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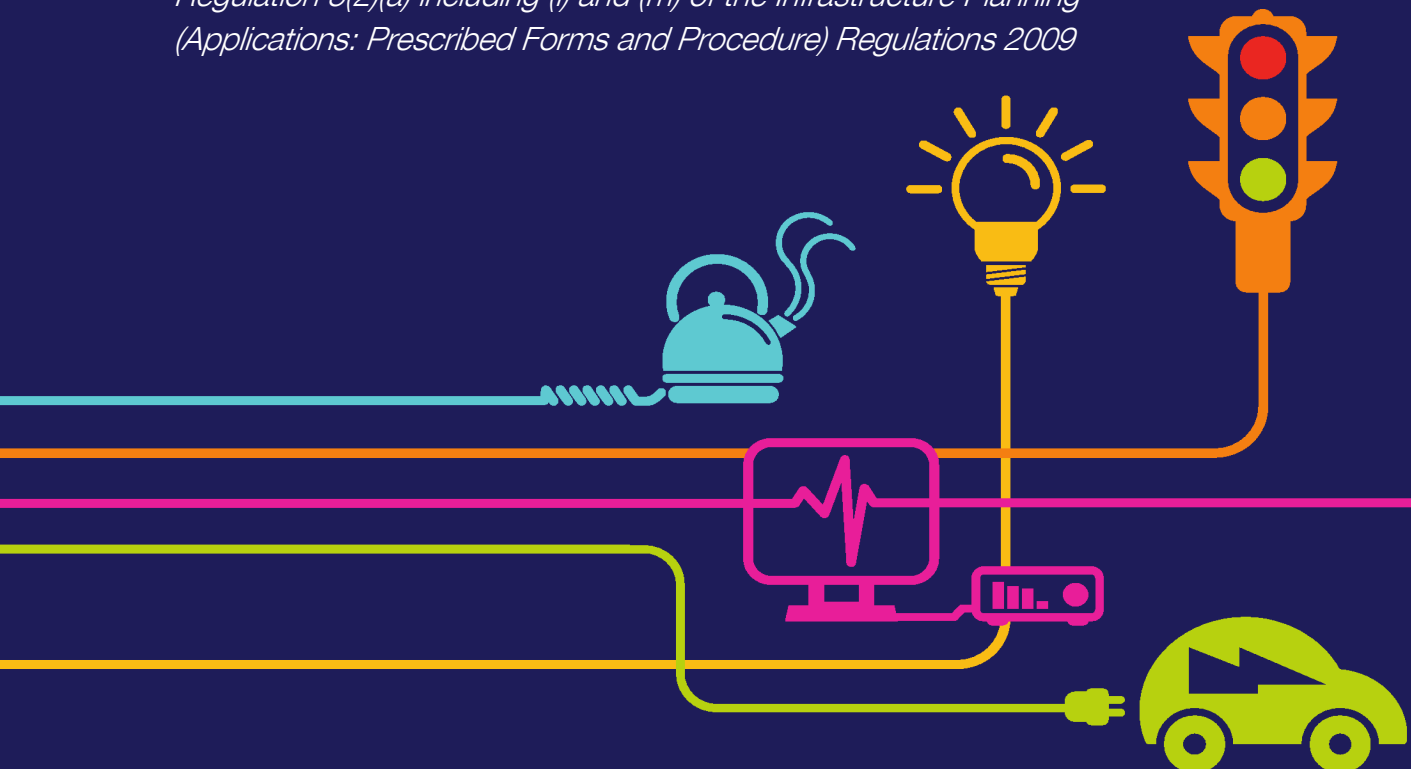
Freshwater Report

(Confidential Information Removed)

Chapter 9 – Appendix 13

National Grid (North Wales Connection Project)

*Regulation 5(2)(a) including (l) and (m) of the Infrastructure Planning
(Applications: Prescribed Forms and Procedure) Regulations 2009*





North Wales Connection Project

Volume 5

Document 5.9.2.13 Appendix 9.13 Freshwater Report

National Grid
National Grid House
Warwick Technology Park
Gallows Hill
Warwick
CV34 6DA

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Author		Nicolas Gare	
Approved by		Daniel Ahern/Rob Pilcher	
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1 Introduction

1.1 INTRODUCTION

Description of the Proposed Development

- 1.1.1 The Proposed Development would provide a new 400 kilovolt (kV) connection between the existing substations at Wylfa and Pentir and includes the following principal components:
- extension to the existing substation at Wylfa;
 - sections of new 400 kV overhead line between Wylfa Substation and Braint Tunnel Head House (THH) and Cable Sealing End Compound (CSEC) on Anglesey including modifications to parts of the existing 400 kV overhead line between Wylfa and Pentir;
 - Braint THH and CSEC on Anglesey;
 - tunnel between Braint and Tŷ Fodol THHs;
 - Tŷ Fodol THH and CSEC in Gwynedd;
 - new section of 400 kV overhead line between Tŷ Fodol THH and CSEC and Pentir Substation;
 - extension to the existing substation at Pentir; and
 - temporary construction compounds, access tracks, construction working areas, localised widening of the public highway and third party works that are required to construct the infrastructure listed above.
- 1.1.2 The Proposed Development has been split into six sections (A – F), see Figure 1.
- 1.1.3 A full description of the Proposed Development is provided in Chapter 3, Description of the Proposed Development (**Document 5.3**) and Chapter 4, Construction, Operation, Maintenance and Decommissioning of the Proposed Development (**Document 5.4**).

Introduction to the Report

- 1.1.4 This report details the methods and results of surveys carried out to assess the aquatic macroinvertebrate value of a sample of watercourses located in the Order Limits identified through desk-based assessments and field surveys.
- 1.1.5 In addition, a review of fish data provided by Natural Resources Wales (NRW) was carried out.
- 1.1.6 This report also identifies relevant legislation and planning policy relating to aquatic macroinvertebrates and fish, which are outlined in section 2. Other water related species (e.g. water vole (*Arvicola amphibious*)) are covered in the separate Appendix 9.8, Otter and Water Vole Report, (**Document 5.9.2.8**).
- 1.1.7 Whilst English names are given where appropriate, as not all macroinvertebrates have an English name, commonly used scientific names are used throughout.

Objectives

- 1.1.8 The objectives of the surveys and report are to:
- review existing ecological data to identify any records for aquatic macroinvertebrates of conservation value within and up to 2 km from the Order Limits, referred to as the study area in this report;
 - review available fish data for watercourses potentially impacted by the Proposed Development;
 - present the results of the freshwater surveys completed in relation to the Proposed Development;
 - identify any aquatic macroinvertebrate species of conservation interest within a sample of watercourses located within the Order Limits, referred to as the survey area in this report;
 - assess the sensitivity of watercourses and macroinvertebrate communities to provide baseline data for future monitoring;
 - use the above information to inform the Ecological Impact Assessment (EclA) set out in Chapter 9, Ecology and Nature Conservation (**Document 5.9**) to determine whether aquatic macroinvertebrate populations could be affected by the Proposed Development; and

- inform the Biodiversity Mitigation Strategy (**Document 7.7**) for the Proposed Development.

2 Legislation and Planning Policy

2.1 LEGISLATION

- 2.1.1 Several acts of legislation and regulations refer to the protection of wildlife. Legislation relevant to aquatic wildlife is outlined below.

The Conservation of Habitats and Species Regulations 2017

- 2.1.2 The Conservation of Habitats and Species Regulations 2017 (referred to as 'the Habitats Regulations') consolidates the various amendments made to the Conservation (Natural Habitats, &c.) Regulations 1994 in respect of England and Wales. The 1994 Regulations transposed Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (EC Habitats Directive) into law for Wales and England and came into force on 30 October 1994.
- 2.1.3 The Habitats Regulations provide for the designation and protection of 'European sites', the protection of 'European protected species', and the adaptation of planning and other controls for the protection of European sites.
- 2.1.4 In summary the Habitats Regulations protect European protected species against:
- deliberate capture, injury or killing;
 - deliberate disturbance, where this is likely to impair the species ability to survive, breed, reproduce, rear young, hibernate or migrate, or significantly affect the local distribution or abundance of the species;
 - deliberate destruction of eggs (where relevant); and
 - damage or destruction of a breeding or resting place.
- 2.1.5 It is also an offence to be in possession or control, transport, sell or exchange any live or dead (or part of an) wild animal listed on Schedule 2.
- 2.1.6 European sea sturgeon (*Acipenser sturio*) is a fish species listed on Schedule 2 making it a European protected species, protected under the

Habitats Regulations. Little whirlpool ramshorn snail (*Anisus vorticulus*) is an aquatic invertebrate listed on Annex II and Annex IV of the Habitats Regulations. These two species are not expected to be found within the study area and no records were provided during the desk study.

- 2.1.7 Atlantic salmon (*Salmo salar*), brook lamprey (*Lampetra planeri*), river lamprey (*Lampetra fluviatilis*) and sea lamprey (*Petromyzon marinus*) are listed as Annex II species on the Habitats Regulations; these species have been found in the study area.

The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017

- 2.1.8 The Water Framework Directive (WFD) 2000/60/EC was adopted and came into force in 2000 and represents a culmination in EU water resource protection. The WFD is transposed into law in England and Wales by The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017. The Directive aims for 'good status' for all ground and surface waters (rivers, lakes, transitional waters, and coastal waters) in the EU, according to biological, hydro morphological, physico-chemical and chemical criteria.

- 2.1.9 WFD classifications are based on four main elements two of which are fish and macroinvertebrates.

The Eels (England and Wales) Regulations, 2009

- 2.1.10 The Eel Regulations have been enacted to establish measures for the recovery of the stock of European eel (*Anguilla anguilla*). The regulations apply to England and Wales and came into force in January 2010. The regulations apply to individuals and businesses abstracting or discharging water, impoundment works and anyone constructing, altering or maintaining a dam/structure in or near water, liable to cause an obstruction to the passage of eels. It is an offence to fail to comply with the regulations.

The Countryside and Rights of Way Act, 2000

- 2.1.11 The Countryside and Rights of Way Act 2000 applies to England and Wales only. Part III of the Act deals specifically with wildlife protection and nature conservation.
- 2.1.12 The Act places a duty on Government Departments and the Welsh Government to have regard for the conservation of biodiversity and maintain lists of species and habitats for which conservation steps should be taken or promoted, in accordance with the Convention on Biological Diversity.

- 2.1.13 Schedule 12 of the Act amends the species provisions of the Wildlife and Countryside Act 1981 (as amended), strengthening the legal protection for threatened species. The provisions make certain offences 'arrestable', include an offence of reckless disturbance, confer greater powers to police and wildlife inspectors for entering premises and enable heavier penalties on conviction of wildlife offences.

Salmon and Freshwater Fisheries Act (SAFFA), 1975 (amended)

- 2.1.14 The SAFFA aims to protect freshwater fish, with a particularly strong focus on salmon and sea/brown trout (*Salmo trutta*). There are many activities that could constitute an offence under the SAFFA including direct mortality, barriers to migration and degradation of habitats.

Environment (Wales) Act 2016

- 2.1.15 Section 6 of the Environment (Wales) Act 2016 places a duty on public authorities to 'seek to maintain and enhance biodiversity' so far as it is consistent with the proper exercise of those functions. In doing so, public authorities must also seek to 'promote the resilience of ecosystems'. The duty replaces the section 40 duty in the Natural Environment and Rural Communities Act 2006 (NERC Act 2006), in relation to Wales, and applies to those authorities that fell within the previous duty (Ref 1).
- 2.1.16 To assist in complying with this duty, public authorities must have regard to relevant evidence provided in the State of Natural Resources Report and any relevant area statement for an area in which the authority exercises functions, as well as having to regard to the list of living organisms and habitats published under Section 7 of the Act (which replaces the section 42 list for Wales provided in the NERC Act 2006) (Ref 1).
- 2.1.17 Under Section 7 of the Act, 13 species of aquatic macroinvertebrate and ten species of fish are currently listed as species of key significance. This list is currently under review by the Welsh Government in consultation with National Resources Wales (NRW).

2.2 PLANNING POLICY

National Policy

- 2.2.1 Government planning policy and guidance throughout the UK requires local planning authorities to take account of the conservation of protected species when determining planning or development consent applications. This makes the presence of a protected species a material consideration when assessing a development proposal. In the case of European protected

species, planning policy emphasises the strict statutory provisions to which a planning authority must have due regard.

- 2.2.2 In Wales this is implemented through Planning Policy Wales - Edition 9, November 2016, supplemented by a series of Technical Advice Notes (TANs) (Ref 2) which sets out the land use planning policies of the Welsh Government. Consultation is currently being held on the draft Planning Policy Wales – Edition 10 which was issued in February 2018; the consultation period ended in May 2018.
- 2.2.3 Chapter 5 of PPW (9) sets out the Welsh Government's objectives for the natural heritage of Wales which includes the safeguarding of protected species. It states that '*the presence of a species protected under European or UK legislation is a material consideration when a local planning authority is considering a development proposal which, if carried out, would be likely to result in disturbance or harm to the species or its habitat*'. It also states that '*an ecological survey to confirm whether a protected species is present and an assessment of the likely impact of the development on a protected species may be required in order to inform the planning decision*'.
- 2.2.4 Further information on the detail of Planning Policy Wales is provided in Chapter 9, Ecology and Nature Conservation (**Document 5.9**).

Local Policy

- 2.2.5 There are a number of local planning policies set out in the Anglesey and Gwynedd Joint Local Development Plan 2017 (Ref 3) that relate to ecology and nature conservation which in combination with other planning policies will guide local authority expectations in relation to the Proposed Development:
- Strategic Policy PS 19 relates to conserving and enhancing the natural environment;
 - Policy AMG 4 relates to coastal protection;
 - Policy AMG 5 relates to the protection and enhancement of local biodiversity; and
 - Policy AMG 6 relates to protecting sites of regional or local significance.

Biodiversity Policy

- 2.2.6 As a result of devolution, and new country-level and international drivers and requirements, much of the work previously carried out by the UK BAP is now focussed at a country-level rather than a UK-level. The UK BAP was succeeded by the 'UK Post-2010 Biodiversity Framework' in July 2010. The UK list of priority species and habitats, however, remains an important reference source and has been used to help draw up statutory lists of priorities in England, Scotland, Wales and Northern Ireland. In Wales the current lists are those under Section 7 of the Environment (Wales) Act 2016 which includes 13 species of aquatic macroinvertebrate and ten species of fish as priority species requiring conservation.
- 2.2.7 The national strategy for biodiversity is delivered at local level via Local Biodiversity Action Plans (LBAPs). Species and habitats of local conservation concern or value are included in the LBAP and an action plan is created for each species and certain habitat types. The LBAPs relevant to the study area for the Proposed Development are the Anglesey LBAP published by Isle of Anglesey County Council (IACC) and the Natur Gwynedd LBAP for Gwynedd developed by a partnership of organisations and individuals
- 2.2.8 The southern damselfly (*Coenagrion mercuriale*) is a priority species on the Anglesey LBAP which utilises shallow streams in wetland heath for breeding. 'River and Stream Habitat' is listed as a locally significant habitat on the Anglesey LBAP due to their importance for supporting aquatic fauna and their linear function as 'corridors'. There is also a LBAP covering 'River Corridors' for the Gwynedd area and lampreys and salmonids have a Species Habitat Action Plan (SAP).
- 2.2.9 The Wales Biodiversity Partnership (WBP) brings together key members from the public, private and voluntary sectors to promote and monitor biodiversity and ecosystem action in Wales. WBP provides a leadership role and an expert steer on priorities for action on biodiversity and ecosystems in Wales. The WBP Steering Group has now formally disbanded and the biodiversity action work programme taken on by the Wales Biodiversity Strategy Board (WBSB) and the WBP working groups.

2.3 IUCN RED LIST SPECIES

- 2.3.1 The desk based study refers to species that are listed on the International Union for Conservation of Nature (IUCN) Red List (also known as the Red List of Threatened Species). This comprises comprehensive lists, which are regularly produced and updated, of endangered and threatened species.

2.3.2 The lists deal with many plants, fungi and animals, and uses a set of criteria to identify those species at greatest risk of extinction and to identify the factors responsible in order to inform conservation approaches. Species are classified into nine defined categories (Ref 5):

- extinct – when there is no reasonable doubt that the last individual has died;
- extinct in the wild – surviving in cultivation, in captivity or as a naturalised population well outside the past range;
- critically endangered – considered to be facing an extremely high risk of extinction in the wild;
- endangered - considered to be facing a very high risk of extinction in the wild;
- vulnerable - considered to be facing a high risk of extinction in the wild;
- near threatened – close to qualifying for or likely to qualify for a threatened category in the near future;
- least concern – does not qualify for the above criteria. Widespread and abundant taxa are included in this category;
- data deficient – inadequate information to make an assessment; and
- not evaluated.

3 Methodology

3.1 DESK STUDY

Designated Sites and Species

- 3.1.1 A desk study was carried out to identify whether aquatic macroinvertebrates or fish were listed as qualifying or supporting features within Designated Sites relevant to the Proposed Development.

Aquatic Macroinvertebrates

- 3.1.2 A desk study was carried out to identify existing information concerning the presence of aquatic macroinvertebrates of conservation value within the study area.
- 3.1.3 Protected species record data (including aquatic macroinvertebrate and freshwater fish records) were requested from Cofnod, the local environmental centre in February 2018; this provided an update to data obtained in November 2016 and May 2015.
- 3.1.4 Aquatic invertebrate populations may fluctuate in response to natural and human-caused events. Therefore only records dated since 2007 were considered in the baseline study; older records were considered to offer limited value in determining current presence and distribution of aquatic invertebrates.
- 3.1.5 The data obtained was reviewed in relation to the list of species published under Section 7 of the Environment (Wales) Act 2016 and other designations, such as Red Lists (Joint Nature Conservation Committee (JNCC)) and European Directives, in order to identify the presence of species of particular conservation interest.
- 3.1.6 The Freshwater Invertebrate Report (2012) (Ref 4) and the Freshwater Baseline Survey Report (2017) (Ref 5) produced on behalf of Horizon Nuclear Power for the Wylfa Newydd project were reviewed for relevant information.
- 3.1.7 The Indicative Watercourse Crossing Schedule (**Document 5.3.2.2**) was consulted to determine which watercourses within the Order Limits were proposed for access track crossings as these were the ones where an

impact could potentially occur through the installation of a bridge/culvert. A total of 63 watercourse crossing locations were identified; the crossings are located on 46 watercourses (some watercourses have more than one crossing). Interim results obtained from the otter (*Lutra lutra*) and water vole surveys were used to identify watercourses holding sufficient water depth to conduct aquatic macroinvertebrate sampling, refer to Appendix 9.8, Otter and Water Vole Report (**Document 5.9.2.8**).

Fisheries

- 3.1.8 Fish data provided by NRW for watercourses potentially impacted by the Proposed Development were reviewed.
- 3.1.9 Data was available for the following watercourses (see Figure 2 for their locations):
- River Braint at National Grid Reference (NGR) SH 52420 73258 (approximately 1.5 km downstream of the Order Limits), between 2004 and 2014;
 - River Erddreiniog at NGR SH 4590 7970 (approximately 1 km downstream of the Order Limits), between 2011 and 2014;
 - River Ceint at NGR SH 489157 4854 (approximately 200 m of the Order Limits), between 2004 and 2014;
 - River Goch at NGR SH 45144 86245 (approximately 1 km downstream of the Order Limits), between 2009 and 2014;
 - River Cefni at NGRs SH 4610 7460 and SH 45603 75906 (approximately 2 km and 2.5 km downstream of the Order Limits), between 2004 and 2015; and
 - River Wygyr at NGR SH 37232 93057 (approximately 1 km downstream of the Order Limits), between 2004 and 2014.
- 3.1.10 Since 1997, all data across England and Wales has been classified using the National Fisheries Classification Scheme (NFCS), which superseded all previous classification schemes. This national system allows comparison of the abundance of different species over a wider geographical area.
- 3.1.11 Under the classification, watercourses are given a grade based on the abundances of salmonid species (trout and salmon) recorded in relation to the national data set. Those classes are presented in Table 3.1.

Table 3.1: National Fishery Classification Scheme Grades		
Grade	Class	Description
A	Excellent	In the top 20% for a fishery of this type.
B	Good	In the top 40% for a fishery of this type.
C	Fair	In the middle 20% of fisheries
D	Fair	In the bottom 40% for a fishery of this type.
E	Poor	In the bottom 20% for a fishery of this type
F	Fishless	No fish of this type present.

3.2 FIELD SURVEY

- 3.2.1 Following the review of the Indicative Watercourse Crossing Schedule (**Document 5.3.2.2**), desk study results and interim results from the otter and water vole surveys, 25 watercourse crossing locations were initially identified as potentially suitable for survey; these comprised different types of watercourses (ditches, streams and rivers) and were a sample of watercourses from all sections of the Proposed Development.
- 3.2.2 Access was not possible to 11 of the watercourse crossing locations (see section 3.3 Assumptions and Limitations), resulting in a total of 14 watercourse crossing locations being taken forward for survey. The 14 watercourse locations identified were sampled as close to the relevant crossing point as possible (Figure 2).
- 3.2.3 Details of the sampling sites are given in Table 3.2, their locations are shown on Figure 2 and photographs of the sampling sites are presented in Appendix A.

