Welsh Government

M4 Corridor around Newport

Environmental Statement Volume 3: Appendix 10.30

Aquatic Macrophyte Survey 2015

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Summary

S.1 RPS has undertaken an aquatic macrophyte survey at sampling points along the route of the proposed M4 Corridor around Newport (M4CaN) between Castleton and Magor to inform the ecological baseline for the Environmental Impact Assessment (EIA) of the Scheme. The EIA is reported in the M4CaN Environmental Statement (ES) of which this document is an appendix to the chapter on Ecology and Nature Conservation.

S.2 An aquatic macrophyte survey undertaken by Rachel Hacking Ecology for Arup on behalf of Welsh Government in 2014 is reported separately in Appendix 10.14 of the M4CaN ES.

S.3 During the 2015 aquatic macrophyte surveys samples were taken at a total of 40 sampling points in areas not previously surveyed during 2014. These sample points covered main rivers, reens and field ditches.

S.4 Where reens were not covered by specific sampling points, but aquatic macrophyte data was collected during the river corridor survey, this data was also analysed (an additional four samples within the 300m survey lengths).

S.5 For the purposes of analysis the sample sections were assigned a diversity score and a rarity score in accordance with the Botanical Survey of Reens, Gwent Levels (CCW, 1991) which provides categories for both scores. These two categories were then taken into account and the highest of the two was used to provide the overall assessment of the sample section or, in the case of the River Corridor Surveys, per 300 metre sample length.

S.6 The 2015 survey identified the following.

- Two sample stations with very high overall rating in terms of botanical diversity.
- Twelve sample stations with a high overall rating in terms of botanical diversity.
- Fourteen sample stations with a moderate overall rating in terms of botanical diversity.
- Twelve sample stations with a low overall rating in terms of botanical diversity.

S.7 The four samples collected during the river corridor survey identified the following:

- Two samples with very high overall rating in terms of botanical diversity.
- One sample with a high overall rating in terms of botanical diversity.
- One sample with a moderate-high overall rating in terms of botanical diversity.

S.8 A total of eighteen nationally or locally rare species were found during the survey. Of these species, the following was noted.

- Two were rare within the UK.
- Seven were rare within Wales.

- Four were rare within Gwent.
- Five were locally distributed in Wales.

1 Introduction

1.1.1 RPS has undertaken an aquatic macrophyte survey of watercourses along the route of the proposed M4 Corridor around Newport (M4CaN) between Castleton and Magor to inform the ecological baseline for Environmental Impact Assessment (EIA) of the Scheme. The survey included areas generally within 100 m of the proposed alignment following the methodology set out in Interim Guidance Note 2: Flora Monitoring on The Gwent Levels Sites of Special Scientific Interest (CCW, 1996). The EIA is reported in the M4CaN Environmental Statement of which this document is an appendix to the chapter on Ecology and Nature Conservation.

1.1.2 An aquatic macrophyte survey previously undertaken by Rachel Hacking Ecology for Arup on behalf of Welsh Government in 2014 is reported separately in Appendix 10.14 of the M4CaN Environmental Statement (ES). A review of that work was undertaken independently by Hyder (see Appendix 9.1 in the ES Scoping Report (ES Appendix 5.1)) and RPS (see ES Chapter 10). The conclusions of that review and the requirements for additional surveys in 2015 were set out in the Scope of Ecology Surveys Report (see Appendix 9.1 of the ES Scoping Report). This was discussed with Natural Resources Wales (NRW) and they were further consulted on the scope of the proposed surveys through the consultation on the ES Scoping Report. Waterbodies surveyed in 2015 included those in areas not previously surveyed in 2014 and within the footprint of the new section of motorway, together with an approximate 100 metre corridor to either side.

1.1.3 This document reports the findings of the aquatic macrophyte survey which was undertaken during June, July and August 2015. This report outlines the previous survey carried out and the reasons for this additional survey (Section 2), describes the methods used in the survey (Section 3) and the findings of the survey (Section 4). A discussion of the survey findings is provided in Section 5.

2 Previous Surveys

2.1 Introduction

2.1.1 The 2014 aquatic macrophytes survey is reported in Appendix 10.14 of the ES. The aquatic macrophyte survey was commissioned to determine the plant species assemblages present along the route alignment proposed at that time and whether any species of conservation concern existed within the survey area.

2.2 2014 Survey Method

2.2.1 Maps were studied to identified survey sites. There were approximately 100 sites, mainly watercourses or waterbodies, which would be affected by the route alignment under consideration at that time. Due to timing considerations, 50% of the sites were selected for survey. The sites were selected either based on access availability or based on ground work i.e. visiting the sites and deciding which to survey.

2.2.2 At each suitable site, the sampling methodology followed that of the Countryside Council for Wales Guidance Note 2: Flora Monitoring on the Gwent Levels Sites of Special Scientific Interest (CCW, 1996).

2.2.3 A 20 metre section of each site was chosen and the following parameters recorded.

- Water depth.
- Turbidity (on a 1-5 scale; 1 = clear, 5 = turbid).
- Water flow and direction.
- Ditch width.
- Bank alignment, depth and slope.
- Nature of bank vegetation.
- Adjacent land use.
- Presence/absence of fencing, stock trampling, stock grazing, hedging, hedge height.
- % shade from woody vegetation (trees and hedges only).
- Ditch and bank management.
- % vegetation cover from submerged, floating, emergent and bank species.

2.2.4 All plant species within the water were recorded, as well bank species. A grapnel was used to sample submerged vegetation.

2.2.5 Three visits were made to each watercourse in May, July and September 2014. Identification was made in the field unless a specimen of the plant needed to be taken away for critical subsequent identification, for example, using a microscope. In this case, a specimen of the plant was obtained, bagged and labelled.

2.2.6 Each plant species was assessed for current rarity designations, such as Red Data Book, Nationally Scarce and/or Species of Principal Importance in Wales (as listed in accordance with Section 42 of the NERC Act 2006).

2.3 Limitations

2.3.1 Few constraints applied to any of the botanical survey visits. Some reens were difficult to access for the whole 20 metre stretch due to dense vegetation and/or steep banks.

2.4 Requirements for Further Survey

2.4.1 The 2014 survey report made the following recommendations for further survey work.

- Surveys of the ditches and ruderal habitats surrounding the M4 toll booth at Rogiet Moor. No access was given in 2014.
- Consecutive surveys of the species-rich sites covered in 2014. Species-rich sites include those with a good diversity of botanical species (i.e. 12 species of more).

2.4.2 At the Hyder/NRW meeting on 30th January 2015, aquatic macrophytes were discussed along with aquatic invertebrates.

2.4.3 NRW had been carrying out some survey work of the reens recently as part of the condition assessment for the Sites of Special Scientific Interest (SSSIs). NRW stated that they would make this information available (either to Hyder and/or to the Contractor's ecologist). This could then be used to inform the assessment, both as direct information for those reens due to be affected but also as contextual information regarding the status of the reen network more widely. It was noted that this could also be useful in targeting any reen mitigation and/or enhancement as part of the works.

2.4.4 It was agreed that the NRW data, combined with the 2014 survey information would provide a good baseline for the impact assessment and that any further survey work could therefore simply focus on assessing any particularly good reens which have not yet been surveyed (for reasons of access availability) and which would be directly affected by the alignment of the new section of motorway.

2.4.5 It was also agreed that the NRW reen scoring method could be used to determine how many reens of high, medium or low current value would be affected by the new section of motorway, which could then inform the impact assessment as well as the development of mitigation and enhancement design.

2.4.6 Having considered the report of the aquatic macrophyte survey in the context of the above recommendations, and on the basis that further information would be provided by NRW, RPS considered the requirement for further aquatic macrophyte survey based on consideration of the quality of those waterbodies new section of motorway.

2.4.7 The NRW further information was confined to aquatic invertebrate surveys and, therefore, following this further consideration, the survey described in this report was carried out.

3 2015 Survey Methods

3.1 Introduction

3.1.1 The 2015 aquatic macrophyte survey was carried out during June to August 2015. June and July are optimal periods for this type of survey. However, August is a suitable month and it is considered that the August survey findings were consistent with the June/July findings.

3.1.2 The survey locations are shown on Figure 1. Waterbodies surveyed were those in areas not previously surveyed in 2014 and within the footprint of the new section of motorway, together with an approximate 100 metre corridor to either side.

3.2 Objectives

3.2.1 The objectives of the 2015 aquatic macrophyte survey were as follows.

- Provide baseline data to inform the Environmental Impact Assessment for the Scheme.
- Identify reens/ditches with interesting species/communities for potential translocation to new reens.
- Identify the presence and distribution of rare and notable species within the 2015 survey areas (see Figure 1).
- Provide some understanding of the distribution of certain species within specific watercourses and areas.

3.3 Methodology

Aquatic Macrophyte Sampling Points

3.3.1 The survey method followed the Flora Monitoring on the Gwent Levels Sites of Special Scientific Interest (CCW, 1996) methodology described in Section 2.2.

3.3.2 A 20 metre section representing the characteristic length of each reen or field ditch was measured and marked on the ground. For each sample point, the following parameters were recorded:

- water depth;
- turbidity (on a 1 5 scale 1= clear 5=turbid);
- water flow and direction;
- ditch width;
- bank alignment depth and slope;
- nature of bank vegetation (i.e. bare/ short herbs/ monocotyledons and herbaceous/mixed vegetation including hedges and trees)
- adjacent land use;
- presence/absence of fencing; livestock trampling; livestock grazing; hedgerows;

- % shade from woody vegetation (trees and hedges not due to emergent vegetation such as common reed (*Phragmites australis*);
- ditch and bank management; and
- % vegetation cover from submerged floating emergent and bank species.

3.3.3 All plant species within the 20 metre sample section on the bank and within the reen were recorded. Aquatic species were sampled using a grapnel. To ensure that all species present were captured, the grapnel was thrown throughout the sample section until no new species were captured for at least 10 throws. Vegetation types were categorised into three sections, these were as follows.

- Bankside: species not clearly established within the water.
- Emergent: species clearly with roots and base of stem emerging from surface of the water.
- Floating/Submerged: species floating flat on water surface or submerged under water surface.

3.3.4 Each species was identified separately with the abundance estimated using the DAFOR scale (Dominant / Abundant / Frequent / Occasional /Rare).

3.3.5 A total of 40 samples were taken. This covered a total of seven NRA main rivers, twenty Seven reens and six field ditches. The survey locations are shown in Figure 1.

3.3.6 Sample points were both within the footprint and also within 100 metres of the proposed new section of motorway. This data was collected to provide context to assist in understanding the similarities and/or differences within specific watercourses and areas.

3.3.7 The regular management (casting) of main rivers and reens ensured that the watercourses were open and contained significant potential for aquatic macrophytes. The management of field ditches, however, varied according to how regularly each land owner or land manager managed (or not) the ditches. Consequently some ditches had become scrubbed over and/or dried up through natural infilling.

3.3.8 Therefore the decision to survey field ditches was based upon a plan provided by Natural Resources Wales (NRW). NRW provided a colour coded plan using the *Gwent Levels SSSI Field Ditch Assessment* decision tree (see Annex A) intended to assist in selection of field ditches for sampling by examining aerial imagery to ascertain tree or scrub cover over field ditches. From their Geographical Information System (GIS) Database. NRW provided hard copies of plans relevant to the proposed new section of motorway alignment with the coding highlighting each reen and ditch according to the following criteria.

- No hedge but potentially dry.
- Hedges on two sides.
- Hedge on one side.
- Intermittent hedge.
- No hedge and wet.

3.3.9 Where field ditches were heavily shaded the decision was made to exclude these features as they were considered unlikely to sustain significant populations of aquatic macrophytes.

3.3.10 During surveys the ecologist undertook a ground truthing exercise to ensure that the findings of the NRW plan were accurate and, on the whole, the findings on the ground were consistent with these plans.

3.3.11 Field ditches within the 2015 survey area with partial or no tree or scrub cover were then visited and where significant assemblages of macrophytes were noted these areas were sampled in accordance with the guidance (CCW, 1996). In some locations, surveys were extended to inform mitigation planning.

River Corridor Survey Species Lists

3.3.12 A river corridor survey was undertaken during September 2015 (see Appendix 10.32 of the ES). During the course of this survey a full list of aquatic macrophyte species at each survey location was taken. Four of the surveyed watercourses were not included in the aquatic macrophyte survey and the species lists for these are provided in Annex C and discussed in Section 4.3 and considered in Section 5.

Analysis of Findings

3.3.13 Reens and field ditches are important features of the Gwent Levels SSSIs. The system of reens and ditches within the SSSIs is thus of national importance. In most cases the diversity of individual watercourses and, in many cases, the presence of rare or notable species depends on the level of management occurring and the period of time since the last management operation took place.

3.3.14 For the purposes of this report and to provide a semi-quantified indication of the quality of watercourses covered in the 2015 survey, a diversity score adapted from A Botanical Survey of Reens in the Gwent Levels – CCW (Winder, Spencer and Wood, 1991) was assigned to each sample section.

Diversity Score

3.3.15 The diversity score is the number of aquatic macrophytes (i.e. those with their shoot bases at or below the reen water level) counted in each 20 metre sample section. No account was taken of the relative abundance of each species. These scores are presented in Table 3.1 below.

Table 3.1: Aquatic Macrophyte Diversity Score Categories

Number of species	Category
0 – 10	Low
11 – 15	Moderate
16 – 20	Moderate – high
21+	High

Rarity Score

3.3.16 For each site, rare and local species were scored from 1 – 10 (in accordance with Winder, Spencer and Wood, 1991). Table 3.2 shows all locally and/or nationally rare species found during the 2015 survey assigned a score depending on the rarity of each species.

Table 3.2: Rarity Score for Species

Latin name	English name	Rarity score	Rationale for rating
Wolffia arrhiza	Rootless duckweed	10	Species rare throughout Britain
Potamogeton trichoides	Hairlike Pondweed	8	
Alisma lanceolata	Narrow leaved water plantain	6	Species rare in Wales, local or frequent in England
Oenanthe fistulosa	Tubular water-dropwort	5	
Zanichella palustris	Horned pondweed	4	
Sagittaria sagittarius	Arrowhead	4	
Potamogeton pusillus	Lesser Pondweed	4	
Spirodela polyrhiza	Greater duckweed	4	
Hydrocharis morsus-ranae	Frogbit	4	
Ceratophyllum demersum	Rigid hornwort	3	Species rare in Gwent, local in Britain
Catabrosa aquatica	Whorl grass	3	
Carex pseudocyperus	Cyperus Sedge	3	
Potamogeton berchtoldii	Small pondweed	2	
Butomus umbellatus	Flowering-rush	1	Species local in Wales and/or England, frequent in County
Lemna gibba	Fat duckweed	1	
Lemna trisulca	Ivy-leaved duckweed	1	
Rumex hydrolapathum	Great water dock	1	
Veronica catenata	Pink water speedwell	1	

3.3.17 Nationally rare species are defined as rare or threatened throughout their range in Britain falling in less than 100 10km squares in Britain.

3.3.18 Species rare throughout Wales are those defined in *A Vascular Plant Red Data List for Wales* (Dines 2008).

3.3.19 Local species are defined as rare or threatened in a regional and/or local context but comparatively common throughout Britain. Frequent species are those that can be defined as relatively common throughout the defined range (e.g. county).

3.3.20 Once the rarity scores had been assigned for each sample location, this was then given a category as outlined in Table 3.3 below.

Table 3.3: Rarity Score Categories

Rarity score	Category
0 – 10	Low
11 – 20	Moderate
21-30	High
31+	Very High

3.4 Limitations

3.4.1 Most surveys were carried out during the optimal time of year for aquatic macrophyte surveys (June and July). Some surveys were carried out during August. The findings of the August surveys were consistent with previous surveys and, while it is accepted that some of the early flowering species may have died back, it is considered that this was not a significant limitation as most species were identified on the basis of vegetative material and in particular this included the rare and notable species that were found.

3.4.2 In some areas the banks of the reens were cut prior to the survey. In these cases this limited the identification of plant species. This affected only bank vegetation and did not hamper survey of aquatic macrophyte (emergent, floating and submerged) assemblages. Consequently this was not a significant limitation.

4 Results

4.1 Introduction

4.1.1 This section is split into two sections: The first section presents the results of the aquatic macrophyte survey for each sampling point; and the second section presents the species found during the River Corridor Survey, where relevant to this report (see ES Appendix 10.32).

4.2 Results

4.2.1 All sample locations are shown in Figure 1. Full species lists for each sampling point are provided In Annex B and the physical attributes of each sample section are provided in Annex C. Photographs of the watercourses sampled are provided at the end of this document.

Nant-y-Moor Reen

4.2.2 Nant-y-Moor Reen lies at the northwest boundary of St Brides SSSI. This section contained no noticeable flow however it appears that any flow would go from west to east towards Percoed Reen.

R01

4.2.3 This section lies to the north of a disused section of road. Species poor tall grassland dominates the approximately 45° sloping banks that were over two metres (m) above the water level. Reen width at water level was approximately 3 m with a water depth of approximately 0.5 m. The water column had a moderate turbidity.

4.2.4 Very few emergent species were noted with locally abundant reed sweet grass (*Glyceria maxima*) the predominant species. No submerged or floating species were noted.

4.2.5 A total of three aquatic macrophytes was identified within R01 giving this sample section a low diversity score.

4.2.6 R01 contained no nationally or locally rare species with a rarity score of zero putting it in the low rarity category.

R02

4.2.7 This section passes through an approximately 30 m wide corridor between two areas of plantation woodland. The reen here is approximately 70% shaded and the 2 m high, 45° bank slopes are established with rank grassland species and dense stands of bramble. Along the northern bank is the access track for reen management.

4.2.8 Frequent reed sweet grass and common reed were the main emergent species with occasional lesser water parsnip (*Berula erecta*) and floating sweet grass (*Glyceria fluitans*).

4.2.9 Submerged vegetation characterised by frequent water starwort (*Callitriche sp.*) and curled pondweed (*Potamogeton crispus*) were the only native submerged species noted with the alien, invasive Nuttall's pondweed also present.

4.2.10 A total of ten aquatic macrophytes was identified within R02 giving this sample section a low diversity score.

4.2.11 R02 contained no nationally or locally rare species with a rarity score of zero putting it in the low rarity category.

R03

4.2.12 This sample section of reen is shaded by a species poor hedgerow along the southern bank. The banks are steep (over 50°) and the northern bank is established with tall grassland species. Very few emergent or floating species were present during the survey with water plantain (*Alisma plantago-aquatica*) and branched bur-reed occurring rarely.

4.2.13 Submerged vegetation was limited to occasional water starwort (*Calltriche sp.*) and Nuttall's pondweed the only species found.

4.2.14 A total of five aquatic macrophytes was identified within R03 giving this sample section a low diversity score.

4.2.15 R03 contained no nationally or locally rare species with a rarity score of zero putting it in the low rarity category.

Main Reen (IDB57)

R04

4.2.16 This is a tributary of Percoed Reen. The steep sided banks were established with species poor rank grass with abundant common reed (*Phragmites australis*) and false oat grass (*Arrhenatherum elatius*).

4.2.17 Emergent vegetation was limited to abundant common reed and reed sweet grass. Floating vegetation included occasional common duckweed (*Lemna minor*) and submerged vegetation was limited to occasional water starwort (*Callitriche sp.*) and Nuttall's pondweed along with rare curled pondweed.

4.2.18 A total of eleven aquatic macrophytes was identified within R04 giving this sample section a moderate diversity score.

4.2.19 R04 contained no nationally or locally rare species with a rarity score of zero putting it in the low rarity category.

Percoed Reen

4.2.20 Percoed Reen is a regularly managed reen. The channel is uniform throughout with approximately 1 m depth, 4 m wide with very clear water (at time of survey). Steep (>50°) banks are approximately 1.5 m high and established with tall rank grassland species. There is very little shading from trees. However, tall plantation woodland to the south west does cause some shading of R7 during late afternoons.

R05

4.2.21 Emergent vegetation included the near dominant common reed with occasional arrowhead (*Sagittarius sagittarius*) emerging from within the main channel. Floating sweet grass was occasional within the channel. Reedmace (*Typha latifolia*) was occasional.

4.2.22 Floating vegetation included frequent frogbit (*Hydrocharis morsus-ranae*), common duckweed and greater duckweed (*Spirodela polyrhiza*) also present.

4.2.23 Submerged vegetation included frequent lesser pondweed and rare hairlike pondweed (*Potamogeton trichoides*)

4.2.24 A total of nineteen aquatic macrophytes was identified within R05 giving this sample section a moderate diversity score.

4.2.25 R05 contained six nationally or locally rare species with a rarity score of 27 putting it in the high rarity category. These species were: hairlike pondweed, lesser pondweed, greater duckweed, arrowhead, frogbit and rigid hornwort.

R06

4.2.26 Few emergent species were present within the channel here with frequent reed sweet grass and occasional common reed, meadowsweet and arrowhead.

4.2.27 Floating vegetation was present in small areas established at the base of emergent vegetation. Species here included common duckweed, greater duckweed and frogbit.

4.2.28 Submerged species included frequent hairlike pondweed with occasional lesser pondweed. Nuttall's pondweed was also present in small amounts.

4.2.29 A total of thirteen aquatic macrophytes was identified within R06 giving this sample section a moderate diversity score.

