The Great Grid Upgrade

Sea Link

Sea Link

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1.1 Introduction

1.1.1 The Sea Link Project (hereafter referred to as the 'Proposed Project') is a proposal by National Grid Electricity Transmission plc (hereafter referred to as National Grid) to reinforce the transmission network in the southeast and East Anglia. The Proposed Project is required to accommodate additional power flows generated from renewable and low carbon generation, as well as accommodating additional new interconnection with mainland Europe. This would be achieved by reinforcing the network with a High Voltage Direct Current (HVDC) Link between the proposed Friston substation in the Sizewell area of Suffolk and the existing Richborough to Canterbury 400 kV overhead line close to Richborough in Kent.

1.1.2 The purpose of this document is to:

- summarise relevant legislation and policy;
- describe the methodologies used for desk and field-based assessments;
- describe any limitations to the surveys undertaken; and
- detail the results of ecological surveys for aquatic receptors (macrophytes, macroinvertebrates and fish) conducted in relation to the Suffolk Onshore Scheme.

1.1.3 The baseline findings of this report provide information on any potential ecological constraints associated with aquatic ecology receptors, for incorporation into the **Application Document 6.2.2.2 Part 2 Suffolk Chapter 2 Ecology and Biodiversity** for the Suffolk Onshore Scheme and **Application Document 6.9 Water Framework Directive Assessment**.

1.1.4 Details of avoidance, mitigation, compensation and enhancement measures relating to aquatic receptors are not included in this report and are instead reported within **Application Document 6.2.2.2 Part 2 Suffolk Chapter 2 Ecology and Biodiversity**.

1.1.5 This appendix should be read in conjunction with the following figures:

- **Application Document 6.4.2.2.F Aquatic Ecology Survey Report**.

Scope

1.1.6 This report details the results of surveys undertaken to understand the aquatic macrophyte, macroinvertebrate and fish present within the Suffolk Onshore Scheme Order Limits through appropriate surveys.

1.1.7 The findings of aquatic ecological surveys within the Suffolk Onshore Scheme Order Limits have informed the ecological impact assessment and identification of mitigation measures (where required) which are reported in **Application Document 6.2.2.2 Part 2 Suffolk Chapter 2 Ecology and Biodiversity**.

Survey Area

1.1.8 A total of nine watercourses (including rivers, streams and ditches) were identified as requiring survey. These areas were identified from mapping data, aerial imagery and the proposed crossings and outfalls found in **Application Document 6.3.1.4.A Appendix 1.4.A Crossing Schedules**. The locations of these water courses are shown in **Application Document 6.4.2.2.F.2 Aquatic Ecology Suffolk Study Areas**.

Legislation, Policy and Guidance

1.1.9 This assessment has been undertaken within the context of the following relevant legislation, planning policies and guidance documents:

- Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (the 'Habitats Directive') (European Commission, 1992);
- The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (the 'Water Framework Directive' or WFD) (HM Government, 2017);
- The Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015 (HM Government, 2015);
- Nitrate Vulnerable Zones/Nitrates Directive (The Nitrates Directive 1991) (European Commission, 1991);
- The Bern Convention (1979) also known as the Convention on the Conservation of European Wildlife and Natural habitats (European Union, 1979);
- Convention on Wetlands of International Importance ('Ramsar convention') (United Nations Educational, Scientific and Cultural Organisation, 1971);
- Wildlife and Countryside Act 1981 (as amended) (the 'WCA') (HM Government, 1981);
- Natural Environment and Rural Communities (NERC) Act (2006)[1] (HM Government, 2006);
- Salmon and Freshwater Fisheries Act (SAFFA) 1975 (HM Government, 1975);
- Environmental Protection Act 1990 (HM Government, 1990);
- The Conservation of Habitats and Species Regulations 2010 (as amended) (HM Government, 2010);
- Eels (England and Wales) Regulations 2009 (HM Government, 2009);
- Invasive Alien Species (Enforcement and Permitting) Order 2019 (HM Government, 2019);
- UK Post-2010 Biodiversity Framework (JNCC, 2012);
- Bonn Convention 1979 (JNCC, 1979);
- European Union and Trade in Wild Fauna and Flora (European Union, 2015);
- Endangered Species of Wild Fauna and Flora (CITES) (United Nations, 1973); and

[1] Section 41 of the NERC Act (2006) provides a list of habitats and plant species of principal importance for nature conservation in England

- Oslo and Paris Conventions (OSPAR) 1992 (OSPAR Commission, 1992).

1.2 Methodology

Desk Study

1.2.1 A desk study was conducted to identify water bodies, designated sites and habitats within the Suffolk Onshore Scheme Order Limits and up to 2 km outside of the Order Limits. Where there was no or limited data, a wider search was completed up to 10 km outside of the Order Limits.

1.2.2 The Environment Agency's (EA) Catchment Data Explorer website (Environment Agency, 2024) was used to identify Water Framework Directive (WFD) rivers within or nearby the Suffolk Onshore Scheme Order Limits that could be influenced by construction or operation. Available information has been reviewed for the River Fromus (WFD water body ID: GB105035045980), New Hundred River (WFD water body ID: GB105035046260), River Alde – Ore (d/s confluence) (WFD water body ID: GB105035045950) and associated tributaries.

1.2.3 The EA Ecology and Fish Data Explorer (Environment Agency, 2024) was used to review ecological monitoring data within an approximate 5 km radius of the Suffolk Onshore Scheme Order Limits from the last 5 years. Data from a wider area or historical data were included where considered relevant (e.g. River Fromus macroinverebrate/fish data and smelt records).

1.2.4 Finally, historic crayfish records were reviewed using NBN Atlas (NBN Atlas Partnership, 2024).

1.2.5 Data provided by the local environmental records centre (Suffolk Biodiversity Information Service (SBIS) (Suffolk Biological Data Centre, 2024)) was used to identify the presence of any notable or non-native species within 2 km of the Suffolk Onshore Scheme Order Limits.

Zone of Influence

1.2.6 The potential impact(s) of a development are not always limited to the boundaries of the site concerned. A development may also have the potential to result in impacts upon ecologically important sites, habitats or species that are located beyond the site boundaries.

1.2.7 The area over which a development may impact ecologically important features is known as the ZOI. The ZOI is determined by the source/type of impact, the potential pathway(s) for that impact and the location and sensitivity of the ecologically important feature(s) beyond the Order Limits. The potential ZOI of a project in relation to aquatic ecology receptors (macrophytes, macroinvertebrates and fish) is used to determine the extent of the aquatic ecology survey and study areas.

1.2.8 The ZOI was determined as all suitable habitats within the Order Limits and connected adjacent habitats (watercourses and ponds). This was used to establish the required extent of the aquatic ecology surveys.

Aquatic Macrophyte Surveys

1.2.9 Aquatic macrophyte (plant) surveys were undertaken in July 2024 at three survey locations shown in **Application Document 6.4.2.2.F.2 Aquatic Ecology Suffolk Study Areas** (Table 1.1) led by a suitably qualified ecologist. These locations were chosen as the waterbodies have the greatest potential to be impacted by the Proposed Project. The Hundred River was originally to be surveyed centered on National Grid Reference (NGR) TM 42764 61351 where an outfall is proposed, however at the time of survey this reach was found to be dry and entirely colonised by a terrestrial plant community suggesting it is ephemeral in nature. Consequently, a separate survey was undertaken downstream where the Hundred River was consistently wet and possessed an aquatic macrophyte community. The recommended optimal period for undertaking aquatic macrophyte surveys is between 1 June and 30 September and should not be undertaken during or immediately after periods of high flow.

Table 1.1 Aquatic macrophyte survey locations and dates

Survey reach	National Grid Reference Start (downstream)	National Grid Reference Centre	National Grid Reference End (upstream)	Survey date
River Fromus	TM 38847 61988	TM 38850 62042	TM 38859 62097	22 July 2024
River Fromus trib.	TM 40402 61960	TM 40412 62000	TM 40421 62027	23 July 2024
New Hundred River	TM 43408 60828	TM 43371 60856	TM 43408 60828	23 July 2024

1.2.10 The aquatic macrophyte surveys followed guidance set out in the UKTAG River Assessment Method (Macrophytes and Phytobenthos) for use with LEAFPACS2 (WFD-UKTAG, 2014), which conforms to BS EN 14184:2014 Water quality - Guidance for the surveying of aquatic macrophytes in running waters (The British Standards Institution, 2014). The survey was carried out 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, detailed below (Table 1.2).

Table 1.2 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%

TCV	Percentage cover by macrophyte taxon
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%

1.2.11 Aquatic macrophyte data was processed through the River LEAFPACS2 calculator, available from the WFD UKTAG website (WFD-UKTAG, 2014). 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.
- Cover of filamentous green algae (ALG) – The percentage cover of filamentous green algae over the whole of the surveyed section.

1.2.12 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 Water Framework Directive (WFD) classification (High, Good, Moderate, Poor, or Bad) as shown in **Annex 2.F.1**. Alkalinity data should be obtained from monthly analysis of samples from each over a period of at least one year, whereas for the purpose of this report, alkalinity was based on the average of two samples collected during the different survey periods 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.

1.2.13 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 (WFD-UKTAG, 2014).

1.2.14 Aquatic macrophyte species were cross referenced against the JNCC Taxon Designations list (JNCC, 2023) to identify if any protected and/or notable species were recorded during the surveys.

Aquatic Macroinvertebrate Surveys

1.2.15 Aquatic macroinvertebrate surveys were undertaken at 10 sites in Autumn 2023, five sites in Spring 2024. These sites were chosen due to proposed watercourse crossings or outfalls in these areas. Three additional sites were completed in Autumn 2024 to provide data on riverfly species present on the River Fromus in relation to stakeholder concerns about the potential impact of the proposed bridge designs on dispersing riverfly species (**Annex 2.F.8**). Other watercourses within the Suffolk Order Limits were scoped out of survey as the Proposed Project is unlikely to cause a significant impact to any aquatic features within those watercourses. The specific locations and dates of the surveys are shown in Table 1.3 and **Application Document 6.4.2.2.F.2 Aquatic Ecology Suffolk Study Areas**. No surveys were undertaken during or immediately following periods of high flow in accordance with best practice guidance.

Table 1.3 Macroinvertebrate survey locations and dates

Survey site	Watercourse	National Grid Reference	Autumn 2023 survey date	Spring 2024 survey date	Autumn 2024 survey date
DN1	Ordinary watercourse	TM 46696 58132	21/11/2023	-	-
DN2	Ordinary watercourse	TM 46509 58172	21/11/2023	-	-
DN3	Ordinary watercourse	TM 46535 58360	21/11/2023	-	-
DN4	Ordinary watercourse	TM 46446 58519	21/11/2023	-	-
DN5	Ordinary watercourse	TM 46332 58254	21/11/2023	-	-
DN6	Ordinary watercourse	TM 40965 61397	22/11/2023	28/05/2024 Dry	-
DN7	River Fromus (eastern tributary)	TM 40452 62138	21/11/2023	28/05/2024 Dry	-
DN7A	Ordinary watercourse	TM 40680 61868	-	28/05/2024 Dry	-
DN8	Ordinary watercourse	TM 40211 62516	22/11/2023	-	-

Survey site	Watercourse	National Grid Reference	Autumn 2023 survey date	Spring 2024 survey date	Autumn 2024 survey date
WBN1	Hundred River	TM 46791 58431	22/11/2023	-	-
WBN2	River Fromus	TM 38861 62093	20/11/2023	28/05/2024	28/11/2024
WBN3	River Fromus (western tributary)	TM 38747 62182	-	28/05/2024	-
WBNx1	River Fromus	TM 38771 63161	-	-	28/11/2024
WBNx2	River Fromus	TM 38702 61084	-	-	28/11/2024

1.2.16 The aquatic macroinvertebrate surveys were undertaken by suitably qualified and experienced aquatic ecologists. Sampling procedures followed those standardised by the EA (Environment Agency, 2017), which conform to BS EN ISO 10870:2012 Water Quality – Guidelines for the selection of sampling methods and devices for benthic macroinvertebrates in fresh waters (The British Standards Institution, 2012). 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 FBA pattern kick net (mesh size: 1 mm). The habitats present were proportionally sampled through a combination of kick sampling and sweep sampling for three minutes followed by a one-minute active search of larger substrates in accordance with the standard methods. The samples collected were subsequently preserved in Industrial Methylated Spirit (IMS) for laboratory processing.

1.2.17 Each of the samples collected was sorted and analysed in a laboratory setting by suitably trained and experienced aquatic ecologists. Lists of the aquatic macroinvertebrate taxa present were produced in line with Environment Agency guidance (Environment Agency, 2014). The aquatic macroinvertebrate samples were identified to ‘mixed-taxon level’ using a stereo-microscope. Most groups were identified to species level (where practicable), except for 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.

1.2.18 Aquatic macroinvertebrate species were cross referenced against the JNCC Taxon Designations list (JNCC, 2023) to identify if any protected and/or notable species were identified. 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)

1.2.19 A Community Conservation Index (CCI) (Chadd & Extence, 2004) was calculated for each site as detailed in **Annex 2.F.2**. The CCI classifies many groups of aquatic macroinvertebrates according to their scarcity and nature conservation value in the UK 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. As a result, updated species scores were obtained from the Environment Agency, to take account of this new information (EA, *pers. comm*., 2023). These updated scores have been used within this report.

Lotic-invertebrate Index for Flow Evaluation (LIFE)

1.2.20 Lotic-invertebrate Index for Flow Evaluation (LIFE) scores were calculated (Extence, et al., 1999). 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 2.F.3**. 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 site to be determined so that effect of habitat changes such as sediment accumulation can be monitored.

Proportion of Sediment-sensitive Invertebrates (PSI)

1.2.21 Calculations were undertaken to determine the proportion of sediment sensitive macroinvertebrates present using the Proportion of Sediment-sensitive Invertebrates (PSI) index (Extence, et al., 2013). 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 2.F.4**. 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)

1.2.22 The aquatic macroinvertebrate data were analysed to generate the Whalley, Hawkes, Paisley & Trigg (WHPT) score Average Score Per Taxon (ASPT), and Number of scoring taxa (NTAXA) values, which provides an indication of the ecological quality in the watercourse (WFD-UKTAG, 2023). 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 2.F.5**). 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 an awareness of their potential limitations, and the site-specific context, as described in this report.

1.2.23 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” (WFD-UKTAG, 2023).

River Invertebrate Classification Tool (RICT)

1.2.24 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 (Freshwater Biological Association, n.d.).

1.2.25 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). Alkalinity data should be obtained from monthly analysis of samples from each over a period of at least one year, whereas here, alkalinity was based on the average of two samples collected during the survey visits, which is typical for an assessment of this type.

1.2.26 Furthermore, 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 ditches due the nature (i.e., not naturally permanently flowing condition) of the field drain habitats comprising the survey reaches.

River Fromus Habitat and Existing Bridges’ Appraisal

1.2.27 An aquatic and riparian habitat walkover survey was conducted of the River Fromus between Saxmundham (TM 38651 63388) and Gromford (TM 38490 58708), between the 27 and 29 November 2024. As part of this survey, the characteristics of existing bridges within the stretch of river surveyed, were recorded. This survey was undertaken in response to the Environment Agency’s concerns that inappropriately designed watercourse crossings may create a barrier to the movement of ‘weak dispersing polarotactic invertebrate taxa’, and in particular, migratory riverfly species. As part of this exercise a literature review on flying insects was also completed (**Annex 2.F.9**).

1.2.28 During the walkover, bank vegetation and habitats were identified using the Environment Agency (EA) River Habitat Survey criteria ((Environment Agency, 2004) as guidance, and river substrate and flow type mapped where possible. Each bridge encountered (**Application Document 6.4.2.2.F.3 River Fromus Bridge Locations**) was photographed and the height from water, construction materials and use was noted (Table 1.16). Outfall, pylon, phone/electricity cable locations and surrounding land use were also recorded.

1.2.29 The walkover was undertaken where land access had been agreed. Where access was not possible, observations from adjacent land parcels with access were made. Where this was not possible, a desk-based assessment has been conducted of the river bank habitats and bridges present using aerial imagery.

Fish Surveys

1.2.30 Fish surveys were scheduled to be undertaken at three sites in July 2024; The River Fromus, River Fromus eastern tributary and the Hundred River. These sites were chosen due to the direct impact of proposed outfalls into these WFD rivers and through consultation with the EA. Specific dates and locations are shown in Table 1.4 and **Application Document 6.4.2.2.F.2 Aquatic Ecology Suffolk Study Areas**. Both the River Fromus eastern tributary and Hundred River were found to be dry on arrival with a wetted area not seen for >500 m downstream of either proposed location. Therefore, surveys were only conducted on the River Fromus.

Table 1.4 Fish survey locations

Survey reach	National Grid Reference Start (downstream)	National Grid Reference Centre	National Grid Reference End (upstream)	Survey date	Method
River Fromus	TM3880861988	TM3886262110	TM3883762041	22 July 2024	Semi-quantitative electric fishing
River Fromus Eastern Tributary	NA	TM4041061979	NA	23 July 2024	Survey not completed
New Hundred River	NA	TM4276661348	NA	23 July 2024	Survey not completed

1.2.31 A semi-quantitative electric fishing survey was completed by a team of four experienced aquatic ecologists on the River Fromus at the site of the proposed bridge crossing, where safely accessible. The survey was completed to supplement existing fish monitoring data in the catchment, and as per best practice guidance *"counts of fish species present should be obtained from a single removal, using data either from the first pass of depletion sampling, or the catch from "semi-quantitative" catch-per-area sampling*" (WFD-UKTAG, 2008). Sampling procedure followed standard Environment Agency guidelines (Beaumont, et al., 2002). The survey was completed over a single run in an upstream direction using a bankside electrofishing kit consisting of an Electracatch WFC4 control box with Pramac 4000 generator and single anode. This equipment was chosen after careful consideration of water depth and stream width (i.e., depth < 0.8 m and stream width being an average of 4 m). The river reach surveyed was approximately 60 m in length between natural barriers (fallen tree and debris build up). Fish that were caught were placed in well aerated holding buckets on the river margins and identified to species level. Their fork length was measured to the nearest mm before being released safely and unharmed back into the watercourse.

