Ove Arup and Partners

Cardiff Parkway Development, St Mellons, Cardiff

Vegetation surveys

November 2018

Sturgess Ecology

Contents

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Cover photographs: Left: ungrazed grassland at Hendre Lake Park; Right: reen vegetation (survey section 2S).

This document has been produced for Ove Arup and Partners by:

Sturgess Ecology
12 Lon Ysgubor, Rhiwbina, Cardiff, CF14 6SG
e-mail: peter@sturgess-ecology.co.uk
Web: www.sturgess-ecology.co.uk

1. Introduction

Ove Arup and Partners have commissioned Sturgess Ecology to undertake vegetation surveys within parts of the proposed Cardiff Parkway development site, St Mellons, Cardiff (approximate central grid reference ST250807). The site lies within Gwent Levels and is part of the Rumney and Peterstone Site of Special Scientific Interest (SSSI). It also includes the Marshfield Site of Importance for Nature Conservation (SINC). The survey is required to support the design and assessment process for a new railway station and associated urban infrastructure.

The study involves two distinct elements of vegetation survey: (i) a National Vegetation Classification (NVC) survey of grassland habitats, and (ii) an investigation into the aquatic plants of certain reens (ditches). The survey areas were selected by Ove Arup ecologists following a Phase 1 habitat survey. The fieldwork and assessment for these vegetation studies were undertaken by Dr Peter Sturgess CEnv MCIEEM. He is an experienced botanist and familiar with the NVC and the flora of the Gwent Levels.

2. Survey methods

2.1 National vegetation classification survey

The objective of the study was to map and describe the grassland plant communities within certain parts of the site using NVC methods. The fields that had been selected for survey are shown outlined by a red line in Figure 1.

