PŴER NIWCLEAR
HORIZON
NUCLEAR POWER

WYLFA NEWYDD

ENERGY WORKING FOR BRITAIN

Wylfa Newydd Project
A5025 On-line Highway Improvements

Environmental Report – Volume 3A
Appendices

APPLICATION November 2017

List of Appendices

[This page is intentionally blank]

PŴER NIWCLEAR
HORIZON
NUCLEAR POWER

ENERGY WORKING FOR BRITAIN

A5025 On-line Highway Improvements
Environmental Report
Volume 3 – Appendix 11.1
A5025 Freshwater Baseline Surveys 2014-2015

[This page is intentionally blank]

Wylfa Newydd Project

Horizon Nuclear Power Ltd

A5025 Freshwater Baseline Surveys 2014-2015

60PO8008/AQE/REP/001 | R3

Revision Date

WN03.01.01-S5-PAC-REP-00018

A5025 Freshwater Baseline Surveys 2014-2015
Horizon Nuclear Power Ltd

Document history and status

Revision	Date	Description	By	Review	Approved
1	30/01/2015	2014 Freshwater baseline surveys	Dr Niamh Burke	Gillian McCoy	Rob Bromley
2	06/09/2015	2015 data added, proof read comments addressed, discipline review	Alice Shoebridge	Jon Barnes	Rob Bromley
3	13/04/2017	Updating consultation data	Seán McGrogan	Jon Barnes	

Distribution of copies

Revision	Issue approved	Date issued	Issued to	Comments

JACOBS

Wylfa Newydd Project

Project no:	60PO8033
Document title:	A5025 Freshwater Baseline Surveys 2014-2015
Document No.:	60PO8008/AQE/REP/001
Revision:	R3
Date:	April 2017
Client name:	Horizon Nuclear Power Ltd
Client no:	
Project manager:	Rob Bromley
Author:	Niamh Burke

Jacobs U.K. Limited

Kenneth Dibben House
Enterprise Road,Southampton Science Park
Chilworth, Southampton SO16 7NS
United Kingdom
T +44 (0)23 8011 1250
F +44 (0)23 8011 1251
www.jacobs.com

Contents

Executive summary

Jacobs was commissioned to collect a suite of preliminary ecological data to help characterise the freshwater environment around the A5025 Off-line Highway Improvements scheme, part of the Associated Development[1] to support the delivery of the Wylfa Newydd Generating Station. The Off-line Highway Improvements involve four sections of the A5025 which have been identified for development. These are around the areas of Valley, Llanfachraeth, Llanfaethlu and Llanrhyddlad.

Baseline ecological surveys on representative and suitable waterbodies were used to characterise the watercourses and ponds along the A5025 and within a 500m buffer zone (250m either side of the proposed route), where access was possible. The information gathered was used to identify and value habitats, and to record species of conservation importance.

Receptors were chosen to best represent the existing ecological condition of the freshwater environment around the A5025 Off-line Highway Improvements. The ecological receptors were phytobenthos (diatoms), macroinvertebrates, macrophytes (aquatic plants), fish and pond habitats. Physical habitat assessments and water quality monitoring was also carried out. This report presents the results of all freshwater surveys carried out in 2014 and 2015 around the A5025 Highway Improvements scheme.

The physical habitat of the watercourses varied between natural streams with intact gravel and cobble substrate, and drainage ditches or streams which have been over-deepened and lost much of their natural character through human intervention. Flow types varied between riffle/run in the more natural sections to sluggish flow – chiefly within the ditch habitats. The few ponds present within the site appeared to be natural, some with ephemeral characteristics.

Diatom analysis revealed a large variability in diatom populations, reflecting the range in habitat types sampled across the study area. Most of the 17 sites attained Good or High status in spring surveys (using Diatoms for Assessing River and Lake Ecological Quality (DARLEQ2) analysis), but only five of 13 sites achieved Good or High status during the autumn survey.

Water quality spot sampling was carried out at watercourses and ponds within the study area. Dissolved oxygen and suspended solids concentrations varied spatially and temporally across the site. Nutrient levels were elevated at some sites, possibly due to agricultural input from adjacent land. Copper, iron and zinc were elevated at a number of the sites. This may be attributed to runoff from roads or pesticide/fertiliser application and runoff from adjacent land. Water quality across the study area was typical of that found within a rural setting close to a main transport route.

The majority of the sites were field drains with ditch-like habitat and flow types, which limited the macroinvertebrate communities. In general, the macroinvertebrate communities across the scheme were dominated by ubiquitous species typical of lowland field drainage environments, including leeches, crustaceans, beetles and molluscs, but the more diverse sites included several species of common caddisflies and mayflies.

The macrophyte communities are typical of lowland drains, indicative of nutrient enrichment but poor in species richness with few truly aquatic species. One species of conservation importance was identified: the three-lobed water crowfoot (*Ranunculus tripartitus*) at site D55, which is listed as a Priority Species under Section 42 of the *Natural Environment and Rural Communities* (NERC) *Act 2006*.

Electric fishing surveys were carried out at four sites within the study area. The most abundant species were European eel (*Anguilla anguilla*) (found at all sites sampled), lamprey (likely river), brown trout (*Salmo trutta*) and nine-and three-spined stickleback (*Pungitius pungitius* and *Gasterosteus aculeatus*). The presence of both adult and juvenile lamprey suggest that these watercourses are being utilised as spawning grounds, containing both suitable gravels for spawning and silt beds for juveniles. The presence of European eel at all sites surveyed demonstrates that watercourses within the site maintain connectivity to the sea and are accessible to

[1] Section 115(2) of the *Planning Act 2008* gives the term 'associated development' a narrow and specific meaning in Wales. Horizon recognises this; however, the term is used with the wider meaning set out in this paragraph.

migratory species. Sites immediately above the tidal limit supported flounder (*Platichthys flesus*) and common goby (*Pomatoschistus microps*).

A single pond met the requirements for full Predictive SYstem for Multimetrics (PSYM) analysis, and was found to be of Poor quality. Plants present were principally commonly occurring, nutrient-tolerant species. The PSYM macroinvertebrate indices suggest that communities are typical of standing, slightly enriched waters with fewer key indicator families than expected.

The watercourses within the study area contained a range of habitats; many typical of rural streams which have been modified to some extent to serve as drainage systems. Substrate varied spatially, dependent on flow type, which was also variable. This variation supports a range of species, which is evident from fish and macroinvertebrate surveys. In particular, European eel and lamprey are of conservation importance under European and UK legislation, which may require further consideration during licence applications for development plans.

1. Introduction

1.1 Overview

Horizon Nuclear Power Ltd. (Horizon) is currently planning to develop a new Nuclear Power Station on Anglesey, as identified in the *National Policy Statement for Nuclear Power Generation (EN-6)* (Department of Energy and Climate Change, 2011). The Wylfa Newydd Project will require a number of applications to be made under different legislation to different regulators. As a Nationally Significant Infrastructure Project under the *Planning Act 2008*, the construction and operation must be authorised by a Development Consent Order.

Jacobs UK Ltd (Jacobs) was commissioned by Horizon to undertake ecological surveys to inform the various applications, assessments and permits that will be submitted for approval to construct and operate the Power Station and Associated Development.

This report addresses the baseline characteristics for the A5025 Off-line Highway Improvement scheme, which will serve the Wylfa Newydd Project as part of the Associated Development. The A5025 is the main access road to the site and forms part of the designated freight route during the Wylfa Newydd Project construction phase. The proposed improvement works include road widening, realignment, resurfacing and construction of discrete road sections to alleviate traffic constraints.

This report details the current state of freshwater aquatic receptors within the proposed work areas of the A5025 road. The study is based on field survey work carried out in 2014 and 2015 and characterises the freshwater habitat across the area proposed for the route improvement options, and examines the species and habitats of conservation interest and current ecological status at the site.

1.2 Study area context

The Off-line Highway Improvements would cover four sections of the A5025 which have been identified for development. These are around the areas of Valley, Llanfachraeth, Llanfaethlu and Llanrhyddlad (Figure 1.1). The survey sites are focused on these areas and presented in Figure 1.2 to Figure 1.5. The land use within these areas is mainly agricultural fields, both arable and pasture. A 500m buffer zone was applied to the study area, 250m either side of the proposed roadworks as per the Institute of Ecology and Environmental Management (IEEM) guidelines (IEEM, 2006). Only the watercourses and still waters within the boundary of the study area (with its buffer) were surveyed for this report. Five watercourses along the route of the A5025 are designated under the Water Framework Directive (WFD) (Directive 2000/60/EC) and range from Good ecological status (site D30) to Moderate ecological status (sites D1, D20, D45 and D56/57).

1.3 Study aims and objectives

The objective of the freshwater surveys is to characterise the environment and collect baseline data to inform the various applications, assessments and permits required to construct and operate the Power Station.

As part of the Environmental Impact Assessment, the need for detailed knowledge of temporal and spatial data on the proposed A5025 Highway Improvements has been identified. This report presents the findings of work undertaken over three seasons (spring, summer and autumn) during 2014 and spring 2015.

By collecting baseline information on the freshwater aquatic receptors, assessments can be made of potential effects on freshwater habitats within the development site boundaries and the species they support; of particular interest was the presence of any key aquatic species with protected or conservation status and habitats which could be defined as protected or of value.

1.4 Previous work

Previous reports have covered terrestrial and some riparian species including water vole (*Arvicola amphibious*), otter (*Lutra lutra*) and great crested newt (*Triturus cristatus*) (Jacobs, 2014). Phase 1 habitat surveys were also carried out by Mott MacDonald during 2013 and reported during 2014 (Mott MacDonald, 2014). This report details the freshwater baseline surveys and investigation undertaken by Jacobs, which took place during 2014 and 2015.

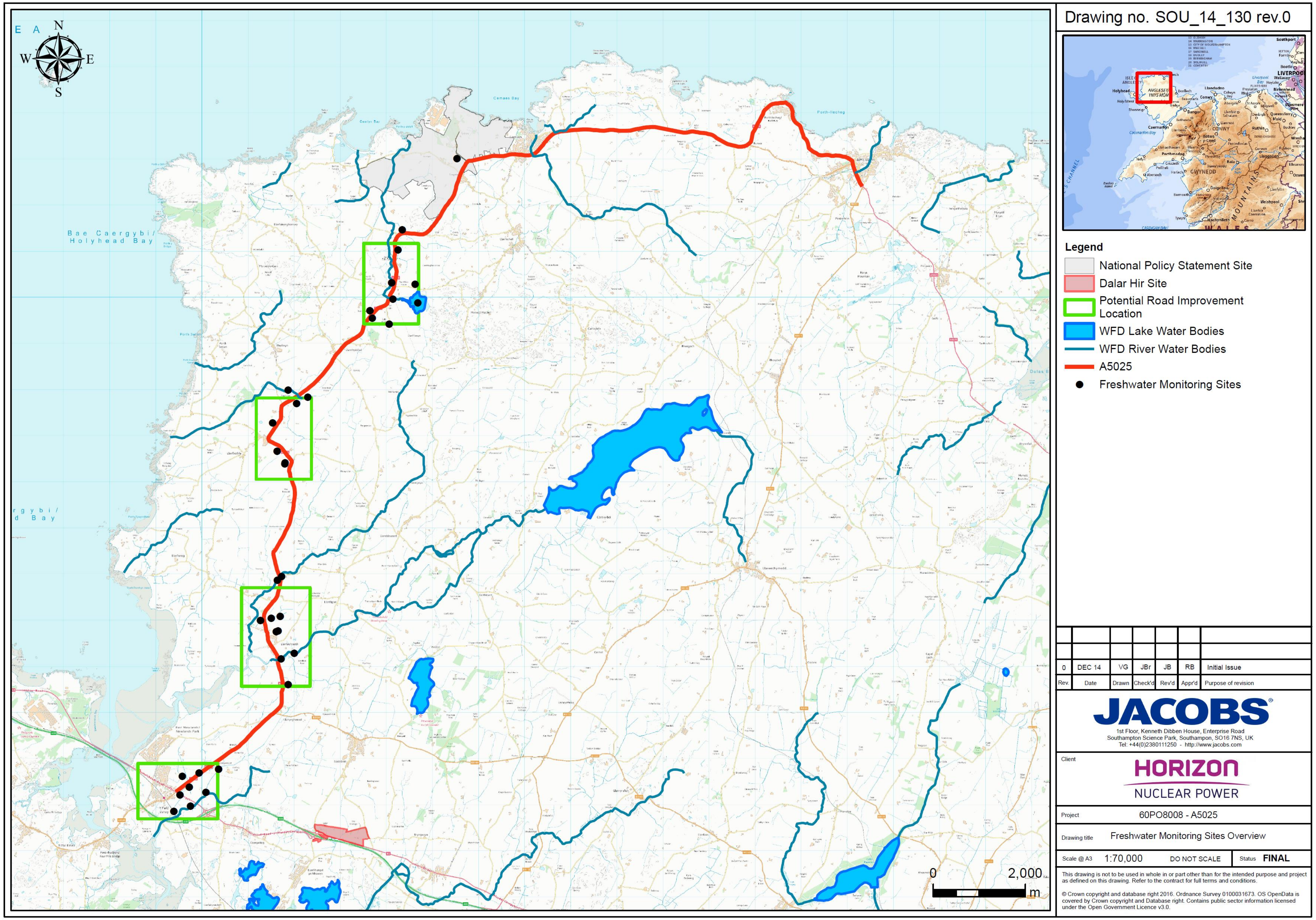


Figure 1.1: Overview of field sampling areas on the A5025 road improvement scheme. Green rectangles highlight the key areas of Llanrhyddlad, Llanfaethlu, Llanfachraeth and Valley, from north to south respectively.

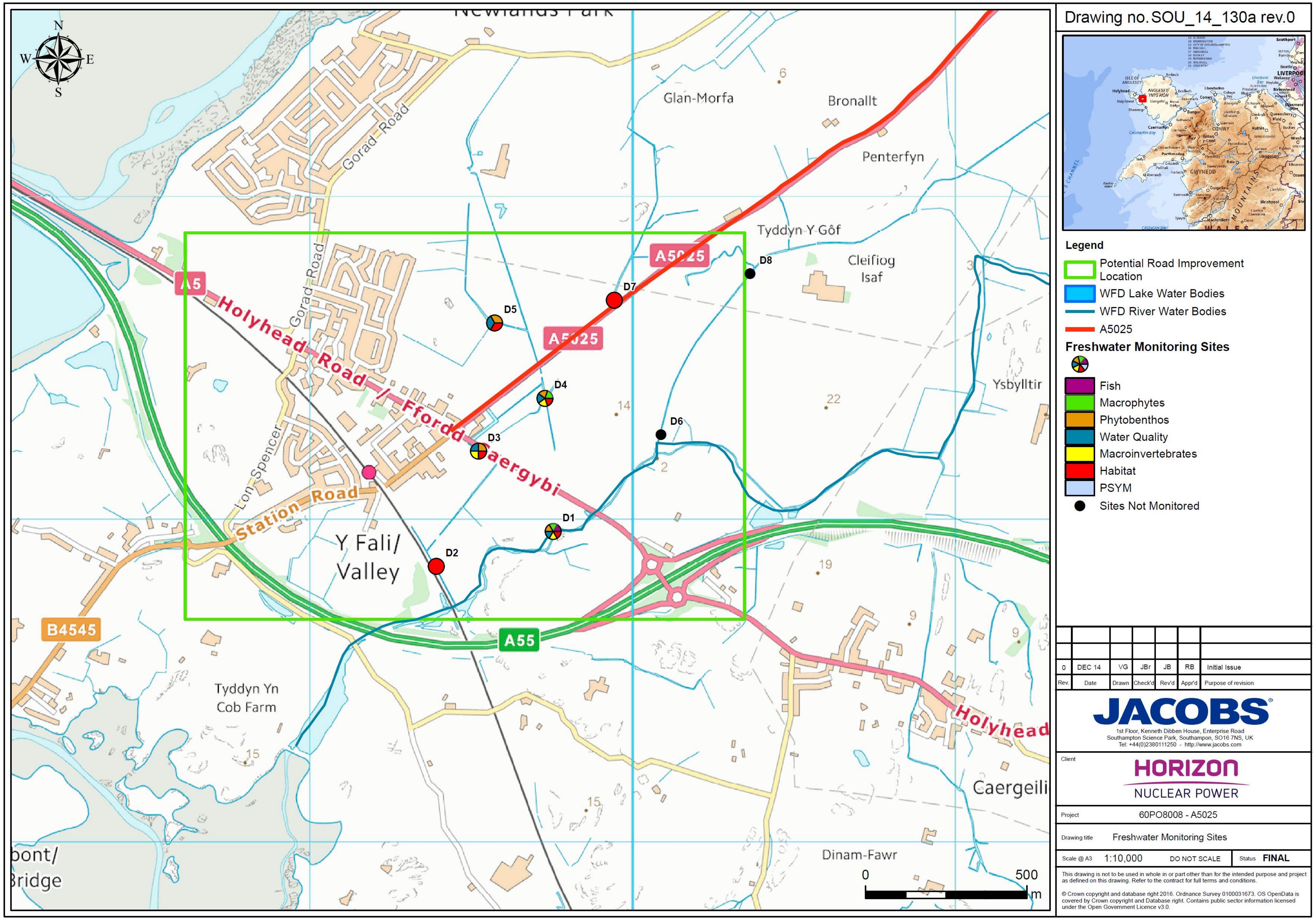


Figure 1.2: Valley area sampling sites (D = flowing watercourses and ditches, P = pond)

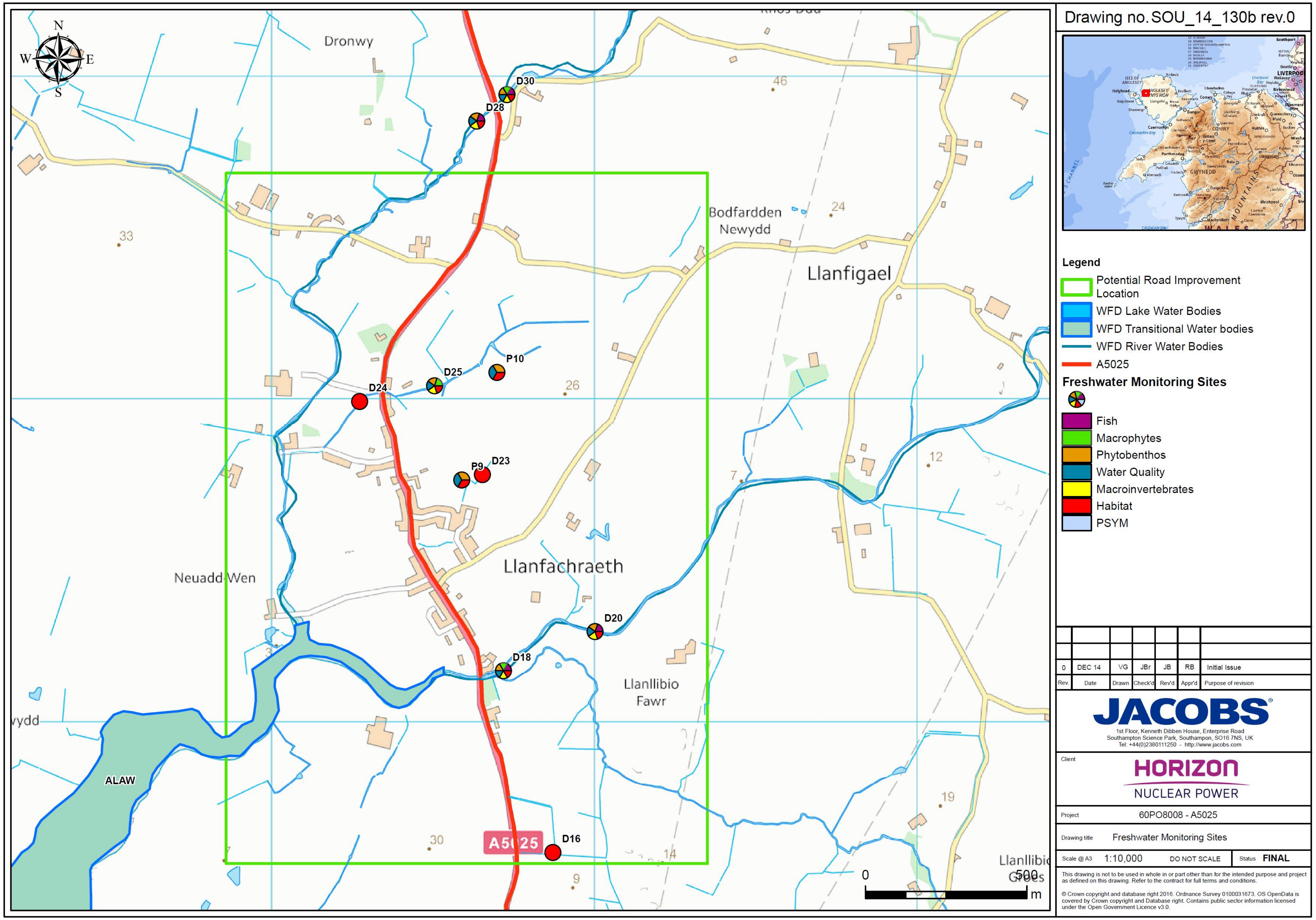


Figure 1.3: Llanfachraeth area sampling sites (D = flowing watercourses and ditches, P = pond)

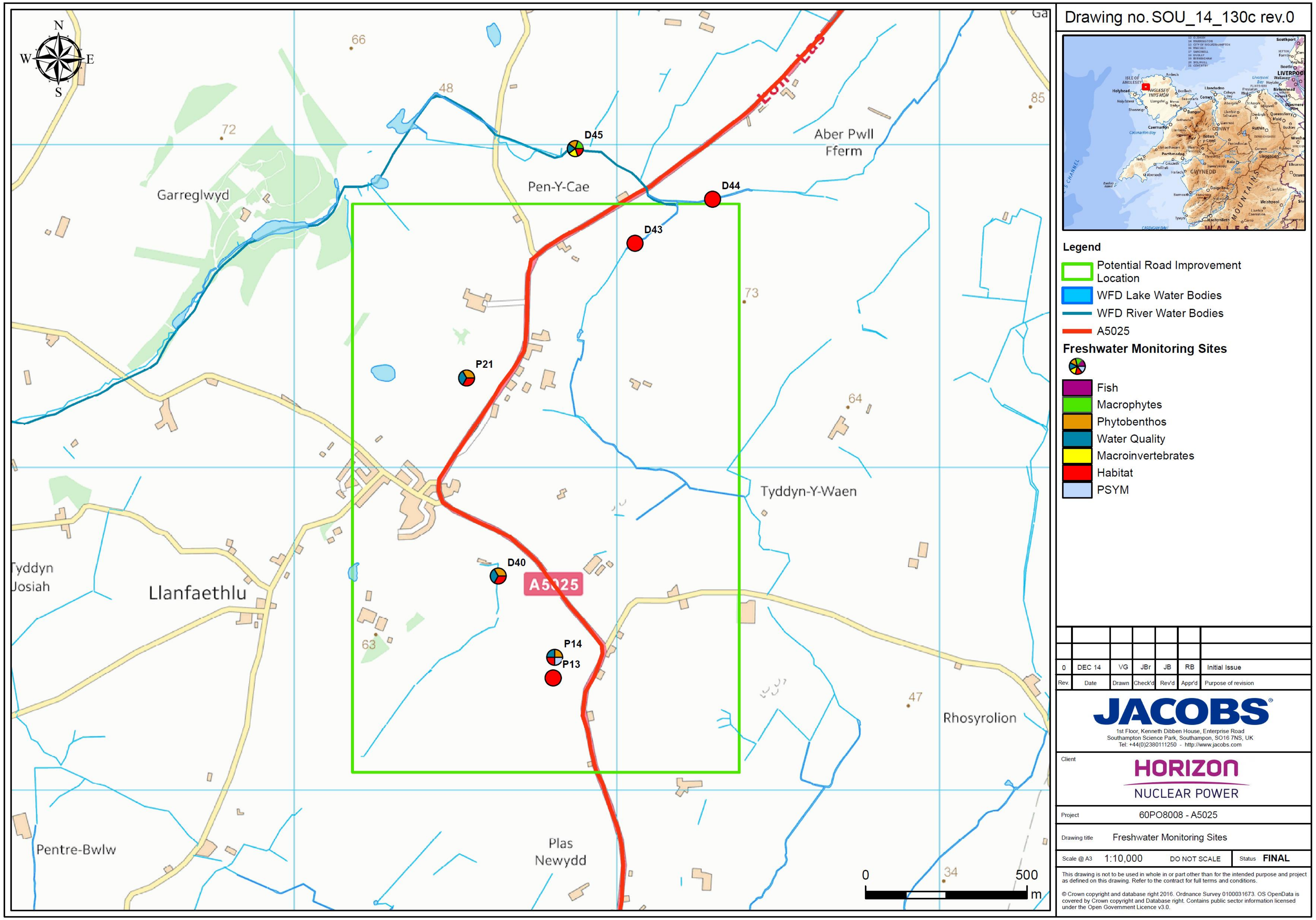


Figure 1.4: Llanfaethlu area sampling sites (D = flowing watercourses and ditches, P = pond)

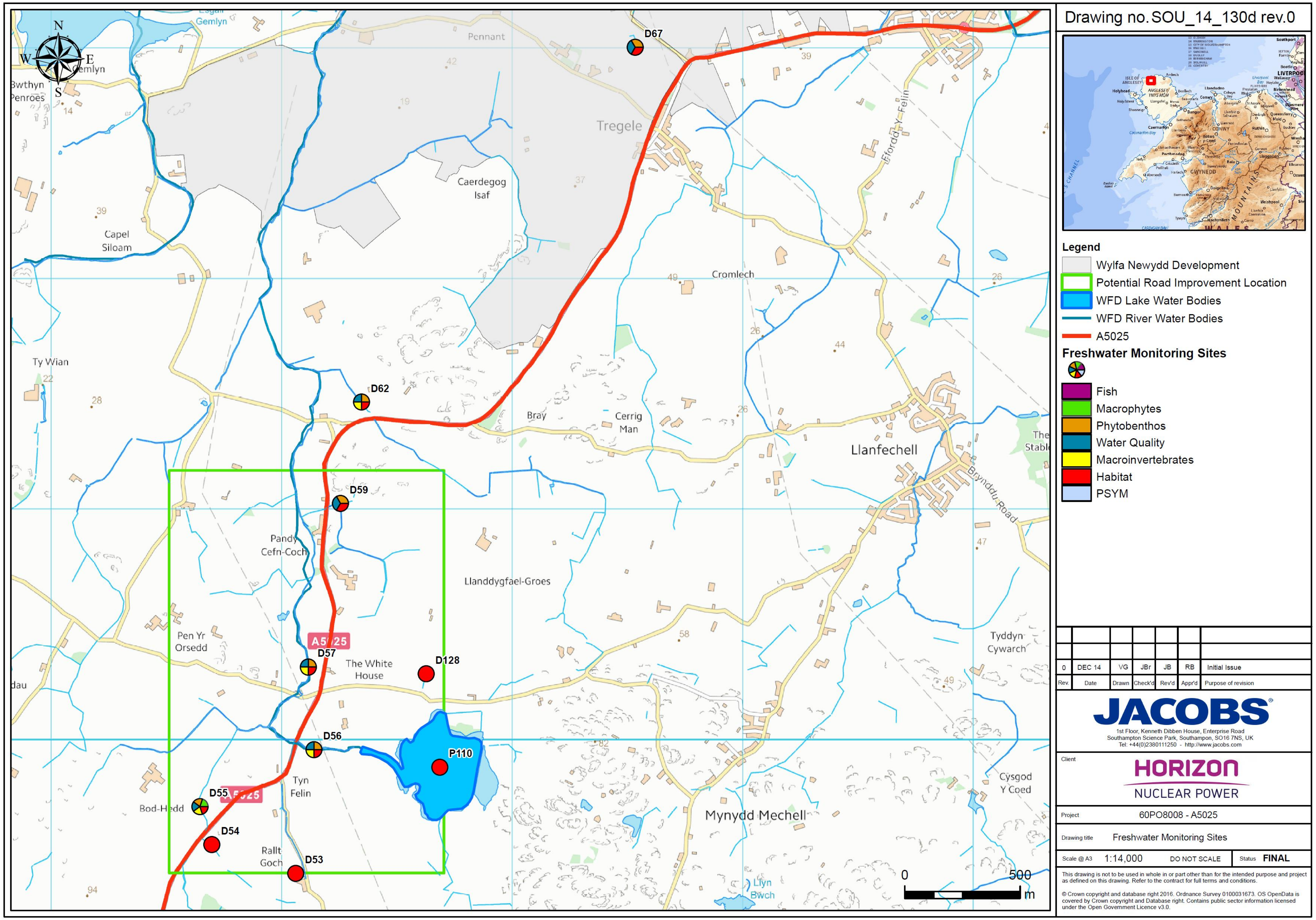


Figure 1.5: Llanrhyddlad area sampling sites (D = flowing watercourses and ditches, P = pond)

2. Methodology

2.1 Approach

A desk-based study of the proposed highway improvement site was conducted to identify watercourses and features within the study area through the use of maps and satellite images. From this study, a list of key freshwater ecological receptors was identified and a survey programme developed to enable baseline data collection suitable for assessment of receptors.

