Connah's Quay Low Carbon Power

Environmental Statement Volume IV
Appendix 11-L: Aquatic Ecology Technical Appendix

Planning Inspectorate Reference: EN010166
Document Reference: EN010166/APP/6.4
Planning Act 2008 (as amended)
Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 - Regulation 5(2)(a)
Revision 00

August 2025

Prepared for:
Uniper UK Limited

Prepared by:
AECOM Limited

Table of Contents

Plates

Tables

1. Background

1.1.1 This report forms a technical appendix accompanying **Chapter 11: Terrestrial and Aquatic Ecology** (**EN010166/APP/6.2.11**) of the **Environmental Statement** (**ES**) for the Connah's Quay Low Carbon Power Project (hereafter referred to as the Proposed Development).

1.1.2 This report describes the approach and findings of aquatic surveys carried out to date in support of the Ecological Impact Assessment (EcIA) of the Proposed Development.

1.1.3 This report does not seek to include recommendations, specify mitigation or make an ecological impact assessment of the Proposed Development.

1.1.4 The purpose of the work completed and this report is to:

- provide species data and information on fish, macroinvertebrate, aquatic macrophyte species and assemblages within the relevant areas of the Proposed Development;
- present the above data in a manner that allows the results to be used to support an assessment of relative nature conservation value; and
- identify potential aquatic invasive non-native species (INNS) constraints to construction and operation of the Proposed Development; and inform the options for impact avoidance, mitigation and/or compensation to be considered.

1.1.5 Field surveys and a desk study have been completed to inform the assessment to be presented in **ES Volume II Chapter 11: Terrestrial and Aquatic Ecology** (**EN010166/APP/6.2.11**).

1.2 Site Location and Development Proposals

1.2.1 The Construction and Operation Area (hereafter referred to as the 'Site') is located north-west of Connah's Quay in Flintshire, north-east Wales, on the area of the existing Connah's Quay Power Station. The Order limits are shown on **Figure 3-1: Order Limits** (**EN010166/APP/6.3**). The Proposed Development comprises of the demolition of the Existing Gas Treatment Plant, store buildings and contractors' facilities on site to be replaced with the construction and operation of a CCGT plant with a CCP up to a likely maximum of 1,380 MWe (with CCP being operational), onto the national electricity transmission network.

1.3 Survey Scope

1.3.1 An initial Preliminary Ecological Appraisal (PEA) of the ecological constraints and opportunities associated with the Site was undertaken in March 2024, including the identification of requirements for further protected species surveys. The findings have been compiled as a PEA report, which is annexed in **Appendix 11-C**: **Botanical Technical Appendix** (**EN010166/APP/6.4**).

1.3.2 Three watercourses and six ponds have been identified within or very close to the Site that might support notable (protected or non-native) aquatic habitats and species. Accordingly, these waterbodies were identified as requiring further survey for macroinvertebrate, fish and macrophytes to understand the impacts and effects from construction, operation and/or decommissioning of the Proposed Development. Waterbodies identified for further survey are detailed below:

- Lead Brook (Lead Brook on **Figure 11-E3** of **Appendix 11-E: Great Crested Newt Technical Appendix** (**EN010166/APP/6.4**) is culverted under an industrial site and main road. This brook has been included as it is located within the Repurposed CO_2 Connection Corridor;
- Rockcliffe Brook (WC5 on **Figure 11-E3** of **Appendix 11-E: Great Crested Newt Technical Appendix** (**EN010166/APP/6.4**) which is associated with the Main Development Area, where construction works for the Proposed Development would be focused;
- Allt-Goch Brook (WC1 on **Figure 11-E3** of **Appendix 11-E: Great Crested Newt Technical Appendix** (**EN010166/APP/6.4**) which is located by the Proposed CO_2 Connection Corridor and under the Repurposed CO_2 Connection Corridor;
- three ponds located on the saltmarsh to the North of the Site (P27, P28 and P29 on **Figure 11-E3** of **Appendix 11-E: Great Crested Newt Technical Appendix** (**EN010166/APP/6.4**) which is part of Connah's Quay Nature Reserve and are connected to Kelsterton Brook, via a sluice gate; and
- three ponds to the East of Lead Brook North of the A548 Chester Road (P19, P20 and P21 on **Figure 11-E3** of **Appendix 11-E: Great Crested Newt Technical Appendix** (**EN010166/APP/6.4**) and adjacent to the Site.

1.3.3 There are other waterbodies within 2 km of the Site, but these will not be directly affected by the Proposed Development or they are ephemeral. Therefore, as there are no expected direct or indirect pathways to these watercourses, they have been scoped out. Similarly, the Dee Estuary, as a tidal river, has been scoped out and is considered in **ES Volume II Chapter 12: Marine Ecology** (**EN010166/APP/6.2.12**)**.**

2. Methodology

2.1.1 The data sources for the assessment are primarily based on a desk-based study which is described in the following sections.

2.2 Evaluation of Ecological Importance

2.2.1 Evaluation of ecological importance of identified ecological features within a Site is required to inform an EcIA. This report presents the evaluation of importance for aquatic ecology, and the impact assessment is presented in **ES Volume II Chapter 11: Terrestrial and Aquatic Ecology** (**EN010166/APP/6.2.11**).

2.2.2 The method of evaluation of ecological importance is presented in **Appendix 11-A: Ecological Impact Assessment Methodology** (**EN010166/APP/6.4**).

2.2.3 All aquatic ecology features of Local value and above, where there is the potential for the Proposed Development to impact them directly or indirectly, will be taken forward to impact assessment (presented in **ES Volume II Chapter 11: Terrestrial and Aquatic Ecology** (**EN010166/APP/6.2.11**)) and will be the 'relevant aquatic ecology features' for the purposes of the EIA.

2.3 Desk Study

2.3.1 An initial desk study was undertaken in March 2024 as part of the scope of works for the PEA, which is annexed in **Appendix 11-C: Botanical Technical Appendix** (**EN010166/APP/6.4**). Data relevant to the aquatic environment has been brought forward from the PEA into this report. This includes information on the statutory and non-statutory nature conservation designations and records of any protected, notable or invasive species. Protected notable aquatic macroinvertebrate, fish and macrophyte records were obtained from Local Environmental Records Centre (LERC) Cofnod (Ref 1) and the National Biodiversity Network (NBN) Atlas (Ref 2), and a data request from National Resources Wales (NRW) (Ref 3) for a search radius of up to 5 km from the Site. Records were restricted to those collated over the last 10 years (i.e. post-2014), as these are most likely to reflect the current (rather than historic) baseline conditions.

2.3.2 The desk study included a review of:

- Cofnod data request of aquatic species;
- freely available species data from the NBN atlas (Ref 2);
- freedom of information request sent to NRW data request for prior aquatic receptor surveys (Ref 3);
- freedom of information request sent to NRW for Reason(s) for Not Achieved Good Status (RNAG) (Ref 4);
- Environment Agency (EA) ecological survey data using EA Ecology and Fish Data Explorer website (Ref 5);
- Ordnance Survey Mapping (Ref 6) was used to gather information on the location of the waterbodies within 2 km of the Site;

- MAGiC Map (Ref 7) was used to establish statutory sites with the spatial limits of the desk study; and
- Data Map Wales (Ref 8) for species and Water Framework Waterbodies.

2.4 Aquatic Macrophytes

2.4.1 Aquatic macrophyte (plant) surveys were undertaken in July at three locations (**Annex A**) and in September 2024 at two locations (**Table 1**), each led by a suitably qualified ecologist within the recommended time period for aquatic macrophyte surveys (1st June to 30th September) and not during/immediately after periods of high flow. Aquatic macrophyte surveys were undertaken in July at three locations and September 2024 at two locations **Table 1**. The surveys were conducted at separate times because of the access available due to the avoidance of breeding birds nesting in the area.

2.4.2 Locations WC5, P27 and P29 could not be completed due to restricted access. P21 was found to be dry on arrival.

Table 1: Aquatic macrophyte survey locations and dates

Location name	Waterbody type	National Grid Reference Start (upstream)	National Grid Reference End (centre)	National Grid Reference End (downstream)	Survey date
WC5	Brook	Could not be completed			30/07/2024
WC1	Brook	SJ 25390 71010	SJ 25391 71067	SJ 25391 71119	30/07/2024
Lead Brook	Brook	SJ 26260 71279	SJ 26247 71339	SJ 26238 71390	31/07/2024
P19	Pond		SJ 26577 189		10/09/2024
P20	Pond		SJ 26707 187		10/09/2024
P21	Pond	Could not be completed			10/09/2024
P27	Pond	Could not be completed			10/09/2024
P28	Pond		SJ 27707 139		10/09/2024
P29	Pond	Could not be completed			10/09/2024

2.4.3 The aquatic macrophyte surveys at WC1 and Lead Brook followed guidance set out in the UKTAG River Assessment Method (Macrophytes and Phytobenthos) for use with LEAFPACS2 (Ref 9), which conforms to BS EN 14184:2014 Water quality – Guidance (Ref 10) for the surveying of aquatic macrophytes in running waters. The survey was conducted by walking within the channel of each watercourse along a 100 m transect, where safely

accessible. Any inaccessible areas were bypassed as necessary before re-entering the channel at the next available access point. A list of all macrophytes encountered was collated and their relative abundance was recorded using Taxon Cover Values (TCV), detailed below (**Table 2**). Pond Predictive System of Multimetrics Surveys (PSYM) was completed for the three pond sites (P19, P20 and P28). For further information see the methodology in paragraph 1.4.36 (Ref 11).

Table 2: Taxon Cover Values (TCV) and associated percentage cover

TCV	Percentage cover by macrophyte taxon
B	Bank only
C1	<0.1%
C2	0.1 to 1%
C3	1 to 2.5%
C4	2.5 to 5%
C5	5 to 10%
C6	10 to 25%
C7	25 to 50%
C8	50 to 75%
C9	>75%

2.4.4 Aquatic macrophyte data for WC1 and Lead Brook was processed through the River LEAFPACS2 calculator, available from the WFD UKTAG website (Ref 12). Four metrics were calculated using macrophyte species and groups data:

- **River macrophyte nutrient index (RMNI)** – Macrophyte taxa are allocated a score based on their relative tolerance of nutrients. The overall observed RMNI score for a survey is the cover weighted average of the individual scores of the different taxa found;
- **Number of macrophyte taxa (NTAXA)** – The number of scoring taxa recorded in the field survey. Only true hydrophytes are included;
- **Number of functional groups (NFG)** – Hydrophytes are allocated to one of 24 "functional groups". These are groups of organisms which exploit a resource in a similar way; and
- **Cover of filamentous green algae (ALG)** – The percentage cover of filamentous green algae over the whole of the surveyed section.