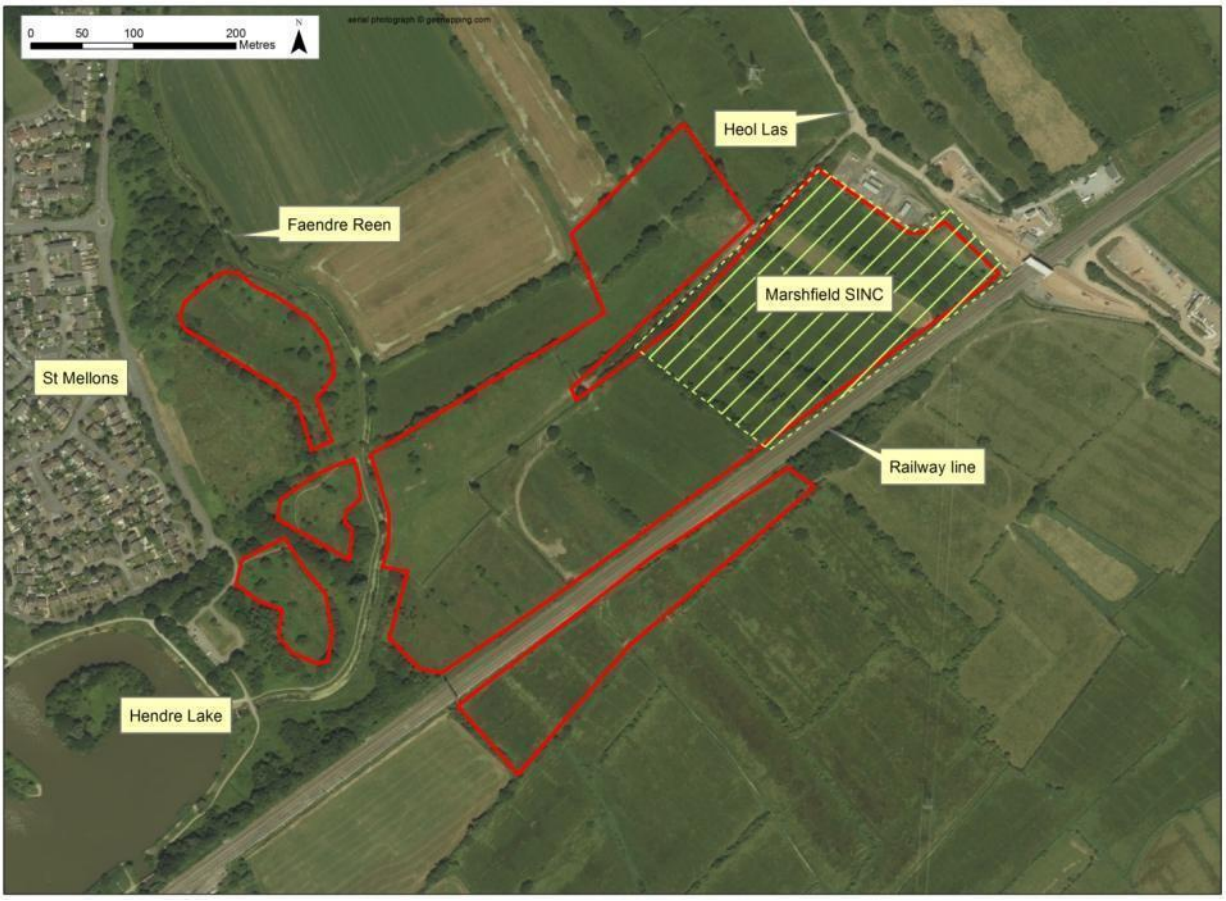

Figure 1. Location of NVC survey areas.

The survey was mainly undertaken using a simple walk-through method, walking the site to examine and map the various grassland types. The plant communities were plotted by eye onto an aerial photograph base plan.

The vegetation was delineated into approximately homogeneous stands for mapping purposes. These mostly coincide with the broad habitats and therefore the mapping has attempted to use similar map colouring to standard JNCC habitat survey methodology (JNCC, 2010). The plant communities were described in terms of the published NVC communities (Rodwell, 1991, etc.) through the use of quadrat sampling and target notes.

A total of 73 quadrats were recorded. These involved recording every species within square 2x2m sample areas. These quadrat areas were generally selected as being representative samples of the stand in which they occurred. The cover of every species within each quadrat was assessed using the Domin scale, as shown in Table 1. An estimate was also made of the percentage cover by vegetation and the approximate vegetation height (as an average through the quadrat).

Table 1. Domin scale for recording vegetation cover

Percentage cover	Domin score
91-100%	10
76-90%	9
51-75%	8
34-50%	7
26-33%	6
11-25%	5
4-10%	4
<4% - many individuals	3
<4% - several individuals	2
<4% - few individuals	1
Associate species (within 1m of a quadrat)	A

The quadrats recorded from each broadly similar plant community were grouped together into floristic tables, giving each distinct community its own table. Following NVC methodology, the occurrence of each species within the group of quadrats was assigned a constancy score as indicated in Table 2. The species within each table were then listed in order of their constancy score. Once the tables were completed, they were compared with the communities within the published NVC classification. In this case, all comparisons have been made on the basis of the author's experience, rather than use of any analytical software.

Table 2. Constancy scores for quadrat data

Frequency within quadrats	Constancy Score
81 - 100%	V
61 - 80%	IV
41 - 60%	III
21 - 40%	II
1 - 20%	I
Associate species (A) only	

The survey work was carried out during the week beginning 24 September 2018. The weather was dry and mostly sunny, and considered ideal for this type of survey. However, the timing is relatively late in the fieldwork season so it is possible that some early-flowering plants might have been overlooked if they had died back or been removed during hay-cutting earlier in the summer. A period of unusually hot and dry weather during the summer may have meant that some species had finished flowering earlier than usual and might therefore be under-represented in the findings. Access was readily available to all parts of the survey area.

A grassland quadrat marked for recording in Marshfield SINC. Note that the vegetation is relatively short after the summer hay cut.