Table 3.2: Macroinvertebrate sampling sites

Sampl- ing Site Ref	Watercourse	Watercourse Ref No.	Crossing Point No.	National Grid Reference (NGR)	Date of survey
W004-9	Tributary of River Wygyr	W004	NG-DRX A/44	SH 36848 91933	autumn 2016, spring 2017
W005-13	Tributary of River Wygyr	W005	NG-RVX A/48	SH 37276 91398	autumn 2016, spring 2017
W056-84	River Erddreiniog	W056	NG-DRX C/155 & NG-RVX C/156	SH 46215 81556	autumn 2016, spring 2017
W066-98	Tributary of River Cefni	W066	NG-DRX C/183	SH 47830 77712	autumn 2016, spring 2017
W069- 101	Tributary of River Ceint	W069	NG-RVX D/196	SH 48314 76001	autumn 2016, spring 2017
W1048- 103	Tributary of River Ceint	W1048	NG-RVX D/196	SH 48415 75855	autumn 2016, spring 2017
W077	River Ceint	W077	NG-RVX D/206	SH 48622 74553	spring 2017
W091- 112	Tributary of River Ceint	W091	NG-DRX E/220	SH 49177 73494	autumn 2016, spring 2017
W106- 117	Tributary of River Braint	W106	NG-DRX E/229	SH 50108 72282	autumn 2016, spring 2017
W119- 121	Tributary of River Braint	W119	NG-STRX E/236	SH 50513 71753	autumn 2016
W119- 122	Tributary of River Braint	W009	NG-STRX E/236	SH 50625 71776	autumn 2016
W206	Tributary of Nant y Garth	W206	NG-STRX F/256	SH 55506 68281	spring 2017
D319	Tributary of Nant y Garth	D319	NG-DRX F/262 & NG-DRX F/263	SH 55526 67881	spring 2017

Table 3.2: Macroinvertebrate sampling sites

Sampl- ing Site Ref	Watercourse	Watercourse Ref No.	Crossing Point No.	National Grid Reference (NGR)	Date of survey
D322	Tributary of Nant y Garth	D322	NG-DRX F/264	SH 55653 67672	spring 2017

Macroinvertebrate sampling

- 3.2.4 Macroinvertebrate surveys were undertaken at the 14 sampling sites by experienced aquatic ecologists.
- 3.2.5 Aquatic macroinvertebrate surveys were carried out during November 2016 (autumn) and April 2017 (spring) within the recommended survey windows. Where access allowed, a sample was taken at the same site in both seasons. This is because species of macroinvertebrates are seasonally present or seasonally abundant, notably insect larval stages, and therefore may not be present in a watercourse at all times of the year.
- 3.2.6 Samples were collected using a standard Freshwater Biological Association (FBA) pattern pond net (mesh size: 1 mm), in line with the standard Environment Agency (2012) methodology (Ref 6). The instream habitats were 'kick-sampled' or 'sweep-sampled' for three minutes followed by a one-minute hand search of larger substrates.
- 3.2.7 The samples were then preserved in isopropyl alcohol 70% v/v (volume of solute per volume of solvent) in accordance with recommended practice and returned to the laboratory for processing.

Sample analysis

- 3.2.8 Detailed sorting of the entire sample was undertaken by a trained and experienced taxonomist using stereo-microscopes (under low power) and appropriate identification keys in line with Environment Agency (2014) guidance (Ref 7). In accordance with this guidance, macroinvertebrates were identified to 'mixed taxon level' which is to species level (where practicable) for the majority of groups.

Data Analysis

- 3.2.9 In order to assess the sensitivity of the watercourses to potential impacts during construction and provide baseline for future monitoring, the macroinvertebrate data were analysed using the following indexes:
- Biological Monitoring Working Party (BMWP) scores and Average Score Per Taxon (ASPT) values (Ref 8) – to assess the general biological quality of the waterbodies and provide baseline data for future monitoring;
 - Proportion of Sediment-sensitive Invertebrates (PSI) index (Ref 9) – to assess the cover of streambed by fine sediments (the Fine Sediment Sensitivity Rating (FSSR) as set out in Appendix D) and provide baseline data for future monitoring; and
 - Community Conservation Index (CCI) method (Ref 10) – to assess the ecological value of the waterbodies and identify the presence of rare species.
- 3.2.10 The BMWP scores and ASPT values are routinely used to assess the water quality, based on the composition of macroinvertebrate samples. Scores are derived from the sensitivity of particular taxa (families) of invertebrates to organic pollution (Appendix B). These indices will be used to assess the communities that are potentially the most sensitive to effects such as habitat loss, hydrological change and changes to water quality
- 3.2.11 Under the CCI method, macroinvertebrate species are given a Conservation Score (CS) according to their scarcity and conservation value in Great Britain (Appendix C). The scores range from one to ten, with one being very common and ten being endangered, relating closely to the categorisation used in Red Data Book (RDB) categories as illustrated in Table 3.3. Species scoring above seven are likely to be important at a National or International level. Species scoring five or six are likely to be important at County level, whereas species scoring three or four are likely to be important at a Parish or District level (Ref 11, 12 and 13).

Table 3.3: Conservation Scores from the Community Conservation Index

Conservation Score	Conservation value/Equivalent RDB status
10	RDB1 (Endangered)
9	RDB2 (Vulnerable)

Table 3.3: Conservation Scores from the Community Conservation Index

Conservation Score	Conservation value/Equivalent RDB status
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)

3.2.12 The overall index provides an indication of the conservation value of the community sampled based on a combination of the rarity of the different species present and overall community richness, as shown in Table 3.4.

Table 3.4: Guidance on interpretation of CCI scores (Ref 10)

CCI Score	Description	Interpretation
0.0 – 5.0	Sites supporting only common species and/or a community of low taxon richness	Low conservation value
5.0 – 10.0	Sites supporting at least one species of restricted distribution and/or a community of moderate taxon richness	Moderate conservation value
10.0 – 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 – 20.0	Sites supporting several uncommon species, at least one of which may be nationally rare and/or a community of high	High conservation

Table 3.4: Guidance on interpretation of CCI scores (Ref 10)		
CCI Score	Description	Interpretation
	taxon richness	value
>20.0	Sites supporting several rarities, including species of national importance, or at least one extreme rarity and/or a community of high taxon richness	Very high conservation value

- 3.2.13 The PSI index was used to provide an assessment of the extent to which the river bed was composed of, or covered by, fine sediments (Appendix D). Under the assessment, individual species have been assigned a rating based upon their sensitivity to fine sediment. A PSI score was then derived based on the composition of the sample and abundances of individual taxa. Table 3.5 gives a guidance to interpret PSI scores.

Table 3.5: Interpretation of PSI scores (Ref 9)	
PSI	Description
81-100	Minimally sedimented
61-80	Slightly sedimented
41-60	Moderately sedimented
21-40	Sedimented
0-20	Heavily sedimented

- 3.2.14 In addition, the number of taxa was calculated for each sample taken in order to provide an assessment of the diversity of the communities sampled. As there is no guidelines as to how to interpret such values and it varies depending on the type of watercourse sampled, this assessment was based on the surveyor's professional judgement and experience.

3.3 ASSUMPTIONS AND LIMITATIONS

Desk Study

- 3.3.1 The aim of a desk study is to help characterise the baseline context of a proposed development and provide valuable background information that would not be captured by site surveys alone. Information obtained during the course of a desk study is dependent upon people and organisations having made and submitted records for the area of interest. As such, a lack

of records for a particular species does not necessarily mean that these species do not occur in a study area. Likewise, the presence of records for particular species does not automatically mean that these still occur within the area of interest or are relevant in the context of a proposed development.

- 3.3.2 The detail and accuracy of the desk study records rely on those provided to Cofnod from a variety of sources. The results of the updated desk study undertaken in February 2018 have been considered for the baseline assessment. The latest desk study search was conducted on the Proposed Development layout which now covers a smaller area resulting in some records being excluded that had previously been considered. The search also uses the latest priority and conservation lists which has also resulted in some further additions and exclusions of certain species.
- 3.3.3 The data provided by Cofnod was limited to a few groups of aquatic macroinvertebrates (annelids, beetles, dragonflies, trueflies, molluscs, true bugs etc.). As such, historical data was not available for some key macroinvertebrate groups of conservation interest, such as mayfly, caddisfly, or crustaceans. The freshwater ecology surveys were planned and completed to address this limitation.

Site Surveys

- 3.3.4 Of the 25 watercourse crossing locations initially selected as potentially suitable for survey, 11 could not be accessed for survey in 2016/2017 for health and safety reasons or where permission for access was not permitted. The remaining 14 locations were considered to provide a representative sample of the watercourses crossed by the Proposed Development. There were no particular limitations to the surveys of these 14 watercourse crossing locations being conducted, all of which were undertaken within optimal seasonal windows (autumn 2016 and spring 2017) and therefore provide a good indication of the macroinvertebrate species groups likely to be present.
- 3.3.5 The surveys recorded species and conditions that could be identified at the specific time of the survey and other species that may be present at other times of year, sporadically and/or in low numbers may not have been recorded. Although the sampling methods adopted allow characterisation of the macroinvertebrate communities and establish the biological quality of freshwater habitats surveyed, they do not generate a comprehensive list of every taxon present. To attempt to detect all species that occur, including those at low abundance, or occurring sporadically, would be impractical, generate unnecessary information and would not necessarily improve the

quality of the assessment and as such was not considered necessary. This is in accordance with recommended practice (Ref 6).

- 3.3.6 It was not always possible to identify the specimens collected to a species level, for example where specimens collected were juvenile, damaged or females (i.e. for some groups of invertebrates, identification of a species relies on male features). This was in accordance with recommended practice and therefore not considered a significant limitation (Ref 7).

4 Results

4.1 DESK STUDY

Aquatic Macroinvertebrate Records

- 4.1.1 With respect to freshwater species, the Anglesey Fens SAC lists the southern damselfly as a qualifying feature, and the Anglesey and Llyn Fens Ramsar lists it as a noteworthy species occurring at levels of international importance. The species is typical of flowing waters (Ref 14).
- 4.1.2 The clubbed general soldier fly (*Stratiomys chamaeleon*) and the medicinal leech (*Hirudo medicinalis*), typical of rain fed habitats (i.e. eutrophic ponds), are also listed as nationally important species occurring on the Anglesey and Llyn Fens Ramsar. Two species of snail, Desmoulin's whorl snail (*Vertigo moulinsiana*) and the Geyer's whorl snail (*Vertigo geyeri*), are also listed on the Ramsar Information Sheet as noteworthy species occurring at levels of international importance, however without being truly aquatic, are often associated with wetlands or fens. The Geyer's whorl snail is also a primary reason for selection of the Anglesey Fens SAC.
- 4.1.3 The Order Limits lie adjacent to the SAC/Ramsar with small incursions along the western boundary due to very small areas of drainage mitigation and requirements to manage vegetation beneath the Overhead Line (OHL).
- 4.1.4 As construction of the Proposed Development does not affect prime habitat for the species identified as being of international or national importance apart from clubbed general soldier fly, there is considered to be minimal potential for loss/fragmentation of supporting habitat or significant changes in hydrological regimes. The soldier fly is reported to be present within several management units within the SAC/Ramsar site ensuring that suitable habitat for this species is available.
- 4.1.5 The review of the data provided by Cofnod and of the surveys undertaken by Horizon Nuclear Power for the Wylfa Newydd project (Ref 4) showed records for six species of aquatic macroinvertebrates comprising three species of damselfly and two species of water scavenger beetle and one species of diving beetle, within the study area (Table 4.1). The Freshwater

Baseline Survey Report (Ref 5) did not report any macroinvertebrate species of conservation importance within the Proposed Development study area.

- 4.1.6 The closest record provided by Cofnod is of the variable damselfly (*Coenagrion pulchellum*) which falls 21 m from the Order Limits; this was recorded within Cors Erddreiniog SSSI and National Nature Reserve (NNR) in 2011 (Reference 3 on Figure 1). All the other records are over 250 m from the Order Limits.
- 4.1.7 The British Dragonfly Society notes variable damselfly and hairy dragonfly (*Brachytron pratense*) as Anglesey specialities and lists the following four sites on Anglesey as good places for dragonflies:
- Cors Erddreiniog SSSI and NNR;
 - Cors Bodeilio SSSI and NNR;
 - Cors Goch NNR; and
 - Valley Wetlands RSPB reserve.
- 4.1.8 For damselflies, Cofnod records are for adults only, which are not aquatic, but depend on aquatic habitats for breeding and larval stages.
- 4.1.9 With the exception of the southern damselfly, none of the species for which records were returned are qualifying features of a designated site.
- 4.1.10 Table 4.1 presents details of the records and conservation status of the species identified through the desk study; their locations are shown on Figure 1.

Table contains confidential information. This Table is only available on request to those who have a legitimate need to view the Information

Fish data

- 4.1.11 Freshwater fish records from Cofnod were provided for Atlantic salmon, sea/brown trout, brook lamprey, nine-spined stickleback (*Pungitius pungitius*) and European eel for within the study area.
- 4.1.12 The review of the data provided by NRW, as shown in Table 4.2, demonstrated that all the watercourses for which data was available support both coarse and migratory salmonid fish species, such as Atlantic salmon and brown trout.
- 4.1.13 The data from NRW indicate that the River Braint, River Erddreiniog, River Ceint and River Wygyr support high abundances of (NFCS grades A and B) brown trout populations. The River Goch and River Cefni support less dense populations of brown trout. Abundances of salmon are however low (NFCS grades E to F) in all watercourses.
- 4.1.14 Other migratory species were recorded, such as European eel in low to moderate abundances in all watercourses and lamprey in relatively low abundances in the River Braint, River Ceint and River Wygyr. For lamprey, there are three different species in the UK (river lamprey, brook lamprey and sea lamprey), but the data provided by NRW does not specify which species were recorded.
- 4.1.15 Brown trout, Atlantic salmon, European eel and two species of lamprey (river and sea lamprey) are listed under Section 7 of the Environment (Wales) Act 2016. Atlantic salmon and three species of lamprey are also listed under the EU Habitats Directive (Annex II and Annex V).
- 4.1.16 In addition, with the exception of the River Erddreiniog (Good WFD status for fish), all other watercourses have a 'High' WFD status for the fish quality element.

Table 4.2: Summary of the fish data provided by NRW

River	River crossed by the Order Limits	Salmonids	Other species
River Braint	Yes, and two tributaries	Salmon fry (NFCS grade E to F), trout fry and parr (NFCS grade A)	Eel, lamprey and stickleback in low abundances

Table 4.2: Summary of the fish data provided by NRW

River	River crossed by the Order Limits	Salmonids	Other species
River Erddreiniog	Yes	Salmon fry (NFCS grade F), trout fry (NFCS grade A)	Eel in very low abundances
River Ceint	Yes, and two tributaries	Salmon fry (NFCS grade F), trout fry (NFCS grade A to B)	Eel in moderate abundances and stickleback in low abundances
River Goch	No, but a tributary is crossed	Salmon fry (NFCS grade F), trout fry (NFCS grade B to C)	Eel in low abundances
River Cefni	No, but a tributary is crossed	Salmon fry and parr (NFCS grade D to F), trout fry (NFCS grade B to C)	Flounder, minnow, lamprey and stickleback in low abundances, eel in moderate abundances
River Wygyr	No, but two tributaries are crossed	Salmon fry (NFCS grade F), trout fry (NFCS grade A to B)	Flounder in low abundances, eel in moderate abundances. No recent records of lamprey and stickleback although present in 2004

4.1.17 Although three of the watercourses (River Cefni, River Goch and River Wygyr) are not directly crossed, some of their tributaries could be crossed by the Proposed Development. Two tributaries of the River Ceint and two tributaries of the River Braint could also be crossed in addition to the main river channels.

4.1.18 Salmonid species such as trout and salmon migrate upstream for reproduction and small tributaries are important habitats for spawning and nurseries. This, coupled with the presence of other transitory species of fish, means the potential effect of the Proposed Development that fish are

likely to be most sensitive to will be the culverting of short lengths of watercourses for construction and operational maintenance access tracks. All of the watercourse crossings on the main rivers and some of the crossings on the tributaries detailed in Table 4.2 will comprise clear span bridges which would not restrict the movement of fish.

4.2 FIELD SURVEY

Site description and observations

- 4.2.1 A summary of the main habitat features present at the different sampling sites is provided in Table 4.3; locations are shown on Figure 2.

Table 4.3: Description of the main habitat features at each macroinvertebrate sampling site	
Sampling Site Ref	Description
W004-9 (Tributary of the River Wygyr)	Ditch with the bed dominated by silt/clay. Unshaded watercourse, approximately 1.5 – 2 m wide and approximately 0.20 – 0.30 m deep. Water highly turbid in autumn 2016 and clear in spring 2017. Flow < 10 cm/sec in autumn 2016 and spring 2017. Surrounding land use was improved pasture, wetland and farm buildings (Appendix A, Plate 1).
W005-13 (Tributary of the River Wygyr)	Stream with slack, riffle and glide habitats with the bed dominated by bedrock and sand. Unshaded watercourse, approximately 1 – 1.5 m wide and approximately > 0.5 m deep. Water slightly turbid in autumn 2016 and clear in spring 2017. Flow < 10 cm/sec in autumn 2016 and spring 2017. Surrounding land use was broadleaf woodland and improved pasture (Appendix A, Plate 2).
W056-84 (River Erddreiniog)	Ditch with the bed dominated by small stony substrate and sand. Heavily shaded watercourse, approximately 1.5 – 2 m wide and approximately 0.20 m deep. Water clear and flow 10 – 25 cm/sec in autumn 2016 and spring 2017. Surrounding land use was improved pasture and scrub (Appendix A, Plate 3).

Table 4.3: Description of the main habitat features at each macroinvertebrate sampling site

Sampling Site Ref	Description
W066-98 (Tributary of River Cefni)	Ditch with the bed dominated by silt/soft mud and small stony substrate. Unshaded watercourse, approximately 0.5 – 0.75 m wide and approximately 0.10 – 0.20 m deep. Water moderately turbid in autumn 2016 and clear in spring 2017. Flow < 10 cm/sec in autumn 2016 and spring 2017. Oil layer present in autumn 2016. Surrounding land use was improved pasture (Appendix A, Plate 4).
W069-101 (Tributary of River Ceint)	Ditch with the bed dominated by small – large stony substrate. Unshaded watercourse, approximately 0.5 – 1 m wide and approximately 0.05 – 0.10 m deep. Water clear and flow < 10 cm/sec in autumn 2016 and spring 2017. Surrounding land use was improved pasture and scrub (Appendix A, Plate 5).
W1048-103 (Tributary of River Ceint)	Ditch with the bed dominated by small – medium stony substrate. Moderately shaded watercourse, approximately 1.5 – 2 m wide and approximately 0.20 – 0.30 m deep. Water clear in autumn 2016 and spring 2016. Flow < 10 cm/sec in autumn 2016 and 10 – 25 cm/sec in spring 2017. Surrounding land use was improved pasture and scrub (Appendix A, Plate 6).
W091-112 (Tributary of River Ceint)	Ditch with the bed dominated by small – medium stony substrate. Lightly shaded watercourse, approximately 2 m wide and approximately 0.20 m deep. Water slightly turbid in autumn 2016 and clear in spring 2017. Flow 10 – 25 cm/sec in autumn 2016 and spring 2017. Surrounding land use was improved pasture and farm buildings (Appendix A, Plate 7).
W106-117 (Tributary of River Braint)	Stream with riffle, run and slack habitats; the bed dominated by small – large stony substrate and sand. Light - moderately shaded watercourse, approximately 1 – 1.5 m wide and approximately 0.10 – 0.20 m deep. Water clear and flow 10 – 25 cm/sec in autumn 2016 and spring 2017. Surrounding land use was improved pasture (Appendix A, Plate 8).