4.2.30 R06 contained six nationally or locally rare species with a rarity score of 25 putting it in the high rarity category. These species were: hairlike pondweed, lesser pondweed, greater duckweed, arrowhead, frogbit and ivy-leaved duckweed.

R07

4.2.31 Emergent vegetation here included frequent reed sweet grass and common reed along with occasional arrowhead.

4.2.32 Floating vegetation was only present at the base of emergent vegetation. Species present included occasional common duckweed with frogbit occurring rarely with this sample section.

4.2.33 Nuttall's pondweed was frequent, with rare lesser pondweed and occasional hairlike pondweed. Curled pondweed and ivy leaved duckweed (*Lemna trisulca*) were also present.

4.2.34 A total of thirteen aquatic macrophytes was identified within R07 giving this sample section a moderate diversity score.

4.2.35 R07 contained six nationally or locally rare species with a rarity score of 22 putting it in the high rarity category. The species noted were: hairlike pondweed, lesser pondweed, arrowhead, frogbit, ivy-leaved duckweed and great water dock.

Main Reen (IDB55)

R08

4.2.36 This reen did not appear to have been recently managed. As a consequence there was a high percentage of emergent vegetation with less than 50% open water. The steep banks of this water course were over 2 m high and established with dense stands of bramble and tall rank grassland is present to the north and south.

4.2.37 Emergent vegetation was established with locally abundant fool's-watercress (*Apium nodiflorum*) and abundant reed sweet grass. Lesser water parsnip was frequent and occasional patches of yellow flag iris were also noted.

4.2.38 Floating vegetation was characterised by dense mats of least pondweed with frequent fat duckweed and occasional common duckweed also present. No submerged vegetation was identified during the survey.

4.2.39 A total of eight aquatic macrophytes was identified within R08 giving this sample section a low diversity score.

4.2.40 R08 contained one nationally or locally rare species with a rarity score of 1 putting it in the low rarity category. This species was fat duckweed.

Julian's Reen

4.2.41 Julian's Reen lies along the western boundary of the Nash and Goldcliff SSSI. All three sample points along the reen were established with thick mats of duckweed (mainly least duckweed but also including common duckweed, fat duckweed and greater duckweed) with very few emergent species noted. The remnants of a hedgerow, under-grazed by sheep, creates some localised shading along the east bank. However, generally the reen is unshaded.

R09

4.2.42 A total of four aquatic macrophytes was identified within R09 giving this sample section a low diversity score.

4.2.43 R09 contained two nationally or locally rare species with a rarity score of 5 putting it in the low rarity category. These species were greater duckweed and fat duckweed.

R10

4.2.44 A total of four aquatic macrophytes was identified within R10 giving this sample section a low diversity score.

4.2.45 R10 contained three nationally or locally rare species with a rarity score of 8 putting it in the low rarity category. These species were: greater duckweed, rigid hornwort and fat duckweed.

R12

4.2.46 A total of seven aquatic macrophytes was identified within R12 giving this sample section a low diversity score.

4.2.47 R12 contained two nationally or locally rare species with a rarity score of 5 putting it in the low rarity category. The species were: greater duckweed and fat duckweed.

Field Ditches

4.2.48 Field ditches R11, R13 and R14 are located within an area of sheep and cattle grazed land to the south of the derelict Tatton Farm.

R11

4.2.49 This field ditch lies to the north of the proposed new section of motorway alignment and was heavily vegetated with only a small amount of open water available. Emergent marsh vegetation was the predominant type with only parts of the ditch fenced and cattle poaching in the unfenced areas. Water within the channel was up to 0.25 m deep and the channel approximately 4 m wide.

4.2.50 The ditch was characterised by dense stands of lesser water parsnip, reed sweet grass and greater pond sedge (*Carex riparia*). Common duckweed was occasional within the dense carpet of least duckweed.

4.2.51 A total of twelve aquatic macrophytes was identified within R11 giving this sample section a moderate diversity score.

4.2.52 R11 contained one nationally or locally rare species with a rarity score of 4 putting it in the low rarity category. This species was greater duckweed.

R13

4.2.53 This sample section is on the same field ditch as R11. Both sides of this vegetated ditch were protected from cattle poaching by a barbed wire fence.

4.2.54 The channel contained over 90% emergent vegetation with predominantly lesser water parsnip, reed sweet grass and greater pond sedge as the main species.

4.2.55 Small areas of open water were dominated by floating vegetation with occasional common duckweed and dense mats of the invasive least duckweed.

4.2.56 A total of nine aquatic macrophytes was identified within R13 giving this sample section a low diversity score.

4.2.57 R13 contained one nationally or locally rare species with a rarity score of 4 putting it in the low rarity category. This species was greater duckweed.

R14

4.2.58 This sample section was partially vegetated and characterised by 50% shading from willow (*Salix sp.*) and hawthorn (*Cretaegus monogyna*) scrub at either end with locally abundant stands of common reed. Water depth was approximately 0.5 m with no obvious flow. Shallow banks were protected from excessive grazing by barbed wire fencing.

4.2.59 Frequent reed sweet grass and occasional soft rush (*Juncus effusus*) were present along with floating mats of common duckweed and least duckweed also found within this sample section.

4.2.60 A total of seven aquatic macrophytes was identified within R14 giving this sample section a low diversity score.

4.2.61 R14 contained no nationally or locally rare species with a rarity score of zero putting it in the low rarity category.

R15

4.2.62 Field ditch 15 lies to the west of Ellen Reen within the Tata Steel landholding. The ditch is regularly subject to management and contained very few aquatic macrophytes but, like R16, contained species rich bank vegetation of tall grassland with forbs.

4.2.63 The channel was approximately 4 m wide and 0.5 m deep and relatively open. Emergent vegetation was approximately 5% of the ditch with yellow flag iris (*Iris pseudacorus*), hard rush (*Juncus inflexus*), purple loosestrife (*Lythrum salicaria*) and amphibious bistort (*Persicaria amphibia*) all present.

4.2.64 A total of nine aquatic macrophytes was identified within R15 giving this sample section a low diversity score.

4.2.65 R15 contained one nationally or locally rare species with a rarity score of 4 putting it in the low rarity category. This species was greater duckweed.

Ellen Reen

4.2.66 Ellen Reen lies within the Tata Steel landholding.

R16

4.2.67 This sample section of Ellen Reen was approximately 0.75 m deep and 3.5 m wide. The banks were established with species rich tall grassland along the north east and with dense scrub with occasional semi-mature tree along the southwest bank. Occasional emergent vegetation includes reed canary grass and lesser water parsnip.

4.2.68 Notably within this sample section the submerged vegetation is dominated by nationally rare hairlike pondweed while curled pondweed was also present.

4.2.69 A total of eleven aquatic macrophytes was identified within R16 giving this sample section a moderate diversity score.

4.2.70 R16 contained two nationally or locally rare species with a rarity score of 12 putting it in the moderate rarity category. These species were: hairlike pondweed and greater duckweed.

R19

4.2.71 The R19 sample section was at the confluence of Ellen Reen and Blackwall Reen. The channel was 5 m wide and a water channel approximately 1 m deep. Steep banks were no higher than 1 m and were characterised by abundant

common reed with crack willow (*Salix cf. fragilis*) partially shading along the west bank.

4.2.72 Very few species were noted within the channel with abundant common reed and occasional hemlock water dropwort (*Oenanthe crocata*) the main species present. Floating mats of vegetation dominated the water column including abundant common duckweed with occasional greater duckweed and the alien invasive water fern (*Azolla filliculoides*) also present. No submerged species were present.

4.2.73 A total of five aquatic macrophytes was identified within R19 giving this sample section a low diversity score.

4.2.74 R19 contained one nationally or locally rare species with a rarity score of 4 putting it in the low rarity category. This species was greater duckweed.

Blackwall Reen

4.2.75 The sample areas along Blackwall Reen were within the landownership of Tata Steel. The southern section of this reen was heavily shaded by a tall hedgerow along the southern bank. The northern section was more open with occasional semi-mature trees adjacent to the sample section.

R17

4.2.76 The channel at this location was 4 m wide with shallow banks less than 1 m above water level. Very few emergent species were present with small stands of reed sweet grass. Submerged vegetation was characterised by abundant rigid hornwort (*Ceratophyllum demersum*) and rarely occurring hairlike pondweed was also present. Floating vegetation covered 100% of the water surface with abundant common duckweed the predominant species with frequent greater duckweed. The nationally rare frogbit was present as was the invasive alien water fern.

4.2.77 A total of ten aquatic macrophytes were identified within R17 giving this sample section a low diversity score.

4.2.78 R17 contained five nationally or locally rare species with a rarity score of 20 putting it in the moderate rarity category. These species were hairlike pondweed, greater duckweed, frogbit, rigid hornwort and pink water speedwell.

R18

4.2.79 The shallow sloping west banks of this reen had been cut at the time of the surveys. However, the steeper approximately 2 m high east banks supported a species rich assemblage of tall grass and herb species. The water was over 1 m deep and open with few emergent species noted including greater pond sedge, reed sweet grass and reed canary grass (*Phalaris arundinacea*) all occasional.

4.2.80 Dense submerged vegetation was present with abundant hairlike pondweed. The invasive Nuttall's pondweed was occasional. Floating vegetation covered 20% of the water surface with greater duckweed occasional along with frogbit.

4.2.81 A total of eleven aquatic macrophytes was identified within R18 giving this sample section a moderate diversity score.

4.2.82 R18 contained four nationally or locally rare species with a rarity score of 19 putting it in the moderate rarity category. These were: hairlike pondweed, greater duckweed, frogbit and rigid hornwort.

Middle Reen

R20

4.2.83 Middle Reen is a small (2 m wide) watercourse with a defunct (i.e. approximately 15% gaps) hedgerow along the western bank. The reen sits between two areas of improved grassland.

4.2.84 Emergent vegetation included frequent reed sweet grass and branched bur-reed with lesser water-parsnip also present. Floating vegetation included frequent greater duckweed with occasional frogbit and common duckweed. Invasive water fern is rarely present to the south east of this sample area.

4.2.85 Submerged species included occasional hairlike pondweed and rare rigid hornwort.

4.2.86 A total of fourteen aquatic macrophytes was identified within R20 giving this sample section a moderate diversity score.

4.2.87 R20 contained four nationally or locally rare species with a rarity score of 19 putting it in the moderate rarity category. These species were: hairlike pondweed, greater duckweed, frogbit and rigid hornwort.

Chapel Reen

4.2.88 This reen lies to the south of Blackwall Reen and, at the sample point, was surrounded on both sides by dense scrub and bramble. There was no discernible flow within the reen. The reen appeared to emerge from underneath an embankment between Blackwall Reen and Monk's Ditch to the north and east.

R21

4.2.89 The channel was approximately 4 m wide and 0.75 m deep with moderate water clarity. Emergent species noted were frequent reed sweet grass and occasional greater pond sedge.

4.2.90 Floating vegetation covers 100% of the water surface with abundant greater duckweed with occasion common duckweed and rare fat duckweed (*Lemna gibba*). The invasive Nuttall's pondweed was abundant within the channel with the nationally rare hairlike pondweed frequent and occasional ivy-leaved duckweed (*Lemna trisulca*) also present. Lesser pondweed (*Potamogeton cf. pusillus*) was rare within this sample section.

4.2.91 A total of nine aquatic macrophytes was identified within R21 giving this sample section a low diversity score.

4.2.92 R21 contained five nationally or locally rare species with a rarity score of 17 putting it in the moderate rarity category. These species were: hairlike pondweed, greater duckweed, small pondweed, fat duckweed and ivy-leaved duckweed.

Middle Road Reen

R22

4.2.93 Middle Road Reen lies within the Tata Steel landholding to the south of reedbed Water Treatment Area 2. The reen is approximately 6 m wide and 1 m deep. Species rich tall grassland was present along the steep over 2 m high banks.

4.2.94 Emergent vegetation was characterised by frequent reed sweet grass, greater pond sedge and the locally important cyperus sedge (*Carex pseudocyperus*) with water mint (*Metha aquatica*) and lesser water parsnip occasional.

4.2.95 Within floating vegetation the nationally rare frogbit was occasionally encountered along with occasion common duckweed, greater duckweed and rare fat duckweed were also present.

4.2.96 Submerged vegetation contained abundant rigid hornwort, frequent ivy-leaved duckweed with occasional fennel pondweed (*Potamogeton pectinatus*). The invasive Nuttall's pondweed was occasional within this sample section with lesser pondweed occurring rarely.

4.2.97 A total of fifteen aquatic macrophytes was identified within R22 giving this sample section a moderate diversity score.

4.2.98 R22 contained seven nationally or locally rare species with a rarity score of 20 putting it in the high rarity category. These species were: lesser pondweed, greater duckweed, frogbit, rigid hornwort, cyperus sedge, fat duckweed and ivy-leaved duckweed.

Newcut Reen

R23

4.2.99 Newcut Reen is characterised by a tall dense hedgerow along the west bank and by tall (approximately 3 m) heavily cattle poached banks along the east side. The channel is approximately 6 m wide and 0.5 m deep. The east bank is species poor with cattle grazing occurring to the edge of the reen. However the reen is species rich in terms of aquatic macrophytes.

4.2.100 A total of eleven emergent species was present with the rare tubular water dropwort (*Oenanthe fistulosa*) and the locally important arrowhead were occasional within the channel as were lesser water parsnip, hemlock water dropwort and tufted forget-me-not (*Myosotis laxa*).

4.2.101 A further ten floating and submerged species were present with rigid hornwort abundant within submerged vegetation and the nationally rare hairlike pondweed frequent. Other submerged species included occasion Nuttall's pondweed, ivy-leaved duckweed and fennel pondweed. Floating vegetation included frequent greater duckweed along with occasional frogbit and common duckweed and rare fat duckweed.

4.2.102 A total of twenty one aquatic macrophytes was identified within R23 giving this sample section a high diversity score.

4.2.103 R23 contained eight nationally or locally rare species with a rarity score of 30 putting it in the high rarity category. These species were: hairlike pondweed,

tubular water-dropwort, greater duckweed, arrowhead, frogbit, rigid hornwort, fat duckweed and ivy-leaved duckweed.

Main River NRA21

R24

4.2.104 This sample section lies to the south of the proposed alignment of the proposed new section of M4 motorway. The channel is approximately 10 m wide and over 2 m deep. The banks of this sample section were characterised by a species rich dense assemblage of grass and herb species.

4.2.105 Emergent vegetation included a diverse assemblage of species with frequent reed sweet grass, greater pond sedge and mats of floating sweet grass and lesser water parsnip. Reedmace was occasional. Other species included meadowsweet (*Fillipendula ulmaria*), common spike rush (*Eleocharis palustris*), common marsh bedstraw (*Galium palustre*), water mint and tufted forget-me-not. Within this sample section the rare tubular water-dropwort was frequent and locally important arrowhead that occurred in small numbers but was far more abundant within the side channel to the south.

4.2.106 Floating vegetation covered no more than 20% of the water surface with occasional common duckweed and greater duckweed with rare fat duckweed. The nationally rare frogbit was occasional within this sample section.

4.2.107 Submerged vegetation was characterised by abundant rigid hornwort with patches of locally abundant fennel pondweed and frequent ivy-leaved duckweed. The invasive Nuttall's pondweed was occasional and during sampling some small fragments of the nationally rare hairlike pondweed were found indicating the presence of this species in very small amounts.

4.2.108 A total of twenty three aquatic macrophytes was identified within R24 giving this sample section a high diversity score.

4.2.109 R24 contained nine nationally or locally rare species with a rarity score of 31 putting it in the very high rarity category. These species were: hairlike pondweed, tubular water-dropwort, greater duckweed, arrowhead, frogbit, rigid hornwort, fat duckweed, ivy-leaved duckweed and great water dock.

R25

4.2.110 The channel is approximately 8 m wide and over 2 m deep. The east bank is bordered by a shallow side channel established with common reed. The shallow banks were heavily poached along the west of the sample section creating marshy conditions along a 1-2 m wide corridor.

4.2.111 Emergent vegetation, along the east bank and within the channel where this had not been grazed, included frequent common reed along with occasional floating sweet grass and common reed. Nationally rare tubular water dropwort and locally important arrowhead were both occasional.

4.2.112 Floating vegetation covered 50% of the water channel with occasional common duckweed and greater duckweed with rare fat duckweed all present. Nationally rare frogbit was present in small numbers.

4.2.113 Submerged vegetation characterised by abundant rigid hornwort with occasional curled pondweed and the invasive Nuttall's pondweed. Notably the nationally rare hairlike pondweed was frequent within this sample section.

4.2.114 A total of eighteen aquatic macrophytes was identified within R25 giving this sample section a moderate-high diversity score.

4.2.115 R25 contained eight nationally or locally rare species with a rarity score of 30 putting it in the high rarity category. These species were: hairlike pondweed, tubular water-dropwort, greater duckweed, arrowhead, frogbit, rigid hornwort, fat duckweed and ivy-leaved duckweed.

Cock Street Reen

R26

4.2.116 The channel was approximately 4 m wide and 0.5 m deep. The banks of the sample section are steep (over 50°) and approximately 2 m deep banks. To the north is a minor road and to the south the banks were grazed to the point where it was not too steep for cattle to reach the edge.

4.2.117 Reed sweet grass was occasional within the impoverished emergent vegetation with yellow flag iris and hemlock water dropwort also present.

4.2.118 Floating vegetation covered 100% of the water surface with abundant common duckweed and greater duckweed along with occasional fat duckweed.

4.2.119 Submerged vegetation included two species that included nationally rare hairlike pondweed along with occasional curled pondweed.

4.2.120 A total of eight aquatic macrophytes was identified within R26 giving this sample section a low diversity score.

4.2.121 R26 contained three nationally or locally rare species with a rarity score of 13 putting it in the moderate rarity category. These species were: hairlike pondweed, greater duckweed and fat duckweed.

Main Reen IDB45

R27

4.2.122 This sample section sits within two intensively managed improved grass ley fields. The steep banks are over 3 m high and the water channel is approximately 3 m wide. Very few emergent or submerged species were identified within this sample section.

4.2.123 Emergent vegetation was restricted to frequent small patches of reed sweet grass and yellow flag iris.

4.2.124 Floating species were the predominant vegetation type covering 80% of the water surface. Species were frequent least duckweed and fat duckweed along with occasional greater duckweed and common duckweed.

4.2.125 Submerged vegetation included the nationally rare hairlike pondweed that occurred occasionally and rare lesser pondweed.

4.2.126 A total of eight aquatic macrophytes was identified within R27 giving this sample section a low diversity score.

4.2.127 R27 contained four nationally or locally rare species with a rarity score of 17 putting it in the moderate rarity category. These species were: hairlike pondweed, lesser pondweed, greater duckweed and fat duckweed.

R28

4.2.128 This sample section runs along the northern boundary of a farm access track within a landscape of improved fields. The steep (>50°) banks are over 2 m high and established with abundant common nettle (*Urtica dioica*).

4.2.129 Emergent species were frequent reed sweet grass and occasional yellow flag iris with reed canary grass and hemlock water dropwort both rare.

4.2.130 The water surface was completely covered with a mat of floating vegetation. Species included abundant fat duckweed with invasive least duckweed frequent with occasional common duckweed.

4.2.131 No submerged species were found within the sample section during survey.

4.2.132 A total of eight aquatic macrophytes was identified within R28 giving this sample section a low diversity score.

4.2.133 R28 contained two nationally or locally rare species with a rarity score of 5 putting it in the low rarity category. These species were greater duckweed and fat duckweed.

Petty Reen NRA20b

R29

4.2.134 This sample section was characterised by improved grazing marsh to the south and scrub with mature trees along the north bank. The channel is approximately 5 m wide with a water depth over 1 m. The southern bank was near dominated by a dense stand of common reed.

4.2.135 Frequent common reed was the only emergent vegetation noted.

4.2.136 Floating vegetation covered approximately 70% of the water surface with frequent common duckweed, fat duckweed and greater duckweed the only species present.

4.2.137 Submerged species included locally abundant rigid hornwort with the invasive alien species Nuttall's pondweed occasional. The nationally rare hairlike pondweed was frequent within this channel and ivy-leaved duckweed was also present.

4.2.138 A total of eight aquatic macrophytes was identified within R29 giving this sample section a low diversity score.

4.2.139 R29 contained five nationally or locally rare species with a rarity score of 17 putting it in the moderate rarity category. These species were hairlike pondweed, greater duckweed, rigid hornwort, fat duckweed and ivy-leaved duckweed.

R32

4.2.140 This sample section was identified along the same main reen as R29. However, it was of notably different character in terms species present. The channel was 4 m wide and approximately 1 m deep. The shallow, less than 1 m high banks were protected from grazing by a barbed wire fence.

4.2.141 Emergent vegetation included occasional lesser water parsnip, greater pond sedge, whorl grass (*Catabrosa aquatica*) along with frequent reed sweet grass. Other species present included sharp flowered rush (*Juncus acutiflorus*), water mint and water forget-me-not (*Myotis scorpioides*),

4.2.142 The water surface was dominated by a floating mat of common and least duckweed with frequent greater duckweed. The nationally rare frogbit was rare within this sample section.

4.2.143 No submerged species were identified within the sample section however both the nationally rare hairlike pondweed and lesser pondweed were present within the same channel approximately 100 m to the west.