2.2 Reen flora survey

The study of the reen vegetation was based on the CCW 1996 guidance for reen flora monitoring. However, the method was altered slightly, partly because it was carried out outside the usual monitoring time period, and partly because it was intended as a one-time descriptive survey, rather than an exercise to be repeated regularly as a monitoring exercise. In addition, the survey locations were chosen to represent the most diverse reens, rather than being a full cross-section of the ditch types across the site. The smaller, drier, field-ditches, and those overgrown by dense scrub, are generally not represented within the sampled locations.

The survey was based on detailed examination of several 20m lengths of reen. These were mostly chosen with at least one end coinciding with a fixed marker (such as a ditch intersection, field grip or tree), in case the section is ever re-used in future monitoring. The approximate dimensions of every 20m section were measured (the depth and width of deep water sometime had to be estimated), and other physical parameters including shading, turbidity or any flow were noted. Photographs were taken of every section to assist in the description of the habitat and vegetation within and adjacent to the reen.

Within each 20m section the flora was recorded, estimating the relative frequency of species on the bank and in the water separately, using the DAFOR scale (Dominant/ Abundant/ Frequent/ Occasional/ Rare). Aquatic plants were sampled using a hooked stick and grapnel, with sampling undertaken throughout the whole length of each section. Most plants were identified in the field but specimens of certain groups were collected for checking later by microscope (e.g. fine-leaved *Potamogeton* species that require close examination of stipules and other leaf details). In some cases it was not possible to confirm plants to species (e.g. non-fruiting *Callitriche* species).

In addition to the 20m sampling sections, additional observations were made along the adjacent bank to give approximately 100m sections (typically ending at fixed features such as bridges or field corners). Species observed in these extended strips are indicated by an X rather than a DAFOR score. The extended observations were limited to a quick walk-over along the bank and did not include grapnel sampling.

The plants around the edge of Hendre Lake were examined, and recorded as a broad target note description with a species list. The lake was not subject to grapnel sampling.

The chosen survey sections are highlighted in Figure 2. The section numbers follow the labelling used in the previous Arup survey.

Figure 2. Location of reen survey sections.

3. Survey findings

A list of the plant species recorded during both surveys is presented in Appendix 1. This includes the scientific and common names for each species.

3.1 National vegetation classification survey

The vegetation mapping is presented in Figure 3. This broadly shows the main blocks of different vegetation types, overlaid on an aerial photograph to provide a context for the observations. The vegetation stands have been plotted by eye and do not always have clearly defined boundaries, so they should only be considered very approximate. In addition, many of the vegetation types merge into one another, forming mosaics and gradual transitions. Boundaries between communities are also often unclear in areas that have not been grazed for several months and are reverting from one grassland type to another, for example where reed is spreading into formerly grazed fields following removal of livestock. Notes on the variations and mosaics seen are included in the subsequent plant community descriptions.

The locations of the quadrats are shown in Figure 3. Where possible, quadrats were sampled from communities dispersed widely across the site to give an indication of the range of variation within each community and across the site. However, some were also chosen to describe individual features, such as the scrapes at TN4 and 18, which are not found elsewhere within the study area.

The vegetation descriptions and constancy tables are presented below. They attempt to describe the vegetation in terms of the published NVC communities. In some cases it has not been possible to match the vegetation with the published types very precisely, particularly where the plant communities have been subject to disturbance or where they are in a state of transition. The community descriptions are presented together with the quadrat data collected, arranged as NVC vegetation tables. The species in the tables are arranged in order of frequency, as denoted by the constancy score in the right-hand column.