Limitations

1.2.32 It should be noted that ecosystems are dynamic and constantly changing, and therefore species may move, or new species may be recorded in subsequent years. For this

reason and in accordance with current guidance, the field survey data detailed in this report are valid for two years from the date of the survey (CIEEM, 2018). After this date, updated surveys may be required, and advice should be sought from an appropriately qualified ecologist to determine the survey scope and methods.The EA regularly monitor river systems for various receptors in the area this data could be used alongside survey data.

1.2.33 Some watercourses within the Order Limits had limited visibility and access due to steep banks and dense vegetation. While this limited the ability to survey, it is believed that the watercourses were adequately accessed for the results of these surveys to be valid and sufficient to inform the EcIA.

1.2.34 The bridge and habitat appraisal was undertaken where land access had been agreed. Where access was not possible, observations from adjacent land parcels with access were made. Where this was not possible, a desk-based assessment was also conducted of the bank habitats and bridges present using aerial imagery.

1.2.35 Bridge assessments were undertaken from safe vantage points. Where the bridge use was a major road with no pedestrian access, assessment of the bridge use and construction materials was undertaken from adjacent land parcels where access was agreed and by aerial imagery. The width of the bridge was ascertained by using a measuring tool on aerial maps.

1.3 Results

Desk Study Results

Statutory and non-statutory designated sites

1.3.1 Statutory and non-statutory designated sites within 2 km of the Suffolk Onshore Scheme Order Limits were provided by the local records centers (Suffolk Biodiversity Information Service (SBIS)), and from desk based data searches.

1.3.2 A total of four international statutory and four non-statutory designated sites which contain aquatic ecology features as part of the reason for designation were identified (Table 1.5).

Table 1.5 International statutory and non-statutory designated aquatic sites within 2 km of the Suffolk Onshore Scheme Order Limits

Designation	Name	Reasons for Designation	Central National Grid Reference	Distance from Suffolk Onshore Scheme Order Limits
Statutory	Suffolk Coasts and Heaths AONB[1]	Freshwater marshland, river estuaries	TM 452 575	Within Order Limits

Designation	Name	Reasons for Designation	Central National Grid Reference	Distance from Suffolk Onshore Scheme Order Limits
	The Haven Aldeburgh LNR[2]	Shallow lagoons and large reedbeds	TM 467 578	Within Order Limits
	Alde – Ore Estuary SSSI, Ramsar, SPA[4]	Tidal rivers, Estuaries, Mud flats, Sand flats, Lagoons (including saltwork basins), salt marshes, Salt pastures, Salt steppes, shingle, Sea cliffs, Islets	TM 425 512	Approximately 0.1 km
	Alde-Ore & Butley Estuaries SAC[5]	Orfordness, Shingle Street, Havergate Island, and the Butley, Ore and Alde Rivers	TM 425 512	Approximately 0.1 km
Non-Statutory	Knodishall common	Habitat for aquatic invertebrates	TM423609	Approximately 0.3 km
	Benhall Green Meadows	Bordered by River Fromus inc. Brown sedge, greater pond's sedge, fool's water cress	TM387613	Approximately 0.5 km
	Aldeburgh Old Allotments	Open water with wet grassland and populations of Southern Marsh Orchid	TM458567	Approximately 1.5 km
	Leiston – Aldeburgh LNR – Church Farm Marshes	Lowland wetland including basin fen, valley fen, floodplain fen, water fringe fen, spring/flush fen and raised bog lagg	TM 463 597	Approximately 1.0 km

[1]Area of Outstanding Natural Beauty [2]Local Nature Reserve [3]Site of Special Scientific Interest [4]Special Protection Areas [5]Special Areas of Conservation

Water Framework Directive status

1.3.3 There are two waterbodies within the Suffolk Onshore Scheme Order Limits that are assessed as part of the Water Framework Directive Assessment (see **Application Document 6.9 Water Framework Directive Assessment**); the River Fromus and the New Hundred River. Both rivers fall within the Suffolk Coastal Operational Catchment.

The River Alde-Ore (d/s confluence) has also been added into scope due to its confluence with the River Fromus and potential for species to migrate between river catchments, particularly fish.

River Fromus

1.3.4 The River Fromus (WFD water body ID: GB105035045980) has a catchment area of 34.57 km^2 and is designated as 'not designated artificial or heavily modified' and having 'Poor' ecological status. Fish was deemed as 'Poor' with macroinvertebrates and macrophytes deemed 'Good' status. Quality elements that are preventing the catchment from achieving 'Good' ecological status are the physio-chemical quality elements (ammonia, dissolved oxygen, phosphate, temperature and pH) being high, with specific pollutants of Iron and Manganese having been identified as present in high quantities. In addition, the presence of priority hazardous substances including mercury and its compounds and Polybrominated diphenyl ethers (PBDE) have also contributed to towards the Poor ecological status.

1.3.5 The Reasons for Not Achieving Good status (RNAG) include diffuse and point source pollution from discharge and runoff and physical modification by the installation of barriers creating ecological discontinuity.

1.3.6 The Environment Agency (EA) have an objective of reaching overall 'Good' ecological status and 'Good' status for fish by 2027 for the River Fromus, but this has been given a low confidence of being achieved due to it being disproportionately expensive and having disproportionate burdens.

Hundred River

1.3.7 The Hundred River (WFD water body ID: GB105035046260) has a catchment area of 11.07 km^2 and is designated as 'Heavily Modified' and having 'Bad' ecological status. Fish was most recently rated as 'Bad' with macroinvertebrates and macrophytes rated as 'High' status. Quality elements that are preventing the catchment from achieving 'Good' ecological status are the physio-chemical quality elements; with dissolved oxygen classed as 'Bad', phosphate as 'Moderate'. The waterbody also previously failed for levels of Mercury and its compounds and PBDE.

1.3.8 The RNAG include point source pollution from sewage discharges and natural events such as low flow (not from drought) as well as drought, which impact the levels of dissolved oxygen and fish present.

1.3.9 The EA have an objective of reaching overall 'Moderate' ecological status by 2027. But this is given low confidence due to being disproportionately expensive and also technical infeasibility relating to fish and macroinvertebrates.

River Alde-Ore (d/s confluence)

1.3.10 River Alde-Ore (d/s confluence) (WFD water body ID: GB105035045950) has a catchment area of 9.112 km^2 and is designated as 'Heavily Modified' and having 'Poor' ecological status. Fish was most recently rated as 'Poor' in 2022 with macroinvertebrates and macrophytes rated as 'High' and 'Good' status respectively. Quality elements that are preventing the catchment from achieving 'Good' ecological status are the physio-chemical quality elements; with dissolved oxygen classed as

‘Poor’ and, phosphate as ‘Moderate’ and temperature and pH as ‘High’. The waterbody also failed for levels of Mercury and its compounds and PBDE.

1.3.11 The RNAG include diffuse and point source pollution from discharge and runoff and bad hydrological regime due to groundwater abstraction.

1.3.12 The EA had an objective of reaching overall ‘Moderate’ ecological status by 2015. But this was stated as being disproportionately expensive and also technically infeasible.

Notable Species

1.3.13 Four EA monitoring locations that have been surveyed within the last five years were identified within 5 km of the Suffolk Onshore Scheme Order Limits for fish and macroinvertebrate receptors (Table 1.6). A further 13 EA monitoring locations have been identified where data has been collected within the last 20 years. These have been included as they are within 5 km of the Suffolk Onshore Scheme Order Limits and were used to identify notable or non-native species that are present.

Table 1.6 EA monitoring locations within 5 km of the Suffolk Onshore Scheme Order Limits

River	Site Name	Site ID	Site National Grid Reference	Approximate proximity to Order Limits (km)	Last year surveyed	Group monitored
River Fromus	Saxmundham	618	TM 38700 63000	1.0	2012	Fish
	54843	54843	TM 38700 61100	1.0	2014	Macroinvertebrates
	Snape Watering	619	TM 38200 59900	2.0	2011	Fish
	Kelsale Manor	617	TM 38500 65200	2.3	2006	Fish
	149961	149961	TM 38230 58810	3.2	2012	Macrophyte
	54845	54845	TM 38500 58600	3.5	2018	Macroinvertebrates
	Abbey Farm A	27839	TM 38599 58005	4.2	2007	Fish
	Abbey Farm B	27840	TM 38659 58396	4.2	2007	Fish
Hundred River	Knodishall Common	631	TM 43400 60800	0.8	2017	Fish
	54912	54912	TM 46230 59670	3.8	2006	Macroinvertebrates
River Alde	U/S Farnham Bridge	33	TM 35900 60200	3.4	2024	Fish
	54768	54768	TM 36000 60100	3.8	2015	Macroinvertebrates

River	Site Name	Site ID	Site National Grid Reference	Approximate proximity to Order Limits (km)	Last year surveyed	Group monitored
	U/S Langham Bridge	35	TM 37292 58117	4.5	2024	Fish
	150126	150126	TM 37500 58100	4.5	2014	Macrophyte
	54769	54769	TM 37500 58150	4.5	2023	Macroinvertebrates
River Ore	54893	54893	TM 35800 58300	4.6	2022	Macroinvertebrates
	160106	160106	TM 35890 58170	4.6	2014	Macrophytes

1.3.14 Data from the EA Ecology and Fish Data Explorer showed three notable fish species located within 5 km of the Suffolk Onshore Scheme Order Limits on the River Fromus and adjacent watercourses; European eel (*Anguilla anguilla*), brown/sea trout (*Salmo trutta*) and brook lamprey (*Lampetra planeri*) (Table 1.7). European eel was found at the Saxmundham, River Fromus EA site in 2012 which is the closest to the Suffolk Onshore Scheme Order Limits. Brown/sea trout and brook lamprey have not been recorded on the River Fromus in the last ten years, with only one record of brown trout found here in 2007.

1.3.15 No records of notable fish species were found on or near the Hundred River.

1.3.16 It was also noted that although outside the ten-year span of the desk study, there was a confirmed record of European smelt (*Osmerus eperlanus*) by the EA in 2003 on the River Alde located downstream of the River Fromus upstream of Langham Bridge (TM 37292 58117). There have been no records of smelt in connected rivers in the area since. As this species is listed as a Biodiversity Action Plan (BAP) species, NERC Species of Principal Importance (SPI) and are a key indicator species under the WFD it has been considered further in this report.

Table 1.7 Notable fish species identified within 5 km of the Suffolk Onshore Scheme Order Limits with relevant designation/status

Species	Designation/Status	Number of records	Most recent record	Location
European eel (*Anguilla anguilla*)	Global Red List Post 2001 – Critically Endangered NERC Section 41 Biodiversity Action Plan 2007 Habitats Directive-Appendix II OSPAR Bonn Convention-Appendix II European Union and Trade in Wild Fauna and Flora-AB Eel (England and Wales) Regulations 2009 Salmon and Freshwater Fisheries Act (SAFFA) 1975 Suffolk Biodiversity Action Plan	9	09/05/2024 20/05/2020 05/07/2016 20/02/2012	River Alde (TM 37321 58133) River Alde (TM 40204 56167) River Alde (TM 35960 60228) River Fromus (TM 38700 63000)
Brown/sea trout (*Salmo trutta*)	Biodiversity Action Plan 2007 NERC Section 41	4	14/05/2024 09/05/2024	River Alde (TM 35960 60228) River Alde (TM 37321 58133)

Species	Designation/Status	Number of records	Most recent record	Location
Brook lamprey (*Lampetra planeri*)	Bern Convention - Appendix III Habitats Directive - Appendix II	4	09/05/2024 05/07/2016	River Alde (TM 37321 58133) River Alde (TM 35960 60228)

1.3.17 Two records of the notable macroinvertebrate species Great Silver Water Beetle (*Hydrophilus piceus*) were identified. This species is listed as Near Threatened under the International Union for Conservation of Nature (IUCN) Red List of Threatened Species (Foster, 2010). Both records were located near to Thorpeness on the Suffolk coast within 2 km of the Suffolk Onshore Scheme Order Limits.

1.3.18 No records of any notable species of aquatic macrophytes were identified in the desk study.

1.3.19 No records of American signal crayfish (*Pacifastacus leniusculus*) or white-clawed crayfish (*Austropotamobius pallipes*) were found within 10 km of the Suffolk Onshore Scheme Order Limits within the last ten years.

1.3.20 Six species of non-native species were identified in the desk study with a 2 km radius of the Suffolk Onshore Scheme Order Limits; fish: goldfish (*Carassius auratus*); macroinvertebrate: free-living freshwater amphipod *Crangonyx pseudogracilis/ floridanus*; macrophyte: Canadian waterweed (*Elodea canadensis*), *Potamopyrgus antipodarum*, least duckweed (*Lemna minuta*) and giant hogweed (*Heracleum mantagazzianum*) (Table 1.8). All of these were located either in ponds or on adjacent watercourses to the Suffolk Onshore Scheme Order Limits.

Table 1.8 Non-native species identified within 2 km of the Suffolk Onshore Scheme Order Limits with relevant designation/status

Species	Designation/Status	Number of records	Most recent record	Location
Goldfish (*Carassius auratus*)	Non-native	1	26/07/2010	TM 359 602 (3.3km W of Suffolk Onshore Scheme Boundary)
Free-living freshwater amphipod (*Crangonyx pseudogracilis/ floridanus*)	Non-native	11	09/09/2019	TM 3750 5815 (3.3 km SW of Suffolk Onshore Scheme Boundary)

Species	Designation/Status	Number of records	Most recent record	Location
Canadian waterweed (*Elodea canadensis*)	Wildlife and Countryside Act Schedule 9	12	24/09/2015	TM 385 586 (2.3 km SW of Suffolk Onshore Scheme Boundary)
Least duckweed (*Lemna minuta*)	Non-native	2	24/11/2006	TM 4623 5967 (1 km NE of Suffolk Onshore Scheme Boundary)
Giant hogweed (*Heracleum mantagazzianum*)	Wildlife and Countryside Act Schedule 9 Invasive Alien Species (Enforcement and Permitting) Order 2019	14	12/06/2018	TM 466 598 (1.3 km NE of Suffolk Onshore Scheme Boundary)
Potamopyrgus antipodarum	Non-native	2	04/05/2021	TM 35800 58300 (4.5 km SW of Suffolk Onshore Scheme Boundary)

Aquatic Macrophyte Survey Results

1.3.21 The full aquatic macrophyte taxa list can be found in **Annex 2.F.1**. Cross-reference with the JNCC Taxon Designations list and the Suffolk BAP (SBIS, n.d.) revealed that none of the macrophyte taxa identified during the surveys were protected and/or notable. The invasive non-native species (INNS) Himalayan balsam (*Impatiens glandulifera*) was recorded within the Hundred River and River Fromus survey reaches.

Hundred River

1.3.22 The macrophyte survey was originally intended to be conducted between grid references TM 42777 61412 and TM 42761 61284. However, since the channel was dry at this location, surveyors checked downstream until water was observed in the channel and conducted the survey between TM 43297 60893 and TM 43408 60828.

1.3.23 Approximately 50% broken shading was observed on the right and left banks of the survey reach, with the remainder of both banks unshaded. The channel substrate primarily comprised 70% silt/clay, with the addition of 30% sand.

1.3.24 The macrophyte community consisted of 82% channel cover from eight in-channel aquatic plants: lesser water-parsnip *Berula erecta*, pendulous sedge (*Carex pendula*), flag iris (*Iris pseudacorus*), common water-plantain (*Alisma plantago-aquatica*), water mint (*Mentha aquatica*), common reed (*Phragmites australis*), reed canary-grass

(*Phalaris arundinacea*) and water-starwort *Callitriche* sp..Himalayan balsam was recorded as present on the bank within the surveyed reach.

River Fromus

1.3.25 Bankside shading of the surveyed channel reach was dense for 80% of both banks and broken for 10% of the left bank and 15% of the right bank. The channel substrate was composed entirely of silt/clay.

1.3.26 The macrophyte community consisted of 10% channel cover from eight in-channel aquatic plants: Himalayan balsam, branched bur-reed (*Sparganium erectum*), bittersweet (*Solanum dulcamara*), Cyperus sedge (*Carex pseudocyperus*), great scented liverwort (*Conocephalum conicum*), broad-leaved pondweed (*Potamogeton natans*), reed canary-grass, water-starwort *Callitriche* sp. The filamentous green algae blankweed *Cladophora* sp. accounted for an additional 2% cover of the river channel.

River Fromus eastern tributary

1.3.27 The survey reach was found to be completely dry at the time of survey, with the macrophyte community present within the dry watercourse channel comprising terrestrial species except for a small quantity (~1% cover) of reed canary-grass.

Macrophyte Indices and WFD classification

1.3.28 Based on the criteria outlined in the Methods, River Macrophyte Nutrient Index (RMNI), number of macrophyte taxa (NTAXA), Number of Functional Groups (NFG) and cover of filamentous green algae (ALG), observed and predicted scores for each survey reach on the Hundred River and River Fromus are detailed in Table 1.9. The table also includes the overall Ecological Quality Ratio (EQR) and WFD macrophyte status for each survey reach.