The following surveys were undertaken:

- physical habitat assessment;
- phytobenthos (diatoms);
- water quality;
- macroinvertebrates;
- macrophytes;
- fish; and
- pond surveys.

Receptors were chosen to best represent the existing ecological condition of each survey site. The WFD initiated an international commitment to assess and maintain the ecological status of aquatic ecosystems. The receptors and method used to assess ecological status for reporting under the WFD is used in this report, where applicable, to add a further tool to help characterise waterbodies within the study area. The freshwater environment supports a diverse range of floral and faunal communities with a high level of interdependency underpinning natural functioning.

Where physical conditions were not suitable for a particular receptor, or where sites lay in close proximity to each other and data could be shared across such sites, the full suite of receptors was not assessed.

The scope of this work did not include gathering baseline data in relation to other riparian fauna such as water vole, otter and great crested newt. However, these species were surveyed as part of a wider terrestrial ecology baseline programme in the off-site area and are reported by Jacobs (2014). Any incidental sightings of invasive non-native species or species of conservation importance were recorded. Section 2.3 provides details on the various components examined to provide a robust baseline habitat assessment.

2.2 Desk study

A desk study was undertaken in order to gather existing aquatic information and records for each of the A5025 study areas. The 'Water Watch Wales' interactive tool on the Natural Resources Wales website was used to identify WFD watercourses in the study area and obtain the latest WFD classifications (Natural Resources Wales, 2016). To obtain more detailed ecological information, data requests were submitted to the following organisations:

- Natural Resources Wales (to obtain species lists and analysis outputs of macroinvertebrates, macrophytes, fish and diatoms); and
- COFNOD Local Environmental Records Centre (LERC) (to obtain protected species records).

2.3 Field surveys

2.3.1 Habitat characterisations

Surveys were carried out on the key reaches within the relevant watercourses to characterise the physical habitat and associated biotopes within the sites covered.

The chief parameters recorded were of substrate, channel platform, cross-sectional profile, bank characteristics, flow type, flow diversity and details of fluvial processes in action such as bank erosion, transfer and deposition. Appendix A provides details and photographic evidence on the habitat characteristics of each of the field sites.

2.3.2 Phytobenthos (diatoms)

Phytobenthos are sampled by taking a scrape sample from submerged rocks. Where rocks are not available, submerged macrophytes (aquatic plant) stems can be used. In the majority of cases, stems of bulrush (*Typha* sp.) or rushes (*Juncus* sp.) were used. Permanently wetted, unshaded sites with clear water were chosen. Methods follow the DARLEQ2 methodology (Kelly *et al*., 2005; Environment Agency, 2007a; WFD-UKTAG, 2014a).

Samples were fixed using Lugol's Iodine solution in a sample bottle covered with foil to avoid light penetration. Samples were transported to the Jacobs laboratory for sample preparation and subsequent analysis.

Diatoms were collected over two seasons for 2014 with 17 samples collected in spring (April/May) and 13 collected in autumn (October). In 2015, diatoms were collected in spring (April) at one site (D30; Table 2.1, Figure 1.2 to Figure 1.5). The data was analysed using the updated DARLEQ2 classification tool, which uses known tolerances of diatom species to nutrients (WFD-UKTAG, 2014a).

Table 2.1: Phytobenthos surveys within the A5025 study area (2014-2015).

Site	Waterbody (WFD reference)	National Grid Reference (NGR)	2014		2015
			Spring	Autumn	Spring
D1	Cleifiog (GB110102058930)	SH 29887 79010	✓	✓	
D4	Tributary of Cleifiog	SH 29723 79385	✓	✓	
D5	Tributary of Cleifiog	SH 29558 79612	✓	✓	
D18	Afon Alaw (GB110102058981)	SH 31980 82062	✓	✓	
D20	Afon Alaw (GB110102058981)	SH 32002 82281	✓	✓	
D25	Tributary of Tan R'Allt	SH 31405 83007	✓		
D28	Tan R'Allt (GB110102059100)	SH 31738 83941	✓		
D30	Tan R'Allt (GB110102059100)	SH 31563 83708		✓	✓
D40	Unnamed watercourse	SH 31630 86554	✓	✓	
D45	Unnamed watercourse	SH 31961 87953	✓	✓	
D55	Unnamed watercourse	SH 33660 89692	✓	✓	
D57	Unnamed watercourse	SH 34097 90243	✓	✓	
D59	Unnamed watercourse	SH 34257 91019	✓	✓	
D62	Unnamed watercourse	SH 34346 91465	✓		
D67	Unnamed watercourse	SH 35529 93043	✓		
P10	Unnamed pond	SH 31705 83080	✓		
P14	Unnamed pond	SH 31797 86404	✓	✓	
P21	Unnamed pond	SH 31538 87251	✓	✓	

2.3.3 Water quality

Water quality samples were collected from 20 watercourses and three ponds within the study area (refer to Appendix A for site descriptions). Water quality samples were collected on four occasions:

- spring (28 – 29 May 2014 and 30 April 2014);
- summer (26 – 28 August 2014);
- autumn (21 – 22 October 2014); and
- spring (30 April 2015).

Temperature, conductivity, pH, and dissolved oxygen (both percent saturation and concentration in mg L^{-1}) were measured *in situ*. Field measurements were collected using a YSI 556 multiprobe system handheld meter calibrated to manufacturer specifications. Samples of water were also collected for analysis at a United Kingdom Accreditation Service laboratory. These were analysed for metals, hydrocarbons, organic compounds and nutrients. For full laboratory results, refer to Appendix B. Pond water quality analysis can be found in Section 3.9.4.

All efforts have been made to compare observed readings against current standards. WFD classifications are commonly made against long-term datasets of routine monitoring points, ensuring that standards can be applied to annual averages. As only four datasets were obtained, such comparative interpretation should be made with caution as there are limited replicates with which to calculate an annual average.

2.3.4 Macroinvertebrates

Freshwater macroinvertebrates can be used to detect a range of stressors, such as organic pollution, low flows and habitat quality. Aquatic macroinvertebrates were sampled in spring and autumn to account for the differing life cycles of macroinvertebrate species and abundances. Macroinvertebrates were sampled using the standard three-minute kick sample and one-minute hand search. Where safe access to the watercourse was not possible, sites were evaluated using a sweep net sample (British Standards Institute, 2012). In addition, environmental and habitat data was also collected (Environment Agency, 2008; 2012). Twelve sites were chosen for macroinvertebrate sampling within the A5025 scheme, but due to access constraints and/or watercourses drying up, not all sites were sampled in both seasons in 2014 (Table 2.2). In 2015, site D30 was sampled for macroinvertebrates in spring only.

Table 2.2: Freshwater macroinvertebrate sampling sites within the A5025 study area (2014-2015)

Site	Waterbody (WFD reference)	NGR	2014		2015
			Spring	Autumn	Spring
D1	Cleifiog (GB110102058930)	SH 29887 79010	✓	✓	
D4	Tributary of Cleifiog	SH 29723 79385	✓	✓	
D5	Tributary of Cleifiog	SH 29558 79612		✓	
D18	Afon Alaw (GB110102058981)	SH 31980 82062	✓	✓	
D20	Afon Alaw (GB110102058981)	SH 32002 82281	✓	✓	
D25	Tributary of Tan R'Allt	SH 31405 83007	✓		
D30	Tan R'Allt (GB110102059100)	SH 31563 83708	✓	✓	✓
D45	Unnamed watercourse	SH 31961 87953	✓	✓	
D55	Unnamed watercourse	SH 33660 89692	✓	✓	
D57	Unnamed watercourse	SH 34097 90243	✓	✓	
D59	Unnamed watercourse	SH 34257 91019		✓	

Site	Waterbody (WFD reference)	NGR	2014		2015
			Spring	Autumn	Spring
D62	Unnamed watercourse	SH 34361 91471	✓		

Samples were preserved using industrial methylated spirit for species-level macroinvertebrate analysis at the laboratory in Southampton. Samples were processed in the laboratory following standard WFD compliant procedures (Environment Agency, 2008). Samples were identified, where possible, to species level with the exception of Oligochaeta, Sphaeriidae and Diptera, which have large numbers of similar species and for which the separation to species level would not add significantly to the evaluation of the fauna.

Macroinvertebrate data collected in 2014 was analysed using the following biological metrics.

- Biological Monitoring Working Party (BMWP) derived indices (Hawkes, 1997). BMWP score is based on the tolerance of different freshwater macroinvertebrate families to organic pollution. The BMWP score is the total of all the family scores from a given sample. This score is divided by the number of scoring taxa (NTAXA) to give the average score per taxon (ASPT). NTAXA is therefore a measure of species richness and ASPT is a measure of average pollution tolerance.
- The Community Conservation Index (CCI) (Chadd and Extence, 2004) represents the national rarity and diversity of species identified at a site and designates a conservation value to the sampled community based upon both a species rarity and the overall community richness.
- Lotic-invertebrate Index for Flow Evaluation (LIFE) (Extence *et al*., 1999). Each species or family within a sample is assigned to a flow group depending on their flow/velocity preference, giving two indices: LIFE (species) and LIFE (Family). A high LIFE score represents a higher number of taxa with a preference for high velocity habitats and vice versa.
- Proportion of Sediment-sensitive Invertebrates (PSI) (Extence *et al*., 2011). Each macroinvertebrate family is assigned a score based on their sensitivity to sediment. The resulting PSI scores indicate how sediment-laden the watercourse is, from Minimally Sedimented to Heavily Sedimented.

In addition, the macroinvertebrate sample collected in spring 2015 was analysed using the new biological index, the Walley, Hawke, Paisley & Trigg (WHPT) score. The WHPT score (WFD-UKTAG, 2014c) is based on the tolerance of different freshwater macroinvertebrates to organic pollution and relative abundance and replaces the Biological Monitoring Working Party (BMWP) score. Each macroinvertebrate family is assigned a score between -1.6 and 13.0 depending on their tolerance to pollution; low scores are given to pollution-tolerant taxa, pollution-sensitive taxa score highly. The WHPT score is the total of all the scores from a given sample. This score is divided by the number of scoring taxa (WHPT-NTAXA) to give the WHPT-ASPT. WHPT-NTAXA is a measure of species richness, whilst WHPT-ASPT is a measure of pollution sensitivity.

Where applicable, the ecological quality of the macroinvertebrate communities was assessed using the WFD-compliant River Invertebrate Classification Tool (RICT) (SNIFFER, 2007). This software generates classifications and Ecological Quality Ratios (EQRs) to allow comparison of biological metrics to reference sites and therefore expected standards. There are limitations with its use: it does not hold reference sites for man-made, non-flowing or ephemeral waterbodies (such as ditches) or watercourses within 2.5km of their source.

Ponds were also surveyed for macroinvertebrates as part of the separate assessment using a different method, and as such are covered in Section 2.3.7.

2.3.5 Macrophytes

Macrophyte surveys were carried out in eight watercourses within the A5025 study area in 2014 (Table 2.3) and followed the methods outlined by the Environment Agency (2011). Macrophyte assessment requires compilation of species lists and taxon cover values (TCVs) from a 100m length of watercourse, alongside local environment data collection.

This data was used to calculate a number of macrophyte indices:

- River Macrophyte Nutrient Index (RMNI), which indicates nutrient enrichment;
- number of scoring taxa (NTAXA) which indicates species richness;
- number of functional groups (NFG) which is a measure of how truly aquatic the community is; and
- percentage algal cover (ALG).

In flowing watercourses, the WFD assessment tool LEAFPACS2 can be used to characterise and assess ecological condition using reference sites. LEAFPACS2 is the standard method for the characterisation of watercourses using macrophytes (WFD-UKTAG, 2014b).

Table 2.3: Macrophyte sites in the A5025 study area (2014).

Site	Waterbody (WFD reference)	NGR
D1	Cleifiog (GB110102058930)	SH 29887 79010
D3	Tributary of Cleifiog	SH 29551 79204
D4	Tributary of Cleifiog	SH 29723 79385
D18	Afon Alaw (GB110102058981)	SH 31980 82062
D20	Afon Alaw (GB110102058981)	SH 32002 82281
D25	Tributary of Tan R'Allt	SH 31405 83007
D30	Tan R'Allt (GB110102059100)	SH 31563 83708
D45	Unnamed watercourse	SH 31961 87953
D55	Unnamed watercourse	SH 33660 89692
D56	Unnamed watercourse	SH 34050 90198

2.3.6 Fish

Electric fishing surveys were conducted to identify the presence and species of fish. Fish surveys were conducted using a standard electric fishing technique (Electric fishing backpack unit with single anode) following guidelines developed by the Environment Agency (Beaumont *et al*., 2002; Environment Agency, 2001; Environment Agency, 2007b). Electric fishing was undertaken to the British Standard *BS EN 14011:2003 Water Quality. Sampling of Fish with Electricity* (British Standards Institution, 2003). All electric fishing surveys were conducted under an FR2 licence from Natural Resources Wales by trained members of staff.

Where conditions allowed, a quantitative three-run catch-depletion survey was conducted over a 100m stretch of each watercourse. Where a clear 100m stretch could not be accessed, qualitative spot checks were carried out, giving an indication of the species present within the watercourse. All fish caught were identified to species level, measured and returned to the stretch where they were caught.

Electric fishing surveys were carried out at three sites within the study area in May and four sites in August and October, representing spring, summer and autumn sampling respectively (Table 2.4).

Table 2.4: Electric fishing sites within the A5025 study area in 2014.

Site		NGR	Spring	Summer	Autumn
D1	Cleifiog (GB110102058930)	SH 29887 79010	✓	✓	✓
D18	Afon Alaw (GB110102058981)	SH 31980 82062	✓	✓	✓
D20	Afon Alaw (GB110102058981)	SH 32002 82281		✓	✓
D30	Tan R'Allt (GB110102059100)	SH 31563 83708	✓	✓	✓

2.3.7 Pond habitat assessment

Still waters and ponds differ significantly in their hydrology, morphology and ecology from riverine habitats and, as such, require specific ecological consideration. Three ponds were visited for PSYM survey in 2014 within the A5025 study area: P10, P14 and P21 (Table 2.5).

Table 2.5: Pond habitat assessments within the A5025 study area in 2014.

Site	Waterbody	NGR
P10	Unnamed pond	SH 31705 83080
P14	Unnamed pond	SH 31797 86404
P21	Unnamed pond	SH 31538 87251

The standard method used to survey ponds is the PSYM assessment method, which evaluates the macroinvertebrate and aquatic plant communities (Pond Action, 2002). A brief description is given below.

At each pond site, the aquatic plant species present in the wetted zone were recorded, which included submerged macrophytes, floating-leaved species and emergent macrophytes. A species list was recorded by wading/walking around the entire perimeter of the survey area.

The macroinvertebrate sample was collected using the standard three-minute hand/net search (Pond Action, 1988) which sampled all the main mesohabitats in the pond so that as many macroinvertebrate species were collected from the site as possible. This involves disturbing the margins and substrate and collecting the macroinvertebrates in a net of specific mesh-size. Following this, a one-minute hand search was conducted. The macroinvertebrate sample was preserved in industrial methylated spirit and taken to the laboratory in Southampton for analysis to species level.

Predictive variable data (environmental data) were also required for PSYM analysis. PSYM analysis requires recording of location (grid reference, easting and northing), substrate composition, altitude (m), shade (percentage of pond overhung), inflow (present/absent), percentage of margin grazed, pH, percentage of emergent plant cover and pond area (m^2).

Macroinvertebrate samples were analysed to species level to identify any species of conservation importance, and data were processed using the following PSYM indices:

Plant metrics:

- number of submerged and marginal (not floating) species (SM) – indicates species richness of a site;
- number of uncommon plant species (U) – measures conservation value of a community; and
- trophic ranking score (TRS) – indicates nutrient tolerance on a scale of 1 to 10 (10 = very tolerant).

Macroinvertebrate metrics:

- average score per taxon (ASPT) – indicates average pollution tolerance of macroinvertebrates within a community;
- number of Odonata and Megaloptera families (OM) – indicate long-term quality of a pond as larvae have a long aquatic life stage; and
- number of Coleoptera families (CO) – indicate the habitat quality and diversity of a pond.

Observed data were compared with predicted values generated by analysts at Freshwater Habitats Trust (formerly Pond Conservation) to calculate ecological quality indices (EQIs). These EQIs are then used to inform the index of biological Integrity (IBI), which is interpreted as an overall percentage and quality class. Ponds meeting Good quality or above qualify as Priority Ponds, as do those which contain species of conservation concern (such as Section 42 Species of Principal Importance under the NERC Act 2006, Red Data Book species, and species protected under UK legislation).

2.4 Incidental sightings of invasive non-native species

The following species, which are classed as invasive non-native, were recorded at the following sites during field surveys:

- Afon Alaw (D18) – Canadian pondweed (*Elodea canadensis*), Himalayan balsam (*Impatiens glandulifera*) and Japanese knotweed (*Fallopia japonica*);
- Afon Alaw (D20) – Canadian pondweed and Himalayan balsam; and
- Cleifiog (D1) – Canadian pondweed in tributary.

2.5 Limitations

2.5.1 Seasonal variations

The aquatic sampling regime is in part dictated by seasonal constraints, including optimum seasons for sampling, avoiding species-specific sensitive periods, natural variations in flow (low flows or flood) restricting access, substrate visibility or preventing sufficient sample material. Standard sampling seasons for aquatic receptors are used whereby spring includes March to May, summer is June to August, autumn is September to November and winter is December to February. Samples were successfully collected within these periods, so seasonal constraints do not present any additional limitations for the Wylfa Newydd Project.

2.5.2 Access

Sampling locations were dictated by access agreements with landowners, and the use of public footpaths to reach the majority of sites. Where possible, sites without land access agreements in place were assessed at distance from public ground to gain an understanding of physical habitat. Sites were removed from the sampling programme where access permission could not be obtained.

3. Results

3.1 Desk study

The main watercourses crossed by the A5025 are the Tan R'Allt (WFD GB110102059100) and the Alaw - downstream Llyn Alaw (WFD GB110102058981). The Un-named - Wygyr catchments (WFD GB110102059160, and WFD GB110102059110) water bodies were included within the first cycle of the WFD River Basin Management Plan but have been de-classified for the second cycle. A number of smaller tributaries drain waterbodies across the A5025 study area. The Cleifiog (GB110102058930) lies within the wider study area but is not crossed by the A5025.

The source of the Tan R'Allt is located to the west of Mynydd Mechell, where it flows south to its confluence with the Alaw estuary. The water body flows under the A5025, several small road bridges and access tracks. The Tan R'Allt has a sinuous planform with some sections where the water body appears to have been straightened. Aerial photography shows that the water body is predominantly bordered by agricultural land, consisting of both semi-improved grassland and tilled arable fields. There appears to be very little riparian corridor present on either bank. The Tan R'Allt was classified as Good in 2009 (Natural Resources Wales, 2014a), but has deteriorated to Moderate in 2015 (Natural Resources Wales, 2016). The latest macroinvertebrate monitoring data available for the Tan R'Allt at Pont Aberalaw in 2015 show that a wide variety of mollusc, mayfly, caddisfly and beetle families are present, resulting in high biological metric scores. These species have potential to occur throughout the catchment in other waterbodies where habitat is suitable. Diatom data from the same location indicates that the algae community is moderately nutrient tolerant. European eel, brown trout and river lamprey have been historically recorded on the Tan R'Allt.

The source of the Alaw is located to the north-east of Llanerchymedd, where it flows in a northerly then westerly direction into the Llyn Alaw reservoir. The Alaw flows out of the reservoir through an overflow and continues in a south-westerly direction. The water body then passes under several small road bridges and access tracks before joining the Alaw estuary at Llanfachraeth. The Alaw has a uniform, straight planform for the majority of its length. Aerial photography shows large areas of woodland and shrub bordering the water body for approximately 2.4km downstream of the Llyn Alaw reservoir. Further downstream, the water body flows adjacent to pastoral grazing fields with very little riparian/buffer zone. The Alaw was classified as Moderate in 2009 (Natural Resources Wales, 2014b), and has remained as Moderate in 2015 (Natural Rescources Wales, 2016). The latest macroinvertebrate monitoring data available for the Alaw at Llanfigael in 2014 show that a wide variety of mollusc, mayfly, caddisfly, stonefly and beetle families are present, resulting in high biological metric scores. These species have potential to occur throughout the catchment on other waterbodies where habitat is suitable. The data requested from Natural Resources Wales returned a single species of conservation interest. The Nationally Scarce riffle beetle (*Oulimnius troglodytes*) was recorded from the Llyn Alaw reservoir (WFD GB31032538) in 2006, which is the upstream water body of the Alaw - downstream Llyn Alaw (WFD GB110102058981). Diatom data from the same location in 2014 indicate that the algae community is moderately nutrient tolerant. Fish monitoring data was returned for the Alaw at Pont Llanfigael (2004-2014). A number of species were recorded, including Atlantic salmon (*Salmo salar*), brown trout, European eel and lamprey.

Un-named - Wygyr catchment (WFD GB110102059160) is a small channel flowing north from Llyn Llygeirian to Porth-y-pistyll. It has a relatively straight planform and forms the boundary of several fields. No ecology data was available from the desk study for this waterbody. European eel has been recorded previously from the Un-named Wygyr catchment (WFD GB110102059110), also known as the Carrelgwyd.

The data requested from COFNOD returned no aquatic species data for any of the watercourses in the A5025 study area. The absence of data should not be taken to indicate definitive absence of these species, rather low survey effort for these areas of Anglesey.

3.2 Habitat characterisation

The watercourses in the study area consisted of three main watercourses (Cleifiog, Afon Alaw and Tan R'Allt) and several smaller streams and field ditches. The watercourses varied significantly in character with average width ranging between 0.4m (D55 and D59) and 6m (Afon Alaw - D20). The majority of the surrounding land use was pastoral and heavily grazed by cattle and sheep.

Many of the watercourses were found to be over-deepened or realigned along field boundaries and frequently both. Silt substrate was also prevalent in watercourses which had undergone intervention to act as part of the field drainage systems. There were very few ponds in the study area, most of which appeared to be natural and largely ephemeral. Of the ponds visited, only one (P14) was considered suitable for survey and was sampled for macroinvertebrates and macrophytes. Pond P9 was not accessible, whilst ponds P10 and P21 had insufficient water levels for survey, and thus no biological assessments were made.