2.4.5 LEAFPACS2 predicts the RMNI, NTAXA and NFG scores for the surveyed reach based on altitude, alkalinity, and slope. The predicted scores are then compared to reference scores and the output is an Ecological Quality Ratio (EQR). The EQR can be translated into a WFD classification (High, Good, Moderate, Poor, or Bad) as shown in **Annex A**. Alkalinity data should be obtained from monthly analysis of samples from each site over a period of at least one year, whereas here, alkalinity was based on the average of two

samples collected during the survey visits as is typical for a project of this type. It is considered likely that the calculated average will be sufficiently close to the annual average to not be a limitation of the presented results.

2.4.6 River LEAFPACS2 analysis was designed to reflect the impact of nutrient enrichment on macrophyte communities, with High status indicating there is no impact and Bad status indicating there is a severe impact. The method may also be sensitive to alterations in river flow and/or modifications to morphological conditions which may impact macrophyte communities (Ref 13).

2.4.7 Aquatic macrophyte species were cross referenced against the JNCC Taxon Designations list (Ref 14), the Environment (Wales) Act 2016 (Ref 15) to identify if any protected and/or notable species were recorded during the surveys.

2.5 Aquatic Macroinvertebrates

2.5.1 Aquatic macroinvertebrate surveys were conducted at six locations in autumn 2024 (**Annex A**). A spring survey could not be completed due to available access at the time. The specific locations and dates of the surveys are shown in **Table 3**. No surveys were undertaken during or immediately following periods of high flow in accordance with best practice guidance (Ref 17).

2.5.2 Survey locations were chosen due to the possible impact of works relating to the Repurposed CO_2 Connection Corridor, Water Connection Corridor and Main Development Area.

2.5.3 P27 and P29 could not be completed due to restricted access. P21 was found to be dry on arrival.

Table 3: Macroinvertebrate survey locations and dates

Survey Location	Waterbody type	National Grid Reference	Autumn survey date
WC5	Brook	SJ 27269 70525	09/09/2024
WC1	Brook	SJ 25387 71038	09/09/2024
Lead Brook	Brook	SJ 26243 71299	09/09/2024
P19	Pond	SJ 26626 71906	10/09/2024
P20	Pond	SJ 26677 71843	10/09/2024
P28	Pond	SJ 27702 71386	10/09/2024

2.5.4 The aquatic macroinvertebrate surveys were undertaken by suitably qualified and experienced aquatic ecologists. Sampling procedures followed those standardised by the Environment Agency (Ref 17), which conforms to BS EN ISO 10870:2012 Water Quality – Guidelines for the selection of sampling methods and devices for benthic macroinvertebrates in fresh waters. These methods allow characterisation of aquatic macroinvertebrate communities and can be used to determine whether rare or notable species or communities are present. The samples were taken using a standard

Freshwater Biological Association (FBA) pattern pond net (mesh size: 1 mm). The habitats present were sampled via kick sampling for three minutes followed by a one-minute hand search of larger substrates in accordance with the standard methods. The samples collected were subsequently preserved in Industrial Methylated Spirit (IMS) for laboratory processing.

2.5.5 Each of the samples collected were sorted and analysed in a laboratory setting by a suitably trained and experienced aquatic ecologists. Lists of the aquatic macroinvertebrate taxa present were produced in line with Environment Agency guidance (Ref 18). The aquatic macroinvertebrate samples were identified to 'mixed taxon level' using a stereo-microscope. Most groups were identified to species level (where practicable), with the exception of the following:

- Worms (Oligochaeta) which were identified to sub-class;
- Marsh beetles (Scirtidae) which were identified to family;
- True-fly larvae, which were identified to the maximum resolution possible; and
- Immature or damaged specimens, which were identified to the maximum resolution possible on a case-by-case basis.

2.5.6 Aquatic macroinvertebrates species were cross referenced against the JNCC Taxon Designations list (Ref 14) and the Environment (Wales) Act 2016 (Ref 15) to identify if any protected and/or notable species were recorded during the surveys. The survey data was then used to calculate metrics that can be used to inform an assessment of relative nature conservation value, habitat condition and general degradation as detailed below.

Community Conservation Index (CCI)

2.5.7 A Community Conservation Index (CCI) (Ref 19) was calculated for each survey location as detailed in **Annex B**. The CCI classifies many groups of aquatic macroinvertebrates according to their scarcity and nature conservation value in England as understood at the time that the classification was developed. Species scores range from 1 to 10, with 1 being very common and 10 being Endangered. Since its initial publication, in some cases the references used in the CCI classification to define scarcity and value have been superseded by more recent assessments. Due to this, the author has provided AECOM with updated species scores to take account of this new information (Chadd, *pers. comm.*, 2018). These updated scores have been used within this assessment.

Lotic-invertebrate Index for Flow Evaluation (LIFE)

2.5.8 Lotic-invertebrate Index for Flow Evaluation (LIFE) scores were calculated (Ref 20). This is an index that links benthic macroinvertebrate data to flow regimes prevailing in UK waters. Flow scores have been allocated to various macroinvertebrates based on species/family abundance and ecological association with different flows, as detailed in **Annex C**. The overall LIFE score for a site is calculated as the sum of the individual scores divided by the number of scoring species/families. LIFE scores increase with current velocity, scores <6.00 generally indicating sluggish or still water conditions

and score >7.5 indicate fast flows. LIFE allows the mean flow preference of invertebrates colonising a reach to be determined so that effect of habitat changes such as sediment accumulation can be monitored.

Proportion of Sediment-sensitive Invertebrates (PSI)

2.5.9 Calculations were undertaken to determine the proportion of sediment sensitive macroinvertebrates present using the Proportion of Sediment-sensitive Invertebrates (PSI) index (Ref 21). Using this approach, individual taxa of aquatic macroinvertebrate are assigned a Fine Sediment Sensitivity Rating (FSSR) ranging from A to D, as detailed in **Annex D**. The PSI score for each aquatic macroinvertebrate sample was derived from individual species scores and abundances. The derived PSI score corresponds to the percentage of fine sediment-sensitive taxa present in a sample and ranges from 0 to 100, where low scores correspond to watercourses with high fine sediment cover. The PSI score therefore provides an indication of the extent to which watercourses are influenced by fine sediments, and therefore by inference the potential sensitivity of the associated aquatic macroinvertebrate community to changes in silt load and deposition.

Whalley, Hawkes, Paisley & Trigg (WHPT)

2.5.10 The aquatic macroinvertebrate data were analysed to generate the Whally, Hawkes, Paisley & Trigg (WHPT) score (**Annex E**) Average Score Per Taxon (ASPT), and Number of scoring taxa (NTAXA) values, which provide an indication of the ecological quality in the watercourse (Ref 22). This assigns numerical value to taxa according to their sensitivity to organic pollution. The average of the values for each taxon in a sample, known as ASPT, is a stable and reliable index of organic pollution. Therefore, these assessments can indicate to what extent an aquatic macroinvertebrate community is exposed to organic pollution (further information is provided in **Annex E**). It is important to note that these indices can vary between geological regions and habitat types. Ditches for example are unable to support many of the high-scoring taxa associated with fast flowing habitats. Therefore, the resultant metrics should be reviewed with awareness of the potential limitations, and the Site-specific context, as described in this report.

2.5.11 The WHPT method has been primarily designed to respond to organic pollution, however it is suitable for monitoring other types of impact and is used for assessing the WFD classification parameter "General degradation" (Ref 22).

River Invertebrate Classification Tool (RICT)

2.5.12 The resultant WHPT-ASPT and NTAXA values and environmental data collected were processed through the River Invertebrate Classification Tool version 3 (RICT) web application, available on the Freshwater Biological Association website (Ref 23).

2.5.13 RICT predicts the WHPT-ASPT and NTAXA scores for the surveyed locations based on the site location, altitude, alkalinity, slope, discharge category, distance from source, channel dimensions and substrate composition. The predicted scores are then compared to actual scores and

the output is an Ecological Quality Ratio (EQR). The EQR can be translated into a WFD classification (High, Good, Moderate, Poor, or Bad).

2.6 Pond PSYM

2.6.1 The biological quality of ponds surveyed within the study area was assessed using the pond PSYM method (Ref 11). Pond PSYM is a standard method that provides an assessment of the biological quality of a pond and includes collection of physical data, macroinvertebrate sampling and macrophyte recording following the standardised protocols set by Freshwater Habitats Trust (FHT). As previously stated the surveys were completed on 10th September 2024 for ponds listed in **Table 4**. Guidance suggests that surveys should be carried out within the optimal pond PSYM survey season (summer: June – August). Due to land access availability to avoid breeding birds the surveys on the ponds were conducted 10 days outside of this window.

Table 4: Ponds surveyed using the PYSM methodology

Pond	National Grid Reference
P28	SJ 27702 71386
P19	SJ 26570 71890
P20	SJ 26677 71843

2.6.2 Macroinvertebrate samples were taken using 'kick/sweep sampling' as described in paragraph 2.5.4 which is in line with the PSYM methodology (Ref 11). The samples were analysed, and specimens were identified to mixed taxon level; additional care was taken to identify any potential INNS and protected/notable specimens to species.

2.6.3 Pond macrophytes were surveyed by walking or wading the entire perimeter of the dry and shallow water areas of the water body and identifying species. Deeper water areas were sampled by grapnel thrown from shallow water or the bank. The aim of plant recording was to make a complete list of wetland plants present within and on the banks of each pond to inform an assessment of conservation value and INNS presence.

2.6.4 To determine conservation importance of the ponds, the data collected during the surveys was submitted to the FHT to be compared against the national pond database. This analysis provides a rating from 'Very Poor' to 'Good' and determines whether the pond is a 'Priority Pond' for conservation purposes.

2.7 Fish

2.7.1 Environmental DNA (eDNA) samples were collected on 31 July 2024 on Lead Brook and WC1 and on 10 September 2024 at pond sites; P19, P20 and P28 (**Table 5**). WC5 was scheduled to be surveyed, but water levels were too low on both visits to collect a viable sample. The eDNA sampling methodology employed was informed by NatureMetrics guidance (Ref 24). At each waterbody one sample was collected which comprised of a series of subsamples equating to a volume of water which was filtered.

Table 5: Location of environmental DNA (eDNA) surveys

Site Code	Grid Reference	Survey Date
P19	SJ 26700 71876	31/07/2024
P20	SJ 26628 71933	31/07/2024
P28	SJ 27689 71402	10/09/2024
Lead Brook	SJ 26239 71461	10/09/2024
WC1	SJ 25397 71060	10/09/2024

2.7.2 Sub-samples were collected from suitable habitats (i.e., dam wall, overhanging tress, and areas of macrophytes) to increase the probability of detection rates. All sub-samples were pooled together, thoroughly mixed, and immediately filtered to extract the eDNA. The filtered sample was then preserved with a lysis solution in-situ to maintain DNA integrity at ambient temperatures until the DNA could be abstracted for laboratory analysis.