Table 1.9 Macrophyte WFD metrics for Hundred River and River Fromus

Metric		Hundred River	River Fromus
River macrophyte nutrient index (RMNI)	Observed	7.18	7.90
	Predicted	7.50	7.46
Number of macrophyte taxa (NTAXA)	Observed	2.00	3.00
	Predicted	8.52	9.42
Number of functional groups (NFG)	Observed	2.00	3.00
	Predicted	5.46	5.97
Cover of filamentous green algae (ALG)	-	0.00	1.70
Overall Ecological Quality Ratio (EQR)	-	0.82	0.58
Indicative WFD macrophyte classification	**-**	**High**	**Moderate**

1.3.29 The EQR of 0.82 at for the Hundred River equates to High WFD status, indicating the site is minimally or un-impacted by eutrophication and/or modification to morphological conditions. In comparison, the River Fromus attained an EQR of 0.58, equating to Moderate WFD status and indicating the site is subject to moderate impact by eutrophication and/or modification to morphological conditions.

1.3.30 As the alkalinity of both survey sites was >200 mgL^{-1} (varying between to be 243 and 258 mgL^{-1}), LEAFPACS2 analysis alone can be used, as the macrophyte-based status is consistently lower than the diatom-based status in waters of these alkalinities (WFD-UKTAG, 2014).

1.3.31 It should be noted, however, that whilst the River Fromus had three scoring taxa, the Hundred River only had two scoring macrophyte taxa. The minimum requirement for LEAFPACS2 classification is three scoring macrophyte taxa (WFD-UKTAG, 2014). Furthermore, alkalinity data should be obtained from monthly analysis of samples from each over a period of at least one year, whereas here, the average of two samples collected during the survey period was used. Consequently, these results should be treated with caution.

Aquatic Macroinvertebrates Survey Results

Autumn 2023 survey results

1.3.32 The full aquatic macroinvertebrate taxa list for Autumn 2023 can be found in **Annex 2.F.6**. A description of the macroinvertebrate community at each site is provided below. Location of the sites can be seen in **Application Document 6.4.2.2.F.2 Aquatic Ecology Suffolk Study Areas**.

DN2 (Unnamed ditch – Hundred River catchment)

1.3.33 Early instar caddisfly larvae Limnephilidae comprised most of the individuals recorded at DN2, accounting for 60% of the community. Snails comprised a further 20%, including species belonging to Lymnaeidae *Ampullaceana balthica* and *Stagnicola* sp., bladder snails (non-native but non-invasive *Physella* sp.) and nine individuals of the non-native but non-invasive New Zealand mud snail (*Potamopyrgus antipodarum*). Although not overly abundant, several true bug species were also recorded, including water scorpion (*Ilyocoris cimicoides*), lesser water boatmen *Corixa punctata, Hesperocorixia linnaei* and *Hesperocorixia sahlbergi* and backswimmers *Notonecta glauca* and *Notonecta viridis*.

DN4 (Unnamed ditch – Hundred River catchment)

1.3.34 The autumn community at DN4 was dominated by non-native but non-invasive bladder snails *Physella* sp., which comprised 77% of the community. A relatively diverse beetle assemblage was also recorded, including species of Dytiscidae (*Colymbetes fuscus*) and Hydrophiliae (*Helophorus brevipalpis, Hydrobius fuscipes, Helochares lividus* and *Enochrus quadripunctatus*). The water beetle *E. quadripunctatus* is Nationally Scarce (occurring in 16 to 100 ten-km squares) but not rare enough to qualify for an IUCN Red List status (Foster, 2010).

DN5 (Unnamed ditch – Hundred River catchment)

1.3.35 The community at DN5 was primarily composed of caddisflies juvenile Limnephilidae, which totaled 33%, and the non-native but non-invasive freshwater shrimp *Crangonyx pseudogracilis/floridanus*, which totaled 20% of the assemblage. Two individuals of the non-native, but also non-invasive New Zealand mud snail were also recorded. Two adults of the Haliplidae beetle (*Peltodytes caesus*) were recorded, which are considered Nationally Scarce but do not meet the criteria for an IUCN Red List status (Foster, 2010).

DN6 (Unnamed ditch – Suffolk Coastal catchment)

1.3.36 The freshwater hoglouse *Asellus aquaticus* accounted for 80% of the community at DN6 and the non-native shrimp *C. pseudogracilis/floridanus* accounted for a further 14%. These two species are indicative of watercourses with slower flows and ditch habitats. Additional species recorded include the Hydrophilidae beetles (*Hydrobius fuscipes* and *Anacaena globulus*), and the non-native flatworm *Girardia tigrina*.

DN7 (Unnamed ditch – River Fromus catchment)

1.3.37 The community recorded at DN7 was relatively small, with just 36 individuals across all taxa. Over half of the community (53%) comprised of the sub-family of non-biting midges Orthocladiinae. In addition, four individuals of the bladder snail *Aplexa hypnorum* were also recorded. This species is an indicator of habitats, such as marshes and ponds, that dry out in summer.

DN8 (Unnamed ditch – River Fromus catchment)

1.3.38 Seed shrimp Ostracoda comprised 64% of the community at DN8. Also present were the non-native *C. pseudogracilis/floridanus* (2%) and freshwater hoglouse *A. aquaticus* (5%), both typical of ditch habitats. The remainder of the community primarily comprised true-fly larvae, including mosquitoes (Culicidae), sub-families of non-biting midges (Tanytarsini and Orthocladiinae) and crane flies (Tipulidae).

WBN1(River Fromus)

1.3.39 Non-native New Zealand mud snail dominated the autumn community at WBN1, comprising 91% of recorded species. Next in abundance were early-instar Limnephilidae larvae (7%).

WBN2 (River Fromus)

1.3.40 The community at WBN2 primarily comprised freshwater hoglouse *A. aquaticus* (52%) and the freshwater shrimp *Gammarus pulex/fossarum* (24%) and *G. pulex* (7%). The remaining assemblage included the lesser water boatman *H. sahlbergi* and several species of water beetles *Haliplus lineaticollis, Gyrinus substriatus*, and *Anacaena globulus*.

Spring 2024 Survey Results

1.3.41 The full aquatic macroinvertebrate taxa list for Spring 2024 can be found in **Annex 2.F.6**. Sites DN6, DN7 and DN7A were all found to be dry at the time of survey, and as such no sample could be collected. A description of the macroinvertebrate community at each site where a macroinvertebrate sample was collected is provided below.

WBN2 (River Fromus)

1.3.42 Non-biting midge larvae Chironomidae (consisting of Tanytarsini accounting for 36% and Chironomini 16% of the assemblage) and the freshwater hoglouse *A. aquaticus* (16% of the assemblage) dominated the spring community at WBN2. A relatively diverse array of aquatic beetles was also recorded from the families Dytiscidae (*Hydroporus palustris, Hydroporus planus* and *Ilybius fuliginosus*) and Hydrophilidae (*Helophorus aequalis, Helophorus brevipalpis, Hydrobius fuscipes, Anacaena bipustulata* and *Anacaena globulus*).

WBN3 (Western tributary of River Fromus)

1.3.43 Species indicative of slow-flowing watercourses primarily composed the community at WBN3, with the freshwater hoglouse *A. aquaticus* accounting for 33% and non-native *C. pseudogracilis/floridanus* 15% of the assemblage. A diverse beetle fauna was also present, consisting of the common species *Hydroporus palustris, Hydroporus planus, Anacaena limbata* and *Laccobius bipunctatus*.

Autumn 2024 Survey Results

1.3.44 The full aquatic macroinvertebrate taxa list for Autumn 2024 samples taken from the River Fromus can be found in **Annex 2.F.6**. A description of the macroinvertebrate community at each site where a macroinvertebrate sample was collected is provided below.

WBN2 (Location of proposed bridge)

1.3.45 The most abundant taxon recorded at WBN2 in Autumn 2024 was the non-biting midge sub-tribe Chironomini, which comprised 39% of the macroinvertebrate community. The next most abundant group was pea mussel Sphaeriidae, which accounted for 21%, and followed by freshwater hoglouse *A. aquaticus* accounting for a further 19%. In addition, one specimen of the non-native *Crangonyx pseudogracilis/floridanus* was recorded. Four larval specimens of the Limnephilidae caddisfly species *Glyphotaelius pellucidus* were also recorded alongside one specimen of the larval wood-feeding caddisfly species *Lype paheopa.*

WBNx1 (Upstream of proposed bridge location)

1.3.46 The amphipod aggregate *Gammarus pulex/fossarum* accounted for 64% of the macroinvertebrate community at WBNx1, with 43% identified as *G. pulex*. The next most abundant species were the non-native New Zealand mud snail and the freshwater hoglouse *A. aquaticus*, which each comprised an additional 9%. Two specimens of the mayfly species aggregate *Baetis rhodani/atlanticus* and one specimen of the Glossosomatidae caddis fly species *Agapetus* sp. were also present.

WBNx2 (Downstream of proposed bridge location)

1.3.47 A small macroinvertebrate community of only 57 specimens was recorded at the downstream site of the River Fromus. The non-biting midge sub-Family Chironomini comprised 68% of the community. The remaining community comprised small numbers of pea mussels (Sphaeriidae), the leech *Glossiphonia complanate*, water hoglouse (*A.*

aquaticus), small juvenile Limnephilidae, the alderfly *Sialis lutaria* and additional sub-families of non-biting midge larvae Tanypodinae and Tanytarsini.

Aquatic macroinvertebrate indices and WFD classification

1.3.48 Based on the criteria outlined in the Methodology, the CCI, WHPT Average Score Per Taxon (ASPT) and Number of scoring taxa (NTAXA), LIFE and PSI species values for each survey site are summarised in Table 1.10 (autumn 2023), Table 1.11 (spring 2024), and Table 1.12 (Autumn 2024).

Table 1.10 Macroinvertebrate index scores for autumn 2023 surveys

Index	DN2	DN4	DN5	DN6	DN7	DN8	WBN1	WBN2
WHPT-NTAXA	19	20	20	13	8	8	7	10
WHPT-ASPT	4.15	4.06	4.23	3.56	4.13	3.44	3.94	4.23
CCI score	5.2	16.8	16.2	5.0	11.7	1.0	7.0	1.1
CCI score - interpretation	Moderate conservation value	High conservation value	High conservation value	Moderate conservation value	Fairly High conservation value	Low conservation value	Moderate conservation value	Low conservation value
LIFE score (species)*	5.55	5.20	5.77	5.20*	6.00*	5.50*	6.00*	6.29*
LIFE score - interpretation	Low sensitivity to reduced flows	Low sensitivity to reduced flows	Low sensitivity to reduced flows	Low sensitivity to reduced flows	Low sensitivity to reduced flows	Low sensitivity to reduced flows	Low sensitivity to reduced flows	Low sensitivity to reduced flows
PSI score (species)*	0.00	0.00	0.00	6.67*	16.67*	8.33*	30.77*	20.00*
PSI score - interpretation	Heavily sedimented	Heavily sedimented	Heavily sedimented	Heavily sedimented	Heavily sedimented	Heavily sedimented	Sedimented	Sedimented

*Lack of scoring species may result in inaccurate scores, consequently family level scores have been presented

Table 1.11 Macroinvertebrate index scores for spring 2024 surveys

Index	WBN2	WBN3
WHPT-NTAXA	17	13
WHPT-ASPT	4.16	4.48
CCI score	7.1	1.3
CCI score - interpretation	Moderate conservation value	Low conservation value
LIFE score (Family)*	6.27*	5.33*
LIFE score - interpretation	Low sensitivity to reduced flows	Low sensitivity to reduced flows
PSI score (Family)*	24.14*	17.86*
PSI score - interpretation	Sedimented	Heavily Sedimented

*Lack of scoring species may result in inaccurate scores, consequently family level scores have been presented

Table 1.12 Macroinvertebrate index scores for autumn 2024 surveys

Index	WBNx1	WBN2	WBNx2
WHPT-NTAXA	13	10	6
WHPT-ASPT	4.15	3.83	3.87
CCI Score	1.0	4.7	1.0
CCI Score interpretation	Low conservation value	Low conservation value	Low conservation value
LIFE Score (Family)*	6.80	6.25	6.00
LIFE Score interpretation	Moderate sensitivity to reduced flows	Low sensitivity to reduced flows	Low sensitivity to reduced flows
PSI Score (Family)*	38.46	17.65	12.50
PSI Score interpretation	Sedimented	Heavily Sedimented	Heavily Sedimented

*Lack of scoring species may result in inaccurate scores, consequently family level scores have been presented

1.3.49 For Autumn 2023, the CCI scores ranged between 1.0 and 16.8 demonstrating the resident macroinvertebrate communities ranged from Low conservation value (DN8, WBN2) to High conservation value (DN4, DN5). The CCI scores for the spring 2024 sites ranged between 1.3 and 7.1, reflecting resident macroinvertebrate communities with Low conservation value (WBN3) to Moderate conservation value (WBN2). CCI scores for autumn 2024 ranged from 1.0 to 4.7, demonstrating the resident macroinvertebrate communities were of Low conservation value at all surveyed locations.

1.3.50 The highest CCI-scoring species within the sites were the beetles *Peltodytes caesus* and *Enochrus quadripunctatus*, both of which have a Conservation Score of seven and are designated as Nationally Scarce (Foster, 2010) but neither are sufficiently rare to qualify for an IUCN Red List status. The next highest scoring species was the Hydrophilidae beetle (*Enochrus melanocephalus*) which has a Conservation Score of six and was formerly recognised as Nationally Notable List B but is currently considered too widespread to qualify as Nationally Scarce (Foster, 2010). Both species were found during the autumn survey at DN5. In addition, three species with a Conservation Score of five and considered Local were also found: in Autumn the Hydrophilidae beetle (*H. lividus*) recorded at DN4 and the bladder snail *A. hypnorum* recorded at DN7, and in spring the Hydrophilidae beetle (*A. bipustulata*) was recorded at WBN2. All other species identified were occasional (present to 10% of all samples from similar habitats) or frequent (present to >10-25% of all samples from similar habitats).

1.3.51 The LIFE score for all sites across all survey seasons represented low to moderate sensitivity to reduced flows. WBN2 in Autumn 2024 had the highest LIFE score (6.80 – reflecting moderate sensitivity to reduced flows), whilst all other sites had scores indicating low sensitivity to reduced flows. DN4 in Autumn 2023 attained the lowest LIFE score (5.20).

1.3.52 The PSI scores for the autumn 2023 ditch sites ranged between 0.00 and 16.70, indicating all sites were heavily sedimented. In contrast, WBN1 and WBN2 in Autumn 2023 had scores (30.77 and 20.00 respectively) which indicated that they were sedimented. WBN2 retained a PSI score reflecting sedimented conditions (24.14) in spring 2024, whilst WBN3 attained a PSI score indicative of heavily sedimented conditions (17.86). WBN2 and WBNx2 both attained PSI scores (17.65 and 12.50 respectively) reflecting heavily sedimented conditions in autumn 2024, whilst in the same season WBNx1 attained a PSI score of 38.46 indicating sedimented conditions.

1.3.53 In Autumn 2023, the WHPT-NTAXA number was low (10 or less) at sites DN7, DN8, WBN1 and WBN2, with the highest WHPT-NTAXA scores of 20 achieved by sites DN4 and DN5. WHPT-ASPT scores ranged from 3.44 for DN8 to 4.23 for DN2 and WBN2. All WHPT-ASPT scores are indicative of Poor, Polluted or Impacted conditions. In spring 2024 the WHPT-NTAXA number ranged from 13 at WBN3 to 17 at WBN2. WHPT-ASPT scores ranged from 4.16 at WBN2 to 4.48 at WBN3. In Autumn 2024, the WHPT-NTAXA number was low (10 or less) at the WBN2 and WBNx2 sites, with the highest WHPT-NTAXA score of 13 achieved by WBNx1. WHPT-ASPT scores ranged from 3.83 at WBN2 to 4.15 at WBNx1.

1.3.54 Table 1.13 displays the Ecological Quality Ratio (EQR) and WFD macroinvertebrate status for the WHPT ASPT and NTAXA indices for each riverine survey site surveyed in autumn 2023 and spring 2024, as well as the most probable WFD status based on the combination of the modelled distributions for each of ASPT and NTAXA across all classes, termed MINTA (Minimum of NTAXA and ASPT EQRs). Note that whilst MINTA for WBN2 is based on the combination of spring and autumn EQR values, MINTA for

WBN1 and WBN3 are based only on single season values and are included for interpretative purposes only. Table 1.14 displays the same values for the riverine sites surveyed in autumn 2024, with the displayed MINTA based on single season values included for interpretative purposes only.

1.3.55 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 ditches due to their nature (i.e., not naturally permanently flowing condition) as the application is only applicable to sites located on naturally and permanently flowing watercourses.

Table 1.13 Macroinvertebrate indicative WFD classification for riverine survey sites for autumn 2023 and spring 2024

Index	Season	WBN1	WBN2	WBN3
WHPT-NTAXA Ecological Quality Ratio (EQR)	Autumn 2023	0.33 (Bad)	0.45 (Bad)	-
	Spring 2024	-	0.70 (Good)	0.55 (Moderate)
WHPT-ASPT Ecological Quality Ratio (EQR)	Autumn 2023	1.04 (High)	1.07 (High)	-
	Spring 2024	-	1.01 (High)	1.08 (High)
MINTA most probable WFD invertebrate classification	Spring and autumn combined	Bad†	Moderate	Moderate†

† MINTA WFD classifications should be completed across the two seasons, whereas the classification presented here is based on the single-season data available, and should be treated with caution

Table 1.14 Macroinvertebrate indicative WFD classification for riverine survey sites for autumn 2024

Index	WBNx1	WBN2	WBNx2
WHPT_NTAXA Ecological Quality Ratio	0.56 (Moderate)	0.45 (Bad)	0.30 (Bad)
WHPT-ASPT Ecological Quality Ratio (EQR)	0.85 (Moderate)	0.99 (High)	0.95 (High)
MINTA most probable WFD invertebrate classification†	Moderate	Bad	Bad

† MINTA WFD classifications should be completed across the two seasons, whereas the classification presented here is based on the single-season data available, and should be treated with caution

1.3.56 WBN2 attained a WFD classification for invertebrates using Autumn 2023 and spring 2024 data of Moderate, achieving High EQRs for WHPT-ASPT in both seasons but WHPT-NTAXA EQRs reflecting Bad condition in autumn and Good condition in spring. These results suggest poor habitat quality is dictating the quality of the resident macroinvertebrate community at WBN2. A similar result occurs Autumn 2024 data is considered, with the site attaining a Bad WFD classification overall resulting from a WHPT-ASPT EQR reflecting High condition and a WHPT-NTAXA EQR reflecting Bad condition, again implying that habitat quality is the controlling factor for the resident macroinvertebrate community.