Three of the watercourses along the route are designated under the WFD Cycle 2. Tan R'Allt (D30) is classified as being of Good ecological quality while Cleifiog (D1) and Afon Alaw (D20) are classified as Moderate.

Appendix A provides characterisation details on each of the sites covered in terms of their physical attributes and habitat potential.

3.3 Phytobenthos (diatoms)

Spring and autumn samples were analysed in line with standard WFD classifications. Results were calculated using the average alkalinity from water quality lab analysis from both seasons for each site where possible in 2014. In 2015, only one site (D30) was sampled for phytobenthos and analysis was performed using mean alkalinity from 2014 and 2015 water quality data.

The results of the phytobenthos samples are shown in Table 3.1. This lists the EQR (observed/expected diatom community) and is colour coded to express WFD classification for each season and overall status. As per the DARLEQ2 guidance, EQR values >1.00 for rivers and >1.25 for lakes (and ponds) have been reported. The minimum number of diatoms was available (300 valves) for analysis for all of the samples. Overall, the most abundant diatom taxa present was *Achnanthidium minutissimum* followed by *Navicula gregaria*.

Table 3.1: Diatom EQRs and overall ecological status, for spring and autumn 2014 and spring 2015 (D30 only). (Grey= not surveyed, blue= High, green= Good, yellow= Moderate, orange= Poor, red= Bad). *Sites with missing alkalinity (set to HA (high alkalinity) for ponds and 100mg/l for ditches. Sites not all suitable for WFD classification.

Site	Spring	Autumn	Annual average	Status
D1	0.77	0.74	0.76	Good
D4	0.84	0.68	0.76	Good
D5	0.85	0.64	0.74	Good
D18	0.53	0.53	0.53	Moderate
D20	0.35	0.57	0.46	Moderate
D25	0.84		0.84	High
D28	0.52		0.52	Moderate
D30*		0.62	0.62	Good
D30 (2015)	0.49		0.49	Moderate
D40	0.63	0.60	0.61	Good
D45	0.58	0.61	0.60	Moderate
D55	0.76	0.59	0.68	Good

Site	Spring	Autumn	Annual average	Status
D57	0.69	0.56	0.62	Good
D59	0.61	0.60	0.60	Good
D62	0.75		0.75	Good
D67	0.65		0.65	Good
P10	0.53		0.53	Moderate
P14	0.35	0.37	0.36	Poor
P21	0.53	0.14	0.33	Poor

Only one site (D25) demonstrated a diatom community of High ecological status (EQR >0.8) overall. This suggests a site at reference condition; however, this was based on only one season of data. No site with two seasons of data scored High, but seven sites out of 10 did achieve Good ecological status. However, these results should be interpreted with caution as the method used to derive EQRs is an alkalinity model and is not based upon physical habitat or flow variables.

Seven of the 10 sites with both spring and autumn data present dropped in ecological status between the two seasons. Sites feeding the Cleifiog (D4 and D5) dropped from High to Good; D40, D55, D57 and D59 dropped from Good to Moderate; and P21 dropped from Moderate to Bad. The only site which increased in status was situated on the Afon Alaw (D20), which went from Poor to Moderate.

Similar substrates and channel features were sampled to minimise sampling variation; however, there will be some differences in the sampling location, due to access or availability of wetted areas.

In the 2014 spring sample, seven of the 17 sites surveyed failed to meet Good ecological status for diatoms. Sites D20 and P14 were the only sites to achieve an ecological status of Poor. Site D20 had the lowest diversity of phytobenthos with only 14 taxa present in the sample, which was dominated by *Gomphonema angustatum* making up 90% of the sample: the highest level of dominance of any taxa over all the spring sites.

The presence of elevated concentrations of orthophosphate can affect the phytobenthos community within freshwaters as orthophosphate is a limiting nutrient. However, the water quality results show that orthophosphate concentrations were low for the majority of the flowing watercourse or ditch sites (D), which achieved either Good or High ecological status.

All ponds (P) surveyed achieved Moderate or worse for ecological status. Phytobenthos classification suggests high levels of nutrient enrichment. Sites P10 and P21 showed the two highest levels of orthophosphate from the 17 samples, which could be limiting phytobenthos growth. Pond P10 also gave the highest reading for ammonia, which is another important factor influencing diatom populations. It is probable that habitat is the primary cause of the Poor phytobenthos status at P14, as phosphate levels are low.

In the 2014 autumn samples, eight of the 13 samples failed to meet Good ecological status for phytobenthos. Site P21 achieved the only Bad classification. Here, as in the spring, orthophosphate and ammonia levels were very high and had increased between seasons, potentially causing the fall in status from Moderate due to nutrient enrichment. Ammonia levels had increased by more than double between spring and autumn for site D4, possibly causing the drop from High to Good status, whilst site D5 experienced a similar change but in phosphate levels.

Concentrations of ammonia and phosphate were low for all other sites, indicating that factors other than nutrient levels are responsible for determining phytobenthos communities. Other dynamics known to influence diatom populations include availability of suitable substrate, amount of shading, grazing/poaching pressures and stability of the substrate. Slow flowing or ponded ditch-like conditions dominated by a silt substrate will tend to lead to a low EQR score and subsequently Bad, Poor or Moderate ecological status.

3.3.1 Summary

In total, 31 samples were taken for 2014: 17 in spring, 13 in autumn and one in spring 2015. Diatom populations varied by site and season, with 10 sites out of 17 meeting or exceeding Good ecological status for diatoms in spring 2014 and five out of 13 in autumn in 2014. Site D30 sampled in spring 2015 achieved Moderate ecological status.

The observed variability in diatom populations seen during monitoring are likely to be a result of changes in water levels and velocity. Although diatom sampling should avoid periods when the river is or has recently been in high flow, during prolonged periods of rainfall this is not always possible.

It should be noted that the DARLEQ2 classification tool was not developed or calibrated to classify wetlands, ditches and ponds. For the purposes of baseline monitoring, this tool has been used to provide comparisons between seasons/years at a site. The diatom sampling to date shows that there is large variability in diatom populations across the development site, which would be expected given the diverse range of habitat types assessed.

3.4 Water quality

All field measurement results can be found in Appendix B. A brief summary of individual parameters is given below.

3.4.1 Temperature

Temperature varied on a local, seasonal and temporal scale in 2014. As would be expected, an increase in temperature was noted during the summer with the warmest temperatures recorded at all sites. The coolest temperatures were recorded in autumn. Average temperatures for each season in 2014 were 13.0˚C in spring, 15.2˚C in summer and 11.4˚C in autumn. In spring 2015, the temperature recorded at site D30 was 8.9˚C.

In 2014, temperature in the watercourses ranged between 10.8˚C at D4 to 18.2˚C at D55. D55 also showed the largest variation in temperature over the sampling period, ranging from 11.3˚C in autumn to 18.2˚C in summer. All temperatures were within expected values for the type of streams sampled.

3.4.2 Conductivity

Similar to temperature, conductivity readings showed an increase during the summer compared to spring and autumn in 2014. The average conductivity in summer was 340.3μS cm^{-1}, compared to 312.9μS cm^{-1} in spring and 264.3μS cm^{-1} in autumn.

In 2014, the highest conductivity was recorded at D40 (539μS cm^{-1}) in the summer; this site also showed the largest range in conductivity as readings dropped to 307μS cm^{-1} in autumn, a change of 232μS cm^{-1}. In 2015, conductivity at site D30 was 328μS cm^{-1}. Conductivity readings were within expected values for the type of streams sampled.

3.4.3 Dissolved oxygen

Dissolved oxygen varied between sites and seasons in 2014. The season with the highest average dissolved oxygen saturation percentage across all sites was spring with an average of 79.8%. Concentrations dropped in summer to an average of 68% and then increased again in autumn to 72.9%. The lowest dissolved oxygen recorded across all sites and seasons was 29.5% in spring at D40. Most of the sites meet the requirements for Good or High WFD status for dissolved oxygen over the sampling period in 2014 and 2015, with the exception of D1, D4, D25, D40 and D45 (2014).

Variation in dissolved oxygen levels between sites and seasons is likely to be attributed to changes in flow/water levels, water temperature, the degree of riparian vegetation and macrophyte growth.

3.4.4 pH

pH was indicative of Good or High WFD status at all sites in 2014 and 2015, and ranged between 5.85 (D5, 2014) and 7.79 (D30, 2015).

3.5 Water quality laboratory results

All laboratory results can be found in Appendix B. A brief summary of individual parameters is given below.

3.5.1 Biological oxygen demand

Biological oxygen demand (BOD) is the amount of oxygen required for microbial metabolism of decomposing organic matter in stream water. BOD is not used in the classification of waterbodies under the WFD; however, standards and classification boundaries are given. In 2014, all sites represented Good or High WFD status. However, in spring 2015, sites D5 and D138 both failed Good status, achieving Poor and Moderate respectively.

3.5.2 Suspended solids

Suspended solids varied greatly between sample sites and season. In 2014, results ranged between less than laboratory minimum recordable value (MRV) (<3mgL^{-1}) at D18 in spring, D20 in summer and autumn and D1 in autumn to 165mg L^{-1} at D45 in summer. The current UK guideline standard for fine sediment stipulates that suspended solid concentrations should not exceed a guideline annual mean of 25mg L^{-1}. Values were generally low across the sites suggesting low energy, stable systems with limited sediment mobilisation. The highest average values across all sites were recorded in summer with an average of 44mg L^{-1}. Spring and autumn averaged 24mg L^{-1} and 7mg L^{-1} respectively. Some sites did exceed the annual guideline value of 25mg L^{-1} (D5, D40, D45 with average values of 38.1, 41.5 and 60.9mg L^{-1} respectively). However, this is based on averages of three data points only. In spring 2015, site D5 greatly exceeded the annual guideline value with a measurement of 151mg L^{-1}, suggesting a turbid, high-energy environment in which suspended solids are mobilised within the water column.

3.5.3 Nutrients

Reactive phosphorus (orthophosphate, reactive as phosphorus) is used to classify watercourses under the WFD. Reactive phosphorus is a measure of the soluble phosphorus compounds readily taken up by plants and algae. Reactive phosphorus concentrations met Good or High WFD status at all sites with the exception of D18, D30, D40, and D45 (2014). The highest reactive phosphorus concentration was recorded at D40 with a reading of 0.876mg L^{-1}.

Ammoniacal nitrogen is also used to classify watercourses under the WFD. Ammoniacal nitrogen is a common pollutant that is toxic to fish and invertebrates at elevated concentrations. The toxicity of ammoniacal nitrogen is related to temperature and pH conditions. Concentrations suggested High or Good WFD status at all sites on all sampling occasions.

3.5.4 Metals

Each of the following metals is listed under the WFD as a 'specific pollutant' or 'priority substance'. Metal concentrations noted from the study area can be summarised as follows.

- Arsenic concentrations were indicative of Good WFD status (below 50µg L^{-1}) at all sites on all sampling occasions. The highest concentration of 4.89µg L^{-1} was detected at site D45 in summer 2014.
- Cadmium levels were below laboratory MRV at all sites on all sampling occasions. Concentrations were all below AA-EQS (annual average Environmental Quality Standard) inland surface water standards.

- Chromium levels met WFD Good status for all sites. Slightly elevated readings were noted in summer (2014) at D25, D45 and D59 with readings of 3.83μg L^{-1}, 5.19μg L^{-1} and 4.48μg L^{-1} respectively.
- Copper levels varied between sites and seasons. All sites reached Good WFD status with the exception of D59, D55, D20 and D45 in 2014. On average, the highest readings across the sites were recorded in autumn.
- Lead concentrations were largely below laboratory MRV. Concentrations at D45 were elevated in summer 2014 (7.35μg L^{-1}), but fell below MRV in spring and autumn. In spring 2015, elevated concentrations of 9.19μg L^{-1} were recorded at D59.
- Nickel concentrations ranged between below laboratory MRV to 9.87μg L^{-1}. Zinc concentrations meet Good WFD status at all sites with the exception of D40 and D55 in 2014 and D59 in 2015. The highest zinc recording of 453μg L^{-1} was at D59 in spring 2015.
- Iron concentrations varied significantly between sites and seasons in 2014. The largest range occurred in summer where 81.9μg L^{-1} was recorded at D20 and 8890μg L^{-1} was recorded at D40. D4, D5, D25, D40, D45, D55, D59 and D67 all had elevated readings, resulting in a failure to meet Good WFD status.
- Mercury levels were low at all sites on all sampling occasions with all but four readings below laboratory MRV.
- Manganese currently does not have standards given under the WFD. All sites recorded the presence of manganese ranging from 32.8μg L^{-1} at D20 in autumn to 2680μg L^{-1} at D40 in summer. On average, across all sites, manganese levels were at their highest in summer and at their lowest in autumn.

3.5.5 Phenols

Phenols were largely below laboratory MRV with the exception of 2,4-Dimethylphenol and 2-Methylphenol, 3-Methylphenol, 4-Methylphenol, 3,5-Dimethylphenol and phenol, which were just above MRV on occasion. All sites were indicative of Good WFD status.

3.5.6 Polycyclic aromatic hydrocarbons

Polycyclic aromatic hydrocarbons (PAHs) were all below laboratory MRV during the autumn surveys. Hydrocarbons, acenaphthene, fluoranthene, fluorene, phenanthrene and pyrene were just above detectable limits on occasions during spring and summer. All sites were indicative of Good WFD status.

3.5.7 Volatile organic compounds and others

Volatile organic compounds and others were either below or marginally above laboratory MRV. All sites were indicative of Good WFD status.

3.5.8 Summary

Spot sampling was carried out at watercourses and ponds found along the A5025.

Dissolved oxygen saturation varied across the A5025 study area. This is largely attributed to changes in flow/water levels, water temperature, riparian vegetation and macrophyte growth as well as the time at which samples were collected during the day. Dissolved oxygen concentrations vary both seasonally and diurnally due to changes in temperature, evaporation and plant photosynthesis.

Suspended solids varied across sites and seasons. Suspended solid concentrations can be influenced by a number of factors. These include seasonal variation of organic and inorganic material in the water, such as algae, silts and sediment becoming suspended due to runoff, erosion, livestock poaching or the re-suspension of bed material following changes in river flow. Values in the vicinity of the A5025 were generally low, indicating low-energy, stable systems with limited sediment mobilisation.

Four sites with elevated orthophosphate concentrations were located within rural environments where the waterbody runs close to managed arable and grasslands or where livestock may be present. Land management can contribute to diffuse source nutrients entering adjacent ponds and watercourses.

Copper, iron and zinc were elevated at a number of sites. Factors that can influence metal concentrations within a watercourse include the use of fertilisers and pesticides on pasture/crop land, runoff from roads and local geology.

Phenols, PAHs and volatiles were generally below laboratory MRV across all sites. Phenols in the environment are typically associated with production and degradation of numerous pesticides and the generation of industrial and municipal sewages. The presence of PAHs can be due to vehicle emissions, runoff of petroleum products from roads, refuse incineration and the by-products of power generation processes. Volatile organic compounds sources include vehicle emissions, fuel combustion and domestic solvent usage. Other major sources of volatile organic compounds include commercial and industrial activities using organic solvents.

In summary, water quality across the A5025 site is typical of that found within a rural setting close to a main transport route.

3.6 Macroinvertebrates

In 2014, twelve sites in the study area were identified and sampled for macroinvertebrates across two seasons. Eight sites were successfully sampled in both seasons, whilst the remaining four were visited in one season due to access constraints or watercourses drying out. In spring 2015, one site (D30) was sampled for macroinvertebrates. All sites were assessed using standard metrics to indicate biological quality, and six sites met the minimum requirements for WFD classification using RICT.

The majority of the sites were field drains and had ditch-like habitat and flow types, but the sites on major watercourses and their tributaries (D1, D18, D20 and D30) demonstrated a good diversity of habitat and flow types for macroinvertebrates. See Appendix A for detailed habitat characterisations and photographs.

This section is divided into presentation of results for macroinvertebrate indices, species present and results for the WFD classification of eligible sites in 2014 and 2015.

Ponds were assessed for macroinvertebrates as part of the PSYM methodology; see Section 3.8.2 for results.

3.6.1 Macroinvertebrate indices

Indices were calculated for 12 sites in 2014 using the BMWP scoring system, LIFE and PSI (Table 3.2).

BMWP-derived scores varied considerably across the catchments surveyed. Sites D25, D45 and D59 (ditch-like watercourses) had very low scores, between 53 and 59, in contrast to the high scoring streams D18, D20 and D30 (BMWP 155 to 186). Site D59 had the lowest scoring BMWP (53), NTAXA (13) and ASPT (3.9), indicating a very low diversity of invertebrates, and few pollution-sensitive taxa.

Half of the sites demonstrated PSI indicative of Sedimented or Heavily Sedimented communities. PSI showed correlation to other invertebrate indices; for example, the ecological communities of the higher pollution tolerant stream sites were less sedimented. Sites with less accumulated sediment are more likely to have higher habitat diversity and fewer accumulated pollutants. EQRs were calculated for five sites, and four of these indicated only a slight effect from sedimentation. D45 and D1, however, scored EQRs of 0.46 and 0.22 respectively, suggesting there is a significant deviation in ecological quality as a result from sedimentation when compared to reference conditions.

LIFE (F) scores varied between sites, with sites D4, D25 and D45 characteristic of slow flowing or standing waters. Sites D18, D57 and D62 were the highest scoring with LIFE (F) values between 7.0 and 7.1, reflecting communities of faster, consistently flowing waters. LIFE EQRs of between 0.88 and 0.93 were reported for four sites, indicating a minor deviation from flow communities in reference conditions. Sites D1 and D45 show only a slight effect from flow stress, with an EQR of 0.78.

Table 3.2: Macroinvertebrate indices for 12 sites on the A5025 scheme in 2014 (Biological Monitoring Working Party score (BMWP), number of taxa (NTAXA), average score per taxon (ASPT), Proportion of Sediment-sensitive Invertebrates (PSI) and Lotic invertebrate Index for Flow Evaluation (LIFE; species and family)).

Site	BMWP	NTAXA	ASPT	PSI	PSI interp.	PSI EQR	LIFE (sp.)	LIFE (F)	LIFE (F) EQR
D1	90	22	4.1	15.5	Heavily Sed.	0.22	6.1	6.0	0.78
D4	74	18	4.1	3.0	Heavily Sed.	-	5.7	5.3	-
D5	91	22	4.1	10.8	Heavily Sed.	-	5.4	5.8	-
D18	158	27	5.9	57.7	Mod. Sed.	0.88	7.3	7.1	0.93
D20	186	33	5.6	46.2	Mod. Sed.	0.72	7.0	6.6	0.88
D25	59	15	3.9	19.4	Heavily Sed.	-	5.9	5.4	-
D30	155	28	5.5	55.6	Mod. Sed.	0.82	7.4	6.9	0.90
D45	59	14	4.2	22.2	Sed.	0.46	6.1	5.5	0.78
D55	95	21	4.5	50.0	Mod. Sed.	-	6.7	6.4	-
D57	120	24	5.0	56.8	Mod. Sed.	0.85	7.7	7.0	0.92
D59	53	13	4.1	40.9	Sed.	-	7.0	6.0	-
D62	69	15	4.6	59.4	Mod. Sed.	-	7.9	7.1	-
D1	90	22	4.1	15.5	Heavily Sed.	0.22	6.1	6.0	0.78

The macroinvertebrate sample collected in 2015 was analysed using the WHPT index (which replaces BMWP) in addition to BMWP, LIFE and PSI scoring systems (Table 3.3).

Table 3.3: Macroinvertebrate indices for site D30 in 2015, including WHPT metrics. (Biological Monitoring Working Party score (BMWP), number of taxa (NTAXA), average score per taxon (ASPT), Proportion of Sediment-sensitive Invertebrates (PSI) and Lotic invertebrate Index for Flow Evaluation (LIFE; species and family)) and Wallis Hawkes Paisley and Trigg (WHPT) scores.

Site	BMWP	NTAXA	ASPT	WHPT BMWP	WHPT NTAXA	WHPT ASPT	PSI	PSI interp.	PSI EQR	LIFE (sp.)	LIFE (F)	LIFE (F) EQR
D30	163	27	6.03	168.9	29	5.82	54.16	Mod. Sed	-	7.68	6.92	-

The macroinvertebrate indices suggest the macroinvertebrate community at site D30 (spring 2015) had a high taxon richness (NTAXA 27) and a number of pollution-sensitive species (ASPT and WHPT ASPT). LIFE (Sp.) scores suggest a macroinvertebrate community with a higher number of taxa tolerant to greater flows, suggesting a consistently fast-flowing environment. PSI (F) was interpreted as Moderately Sedimented, indicating a number of taxa are tolerant of sedimentation. The 2015 data were comparable to ecological data collected from D30 in 2014.

3.6.2 Macroinvertebrate species and conservation value

Macroinvertebrates recorded across the study area were dominated by widespread and common crustaceans, leeches, beetles and molluscs, all of which are tolerant to sedimentation, low energy flow types and organic pollutants. At least 10 sites supported medium pollution-sensitive caddisflies (Limnephilidae) and freshwater shrimps (Gammaridae), in addition to pollution-sensitive pea mussels (Sphaeriidae), leeches (Glossiphoniidae) and freshwater hoglice (*Asellus aquaticus)*.

The caseless caddisfly family Hydropsychidae is one of the few families recorded across the area that is typical of fast-flowing streams, present at sites D18 and D57. Several species of mayfly (from families Baetidae, Caenidae and Ephemerellidae) were recorded in the study area, predominantly from sites D18, D20, D30 and D57. Site D20 (Afon Alaw) was sampled close to the estuary into which it discharges, and although the area sampled was predominantly influenced by fresh water, some brackish water shrimps (*Gammarus zaddachi*, *G. duebeni* and *Echinogammarus* sp.) were recorded, along with marine isopods. See Appendix C for the full species list.

None of the macroinvertebrates recorded are designated at European, national or local conservation level. CCI scores ranged from Low to Fairly High, with the lowest scoring community at D25 (3.8), and the highest at D18 (11.8) (Table 3.4). The latter site had no invertebrates of conservation importance above Local importance, yet supported a diverse and species-rich community. The leeches *Haemopis sanguisuga* and *Erpobdella testacea* are of Local conservation importance and were recorded from one (D55) and five (D1, D5, D20, D30, D45) of the sites respectively. The lesser water-boatman *Sigara semistriata* and freshwater shrimp *Gammarus lacustris* were present at one site each, and are also of Local conservation importance.

Table 3.4: Macroinvertebrate CCI indices for twelve sites on the A5025 scheme (2014-2015).

Site	CCI score	CCI value	Species of conservation importance (Local or above)
D1	8.1	Moderate	*Erpobdella testacea* (leech) Local
D4	4.2	Low	None
D5	10.0	Fairly High	*Erpobdella testacea* (leech) Local
D18	11.8	Fairly High	None
D20	11.3	Fairly High	*Erpobdella testacea* (leech) Local
D25	3.8	Low	None
D30	10.8	Fairly High	*Erpobdella testacea* (leech) Local
D30 (2015)	11.26	Fairly High	*None*
D45	8.2	Moderate	*Erpobdella testacea* (leech) Local
D55	9.0	Moderate	*Haemopis sanguisuga* (leech) Local
D57	7.8	Moderate	*Sigara semistriata* (lesser water-boatman) Local
D59	8.9	Moderate	*Gammarus lacustris* (shrimp) Local
D62	4.5	Low	None

3.6.3 RICT classification

RICT classification was possible for six out of 12 sites (Table 3.5) in 2014. Sites D18, D20 and D30 all achieved Good status, indicating that these watercourses only slightly deviate from reference conditions. This correlates with high BMWP and species richness indices at these sites. It is worth noting that D20 (Afon Alaw) was sampled close to the estuary into which it discharges. Although the area sampled was predominantly influenced by fresh water, RICT is not designed for brackish water classification, so this result must be interpreted with some caution and is provided as a guide for comparative assessment.

Site D45 was classified as Poor overall and achieved Moderate for ASPT and Poor for NTAXA. This shows that habitat diversity is limiting the community to a greater extent than water quality. Site D1 was also classified as Poor status overall, with ASPT achieving Poor and NTAXA High, suggesting a water quality pressure rather than a lack of habitat availability. Site D57 achieved High status for NTAXA but Moderate for ASPT, indicating an effect from water quality and downgrading the classification to Moderate overall.

Table 3.5: RICT classifications for six sites on the A5025 scheme (grey cells indicate overall classification for site) in 2014. The minimum of NTAXA and ASPT EQRs (MINTA) is used to determine the WFD classification of the site.

Site	Index	EQR	Class	Probability of Class (%)
D1	ASPT	0.70	Poor	80.74
	NTAXA	1.04	High	91.94
	MINTA	-	Poor	80.74
D18	ASPT	0.96	Good	78.18
	NTAXA	1.08	High	97.33
	MINTA	-	Good	78.18
D20	ASPT	0.93	Good	76.11
	NTAXA	1.23	High	99.98
	MINTA	-	Good	76.11
D30	ASPT	0.90	Good	59.33
	NTAXA	1.10	High	98.24
	MINTA	-	Good	59.33
D45	ASPT	0.79	Moderate	57.66
	NTAXA	0.59	Poor	45.20
	MINTA	-	Poor	49.86
D57	ASPT	0.82	Moderate	79.10
	NTAXA	0.98	High	82.27
	MINTA	-	Moderate	79.10

RICT classification using the improved index WHPT was performed on-site D30, sampled in spring 2015 (Table 3.6). D30 achieved High for WHPT-NTAXA, suggesting a diverse number of species comparable to reference conditions, whilst WHPT-ASPT was classified as Good.

Table 3.6: RICT classifications (using WHPT) for site D30 on the A5025 scheme (grey cells indicate overall classification for site) in 2015.

