0.490
REE_SA4	2	1	0	-4	0	1	1	3	4	1	1	0	0	0	-1	0	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0	0.562
REE_W3	2	0	0	0	0	1	0	3	2	1	0	0	0	0	0	1	0	0	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0.736

	River condition indicator score																														Preliminary condition Score			
Map reference	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	D1	D2	D3	D4	D5	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10		E11	E12	
REE_W4	4	0	0	0	0	1	1	2	2	3	4	0	0	0	0	0	0	0	1	1	0	2	2	1	2	1	3	0	0	0	0	0	0	1.578
REE_W7	1	0	0	0	0	1	0	2	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0.368
REE_SA5	1	2	0	0	-3	2	2	2	2	1	1	0	0	0	0	0	0	1	1	0	1	2	0	3	1	1	0	0	0	0	0	0	0	0.979
REE_N12	1	0	0	0	-2	1	1	2	1	1	3	0	-3	-4	0	2	1	0	0	0	0	2	1	0	0	1	-4	-4	-4	0	0	0	-0.720	
REE_N1	1	0	0	0	-4	0	0	2	1	0	0	0	-4	-4	0	1	0	0	0	0	2	0	0	0	0	1	0	0	0	0	0	-1	-0.578	
REE_SA12	2	0	0	0	-2	1	0	3	3	1	0	0	-4	-3	0	3	3	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0.307	
REE_N9	2	1	0	-3	-2	1	1	3	2	2	3	0	0	0	-3	1	0	1	1	0	1	0	0	0	0	1	0	0	0	0	0	-1	0.360	
REE_N10	1	0	0	0	-3	1	0	2	1	0	2	0	-4	-4	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	-0.360	
REE_N11	3	0	0	-3	0	1	2	2	1	2	1	0	0	0	-2	0	0	1	1	0	0	0	1	0	0	1	0	0	0	0	0	0	0.457	
REE_N14	1	0	1	0	-3	1	0	2	1	1	0	0	0	0	0	3	1	1	1	0	2	1	0	0	0	2	0	0	0	0	0	0	0.716	

River type and final river condition

2.1.2 Results are detailed in **Table 5K4 2.2**. A total of four river types were determined and these included Type K, Large river, Navigable river and Type H.

Table 5K4 2.2 River type and final river condition

Map Reference	River Type	Final Condition Class / Score
STRX-01-00-00-001	K	Moderate / 3
RVX-01-00-00-003	K	Moderate / 3
STRX-01-00-00-009	K	Moderate / 3
RVX-01-00-00-004	K	Moderate / 3
STRX-01-00-00-019	K	Fairly Good / 4
RVX-01-00-00-010	K	Moderate / 3
STRX-01-00-00-025	K	Moderate / 3
STRX-01-00-00-027	K	Moderate / 3
RVX-01-00-00-013	K	Moderate / 3
RVX-01-00-00-015	Large river	Fairly Poor / 2
CLX-01-00-00-001	Navigable	Fairly Poor / 2
STRX-01-00-00-031	K	Fairly Poor / 2
CLX-01-00-00-002	Navigable	Fairly Poor / 2
RVX-02-00-00-001	Large river	Fairly Poor / 2
STRX-02-00-00-002	K	Moderate / 3
RVX-02-00-00-002	K	Fairly Good / 4
RVX-02-00-00-003	Large river	Fairly Poor / 2
CLX-02-01-00-002	Navigable	Fairly Poor / 2
RVX-03-00-00-002	H	Fairly Poor / 2
STRX-03-00-00-005	K	Moderate / 3
CLX-03-00-00-001	Navigable	Fairly Poor / 2
CLX-04-00-00-001	Navigable	Fairly Poor / 2
STRX-04-00-00-008	K	Moderate / 3

Map Reference	River Type	Final Condition Class / Score
STRX-04-00-00-009	K	Moderate / 3
CLX-04-00-00-003	Navigable	Poor / 1
STRX-04-03-01-001	K	Fairly poor / 2
REE_W12	K	Moderate / 3
REE_W14	K	Moderate / 3
REE_SA3	Navigable/Canal	Fairly Poor / 2
REE_SA4	H	Moderate / 3
REE_W3	K	Moderate / 3
REE_W4	K	Fairly Good / 4
REE_W7	K	Moderate / 3
REE_SA5	K	Moderate / 3
REE_N12	K	Fairly Poor / 2
REE_N1	Navigable/Canal	Fairly Poor / 2
REE_SA12	Navigable/Canal	Moderate / 3
REE_N9	Large river	Moderate / 3
REE_N10	Navigable/Canal	Fairly Poor / 2
REE_N11	K	Fairly Poor / 2
REE_N14	K	Moderate / 3
RVX-04-03-01-001	No access	
RVX-01-00-00-001	No access	
RVX-02-00-00-004	No access	
RVX-03-00-00-005	No access	
STRX-03-00-00-013	No access	
RVX-03-00-00-007	No access	
CLX-04-00-00-002	No access	
RVX-04-00-00-005	No access	

3. Summary

3.1 Overview

- 3.1.1 In response to the Project, a River Condition Assessment (RCA) was undertaken at 41 of the watercourses crossing points. MoRPh field surveys were carried out to characterise the local physical structure of the watercourse channels and margins at a scale that complemented biological surveys. Using a MoRPh5 approach, a sequence of five adjacent MoRPh surveys quantified over 30 indicators that contribute to a preliminary condition score for a watercourses sub reach. To conclude the RCA, a river type survey was undertaken at a desk-based reach-scale, to evaluate the hydro geomorphological river type. This translated the preliminary condition score for each MoRPh into a final condition score, shown in **Table 5K4 2.2**, which reflects what is achievable for that river type. Of the 41 watercourses surveyed, the most common river type was 'Type K', followed by 'Navigable', 'Large river', and 'Type H' the least common, see **Table 5K4 3.1**.

Table 5K4 3.1 Summary of river types

River Type	Number of surveyed watercourses
Type K	25
Navigable	10
Large River	4
Type H	2

- 3.1.2 The most common final condition score was 'Moderate', followed by 'Fairly Poor', 'Fairly Good' and 'Poor', see **Table 5K4 3.2**.
- 3.1.3 Of the MoRPh5 sub reaches surveyed, no sub reaches within the survey receiving a final condition score of 'Good' at the time of observations, with only three (STRX-01-00-00-019, RVX-02-00-00-002 and REE_W4) received a 'Fairly Good' final condition class. Twenty-one sites recorded a final condition class of 'Moderate'. A total of 16 sub reaches received a final condition score of 'Fairly Poor', all of which were associated with negative indicator scoring features to a certain extent. Finally, only one site (CLX-04-00-00-003) received a final condition score of 'Poor'.

Table 5K4 3.2 Summary of final condition scores

Final condition category / score	Number of surveyed watercourses
Good / 5	0
Fairly Good / 4	3
Moderate / 3	21

Final condition category / score	Number of surveyed watercourses
Fairly Poor / 2	16
Poor / 1	1

3.2 Next Steps

- 3.2.1 Should further changes to the Project be outside the Preliminary Order Limits at the time of reporting, further surveys may be required to provide a baseline of the macrophyte community present within any additional watercourses.

Annex 1 Site Photographs

Graphic 5K4 1.1 STRX-01-00-00-001 Survey Area



Graphic 5K4 1.2 RVX-01-00-00-003 Survey Area



Graphic 5K4 1.3 STRX-01-00-00-009 Survey Area



Graphic 5K4 1.4 RVX-01-00-00-004 Survey Area



Graphic 5K4 1.5 STRX-01-00-00-019 Survey Area



Graphic 5K4 1.6 RVX-01-00-00-010 Survey Area



Graphic 5K4 1.7 STRX-01-00-00-025 Survey Area



Graphic 5K4 1.8 STRX-01-00-00-027 Survey Area



Graphic 5K4 1.9 RVX-01-00-00-013 Survey Area



Graphic 5K4 1.10 RVX-01-00-00-015 Survey Area



Graphic 5K4 1.11 CLX-01-00-00-001 Survey Area



Graphic 5K4 1.12 STRX-01-00-00-031 Survey Area



Graphic 5K4 1.13 CLX-01-00-00-002 Survey Area



Graphic 5K4 1.14 RVX-02-00-00-001 Survey Area



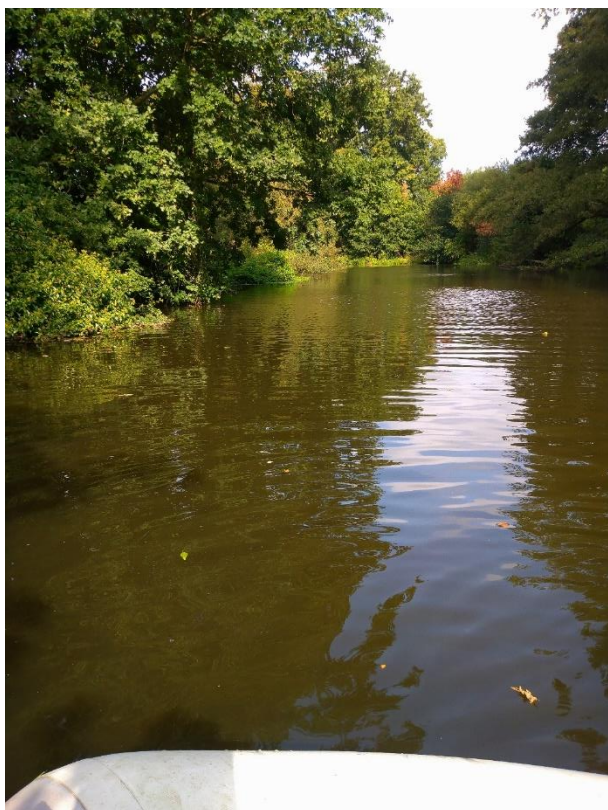
Graphic 5K4 1.15 STRX-02-00-00-002 Survey Area