4.2.144 A total of eighteen aquatic macrophytes was identified within R32 giving this sample section a moderate-high diversity score.

4.2.145 R32 contained eight nationally or locally rare species with a rarity score of 21 putting it in the high rarity category. These species were: lesser pondweed, greater duckweed, frogbit, whorl grass, rigid hornwort, fat duckweed, ivy-leaved duckweed and great water dock.

Petty Reen NRA20a

R31a

4.2.146 The channel is approximately 4 m wide with a water depth of 1 m. There was no shading from trees. The banks of the reen are protected with a barbed wire fence to prevent cattle poaching and support a species rich assemblage of tall herb and grass species.

4.2.147 Emergent vegetation included abundant stands of reed sweet grass with occasional cyperus sedge. Narrow leaved water-plantain (*Alisma lanceolata*) was found in small number within this sample section.

4.2.148 This reen notably included a very diverse assemblage of floating and submerged species. Floating species included occasional frogbit, fat duckweed and common duckweed with frequent greater duckweed.

4.2.149 Submerged species included frequent rigid hornwort, the invasive Nuttall's pondweed and the nationally rare hairlike pondweed. Notably whorled pondweed (*Zanichella palustris*) was occasional within this reen. Other species present were common stonewort (*Chara vulgaris agg.*), ivy-leaved duckweed and lesser pondweed.

4.2.150 A total of twenty two aquatic macrophytes was identified within R31A giving this sample section a high diversity score.

4.2.151 R31a contained eleven nationally or locally rare species with a rarity score of 39 putting it in the very high rarity category. These species were: hairlike pondweed,

narrow leaved water-plantain, lesser pondweed, greater duckweed, horned pondweed, frogbit, rigid hornwort, cyperus sedge, fat duckweed, ivy-leaved duckweed and great water dock.

R34

4.2.152 This sample section sits at the confluence between Petty Reen and Stutwall Reen. The channel width varies between 4 m to 6 m wide and was approximately 0.75 m deep. Surrounding land use is woodland and scrub to the east and south and cattle grazing marsh to the west.

4.2.153 Emergent vegetation was characterised by frequent reed sweet grass with occasional great water dock (*Rumex hydrolapathum*) and yellow flag iris.

4.2.154 Floating vegetation included the nationally rare frogbit and common duckweed that occurred occasionally along with frequent greater duckweed.

4.2.155 Submerged vegetation was characterised by abundant stands of the nationally rare hairlike pondweed along with occasional water starwort, ivy-leaved duckweed and the invasive Nuttall's pondweed. Rigid hornwort and lesser pondweed were rare within this sample section.

4.2.156 A total of thirteen aquatic macrophytes was identified within R34 giving this sample section a moderate diversity score.

4.2.157 R34 contained seven nationally or locally rare species with a rarity score of 25 putting it in the high rarity category. These species were: hairlike pondweed, lesser pondweed, greater duckweed, frogbit, rigid hornwort, ivy-leaved duckweed and great water dock.

R38

4.2.158 This sample section lies on Petty Reen between R31a and R34. The channel at this location has been fenced with a barbed wire fence along the west bank, this fence has become overgrown with bramble (*Rubus fruiticosus agg.*). Along the west bank tall common reed swamp is the dominant habitat type and does not appear to have been recently managed.

4.2.159 Emergent vegetation along the east bank was characterised by a stand of common reed with occasional meadowsweet, marsh woundwort (*Stachys palustris*) and great water dock.

4.2.160 Floating vegetation was established with abundant greater duckweed along with frequent common duckweed, fat duckweed and the alien, invasive least duckweed. The nationally rare frogbit was also present within this sample section.

4.2.161 Rarely occurring rigid hornwort was the only submerged species present.

4.2.162 A total of nine aquatic macrophytes was identified within R38 giving this sample section a low diversity score.

4.2.163 R38 contained five nationally or locally rare species with a rarity score of 13 putting it in the moderate rarity category. These species were: greater duckweed, frogbit, rigid hornwort, fat duckweed and great water dock.

Field Ditches

R30

4.2.164 This field ditch lies to the south of Petty Reen (NRA20b). The sample section lies within cattle grazed pasture to the east and west and is protected from cattle grazing by barbed wire fencing along both banks.

4.2.165 Emergent vegetation was characterised by dense stands of reed sweet grass, greater pond sedge and cyperus sedge with jointed rush (*Juncus articulatus*) and sharp-flowered rush (*Juncus acutiflorus*) rare within this sample section.

4.2.166 Floating vegetation covered approximately 60% of the water surface. The nationally rare frogbit was abundant along with occasional fat duckweed and frequent common duckweed and greater duckweed.

4.2.167 Submerged vegetation was characterised by locally abundant rigid hornwort with frequent Nuttall's pondweed and ivy-leaved duckweed. The nationally rare hairlike pondweed was frequent.

4.2.168 A total of twenty one aquatic macrophytes was identified within R30 giving this sample section a high diversity score.

4.2.169 R30 contained eight nationally or locally rare species with a rarity score of 25 putting it in the high rarity category. These species were: hairlike pondweed, greater duckweed, frogbit, rigid hornwort, cyperus sedge, fat duckweed, ivy-leaved duckweed and great water dock.

R31

4.2.170 This field ditch lies between Petty Reen (NRA20b) to the south and the A4810 to the north. The west bank is protected from cattle grazing on adjacent pasture by a barbed wire fence and the east bank abuts an area of dense scrub. Emergent vegetation covered approximately 50% of the water surface.

4.2.171 Emergent vegetation was characterised by a frequent stands of great pond-sedge and reedmace with occasion gypsywort (*Lycopus europaeus*), bittersweet (*Solanum dulcamara*) with great water dock, lesser spearwort (*Ranunculus flammula*) and cyperus sedge. Fool's watercress and lesser water parsnip were also present in small patches.

4.2.172 Floating vegetation covered 40% of the water channel and included frequent greater duckweed and common duckweed with frogbit and fat duckweed also found rarely.

4.2.173 Submerged vegetation was established with near dominant rigid hornwort with occasional ivy-leaved duckweed and Nuttall's pondweed. The nationally rare hairlike pondweed was found to the south of this sample section.

4.2.174 A total of twenty four aquatic macrophytes was identified within R31 giving this sample section a high diversity score.

4.2.175 R31 contained nine nationally or locally rare species with a rarity score of 24 putting it in the high rarity category. These species were: lesser pondweed, arrowhead, frogbit, whorl grass, rigid hornwort, cyperus sedge, fat duckweed, ivy-leaved duckweed and great water dock.

Bareland Street Reen (west)

R33

4.2.176 This sample section of Bareland Street Reen lies to the west of the A4810. The water depth was approximately 2 m and the width of the reen was 5 m. Steep banks were less than 1 m high and established with a diverse assemblage of terrestrial and macrophyte species. The sample section is bordered to the south by a minor road and an approximately 3 m wide corridor of tall vegetation is fenced with barbed wire to prevent poaching by cattle within pasture to the north.

4.2.177 Emergent vegetation was established with mats of frequent lesser water parsnip along with floating mats of occasional fool's watercress and common bent. Branched bur-reed and yellow flag iris were occasional along marsh woundwort.

4.2.178 Abundant greater duckweed was the main floating vegetation found with common duckweed and frogbit occurring occasionally and fat duckweed rarely within this sample section.

4.2.179 Submerged vegetation was characterised by abundant Nuttall's pondweed with occasional water starwort, ivy leaved duckweed and hairlike pondweed. Both rigid hornwort and lesser pondweed were rarely encountered.

4.2.180 A total of twenty two aquatic macrophytes was identified within R33 giving this sample section a high diversity score.

4.2.181 R33 contained eight nationally or locally rare species with a rarity score of 26 putting it in the high rarity category. These species were: hairlike pondweed, lesser pondweed, greater duckweed, frogbit, rigid hornwort, fat duckweed, ivy-leaved duckweed and great water dock.

Stutwall Reen IDB46a

R35

4.2.182 This section of reen is within land managed by the Gwent Wildlife Trust. The reen is fenced on both the north and the south side to prevent cattle poaching and consequently has established with tall, dense bank vegetation with frequent false oat grass, meadowsweet and great willowherb (*Epilobium hirsutum*). The channel is approximately 4 m wide and 1 m deep with very clear water.

4.2.183 Emergent vegetation occupied some 10% of the water channel with frequent reed sweet grass and branched bur-reed along with occasional reedmace, great water dock and cyperus sedge.

4.2.184 Floating vegetation covered 40% of the water surface and included frequent greater duckweed with common duckweed and frogbit also present.

4.2.185 The nationally rare hairlike pondweed was abundant within this sample section. Other submerged species included ivy-leaved pondweed, lesser pondweed and rigid hornwort.

4.2.186 A total of eighteen aquatic macrophytes was identified within R35 giving this sample section a moderate-high diversity score.

4.2.187 R35 contained eight nationally or locally rare species with a rarity score of 31 putting it in the high rarity category. These species were: hairlike pondweed, lesser pondweed, greater duckweed, frogbit, rigid hornwort, cyperus sedge, ivy-leaved duckweed and great water dock.

Bareland Street Reen (east)

R36

4.2.1 This sample section lies within an area of rush pasture to the south and improved horse grazed fields to the north. The banks of the reen are protected from grazing by barbed wire fences although sections of the fence were relatively low allowing horses to reach over to graze. The reen channel is approximately 4 m wide and 1 m deep with no obvious flow.

4.2.2 Emergent vegetation included locally abundant floating mats of creeping bent (*Agrostis stoloniferous*) and watercress (*Rorippa nasturtium-officinale*) with frequent reed sweet grass and tubular water dropwort. Floating sweet grass, soft rush, amphibious bistort and water mint were all occasional with marsh thistle, marsh foxtail and lesser water parsnip also present.

4.2.3 Floating vegetation included frequent frogbit with common duckweed along with occasional greater duckweed.

4.2.4 There were few submerged species noted during this survey with ivy-leaved duckweed and a water starwort (*Callitriche sp.*) occurring rarely. Two species of invasive pondweed were identified within this sample section; these were Nuttall's pondweed and Canadian pondweed (*Elodea canadensis*).

4.2.5 A total of twenty three aquatic macrophytes was identified within R36 giving this sample section a high diversity score.

4.2.6 R36 contained four nationally or locally rare species with a rarity score of 14 putting it in the moderate rarity category. These species were tubular water dropwort, greater duckweed, frogbit and ivy-leaved duckweed.

R37

4.2.7 This sample section of Bareland Street Reen lies to the east of the A4810. To the northeast of the sample section the wide road verge has established with tall grassland with locally dominant areas of nettle and bramble and scrub to the southeast. The reen width was approximately 3 m with 0.5 m deep, very clear water. The road verge is regularly mown to the northwest; however no management was apparent to the southeast.

4.2.8 Emergent vegetation included locally abundant common reed with bulrush also present occasionally.

4.2.9 Floating vegetation included frequent common duckweed with occasional frogbit and greater duckweed.

4.2.10 Dense mats of submerged vegetation were characterised by near dominant rigid hornwort with occasional water starwort (*Callitriche* sp.) and frequent lesser pondweed. Curled pondweed occurred rarely within this sample section.

4.2.11 A total of fifteen aquatic macrophytes was identified within R37 giving this sample section a moderate diversity score.

4.2.12 R37 contained four nationally or locally rare species with a rarity score of 15 putting it in the moderate rarity category. These species were: lesser pondweed, greater duckweed, frogbit and rigid hornwort.

Moor Ditch

R39

4.2.13 Moor Ditch sits adjacent to the southern boundary of a farm access track. Along the southern bank a defunct hedgerow borders an area of cattle grazed improved pasture. The bank of the section sloped at approximately 40° and were 2 m high. Clear water was less than 0.5 m deep within a 3 m wide channel. Dense stands of nettle along the species poor ditch banks indicate high levels of nutrients. The watercourse appeared to have been cast during early 2015.

4.2.14 Locally abundant reed sweet grass was the main emergent species with very few other species noted. However, stands of common reed were noted to the west.

4.2.15 Floating species were established over 50% of the water surface; this included abundant frequent common duckweed with fat duckweed and greater duckweed also present.

4.2.16 Submerged vegetation was characterised by locally abundant Nuttall's pondweed with occasional water starwort (*Callitriche sp.*) and small pondweed (*Potamogeton berchtoldii*) with hairlike pondweed also present.

4.2.17 A total of twelve aquatic macrophytes was identified within R39 giving this sample section a moderate diversity score.

4.2.18 R39 contained six nationally or locally rare species with a rarity score of 17 putting it in the moderate rarity category. These species were: hairlike pondweed, greater duckweed, small pondweed, fat duckweed, ivy-leaved duckweed and pink water speedwell.

4.3 River Corridor Survey Species Lists

4.3.1 This section presents the findings of the macrophyte sampling carried out during river corridor surveys conducted during August and September 2015. The method involved sampling throughout the 300 m sample section of the reen and the results are consequently not directly comparable with the findings of the aquatic macrophytes survey findings presented in Section 4.2.

RCS1 Morfa Gronw Reen (IBD34)

4.3.2 The reen is 4 m wide and 1 m deep with shallow banks. The waterbody is divided into two distinct section dissected by a railway line running between east and west. The reen is well connected to other watercourses in the surrounding area through the adjoining field ditches.

4.3.3 The northern section is surrounded by areas of improved grassland divided by connecting field ditches. The predominant bank and emergent species is common reed with occasional hemlock water-dropwort. Emergent vegetation

included occasional lesser water parsnip with wild angelica (*Angelica sylvestris*), great willowherb and yellow flag iris. Floating species included abundant common duckweed along with frequent frogbit and rare greater duckweed and fat duckweed. Submerged species included occasional water starwort, Nuttall's pondweed and ivy-leaved duckweed. Small pondweed and hairlike pondweed were also present in small quantities.

4.3.4 The aquatic macrophyte vegetation was more diverse than the northern section of this reen with notably less common reed present throughout, which is a likely consequence of management regimes for each reen section. Emergent vegetation was a mosaic of occasional patches of reed sweet grass, floating sweet grass, lesser water parsnip, branched bur-reed and common reed. Tubular water-dropwort was occasional throughout this section of reen. Floating vegetation was notable for locally abundant areas of frogbit and the nationally rare rootless duckweed (*Wolffia arrhiza*). Submerged vegetation here included hairlike pondweed, ivy-leaved duckweed and common stonewort.

4.3.5 RCS1 contained eight nationally or locally rare species with a rarity score of 41 putting it in the very high rarity category. These species were: rootless duckweed, hairlike pondweed, narrow leaved water-plantain, tubular water-dropwort, greater duckweed, small pondweed, frogbit, fat duckweed and ivy-leaved duckweed.

RCS2 New Dairy Reen (IDB37)

4.3.6 New Dairy Reen is a 5 m wide reen with heavily poached banks and deep water (approximately 1.5 m). The Banks of the reen are unfenced and heavily poached by cattle and as a result the reen is open with short cropped banks. Emergent vegetation was characterised by stands of branched bur-reed growing through the centre of the channel throughout with locally abundant creeping bent and occasional dense stands of common reed. Lesser water parsnip was encountered throughout. Notable emergent vegetation included flowering rush (*Butomus umbellatus*) and tubular water-dropwort.

4.3.7 Notable floating species included locally abundant frogbit with frequent common duckweed and greater duckweed.

4.3.8 RCS2 contained five nationally or locally rare species with a rarity score of 18 putting it in the moderate rarity category. These species were: tubular water-dropwort, greater duckweed, arrowhead, frogbit, and flowering rush.

RCS3 Pont y Cwcw Reen (NRA10)

4.3.9 Pont y Cwcw reen runs parallel with a farm access track servicing Old Dairy Farm. It is approximately 2 m wide and approximately 0.5 m deep with steep 1.5 m deep banks.

4.3.10 Stands of branched bur-reed were abundant throughout with locally abundant common reed and reed sweet grass also present. Large dense stands of locally abundant arrowhead were also identified.

4.3.11 Floating vegetation included locally abundant unbranched bur-reed (*Sparganium emersum*) with frogbit also present. Occasional Nuttall's pondweed and ivy-leaved duckweed were the main submerged species present.

4.3.12 RCS3 contained four nationally or locally rare species with a rarity score of 10 putting it in the low rarity category. These species were: arrowhead, frogbit, fat duckweed and ivy-leaved duckweed.

RCS4 Sea Wall Reen (NRA11)

4.3.13 Two sections to the north of a sluice gate and to the south have distinctive characters due to relative levels of management.

4.3.14 North of the sluice appeared to have been more recently managed with a very open channel with far less emergent species and a higher proportion of submerged and floating species. Emergent species included locally abundant floating mats of creeping bent with occasional floating sweet grass and reed sweet grass also present. Other species included occasional fool's watercress, lesser water-parsnip along with a diverse assemblage of species including tubular water-dropwort, narrow water plantain, gypsywort, skullcap (*Scutellaria galericulata*), marsh foxtail and marsh ragwort (*Senecio aquaticus*).

4.3.15 Floating species within the northern section included broad leaved pondweed (*Potamogeton natans*) with frogbit with fat duckweed and common duckweed. Submerged vegetation included locally abundant rigid hornwort, fennel pondweed and the invasive Nuttall's pondweed with hairlike pondweed occurring rarely.

4.3.16 South of the sluice appears not to have been recently managed and consequently there is a much higher proportion of emergent vegetation including abundant branched bur-reed, common reed and reedmace. Both narrow leaved water-plantain and water-plantain were also present throughout this reen.

4.3.17 Notable within the floating vegetation along the southern section of Sea Wall Reen were areas of near dominant water fern and patches of least duckweed. In the few areas where water fern and least duckweed were less prevalent frogbit, common duckweed, and fat duckweed were present.

4.3.18 Submerged species throughout this reen included hairlike pondweed and tubular water-dropwort. Arrowhead and frogbit were rare in the southern section.

4.3.19 RCS4 contained eleven nationally or locally rare species with a rarity score of 38 putting it in the very high rarity category. These species were: hairlike pondweed, narrow leaved water-plantain, tubular water-dropwort, greater duckweed, arrowhead, frogbit, rigid hornwort, flowering rush, fat duckweed, ivy-leaved duckweed and great water dock.

4.4 Overall Rating

4.4.1 Table 4.1 below provides a summary of diversity scores and categories along with the rarity scores and categories. The overall rating for each sample section is then given based upon the highest rating of the two scores.

Table 4.1: Summary of Overall Ratings in Terms of Botanical Diversity.

Sample Section Reference	Diversity Score	Diversity Category	Rarity score	Rarity Category	Overall rating in terms of botanical diversity.
R1	3	Low	0	Low	Low
R2	10	Low	0	Low	Low
R3	5	Low	0	Low	Low
R4	11	Moderate	0	Low	Moderate
R5	19	Moderate	27	High	High
R6	13	Moderate	25	High	High
R7	13	Moderate	22	High	High
R8	8	Low	1	Low	Low
R9	4	Low	5	Low	Low
R10	4	Low	8	Low	Low
R11	12	Moderate	4	Low	Moderate
R12	7	Low	5	Low	Low
R13	9	Low	4	Low	Low
R14	7	Low	0	Low	Low
R15	9	Low	4	Low	Low
R16	11	Moderate	12	Moderate	Moderate
R17	10	Low	20	Moderate	Moderate
R18	11	Moderate	19	Moderate	Moderate
R19	5	Low	4	Low	Low
R20	14	Moderate	19	Moderate	Moderate
R21	9	Low	17	Moderate	Moderate
R22	15	Moderate	20	Moderate	Moderate
R23	21	High	30	High	High
R24	23	High	31	Very High	Very High
R25	18	Moderate-High	30	High	High
R26	8	Low	13	Moderate	Moderate
R27	8	Low	17	Moderate	Moderate
R28	8	Low	5	Low	Low
R29	8	Low	20	Moderate	Moderate
R30	21	High	25	High	High
R31	24	High	24	High	High
R31a	22	High	39	Very High	Very high
R32	18	Moderate-High	21	High	High
R33	22	High	26	High	High
R34	13	Moderate	25	High	High
R35	18	Moderate	28	High	High
R36	23	High	14	Moderate	High
R37	15	Moderate	15	Moderate	Moderate
R38	9	Low	13	Moderate	Moderate
R39	12	Moderate	17	Moderate	Moderate
RCS1	29	High	41	Very High	Very High
RCS2	25	High	18	Moderate	High
RCS3	16	Moderate-High	10	Low	Moderate-High
RCS4	39	High	38	Very High	Very High

4.5 Rare and Scarce Species per Sample Location

4.5.1 Table 4.2 below provides a summary of the number of rare or scarce species per sample area and a list of those species where relevant. The locations of each rare and scarce species are also shown on Figure 2.