2.7.3 Sampling was completed by foot where suitable bankside access was available.

2.7.4 Prior to sampling at each site, all kit was sterilised to ensure no introduction of foreign DNA occurred at the initial sampling site and to prevent cross contamination between sites.

2.7.5 Care was taken to avoid areas of inflow and disturbing the reservoir banks/bed when sampling, to prevent DNA cross contamination from external watercourses and sediments respectively.

2.7.6 All samples were sent to NatureMetrics who conducted the extraction and analysis of DNA from the hypervariable region of the 12S gene to target fish as part of the eDNA survey – fish pipeline.

2.8 Limitations and Assumptions

2.8.1 Species, particularly highly mobile ones such as fish, can be transient and their presence intermittent. Desk study data provides a snapshot of the presence of species rather than a comprehensive record of all the species that use the habitats within a search area. Furthermore, they are dependent on records being collected and submitted to the relevant records centre, rather than being collected systematically by means of a formal survey protocol carried out at regular intervals. Therefore, the absence of a species record cannot be interpreted as the absence of a species within a search area. Conversely, the effects of habitat and other environmental changes (such as climate change) and other factors acting that influence the distribution and numbers of a given species over time means that the absence of a species record cannot be taken to mean that the species is entirely absent from a search area.

2.8.2 Given the health and safety concerns with sampling the saline ponds, the use of conventional fisheries methods such as electric fishing and netting techniques was not permissible. In this instance, eDNA represented the only viable method to characterise the fish assemblage. That said, completing eDNA surveys within this environment is not without its own limitations.

Given that these ponds get filled from the adjacent tidal River Dee (it is currently not understood how often saline intrusion occurs), there is a possibility that eDNA will be contaminated from species present in the river and not resident (temporary or permanent) to the ponds. In this instance, results required expert judgment to establish the likely presence of all species identified from the subsequent analysis.

3. Baseline Survey Results

3.1 Desk Study

Statutory and non-statutory Freshwater Designations

3.1.1 Three statutory designated sites have been identified with habitat connectivity within 2 km of the Site (**Table 6**). These sites all have aquatic conservation features as part of their reason for designation. No non-statutory sites were identified within 2 km of the Order limits.

Table 6: Statutory designations with aquatic ecology features within 2 km of the Order limits.

Name	Reason for Designation (aquatic features)	Location relative to Site
Dee Estuary / Aber Dyfrdwy Special Area of Conservation (SAC)	The Dee Estuary is of special interest to over wintering bird species and nationally scarse plants – cliff vegetation, maritime heathland and grassland. It supports river lamprey, *Lampetra fluviatilis*, sea lamprey, *Petromyzon marinus*, and petalwort *Petalophyllum ralfsii* which are listed as Annex II species.	Overlaps with the Main Development Area , specifically the Water Connection Corridor
The River Dee and Bala Lake / Afon Dyfrdwy a Llyn Tegid (SAC)	Designated for the presence of Annex I habitat Watercourses of plain to montane levels with *Ranunculion fluitantis* and *Callitricho-batrachion* vegetation; and its populations of the Annex II species Atlantic salmon *Salmo salar* and floating water plantain *Luronium natans*. Annex II qualifying features for selection of the site include sea lamprey, river lamprey, petalwort *Petalophyllum ralfsii,* brook lamprey and bullhead *Cottus gobio*.	Located adjacent to the Main Development Area
River Dee (Aber Dyfrdwy) Site of Special Scientific Interest (SSSI)	Annex II species – Brown trout *Salmo trutta*	Approximately 0.1 km upstream of the Water Connection Corridor.

Water Framework Directive (WFD) status

3.1.2 Wepre Brook (WFD waterbody ID: GB111067056880) is located approximately 1.5 km from the Site. Wepre Brook is classed as having a natural hydromorphology and moderate ecological status and moderate overall status due to the presence of phosphates, although the source of the phosphate has not yet been identified. The ecological components include macroinvertebrates and macrophytes. Fish are not part of the ecological status assessment.

3.1.3 Swinchiard Brook (WFD waterbody ID: GB111067056940) is located approximately 1.7 km from the Site. Swinchiard Brook is classified as having natural hydromorphology and good ecological status and good overall status. The ecological components include macroinvertebrates and macrophytes. Fish are not part of the ecological status assessment.

3.1.4 As the Site does not encroach on either Wepre Brook or Swinchiard Brook, they have been scoped out for further assessment. However, as it is a primary survey location for Natural Resources Wales (NRW) it has been used in the baseline assessment to understand which species may be present within the catchment area.

Notable Species

3.1.5 Five NRW monitoring locations were identified within 5 km of the Site (**Table 7**). One of these is monitored for macroinvertebrate and macrophyte receptors, two for macrophyte receptors only and two for fish receptors only. A couple of the sites included are outside of the 10 year desk study, but as they are the only surveyed locations found within 5 km of the Site, they have been included in the analysis.

Table 7: NRW monitoring locations within 5 km of the Site

River	Site Name	Site ID	National Grid Reference	Proximity to Proposed Development (km)	Last Year Surveyed	Group monitored
Swinchiard Brook	At Flint	46286	SJ 24000 73100	2.6	2013	Macrophyte
	D8 Eel Site	33869	SJ 24028 73481	2.6	2022	Fish
Lead Brook	D/S Paper Mill	161164	SJ 26333 71763	0.01	2013	Macrophyte
Wepre Brook	Civic Centre	46287	SJ 30200 69400	1.5	2019	Macroinvertebrate Macrophyte
	D5 Eel Site	33866	SJ 30142 68806	1.8	2022	Fish

Aquatic Macrophytes

3.1.6 The desk study returned nine species of aquatic plant records collected by NRW in 2019 at Wepre Brook, but no notable species were recorded. The only other plant species identified are detailed within the nature conservation designations summarised in **Table 6**.

3.1.7 Data received from NRW in May 2024 identified one flowering plant macrophyte species present on Swichiard and Wepre Brook as hemlock water-dropwort *Oenanthe crocata*. All other species identified were liverworts and mosses.

3.1.8 Within the Study Area, three invasive non-native macrophyte species were identified (**Table 8**). Parrot's-feather *Myriophyllum aquaticum* was identified under 1 km south-west from the Site within a pond. Himalayan balsam *Impatiens glandulifera* and Japanese knotweed *Reynoutria japonica* were also identified within 500 m from the Site on Pentre and Swinchiard Brook. All three species are listed under the Wildlife and Countryside Act 1981 (Ref 25), whilst parrot's-feather is also listed under The Invasive Alien Species (Enforcement and Permitting) Order 2019 (Ref 26).

Table 8: Invasive aquatic macrophyte species identified within 2 km of the Site.

Species	Common Name	NGR	Last Record	No. of records	Location	Designations
Myriophyllum aquaticum	Parrot's Feather	SJ24267097	2014	1	Pond, south-west of Site	Wildlife and Countryside Act 1981 (Ref 25) The Invasive Alien Species (Enforcement and Permitting) Order 2019 (Ref 26)
Impatiens glandulifera	Himalayan Balsam	SJ30116879 SJ23997253	2023 2021	1 1	Wepre Brook Swinchiard Brook	Wildlife and Countryside Act 1981 (Ref 25)
Reynoutria japonica	Japanese knotweed	SJ193742	2014	1	Trib of Swinchiard Brook	Wildlife and Countryside Act 1981 (Ref 25)

Aquatic Macroinvertebrates

3.1.9 There were no specific records of protected macroinvertebrate species identified in the desk study data. However, some notable taxa were found in NBN data (**Table 9**). All notable species were found within a 2 km radius of the Site within the last 10 years.

Table 9: Notable aquatic macroinvertebrate species identified within 2 km of the Site.

Species	Common Name	NGR	Last Record	No. of records	Location	Designations
Cheilotrichia imbuta	A cranefly	SJ 303 699	2018	1	River Dee, Shotton	GB Notable
Dicranomyia chorea	A true fly	SJ 29 68	2014	1	Wepre CP	RedList - Rare (based on pre 1994 IUCN guidelines)

3.1.10 The River Dee SAC notes the presence of Britain's only known population of stonefly *Isogenus nubcula* and the club-tailed dragonfly *Gomphus vulgatissimus* which is Nationally Scare, both species can be found in the lower reaches of the River Dee which extends into the Dee Estuary. Further up the River Dee, the middle reaches are also known for the Nationally Scarce freshwater pearl mussel *Margaritifera margaritifera* and the water beetle *Bidessus minutissimus.*

3.1.11 There were no records of the white-clawed crayfish *Austropotamobius pallipes* within 2 km of the Order limits within the last ten years and there is no mention of their presence within any of the designations in the area. However, there have been recent records of the non-native species Chinese mitten crab *Eriocheir sinensis* on Wepre Brook, which is situated outside the Order limits but within the study area.

Fish

3.1.12 Two NRW fish monitoring locations that have been surveyed within the last five years were identified within 2 km of the Order limits. The closest data recorded was on Wepre Brook and Swinchiard Brook. Six species of fish have been recorded during NRW surveys in Swinchiard Brook and eight species on Wepre Brook. Of these, four are protected species; Atlantic salmon *Salmo salar*, brown/sea trout *Salmo trutta*, bullhead *Cottus gobio* and European eel *Anguilla anguilla* (**Table 10**).

Table 10: Notable fish species identified within 5 km of the Site with relevant designations/ status

Species	Most recent record	Number of records	Location	Designation/ Status	Receptor Value
Atlantic salmon (Salmo salar)	2019	5	Wepre Brook (SJ 29581 68363)	Bern Convention –Appendix III (Ref 27) The Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR Convention) (Ref 28) Habitat Directive (Ref 29) - Appendix II & V UK Biodiversity Action Plan-2007 (Ref 30) NERC Section 41 (Ref 33) Environment (Wales) Act 2016 Section 7 (Ref 15) The Conservation of Habitats and Species Regulations 2017 (Ref 31) - Sch4	Very High
Brown/sea trout (*Salmo trutta*)	2022	4	Swinchiard Brook (SJ 24028 73481)	UK Biodiversity Action Plan 2007 (Ref 30)	High

Species	Most recent record	Number of records	Location	Designation/ Status	Receptor Value
		15	Wepre Brook (SJ 30142 68806)	NERC Section 41 (Ref 33) Environment (Wales) Act 2016 (Ref 15)	
Bullhead (*Cottus gobio*)	2022	12 95	Swinchiard Brook (SJ 24028 73481) Wepre Brook (SJ 30142 68806)	The Conservation of Habitats and Species Regulations 2017 (Ref 31) - Appendix II	High
European eel (*Anguilla anguilla*)	2022	171 114	Swinchiard Brook (SJ 24028 73481) Wepre Brook (SJ 30142 68806)	Global Red List Post 2001 – Critically Endangered (Ref 32) NERC Section 41 (Ref 33) UK Biodiversity Action Plan 2007 (Ref 30) The Conservation of Habitats and Species Regulations 2017 (Ref 31) - Appendix II OSPAR Convention (Ref 28) Environment (Wales) Act 2016 (Ref 15)	Very High

Species	Most recent record	Number of records	Location	Designation/ Status	Receptor Value
				Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention) (Ref 34) - Appendix II The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (Ref 38) -AB Eel (England and Wales) Regulations 2009 (Ref 34) Salmon and Freshwater Fisheries Act (SAFFA) 1975 (Ref 37)	

3.1.13 Seven species of notable fish were also found in the Dee Estuary found by NRW (**Table 11**); sand goby *Potmatoschistus minutus*, European smelt *Osmerus eperlanus*, common goby *Potmatoschistus microps*, European eel, common sole *Solea solea*, and cod *Gadus morhua*. These have been examined in more detail in **Chapter 12: Marine Ecology** (**EN010166/APP/6.2.12**).