Graphic 5K4 1.16 RVX-02-00-00-002 Survey Area



Graphic 5K4 1.17 RVX-02-00-00-003 Survey Area



Graphic 5K4 1.18 CLX-02-01-00-002 Survey Area



Graphic 5K4 1.19 RVX-03-00-00-002 Survey Area



Graphic 5K4 1.20 STRX-03-00-00-005 Survey Area



Graphic 5K4 1.21 CLX-03-00-00-001 Survey Area



Graphic 5K4 1.22 CLX-04-00-00-001 Survey Area



Graphic 5K4 1.23 STRX-04-00-00-008 Survey Area



Graphic 5K4 1.24 STRX-04-00-00-009 Survey Area



Graphic 5K4 1.25 CLX-04-00-00-003 Survey Area



Graphic 5K4 1.26 STRX-04-03-01-001 Survey Area



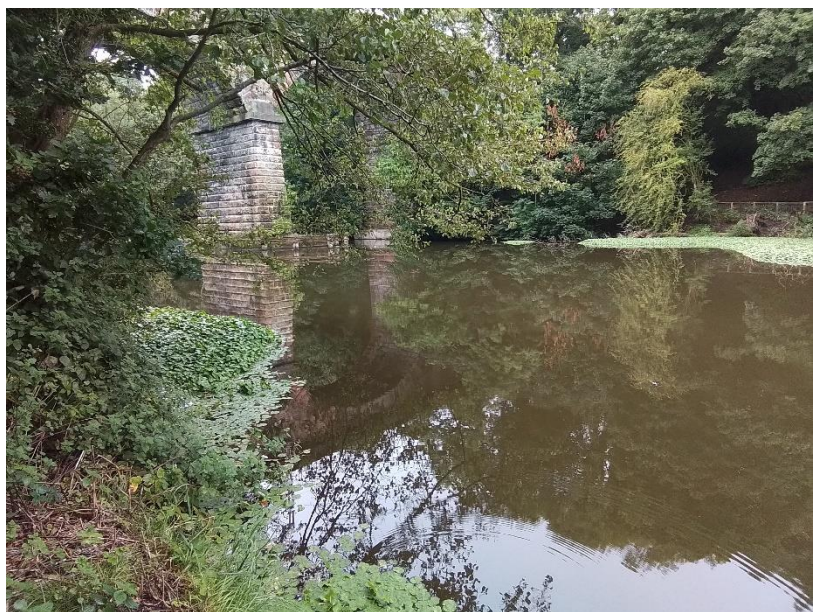
Graphic 5K4 1.27 REE_W12 Survey Area



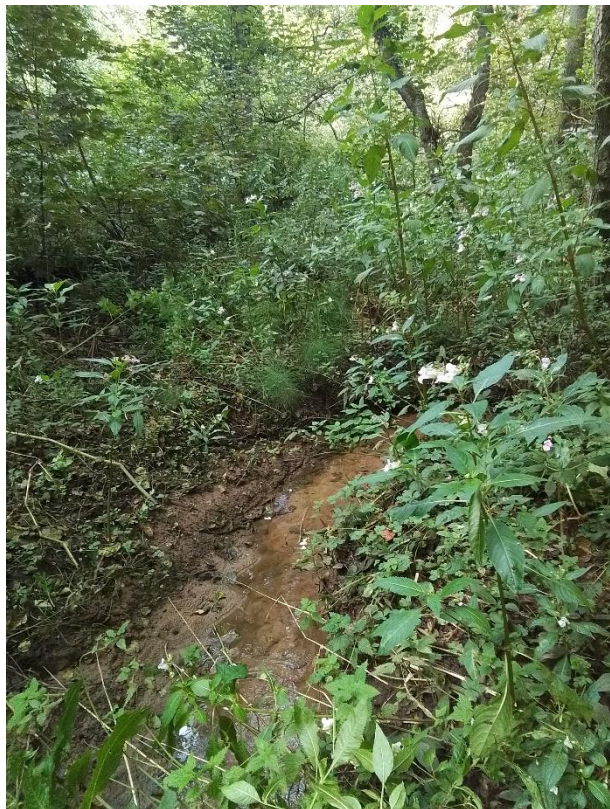
Graphic 5K4 1.28 REE_W14 Survey Area



Graphic 5K4 1.29 REE_SA3 Survey Area



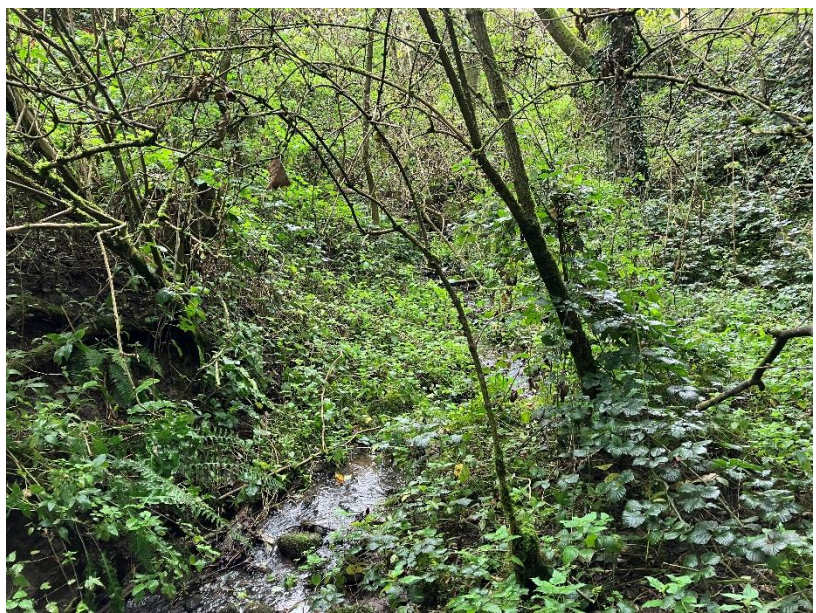
Graphic 5K4 1.30 REE_SA4 Survey Area



Graphic 5K4 1.31 REE_W3 Survey Area



Graphic 5K4 1.32 REE_W4 Survey Area



Graphic 5K4 1.33 REE_W7 Survey Area



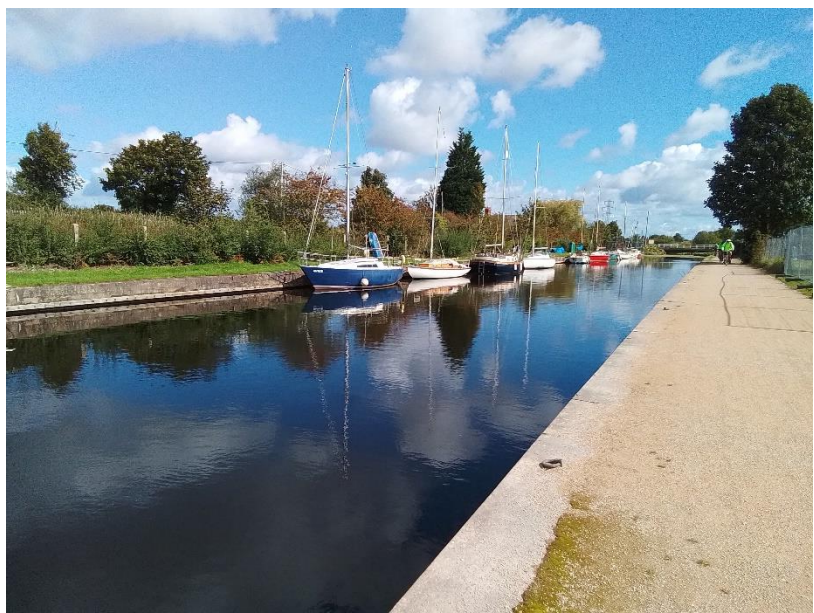
Graphic 5K4 1.34 REE_SA5 Survey Area



Graphic 5K4 1.35 REE_N12 Survey Area



Graphic 5K4 1.36 REE_N1 Survey Area



Graphic 5K4 1.37 REE_SA12 Survey Area



Graphic 5K4 1.38 REE_N9 Survey Area



Graphic 5K4 1.39 REE_N10 Survey Area



Graphic 5K4 1.40 REE_N11 Survey Area



Graphic 5K4 1.41 REE_N14 Survey Area



Annex 2 Raw Cartographer Outputs

Annex 2 is the raw Cartographer outputs provided in Excel format 'HyNet_Morph-Survey-DataFile_All Sites_Appendix B'.

Year	River Cross	River type	X	Y	NGR	Lat	Long	Survey stat	Watercour	Watercour	Watercou	Hydro-mor	WFD	Wate	Ecological	Fish	Invertebrat	Macrophyt	Macrophyt	Phyto bentl	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	D1	D2	D3	D4	D5	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	E12	Prelimin	River Type	Final Condition	Class / Score		
2023	REE_W12	K - Straight	347041	376611	SJ4704176	53.28381	-2.7958	Completec River	Main River	not design	GB11206	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	-	1	0	0	0	0	1	2	2	1	1	0	0	0	0	0	0	0	0	0	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0.578	K	Moderate	/ 3
2023	REE_W14	K - Straight	347614	376825	SJ4761476	53.28579	-2.78723	Completec River	Main River	not design	GB11206	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	-	1	0	1	0	-2	1	0	1	2	1	0	-4	0	0	0	2	1	1	1	-1	3	0	0	0	0	1	0	0	0	0	0	0	-3	0.073	K	Moderate	/ 3
2023	REE_SA3	Navigable/	364283	370719	SJ6428370	53.2323	-2.56563	Completec River	WFD	heavily mo	GB11206	Moderate	Poor	Poor	-	Poor	-	Poor	-	-	-	2	0	0	-3	-2	2	1	2	2	1	2	0	0	-1	0	0	0	-1	0	1	0	0	0	3	0	0	0	-3	-4	0	-0.49	Navigable/	Fairly Poor	/ 2			
2023	REE_SA4	H - Straight	364079	370722	SJ6407970	53.23231	-2.53959	Completec River	Ordinary w	heavily mo	GB11206	Moderate	Poor	Poor	-	Poor	-	Poor	-	-	-	2	1	0	-4	0	1	1	3	4	1	1	0	0	0	-1	0	0	0	0	0	2	0	0	0	2	0	0	0	0	0	0.562	H	Moderate	/ 3			
2023	REE_W3	K - Straight	352225	378969	SJ5222576	53.3055	-2.71841	Completec Canal	Ordinary w	heavily mo	GB11206	Moderate	-	Bad	Good	Poor	Good	-	-	-	-	2	0	0	0	0	1	0	3	2	1	0	0	0	0	0	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0.736	K	Moderate	/ 3		
2023	REE_W4		357489	377548	SJ5748977	53.28318	-2.63922	Completec Canal	Ordinary w	heavily mo	GB11206	Moderate	-	Bad	Good	Poor	Good	-	-	-	-	4	0	0	0	0	1	1	2	2	3	4	0	0	0	0	0	0	0	0	1	1	0	2	2	1	2	1	3	0	0	0	0	0	1.578	K	Fairly Good	/ 4
2023	REE_W7	K - Straight	349035	376970	SJ4903576	53.28723	-2.76596	Completec Canal	Ordinary w	heavily mo	GB11206	Moderate	-	Bad	Good	Poor	Good	-	-	-	-	1	0	0	0	0	1	0	2	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0.368	K	Moderate	/ 3		
2023	REE_SA5		361939	370779	SJ6193970	53.23267	-2.57165	Completec River	Ordinary w	not design	GB112068	Moderate	High	Good	Moderate	Good	Good	-	-	-	-	1	2	0	0	-3	2	2	2	2	1	1	0	0	0	0	0	1	1	0	1	2	0	3	1	1	0	0	0	0	0	0	0.979	K	Moderate	/ 3		
2023	REE_W12	K - Straight	350454	381212	SJ5045497	53.41537	-2.7469	Completec River	WFD	heavily mo	GB11206	Moderate	-	Good	Moderate	Good	Good	-	-	-	-	1	0	0	0	-2	1	1	2	1	1	0	0	0	-3	-4	0	0	2	1	0	0	0	1	-4	-4	0	0	0	0	-0.72	K	Fairly Poor	/ 2				
2023	REE_N1	Navigable/	356261	366654	SJ5626186	53.37492	-2.6589	Completec Canal	WFD	Artificial	GB71210	Moderate	-	-	-	-	-	-	-	-	-	1	0	0	0	-4	0	2	1	0	0	0	0	-4	-4	0	0	0	0	0	2	0	0	0	0	1	0	0	0	0	-1	-0.578	Navigable/	Fairly Poor	/ 2			
2023	REE_SA12	Navigable/	359987	376589	SJ5998776	53.28475	-2.60163	Completec Canal	WFD	heavily mo	GB71210	Moderate	-	-	-	-	-	-	-	-	-	2	0	0	0	-2	1	0	3	3	1	0	0	-4	-3	0	3	3	1	1	0	0	0	0	0	1	0	0	0	0	0	0.307	Navigable/	Moderate	/ 3			
2023	REE_N9	Large	360136	386461	SJ6013686	53.37349	-2.60064	Completec River	Ordinary w	not design	N/A	N/A	N/A	N/A	N/A	N/A	N/A	-	-	-	-	2	1	0	0	-3	-2	1	1	3	2	2	3	0	0	0	-3	1	0	1	0	0	0	0	1	0	0	0	0	-1	0.36	Large river	Moderate	/ 3				
2023	REE_N10	Navigable/	360058	386426	SJ6005886	53.3732	-2.60181	Completec Canal	Ordinary w	not design	N/A	N/A	N/A	N/A	N/A	N/A	N/A	-	-	-	-	1	0	0	0	-3	1	0	2	1	0	2	0	-4	-4	0	0	0	0	2	0	0	0	0	0	0	0	0	-0.36	Navigable/	Fairly Poor	/ 2						
2023	REE_N11		360095	386439	SJ6009586	53.37329	-2.60126	Completec Stream/ditch	Ordinary w	not design	N/A	N/A	N/A	N/A	N/A	N/A	N/A	-	-	-	-	3	0	0	-3	0	1	2	2	1	2	1	0	0	-2	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0.457	K	Fairly Poor	/ 2					
2023	REE_N14	K - Straight	356978	385846	SJ5697885	53.36772	-2.64802	Completec River	Main River	not design	N/A	N/A	N/A	N/A	N/A	N/A	N/A	-	-	-	-	1	0	1	0	-3	1	0	2	1	1	0	0	0	0	3	1	1	0	2	1	0	0	0	2	0	0	0	0	0	0.716	K	Moderate	/ 3				
2022	STRX-04-0-K		357474	385837	SJ5747485	53.36768	-2.64056	Completec Stream/dit -	Ordinary w -	-	-	-	-	-	-	-	-	-	-	-	1	2	0	0	-4	2	4	2	2	2	1	1	0	0	0	0	0	0	0	0	3	0	0	0	0	2	0	0	0	0	0	0.74	K	Moderate	/ 3			
2022	STRX-04-0-K		356659	385903	SJ5665985	53.3682	-2.65282	Completec Stream/dit -	Ordinary w -	-	-	-	-	-	-	-	-	-	-	-	3	2	1	-2	-3	2	1	2	3	1	4	-2	0	0	-2	1	0	0	0	1	2	0	0	0	0	2	0	0	-4	0	0.32	K	Moderate	/ 3				
2022	RVK-01-00-K		347808	375776	SJ4780875	53.27638	-2.78416	Completec River	-	Main River	not design	GB11206	Moderate	Moderate	Moderate	Moderate	Moderate	-	-	-	-	1	0	0	0	-3	1	1	2	1	2	0	0	0	0	0	3	1	1	0	2	0	0	0	0	1	-4	0	0	0	0.36	K	Moderate	/ 3				
2022	STRX-01-0-K		346742	375265	SJ4674275	53.27168	-2.80065	Completec Stream/dit -	Main River	not design	GB11206	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	-	-	-	-	1	0	0	0	-2	1	0	3	2	1	0	0	0	0	0	2	1	0	0	2	0	0	0	0	1	-4	0	0	0.28	K	Moderate	/ 3					
2022	STRX-01-0-K		348074	375992	SJ4807475	53.27835	-2.7802	Completec Stream/dit -	Main River	not design	GB11206	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	-	-	-	-	1	0	0	0	-2	2	0	2	1	2	1	0	0	0	3	1	0	0	0	2	0	0	0	3	0	0	0	0.79	K	Moderate	/ 3						
2022	RVK-03-00-H		365417	381247	SJ6541781	53.327	-2.5207	Completec River	Gale Brook WFD	not design	GB11206	Moderate	-	High	Moderate	Moderate	-	-	-	-	-	3	0	0	-3	-3	2	1	3	2	1	2	0	0	0	-3	0	0	1	1	0	1	2	0	0	3	0	0	-4	0	0.21	H	Fairly Poor	/ 2				
2022	STRX-03-0-K		365826	381479	SJ6582681	53.32911	-2.51458	Completec Stream/dit -	Ordinary w	not design	GB11206	Moderate	-	High	Moderate	Moderate	-	-	-	-	-	2	0	0	0	-2	1	1	2	1	1	1	0	0	0	0	2	1	0	0	0	1	2	0	0	0	2	0	0	0	0.74	K	Moderate	/ 3				
2022	RVK-02-00 Large river		363957	370272	SJ6395770	53.22826	-2.54137	Completec River	River Weav WFD	heavily mo	GB11206	Moderate	Poor	Poor	-	Moderate	-	-	-	-	-	2	0	1	-3	-2	2	2	1	1	1	0	-1	0	0	-4	1	0	0	0	2	2	0	0	0	1	-4	0	0	-3	0	-0.36	Large river	Fairly Poor	/ 2			
2022	RVK-02-00-K		360267	373928	SJ6026775	53.26086	-2.5971	Completec River	Grange Brd Main River	not design	GB11206	Moderate	-	Moderate	Moderate	Moderate	-	-	-	-	-	3	3	1	0	-2	2	3	3	4	1	4	-3	0	0	0	1	2	1	2	-1	1	3	2	0	0	3	-2	0	0	0	1.44	K	Fairly Good	/ 4			
2022	RVK-01-00-K		348528	376388	SJ4852876	53.28177	-2.77345	Completec River	River Weav WFD	heavily mo	GB11206	Moderate	-	Bad	Good	Poor	Good	-	-	-	-	1	0	0	0	-4	2	0	2	1	1	0	0	0	0	2	2	0	0	0	2	0	0	0	0	1	0	0	0	0.48	K	Moderate	/ 3					
2022	RVK-01-00-K		350511	377876	SJ5051177	53.28552	-2.74395	Completec River	-	Main River	heavily mo	GB11206	Moderate	-	Bad	Good	Poor	Good	-	-	-	1	0	0	0	-3	2	0	2	1	1	0	0	0	0	0	3	1	0	0	0	2	2	0	0	0	2	0	0	0	0.66	K	Moderate	/ 3				
2022	RVK-01-00-K		351744	378636	SJ5174478	53.30246	-2.72557	Completec River	Unnamed IWFD	heavily mo	GB11206	Moderate	-	Bad	Good	Poor	Good	-	-	-	-	2	0	0	0	-4	1	0	2	1	1	0	0	0	0	3	1	0	0	0	1	1	0	0	0	2	0	0	0	0.48	K	Moderate	/ 3					
2022	RVK-01-00 Large river		352471	379128	SJ5247175	53.30695	-2.71474	Completec River	River Weav WFD	heavily mo	GB11206	Moderate	-	Bad	Good	Poor	Good	-	-	-	-	2	0	0	0	-2	1	0	2	1	1	0	-2	-2	-2	0	2	1	1	1	-1	1	0	0	0	0	1	0	0	-0.19	Large river	Fairly Poor	/ 2					
2022	RVK-02-00 Large river		359816	376175	SJ5981676	53.28102	-2.60414	Completec River	River Weav WFD	heavily mo	GB11206	Moderate	-	Bad	Good	Poor	Good	-	-	-	-	2	0	0	0	-4	2	0	2	1	1	0	0	-3	-4	0	2	1	0	0	0	1	0	0	0	1	0	0	-0.16	Large river	Fairly Poor	/ 2						
2022	STRX-01-0-K		349595	377364	SJ4959577	53.28083	-2.73761	Completec Stream/dit -	Main River	heavily mo	GB11206	Moderate	-	Bad	Good	Poor	Good	-	-	-	-	2	0	0	0	-3	3	2	2	1	1	3	0	0	0	4	2	1	0	1	1	0	1	0	2	0	0	0	0.9	K	Fairly Good	/ 4						
2022	STRX-01-0-K		350913	377962	SJ5091377	53.29633	-2.73793	Completec Stream/dit -	Main River	heavily mo	GB11206	Moderate	-	Bad	Good	Poor	Good	-	-	-	-	1	0	4	0	-2	2	1	2	1	1	0	0	0	0	0	3	1	0	0	0	2	0	0	0	2	0	0	0	0	0.9	K	Moderate	/ 3				
2022	STRX-01-0-K																																																									