Table 4.2: Summary of rare and scarce species per sample location

Latin name	English name	Total number of sample areas where species found	Sample areas where species found
Wolffia arrhiza	Rootless duckweed	1	RCS1
Potamogeton trichoides	Hairlike Pondweed	22	R5, R6, R7, R16, R17, R18, R20, R21, R23, R24, R25, R26, R27, R29, R30, R31a, R33, R34, R35, R39, RCS1, RCS4
Alisma lanceolata	Narrow leaved water plantain	3	R31a, RCS1, RCS4
Oenanthe fistulosa	Tubular water-dropwort	7	R23, R24, R25, R36, RCS1, RCS2, RCS4
Zanichella palustris	Horned pondweed	1	R31a
Sagittaria sagittarius	Arrowhead	9	R5, R6, R7, R23, R24, R25, RSC2, RSC3, RSC4
Potamogeton pusillus	Lesser Pondweed	12	R5, R6, R7, R22, R27, R31, R31a, R32, R33, R34, R35, R37
Spirodela polyrhiza	Greater duckweed	36	R5, R6, R9, R10, R11, R12, R13, R15, R16, R17, R18, R19, R20, R21, R22, R23, R24, R25, R26, R27, R28, R29, R30, R31, R31a, R32, R33, R34, R35, R36, R37, R38, R39, RSC1, RSC2, RSC4
Hydrocharis morsus-ranae	Frogbit	24	R5, R6, R7, R17, R18, R20, R22, R23, R24, R25, R30, R31, R31a, R32, R33, R34, R35, R36, R37, R38, RCS1, RCS2, RCS3, RCS4
Ceratophyllum demersum	Rigid hornwort	20	R5, R10, R17, R18, R20, R22, R23, R24, R25, R29, R30, R31, R31a, R32, R33, R34, R35, R37, R38, RSC4
Catabrosa aquatica	Whorl grass	2	R31, R32,
Carex pseudocyperus	Cyperus Sedge	5	R22, R30, R31, R31a, R35
Potamogeton berchtoldii	Small pondweed	2	R21, RCS4
Butomus umbellatus	Flowering-rush	2	RCS2, RCS4
Lemna gibba	Fat duckweed	22	R8, R9, R10, R12, R21, R22, R23, R24, R25, R26,

Latin name	English name	Total number of sample areas where species found	Sample areas where species found
			R27, R28, R29, R30, R31, R31a, R32, R33, R38, R39, RCS1, RCS4
Lemna trisulca	Ivy-leaved duckweed	20	R6, R7, R21, R22, R23, R24, R25, R29, R30, R31, R31a, R32, R33, R34, R35, R36, R39, RCS1, RCS3, RCS4
Rumex hydrolapathum	Great water dock	9	R7, R24, R30, R31, R31a, R32, R34, R35, R38,
Veronica catenata	Pink water speedwell	2	R17, R39

5 Discussion

5.1 Introduction

5.1.1 This section provides discussion of the finding of the 2015 aquatic macrophyte survey. A total of forty aquatic macrophyte sampling points were covered during the survey (plus four additional sampling points from the river corridor survey) and are shown on Figure 1.

5.2 Survey Findings

5.2.1 For the purposes of analysis the sample sections were assigned a diversity score and a rarity score in accordance with the Botanical Survey of Reens, Gwent Levels (CCW, 1991) which in turn provided categories for both scores. These two categories were then taken into account and the highest of the two was used to ascertain the overall rating of the survey length.

- Two sample stations with very high overall rating in terms of botanical diversity.
- Twelve sample stations with a high overall rating in terms of botanical diversity.
- Fourteen sample stations with a moderate overall rating in terms of botanical diversity.
- Twelve sample stations with a low overall rating.

5.2.2 The additional four samples collected during the river corridor survey identified the following:

- Two samples with very high overall rating in terms of botanical diversity.
- One sample with a high overall rating in terms of botanical diversity.
- One sample with a moderate-high overall rating in terms of botanical diversity.

5.2.3 A total of eighteen nationally or locally rare species were found during the survey, of these species:

- Two were rare within the UK.
- Seven were rare within Wales.
- Four were rare within Gwent.
- Five were locally distributed in Wales.

5.2.4 These were widely distributed throughout the sample areas covered. The locations of these species are shown in Figure 2.

5.3 Key Considerations

5.3.1 All sample sections are within the Gwent Levels SSSIs which are designated for the assemblages of aquatic plants and invertebrates within the reen and field

ditch system. Management of the watercourses results in various stages of vegetation succession from recently cast to fully established with in some cases a dense species poor stand of common reed. The reen and field ditch system as a whole is of national importance for nature conservation.

5.3.2 Findings of the survey show that the more regularly the feature is managed the higher the diversity of aquatic macrophyte species present and where management has not occurred for some time the watercourse becomes over grown and the aquatic plant assemblages, especially those that are floating and submerged, are gradually lost.

5.3.3 Field ditches R11, R13 and R14 are located within an area of sheep and cattle grazed land to the south of the now derelict Tatton Farm. This landscape may have at one time been well managed. However, today the field ditch system is unmanaged and many of the ditches are now near dry and have become established with dense scrub vegetation.

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Dines T.D., Jones R.A., Leach S.J., McKean D.R., Pearman D.A., Preston C.D., Rumsey F.J., Taylor I. (2005). The Vascular Plant Red Data List or Great Britain.

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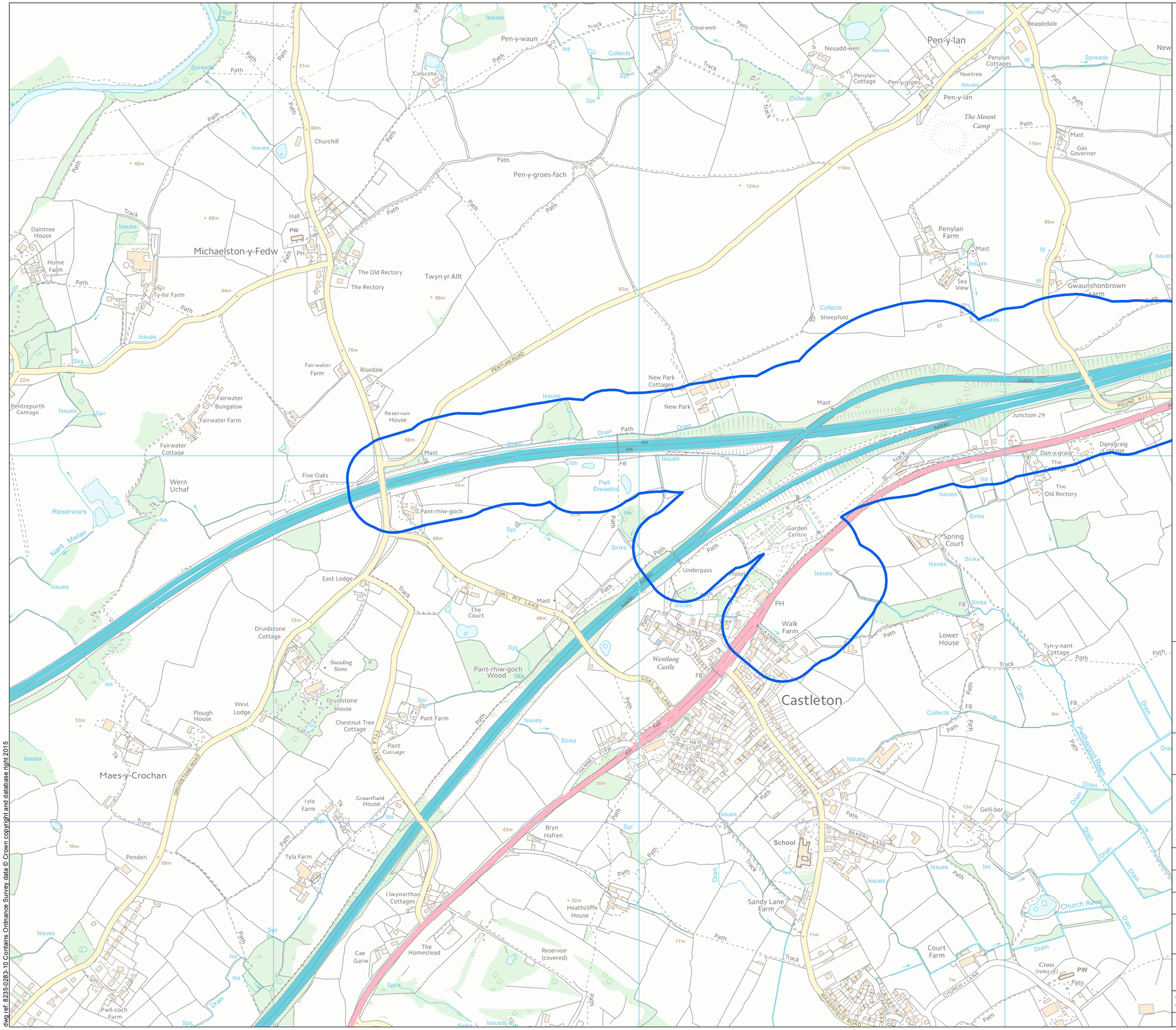
Figures



Legend

100m Study area

Aquatic Macrophyte 20m Sample

- Low
- Moderate
- Moderate-High
- High
- Very High

Study area shown reflects the scheme design at the time of the survey

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Welsh Government

Appendix 10.30 Aquatic Macrophyte Survey Report

2015 Aquatic Macrophytes Survey

Figure: 1a	Revision: -
Date: March 2016	Status: AT ISSUE
Drawn: CR	Checked: KJ

Scale: A3 @ 1:10,000

0 250 500m

N

dwg ref: 8235-0283-10

Legend

- 100m Study area

Aquatic Macrophyte 20m Sample

- Low
- Moderate
- Moderate-High
- High
- Very High

Study area shown reflects the scheme design at the time of the survey

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Appendix 10.30 Aquatic Macrophyte Survey Report

2015 Aquatic Macrophytes Survey

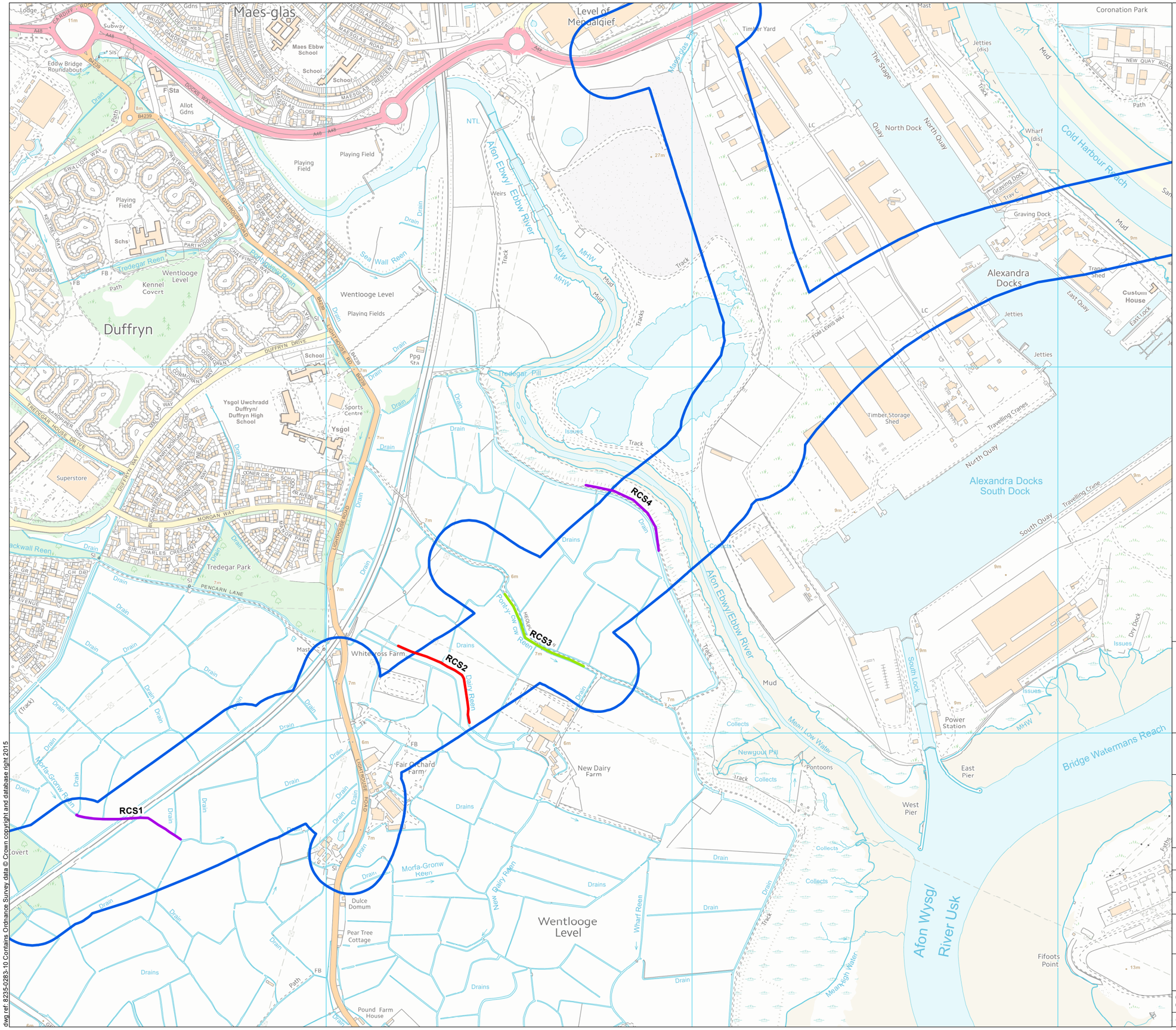
Figure: 1b	Revision: -
Date: March 2016	Status: AT ISSUE
Drawn: CR	Checked: KJ

Scale: A3 @ 1:10,000

0 250 500m

N

dwg ref: 8235-0283-10



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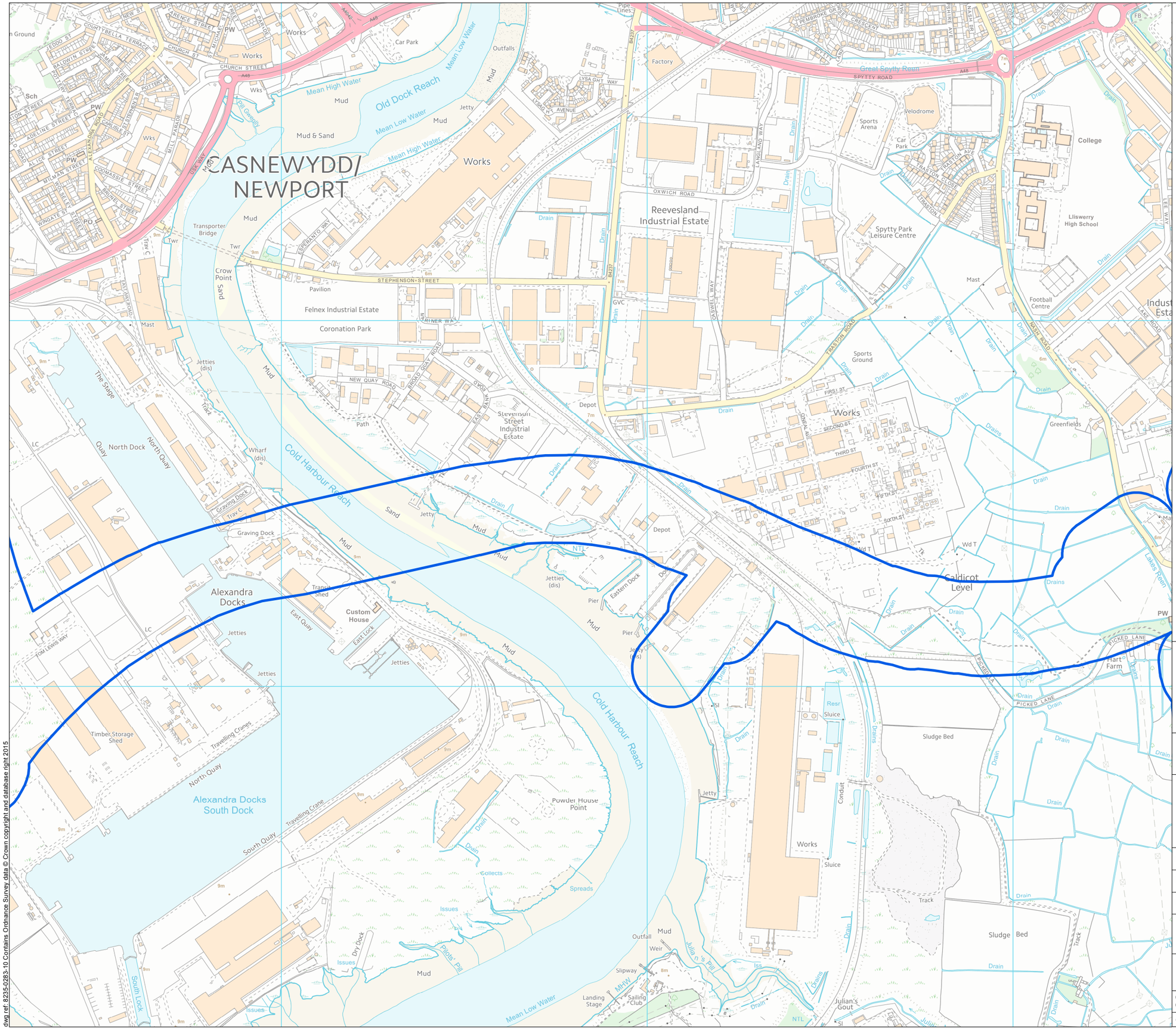

Legend

- 100m Study area

Aquatic Macrophyte 20m Sample

- Low
- Moderate
- Moderate-High
- High
- Very High

Study area shown reflects the scheme design at the time of the survey

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Appendix 10.30 Aquatic Macrophyte Survey Report

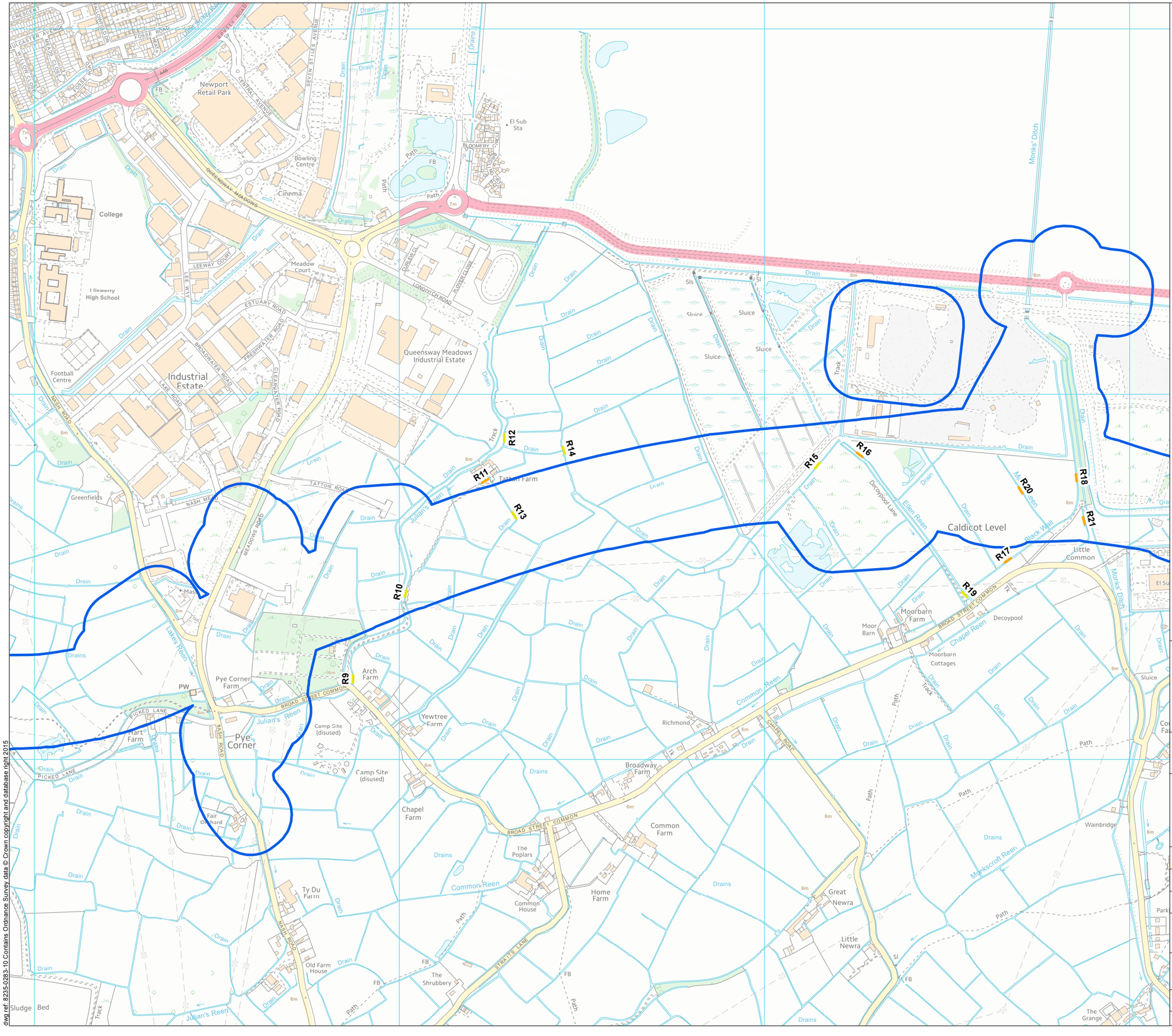
2015 Aquatic Macrophytes Survey

Figure: 1d	Revision: -
Date: March 2016	Status: AT ISSUE
Drawn: CR	Checked: KJ

Scale: A3 @ 1:10,000
0 250 500m

N

dwg ref: 8235-0283-10



Legend

100m Study area

Aquatic Macrophyte 20m Sample

- Low
- Moderate
- Moderate-High
- High
- Very High

Study area shown reflects the scheme design at the time of the survey

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Appendix 10.30 Aquatic Macrophyte Survey Report