Table 11: Notable fish species found in the Dee Estuary

Species	Location	Last Record	Number of records	Designations
Sand goby (*Potmatoschistus minutus*)	SJ292337 0304	2022	26	Bern Appendix III
European smelt (*Osmerus eperlanus*)	SJ290647 0442	2022	20	UK Biodiversity Action Plan 2007 NERC Environment (Wales) Act- Section 7
Common goby (*Potmatoschistus microps*)	SJ275037 2100	2022	14	Bern Appendix III
European eel (*Anguilla anguilla)*	SJ275037 2100	2022	7	OSPAR JNCC Redlist – Critically Endangered BAP NERC Environment (Wales) Act 2016 - Section 7
Common sole (*Solea solea*)	SJ262437 2554	2022	2	UK Biodiversity Action Plan 2007 NERC Environment (Wales) Act 2016 - Section 7
Cod (*Gadus morhua*)	SJ290647 0442	2022	1	OSPAR

Species	Location	Last Record	Number of records	Designations
				JNCC RedList – Vulnerable UK Biodiversity Action Plan 2007 NERC Environment (Wales) Act 2016 - Section 7

3.1.14 The INNS Chinese mitten crab was found in desk study data as being present on Wepre Brook. The last record was in 2022. Alongside, multiple records of Chinese mitten crab being present within the Dee Estuary. This species is covered by the Wildlife and Countryside Act 1981 – schedule 9 and 14 which means makes it is an offence to plant or otherwise cause to grow (including allowing to spread), listed plant species in the wild. If transported off site, there is a duty of care with regards to the disposal of any part of the plant that may facilitate establishment in the wild and cause environmental harm (as per the Environmental Protection Act 1990). The legislation also makes it an offense to release, or allow to escape, listed species (or species not ordinarily resident in and is not a regular visitor to Great Britain in a wild state) into the wild.

3.2 Aquatic Macrophytes

3.2.1 A full aquatic macrophyte list can be found in **Annex F**. No macrophyte species found were identified as notable or protected when cross-referenced with the JNCC Taxon Designation list and the Priority Species List of the Environmental (Wales) Act 2016 (Ref 15). LEAFPACS2 analysis could not be conducted at WC1 and Lead Brook. This is due to the analysis requiring three taxa (Ref 13), but only one scoring taxa was recorded at each of these sites.

WC1

3.2.2 The channel was less than 1 m wide and less than 25 cm deep throughout the survey reach (**Plate 1**). The substrate primarily comprised of 70% silt/clay, with the addition of 25% pebbles/gravel and 5% sand. Bankside shading was dense for 95% of both banks.

3.2.3 No filamentous algae were observed during the survey and only one macrophyte species; bittersweet *Solanum dulcamara* was found on the margins of the reach.

Plate 1: WC1 macrophyte survey location

Lead Brook

3.2.4 The channel was between 1 and 5 m wide and mostly artificial (**Plate 2**). The survey reach was predominantly <25 cm deep. The channel substrate consisted of 80% boulders/cobbles, 10% pebbles/gravel, 7% bedrock and 3% sand. The shading was 90% dense and 10% broken on both banks.

3.2.5 The macrophyte community consisted of 40% channel cover from a single macrophyte species; willow moss *Fontinalis antipyretica*.

Plate 2: Lead Brook macrophyte survey location

P28

3.2.6 The pond was 10% wadable, with 0% aquatic macrophyte and filamentous algae cover at the time of sampling (**Plate 3**). A large drawdown was observed at low tide as well as a shallow vertical bank with salt-marsh vegetation found between the lagoons.

Plate 3: P28 macrophyte survey location

P19

3.2.7 The pond was 10% wadable and covered by 30% aquatic macrophytes and 60% filamentous algae (**Plate 4**); Common reed *Phragmites australis*, saltmarsh tuber-bulrush *Bolboschoenus maritimus* and *Vaucheria sp*..

Plate 4: P19 macrophyte survey location

P20

3.2.8 The pond was 100% wadable with a water depth between 25 and 50 cm (**Plate 5**). A total of nine macrophyte species were recorded; saltmarsh tuber-bulrush, common reed, blanket weed aggregate *Spyrogyra sp*., pointed spear-moss *Calliergon cuspidatum*, Eurasian watermilfoil *Myriophyllum spicatum*, common water-crowfoot *Ranunculus aquatilis*, broadleaf cattail *Typha latifolia*, great willowherb *Epilobium hirsutum* and marsh willowherb *Epilobium palustre*.

Plate 5: P20 macrophyte survey location

Macrophyte Indices and WFD Classification

3.2.9 Based on the criteria outlined in the Methods, RMNI, NTAXA, NFG and ALG, observed and predicted scored for each survey reach on the two watercourses; WC1 and Lead Brook, are detailed in **Table 12**. The table also includes the overall EQR and WFD macrophyte status for each survey reach. Analysis was only conducted on running watercourses not on sites deemed as ponds (P28, P19 and P20) as per LEAFPACS2 protocol (Ref 8).

Table 12: Macrophyte WFD metrics for WC1 and Lead Brook

Metric		WC1	Lead Brook
River macrophyte nutrient index (RMNI)	Observed	*	5.40
	Predicted	6.78	6.71

Metric		WC1	Lead Brook
Number of macrophyte taxa (NTAXA)	Observed	0.00	1.00
	Predicted	*	10.02
Number of functional groups (NFG)	Observed	0.00	1.00
	Predicted	6.30	6.30
Cover of filamentous green algae (ALG)	-	0.00	0.00
Overall Ecological Quality Ratio (EQR)	-	*	1.00
WFD macrophyte classification	-	Unclassifiable	Unclassifiable

** No result due to no macrophyte being present*

3.2.10 Both Lead Brook and WC1 had an unclassifiable WFD status, due to only one and no macrophytes being present respectively. As a minimum of three species are needed for WFD classification to be calculated there was insufficient data for the analysis.

3.2.11 As the alkalinity of both survey sites was >200 mgL^{-1} (varying between 213 and 264 mgL^{-1}), LEAFPACS analysis alone can be used, as the macrophyte-based status is consistently lower than the diatom-based status in waters of these alkalinities (Ref 8).

3.3 Aquatic Macroinvertebrates

3.3.1 The full aquatic macroinvertebrate taxa list for the Autumn 2024 survey can be found in **Annex F**. A description of the macroinvertebrate community at each survey location is provided below.

WC1

3.3.2 The freshwater amphipod *Gammarus pulex* comprised 38% of the macroinvertebrate community. The subfamily of non-biting midges, Tanypodinae, accounted for a further 19%. The true fly assemblage was relatively diverse, including species belonging to Orthocladiinae, Prodiamesinae, Tanytarsini, Limoniidae, Simuliidae, Psychodidae, Empididae, Culicidae, Muscidae, Ptychoptera and the species *Dixa nebulosa*.

WC5

3.3.3 The freshwater amphipod *Gammarus pulex* was the most abundant macroinvertebrate making up 28% of the community. Oligochaeta accounted for a further 23%. 40 specimens of the non-native non-invasive New Zealand mudsnail *Potamopyrgus antipodarum* were recorded. Several beetle groups were found including; *Agabus bipustulatus, Anacaena globulus* and Scirtidae and Dytiscidae larvae. The survey location also included a small but diverse true fly assemblage.

Lead Brook

3.3.4 A large macroinvertebrate community was recorded at Lead Brook, totaling over 4000 specimens. 40% of the sample comprised the isopod Asellidae, with approximately one third identified as *Asellus aquaticus*. Additional crustaceans included Ostracoda (10%), Gammaridae and the non-native but non-invasive amphipod *Crangonyx floridanus/pseudogracilis.* A further 29% of the community comprised mostly *Baetis* mayflies, including *Baetis vernus*. Five specimens of *Eiseniella tetraedra*, known to inhabit brackish and estuarine habitats, were also found. In addition, relatively small yet diverse assemblages of flatworms, snails and true flies were recorded. Of the flatworms, *Dendrocoelum lacteum*, *Polycelis* sp., *Polycelis felina* and *Schmidtea lugubris/polychroa* were all represented. Snails included Lymnaeidae, *Stagnicola* sp., *Ampullaceana balthica*, *Bithynia tentaculata*, *Gyraulus albus* and *Gyraulus crista*.

P28

3.3.5 The macroinvertebrate community at P28 was dominated by the saltwater amphipod *Corophium volutator*, which comprised 62% of the species recorded. The species is widely distributed on all coasts of Britain and tolerates a wide range of salinities, from fully saline to almost freshwater. Other species tolerant of brackish waters, such as the mudsnail *Hydrobia ulvae* and the polychaete or brackish ragworm *Nereis diversicolor*, were also found, each comprising 10% of the community.

P19

3.3.6 Water boatman comprised 47% of recorded species at P19, with *Sigara lateralis* being the most abundant. Also present were two specimens of *Paracorixa concinna*, which is considered 'Local' conservation value, as per the CCI (Ref 29).

P20

3.3.7 Dragonfly and damselfly species accounted for 31% of the macroinvertebrate community at P20, including the blue-tailed damselfly *Ischnura elegans*, southern hawker *Aeshna cyanea* and the black-tailed skimmer *Orthetrum cancellatum*. A relatively diverse true bug assemblage was also recorded, including the pygmy backswimmer *Plea minutissima*, the water boatman species *Micronecta scholtzi*, *Cymatia bonsdorffi*, *Callicorixa praeusta*, *Corixa punctata*, *Sigara dorsalis*, *Sigara distincta and Sigara limitata,* and the backswimmer *Notonecta viridis*. *S. limitata* which is considered of 'Regionally Notable' conservation value, and *M. scholtzi* and *C. bonsdorffi* are both considered of 'Local' conservation value as per the CCI. Additional recorded species also considered of 'Local' conservation value are the Hydrophilidae beetle *Helochares lividus* and the Hydroptilidae caddisfly *Agraylea sexmaculata*.