Table 4.3: Description of the main habitat features at each macroinvertebrate sampling site

Sampling Site Ref	Description
W119-121 (Tributary of River Braint)	Ditch with the bed dominated by soft mud. Moderate – heavily shaded watercourse, approximately 0.5 m wide and approximately 0.05 – 0.10 m deep. Water moderately turbid and flow < 10 cm/sec in autumn 2016. Surrounding land use was improved pasture (Appendix A, Plate 9).
W119-122 (Tributary of River Braint)	Ditch with the bed dominated by sand and small stony substrate. Lightly shaded watercourse, approximately 1.5 m wide and approximately 0.05 m deep. Water clear and flow < 10 cm/sec in autumn 2016. Surrounding land use was improved pasture (Appendix A, Plate 10).
W206 (Tributary of Nant y Garth)	Ditch with the bed dominated by silt. Lightly shaded watercourse, approximately 1.5 – 2 m wide and approximately 0.15 m deep. Water moderately turbid, flow < 10 cm/sec and ochre present in spring 2017. Surrounding land use was improved pasture and scrub (Appendix A, Plate 11).
W077 (River Ceint)	Stream with the bed dominated by small stony substrate and sand. Unshaded watercourse, approximately 3 – 4 m wide and approximately 0.5 m deep. Water clear and flow 10 – 25 cm/sec in spring 2017. Surrounding land use was improved pasture (Appendix A, Plate 12).
D319 (Tributary of Nant y Garth)	Ditch with the bed dominated by silt. Unshaded watercourse, approximately 0.5 m wide and approximately 0.02 – 0.10 m deep. Water clear and flow < 10 cm/sec in spring 2017. Surrounding land use was improved pasture (Appendix A, Plate 13).
D322 (Tributary of Nant y Garth)	Stream with riffle habitat; the bed dominated by silt. Lightly shaded watercourse, approximately 1 – 1.5 m wide and approximately 0.15 m deep. Water slightly turbid and flow < 10 cm/sec in spring 2017. Surrounding land use was broadleaf woodland, coniferous woodland and scrub (Appendix A, Plate 14).

Biological analyses

- 4.2.2 Where species identification was not certain (e.g. due to insufficiently mature specimens, damaged specimens or specimens of the 'wrong' sex for identification purposes) any tentative identifications are recorded as 'cf.'

Tributary of River Wygyr (W004-9)

- 4.2.3 Table 4.4 presents the results of the macroinvertebrate analyses undertaken at sampling site W004-9 at crossing point NG-DRX A/44.

Table 4.4: Composition of the macroinvertebrate samples at W004-9

BMWP group	Species	BMWP score	CS	FSSR Score	Autumn 2016	Spring 2017
Snails						
Lymnaeidae	<i>Galba truncatula</i>	3	3	D		5
Succineidae	<i>Succinea putris</i>	-	1			9
Planorbidae	<i>Planorbis planorbis</i>	3	1	D		3
	<i>Anisus vortex</i>		1	D	13	58
	<i>Armiger crista</i>		2	C	2	
	<i>Bathyomphalus contortus</i>		2	D	3	
Worms						
Oligochaeta	Oligochaeta	1		D		5
Leeches						
Glossiphoniidae	<i>Helobdella stagnalis</i>	3	1	C	3	
Erpobdellidae	<i>Erbodella octoculata</i>	3	1	C	1	3
Crustaceans						
Gammaridae	<i>Gammarus pulex</i>	6	1	B	11	1

Table 4.4: Composition of the macroinvertebrate samples at W004-9

BMWP group	Species	BMWP score	CS	FSSR Score	Autumn 2016	Spring 2017
Crangonyctidae	<i>Crangonyx pseudogracilis</i>	6	1	D	12	4
Asellidae	<i>Asellus</i> sp.	3		D	10	
	<i>Asellus aquaticus</i>		1	D	30	6
	<i>Asellus meridianus</i>		3	D	3	
True bugs						
Corixidae	<i>Corixa panzeri</i>	5	5	D	1	
Beetles						
Dytiscidae	<i>Hydroporus (cf) incognitus</i>	5	3	D	3	
	<i>Suphrodytes dorsalis</i>		5	D	2	
Hydrophilidae	<i>Helophorus strigifrons</i>	5	7	D		3
	<i>Laccobius bipunctatus</i>		2	D	1	
Trueflies						
Chironomidae	Chironomidae (pupea)	2				1
	Tanypodinae				17	
	Orthocladiinae					251
	Chironomini				1	
Number of species					13	9
Number of genus/above					3	3
Total number of families (BMWP)					9	9

Table 4.4: Composition of the macroinvertebrate samples at W004-9

BMWP group	Species	BMWP score	CS	FSSR Score	Autumn 2016	Spring 2017
BMWP score					35	26
ASPT					3.9	3.3
PSI Score (species)					6.9	6.7
CCI Score					10.8	13.2

- 4.2.4 At this site, diversity was moderate with a total of 23 taxa recorded during the two sampling periods, 17 having been identified to a species level and a further six to genus or higher taxonomic level (see 'Species' column in the table).
- 4.2.5 Samples were typical of slow flowing waters and included a range of snails, leeches, crustaceans, true bugs, beetles and truefly larvae, with the presence of drought resistant species (the aquatic beetles *Helophorus strigifrons* and *Laccobius bipunctatus*) and the absence of pollution sensitive taxa (BMWP scores and ASPT indicative of a 'poor' quality). This indicates that the watercourse is likely to be ephemeral at this location.
- 4.2.6 Most species recorded were relatively common, with the exception of the diving beetle (*Suphrodytes dorsalis*) ('Local' (Conservation Score 5)) and the water scavenger beetle (*Helophorus strigifrons*) (Conservation Score 7, 'Notable' but not RDB status). The CCI scores are indicative of a 'fairly high' conservation value.
- 4.2.7 Although *Suphrodytes dorsalis* is not considered uncommon, *Helophorus strigifrons* is classed as Nationally Scarce (Ref 16), although not listed under Section 7 of the Environment (Wales) Act 2016. The species is typical of temporary marshes, often in well-established sites. It is widespread on low ground but the only records from the islands around Britain are Anglesey and Cumbrae (Ref 17).
- 4.2.8 The PSI scores are indicative of 'heavily sedimented' conditions. This is consistent with the flow regime at this site.

Tributary of River Wygyr (W005-13)

- 4.2.9 Table 4.5 presents the results of the macroinvertebrate analyses undertaken at sampling site W005-13 at crossing point NG-RVX A/48.

Table 4.5: Composition of the macroinvertebrate samples at W005-13

BMWP group	Species	BMWP score	CS	FSSR Score	Autumn 2016	Spring 2017
Snails						
Lymnaeidae	Lymnaeidae (juvenile/ damaged)	3		D	2	
	<i>Radix balthica</i>		1	D	6	
Hydrobiidae	<i>Potamopyrgus antipodarum</i>	3	1	C	19	10
Planorbidae	<i>Gyraulus albus</i>	3	1	C	4	
	<i>Armiger crista</i>		2	C	8	
Limpets and mussels						
Sphaeriidae	<i>Sphaerium</i> sp.	3		D	3	
	<i>Sphaerium corneum</i>		1	D	15	
	<i>Pisidium</i> sp.			D	15	1
Worms						
Oligochaeta	Oligochaeta	1		D	50	3
Leeches						
Glossiphoniidae	<i>Glossiphonia complanata</i>	3	1	C	3	
	<i>Helobdella stagnalis</i>		1	C		1
Erpobdellidae	<i>Erbodella octoculata</i>	3	1	C	2	
Mites						
Hydracarina	Hydracarina	-			1	3

Table 4.5: Composition of the macroinvertebrate samples at W005-13

BMWP group	Species	BMWP score	CS	FSSR Score	Autumn 2016	Spring 2017
Crustaceans						
Gammaridae grp.	<i>Gammarus</i> sp.	6		B	7	1
	<i>Gammarus pulex</i>		1	B	7	
	<i>Crangonyx pseudogracilis</i>		1	D	2	3
Asellidae	<i>Asellus aquaticus</i>	3	1	D	10	5
	<i>Asellus meridianus</i>		3	D	1	
Mayflies						
Baetidae	Baetidae (juvenile/damaged)	4		A		2
	<i>Baetis rhodani</i>		1	A		2
Damselflies						
Calopterygidae	<i>Calopteryx</i> sp.	8		C		1
Dragonflies						
Cordulegasteridae	<i>Cordulegaster boltonii</i>	8		D		1
Beetles						
Dytiscidae	Dytiscidae (larvae)	5		D	6	
Elmidae	<i>Elmis aenea</i>	5	1	B	1	5
	<i>Limnius volckmari</i>		2	B		1
Alderflies						
Sialidae	<i>Sialis lutaria</i>	4	1	D	3	1
Caddisflies						

Table 4.5: Composition of the macroinvertebrate samples at W005-13

BMWP group	Species	BMWP score	CS	FSSR Score	Autumn 2016	Spring 2017
Psychomyiidae	<i>Lype reducta</i>	8	3		1	
Hydropsychidae	Hydropsychidae (juvenile/damaged)	5		A		1
Limnephilidae	Limnephilidae (juvenile/damaged)	7		B	4	9
	<i>Limnephilus lunatus</i>		1	C		2
	<i>Limnephilus auricula</i>		3	C		3
	<i>Halesus</i> sp.			C		3
	<i>Halesus radiatus</i>		2	C		1
Beraeidae	<i>Beraeodes minutus</i>	10	5	B		3
Odontoceridae	<i>Odontocerum albicorne</i>	10	3	B		1
Sericostomatidae	<i>Sericostoma personatum</i>	10	1	B	4	2
Trueflies						
Chironomidae	Chironomidae (pupae)	2				1
	<i>Tanypodinae</i>					2
	<i>Orthocladiinae</i>					10
	<i>Chironomini</i>				250	
	<i>Tanytarsini</i>				90	1
	<i>Prodiamesinae</i>				10	7

Table 4.5: Composition of the macroinvertebrate samples at W005-13

BMWP group	Species	BMWP score	CS	FSSR Score	Autumn 2016	Spring 2017
Pediciidae	<i>Dicranota</i> sp.	5		B		1
Tipulidae grp.	Limoniidae	5		B		2
	<i>Eleophila</i> sp.			B		1
Dixidae	Dixidae (damaged/ juvenile)	-		B	1	
Psychodidae	Psychodidae	-		D		1
Ceratopogonidae	Ceratopogonidae	-				2
Ptychopteridae	<i>Ptychoptera</i> sp.	-		D		1
Number of species					15	15
Number of genus/above					12	20
Total number of families (BMWP)					18	22
BMWP score					69	97
ASPT					4.3	5.4
PSI Score (species)					13.8	33.3
CCI Score					4.0	8.6

4.2.10 Diversity was high, with a total of 49 taxa recorded during the two sampling periods, 24 having been identified to species and 25 to genus or higher taxonomic level (see 'Species' column in the table).

4.2.11 The two samples taken were distinctly different from one another, with the autumn sample dominated by species typical of slow-flowing conditions, including several species of snails, mussels, leeches, crustaceans and alderfly larvae. In spring 2017, the sample included species more adapted to fast flows, such as *Odontocerum albicorne*, Welshman's button (*Sericostoma personatum*), *Beraeodes minutus*, *Halesus radiatus* (caddisfly) *Elmis aenea*, *Limnius volckmari* (beetles) and the golden-ringed dragonfly (*Cordulegaster boltonii*).

4.2.12 The BMWP scores and ASPT were indicative of a moderate (autumn 2016) to good (spring 2017) biological quality, with the presence of several pollution sensitive taxa in spring 2017 (Sericostomatidae, Odontoceridae) PSI scores were indicative of 'sedimented' to 'heavily sedimented' conditions.

4.2.13 Most of the species recorded were common, as reflected in the CCI scores, indicative of a 'low' to 'moderate' conservation value. The 'Local' (Conservation Score 5) caddisfly larvae (*Beraeodes minutus*) was however recorded in spring 2017; though this species is not legally protected.

River Erddreiniog (W056-84)

4.2.14 Table 4.6 below presents the results of the macroinvertebrate analyses undertaken at sampling site W056-84 at crossing points NG-DRX C/155 and NG-RVX C/156.

Table 4.6: Composition of the macroinvertebrate samples at W056-84						
BMWP group	Species	BMWP score	CS	FSSR Score	Autumn 2016	Spring 2017
Snails						
Hydrobiidae	<i>Potamopyrgus antipodarum</i>	3	1	C	125	800
Succineidae	<i>Succinea</i> sp.	-				1
Limpets and mussels						
Sphaeriidae	<i>Pisidium</i> sp.	3		D	40	1
Worms						
Oligochaeta	Oligochaeta	1		D	25	2
Leeches						
Glossiphoniidae	<i>Glossiphonia complanata</i>	3	1	C	6	
Crustaceans						
Gammaridae	<i>Gammarus pulex</i>	6	1	B	8	19
Asellidae	<i>Asellus aquaticus</i>	3	1	D	10	

Table 4.6: Composition of the macroinvertebrate samples at W056-84

BMWP group	Species	BMWP score	CS	FSSR Score	Autumn 2016	Spring 2017
	<i>Asellus meridianus</i>		3	D	10	1
Stoneflies						
Nemouridae	Nemouridae (juvenile/damaged)	7		C		2
	<i>Nemurella picteti</i>		2	C	15	
Dragonflies						
Cordulegasteridae	<i>Cordulegaster boltonii</i>	8		D	1	
Beetles						
Gyrinidae	<i>Gyrinus substriatus</i>	5	1		1	
Dytiscidae	Dytiscidae (larvae)	5		D	1	1
Scirtidae	Scirtidae (larvae)	5		B	18	1
Caddisflies						
Glossosomatidae	<i>Agapetus</i> sp.	7		A		4
	<i>Agapetus fuscipes</i>		1	A		6
Philopotamidae	<i>Wormalida subnigra</i>	8	5	A		6
Polycentropodidae	<i>Plectrocnemia</i> sp.	7		B	1	
	<i>Plectrocnemia conspersa</i>		2	B		3
Hydropsychidae	Hydropsychidae (juvenile/damaged)	5		A	1	
	<i>Diplectrona felix</i>		4	A		13
Limnephilidae	Limnephilidae (juvenile/damaged)	7		B	1	1
	<i>Glyphotaelius</i>		3	D		1

Table 4.6: Composition of the macroinvertebrate samples at W056-84

BMWP group	Species	BMWP score	CS	FSSR Score	Autumn 2016	Spring 2017
	<i>pellucidus</i>					
Beraeidae	<i>Beraea pullata</i>	10	4	A		1
Sericostomatidae	<i>Sericostoma personatum</i>	10	1	B	5	1
Trueflies						
Chironomidae	<i>Tanypodinae</i>	2			10	2
	<i>Orthocladiinae</i>				5	5
	<i>Prodiamesinae</i>				5	
Tipulidae grp.	<i>Tipula</i> sp.	5		B		1
	<i>Pedicia</i> sp.			B		1
Simuliidae	Simuliidae (damaged/juvenile)	5		A		10
	<i>Simulium ornatum</i> group			B		4
Psychodidae	Psychodidae	-		D		2
Empididae	Empididae	-				1
Ceratopogonidae	Ceratopogonidae	-			1	1
Ptychopteridae	<i>Ptychoptera</i> sp.	-		D	10	2
Number of species					9	11
Number of genus/above					12	17
Total number of families (BMWP)					18	23
BMWP score					80	99
ASPT					5.0	5.5
PSI Score (species)					13.0	62.1
CCI Score					4.1	12.5

- 4.2.15 Diversity was moderate, with a total of 36 taxa recorded during the two sampling periods, of which 15 were identified to species and a further 21 taxa to genus or higher taxonomic level (see 'Species' column in the table).
- 4.2.16 Samples were largely comparable between the two survey seasons, including a range of snails, mussels, crustaceans, beetles, caddisfly, stonefly and truefly larvae. However, the sample taken in spring 2017 included a greater diversity of taxa adapted to fast flows, such as caddisfly larvae (*Agapetus fuscipes*, *Wormaldia subnigra*, *Plectrocnemia conspersa*, *Diplectrona felix*) and truefly larvae (*Pecidia* sp., Simuliidae). In autumn 2016, stonefly larvae (*Nemurella picteti*) were also recorded.
- 4.2.17 Most species recorded were relatively common, as reflected in the CCI scores indicative of 'low' conservation value for autumn 2016. In spring 2017, the CCI score was higher, indicative of a 'fairly high' conservation value, due to the presence of the 'Local' (Conservation Score 5) caddisfly (*Wormaldia subnigra*). The species is however not legally protected.
- 4.2.18 BMWP scores and ASPT values indicated a 'good' to 'very good' biological quality, with the presence of several taxa considered to be highly sensitive to pollution (Sericostomatidae, Beraeidae, Philopotamidae).
- 4.2.19 PSI scores reflected 'slightly sedimented' conditions in spring 2017 but 'heavily sedimented' conditions in autumn 2016.

Tributary of River Cefni (W066-98)

- 4.2.20 Table 4.7 presents the results of the macroinvertebrate analyses undertaken at sampling site W066-98 at crossing point NG-DRX C/183.

Table 4.7: Composition of the macroinvertebrate samples at W066-98						
BMWP group	Species	BMWP score	CS	FSSR Score	Autumn 2016	Spring 2017
Snails						
Lymnaeidae	<i>Stagnicola palustris</i>	3	2	D	1	
Limpets and mussels						
Sphaeriidae	<i>Pisidium</i> sp.	3		D	55	
Worms						

Table 4.7: Composition of the macroinvertebrate samples at W066-98

BMWP group	Species	BMWP score	CS	FSSR Score	Autumn 2016	Spring 2017
Oligochaeta	Oligochaeta	1		D	2	
Leeches						
Glossiphoniidae	<i>Glossiphonia complanata</i>	3	1	C	1	1
	<i>Helobdella stagnalis</i>		1	C	6	3
Erpobdellidae	Erpobdellidae (juvenile/damaged)	3		C	3	
	<i>Erbodella octoculata</i>		1	C		1
Mites						
Hydracarina	Hydracarina	-			1	
Crustaceans						
Ostracoda	Ostracoda	-			4	
Asellidae	<i>Asellus meridianus</i>	3	3	D	12	
Mayflies						
Baetidae	Baetidae (juvenile/damaged)	4		A	9	
	<i>Baetis rhodani</i>		1	A	8	
	<i>Alainites muticus</i>		2	A	2	
Stoneflies						
Nemouridae	Nemouridae (juvenile/damaged)	7		C	10	
	<i>Nemurella picteti</i>		2	C	9	
	<i>Nemoura</i> sp.			C		1
Leuctridae	<i>Leuctra hippopus</i>	10	3	A	4	

Table 4.7: Composition of the macroinvertebrate samples at W066-98

BMWP group	Species	BMWP score	CS	FSSR Score	Autumn 2016	Spring 2017
	<i>Leuctra nigra</i>		4	B	6	
Perlodidae	<i>Isoperla grammatica</i>	10	2	A	15	
Damselflies						
Coenagrionidae	Coenagrionidae (juvenile/damaged)	6		D	1	
Beetles						
Hydrophilidae	<i>Helophorus</i> sp.	5		D	1	
Scirtidae	Scirtidae (larvae)	5		B	13	
Elmidae	<i>Elmis aenea</i>	5	1	B	1	
Caddisflies						
Polycentropodidae	<i>Plectrocnemia conspersa</i>	7	2	B	6	2
Hydroptilidae	<i>Oxyethira</i> sp.	6			1	
Limnephilidae	Limnephilidae (juvenile/damaged)	7		B	23	51
	<i>Limnephilus extricatus</i>		2	C	1	
Trueflies						
Chironomidae	<i>Tanypodinae</i>	2			9	8
	<i>Orthocladiinae</i>				1	
Limoniidae	Limoniidae	5		B	6	1
Simuliidae	Simuliidae (damaged/juvenile)	5		A	4	
Ceratopogonidae	Ceratopogonidae	-			4	
Ptychopteridae	<i>Ptychoptera</i> sp.	-		D	3	

Table 4.7: Composition of the macroinvertebrate samples at W066-98

BMWP group	Species	BMWP score	CS	FSSR Score	Autumn 2016	Spring 2017
Tabanidae	<i>Tabanus</i> sp.	-		D	1	
Number of species					13	4
Number of genus/above					19	4
Total number of families (BMWP)					25	7
BMWP score					100	34
ASPT					5.0	4.9
PSI Score (species)					42.9	20.0
CCI Score					6.0	1.3

- 4.2.21 Diversity was moderate, with a total of 34 taxa recorded during the two sampling periods, of which 14 were identified to a species level and a further 20 to genus or higher taxonomic level (see 'Species' column in the table).
- 4.2.22 Samples were very different between the two survey seasons. Diversity was relatively high in autumn 2016, with a range of snails, mussels, leeches, crustaceans, beetles, damselfly larvae, truefly larvae, mayfly larvae and the several pollution sensitive species of stonefly (*Nemurella picteti*, *Leuctra hippopus*, *Leuctra nigra*, *Isoperla grammatica*) and caddisfly (*Plectrocnemia conspersa*, *Oxyethira* sp. and *Limnephilus extricatus*).
- 4.2.23 Diversity was very low in spring 2017, with only three families of leeches, two families of caddisfly, two families of truefly and one family of stonefly recorded. This drop in diversity is unlikely to be due to water quality issues, as caddisfly larvae and stonefly larvae are considered to be pollution sensitive. However, the decline could be the result of drier conditions, as most of species absent in comparison to autumn 2016 were adapted to fast flows (*Leuctra hippopus*, *Isoperla grammatica*, *Leuctra nigra*, *Baetis rhodani*, *Alainites muticus* and *Elmis aenea*).
- 4.2.24 These differences are reflected in the BMWP score, indicative of 'very good' quality in autumn 2016 and 'poor' quality in spring 2017. However, ASPT values were indicative of 'good' quality for both seasons.