2015 Aquatic Macrophytes Survey

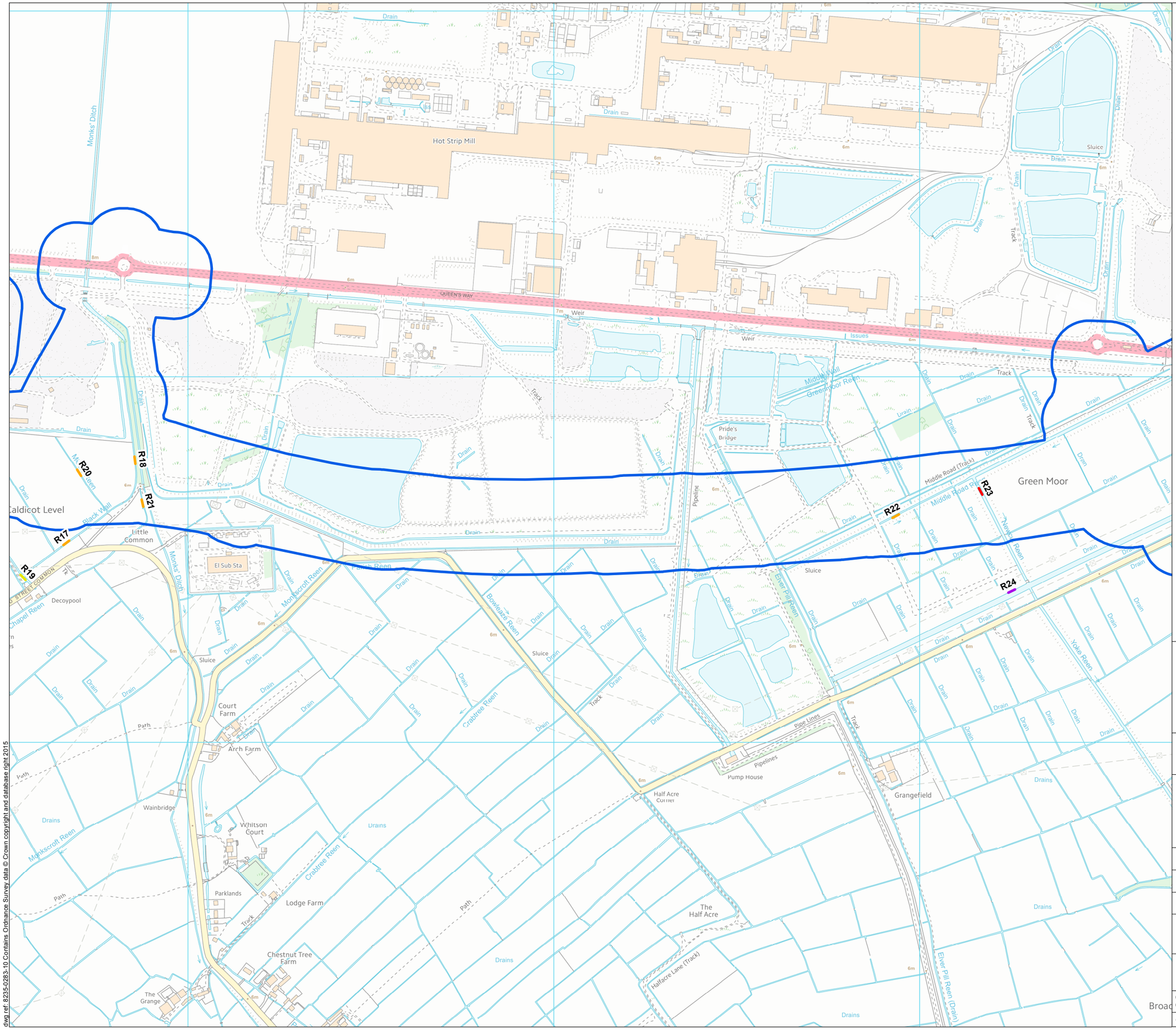
Figure: 1e	Revision: -
Date: March 2016	Status: AT ISSUE
Drawn: CR	Checked: KJ

Scale: A3 @ 1:10,000

0 250 500m

N

dwg ref: 8235-0283-10



Legend

100m Study area

Aquatic Macrophyte 20m Sample

- Low
- Moderate
- Moderate-High
- High
- Very High

Study area shown reflects the scheme design at the time of the survey

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Appendix 10.30 Aquatic Macrophyte Survey Report

2015 Aquatic Macrophytes Survey

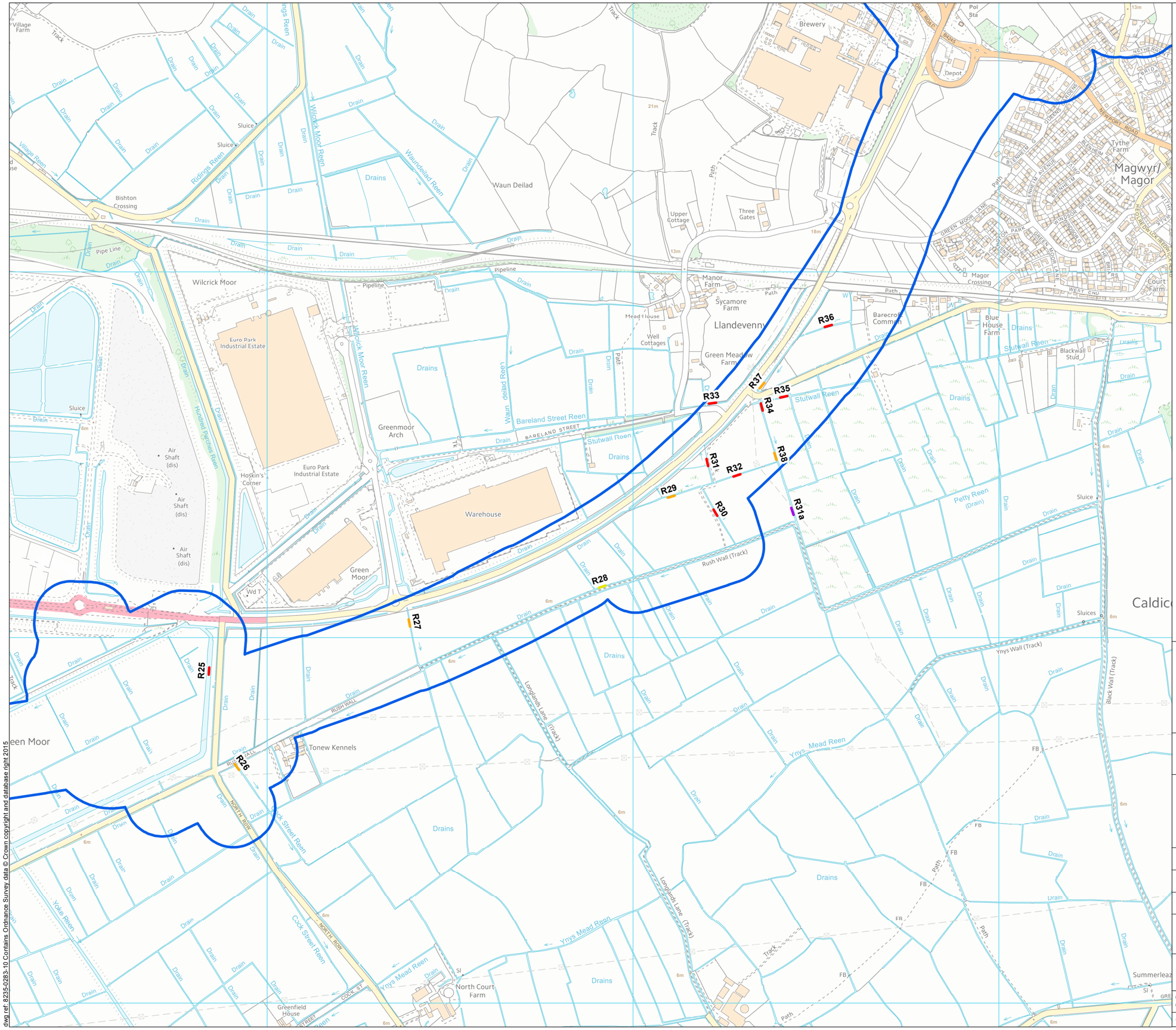
Figure: 1f	Revision: -
Date: March 2016	Status: AT ISSUE
Drawn: CR	Checked: KJ

Scale: A3 @ 1:10,000

0 250 500m

N

dwg ref: 8235-0283-10



Legend

- 100m Study area

Aquatic Macrophyte 20m Sample

- Low
- Moderate
- Moderate-High
- High
- Very High

Study area shown reflects the scheme design at the time of the survey

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Appendix 10.30 Aquatic Macrophyte Survey Report

2015 Aquatic Macrophytes Survey

Figure: 1g	Revision: -
Date: March 2016	Status: AT ISSUE
Drawn: CR	Checked: KJ

Scale: A3 @ 1:10,000

0 250 500m

N

dwg ref: 8235-0283-10

Legend

- 100m Study area

Aquatic Macrophyte 20m Sample

- Low
- Moderate
- Moderate-High
- High
- Very High

Study area shown reflects the scheme design at the time of the survey

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Appendix 10.30 Aquatic Macrophyte Survey Report

2015 Aquatic Macrophytes Survey

Figure: 1h	Revision: -
Date: March 2016	Status: AT ISSUE
Drawn: CR	Checked: KJ

Scale: A3 @ 1:10,000

0 250 500m

N

dwg ref: 8235-0283-10

Legend

100m Study area

Aquatic Macrophyte 20m Sample

- Low
- Moderate
- Moderate-High
- High
- Very High

Study area shown reflects the scheme design at the time of the survey

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Appendix 10.30 Aquatic Macrophyte Survey Report

2015 Aquatic Macrophytes Survey

Figure: 1i	Revision: -
Date: March 2016	Status: AT ISSUE
Drawn: CR	Checked: KJ

Scale: A3 @ 1:10,000
0 250 500m

N

dwg ref: 8235-0283-10

Aquatic Macrophyte 20m Sample

- Low
- Moderate
- Moderate-High
- High
- Very High

Legend

100m Study Area

Rare and Scarce Species

Alan	Alisma lanceolata
Bumb	Butomus umbellatus
Cpse	Carex pseudocyperus
Caqu	Catabrosa aquatica
Cdem	Ceratophyllum demersum
Hmor	Hydrocharis morsus-ranae
Lgib	Lemna gibba
Ltri	Lemna trisulca
Ofis	Oenanthe fistulosa
Pber	Potamogeton berchtoldii
Ppus	Potamogeton pusillus
Ptri	Potamogeton trichoides
Rhyd	Rumex hydrolapathum
Ssag	Sagittaria sagittarius
Spol	Spirodela polyrhiza
Vcat	Veronica catenata
Warr	Wolffia arrhiza
Zpal	Zanichella palustris

NOTE

Study area shown reflects the scheme design at the time of survey

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Appendix 10.30 Aquatic Macrophyte Survey Report

2015 Aquatic Macrophytes Survey Rare and Scarce Species

Figure: 2a	Revision: -
Date: March 2016	Status: At Issue
Drawn: JGB	Checked: SF

Scale: A3 @ 1:10,000

0 200 400 m

N

dwg ref: JER6591_2015AquaticMacrophytesSurvey

Aquatic Macrophyte 20m Sample

- Low
- Moderate
- Moderate-High
- High
- Very High

R1 R2 R3 R4 R5 R6 R7 R8 RCS1

Lgib

Cdem Hmor Ppus Ptri Spol Ssag

Hmor Ltri Ppus Ptri Ssag Rhyd

Ltri Hmor Ppus Ptri Spol Ssag

Legend

100m Study Area

Rare and Scarce Species

Alan	Alisma lanceolata
Bumb	Butomus umbellatus
Cpse	Carex pseudocyperus
Caqu	Catabrosa aquatica
Cdem	Ceratophyllum demersum
Hmor	Hydrocharis morsus-ranae
Lgib	Lemna gibba
Ltri	Lemna trisulca
Ofis	Oenanthe fistulosa
Pber	Potamogeton berchtoldii
Ppus	Potamogeton pusillus
Ptri	Potamogeton trichoides
Rhyd	Rumex hydrolapathum
Ssag	Sagittaria sagittarius
Spol	Spirodela polyrhiza
Vcat	Veronica catenata
Warr	Wolffia arrhiza
Zpal	Zanichella palustris

NOTE

Study area shown reflects the scheme design at the time of survey

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Appendix 10.30 Aquatic Macrophyte Survey Report

2015 Aquatic Macrophytes Survey Rare and Scarce Species

Figure: 2b	Revision: -
Date: March 2016	Status: At Issue
Drawn: JGB	Checked: SF

Scale: A3 @ 1:10,000

0 200 400 m

N

dwg ref: JER6591_2015AquaticMacrophytesSurvey

Aquatic Macrophyte 20m Sample

- Low
- Moderate
- Moderate-High
- High
- Very High

RCS1

Alan
Hmor
Lgib
Ltri
Ofis
Ptri
Spol
Warr

RCS2

Bumb
Hmor
Ofis
Spol
Ssag

RCS3

Hmor
Ltri
Ssag

RCS4

Alan
Bumb
Cdem
Hmor
Lgib
Ltri
Ofis
Pber
Ptri
Spol
Ssag

Legend

100m Study Area

Rare and Scarce Species

Alan	Alisma lanceolata
Bumb	Butomus umbellatus
Cpse	Carex pseudocyperus
Caqu	Catabrosa aquatica
Cdem	Ceratophyllum demersum
Hmor	Hydrocharis morsus-ranae
Lgib	Lemna gibba
Ltri	Lemna trisulca
Ofis	Oenanthe fistulosa
Pber	Potamogeton berchtoldii
Ppus	Potamogeton pusillus
Ptri	Potamogeton trichoides
Rhyd	Rumex hydrolapathum
Ssag	Sagittaria sagittarius
Spol	Spirodela polyrhiza
Vcat	Veronica catenata
Warr	Wolffia arrhiza
Zpal	Zanichella palustris

NOTE

Study area shown reflects the scheme design at the time of survey

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Appendix 10.30 Aquatic Macrophyte Survey Report

2015 Aquatic Macrophytes Survey Rare and Scarce Species

Figure: 2c	Revision: -
Date: March 2016	Status: At Issue
Drawn: JGB	Checked: SF

Scale: A3 @ 1:10,000
0 200 400 m

N

dwg ref: JER6591_2015AquaticMacrophytesSurvey

Aquatic Macrophyte 20m Sample

- Low
- Moderate
- Moderate-High
- High
- Very High

Legend

100m Study Area

Rare and Scarce Species

Alan	Alisma lanceolata
Bumb	Butomus umbellatus
Cpse	Carex pseudocyperus
Caqu	Catabrosa aquatica
Cdem	Ceratophyllum demersum
Hmor	Hydrocharis morsus-ranae
Lgib	Lemna gibba
Ltri	Lemna trisulca
Ofis	Oenanthe fistulosa
Pber	Potamogeton berchtoldii
Ppus	Potamogeton pusillus
Ptri	Potamogeton trichoides
Rhyd	Rumex hydrolapathum
Ssag	Sagittaria sagittarius
Spol	Spirodela polyrhiza
Vcat	Veronica catenata
Warr	Wolffia arrhiza
Zpal	Zanichella palustris

NOTE

Study area shown reflects the scheme design at the time of survey

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Welsh Government

Appendix 10.30 Aquatic Macrophyte Survey Report

2015 Aquatic Macrophytes Survey Rare and Scarce Species

Figure: 2d	Revision: -
Date: March 2016	Status: At Issue
Drawn: JGB	Checked: SF

Scale: A3 @ 1:10,000

0 200 400 m

N

dwg ref: JER6591_2015AquaticMacrophytesSurvey

Aquatic Macrophyte 20m Sample

- Low
- Moderate
- Moderate-High
- High
- Very High

R12 Lgib Spol
R14
R11 Spol
R13 Spol
R10 Cdem Lgib Spol
R9 Lgib Spol
R15 Spol
R16 Ptri Spol
R20 Cdem Hmor Ptri Spol
R18 Cdem Hmor Spol Ptri
R21 Lgib Ltri Pber Ptri Spol
R17 Cdem Hmor Ptri Spol Vcat
R19 Spol

Legend

100m Study Area

Rare and Scarce Species

Alan	Alisma lanceolata
Bumb	Butomus umbellatus
Cpse	Carex pseudocyperus
Caqu	Catabrosa aquatica
Cdem	Ceratophyllum demersum
Hmor	Hydrocharis morsus-ranae
Lgib	Lemna gibba
Ltri	Lemna trisulca
Ofis	Oenanthe fistulosa
Pber	Potamogeton berchtoldii
Ppus	Potamogeton pusillus
Ptri	Potamogeton trichoides
Rhyd	Rumex hydrolapathum
Ssag	Sagittaria sagittarius
Spol	Spirodela polyrhiza
Vcat	Veronica catenata
Warr	Wolffia arrhiza
Zpal	Zanichella palustris

NOTE

Study area shown reflects the scheme design at the time of survey

Llywodraeth Cymru
Welsh Government

Appendix 10.30 Aquatic Macrophyte Survey Report

2015 Aquatic Macrophytes Survey Rare and Scarce Species

Figure: 2e	Revision: -
Date: March 2016	Status: At Issue
Drawn: JGB	Checked: SF

Scale: A3 @ 1:10,000
0 200 400 m

N

dwg ref: JER6591_2015AquaticMacrophytesSurvey

Aquatic Macrophyte 20m Sample

- Low
- Moderate
- Moderate-High
- High
- Very High

R17: Cdem, Hmor, Ptri, Spol, Vcat
R18: Cdem, Hmor, Spol, Ptri
R19: Spol
R20: Cdem, Hmor, Ptri, Spol
R21: Lgib, Ltri, Pber, Ptri, Spol
R22: Cdem, Cpse, Hmor, Lgib, Ltri, Ppus, Spol
R23: Cdem, Hmor, Lgib, Ltri, Ofis, Ptri, Spol, Ssag
R24: Cdem, Hmor, Lgib, Ltri, Ofis, Ptri, Rhyd, Ssag, Spol

Legend

100m Study Area

Rare and Scarce Species

- Alan — Alisma lanceolata
- Bumb — Butomus umbellatus
- Cpse — Carex pseudocyperus
- Caqu — Catabrosa aquatica
- Cdem — Ceratophyllum demersum
- Hmor — Hydrocharis morsus-ranae
- Lgib — Lemna gibba
- Ltri — Lemna trisulca
- Ofis — Oenanthe fistulosa
- Pber — Potamogeton berchtoldii
- Ppus — Potamogeton pusillus
- Ptri — Potamogeton trichoides
- Rhyd — Rumex hydrolapathum
- Ssag — Sagittaria sagittarius
- Spol — Spirodela polyrhiza
- Vcat — Veronica catenata
- Warr — Wolffia arrhiza
- Zpal — Zanichella palustris

NOTE

Study area shown reflects the scheme design at the time of survey

Llywodraeth Cymru
Welsh Government

Appendix 10.30 Aquatic Macrophyte Survey Report

2015 Aquatic Macrophytes Survey Rare and Scarce Species

Figure: 2f	Revision: -
Date: March 2016	Status: At Issue
Drawn: JGB	Checked: SF

Scale: A3 @ 1:10,000
0 200 400 m

N

dwg ref: JER6591_2015AquaticMacrophytesSurvey

Aquatic Macrophyte 20m Sample

- Low
- Moderate
- Moderate-High
- High
- Very High

R25: Cdem, Hmor, Lgib, Ltri, Ofis, Ptri, Spol, Ssag

R26: Lgib, Ptri, Spol

R27: Lgib, Ppus, Ptri, Spol

R28: Lgib, Spol

R29: Cdem, Lgib, Ltri, Ptri, Spol, Vcat

R30: Cdem, Cpse, Hmor, Lgib, Ltri, Ptri, Rhyd, Spol

R31: Caqu, Cdem, Hmor, Lgib, Ltri, Ppus, Rhyd, Spol

R31a: Alan, Cdem, Cpse, Hmor, Lgib, Ltri, Ppus, Ptri, Rhyd, Spol, Zpal

R32: Caqu, Cdem, Hmor, Lgib, Ltri, Ppus, Ptri, Rhyd, Spol

R33: Cdem, Hmor, Lgib, Ltri, Ppus, Ptri, Rhyd, Spol

R34: Cdem, Hmor, Ltri, Ppus, Ptri, Rhyd, Spol

R35: Cdem, Cpse, Hmor, Ltri, Ppus, Ptri, Rhyd, Spol

R36: Ofis, Hmor, Ltri, Spol

R37: Cdem, Hmor, Spol, Ppus

R38: Cdem, Hmor, Lgib, Rhyd, Spol

Legend

100m Study Area

Rare and Scarce Species

Alan	Alisma lanceolata
Bumb	Butomus umbellatus
Cpse	Carex pseudocyperus
Caqu	Catabrosa aquatica
Cdem	Ceratophyllum demersum
Hmor	Hydrocharis morsus-ranae
Lgib	Lemna gibba
Ltri	Lemna trisulca
Ofis	Oenanthe fistulosa
Pber	Potamogeton berchtoldii
Ppus	Potamogeton pusillus
Ptri	Potamogeton trichoides
Rhyd	Rumex hydrolapathum
Ssag	Sagittaria sagittarius
Spol	Spirodela polyrhiza
Vcat	Veronica catenata
Warr	Wolffia arrhiza
Zpal	Zanichella palustris