1.3.57 WBN1 attained a Bad WFD classification for invertebrates based on the single autumn season data available. WHPT-ASPT EQR reflected High condition, whilst WHPT-NTAXA EQR reflected Bad condition, again implying that habitat quality is the controlling factor for the resident macroinvertebrate community at WBN1.

1.3.58 WBN3 achieved a Moderate WFD classification for invertebrates based on the single autumn season data available. WHPT-ASPT EQR reflected High condition, whilst WHPT-NTAXA EQR reflected Moderate condition. Similar to WBN1 and WBN2, these results suggest that habitat quality is the controlling factor for the resident macroinvertebrate community at WBN3.

1.3.59 WBNx1 attained a WFD classification for invertebrates of Moderate on the single autumn season data available, achieving Moderate EQRs for both WHPT-ASPT and WHPT-NTAXA. These results suggest poor habitat quality is dictating the quality of the resident macroinvertebrate community at WBNx1.

1.3.60 WBNx2 attained a Bad WFD classification for invertebrates based on the single autumn season data available. The WHPT-ASPT EQR reflected High condition, whilst WHPT-NTAXA EQR reflected Bad condition. This result implies habitat quality is the controlling factor for the resident macroinvertebrate community at the site.

River Fromus Habitat and Existing Bridges' Appraisal

1.3.61 Table 1.15 summarises the habitat features of the River Fromus recorded during the walkover survey conducted 27-29 November 2024.

Table 1.15 Habitat features of surveyed reaches on the River Fromus in relation to the proposed bridge location

† Predominant habitat and substrate types within survey reaches indicated in bold

Reach	Reach extents (grid references)	Wetted Width (m)	Depth (m)	Flow rate (cm/s)	Habitat types†	Dominant substrate†	Bank material
Upstream survey reach (upstream of proposed bridge crossing)	Upstream: TM 38651 63388 Downstream: TM 38810 62982	2 - 4	0.2	10 - 25	Run; Riffle; **Glide**	**Gravel** Sand	Natural (earth) and artificial (bricks/concrete)
Mid survey rach (proposed bridge crossing point)	Upstream: TM 38810 62982 Downstream: TM 38779 61798	2 - 4	1.0	< 10	**Glide**; Pool	**Silt**	Natural (earth)
Downstream survey reach (downstream of proposed bridge crossing)	Upstream: TM 38779 61798 Downstream: TM 38490 58708	2 - 4	0.5	10 - 25	**Run**; Riffle; Glide; Pool	**Gravel** Sand	Natural (earth)

1.3.62 The upstream survey reach within Saxmundham town between TM 38651 63388 and TM 38810 62982 was generally shallow with an average depth of 20 cm and a flow rate of 10-25 cm/s (Table 1.15). At the upstream reach the wetted width was 2.0 m widening to 4.0 m at Church Hill Bridge (B1119). Run, riffle and glide habitat types were present within the upstream reach, with substrate dominated by gravel and sand, suggesting potential for salmonid spawning grounds (Jonsson & Jonsson, 2011) (Environment Agency, 2004). Banks along this reach were primarily composed of earth, with artificial banks constructed of brick and concrete present where residential and industrial buildings abut the river (Plate 1.1).

Plate 1.1 Typical habitat upstream of the proposed River Fromus bridge location - Saxmundham

1.3.63 The mid survey reach, between TM 38810 62982 and TM 38779 61798 which included the location of the proposed River Fromus bridge crossing, was dominated by plantation woodland with little understory. Where there were gaps in the tree line, in-channel macrophytes were present. Depth increased from 20 cm in the upstream survey reach to approximately 1.0 m in this area and flow rate was <10 cm/s. The substrate was dominated by silt. Many trees had fallen within the River Fromus creating natural weirs and pools, providing valuable habitat for both fish and aquatic macroinvertebrates (Plate 1.2). The mid-section reach and woodland further downstream, south of the A1094 at

Snape Watering, had extensive vertical earth banks and submerged tree roots which were considered to have the potential to support crayfish species.

Plate 1.2 Typical habitat at the proposed bridge location

1.3.64 The downstream survey reach extended south of Benhall bridge, between TM 38779 61798 and TM 38490 58708. The habitat consisted of both broadleaf/mixed woodland strips and large open areas which were dominated by tall herb or emergent reeds, sedges or rushes, which were evident despite having either died or been cut back as part of land management. Wider land use was dominated by agriculture, both for growing crops and the rearing of animals. It should also be noted that there were large expanses of lakes and conservation waterbodies present in the area between Benhall bridge and the A1094 (TM 38272 59885) which also had emergent vegetation present. In-channel submerged linear macrophytes increased in abundance towards Gromford (Plate 1.3), providing potential habitat for coarse fish, salmonid juveniles and invertebrate species.

Plate 1.3 Typical habitat downstream of the porposed bridge location - Gromford

Bridges

1.3.65 During the walkover 20 bridges were identified between Saxmundham and Gromford (Table 1.16; **Annex 2.F.8**). These consist of one rail bridge, four road bridges, and three farm track/haul road bridges, with the remainder comprising footbridges either encompassing public footpaths or situated on private land.

1.3.66 The dimensions and construction of the bridges depended on the use of the bridge. Vehicle bridges (both farm tracks/haul roads and road bridges) were between 4.0 and 10.0 m wide. These were constructed entirely from either concrete or brick, with one bridge being constructed of concrete with a wooden deck. Footbridges had a width between 1.0 and 2.0 m wide. These were predominantly constructed with a steel/metal parapet with a concrete or wooden deck, with three bridges comprised solely of wood. Where parapets were present, they were constructed of wood or metal and were between 1.0 and 1.2 m in height. All bridges identified during the walkover had a clearance[2] from the water between 0.5 m and 3.0 m (Table 1.16). Examples of the different types of bridges found can be seen in Plate 1.4.

[2] Clearance from water level on the day of survey = 1.2m above stage datum (8.6m AOD) Saxmundham

Plate 1.4 Typical examples of bridge types found on the River Fromus

1.3.67 A further four bridges were identified as part of the desk-based assessment of inaccessible land (A-D in Table 1.16). Two bridges, both private/farm tracks, appear to be constructed with a concrete deck approximately 5.0 m in width, one had open parapets on both sides rendering it as a potential barrier, whilst the other had no parapets rendering it as no/minimal barrier to migratory riverfly species. Two other bridges were identified as footbridges; one between two agricultural fields likely forming a permissive footpath, whilst another connected two areas of a private garden likely formed of wood with parapets.

Table 1.16 Bridges located on the surveyed reaches of the River Fromus between Saxmundham and Gromford (upstream to downstream of proposed River Fromus bridge)

Bridge Number	National Grid Reference	Survey reach	Dimensions (m)	Bridge Construction Material	Bridge Parapet Type	Use
1 (Culvert)	TM 38660 63385	Upstream	Clearance[3]: 3.0 Deck height: N/A Parapet height: N/A Bridge Width: N/A	Concrete with earth – built into hillside	Solid	Rail
2	TM 38678 63319	Upstream	Clearance: 3.0 Deck height: Not visible due to foliage Parapet height: 1.2 Bridge width: 10.0	Concrete bridge	Vertical metal bars 0.1 m spacing (width)	Road bridge with pavement
3	TM 38742 63214	Upstream	Clearance: 2.0 Deck height: 0.2 Parapet height: 1.2 Bridge width: 2.0	Steel bridge with lain concrete deck	Vertical metal bars 0.1 m spacing (width)	Footbridge
4	TM 38777 63111	Upstream	Clearance: 1.5 Deck height: 0.2 Parapet height: 1.2 Bridge width: 2.0	Steel bridge with lain concrete deck	Vertical metal bars 0.1 m spacing (width)	Footbridge
5	TM 38803 62987	Upstream	Clearance: 1.5	Concrete bridge with brick	Solid	Road bridge with pavement

[3] Clearance from water level on the day of survey (1.2m above stage datum (8.6m AOD) Saxmundham)

Bridge Number	National Grid Reference	Survey reach	Dimensions (m)	Bridge Construction Material	Bridge Parapet Type	Use
			Deck height: 0.5 Parapet height: 1.2 Bridge width: 10.0	reinforcement on banks		Runoff outfall
6	TM 38786 61804	Mid	Clearance: 3.0 Deck height: ~0.75 (Curved Arch) Parapet height: 2.0 Bridge width: 6.0	Brick	Solid	Road bridge Runoff outfall
7	TM 38693 61079	Downstream	Clearance: 1.0 Deck height: 0.2 Parapet height: 1.2 Bridge width: 1.0	Concrete with wooden deck.	Horizontal metal bars 1 m spacing (width)	Footbridge over ford
8	TM 38628 60974	Downstream	Clearance: 1.2 Deck height: 0.1 Parapet height: 1.0 Bridge width: 1.0	Metal structure with wood deck	Only on one side. Vertical metal bars. 1 m spacing (width & height)	Footbridge
9	TM 38607 60875	Downstream	Clearance: 2.0 Deck height: 0.2 Parapet height: 1.5 Bridge width: 1.5	Metal structure with wood deck	Horizontal metal bars 1 m spacing (width) 0.5 m spacing (height)	Footbridge
10	TM 38605 60778	Downstream	Clearance: 1.5 Deck height: 0.2 Parapet height: 1.5 Bridge width: 1.5	Metal structure with wood deck	Horizontal metal bars 1 m spacing (width) 0.5 m spacing (height)	Footbridge

Bridge Number	National Grid Reference	Survey reach	Dimensions (m)	Bridge Construction Material	Bridge Parapet Type	Use
11	TM 38571 60711	Downstream	Clearance: 0.5 Deck height: 0.4 Parapet height: N/A Bridge width: 4.0	Concrete	None	Vehicle bridge on farmland
12	TM 38481 60675	Downstream	Clearance: 1.0 Deck height: 0.2 Parapet height: N/A Bridge width: 1.0	Metal structure with wood deck	None	Footbridge
13	TM 38277 60487 (on tributary right next to R.Fromus)	Downstream	Clearance: 1.0 (culvert pipe) Deck height: 0.7 Parapet height: 1.2 Bridge width: 6.0	Stone	Wooden panel 1 m spacing (width). 0.3 m spacing (height)	Private haul road
14	TM 38226 60368	Downstream	Clearance: 0.5 Deck height: 0.2 Parapet height: 1.0 Bridge width: 1.0	Steel frame bridge with wooden deck	Horizontal metal bars. 1 m spacing (width) 0.5 m spacing (height)	Footbridge (PRoW)
15	TM 38272 59887	Downstream	Clearance: 1.2 Deck height: 0.5 Parapet height: 1.0 Bridge width: 10.0	Concrete bridge with metal soffit Banks beneath the bridge reinforced with concrete.	Horizontal metal bars. 2 m spacing (width) 0.5 m spacing (height)	Road bridge with no pavement
16	TM 38169 58979	Downstream	Clearance: 1.0 Deck height: 0.2	Wood	None	Footbridge

Bridge Number	National Grid Reference	Survey reach	Dimensions (m)	Bridge Construction Material	Bridge Parapet Type	Use
			Parapet height: N/A Bridge width: 1.0			
17	TM 38167 58940	Downstream	Clearance: 1.0 Deck height: 0.2 Parapet height: 1.0 Bridge width: 1.0	Steel bridge with laid concrete deck	Horizontal metal bars. 1 m spacing (width) 0.5 m spacing (height)	Footbridge (PRoW)
18	TM 38244 58820	Downstream	Clearance: 1.0 Deck height: 0.2 Parapet height: N/A Bridge width: 1.0	Wood	None	Footbridge
19	TM 38315 58807	Downstream	Clearance: 1.0 Deck height: 0.2 Parapet height: 1.0 Bridge width: 5.0	Wooden bridge with concrete foundations	Wooden horizontal panels. 1 m spacing (width) 0.5 m spacing (height)	Farm track
20	TM 38372 58769	Downstream	Clearance: 1.0 Deck height: 0.1 Parapet height: N/A Bridge width: 1.0	Wood	None	Footbridge
A	TM 38760 62849	Mid	Clearance: Unknown Width: 5.0 m Deck and parapets	Concrete	Parapet appears to have horizontal metal bars.	Farm track
B	TM 38814 62390	Mid	Clearance: Unknown Width: 1.2 m	Unknown dimensions and	Unknown	Footbridge

Bridge Number	National Grid Reference	Survey reach	Dimensions (m)	Bridge Construction Material	Bridge Parapet Type	Use
			Deck and parapets	material due to bridge under tree cover.		
C	TM 38688 61069	Downstream	Clearance: Unknown Deck Height: Unknown	Wooden bridge	Wooden cross hatch parapet	Footbridge
D	TM 38173 59190	Downstream	Clearance: Unknown Width: 4.0 m	Concrete	Unknown	Farm track

Outfalls

1.3.68 Six outfalls or land drains were located during the walkover. Five of these were found upstream or at the location of the proposed bridge crossing on the River Fromus (Table 1.17).

Table 1.17 Outfalls located during the walkover of the River Fromus between Saxmundham and Gromford

Type	Location (Grid Reference)	River Habitat Survey Classification	Observed discharging
Outfall	TM 38742 63208	Minor	No
Outfall	TM 38765 63169	Minor	No
Outfall	TM 38777 63114	Minor	No
Road drain	TM 38824 62991	Minor	No
Field drain	TM 38830 62302	Minor	Yes
Field drain/culvert	TM 38620 60897	Minor	No

Invertebrates

1.3.69 Table 1.18 summarises the larval riverfly taxa recorded throughout all macroinvertebrate surveys undertaken on the River Fromus as detailed in Section 2.3 Results - Aquatic Macroinvertebrates of this report.

Table 1.18 Larval riverfly records and index values for River Fromus surveys

Taxon	Taxon type	WBNx1 autumn 2024	WBN2 autumn 2023	WBN2 spring 2024	WBN2 autumn 2024	WBNx2 autumn 2024
Baetis rhodani/atlanticus	Mayfly					2
Cloeon dipterum	Mayfly			1		
Agapetus sp.	Caddisfly					1
Lype sp.	Caddisfly			1		
Lype phaeopa	Caddisfly				1	
Limnephilidae	Caddisfly	1	2		3	
Limnephilus lunatus	Caddisfly		1	28		

Taxon	Taxon type	WBNx1 autumn 2024	WBN2 autumn 2023	WBN2 spring 2024	WBN2 autumn 2024	WBNx2 autumn 2024
Glyphotaelius pellucidus	Caddisfly				4	

1.3.70 A single specimen of Limnephilidae caddisfly was recorded at WBNx1 located upstream of the proposed River Fromus bridge crossing location. All other specimens presented in Table 1.18 were recorded approximately at or downstream of the proposed bridge location. None of the species presented in Table 1.18 are protected, notable or invasive.

Fish Survey Results

1.3.71 Species presence, abundance and fork length (nearest mm) were recorded for fish species captured. The raw species data are provided in **Annex 2.F.7**.

River Fromus

1.3.72 At the River Fromus survey reach, the channel was 4 m wide with an average water depth of 50 cm (Plate 1.5). The shading was moderate, approximately 60%. The flow within the channel was considered normal and there was moderate turbidity with a film on the water surface (SPC = 1164 µS/cm). The channel substrate was dominated by silt (90%) with some sand (10%). The habitat within the survey reach was completely dominated by dead water (95%) with only a small area of flowing water (5%). The bank structure was considered simple (1-3 vegetation types present) and the surrounding land was deciduous woodland and improved pasture. During the survey the weather was sunny, humid and windy.

Plate 1.5 River Fromus Fish Survey Location

1.3.73 The fish found were common of still, slow moving watercourses. Three-spined stickleback (*Gasterosteus aculeatus*) were the only species caught at the River Fromus during the survey. 45 specimens of this species were caught, with fork length ranging between 12 and 74 mm, representing most likely multiple age class's (Plate 1.6). Three-spined stickleback are a ubiquitous species and deemed to be a highly tolerant species as per the Fisheries Classification Scheme ((WFD-UKTAG), 2008).