HyNet North West Hydrogen Pipeline

Delivering clean growth

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Annex 5K5

Aquatic Ecology Survey Report – Drone Surveys – All Sites

October 2024

Revision	1
Volume	0001
Document ref.	0001

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1. Methodology

1.1 Desk Study

- 1.1.1 A desk study was undertaken in Spring 2022 and the methodology for this is set out in **Section 5.5** and **Table 5.8** of the Preliminary Environmental Information Report (PEIR). The desk study recorded the presence of statutory designated sites within up to 20km^[1] of the Preliminary Order Limits (**Section 5.6.1**, **Table 5.10**, and **Figure 5.1** of the PEIR) and non-statutory designated sites within 2km (**Section 5.6.2**, **Table 5.11**, and **Figure 5.2** of the PEIR). The desk study also recorded the presence of Habitats of Principal Importance (HPI) within 2km of the Preliminary Order Limits (**section 5.6.3**, **Table 5.12** and **Figure 5.3** of the PEIR). Records of protected and notable species within 2km of the Preliminary Order Limits are discussed within **section 5.6.12-5.6.41** of the PEIR.
- 1.1.2 The desk study information from the PEIR is not repeated in this report or discussed further. The desk study will be updated for the Environmental Statement following design freeze for the Project.

1.2 Survey Area

- 1.2.1 Please note that as part of the design process, the order limits have undergone a number of iterations (as described in **Appendix 2A: Design evolution** of the Draft ES) and this report is based on the Preliminary Order Limits as they stood in early 2023.
- 1.2.2 Initially, 129 sites were planned in for surveys, these surveys were carried out between July 2022 and February 2023. These sites cover the extent of the updated redline boundary of the Project as updated in June 2022. From the 129 locations, 117 were surveyed, due to land access permissions not being granted by landowners, the final 12 sites were not surveyed.
- 1.2.3 An updated pipeline route was provided during August 2023 to cover the updated redline boundary as of April 2023, with 43 new sites being surveyed from August 2023 to September 2023. These new 43 sites in conjunction with the original 129 sites provided to Ricardo in July 2022 cover the extent of the Project.
- 1.2.4 In total the drone surveys included 172 watercourse crossings combined over the two survey scopes, as shown in **Figure 5K5 1.1**.
- 1.2.5 Locations were spread between all pipeline routes but particularly concentrated along the Stanlow to Central Hub route, shown in **Figure 5K5 1.2** to **Figure 5K5 1.7**. These sites cover the extent of the updated redline boundary as of April 2023 of the Project. Survey site details for the first and second group of sites are provided in **Table 5K5 1.1** and **Table 5K5 1.2**, respectively.

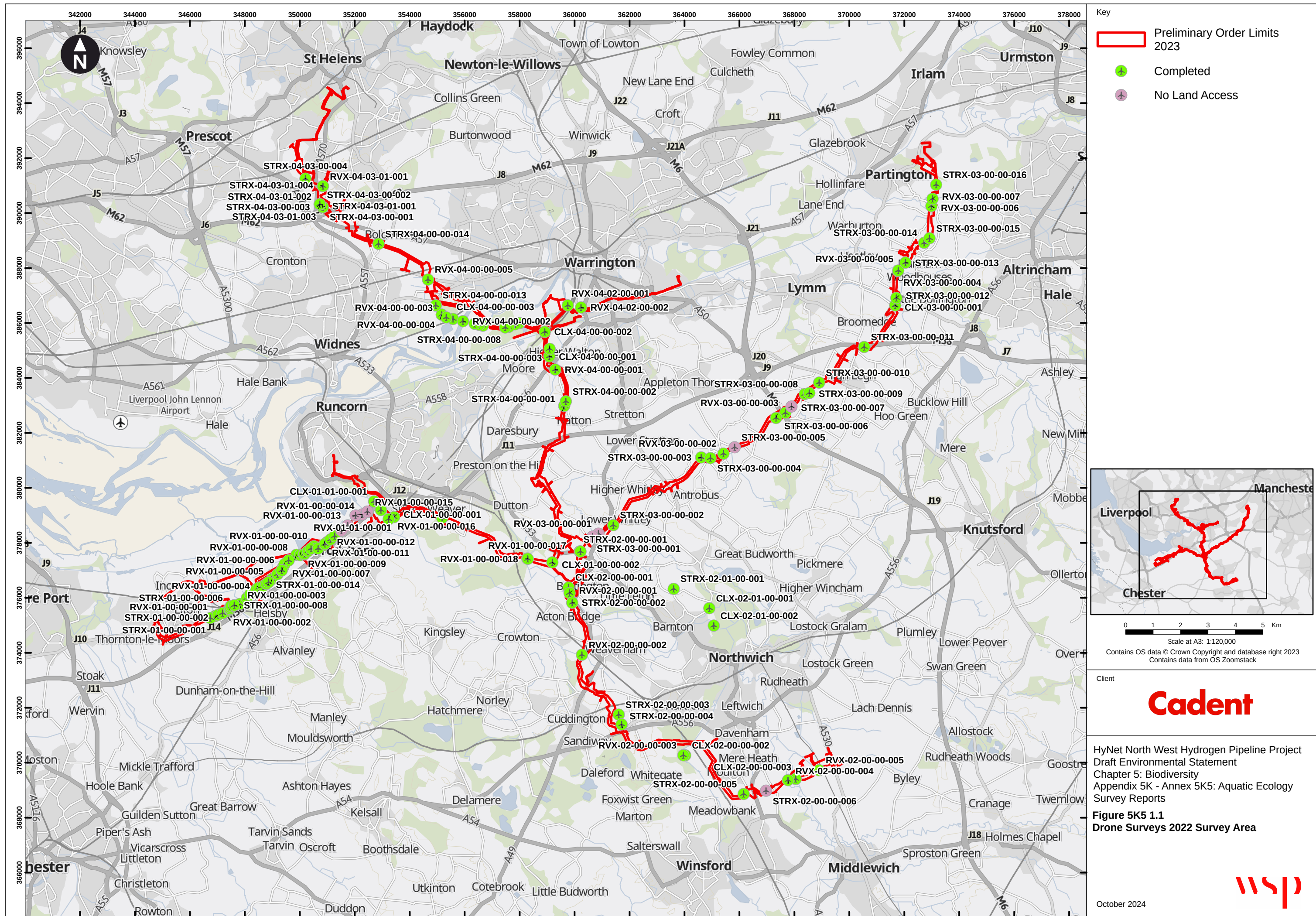
¹ Dependent on reasons for designations; within two kilometres for habitats, extending to 10 kilometres for bats and up to 20 kilometres for all the ornithological interests for international sites.