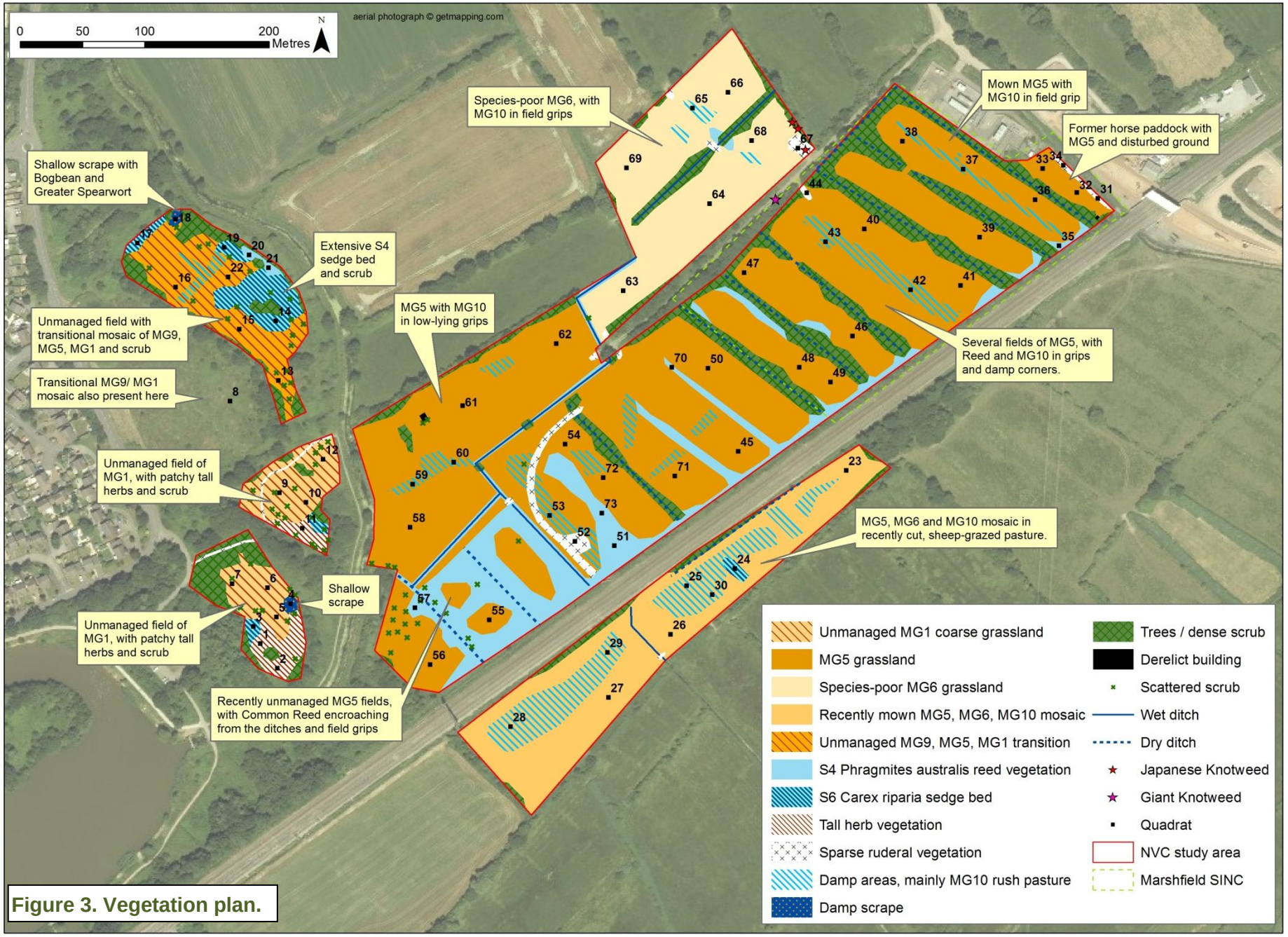

Figure 3. Vegetation plan.

MG5: Centaurea nigra Cynosurus cristatus grassland

The majority of the study area grassland supports a moderately species-rich sward of fine-leaved grasses with a good range of flowering herbs, most notably Common Knapweed. Much of the MG5 pasture appears to have been managed by a combination of grazing by cattle, and taking a crop of hay. However, most of it was ungrazed at the time of the survey, and hay had only been taken from a small proportion of it.