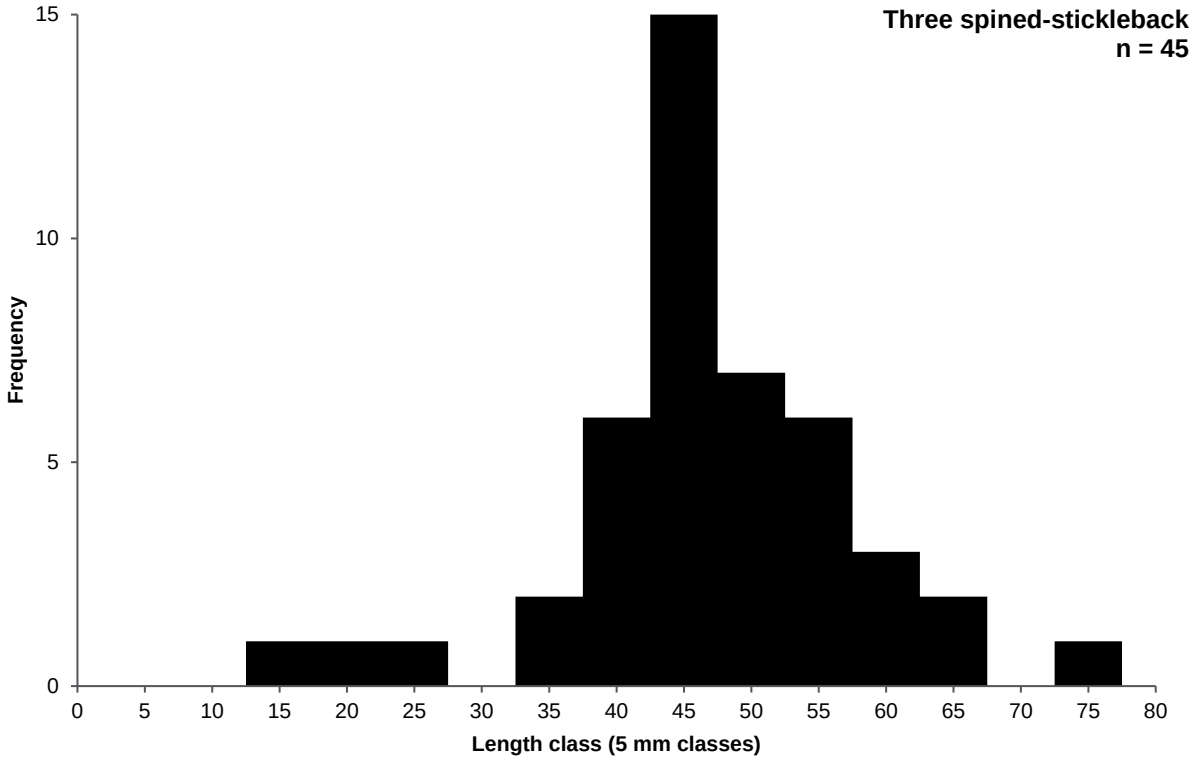

Plate 1.6 Length frequencies of three-spined stickleback in River Fromus

1.3.74 Fish assemblages found were similar to that of the EA survey site at Saxmundham (Site ID: 618) located approximately 800 m upstream of the survey site, which was dominated by three-spined stickleback with the addition of a single European eel (*Anguilla Anguilla*) caught in 2012. Species richness is shown to increase downstream of both the EA's Saxmundham (n = 2) and the survey site (n = 1), to six species at the three other EA monitoring sites on the River Fromus (Table 1.19). This may be due to increased habitat heterogeneity (i.e., diverse flow and depth patterns and in-stream macrophytes) supporting a more diverse fish assemblage. Furthermore, habitat quality was recorded by the survey team as generally poor with deep silt deposits and almost stagnant water.

Table 1.19 Fish species and total number of fish caught by the EA during WFD monitoring on the River Fromus Water Body (WB ID: GB105035045980). Sites are ordered from upstream to downstream.

Site name	Saxmundham		Snape Watering	Abbey Farm B	Abbey Farm A
Site ID	618	619	27840	27839	
Years surveyed	2006 & 2012	2006 & 2011	2007	2007	

Site name	Saxmundham	Snape Watering	Abbey Farm B	Abbey Farm A	
Brook lamprey (*Lampetra planeri*)			5		
Brown / sea trout (*Salmo trutta*)				1	
Dace (*Leuciscus leuciscus*)				2	
European eel (*Anguilla anguilla*)		1	3	4	4
Lamprey sp. (*Petromyzontidae*)			2		12
Roach (*Rutilus rutilus*)					1
Rudd (*Scardinius erythrophthalmus*)				1	6
Stone loach (*Barbatula barbatula*)			17	6	3
Three-spined stickleback		30	8	8	8
Ten-spined stickleback (*Pungitius pungitius*)			1		
	Species richness	2	6	6	6

River Fromus eastern tributary

1.3.75 The fish survey at the River Fromus eastern tributary could not be completed as the proposed sampling location was dry and full of terrestrial macrophytes (Plate 1.7). This tributary appeared to be a field drain.

Plate 1.7 Proposed fish survey location on River Fromus trib.

New Hundred River

1.3.76 The fish survey at the New Hundred River could not be completed as the proposed sampling location was dry and full of terrestrial macrophytes (Section: 1.3.27) (Plate 1.8) Surveyors proceeded to the Knodishall Common, an EA monitoring site located approximately 850 m downstream, to find the watercourse damp with pools in places close to land drains (Plate 1). Therefore, a fish survey was not conducted as the site was not appropriate.

Plate 1.8 New Hundred River proposed sampling point

1.3.77 Although, assessment of fish assemblage was not possible at the New Hundred River site, fish assemblage has been previously recorded during 2006, 2011 and 2017 at the EA monitoring site Knodishall Common (TM 43400 60800) located approximately 850 m downstream of this sample site. Three-spined and 10-spined stickleback are the only species that have been found at the site (Plate 1.9). Knodishall Common is classified as Poor and Bad for the fish biological elements across assessments conducted between 2009 and 2022.

Plate 1.9 New Hundred River proposed sampling point

Table 1.20 Fish species and total number of fish caught by the EA during WFD monitoring of the Hundred River (GB105045046260)

Site name	Knodishall Common		
Site ID	631	631	631
Years surveyed	2006	2011	2017
Three-spined stickleback	52	2	1
Ten-spined stickleback	16	1	4
Species richness	2	2	2

1.4 Discussion

Summary

1.4.1 There are three statutory and four non-statutory designations within the Suffolk Onshore Scheme Order Limits with associated aquatic ecology features that form part of their designation, which could be impacted by the proposed crossing points and/or outfalls. Of which, the non-statutory site Knodishall Common located on the New Hundred River is of particular interest as it is designated for its habitat for aquatic macroinvertebrates.

1.4.2 The overall status of the two WFD waterbodies located within the Suffolk Onshore Scheme Order Limits; the River Fromus and New Hundred River are of Poor or Bad

ecological status respectively according to the EA WFD Directive, with the RNAG suggesting water quality pressures from point and diffuse sources. Proposed outfalls at each of these rivers could further reduce their ecological status.

Aquatic Macrophytes

1.4.3 No notable aquatic macrophytes were identified in the desk study. Three non-native species were identified; Canadian waterweed, least duckweed and giant hogweed. Least duckweed is not listed in any current UK legislation, whereas Canadian waterweed and giant hogweed are both listed in Schedule 9 of the Wildlife and Countryside Act 1981 (as amended) and giant hogweed is also listed in the Invasive Alien Species (Enforcement and Permitting) Order 2019. Thus, whilst there are no statutory obligations due to least duckweed, the legislation referenced in relation to Canadian waterweed and giant hogweed makes it 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.

1.4.4 The results of the macrophyte surveys completed in 2024 indicate that the Hundred River is minimally or un- impacted by eutrophication and/or modification to morphological conditions at the surveyed reach, demonstrated by the High WFD macrophyte status attained for the surveyed reach. It should be noted, however, that this classification is based on only two scoring macrophyte taxa, and the minimum requirement for LEAFPACS2 classification is three scoring macrophyte taxa (WFD-UKTAG, 2014). Consequently, this result should be treated with caution as it may not constitute an accurate estimate of WFD macrophyte status.

1.4.5 In contrast, the Moderate WFD macrophyte status attained for the reach of the River Fromus surveyed in 2024, based on three scoring macrophyte taxa, indicates the site is subject to moderate impact by eutrophication and/or modification to morphological conditions.

1.4.6 No protected or notable species were recorded at either survey reach, nor were any of the species recorded present in the Suffolk BAP. All species were common and widespread, and highly likely to be present in the wider landscape.

1.4.7 The INNS Himalayan balsam was recorded at both the Hundred River and River Fromus survey reaches. Himalayan balsam is listed in both Schedule 9 of the Wildlife and Countryside Act 1981 (as amended) and the Invasive Alien Species (Enforcement and Permitting) Order 2019.

Aquatic Macroinvertebrates

1.4.8 Two records of the notable great silver diving beetle were identified in the desk study. The species is listed as IUCN Near Threatened (Foster, 2010).

1.4.9 One non-native macroinvertebrate species was identified from the desk study; the freshwater amphipod *Crangonyx pseudogracilis/ floridanus*. The species is wide-spread and common across the UK.

1.4.10 The surveys undertaken in Autumn 2023 found that all ditch survey sites were resident to a typical macroinvertebrate community indicative of heavily sedimented conditions

and with low sensitivity to flow reductions. All ditch locations attained WHPT-ASPT scores reflecting generally good water quality, however DN7 and DN8 both attained low WHPT-NTAXA scores (eight scoring taxa in both cases) suggesting habitat pressures at these sites.

1.4.11 The surveys completed on the riverine sites demonstrated that all survey locations possessed a macroinvertebrate community adapted towards sedimented/heavily sedimented habitats and with a low sensitivity to flow reductions. Analysis by RICT indicated that all sites had good water quality but a lack of habitat diversity/quality is restricting the quality of the macroinvertebrate community.

1.4.12 All sites attained CCI scores indicative of a resident macroinvertebrate community with Moderate conservation value or greater except DN8 (ordinary watercourse), WBN2 (River Fromus) in autumn 2023, and WBN3 (River Fromus western tributary) which all attained CCI scores indicative of Low conservation value. Notable macroinvertebrate species recorded comprise the beetle species *Peltodytes caesus* (recorded at DN5) and *Enochrus quadripunctatus* (recorded at DN4), both of which are designated as Nationally Scarce (Foster, 2010) but neither are sufficiently rare to qualify for an IUCN Red List status, and the beetle *Enochrus melanocephalus* (recorded at DN5) which was formerly recognized as Nationally Notable List B but is currently considered too widespread to qualify as Nationally Scarce (Foster, 2010).

1.4.13 No macroinvertebrate INNS were recorded, however several non-native and non-invasive species were found. The Autumn 2023 surveys found the flatworm *Girardia tigrina* at DN6, the New Zealand mud snail at DN2, DN5 and WBN1, the bladder snail *Physella* sp. at DN2 and DN4, and the freshwater amphipod *C. pseudogracilis/floridanus* at DN5, DN6, DN7, and DN8. The spring 2024 surveys found *C. pseudogracilis/floridanus* at WBN3, and the New Zealand mud snail at WBN2. The autumn 2024 survey found *C. pseudogracilis/floridanus* at WBN2, and the New Zealand mud snail at WBNx2. Whilst there are no statutory constraints arising due to the presence of these non-native and non-invasive macroinvertebrate species, best practice biosecurity measures should be implemented for any in-channel works undertaken.

River Fromus Habitat and existing Bridge's Appraisal

Literature Review

1.4.14 The findings of a literature review (**Annex 2.F.9**) undertaken in November 2024 show that no scientific data pertaining to flight elevation of adult UK riverfly species during compensation flight (upstream migration of adult riverflies to compensate for the downstream drift experienced by the aquatic larvae) was identified and very limited information on the general flying ability of adult UK riverfly species is available. *P. longicauda* (Málnás, et al., 2011) is not an appropriate model species to act as a substitute of UK riverfly species to provide suitable and relevant data upon which to base decisions, due to the substantial difference in size between this European species and even the largest UK mayfly (*Ephemera danica)* and consequent differences in flying ability and perceptual range. Málnás et al. (Málnás, et al., 2011) remains the single study contending that bridges may act as an optical barrier to riverfly species; no further literature has been found to support this view or exploring the cumulative effects of multiple bridges on riverfly species.

1.4.15 Dr Loxdale (Loxdale, et al., 2013) makes the valid point that there are issues facing macroinvertebrate populations which are likely to pose greater threats to species survival than the effects of light polarization reflected by large bridges. This

communication was also written only two years after publication of Málnás et al. (2011), when it might have been expected that further instances of optically barring bridges affecting other species would be documented in the future. It has now been over a decade and there is yet to be a single other documented case of bridges acting as optical barriers to riverfly dispersal.

1.4.16 All published observations as detailed in the literature review (**Annex 2.F.9**) document mayflies routinely flying at least 0.5 m from the water surface during swarming and compensation flights. From a scientific perspective, Málnás et al. (2011) remains the only study to suggest that a bridge, devoid of electrical lighting, with ample space for underway passage, could obstruct upstream riverfly dispersal. To accept that bridges pose a significant threat to riverfly populations by acting as optical barriers requires further study and corroborating evidence from a source external to the research group that introduced this concept to the scientific community. At present, it is not possible to conclude, given the current body of scientific data, that any given bridge, or multiple bridges, could impact riverfly species found in the UK in the manner described by Málnás et al. (2011).

Existing Bridges' Appraisal

1.4.17 Along the River Fromus 20 bridges were recorded. All bridges had a clearance of 0.5-3.0 above water on the day of survey. The bridges situated within Saxmundham town typically had a higher clearance than those downstream of Saxmundham Bridge (Bridge 5 – Table 1.16). Build materials, parapet height and width of either of the proposed bridge options is in keeping with bridges located on the River Fromus.

Habitat Appraisal

1.4.18 The mid survey reach at the proposed bridge location differs in habitat from both upstream and downstream survey reaches. Both upstream and downstream sections consist of semi-natural woodlands with open sections dominating the bank top habitat. Whilst in this mid survey reach dense willow plantation woodland dominates with a number of fallen trees. The depth in the mid survey reach also increases significantly compared to Saxmundham town, increasing from 0.2 m to 1.0 m.

1.4.19 Due to the lack of understory vegetation, runoff from the surrounding agricultural landscape with slight gradient is likely to input high silt loads into the channel. In addition, outfalls located in the upstream survey reach within Saxmundham town and from local field drains in the mid surveyed area are also likely to be heavy with silt and debris. At the time of survey of the six outfalls identified (Table 1.17) only one, a field drain, located at the proposed bridge location was discharging.

1.4.20 The depth and straightened planform of the watercourse combined with the number of fallen trees, slows the flow at the proposed River Fromus bridge location compared to the upstream survey reach through Saxmundham, resulting in increased deposition of fine sediments on the riverbed. Additionally, the fallen trees act as a strainer capturing woody debris floating down the channel, creating temporary debris dams and increasing impoundment of flow. This explains why the substrate at the proposed bridge location, which is dominated by silt, differs from the gravel/pebble substrate found upstream and the gravel/sandy substrate found downstream.

1.4.21 Limited numbers of riverfly taxa were recorded during the surveys of the River Fromus (Table 1.18). Whilst different species are present at different locations, it is notable that all survey sites had at least one riverfly taxon present for each survey. Furthermore, Limnephilidae caddisfly larvae were present at both WBNx1 and WBN2 during the

autumn 2024 survey, despite the presence of three bridges defined as substantial or partial barriers between the two survey locations. Whilst the riverfly communities of the three survey locations are clearly different, this may be a result of the riverine habitat at the survey location as detailed in the results section. WBNx2 is located within the 'downstream' section of the habitat survey, characterised as riffle/run/glide/pool habitat with glide the dominant habitat and with gravel/sand the dominant substrate and water velocity in the range 10-25 cm/s. This is reflected in the riverfly taxa recorded at the site, with larvae of both the mayfly *Baetis rhodani/atlanticus* and the caddisfly *Agapetus* sp. requiring faster flow velocities and the caddisfly requiring ample sand and gravel for case construction. In contrast, the habitat at WBN2, located within the 'mid' section of the habitat survey, is dominated by slow-flow (<10 cm/s) glide/pool habitat types with silt dominated substrate and submerged woody material. This combination is again reflected in the riverfly taxa recorded at the site, with the mayfly *Cloeon dipterum* and caddisflies *Limnephilus* lunatus and *Glyphotaelius pellucidus* known as inhabitants of lentic and slow-flowing habitats. Larvae of the caddisfly genus *Lype* build galleries of wood fragments using silk on large woody material substrates, as well as feeding on woody debris. The habitat at WBNx1, the 'upstream' section of the habitat survey, is similar to that present at WBNx2, however the habitat is not continuous as the mid survey reach (approximately 1.2 km in length) is located between these survey points and is a separate habitat as detailed for WBN2. Consequently, the lack of continuous habitat for rheophilic larval riverfly species along the surveyed length of the River Fromus and the change of habitat type between WBN2 (supporting Limnephilidae larval riverfly species) and WBNx1 appears to be the main driver of the larval riverfly community at the surveyed points rather than other factors such as barriers to adult riverfly migration.

1.4.22 The fragmented nature of the habitat of the River Fromus appears not to have overly influenced the macroinvertebrate WFD classification as presented in Table 1.13 and Table 1.14, which is consistently Bad/Moderate at all sites and seasons presented. However, it is notable that the overall habitat quality and diversity for riverfly taxa increases along the River Fromus downstream of the proposed bridge location. The density of emergent and submerged macrophytes also increase downstream along with the quantity of woody debris (**Annex 2.F.8**). There is also an increase in the frequency of different flow habitats (riffle, run and glide) downstream of the proposed bridge location due to the increased presence of in-channel macrophytes and the river channel following a more natural planform as it meanders frequently in comparison to the straightened planform of the upstream and mid surveyed reaches. The increase in habitat diversity downstream of the proposed bridge location is considered to be the majority contribution factor, alongside the collection of data over a longer time period, to the greater diversity of larval riverfly taxa that have been found at EA monitoring points in comparison to what has been found on the more recent macroinvertebrate sampling undertaken for this report.

Fish

1.4.23 No notable fish species were identified during the survey at the River Fromus but the desk study identified that European eel had previously been recorded upstream of the survey site in 2012. With habitat seen on site suitable for European Eel it is highly likely they are still present.

1.4.24 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. The species is protected under the Eels (England and Wales) Regulations 2009, as well as the Salmon and Freshwater Fisheries Act (SAFFA) 1975 (as amended under the Environment Act 1995).

1.4.25 The desk study also showed protected species of brown trout and brook lamprey on the nearby River Alde. The River Alde is a downstream confluence to the River Fromus. This creates a potential for eel, lamprey and/or salmonid species to migrate up the River Fromus. Eel was previously seen in 2012 by the EA at their Saxmundham survey location 1 km from the proposed bridge crossing.