4.2.25 In terms of conservation values, CCI scores were indicative of a 'low' to 'moderate' conservation value, with most species being relatively common and no species of conservation interest being recorded.

4.2.26 PSI scores were indicative of 'moderately sedimented' to 'sedimented' conditions.

Tributary of River Ceint (W069-101)

4.2.27 Table 4.8 presents the results of the macroinvertebrate analyses undertaken at sampling site W069-101 at crossing point NG-RVX D/196.

Table 4.8: Composition of the macroinvertebrate samples at W069-101						
BMWP group	Species	BMWP score	CS	FSSR Score	Autumn 2016	Spring 2017
Snails						
Lymnaeidae	Lymnaeidae (juvenile/damaged)	3		D	1	
Hydrobiidae	<i>Potamopyrgus antipodarum</i>	3	1	C	6	
Zonitoides	<i>Zonitoides nitidus</i>	-	4		1	
Worms						
Oligochaeta	Oligochaeta	1		D	8	
Leeches						
Glossiphoniidae	Glossiphoniidae (juvenile/damaged)	3		C	1	
Mites						
Hydracarina	Hydracarina	-			1	5
Crustaceans						
Gammaridae grp.	<i>Gammarus</i> sp.	6		B	23	
	<i>Gammarus pulex</i>		1	B	23	7
	<i>Gammarus fossarum</i>					1

Table 4.8: Composition of the macroinvertebrate samples at W069-101						
BMWP group	Species	BMWP score	CS	FSSR Score	Autumn 2016	Spring 2017
	<i>Crangonyx pseudogracilis</i>		1	D		3
Mayflies						
Baetidae	<i>Baetis rhodani</i>	4	1	A	12	2
	<i>Alainites muticus</i>		2	A	2	
Stoneflies						
Nemouridae	Nemouridae (juvenile/damaged)	7		C	10	
	<i>Nemurella picteti</i>		2	C	7	5
Leuctridae	<i>Leuctra</i> sp.	10		A	4	
	<i>Leuctra nigra</i>		4	B	2	1
	<i>Leuctra fusca</i>		1	A	4	
Dragonflies						
Cordulegasteridae	<i>Codulegaster boltonii</i>	8		D		2
Beetles						
Dytiscidae	<i>Agabus paludosus</i>	5	1	C		1
Scirtidae	Scirtidae (larvae)	5		B	5	
Elmidae	<i>Elmis aenea</i>	5	1	B	2	1
Caddisflies						
Glossosomatidae	<i>Agapetus</i> sp.	7		A		2
	<i>Agapetus fuscipes</i>		1	A	7	
Philopotamidae	<i>Wormalidia occipitalis</i>	8	2	A	5	
Polycentropodidae	Polycentropodidae (juvenile/damaged)	7		B	1	

Table 4.8: Composition of the macroinvertebrate samples at W069-101

BMWP group	Species	BMWP score	CS	FSSR Score	Autumn 2016	Spring 2017
	<i>Plectrocnemia conspersa</i>		2	B		1
	<i>Plectrocnemia geniculata</i>		3	B		1
Hydropsychidae	<i>Hydropsyche</i> sp.	5		A		1
	<i>Hydropsyche siltatai</i>		1	A	4	
Limnephilidae	Limnephilidae (juvenile/damaged)	7		B	15	23
	<i>Limnephilus lunatus</i>		1	C		4
	<i>Limnephilus auricula</i>		3	C		4
	<i>Micropterna sequax</i>		1	B	12	1
Sericostomatidae	Sericostomatidae (juvenile/damaged)	10		B	9	
	<i>Sericostoma personatum</i>		1	B	4	1
Trueflies						
Chironomidae	Chironomidae (pupea)	2				1
	Tanypodinae				3	1
	Orthocladiinae				5	4
	Tanytarsini				10	
	Prodiamesinae				1	1
Tipulidae	<i>Tipula</i> sp.	5		B		2

Table 4.8: Composition of the macroinvertebrate samples at W069-101

BMWP group	Species	BMWP score	CS	FSSR Score	Autumn 2016	Spring 2017
Pediciidae	<i>Dicranota</i> sp.	5		B		1
Simuliidae	Simuliidae (juvenile)	5		A		2
Dixidae	Dixidae (pupea)	-		B	1	1
	<i>Dixa</i> sp.			B	1	
Psychodidae	Psychodidae	-		D	1	1
Empididae	Empididae	-			1	
Ceratopogonidae	Ceratopogonidae	-			4	2
Ptychopteridae	<i>Ptychoptera</i> sp.	-		D	1	
Tabanidae	<i>Tabanus</i> sp.	-		D		1
Other Taxa						
Lepidoptera		-				1
Number of species					14	15
Number of genus/above					21	16
Total number of families (BMWP)					24	21
BMWP score					93	93
ASPT					5.5	6.2
PSI Score (species)					86.2	65.2
CCI Score					4.9	5.1

4.2.28 Diversity was high, with a total of 50 taxa recorded during the two sampling periods, 22 of which were identified to species and a further 28 to genus or higher taxonomic level (see 'Species' column in the table).

4.2.29 The samples were similar, and included a range of snails, worms, crustaceans, mayfly larvae, beetles, truefly larvae, including species sensitive to pollution and adapted to fast flows, such as *Leuctra nigra*,

Leuctra fusca (stonefly larvae), golden-ringed dragonfly (larvae) and Welshman's button and *Plectrocnemia conspersa* (caddisfly larvae).

4.2.30 However, most species recorded were relatively common, as reflected in the CCI scores ('low' to 'moderate' conservation value). No species of conservation interest were recorded.

4.2.31 BMWP scores and ASPT value were indicative of a very good biological quality and PSI scores suggest 'slightly' to 'unsedimented' conditions.

Tributary of River Ceint (W1048-103)

4.2.32 Table 4.9 presents the results of the macroinvertebrate analyses undertaken at sampling site W1048-103 at crossing point NG-RVX D/196.

Table 4.9: Composition of the macroinvertebrate samples at W1048-103						
BMWP group	Species	BMWP score	CS	FSSR Score	Autumn 2016	Spring 2017
Snails						
Lymnaeidae	<i>Radix balthica</i>	3	1	D	1	1
Hydrobiidae	<i>Potamopyrgus antipodarum</i>	3	1	C	250	20
Limpets and mussels						
Anyclidae	<i>Ancylus fluviatilis</i>	6	1		1	
Sphaeriidae	<i>Pisidium</i> sp.	3		D	90	1
Worms						
Oligochaeta	Oligochaeta	1		D	30	3
Leeches						
Glossiphoniidae	<i>Glossiphonia complanata</i>	3	1	C	2	
	<i>Helobdella stagnalis</i>		1	C	5	
Erpobdellidae	<i>Erpobdella octoculata</i>	3	1	C	2	
Mites						

Table 4.9: Composition of the macroinvertebrate samples at W1048-103

BMWP group	Species	BMWP score	CS	FSSR Score	Autumn 2016	Spring 2017
Hydracarina	Hydracarina	-			1	
Crustaceans						
Gammaridae	<i>Gammarus pulex</i>	6	1	B	5	15
Crangonyctidae	<i>Crangonyx pseudogracilis</i>	6	1	D	5	
Mayflies						
Baetidae	Baetidae (juvenile/damaged)	4		A	3	3
	<i>Baetis rhodani</i>		1	A		2
Leptophlebiidae	Leptophlebiidae (juvenile/damaged)	10		B	1	2
Stoneflies						
Nemouridae	<i>Nemurella picteti</i>	7	2	C		5
	<i>Nemoura</i> sp.			C		20
	<i>Nemoura cambrica</i>		2	B		4
Leuctridae	<i>Leuctra hippopus</i>	10	3	A		10
Beetles						
Gyrinidae	<i>Gyrinus substriatus</i>	5	1		3	
Dytiscidae	Dytiscidae (larvae)	5		D		1
Scirtidae	Scirtidae (larvae)	5		B	3	2
Elmidae	<i>Elmis aenea</i>	5	1	B	2	10
	<i>Limnius volckmari</i>		2	B	8	
Caddisflies						
Glossosomatidae	<i>Agapetus fuscipes</i>	7	1	A		14
Philopotamidae	<i>Wormalidia</i>	8	2	A		15

Table 4.9: Composition of the macroinvertebrate samples at W1048-103

BMWP group	Species	BMWP score	CS	FSSR Score	Autumn 2016	Spring 2017
	<i>occipitalis</i>					
Polycentropodidae	Polycentropodidae (juvenile/damaged)	7		B	2	10
	<i>Plectrocnemia conspersa</i>		2	B	3	8
Psychomyiidae	<i>Lype reducta</i>	8	3		1	1
Limnephilidae	Limnephilidae (juvenile/damaged)	7		B	1	2
	<i>Micropterna sequax</i>		1	B	1	5
Beraeidae	<i>Beraea pullata</i>	10	4	A	3	
Sericostomatidae	<i>Sericostoma personatum</i>	10	1	B		1
Trueflies						
Chironomidae	Chironomidae (pupea)	2			2	
	Tanypodinae				1	6
	Orthocladiinae				8	10
	Prodiamesinae				1	4
Tipulidae	<i>Tipula</i> sp.	5		B	1	1
Limoniidae	Limoniidae	5		B	1	
Simuliidae	Simuliidae (damaged/juvenile)	5		A		5
Psychodidae	Psychodidae	-		D	2	3
Empididae	Empididae	-			1	
Ceratopogonidae	Ceratopogonidae	-				7

Table 4.9: Composition of the macroinvertebrate samples at W1048-103						
BMWP group	Species	BMWP score	CS	FSSR Score	Autumn 2016	Spring 2017
Ptychopteridae	<i>Ptychoptera</i> sp.	-		D		1
Number of species					15	14
Number of genus/above					16	17
Total number of families (BMWP)					22	24
BMWP score					96	121
ASPT					5.1	5.8
PSI Score (species)					38.1	64.5
CCI Score					4.4	7.9

- 4.2.33 Diversity was high at this site, with 43 taxa recorded during the two sampling periods, of which 22 were identified to species and a further 21 to genus or higher taxonomic level (see 'Species' column in the table).
- 4.2.34 The BMWP scores and ASPT values were indicative of a 'good' to 'very good' quality, with the presence of several clean water indicator species, including stonefly (*Nemurella picteti*, *Nemoura cambrica* and *Leuctra hippopus*), mayfly (*Leptophlebiidae*) and caddisfly larvae (*Wormaldia occipitalis*, *Berea pullata* and Welshman's button).
- 4.2.35 Other taxa recorded included a range of snails, mussels, leeches, crustaceans, beetles and truefly larvae, with several species typical of fast flowing conditions (*Elmis aenea*, *Limnius volckmari*, *Gammarus pulex*, *Ancylus fluviatilis*, *Leuctra hippopus*, *Wormaldia occipitalis* and the river limpet (*Ancylus fluviatilis*)).
- 4.2.36 The samples were similar, although no stonefly larvae were recorded in autumn 2016 and no leeches were recorded in spring 2017. These differences are likely to reflect habitat and/or seasonal variations.
- 4.2.37 Most species are relatively common, with no species of conservation interest encountered. This is reflected in the CCI scores indicative of a 'low' to 'moderate' conservation value.
- 4.2.38 PSI scores indicate that the watercourse is 'slightly sedimented' to 'sedimented'.

Tributary of River Ceint (W091-112)

4.2.39 Table 4.10 presents the results of the macroinvertebrate analyses undertaken at sampling site W091-112 at crossing point NG-DRX E/220.

Table 4.10: Composition of the macroinvertebrate samples at W091-112						
BMWP group	Species	BMWP score	CS	FSSR Score	Autumn 2016	Spring 2017
Snails						
Hydrobiidae	<i>Potamopyrgus antipodarum</i>	3	1	C	139	426
Physidae	<i>Aplexa hypnorum</i>	3	5	D		2
Succineidae	<i>Succinea putris</i>	-	1		1	
Planorbidae	Planorbidae (juvenile/damaged)	3		D		3
	<i>Anisus leucostoma</i>		5	D		1
	<i>Bathyomphalus contortus</i>		2	D	2	
	<i>Hippeutis complanata</i>		3	D		1
Limpets and mussels						
Anyclidae	<i>Ancylus fluviatilis</i>	6	1		6	
Sphaeriidae	<i>Pisidium</i> sp.	3		D	10	
Worms						
Oligochaeta	Oligochaeta	1		D	4	3
Leeches						
Glossiphoniidae	<i>Glossiphonia complanata</i>	3	1	C	2	
	<i>Helobdella stagnalis</i>		1	C		1
Erpobdellidae	<i>Erbodella</i>	3	1	C	1	

Table 4.10: Composition of the macroinvertebrate samples at W091-112						
BMWP group	Species	BMWP score	CS	FSSR Score	Autumn 2016	Spring 2017
	<i>octocolata</i>					
Mites						
Hydracarina	Hydracarina	-				1
Crustaceans						
Ostracoda		-			25	22
Gammaridae	<i>Gammarus</i> sp.	6		B	100	
	<i>Gammarus pulex</i>		1	B	50	184
Asellidae	<i>Asellus meridianus</i>	3	3	D	94	24
Mayflies						
Baetidae	<i>Baetis rhodani</i>	4	1	A	1	1
Stoneflies						
Nemouridae	Nemouridae (juvenile/damaged)	7		C		9
	<i>Nemurella picteti</i>		2	C		2
	<i>Nemoura</i> sp.			C	1	
Leuctridae	<i>Leuctra</i> sp.	10		A	48	
	<i>Leuctra hippopus</i>		3	A		28
Beetles						
Hydrophilidae	<i>Helophorus</i> sp.	5		D	1	
Scirtidae	Scirtidae (larvae)	5		B	21	22
Elmidae	<i>Elmis aenea</i>	5	1	B	17	165
Caddisflies						
Glossosomatidae	<i>Agapetus</i> sp.	7		A	1	42
Hydropsychidae	<i>Hydropsyche siltatai</i>	5	1	A		1

Table 4.10: Composition of the macroinvertebrate samples at W091-112

BMWP group	Species	BMWP score	CS	FSSR Score	Autumn 2016	Spring 2017
Hydroptilidae	Hydroptilidae (juvenile/damaged)	6			1	
Limnephilidae	Limnephilidae (juvenile/damaged)	7		B	7	1
	<i>Limnephilus lunatus</i>		1	C	1	
	<i>Glyphotaelius pellucidus</i>		3	D	2	
	<i>Potamophylax latipennis</i>		2	B	2	1
	<i>Halesus</i> sp.			C		1
	<i>Mesophylax</i> sp.			A		1
Beraeidae	<i>Beraea pullata</i>	10	4	A	1	3
Sericostomatidae	<i>Sericostoma personatum</i>	10	1	B		1
Trueflies						
Chironomidae	Tanypodinae	2			4	
	Orthocladiinae				30	2
Tipulidae grp.	<i>Dicranota</i> sp.	5		B		2
	Limoniidae			B		1
Simuliidae	Simuliidae (damaged/juvenile)	5		A	15	7
Simuliidae	<i>Simulium venum</i>	5				1
Psychodidae	Psychodidae	-		D	4	
Empididae	Empididae	-				1
Ceratopogonidae	Ceratopogonidae	-			1	

Table 4.10: Composition of the macroinvertebrate samples at W091-112						
BMWP group	Species	BMWP score	CS	FSSR Score	Autumn 2016	Spring 2017
Number of species					14	16
Number of genus/above					16	15
Total number of families (BMWP)					25	23
BMWP score					104	104
ASPT					5.0	5.2
PSI Score (species)					47.2	60.5
CCI Score					8.2	11.3

4.2.40 Diversity was high at this site, with a total of 47 taxa recorded during the two sampling periods, 23 identified to species level and another 24 to genus or higher taxonomic level (see 'Species' column in the table).

4.2.41 The two samples were similar with BMWP scores and ASPT values indicative of a 'good' to 'very good quality, with the presence of several clean water indicators, such as stonefly larvae (*Leuctra hippopus*, *Nemurella picteti*) and caddisfly larvae (*Beraea pullata* and Welshman's button). Other taxa recorded included snails, mussels, worms, leeches, crustaceans, mayfly larvae, beetles and truefly larvae, with the presence of several species typical of fast flowing conditions (*Simulium vernum*, *Elmis aenea* and *Leuctra hippopus*).

4.2.42 No species of conservation interest were recorded, all species being relatively common, with the exception of the 'Local' (Conservation Score 5) white-lipped ramshorn snail (*Anisus leucostoma*) and the moss bladder snail (*Aplexa hypnorum*) both in spring 2017. However, these species are not legally protected. This is reflected in the CCI scores, indicative of 'moderate' to 'fairly high' conservation value.

4.2.43 The PSI scores indicated 'slightly' to 'moderately' sedimented conditions.

Tributary of River Braint (W106-117)

4.2.44 Table 4.11 presents the results of the macroinvertebrate analyses undertaken at sampling site W106-117 at crossing point NG-DRX E/229.

Table 4.11: Composition of the macroinvertebrate samples at W106-117

BMWP group	Species	BMWP score	CS	FSSR Score	Autumn 2016	Spring 2017
Snails						
Lymnaeidae	<i>Radix balthica</i>	3	1	D	1	
Hydrobiidae	<i>Potamopyrgus antipodarum</i>	3	1	C	10	
Succineidae	<i>Succinea</i> sp.	-				2
Worms						
Oligochaeta	Oligochaeta	1		D	10	
Leeches						
Erpobdellidae	<i>Erpobdella</i> sp.	3		C	18	
Erpobdellidae	<i>Erbodella octoculata</i>	3	1	C	1	3
Mites						
Hydracarina	Hydracarina	-			1	1
Crustaceans						
Gammaridae	<i>Gammarus</i> sp.	6		B		10
	<i>Gammarus pulex</i>		1	B	40	5
Asellidae	<i>Asellus meridianus</i>	3	3	D	25	1
Mayflies						
Baetidae	Baetidae (juvenile/damaged)	4		A		10
	<i>Baetis rhodani</i>		1	A	35	6
Heptageniidae	Heptageniidae (juvenile/damaged)	10		A	2	4
Leptophlebiidae	Leptophlebiidae (juvenile/damaged)	10		B		1
Stoneflies						

Table 4.11: Composition of the macroinvertebrate samples at W106-117

BMWP group	Species	BMWP score	CS	FSSR Score	Autumn 2016	Spring 2017
Nemouridae	Nemouridae (juvenile/damaged)	7		C		2
Leuctridae	Leuctridae (juvenile/damaged)	10		A	2	
	<i>Leuctra</i> sp.			A		5
	<i>Leuctra hippopus</i>		3	A	2	5
	<i>Leuctra nigra</i>		4	B		2
Perlodidae	<i>Isoperla grammatica</i>	10	2	A		1
Chloroperlidae	<i>Chloroperla torrentium</i>	10	1	A		4
Beetles						
Gyrinidae	Gyrinidae (larvae/damaged)	5			1	1
Dytiscidae	<i>Oreodytes</i> sp.	5		B		1
Scirtidae	Scirtidae (larvae)	5		B	1	2
Elmidae	<i>Elmis aenea</i>	5	1	B	12	25
	<i>Limnius volckmari</i>		2	B	1	
	<i>Oulimnius tuberculatus</i>		2	C		1
Caddisflies						
Rhyacophilidae	<i>Rhyacophila dorsalis</i>	7	1	A	5	
Polycentropodidae	<i>Plectrocnemia conspersa</i>	7	2	B	1	
Hydropsychidae	Hydropsychidae (juvenile/damaged)	5		A		2
	<i>Hydropsyche siltatai</i>		1	A	40	1

Table 4.11: Composition of the macroinvertebrate samples at W106-117						
BMWP group	Species	BMWP score	CS	FSSR Score	Autumn 2016	Spring 2017
Limnephilidae	Limnephilidae (juvenile/damaged)	7		B	15	4
	<i>Limnephilus lunatus</i>		1	C		1
	<i>Potamophylax latipennis</i>		2	B	1	
	<i>Halesus</i> sp.			C		5
Goeridae	<i>Silo</i> sp.	10		A		1
Sericostomatidae	Sericostomatidae (juvenile/damaged)	10		B		3
	<i>Sericostoma personatum</i>		1	B	8	2
Trueflies						
Chironomidae	Orthocladiinae	2			3	4
Tipulidae grp.	<i>Tipula</i> sp.	5		B	1	
	<i>Dicranota</i> sp.			B	6	2
	<i>Neolimnomya</i> sp.			B		2
Simuliidae	Simuliidae (damaged/juvenile)	5		A	1	1
Psychodidae	Psychodidae	-		D	1	1
Empididae	Empididae	-				1
Muscidae	Muscidae	-			1	
Number of species					14	13
Number of genus/above					14	22
Total number of families (BMWP)					23	25
BMWP score					106	137
ASPT					5.3	6.5

Table 4.11: Composition of the macroinvertebrate samples at W106-117						
BMWP group	Species	BMWP score	CS	FSSR Score	Autumn 2016	Spring 2017
PSI Score (species)					66.7	80.0
CCI Score					7.5	8.5

- 4.2.45 Diversity was high at this site, with a total of 46 taxa recorded during the two sampling periods, 19 having been identified to species level and a further 27 to genus or higher taxonomic level (see 'Species' column in the table).
- 4.2.46 Samples were similar between autumn 2016 and spring 2017, and included several clean water indicators, such as stonefly (*Leuctra nigra*, *Leuctra hippopus*, *Isoperla grammica*, *Chloroperla torrentium* and Nemouridae), mayfly (Heptageniidae and Leptophlebiidae) and caddisfly larvae (*Rhyacophila dorsalis*, *Plectrocnemia conspersa*, *Silo* sp. and Welshman's button).
- 4.2.47 Other taxa included a range of snails, worms, crustaceans, beetles and truefly larvae. Such communities are typical of clean, stony and relatively fast-flowing watercourses.
- 4.2.48 These elements are reflected in the high BMWP scores and ASPT values, indicative of a 'very good' biological quality.
- 4.2.49 All species recorded were relatively common, with no species of conservation interest recorded (CCI scores indicative of a 'moderate' conservation value).
- 4.2.50 The PSI score suggests 'slightly sedimented' to 'unsedimented' conditions.