Site	Index	EQR	Class	Probability of Class (%)
D30	WHPT-ASPT	0.917	Good	62.2
	WHPT-NTAXA	0.955	High	70.9
	WHPT-MINTA	-	Good	62.2

3.6.4 Summary

The majority of the sites were field drains with ditch-like habitat and flow types, supporting communities typical of these habitats. A number of sites on the major watercourses and their tributaries (D18, D20 and D30), which demonstrated a good diversity of habitat and flow types for macroinvertebrates and were classified as Good quality under WFD. In general, the macroinvertebrate communities across the scheme were dominated by pollution-tolerant leeches, crustaceans, beetles and molluscs. There were two leeches, a true bug and a freshwater shrimp of Local conservation importance across the area, which coupled with high species diversity led to four sites achieving Fairly High conservation value. None of the species reported are designated for their conservation value

3.7 Macrophytes

Eight out of ten of the waterbodies originally identified for macrophyte surveys in 2014 were sampled; access was not possible at two sites (D3 and D56).

Four of the eight sites were unsuitable for LEAFPACS2 classification. One site had a saline influence (the Afon Alaw at site D20 and has not been reported on) and the remaining three (sites D4, D25 and D55, which have been described in this section) were not detailed on a 1:50,000 Ordnance Survey map, which is a pre-requisite for LEAFPACS2 index calculations and generating accurate comparison to reference sites.

3.7.1 Species present

Fool's watercress (*Apium nodiflorum*), water mint (*Mentha aquatica*), amphibious bistort (*Persicaria hydropiper*) and branched bur-reed (*Sparganium erectum*) were present at the majority of sites, and are ubiquitous species. The TCVs varied between sites, with branched bur-reed and fool's watercress the most abundant. Full species lists can be found in Appendix D.

Species indicative of nutrient-enriched slow-flowing environments, including two species of duckweed, the fat duckweed (*Lemna gibba*) and the duckweed (*Lemna minuta*), were present at sites D1 (Cleifiog), D4 and D25. The blanketweed macroalgae (*Cladophora glomerata*/*Rhizoclonium hieroglyphicum* group) was present at site D30 (Tan R'Allt). Other nutrient-tolerant species included the blunt-fruited water starwort (*Callitriche obtusangula*) present at site D25 and the mole-pelt algae (*Vaucheria* sp.) at site D45, both at low abundance (TCV 1).

3.7.2 Macrophyte indices

Table 3.7 shows the individual indices calculated from LEAFPACS2 prior to classification (sites D4, D25 and D55 were unsuitable for classification).

Table 3.7: Macrophyte indices for seven sites across the A5025 prior to LEAFPACS2 classification (River Macrophyte Nutrient Index (RMNI), NTAXA, non-scoring taxa, number of functional groups (NFG) and percentage algal cover (ALG)).

Site	Observed RMNI	Observed NTAXA (scorers)	Total NTAXA (inc. non-scorers)	Observed NFG	Observed ALG (%)
D1	7.86	7	16	6	0.5
D4	7.85	4	12	4	0.0
D18	7.25	8	15	6	0.0
D25	8.11	5	12	3	0.0
D30	7.18	6	14	4	37.5
D45	6.99	3	9	3	0.05
D55	6.19	4	15	3	0.0

The RMNI score gives an indication of nutrient enrichment, with scores ranging from 1 (low) to 10 (high). The scores varied across the sites surveyed and ranged from the lowest at site D55 (6.19) to the highest at site D25 (8.11) (Table 3.7).

Site D45 had only three scoring macrophyte species (NTAXA) which is the minimum requirement for LEAFPACS2 classification. Other sites with few scoring taxa include sites D4 and D55 (four taxa) and infer low species richness. D18 had a total of eight scoring species.

The NFG gives an indication of the proportion of truly aquatic species at each site and was low at sites D25, D45 and D55 (three). The highest NFG recorded was six at sites D1 and D18.

The observed algae cover (ALG) was very low at all sites, with the exception of site D30 with 37.5% algae cover which corresponds to the presence and abundance of the blanketweed algae.

LEAFPACS2 classification was performed on four out of the seven suitable sites. Of these four, three failed to meet the threshold for WFD Good status (Table 3.8).

Table 3.8: The results of LEAFPACS2 classification at the A5025 sites and the percentage confidence for each class. Green = Good, yellow = Moderate, orange = Poor (WFD classifications).

Site	EQR	Status	Classification of Class				
			Bad	Poor	Moderate	Good	High
D1	0.534	Moderate	0.0	4.5	75.4	20.1	0.0
D18	0.739	Good	0.0	0.0	1.8	85.4	12.8
D30	0.374	Poor	1.0	60.4	37.8	0.7	0.0
D45	0.525	Moderate	0.0	5.9	76.9	17.2	0.0

Site D1 failed of met Good quality due to the presence of two high RMNI-scoring species of duckweed. Similarly, sites D30 and D45 failed to reach Good status due to the presence of blanketweed (site D30) and mole-pelt alga (site D45). Algae are a key indicator of nutrient enrichment.

Site D18 exceeded the threshold for Good status, indicating a plant community that slightly deviates from reference condition. Site D18 had the highest number of scoring taxa and functional groups. Alkalinity is a dominant predictor value in the LEAFPACS2 model and D18 was the most acidic of the four sites classified with an alkalinity of 63mg L^{-1} $CaCO_3$.

3.7.3 Species of conservation interest

The nationally scarce three-lobed water-crowfoot (*Ranunculus tripartitus*) was recorded at D55. It is listed on *The Vascular Plant Red Data List for Great Britain* (Cheffings and Farrell, 2005) as Endangered and is also a priority species (under the NERC Act 2006, Section 42) which has declined nationally due to habitat loss.

3.7.4 Summary

The sites surveyed are typical of field drains and lowland streams in a semi-rural environment. Plant communities are broadly ubiquitous to this habitat type, reasonably tolerant of nutrient enrichment and relatively poor in species richness with few truly aquatic species.

3.8 Fish

Electric fishing surveys were carried out at three sites in May, and four sites in both August and October, representing spring, summer and autumn sampling respectively (2014).

Table 3.9: Fish survey results with size range (mm) in brackets (P = present but not caught and measured).

Site	Species	Spring	Summer	Autumn
Cleifiog (D1)	European eel	P	-	2 (410-430)
	Three-spined stickleback	P	P	1 (40)
Afon Alaw (D18)	Brown trout	4 (17-45)	3 (67-144)	40 (72-190)
	European eel	22 (50-450)	-	20 (80-400)
	River lamprey	2 (100)	-	3 (100)
	Three-spined stickleback	20 (14-48)	-	4 (28-48)
	Flounder	1 (82)	-	21 (38-97)
	Common goby	-	-	1 (45)
Afon Alaw (D20)	Brown trout		30 (54-245)	44 (65-247)
	European eel		7 (70-400)	22 (50-130)
	Lamprey (sp.)		7 (70-110)	16 (80-150)
	Three-spined stickleback		11 (15-35)	41 (20-50)
	Flounder		4 (53-140)	22 (50-130)
	Perch		-	2 (148-165)
Tan R'Allt (D30)	Brown trout	P	87 (45-178)	25 (73-210)
	European eel	P	28 (60-450)	12 (85-350)
	Lamprey (sp.)	-	1 (130)	-
	Three-spined stickleback	-	9 (12-44)	6 (18-50)

Fish surveys were carried out at D1 in three seasons in 2014; however, only qualitative sampling could be carried out owing to the water depth. The main channel was fished in spring and summer and European eel and three-spined stickleback were observed but not caught (Table 3.9). In autumn, the main channel was too deep to survey safely so a smaller side channel was qualitatively sampled. Two European eels were recorded from this channel. As this side channel is directly connected to the main channel, European eels can be assumed present in the main channel.

At site D18, fish surveys were undertaken in spring, summer and autumn in 2014. In summer, the watercourse was fished qualitatively due to choking of the channel from heavy macrophyte cover. Quantitative surveys were carried out in spring and autumn. This small watercourse supports a large number of European eel year round with 22% of the population in spring consisting of juvenile eels of less than 75mm in length (Table 3.9). Brown trout and flounder were present in both spring and autumn but were more abundant in the autumn survey. Small adult river lamprey (*Lampetra fluviatilis*) were caught in both the spring and autumn surveys. In the autumn surveys, a common goby was also caught; this, in addition to the flounder, suggests connectivity to the adjacent estuary and fluctuating salinities.

Fish surveys were carried out in summer and autumn on D20. During the spring macroinvertebrate surveys, one eel was observed and two small flounder were caught (see Section 3.8.1 for incidental records). Five species were recorded during the summer survey, and six in the autumn. Adult and juvenile lamprey (expected to be river lamprey) were recorded in both seasons, whilst two perch (*Perca fluviatilis*) were recorded in autumn only. Spring, summer and autumn surveys were carried out at D30; however, the spring survey was carried out on a short section upstream of the A5025 due to the presence of nesting moorhens on the downstream side. Four species of fish were caught from this watercourse with brown trout the most abundant (Table 3.9). A range of age classes were present for both brown trout and European eel, with one-third of the eel population consisting of individuals less than 100mm in length and almost one-third greater than 250mm in length. One lamprey was caught at this site but could not be positively identified in the field and was recorded as *Lampetra* sp.

3.8.1 Incidental sightings

In addition to the fish caught during the electric fishing surveys, a number of fish were recorded during the macroinvertebrate sampling. These are detailed in Table 3.10 below.

Table 3.10: Incidental fish records.

Watercourse	Species	Number observed
D1	Nine-spined stickleback	4
D4	Nine-spined stickleback	3
D5	Nine-spined stickleback	9
	Three-spined stickleback	1
D18	Three-spined stickleback	1
D20	Flounder	2
	European eel	1
D25	Three-spined stickleback	2
D45	Three-spined stickleback	1
D57	Three-spined stickleback	1

3.8.2 Species of conservation interest

European eel is classified as Critically Endangered by the International Union for the Conservation of Nature and stocks currently lie outside safe biological limits. European eels are afforded protection under the *Eels (England and Wales) Regulations 2009* are listed as a priority species on the Section 42 list of the NERC Act 2006. European eels require hydrological connectivity between sea and river and prefer silt or coarse substrate into which an eel can bury. Any potential impacts on watercourses at this site would need to be assessed in terms of the effects on eel habitat.

Brown trout were recorded at all sites in at least one season. Trout are listed as a priority species on the Section 42 list of the NERC Act 2006. Native to Wales, trout require a number of interconnection habitats to support different life stages, from spawning, through adolescence to full maturity. Trout may be sensitive to changes in physical habitat, water quality, oxygenation and water quality.

River lampreys were recorded on the Afon Alaw. The presence of both adult and juvenile lamprey indicate good connectivity between spawning gravels, juvenile silt beds and unimpeded access to the estuary. The existing A5025 crossing of the Afon Alaw is low in the waterbody catchment, with no barriers to migration. Channel modification can damage suitable habitat and remove spawning/nursery habitat through sediment mobilisation and alteration to flow regimes. Lampreys are indicative of good water quality and pollution and eutrophication can influence migration. River lampreys are listed as a priority species on the Section 42 list of the NERC Act 2006.

In addition to the specific species listed above, all fish species are afforded protection under the *Salmon and Freshwater Fisheries Act 1975*. The Act provides the framework for legislation relating to the input of polluting materials into watercourses; construction, alteration and removal of in-channel obstructions; closed season for fishing; licencing and enforcement.

3.9 Pond habitat assessment

Of four ponds visited, one (P14) was sampled for invertebrates and macrophytes. Pond P9 was not accessible; whilst ponds P10 and P21 had insufficient water levels for survey (see Appendix A for habitat characterisations and description of these ponds).

3.9.1 Macroinvertebrates

The majority of macroinvertebrates in P14 belonged to low-BMWP scoring families of leeches, molluscs, true flies and true bugs (see Appendix E for species list). This type of community is characteristic of standing waters with high coverage of macrophytes, fine sediment and decomposing organic matter.

ASPT was 3.5 due to the absence of any high-BMWP scoring families such as stoneflies and mayflies, and there were no Odonata (dragonflies) and Megaloptera (alderflies) (OM) families recorded. Two Coleoptera (CO) (beetle) families were present.

The macroinvertebrate community is of Fairly High conservation value, due to the presence of two species of Local conservation importance (Table 3.11).

Table 3.11: Community Conservation Index (CCI) result for Pond P14

CCI score	CCI value	Species of conservation importance
11.15	Fairly High	*Corixa panzeri* (lesser water-boatman, Local), *Erpobdella testacea* (leech, Local)

3.9.2 Aquatic pond plants

Pond 14 was dominated by bulrush (*Typha latifolia*), which formed dense stands in the shallow water and deep mud. Branched bur-reed was also prevalent along with rushes in the margins. These species, along with fool's watercress are characteristic of enriched standing waters. There were no species of conservation importance, although three relatively uncommon species occurred: water-purslane (*Lythrum portula*), nodding bur-marigold (*Bidens cernua*) and fat duckweed.

There were 15 SM in total, and the TRS of 9.00 is indicative of a pond plant community very tolerant to elevated nutrient levels.

3.9.3 PSYM quality class

The PSYM classification, along with observed indices and EQIs, are summarised in Table 3.12. For the full output (including predicted values for indices and IBI values), see Appendix E. Pond P14 was classified as Poor overall.

The SM- and U-EQIs suggest that pond P14 is supporting slightly lower species richness and fewer uncommon species than would be expected under reference conditions. The TRS-EQI of 1.60 indicates that significantly more nutrient-tolerant species are present than would be expected at reference sites.

The ASPT-EQI of 0.67 suggests that the pollution tolerance of the macroinvertebrate community is significantly higher than expected. The pond contained no Odonata and Megaloptera resulting in an OM-EQI of zero. The CO-EQI of 0.53 indicates that the number of beetle families observed is much lower than would be expected under reference conditions.

Table 3.12: PSYM results and classification of ponds. Observed indices and ecological quality indices (EQIs) (for all indices except TRS, EQI of ≥1 denotes a pond meeting or exceeding reference site quality – marked in bold). (PSYM quality category = IBI >75%=Good, 51-75%=Moderate, 25-50%=Poor, <25%=V Poor). United Kingdom Biodiversity Action Plan (UKBAP) lists those species identified as most threatened, requiring conservation action under UKBAP.

PSYM Index	Pond 14
No. of submerged and marginal plant species (SM)	15
EQI (SM)	0.81
Number of uncommon plant species (U)	3
EQI (U)	0.72
Trophic Ranking Score (TRS)	9.00
EQI (TRS)	1.60
Average Score Per Taxon (ASPT)	3.50
EQI (ASPT)	0.67
Odonata and Megaloptera (OM) families	0
EQI (OM)	0
Coleoptera families (CO)	2
EQI (CO)	0.53
Index of Biotic Integrity (%)	44%
PSYM quality category	**Poor**
Priority species (UKBAP)	0
Is this a UKBAP Priority Pond?	**No**

3.9.4 Pond water quality

In situ water quality measurements (temperature, pH, dissolved oxygen and conductivity) were collected for the ponds in spring, summer and autumn where sufficient water was present. The mean annual results from 2014 are summarised in Table 3.13. All ponds have a very similar pH of between 6.7 and 6.9, but conductivity is slightly variable with the lowest recorded at pond P21 (448µs cm^{-1}) and the highest at pond P14 (685µs cm^{-1}). The dissolved oxygen percentage is variable between ponds, with the lowest measurements at pond P10 (49.2%) and the highest at pond P14 (79.2%).

Table 3.13: Water quality measurements for ponds, taken *in situ* with YSI-sonde (averaged from three seasons; *denotes spring and summer only, **denotes summer and autumn only).

Site	Temperature (°C)	Conductivity (µs cm^{-1})	pH	Salinity	DO sat (%)	DO (mg L^{-1})
P10*	14.1	575	6.7	0.36	49.2	5.10
P14	14.5	685	6.8	0.42	79.2	8.01
P21**	12.2	448	6.9	0.32	55.0	5.63

Water quality samples for determinands requiring laboratory analysis (such as nutrients, metals and solvents) were taken in 2014 over three seasons (averaged where possible) and in spring 2015 (Table 3.14). EQS thresholds and WFD limits were not designed for use in classification of ponds, so they have not been applied.

In 2014, ponds P21 and P14 had broadly similar readings of nutrients and metals. Pond P10, which is heavily poached by sheep and cattle, had particularly high levels of ammoniacal nitrogen (6.29mg L^{-1}), arsenic (53.28µg L^{-1}), lead (9.20µg L^{-1}), zinc (43.85µg L^{-1}), iron (13,100µg L^{-1}) and manganese (4,255µg L^{-1}). It also had the highest BOD of 18.5mg L^{-1}. Suspended solids were much lower at P21 than in the other two ponds (8mg L^{-1}).

In 2015, water quality samples were collected from pond P21 in spring (Table 3.14). These results were broadly similar to those readings in 2014, with the exception of iron and manganese being greater in 2015.

Table 3.14: Mean water quality determinands for ponds (2014 – 2015) analysed by National Laboratory Service (averaged from three seasons; *denotes spring and summer only, **denotes spring and autumn only, * denotes spring only).**

Year	2014			2015
Site	P10 *	P14	P21 **	P21***
Alkalinity, dissolved as $CaCO_3$ (mg L^{-1})	107.5	99.6	187.0	180
BOD 5 Day ATU (Allyl thiourea) (mg L^{-1})	18.5	13.0	2.1	3.6
Suspended solids (mg L^{-1})	353	72	8	12.5
Orthophosphate, reactive as P (mg L^{-1})	0.35	0.20	0.56	0.202
Chloride (filtered) (mg L^{-1})	58.2	80.8	46.2	49.5
Ammoniacal nitrogen as N (mg L^{-1})	6.29	2.16	0.38	0.461
Arsenic (µg L^{-1})	53.28	15.37	5.84	5.35
Cadmium (µg L^{-1})	0.23	<0.1	<0.1	<0.1
Chromium (µg L^{-1})	6.95	1.29	<0.5	<0.5
Copper (µg L^{-1})	12.82	4.06	3.74	3.62
Lead (µg L^{-1})	9.20	2.76	<2	2.58
Nickel (µg L^{-1})	6.70	1.87	3.08	5.75
Zinc (µg L^{-1})	43.85	15.10	9.48	<5
Iron (µg L^{-1})	13,100	2,165	435	1,000
Manganese (µg L^{-1})	4,255	495	444	950
Mercury (µg L^{-1})	0.01	0.02	<0.01	<0.01

3.9.5 Summary

The only pond (P14) eligible for full classification on the scheme was of Poor quality. Plants present are mainly commonly occurring, nutrient-tolerant species. The PSYM macroinvertebrate indices suggest that communities are typical of standing, slightly enriched waters with fewer key indicator families than expected; however, there were two species of Local conservation value. Water quality is variable between the ponds, with particularly high BOD and levels of nutrients and metals at P10.

4. Evaluation

The physical habitat of the sites is characteristic of watercourses that have undergone some level of human intervention, with a high proportion of channels affected by over-deepening, realignment or both. This has repercussions for the kind of habitat created within these streams, with limitations on flow diversity where the channel is more uniform, and potential for sediment deposition in oversized channels relative to the volume of water carried if the stream were natural.

The diatom communities varied across the sites. The variation is to be expected considering the range of habitats (flow types and substrates) present and is reflective of differing seasonal flow conditions and factors, such as preceding wet weather events and suspended solids concentrations. As such, a single field visit can be seen as a snapshot of conditions at that time, but repeated surveys can create a more complete picture of the inherent variation in a community based on the natural variations within a watercourse subject to seasonal shifts. No species of conservation interest were recorded.

Water quality was generally found to be moderate to good. There were incidences of elevated orthophosphates at some sites, which may be attributed to agricultural land use and periodic application of fertilizers. Application of fertilisers and pesticides can contain concentrations of heavy metals that may end up in watercourses. Copper, iron and zinc were elevated at a number of the A5025 sites. Runoff from roads may also contribute to elevated levels of these metals in the watercourse; however, it is beyond the scope of this study to determine the provenance of these metals. The major watercourses Afon Alaw and Tan R'Alt were indicative of Good status due to good water quality, diverse clean gravel substrate, variety of flow types and some macrophyte cover. The other major watercourse, D1, had low flow velocities and was heavily overlain with silt, which limits invertebrate diversity.

For the remaining smaller watercourses, macroinvertebrate communities of the majority of sites were dominated by low to medium BMWP-scoring families such as leeches, crustaceans, beetles and molluscs. This could be attributed to a combination of sedimentation and lack of habitat/flow diversity and water quality (enrichment from improved pasture). In the main watercourses, medium to high BMWP scorers, such as caddisflies and mayflies, were present as well, which is consistent with the higher flow and habitat diversity in these reaches and the limited nutrient enrichment here.

Macrophyte analysis revealed that the number of truly aquatic groups was generally low because of the low flows and silted substrates within the ditch systems in the study area. The majority of land use was improved pasture in close proximity to roads, which explains the dominance of common species with moderate to high tolerance for nutrient enriched water. There were some records of alkaline-tolerant bryophyte and liverwort species found in more acid environments including smaller lattice-moss (*Cinclidotus fontinaloides*) and endive pellia (*Pellia endiviifolia*), which may indicate fluctuations in pH levels at these sites.

Based on the data available, there is evidence of nutrient enrichment relative to the low baseline expected from the west of Britain. The relatively uniform habitat and low water levels are not conducive to diverse invertebrate life, which explains the low species diversity. The ponds visited on the scheme are largely ephemeral and heavily influenced by agriculture. Water quality was variable between ponds. P10 had particularly high BOD, metal concentrations and suspended solids, and low oxygen content – most likely due to heavy poaching (and associated defecation), lack of macrophytes and ion-rich soils. P14 had the highest oxygen content, probably due to high coverage of macrophytes.

Electric fishing surveys were carried out at four sites in the study area. Of the four sites surveyed, the watercourses D18 and D20 were found to have the greatest variety of species. A contributing factor here is likely to be the proximity of these sites to the sea, which augmented the species composition with marine/estuarine species such as flounder and common goby. The Afon Alaw (D18 and D20) support populations of lamprey. The presence of both juveniles and adult lamprey suggest that these watercourses are important spawning grounds, containing both suitable gravels for spawning and silt beds for juveniles. Perch were also recorded in these watercourses and are not thought to be native to Anglesey. It is likely the presence of this species is a result of stocking for coarse fishing, which is carried out at a number of locations on Anglesey (Pers comm: The Barn at Anglesey, Neuadd). The size range of brown trout at sites on the Afon Alaw and Tan R'Allt indicate that suitable habitat is available for most life stages of this species within these catchments. The presence of European eel at all sites surveyed demonstrates that access to these watercourses from the sea is good.

Brown trout, European eel and river lamprey are Section 42-listed species of principal importance for conservation of biological diversity in Wales, produced as a requirement of the NERC Act 2006. In addition, these three species are in the WFD guidelines, which require maintenance of access routes within a river catchment for these species. All species of lamprey are listed under Annex II of the EU Habitats Directive and Appendix III of the Bern Convention, and European eel receive protection under the *Eels (England and Wales) Regulations 2009*.

In contrast, Cleifiog (D1) appears to be species poor, containing only European eels and stickleback. This may be indicative of barriers to migration for other species or simply a result of poor habitat quality. Based on physical habitat assessments, water quality and macroinvertebrate indices, this site was shown to be silt laden, lacking in invertebrate diversity; thus, habitat quality is likely to be the chief influencing factor on fish species diversity also.

5. Conclusions

The habitats crossed by the A5025 were found to be typical of coastal watercourses in lowland rural landscapes. Evidence of historic modification to channel planforms was reported across main rivers and ditch sites. A number of the minor tributaries were observed to be ephemeral, only supporting water during high rainfall events or over winter. Habitats differed between the main watercourses, which exhibited areas of good flow and habitat diversity with exposed gravels and some healthy macrophyte cover, and the slow-flowing silt-laden ditches typified by poor macrophyte and macroinvertebrate diversity. Water quality overall was moderate to good with evidence of nutrient input, most likely linked to riparian land use activity.

Macroinvertebrate diversity was lower than expected overall, but some species of local interest were recorded; however, none which are considered as rare or notable species were recorded. The invertebrate communities recorded are typical of lowland watercourses and the habitats they support.

The overall species richness for macrophytes surveyed was considered poor. There was one plant species of note – the nationally scarce three-lobed water-crowfoot (*Ranunculus tripartitus*). It is listed on The Vascular Plant Red Data List for Great Britain (Cheffings and Farrell, 2005) as Endangered and is also a priority species which has declined nationally due to habitat loss.

Watercourses along the route of the A5025 between Valley and Tregele provide a variety of habitats, with the larger watercourses capable of supporting several species of fish, including those of conservation importance (European eel, lamprey and brown trout). The size range of these species indicates the suitability of the watercourses for all stages of the life cycle, including spawning and juvenile habitat. The smaller watercourses and field ditches support a limited number of species, including European eel and three- and nine-spined stickleback. The presence of European eel at all sites indicates good connectivity with the sea and access for adults and juveniles during migratory cycles.

6. References

Beaumont, W. R. C., Taylor, A. A. L., Lee, M. J. and Welton, J. S. (2002). *Guidelines for Electric fishing Best Practice*. Environment Agency R & D Technical Report W2-054/TR. Bristol, Environment Agency.

British Standards Institution. (2003). *BS EN 14011:2003*. *Water Quality. Sampling of Fish with Electricity*. British Standards Institution, London.

British Standards Institution. (2012). *BS EN ISO 10870:2012. Water Quality. Guidelines for the selection of sampling methods and devices for benthic invertebrates in freshwaters*. British Standards Institution, London.

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

Cheffings, C and Farrell, L. (Editors), (2005). The Vascular Plant Red Data List for Great Britain, ISSN 1473-0154.

Department of Energy and Climate Change (2011). *National Policy Statement for Nuclear Power Generation (EN-6)*. The Stationery Office, London.

The Eels (England and Wales) Regulations 2009 (SI 2009/3344). The Stationery Office, London.

Environment Agency. (2001). *Electric fishing Code of Practice*. EAS/6100/4/02. Environment Agency, Bristol.