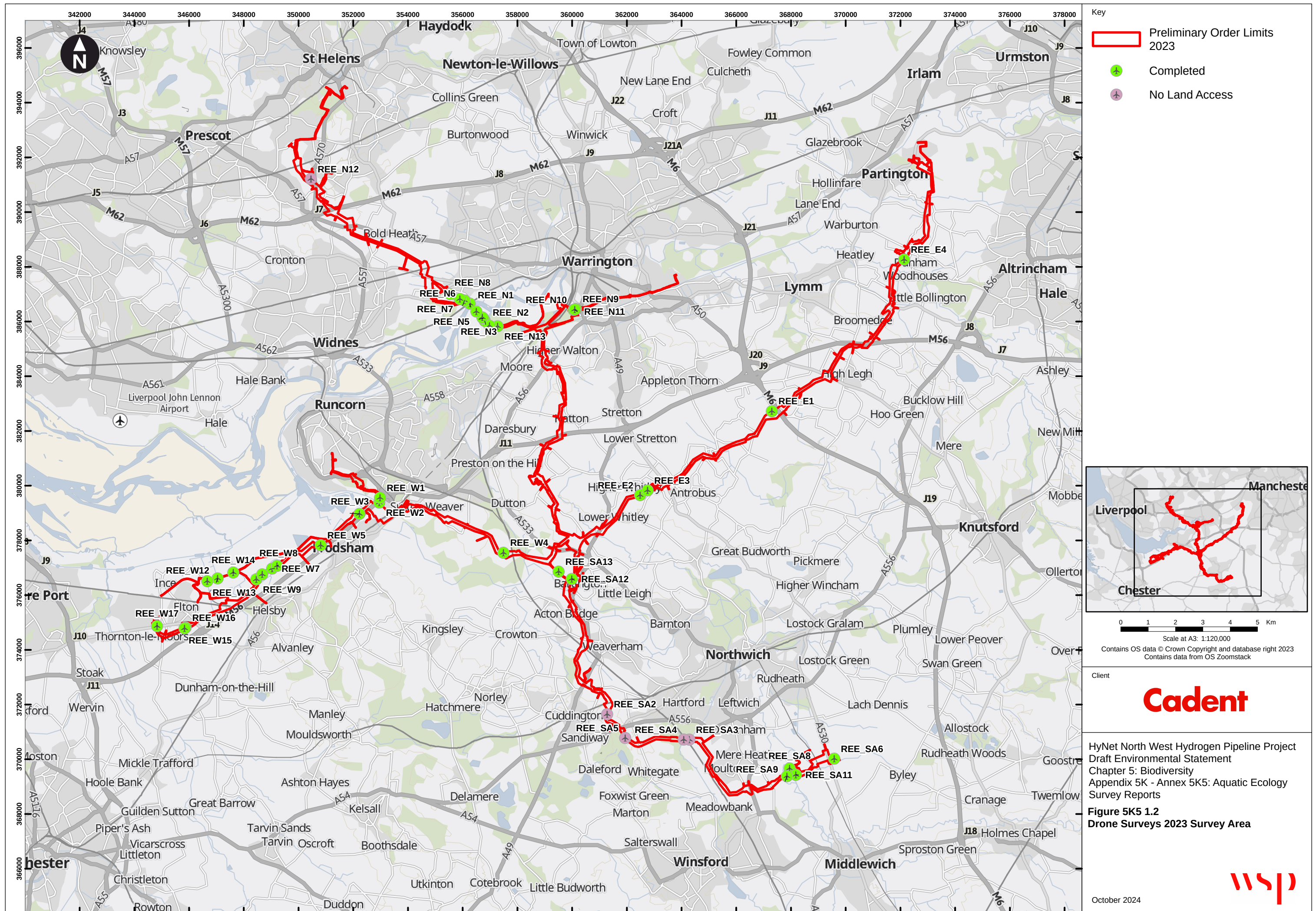
- 1.2.6 Survey locations were chosen where all watercourses crossed the proposed pipeline routes, including all classified and non-classified WFD waterbodies.

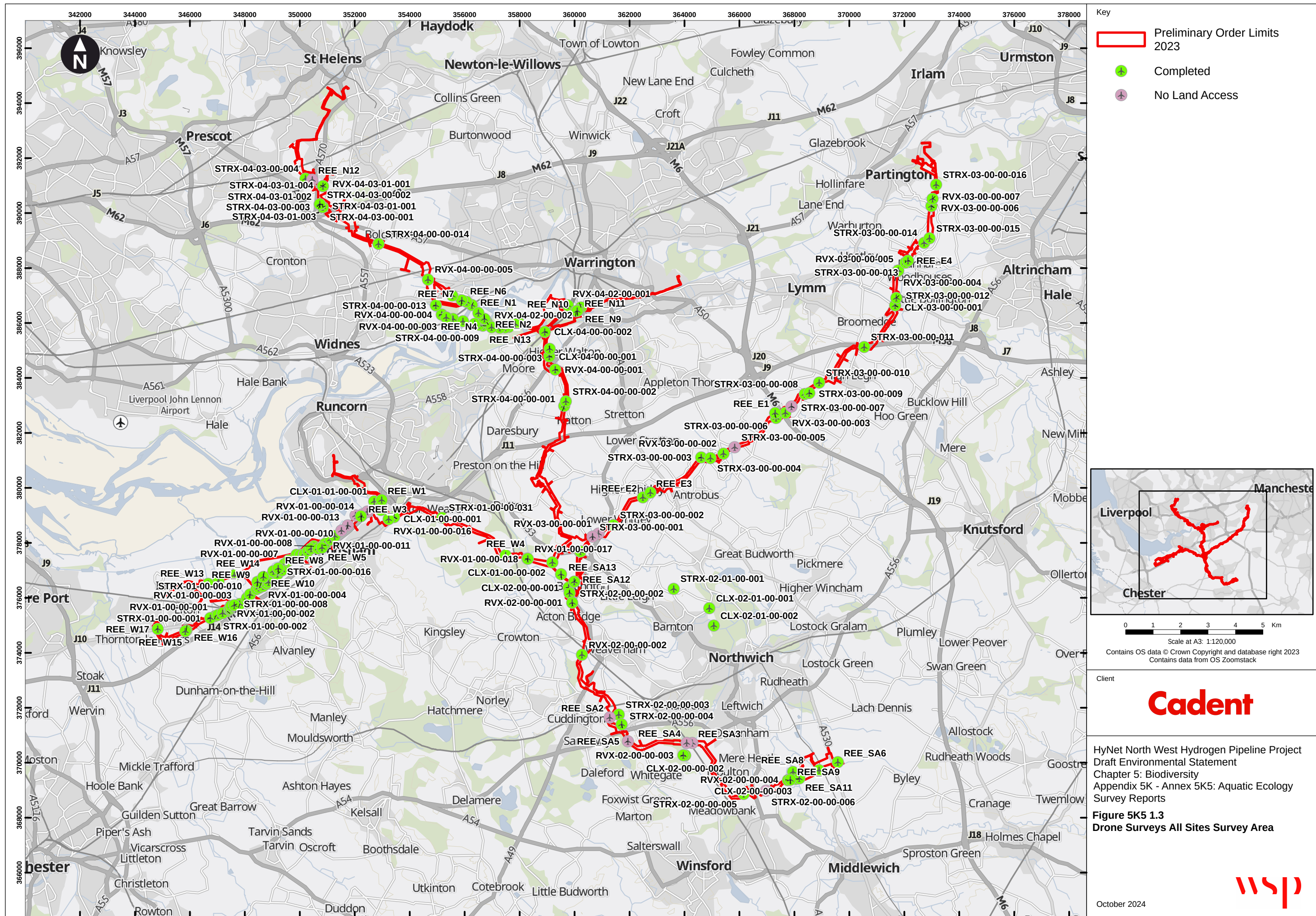
1.3 Field Surveys

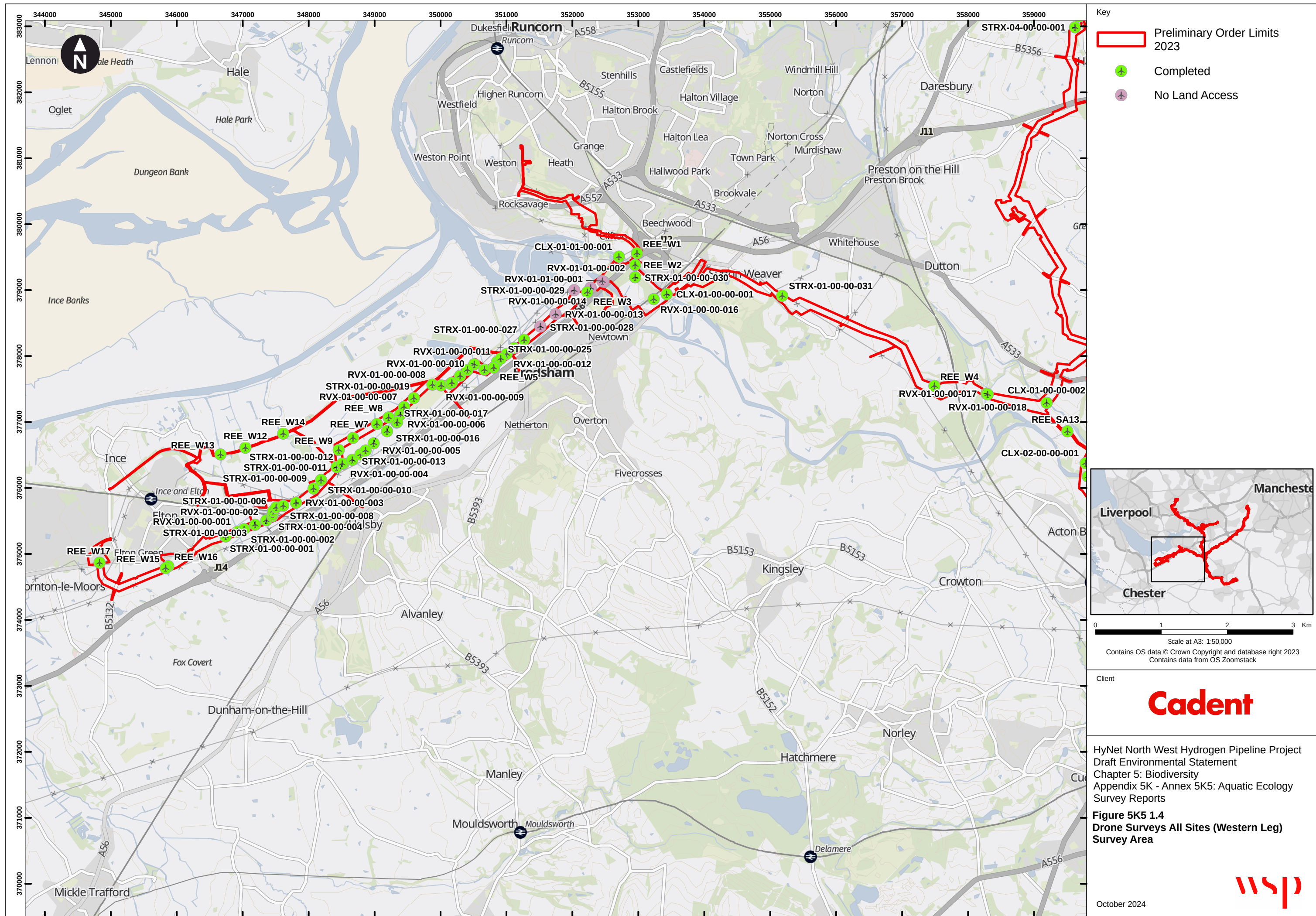
Approach to field survey design

- 1.3.1 Additional drone surveys were conducted along watercourse crossing points within the survey area detailed in **Table 5K5 1.1** below, beginning August 2023 and concluding September 2023. **Table 5K5 1.2** below shows the original scope of sites, with surveys beginning in July 2022 and concluding in February 2023.
- 1.3.2 The initial study area considers 129 watercourse crossings based on WFD waterbody classification or chosen as representative watercourses within each geographical area/ watercourse type (Canal, River or Stream/Ditch) which were crossed by the route of the Project, within the redline boundary as updated in June 2022. Of these, 34 watercourses are identified by the Environment Agency as a main river, the remaining sites 95 are classified as ordinary watercourses.
- 1.3.3 A further 43 watercourse crossings were completed in August and September 2023 to cover the updated redline boundary as of April 2023. Seven watercourses are identified by the Environment Agency as main rivers, with the remaining 36 being classified as ordinary watercourses.
- 1.3.4 Each site was visited by the Ricardo field team and photographed with a remotely piloted aircraft (RPA), more specifically a *DJI Air 2S*. The RPA was flown at an elevation of 50m where possible. When photographing sites with nearby overhead cables, the RPA was flown at 80m in order to minimise risk of collision. Once the RPA had taken the photograph of the river crossing, it would either return to the take-off site, or continue to another site located close enough to be included in the same flight. The flights were pre-programmed using the software DRONELINK. The flights consisted of both single site flights and flights where multiple sites were captured due to their proximity.