NOTE

Study area shown reflects the scheme design at the time of survey

Llywodraeth Cymru
Welsh Government

Appendix 10.30 Aquatic Macrophyte Survey Report

2015 Aquatic Macrophytes Survey Rare and Scarce Species

Figure: 2g	Revision: -
Date: March 2016	Status: At Issue
Drawn: JGB	Checked: SF

Scale: A3 @ 1:10,000
0 200 400 m

N

dwg ref: JER6591_2015AquaticMacrophytesSurvey

Aquatic Macrophyte 20m Sample

- Low
- Moderate
- Moderate-High
- High
- Very High

Legend

100m Study Area

Rare and Scarce Species

Alan	Alisma lanceolata
Bumb	Butomus umbellatus
Cpse	Carex pseudocyperus
Caqu	Catabrosa aquatica
Cdem	Ceratophyllum demersum
Hmor	Hydrocharis morsus-ranae
Lgib	Lemna gibba
Ltri	Lemna trisulca
Ofis	Oenanthe fistulosa
Pber	Potamogeton berchtoldii
Ppus	Potamogeton pusillus
Ptri	Potamogeton trichoides
Rhyd	Rumex hydrolapathum
Ssag	Sagittaria sagittarius
Spol	Spirodela polyrhiza
Vcat	Veronica catenata
Warr	Wolffia arrhiza
Zpal	Zanichella palustris

NOTE

Study area shown reflects the scheme design at the time of survey

Llywodraeth Cymru
Welsh Government

Appendix 10.30 Aquatic Macrophyte Survey Report

2015 Aquatic Macrophytes Survey Rare and Scarce Species

Figure: 2h	Revision: -
Date: March 2016	Status: At Issue
Drawn: JGB	Checked: SF

Scale: A3 @ 1:10,000

0 200 400 m

N

dwg ref: JER6591_2015AquaticMacrophytesSurvey

Aquatic Macrophyte 20m Sample

- Low
- Moderate
- Moderate-High
- High
- Very High

R39

Lgib
Ltri
Ptri
Spol

Legend

100m Study Area

Rare and Scarce Species

Alan	Alisma lanceolata
Bumb	Butomus umbellatus
Cpse	Carex pseudocyperus
Caqu	Catabrosa aquatica
Cdem	Ceratophyllum demersum
Hmor	Hydrocharis morsus-ranae
Lgib	Lemna gibba
Ltri	Lemna trisulca
Ofis	Oenanthe fistulosa
Pber	Potamogeton berchtoldii
Ppus	Potamogeton pusillus
Ptri	Potamogeton trichoides
Rhyd	Rumex hydrolapathum
Ssag	Sagittaria sagittarius
Spol	Spirodela polyrhiza
Vcat	Veronica catenata
Warr	Wolffia arrhiza
Zpal	Zanichella palustris

NOTE

Study area shown reflects the scheme design at the time of survey

Llywodraeth Cymru
Welsh Government

Appendix 10.30 Aquatic Macrophyte Survey Report

2015 Aquatic Macrophytes Survey Rare and Scarce Species

Figure: 2i	Revision: -
Date: March 2016	Status: At Issue
Drawn: JGB	Checked: SF

Scale: A3 @ 1:10,000
0 200 400 m

N

dwg ref: JER6591_2015AquaticMacrophytesSurvey

Photographs

R01

R02

Client:	Welsh Government
Project:	M4CaN
Job Ref:	JER6591 Checked By: Date: 10/2015

R03

R04

Client:	Welsh Government
Project:	M4CaN
Job Ref:	JER6591 Checked By: Date: 10/2015

R05

R06

Client:	Welsh Government
Project:	M4CaN
Job Ref:	JER6591 Checked By: Date: 10/2015

R07

R08

Client:	Welsh Government
Project:	M4CaN
Job Ref:	JER6591 Checked By: Date: 10/2015

R09

R10

Client:	Welsh Government
Project:	M4CaN
Job Ref:	JER6591 Checked By: Date: 10/2015

R11

R12

Client:	Welsh Government
Project:	M4CaN
Job Ref:	JER6591 Checked By: Date: 10/2015

R13

R14

Client:	Welsh Government			
Project:	M4CaN			
Job Ref:	JER6591	Checked By:	Date:	10/2015

R15

R16

Client:	Welsh Government
Project:	M4CaN
Job Ref:	JER6591 Checked By: Date: 10/2015

R17

R18

Client:	Welsh Government			
Project:	M4CaN			
Job Ref:	JER6591	Checked By:	Date:	10/2015

R19

R20

Client:	Welsh Government			
Project:	M4CaN			
Job Ref:	JER6591	Checked By:	Date:	10/2015

R21

R22

Client:	Welsh Government
Project:	M4CaN
Job Ref:	JER6591 Checked By: Date: 10/2015

R23

R24

Client:	Welsh Government
Project:	M4CaN
Job Ref:	JER6591 Checked By: Date: 10/2015

R25

R26

Client:	Welsh Government
Project:	M4CaN
Job Ref:	JER6591 Checked By: Date: 10/2015

R27

R28

Client:	Welsh Government
Project:	M4CaN
Job Ref:	JER6591 Checked By: Date: 10/2015

R29

R30

Client:	Welsh Government
Project:	M4CaN
Job Ref:	JER6591 Checked By: Date: 10/2015

R31

R31a

Client:	Welsh Government
Project:	M4CaN
Job Ref:	JER6591 Checked By: Date: 10/2015

R32

R33

Client:	Welsh Government
Project:	M4CaN
Job Ref:	JER6591 Checked By: Date: 10/2015

R34

R35

Client:	Welsh Government			
Project:	M4CaN			
Job Ref:	JER6591	Checked By:	Date:	10/2015

R36

R37

Client:	Welsh Government
Project:	M4CaN
Job Ref:	JER6591 Checked By: Date: 10/2015

R38

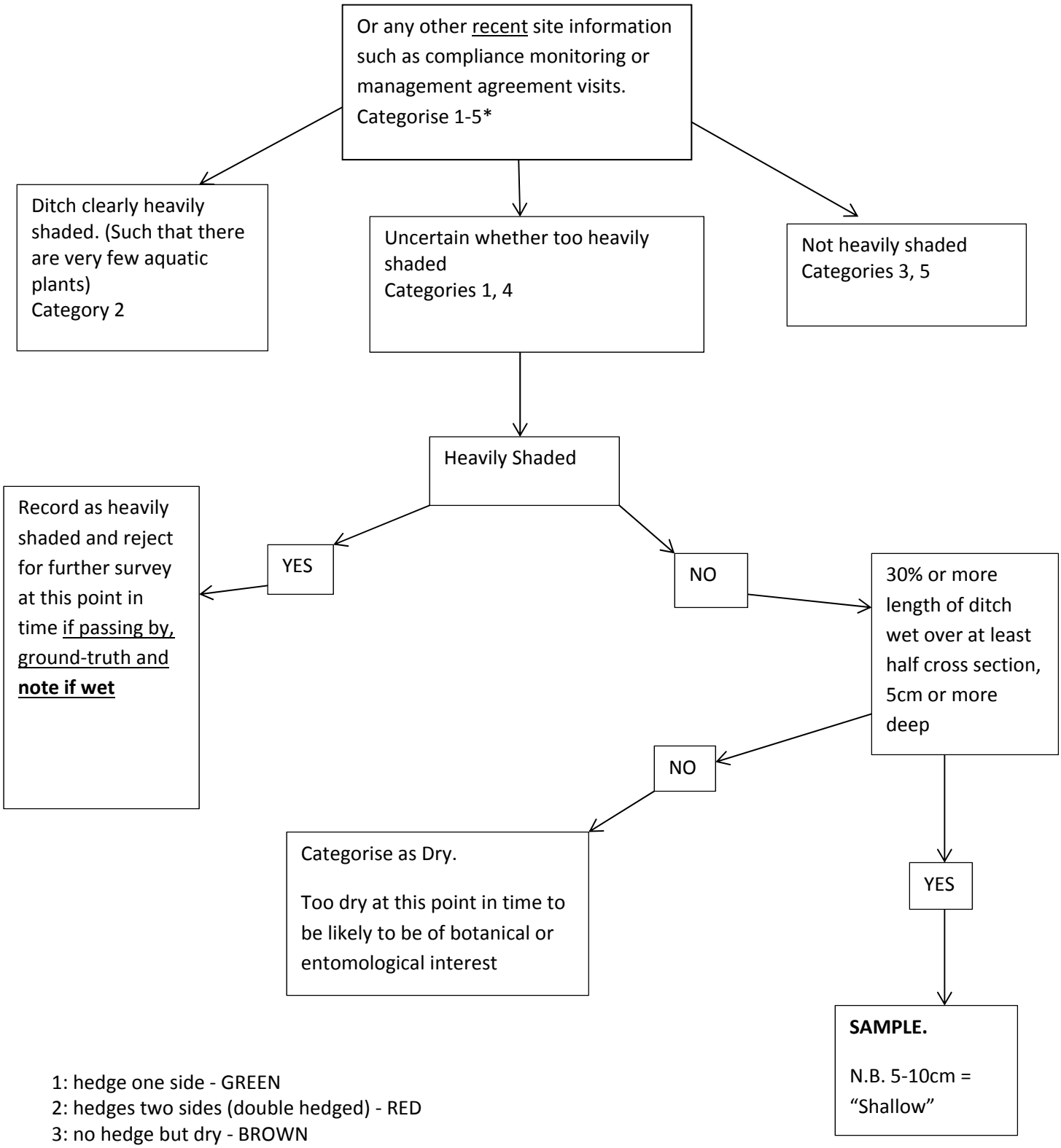
R39

Client:	Welsh Government			
Project:	M4CaN			
Job Ref:	JER6591	Checked By:	Date:	10/2015

Annexes

Annex A: NRW Gwent Levels SSSI Field Ditch Assessment Decision Tree

NRW: GWENT LEVELS SSSI DITCHES, base-line survey 2010/11 (not condition assessment)
Choosing whether to visit in the field and whether to sample
Decision tree v4
Based on predetermined lengths (sections) of ditch within a unit



1: hedge one side - GREEN
2: hedges two sides (double hedged) - RED
3: no hedge but dry - BROWN
4: intermittent hedge - PINK
(4a intermittent one side, open other, 4b intermittent both sides, 4c 1 side intermittent one side hedge)
5: no hedge and wet - BLUE

Annex B: Species Lists from Aquatic Macrophyte Survey Sampling Section

Note: The ‘R’ numbers in the table below refer to the sample locations

		Number of species - BANK																																				
Scientific name	**Common name**	**6**	**13**	**11**	**11**	**6**	**10**	**7**	**5**	**5**	**3**	**9**	**14**	**14**	**6**	**22**	**16**	**5**	**19**	**6**	**23**	**9**	**17**	**8**	**21**	**9**	**11**	**7**	**12**	**6**	**12**	**20**	**20**	**15**	**26**	**9**	**13**	**17**	**8**	**9**	**6**
		R1	**R2**	**R3**	**R4**	**R5**	**R6**	**R7**	**R8**	**R9**	**R10**	**R11**	**R12**	**R13**	**R14**	**R15**	**R16**	**R17**	**R18**	**R19**	**R20**	**R21**	**R22**	**R23**	**R24**	**R25**	**R26**	**R27**	**R28**	**R29**	**R30**	**R31**	**R31a**	**R32**	**R33**	**R34**	**R35**	**R36**	**R37**	**R38**	**R39**
Agrostis capillaris	Common Bent				F								O	O		O			O						O										O						
Agrostis stolonifera	Creeping Bent		O		O				O			R							O							O								O		R	O	F			
Alnus glutinosa	Alder		R																																						
Angelica Sylvestris	Wild Angelica																		O													R									
Aloepecurus geniculatus	Marsh foxtail																														R	O		O			R			
Anthriscus sylvestris	Cow-parsley					R	R																										O								
Arrhenatherum elatius	False Oat-grass	A	O	O	A	O	O		A	A	A		O			F	F	O	F		O		F				F	F	F				F		O	O	F	A	A	F	A
Artemisia vulgaris	Mugwort																																								
Bromus hordeaceus	Soft brome																				R																				
Calystegia sepium	Hedge Bindweed					R										O					O	O	O															O			
Carex acutiformis	Lesser Pond-sedge																																								
Carex hirta	Hairy sedge													R							R		R																		
Carex otrubae	False Fox-sedge											R									O		O		O							O	R	O							
Carex riparia	Greater Pond-sedge																O		F(LA)		O										R	A		F	LF						
Centaurea nigra	Common Knapweed	R																			F		F		O																
Cirsium arvense	Creeping Thistle		R	O	O		R		A		O	A		A					R		O	O	O			R			O		O		F				O		O	
Cirsium palustre	Marsh Thistle																																				O	R			
Cirsium vulgare	Spear Thistle													O											O		O		O			R			F						
Crataegus monogyna	Hawthorn						R	R		R		R	O	R	O			A		R	A (W)	O		D (W)	F		F		R	R										O	
Dactylis glomerata	Cock's-foot	F	R	R	O		O			O						O	O		O	R			R		O		O	O	O						R	O	O	O			
Dipsacus fullonum	Teasel				R																O																				

Elymus repens	Common Couch																		O												O				R		R				
Epilobium hirsutum	Great Willowherb		O	F	O		R	F								F	O		O		F	F	F		F		F	LA	O		F	F	LA	F		F	F		R	O	R
Cynosurus Cristatus	Crested Dogstail											O	R	O	O									O		O								R							
Epilobium ciliatum	Americal willowherb																															R									
Equisetum fluviatile	Water Horsetail																																								
Eupatorium cannabinum	Hemp-agrimony																		F														O								
Filipendula ulmaria	Meadowsweet			O	O		O	O									F		F		F	F							F		O		A		O	F	F			F	
Fraxinus excelsior	Ash												R																												
Gallium aparine	Cleavers															O																	R						O		O
Galium palustre	Marsh-bedstraw											O																				O		R	R						
Geranium dissectum	Cut leaved cranesbill																		R																R						
Glyceria maxima	Reed sweet grass																																				F				
Heracleum sphondylium	Common Hogweed			R	O											O	F	O	O						O		O		O				O		R			R	R	F	O
Holcus lanatus	Yorkshire-fog		O	R	F								A			O		O	O		O		O												O			O			
Hordeum brachyantherum	Meadow barley													O										O																	
Hypericum perforatum	Perforate St. John's Wort																																								
Hypericum tetrapterum	Square stalked st. john's wort																																								
Iris pseudacorus	Yellow Flag Iris															O					O					O		O					R		O						
Juncus acutiflorus	Sharp-flowered Rush																														R	O		F							
Juncus articulatus	Jointed rush																													O	R			R							
Juncus effusus	Soft Rush				R							A	O		O	O									O				O			O		O	O			O			
Juncus inflexus	Hard Rush												O								F	O	F		O																
Lathyrus pratensis	Meadow Vetchling																										O														
Leucanthemum vulgare	Oxeye Daisy																		O																						
Lolium perenne	Perennial Rye-grass											F	O	A	A							A				F															

Lotus pedunculatus	Greater Bird's-foot-trefoil				O											R					F		F		O		O				O	R	O			F	R	O			
Lycopus europaeus	Gypsywort																															O		R							
Lysimachia vulgaris	Yellow Loosestrife																R																								
Medicago lupulina	Black medic																		R																						
Mentha aquaticum	Water mint																							O	R								F				O			
Oenanthe crocata	Hemlock Water-dropwort	F	A	A	O	F	O	F								F	F			R	O		O	R		O	O	O	F	O	R	D	O							
Oenanthe fistulosa	Tubular Water-dropwort																								F															
Persicaria maculosa	Redshank															O																		LA			O (LA)			
Picris echioides	Bristly Oxtongue																				R								R											
Phalaris arundinacea	Reed Canary-grass																								O							R		O						
Phleum bertolonii	Small timothy																																							
Phleum pratense	Timothy													O																										
Phragmites australis	Common Reed		A	A		A	A	A							F (LA)	O				A						O (LA)				D			O		F			O (LA)		LA
Poa trivialis	Rough meadow grass																													O		O	O							
Polygonium amphibium	Amphibious bistort																															O					O			
Populus alba	White Poplar																																							
Potentilla anserina	Silverweed																																				O			
Prunus spinosa	Blackthorn																																							
Pulicaria dysenterica	Common Fleabane																				O		O	O									R							
Ranunculus acris	Meadow Buttercup															O																R			R	R	R			
Ranunculus repens	Creeping Buttercup		O					R		O														O																
Rosa canina	Dog Rose																																	R						
Rosa sp.																					R	O	R															O	
Rumex conglomeratus	Clustered Dock			O												O	O				O		O	O	O		O						O	R	F	O	R			
Rubus fruticosus agg.	Bramble	O (LA)	F	D (s)	R	A		R	F(LD)								F (LA)	O			R	F	R			F		F	F			D (W)	O		R			X		F	

Rumex crispus	Curled Dock																R							R																	
Rumex obtusifolius	Broad-leaved Dock								O																						O				R			R			
Salix caprea	Goat Willow										R																														
Salix cinerea	Grey Willow																		O													R									
Salix c.f. fragilis	Willow species																O			O																	O				
Salix sp.	A willow														O	O																									
Scrophularia nodosa	Common Figwort																																								
Scutellaria galericulata	Skullcap																																		R						
Senecio Sp	Ragwort	R																														O									
Sonchus asper	Prickly Sow-thistle				O												R																					R			
Sonchus oleraceus	Smooth sow thistle																															R	R						R		R
Stachys palustris	Marsh Woundwort																R					O										O	O		O		O	O		O	
Urtica dioica	Common Nettle		F		R		R	R				F	F	O						O					F	F	F	A	LA	O			LF		R		O	F	A (LD)		
Valariana officinalis	Common valarian																		R													O	O								
Vicia cracca	Tufted Vetch															O	F						O		O																
Vicia sativa	Common Vetch																F																								
Vicia tetrasperma	Smooth Tare				O																																				
Hypericum pulchrum	Slender St Johns Wort																		R																						

Emergent Vegetation		Number of species - EMERGENT																																						
Scientific name	**Common name**	**3**	**7**	**3**	**7**	**10**	**5**	**4**	**5**	**1***	**1***	**9**	**4**	**7**	**5**	**6**	**7**	**3**	**5**	**2**	**8**	**2**	**6**	**11**	**13**	**9**	**3**	**2**	**4**	**1**	**13**	**16**	**10**	**10**	**12**	**4**	**9**	**16**	**7**	**3**	**4**
		R1	**R2**	**R3**	**R4**	**R5**	**R6**	**R7**	**R8**	**R9**	**R10**	**R11**	**R12**	**R13**	**R14**	**R15**	**R16**	**R17**	**R18**	**R19**	**R20**	**R21**	**R22**	**R23**	**R24**	**R25**	**R26**	**R27**	**R28**	**R29**	**R30**	**R31**	**R31a**	**R32**	**R33**	**R34**	**R35**	**R36**	**R37**	**R38**	**R39**
Agrostis stolonifera	Creeping Bent																																					O (LA)			
Alisma plantago-aquatica	Water-plantain			R	R	R																				R						R				R			R		R
Alisma lanceolata	Narrow leaved water-plantain																																R									
Aloepecurus geniculatus	Marsh foxtail																														R	O		O			R	R			
Angelica sylvestris	Wild Angelica																		R													R									
Apium nodiflorum	Fool's-watercress								LA			R																				R		R	O						
Berula erecta	Lesser Water-parsnip		O	R					F			A		F(LA)	O		O				F		O	O	R	R					R	R	O	F			R			
Bidens cernua	Nodding bur-marigold																																								
Butomus umbelatus	Flowering rush																																								
Carex acutiformis	Lesser Pond Sedge												O											R		R															
Carex hirta	Hairy Sedge																								O																
Carex otrubae	False Fox-sedge											R		R																											
Carex pseudocyperus	Cyperus Sede																						F								F	R	O				O			
Carex riparia	Greater Pond-sedge											O		F	O		F		F		F	O	F								F	F		O	R						
Carex remota	Remote Sedge																R								R																
Catabrosa aquatica	Whorl grass																															R		O							
Cirsium palustre	Marsh Thistle																																				O	R			
Eleocharis palustris	Common spikerush																				R				O																
Epilobium hirsutum	Great Willow-herb			R										X																	F		R		R		O		R		
Equisetum fluviatile	Water Horsetail				R														R													R									
Eriophorum paulustris	Common spiked rush																				R																				
Filipendula ulmaria	Meadowsweet					O	O										O				F				O																