Aquatic macroinvertebrate indices

3.3.8 Based on the criteria outlined in the methodology (Section 2.5.7), Community Conservation Index (CCI), Whalley, Hawkes, Paisley & Trigg (WHPT) Average Score Per Taxon (ASPT) and Number of scoring taxa

(NTAXA) species values for each survey location are summarised in **Table 13**. LIFE and PSI analysis was only conducted on survey locations that were deemed running watercourses; WC1, WC5 and Lead Brook. Sites P19 and P20 were considered freshwater ponds. While P28 is a semi-tidal pond which sits above the mean high-water line but floods during very high tide.

Table 13: Macroinvertebrate index scores for Autumn 2024 surveys

Index	WC1	WC5	Lead Brook	P28	P19	P20
WHPT-NTAXA	20	15	25	4	5	16
WHPT-ASPT	4.62	4.58	4.40	4.50	3.34	4.16
CCI Score	6.0	4.3	4.5	6.0	12.5	13.6
CCI Score - interpretation	Moderate conservation value	Low conservation value	Low conservation value	Moderate conservation value	Fairly High conservation value	Fairly High conservation value
LIFE** score (species)	6.77*	5.90*	6.50	N/A	N/A	N/A
LIFE** score – interpretation	Moderate sensitivity to reduced flows*	Low sensitivity to reduced flows *	Moderate sensitivity to reduced flows	N/A	N/A	N/A
PSI** score (species)	44.12*	30.78	29.09	N/A	N/A	N/A
PSI** score - interpretation (MTL)	Moderately sedimented*	Sedimented	Sedimented	N/A	N/A	N/A

*Lack of scoring species may result in inaccurate scores, consequently family level scores have been presented
**LIFE and PSI scores are only applicable to running watercourses

3.3.9 All taxa identified had a conservation score that was 'Occasional', representing species which occur in up to 10% of all samples from similar habitats, or lower, with the exception of the water boatman *M. scholtzi*, *C. bonsdorffi, P. concinna* and *S. limitata*, the beetle *H. lividus* and the caddisfly *A. sexmaculata*. All of these were recorded at P20, except *P. concinna* which was found at P19.

3.3.10 The non-native but non-invasive species *P. antipodarum* and *C. pseudogracilis*/*floridanus* were recorded at WC5 and Lead Brook

respectively. There exist no statutory constraints due to the presence of these species.

3.3.11 The WHPT-NTAXA was low (10.00 or less) at sites P28 and P19, the highest score of 25.00 was achieved by Lead Brook. All survey locations (WC1, WC5, P28 and P19) attained a biological water quality WHPT-ASPT interpretation of Poor, Polluted or Impacted, except for Lead Brook, which was Moderate, moderately impacted, and P20, which was Good, Clean but slightly impacted. WHPT-ASPT scores ranged from 3.34 at P19 to 4.62 at WC1, which indicate relatively high pressure from water quality.

3.3.12 The Community Conservation Index (CCI) scores for the samples ranged from 4.3 at WC5 to 13.6 at P20. Two sites (Lead Brook and WC5) had a low conservation value. Two sites (WC1 and P28) had a moderate conservation value. Sites P19 and P20 had a fairly high conservation value.

3.3.13 The LIFE scores are applicable for running watercourses only and ranged from 5.90 at WC5 to 6.77 at WC1. WC5 was interpreted to have low sensitivity to reduced flows. The remaining two sites (WC1 and Lead Brook) were considered to have moderate sensitivity to reduced flows.

3.3.14 Two sites were interpreted to be sedimented, they were Lead Brook and WC5. Site WC1 was deemed to be moderately sedimented. The PSI scores ranged from 29.09 at Lead Brook, to 44.12 WC1.

3.3.15 **Table 14** displays the EQR and WFD macroinvertebrate status for the WHPT ASPT and NTAXA indices for each riverine survey site, as well as the most probable WDF status based on the combination of the modelled distributions for each ASPT and NTAXA across all classes, termed MINTA (Minimum of NTAXA and ASPT EQRs).

3.3.16 Analysis using RICT is only suitable for freshwater (not estuarine or marine) sites on rivers or streams that are naturally permanently flowing. As such, RICT analysis was not undertaken for those sites identified as ponds due to their nature (i.e., not naturally permanently flowing condition).

Table 14: Macroinvertebrate WFD classification for riverine survey sites

Index	Season	WC1	Lead Brook	WC5
WHPT-NTAXA Ecological Quality Ratio (EQR)	Autumn	1.26 (High)	0.99 (High)	0.80 (High)
WHPT-ASPT Ecological Quality Ratio (EQR)	Autumn	0.78 (Moderate)	0.83 (Moderate)	0.83 (Moderate
MINTA, most probable WFD invertebrate classification	Autumn	Moderate	Moderate	Moderate

3.3.17 All sites received a Moderate WFD classification for invertebrates. With the WHPT-NTAXA EQR being deemed High and the WHPT-ASPT EQR being considered Moderate for all sites. The results suggest that the quality of the resident macroinvertebrate community at all sites have adequate, yet unremarkable habitat quality.

3.4 Pond PSYM

3.4.1 The results of the pond PYSM analysis by the Freshwater Habitats Trust (FHT) are presented in **Table 15**.

Table 15: PSYM Analysis Outputs

Index category	P28	P19	P20
No. of submerged + marginal plant species	0	2	6
No. of uncommon plant species	0	1	3
Trophic Ranking Score (TRS)	*	7.30	9.17
ASPT(BWMP)	5	3.75	5.33
Odonata + Megaloptera (OM) families	0	0	3
Coleoptera families	0	1	2
PSYM quality category	Very Poor	Poor	Moderate
Priority Pond	No	No	No
Index of Biotic integrity (%)	17%	33%	72%

** No result due to no macrophyte being present*

3.4.2 PSYM results indicated a difference between all three ponds. With the semi-tidal pond P28 being classified as Very Poor. While P19 and P20 received Poor and Moderate classifications respectively. None of the ponds were deemed to be 'Priority Ponds' for conservation purposes.

3.4.3 Details on the physical characteristics and biological communities of each pond are provided below. Macrophyte taxa lists are presented in **Annex A**. Macroinvertebrate taxa lists are presented in **Annex F**, and the Community Conservation Index (CCI), Average Score Per Taxon (BMWP-ASPT), and Number of scoring taxa (BMWP-NTAXA) values for each pond surveyed is shown in **Table 14**.

P28

3.4.4 The pond surveyed was approximately 58,237 m² with 0% shading and emergent plant cover of 1%. The substrate at the pond primarily comprised of clay/silt. There was no evidence of the pond margin being grazed, but there was an inflow present.

3.4.5 The aquatic macrophyte community at P28 was nonexistent, with zero species being recorded at this pond. It did feature a saltmarsh vegetation separating it from other lagoons. The lack of macrophytes could be due to its semi-tidal existence.

3.4.6 The macroinvertebrate community at this pond was relatively low in diversity, with only four taxa being recorded. The majority of the community comprised

of the saltwater amphipod *Corophium volutator* which made up 62% of the total community. Followed by *Corophium sp.* and the brackish mud snail *Hydrobia ulvae*. Also featured in small quantities were Asellidae. The CCI score was 6.0 suggesting moderate conservation value.

P19

3.4.7 P19 pond was approximately 9,662 m^2 with no shading and 10% emergent plant cover. Clay/silt was the primary substrate with sand, gravel and cobbles also present. There was no evidence suggesting that the pond margin had been grazed and no inflow was present.

3.4.8 The aquatic macrophyte community at this pond consisted of two species of emergent macrophyte. The first; saltmarsh tuber-bulrush with a rarity score of two. The second; the common reed. None of the macrophyte taxa identified during the surveys were a protected species.

3.4.9 The macroinvertebrate community at this pond again consisted of four differing taxa. The community was split primarily between water boatman (Corixidae) 47% and tribes of non-biting midges (Chironomidae) 40%. One species of water boatman *Paracorixa concinna* present had a conservation score of five making it a 'local' conservation value species. Water beetles (Haplidae) and freshwater leeches (Glossiphononiidae) such as *Helobdella stagnalis*, also featured in small quantities. P19 received a CCI score 12.5 which is interpretated as a fairly high conservation score.

P20

3.4.10 The P20 pond was approximately 2,939 m^2, it had zero shading and 60% emergent plant cover. The substrate was made up of entirely silt/clay. There was absence of an inflow and no indication that the pond margin had been grazed.

3.4.11 The macrophyte community at P20 featured a total of six species. Four of which were emergent plants; great willowherb, marsh willowherb, broadleaf cattail and saltmarsh tuber-bulrush. It also comprised of two species of submerged plants: Eurasian watermilfoil and common water-crowfoot, both with a rarity score of two. None of the macrophyte taxa identified during the surveys were protected.

3.4.12 The macroinvertebrate community at P20 had greatest amount of different taxa with fifteen total. It featured four species with a conservation score of five making them species of 'local' conservation value. This included two species of water boatman *Micronecta scholtzi* and *Cymatia bonsdorffi*, one water beetle *Helochares lividus* and one caddisfly *Agraylea sexmaculata*. There was also one species of water boatman, *Sigara limitata* with a conservation score of 6 making it regionally notable. The blue-tailed damselfly, southern hawker and the black-tailed skimmer were among some of the dragonfly and damselfly species that made up 31% of the macroinvertebrate community at P20. Other species that featured included the mayfly *Cloen dipterum*, tribes of non-biting midges (Tanypondinae, Orthocladiinae and Tanytarsini) and pygmy backswimmer. This pond received a CCI score of 13.6 making it a fairly high conservation value.

3.5 Fish

3.5.1 eDNA samples were collected from watercourses; WC1, Lead Brook and ponds; P28, P20 and P19. No DNA was available to amplify from the pond sites P28 and P20 suggesting no fish species were present.

3.5.2 In total seven species were identified across all three sites (**Table 16**). They included the protected species European eel as well as common bream *Abramis brama*, carp sp., Leuciscus sp. (which includes dace *Leuciscus leuciscus* and ide *Leuciscus idus*), roach *Rutilus rutilus*, three spined-stickleback *Gasterosteus aculeatus*, and European perch *Perca fluviatilis*.

3.5.3 That said, given that only one Cyprinus species exists in the UK, this is likely to be common carp *Cyprinus carpio* as the known invasive carps within the UK are from different genus'. In this instance, common carp has been substituted in here based on expert judgement.

WC1

3.5.4 The fish community at WC1 was dominated by European eel 95.88%, with a small percentage of European perch 2.63%.

Lead Brook

3.5.5 Roach was the most dominant species (37.28%) at Lead Brook, followed by perch (34.81%), common bream (17.42%) and European eel (4%). A small amount of eDNA could only be identified to genus level. Specifically, common carp (2.15%) and Leuciscus sp. potentially dace or ide (1.99%).

P19

3.5.6 eDNA analysis for WP1 revealed the presence of only one fish species; three-spined stickleback.