Environment Agency. (2007a). *Technical reference material: sampling diatoms from rivers and lakes*. Operational instruction. Environment Agency, Bristol.

Environment Agency. (2007b). *Technical reference material: WFD electric fishing in rivers*. Operational instruction. Environment Agency, Bristol.

Environment Agency. (2008). *Freshwater macroinvertebrate analysis of riverine samples*. Document number 024_08.

Environment Agency. (2011). *Surveying freshwater macrophytes in rivers*. Operational instruction 131_07.

Environment Agency. (2012). *Freshwater macroinvertebrate sampling in rivers*. Operational instruction. Document no. 018_08.

Extence, C., Balbi, D. and Chadd, R. (1999). River flow indexing using British benthic macroinvertebrates: a framework for setting hydroecological objectives. *Regulated Rivers: Research & Management*. 15(6):. 545–574.

Extence, C. A., Chadd, R.P., England, J., Dunbar, M.J., Wood, P.J. and Taylor, E.D. (2011). The assessment of fine sediment accumulation in rivers using macroinvertebrate community response. *Rivers Research and Application*, 29(1): 17–55.

Hawkes, H.A. (1997). Origin and development of the biological monitoring working party score system. *Water Research*, 32 (3): 964–968.

IEEM. (2006). *Guidelines for ecological impact assessment in the United Kingdom* (version July 2006). [Online] Available at: http://www.cieem.net/ecia-guidelines-terrestrial-freshwater-and-coastal- [Accessed 08/01/2015].

Jacobs. (2014). *Consultancy Report: A5025 Terrestrial Ecology Factual Report 2014*. Document number: 60PO8008/TER/REP001

Kelly, M.G., Yallop, M.L., Hirst, H. & Bennion, H. (2005). Sample collection. Version 2.1. Unpublished DARES/DALES protocol. [Online] Available at: http://craticula.ncl.ac.uk/dares/methods.htm [Accessed 30/10/14].

Mott MacDonald. (2014). *A5025 Route Improvement Contract Preliminary Ecological Appraisal May 2014*.

Natural Environment and Rural Communities (NERC) *Act 2006* (c. 16). The Stationery Office, London.

Natural Resources Wales (2016). [Online] Available from: https://naturalresources.wales/splash?orig=/ [April 2016].

Natural Resources Wales (2014a) *Water Framework Directive: River Catchment Summary – Tan R'Allt, 12/02/2014.* [Online] Available from: https://drive.google.com/file/d/0B2hsDbbdxz1ta0ZZZXFXNXd5dFk/edit?pref=2&pli=1 [Accessed: 30/03/2016].

Natural Resources Wales (2014b) Water Framework Directive: River Catchment Summary – Alaw, 12/02/2014. [Online] Available from: https://drive.google.com/file/d/0B2hsDbbdxz1tN0M3MV9qZ3NTQUk/edit?pref=2&pli=1 [Accessed: 30/03/2016].

Planning Act 2008 (c. 29). The Stationery Office, London.

Pond Action (1998). *A guide to the methods of the National Pond Survey*. Pond Action, Oxford.

Pond Action. (2002). *A guide to monitoring the ecological quality of ponds and canals using PSYM.* Pond Conservation Trust, Oxford Brookes University, Oxford and the Environment Agency, West Midlands.

Salmon and Freshwater Fisheries Act 1975 (c. 51). Her Majesty's Stationery Office, London.

SNIFFER. (2007). *River Invertebrate Classification Tool-System Developments*. Detailed functional specification. SEPA. Stirling.

Water Framework Directive – United Kingdom Technical Advisory Group (WFD-UKTAG) (2014a). *UKTAG Rivers Assessment Method. Macrophytes and Phytobenthos. Phytobenthos – Diatoms for Assessing River and Lake Ecological Quality (River DARLEQ2)*. WFD-UKTAG, Edinburgh.

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

Water Framework Directive – United Kingdom Technical Advisory Group (WFD-UKTAG). (2014c). *Guide to Invertebrates in Rivers Invertebrates (General Degradation): Whalley, Hawkes, Paisley & Trigg (WHPT) metric in River Invertebrate Classification Tool (RICT)*. WFD-UKTAG, Stirling.

7. Glossary

Acronym	Term	Definition
ALG	Cover of green filamentous algae	Macrophyte index used to calculate the percent algal cover.
ASPT	Average score per taxa	The ASPT for a given site is a calculation of the average of the tolerance scores of all macroinvertebrate families found, and ranges from 0 to 10.
BMWP	Biological Monitoring Working Party	An invertebrate scoring system which indicates the pollution tolerance of invertebrates at a given site.
BOD	Biological oxygen demand	Biochemical oxygen demand is a measure of the quantity of oxygen used by microorganisms in the oxidation of organic matter.
CCI	Community Conservation Index	CCI represents the national rarity and diversity of invertebrate species identified at a site and designates a conservation value to the sampled community based upon both a species rarity and the overall community richness.
CO	Coleoptera	Number of Coleoptera families indicates the habitat quality and diversity of a pond.
DARLEQ2	Diatoms for Assessing River and Lake Ecological Quality	Microsoft Windows® program for the assessment of river and lake ecological status using diatoms.
EQI	Ecological quality indices	Observed data collected from pond surveys is predicted against values generated by analysts at Freshwater Habitats Trust to calculate ecological quality indices.
EQR	Ecological Quality Ratios	As per EQI above, EQR is the ratio which incorporates the key WFD requirements for ecological classification: typology, reference conditions and class boundary settings.
IBI	Index of Biological Integrity	A measure of the output from several pond habitat metrics, which is interpreted as a final percentage, and assigns a quality class.
LEAFPCAS2	n/a	A classification method that assesses macrophytes in rivers according to the requirements of the Water Framework Directive (WFD).
LIFE	Lotic-invertebrate Index for Flow Evaluation	Each macroinvertebrate species or family within a sample is assigned to a flow group depending on their flow/velocity preference, giving two indices: LIFE (sp.) and LIFE (F). A high LIFE score represents a higher number of taxa with a preference for high-velocity habitats and vice versa.
MRV	Minimum Reporting Value	The lowest concentration of a substance that is reported in any analysis. It usually represents the acceptable background concentration for a given substance according to water quality guidelines.
NFG	Number of Functional Groups	Number of functional groups is a macrophyte metric used to measure how truly aquatic the community is.
NRW	Natural Resource Wales	Welsh Government Sponsored Body that since 2013 has

Acronym	Term	Definition
		completed the functions of the Countryside Council for Wales, Forestry Commission Wales and the Environment Agency in Wales.
NTAXA	Number of scoring taxa	A measure of the number of species taxa present at a given site.
OM	Odonata and Megaloptera	Number of Odonata and Megaloptera families indicates long-term quality of a pond as larvae have a long aquatic life stage.
PAH	Polycyclic Aromatic Hydrocarbons	The term polycyclic aromatic hydrocarbons (PAHs) refers to a group of several hundred chemically-related environmentally persistent organic compounds of various structures and varied toxicity.
PSI	Proportion of Sediment-sensitive Invertebrates	Macroinvertebrate families within a sample are assigned a score based on their sensitivity to sediment. The resulting PSI scores indicate how sedimented the watercourse is from Minimally Sedimented to Heavily Sedimented.
PSYM	Predictive SYstem for Multimetrics	PSYM is a method for assessing the biological quality of still waters in England and Wales.
RICT	River Invertebrate Classification Tool	A method which enables the assessment of the condition of the quality element, 'benthic invertebrates', listed in Table 1.2.1 of Annex V of the Water Framework Directive.
RMNI	River Macrophyte Nutrient Index	The measure of which plants grow in the river and their association with high nutrients. RMNI is measured on a scale from 1-10.
SM	Number of submerged and marginal (not floating) species	The number of submerged and marginal (not floating) species indicates plant species richness of a site.
TCV	Taxon cover values	An estimate of the percentage cover of a particular species at a given survey site
TRS	Trophic Ranking Score	Indicator of nutrient tolerance on a scale of 1 to 10 (10 = very tolerant).
U	Number of uncommon plant species	The number of uncommon plant species is used as a measure of conservation value of a plant community.
UKBAP	UK Biodiversity Action Plan	UKBAP describes the biological resources of the UK and its associated conservation plans for these resources.
WFD	Water Framework Directive	EU Water Framework Directive (2000/60/EU) (WFD) 2000.
WHPT	Walley, Hawke, Paisley & Trigg	a score based on the tolerance of different freshwater macroinvertebrates to organic pollution and relative abundance. Each macroinvertebrate family is assigned a score depending on their tolerance to pollution. The WHPT score is the total of all the scores from a given sample.

Appendix A. Habitat characterisations

Site Reference	D1 - Cleifiog
Grid Reference	SH 29887 79010
Access: Yes	**Wetted**: Yes

Site Description

Access to this site was only available on the downstream side of the bridge. The channel width averages 3.5m with banks around 1m high. Water depth varies throughout the site, shallow at the bridge and deepening downstream and is dominated by glide flow type. The substrate is cobble at the bridge and silt/organic matter downstream.

Surrounding land use is rough pasture on the right bank and scrub, rough pasture and bog on the left bank. When visited in spring the channel had been recently dredged (top photograph), but when visited in summer, the channel was heavily vegetated (bottom photograph).

A tributary drain enters the watercourse downstream and then the watercourse flows into a large wetland area.

Surveys

Water quality, diatoms, macroinvertebrates, macrophytes and fish.

<table>
<tr><th>Site Reference</th><th>D2</th></tr>
<tr><td>Grid Reference</td><td>SH 29400 78827</td></tr>
<tr><td>Access: Via Public Right of Way</td><td>Wetted: Yes</td></tr>
<tr><td>Site Description
Channel is 1.5m wide and averages 10cm deep. The grassy earth banks are around 1m high and the substrate is fine silt with some terrestrial grasses.

The watercourse is surrounded by improved pasture on the left bank and a rail line on the right bank. Where the watercourse turns to run along the rail line there is a polluted backwater. At the downstream end the watercourse flows into a large wetland area (joined by D1).

The channel has been artificially straightened and deepened.

Surveys
None</td><td>
</td></tr>
</table>

<table>
<tr><th>Site Reference</th><th>D3</th></tr>
<tr><td>Grid Reference</td><td>SH 29551 79204</td></tr>
<tr><td>Access: No</td><td>Wetted: Yes</td></tr>
<tr><td>Site Description
Access to this site was not available so the assessment was carried out from the adjacent footpath. The channel width averages 2m, with bank height approximately 1m and water depth of around 10cm. Soft mud substrate and exposed earth banks.

The surrounding land is rough pasture on the right bank and a wall and road on the left bank. It is unlikely that the watercourse will flood during high flow conditions.</td><td></td></tr>
</table>

The watercourse receives input from a field drain at the upstream end. The channel has been historically straightened and deepened, with an embankment on the left bank.

Surveys

None

Site Reference	D4
Grid Reference	SH 29707 79466
Access: Yes	Wetted: Yes

Site Description

Average channel width 1.5m, 15–30cm water depth and vegetated earth banks around 25cm high. Silt organic matter substrate, approximately 10cm deep. High macrophyte cover.

Rough pasture on left bank and bordered by hedgerow and the A5025 on the right bank.

The ditch has been widened and straightened but is likely to spill onto the surrounding pasture at the top end where it is connected to the remnants of the old natural drainage ditch. This watercourse is connected to D5 at the upstream end and D3 at the downstream end.

Surveys

Water quality, diatoms, macroinvertebrates and macrophytes.

Site Reference	D5
Grid Reference	SH 29558 79612
Access: Yes	**Wetted:** Yes

Site Description

Average channel width around 2m, with water depth of 30cm and banks a further 30cm in height. The substrate is soft silt and organic matter and there is a substantial amount of grass growing in the channel.

The surrounding land use is rough pasture on both banks and is subject to grazing by sheep.

The section of the watercourse running through the centre of the field appears natural and there is a ponded area where a small channel joins the main channel. The watercourse is then straightened to run along the northern edge of the field, under the A5025 and into D4.

Surveys

Water quality, diatoms and macroinvertebrates.

Site Reference	D7
Grid Reference	SH 30006 79830
Access: Yes	**Wetted:** Yes

Site Description

This channel had recently been dredged at the time of survey. The channel averages 1.5m wide with 40cm water depth and bank height of 40cm above the water level. The substrate is soft silt and the banks are earth, bare at the time of survey but subsequently vegetated.

The surrounding land use is rough pasture on both banks.

The channel is deepened and straightened. A

network of small field ditches drain into D7, which in turn flows under the A5025 and eventually joins D4.

Surveys

None

Site Reference	D16
Grid Reference	SH 32004 81581
Access: Yes	**Wetted:** Yes

Site Description

This site is a network of field drains which feed into a main channel along the eastern edge of the field. The main channel is 1.5m wide, with 30cm deep water and banks 35cm high. The substrate is earth and organic matter and sections are heavily choked with terrestrial grass.

The surrounding land use is arable fields on the left bank and a hedgerow then pasture on the right bank.

Several deepened and straightened field ditches drain into the watercourse, which then flows into D18.

Surveys

None

Site Reference	D18 – Afon Alaw
Grid Reference	SH 31980 82062
Access: Yes	**Wetted:** Yes

Site Description

Channel width averages 1.5m, water depth of 50cm and bank height 40cm above the water level. Substrate is varied with around 40% mud, 50% gravel and 10% cobble and pebble. Banks are well vegetated earth with a small amount of undercutting. The predominant flow type is glide with small sections of run and riffle.

Surrounding land use is improved pasture on the left bank and mixed woodland, grass and scrub on the right. Poaching by cattle is evident on the left bank.

This watercourse is not obviously modified. D16 is a tributary of this watercourse, which subsequently flows into D20 (bottom photograph). During the summer surveys, this watercourse was heavily choked with macrophytes but in both spring and autumn was relatively clear.

Surveys

Water quality, diatoms, macroinvertebrates, macrophytes and fish.

Site Reference	D20 – Afon Alaw
Grid Reference	SH 32002 82281
Access: Yes	**Wetted:** Yes

Site Description

Average channel width 3.5m, variable water depth ranging from 15cm–80cm, average bank height over 1m. Substrate comprises around 50% gravel/pebble and 40% silt, with small areas of bedrock and boulder. Flow type is predominantly glide.

Surrounding land use is improved pasture on both banks. The banks are vegetated earth but there is substantial trampling and collapse on the left bank.

A small field ditch enters the watercourse on the right bank, and D18 joins the watercourse close to the A5025 bridge. A small weir (approximately 0.5m) is present upstream of the confluence with D18. **Surveys** Water quality, diatoms, macroinvertebrates and fish.	

Site Reference	D23
Grid Reference	SH 31632 82749
Access: No	**Wetted:** Yes
Site Description This site is a small field ditch running along the edge of a field to which no access was permitted. The channel is 1m wide with an estimated water depth of 30cm. The grassy earth banks are 50cm high. There is little flow and the substrate is mud. Surrounding land use is improved pasture on both banks although a dry stone wall separates the channel from the field on the right bank. The channel has been deepened and forms a ponded area at the field corner (P9). **Surveys** None	 

Site Reference	D24
Grid Reference	SH 31333 83021
Access: No	**Wetted:** Yes

Site Description

This site is a field ditch to which no access was granted, and so it was assessed from the adjacent footpath. The channel averages 1.5m wide, with approximately 25cm water and a soft mud substrate. There is little flow.

The surrounding land use is improved pasture on the left bank and a hedge separates the watercourse from a road on the right bank.

The ditch is not obviously modified but receives input from D25 via a culvert under the A5025.

Surveys

None

Site Reference	D25
Grid Reference	SH 31405 83007
Access: Yes	**Wetted:** Yes

Site Description

Channel width of 2m, 30cm water depth and bank height of around 50cm. There is very little flow, resulting in a soft mud substrate. Sections of this watercourse are heavily vegetated.

The surrounding land use is mostly improved grassland on both banks, although a private garden borders the ditch on the right bank near the A5025.

This site is fed by a series of small man-made field ditches and flows under the A5025 into D24. **Surveys** Water quality, diatoms, macroinvertebrates and macrophytes.	

Site Reference	**D28 - Tan R'Allt**
Grid Reference	SH 31744 83951
Access: Yes	**Wetted:** Yes
Site Description This site is a short (40m) section of river between two road bridges. The channel is around 5m wide and 45cm deep, with banks around 1m high. The substrate is mixed but contains a large amount of cobble and pebble. Flow is relatively fast run and riffle. The surrounding land use is improved pasture on both banks, with gorse present along much of the length. Poaching and bank erosion is evident at the upstream end. There are no tributaries or inputs in this section. Obvious modifications include bridges at both ends and the concrete extending along both banks at the downstream end. This river is renamed D30 on the opposite side of the A5025 road bridge. **Surveys** Water quality, diatoms, macroinvertebrates and fish (spring only).	

<table>
<tr><th>Site Reference</th><th>D30 – Tan R'Allt</th></tr>
<tr><td>Grid Reference</td><td>SH 31563 83708</td></tr>
<tr><td>Access: Yes</td><td>Wetted: No</td></tr>
<tr><td>Site Description
Average channel width of 3m, water depth varies at over 1m in places but averages 50cm. Grassy earth banks average 1m high and are eroded in places. The flow type is mixed with glides, runs and riffles throughout and deep pools at the downstream end. The substrate is mixed with a high proportion of boulder and cobble.

Surrounding land use is improved pasture on both banks. Sporadic patches of gorse are present along both banks and poaching is evident at the upstream end.

The watercourse is not obviously modified with the exception of the A5025 road bridge at the upstream end.

Surveys
Water quality, diatoms, macroinvertebrates, macrophytes and fish.</td><td>
</td></tr>
</table>

<table>
<tr><th>Site Reference</th><th>D40</th></tr>
<tr><td>Grid Reference</td><td>SH 31630 86554</td></tr>
<tr><td>Access: Yes</td><td>Wetted: Yes</td></tr>
<tr><td>Site Description
This site is a field ditch that forms a ponded area at the bottom of the field. The channel averages 50cm wide, with 15cm water depth and bank height of 50cm. Flow type is slow glide and run. The substrate is a mixture of gravel and organic matter and a there is a substantial amount of terrestrial grass within the channel.

The surrounding land use is improved pasture on both banks but a dry stone wall separates</td><td></td></tr>
</table>

<table>
<tr><td>the ditch from the field on the right bank along much of its length.

The ditch appears to be man-made and is culverted at the upstream end to allow access to the adjacent field.

Surveys
Water quality and diatoms (at the ponded section).</td><td></td></tr>
</table>

Site Reference	D43
Grid Reference	SH 32042 87683
Access: Yes	**Wetted:** Yes

<table>
<tr><td>Site Description
This small stream runs along the boundary of two fields. The channel averages 1m and 35cm deep, with banks around 1m high. Flow types are a mixture of run and glide and the substrate is a mixture of silt (60%), gravel (30%) and cobble (10%).

The surrounding land use is improved pasture on both banks but scrub and scattered trees are present on the right bank. At the downstream end, the watercourse runs through an area of thick scrub, which reduces visibility of channel features.

No modifications were obvious but the ditch may have been deepened.

Surveys
None</td><td>
</td></tr>
</table>

Site Reference	D44
Grid Reference	SH 32219 87826
Access: Yes	**Wetted:** Yes

Site Description

The average channel width at this site is 40cm, with 30cm water depth and bank height of 40cm. There is a mixture of run and glide flow types and a mud and soft organic matter substrate.

The land use on both sides is improved pasture.

This ditch receives input from D45 via a culvert under the A5025 and flows into D43.

Surveys

None

Site Reference	D45
Grid Reference	SH 31961 87953
Access: Yes	**Wetted:** Yes

Site Description

This site is a field ditch averaging 1.5m wide and 20cm deep with 0.75m high banks. It is a slow run/glide with a predominantly soft mud substrate with small patches of gravel.

The surrounding land use is improved pasture on the left bank and rough pasture on the right. Poaching is evident in areas along the vegetated earth banks.

The ditch appears to be deepened. A small

field drain enters the watercourse approximately 80m upstream of the A5025 and there is a culvert allowing access into a neighbouring field. Close to the A5025, another field ditch joins the watercourse on the left bank. **Surveys** Water quality, diatoms and macrophytes.	

Site Reference	D53
Grid Reference	SH 34004 89778
Access: No	**Wetted:** Yes
Site Description This small watercourse has an average width of 25cm, water depth of 5cm and bank height of 40cm. It has a run flow type with cobble/pebble/gravel substrate. The watercourse is surrounded by improved pasture on the left bank and a dry stone wall and road on the right. There are no obvious modifications to this watercourse. **Surveys** None	 

Site Reference	D54
Grid Reference	SH 33705 89523
Access: Yes	**Wetted:** Yes

Site Description

This small drainage ditch has an average width of 20cm, depth 10cm and bank heights of 1m on the right and 40cm on the left. It has a run flow type and substrate comprised of bedrock (60%), cobble (20%) and gravel (20%).

The surrounding land use is improved pasture on both sides although the watercourse is bordered by scrub on the banks.

There are no obvious modifications to the watercourse but it is within the banked section between two fences.

Surveys

None

Site Reference	D55
Grid Reference	SH 33660 89692
Access: Yes	**Wetted:** Yes

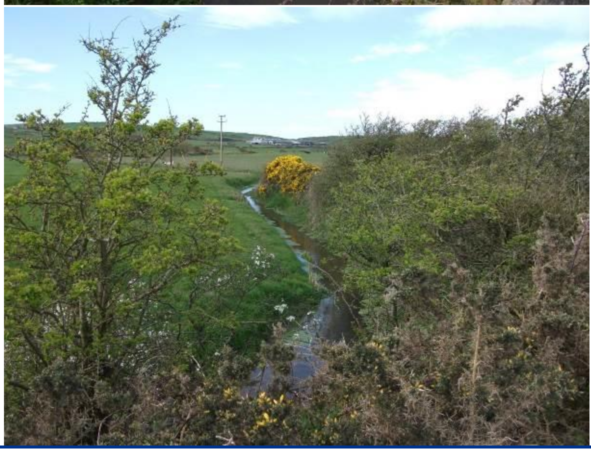
Site Description

The width and depth of this watercourse vary but average 40 cm and 20cm respectively. Bank height varies from 20cm to 1m. The flow type is run and cascade predominantly and the substrate comprises 40% bedrock and 60% cobble/pebble/gravel.

The stream runs down a relatively steep hill through the middle of an improved pasture.

The watercourse itself is not obviously

modified but is culverted at the upstream end under the A5025 (into D54) and at the downstream end under a farm access track and into the adjacent field. **Surveys** Water quality, macroinvertebrates, diatoms and macrophytes.	

Site Reference	**D56**
Grid Reference	SH 34050 90198
Access: No	**Wetted:** Yes
Site Description Access to this site was not permitted so the assessment was carried out from a distance. The channel dimensions are around 1m, water depth 40cm and bank height 1m. Glide flow type and silt substrate were observed. The surrounding land use is improved pasture on both banks, although a section runs along the road on the right bank. The watercourse appears to be over-deepened. The watercourse originates from Pond 110 and flows into D57. **Surveys** None	 

Site Reference	D57
Grid Reference	SH 34097 90243
Access: Yes	**Wetted:** Yes

Site Description

Channel width averages 2m, 40cm deep and bank height of 1m. The substrate is 50% silt and 50% gravel/pebble/cobble. The flow type is run and glide.

The surrounding land use is improved pasture on both banks but there is extensive gorse cover along both banks.

The ditch appears to be over-deepened and is culverted under a field access gate. The upstream section of the watercourse was not accessible but originates from D56.

Surveys

Water quality, diatoms and macroinvertebrates.

Site Reference	D59
Grid Reference	SH 34257 91019
Access: Yes	**Wetted:** Yes

Site Description

This small watercourse runs along the boundary between two fields and forms a small ponded section at the downstream end. The channel dimensions average 40cm wide, 15cm deep with 30cm high banks. The substrate is 50% silt, 40% gravel and 10% cobble.

The surrounding land use is improved pasture, although there are sporadic gorse and brambles on both banks.

The watercourse does not appear to be modified with the exception of a small pipe culvert at the field access. **Surveys** Water quality, diatoms and macroinvertebrates.	

Site Reference	**D62**
Grid Reference	SH 34344 91456
Access: In spring only	**Wetted:** Yes
Site Description This watercourse averages 50cm wide, 5cm deep with 40cm high banks. The flow type is run and the substrate is 70% and 30% cobble/pebble. The surrounding land use is improved pasture on both banks with a drystone wall on the left bank at the upstream end, crossing to the right bank at the downstream end. This stream receives input from a road drain off the A5025. The watercourse does not appear modified in the survey section but looks to be straightened downstream. **Surveys** Water quality, diatoms and macroinvertebrates (spring only).	

Site Reference	D67
Grid Reference	SH 35529 93043
Access: Yes	**Wetted:** Yes
Site Description This is a slow flowing ditch which connects several ponds. Where there is a discernible channel, it averages 2m wide and 5cm deep. There are no banks and the area is heavily poached mud. The surrounding land use is improved pasture. The ditch does not appear to be modified. **Surveys** Water quality and diatoms (spring only).	 

Site Reference	**D128**
Grid Reference	SH 34596 90203
Access: No	**Wetted:** Yes

Site Description

No access was permitted to this watercourse, so an assessment was made from a distance. The watercourse appears to be a man-made ditch which forms a ponded section next to the road. The channel width looks to be around 2m. The depth and substrate could not be determined, but it is likely to be shallow with a silt/organic matter substrate.

The surrounding land use is improved grassland on the left bank and a marshy area on the right bank.

Surveys

None

Site Reference	**Pond 9**
Grid Reference	SH 31606 82759
Access: No	**Wetted:** Yes

Site Description

No access was permitted to this pond. The site appears to be a ponded area of D25. It is approximately 5m x 8m, and while the depth is unknown, the substrate is likely to be mud.