Galium palustre	Common marsh-bedstraw				R				R															O	O									R						
Glyceria fluitans	Floating sweet grass		O			F							R												F												O			O (LA)
Glyceria maxima	Reed Sweet-grass	F (LA)	F		A		F	F	A	O	O	F	F	F	F			F	O			F	F	F	F	F	F	F	O		O	R	A	F	R	F	F	F			
Iris pseudacorus	Yellow Iris				O	R			O							F	F	O	O		O						O	O					O		O	O		R	R		
Juncus acutiflorus	Sharp-flowered Rush																														R		O						
Juncus articulatus	Jointed Rush																														R								
Juncus effusus	Soft Rush											O	O	F	O	O										O					O			R			O			
Juncus inflexus	Hard Rush											F		F		F					O																			
Juncus acutiflorus	Sharp flowered rush																				O									R	R								
Lycopus europaeus	Gypsywort																													R	O								
Lythrum salicaria	Purple Loosestrife															R	O		R																				
Mentha aquatica	Water Mint																						O	O	O								O				O			
Myosotis laxa	Tufted forget-me-not											R		R										R	O	O														
Myosotis scorpioides	Water forget-me-not																																R							
Myosotis Sp.																				R																			
Oenanthe crocata	Hemlock Water-dropwort	R	O		F	R	R										O			F			R	O	O		R		R			R	R				R		
Oenanthe fistulosa	Tubular Water-dropwort																							O	F	O											F			
Persicaria amphibia	Amphibious bistort					R										O																					O			
Phalaris arundinacea	Reed Canary Grass																O		O										R				R	R					
Phragmites australis	Common Reed		F		LA	O	O	F							F					A				F		F				F						LA	O		
Polygonium amphibium	Amphibious bistort																													O	R						O	R		R
Ranunculus flammula	Lesser spearwort																														R								
Rorippa nasturtium-aquaticum	Watercress																																				F (LA)			
Rumex hydrolapathum	Water dock							R																	R					R	R	O	R		O	O			O	
Sagittaria sagittifolia	Arrowhead					R	O	O																O	R	O														

Salix caprea	Goat Willow																																				R			
Salix fragilis	Crack Willow																																R						
Scrophularia auriculata	Water figwort																		R																				
Scutellaria galericulata	Skullcap																																						
Senecio aquaticus	Marsh ragwort																														R									
Solanum dulcamara	Bittersweet																														O									
Sparganium erectum	Bur-reed	R	R			R														F										O			R	O		F	O			
Stellaria uliginosa	Bog Stitchwort																														R									
Typha latifolia	Bulrush					O																	F	O						O	F		R			O		O		
Urtica dioica	Common nettle										O																													
Impatiens capensis	Orange balsam																																							
Veronica becabunga	Brooklime																																	R						
Veronica Catenta	Pink Water Speedwell																R																							R
Stachys palustris	Marsh Woundwort																														O	O		O		O	O		O	R

Submerged and floating vegetation		Number of species - FLOATING AND SUBMERGED																																						
Scientific name	**Common name**	**0**	**3**	**2**	**4**	**9**	**8**	**9**	**3**	**4**	**4**	**3**	**3**	**2**	**2**	**3**	**4**	**7**	**6**	**3**	**6**	**7**	**9**	**10**	**10**	**9**	**5**	**6**	**4**	**7**	**8**	**8**	**12**	**8**	**10**	**9**	**9**	**7**	**8**	**6**	**8**
		R1	**R2**	**R3**	**R4**	**R5**	**R6**	**R7**	**R8**	**R9**	**R10**	**R11**	**R12**	**R13**	**R14**	**R15**	**R16**	**R17**	**R18**	**R19**	**R20**	**R21**	**R22**	**R23**	**R24**	**R25**	**R26**	**R27**	**R28**	**R29**	**R30**	**R31**	**R31a**	**R32**	**R33**	**R34**	**R35**	**R36**	**R37**	**R38**	**R39**
Azolla filliculoides	Water fern																	R		F	R																				
Callitriche obtusangula	Blunt-fruited Water-starwort																																								
Callitriche sp.	Starwort species		F	O	O	R	O	O																R	R							R		O	O		R	O		O
Catabrosa aquatica	Whorl grass																													X				O							
Ceratophyllum demersum	Rigid Hornwort										R							A	R		R		A	A	A	A				F(LA)	F(LA)	A(or D)	F	R	R	R	R		A(LD)	R	
Chara vulgaris agg.	Common stonewort																																O								
Elodea nuttallii	Nuttall's Pondweed		F	R	O	O	R	F										F	O			A	O	F	O	O				O	F	O	F		A	O		O			O (LA)
Elodea canadensis	Canadian pondweed																																					R			
Enteramorpha sp.	An algae																																				O				
Hydrocharis morsus-ranae	Frogbit					F	R	R										R	O		O		O	O	O	R					A	R	O	R	O	O	R	F	O	R	
Lemna gibba	Fat Duckweed								F	R	F		F									R	R	R	R	R	O	F	A	F	O	R	O	R	R				F	R
Lemna minor	Common Duckweed				O	R	R	O	O	R	A	O	A		O	R	R	O	R	F	O	O	O	O	O	O	A	O	O	F	F	O	O	A	O	O	R	F	F	F	F
Lemna minuta	Least Duckweed								A	A		A		A	A	D												F	F					O					O	F	
Lemna trisulca	Ivy-leaved Duckweed					R	R	R														O	F	O	F					R	F	O	R		O	O	R	R			R
Myriophyllum spicatum	Spiked water milfoil																																								
Potamogeton berchtoldii	Small pondweed																					R																			R
Potamogeton crispus	Curled Pondweed		R		R			R									R									O	O					R				R		R		
Potamogeton natans	Broad-leaved Pondweed																																								
Potamogeton pectinatus	Fennel pondweed																						O	O	F(LA)																
Potamogeton pusillus	Lesser Pondweed					O	O	R														R					R				X	R		VR	R	R		F			
Potamogeton trichoides	Hairlike Pondweed					F	F	O									D	R	A		O	F		F	VR	F	F	O		F	F		F	X	F	A	A				R

Rorippa nasturtium officinale	Watercress																																						
Sparganium emersum	Unbranched bur-reed																																						
Spirodela polyrhiza	Greater Duckweed					R	R			R	O	R	F	O		O	O	F	O	R	F	A	O	F	O	O	A	O	R	F	F	F	F	F	A	F	F	O	O	A	R
Wolffia arrhiza	Rootless duckweed																																						
Zanichella paulustris	Horned pondweed																															O							
Leptodictum riparium	Kneb's feather moss					O																																	

Annex C: River Corridor Survey Aquatic Macrophyte Species Lists

Note: the ‘RCS’ numbers refer to the corridor survey lengths

Bank vegetation		5	5	10	11	8	7
		IDB34 Morfa Gronw Reen		IDB37 Old	NRA10 Pont-y-	NRA11 Sea Wall Reen	
		RCS1		RCS2	RCS3	RCS4	
Scientific name	Common name	S	N			N	S
Agrostis capillaris	Common Bent	O					
Agrostis stolonifera	Creeping Bent						
Alnus glutinosa	Alder						
Alopecurus pratensis	Meadow Foxtail	O					
Anthriscus sylvestris	Cow-parsley				R		
Arrhenatherum elatius	False Oat-grass			O	F		
Artemisia vulgaris	Mugwort						
Bromus hordeaceus	Soft brome						
Calystegia sepium	Hedge Bindweed						
Carex acutiformis	Lesser Pond-sedge						
Carex hirta	Hairy sedge						
Carex otrubae	False Fox-sedge						
Carex riparia	Greater Pond-sedge						
Centaurea nigra	Common Knapweed						
Cirsium arvense	Creeping Thistle			O			F
Cirsium palustre	Marsh Thistle						
Cirsium vulgare	Spear Thistle						
Crataegus monogyna	Hawthorn						
Dactylis glomerata	Cock's-foot				F		
Dipsacus fullonum	Teasel						
Elymus repens	Common Couch						

Epilobium hirsutum	Great Willowherb				O		
Epilobium parviflorum	Hoary willowherb						
Equisetum fluviatile	Water Horsetail						
Eupatorium cannabinum	Hemp-agrimony				F		
Filipendula ulmaria	Meadowsweet			F	O		
Fraxinus excelsior	Ash						
Gallium aparine							
Galium palustre	Marsh-bedstraw						
Geranium dissectum	Cut leaved cranesbill						R
Glyceria maxima	Reed sweet grass						
Heracleum sphondylium	Common Hogweed			O			
Holcus lanatus	Yorkshire-fog			R		O	
Hordeum brachyantherum	Meadow barley						
Hypericum perforatum	Perforate St. John's Wort						
Hypericum tetrapterum	Square stalked st. john's wort					R	R
Iris pseudacorus	Yellow Flag Iris						
Juncus acutiflorus	Sharp-flowered Rush						
Juncus articulatus	Jointed rush						
Juncus effusus	Soft Rush		O				
Juncus inflexus	Hard Rush					F	
Lathyrus pratensis	Meadow Vetchling						
Leucanthemum vulgare	Oxeye Daisy						
Lolium perenne	Perennial Rye-grass		F	O	O		
Lotus pedunculatus	Greater Bird's-foot-trefoil					O	O
Lycopus europaeus	Gypsywort						

Lysimachia vulgaris	Yellow Loosestrife						
Medicago lupulina	Black medic						
Mentha aquaticum	Water mint						
Oenanthe crocata	Hemlock Water-dropwort	O	O				
Oenanthe fistulosa	Tubular Water-dropwort						
Persicaria maculosa	Redshank		O	R			
Picris echioides	Bristly Oxtongue						
Phalaris arundinacea	Reed Canary-grass						
Phleum bertolonii	Small timothy						
Phleum pratense	Timothy					F	
Phragmites australis	Common Reed	D					
Poa trivialis	Rough meadow grass						
Polygonium amphibium	Amphibious bistort						
Populus alba	White Poplar						
Potentilla anserina	Silverweed						
Prunus spinosa	Blackthorn						
Pulicaria dysenterica	Common Fleabane						
Ranunculus acris	Meadow Buttercup			R		R	
Ranunculus repens	Creeping Buttercup		O	O		O	O
Rosa canina	Dog Rose						
Rosa sp.							
Rumex conglomeratus	Clustered Dock			R	R	R	
Rubus fruticosus agg.	Bramble				LA		
Rumex crispus	Curled Dock						
Rumex obtusifolius	Broad-leaved Dock						

Salix caprea	Goat Willow	R					
Salix cinerea	Grey Willow						
Salix c.f. fragilis	Willow species						
Salix sp.	A willow						
Scrophularia nodosa	Common Figwort						
Scutellaria galericulata	Skullcap						
Senecio Sp	Ragwort						
Sonchus asper	Prickly Sow-thistle				R		O
Sonchus bleraceus	Smooth sow thistle						
Stachys palustris	Marsh Woundwort						
Urtica dioica	Common Nettle				LA		F
Valariana officinalis	Common valarian						
Vicia cracca	Tufted Vetch						
Vicia sativa	Common Vetch						
Vicia tetrasperma	Smooth Tare						
Emergent Vegetation							
Scientific name	**Common name**	**S**	**N**	**ALL**	**ALL**	**N**	**S**
		18		**20**	**12**	**26**	
Agrostis stolonifera	Creeping Bent			O (LA)		LA	O
Alisma plantago-aquatica	Water-plantain		R	R		R	
Alisma lanceolata	Narrow leaved water-plantain		R			R	R
Aloepecuris geniculatatus	Marsh fowtail					R	R
Angelica sylvestris	Wild Angelica	R					
Apium nodiflorum	Fool's-watercress		R	R		O	

Berula erecta	Lesser Water-parsnip	O	O	O	F	O (LA)	O
Bidens cernua	Nodding bur-marigold			R			
Butomus umbelatus	Flowering rush			R		O	R
Carex acutiformis	Lesser Pond Sedge						
Carex hirta	Hairy Sedge						
Carex otrubae	False Fox-sedge						
Carex pseudocyperus	Cyperus Sede						
Carex riparia	Greater Pond-sedge			R			
Carex remota	Remote Sedge						
Catabrosa aquatica	Whorl grass						
Eleocharis palustris	Common spikerush						
Epilobium hirsutum	Hairy Willow-herb	R					
Equisetum fluviatile	Water Horsetail			R			
Eriophorum paulustris	Common spiked rush					R	
Filipendula ulmaria	Meadowsweet						
Galium palustre	Common marsh-bedstraw		R	R			R
Glyceria fluitans	Floating sweet grass		O	R	F	O	
Glyceria maxima	Reed Sweet-grass		O (LA)		F (LA)	O (LA)	O
Iris pseudacorus	Yellow Iris	R		O			R
Juncus acutiflorus	Sharp-flowered Rush			O		R	R
Juncus articulatus	Jointed Rush		R				
Juncus effusus	Soft Rush			O	F	O	O
Juncus inflexus	Hard Rush			R			R
Juncus Spp.							
Lycopus europaeus	Gypsywort					R	

Lythrum salicaria	Purple Loosestrife						
Mentha aquatica	Water Mint						
Myosotis laxa	Tufted forget-me-not		R	R			
Myosotis scorpioides	Water forget-me-not						
Myosotis Sp.							
Oenanthe crocata	Hemlock Water-dropwort	R		R	O		
Oenanthe fistulosa	Tubular Water-dropwort		O	O		O	R
Persicaria amphibia	Amphibious bistort						
Phalaris arundinacea	Reed Canary Grass						
Phragmites australis	Common Reed		O		LA		A
Polygonium amphibium	Amphibious bistort					O	
Ranunculus flammula	Lesser spearwort					R	
Rorippa nasturtium-aquaticum	Watercress				O		
Rumex hydrolapathum	Water dock					R	R
Sagittaria sagittifolia	Arrowhead			R	O (LA)	O	R
Salix caprea	Goat Willow						
Salix fragilis	Crack Willow						
Scrophularia auriculata	Water figwort				R		
Scutellaria galericulata	Skullcap					R	R
Senecio aquaticus	Marsh ragwort	R			R	R	R
Solanum dulcamera	Bittersweet				O		
Sparganium erectum	Bur-reed		F	F	A	O	
Typha latifolia	Bulrush						O (LA)
Urtica dioica	Common nettle						
Impatiens capensis	Orange balsam	R					

Veronica becabunga	Brooklime			R			
Submerged and floating vegetation							
		RCS1		**RCS2**	**RCS3**	**RCS4**	
		S	**N**			**N**	**S**
Scientific name	**Common name**	**11**		**5**	**4**	**13**	
Azolla filliculoides	Water fern						O (LA)
Callitriche obtusangula	Blunt-fruited Water-starwort						
Callitriche sp.	Starwort species	O					
Ceratophyllum demersum	Rigid Hornwort					O (LA)	R
Chara vulgaris agg.	Common stonewort		R				
Elodea nuttallii	Nuttall's Pondweed	O		O	O	O (LA)	
Elodea canadensis	Canadian pondweed						
Enteramorpha sp.	An algae			R			
Hydrocharis morsus-ranae	Frogbit	F	O (LA)	O (LA)	R	O	R
Lemna gibba	Fat Duckweed	R	R			R	R
Lemna minor	Common Duckweed	A	O				F
Lemna minuta	Least Duckweed			F			O (LA)
Lemna trisulca	Ivy-leaved Duckweed	O	R		O		O
Myriophyllum spicatum	Spiked water milfoil					R	
Potamogeton berchtoldii	Small pondweed	R					
Potamogeton crispus	Curled Pondweed						
Potamogeton natans	Broad-leaved Pondweed					R	
Potamogeton pectinatus	Fennel pondweed					O (LA)	
Potamogeton pusillus	Lesser Pondweed						

Potamogeton trichoides	Hairlike Pondweed	R	R			R	R
Rorippa nasturtium officinale	Watercress						
Sparganium emersum	Unbranched bur-reed				O (LA)		
Spirodela polyrhiza	Greater Duckweed	R	R	R		R	R
Wolffia arrhiza	Rootless duckweed		R (LA)				
Zanichella paulustris	Horned pondweed						

Annex D: Attributes of Aquatic Macrophytes Survey Sample Section

Note: The ‘R’ numbers in the table below refer to the sample locations

R1	
Water depth (m)	0.5
Reen width (m)	2.5
Obvious water flow	N
Turbidity: 1 (clear) – 5 (turbid):	3
Filamentous algae (%)	0%
Bank depth	>2.0m
Bank slope	0-50 deg
Dominant bank vegetation	Monocots & herbs
Successional state	Mid (16-70% emergent)
Adjacent land-use3	Scrub
Shade from trees/ shrubs (%)	0%
	0% submerged
Vegetation cover (%):	90% emergent species[1]
Vegetation cover (%):	100% bank species[2]
Bank management - N	N
Bank management - S	N

R2	
Water depth (m)	0.5
Reen width (m)	3
Obvious water flow	N
Turbidity: 1 (clear) – 5 (turbid):	2
Filamentous algae (%)	0%
Bank depth	>2.0m
Bank slope	0-50 deg
Dominant bank vegetation	Monocots & herbs
Successional state	Early (<15 emergent)
Adjacent land-use3	Scrub and Woodland
Shade from trees/ shrubs (%)	70%
Vegetation cover (%):	5% submerged species[1]
	20% emergent species
	10% floating species[1]
	100% bank species[2]

Bank management - N	N
Bank management - S	N

R3	
Water depth (m)	0.5m
Reen width (m)	3
Obvious water flow	N
Turbidity: 1 (clear) – 5 (turbid):	1
Filamentous algae (%)	0%
Bank depth	>2.0m
Bank slope	0-50 deg
Dominant bank vegetation	Monocots & herbs
Successional state	Early (0-15% emergent)
Adjacent land-use3	Grazing pasture to south
Shade from trees/ shrubs (%)	20% from hedgerow along south bank.
Vegetation cover (%):	10% submerged species[1]
	0% emergent species[1]
	50% floating species[1]
	100% bank species[2]
Bank management - N	N
Bank management - S	N

R4	
Water depth (m)	0.3m
Reen width (m)	4
Obvious water flow	N
Turbidity: 1 (clear) – 5 (turbid):	1
Filamentous algae (%)	0%
Bank depth	>2.0m
Bank slope	>50 deg
Dominant bank vegetation	Monocots & herbs
Successional state	Mid (16-70% emergent)
Adjacent land-use3	Road
Shade from trees/ shrubs (%)	0%
Vegetation cover (%):	10% submerged species[1]

	50% floating species[1]
	% emergent species
	100% bank species[2]
Bank management - N	Cut
Bank management - S	Tall grass

R5	
Water depth (m)	1
Reen width (m)	4
Obvious water flow	N
Turbidity: 1 (clear) – 5 (turbid):	1
Filamentous algae (%)	0%
Bank depth	1.0-2.0m
Bank slope	0-50 deg
Dominant bank vegetation	Monocots & herbs
Successional state	Early (<15 emergent)
Adjacent land-use3	Arable and Woodland
Shade from trees/ shrubs (%)	0%
Vegetation cover (%):	5% submerged species[1]
	10% floating species[1]
	30% emergent species[1]
	100% bank species[2]
Bank management - N	N
Bank management - S	N

R6	
Water depth (m)	1
Reen width (m)	4
Obvious water flow	N
Turbidity: 1 (clear) – 5 (turbid):	2
Filamentous algae (%)	0%
Bank depth	1.0-2.0m
Bank slope	0-50 deg
Dominant bank vegetation	Monocots & herbs
Successional state	Early (<15 emergent)

Adjacent land-use3	Reedbed and Silage field
Shade from trees/ shrubs (%)	0%
	100% floating species[1]
Vegetation cover (%):	10% emergent species[1]
Vegetation cover (%):	100% bank species[2]
Bank management - N	Cut (W)
Bank management - S	N

R7	
Water depth (m)	1
Reen width (m)	3
Obvious water flow	N
Turbidity: 1 (clear) – 5 (turbid):	1
Filamentous algae (%)	0%
Bank depth	1.0-2.0m
Bank slope	0-50 deg
Dominant bank vegetation	Monocots & herbs (90%)
Bank slope	Mixed (inc trees & shrubs) (10%)
Dominant bank vegetation	Early (<15 emergent)
Adjacent land-use3	Arable
Shade from trees/ shrubs (%)	0%
Vegetation cover (%):	10% submerged species[1]
Vegetation cover (%):	<5% floating species[1]
Vegetation cover (%):	30% emergent species[1]
Vegetation cover (%):	100% bank species[2]
Bank management - N	N
Bank management - S	N

R8	
Water depth (m)	1
Reen width (m)	3
Obvious water flow	N
Turbidity: 1 (clear) – 5 (turbid):	1
Filamentous algae (%)	50%
Bank depth	1.0-2.0m

Bank slope	>50 deg
Dominant bank vegetation	Monocots & herbs
Successional state	Mid (16-70% emergent)
Adjacent land-use3	
Shade from trees/ shrubs (%)	0%
Vegetation cover (%):	15% floating species[1]
Vegetation cover (%):	60% emergent species[1]
Vegetation cover (%):	100% bank species[2]
Bank management - N	None
Bank management - S	None

R9	
Water depth (m)	1
Reen width (m)	5
Obvious water flow	N
Turbidity: 1 (clear) – 5 (turbid):	2
Filamentous algae (%)	N
Bank depth	1.0-2.0m
Bank slope	0-50 deg
Dominant bank vegetation	Short herbs (Cut)
Dominant bank vegetation	Monocots & herbs (Cut)
Successional state	Early (<15 emergent)
Adjacent land-use3	Road verge and Grazed grassland
Shade from trees/ shrubs (%)	50%
Vegetation cover (%):	0% submerged species[1]
Vegetation cover (%):	100% floating species[1]
Vegetation cover (%):	5% emergent species[1]
Vegetation cover (%):	100% / Cut bank species[2]
Bank management - N	Mown
Bank management - S	Mown

R10	
Water depth (m)	1
Reen width (m)	5

Obvious water flow	N
Turbidity: 1 (clear) – 5 (turbid):	2
Filamentous algae (%)	N
Bank depth	1.0-2.0m
Bank slope	>50 deg
Dominant bank vegetation	Short herbs (Cut)
	Monocots & herbs (Cut)
	Mixed (inc trees & shrubs) - Willow
Successional state	Early (<15 emergent)
Adjacent land-use3	Road verge grassland
Shade from trees/ shrubs (%)	5%
Vegetation cover (%):	0% submerged species[1]
Vegetation cover (%):	5% emergent species[1]
Vegetation cover (%):	100% floating species[1]
Bank management - N	Mown
Bank management - S	Mown

R11	
Water depth (m)	0.25m
Reen width (m)	4m
Obvious water flow	N
Turbidity: 1 (clear) – 5 (turbid):	4
Filamentous algae (%)	N
Bank depth	<1m
Bank slope	0-50 deg
Dominant bank vegetation	Monocots & herbs
Successional state	Late (>70% emergent)
Adjacent land-use3	Cow and Sheep grazed grassland
Shade from trees/ shrubs (%)	10%
Vegetation cover (%):	100% floating species[1]
Vegetation cover (%):	70% emergent species[1]
Vegetation cover (%):	100% bank species[2]
Bank management – East	Fenced
Bank management – West	Partially fenced. Cattle poached in open areas.