Table 16: Percentage of amplifiable DNA within each eDNA sample for fish species

Species	WC1		Lead Brook		P19	
	% of sample	Read Count	% of sample	Read Count	% of sample	Read Count
Common carp* (*Cyprinus carpio*)	-	-	2.15	196	-	-
Common bream (*Abramis brama*)	-	-	17.42	1590	-	-
European eel (*Anguilla anguilla*)	95.88	21965	4.00	365	-	-

Species	WC1		Lead Brook		P19	
	% of sample	Read Count	% of sample	Read Count	% of sample	Read Count
Leuciscus sp.	-	-	1.99	182	-	-
Perch (*Perca fluviatilis*)	2.63	603	34.81	3177	-	-
Roach (*Rutilus rutilus*)	-	-	37.28	3403	-	-
Three spined-stickleback (*Gasterosteus aculeatus*)	-	-	-	-	99.01	38710
Total % fish DNA amplified**	98.51	22,568	97.65	8,913	99.01	38,710

* Species inferred through expert judgement.
** non-fish species were also included in the amplified DNA results. As these are not of interest to Aquatic Ecology they have not been included.

4. Discussion

4.1 Summary

4.1.1 There are three statutory designations within 2 km of the Site that need to be considered in the construction and operational phase of the Proposed Development due to the associated aquatic features that form part of their designation, which could be impacted by any proposed crossing points and/or outfalls.

4.1.2 The overall status of the two WFD waterbodies located within 2 km of the Site, the Swinchiard Brook and Wepre Brook, are of good and moderate ecological status respectively according to the WFD Directive, with the RNAG suggesting water quality pressures from phosphate inputs.

4.2 Aquatic Macrophytes

4.2.1 No notable aquatic macrophytes were identified within the desk study within 5 km of the Site. Three invasive non-native species were identified; parrots feather, Himalayan balsam and Japanese knotweed. All three are listed in Schedule 9 of the Wildlife and Countryside Act 1981 (as amended) and parrots feather is also listed in the Invasive Alien Species (Enforcement and Permitting) Order 2019. Therefore, it is an offence to plant, or otherwise cause to grow (including allowing to spread), listed plant species in the wild. If transported off site, there is a duty of care with regards to the disposal of any part of the plant that may facilitate establishment in the wild and cause environmental harm (as per the Environmental Protection Act 1990). The legislation also makes it an offense to release, or allow to escape, listed species (or species not ordinarily resident in and is not a regular visitor to Great Britain in a wild state) into the wild.

4.2.2 No notable or protected species were recorded at any of the macrophyte survey locations. Also, no macrophyte INNS or non-native species were recorded. All species were common and widespread, and highly likely to be present in the wider landscape.

4.2.3 The three survey locations that were ponds (P28, P19 and P20) were considered non-priority ponds. The semi-tidal pond P28 was considered very poor and featured no macrophytes. P19 was classified as poor and only had two macrophytes. Site P20 was given a moderate classification, with 6 macrophytes being noted. It should be noted, that these classifications are based on data collected outside of the optimal survey season for PSYM surveys. Consequently, this result should be treated with caution as it may not constitute an accurate estimate of status.

4.3 Aquatic Macroinvertebrates

4.3.1 Two species of note were identified in the desk study within 2 km of the Site but within the Site; the cranefly *Cheilotrichia imbuta* and the true fly *Dicranomyia chorea*. These species are listed as IUCN Notable and Threatened respectively.

4.3.2 One invasive non-native species was also identified on Wepre Brook 1.5 km from Site; Chinese mitten crab, which is listed in Schedule 9 of the Wildlife and Countryside Act 1981 (as amended) and in the Invasive Alien Species (Enforcement and Permitting) Order 2019. It is therefore an offence to release or allow the species to escape into the wild.

4.3.3 A total of six notable macroinvertebrate species were recorded from the Autumn 2024 samples. Three different water boatman which were deemed to be local species: *M. scholtzi*, *C. bonsdorffi* and *P. concinna*. Another two local species recorded were the caddisfly *A. sexmaculata* and the beetle *H. lividus*. There was also one regionally notable species, the water boatman *S. limitata*. All were found at pond P20 except *P. concinna* which was recorded at P19. Despite being notable species, there are no specific designations for any of the species mentioned above.

4.3.4 There were two non-native non-invasive species recorded across the autumn surveys. The New Zealand mud snail *P. antipodarum* was sampled at WC5, and the freshwater shrimp *C. pseudogracilis/floridanus* was documented at Lead Brook. Although the presence of these non-native and non-invasive macroinvertebrate species does not constitute any statutory legislative constraints, any in-channel work deemed to be required should incorporate best practice biosecurity procedures.

4.3.5 From the surveys that were undertaken, it was found that all running watercourses sites (WC1, Lead Brook and WC5) shared a typical macroinvertebrate community. With them either being considered sedimented or moderately sedimented and having moderate or low sensitivity to reduced flows. All had WHPT-NTAXA scores of above 10, with Lead Brook in particular being very diverse having 43 differing taxa. This was also reflected in the WHPT-ASPT scores with the survey locations either being of moderate or low conservation value, suggesting habitat pressures. Analysis by RICT showed that all survey locations received a moderate WFD classification for invertebrates. This indicated that all survey locations had generally good water quality, but lack of habitat diversity is a restricting factor in the condition of the macroinvertebrate community present.

4.3.6 The surveys that were carried out on the pond sites (P28, P19 and P20) possessed varying macroinvertebrate communities. Site P28 encompassed a community that would be partially adapted to brackish conditions. With species such as the saltwater amphipod *C. volutator*, the brackish mud snail *H. ulvae* and the brackish ragworm *N. diversicolor*. The site was considered to be of moderate conservation value. It shared a low (10 or below) WHPT-NTAXA score with the other pond P19 showing a lack of diversity. Site P19 and P20 had a mutual CCI score interpretation, with both being of fairly high conservation value. P20 differed as had a high WHPT-NTAXA score of 16 and contained five notable species. All pond sites provide useful habitats for the communities that inhabit them. P19 most likely contains the least amount of habitat diversity which is reflected in the community sampled. Form the PSYM analysis; P28 was deemed very poor, P19 was poor and P20 was moderate. All pond survey locations were perceived to not be priority ponds.

4.4 Fish

4.4.1 European eel have been identified within the desk study as well as being identified in eDNA results within WC5 and Lead Brook. European eel is listed as Critically Endangered on the IUCN Red List of Threatened Species. It is also a Section 41 Species of Principle Importance (SPI) for the purpose of conserving of biodiversity under the Natural Environment and Rural Communities (NERC) Act 2006 (Ref 27). The species is protected under the Eels (England and Wales) Regulations 2009 (Ref 36), as well as the Salmon and Freshwater Fisheries Act (SAFFA) 1975 (Ref 37) (as amended under the Environment Act 1995).

4.4.2 The desk study also showed protected species of Atlantic salmon, brown/sea trout, and bullhead on nearby freshwater WFD brooks - Swinchiard Brook and Wepre Brook. These are within 2 km of the Site and are connected to the Dee Estuary which WC5, Lead Brook and WC1 also have a confluence with. Therefore, there is the potential for these species to migrate up these watercourses. Atlantic salmon and brown/sea trout are a Section 41 SPI for the purpose of conserving of biodiversity under the NERC Act 2006 (Ref 33). The species are protected under the SAFFA 1975 (Ref 37) (as amended under the Environment Act 1995).

5. Summary

Aquatic Macrophytes

5.1.1 The surveys demonstrated the aquatic macrophyte community of Lead Brook was of high biological quality. This could not be determined for other watercourses due to the lack of plant species present.

5.1.2 No notable species were recorded on any of the survey locations. Nor were any species recorded present on the list of priority species in the Wales Environment Act 2016 (Ref 16).

5.1.3 No non-native or invasive species were found on the surveys. However, three INNS species were identified in the desk study; parrots feather, Himalayan balsam and Japanese knotweed within 1 km of the Site.

Aquatic Macroinvertebrates

5.1.4 The surveys found that the survey locations contained a macroinvertebrate community adapted to sedimented or moderately sedimented habitats and having a moderate or low sensitivity to reduced flows. The survey results indicated water quality to be Poor, Polluted or Impacted apart from Lead Brook which was Moderate, moderately impacted and pond P20 which was Good, Clean but slightly impacted.

5.1.5 Five notable species (water boatman: *M. scholtzi*, *C. bonsdorffi* and *P. concinna*, caddisfly: *A. sexmaculata* and the beetle *H. lividus*) were identified from the surveys in pond P20 and another one (*P. concinna*) in P19. Two other notable species (the cranefly *Cheilotrichia imbuta* and the true fly *Dicranomyia chorea*) were identified in the desk study within 2 km of the Site. Although notable, there are no specific designations for these species.

5.1.6 Two non-native non-invasive were recorded during the surveys; The New Zealand mud snail *P. antipodarum* at WC5 and the freshwater shrimp at Lead Brook *C. pseudogracilis/floridanus*. With a single INNS; Chinese mitten crab, identified in the desk study which is listed in the Schedule 9 of the Wildlife and Countryside Act 1981 (as amended) and in the Invasive Alien Species (Enforcement and Permitting) Order 2019. Making it an offence to release or allow the species to escape into the wild.

Fish

5.1.7 The protected species; European eel, was identified both through the eDNA surveys of WC5 and Lead Brook and in the desk study. The desk study also identified protected species; Atlantic salmon, brown/sea trout, and bullhead on nearby freshwater WFD brooks - Swinchiard Brook and Wepre Brook. These are within 2 km of the Order limits and are all connected to the Dee Estuary which WC5, Lead Brook and WC1 have a confluence with. European eel, Atlantic salmon and brown/sea trout are a Section 41 SPI for the purpose of conserving of biodiversity under the NERC Act 2006. The species are also protected under SAFFA 1975 (as amended under the Environment Act 1995).

5.1.8 No fish INNS were recorded.

References

Ref 1. Cofnod (2024), Cofnod Environmental Records. Available at: https://www.cofnod.org.uk/Home (Accessed 31/07/2025).

Ref 2. NBN Trust (2024), The National Biodiversity Network (NBN) Atlas. https://ror.org/00mcxye41. NBN Atlas occurrence download at https://nbnatlas.org accessed on (date of download, 24 April 2024).

Ref 3. Natural Resources Wales (NRW) (2024), Aquatic receptor survey data. Contains Natural Resources Wales information © Natural Resources Wales and database right. All rights reserved.

Ref 4. Natural Resources Wales (NRW) (2024), Reasons for not achieving Good status (RNAG) data. Contains Natural Resources Wales information © Natural Resources Wales and database right. All rights reserved.

Ref 5. Environment Agency (2024), Environment Agency Ecology and Fish Data Explorer. Available at: EA Ecology & Fish Data Explorer. (Accessed 24/02/2025).

Ref 6. Ordnance Survey (2024), Ordnance Survey Mapping.