1.4.26 Brown or sea trout are a Section 41 Species of Principle Importance (SPI) for the purpose of conserving of biodiversity under the NERC Act 2006. The species is protected under the Salmon and Freshwater Fisheries Act (SAFFA) 1975 (as amended under the Environment Act 1995). There are no data records of the species on the River Fromus in the last 10 years but was found on the River Alde in 2016. Habitat appraisal of the River Fromus showed there to be potential suitable spawning habitat for salmonids. Brook Lamprey are protected under Annex II of the Habitats Directive and Bern Convention.

1.4.27 One non-native fish; goldfish, was identified in the desk study. However, this was recorded in a pond almost 2 km from the Suffolk Onshore Order Limits, therefore it is discounted it as it will not be influenced by site works.

1.4.28 Three-spined stickleback were the only species caught on the River Fromus. They are ubiquitous and a highly tolerant species. The fish assemblage was similar to that of the last survey completed by the EA at their monitoring location at Saxmundham located approximately 800 m upstream. Therefore, the findings of this survey can be considered representative of the River Fromus in this location. This is further supported by the Site Classifications for the EA monitoring locations, whereby Saxmundham has been classified as ‘Poor’ for the Fish biological quality element across all assessment years between 2009 – 2016, apart from 2010 where fish were classified as ‘Bad’.

1.4.29 Statutory consultation comments showed there was concern over the presence of European smelt in relation to the Proposed Project. The fish survey on the River Fromus suggested that no smelt were present. Similarly, no smelt were present in any of the previous EA surveys (WFD or routine monitoring sites) completed on the Fromus Water Body. The closest record for smelt is approximately 7.9 km downstream of the proposed crossing point within the main River Alde which was recorded at the EA monitoring site U/S Langham Bridge (Site ID: 35) in 2003. Smelt migrate into rivers to spawn amongst gravels in fast flowing river water (normally above the saline influence). Given that the habitat present at the proposed bridge location on the River Fromus does not represent suitable spawning habitat for smelt, it is highly unlikely that smelt will be within the vicinity of the Proposed Project.

1.4.30 Given the habitat conditions at the original New Hundred River survey location it is highly likely that fish species are not present in this area apart from in high runoff/rain events where fish species can migrate upstream. Given the close proximity of this site to the EA monitoring site Knodishall Common (<1 km), it is likely that the three-spined stickleback and ten-spined stickleback previously found at Knodishall Common occur in the area.

1.5 Conclusions

Aquatic Macrophytes

1.5.1 The surveys demonstrated the aquatic macrophyte community of the Hundred River was of high biological quality and that of the River Fromus was of moderate quality.

1.5.2 No protected or notable species were recorded from either the River Fromus or the Hundred River, nor were any of the species recorded present in the Suffolk BAP. All species common and widespread, and highly likely to be present in the wider landscape.

1.5.3 The macrophyte INNS Himalayan balsam was recorded within the Hundred River and River Fromus survey reaches, whilst the desk study demonstrated records of the macrophyte INNS Canadian waterweed and giant hogweed within 2 km the Suffolk Onshore Scheme Order Limits. The desk study also returned a record of the non-native and non-invasive least duckweed within 2 km of the Suffolk Onshore Scheme Order Limits.

Aquatic Macroinvertebrates

1.5.4 The surveys found that all survey sites contained a macroinvertebrate community adapted to tolerate sedimented/heavily sedimented habitats and low flow-velocity conditions. The survey results indicated good water quality at all locations, but that habitat quality was likely restricting the quality of the residing macroinvertebrate community.

1.5.5 Two notable macroinvertebrate species were recorded during the macroinvertebrate surveys; the Nationally Scarce beetles *Peltodytes caesus* and *Enochrus quadripunctatus*. Neither beetle is considered sufficiently rare to qualify for an IUCN Red List status, and both are likely to occur in the local landscape where suitable habitat is present. The IUCN Near Threatened great silver diving beetle was also highlighted by the desk study as within 2 km of the study site.

1.5.6 No macroinvertebrate INNS were recorded. However, several non-native and non-invasive species were found; namely the flatworm *Girardia tigrina* the New Zealand mud snail, the bladder snail *Physella* sp., and the freshwater amphipod *C. pseudogracilis/floridanus*.

River Fromus Habitat and Existing Bridges' Appraisal

1.5.7 Habitat fragmentation and diversity appear to have a greater influence on larval riverfly species presence than bridges potentially acting as barriers to adult riverfly migration.

Fish

1.5.8 The fish assemblage of just three-spined stickleback recorded at the River Fromus was similar to what has previously been reported at EA monitoring locations on the river.

1.5.9 It is highly unlikely that European smelt will use the River Fromus for spawning due to a lack of suitable spawning habitat.

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Annex 2.F.1 Macrophyte taxa list

Table A.1 Water Framework Directive boundary values for macrophytes in rivers

Ecological Quality Ratio (EQR)	WFD Ecological Status for Macrophytes
≥ 0.80	High
≥ 0.60	Good
≥ 0.40	Moderate
≥ 0.20	Poor
< 0.20	Bad

Table A.2 Macrophyte taxa list and associated cover values for New Hundred River and River Fromus

Scientific name	Common name	New Hundred River	River Fromus
Alisma plantago-aquatica	Common water-plantain	C2	
Berula erecta	Lesser water parsnip	C3	
Callitriche spp.	Water-starwort	C2	C1
Carex pendula	Pendulous sedge	C5	
Carex pseudocyperus	Cyperus sedge		C1
Cladophora sp.	Blanketweed		C3
Conocephalum conicum	Great scented liverwort		C2
Iris pseudacorus	Flag iris	C3	
Impatiens glandulifera	Himalayan balsam	B	C5
Mentha aquatica	Water mint	C7	
Phalaris arundinacea	Reed canary grass	C8	C4
Phragmites australis	Common reed	C2	
Potamogeton natans	Broad-leaved pondweed		C1
Sparganium erectum	Branched bur-reed		C6

Scientific name	Common name	New Hundred River	River Fromus
Solanum dulcamara	Bittersweet		C3

Annex 2.F.2 Community Conservation Index (CCI)

A.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 A.3 below. The derived CCI scores generally vary from 0 to > 20, as detailed in the Table A.4 below. The Table A.4 below provides a guide to interpreting CCI scores.

Table A.3 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 A.4 General guide to CCI scores (from Chadd & Extence, 2004)

CCI Score	Description	Interpretation
0 to 5.0	Sites supporting only common species and/or community of low taxon richness	Low conservation value

CCI Score	Description	Interpretation
> 5.0 to 10.0	Sites supporting at least one species of restricted distribution and/or a community of moderate taxon richness	Moderate conservation value
> 10.0 to 15.0	Sites supporting at least one uncommon species, or several species of restricted distribution and/or a community of high taxon richness	Fairly high conservation value
> 15.0 to 20.0	Sites 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	Sites supporting several rarities, including species of national importance and/or a community of very high taxon richness	Very high conservation value

Annex 2.F.3 Lotic-Invertebrate Index of Flow Evaluation (LIFE)

A.1.1 The Lotic-Invertebrate Index for Flow Evaluation (LIFE) provides an assessment of the impact of variable flows on benthic macroinvertebrate communities (Extence, et al., 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 A.5 below. The LIFE score for a macroinvertebrate sample is then derived (mean of individual scores) from individual taxon scores and abundances, as detailed in the Table A.6. LIFE scores for a macroinvertebrate sample ranges from 1 to 12, where highest scores describe communities adapted to rapid flows.

Table A.5 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 A.6 LIFE scoring matrix combining 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 2.F.4 Proportion of Sediment-sensitive Invertebrates (PSI)

A.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 A.7, and an abundance rating. The PSI score for the aquatic macroinvertebrate sample is then derived from the individual species scores and abundances, as detailed in Table A.8. 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 A.9).

Table A.7 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 A.8 Abundance categories and scoring matrix used to derive PSI scores

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 A.9 Interpretation of PSI scores

PSI	Description
81-100	Minimally sedimented
61-80	Slightly sedimented
41-60	Moderately sedimented
21-40	Sedimented
0-20	Heavily sedimented

Annex 2.F.5 Whalley, Hawkes, Paisley & Trigg (WHPT) Metric

A.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).

A.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.

A.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.

A.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.

A.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:

- WHPT score;
- NTAXA; and
- ASPT.

A.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.

A.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 2.F.6 Macroinvertebrate Taxa Lists

Table A.10 Macroinvertebrate taxa list for autumn 2023 surveys

Family	Taxon	DN2	DN4	DN5	DN6	DN7	DN8	WBN1	WBN2
Flatworms									
Planariidae	Planariidae						2		
Planariidae	*Polycelis* sp.				5				
Dugesiidae	*Girardia tigrina*				2				
Snails									
Lymnaeidae	*Galba truncatula*				1				
Lymnaeidae	*Stagnicola* sp.	4	5					1	
Lymnaeidae	*Lymnaea stagnalis*			3					
Lymnaeidae	*Ampullaceana balthica*	43	25	10					
Tateidae	*Potamopyrgus antipodarum*	9		2				776	
Physidae	*Aplexa hypnorum*					4			
Physidae	*Physella* sp.	32	1298						
Planorbidae	*Anisus vortex*			8	14				
Planorbidae	*Gyraulus albus*			1					
Planorbidae	*Gyraulus crista*		2						
Limpets and mussels									
Sphaeriidae	*Pisidium/Euglesa/Odhneripisidium*		1		48				
Worms									
Oligochaeta	Oligochaeta	2	10		8	3	8	1	2
Crustaceans									
Ostracoda							126		
Cladocera			2						
Gammaridae	*Gammarus* sp.							5	
Gammaridae	*Gammarus duebeni*							5	

Family	Taxon	DN2	DN4	DN5	DN6	DN7	DN8	WBN1	WBN2
Gammaridae	*Gammarus pulex/fossarum* agg.								31
Gammaridae	*Gammarus pulex*								10
Crangonyctidae	*Crangonyx floridanus/pseudogracilis*			34	260	1	5		
Asellidae	*Proasellus* sp.		1						
Asellidae	*Asellus aquaticus*	6		4	1443		11		67
Mayflies									
Baetidae	Baetidae	1	11	7					
Damselflies									
Coenagrionidae	Coenagrionidae	18	16	14					
Coenagrionidae	*Pyrrhosoma nymphula*		2						
Dragonflies									
Aeshnidae	*Anax* sp.		1						
Libellulidae	Libellulidae		1						
True bugs									
Naucoridae	*Ilyocoris cimicoides*	8		2					
Corixidae	*Corixa punctata*	1							
Corixidae	*Hesperocorixa linnaei*	15		1					
Corixidae	*Hesperocorixa sahlbergi*								1
Corixidae	*Sigara* sp.			1					
Notonectidae	*Notonecta glauca*	3	5	1					
Notonectidae	*Notonecta viridis*	1							
Beetles									
Haliplidae	Haliplidae	1							
Haliplidae	*Peltodytes caesus*			2					
Haliplidae	*Haliplus* sp.			1					
Haliplidae	*Haliplus lineaticollis*								2

Family	Taxon	DN2	DN4	DN5	DN6	DN7	DN8	WBN1	WBN2
Gyrinidae	*Gyrinus substriatus*								3
Dytiscidae	Dytiscidae		5	1	12	1	7		
Dytiscidae	*Colymbetes fuscus*		1						
Noteridae	Noteridae			1					
Noteridae	*Noterus clavicornis*	1						1	
Hydrophilidae	*Helophorus brevipalpis*		1			1			
Hydrophilidae	*Hydrobius fuscipes*		1		1				
Hydrophilidae	*Anacaena globulus*				1				1
Hydrophilidae	*Anacaena limbata*	1							
Hydrophilidae	*Helochares lividus*		1						
Hydrophilidae	*Enochrus melanocephalus*			1					
Hydrophilidae	*Enochrus quadripunctatus*		1						
Hydraenidae	*Ochthebius minimus*	1							
Dryopidae	Dryopidae	2							
Dryopidae	*Dryops* sp.		1						
Alderflies									
Sialidae	Sialidae								
Sialidae	*Sialis lutaria*			1					
Caddisflies									
Limnephilidae	Limnephilidae	257	245	56	4	2		59	2
Limnephilidae	*Limnephilus marmoratus*		13						
Limnephilidae	*Limnephilus lunatus*					2			1
Leptoceridae	*Mystacides azurea*			1					
True-flies									
Chironomidae	Tanypodinae	1	2	1	1	1			1
Chironomidae	Orthocladiinae	8	2		3	19	8		4
Chironomidae	Chironomini	2	6	5				2	2
Chironomidae	Tanytarsini					1	4		
Tipulidae	*Tipula* sp.					1	3		

Family	Taxon	DN2	DN4	DN5	DN6	DN7	DN8	WBN1	WBN2
Limoniidae	Limoniidae	5	1		1				
Dixidae	Dixidae		1	4					
Dixidae	*Dixella* sp.		15	6					
Ceratopogonidae				1					
Stratiomyidae	Stratiomyidae	3	2						1
Culicidae	Culicidae		4				21		
Other Taxa									
Collembola	Collembola						1		
Lepidoptera	Crambidae	13							

Table A.11 Macroinvertebrate taxa list for spring 2024 surveys

Family	Taxon	WBN2	WBN3
Flatworms			
Planariidae	*Polycelis* sp.	2	15
Planariidae	*Polycelis felina*	2	
Dugesiidae	Dugesiidae	1	
Snails			
Lymnaeidae	*Stagnicola* sp.		3
Lymnaeidae	*Ampullaceana balthica*	9	
Hydrobiidae	*Potamopyrgus antipodarum*	1	
Succineidae	*Succinea* sp.		25
Limpets and mussels			
Sphaeriidae	*Pisidium/Euglesa/Odhneripisidium*	6	1
Worms			
Oligochaeta	Oligochaeta	2	50
Leeches			
Glossiphoniidae	*Glossiphonia complanata*	3	
Crustaceans			
Gammaridae	*Gammarus* sp.	16	
Gammaridae	*Gammarus pulex*	7	
Crangonyctidae	*Crangonyx floridanus/pseudogracilis*		60
Asellidae	*Asellus aquaticus*	60	135
Mayflies			
Baetidae	*Cloeon dipterum*	1	
True bugs			
Veliidae	*Velia* sp.	1	
Beetles			
Dytiscidae	Dytiscidae (larvae / damaged)		3
Dytiscidae	*Hydroporus palustris*	1	1
Dytiscidae	*Hydroporus planus*	2	1
Dytiscidae	*Ilybius fuliginosus*	4	

Family	Taxon	WBN2	WBN3
Hydrophilidae	Hydrophilidae	2	
Hydrophilidae	*Helophorus aequalis*	1	
Hydrophilidae	*Helophorus brevipalpis*	11	
Hydrophilidae	*Hydrobius fuscipes*	2	
Hydrophilidae	*Anacaena bipustulata*	4	
Hydrophilidae	*Anacaena globulus*	1	
Hydrophilidae	*Anacaena limbata*		1
Hydrophilidae	*Laccobius bipunctatus*		1
Scirtidae	Scirtidae		2
Curculionidae	Curculionidae	1	
Alderflies			
Sialidae	Sialidae (juvenile / damaged)		
Sialidae	*Sialis lutaria*	2	
Caddisflies			
Psychomyiidae	*Lype* sp.	1	
Limnephilidae	Limnephilidae		90
Limnephilidae	*Limnephilus lunatus*	28	10
True-flies			
Chironomidae	Tanypodinae	8	
Chironomidae	Orthocladiinae	4	
Chironomidae	Chironomini	62	2
Chironomidae	Tanytarsini	136	1
Chironomidae	Prodiamesinae		1
Limoniidae	Limoniidae		1
Tabanidae	Tabanidae		1
Diptera	Diptera (indeterminate)		1

Table A.12 Macroinvertebrate taxa list for autumn 2024 surveys

Family	Taxon	WBNx1	WBN2	WBNx2
Flatworms				
Planariidae	*Polycelis nigra / tenuis*			1
Snails				
Lymnaeidae	*Ampullaceana balthica*			2
Hydrobiidae	*Potamopyrgus antipodarum*			38
Limpets and mussels				
Sphaeriidae	*Sphaerium sp.*			1
Sphaeriidae	*Pisidium/Euglesa/Odhneripisidium*	1	24	
Worms				
Oligochaeta	Oligochaeta		4	23
Leeches				
Glossiphoniidae	*Glossiphonia complanata*	1		
Crustaceans				
Gammaridae	*Gammarus pulex/fossarum agg.*		2	86
Gammaridae	*Gammarus pulex*		2	173
Crangonyctidae	*Crangonyx floridanus/pseudogracilis*		1	
Asellidae	*Asellus aquaticus*	2	22	36
Mayflies				
Baetidae	*Baetis rhodani / atlanticus*			2
True bugs				
Corixidae	*Hesperocorixa sahlbergi*		2	
Beetles				
Elmidae	*Elmis aenea*			2
Alderflies				
Sialidae	*Sialis lutaria*	1	2	
Caddisflies				
Glossosomatidae	*Agapetus sp.*			1
Psychomyiidae	*Lype phaeopa*		1	
Limnephilidae	Limnephilidae	1	3	

Family	Taxon	WBNx1	WBN2	WBNx2
Limnephilidae	*Glyphotaelius pellucidus*		4	
Trueflies				
Chironomidae	Tanypodinae	6	2	
Chironomidae	Orthocladiinae			2
Chironomidae	Chironomini	39	44	
Chironomidae	Tanytarsini	6		26
Chironomidae	Prodiamesinae			2
Tipulidae	*Tipula sp.*			1
Pediciidae	*Dicranota* sp.			6
Psychodidae	Psychodidae			1