The pond is surrounded by improved pasture on one side and a drystone wall and hedge on the other.

Surveys

None

Site Reference	Pond 10
Grid Reference	SH 31705 83080
Access: Yes	**Wetted:** Yes

Site Description

This is a large pond in the middle of an improved pasture field. The approximate dimensions are 27m x 20m and it appears around 50cm deep. The substrate is soft mud.

The pond is heavily poached by cattle and sheep. During the summer months, the pond almost dries up, forming a few small stagnant puddles (see bottom photograph).

Surveys

Water quality and diatoms (spring only)

Site Reference	Pond 13
Grid Reference	SH 31809 86422
Access: Yes	Wetted: Ephemeral

Site Description

This pond is adjacent to P14 in a hollow in the field opposite the Black Lion. It is approximately 10m x 5m in size. The depth is unclear and the substrate is soft mud.

The surrounding land use is improved pasture, although the area immediately surrounding the pond is marshy grassland and gorse. This pond dries in the summer months.

Surveys

None

JACOBS

Site Reference	Pond 14
Grid Reference	SH 31797 86404
Access: Yes	**Wetted:** Yes
Site Description This pond is adjacent to P13 in a hollow in the field opposite the Black Lion. It is approximately 45m x 45m in size, over 50cm and the substrate is soft mud. There is a large reed bed in the middle of the pond and the banks are subject to a small amount of poaching. In the summer months, the water level drops significantly (bottom photograph). **Surveys** Water quality and diatoms	 

Site Reference	Pond 21
Grid Reference	SH 31538 87251
Access: Yes	**Wetted:** Ephemeral
Site Description This large pond is in a hollow in the middle of an improved pasture field. It is approximately 30m x 30m in size and around 1m deep in the centre. One bank is heavily poached and the other is a 1.5m high bedrock wall. The water level of this pond varies substantially throughout the year. The top photograph was taken in April and the bottom picture was taken in May. In summer, this pond was completely dry and the entire area	

was vegetated.

Surveys

Water quality and diatoms.

Site Reference	Pond 110 – Llyn Llygeirian
Grid Reference	SH 34852 89881
Access: No	**Wetted:** Yes

Site Description

Access was not granted to this site, so the assessment was carried out from a public access track. This lake is approximately 400m across. The depth and substrate are unknown, although there are boulders in the shallows alongside the access track. The waterbody is surrounded by trees, gorse and scrub.

An access track runs along the eastern edge of the lake. Water flows out of the lake on the western side and into D56.

Surveys

None

Appendix B. Water quality raw data

B.1 Water quality results spring 2014

B.1.1 Physiochemical and biochemical properties

Analyte	Units	MRV	D1	D4	D5	D18	D20	D25	D28	D40	D45	D55	D57	D59	D62	D67	P10	P14	P21
Sampling date			28/05/14	29/05/14	29/05/14	28/05/14	28/05/14	29/05/14	28/05/14	29/05/14	29/05/14	30/04/14	30/04/14	30/04/14	29/05/14	30/04/14	29/05/14	29/05/14	29/05/14
Time			11:15	13:30	14:15	13:10	17:50	12:50	16:40	10:50	10:00	12:00	11:40	11:10	09:30	09:50	12:35	11:50	10:25
Conductivity : *in situ*	µS cm^{-1}		395	424	336	279	209	312	285	331	376	235	247	394	217	341	343	614	330
Oxygen, dissolved : I/S as O2	%		52.3	59.0		94	84.3	39.8	85.2	29.5	56.5	111	123.4	117.1	91.2	94.5	45.2	71.6	55.0
Dissolved oxygen	mg L^{-1}			6.0				4.2		2.95	6.15	11.76	13.17	12.83	9.81	10.1	4.61	7.51	5.63
Salinity			0.25	0.26	0.21	0.17	0.12	0.2	0.17	0.21	0.25	0.15	0.16	0.26	0.14	0.22	0.21	0.39	0.25
Temperature of water	°C	n/a	12.8	14.5	13.7	14.6	16	12.8	14.4	12.1	11.4	12.6	12.4	11.2	11.8	12.2	14.5	13.2	13.2
pH	pH Units	n/a	6.7	7.7	6.58	7.06	7.22	6.5	7.3	5.85	6.52	6.8	7.07	7.05	6.8	5.95	6.7	5.97	6.4
BOD 5 Day ATU	mg L^{-1}	1	<1.00	1.16	2.72	<1.00	1.16	<1.00	<1.00	2.45	1.42	5.84	1.45	1.2	<1.00	2.6	9.12	5.86	1.86
Chemical oxygen demand :- {COD}	mg L^{-1}	10	26	37	93	17	20	20	20	71	23	<10.0	<10.0	<10.0	30	<10.0	420	73	37
Solids, suspended at 105 °C	mg L^{-1}	3	3.37	4.32	92.1	<3	5.42	5.52	4.47	106	4.02	49.4	14.7	11.4	6.82	27.1	280	23	12

Analyte	Units	MRV	D1	D4	D5	D18	D20	D25	D28	D40	D45	D55	D57	D59	D62	D67	P10	P14	P21
Alkalinity to pH 4.5 as $CaCO_3$	$mg\ L^{-1}$	5	123	113	97	62	42	95	83	90	107	43	53	122	76	80	131	80	177
Alkalinity, dissolved as $CaCO_3$	$mg\ L^{-1}$	5	118	104	94	61	37.4	97.4	82.6	91.8	109	43.1	51.7	129	76.2	77	121	80.3	166
Carbon, Organic : Total as C :- {TOC}	$\mu g\ L^{-1}$	1	11	15	23	8	8	8	5	12	9	10.2	7.28	9.68	11	11.2	7.14	<1	6.87

B.1.2 Nutrients

Analyte	Units	MRV	D1	D4	D5	D18	D20	D25	D28	D40	D45	D55	D57	D59	D62	D67	P10	P14	P21
Orthophosphate, reactive as P	$mg\ L^{-1}$	0.02	0.097	0.062	0.05	0.128	<0.0200	0.044	0.06	0.171	0.21	<0.0200	0.028	0.066	0.068	0.036	0.638	0.079	0.457
Orthophosphate, filtered as P	$mg\ L^{-1}$	0.02	0.087	0.043	0.023	0.12	<0.0200	0.035	0.057	0.101	0.188	<0.0200	0.03	0.058	0.058	0.06	0.303	0.056	0.425
Ammoniacal Nitrogen, filtered as N	$mg\ L^{-1}$	0.03	0.109	0.06	<0.0300	0.065	<0.0300	0.062	0.044	0.116	0.366	<0.0300	<0.0300	0.04	0.046	0.088	1.19	<0.0300	0.277
Ammoniacal Nitrogen as N	$mg\ L^{-1}$	0.03	0.103	0.063	0.101	0.045	0.049	0.075	0.038	0.154	0.436	<0.03	<0.03	0.0311	0.035	0.12	1.38	0.082	0.269
Ammonia un-ionised as N	$\mu g\ L^{-1}$	n/a	0.000126	0.00078	<0.0000282	0.000197	<0.000146	0.0000716	0.000228	0.000018	0.000251	<0.0000430	<0.0000787	0.0000913	0.0000619	0.0000173	0.00157	<0.00000666	0.000166
Chloride, filtered	$mg\ L^{-1}$	1	55.9	56.3	42	39.1	29.3	41.1	32.1	53.3	56.2	41.5	39	49.3	31.5	63.8	37.1	100	45.8
Chloride	$mg\ L^{-1}$	1	56.2	58.8	43.5	39.6	29.1	42.8	32.1	53.2	56.3	40.7	38.2	47.9	31.4	63	36.6	102	46.4

B.1.3 Metals

Analyte	Units	MRV	D1	D4	D5	D18	D20	D25	D28	D40	D45	D55	D57	D59	D62	D67	P10	P14	P21
Arsenic	µg L^{-1}	1	<1	<1	1.46	<1	<1	<1	<1	1.94	1.17	1.22	<1	<1	<1	<1	97.8	41.5	9.97
Cadmium	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium	µg L^{-1}	0.5	<0.5	0.686	3.11	<0.5	<0.5	0.56	<0.5	0.635	<0.5	0.95	0.54	0.567	1.26	1.46	2.41	0.589	<0.5
Copper	µg L^{-1}	1	2.57	1.67	3.79	3.35	2.55	2.77	2.26	2.73	3.03	1.98	2.55	2.07	2.54	7.43	5.23	2.01	1.73
Lead	µg L^{-1}	2	<2	<2	2.21	<2	2.08	<2	<2	<2	<2	2.25	<2	<2	<2	6.38	4.4	<2	<2
Nickel	µg L^{-1}	1	1.47	3.65	7.9	<1	<1	1.24	1.32	2.87	1.21	2.59	1.67	2.51	1.44	2.16	3.19	1.49	4.04
Zinc	µg L^{-1}	5	<5	<5	19.9	5.67	6.08	<5	<5	6.37	9.85	10.2	7.45	<5	<5	23.7	18.3	19.1	<5
Iron	µg L^{-1}	30	590	1690	3550	266	225	1050	450	4730	403	1590	509	357	823	8330	10900	719	768
Manganese	mg L^{-1}	10	352	1160	943	48.6	72.9	513	77	833	46.2	509	102	34.2	50.1	783	2700	500	861
Mercury	mg L^{-1}	0.01	<0.01	0.0107	<0.01	<0.01	<0.01	<0.01	<0.01	0.0117	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.0124	<0.01	<0.01

B.1.4 PAH

Analyte	Units	MRV	D1	D4	D5	D18	D20	D25	D28	D40	D45	D55	D57	D59	D62	D67	P10	P14	P21
Hydrocarbons Screen >C5 - C44	µg L^{-1}	0.01	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.24	0.223	<0.2	<0.2	<0.2	0.272	<0.2	<0.2	0.279	0.284
Acenaphthene	µg L^{-1}	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.0192	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthylene	µg L^{-1}	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Anthracene	µg L^{-1}	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(a)anthracene	µg L^{-1}	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(a)pyrene	µg L^{-1}	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(b)fluoranthene	µg L^{-1}	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(e)pyrene	µg L^{-1}	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(ghi)perylene	µg L^{-1}	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Analyte	Units	MRV	D1	D4	D5	D18	D20	D25	D28	D40	D45	D55	D57	D59	D62	D67	P10	P14	P21
Benzo(k)fluoranthene	$\mu g\ L^{-1}$	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Chrysene	$\mu g\ L^{-1}$	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Dibenzo(ah)anthracene	$\mu g\ L^{-1}$	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fluoranthene	$\mu g\ L^{-1}$	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fluorene	$\mu g\ L^{-1}$	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.0124	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Indeno(1,2,3-cd)pyrene	$\mu g\ L^{-1}$	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Perylene	$\mu g\ L^{-1}$	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Phenanthrene	$\mu g\ L^{-1}$	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.023	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Pyrene	$\mu g\ L^{-1}$	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

B.1.5 Phenol

Analyte	Units	MRV	D1	D4	D5	D18	D20	D25	D28	D40	D45	D55	D57	D59	D62	D67	P10	P14	P21
2,3,5,6-Tetrachlorophenol	$\mu g\ L^{-1}$	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2,3-Dichlorophenol	$\mu g\ L^{-1}$	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2,3-Dimethylphenol :- {2,3-Xylenol}	$\mu g\ L^{-1}$	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2,4,5-Trichlorophenol	$\mu g\ L^{-1}$	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2,4,6-Trichlorophenol	$\mu g\ L^{-1}$	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2,4-Dichlorophenol	$\mu g\ L^{-1}$	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2,4-Dimethylphenol :- {2,4-Xylenol}	$\mu g\ L^{-1}$	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.0323	0.523	<0.02	<0.02	<0.02	<0.02	<0.02	0.0548	0.322	<0.02	<0.02
2,5-Dichlorophenol	$\mu g\ L^{-1}$	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02

Analyte	Units	MRV	D1	D4	D5	D18	D20	D25	D28	D40	D45	D55	D57	D59	D62	D67	P10	P14	P21
2,5-Dimethylphenol :- {2,5-Xylenol}	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2,6-Dichlorophenol	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2,6-Dimethylphenol :- {2,6-Xylenol}	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2-Chlorophenol	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2-Ethylphenol	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2-Methylphenol :- {o-Cresol}	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.0543	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.0446	<0.02	<0.02
3,4-Dimethylphenol :- {3,4-Xylenol}	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
3,5-Dimethylphenol :- {3,5-Xylenol}	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
3-Chlorophenol	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
3-Methylphenol :- {m-Cresol}	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.0244	0.124	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.384	<0.02	<0.02
4-Chloro-2-methylphenol :- {p-Chloro-o-cresol}	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
4-Chloro-3,5-dimethylphenol :- {PCMX}	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
4-Chloro-3-methylphenol :- {p-Chloro-m-cresol}	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
4-Chlorophenol	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02

Analyte	Units	MRV	D1	D4	D5	D18	D20	D25	D28	D40	D45	D55	D57	D59	D62	D67	P10	P14	P21
4-Methylphenol :- {p-cresol}	µg L^{-1}	0.02	0.0301	<0.02	0.097	<0.02	0.0255	<0.02	0.0501	1.57	0.0484	<0.02	0.045	<0.02	0.0357	0.574	0.405	<0.02	0.0989
Pentachlorophenol	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Phenol	µg L^{-1}	0.05	0.0506	<0.05	<0.05	<0.05	0.0647	0.06	0.0647	0.217	0.136	<0.05	<0.05	<0.05	0.0976	0.172	0.695	0.0513	0.216

B.1.6 Volatile organic compounds and others

Analyte	Units	MRV	D1	D4	D5	D18	D20	D25	D28	D40	D45	D55	D57	D59	D62	D67	P10	P14	P21
1,1,1,2-Tetrachloroethane	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,1,1-Trichloroethane	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,1,2,2-Tetrachloroethane	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,1,2-Trichloroethane	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,1-Dichloroethane	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,1-Dichloroethylene :- {1,1-Dichloroethene}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,1-Dichloropropylene :- {1,1-Dichloropropene}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,2,3-Trichlorobenzene	µg L^{-1}	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2,3-Trichloropropane	µg L^{-1}	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2,3-Trimethylbenzene	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

Analyte	Units	MRV	D1	D4	D5	D18	D20	D25	D28	D40	D45	D55	D57	D59	D62	D67	P10	P14	P21
1,2,4-Trichlorobenzene	µg L^{-1}	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2,4-Trimethylbenzene	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,2-Dibromo-3-chloropropane	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,2-Dibromoethane	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,2-Dichlorobenzene	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,2-Dichloroethane	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,2-Dichloropropane	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,2-Dimethylbenzene :- {o-Xylene}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,3,5-Trichlorobenzene	µg L^{-1}	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,3,5-Trimethylbenzene :- {Mesitylene}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,3-Dichlorobenzene	µg L^{-1}	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,3-Dichloropropane	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,4-Dichlorobenzene	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2,2-Dichloropropane	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2-Chlorotoluene :- {1-Chloro-2-methylbenzene}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
3-Chlorotoluene :- {1-	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

Analyte	Units	MRV	D1	D4	D5	D18	D20	D25	D28	D40	D45	D55	D57	D59	D62	D67	P10	P14	P21
Chloro-3-methylbenzene}																			
4-Chlorotoluene :- {1-Chloro-4-methylbenzene}	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
4-Isopropyltoluene :- {4-methyl-Isopropylbenzene}	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzene	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Bromobenzene	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Bromochloromethane	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Bromodichloromethane	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Bromoform :- {Tribromomethane}	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Carbon Disulphide	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Carbon tetrachloride :- {Tetrachloromethane}	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chlorobenzene	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chlorodibromomethane	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chloroform :- {Trichloromethane}	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chloromethane :- {Methyl Chloride}	$\mu g\ L^{-1}$	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

Analyte	Units	MRV	D1	D4	D5	D18	D20	D25	D28	D40	D45	D55	D57	D59	D62	D67	P10	P14	P21
Dibromomethane	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dichloromethane :- {Methylene Dichloride}	$\mu g\ L^{-1}$	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Dimethylbenzene : Sum of isomers (1,3- 1,4-) : {m+p xylene}	$\mu g\ L^{-1}$	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Ethyl tert-butyl ether :- {ETBE}	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Ethylbenzene	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Hexachlorobutadiene	$\mu g\ L^{-1}$	0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Hexachloroethane	$\mu g\ L^{-1}$	0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Isopropylbenzene	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MTBE :- {Methyl tert-butyl ether}	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Naphthalene	$\mu g\ L^{-1}$	0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Styrene :- {Vinylbenzene}	$\mu g\ L^{-1}$	0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Tetrachloroethylene :- {Perchloroethylene}	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Toluene :- {Methylbenzene}	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Trichloroethylene :- {Trichloroethene}	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

Analyte	Units	MRV	D1	D4	D5	D18	D20	D25	D28	D40	D45	D55	D57	D59	D62	D67	P10	P14	P21
Trichlorofluoromethane	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Vinyl Chloride :- {Chloroethylene}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
cis-1,2-Dichloroethylene :- {cis-1,2-Dichloroethene}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
cis-1,3-Dichloropropylene :- {cis-1,3-Dichloropropene}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
n-Butylbenzene :- {1-Phenylbutane}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
n-Propylbenzene :- {1-phenylpropane}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
sec-Butylbenzene :- {1-Methylpropylbenzene}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
tert-Amyl methyl ether :- {TAME}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
tert-Butylbenzene :- {(1,1-Dimethylethyl)benzene}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
trans-1,2-Dichloroethylene :- {trans-1,2-Dichloroethene}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
trans-1,3-Dichloropropylene :-	µg L^{-1}	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

Analyte	Units	MRV	D1	D4	D5	D18	D20	D25	D28	D40	D45	D55	D57	D59	D62	D67	P10	P14	P21
{trans-1,3-Dichloropropene}																			
2,4-D :- {2,4-Dichlorophenoxyacetic acid}	µg L^{-1}	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Mecoprop	mg L^{-1}	0.005	0.0116	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Chlorine Free as Cl2	mg L^{-1}	0.05	0.07	0.06	<0.05	<0.05	<0.05	<0.05	<0.05	0.13	<0.05				<0.05		0.19	<0.05	0.17
Cyanide as CN	mg L^{-1}	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005

B.2 Water quality results summer 2014

B.2.1 Physiochemical and biochemical properties

Analyte	Units	MRV	D1	D4	D5	D18	D20	D25	D30	D40	D45	D55	D57	D59	P10	P14
Sampling date			27/08/14	27/08/14	27/08/14	27/08/14	27/08/14	27/08/14	26/08/14	27/08/14	27/08/14	27/08/14	28/08/14	28/08/14	27/08/14	27/08/14
Time			16:40:00	17:05:00	09:30:00	16:00:00	15:45:00	10:30:00	16:40:00	12:25:00	09:40:00	14:55:00	10:40:00	10:20:00	10:55:00	11:55:00
Conductivity : *in situ*	µS cm^{-1}		423	364	224	283	240	343	325	539	379	293	252	418	807	802
Oxygen, Dissolved : I/S as O2	%		40.2	31.2	64.9	66.3	101	31.2	95.8	76.6	58.2	86.2	78.5	86.3	53.2	89.6
DO	µS cm^{-1}		4.12	3.14	6.50	6.71	9.88	3.25	9.36	7.3	6.2	8.09	7.99	8.78	5.52	7.96
Salinity			0.26	0.22	0.13	0.17	0.14	0.21	0.19	0.31	0.24	0.16	0.15	0.25	0.51	0.43
Temperature of water	°C	n/a	14.1	15	15.3	14.7	16.2	13.3	16.4	17.6	12.5	18.2	14.5	14.5	13.6	21.2
pH	pH Units	n/a	6.84	6.45	5.85	6.92	7.73	6.25	7.65	6.86	6.15	7.69	6.82	7.05	6.63	7.57
BOD 5 Day ATU	mg L^{-1}	1	3.06	<3	2.2	1.77	1	4.78	<2.92	7.35	4.38	1.09	2.72	2.42	27.8	30.1

Analyte	Units	MRV	D1	D4	D5	D18	D20	D25	D30	D40	D45	D55	D57	D59	P10	P14
Chemical Oxygen Demand :- {COD}	mg L^{-1}	10	41	49	29	27	15	96	40	126	94	35	24	53	345	287
Solids, Suspended at 105 °C	mg L^{-1}	3	13	12.1	19.6	23.9	<3	118	6.3	13.2	165	45.2	15.7	98	425	187
Alkalinity to pH 4.5 as $CaCO_3$	mg L^{-1}	5	70	119	74	63	54	99	77	126	115	55	70	135	96	149
Alkalinity, Dissolved as $CaCO_3$	mg L^{-1}	5	127	109	71.4	61.2	51.1	98.8	74.7	121	115	51.3	67.2	131	93.9	152
Carbon, Organic, Dissolved as C	mg L^{-1}	0.2	9.42	11.7	8.04	7.85	5.35	9.49	9.69	35.8	9.89	5.32	6.27	4.59	22.4	31.3
Carbon, Organic : Total as C :- {TOC}	µg L^{-1}	1	9.9	12.5	8.5	8.5	5.9	9.8	10.4	33.4	8.8	5.3	6.7	4.8	31.6	53

B.2.2 Nutrients

Analyte	Units	MRV	D1	D4	D5	D18	D20	D25	D30	D40	D45	D55	D57	D59	P10	P14
Orthophosphate, reactive as P	mg L^{-1}	0.02	0.127	0.076	0.037	0.408	<0.0200	0.061	0.179	0.876	0.097	<0.0200	0.128	0.127	0.056	0.295
Orthophosphate, filtered as P	mg L^{-1}	0.02	0.134	0.048	0.028	0.399	0.021	0.078	0.158	0.483	0.106	<0.0200	0.13	0.125	0.075	0.301
Ammoniacal Nitrogen, filtered as N	mg L^{-1}	0.03	<0.0300	0.047	<0.0300	0.034	<0.0300	0.168	<0.0300	0.172	0.409	<0.0300	0.05	<0.0300	11.4	6.1
Ammoniacal Nitrogen as N	mg L^{-1}	0.03	0.07	0.093	0.044	0.088	0.093	0.118	0.039	0.144	0.447	0.049	0.069	<0.0300	11.2	6.3
Ammonia un-ionised as N	µg L^{-1}	n/a	<0.0000528	0.0000361	<0.00000593	0.0000599	<0.000474	0.0000716	<0.000401	0.000412	0.000143	<0.000501	0.0000867	<0.0000882	0.0119	0.0964
Chloride, filtered	mg L^{-1}	1	67.9	54.7	25.9	44.1	32.8	55.3	44.7	97.1	56.9	48.1	43.3	54.1	79.3	131
Chloride	mg L^{-1}	1	44	54.8	26.2	44.6	33.2	56.6	45.4	98.9	57.1	49.1	44.1	54.7	80.4	131

B.2.3 Metals

Analyte	Units	MRV	D1	D4	D5	D18	D20	D25	D30	D40	D45	D55	D57	D59	P10	P14
Arsenic	µg L^{-1}	1	1.18	1.11	<1	1.06	<1	1.9	<1	3.49	4.89	2.8	<1	1.09	8.77	3.34
Cadmium	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.226	<0.1
Chromium	µg L^{-1}	0.5	<0.5	<0.5	<0.5	0.668	<0.5	3.83	<0.5	0.668	5.19	1.4	0.631	4.48	11.5	2.59
Copper	µg L^{-1}	1	2.32	<1	1.72	2.91	1.91	4.03	5.31	2.77	8.94	4.03	3.01	11.6	20.4	4.59
Lead	µg L^{-1}	2	<2	<2	<2	<2	<2	<2	<2	<2	7.35	4.12	<2	2.44	14	2.76
Nickel	µg L^{-1}	1	1.04	1.62	1.55	1.27	<1	1.81	1.66	3.46	6	4.74	2.12	9.87	10.2	1.64
Zinc	µg L^{-1}	5	10.4	<5	<5	7.24	6.46	10.7	15.7	5.58	27.2	18.2	11.2	81.8	69.4	16
Calcium	µg L^{-1}	1	40.7	32.3	22.4	22.4	20.7	28.6	27.1	41.9	35.4	21.2	24.1	47.9	88.5	39.1
Iron	µg L^{-1}	30	1470	2220	1280	791	81.9	4710	569	8890	5820	2350	664	3120	15300	5070
Manganese	mg L^{-1}	10	179	1100	288	170	39	616	71.5	2680	841	1070	171	290	5810	945
Mercury	mg L^{-1}	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.015	0.0166

B.2.4 PAH

Analyte	Units	MRV	D1	D4	D5	D18	D20	D25	D30	D40	D45	D55	D57	D59	P10	P14
Hydrocarbons Screen >C5 - C44	µg L^{-1}	0.01	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		<0.2	<0.2	0.274
Acenaphthene	µg L^{-1}	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.0385	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthylene	µg L^{-1}	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Anthracene	µg L^{-1}	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Analyte	Units	MRV	D1	D4	D5	D18	D20	D25	D30	D40	D45	D55	D57	D59	P10	P14
Benzo(a)anthracene	µg L^{-1}	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(a)pyrene	µg L^{-1}	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(b)fluoranthene	µg L^{-1}	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(e)pyrene	µg L^{-1}	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(ghi)perylene	µg L^{-1}	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(k)fluoranthene	µg L^{-1}	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Chrysene	µg L^{-1}	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Dibenzo(ah)anthracene	µg L^{-1}	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fluoranthene	µg L^{-1}	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.0649	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fluorene	µg L^{-1}	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.0309	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Indeno(1,2,3-cd)pyrene	µg L^{-1}	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Perylene	µg L^{-1}	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Phenanthrene	µg L^{-1}	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.0726	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Pyrene	µg L^{-1}	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.0373	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

B.2.5 Phenol

Analyte	Units	MRV	D1	D4	D5	D18	D20	D25	D30	D40	D45	D55	D57	D59	P10	P14
2,3,5,6-Tetrachlorophenol	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02