- Key
- Preliminary Order Limits 2023
 - Completed
 - No Land Access



0 1 2 3 Km

Scale at A3: 1:50,000

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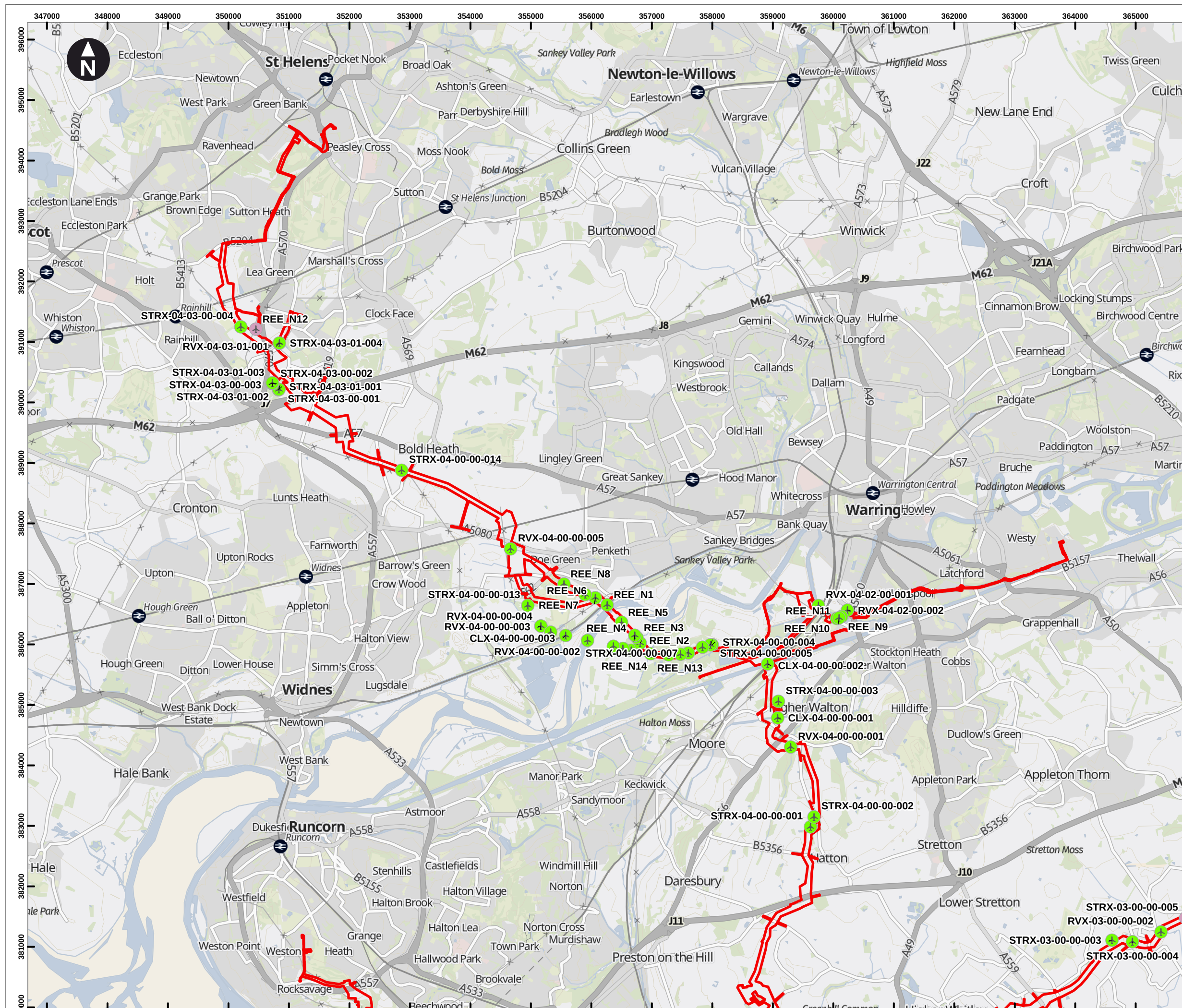
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Chapter 5: Biodiversity
Appendix 5K - Annex 5K5: Aquatic Ecology
Survey Reports

Figure 5K5 1.4
Drone Surveys All Sites (Western Leg)
Survey Area



Key

- Preliminary Order Limits 2023
- Completed
- No Land Access

0 1 2 3 Km

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Survey Reports

Figure 5K5 1.7
Drone Surveys All Sites (Northern Leg)
Survey Area

October 2024

Table 5K5 1.1 Additional 2023 scope of sites

River Crossing Name	X	Y	Survey status	Watercourse Type	Watercourse name	Watercourse Status (WFD / Main River/ Ordinary watercourse)	Hydro- morphological designation	WFD Waterbody	Ecological Classification
REE_E1	367299	382723	Completed	Stream/ditch	-	Ordinary Watercourse	Heavily modified	GB112069060680 Netherley Brook	Moderate
REE_E2	362485	379655	Completed	Stream/ditch	-	Ordinary Watercourse	Not designated artificial or heavily modified	GB112068060510 Cogshall Brook	Moderate
REE_E3	362757	379829	Completed	Stream/ditch	-	Ordinary Watercourse	Not designated artificial or heavily modified	GB112068060510 Cogshall Brook	Moderate
REE_E4	372135	388267	Completed	Stream/ditch	-	Ordinary Watercourse	Not designated artificial or heavily modified	GB112069061382 Bollin (Ashley Mill to Manchester Ship Canal)	Moderate

River Crossing Name	X	Y	Survey status	Watercourse Type	Watercourse name	Watercourse Status (WFD / Main River/ Ordinary watercourse)	Hydro- morphological designation	WFD Waterbody	Ecological Classification
REE_N1	356291	386578	Completed	Canal	St Helens Canal	Ordinary Watercourse	Heavily modified	GB112069060990 Whittle Brook (Mersey Estuary)	Moderate
REE_N2	356806	356806	Completed	Stream/ditch	-	Ordinary Watercourse	-	-	-
REE_N3	356753	386115	Completed	Stream/ditch	-	Ordinary Watercourse	-	-	-
REE_N4	356718	386151	Completed	Stream/ditch	-	Ordinary Watercourse	-	-	-
REE_N5	356499	386366	Completed	Stream/ditch	-	Ordinary Watercourse	-	-	-
REE_N6	356065	386772	Completed	Stream/ditch	-	Ordinary Watercourse	-	-	-
REE_N7	355897	386824	Completed	Stream/ditch	-	Ordinary Watercourse	-	-	-

River Crossing Name	X	Y	Survey status	Watercourse Type	Watercourse name	Watercourse Status (WFD / Main River/ Ordinary watercourse)	Hydro- morphological designation	WFD Waterbody	Ecological Classification
REE_N8	355547	386999	Completed	Stream/ditch	-	Ordinary Watercourse	-	-	-
REE_N9	360136	386461	Completed	River	River Mersey	Ordinary Watercourse	Heavily modified	GB531206908100 MERSEY	Moderate
REE_N1 0	360058	386429	Completed	Canal	-	Ordinary Watercourse	-	-	-
REE_N1 1	360095	386439	Completed	Canal	-	Ordinary Watercourse	-	-	-
REE_N1 2	350454	391212	Outstandin g	River	-	Main River	Heavily modified	GB112069061170 Sutton Brook	Moderate
REE_N1 3	357277	385827	Completed	Stream/ditch	-	Ordinary Watercourse	-	-	-
REE_N1 4	356978	385846	Completed	Stream/ditch	-	Main River	-	-	-
REE_SA 2	361279	371646	Completed	Stream/ditch	-	Ordinary Watercourse	Not designated artificial or	GB112068060550 Crowton Brook	Poor

River Crossing Name	X	Y	Survey status	Watercourse Type	Watercourse name	Watercourse Status (WFD / Main River/ Ordinary watercourse)	Hydro- morphological designation	WFD Waterbody	Ecological Classification
							heavily modified		
REE_SA 3	364283	370719	Completed	River	River Weaver	Main River	Heavily modified	GB112068060463 Weaver (Winsford Flashes to Dane)	Moderate
REE_SA 4	364079	370722	Completed	Stream/ditch	-	Ordinary Watercourse	Heavily modified	GB112068060463 Weaver (Winsford Flashes to Dane)	Moderate
REE_SA 5	361939	370779	Completed	Stream/ditch	-	Ordinary Watercourse	Not designated artificial or heavily modified	GB112068060540 Bogart Brook	Moderate
REE_SA 6	369580	370022	Completed	Stream/ditch	-	Ordinary Watercourse	Not designated artificial or heavily modified	GB112068060220 Puddinglake Brook	Poor

River Crossing Name	X	Y	Survey status	Watercourse Type	Watercourse name	Watercourse Status (WFD / Main River/ Ordinary watercourse)	Hydro- morphological designation	WFD Waterbody	Ecological Classification
REE_SA 8	367949	369665	Completed	Canal	Trent and Mersey Canal	Ordinary Watercourse	Not designated artificial or heavily modified	GB112068060220 Puddinglake Brook	Poor
REE_SA 9	367852	369381	Completed	Stream/ditch	-	Ordinary Watercourse	Not designated artificial or heavily modified	GB112068060220 Puddinglake Brook	Poor
REE_SA 11	368177	369431	Completed	Stream/ditch	-	Ordinary Watercourse	Not designated artificial or heavily modified	GB112068060220 Puddinglake Brook	Poor
REE_SA 12	359987	376589	Completed	Canal	Trent and Mersey Canal	Ordinary Watercourse	Heavily modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate

River Crossing Name	X	Y	Survey status	Watercourse Type	Watercourse name	Watercourse Status (WFD / Main River/ Ordinary watercourse)	Hydro- morphological designation	WFD Waterbody	Ecological Classification
REE_SA 13	359506	376860	Completed	Stream/ditch	Dean Brook	Ordinary Watercourse	Heavily modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate
REE_W1	352979	379560	Completed	River	Flood Brook	Ordinary Watercourse	-	-	-
REE_W2	352950	379382	Completed	Canal	Weaver Navigation	Ordinary Watercourse	-	-	-
REE_W3	352225	378969	Completed	Stream/ditch	-	Main River	Heavily modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate
REE_W4	357489	377548	Completed	Stream/ditch	-	Ordinary Watercourse	Heavily modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate
REE_W5	350808	377825	Completed	Stream/ditch	-	Ordinary Watercourse	Heavily modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate

River Crossing Name	X	Y	Survey status	Watercourse Type	Watercourse name	Watercourse Status (WFD / Main River/ Ordinary watercourse)	Hydro- morphological designation	WFD Waterbody	Ecological Classification
REE_W7	349035	376970	Completed	Stream/ditch	-	Main River	Heavily modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate
REE_W8	349213	377070	Completed	Stream/ditch	-	Ordinary Watercourse	Heavily modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate
REE_W9	348456	376577	Completed	Stream/ditch	-	Ordinary Watercourse	Heavily modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate
REE_W1 0	348673	376759	Completed	Stream/ditch	-	Ordinary Watercourse	Heavily modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate
REE_W1 2	347041	376611	Completed	Stream/ditch	-	Ordinary Watercourse	not designated artificial or heavily modified	GB112068060330 Peckmill Brook, Hoolpool Gutter at Ince Marshes	Moderate
REE_W1 3	346663	376509	Completed	Stream/ditch	-	Main River	not designated	GB112068060330	Moderate