Tributary of River Braint (W119-121)

- 4.2.51 Table 4.12 below presents the results of the macroinvertebrate analyses undertaken at sampling site W119-121 at crossing point NG-STRX E/236.

Table 4.12: Composition of the macroinvertebrate sample at W119-121					
BMWP group	Species	BMWP score	CS	FSSR Score	Autumn 2016
Snails					
Lymnaeidae	Lymnaeidae	3		D	1

Table 4.12: Composition of the macroinvertebrate sample at W119-121

BMWP group	Species	BMWP score	CS	FSSR Score	Autumn 2016
	(juvenile/damaged)				
Succineidae	<i>Succinea</i> sp.	-			1
Planorbidae	<i>Bathyomphalus contortus</i>	3	2	D	15
Limpets and mussels					
Sphaeriidae	<i>Pisidium</i> sp.	3		D	89
	<i>Pisidium subtruncatum</i>		1	D	
Worms					
Oligochaeta	Oligochaeta	1		D	17
Leeches					
Erpobdellidae	Erpobdellidae (juvenile/damaged)	3		C	1
	<i>Erbodella octoculata</i>		1	C	1
Crustaceans					
Gammaridae	<i>Gammarus</i> sp.	6		B	145
	<i>Gammarus pulex</i>		1	B	70
Asellidae	<i>Asellus aquaticus</i>	3	1	D	200
Stoneflies					
Nemouridae	Nemouridae (juvenile/damaged)	7		C	11
	<i>Nemurella picteti</i>		2	C	3
Beetles					
Hydrophilidae	<i>Helophorus</i> sp.	5		D	1
Hydraenidae	<i>Hydraena riparia</i>	5	1	B	2
Scirtidae	Scirtidae (larvae)	5		B	37

Table 4.12: Composition of the macroinvertebrate sample at W119-121

BMWP group	Species	BMWP score	CS	FSSR Score	Autumn 2016
Alderflies					
Sialidae	<i>Sialis lutaria</i>	4	1	D	1
Caddisflies					
Polycentropodidae	Polycentropodidae (juvenile/damaged)	7		B	3
	<i>Plectrocnemia conspersa</i>		2	B	1
Limnephilidae	Limnephilidae (juvenile/damaged)	7		B	5
	<i>Glyphotaelius pellucidus</i>		3	D	2
Beraeidae	<i>Beraea maurus</i>	10	3	A	6
Leptoceridae	Leptoceridae (juvenile/damaged)	10			1
Sericostomatidae	Sericostomatidae (juvenile/damaged)	10		B	1
Trueflies					
Chironomidae	Tanypodinae	2			12
	Orthocladiinae				9
	Chironomini				18
	Tanytarsini				6
Tipulidae grp.	<i>Eleophila</i> sp.	5		B	2
	<i>Neolimnomya</i> sp.			B	2
Dixidae	<i>Dixa nebulosa</i>	-	4		4
Psychodidae	Psychodidae	-		D	4
Ceratopogonidae	Ceratopogonidae	-			9

Table 4.12: Composition of the macroinvertebrate sample at W119-121

BMWP group	Species	BMWP score	CS	FSSR Score	Autumn 2016
Ptychopteridae	<i>Ptychoptera</i> sp.	-		D	56
Number of species					11
Number of genus/above					22
Total number of families (BMWP)					23
BMWP score					94
ASPT					5.2
PSI Score (species)					34.4
CCI Score					5.7

- 4.2.52 Diversity was moderate at this site, with a total of 33 taxa recorded during the autumn sampling period, 11 having been identified to species level and a further 22 to genus or higher taxonomic level (see 'Species' column in the table).
- 4.2.53 The most abundant taxa were crustaceans (*Gammarus pulex* and the water louse (*Asellus aquaticus*)), mussels (*Pisidium* sp.) and beetles (Scirtidae). Other taxa were present in low to moderate abundances and included a range of snails, worms, leeches, stonefly, alderfly, caddisfly and truefly larvae. There were a number of pollution sensitive species (*Nemurella picteti*, *Plectrocnemia conspersa*, *Beraea maurus*, Letpoceridae, and Sericostomatidae), as reflected in the BMWP score and ASPT value, indicative of 'good' biological quality.
- 4.2.54 However, all species recorded were relatively common, with no species of conservation interest recorded, as shown by the CCI score being indicative of a 'moderate' conservation value.
- 4.2.55 The PSI score suggests that the watercourse is 'sedimented' at this location.

Tributary of River Braint (W119-122)

- 4.2.56 Table 4.13 presents the results of the macroinvertebrate analyses undertaken at sampling site W119-122 at crossing point NG-STRX E/236.

Table 4.13: Composition of the macroinvertebrate sample at W19-122					
BMWP group	Species	BMWP score	CS	FSSR Score	Autumn 2016
Snails					
Hydrobiidae	<i>Potamopyrgus antipodarum</i>	3	1	C	1
Limpets and mussels					
Sphaeriidae	<i>Pisidium</i> sp.	3		D	60
Worms					
Oligochaeta	Oligochaeta	1		D	7
Leeches					
Glossiphoniidae	<i>Helobdella stagnalis</i>	3	1	C	1
Crustaceans					
Gammaridae	<i>Gammarus</i> sp.	6		B	90
	<i>Gammarus pulex</i>		1	B	30
Asellidae	<i>Asellus aquaticus</i>	3	1	D	34
Stoneflies					
Nemouridae	<i>Nemoura</i> sp.	7		C	1
Leuctridae	<i>Leuctra inermis</i>	10	1	A	1
Beetles					
Hydrophilidae	<i>Helophorus brevipalpis</i>	5	1	D	1
Scirtidae	Scirtidae (larvae)	5		B	7
Caddisflies					
Polycentropodidae	Polycentropodidae (juvenile/damaged)	7		B	1
	<i>Plectrocnemia conspersa</i>		2	B	1
Psychomyiidae	<i>Lype phaeopa</i>	8	4		1
Limnephilidae	Limnephilidae (juvenile/damaged)	7		B	3

Table 4.13: Composition of the macroinvertebrate sample at W19-122					
BMWP group	Species	BMWP score	CS	FSSR Score	Autumn 2016
Trueflies					
Chironomidae	Tanypodinae	2			13
Limoniidae	<i>Neolimnomya</i> sp.	5		B	1
Ceratopogonidae	Ceratopogonidae	-			2
Ptychopteridae	<i>Ptychoptera</i> sp.	-		D	4
Number of species					8
Number of genus/above					11
Total number of families (BMWP)					17
BMWP score					75
ASPT					5.0
PSI Score (species)					38.10
CCI Score					4.50

- 4.2.57 Diversity was low at this site, with 19 taxa recorded during the autumn sampling period, eight having been identified to species level and a further 11 to genus or higher taxonomic level (see 'Species' column in the table).
- 4.2.58 The most abundant taxa were mussels (*Pisidium* sp.) and crustaceans (*Gammarus pulex* and the water louse). Other taxa were recorded in relatively low abundances and included a range of snails, worms, leeches, stonefly larvae, beetles, caddisfly larvae and truefly larvae. There were a number of clean water indicators (*Lype phaeopa*, *Leuctra inermis*, *Plectrocnemia conspersa* and Limnephilidae). This is reflected in the BMWP score and ASPT value, indicative of 'good' biological quality.
- 4.2.59 However, all species recorded were relatively common, with no species of conservation interest recorded, as shown by the low CCI score indicative of a 'low' conservation value.
- 4.2.60 The PSI score suggests that the watercourse is 'sedimented' at this location.

Tributary of Nant y Garth (W206)

4.2.61 Table 4.14 below presents the results of the macroinvertebrate analyses undertaken at sampling site W206 at crossing point NG-STRX F/256.

Table 4.14: Composition of the macroinvertebrate sample at W206					
BMWP group	Species	BMWP score	CS	FSSR Score	Spring 2017
Snails					
Hydrobiidae	<i>Potamopyrgus antipodarum</i>	3	1	C	22
Succineidae	<i>Succinea</i> sp.	-			2
Limpets and mussels					
Sphaeriidae	<i>Pisidium subtruncatum</i>	3	1	D	15
Worms					
Oligochaeta	Oligochaeta	1		D	1
Leeches					
Glossiphoniidae	<i>Glossiphonia complanata</i>	3	1	C	1
	<i>Helobdella stagnalis</i>		1	C	4
Hirudinidae	<i>Haemopsis sanguisuga</i>	3	5	D	1
Mites					
Hydracarina	Hydracarina	-			1
Crustaceans					
Ostracoda	Ostracoda	-			2
Gammaridae	<i>Gammarus</i> sp.	6		B	8
Asellidae	<i>Asellus aquaticus</i>	3	1	D	2
Stoneflies					
Nemouridae	<i>Nemoura</i> sp.	7		C	21
	<i>Nemoura avicularis</i>		4	C	6
Beetles					
Dytiscidae	<i>Hydroporus melanarius</i>	5	5	D	1
Hydrophilidae	<i>Anacaena limbata</i>	5	1	D	2
Scirtidae	<i>Scirtes</i> sp.	5		B	3

Table 4.14: Composition of the macroinvertebrate sample at W206					
BMWP group	Species	BMWP score	CS	FSSR Score	Spring 2017
Limnephilidae	Limnephilidae (juvenile/damaged)	7		B	1
Trueflies					
Chironomidae	Tanypodinae	2			8
	Tanytarsini				1
Tipulidae grp.	<i>Tipula</i> sp.	5		B	2
	Limoniidae			B	1
Psychodidae	Psychodidae	-		D	2
Ceratopogonidae	Ceratopogonidae	-			3
Ptychopteridae	<i>Ptychoptera albirana</i>	-		D	1
Tabanidae	<i>Tabanus</i> sp.	-		D	1
Other Taxa					
Nematoda	Nematoda	-			1
Number of species					9
Number of genus/above					17
Total number of families (BMWP)					22
BMWP score					58
ASPT					4.1
PSI Score (species)					9.1
CCI Score					11.1

4.2.62 Diversity was moderate at this site, with 26 taxa recorded during the spring sampling period, ten having been identified to species level and a further 16 to genus or higher taxonomic level (see 'Species' column in the table).

4.2.63 The most abundant taxa were snails with Jenkins' spire snail (*Potamopyrgus antipodarum*) and stonefly larvae (*Nemoura* sp. and *Nemoura avicularis*). Other taxa recorded included a range of mussels, worms, leeches, crustaceans, beetles, caddisfly larvae and truefly larvae. There was a lack of pollution sensitive indicators, with the exception of Nemouridae and

Limnephilidae. This is reflected in the BMWP score and ASPT value, indicative of a 'poor' to 'moderate' quality.

4.2.64 As shown by the CCI score ('fairly high' conservation value), although most species recorded were relatively common, two 'Local' species (Conservation Score 5) were recorded, the diving beetle (*Hydroporus melanarius*) and the horse leech (*Haemopsis sanguisuga*). However, none of these species are legally protected.

4.2.65 The PSI score suggests that the watercourse is heavily sedimented at this location.

River Ceint (W077)

4.2.66 Table 4.15 presents the results of the macroinvertebrate analyses undertaken at sampling site W077 at crossing point NG-RVX D/206.

Table 4.15: Composition of the macroinvertebrate sample at W077					
BMWP group	Species	BMWP score	CS	FSSR Score	Spring 2017
Snails					
Lymnaeidae	<i>Radix balthica</i>	3	1	D	1
Hydrobiidae	<i>Potamopyrgus antipodarum</i>	3	1	C	18
Succineidae	<i>Succinea</i> sp.	-			1
Planorbidae	<i>Bathyomphalus contortus</i>	3	2	D	2
Crustaceans					
Gammaridae	<i>Gammarus</i> sp.	6		B	5
	<i>Gammarus pulex</i>		1	B	17
Asellidae	<i>Asellus meridianus</i>	3	3	D	1
Mayflies					
Baetidae	<i>Baetis</i> sp.	4		A	1
Beetles					
Elmidae	<i>Elmis aenea</i>	5	1	B	20
	<i>Limnius volckmari</i>		2	B	3

Table 4.15: Composition of the macroinvertebrate sample at W077					
BMWP group	Species	BMWP score	CS	FSSR Score	Spring 2017
Alderflies					
Sialidae	<i>Sialis lutaria</i>	4	1	D	3
Caddisflies					
Glossosomatidae	<i>Agapetus</i> sp.	7		A	3
Polycentropodidae	Polycentropodidae (juvenile/damaged)	7		B	2
	<i>Plectrocnemia conspersa</i>		2	B	1
Limnephilidae	Limnephilidae (juvenile/damaged)	7		B	10
	<i>Limnephilus lunatus</i>		1	C	20
	<i>Halesus radiatus</i>		2	C	1
	<i>Chaetopteryx villosa</i>		3	B	2
Sericostomatidae	<i>Sericostoma personatum</i>	10	1	B	1
Trueflies					
Chironomidae	Chironomidae (pupea)	2			4
	Tanypodinae				2
	Orthocladiinae				9
	Chironomini				53
	Tanytarsini				6
	Prodiamesinae				9
Pediciidae	Pediciidae	5		B	1
Limoniidae	Limoniidae	5		B	1
Dixidae	Dixidae (damaged/juvenile)	-		B	1
Number of species					13
Number of genus/above					15

Table 4.15: Composition of the macroinvertebrate sample at W077					
BMWP group	Species	BMWP score	CS	FSSR Score	Spring 2017
Total number of families (BMWP)					16
BMWP score					69
ASPT					4.9
PSI Score (species)					50.0
CCI Score					4.8

- 4.2.67 Diversity was moderate at this site, with 28 taxa recorded during the spring sampling period, 13 having been identified to species level and a further 15 to genus or higher taxonomic level (see 'Species' column in the table).
- 4.2.68 The most abundant taxa were snails (Jenkins' spire snail), crustaceans (*Gammarus pulex*), beetles (*Elmis aenea*), caddisfly larvae (Limnephilidae) and truefly larvae (Chironomini). Other taxa were in low abundances and included several families of truefly larvae and caddisfly larvae, as well as alderflies (*Sialis lutaria*) and mayfly (*Baetis* sp.).
- 4.2.69 A number of pollution sensitive taxa (Welshman's button, Limnephilidae and *Plectrocnemia conspersa*) were recorded, as shown by the BMWP score and ASPT value indicative of a 'moderate' to 'good' quality.
- 4.2.70 All species recorded were common (CCI score indicative of 'low' conservation value) and the PSI score suggest 'moderately' sedimented conditions.

Tributary of Nant y Garth (D319)

- 4.2.71 Table 4.16 below presents the results of the macroinvertebrate analyses undertaken at sampling site D319 at crossing point locations NG-DRX F/262 and NG-DRX F/263.

Table 4.16: Composition of the macroinvertebrate samples at D319					
BMWP group	Species	BMWP score	CS	FSSR Score	Spring 2017
Limpets and mussels					
Sphaeriidae	<i>Sphaerium</i> sp.	3		D	15

Table 4.16: Composition of the macroinvertebrate samples at D319

BMWP group	Species	BMWP score	CS	FSSR Score	Spring 2017
Worms					
Oligochaeta	Oligochaeta	1		D	15
Stoneflies					
Nemouridae	<i>Nemoura cambrica</i>	7	2	B	2
Beetles					
Halipidae	Halipidae (larvae/damaged)	5		D	3
Dytiscidae	Dytiscidae (larvae)	5		D	3
	<i>Hydroporus</i> sp.			D	2
	<i>Hydroporus memnonius</i>		2	D	1
	<i>Hydroporus gyllenhalii</i>		4	D	1
Hydrophilidae	<i>Helophorus brevipalpis</i>	5	1	D	1
	<i>Anacaena lutescens</i>		3	D	1
Dryopidae	<i>Dyops</i> sp.	5		D	1
Scirtidae	Scirtidae (larvae)	5		B	1
Trueflies					
Chironomidae	Tanypodinae	2			75
	Chironomini				1
Dixidae	<i>Dixella</i> sp.	-			1
Ptychopteridae	<i>Ptychoptera</i> sp.	-		D	1
Number of species					5
Number of genus/above					11
Total number of families (BMWP)					11
BMWP score					38

Table 4.16: Composition of the macroinvertebrate samples at D319

BMWP group	Species	BMWP score	CS	FSSR Score	Spring 2017
ASPT					4.2
PSI Score (species)					5.6
CCI Score					7.2

- 4.2.72 Diversity was low at this site, with 16 taxa recorded during the spring sampling period, five having been identified to species level and a further 11 to genus or higher taxonomic level (see 'Species' column in the table).
- 4.2.73 The sample was dominated by mussels (*Sphaerium* sp.), worms (Oligochaeta) and truefly larvae (*Tanypodinae*). Other taxa were recorded in low abundances and included five families of beetles as well as stonefly larvae (*Nemoura* sp.). However, there was a lack of pollution sensitive taxa, as reflected in the ASPT and BMWP score being indicative of a 'poor' quality.
- 4.2.74 No species of conservation interest was recorded, as shown by the CCI score ('moderate' conservation value).
- 4.2.75 The PSI score suggests that the watercourse is heavily sedimented at this location.

Tributary of Nant y Garth (D322)

- 4.2.76 Table 4.17 below presents the results of the macroinvertebrate analyses undertaken at sampling site D322 at crossing location NG-DRX F/264.

Table 4.17: Composition of the macroinvertebrate sample at D322

BMWP group	Species	BMWP score	CS	FSSR Score	Spring 2017
Snails					
Hydrobiidae	<i>Potamopyrgus antipodarum</i>	3	1	C	345
Limpets and mussels					
Sphaeriidae	<i>Pisidium</i> sp.	3		D	41
	<i>Pisidium subtruncatum</i>		1	D	105

Table 4.17: Composition of the macroinvertebrate sample at D322					
BMWP group	Species	BMWP score	CS	FSSR Score	Spring 2017
Worms					
Oligochaeta	Oligochaeta	1		D	2
Crustaceans					
Gammaridae	<i>Gammarus</i> sp.	6		B	30
Asellidae	<i>Asellus aquaticus</i>	3	1	D	2
Stoneflies					
Nemouridae	<i>Nemoura</i> sp.	7		C	1
Dragonflies					
Cordulegasteridae	<i>Cordulegaster boltonii</i>	8		D	1
Caddisflies					
Polycentropodidae	<i>Plectrocnemia conspersa</i>	7	2	B	1
Psychomyiidae	<i>Lype reducta</i>	8	3		2
Limnephilidae	<i>Potamophylax cingulatus</i>	7	2	B	5
Trueflies					
Chironomidae	Tanypodinae	2			40
	Prodiamesinae				12
Tipulidae	<i>Tipula</i> sp.	5		B	2
Ceratopogonidae	Ceratopogonidae	-			1
Number of species					7
Number of genus/above					8
Total number of families (BMWP)					13
BMWP score					60
ASPT					5.0
PSI Score (species)					25.0

Table 4.17: Composition of the macroinvertebrate sample at D322

BMWP group	Species	BMWP score	CS	FSSR Score	Spring 2017
CCI Score					5.0

- 4.2.77 Diversity was low at this site, with 15 taxa recorded during the spring sampling period, seven to species level and a further eight to genus or higher taxonomic level (see 'Species' column in the table).
- 4.2.78 The sample was dominated by snails (Jacksons' spire snail), mussels with short-ended pea mussel (*Pisidium subtruncatum*) and truefly larvae (Tanypodinae, Prodiamesinae). Other taxa were recorded in low abundances and included crustaceans, stonefly, dragonfly and caddisfly larvae.
- 4.2.79 No species of conservation interest were recorded, as shown by the CCI score ('moderate' conservation value).
- 4.2.80 BMWP score and ASPT value are indicative of 'moderate' to 'good' quality, because of the presence of a several species considered to be pollution sensitive (*Nemoura* sp., golden-ringed dragonfly and caddisflies (*Lype reducta*, *Plectrocnemia conspersa* and *Potamophylax cingulatus*)).
- 4.2.81 The PSI score suggests that the watercourse is heavily sedimented at this location.