The most frequent plant species in this vegetation included Common Bent, Sweet Vernal-grass, Common Knapweed, Crested Dog's-tail, Yorkshire Fog and Perennial Rye-grass, which are all constant species of the MG5 community. However, it is not a typical MG5 flora due to the relatively low proportion of Red Fescue, and because it has several elements that are usually associated with damper soils, including high frequencies of Amphibious Bistort, Meadow Barley, Hairy Sedge and rushes. In some areas there are transitions towards less diverse MG6 vegetation, and rush pasture communities. In particular, towards MG10 where Soft Rush is frequent (often close to field grips), and areas with patchy Sharp-flowered Rush that show elements of M23 vegetation.

The most significant species found in this vegetation was Corky-fruited Water-dropwort, in part of the Marshfield SINC at Quadrat 47.

MG5 grassland.

Seedhead of Corky-fruited Water-dropwort in MG5 grassland (Quadrat 47)

Table 3. Quadrat data for MG5 *Centaurea nigra Cynosurus cristatus* grassland

Species	32	33	39	40	41	45	46	47	48	49	50	54	55	56	58	61	62	66	71	72	Frequency
Agrostis capillaris	5	4	4	7	6	8	5	3	5	4	5	6	4	4	6	6	8	5	4	4	V
Anthoxanthum odoratum			6	5	5	4	5	5	5	4	4	5	4	2		4	2	5	7	4	V
Centaurea nigra	5	9	5	4	5	5	5	6	5	6	5	7	1	4	A	2	4	2	4	8	V
Cynosurus cristatus				6	6	5	4	7	5	7	5	6	4	4	8	7	6	4	2	4	V
Holcus lanatus			2	4	4	6	4	3	2	7	3	2	2	4	5	1	4	4	4	2	V
Lolium perenne	2	1		6	3	2	5	3	2	2		5			5	5	6	2	2	2	IV
Lotus corniculatus			5		4	5	3	4	4	3	6	4		3		3	4	6	4	5	IV
Persicaria amphibia	4	A	2	2		1		1	4		2	1			A	2	3	1	1	2	IV
Plantago lanceolata	2	3		4	2	3	1	2	2	2	2	2			2	4	3	3		4	IV
Carex hirta			7	2	3	1	4	4	6	4	5			5					4	4	III
Lathyrus pratensis	1		3	A	4	3	3	2		3	2	3		2				A	2	4	III
Potentilla reptans	2		3	A	3		5		3	2	4			4		3		4			III
Ranunculus repens	5	7	A	2	2		1			2			1		3	5				1	III
Taraxacum sp.	2	2		2	2	1		1							2	A	2	2			III
Trifolium pratense	2	1	2	A	3	2		3		3	1	A	A		7		3			3	III
Trifolium repens	2	1		A		2	1						6		4	4	5	4			III
Agrostis stolonifera	7	4										4	2	4							II
Brachythecium rutabulum	2									2		2		2	2						II
Carex flacca			1									2	2	3			4			2	II
Equisetum arvense		3				3						2	2	2				1			II
Festuca rubra				2		2	3	2	3	5	2								2		II
Hordeum secalinum				5	4			3		2		5	1			4	2				II
Juncus acutiflorus					6		7			7						1		8			II
Juncus conglomeratus							2	A	A		A		2	5		1			4	A	II
Phleum pratense				5	4		1	3		A		1				5	A	4		A	II
Pulicaria dysenterica													4	1		2	3			1	II
Vicia cracca			3			1				2	2		1	2				3			II
Achillea ptarmica														2							I
Alopecurus pratensis								2													I
Calliergonella cuspidata															2	2				2	I
Cerastium fontanum		1					2											1			I
Cirsium palustre						A								1							I
Dactylis glomerata	A	2						2	2	A	2	A									I
Elytrigia repens			8							2		A									I
Helminthotheca echioides																	1				I
Hypochaeris radicata										A					1	2	1				I
Juncus effusus			1				1	A											6		I
Juncus inflexus					5	A	A				A							A		A	I