Annex 2.F.7 Fish Survey Data

Date	Gear/method used	Run number
7/22/2024	Bankside e-fish, semi-quantitative	1 of 1

Site (waterbody)	Survey personnel	Duration (mins)
River Fromus	KG AW JM AR	90

Start Time	Start NGR	End Time	End NGR
15:00	TM3883461924	16:30	TM3885362177

Fish species and fork length (mm)

3-Spined stickleback				
74	55	43	52	43
42	43	52	47	60
47	42	34	44	41
40	47	43	47	54
46	40	49	45	56
52	37	62	43	41
40	56	38	42	21
51	32	63	42	44
20	12	42	47	36
			Total =	45

Notes

Scales taken
Weights

Annex 2.F.8 Habitat Appraisal Data

Assessment Type	National Grid Reference	Habitat Paragraph
Walkover	TM 38678 63319	At this point the watercourse is 2 m wide, widening upstream of the road bridge to 3 m on average, with an average flow between 10 and 25 cm/s. Due to high turbidity along this reach, it was not possible to assess the substrate nor bed features. Banktop vegetation on both banks was of a simple structure, dominated by tall herb vegetation providing light shading across the watercourse. The wider land use was dominated by urban and industrial land uses. Upstream of this point the railway crossed the River Fromus on a brick bridge.
Walkover	TM 38678 63319	Here the watercourse was 2 m wide with an average depth of 20 cm. The average flow was between 10 and 25 cm/s and the channel was moderately shaded by over-hanging trees. In summer it is likely that this channel is heavily shaded when the trees are in leaf. Along this reach the flow type was dominated by riffle habitat. Due to the high turbidity, it was not possible to see the substrate and bed features. There were several areas of modification along this stretch, with a large outfall on the left bank and grey bank protection on the right bank. Here the watercourse flowed through a woodland strip with broadleaved woodland on both banktops, with limited understory vegetation. In the wider environment, the bank top habitat was dominated by improved grassland on the left bank, and houses and gardens on the right bank.
Macroinvertebrate sample	TM 38771 63161	Here the watercourse was 2.5 m wide with an average depth of 20 cm. The flow here was between 10 and 25 cm/s, and had high turbidity. The substrate in this reach was dominated by gravel and sand, with a small amount of boulders, cobble and pebbles also present. This reach was dominated by run habitat. Along the left bank, a brick wall formed an area of bank protection. Both banks had complex vegetation structures, dominated by broadleaved woodland providing woody debris and tree roots into the channel. The wider land use was dominated by improved grassland and houses. The gravel bed material formed suitable habitat for spawning salmonoid species. Whilst the earth banks and tree roots provide suitable habitats for crayfish.
Walkover	TM 38777 63111	Here the channel was 3.5 m wide with a maximum width of 4 m. Within this reach the flow was between 10 and 25 cm/s and dominated by run flow type with riffles also present. The substrate here was dominated by pebble and gravel with boulders also present. Both banks had complex bank vegetation structure, dominated by broadleaved woodland which moderately shaded the channel. Within the wider environment the land use was dominated by improved grassland and urban land uses. The presence of gravels within the channel provides good habitat for salmonid species. The reach also provided suitable habitat for crayfish with vertical earth banks and submerged tree roots.
Walkover	TM 38803 62987	At this point Church Road crosses the River Fromus. Within this reach the watercourse was 4 m wide on average with a maximum width of 5 m, downstream of the bridge the watercourse widens to 10 m. The flow here was between 10 and 25 cm/s. Due to the high turbidity, it was not possible to see the substrate and bed features. The bank vegetation structure was dominated by complex vegetation, within an area of

Assessment Type	National Grid Reference	Habitat Paragraph
		broadleaved woodland, on the right bank and simple on the left, comprising of housing and gardens. Both banks had grey bank protection comprising of brick walls under the bridge, protecting the wider urban landscape. From the bridge there was an outfall.
Desk based assessment	TM 38803 62983	Within this reach the watercourse was within an area of broadleaved woodland with urban land uses on both banks.
Desk based assessment	TM 38759 62852	Here the watercourse was 2m wide within a tall herb strip. The wider landscape here was dominated by improved grassland on the left bank forming an area of formal garden whilst on the right was dominated by arable land.
Walkover	TM 38827 62301	Within this reach the wetted width was 3 m on average with a maximum width of 4 m. Here the flow was dominated by glide habitat with a flow rate between 10 and 25 cm/s. Due to the high turbidity, it was not possible to see the substrate and bed features. Within the channel, large quantities of submerged woody material were present with submerged tree roots present along the whole reach. A field drain outfall was also present within this reach. Both banks had a complex bank top structure, dominated by broadleaved woodland on both banks with tilled/arable land in the wider landscape. Fish and crayfish habitat was limited due to high levels of siltation, however, the vertical earth bank, tree roots and submerged woody debris provided habitat for crayfish burrowing.
Macroinvertebrate sample	TM 38858 62125	Through this reach the water width was 3.5 m with an average depth of 50 cm. The flow here had an average flow less than 10 cm/s. Due to high turbidity it was not possible to see the substrate and bed features. Across the reach, the flow type was dominated by glide flow. Stands of macrophytes were present at intervals along the reach, these included pondweed *Potamogeton* species, starwort *Callitriche* species, and branched bur-reed *Sparganium errectum*. Both banks had complex vegetation structure, dominated by broadleaved woodland. This provided woody debris and submerged tree roots in the channel. The wider environment here was dominated by tilled/arable land. This reach had suitable habitat for crayfish, with vertical earth banks and submerged tree roots.
Walkover	TM 38792 61824	At this point, the channel was 3 m wide on average with a maximum width of 4 m. The flow here was less than 10 cm/s with an EA monitoring station downstream of the bridge. Due to the high turbidity, it was not possible to see the substrate and bed features. The flow type within this area was dominated by glide habitat, within the channel there was a low coverage of macrophytes. The banks here were dominated by complex vegetation structure, with broadleaved woodland present on both banks with an understory of tall herb. Within the wider environment tilled/arable land and a road was present. An outfall from the road was present on the banks of the watercourse.
Desk based assessment	TM 38792 61824	Through this reach the channel is 2.5 m wide, flowing through a woodland strip. In the wider environment, the right bank is dominated by grazed land whilst the right is dominated by parks and garden.
Walkover	TM 38755 61585	Throughout this reach the watercourse was 2 m wide on average, with a flow less than 10 cm/s. The substrate here was not assessed due to high turbidity. Through the reach the flow habitat was dominated by glides. At the upstream end of the reach there were small stands of

Assessment Type	National Grid Reference	Habitat Paragraph
		sedges *Carex* within the channel, however these become limited throughout the reach. The bank vegetation structure on both banks was simple with the land use dominated by tall herbs and semi-improved grassland, with buildings and houses within the wider environment. On the left bank throughout this reach there were scattered young trees, downstream of this towards TM 38734 61374 the trees become denser forming a woodland block at the downstream end of the reach. This section provided suitable habitat for crayfish with vertical earth banks. Holes (8-12 cm) were present within the banks. Habitat for fish was limited through this reach, with the most suitable habitat at the upstream points where sedge stands were present.
Desk based assessment	TM 38723 61287	Through this section the river is 4 m wide. The land use here on the left bank is dominated by woodland whilst on the right bank is grassland with a tall herb strip.
Walkover	TM 38702 61084	Here the wetted width was 3 m, and the water depth was 80 cm, with an average flow between 10 and 25 cm/s. Due to high turbidity, it was not possible to see the substrate and bed features, however, from the macroinvertebrate sample, the substrate is assumed to be dominated by sand with gravel also present. The flow here was dominated by glide habitat. Both banks had complex vegetation structure, dominated by broadleaved woodland with an understory of tall herb, which provided woody debris into the channel. Within the wider environment, buildings and minor roads were present. The vertical earth banks provided suitable crayfish burrowing habitat. However, due to the high turbidity, it was not possible to identify suitable fish habitat.
Desk based assessment	TM 38702 61084	Here the watercourse flowed through a hamlet with gardens on both banks dominated by woodland and grassland.
Walkover	TM 38645 61011	Within this land parcel the watercourse was 2.5 m wide on average with a maximum width of 3 m, through this reach the flow was between 10 and 25 cm/s. Here the substrate comprised of sand and gravel, with tree roots and woody debris within the channel. This section had both run and glide habitats with areas of pools also present. On the right bank the bank top vegetation was dominated by simple vegetation structure with the surrounding land use on this bank dominated by houses and gardens, whilst the right bank had a complex bank vegetation structure dominated by broadleaved woodland. A layer of foam was present on a pool at this point. This section of the reach provided optimal habitat for crayfish with vertical earth banks and submerged tree roots. This area was, however, not suitable for fish due to limited refuge areas such as vegetation and pools.
Walkover	TM 38633 60984	Here the watercourse was 2 m wide on average with an average depth of 50 cm. The flow here was less than 10 cm/s with no shading of the watercourse. Due to high turbidity it was not possible to see the substrate or bed features, however, where access to the watercourse was possible the substrate was dominated by sand with areas of gravel. Woody debris was present in the channel at the upstream extent of the surveyed reach, with recently cut stands of macrophytes along both banks for the majority of the reach. The surveyed reach flow type was

Assessment Type	National Grid Reference	Habitat Paragraph
		dominated by glide habitat. A small impoundment was present in the channel, this acted as an aeration feature forming an area of riffle habitat over concrete. The reach through Marsh Farm had been historically altered before 2000 (Google, 2007). The bank vegetation on both banks was dominated by uniform vegetation, with the surrounding land use comprised of improved grassland and areas of open water forming a fishing and camping site. Along this reach there was limited habitat for crayfish due to no bankside trees and limited exposed banks. The stands of vegetation provided suitable habitat for juvenile fish.
Walkover	TM 38283 60479	Here the watercourse was approximately 2 m wide, with an average flow less than 10 cm/s. Due to high turbidity it as not possible to see the substrate nor bed features. Bankside trees along the reach provided submerged roots and overhanging bows. Throughout the reach there were intermittent stands of sedge species and reed species along both banks. The flow habitats within the reach were a combination of run and glide habitats. The bank top vegetation on the right bank was dominated by complex vegetation structure with a mix of complex and simple vegetation structures on the left bank. The surrounding land use was dominated semi-improved grassland with areas of broadleaved woodland also present. Two residential properties were also present along this stretch on the left bank, around these there was no bankside vegetation. Along this reach there was limited habitat for fish and crayfish, with the habitat more suitable at the downstream end of the reach. Submerged roots and stands of vegetation provided suitable refuge for both groups, however the wider aquatic habitat was limited with little vegetation and bare banks.
Walkover	TM 38272 59887	Here the banks of the watercourse were dominated by broadleaved woodland with areas of improved grassland. On the right bank the vegetation structure was dominated by complex vegetation whilst the left bank was dominated by simple vegetation. The road also crossed the watercourse here.
Desk based assessment	TM 38267 59892	The watercourse here is 2 m wide with earth banks. Assessment from the road was ground-truthed using aerial imagery. The upstream section of this reach was dense broadleaved woodland thinning to a line of trees on both banks. The land adjacent to the watercourse was dominated by grazed land.
Walkover	TM 38103 59615	Here the watercourse was 2 m wide on average with a water depth of 50 cm and an average channel depth of 2 m. The channel here had an averaged flow between 10 and 25 cm/s with moderate turbidity. Through this section, glide flow was dominant and the substate was dominated by gravel and sand. The channel had moderate shading with dense overhanging trees and tree roots dominating both banks, within the channel small stands of vegetation were present. Both banks had simple vegetation structures dominated by broadleaved woodland with limited understory vegetation. Within the wider environment, the left bank was dominated by improved grassland and the right bank was dominated marshy fallow land dominated by tall herb. The channel here provided good habitat for crayfish species with earth banks and submerged tree roots along both banks. The habitat also

Assessment Type	National Grid Reference	Habitat Paragraph
		provided suitable habitat for fish with areas pools and large proportions of gravels in the substrate providing spawning habitat for salmonoids.
Desk based assessment	TM 38084 59570	Through this land parcel, the watercourse is approximately 2m wide flowing through areas of tall herb and dense broadleaved woodland. On the left bank the wider landscape is dominated by grazed grassland whilst on the right bank, arable land dominated the wider landscape.
Walkover	TM 38174 59131	Here the watercourse was 2 m wide with an average depth of 50 cm. The flow here was between 10 and 25 cm/s and the channel was lightly shaded with high turbidity. The substrate here was dominated by sand and gravel. Macrophytes were present along both banks for the whole reach and included species such as willowherb, branched bur-reed and watercress. Both banks had complex bank vegetation structure, the channel flowed within a woodland strip with a scrub understory. Along this reach the woodland had open areas dominated by tall herb vegetation. The wider landscape dominated by improved grassland. Overhead cables also crossed the watercourse in this reach, the phone line was approximately 8 m above the water whilst the pylons were approximately 20 m above the water. Throughout this reach, the macrophyte coverage provided good habitat for fish species. The lack of bankside trees and exposed banks limited the suitable habitat for crayfish species.
Desk based assessment	TM 38412 58735	Here the watercourse flows through a broadleaved woodland with dense tall herb understory.

Annex 2.F.9 River Fromus Riverfly Literature Review

To Environment Agency	**Project name** SEA Link	**Project number** 60664308
Client National Grid	**Subject** Literature review on riverfly flight ability	**Date** 12 November 2024

Aquatic Macroinvertebrates – Flying Insects Literature Review

Permanent access over the River Fromus

The Environment Agency has raised concerns regarding the height of the proposed watercourse crossing of the River Fromus, as part of the Sea Link project (EA reference: XA/2024/100083/01-L01, AECOM reference: EN020026).

The developer proposes a soffit height of 4 m for the crossing of the River Fromus, located between two existing bridges of 2.5 m – 3 m soffit height (approximately 300 m upstream and 860 m downstream distance from the proposed crossing).

The EA has cited evidence that inappropriately designed watercourse crossings may create a barrier to the movement of 'weak dispersing invertebrate taxa.'

The EA has requested a minimum 6 m soffit height from the water surface at Q95, stating this is based on several publications demonstrating that weak dispersing polarotactic invertebrates (those attracted to polarized light reflected from water or other surfaces) require a minimum clearance height below watercourse crossings, and a level of reflected polarised light under watercourse crossings, for them to successfully migrate upstream. The specific publication referenced by the EA (Málnás *et al.*, 2011) relates to a European species that is not present in the UK, and no further publications to support the request have been provided.

The EA has requested an assessment of the impacts of the proposed crossing on weak dispersing invertebrate taxa found at the EA monitoring sites on the River Fromus, and at monitoring locations surveyed specifically to support the impact assessment, due to the crossing with a soffit height of 4 m.

In response and in addition to the already completed ecological surveys and further ecological surveys specific for the proposed River Fromus crossing, this scientific literature review has been completed in order to address the following points as originally provided in 'Permanent access over River Fromus' response note dated 13 September 2024:

1. Review the extent and content of literature regarding the flying ability of the riverfly species recorded at relevant EA monitoring sites and specific monitoring sites surveyed to support the impact assessment;
2. Compare the flying ability of *Palingenia longicauda* (target species for Málnás *et al*. (2011), absent in the UK) with that of the largest mayfly present in UK (*Ephemera danica*) to determine if these two species possess a comparable flying ability; and
3. Review the extent and content of literature (if any) on the cumulative effects of multiple bridges on flying riverfly species.

This technical note presents the findings of the AECOM literature review, considering each point in turn. **The key findings are summarised as follows**:

- No details regarding the flight elevation of adult UK riverfly species during compensation flight (upstream migration of adult riverflies to compensate for the downstream drift experienced by the aquatic larvae) has been identified, and very limited information on general flying ability of adult UK riverfly species is available;

- *P. longicauda* is not an appropriate model species to act as a substitute of UK riverfly species to provide suitable and relevant data upon which to base decisions, due to substantial difference in size and consequent differences in flying ability and perceptual range; and

- Málnás *et al*. (2011) remains the single study contending that bridges may act as an optical barrier to riverfly species; no further literature has been found to support this view or exploring the cumulative effects of multiple bridges on riverfly species.

Literature Review Results

1. Review of the extent and content of scientific literature on the flying ability of riverfly species recorded at relevant monitoring sites

The River Fromus is currently classified as 'Good WFD status' for invertebrates (overall WFD ecological status 'Poor') despite the existence of at least nine bridges with lower soffit heights than the proposed crossing within 4 km upstream from one of the EA monitoring sites used for the invertebrate element for WFD assessment by the EA; the Benhall Green Bridge EA monitoring site.

It is noted that the second EA monitoring site, Gromford EA monitoring site, is more than 4.5 km downstream of the proposed crossing location. Given that the compensation flight for riverflies such as mayflies has been observed to be **up to 4 km** (Russev, 1959), taxa recorded at this location will be unaffected by the proposed crossing and are not considered further, where not identified at the closer monitoring site(s).

The Benhall Green Bridge EA monitoring site is located 1 km downstream of the proposed crossing, and approximately 700 m downstream of the B1121 road bridge, which has a soffit height of 2.5 - 3 m. Despite the presence of the B1121 road bridge, 13 species, two genera, and seven families of weak-dispersing taxa have been recorded at the Benhall Green Bridge EA monitoring site (Table 1).

No details regarding the flight elevation of adult UK riverfly species during compensation flight identified in Table 1 have been found as part of this literature review. The most extensive database of mayfly and caddisfly dispersal abilities currently available in the body of published scientific literature was compiled as part of a review by Arce *et al*. (2021). This review details the flight abilities of 180 Ephemeroptera (mayfly), Plecopetera (stonefly), and Trichoptera (caddisfly) species based on 71 publications. Together these studies employed an array of empirical methods to infer flight behaviors, such as trapping, direct observation, recapture of marked individuals, and genetic analysis. Nine of the 13 species highlighted as poor dispersers at the EA Benhall Green Bridge monitoring site are included in the database, as well as five Phryganeidae species (Table 1). Searches in Google Scholar using the remaining four species names as search terms alongside "dispersal", "flight", or "flight distance" failed to yield relevant results to supplement the information documented by Arce *et al*. (2021).