4.3 SUMMARY

Aquatic Macroinvertebrate Summary

- 4.3.1 Across the 14 survey sites surveyed during autumn 2016 and spring 2017, a total of 153 taxa were recorded, 83 having been identified to a species level and a further 70 to genus or a higher taxonomic level.
- 4.3.2 The vast majority of species recorded are common, although 'Local' (Conservation value 5) species were recorded in watercourses W004, W005, W056, W091 and W206. Those species included the diving beetle *Suphrodytes dorsalis* (W004), the caddisfly larvae *Beraeodes minutus* (W005), the caddisfly *Wormaldia subnigra* (W056), the moss bladder snail and white-lipped ramshorn snail (W091) and the diving beetle *Hydroporus melanarius* and the horse leech (W206). However, none of these species are legally protected.

- 4.3.3 The only species of conservation interest recorded during the site surveys undertaken was the beetle *Helophorus strigifrons* (Nationally Scarce), in watercourse W004 in spring 2017. The historical data review showed that it had previously (2008) been recorded in a seasonally flooded pasture within the study area.
- 4.3.4 The desk study also identified five other records of conservation interest within the study area: the southern damselfly (listed under Section 7 of the Environment (Wales) Act 2016, Endangered), the variable damselfly (Near Threatened), the scarce blue-tailed damselfly (Near Threatened), the water scavenger beetle *Helochaeres punctatus* (Nationally Scarce) and the diving beetle *Ilybius subaeneus* (Nationally Scarce). However, only the variable damselfly was recorded within 50 m of the Order Limits. For damselflies, desk study records are for adults, which are not aquatic, but suggest that these species breed within proximity of the Order Limits.
- 4.3.5 In addition, the southern damselfly is a qualifying feature of the Anglesey Fens SAC and a noteworthy species occurring at levels of international importance on the Anglesey and Llyn Fens Ramsar. It is important to note that, with the exception of the southern damselfly, the other species are typical of rain-fed wetland habitats (i.e. shallow standing waters) and therefore are unlikely to be affected by changes in flow regimes that may arise from the Proposed Development.
- 4.3.6 Two species of snail, Desmoulin's whorl snail and the Geyer's whorl snail are also listed on the Information Sheet of the Anglesey and Llyn Fens Ramsar as noteworthy species occurring at levels of international importance, however without being truly aquatic, are often associated with wetlands or fens. The Geyer's whorl snail is also a primary reason for selection of the Anglesey Fens SAC. The clubbed general soldier fly and the medicinal leech are also listed as nationally important species occurring on the Anglesey and Llyn Fens Ramsar.
- 4.3.7 Table 4.18 summarises the conservation status and habitat requirements of the species of conservation interest identified.

Table 4.18: Macroinvertebrate species of conservation interest

Species	Status	Notes on habitat of aquatic stage	Records	Comments
Water scavenger beetle (<i>Helophorus strigifrons</i>)	Nationally Scarce - not based on IUCN criteria (Ref 16)	Typically found in marshes, often in well-established sites (Ref 17)	Ty Mawr development site, Llanfairpwll in 2008 (Cofnod, 2018). Also recorded during field surveys in 2017 in watercourse W004-9, a tributary of the River Wygyr.	Not a feature of a designated site
Diving beetle (<i>Ilybius subaeneus</i>)	Nationally Scarce - not based on IUCN criteria (Ref 16)	Often found in man-made sites but also typical of natural coastal pools (Ref 18)	Two records in 2012 in a fen and a stream approximately 1.20 km and 1.69 km west of the Order Limits (Ref 4)	Not a feature of a designated site
Southern damselfly (<i>Coenagrion mercuriale</i>)	Section 7 of the Environment (Wales) Act 2016, Endangered (Ref 15), BAP Species (2007)	Typical of relatively open and unshaded stretches of flowing waters, in heathland streams and runnels (Ref 14 and Ref 19).	Records from Cors Erddreiniog NNR between 2007 and 2016 (Cofnod, 2018); however, no records within 250 m of the Order Limits	The species is a qualifying feature of the Anglesey Fens SAC and is a noteworthy faunal species occurring at levels of international importance on the Anglesey and Llyn Fens Ramsar

Table 4.18: Macroinvertebrate species of conservation interest				
Species	Status	Notes on habitat of aquatic stage	Records	Comments
Variable damselfly (<i>Coenagrion pulchellum</i>)	Near Threatened (Ref 15)	Typical found in well vegetated lakes (Ref 19), dykes and canals, also in water meadows (Ref 14)	Records from Cors Bodeilio NNR/SSSI and Cors Erddreiniog NNR between 2008 and 2016 (Cofnod, 2018). One record was approximately 20 m of the Order Limits.	Not a feature of a designated site
Scarce blue-tailed damselfly (<i>Ischnura pumilio</i>)	Near Threatened (Ref 15)	Typical of shallow pools and boggy grounds. Oviposition can take place in almost dried up ditches and larvae can be found in very shallow runnels, slow flowing seepages and ditches with very little water (Ref 14 and Ref 19)	Records from Cors Erddreiniog NNR and Craig Wen SSSI between 2008 and 2016 (Cofnod, 2018); however, no records within 250 m of the Order Limits	Not a feature of a designated site
Water scavenger beetle (<i>Helochaeres punctatus</i>)	Nationally Scarce - not based on IUCN criteria (Ref 16)	Typical of bogs and acidic pools (Ref 17)	One record in 2012 in a pond approximately 0.99 km west of the Order Limits (Ref 4)	Not a feature of a designated site

Table 4.18: Macroinvertebrate species of conservation interest				
Species	Status	Notes on habitat of aquatic stage	Records	Comments
Desmoulin's whorl snail (<i>Vertigo moulinsiana</i>)	Section 7 of the Environment (Wales) Act 2016, Annex II of the EU Habitats Directive (1992), BAP Species (2007)	Restricted to calcareous wetlands or in fens. Highly dependent on maintenance of existing local hydrological conditions (Ref 20)	No records within study area dated since 2007.	A noteworthy faunal species occurring at levels of international importance on the Anglesey and Llyn Fens Ramsar.
Geyer's whorl snail (<i>Vertigo geyeri</i>)	S7 of the Environment (Wales) Act 2016, Annex II of the EU Habitats Directive (1992), BAP Species (2007)	Generally found in relatively exposed, and constantly humid calcareous flush-fens. Highly dependent on maintenance of existing local hydrological conditions (Ref 20).	No records within study area dated since 2007.	Primary reason for selection of the Anglesey Fens SAC and a noteworthy faunal species occurring at levels of international importance on the Anglesey and Llyn Fens Ramsar

Table 4.18: Macroinvertebrate species of conservation interest				
Species	Status	Notes on habitat of aquatic stage	Records	Comments
Clubbed general soldier fly (<i>Stratiomys chamaeleon</i>)	Endangered (Ref 21)	Typically found in pool seepages in fens, carrs and damp woods (Ref 21). Can be found amongst mosses and sediment in tufaceous seepages and shallow standing waters (Ref 22)	No records within study area dated since 2007.	Listed as a nationally important species occurring on the Anglesey and Llyn Fens Ramsar
Medicinal leech (<i>Hirudo medicinalis</i>)	Annex V of the UE Habitat Directive (1992)	Typically found in eutrophic ponds with muddy substratum, marginal vegetation and high summer temperature (Ref 23)	No records within study area dated since 2007.	Listed as a nationally important species occurring on the Anglesey and Llyn Fens Ramsar.

4.3.8 Based on the combination of the biotic indices (diversity, BMWP, ASPT, conservation value) presented in Table 4.19 and professional judgement, the watercourses considered to be of the highest ecological value, with communities potentially sensitive to potential impacts from the Proposed Development (i.e. hydrological changes, sediment runoff and or accidental pollution during construction, changes in water quality and loss of habitat) are: the River Erddreiniog (W056), tributaries of the River Ceint (W069, W091, W1048) and a tributary of the River Braint (W106). The tributary of

the River Wygyr (W004) is of lower diversity value and lacks clean water indicators however it supports the Nationally Scarce water scavenger beetle *Helophorus strigifrons*.

- 4.3.9 Based on the combination of the biotic indices presented in Table 4.19 and professional judgement, six of the watercourse sites are considered to be of moderate ecological value for macroinvertebrates and moderate sensitivity, these are: tributary of River Braint (W119 x two), a tributary of the River Wygyr (W005), the River Ceint (W077), a tributary of the River Cefni (W066) and a tributary of Nant y Garth (D322).
- 4.3.10 The two remaining watercourses (two tributaries of Nant y Garth (W206, D319) are considered to be of lower ecological value, and support communities likely to be relatively insensitive to potential effects during construction of the Proposed Development.
- 4.3.11 Table 4.19 summarises the key findings of the macroinvertebrate surveys undertaken.

Table 4.19: Summary of the findings from the aquatic macroinvertebrate site surveys				
Site	Summary	Biological quality (BMWP and ASPT) (Appendix B)	PSI score (Appendix D)	CCI score (Appendix C)
W004-9 (Tributary of River Wygyr)	Moderate diversity (23 taxa). Sample dominated by snails, crustaceans and truefly larvae. Absence of clean water indicators. Communities typical of slow flowing waters. Lower ecological value / sensitivity but presence of a Nationally Scarce beetle.	Poor	Heavily sedimented	Fairly high conservation value, due to the presence of the Nationally Scarce beetle <i>Hydroporus strigifrons</i> .
W005-13 (Tributary of River Wygyr)	High diversity (49 taxa). Presence of several clean water indicators (caddisfly, damselfly), especially in spring 2017. In 2016, greater diversity of molluscs. Communities typical of moderately flowing and vegetated streams. Moderate ecological value / sensitivity.	Moderate/ Good	Sedimented/ Heavily sedimented	Moderate. No species of conservation interest recorded.
W056-84 (River Erddreiniog)	Moderate diversity (36 taxa). Presence of several clean water indicators (stonefly, dragonfly, caddisfly). Communities typical of moderate flows. Highest ecological value / sensitivity.	Good/Very good	Slightly sedimented/ Heavily sedimented	Fairly high. However no species of conservation interest recorded.

Table 4.19: Summary of the findings from the aquatic macroinvertebrate site surveys				
Site	Summary	Biological quality (BMWP and ASPT) (Appendix B)	PSI score (Appendix D)	CCI score (Appendix C)
W066-98 (Tributary of River Cefni)	Moderate diversity (34 taxa). Presence of clean water indicators (stonefly, dragonfly, caddisfly) in moderate abundances. Important drop in diversity in 2017 in comparison to 2016 with however no obvious evidence of pollution. Moderate ecological value / sensitivity.	Poor/Good	Moderately sedimented/ Sedimented	Moderate. No species of conservation interest recorded.
W069-101 (Tributary of River Ceint)	High diversity (50 taxa). Presence of several clean water indicators (stonefly, dragonfly, caddisfly) in moderate abundances. Communities typical of clean and fast-flowing streams. Highest ecological value / sensitivity.	Very good	Unsedimented/ Slightly sedimented	Moderate. No species of conservation interest recorded.
W077 (River Ceint)	Moderate diversity (28 taxa). Presence of a few clean water indicators (caddisfly). Communities typical of small ditches. Moderate ecological value / sensitivity.	Moderate/ Good	Moderately sedimented	Low. No species of conservation interest recorded.
W091-112 (Tributary of River Ceint)	High diversity (47 taxa). Presence of several clean water indicators (caddisfly, stonefly) in low to moderate abundances. Communities typical of clean and fast flowing watercourses. Highest ecological value / sensitivity.	Good	Slightly sedimented/ Moderately sedimented	Moderate to fairly high. However no species of conservation interest recorded.

Table 4.19: Summary of the findings from the aquatic macroinvertebrate site surveys				
Site	Summary	Biological quality (BMWP and ASPT) (Appendix B)	PSI score (Appendix D)	CCI score (Appendix C)
W1048-103 (Tributary of River Ceint)	High diversity (43 taxa). Presence of several clean water indicators (stonefly, mayfly, caddisfly) in moderate abundances. Communities typical of clean, stony and fast-flowing rivers. Highest ecological value / sensitivity.	Good/Very good	Slightly sedimented/ Sedimented	Moderate. No species of conservation interest recorded.
W106-117 (Tributary of River Braint)	High diversity (46 taxa). Presence of several clean water indicators (stonefly, mayfly, caddisfly) in moderate abundances. Communities typical of clean, stony and fast-flowing rivers. Highest ecological value / sensitivity.	Very good	Unsedimented/ Slightly sedimented	Moderate. No species of conservation interest recorded.
W119-121 (Tributary of River Braint)	Moderate diversity (33 taxa). Presence of several clean water indicators (stonefly, caddisfly) in moderate abundances. Moderate ecological value / sensitivity.	Good	Sedimented	Moderate. No species of conservation interest recorded.
W119-122 (Tributary of River Braint)	Low diversity (19 taxa recorded). Presence of a few clean water indicators (caddisfly, stonefly) although in low abundances. Moderate ecological value / sensitivity.	Good	Sedimented	Low. No species of conservation recorded.

Table 4.19: Summary of the findings from the aquatic macroinvertebrate site surveys				
Site	Summary	Biological quality (BMWP and ASPT) (Appendix B)	PSI score (Appendix D)	CCI score (Appendix C)
W206 (Tributary of Nant y Garth)	Moderate diversity (26 taxa recorded). Sample dominated by snails and stonefly larvae. Lack of pollution sensitive taxa. Lower ecological value / sensitivity.	Poor/Moderate	Heavily sedimented	Fairly high. However no species of conservation interest recorded.
D319 (Tributary of Nant y Garth)	Low diversity (16 taxa). Most abundant taxa truefly larvae, mussels and worms. Abundances generally low. Lack of pollution sensitive taxa. Communities typical of slow flow velocities and silted conditions. Lower ecological value / sensitivity.	Poor	Heavily sedimented	Moderate. No species of conservation interest recorded.
D322 (Tributary of Nant y Garth)	Low diversity (15 taxa). High abundances of snails, mussels and truefly larvae. Presence of a few clean water indicators (stonefly, dragonfly, caddisfly). Communities typical of moderate flow velocities. Moderate ecological value / sensitivity.	Moderate/ Good	Sedimented	Moderate. No species of conservation interest recorded.

Fish Data Summary

- 4.3.12 In terms of fish, the data demonstrated the presence of migratory fish species (Atlantic salmon, brown trout, European eel, lamprey), all listed under Section 7 of the Environment (Wales) Act 2016 and listed as priority species, in watercourses crossed and/or with tributaries crossed by the Proposed Development. Atlantic salmon and the three species of lamprey in the UK are also present on the EU Habitats Directive (Annex II). All of the watercourse crossings on the main rivers and some of the crossings on the tributaries will comprise clear span bridges which would not restrict the movement of fish.
- 4.3.13 The most sensitive watercourses in terms of fish communities are considered to be a tributary of the River Braint (W119), the River Erddreiniog (W056), the River Ceint (W077) and the River Wygyr of which two tributaries will be crossed (W004 and W005), as they notably support abundant brown trout populations.
- 4.3.14 Based on site observations, most of the watercourses that will be crossed are shallow and slow flowing watercourses, with substrate dominated by silt and are therefore unlikely to support suitable spawning habitat for salmonid species at the crossing locations. However, the tributary of the River Braint (W106) and tributary of the River Ceint (W091) appear to be faster flowing watercourses with potential salmonid spawning habitat (gravel substrate) at the crossing locations. In addition, lamprey ammocoete live in silt for up to five years before transforming into adults.
- 4.3.15 The habitats present at and/or upstream of the actual crossing locations could also be of other value (i.e. refuges, shelter for juveniles, passage to the wider catchment) for the migratory fish species known to be present. All of the watercourse crossings on the main rivers and some of the crossings on the tributaries will comprise clear span bridges which would not restrict the movement of fish.

5 Conclusion

- 5.1.1 The objectives of the desk study and site surveys undertaken were to assess the ecological value and sensitivity of the aquatic fauna present and identify the presence of aquatic faunal communities and identify species associated with designated sites of conservation importance.
- 5.1.2 The desk study highlighted that the Anglesey Fens SAC and Anglesey and Llyn Fens Ramsar (which lies within the Order Limits) lists the southern damselfly as a qualifying feature and a species occurring at levels of international importance respectively. In addition, the clubbed general soldier fly which is listed as a nationally important species occurs on the Anglesey and Llyn Fens Ramsar. However, the two species were not found in the historical data within 250 m of the Order Limits and not recorded during the baseline surveys undertaken.
- 5.1.3 The results demonstrated that five watercourses that would be crossed by the Proposed Development are of the highest ecological value for macroinvertebrates and support communities likely to be highly sensitive to potential impacts from the Proposed Development.
- 5.1.4 The most sensitive watercourses identified are: River Erddreiniog (W056), a tributary of the River Ceint (W069), two tributaries of the River Ceint (W091, W1048) and a tributary of the River Braint (W106). A tributary of the River Wygyr (W004) was also identified for its conservation value as it supports the Nationally Scarce water scavenger beetle *Helophorus strigifrons*.
- 5.1.5 The results revealed the presence of two species of conservation importance within close proximity of the Order Limits, the water scavenger beetle *Helophorus strigifrons* and the variable damselfly. Both species are typical of rain-fed wetland habitats and are therefore unlikely to be impacted by drainage changes that may arise from the Proposed Development.
- 5.1.6 Water quality, habitat heterogeneity and flow regime are the main environmental factors which macroinvertebrate species depend. In addition, many macroinvertebrate species depend on a wide network of aquatic habitats.
- 5.1.7 While no recently introduced non-native invasive species were recorded in the samples, several 'established' non-native species were present. These

were the Jacksons' spire snail recorded in nine watercourses (W005, W056, W069, W077, W1048, W106, W119, W206 and W319) and the Northern river crangonyctid (*Crangonyx pseudogracilis*) recorded in five watercourses (W004, W005, W069, W091 and W1048). As these species are well established, they are not considered as being of significant concern. They are not listed in any legislation in the UK (such as Schedule 9 of the Wildlife and Countryside Act 1981 (as amended) or list of species of EU concern).

- 5.1.8 The study also demonstrated the presence of several watercourses of good ecological value for fish species, with populations of migratory species listed on Section 7 of the Environment (Wales) Act 2016 (Atlantic salmon, brown trout, European eel and lamprey).
- 5.1.9 Although third party fish data was generally not available for the watercourse crossing locations, review of the historical data provided demonstrated that the tributary of the River Braint (W119), the River Erddreiniog (W056) and the River Ceint (W077), which could be directly crossed by watercourse crossings, support abundant populations of brown trout downstream of the Order Limits, as well as other migratory and protected species of fish (Atlantic salmon, European eel, lamprey). Abundances of salmon are however low in all of the watercourses. The River Ceint, with three tributaries crossed (W069, W091, W1048) and the River Braint, with one tributary crossed (W106), would be most sensitive.
- 5.1.10 Other watercourses, directly crossed by the Proposed Development (River Goch)/or with tributaries crossed by access track crossings (W005 and W004 for the River Wygyr; W066 for the River Cefni) also support salmonid species (Atlantic salmon and brown trout) downstream of the Order Limits.
- 5.1.11 Atlantic salmon and brown trout, for example, migrate upstream for reproduction and small tributaries can constitute valuable habitats (spawning, refuges/shelter for juveniles) for those species.
- 5.1.12 The use of clear span bridges on the main rivers and some of their tributaries will not restrict the movement of fish.
- 5.1.13 Effects as a result of the Proposed Development and mitigation measures are detailed in Chapter 9, Ecology and Nature Conservation (**Document 5.9**). Effects on migratory species such as salmon and brown/sea trout within the marine environment are detailed within the marine sections of Chapter 9, Ecology and Nature Conservation (**Document 5.9**).
- 5.1.14 Further details on the mitigation measures are provided in the Biodiversity Mitigation Strategy (**Document 7.7**). Potential enhancement opportunities

are detailed within the Enhancement Strategy (**Document 7.13**) which includes opportunities for enhancement of aquatic habitats that could in turn benefit aquatic macroinvertebrates and fish populations.