River Crossing Name	X	Y	Survey status	Watercourse Type	Watercourse name	Watercourse Status (WFD / Main River/ Ordinary watercourse)	Hydro- morphological designation	WFD Waterbody	Ecological Classification
							artificial or heavily modified	Peckmill Brook, Hoolpool Gutter at Ince Marshes	
REE_W1 4	347614	376825	Completed	River	Hoolpool Gutter	Main River	not designated artificial or heavily modified	GB112068060330 Peckmill Brook, Hoolpool Gutter at Ince Marshes	Moderate
REE_W1 5	345832	374786	Completed	Stream/ditch	-	Ordinary Watercourse	not designated artificial or heavily modified	GB112068060330 Peckmill Brook, Hoolpool Gutter at Ince Marshes	Moderate
REE_W1 6	345872	374815	Completed	Stream/ditch	-	Ordinary Watercourse	not designated artificial or heavily modified	GB112068060330 Peckmill Brook, Hoolpool Gutter at Ince Marshes	Moderate
REE_W1 7	344829	374868	Completed	Stream/ditch	-	Ordinary Watercourse	-	-	-

Table 5K5 1.2 Original scope of sites

River Crossing Name	X	Y	Survey status	Watercourse Type	Watercourse name	Watercourse Status (WFD / Main River / Ordinary watercourse)	Hydro-morphological designation	WFD Waterbody	Ecological Classification
CLX-01-00-00-002	359191	377291	Completed	Canal	Trent and Mersey Canal	WFD	Artificial	GB71210247 Trent and Mersey Canal, summit to Preston Brook Tunnel	Moderate
CLX-01-01-00-001	352705	379508	Completed	Canal	Weaver Navigation	WFD	Artificial	GB71210545 Weaver Navigation (canal section Frodsham to Weston Point Docks)	Moderate
CLX-02-00-00-001	359782	376376	Completed	Canal	-	Ordinary watercourse	Heavily Modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate
CLX-02-00-00-002	364024	370270	Completed	Canal	Weaver Navigation	Main River	Heavily Modified	GB112068060463 Weaver (Winsford Flashes to Dane)	Moderate
CLX-02-00-00-003	368048	369411	Completed	Canal	Trent and Mersey Canal	WFD	Artificial	GB71210247 Trent and Mersey Canal, summit to Preston Brook Tunnel	Moderate

River Crossing Name	X	Y	Survey status	Watercourse Type	Watercourse name	Watercourse Status (WFD / Main River / Ordinary watercourse)	Hydro-morphological designation	WFD Waterbody	Ecological Classification
CLX-02-01-00-001	364903	375623	Completed	Canal	Trent and Mersey Canal	WFD	Artificial	GB71210247 Trent and Mersey Canal, summit to Preston Brook Tunnel	Moderate
CLX-02-01-00-002	365066	374990	Completed	Canal	River Weaver	WFD	Artificial	GB71210247 Trent and Mersey Canal, summit to Preston Brook Tunnel	Moderate
CLX-03-00-00-001	371666	386642	Completed	Canal	Bridgewater Canal	WFD	Artificial	GB71210001 Bridgewater Canal	Moderate
CLX-04-00-00-001	359080	384785	Completed	Canal	Bridgewater Canal	WFD	Artificial	GB71210001 Bridgewater Canal	Moderate
CLX-04-00-00-002	358914	385677	Completed	Canal	Manchester Ship Canal	WFD	Artificial	GB71210004 Manchester Ship Canal Water Body	Moderate
CLX-04-00-00-003	355575	386148	Completed	Canal	Sankey Canal	WFD	Artificial	GB71210055 Sankey Canal	Moderate

River Crossing Name	X	Y	Survey status	Watercourse Type	Watercourse name	Watercourse Status (WFD / Main River / Ordinary watercourse)	Hydro-morphological designation	WFD Waterbody	Ecological Classification
RVX-01-00-00-001	346924	375338	Completed	River	-	Main River	not designated artificial or heavily modified	GB112068060330 Peckmill Brook, Hoolpool Gutter at Ince Marshes.	Moderate
RVX-01-00-00-002	347359	375510	Completed	River	-	Main River	not designated artificial or heavily modified	GB112068060330 Peckmill Brook, Hoolpool Gutter at Ince Marshes.	Moderate
RVX-01-00-00-003	347808	375776	Completed	River	Hornsmill Brook	Main River	not designated artificial or heavily modified	GB112068060330 Peckmill Brook, Hoolpool Gutter at Ince Marshes.	Moderate
RVX-01-00-00-004	348528	376368	Completed	River	-	Ordinary watercourse	Heavily Modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate
RVX-01-00-00-005	348986	376678	Completed	River		Main River	Heavily Modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate
RVX-01-00-00-006	349389	377112	Completed	River	-	Main River	Heavily Modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate

River Crossing Name	X	Y	Survey status	Watercourse Type	Watercourse name	Watercourse Status (WFD / Main River / Ordinary watercourse)	Hydro-morphological designation	WFD Waterbody	Ecological Classification
RVX-01-00-00-007	349447	377229	Completed	River	-	Ordinary watercourse	Heavily Modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate
RVX-01-00-00-008	349877	377567	Completed	River	-	Main River	Heavily Modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate
RVX-01-00-00-009	350009	377555	Completed	River	-	Main River	Heavily Modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate
RVX-01-00-00-010	350511	377876	Completed	River	-	Main River	Heavily Modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate
RVX-01-00-00-011	350858	377914	Completed	River	-	Ordinary watercourse	Heavily Modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate
RVX-01-00-00-012	351003	378033	Completed	River	-	Main River	Heavily Modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate
RVX-01-00-00-013	351744	378636	No land access	River	Unnamed River / Main Drain	Main River	Heavily Modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate

River Crossing Name	X	Y	Survey status	Watercourse Type	Watercourse name	Watercourse Status (WFD / Main River / Ordinary watercourse)	Hydro-morphological designation	WFD Waterbody	Ecological Classification
RVX-01-00-00-014	352268	379020	No land access	River	-	Main River	Heavily Modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate
RVX-01-00-00-015	352471	379128	No land access	River	River Weaver	WFD	Heavily Modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate
RVX-01-00-00-016	353233	378863	Completed	River	-	Ordinary watercourse	Heavily Modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate
RVX-01-00-00-017	358279	377431	Completed	River	Longacre Brook	Ordinary watercourse	Heavily Modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate
RVX-01-00-00-018	358297	377420	Completed	River	-	Ordinary watercourse	Heavily Modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate
RVX-01-01-00-001	352277	379036	No land access	River	-	Main River	Heavily Modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate
RVX-01-01-00-002	352455	379137	No land access	River	River Weaver	WFD	Heavily Modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate

River Crossing Name	X	Y	Survey status	Watercourse Type	Watercourse name	Watercourse Status (WFD / Main River / Ordinary watercourse)	Hydro-morphological designation	WFD Waterbody	Ecological Classification
RVX-02-00-00-001	359816	376175	Completed	River	River Weaver	WFD	Heavily Modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate
RVX-02-00-00-002	360267	373928	Completed	River	Grange Brook	Ordinary watercourse	not designated artificial or heavily modified	GB112068060480 Cuddington Brook (Source to Crowton Brook)	Moderate
RVX-02-00-00-003	363957	370272	Completed	River	River Weaver	WFD	Heavily Modified	GB112068060463 Weaver (Winsford Flashes to Dane)	Moderate
RVX-02-00-00-004	367766	369366	Completed	River	River Dane	WFD	not designated artificial or heavily modified	GB112068060470 Dane (Wheelock to Weaver)	Moderate
RVX-02-00-00-005	368897	369728	Completed	River	Puddinglake Brook	WFD	not designated artificial or heavily modified	GB112068060220 Puddinglake Brook	Poor
RVX-03-00-00-001	360867	378336	No land access	River	Whitely Brook	Main River	not designated artificial or heavily modified	GB112068060510 Cogshall Brook	Moderate

River Crossing Name	X	Y	Survey status	Watercourse Type	Watercourse name	Watercourse Status (WFD / Main River / Ordinary watercourse)	Hydro-morphological designation	WFD Waterbody	Ecological Classification
RVX-03-00-00-002	365417	381247	Completed	River	Gale Brook	WFD	not designated artificial or heavily modified	GB112068060420 Arley Brook (Source to Gale Brook)	Moderate
RVX-03-00-00-003	367669	382728	Completed	River	Crowley Brook	Main River	not designated artificial or heavily modified	GB112068060430 Gale Brook	Moderate
RVX-03-00-00-004	371772	387884	Completed	River	Agden Brook	WFD	not designated artificial or heavily modified	GB112069061382 Bollin (Ashley Mill to Manchester Ship Canal)	Poor
RVX-03-00-00-005	371779	387909	Completed	River	River Bollin	WFD	not designated artificial or heavily modified	GB112069061382 Bollin (Ashley Mill to Manchester Ship Canal)	Poor

River Crossing Name	X	Y	Survey status	Watercourse Type	Watercourse name	Watercourse Status (WFD / Main River / Ordinary watercourse)	Hydro-morphological designation	WFD Waterbody	Ecological Classification
RVX-03-00-00-006	372985	390256	Completed	River	Caldwell Brook	Main River	not designated artificial or heavily modified	GB112069060980 Sinderland Brook	Poor
RVX-03-00-00-007	373027	390517	Completed	River	Red Brook	WFD	not designated artificial or heavily modified	GB112069060980 Sinderland Brook	Poor
RVX-04-00-00-001	359295	384304	Completed	River	-	Ordinary watercourse	Heavily Modified	GB112068060520 Keckwick Brook	Moderate
RVX-04-00-00-002	355937	386066	Completed	River	River Mersey	WFD	-	-	-
RVX-04-00-00-003	355165	386304	Completed	River			-	-	-
RVX-04-00-00-004	355165	386304	Completed	River			-	-	-

River Crossing Name	X	Y	Survey status	Watercourse Type	Watercourse name	Watercourse Status (WFD / Main River / Ordinary watercourse)	Hydro-morphological designation	WFD Waterbody	Ecological Classification
RVX-04-00-005	354664	387580	Completed	River	Unnamed River / Main Ditch	Main River	-	-	-
RVX-04-02-00-001	359754	386642	Completed	River			-	-	-
RVX-04-02-00-002	360233	386566	Completed	River			-	-	-
RVX-04-03-01-001	350837	390977	Completed	River	Unnamed River / Main Drain	WFD	Heavily Modified	GB112069061170 Sutton Brook	Moderate
STRX-01-00-00-001	346742	375265	Completed	Stream/ditch	-	Main River	not designated artificial or heavily modified	GB112068060330 Peckmill Brook, Hoolpool Gutter at Ince Marshes.	Moderate
STRX-01-00-00-002	347021	375376	Completed	Stream/ditch	-	Ordinary watercourse	not designated artificial or heavily modified	GB112068060330 Peckmill Brook, Hoolpool Gutter at Ince Marshes.	Moderate

River Crossing Name	X	Y	Survey status	Watercourse Type	Watercourse name	Watercourse Status (WFD / Main River / Ordinary watercourse)	Hydro-morphological designation	WFD Waterbody	Ecological Classification
STRX-01-00-003	347189	375443	Completed	Stream/ditch	-	Ordinary watercourse	not designated artificial or heavily modified	GB112068060330 Peckmill Brook, Hoolpool Gutter at Ince Marshes.	Moderate
STRX-01-00-004	347447	375572	Completed	Stream/ditch	-	Ordinary watercourse	not designated artificial or heavily modified	GB112068060330 Peckmill Brook, Hoolpool Gutter at Ince Marshes.	Moderate
STRX-01-00-005	347453	375604	Completed	Stream/ditch	-	Ordinary watercourse	not designated artificial or heavily modified	GB112068060330 Peckmill Brook, Hoolpool Gutter at Ince Marshes.	Moderate
STRX-01-00-006	347462	375653	Completed	Stream/ditch	-	Ordinary watercourse	not designated artificial or heavily modified	GB112068060330 Peckmill Brook, Hoolpool Gutter at Ince Marshes.	Moderate

River Crossing Name	X	Y	Survey status	Watercourse Type	Watercourse name	Watercourse Status (WFD / Main River / Ordinary watercourse)	Hydro-morphological designation	WFD Waterbody	Ecological Classification
STRX-01-00-007	347507	375706	Completed	Stream/ditch	-	Ordinary watercourse	not designated artificial or heavily modified	GB112068060330 Peckmill Brook, Hoolpool Gutter at Ince Marshes.	Moderate
STRX-01-00-008	347614	375731	Completed	Stream/ditch	-	Ordinary watercourse	not designated artificial or heavily modified	GB112068060330 Peckmill Brook, Hoolpool Gutter at Ince Marshes.	Moderate
STRX-01-00-009	348074	375992	Completed	Stream/ditch	-	Main River	not designated artificial or heavily modified	GB112068060330 Peckmill Brook, Hoolpool Gutter at Ince Marshes.	Moderate
STRX-01-00-0010	348188	376123	Completed	Stream/ditch	-	Ordinary watercourse	Heavily Modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate
STRX-01-00-0011	348424	376318	Completed	Stream/ditch	-	Ordinary watercourse	Heavily Modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate
STRX-01-00-0012	348509	376369	Completed	Stream/ditch	-	Main River	Heavily Modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate

River Crossing Name	X	Y	Survey status	Watercourse Type	Watercourse name	Watercourse Status (WFD / Main River / Ordinary watercourse)	Hydro-morphological designation	WFD Waterbody	Ecological Classification
STRX-01-00-00-013	348661	376427	Completed	Stream/ditch	-	Ordinary watercourse	Heavily Modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate
STRX-01-00-00-014	348786	376509	Completed	Stream/ditch	-	Ordinary watercourse	Heavily Modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate
STRX-01-00-00-015	348863	376568	Completed	Stream/ditch	-	Ordinary watercourse	Heavily Modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate
STRX-01-00-00-016	349188	376861	Completed	Stream/ditch	-	Main River	Heavily Modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate
STRX-01-00-00-017	349333	376992	Completed	Stream/ditch		Ordinary watercourse	Heavily Modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate
STRX-01-00-00-018	349343	377001	Completed	Stream/ditch		Ordinary watercourse	Heavily Modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate

River Crossing Name	X	Y	Survey status	Watercourse Type	Watercourse name	Watercourse Status (WFD / Main River / Ordinary watercourse)	Hydro-morphological designation	WFD Waterbody	Ecological Classification
STRX-01-00-00-019	349595	377364	Completed	Stream/ditch	-	Ordinary watercourse	Heavily Modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate
STRX-01-00-00-020	350149	377579	Completed	Stream/ditch	-	Ordinary watercourse	Heavily Modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate
STRX-01-00-00-021	350172	377597	Completed	Stream/ditch	-	Ordinary watercourse	Heavily Modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate
STRX-01-00-00-022	350297	377701	Completed	Stream/ditch	-	Ordinary watercourse	Heavily Modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate
STRX-01-00-00-023	350408	377791	Completed	Stream/ditch	-	Ordinary watercourse	Heavily Modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate
STRX-01-00-00-024	350665	377794	Completed	Stream/ditch	-	Ordinary watercourse	Heavily Modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate

River Crossing Name	X	Y	Survey status	Watercourse Type	Watercourse name	Watercourse Status (WFD / Main River / Ordinary watercourse)	Hydro-morphological designation	WFD Waterbody	Ecological Classification
STRX-01-00-00-025	350913	377962	Completed	Stream/ditch	-	Ordinary watercourse	Heavily Modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate
STRX-01-00-00-026	351115	378124	Completed	Stream/ditch	-	Ordinary watercourse	Heavily Modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate
STRX-01-00-00-027	351268	378248	Completed	Stream/ditch	-	Main River	Heavily Modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate
STRX-01-00-00-028	351514	378449	No land access	Stream/ditch	-	Ordinary watercourse	Heavily Modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate
STRX-01-00-00-029	352027	378999	No land access	Stream/ditch	-	Ordinary watercourse	Heavily Modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate
STRX-01-00-00-030	352951	379195	Completed	Stream/ditch	-	Ordinary watercourse	Heavily Modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate

River Crossing Name	X	Y	Survey status	Watercourse Type	Watercourse name	Watercourse Status (WFD / Main River / Ordinary watercourse)	Hydro-morphological designation	WFD Waterbody	Ecological Classification
STRX-01-00-00-031	355181	378914	Completed	Stream/ditch	-	Ordinary watercourse	Heavily Modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate
STRX-02-00-00-001	360188	377688	Completed	Stream/ditch	-	Ordinary watercourse	Heavily Modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate
STRX-02-00-00-002	359913	375821	Completed	Stream/ditch	-	Ordinary watercourse	Heavily Modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate
STRX-02-00-00-003	361607	371751	Completed	Stream/ditch	-	Ordinary watercourse	not designated artificial or heavily modified	GB112068060480 Cuddington Brook (Source to Crowton Brook)	Moderate
STRX-02-00-00-004	361712	371395	Completed	Stream/ditch	-	Ordinary watercourse	not designated artificial or heavily modified	GB112068060480 Cuddington Brook (Source to Crowton Brook)	Moderate
STRX-02-00-00-005	366153	368863	Completed	Stream/ditch	-	Ordinary watercourse	not designated artificial or heavily modified	GB112068060470 Dane (Wheelock to Weaver)	Moderate

River Crossing Name	X	Y	Survey status	Watercourse Type	Watercourse name	Watercourse Status (WFD / Main River / Ordinary watercourse)	Hydro-morphological designation	WFD Waterbody	Ecological Classification
STRX-02-00-006	366967	368983	No land access	Stream/ditch	-	Ordinary watercourse	not designated artificial or heavily modified	GB112068060470 Dane (Wheelock to Weaver)	Moderate
STRX-02-01-00-001	360215	377686	Completed	Stream/ditch	-	Ordinary watercourse	Heavily Modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate
STRX-02-01-00-001	363607	376326	Completed	Stream/ditch	-	Ordinary watercourse	Heavily Modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate
STRX-03-00-00-001	360653	378227	No land access	Stream/ditch	-	Ordinary watercourse	not designated artificial or heavily modified	GB112068060510 Cogshall Brook	Moderate
STRX-03-00-00-002	361407	378644	Completed	Stream/ditch	-	Ordinary watercourse	not designated artificial or heavily modified	GB112068060510 Cogshall Brook	Moderate
STRX-03-00-00-003	364607	381110	Completed	Stream/ditch	-	Ordinary watercourse	not designated artificial or heavily modified	GB112068060420 Arley Brook (Source to Gale Brook)	Moderate

River Crossing Name	X	Y	Survey status	Watercourse Type	Watercourse name	Watercourse Status (WFD / Main River / Ordinary watercourse)	Hydro-morphological designation	WFD Waterbody	Ecological Classification
STRX-03-00-004	364945	381085	Completed	Stream/ditch	-	Ordinary watercourse	not designated artificial or heavily modified	GB112068060420 Arley Brook (Source to Gale Brook)	Moderate
STRX-03-00-005	365826	381479	No land access	Stream/ditch	-	Ordinary watercourse	not designated artificial or heavily modified	GB112068060420 Arley Brook (Source to Gale Brook)	Moderate
STRX-03-00-006	367332	382545	Completed	Stream/ditch	-	Ordinary watercourse	not designated artificial or heavily modified	GB112068060430 Gale Brook	Moderate
STRX-03-00-007	367892	382961	No land access	Stream/ditch	-	Ordinary watercourse	not designated artificial or heavily modified	GB112068060430 Gale Brook	Moderate

River Crossing Name	X	Y	Survey status	Watercourse Type	Watercourse name	Watercourse Status (WFD / Main River / Ordinary watercourse)	Hydro-morphological designation	WFD Waterbody	Ecological Classification
STRX-03-00-008	368378	383416	Completed	Stream/ditch	-	Ordinary watercourse	not designated artificial or heavily modified	GB112068060430 Gale Brook	Moderate
STRX-03-00-009	368541	383451	Completed	Stream/ditch	-	Ordinary watercourse	not designated artificial or heavily modified	GB112068060430 Gale Brook	Moderate
STRX-03-00-00-010	368900	383832	Completed	Stream/ditch	-	Ordinary watercourse	not designated artificial or heavily modified	GB112068060430 Gale Brook	Moderate
STRX-03-00-00-011	370539	385126	Completed	Stream/ditch	-				
STRX-03-00-00-012	371709	386912	Completed	Stream/ditch	-	Ordinary watercourse	not designated artificial or heavily modified	GB112069061382 Bollin (Ashley Mill to Manchester Ship Canal)	Poor
STRX-03-00-00-013	372043	388197	Completed	Stream/ditch	-	Main River	not designated artificial or	GB112069061382 Bollin (Ashley Mill to	Poor

River Crossing Name	X	Y	Survey status	Watercourse Type	Watercourse name	Watercourse Status (WFD / Main River / Ordinary watercourse)	Hydro-morphological designation	WFD Waterbody	Ecological Classification
							heavily modified	Manchester Ship Canal)	
STRX-03-00-00-014	372722	388918	Completed	Stream/ditch	-	Ordinary watercourse	not designated artificial or heavily modified	GB112069060980 Sinderland Brook	Poor
STRX-03-00-00-015	372916	389084	Completed	Stream/ditch	-	Ordinary watercourse	not designated artificial or heavily modified	GB112069060980 Sinderland Brook	Poor
STRX-03-00-00-016	373158	391033	Completed	Stream/ditch	-	Ordinary watercourse	not designated artificial or heavily modified	GB112069060980 Sinderland Brook	Poor
STRX-04-00-00-001	359622	382984	Completed	Stream/ditch	-	Ordinary watercourse	Heavily Modified	GB112068060520 Keckwick Brook	Moderate

River Crossing Name	X	Y	Survey status	Watercourse Type	Watercourse name	Watercourse Status (WFD / Main River / Ordinary watercourse)	Hydro-morphological designation	WFD Waterbody	Ecological Classification
STRX-04-00-00-002	359681	383149	Completed	Stream/ditch	-	Ordinary watercourse	Heavily Modified	GB112068060520 Keckwick Brook	Moderate
STRX-04-00-00-003	359092	385059	Completed	Stream/ditch	-	Ordinary watercourse	-	-	-
STRX-04-00-00-004	357997	385995	Completed	Stream/ditch	-	Ordinary watercourse	-	-	-
STRX-04-00-00-005	357970	385993	Completed	Stream/ditch	-	Ordinary watercourse	-	-	-
STRX-04-00-00-006	357837	385954	Completed	Stream/ditch	-	Ordinary watercourse	-	-	-
STRX-04-00-00-007	357603	385859	Completed	Stream/ditch	-	Ordinary watercourse	-	-	-

River Crossing Name	X	Y	Survey status	Watercourse Type	Watercourse name	Watercourse Status (WFD / Main River / Ordinary watercourse)	Hydro-morphological designation	WFD Waterbody	Ecological Classification
STRX-04-00-00-008	357474	385837	Completed	Stream/ditch	-	Ordinary watercourse	-	-	-
STRX-04-00-00-009	356659	385903	Completed	Stream/ditch	-	Ordinary watercourse	-	-	-
STRX-04-00-00-010	356521	385934	Completed	Stream/ditch	-	Ordinary watercourse	-	-	-
STRX-04-00-00-011	356364	385969	Completed	Stream/ditch	-	Ordinary watercourse	-	-	-
STRX-04-00-00-012	355328	386203	Completed	Stream/ditch	-	Ordinary watercourse	-	-	-
STRX-04-00-00-013	354949	386644	Completed	Stream/ditch	-	Ordinary watercourse	-	-	-

River Crossing Name	X	Y	Survey status	Watercourse Type	Watercourse name	Watercourse Status (WFD / Main River / Ordinary watercourse)	Hydro-morphological designation	WFD Waterbody	Ecological Classification
STRX-04-00-00-014	352863	388879	Completed	Stream/ditch	-	Ordinary watercourse	-	-	-
STRX-04-03-00-001	350829	390209	Completed	Stream/ditch	-	Ordinary watercourse	Heavily Modified	GB112069061170 Sutton Brook	Moderate
STRX-04-03-00-002	350727	390312	Completed	Stream/ditch	-	Ordinary watercourse	Heavily Modified	GB112069061170 Sutton Brook	Moderate
STRX-04-03-00-003	350719	390320	Completed	Stream/ditch	-	Ordinary watercourse	Heavily Modified	GB112069061170 Sutton Brook	Moderate
STRX-04-03-00-004	350204	391251	Completed	Stream/ditch	Sutton Brook	WFD	Heavily Modified	GB112069061170 Sutton Brook	Moderate
STRX-04-03-01-001	350834	390216	Completed	Stream/ditch	-	Ordinary watercourse	Heavily Modified	GB112069061170 Sutton Brook	Moderate

River Crossing Name	X	Y	Survey status	Watercourse Type	Watercourse name	Watercourse Status (WFD / Main River / Ordinary watercourse)	Hydro-morphological designation	WFD Waterbody	Ecological Classification
STRX-04-03-01-002	350734	390316	Completed	Stream/ditch	-	Ordinary watercourse	Heavily Modified	GB112069061170 Sutton Brook	Moderate
STRX-04-03-01-003	350726	390324	Completed	Stream/ditch	-	Ordinary watercourse	Heavily Modified	GB112069061170 Sutton Brook	Moderate
STRX-04-03-01-004	350842	390983	Completed	Stream/ditch	-	Ordinary watercourse	Heavily Modified	GB112069061170 Sutton Brook	Moderate

1.4 Constraints

Access limitations

- 1.4.1 Surveys were limited to locations where landowner permission had been obtained within the survey period.
- 1.4.2 RPA surveys require access to a suitable take-off location nearby the site. This site is often located on privately owned land where access permission is required. Access is also required for the flight path of the RPA between the take-off location and the river crossing point. From the original set of 129 survey sites, several sites could not be photographed due to access issues, in this instance all access rights were revoked by the landowner. These 12 sites listed below are therefore absent in this report.
- STRX-01-00-00-028
 - RVX-01-00-00-013
 - STRX-01-00-00-029
 - RVX-01-00-00-014
 - RVX-01-00-00-015
 - RVX-01-01-00-001
 - RVX-01-01-00-002
 - STRX-02-00-00-006
 - STRX-03-00-00-001
 - RVX-03-00-00-001
 - STRX-03-00-00-005
 - STRX-03-00-00-007
- 1.4.3 No access issues were encountered from the additional watercourse crossings, all 43 sites were successfully surveyed.