Flight abilities in Arce *et al*. (2021) are quantified by four metrics:

- *Maximum flying distance*;
- *Dispersal Capacity Metric (DCM)*: a dispersal index developed by Li *et al.* (2016) based on 'expert opinion';
- *Species Flying Propensity (SFP)*: an index developed by Sarremejane *et al.* (2017) based on four species traits (dispersal mode, adult body size, adult lifespan, and generation time); and
- *Relative Wing Length*: calculated as forewing length divided by body length.

The data available for the riverfly species recorded the EA Benhall Green Bridge monitoring site are presented in Table 1.

Table 1. Summary of dispersal abilities of riverfly taxa recorded at the EA Benhall Green monitoring site

Scientific name	Type	Maximum Flight Distance (m)	Dispersal Capacity Metric (DCM)	Species Flying Propensity (SFP)	Relative wing length
Baetis vernus	Mayfly	*	*	*	*
Baetis rhodani/atlanticus	Mayfly	> 3700	1.00	7.0	1.655

Scientific name	Type	Maximum Flight Distance (m)	Dispersal Capacity Metric (DCM)	Species Flying Propensity (SFP)	Relative wing length
Cloeon dipterum	Mayfly	> 1100	0.67	6.3	0.737
Caenis horaria	Mayfly	*	*	*	*
Caenis luctuosa	Mayfly	*	*	*	*
Lype reducta	Caddisfly	> 100	0.33	7.5	0.873
Hydropsyche angustipennis	Caddisfly	*	*	*	*
Phryganeidae:	Caddisfly	*	*	*	*
Phryganea grandis	Caddisfly	> 800	1.00	–	–
Phryganea bipunctata	Caddisfly	> 500	1.00	–	–
Agrypnia varia	Caddisfly	> 800	0.67	–	–
Oligotricha striata	Caddisfly	> 50	0.67	–	–
Agrypnia pagetana	Caddisfly	> 3000	0.67	–	–
Halesus radiatus	Caddisfly	4250	0.67	10.0	1.271
Glyphotaelius pellucidus	Caddisfly	> 1300	0.67	10.0	1.159
Limnephilus extricatus	Caddisfly	> 1000	0.33	10.0	1.215
Limnephilus lunatus	Caddisfly	> 3000	0.33	10.0	–
Limnephilus rhombicus	Caddisfly	> 800	0.33	10.0	0.820
Athripsodes aterrimus	Caddisfly	> 3000	1.00	8.5	—

Source: Arce et al. (2021)

*N.B. Cells with lines indicate data missing in the database from Arce et al. (2021). * Indicates species not studied in Arce et al. (2021) and for whom no flight distance information could be gleaned from online resources.*

Regression analysis undertaken by Arce *et al*. (2021) found that wing length had little relation to observed maximum flight distances, whilst the two dispersal indices (DCM and SFP) appeared to correlate strongly to maximum flight distance records.

The species at Benhall Green Bridge for which empirical data are available show considerable range in flying abilities (Table 1). The largest distance flown by an individual of the nine species was the caddisfly *Halesus radiatus* with a journey of 4,250 m recorded by a mark-release experiment (Svensson, 1974). The remaining eight species on average achieved maximum distances of 1,750 m, ranging from 100 m to 3,700 m according to trapping and recolonisation studies. The only two species observed moving no greater than 1 km were *Limnephilus rhombicus* and *Lype reducta* (Malicky, 1987; light trapping). The same light trap study also found somewhat lower dispersal abilities for five
Phryganeidae species, capturing individuals of four species no greater than 1 km from water sources and one species, *Oligotricha striata*, never attaining more than 50 m from presumed dispersal points. SFP, the dispersal index that correlated most strongly to maximum dispersal distances, suggests that Limnephilidae species may possess the best dispersal abilities of the highlighted Benhall Green species. Conversely, the same index suggests that the two Baetidae may be the least dispersive of the species highlighted at Benhall Green.

In summary for this point, very limited literature on the flying ability of the target riverfly species for this assessment is available. Available literature is largely limited to maximum flight distance and metrics based on expert opinion (DCM) and traits analyses (SFP), with no literature found pertaining to UK riverfly species **flight elevation** during compensation flight. Specific to this assessment, the maximum flight distance data available for the identified target riverfly species illustrates that five species might be affected by the proposed crossing, namely *B. rhodani/atlanticus, H. radiatus*, *G.*

pellucidus, *L. lunatus,* and *Athripsodes aterrimus*, due to the proximity of the proposed crossing to the EA Benhall Green monitoring site. Of these species, three are of the family Limnephilidae (specifically *H. radiatus*, *G. pellucidus*, and *L. lunatus*) which are known for strong flying ability (e.g., Crichton et al 1978; Finn & Poff, 2008).

2. Comparison of the flying ability of *Palingenia longicauda* with that of the largest mayfly present in UK (*Ephemera danica*)

The Tisza mayfly (*Palingenia longicauda*) is the largest mayfly species in continental Europe, with adults measuring **120 mm from head to tail**. This is substantially larger than the largest mayfly to be found in the UK, the green drake mayfly (*Ephemera danica*), which attain length no greater than **20 mm for males or 25 mm in females**. The relationship between freshwater invertebrate body size and flight abilities has been a subject of some considerable study (Rundle, Bilton, & Foggo, 2007; Benton & Bowler, 2012), though relationships between the two factors are variable across taxa. It has been speculated that larger species might be able to achieve greater distances and elevations of flight than smaller species due to factors such as lift provided by larger wings (Gutiérrez & Menéndez, 1997; Malmqvist, 2000) or the greater metabolic efficiency of larger wing muscles (Ellington, 1991; Harrison & Roberts, 2000). Whilst a positive relationship between size and flight ability has been demonstrated in many species, in some taxa size and flight abilities show no relationship, or exhibit the opposite correlation (Bowler & Benton, 2012). Given this data, it is therefore difficult to conclude that dispersal abilities of *P. longicauda* will necessarily be greater than *E. danica* owing merely to its much greater size. However, given that disparity in body size between the two species is of such a large degree, it also cannot be stated that body size has no effect on flight in these species and that they possess comparable dispersal abilities. Thus, attempts to predict dispersal behaviours of one species based on observations of the other should be treated with considerable caution.

Empirical data on the flight abilities of *E. danica* remain unpublished in the literature and thus its flight abilities relative to other mayflies can only be speculated on. The flight abilities of *P. longicauda*, however, have received some modest study. The review by Arce *et al*. (2021) reports an observation of *P. longicauda* flying a maximum distance of 4 km. Additionally, other authors have documented *P. longicauda* attaining sustained flight heights of between 1 m and 30 m above the ground whilst swarming (Russev, 1987; Kriska, Bernáth & Horváth, 2007). A maximum flight distance of 4 km would place *P. longicauda* in the mid-range of mayfly species flight abilities (Arce *et al.,* 2021), as some smaller mayflies have been recorded moving 20+ km (Kurek & Seredszus, 2007; Hammett, 2009). A flying height of 30 m is, however, exceptional among studied mayflies, with only one other species (*Kageronia fuscogrisea*) having been recorded flying at a comparable height (Savolainen, 1978) whilst all other documented species have been observed ascending no greater than 15 m from ground level (Brodskiy, 1973; Savolainen, 1978; Allan & Flecker, 1989; Peckarsky *et al*., 2002). This includes the closest taxonomic relative of *E. danica* with empirical flight data, *Ephemera vulgata*, documented as swarming no higher than 10 m (minimum swarm height observed: 3 m) and with the majority of individuals 2.0 – 5.5 m above ground level depending on swarm height (Savolainen, 1978). Reported flight elevations for UK riverfly species are detailed in Table 2 alongside that for *P. longicauda*.

Table 2. Reported flight elevation for UK riverfly species and *Palingenia longicauda*

Scientific name	Type	Densest flight elevation range (m)	Flight elevation range (m)	Reference(s)	Notes
Kageronia fuscogrisea	UK mayfly species	0.5 - >30	1 – 7	Savolainen (1978)	Based on swarming observations, not compensation flight observation
Centroptilum luteolum	UK mayfly species	0.5 - 13	-	Savolainen (1978)	Based on swarming observations, not compensation flight observation
Caenis horaria	UK mayfly species	0.5 – 10	-	Savolainen (1978)	Based on swarming observations, not compensation flight observation
Ephemera vulgata	UK mayfly species	0.5 – 10	2 - 5.5	Savolainen (1978)	Based on swarming observations, not compensation flight observation
Leptophlebia marginata	UK mayfly species	0.5 – 7	-	Savolainen (1978)	Based on swarming observations, not compensation flight observation
Leptophlebia vespertina	UK mayfly species	0.5 – 10	-	Savolainen (1978)	Based on swarming observations, not compensation flight observation

Palingenia species	European mayfly	1 – 30	-	Russev (1987); Kriska, Bernáth & Horváth (2007)	Based on swarming observations, not compensation flight observation

Scientific name	Type	Flight elevation range (m)	Densest elevation range (m)	Reference(s)	Notes
Palingenia longicauda	European mayfly	5 - 15	-	Málnás *et al.* (2011)	Based on compensation flight observations

It is apparent from Table 2 that the maximum compensation flight elevation is half the maximum swarm flight elevation for *P. longicauda*. In the absence of any other data, and if this logic holds for the UK species detailed in Table 2 then a soffit height of 4 m would be more than sufficient to permit majority of specimen passage for the mayfly species tabulated.

Of the species presented within Table 2, it is considered that *Caenis horaria* (Caenidae), *Centroptlium luteolum* (Baetidae) and *Ephemera vulgata* (Ephemeridae) are good candidates to act as model species for their respective families and are of relevance to the assessment for the River Fromus crossing location.

Whilst no empirical data on flight abilities of *E. danica* exist currently in literature, a single study on flight behaviour by Egri *et al*. (2017) examined how horizontal polarised light reflected from asphalt roads could influence *E. danica* females seeking water to deposit eggs. Mayflies, along with a range of aquatic insect taxa, use horizontally reflected light as a visual cue for water sources, and will instinctively follow such light sources as an adaptation to locate habitat for oviposition (Loxdale *et al*., 2013; Bilton, 2014). Egri *et al*. (2017) documented how horizontal light reflected from smooth road surfaces can attract female *E. danica* in search of water, causing them to follow road trajectories away from water bodies and oviposit fruitlessly on terrestrial surfaces.

These findings on the flight behaviour of *E. danica* relate in a complementary fashion to a study by Málnás *et al*. (2011) on *P. longicauda* which found the species was deterred from passing under or over a bridge by vertical polarised light produced by the bridge's structure and reflection on a river surface. Just as mayflies are attracted to horizontal polarised light as an adaptation to locate water, they are repelled by weakly or vertically polarised light as an adaptation to avoid terrestrial objects that may act as obstacles to aqueous oviposition (Farkas *et al*., 2016). Hence these respective studies of *E. danica* and *P. longicauda* dispersal behaviour complement one another, the former showing harmful mayfly attraction to an anthropogenic structure, and the latter showing mayfly repulsion from an anthropogenic structure, both due to the way human constructions alter the visual environment they occupy.

Based on the evidence of these two studies, it may be concluded that there is one similarity in the flight behaviour of *P. longicauda* and *E. danica*, namely that their flight movements can be affected by polarised light cues. However, an optically repellent effect of bridge structure on movement has yet to be documented conclusively for *E. danica*, or for any other mayfly species, in the 13 years since Málnás *et al*. (2011) was published. It is therefore not possible to conclude that *E. danica* would react to the same conditions in an identical fashion as *P. longicauda*.

Of particular cause for uncertainty in trying to predict how *E. danica*, or indeed other UK riverfly species, would respond to such conditions is the substantial size difference between *P. longicauda* and UK riverfly species, as it may affect at which spatial scales they operate behaviourally. The perceptual range of animals (the radius within which they react to sensory stimuli) correlates to body size, meaning that larger animals perceive larger objects located further away than smaller animals (Mech & Zollner, 2002). Thus, while both *P. longicauda* and *E. danica* appear to respond to polarised light in similar ways, it is uncertain whether a light-reflecting structure of a given size, such as a bridge, would fit within the perceptual range of each species. Whereas the larger *P. longicauda* might be able to perceive and react to an entire bridge, smaller species may be unable to comprehend structures of the same size and may instead be most strongly affected by structures and stimuli that fit within a smaller, more immediate spatial scale. As differently sized species operate at different spatial scales, it is reasonable to speculate that they are adapted to perceive at different scales as well. Thus, even though *P. longicauda* and *E. danica* share one similarity in dispersal behaviour driven by visual cues, the range of scale that visual cues must occupy to induce behavioural responses are highly likely to vary between them.

In summary, it appears that *P. longicauda* is not an appropriate model species to act as a substitute of UK riverfly species to provide suitable and relevant data upon which to base decisions. *P. longicauda* is substantially larger than all UK riverfly species, and consequently flies at a greater height than the majority of UK species (Table 2). Furthermore, likely differences in perceptual range between *P. longicauda* and UK species means that predicting the behavioural responses of UK species using *P. longicauda* as a model is likely to be inaccurate. Finally, no additional literature evidencing an optically repellent effect of bridge structure on any riverfly species movement has been published since Málnás *et al*. (2011).

3. Review of the literature on the cumulative effects of multiple bridges on flying riverfly species.

Málnás *et al*. (2011) contend that bridges pose an existential threat to riverfly species such as *P. longicauda*, claiming that because swarming females are deterred from moving further upstream to lay eggs by their optical aversion to bridges, egg laying is constricted to downstream reaches of river systems, which results in mayfly populations with distorted sex ratios and reduced genetic variability that are hence less able to adapt and counter extinction threats. Though the study by Málnás *et al*. (2011) is informative and its concerns certainly worthy of addressing, in the 13 years since its publication there is yet to be another study documenting a negative impact of bridges on Ephemeropteran, Trichopteran, or Plecopteran dispersal by acting as optical barriers. Consequently, there is currently no body of literature exploring the cumulative effects of multiple bridges on flying riverfly species.

Furthermore, it appears that all data in the literature detailing impacts of polarized light reflected off human infrastructure on mayflies has been exclusively documented by the Hungarian research group that published Málnás *et al*. (2011), with no similar experiments or results provided by anyone outside of this team. This does not undermine the findings of Málnás *et al*. (2011) but without corroborating evidence from a wider variety of independent sources, it is hard to conclude safely, based on a single study, that large, unlit bridges commonly act as optical barriers to any species besides potentially *P. longicauda.* It is even less feasible to claim, based on a lack of evidence or even apparent concern from the wider scientific community, that the optics of river bridge crossings present an existential risk to macroinvertebrate species.

Presently, published scientific research on threats to riverfly conservation is focused heavily on quite different pressures imposed by anthropogenic river crossings on the flight and dispersal of river-flies, such as the impact of electrical lighting which may attract and misdirect dispersing insects (Eisenbeis & Hänel, 2009; Vega *et al*., 2024), physical barriers presented by culverting (Blakely *et al*., 2006; Wild *et al*., 2011; Szaz *et al*., 2015), pollution from road runoff (Perdikaki, 1999; Winston *et al*., 2012; Gołdyn *et al*., 2018), or introduction of alien species (Gál *et al*., 2020). In particular, Blakely *et al*. (2006) found that bridges had no significant effect on the size of catches of flying aquatic insects made above and below the bridges investigated.

Dr Hugh D. Loxdale, an esteemed researcher who was president of the Royal Entomological Society from 2004 to 2008, wrote a communication on the research in Málnás *et al*. (2011) addressing the threat of bridges acting as optical barriers to riverfly dispersal:

> "*Personally, I (HDL) think it is a bit of an overblown statement by Málnás et al. (2011) that by distorting sex ratio bridges are likely to decrease effective population size and hence genetic variability, in turn contributing to the widespread extinction of the species from most of Europe. Nevertheless, it may well have some effect on population densities, survival and hence genetic structuring. Probably, pollution of rivers by agricultural run offs (fertilizers and pesticides) is more likely to have an effect, along with changing the nature of the flow speed of rivers, perhaps by bridges and locks and such like physical impediments, thereby influencing the insect's fundamental physiology, behaviour and ecology*." (Loxdale *et al*., 2013)

Whilst clearly interested in the avenue of research investigated by Málnás *et al.* (2011) and not discounting the relevance of their findings to conservation, Dr Loxdale makes the valid point that there are issues facing macroinvertebrate populations which are likely to pose greater threats to species survival than the effects of light polarization reflected by large bridges. This communication was also written only two years after publication of Málnás *et al.* (2011), when it might have been expected that further instances of optically barring bridges affecting other species would be documented in the future. It has now been over a decade and there is yet to be a single other documented case of bridges acting as optical barriers to riverfly dispersal.

From an intuitive perspective it seems unlikely that a bridge soffit height greater than a couple of meters could seriously obstruct mayfly flight, as all published observations as detailed earlier document mayflies routinely flying at least 0.5 m from the water surface during swarming and compensation flights. From a scientific perspective, Málnás *et al.* (2011) remains the only study to suggest that a bridge, devoid of electrical lighting, with ample space for underway passage, could obstruct upstream riverfly dispersal. To accept that bridges pose a significant threat to riverfly populations by acting as optical barriers requires further study and corroborating evidence from a source external to the research group that introduced this concept to the scientific community. At present, it is not possible to conclude, given the current body of scientific data, that any given bridge, or multiple bridges, could impact riverfly species found in the UK in the manner described by Málnás *et al.* (2011).

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