Ref 7. Defra (2024), MAGiC Map. Available at: Magic Map Application (defra.gov.uk) (Accessed 31/07/2025).

Ref 8. Welsh Government (2024), DataMapWales. Available at: Home | DataMapWales (gov.wales) (Accessed 31/07/2025).

Ref 9. WFD-UKTAG (2014), UKTAG River Assessment Method Macrophytes and Phytobenthos: Macrophytes (River LEAFPACS2). Stirling: Water Framework Directive – United Kingdom Advisory Group.

Ref 10. The British Standards Institution (2014), BS EN 14184:2014 Water quality. Guidance for the surveying of aquatic macrophytes in running waters. London: BSI

Ref 11. Pond Action (2002), A guide to monitoring the ecological quality of ponds and canals using PSYM. Pond Action, Oxford.

Ref 12. WFD-UKTAG (2021), UKTAG River Assessment Method Benthic Invertebrate Fauna: Invertebrates (General Degradation): Whalley, Hawkes, Paisley & Trigg (WHPT) metric in River Invertebrate Classification Tool (RICT). Stirling: Water Framework Directive - United Kingdom Advisory Group.

Ref 13. WFD-UKTAG (2014), UKTAG River Assessment Method Macrophytes. Retrieved from https://www.wfduk.org/resources/rivers-macrophytes. (Accessed 31/07/2025).

Ref 14. JNCC (2023), Conservation Designations for UK Taxa. Retrieved from https://hub.jncc.gov.uk/assets/478f7160-967b-4366-acdf-8941fd33850b (Accessed 31/07/2025).

Ref 15. UK Government (2016), Environment (Wales) Act 2016, available at: Environment (Wales) Act 2016 (legislation.gov.uk) (Accessed 31/07/2025).

Ref 16. Wales Biodiversity Partnership (2024), Environment (Wales) Act 2016. Available at: https://www.biodiversitywales.org.uk/en/legislation-guidance/environment-wales-act/#:~:text=Environment%20(Wales)%20Act%202016,-The%20Environment%20Act&text=Biodiversity%20and%20well%2Dfunctioning%20ecosystems,and%20contribute%20to%20sustainable%20development. (Accessed 31/07/2025).

Ref 17. Environment Agency, (2017). Freshwater macro-invertebrate sampling in rivers Operational Instruction 018_08, Bristol: Environment Agency.

Ref 18. Environment Agency (2014). Freshwater macro-invertebrate analysis of riverine samples Operational Instruction 024_08, Bristol: Environment Agency.

Ref 19. Chadd, R. & Extence, C. (2004). The conservation of freshwater macroinvertebrate populations: a community-based classification scheme. *Aquatic Conservation: Marine and Freshwater Ecosystems,* pp. 14: 597-624

Ref 20. Extence, C., Balbi, B., & Chadd, R. (1999), River flow indexing using British benthic macroinvertebrates: a framework for setting hydroecological objectives. Regulated Rivers: Research and Management, 15: 543-574.

Ref 21. Extence, C., Chadd, R., England, J., Dunbar, M., Wood, P., & Taylor, E. (2013), The assessment of fine sediment accumulation in rivers using macro-invertebrate community response. River Research and Applications, 29: 17–55.

Ref 22. WFD-UKTAG (2023). UKTAG River Assessment Method Benthic Invertebrate Fauna: Invertebrates (General Degradation): Whalley, Hawkes, Paisley & Trigg (WHPT) metric in River Invertebrate Classification Tool (RICT)., Stirling: Water Framework Directive - United Kingdom Advisory Group.

Ref 23. Freshwater Biological Association, n.d., River Invertebrate Classification Tool (RICT). Retrieved from https://www.fba.org.uk/rivpacs-and-rict/river-invertebrate-classification-tool (Accessed 31/07/2025).

Ref 24. Nature Metrics (2024), Sampling Strategies for Aquatic Environments.

Ref 25. UK Government (1981), Wildlife and Countryside Act 1981. Online. Available at: https://www.legislation.gov.uk/ukpga/1981/69 (Accessed 31/07/2025).

Ref 26. UK Government (2019), The Invasive Alien Species (Enforcement and Permitting) Order 2019. Online. Available at: https://www.legislation.gov.uk/uksi/2019/527/contents (Accessed 31/07/2025).

Ref 27. UK Government (1979), Convention on the Conservation of European Wildlife and Natural Habitats (1979). Available at: Directive - 92/43 - EN - Habitats Directive - EUR-Lex (Accessed 31/07/2025).

Ref 28. UK Government (1998), The Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR Convention) (1998) Available at: Directive - 92/43 - EN - Habitats Directive - EUR-Lex (Accessed 31/07/2025).

Ref 29. European Commission (1992), Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora

Ref 30. JNCC (2007), UK BAP List of UK Priority Species 2007. Online. Available at: https://data.jncc.gov.uk/data/98fb6dab-13ae-470d-884b-7816afce42d4/UKBAP-priority-terrestrial-mammals.pdf (Accessed 31/07/2025).

Ref 31. UK Government (2017), The Conservation of Habitats and Species Regulations 2017. Online. Available at: The Conservation of Habitats and Species Regulations 2017 (Accessed 31/07/2025).

Ref 32. International Union for Conservation of Nature (IUCN) Red List of Threatened Species

Ref 33. UK Government (2006), Natural Environment and Rural Communities (NERC) Act 2006. Available at: https://www.legislation.gov.uk/ukpga/2006/16/contents (Accessed 31/07/2025).

Ref 34. Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention) 1983

Ref 35. The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (1975).

Ref 36. UK Government (2009), The Eels (England and Wales) Regulations 2009. Available at The Eels (England and Wales) Regulations 2009 (legislation.gov.uk) (Accessed 31/07/2025).

Ref 37. UK Government (1975), Salmon and Freshwater Fisheries Act (SAFFA) 1975 Online. Available at: https://www.legislation.gov.uk/ukpga/1975/51 (Accessed 31/07/2025).

Ref 38. Garrison, J.L., 1994. Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and the debate over sustainable use. *Pace Envtl. L. Rev.*, *12*, p.301.

Annex A: Macrophyte Taxa List

TCV	Percentage cover for the macrophyte species
C1	<0.1%
C2	0.1 to 1%
C3	1 to 2.5%
C4	2.5 to 5%
C5	5 to 10%
C6	10 to 25%
C7	25 to 50%
C8	50 to 75%
C9	>75%

Table A 1: Macrophyte taxa lsit and associated cover values for watercourses WC1 and Lead Brook

Common name	Scientific name	WC1	Lead Brook
Bittersweet	*Solanum dulcamara*	C3	
Willow moss	*Fontinalis antipyretica*		C6

Table A 2: Macrophyte taxa list and associated cover values for ponds P28, P19 and P20

Common name	Scientific name	P28	P19	P20
Yellow-green algae	*Vaucheria sp.*		C8	
Saltmarsh tuber-bulrush	*Bolboschoenus maritimus*		C6	C8
Common reed	*Phragmites australis*		C6	
Blanketweed agg.	*Spirogyra sp.*			C4
Pointed spear-moss	*Calliergon cuspidatum*			C6
Eurasian watermilfoil	*Myriophyllum spicatum*			C6
Common water-crowfoot	*Ranunculus aquatilis*			C7
Broadleaf cattail	*Typha latifolia*			C7
Great willowherb	*Epilobium hirsutum*			Present
Marsh willowherb	*Epilobium palustre*			Present

Annex B: Community Conservation Index (CCI)

B.1.1. The Community Conservation Index (Chadd & Extence, 2004) allows a classification of the nature conservation value associated with a macroinvertebrate community. The CCI score for one sample is derived from individual Conservation Scores (CS), assigned to some species of aquatic macroinvertebrates and relating closely to the available published Red Data Books and subsequently updated Red Lists. Conservation Scores assigned to individual species vary from 1 to 10, as detailed on the **Table B 1** below. The derived CCI scores generally vary from 0 to > 20, as detailed in the **Table B 2** below. The **Table B 2** below provides a guide to interpreting CCI scores.

Table B 1: Conservation Scores from the Community Conservation Index (from Chadd & Extence, 2004)

Conservation Score	Relation to Red Data Books
10	RDB1 (Endangered)
9	RDB2 (Vulnerable)
8	RDB3 (Rare)
7	Notable (but not RDB status)
6	Regionally notable
5	Local
4	Occasional (species not in categories 10-5, which occur in up to 10% of all samples from similar habitats)
3	Frequent (species not in categories 10-5, which occur in up to >10-25% of all samples from similar habitats)
2	Common (species not in categories 10-5, which occur in up to >25-50% of all samples from similar habitats)
1	Very common (species not in categories 10-5, which occur in up to >50-100 % of all samples from similar habitats)

Table B 2: General guide to CCI scores (from Chadd & Extence, 2004)

CCI Score	Description	Interpretation
0 to 5.0	Reaches supporting only common species and/or community of low taxon richness	Low conservation value
> 5.0 to 10.0	Reaches supporting at least one species of restricted distribution and/or a community of moderate taxon richness	Moderate conservation value
> 10.0 to 15.0	Reaches supporting at least one uncommon species, or several species of restricted	Fairly high conservation value

CCI Score	Description	Interpretation
	distribution and/or a community of high taxon richness	
> 15.0 to 20.0	Reaches supporting several uncommon species, at least one of which may be nationally rare and/or a community of high taxon richness	High conservation value
> 20.0	Reaches supporting several rarities, including species of national importance and/or a community of very high taxon richness	Very high conservation value

Annex C: Lotic-Invertebrate Index of flow Evaluation (LIFE)

C.1.1 The Lotic-Invertebrate Index for Flow Evaluation (LIFE) provides an assessment of the impact of variable flows on benthic macroinvertebrate communities (Extence, Balbi, & Chadd, 1999). Under the assessment, individual species of aquatic macroinvertebrates are assigned to a flow group varying from I to VI, as detailed on the **Table C 1** below. The LIFE score for a macroinvertebrate sample is then derived (mean of individual scores) from individual taxon scores and abundances, as detailed in **Table C 2**. LIFE scores for a macroinvertebrate sample ranges from 1 to 12, where highest scores describe communities adapted to rapid flows.