Technical issues

- 1.4.4 Surveys were undertaken over multiple seasons and therefore water levels and weather conditions vary considerably between sites and should be taken into consideration when viewing footage. Some images have low visibility of the channel due to poor weather conditions or extensive, dense vegetation on the bankside limiting the extent of visibility.

1.5 Personnel

1.5.1 The programme of surveys was led by Jennifer Smalley and Bruce Munroe. The survey lead was assisted by suitably qualified and experienced Ricardo Personnel details of whom are provided in **Table 5K5 1.3**.

Table 5K5 1.3 Survey personnel

Name	Experience
Sean Heard-Hoare	BSc Geography and Zoology, BSc (Hons), MSc Environmental Water Management. Over 2 years of experience in water resource consulting. Remote Pilot Certificate of Competence (A2CofC) holder for 1 year. Modular River Survey River Condition Assessment certificate for 20 months.
Jennifer Smalley	BSc (Hons) Environmental Science, MSc Environmental Impact Assessment and Management, 2 years of experience in water resource consulting. Remote Pilot Certificate of Competence (A2CofC) holder.
Bruce Munroe	BSc (Hons) Environmental Science, MSc Environmental Monitoring, Modelling, and Reconstruction. 2 years of experience in water resource consulting. Remote Pilot Certificate of Competence (A2CofC) holder. Modular River Survey River Condition Assessment certified.
Freya Love	BSc (Hons) Environmental Science. 3 years of experience in water resource and environmental management consulting.
Mark Spence	MSc Sustainability & Environmental Management. 2 years' experience in water resource consulting.

2. Results

2.1 Field Survey

Drone surveys

Overview

- 2.1.1 In total from both sets of sites, 160 channel crossings were successfully surveyed and photographed. These crossings varied considerably in their morphological and ecological characteristics. This section will present the findings by grouping and summarising the images based on these characteristics.

Stream/ditch

- 2.1.2 Due to arable agriculture being the primary land use within the survey area, ditches and streams form the significant majority of the surveyed channel crossings. These sites are usually straight slow flowing artificial channels located at the border between fields. Most of the images provide a clear view of the channel along with the bank vegetation and land either side. From the initial set of sites, 74 of the channel crossings were stream/ditches. There were 32 stream/ditches from the new set of sites.

River

- 2.1.3 39 rivers were photographed within the survey area from the original set of sites, and 5 from the new set. These channels are usually located within agricultural areas, with artificial banks and straightened channels. The bank vegetation varies considerably.

Canal

- 2.1.4 Several canals were present within the survey area, making up 12 images in total from the original set of sites, and six from the new set. These channels are clear to view and morphologically indistinct with artificial banks and straight channels. They usually are lined with a public right of way path and hedgerows/trees.

River Crossing Name	X	Y	Survey status	Watercourse Type	Watercourse name	Watercourse Status (WFD / Main River/ Ordinary watercourse)	Hydro- morphological designation	WFD Waterbody	Ecological Classification
REE_E1	367299	382723	Completed	Stream/ditch	-	Ordinary Watercourse	Heavily modified	GB112069060680 Netherley Brook	Moderate
REE_E2	362485	379655	Completed	Stream/ditch	-	Ordinary Watercourse	Not designated artificial or heavily modified	GB112068060510 Cogshall Brook	Moderate
REE_E3	362757	379829	Completed	Stream/ditch	-	Ordinary Watercourse	Not designated artificial or heavily modified	GB112068060510 Cogshall Brook	Moderate
REE_E4	372135	388267	Completed	Stream/ditch	-	Ordinary Watercourse	Not designated artificial or heavily modified	GB112069061382 Bollin (Ashley Mill to Manchester Ship Canal)	Moderate
REE_N1	356291	386578	Completed	Canal	St Helens Canal	Ordinary Watercourse	Heavily modified	GB112069060990 Whittle Brook (Mersey Estuary)	Moderate

River Crossing Name	X	Y	Survey status	Watercourse Type	Watercourse name	Watercourse Status (WFD / Main River/ Ordinary watercourse)	Hydro-morphological designation	WFD Waterbody	Ecological Classification
REE_N2	356806	356806	Completed	Stream/ditch	-	Ordinary Watercourse	-	-	-
REE_N3	356753	386115	Completed	Stream/ditch	-	Ordinary Watercourse	-	-	-
REE_N4	356718	386151	Completed	Stream/ditch	-	Ordinary Watercourse	-	-	-
REE_N5	356499	386366	Completed	Stream/ditch	-	Ordinary Watercourse	-	-	-
REE_N6	356065	386772	Completed	Stream/ditch	-	Ordinary Watercourse	-	-	-
REE_N7	355897	386824	Completed	Stream/ditch	-	Ordinary Watercourse	-	-	-
REE_N8	355547	386999	Completed	Stream/ditch	-	Ordinary Watercourse	-	-	-
REE_N9	360136	386461	Completed	River	River Mersey	Ordinary Watercourse	Heavily modified	GB531206908100 MERSEY	Moderate
REE_N10	360058	386429	Completed	Canal	-	Ordinary Watercourse	-	-	-
REE_N11	360095	386439	Completed	Canal	-	Ordinary Watercourse	-	-	-

River Crossing Name	X	Y	Survey status	Watercourse Type	Watercourse name	Watercourse Status (WFD / Main River/ Ordinary watercourse)	Hydro-morphological designation	WFD Waterbody	Ecological Classification
REE_N12	350454	391212	Outstanding	River	-	Main River	Heavily modified	GB112069061170 Sutton Brook	Moderate
REE_N13	357277	385827	Completed	Stream/ditch	-	Ordinary Watercourse	-	-	-
REE_N14	356978	385846	Completed	Stream/ditch	-	Main River	-	-	-
REE_SA2	361279	371646	Completed	Stream/ditch	-	Ordinary Watercourse	Not designated artificial or heavily modified	GB112068060550 Crowton Brook	Poor
REE_SA3	364283	370719	Completed	River	River Weaver	Main River	Heavily modified	GB112068060463 Weaver (Winsford Flashes to Dane)	Moderate
REE_SA4	364079	370722	Completed	Stream/ditch	-	Ordinary Watercourse	Heavily modified	GB112068060463 Weaver (Winsford Flashes to Dane)	Moderate

River Crossing Name	X	Y	Survey status	Watercourse Type	Watercourse name	Watercourse Status (WFD / Main River/ Ordinary watercourse)	Hydro- morphological designation	WFD Waterbody	Ecological Classification
REE_SA5	361939	370779	Completed	Stream/ditch	-	Ordinary Watercourse	Not designated artificial or heavily modified	GB112068060540 Bogart Brook	Moderate
REE_SA6	369580	370022	Completed	Stream/ditch	-	Ordinary Watercourse	Not designated artificial or heavily modified	GB112068060220 Puddinglake Brook	Poor
REE_SA8	367949	369665	Completed	Canal	Trent and Mersey Canal	Ordinary Watercourse	Not designated artificial or heavily modified	GB112068060220 Puddinglake Brook	Poor
REE_SA9	367852	369381	Completed	Stream/ditch	-	Ordinary Watercourse	Not designated artificial or heavily modified	GB112068060220 Puddinglake Brook	Poor

River Crossing Name	X	Y	Survey status	Watercourse Type	Watercourse name	Watercourse Status (WFD / Main River/ Ordinary watercourse)	Hydro- morphological designation	WFD Waterbody	Ecological Classification
REE_SA1 1	368177	369431	Completed	Stream/ditch	-	Ordinary Watercourse	Not designated artificial or heavily modified	GB112068060220 Puddinglake Brook	Poor
REE_SA1 2	359987	376589	Completed	Canal	Trent and Mersey Canal	Ordinary Watercourse	Heavily modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate
REE_SA1 3	359506	376860	Completed	Stream/ditch	Dean Brook	Ordinary Watercourse	Heavily modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate
REE_W1	352979	379560	Completed	River	Flood Brook	Ordinary Watercourse	-	-	-
REE_W2	352950	379382	Completed	Canal	Weaver Navigation	Ordinary Watercourse	-	-	-
REE_W3	352225	378969	Completed	Stream/ditch	-	Main River	Heavily modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate

River Crossing Name	X	Y	Survey status	Watercourse Type	Watercourse name	Watercourse Status (WFD / Main River/ Ordinary watercourse)	Hydro-morphological designation	WFD Waterbody	Ecological Classification
REE_W4	357489	377548	Completed	Stream/ditch	-	Ordinary Watercourse	Heavily modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate
REE_W5	350808	377825	Completed	Stream/ditch	-	Ordinary Watercourse	Heavily modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate
REE_W7	349035	376970	Completed	Stream/ditch	-	Main River	Heavily modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate
REE_W8	349213	377070	Completed	Stream/ditch	-	Ordinary Watercourse	Heavily modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate
REE_W9	348456	376577	Completed	Stream/ditch	-	Ordinary Watercourse	Heavily modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate
REE_W10	348673	376759	Completed	Stream/ditch	-	Ordinary Watercourse	Heavily modified	GB112068060500 Weaver (Dane to Frodsham)	Moderate

River Crossing Name	X	Y	Survey status	Watercourse Type	Watercourse name	Watercourse Status (WFD / Main River/ Ordinary watercourse)	Hydro- morphological designation	WFD Waterbody	Ecological Classification
REE_W12	347041	376611	Completed	Stream/ditch	-	Ordinary Watercourse	not designated artificial or heavily modified	GB112068060330 Peckmill Brook, Hoolpool Gutter at Ince Marshes	Moderate
REE_W13	346663	376509	Completed	Stream/ditch	-	Main River	not designated artificial or heavily modified	GB112068060330 Peckmill Brook, Hoolpool Gutter at Ince Marshes	Moderate
REE_W14	347614	376825	Completed	River	Hoolpool Gutter	Main River	not designated artificial or heavily modified	GB112068060330 Peckmill Brook, Hoolpool Gutter at Ince Marshes	Moderate
REE_W15	345832	374786	Completed	Stream/ditch	-	Ordinary Watercourse	not designated artificial or heavily modified	GB112068060330 Peckmill Brook, Hoolpool Gutter at Ince Marshes	Moderate
REE_W16	345872	374815	Completed	Stream/ditch	-	Ordinary Watercourse	not designated artificial or heavily modified	GB112068060330 Peckmill Brook, Hoolpool Gutter at Ince Marshes	Moderate
REE_W17	344829	374868	Completed	Stream/ditch	-	Ordinary Watercourse	-	-	-

- 2.1.5 Table 5K5 1.2 provides a list of the new sites completed within the study area. See “*HyNet_Drone-Survey-DataFile_extended.gpkg*” for drone images at each site.
- 2.1.6 **Table 5K5 1.2** provides a list of the original sites completed within the study area. See “*HyNet_Drone-Survey-DataFile.gpkg*” for drone images at each site.

2.2 Next Steps

- 2.2.1 Should further changes to the Project be outside the Preliminary Order Limits at the time of reported further surveys may be required to provide a baseline of the morphological and ecological characteristics present within any additional watercourse crossings.

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