Species	32	33	39	40	41	45	46	47	48	49	50	54	55	56	58	61	62	66	71	72	Frequency
Kindbergia praelonga									2			2								2	I
Leontodon saxatilis	1	3																			I
Lotus pedunculatus				2	4																I
Luzula campestris								2													I
Odontites vernus												A				1					I
Oenanthe pimpinelloides								4													I
Phragmites australis			2				A	1				A	A								I
Plantago major	3																				I
Poa trivialis		2																			I
Prunella vulgaris												2		2		2					I
Prunus spinosa											1										I
Ranunculus acris													2		A						I
Rhinanthus minor					2				2		2										I
Rhytidiadelphus squarrosus										2											I
Rosa canina										1		A									I
Rumex acetosa	2	A	2												3			2			I
Rumex crispus	1	A													A	1	1	A			I
Scorzoneroides autumnalis															2	2	4				I
Senecio erucifolius												2	3	2		A				1	I
Senecio jacobaea	1	1												2							I
Senecio vulgaris	1	A																			I
Sonchus asper	A	1																			I
Sonchus oleraceus		1																			I
Vicia tetrasperma													1								I
Chenopodium rubrum	A																				
Cirsium vulgare	A	A																			
Crataegus monogyna														A							
Eupatorium cannabinum														A							
Heracleum sphondylium		A																			
Quercus robur																		A			
Rubus fruticosus		A																			
Rumex conglomeratus																	A				
Rumex obtusifolius		A																			
Urtica dioica		A																			
Species total	19	17	16	15	20	17	19	21	15	21	17	19	17	21	14	23	19	18	13	18	
Height (cm)	15	20	25	40	45	20	30	40	30	30	40	30	25	40	30	35	25	40	30	30	
Cover (%)	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	

Recently mown grassland: MG5/ MG6 / MG10 mosaic

A few parts of the study area had been mown shortly before the survey. These most recently cut areas were difficult to classify effectively because some key species might not have been visible, especially to the south of the railway where the fields were also being heavily grazed by sheep. The cut fields were broadly attributable to a species-poor transition between MG5 *Centaurea nigra Cynosurus cristatus* grassland and MG6 *Lolium perenne - Cynosurus cristatus* grassland, with rushy patches most similar to MG10 *Holcus lanatus - Juncus effusus* rush pasture. The rushy areas tended to have a high proportion of unvegetated dead rush material, suggesting that they had previously supported large tussocks of Soft Rush. Hard Rush and Sharp-flowered Rush are also frequent in these damp fields.

Recently cut grassland south of railway, mostly MG10, with patches of MG6 and MG5.

Mown grassland in Marshfield SINC, mostly species-poor MG5, grading to MG10 near the field grips.