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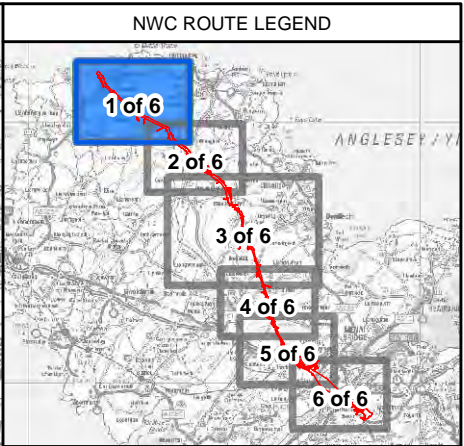
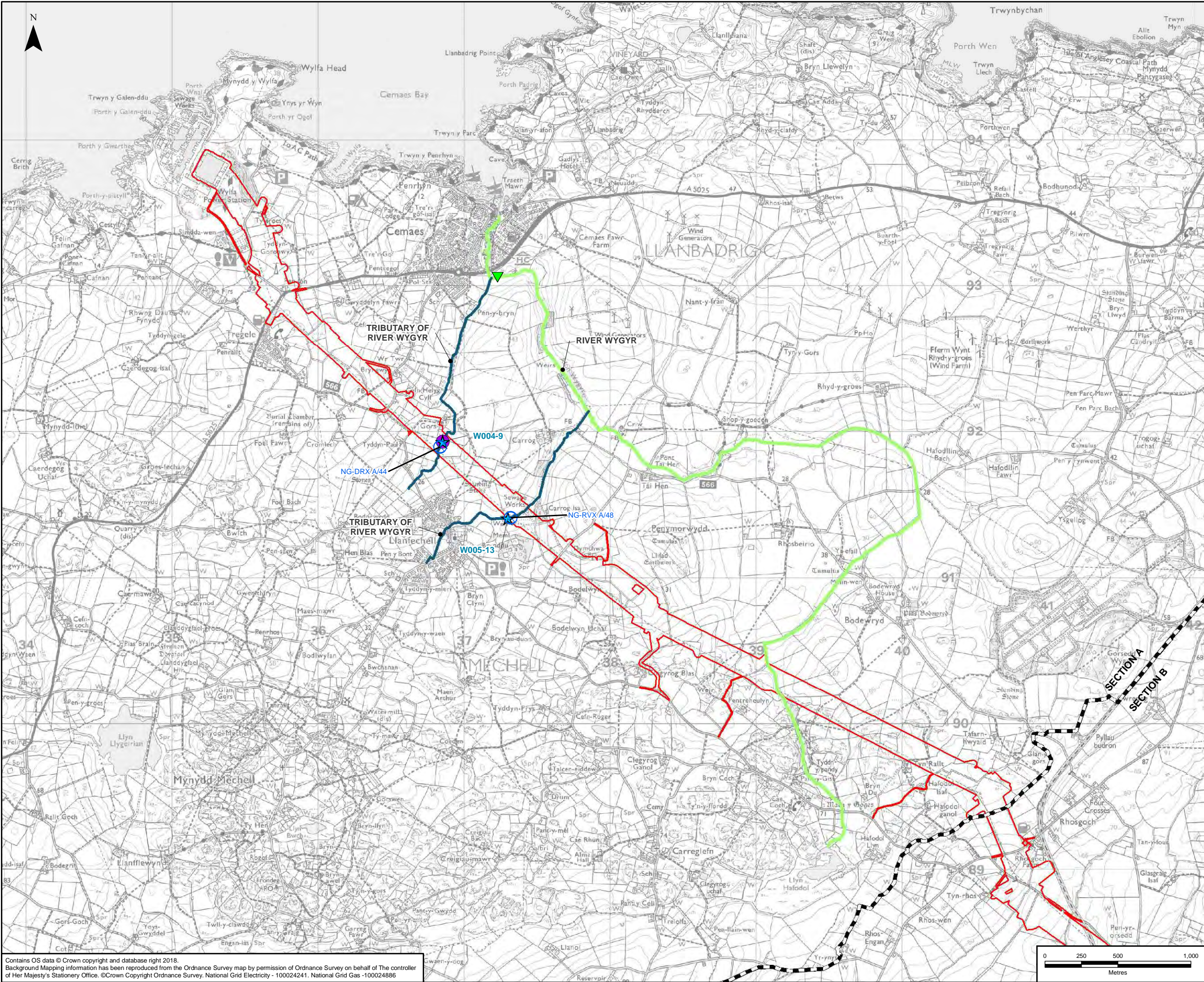
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Figures

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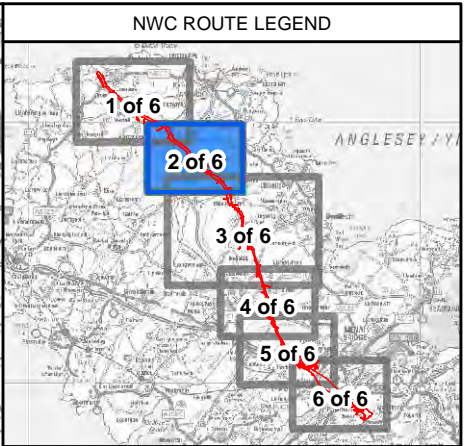
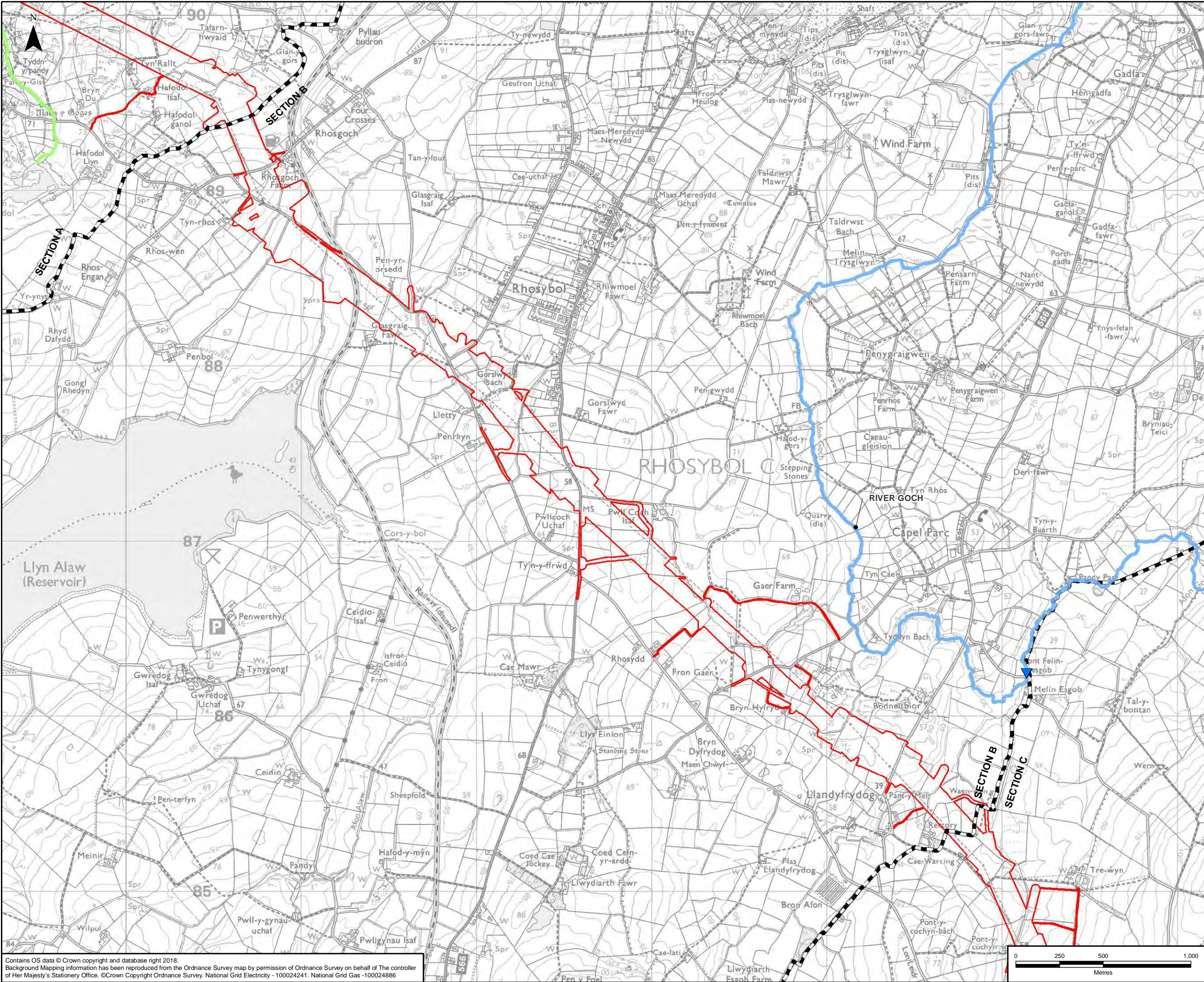
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- AQUATIC INVERTEBRATE SURVEY RESULTS OF NOTE
 - HELOPHORUS STRIGIFRONS
- NATURAL RESOURCES WALES FISH DATA POINT
 - BRAINT
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 - CEINT
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 - GOCH
 - WGYR
- SURVEYED NAMED RIVERS
 - RIVER BRAINT
 - RIVER CEFNI
 - RIVER CEINT
 - RIVER ERDDREINIOG
 - RIVER GOCH
 - RIVER WGYR
 - SURVEYED TRIBUTARIES

NOTES

1: THERE ARE 63 WATERCOURSE CROSSING LOCATIONS FOR THE PROPOSED DEVELOPMENT, ONLY THE WATERCOURSE CROSSINGS THAT WERE SURVEYED ARE SHOWN ON THE FIGURE

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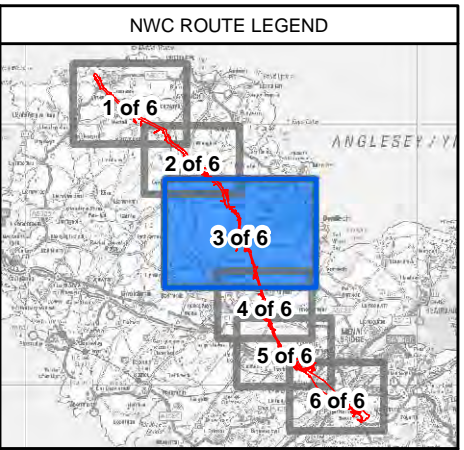
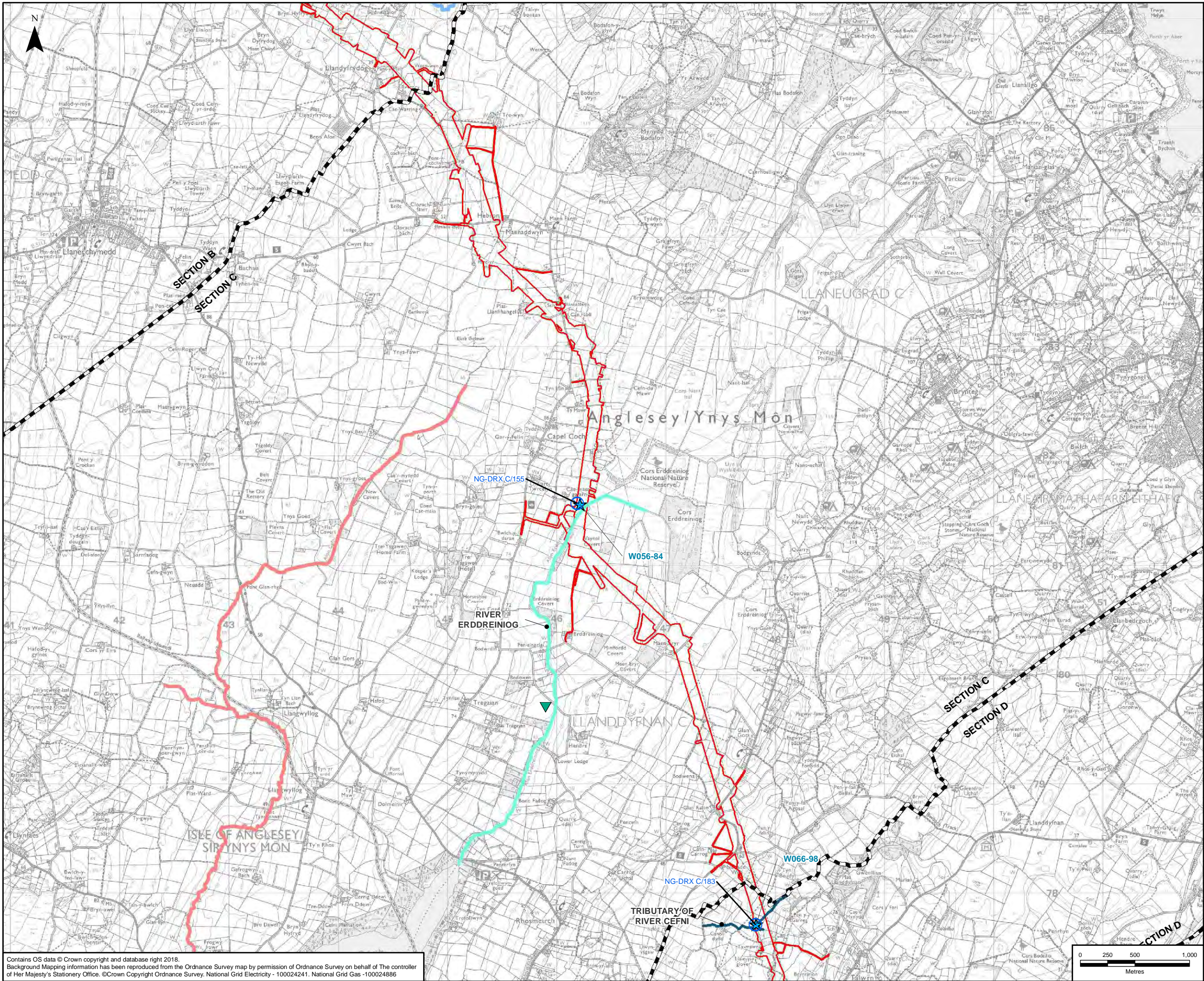


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- ORDER LIMITS
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- AQUATIC INVERTEBRATE SAMPLING LOCATIONS
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 - HELOPHORUS STRIGIFRONS
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- ORDER LIMITS - OPTION A
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- PROPOSED WATERCOURSE CROSSINGS¹
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- AQUATIC INVERTEBRATE SURVEY RESULTS OF NOTE
 - HELOPHORUS STRIGIFRONS
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 - CEINT
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 - GOCH
 - WYGYR
- SURVEYED NAMED RIVERS
 - RIVER BRAINT
 - RIVER CEFNI
 - RIVER CEINT
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 - RIVER WYGYR
 - SURVEYED TRIBUTARIES

NOTES

1: THERE ARE 63 WATERCOURSE CROSSING LOCATIONS FOR THE PROPOSED DEVELOPMENT, ONLY THE WATERCOURSE CROSSINGS THAT WERE SURVEYED ARE SHOWN ON THE FIGURE

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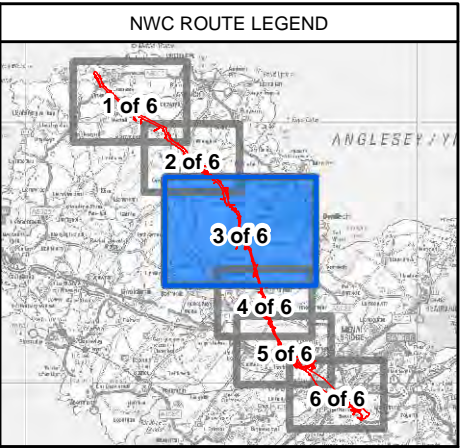
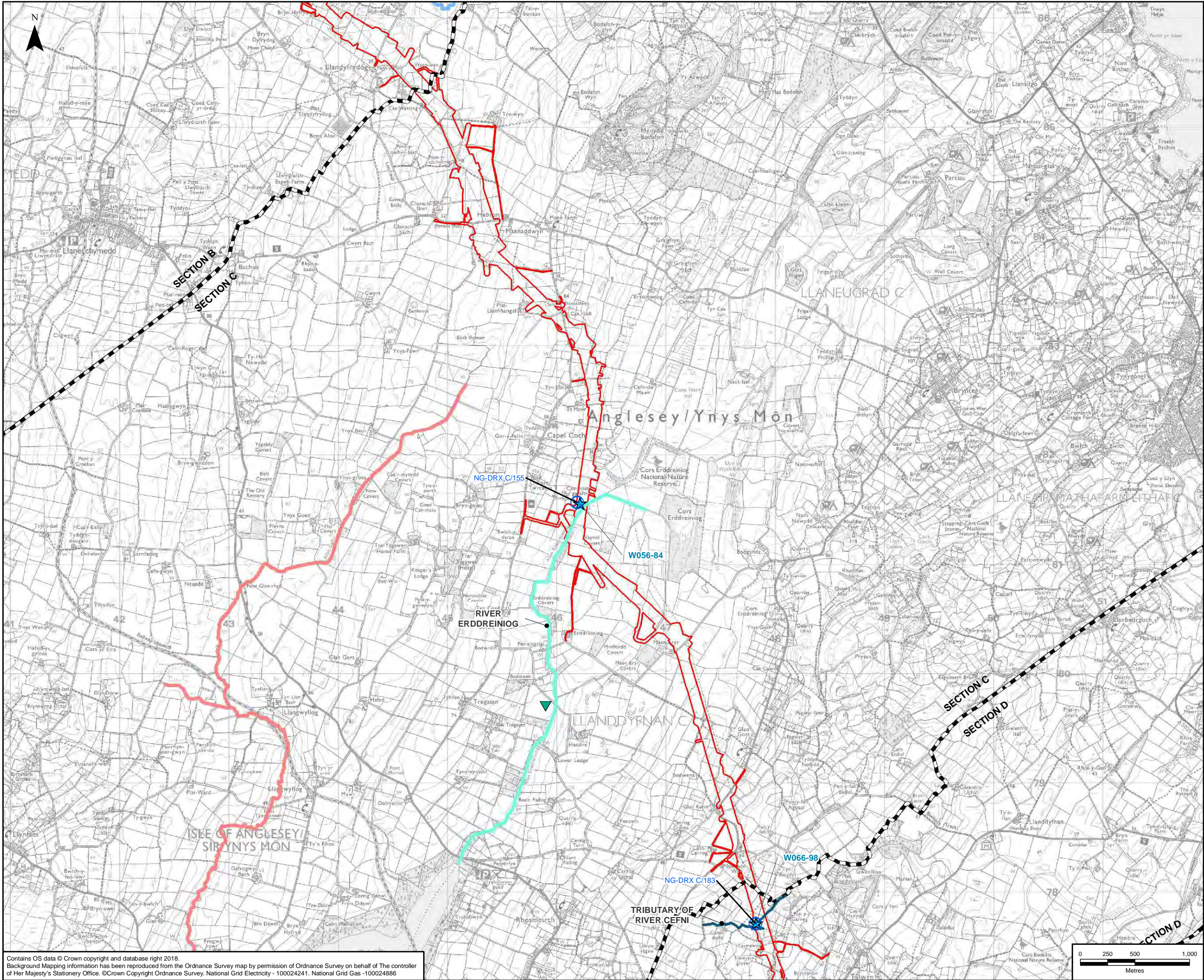
Document Number: 5.9.2.13

Document Title: FIGURE 2
AQUATIC INVERTEBRATE SURVEY RESULTS AND FISH DATA POINTS
SECTION C OPTION A

Creator:	Date:	Checker:	Date:	Approver:	Date:
AB	19/07/2018	LS	19/07/2018	NL	19/07/2018

Document Type:	Scale:	Format:	Sheets:	Rev:
FIGURE	1:32,000	A3	3 of 6 Option A	A

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LEGEND

- ORDER LIMITS - OPTION B
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NOTES