Analyte	Units	MRV	D1	D4	D5	D18	D20	D25	D30	D40	D45	D55	D57	D59	P10	P14
2,3-Dichlorophenol	$\mu g\ L^{-1}$	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2,3-Dimethylphenol :- {2,3-Xylenol}	$\mu g\ L^{-1}$	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2,4,5-Trichlorophenol	$\mu g\ L^{-1}$	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2,4,6-Trichlorophenol	$\mu g\ L^{-1}$	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2,4-Dichlorophenol	$\mu g\ L^{-1}$	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2,4-Dimethylphenol :- {2,4-Xylenol}	$\mu g\ L^{-1}$	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.0465	<0.02	0.39	0.406	<0.02	<0.02	<0.02	<0.02	0.0285
2,5-Dichlorophenol	$\mu g\ L^{-1}$	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2,5-Dimethylphenol :- {2,5-Xylenol}	$\mu g\ L^{-1}$	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2,6-Dichlorophenol	$\mu g\ L^{-1}$	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2,6-Dimethylphenol :- {2,6-Xylenol}	$\mu g\ L^{-1}$	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2-Chlorophenol	$\mu g\ L^{-1}$	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2-Ethylphenol	$\mu g\ L^{-1}$	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2-Methylphenol :- {o-Cresol}	$\mu g\ L^{-1}$	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.0409	0.0227	<0.02	<0.02	<0.02	<0.02	<0.02
3,4-Dimethylphenol :- {3,4-Xylenol}	$\mu g\ L^{-1}$	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
3,5-Dimethylphenol :- {3,5-Xylenol}	$\mu g\ L^{-1}$	0.02	0.0269	<0.02	0.027	<0.02	<0.02	<0.02	0.0278	<0.02	<0.02	0.0268	0.0301	<0.02	<0.02	<0.02
3-Chlorophenol	$\mu g\ L^{-1}$	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02

Analyte	Units	MRV	D1	D4	D5	D18	D20	D25	D30	D40	D45	D55	D57	D59	P10	P14
3-Methylphenol :- {m-Cresol}	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.0791	<0.02	0.1	0.815	<0.02	<0.02	<0.02	<0.02	0.0951
4-Chloro-2-methylphenol :- {p-Chloro-o-cresol}	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
4-Chloro-3,5-dimethylphenol :- {PCMX}	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
4-Chloro-3-methylphenol :- {p-Chloro-m-cresol}	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
4-Chlorophenol	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
4-Methylphenol :- {p-cresol}	µg L^{-1}	0.02	0.0347	0.137	1.26	0.0316	0.0914	0.109	0.0226	1.19	2.79	<0.02	0.0454	0.198	0.0464	0.118
Pentachlorophenol	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Phenol	µg L^{-1}	0.05	0.0709	<0.05	<0.05	<0.05	0.0992	0.072	0.0729	0.211	1.1	<0.05	0.0612	0.0609	0.0623	0.157

B.2.6 Volatile organic compounds and others

Analyte	Units	MRV	D1	D4	D5	D18	D20	D25	D30	D40	D45	D55	D57	D59	P10	P14
1,1,1,2-Tetrachloroethane	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,1,1-Trichloroethane	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,1,2,2-Tetrachloroethane	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,1,2-Trichloroethane	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,1-Dichloroethane	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,1-Dichloroethylene :- {1,1-Dichloroethene}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

Analyte	Units	MRV	D1	D4	D5	D18	D20	D25	D30	D40	D45	D55	D57	D59	P10	P14
1,1-Dichloropropylene :- {1,1-Dichloropropene}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,2,3-Trichlorobenzene	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,2,3-Trichloropropane	µg L^{-1}	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2,3-Trimethylbenzene	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,2,4-Trichlorobenzene	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,2,4-Trimethylbenzene	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,2-Dibromo-3-chloropropane	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,2-Dibromoethane	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,2-Dichlorobenzene	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,2-Dichloroethane	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,2-Dichloropropane	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,2-Dimethylbenzene :- {o-Xylene}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,3,5-Trichlorobenzene	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,3,5-Trimethylbenzene :- {Mesitylene}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,3-Dichlorobenzene	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,3-Dichloropropane	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

Analyte	Units	MRV	D1	D4	D5	D18	D20	D25	D30	D40	D45	D55	D57	D59	P10	P14
1,4-Dichlorobenzene	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2,2-Dichloropropane	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2-Chlorotoluene :- {1-Chloro-2-methylbenzene}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
3-Chlorotoluene :- {1-Chloro-3-methylbenzene}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
4-Chlorotoluene :- {1-Chloro-4-methylbenzene}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
4-Isopropyltoluene :- {4-methyl-Isopropylbenzene}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzene	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Bromobenzene	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Bromochloromethane	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Bromodichloromethane	µg L^{-1}	0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Bromoform :- {Tribromomethane}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Carbon Disulphide	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Carbon tetrachloride :- {Tetrachloromethane}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chlorobenzene	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chlorodibromomethane	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

Analyte	Units	MRV	D1	D4	D5	D18	D20	D25	D30	D40	D45	D55	D57	D59	P10	P14
Chloroform :- {Trichloromethane}	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	0.15	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chloromethane :- {Methyl Chloride}	$\mu g\ L^{-1}$	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Dibromomethane	$\mu g\ L^{-2}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dichloromethane :- {Methylene Dichloride}	$\mu g\ L^{-1}$	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Dimethylbenzene : Sum of isomers (1,3- 1,4-) : {m+p xylene}	$\mu g\ L^{-1}$	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Ethyl tert-butyl ether :- {ETBE}	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Ethylbenzene	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Hexachlorobutadiene	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Hexachloroethane	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Isopropylbenzene	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MTBE :- {Methyl tert-butyl ether}	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Naphthalene	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	0.1	0.13	0.11	<0.1	0.13	<0.1	<0.1	0.13	<0.1	<0.1	<0.1	<0.1
Styrene :- {Vinylbenzene}	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	0.13	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Tetrachloroethylene :- {Perchloroethylene}	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Toluene :- {Methylbenzene}	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

Analyte	Units	MRV	D1	D4	D5	D18	D20	D25	D30	D40	D45	D55	D57	D59	P10	P14
Trichloroethylene :- {Trichloroethene}	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Trichlorofluoromethane	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Vinyl Chloride :- {Chloroethylene}	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
cis-1,2-Dichloroethylene :- {cis-1,2-Dichloroethene}	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
cis-1,3-Dichloropropylene :- {cis-1,3-Dichloropropene}	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
n-ButylBenzene :- {1-Phenylbutane}	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
n-Propylbenzene :- {1-phenylpropane}	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
sec-Butylbenzene :- {1-Methylpropylbenzene}	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
tert-Amyl methyl ether :- {TAME}	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
tert-Butylbenzene :- {(1,1-Dimethylethyl)benzene}	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
trans-1,2-Dichloroethylene :- {trans-1,2-Dichloroethene}	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
trans-1,3-Dichloropropylene :- {trans-1,3-Dichloropropene}	$\mu g\ L^{-1}$	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,4-D :- {2,4-Dichlorophenoxyacetic acid}	$\mu g\ L^{-1}$	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Mecoprop	$mg\ L^{-1}$	0.005	<0.005	<0.005	0.00684	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005

Analyte	Units	MRV	D1	D4	D5	D18	D20	D25	D30	D40	D45	D55	D57	D59	P10	P14
Chlorine Free as Cl2	$mg\ L^{-1}$	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Cyanide as CN	$mg\ L^{-1}$	0.005	<0.00500	<0.00500	<0.00500	<0.00500	<0.00500	<0.00500	<0.00500	<0.00500	<0.00500	<0.00500	<0.00500	<0.00500	<0.00500	<0.00500

B.3 Water quality results autumn 2014

B.3.1 Physiochemical and biochemical properties

Analyte	Units	MRV	D1	D4	D5	D18	D20	D30	D40	D45	D55	D57	D59	P21	P14
Sampling date			21/10/14	21/10/14	22/10/14	21/10/14	22/10/14	21/10/14	22/10/14	21/10/14	21/10/14	21/10/14	21/10/14	21/10/14	22/10/14
Time			16:50:00	18:30:00	16:18:00	15:45:00	17:40:00	09:55:00	10:00:00	11:05:00	14:56:00	12:15:00	11:50:00	10:35:00	09:35:00
Conductivity : *in situ*	$\mu S\ cm^{-1}$		340	324	269	247	211	231	307	316	200	181	281	566	639
Oxygen, Dissolved : I/S as O2	%		60.7	43.7	79.6	94.7	76.1		46.9		108.5				76.3
DO	$mg\ L^{-1}$		6.56	4.83	8.68	10.34	8.35		5.13		11.89				8.77
Salinity			0.22	0.22	0.17	0.16	0.22	0.15	0.20	0.21	0.13	0.12	0.18	0.38	0.45
Temperature of water	°C	n/a	11.9	10.8	11.5	11.4	11.2	11.4	11.4	11.2	11.3	11.4	11.5	11.1	9.09
pH	pH Units	n/a	7.46	7.44	7.34	7.37	7.5	6.5	6.7	7.49	7.41	7.3	7.26	7.4	6.93
BOD 5 Day ATU	$mg\ L^{-1}$	1	1.3	1.46	2.56	1.24	<1.00	2.17	2.03	2.18	1.35	2.1	2.09	2.42	3.05
Chemical Oxygen Demand :- {COD}	$mg\ L^{-1}$	10	32	53	86	32	21	45	26	78	35	43	43	31	106
Solids, Suspended at 105 °C	$mg\ L^{-1}$	3	<3	6.57	4.18	3.28	<3	8.43	5.42	13.7	10.5	12.6	6.18	4.93	5.27
Alkalinity to pH 4.5 as $CaCO_3$	$mg\ L^{-1}$	5	90	76	60	59	49	55	33	63	26	34	63	188	112

Alkalinity, Dissolved as $CaCO_3$	mg L^{-1}	5	89.7	76.1	58.7	58.1	49.6	52.5	32.4	65.3	26.8	38.1	65.9	208	66.6
Carbon, Organic, Dissolved as C :- {DOC}	mg L^{-1}	0.2	10.2	15.7	25.4	9.71	6.72	11.9	6.74	19.2	8.17	10.3	11.6	8.12	29.3
Carbon, Organic : Total as C :- {TOC}	µg L^{-1}	1	10.8	17.3	27.8	10.6	7.2	12.8	7	23.7	8.6	11	13	8.7	32.7

B.3.2 Nutrients

Analyte	Units	MRV	D1	D4	D5	D18	D20	D30	D40	D45	D55	D57	D59	P21	P14
Orthophosphate, reactive as P	mg L^{-1}	0.02	0.093	0.054	0.109	0.138	0.03	0.085	0.044	0.211	0.017	0.034	0.125	0.653	0.23
Orthophosphate, filtered as P	mg L^{-1}	0.02	0.092	0.046	0.101	0.145	0.028	0.093	0.045	0.214	0.022	0.038	0.125	0.657	0.209
Ammoniacal Nitrogen, filtered as N	mg L^{-1}	0.03	0.052	0.123	0.086	0.072	<0.03	0.081	0.138	0.157	0.035	0.058	0.144	0.464	0.069
Ammoniacal Nitrogen as N	mg L^{-1}	0.03	0.051	0.124	0.091	0.061	<0.0300	0.066	0.094	0.161	0.042	0.06	0.129	0.494	0.09
Ammonia un-ionised as N	µg L^{-1}	n/a	0.000319	0.000666	0.000391	0.000348	<0.000192	0.000053	0.000143	0.000983	0.000184	0.000239	0.000545	0.00235	0.000101
Chloride, filtered	mg L^{-1}	1	55.7	58.4	46.4	42.9	35.8	39.1	61.4	60.4	38.3	34	43.3	46.5	178
Chloride	mg L^{-1}	1	56.6	58.4	46.9	43.3	36.6	40.4	61	61.2	37.6	34.4	43.4	47.5	177

B.3.3 Metals

Analyte	Units	MRV	D1	D4	D5	D18	D20	D30	D40	D45	D55	D57	D59	P21	P14
Arsenic	µg L^{-1}	1	<1	<1	1.22	<1	<1	<1	<1	1.69	<1	<1	<1	1.7	1.27
Cadmium	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

Analyte	Units	MRV	D1	D4	D5	D18	D20	D30	D40	D45	D55	D57	D59	P21	P14
Chromium	µg L^{-1}	0.5	0.678	0.928	1.33	0.592	<0.5	0.829	<0.5	1.29	0.688	0.822	1.27	<0.5	0.683
Copper	µg L^{-1}	1	4.06	4.35	10.4	4.31	2.3	3.93	3.24	8.67	3.22	3.96	5.83	5.74	5.58
Lead	µg L^{-1}	2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Nickel	µg L^{-1}	1	1.6	3.91	7.75	1.22	<1	3.52	2.34	3.37	2.72	2.97	4.82	3.57	2.48
Zinc	µg L^{-1}	5	5.4	11	13.3	6.25	<5	<5	18.8	14	10.2	9.86	6.55	9.48	10.2
Calcium	µg L^{-1}	1	37.4	30.6	22.3	24.7	22.5	22.1	20.5	29.2	17	16.3	30	105	39.9
Iron	µg L^{-1}	30	329	1110	2710	346	106	569	439	711	739	663	358	102	707
Manganese	mg L^{-1}	10	58.1	210	272	56.7	32.8	104	312	81.2	206	94.6	38.2	27.1	40.9
Mercury	mg L^{-1}	0.01	<0.01	0.0106	0.0134	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

B.3.4 **PAH**

Analyte	Units	MRV	D1	D4	D5	D18	D20	D30	D40	D45	D55	D57	D59	P21	P14
Hydrocarbons Screen >C5 - C44	µg L^{-1}	0.01	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Acenaphthene	µg L^{-1}	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthylene	µg L^{-1}	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Anthracene	µg L^{-1}	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(a)anthracene	µg L^{-1}	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(a)pyrene	µg L^{-1}	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(b)fluoranthene	µg L^{-1}	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Analyte	Units	MRV	D1	D4	D5	D18	D20	D30	D40	D45	D55	D57	D59	P21	P14
Benzo(e)pyrene	µg L^{-1}	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(ghi)perylene	µg L^{-1}	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(k)fluoranthene	µg L^{-1}	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Chrysene	µg L^{-1}	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Dibenzo(ah)anthracene	µg L^{-1}	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fluoranthene	µg L^{-1}	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fluorene	µg L^{-1}	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Indeno(1,2,3-cd)pyrene	µg L^{-1}	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Perylene	µg L^{-1}	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Phenanthrene	µg L^{-1}	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Pyrene	µg L^{-1}	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

B.3.5 Phenol

Analyte	Units	MRV	D1	D4	D5	D18	D20	D30	D40	D45	D55	D57	D59	P21	P14
2,3,5,6-Tetrachlorophenol	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2,3-Dichlorophenol	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2,3-Dimethylphenol :- {2,3-Xylenol}	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2,4,5-Trichlorophenol	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02

Analyte	Units	MRV	D1	D4	D5	D18	D20	D30	D40	D45	D55	D57	D59	P21	P14
2,4,6-Trichlorophenol	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2,4-Dichlorophenol	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2,4-Dimethylphenol :- {2,4-Xylenol}	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.0221	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2,5-Dichlorophenol	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2,5-Dimethylphenol :- {2,5-Xylenol}	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2,6-Dichlorophenol	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2,6-Dimethylphenol :- {2,6-Xylenol}	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2-Chlorophenol	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2-Ethylphenol	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2-Methylphenol :- {o-Cresol}	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
3,4-Dimethylphenol :- {3,4-Xylenol}	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
3,5-Dimethylphenol :- {3,5-Xylenol}	µg L^{-1}	0.02	<0.02	<0.02	0.0256	0.0317	0.0435	<0.02	0.0221	<0.02	<0.02	0.0259	0.0391	0.0302	<0.02
3-Chlorophenol	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
3-Methylphenol :- {m-Cresol}	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
4-Chloro-2-methylphenol :- {p-Chloro-o-cresol}	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
4-Chloro-3,5-dimethylphenol :- {PCMX}	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
4-Chloro-3-methylphenol :- {p-Chloro-m-cresol}	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02

Analyte	Units	MRV	D1	D4	D5	D18	D20	D30	D40	D45	D55	D57	D59	P21	P14
4-Chlorophenol	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
4-Methylphenol :- {p-cresol}	µg L^{-1}	0.02	<0.02	0.0282	0.0559	<0.02	<0.02	0.0534	0.0842	0.049	<0.02	0.0318	0.0717	0.0401	0.0377
Pentachlorophenol	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Phenol	µg L^{-1}	0.05	0.0655	0.0589	0.103	<0.05	<0.05	0.125	0.0868	0.0569	<0.05	0.0789	0.0759	0.12	0.0802

B.3.6 Volatile organic compounds and others

Analyte	Units	MRV	D1	D4	D5	D18	D20	D30	D40	D45	D55	D57	D59	P21	P14
1,1,1,2-Tetrachloroethane	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,1,1-Trichloroethane	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,1,2,2-Tetrachloroethane	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,1,2-Trichloroethane	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,1-Dichloroethane	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,1-Dichloroethylene :- {1,1-Dichloroethene}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,1-Dichloropropylene :- {1,1-Dichloropropene}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,2,3-Trichlorobenzene	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,2,3-Trichloropropane	µg L^{-1}	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

Analyte	Units	MRV	D1	D4	D5	D18	D20	D30	D40	D45	D55	D57	D59	P21	P14
1,2,3-Trimethylbenzene	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,2,4-Trichlorobenzene	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,2,4-Trimethylbenzene	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,2-Dibromo-3-chloropropane	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,2-Dibromoethane	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,2-Dichlorobenzene	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,2-Dichloroethane	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,2-Dichloropropane	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,2-Dimethylbenzene :- {o-Xylene}	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,3,5-Trichlorobenzene	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,3,5-Trimethylbenzene :- {Mesitylene}	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,3-Dichlorobenzene	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,3-Dichloropropane	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,4-Dichlorobenzene	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2,2-Dichloropropane	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2-Chlorotoluene :- {1-Chloro-2-methylbenzene}	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

Analyte	Units	MRV	D1	D4	D5	D18	D20	D30	D40	D45	D55	D57	D59	P21	P14
3-Chlorotoluene :- {1-Chloro-3-methylbenzene}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
4-Chlorotoluene :- {1-Chloro-4-methylbenzene}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
4-Isopropyltoluene :- {4-methyl-isopropylbenzene}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzene	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Bromobenzene	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Bromochloromethane	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Bromodichloromethane	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Bromoform :- {Tribromomethane}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Carbon Disulphide	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Carbon tetrachloride :- {Tetrachloromethane}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chlorobenzene	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chlorodibromomethane	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chloroform :- {Trichloromethane}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chloromethane :- {Methyl Chloride}	µg L^{-1}	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Dibromomethane	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

Analyte	Units	MRV	D1	D4	D5	D18	D20	D30	D40	D45	D55	D57	D59	P21	P14
Dichloromethane :- {Methylene Dichloride}	µg L^{-1}														
Dimethylbenzene : Sum of isomers (1,3- 1,4-) : {m+p xylene}	µg L^{-1}	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Ethyl tert-butyl ether :- {ETBE}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Ethylbenzene	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Hexachlorobutadiene	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Hexachloroethane	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Isopropylbenzene	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MTBE :- {Methyl tert-butyl ether}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Naphthalene	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Styrene :- {Vinylbenzene}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Tetrachloroethylene :- {Perchloroethylene}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Toluene :- {Methylbenzene}	µg L^{-1}	0.1	0.15	0.11	<0.1	<0.1	0.13	<0.1	0.12	0.11	0.11	0.11	<0.1	0.17	<0.1
Trichloroethylene :- {Trichloroethene}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Trichlorofluoromethane	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Vinyl Chloride :- {Chloroethylene}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

Analyte	Units	MRV	D1	D4	D5	D18	D20	D30	D40	D45	D55	D57	D59	P21	P14
cis-1,2-Dichloroethylene :- {cis-1,2-Dichloroethene}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
cis-1,3-Dichloropropylene :- {cis-1,3-Dichloropropene}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
n-Butylbenzene :- {1-Phenylbutane}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
n-Propylbenzene :- {1-phenylpropane}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
sec-Butylbenzene :- {1-Methylpropylbenzene}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
tert-Amyl methyl ether :- {TAME}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
tert-Butylbenzene :- {(1,1-Dimethylethyl)benzene}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
trans-1,2-Dichloroethylene :- {trans-1,2-Dichloroethene}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
trans-1,3-Dichloropropylene :- {trans-1,3-Dichloropropene}	µg L^{-1}	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,4-D :- {2,4-Dichlorophenoxyacetic acid}	µg L^{-1}	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Mecoprop	mg L^{-1}	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Chlorine Free as Cl2	mg L^{-1}	0.05	<0.05	<0.05	<0.05	<0.05	0.06	<0.05	0.13	<0.05	<0.05	<0.05	<0.05	0.05	<0.05
Cyanide as CN	mg L^{-1}	0.005	<0.00500	<0.00500	<0.00500	<0.00500	<0.00500	<0.00500	<0.00500	<0.00500	<0.00500	<0.00500	<0.00500	<0.00500	<0.00500

B.4 Water quality results spring 2015

B.4.1 Physiochemical and biochemical properties

Analyte	Units	MRV	D1	D5	D30	D57	D59	D138	P21
Sampling date			30/04/2015	30/04/2015	30/04/2015	30/04/2015	30/04/2015	30/04/2015	30/04/2015
Time			15:10	15:15	11:00	09:30	09:00	12:05	10:10
Conductivity : *in situ*	µS cm^{-1}		481	374	328	267	442	301	492
Oxygen, Dissolved : I/S as O2	%		156	110	131	109	90.2	127	80.5
Dissolved oxygen	mg L^{-1}		15.45	11.69	15.13	12.90	10.12	13.7	9.18
Temperature of water	°C	n/a	15	12.4	8.9	8.06	7.94	11.6	9.26
pH	pH Units	n/a	7.85	7.27	7.79	7.76	7.46	8.18	7.62
BOD 5 Day ATU	mg L^{-1}	1	2.33	10.3	1.06	<1.00	<1.00	5.09	3.6
Chemical Oxygen Demand :- {COD}	mg L^{-1}	10	22	155	12	13	11	40	56
Solids, Suspended at 105 °C	mg L^{-1}	3	8.68	151	<3	6.18	6.43	17.8	12.5
Alkalinity to pH 4.5 as $CaCO_3$	mg L^{-1}	5	122	108	81	52	110	35	187
Alkalinity, Dissolved as $CaCO_3$	mg L^{-1}	5	119	105	79.1	50.7	105	34.6	180
Carbon, Organic, Dissolved as C :- {DOC}	mg L^{-1}	0.2	6.06	10.8	3.46	4.06	3.09	2.04	15.9
Carbon, Organic : Total as C :- {TOC}	µg L^{-1}	1	6.2	11.1	3.8	4.6	3.2	10.9	16.1

B.4.2 Nutrients

Analyte	Units	**MRV**	D1	D5	D30	D57	D59	D138	P21
Orthophosphate, reactive as P	mg L^{-1}	0.02	0.038	0.021	0.041	0.018	0.051	0.037	0.202
Orthophosphate, filtered as P	mg L^{-1}	0.02	0.034	0.011	0.043	0.015	0.043	0.03	0.168

Ammoniacal Nitrogen, filtered as N	mg L^{-1}	0.03	0.031	<0.0300	<0.0300	<0.0300	0.035	0.035	0.4
Ammoniacal Nitrogen as N	mg L^{-1}	0.03	0.03	0.03	0.03	0.03	0.041	0.03	0.461
Ammonia un-ionised as N	µg L^{-1}	n/a	0.000588	<0.000125	<0.000312	<0.000273	0.000159	0.00108	0.0029
Chloride, filtered	mg L^{-1}	1	67.9	46.3	39.7	38	47	66.5	48.3
Chloride	mg L^{-1}	1	66.9	45.5	39.5	39	48.3	65.4	49.5

B.4.3 Metals

Analyte	Units	**MRV**	D1	D5	D30	D57	D59	D138	P21
Arsenic	µg L^{-1}	1	<1	<1	<1	<1	<1	<1	5.35
Cadmium	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	3.26	<0.1	<0.1
Chromium	µg L^{-1}	0.5	0.544	<0.5	<0.5	<0.5	<0.5	0.595	<0.5
Copper	µg L^{-1}	1	2.64	1.82	1.35	1.29	1.75	2.21	3.62
Lead	µg L^{-1}	2	<2	<2	<2	<2	9.19	<2	2.58
Nickel	µg L^{-1}	1	<1	1.41	<1	1.02	7.54	<1	5.75
Zinc	µg L^{-1}	5	<5	8.39	<5	<5	453	10.2	<5
Calcium	µg L^{-1}	1	44	33.4	28	20.5	44.5	17.4	57.2
Iron	µg L^{-1}	30	736	642	250	207	109	972	1000
Manganese	mg L^{-1}	10	358	145	42.9	54	16.5	159	950