R12	
Water depth (m)	0.80
Reen width (m)	4
Obvious water flow	N
Turbidity: 1 (clear) – 5 (turbid):	2/3
Filamentous algae (%)	N
Bank depth	1.0-2.0m
Bank slope (North side)	0-50 deg
Bank slope (South side)	>50 deg
Dominant bank vegetation	Monocots & herbs
Successional state	Mid (16-70% emergent)
Adjacent land-use3	Scrub
Shade from trees/ shrubs (%)	0%
Vegetation cover (%):	90% emergent species[1]
Vegetation cover (%):	100% bank species[2]
Bank management - N	N
Bank management - S	N

R13	
Water depth (m)	0.25
Reen width (m)	2.5
Obvious water flow	N
Turbidity: 1 (clear) – 5 (turbid):	2
Filamentous algae (%)	0%
Bank depth	>2.0m
Bank slope	0-50 deg
Dominant bank vegetation	Monocots & herbs
Dominant bank vegetation	Short herbs
Dominant bank vegetation	Mixed (inc trees & shrubs) – Hawthorn Bush
Successional state	Late (>70% emergent)
Adjacent land-use3	Cattle grazed grassland
Shade from trees/ shrubs (%)	10%
Vegetation cover (%):	100% floating species[1]
Vegetation cover (%):	90% emergent species[1]

Vegetation cover (%):	100% bank species[2]
Bank management - N	Cattle – grazing over barbed wire fence
Bank management - S	Cattle – grazing over barbed wire fence

R14	
Water depth (m)	0.5
Reen width (m)	3
Obvious water flow	N
Turbidity: 1 (clear) – 5 (turbid):	2/3
Filamentous algae (%)	N
Bank depth	<1m
Bank slope	>50 deg
Dominant bank vegetation	Monocots & herbs
Dominant bank vegetation	Short herbs
Dominant bank vegetation	Mixed (inc trees & shrubs) - Hawthorn patches
Successional state	Mid (16-70% emergent)
Adjacent land-use3	Cattle grazed grassland
Shade from trees/ shrubs (%)	50%
Vegetation cover (%):	100% floating species[1]
Vegetation cover (%):	60% emergent species[1]
Vegetation cover (%):	100% bank species[2]
Bank management - N	Cattle
Bank management - S	Cattle

R15	
Water depth (m)	0.5
Reen width (m)	4
Obvious water flow	N
Turbidity: 1 (clear) – 5 (turbid):	2
Filamentous algae (%)	20%
Bank depth	1.0-2.0m
Bank slope	>50 deg
Dominant bank vegetation	Monocots & herbs
Successional state	Early (<15 emergent)
Adjacent land-use3	None / NGL

Shade from trees/ shrubs (%)	0%
Vegetation cover (%):	100% floating species[1]
Vegetation cover (%):	5% emergent species[1]
Vegetation cover (%):	100% bank species[2]
Bank management - west	N
Bank management - east	Recent

R16	
Water depth (m)	>1.5
Reen width (m)	3
Obvious water flow	N
Turbidity: 1 (clear) – 5 (turbid):	3
Filamentous algae (%)	0%
Bank depth	1.0-2.0m
Bank slope	0-50 deg
Dominant bank vegetation	Monocots & herbs
Successional state	Early (<15 emergent)
Adjacent land-use3	Hedge/Scrub and NGL
Shade from trees/ shrubs (%)	15%
Vegetation cover (%):	80% submerged species[1]
Vegetation cover (%):	50% floating species[1]
Vegetation cover (%):	20% emergent species[1]
Vegetation cover (%):	100% bank species[2]
Bank management - N	N
Bank management - S	Recent

R17	
Water depth (m)	<1m
Reen width (m)	4m
Obvious water flow	N
Turbidity: 1 (clear) – 5 (turbid):	3
Filamentous algae (%)	5%
Bank depth	<1m
Bank slope	<50 deg
Dominant bank vegetation	Mixed (inc trees & shrubs)

Successional state	Early (<15 emergent)
Adjacent land-use3	Grazed (north), None (south)
Shade from trees/ shrubs (%)	25%
Vegetation cover (%):	80% submerged species[1]
Vegetation cover (%):	95% floating species[1]
Vegetation cover (%):	90% emergent species[1]
Vegetation cover (%):	100% bank species[2]
Bank management - N	Cut
Bank management - S	Cut amongst trees

R18	
Water depth (m)	~1.5m
Reen width (m)	2m
Obvious water flow	N
Turbidity: 1 (clear) – 5 (turbid):	1
Filamentous algae (%)	5%
Bank depth	<1m
Bank slope	>50 deg
Dominant bank vegetation	Monocots & herbs
Successional state	Early (<15 emergent)
Adjacent land-use3	Grazed (west), Access track and scrub (east)
Shade from trees/ shrubs (%)	5%
Vegetation cover (%):	80% submerged species[1]
Vegetation cover (%):	20% floating species[1]
Vegetation cover (%):	10% emergent species[1]
Vegetation cover (%):	100% bank species[2]
Bank management - N	No recent
Bank management - S	Cut for silage

R19	
Water depth (m)	Approx. 1m
Reen width (m)	5m
Obvious water flow	N
Turbidity: 1 (clear) – 5 (turbid):	3
Filamentous algae (%)	20%

Bank depth	<1m
Bank slope	>50 deg
Dominant bank vegetation	Mixed (inc trees & shrubs)
Successional state	Early (<15 emergent)
Adjacent land-use3	None
Shade from trees/ shrubs (%)	25%
Vegetation cover (%):	50% (west) bank species[2]
Vegetation cover (%):	100% floating species[1]
Bank management - N	Cut to the east
Bank management - S	None to the west

R20	
Water depth (m)	0.75m
Reen width (m)	3m
Obvious water flow	N
Turbidity: 1 (clear) – 5 (turbid):	1
Filamentous algae (%)	20%
Bank depth	<1m
Bank slope	0-50 deg
Dominant bank vegetation	Mixed (inc trees & shrubs)
Successional state	Early (<15 emergent)
Adjacent land-use3	Grazed
Shade from trees/ shrubs (%)	40%
Vegetation cover (%):	80% submerged species[1]
Vegetation cover (%):	20% floating species[1]
Vegetation cover (%):	10% emergent species[1]
Vegetation cover (%):	50% (west) bank species[2]
Bank management - N	Cut to the east
Bank management - S	None to the west

R21	
Water depth (m)	<1.5m
Reen width (m)	4m
Obvious water flow	N
Turbidity: 1 (clear) – 5 (turbid):	2

Filamentous algae (%)	10%
Bank depth	>2.0m
Bank slope	0-50 deg
Dominant bank vegetation	Mixed (inc trees & shrubs)
Successional state	Early (<15 emergent)
Adjacent land-use3	None
Shade from trees/ shrubs (%)	10%
Vegetation cover (%):	80% submerged species[1]
Vegetation cover (%):	100% floating species[1]
Vegetation cover (%):	5% emergent species[1]
Vegetation cover (%):	100% bank species[2]
Bank management - N	None
Bank management - S	None

R22	
Water depth (m)	~1m
Reen width (m)	6m
Obvious water flow	N
Turbidity: 1 (clear) – 5 (turbid):	2
Filamentous algae (%)	10%
Bank depth	>2.0m
Bank slope	>50 deg
Dominant bank vegetation	Monocots & herbs
Successional state	Early (<15 emergent)
Adjacent land-use3	Cut by the IDB
Shade from trees/ shrubs (%)	0%
Vegetation cover (%):	80% submerged species[1]
Vegetation cover (%):	10% floating species[1]
Vegetation cover (%):	10% emergent species[1]
Vegetation cover (%):	100% bank species[2]
Bank management - N	none
Bank management - S	Relent

R23	
Water depth (m)	<0.5

Reen width (m)	6m
Obvious water flow	N
Turbidity: 1 (clear) – 5 (turbid):	2
Filamentous algae (%)	0
Bank depth	Approx. 3.0m
Bank slope	0-50 deg
Dominant bank vegetation	Monocots & herbs
Successional state	Mid (16-70% emergent)
Adjacent land-use3	Cow grazed (East) and Unmanaged hedge (West)
Shade from trees/ shrubs (%)	40%
Vegetation cover (%):	40% submerged species
Vegetation cover (%):	60% floating species
Vegetation cover (%):	30% emergent species
Vegetation cover (%):	100% bank species
Bank management – East	Cow poached
Bank management - West	None – large unmanaged hedgerow

R24	
Water depth (m)	>2m
Reen width (m)	10m
Obvious water flow	N
Turbidity: 1 (clear) – 5 (turbid):	2
Filamentous algae (%)	50%
Bank depth	<1m
Bank slope	0-50 deg
Dominant bank vegetation	Monocots & herbs
Successional state	Early (<15 emergent)
Adjacent land-use3	Cattle grazed grassland
Shade from trees/ shrubs (%)	0%
Vegetation cover (%):	60% submerged species[1]
Vegetation cover (%):	20% floating species[1]
Vegetation cover (%):	10% emergent species[1]
Vegetation cover (%):	100% bank species[2]
Bank management - N	Cow poached
Bank management - S	

R25	
Water depth (m)	>2m
Reen width (m)	8m
Obvious water flow	East
Turbidity: 1 (clear) – 5 (turbid):	1
Filamentous algae (%)	50%
Bank depth	<1m
Bank slope	0-50 deg
Dominant bank vegetation	Monocots & herbs
Dominant bank vegetation	Short herbs
Successional state	Early (<15 emergent)
Adjacent land-use3	Cattle grazed grassland
Shade from trees/ shrubs (%)	0%
Vegetation cover (%):	60% submerged species[1]
Vegetation cover (%):	50% floating species[1]
Vegetation cover (%):	25% emergent species[1]
Vegetation cover (%):	100% bank species[2]
Bank management - N	N
Bank management - S	Cattle grazed

R26	
Water depth (m)	0.5m
Reen width (m)	4m
Obvious water flow	N
Turbidity: 1 (clear) – 5 (turbid):	2
Filamentous algae (%)	0
Bank depth	1.0-2.0m
Bank slope	>50 deg
Dominant bank vegetation	Mixed (inc trees & shrubs)
Successional state	Early (<15 emergent)
Adjacent land-use3	Road (North) and Horse grazed (South)
Shade from trees/ shrubs (%)	25%
Vegetation cover (%):	10% submerged species[1]
Vegetation cover (%):	100% floating species[1]
Vegetation cover (%):	10% emergent species[1]

Vegetation cover (%):	80% bank species[2]
Bank management - N	Not recent
Bank management - S	Not recent

R27	
Water depth (m)	<0.5m
Reen width (m)	3m
Obvious water flow	N
Turbidity: 1 (clear) – 5 (turbid):	3
Filamentous algae (%)	0%
Bank depth	1.0-2.0m
Bank slope	>50 deg
Dominant bank vegetation	Monocots & herbs
Successional state	Early (<15 emergent)
Adjacent land-use3	Silage and Grazed (East)
Shade from trees/ shrubs (%)	5%
Vegetation cover (%):	5% submerged species[1]
Vegetation cover (%):	80% floating species[1]
Vegetation cover (%):	5% emergent species[1]
Vegetation cover (%):	80% bank species[2]
Bank management - N	Not recent
Bank management - S	Not recent

R28	
Water depth (m)	0.5m
Reen width (m)	4m
Obvious water flow	N
Turbidity: 1 (clear) – 5 (turbid):	2
Filamentous algae (%)	0%
Bank depth	>2.0m
Bank slope	>50 deg
Dominant bank vegetation	Monocots & herbs
Dominant bank vegetation	Mixed (inc trees & shrubs)
Successional state	Early (<15 emergent)
Adjacent land-use3	Scrub

Shade from trees/ shrubs (%)	0%
Vegetation cover (%):	5% submerged species[1]
Vegetation cover (%):	100% floating species[1]
Vegetation cover (%):	5% emergent species[1]
Vegetation cover (%):	100% bank species[2]
Bank management - N	Not recent
Bank management - S	Not recent

R29	
Water depth (m)	>1
Reen width (m)	5
Obvious water flow	N
Turbidity: 1 (clear) – 5 (turbid):	1
Filamentous algae (%)	0
Bank depth	1.0-2.0m
Bank slope	>50 deg
Dominant bank vegetation	Monocots & herbs
Successional state	Early (<15 emergent)
Adjacent land-use3	Silage (S) and Scrub (N)
Shade from trees/ shrubs (%)	20%
Vegetation cover (%):	20% submerged species[1]
Vegetation cover (%):	70% floating species[1]
Vegetation cover (%):	90% emergent species[1]
Bank management - N	N
Bank management - S	N

R30	
Water depth (m)	0.75m
Reen width (m)	4
Obvious water flow	N
Turbidity: 1 (clear) – 5 (turbid):	1
Filamentous algae (%)	0
Bank depth	<1m (E), 1.0-2.0m (W)
Bank slope	0-50 deg (E), >50 deg (W)
Dominant bank vegetation	Monocots & herbs

Successional state	Early (<15 emergent)
Adjacent land-use3	Cattle grazed
Shade from trees/ shrubs (%)	0%
Vegetation cover (%):	60% submerged species[1]
Vegetation cover (%):	80% floating species[1]
Vegetation cover (%):	20% emergent species[1]
Vegetation cover (%):	100% bank species[2]
Bank management – East	None recent
Bank management - West	None recent

R31	
Water depth (m)	>1
Reen width (m)	3
Obvious water flow	N
Turbidity: 1 (clear) – 5 (turbid):	1
Filamentous algae (%)	0
Bank depth	<1m (E), 1.0-2.0m (W)
Bank slope	0-50 deg (E), >50 deg (W)
Dominant bank vegetation	Monocots & herbs (E)
Dominant bank vegetation	Mixed (inc trees & shrubs) (W)
Successional state	Mid (16-70% emergent)
Adjacent land-use3	Field grazing (E), Scrub (W)
Shade from trees/ shrubs (%)	0%
Vegetation cover (%):	40% submerged species[1]
Vegetation cover (%):	40% floating species[1]
Vegetation cover (%):	10% emergent species[1]
Vegetation cover (%):	100% bank species[2]
Bank management - N	N (W)
Bank management - S	Fenced (E)

R31a	
Water depth (m)	1m
Reen width (m)	4m
Obvious water flow	No
Turbidity: 1 (clear) – 5 (turbid):	1

Filamentous algae (%)	15%
Bank depth	Approximately 1m
Bank slope	0-50^{o}
Dominant bank vegetation	Monocots and herbs
Successional state	Early
Adjacent land-use3	
Shade from trees/ shrubs (%)	
Vegetation cover (%):	
Vegetation cover (%):	
Vegetation cover (%):	
Vegetation cover (%):	
Bank management - N	
Bank management - S	

R32	
Water depth (m)	1
Reen width (m)	5
Obvious water flow	N
Turbidity: 1 (clear) – 5 (turbid):	1
Filamentous algae (%)	0
Bank depth	<1m
Bank slope	0-50 deg
Dominant bank vegetation	Monocots & herbs
Successional state	Early (<15 emergent)
Adjacent land-use3	Fields
Shade from trees/ shrubs (%)	0%
Vegetation cover (%):	100% floating species[1]
Vegetation cover (%):	100% bank species[2]
Bank management - N	Fenced
Bank management - S	

R33	
Water depth (m)	2m
Reen width (m)	5m

Obvious water flow	N
Turbidity: 1 (clear) – 5 (turbid):	1
Filamentous algae (%)	0%
Bank depth	<1m
Bank slope	>50 deg
Dominant bank vegetation	Monocots & herbs
Successional state	Early (<15 emergent)
Adjacent land-use3	Silage and grazing
Shade from trees/ shrubs (%)	0%
Vegetation cover (%):	70% submerged species[1]
Vegetation cover (%):	10% emergent species[1]
Vegetation cover (%):	20% floating species[1]
Bank management - N	None
Bank management - S	Recent

R34	
Water depth (m)	0.75
Reen width (m)	4 - 6
Obvious water flow	N
Turbidity: 1 (clear) – 5 (turbid):	2
Filamentous algae (%)	10%
Bank depth	1.0-2.0m
Bank slope	0-50 deg
Dominant bank vegetation	Monocots & herbs
Successional state	Early (<15 emergent)
Adjacent land-use3	Hedges and Grassland
Shade from trees/ shrubs (%)	20%
Vegetation cover (%):	15% submerged species[1]
Vegetation cover (%):	100% bank species[2]
Vegetation cover (%):	10% emergent species[1]
Vegetation cover (%):	50% floating species[1]
Bank management - N	None
Bank management - S	Recent

R35

Water depth (m)	1
Reen width (m)	4
Obvious water flow	N
Turbidity: 1 (clear) – 5 (turbid):	1
Filamentous algae (%)	5%
Bank depth	<1m
Bank slope	>50 deg
Dominant bank vegetation	Monocots & herbs
Successional state	Early (<15 emergent)
Adjacent land-use3	Wildlife Trust and Grassland
Shade from trees/ shrubs (%)	0%
Vegetation cover (%):	10% submerged species[1]
Vegetation cover (%):	10% emergent species[1]
Vegetation cover (%):	40% floating species[1]
Vegetation cover (%):	100% bank species[2]
Bank management - N	None
Bank management - S	Recent

R36	
Water depth (m)	1
Reen width (m)	4
Obvious water flow	N
Turbidity: 1 (clear) – 5 (turbid):	2
Filamentous algae (%)	0%
Bank depth	1.0-2.0m
Bank slope	>50 deg
Dominant bank vegetation	Monocots & herbs
Successional state	Early (<15 emergent)
Adjacent land-use3	Rush pasture and horse graze fields field
Shade from trees/ shrubs (%)	0%
Vegetation cover (%):	100% bank species
Vegetation cover (%):	40% emergent species
Vegetation cover (%):	30% floating species
Vegetation cover (%):	30% submerged species
Bank management - N	None recent

Bank management - S	None recent

R37	
Water depth (m)	0.5
Reen width (m)	3
Obvious water flow	N
Turbidity: 1 (clear) – 5 (turbid):	1
Filamentous algae (%)	0%
Bank depth	<1m
Bank slope	0-50 deg
Dominant bank vegetation	Monocots & herbs
Successional state	Early (<15% emergent)
Adjacent land-use3	Road (NW); scrub and rush pasture (SE)
Shade from trees/ shrubs (%)	0%
Vegetation cover (%):	10% emergent species
Vegetation cover (%):	50% floating speces
Vegetation cover (%):	90% submerged
Vegetation cover (%):	100% bank species
Bank management - N	Cut
Bank management - S	Tall grass

R38	
Water depth (m)	1m
Reen width (m)	4m
Obvious water flow	N
Turbidity: 1 (clear) – 5 (turbid):	2
Filamentous algae (%)	5%
Bank depth	<1m
Bank slope	0-50 deg
Dominant bank vegetation	Monocots & herbs
Successional state	Mid (16-70% emergent)
Adjacent land-use3	Cattle grazed to west; infrequently managed rush pasture to east
Shade from trees/ shrubs (%)	0%
Vegetation cover (%):	100 %bank species[2]

Vegetation cover (%):	10% submerged species[1]
Vegetation cover (%):	50% emergent species[1]
Vegetation cover (%):	50% floating species[1]
Bank management - N	Horse grazed and cut
Bank management - S	Horse grazed and cut

R39	
Water depth (m)	0.5m
Reen width (m)	4m
Obvious water flow	N
Turbidity: 1 (clear) – 5 (turbid):	1
Filamentous algae (%)	0%
Bank depth	>2.0m
Bank slope	>50 deg
Dominant bank vegetation	Monocots & herbs
Successional state	Early (<15 emergent)
Adjacent land-use3	Grazed
Shade from trees/ shrubs (%)	0%
Vegetation cover (%):	20% submerged species[1]
Vegetation cover (%):	5% emergent species[1]
Vegetation cover (%):	50% floating species[1]
Vegetation cover (%):	100 % bank species[2]
Bank management - N	None
Bank management - S	Recent