Table C 1: Flow groups used to derive LIFE scores (from Extence, Balbi & Chadd, 1999)

LIFE Score Group	Description	Mean Current Velocity
I	Taxa primarily associated with rapid flows	Typically > 100 $cm.s^{-1}$
II	Taxa primarily associated with moderate to fast flows	Typically 20 to 100 $cm.s^{-1}$
III	Taxa primarily associated with slow or sluggish flows	Typically < 20 $cm.s^{-1}$
IV	Taxa primarily associated with (usually slow) and standing waters	
V	Taxa primarily associated with standing waters	
VI	Taxa frequently associated with drying or drought impacted sites	

Table C 2: LIFE scoring matrix combing flow groups and abundance categories (from Extence, Balbi & Chadd, 1999)

Flow Groups	Abundance Categories			
	A (1 to 9)	B (10 to 99)	C (100 to 999)	D/E (> 1000)
I	9	10	11	12
II	8	9	10	11
III	7	7	7	7
IV	6	5	4	3
V	5	4	3	2
VI	4	3	2	1

Annex D: Proportion of Sediment-sensitive Invertebrates (PSI)

D.1.1 The Proportion of Sediment-sensitive Invertebrates (PSI) index allows an assessment of the extent to which a water body is composed of, or covered by, fine sediments (Extence, et al., 2013). Under this system, individual species of aquatic macroinvertebrates are assigned a Fine Sediment Sensitivity Rating (FSSR) as detailed in **Table D 1**, and abundance rating based on LIFE scores as detailed in **Table D 2**. The PSI score for the aquatic macroinvertebrate sample is then derived from the individual species scores and abundances, as detailed in **Table D 3**. The PSI score corresponds to the percentage of fine sediment-sensitive taxa present in a sample and ranges from 0 to 100, with low scores corresponding to waterbodies with high fine sediment cover.

Table D 1: Fine Sediment Sensitivity Rating (FSSR) groups used to derive PSI scores

FSSR group	Description
A	Highly sensitive
B	Moderately insensitive
C	Moderately insensitive
D	Highly insensitive

Table D 2: Abundance categories and scoring matrix used to derive PSI scores FSSR group

FSSR group	Abundance Categories			
	A (1 to 9)	B (10 to 99)	C (100 to 999)	D/E (> 1000)
A	2	3	4	5
B	2	3	4	5
C	1	2	3	4
D	1	2	3	4

Table D 3: Interpretation of PSI scores

PSI	Description
81-100	Minimally sedimented
61-80	Slightly sedimented

PSI	Description
41-60	Moderately sedimented
21-40	Sedimented
0-20	Heavily sedimented

Annex E: Whalley, Hawkes, Paisley & Trigg (WHPT) Metric

E.1.1 There are approximately 4,000 species of aquatic macroinvertebrates in the British Isles. To simplify the analysis of the samples and the data we do not identify individual species but only the major types (taxa), mostly at the family taxonomic level. A key piece of information is the number of different taxa at a site. A fall in the number of taxa indicates ecological damage, including pollution (organic, toxic and physical pollution such as siltation, and damage to habitats or the river channel).

E.1.2 The WHPT scoring system (WFD-UKTAG, 2023) is based upon the sensitivity of macroinvertebrate families to organic pollution. It replaces the Biological Monitoring Working Party (BMWP) system (Hawkes, 1997) previously used in the UK.

E.1.3 The WHPT system assigns a numerical value to about 100 different taxa (known as the WHPT-scoring taxa) according to their sensitivity to organic pollution. In addition to the presence of macroinvertebrate taxa at a sampling Reach, as in the BMWP scoring system, the WHPT system also uses another type of information, this being the abundances of different scoring taxa.

E.1.4 Taxa abundances are classified in four categories (Class 1: 1 to 10 individuals, Class 2: 11 to 100 individuals, Class 3: 101 to 1,000 individuals, and Class 4: > 1,000 individuals). A score (Pressure Sensitivity Scores (PSs) is then assigned to each taxa, depending of the taxa sensitivity and abundances recorded.

E.1.5 The total WHPT score for a sample corresponds to the sum of PSs of scoring taxa recorded. The Average Score Per Taxon (ASPT) values are calculated as the Sum PSs divided by the number of scoring taxa (NTAXA). As such, three metrics are calculated:

i. WHPT score
ii. NTAXA
iii. ASPT

E.1.6 Some animals are more susceptible to organic pollution than others, and the presence of sensitive species indicates good water quality. This fact is taken into account by the WHPT metrics.

E.1.7 The most useful way of summarising the biological data was found to be one that combined the number of taxa and the ASPT. The best quality is indicated by a diverse variety of taxa, especially those that are sensitive to pollution. Poorer quality is indicated by a smaller than expected number of taxa, particularly those that are sensitive to pollution. Organic pollution sometimes encourages an increased abundance of the few taxa that can tolerate it. However, maximum achievable values will vary between geological regions. For example, pristine lowland streams in East Anglia will always score lower than pristine Welsh mountain streams because they are unable to support many of the high-scoring taxa associated with fast flowing habitat. WHPT scores and ASPT for different types watercourse are

dependent on the quality and diversity of habitat, natural water chemistry (associated with geology, distance from source etc.), altitude, gradient, time of year the sample was taken and other factors.

Annex F: Macroinvertebrate Taxa List

Table F 1: Macroinvertebrate taxa list for Autumn 2024 surveys

Family	Species	WC 1	P2 8	Lead Brook	WC 5	P19	P2 0
Flatworms							
Dendrocoelidae	*Dendrocoelum lacteum*			7			
Planariidae	*Polycelis sp.*			7			
Planariidae	*Polycelis felina*			28			
Snails							
Dugesiidae	*Schmidtea lugubris/polychroa*			158			
Lymnaeidae	Lymnaeidae (juvenile / damaged)			50			
Lymnaeidae	*Stagnicola sp.*			2			
Lymnaeidae	*Ampullaceana balthica*	2		6			15
Hydrobiidae	*Hydrobia ulvae*		20				
Hydrobiidae	*Potamopyrgus antipodarum*				40		
Bithyniidae	*Bithynia tentaculata*			6			
Planorbidae	*Gyraulus albus*			17			
Planorbidae	*Gyraulus crista*			1			
Limpets and Mussels							
Sphaeriidae	*Sphaerium sp.*			142			
Sphaeriidae	*Sphaerium corneum*			11			
Sphaeriidae	Pisidium/Euglesa/Odhneripisidium	15			3		
Dreissenidae	*Dreissena polymorpha*			4			
Worms							
Oligochaeta	Oligochaeta	15			80		20
Lumbricidae	*Eiseniella tetraedra*			5			
Nereididae	*Nereis diversicolor*		20				
Leeches							
Glossiphoniidae	*Theromyzon tessulatum*					1	
Glossiphoniidae	*Glossiphonia complanata*			3	25		

Family	Species	WC 1	P28	Lead Brook	WC 5	P19	P20
Glossiphoniidae	*Helobdella stagnalis*	2		11		2	
Mites							
Hydracarina	Hydracarina			5	1	2	1
Oribatei	Oribatei			1			
Crustaceans							
Ostracoda				400			
Cladocera						*Present	20
Gammaridae	*Gammarus sp.*			56			
Gammaridae	*Gammarus pulex/fossarum agg.*			24			
Gammaridae	*Gammarus pulex*	120		16	100		
Crangonyctidae	*Crangonyx sp. (floridanus/pseudogracilis)*			4			
Corophidae	*Corophium sp.*		30				
Corophidae	*Corophium volutator*		120				
Asellidae	Asellidae		1	1130			
Asellidae	*Proasellus sp.*				10		
Asellidae	*Asellus aquaticus*			500	25		
Asellidae	*Proasellus meridianus*	15					
Mayflies							
Baetidae	Baetidae (juvenile / damaged)			95			
Baetidae	*Baetis sp.*	4		855			
Baetidae	*Baetis vernus*			190			
Baetidae	*Cloeon dipterum*						50
Caenidae	*Caenis sp.*			1			
Caenidae	*Caenis luctuosa / macrura*			2			
Caenidae	*Caenis horaria*						4
Damselflies							
Coenagrionidae	Coenagrionidae (juvenile / damaged)						20
Coenagrionidae	*Ischnura sp.*						65

Family	Species	WC 1	P28	Lead Brook	WC 5	P19	P20
Coenagrionidae	*Ischnura elegans*						15
Dragonflies							
Aeshnidae	*Anax sp.*						1
Aeshnidae	*Aeshna cyanea*						1
Libellulidae	*Orthetrum cancellatum*						5
True bugs							
Pleidae	*Plea minutissima*						50
Corixidae	Corixidae (nymph / damaged)					15	2
Corixidae	*Micronecta scholtzi*						3
Corixidae	*Cymatia bonsdorffi*						1
Corixidae	*Callicorixa praeusta*						5
Corixidae	*Corixa punctata*						1
Corixidae	*Sigara sp.*						4
Corixidae	*Sigara dorsalis*						1
Corixidae	*Sigara distincta*						1
Corixidae	*Sigara lateralis*					20	1
Corixidae	*Paracorixa concinna*					2	
Corixidae	*Sigara limitata*						2
Notonectidae	*Notonecta viridis*						1
Beetles							
Haliplidae	Haliplidae (larvae / damaged)					3	
Haliplidae	Haliplus ruficollis group					2	
Dytiscidae	Dytiscidae (larvae / damaged)	4			1		
Dytiscidae	*Agabus bipustulatus*				2		
Noteridae	*Noterus clavicornis*						5
Hydrophilidae	*Helophorus brevipalpis*						1
Hydrophilidae	*Anacaena globulus*				1		
Hydrophilidae	*Helochares lividus*						1
Hydraenidae	*Hydraena riparia*			1			
Scirtidae	Scirtidae (larvae / damaged)	12			25		
Elmidae	*Elmis aenea*			2			

Family	Species	WC 1	P28	Lead Brook	WC 5	P19	P20
Elmidae	*Limnius volckmari*			3			
Caddisflies							
Polycentropodidae	Polycentropodidae (juvenile / damaged)	1					
Psychomyiidae	*Lype sp.*	2					
Hydroptilidae	*Agraylea sexmaculata*						1
Hydroptilidae	*Hydroptila sp.*			10	1		
Leptoceridae	*Mystacides sp.*			5			
Leptoceridae	*Mystacides longicornis*						8
Sericostomatidae	*Sericostoma personatum*			1			
Trueflies							
Chironomidae	Tanypodinae	60		15	6	15	12
Chironomidae	Orthocladiinae	5		22		2	12
Chironomidae	Chironomini					5	
Chironomidae	Tanytarsini	10		5		8	12
Chironomidae	Prodiamesinae	10			1		
Tipulidae	Tipulidae			2	19		
Pediciidae	*Dicranota sp.*	1			1		
Limoniidae	Limoniidae	1					
Simuliidae	Simuliidae (damaged / juvenile)	15		155			
Simuliidae	*Simulium noelleri*			15			
Dixidae	*Dixa maculata / nubilipennis*				1		
Dixidae	*Dixa nebulosa*	1					
Dixidae	*Dixa submaculata*				1		
Psychodidae		9		5	4	1	
Empididae		1					
Ceratopogonidae					3		
Ptychopteridae	*Ptychoptera sp.*	10					
Culicidae	Culicidae	1					
Chaoboridae							3

Family	Species	WC 1	P28	Lead Brook	WC 5	P19	P20
Muscidae	*Limnophora sp.*	1	2	60			
Other taxa							
Lepidoptera					1		
Diptera sp.		2			1		

**Listed as present as exact quantification is not feasible*