Mercury	mg L^{-1}	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

B.4.4 PAH

Analyte	Units	MRV	D1	D5	D30	D57	D59	D138	P21
Hydrocarbons Screen >C5 - C44	$\mu g\ L^{-1}$	0.01	0.21	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Acenaphthene	$\mu g\ L^{-1}$	0.01	<0.01	<0.01	<0.01	<0.01		<0.01	<0.01
Acenaphthylene	$\mu g\ L^{-1}$	0.01	<0.01	<0.01	<0.01	<0.01		<0.01	<0.01
Anthracene	$\mu g\ L^{-1}$	0.01	<0.01	<0.01	<0.01	<0.01		<0.01	<0.01
Benzo(a)anthracene	$\mu g\ L^{-1}$	0.01	<0.01	<0.01	<0.01	<0.01		<0.01	<0.01
Benzo(a)pyrene	$\mu g\ L^{-1}$	0.01	<0.01	<0.01	<0.01	<0.01		<0.01	<0.01
Benzo(b)fluoranthene	$\mu g\ L^{-1}$	0.01	<0.01	<0.01	<0.01	<0.01		<0.01	<0.01
Benzo(e)pyrene	$\mu g\ L^{-1}$	0.01	<0.01	<0.01	<0.01	<0.01		<0.01	<0.01
Benzo(ghi)perylene	$\mu g\ L^{-1}$	0.01	<0.01	<0.01	<0.01	<0.01		<0.01	<0.01
Benzo(k)fluoranthene	$\mu g\ L^{-1}$	0.01	<0.01	<0.01	<0.01	<0.01		<0.01	<0.01
Chrysene	$\mu g\ L^{-1}$	0.01	<0.01	<0.01	<0.01	<0.01		<0.01	<0.01
Dibenzo(ah)anthracene	$\mu g\ L^{-1}$	0.01	<0.01	<0.01	<0.01	<0.01		<0.01	<0.01
Fluoranthene	$\mu g\ L^{-1}$	0.01	<0.01	<0.01	<0.01	<0.01		<0.01	<0.01
Fluorene	$\mu g\ L^{-1}$	0.01	<0.01	<0.01	<0.01	<0.01		<0.01	<0.01
Indeno(1,2,3-cd)pyrene	$\mu g\ L^{-1}$	0.01	<0.01	<0.01	<0.01	<0.01		<0.01	<0.01

Analyte	Units	MRV	D1	D5	D30	D57	D59	D138	P21
Perylene	µg L^{-1}	0.01	<0.01	<0.01	<0.01	<0.01		<0.01	<0.01
Phenanthrene	µg L^{-1}	0.01	<0.01	<0.01	<0.01	<0.01		<0.01	<0.01
Pyrene	µg L^{-1}	0.01	<0.01	<0.01	<0.01	<0.01		<0.01	<0.01

B.4.5 Phenol

Analyte	Units	MRV	D1	D5	D30	D57	D59	D138	P21
2,3,5,6-Tetrachlorophenol	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2,3-Dichlorophenol	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2,3-Dimethylphenol :- {2,3-Xylenol}	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2,4,5-Trichlorophenol	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2,4,6-Trichlorophenol	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.0284	<0.02
2,4-Dichlorophenol	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2,4-Dimethylphenol :- {2,4-Xylenol}	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.256
2,5-Dichlorophenol	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2,5-Dimethylphenol :- {2,5-Xylenol}	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02

Analyte	Units	MRV	D1	D5	D30	D57	D59	D138	P21
2,6-Dichlorophenol	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2,6-Dimethylphenol :- {2,6-Xylenol}	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2-Chlorophenol	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2-Ethylphenol	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
2-Methylphenol :- {o-Cresol}	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
3,4-Dimethylphenol :- {3,4-Xylenol}	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
3,5-Dimethylphenol :- {3,5-Xylenol}	µg L^{-1}	0.02	<0.02	<0.02	0.0354	<0.02	<0.02	<0.02	<0.02
3-Chlorophenol	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
3-Methylphenol :- {m-Cresol}	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.0386	0.0537
4-Chloro-2-methylphenol :- {p-Chloro-o-cresol}	µg L^{-1}	0.02	0.594	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
4-Chloro-3,5-dimethylphenol :- {PCMX}	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
4-Chloro-3-methylphenol :- {p-Chloro-m-cresol}	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
4-Chlorophenol	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
4-Methylphenol :- {p-cresol}	µg L^{-1}	0.02	1.19	<0.02	<0.02	<0.02	0.0557	0.055	0.125
Pentachlorophenol	µg L^{-1}	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Phenol	µg L^{-1}	0.05	0.17	<0.05	0.134	<0.05	0.0663	0.0517	0.109

B.4.6 Volatile compounds and others

Analyte	Units	MRV	D1	D5	D30	D57	D59	D138	P21
1,1,1,2-Tetrachloroethane	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,1,1-Trichloroethane	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,1,2,2-Tetrachloroethane	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,1,2-Trichloroethane	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,1-Dichloroethane	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,1-Dichloroethylene :- {1,1-Dichloroethene}	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,1-Dichloropropylene :- {1,1-Dichloropropene}	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,2,3-Trichlorobenzene	$\mu g\ L^{-1}$	0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,2,3-Trichloropropane	$\mu g\ L^{-1}$	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2,3-Trimethylbenzene	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,2,4-Trichlorobenzene	$\mu g\ L^{-1}$	0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,2,4-Trimethylbenzene	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,2-Dibromo-3-chloropropane	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,2-Dibromoethane	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,2-Dichlorobenzene	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,2-Dichloroethane	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,2-Dichloropropane	$\mu g\ L^{-1}$	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

Analyte	Units	MRV	D1	D5	D30	D57	D59	D138	P21
1,2-Dimethylbenzene :- {o-Xylene}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,3,5-Trichlorobenzene	µg L^{-1}	0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,3,5-Trimethylbenzene :- {Mesitylene}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,3-Dichlorobenzene	µg L^{-1}	0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,3-Dichloropropane	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,4-Dichlorobenzene	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2,2-Dichloropropane	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2-Chlorotoluene :- {1-Chloro-2-methylbenzene}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
3-Chlorotoluene :- {1-Chloro-3-methylbenzene}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
4-Chlorotoluene :- {1-Chloro-4-methylbenzene}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
4-Isopropyltoluene :- {4-methyl-Isopropylbenzene}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzene	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Bromobenzene	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Bromochloromethane	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Bromodichloromethane	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Bromoform :- {Tribromomethane}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Carbon Disulphide	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

Analyte	Units	MRV	D1	D5	D30	D57	D59	D138	P21
Carbon tetrachloride :- {Tetrachloromethane}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chlorobenzene	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chlorodibromomethane	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chloroform :- {Trichloromethane}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chloromethane :- {Methyl Chloride}	µg L^{-1}	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Dibromomethane	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dichloromethane :- {Methylene Dichloride}	µg L^{-1}	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Dimethylbenzene : Sum of isomers (1,3- 1,4-) : {m+p xylene}	µg L^{-1}	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Ethyl tert-butyl ether :- {ETBE}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Ethylbenzene	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Hexachlorobutadiene	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Hexachloroethane	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Isopropylbenzene	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MTBE :- {Methyl tert-butyl ether}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Naphthalene	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Styrene :- {Vinylbenzene}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Tetrachloroethylene :- {Perchloroethylene}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

JACOBS

Analyte	Units	MRV	D1	D5	D30	D57	D59	D138	P21
Toluene :- {Methylbenzene}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1
Trichloroethylene :- {Trichloroethene}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Trichlorofluoromethane	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Vinyl Chloride :- {Chloroethylene}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
cis-1,2-Dichloroethylene :- {cis-1,2-Dichloroethene}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
cis-1,3-Dichloropropylene :- {cis-1,3-Dichloropropene}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
n-Butylbenzene :- {1-Phenylbutane}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
n-Propylbenzene :- {1-phenylpropane}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
sec-Butylbenzene :- {1-Methylpropylbenzene}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
tert-Amyl methyl ether :- {TAME}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
tert-Butylbenzene :- {(1,1-Dimethylethyl)benzene}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
trans-1,2-Dichloroethylene :- {trans-1,2-Dichloroethene}	µg L^{-1}	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
trans-1,3-Dichloropropylene :- {trans-1,3-Dichloropropene}	µg L^{-1}	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,4-D :- {2,4-Dichlorophenoxyacetic acid}	µg L^{-1}	0.005	<0.05	<0.05	<0.005	<0.005	<0.005	<0.005	<0.05
Mecoprop	mg L^{-1}	0.005	0.273	<0.05	<0.005	<0.005	<0.005	<0.005	<0.05
Chlorine Free as Cl2	mg L^{-1}	0.05	0.07	0.21	<0.05	<0.05	<0.05	<0.05	0.08
Cyanide as CN	mg L^{-1}	0.005	<0.00500	<0.00500	<0.00500	<0.00500	<0.00500	<0.00500	<0.00500

Appendix C. Invertebrate raw data

Species	2014																				2015
	D1		D4		D5	D18		D20		D25	D30		D45		D55		D57		D59	D62	D30
	Spr	Aut	Spr	Aut	Aut	Spr	Aut	Spr	Aut	Spr	Spr	Aut	Spr	Aut	Spr	Aut	Spr	Aut	Aut	Spr	Spr
Acroloxus lacustris		4			5														40		
Agabus bipustulatus															1						
Agabus sp.		1																			
Agabus sturmii														1							
Agapetus fuscipes						1	30								1			37		14	
Agapetus sp.																					4
Ancylus fluviatilis						5			8		9	6					4	12		1	5
Asellus aquaticus	316	400	200	88	60	45	73	1	34	197	25	168	41	15			3	37		1	21
Asellidae																	1				
Athripsodes bilineatus						1			3												
Baetidae					10							6									10
Baetis fuscatus																		6			
Baetis rhodani						122	1	3	6		234	47			310		458	1		362	106
Baetis scambus/fuscatus						2					8										
Baetis sp.																				20	

Species	2014																				2015
	D1		D4		D5	D18		D20		D25	D30		D45		D55		D57		D59	D62	D30
	Spr	Aut	Spr	Aut	Aut	Spr	Aut	Spr	Aut	Spr	Spr	Aut	Spr	Aut	Spr	Aut	Spr	Aut	Aut	Spr	Spr
Bathyomphalus contortus							2		26												
Beraea pullata						1															
Caenis luctuosa				4				1	191												
Caenis luctuosa/macrura												1									
Caenis rivulorum											8										11
Caenis sp.												1									1
Callicorixa praeusta					1																
Calopteryx sp.									3												
Calopteryx splendens								1	6												7
Ceratopogoninae					1		1					1					3			1	
Chaetopteryx villosa												1							6	3	
Chironomidae	1068	93	182	150	43			504		780	212		58	396	102	2	26	48	52	89	31
Chironomini									228			31									
Coenagrionidae					96																
Corixidae	1		1																		
Crangonyx pseudogracilis	202	139	49	115	23																
Dicranota sp.									2		3	2			2		2	1		38	

Species	2014																				2015
	D1		D4		D5	D18		D20		D25	D30		D45		D55		D57		D59	D62	D30
	Spr	Aut	Spr	Aut	Aut	Spr	Aut	Spr	Aut	Spr	Spr	Aut	Spr	Aut	Spr	Aut	Spr	Aut	Aut	Spr	Spr
Diptera																	2				
Dixidae														1							
Dugesia polychroa				5																	
Dugesia sp.		5			2																
Dugesia tigrina		17			3																1
Drusus annulatus																				2	
Dytiscidae		1												29				1			
Echinogammarus sp.								59													
Elmidae																147					
Elmis aenea		6					81	2	11		21	58			26		161	143	17	82	17
Elodes sp.															5		2				
Eloeophila sp.																	1		1		1
Ephydridae													10								
Erpobdella octoculata		4	7	4	1				2	11	4	26	28	3	13		1	5	1		17
Erpobdella sp.													13	26				3			
Erpobdella testacea		2			1				1			30	1								
Erpobdellidae																3					
Galba truncatula															3						

Species	2014																				2015
	D1		D4		D5	D18		D20		D25	D30		D45		D55		D57		D59	D62	D30
	Spr	Aut	Spr	Aut	Aut	Spr	Aut	Spr	Aut	Spr	Spr	Aut	Spr	Aut	Spr	Aut	Spr	Aut	Aut	Spr	Spr
Gammarus duebeni								35	6												
Gammarus lacustris																			308		
Gammarus pulex	5								2	612	507	907	1554	148	5432	701	414	895	1092	2263	222
Gammarus zaddachi							1072	324	94												
Glossiphonia complanata					2				6	2		13	3		1		1	8	3		
Glossosomatidae									1												
Gyraulus albus	2				84				17												
Gyraulus crista									18												
Gyrinus substriatus										2			1	1							
Haementeriinae													1								
Haemopis sanguisuga																4					
Halesus radiatus																	2				2
Haliplidae									2												
Haliplus ruficollis			2	1																	
Haliplus sp.		3	1		41																
Helius sp.														2							
Helobdella stagnalis	1	5	2	3			1		2	11		15	1	81	1	2	2	1			

Species	2014																			2015
	D1		D4		D5	D18		D20		D25	D30		D45		D55		D57		D59	D62	D30
	Spr	Aut	Spr	Aut	Aut	Spr	Aut	Spr	Aut	Spr	Spr	Aut	Spr	Aut	Spr	Aut	Spr	Aut	Aut	Spr	Spr
Helophorus brevipalpis										1			5	12	3						
Helophorus grandis										3											
Helophorus sp.										9											
Hemiclepsis marginata			2																		
Heptageniidae									4												
Hesperocorixa linnaei			1										1								
Hesperocorixa sp.					2																
Hippeutis complanatus					59					11											
Hydracarina								4	2	2	11										6
Hydrometra stagnorum															1						
Hydrophilidae																		1			
Hydroporus memnonius													1							1	
Hydroporus palustris										1											
Hydroporus planus													2								
Hydroporus pubescens													2								

Species	2014																				2015
	D1		D4		D5	D18		D20		D25	D30		D45		D55		D57		D59	D62	D30
	Spr	Aut	Spr	Aut	Aut	Spr	Aut	Spr	Aut	Spr	Spr	Aut	Spr	Aut	Spr	Aut	Spr	Aut	Aut	Spr	Spr
Hydroporus striola															1						
Hydroporus tesselatus													3								
Hydropsyche angustipennis		1					1											55			
Hydropsyche siltalai							2				9										9
Hydropsyche sp.																		12			
Hydroptila sp.								4													28
Hygrobia hermanni					1																
Ischnura elegans				1	1					8			2	1	1						
Isopoda (marine)								20													
Laccobius sp.													1								
Lepidostoma hirtum								1			6	13									18
Leuctra geniculata											9										
Leuctra nigra																					2
Limnephilidae		1	1	3	9		1		18			1		13	18	2				1	
Limnephilus lunatus			1	1				1		20			2	3	103					6	8
Limnephilus sp.										37						1					
Limnius volckmari							5	2			4	5					14	35			2
Limnophora sp.											8										

Species	2014																				2015
	D1		D4		D5	D18		D20		D25	D30		D45		D55		D57		D59	D62	D30
	Spr	Aut	Spr	Aut	Aut	Spr	Aut	Spr	Aut	Spr	Spr	Aut	Spr	Aut	Spr	Aut	Spr	Aut	Aut	Spr	Spr
Limoniidae																				1	
Lumbricidae												1									
Lymnaea sp.			1																		
Lymnaeidae														2							
Melanogaster hirtella													1								
Mystacides azurea								1													
Mystacides sp.								1	121			1									1
Nebrioporus elegans								2	5		2	1									8
Nebrioporus sp.												2									
Neolimnomyia sp.																			3		
Neolimnophila sp.													1		1		1				
Noterus clavicornis		1			8																
Notonecta glauca				1																	
Notonecta sp.					4																
Oecetis sp.									2												
Oligochaeta	1	24	138	123	39		100	39	9	168		20	384	798	17	106	6	24	71	57	
Orectochilus sp.									5												
Oreodytes sanmarkii									2		4										3

JACOBS

Species	2014																				2015
	D1		D4		D5	D18		D20		D25	D30		D45		D55		D57		D59	D62	D30
	Spr	Aut	Spr	Aut	Aut	Spr	Aut	Spr	Aut	Spr	Spr	Aut	Spr	Aut	Spr	Aut	Spr	Aut	Aut	Spr	Spr
Oreodytes sp.											5	2									
Ostracoda	2	1							12						1						
Oulimnius sp.		1							57			8									
Oulimnius tuberculatus	2						37	1			2										
Oxyethira sp.									1												
Pericoma sp.							1							105		12		1		1	
Physa fontinalis	1				5				2												
Pilaria sp.												1		6		1					
Piscicola geometra									1	1											
Pisidium sp.	53			336			16		22	331		18			2	6	8	30			5
Planorbis carinatus									1		1	5									5
Planorbis planorbis		3	1		16															2	1
Planorbis sp.												2									
Platambus maculatus	4																				
Plea leachi	1				13																
Plectrocnemia conspersa															1	1	4	3	1	3	
Polycelis felina												1			9		1	2			2
Polycelis nigra	68		1	7						33			4	1		4	2	1			

Species	2014																				2015
	D1		D4		D5	D18		D20		D25	D30		D45		D55		D57		D59	D62	D30
	Spr	Aut	Spr	Aut	Aut	Spr	Aut	Spr	Aut	Spr	Spr	Aut	Spr	Aut	Spr	Aut	Spr	Aut	Aut	Spr	Spr
Polycelis nigra/tenuis												1									
Polycelis sp.		103			4				9			5		1					32		1
Polycentropus flavomaculatus									1												
Potamopyrgus antipodarum	3	45	643	77	3		8640	1209	29		10	11					4	105	1		36
Proasellus meridianus	6	24	22	6			29	1	6				2	1	1	1		8			
Psychodidae																			1		2
Psychomyiidae												1									
Ptychoptera sp.														3							
Radix balthica	56	35	7	40	131					4	11	9									
Rhyacophila dorsalis											5										
Scirtidae																90		1			1
Sericostoma personatum							6		2			3						10			2
Serratella ignita								8			283										40
Sialis lutaria	1		2																		
Sigara nigrolineata													8	3							
Sigara semistriata															1		1				

Species	2014																				2015
	D1		D4		D5	D18		D20		D25	D30		D45		D55		D57		D59	D62	D30
	Spr	Aut	Spr	Aut	Aut	Spr	Aut	Spr	Aut	Spr	Spr	Aut	Spr	Aut	Spr	Aut	Spr	Aut	Aut	Spr	Spr
Sigara sp.	1	1	1						1				12	6							
Silo pallipes							1											1			
Silo sp.									17												1
Simuliidae	48							12	22		272				1		11			38	1
Sphaeriidae		323	574		1					16									33	11	
Sphaerium sp.				2					11	3		1									
Stagnicola palustris					1																
Stictotarsus duodecimpustulatus									1												
Tanytarsini									4												
Theromyzon tessulatum		1			2																
Tinodes waeneri												2									
Tricladida					42																
Velia sp.										1					2		1			1	

Appendix D. Macrophyte raw data

D.1 Scoring taxa

Date	Summer 2014						
	Suitable for LEAFPACS				Not suitable for LEAFPACS		
Site	D1	D18	D30	D45	D4	D25	D55
Total vegetative cover (%)	35	95	30	90	98	95	65
Total Cover Value (TCV)	TCV	TCV	TCV	TCV	TCV	TCV	TCV
Alisma lanceolatum					1		
Alisma plantago-aquatica	4	1			2	2	
Apium nodiflorum		2	1	6	2	3	8
Bidens cernua	1	1					
Bidens tripartita		1					
Blue-green algal scum/pelts		1					
Bryum pseudotriquetrum							1
Butomus umbellatus	2						
Calliergon cuspidatum							1
Callitriche obtusangula						1	
Callitriche platycarpa	6	5			6		
Callitriche stagnalis		4	2			1	3
Callitriche stagnalis/platycarpa				1			
Carex elata	1						
Cinclidotus fontinaloides		1					
Cladophora glomerata/Rhizoclonium hieroglyphicum			7				
Eleocharis palustris	2				3		
Elodea canadensis		1					
Equisetum fluviatile				1		1	
Fontinalis antipyretica			2				2
Glyceria fluitans agg				8		1	3
Lemna gibba	6				6	4	

Date	Summer 2014						
	Suitable for LEAFPACS				Not suitable for LEAFPACS		
Site	D1	D18	D30	D45	D4	D25	D55
Total vegetative cover (%)	35	95	30	90	98	95	65
Total Cover Value (TCV)	TCV	TCV	TCV	TCV	TCV	TCV	TCV
Lemna minuta	5					5	
Leptodictyon riparium		1					
Mentha aquatica	1	3	2	2	2	3	
Montia fontana							4
Myosotis laxa	1					1	3
Myosotis sp(p).			1				
Oenanthe crocata		2	1				
Pellia endiviifolia			1				2
Persicaria hydropiper	2	2	1	1	1		1
Phalaris arundinacea	4	7	6				
Phragmites australis	5				8		
Platyhypnidium riparioides			2				2
Potamogeton crispus	1						
Potamogeton berchtoldii					2		
Potamogeton trichoides	1						
Ranunculus flammula			1				
Ranunculus hederaceus						1	3
Rorippa nasturtium-aquaticum agg.							2
Sparganium erectum	4	3	3	2	6	6	
Vaucheria sp				1			
Veronica beccabunga			2	2			2
Zygnematalean alga	2						

JACOBS

D.2 Additional non-scoring taxa

Date	Summer 2014						
	Suitable for LEAFPACS				Not suitable for LEAFPACS		
Site	D1	D18	D30	D45	D4	D25	D55
Total vegetative cover (%)	35	95	30	90	98	95	65
Total Cover Value (TCV)	TCV	TCV	TCV	TCV	TCV	TCV	TCV
Agrostis stolonifera		P	P	P		P	
Alopecurus geniculatus				P			
Angelica sylvestris				P		P	
Aneura pinguis							P
Aphanorregma patens							P
Conocephalum			P				
Dicranella varia				P			
Epilobium hirsutum						P	
Epipterygium tozeri				P			
Fallopia japonica		P					
Fissidens taxifolium						P	
Filipendula ulmaria			P	P	P	P	
Galium palustre	P	P		P			P
Graphalium uliginosum							P
Hypericum tetrapterum						P	P
Impatiens glandulifera		P					
Juncus acutiflorus		P					
Juncus bicornis							P
Juncus effusus		P	P	P	P	P	
Juncus X surejanus				P			P
Lemna turionifera	P						
Lotus pedunculatus		1	1	1	1	1	
Lunularia cruciata			P			P	
Lycopus europaeus					P		
Palustriella falcata							P
Persicaria maculosa							P
Pseudephemerum nitidum							P
Ranunculus repens				P		P	

Date	**Summer 2014**						
	Suitable for LEAFPACS				**Not suitable for LEAFPACS**		
Site	**D1**	**D18**	**D30**	**D45**	**D4**	**D25**	**D55**
Total vegetative cover (%)	**35**	**95**	**30**	**90**	**98**	**95**	**65**
Total Cover Value (TCV)	**TCV**	**TCV**	**TCV**	**TCV**	**TCV**	**TCV**	**TCV**
Ranunculus tripartitus							P
Rorippa X sterilis					P	P	
Rumex conglomeratus				P			
Sagina procumbens							P
Solanum dulcamara			P		P	P	
Stachys palustre		P	P				
Stellaria uliginosa							P
Vericaria			P				

Appendix E. PSYM raw data

E.1 PSYM raw output data

Table E.1: PSYM results and classification of ponds. Observed indices in unshaded rows and Ecological Quality Indices (EQIs) below (EQI of ≥1 denotes a pond meeting or exceeding reference site quality – marked in bold). (PSYM quality category = IBI >75% = Good, 51-75% = Moderate, 25-50% = Poor, <25% = V Poor)

Site Name	Pond 14
No. of submerged + marginal plant species (SM)	15
Predicted (SM)	18.6
EQI (SM)	0.81
IBI (SM)	3
Number of uncommon plant species (U)	3
Predicted (U)	4.2
EQI (U)	0.72
IBI (U)	2
Trophic Ranking Score (TRS)	9.00
Predicted (TRS)	5.61
EQI (TRS)	0.72
IBI (TRS)	0
Average Score Per Taxon (ASPT)	3.50
Predicted (ASPT)	5.19
EQI (ASPT)	0.65
IBI (ASPT)	1
Odonata + Megaloptera (OM) families	0
Predicted (OM)	3.49
EQI (OM)	0
IBI (OM)	0
Coleoptera families (CO)	2
Predicted (CO)	3.78
EQI (CO)	0.53
IBI (CO)	2
Sum of Individual Metrics	8
Index of Biotic Integrity (%)	44%
PSYM quality category	Poor
Priority species (UKBAP)	0
Is this a UKBAP Priority Pond?	No

E.2 PSYM macroinvertebrate species list

Table E.2: Raw species abundance data for pond P14

Species	Abundance
Agabus bipustulatus	1
Chironomidae	193
Cloeon dipterum	1
Copepoda	53
Corixa panzeri	2
Corixidae	1
Culicoides sp.	8
Erpobdella testacea	1
Glossiphonia complanata	3
Gyraulus crista	6
Haliplus sp.	1
Helobdella stagnalis	18
Hippeutis complanatus	7
Hydroporus palustris	2
Hygrotus inaequalis	1
Noterus clavicornis	24
Oligochaeta	10
Ostracoda	1095
Plea leachi	2
Ptychopteridae	27
Radix balthica	10
Sphaerium sp.	14
Syrphidae	1

E.3 PSYM aquatic plant species list

Table E.3: Raw species presence data from PSYM aquatic plant survey at pond P14

Species
Apium nodiflorum
Bidens cernua
Cardamine pratensis
Eleocharis palustris
Galium palustre
Juncus acutiflorus

Species
Juncus bufonius
Juncus conglomeratus
Juncus effusus
Juncus x han-reichgeltii
Juncus x surejanus
Lemna gibba
Lemna minuta
Lythrum portula
Ranunculus flammula
Sparganium erectum
Typha latifolia

PŴER NIWCLEAR
HORIZON
NUCLEAR POWER

CONTACT US:
If you have any questions or feedback regarding the Wylfa Newydd Project you can contact us on our dedicated Wylfa Newydd freephone hotline and email address, by calling on **0800 954 9516** or emailing **wylfaenquiries@horizonnuclearpower.com**

Horizon Nuclear Power
Sunrise House
1420 Charlton Court
Gloucester Business Park
Gloucester, GL3 4AE

T +44 (0)1242 508508

www.horizonnuclearpower.com

WN0904-JAC-OS-REP-00002 Rev 1.0