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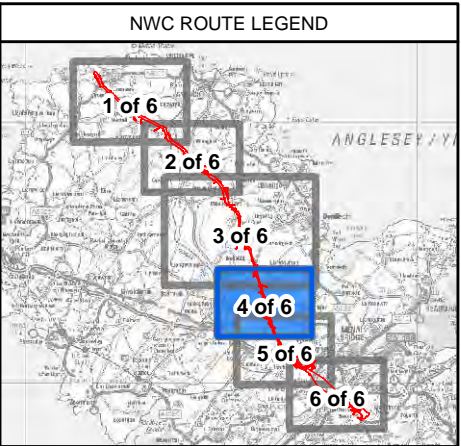
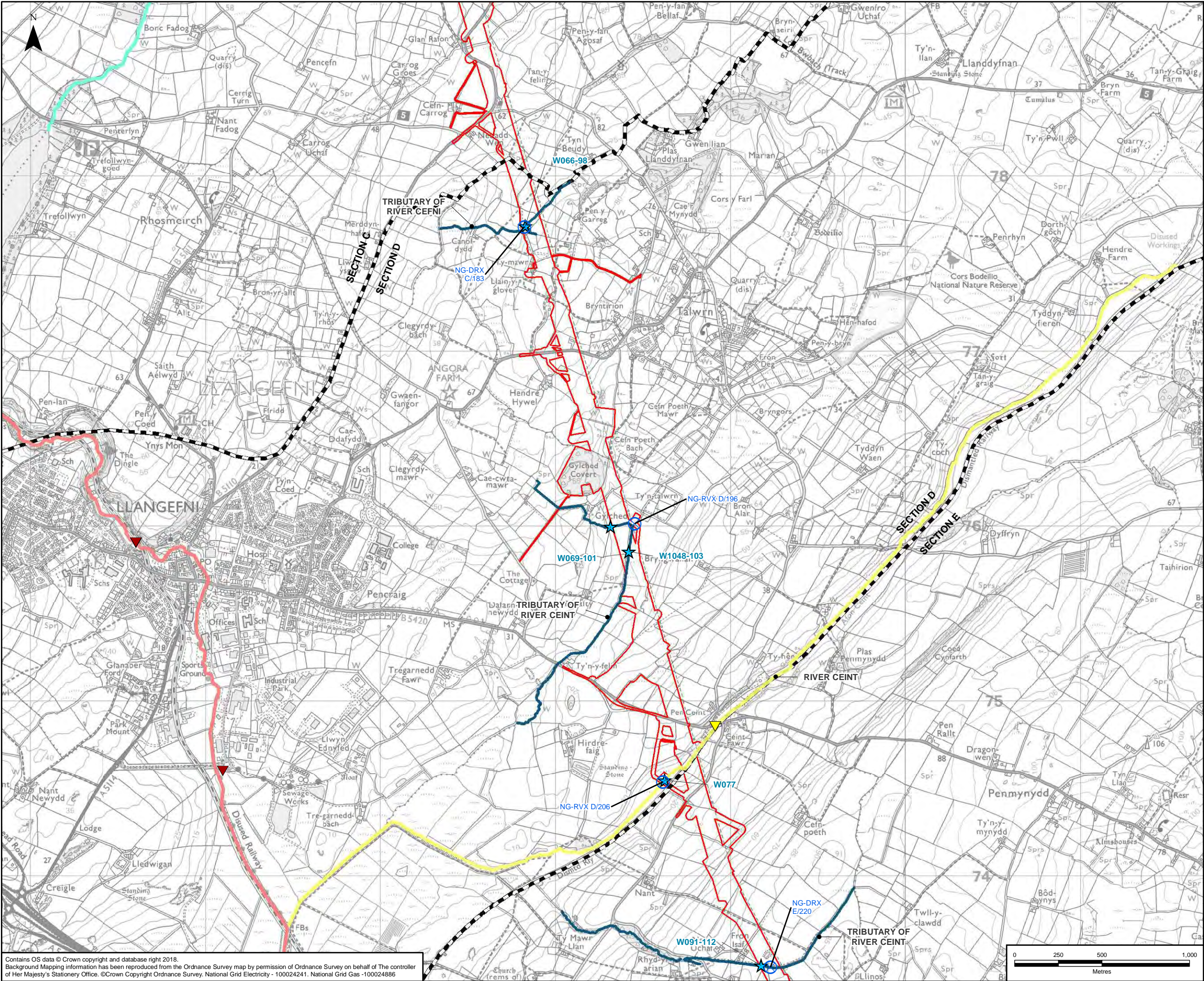
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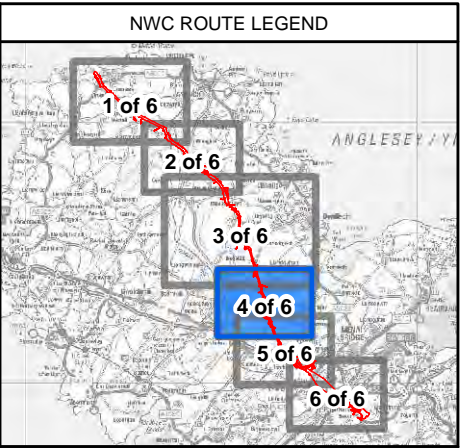
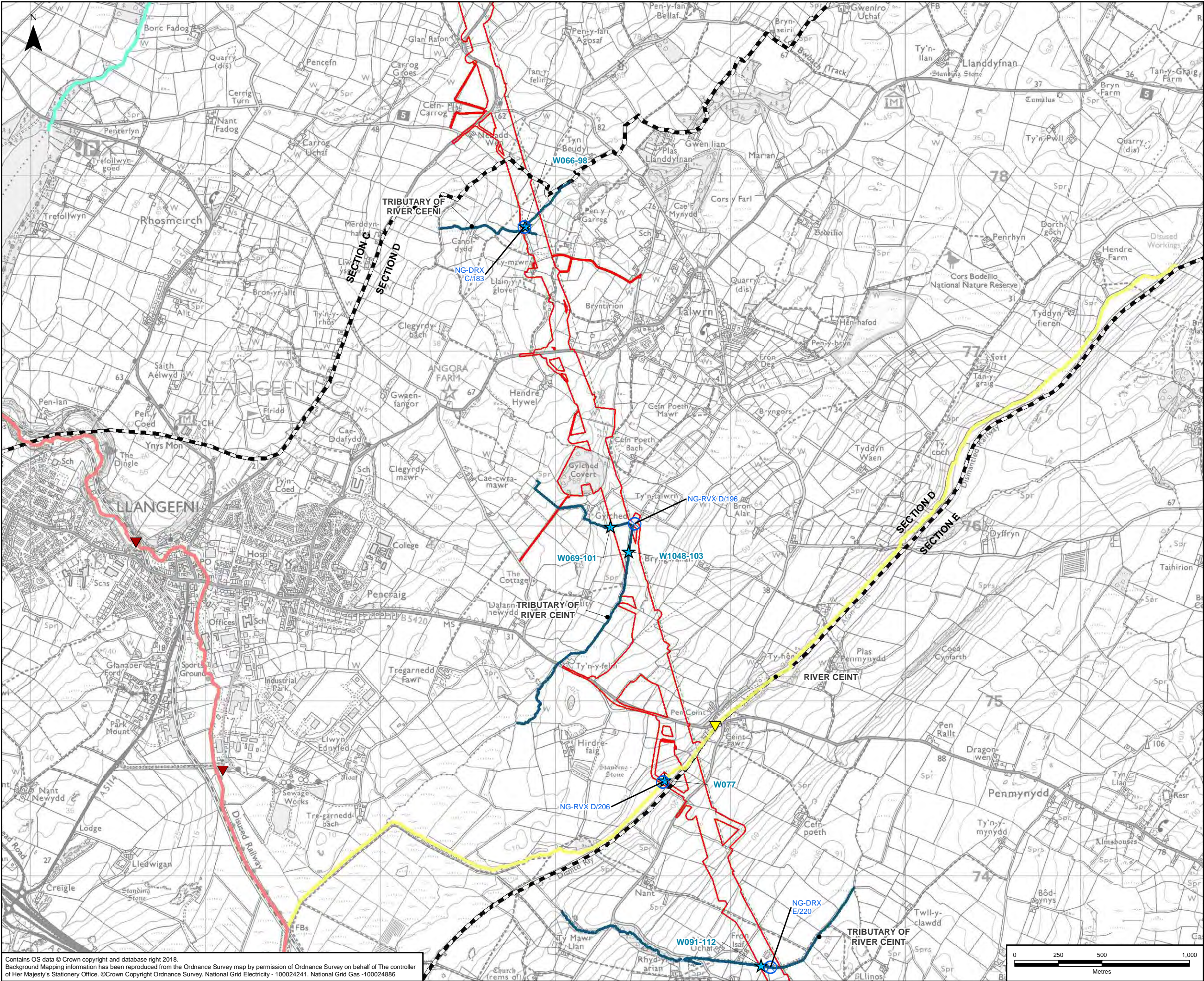
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Document Title: FIGURE 2
AQUATIC INVERTEBRATE SURVEY RESULTS AND FISH DATA POINTS
SECTION D OPTION A

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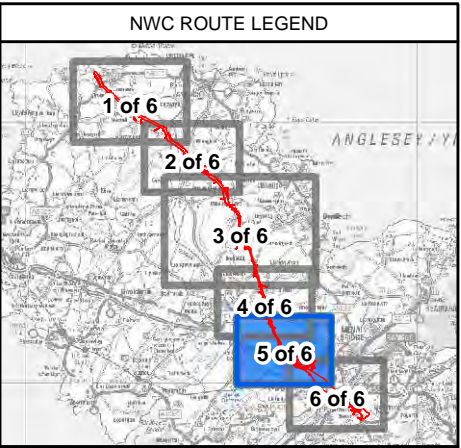
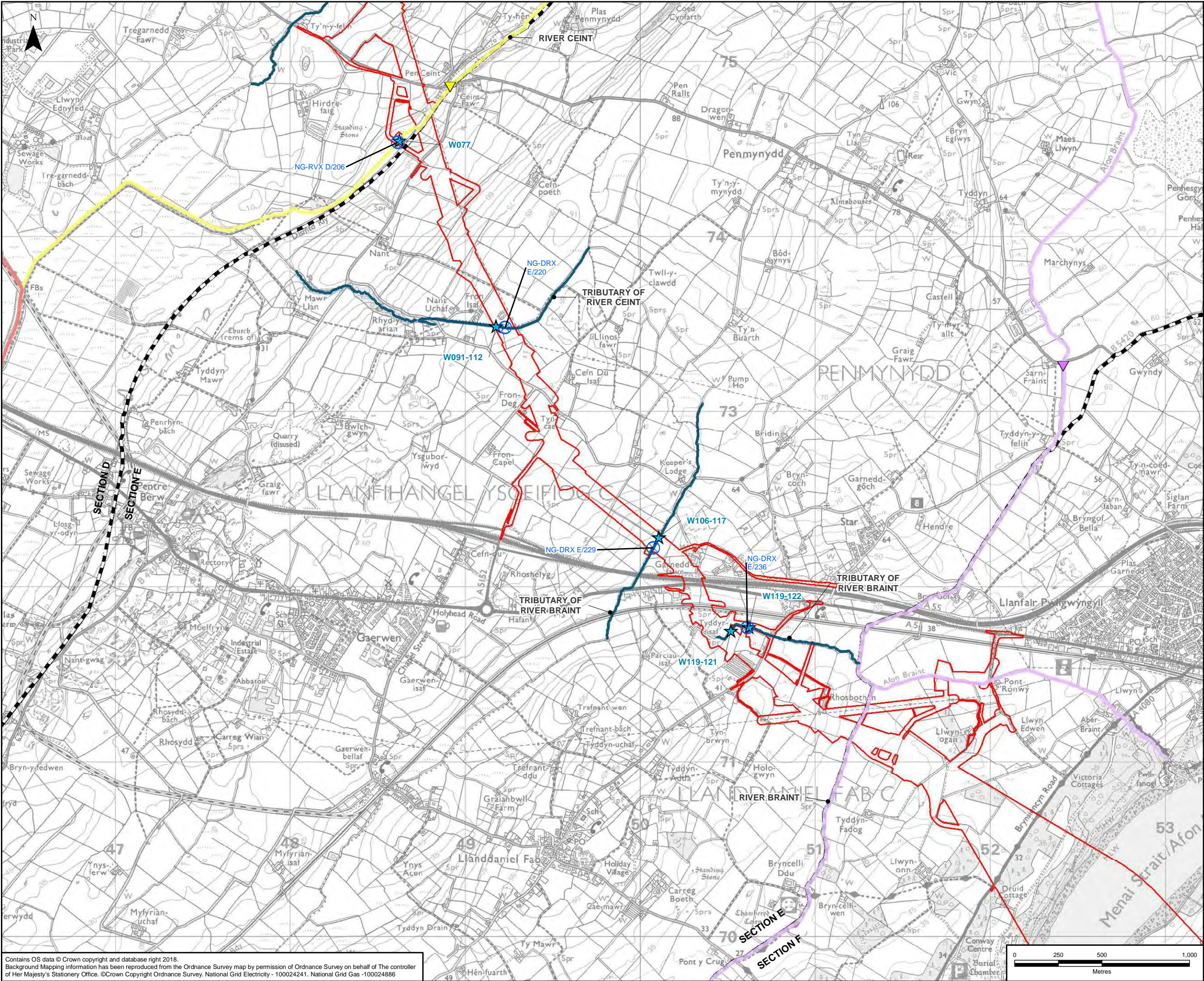
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AQUATIC INVERTEBRATE SURVEY RESULTS AND FISH DATA POINTS
SECTION D OPTION B

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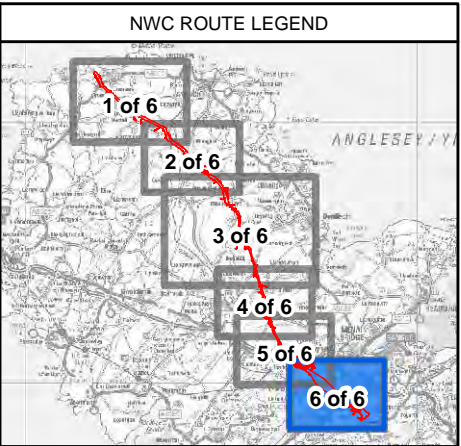
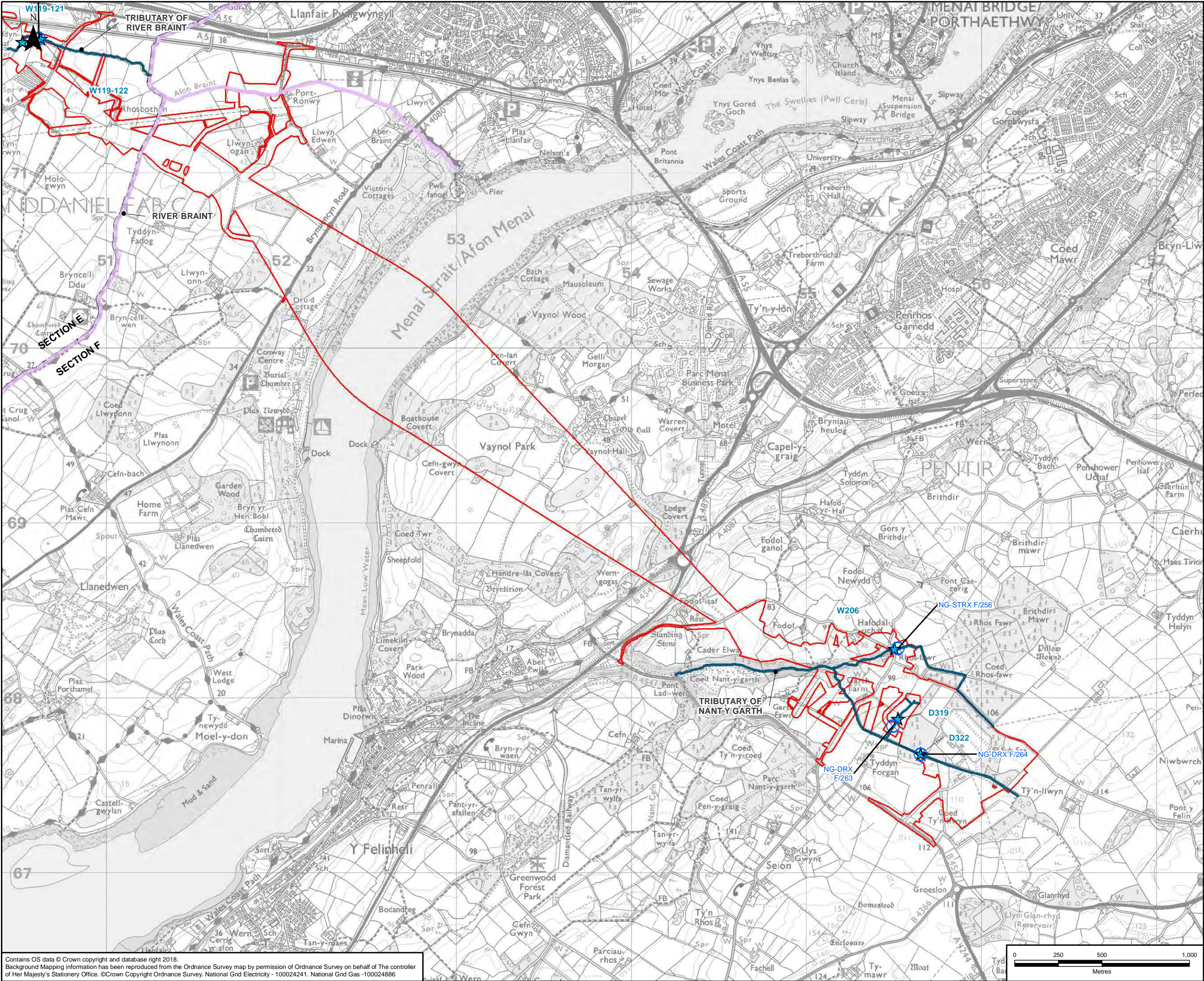
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Document Title: FIGURE 2
AQUATIC INVERTEBRATE SURVEY RESULTS AND FISH DATA POINTS
SECTION E

Creator: AB	Date: 19/07/2018	Checker: LS	Date: 19/07/2018	Approver: NL	Date: 19/07/2018
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AQUATIC INVERTEBRATE SURVEY RESULTS AND FISH DATA POINTS
SECTION F

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Appendix A: Photographs

All site photographs are taken at the approximate proposed crossing point locations.

Plate 1: W004-9
Crossing NG-DRX A/44



Plate 2: W005-13 Crossing
NG-RVX A/48



Plate 3: W056-84 Crossings
NG-DRX C/155 & NG-RVX
C/156



Plate 4: W066-98 Crossing
NG-DRX C/183



Plate 5: W069-101 Crossing
NG-RVX D/196



Plate 6: W1048-103
Crossing NG-RVX D/196



Plate 7: W091-112 Crossing
NG-DRX E/220



Plate 8: W106-117 Crossing
NG-DRX E/229



Plate 9: W119-121 Crossing
NG-STRX E/236



Plate 10: W119-122
Crossing NG-STRX E/236



Plate 11: W206 Crossing
NG-STRX F/256



Plate 12: W077 Crossing
NG-RVX D/206



Plate 13: D319 Crossings
NG-DRX F/262 & NG-DRX
F/263



Plate 14: D322 Crossing
NG-DRX F/264



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Appendix B: Biological Monitoring Working Party (BMWP) System

There are about 4,000 species of aquatic macroinvertebrates in the British Isles. To simplify the analysis of the samples and the data, individual species are not identified 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).

For consistency, only taxa used in the BMWP (Biological Monitoring Working Party) system are reported (see below). 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 BMWP System.

The BMWP system assigns a numerical value to about 80 different taxa (known as the BMWP-scoring families) according to their sensitivity to organic pollution. The average of the values for each taxon in a sample, known as ASPT (average score per taxon) is a stable and reliable index of organic pollution. Values lower than expected indicate organic pollution.

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.

The biotic scores can be interpreted by following the guidelines in Table B1 (Ref 24; Ref 25 and Ref 26). However, these categories are for guidance only and it should be remembered that 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 as they are unable to support many of the high-scoring taxa associated with fast flowing habitat. BMWP 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.

Table B1: A guide to interpreting BMWP Score and ASPT		
BMWP score	ASPT	Interpretation
0-10	<3.0	Very poor, heavily polluted
11-40	3.0-4.3	Poor, polluted or impacted
41-70	4.3-4.8	Moderate, moderately impacted
71-100	4.8-5.4	Good, clean but slightly impacted
>100	>5.4	Very good, unpolluted, not impacted

Appendix C: Community Conservation Index (CCI)

The Community Conservation Index (CCI) 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 (Ref 11; Ref 12 and Ref 13). Conservation Scores assigned to individual species vary from 1 to 10, as detailed on the Table C1 below. The derived CCI scores generally vary from 0 to > 20, as detailed in the Table C1 below. The Table C2 below provides a guide to interpreting CCI scores.

Table C1: Conservation Scores from the Community Conservation Index (Ref 10)

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 C2: General guide to CCI scores (Ref 10)		
CCI Score	Description	Interpretation
0 to 5.0	Sites supporting only common species and/or community of low taxon richness	Low conservation value
> 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

Appendix D: Proportion of sediment-sensitive invertebrates (PSI)

The Proportion of Sediment-sensitive Invertebrates (PSI) index (Ref 9) provides an assessment of the extent to which the river bed is composed of, or covered by, fine sediments.

Under the assessment, individual species of aquatic macroinvertebrates are assigned a Fine Sediment Sensitivity Rating (FSSR) ranging from A to D, as detailed in the Table D1 below. The PSI score for a macroinvertebrate sample is then derived from individual species scores and abundances, as detailed on the Table D2 below. The PSI score corresponds to the percentage of fine sediment-sensitive taxa present in a sample. PSI score for a sample ranges from 0 to 100 where lowest scores correspond to watercourses with high fine sediment cover, Table D3.

Table D1 Fine Sediment Sensitivity Rating (FSSR) groups used to derive PSI scores (Ref 9)

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

Table D2 Abundance categories used to derive PSI scores (Ref 9)

FSSR group	Abundance			
	1-9	10-99	100-999	>999
A	2	3	4	5
B	1	2	3	4
C	1	2	3	4
D	2	3	4	5

Table D3 Interpretation of PSI scores (Ref 9)	
PSI	Description
81-100	Minimally sedimented
61-80	Slightly sedimented
41-60	Moderately sedimented
21-40	Sedimented
0-20	Heavily sedimented