Table 4. Quadrat data for recently mown grassland: MG5/ MG6 /MG10 mosaic

Species	23	26	27	36	38	Frequency
Agrostis capillaris	7	4	8	5	4	V
Carex hirta	5	3	4	6	4	V
Holcus lanatus	5	5	3	2	3	V
Ranunculus repens	3	4	2	2	2	V
Lotus corniculatus	2		4	6	4	IV
Agrostis stolonifera	6	8	5			III
Anthoxanthum odoratum		2		8	6	III
Centaurea nigra			7	7	7	III
Festuca rubra	2		4		2	III
Juncus effusus			4	2	3	III
Lathyrus pratensis	1		A	6	2	III
Taraxacum sp.	1	2	1			III
Trifolium pratense			2	3	4	III
Juncus inflexus	5	4	A			II
Lolium perenne	4				5	II
Persicaria amphibia	1				2	II
Phleum pratense	4	5				II
Rumex acetosa	3			3	A	II
Brachythecium rutabulum			2			I
Carex cf riparia			2			I
Carex flacca				2		I
Cirsium vulgare			1			I
Elytrigia repens		2				I
Kindbergia praelonga	1					I
Lotus pedunculatus					2	I
Luzula campestris			2			I
Plantago lanceolata				2	A	I
Potentilla reptans				5	A	I
Rumex crispus		1				I
Trifolium repens					4	I
Vicia cracca					1	I
Cirsium arvense	A					
Cynosurus cristatus			A			
Dactylis glomerata	A			A		
Urtica dioica	A					
Species total	15	11	15	14	16	
Height (cm)	25	15	15	15	25	
Cover (%)	100	95	90	100	100	
Dead vegetation (%)	0	5	10	0	0	

MG6: Lolium perenne Cynosurus cristatus grassland

Several areas supported a relatively low diversity sward, with a high proportion of Perennial Rye-grass and no signs of recent grazing. These also had a high frequency of Crested Dog's-tail, Yorkshire Fog and Timothy. Species usually associated with damp soils are frequent, including Amphibious Bistort, Creeping Bent, Meadow Barley and rushes. This formerly agriculturally improved grassland can readily be assigned to a damp form of the MG6 community.

Species-poor MG6 grassland.

Table 5. Quadrat data for MG6 *Lolium perenne - Cynosurus cristatus* grassland

Species	63	64	68	69	Frequency
Cynosurus cristatus	3	2	4	2	V
Holcus lanatus	2	5	2	2	V
Lolium perenne	9	7	8	8	V
Phleum pratense	2	2	2	5	V
Persicaria amphibia	3		4	3	IV
Plantago lanceolata	4	A	5	3	IV
Agrostis stolonifera		8	5		III
Carex hirta		4	2	A	III
Dactylis glomerata	1			2	III
Hordeum secalinum	4			1	III
Juncus inflexus		4	5		III
Lotus corniculatus			1	4	III
Potentilla reptans	2			3	III
Ranunculus repens	4	2			III
Taraxacum sp.	2			1	III
Trifolium pratense	2		6		III
Trifolium repens	2		4		III
Agrostis capillaris				4	II
Alopecurus pratensis		4			II
Anthoxanthum odoratum				5	II
Centaurea nigra	1				II
Cirsium arvense	2				II
Elytrigia repens				1	II
Juncus acutiflorus				5	II
Lathyrus pratensis				5	II
Odontites vernus			2		II
Potentilla anserina			1		II
Ranunculus acris		1			II
Rumex crispus	1				II
Senecio erucifolius			2		II
Hypochaeris radicata				A	
Lythrum salicaria			A		
Rumex obtusifolius	A				
Vicia cracca	A			A	
Species total	16	10	15	16	
Height (cm)	30	50	45	40	
Cover (%)	100	100	100	100	

MG10: Holcus lanatus - Juncus effusus rush pasture

Most areas with tussocky Soft Rush and Hard Rush are best classified as MG10 rush pasture. They are typically associated with Creeping Bent, Yorkshire Fog, Hairy Sedge, Creeping Buttercup and Amphibious Bistort. In a few places they show a partial transition towards M23, where there is a higher proportion of Sharp-flowered Rush.

A high proportion of the field-grips can be assigned to MG10. Some of these low-lying strips include a slightly more diverse range of wetland plants (tending towards sub-community MG10c), including Flag Iris, Greater Bird's-foot Trefoil, Marsh Bedstraw, Purple Loosestrife, Cuckoo-flower, Meadowsweet, Meadow Foxtail, and Floating Sweet-grass.

In the recent absence of grazing several patches of MG10 are becoming increasingly dominated by Common Reed and Greater Pond-sedge, indicating transitions to reed-bed and sedge-bed communities.

MG10 rush pasture, with reed encroachment visible in the foreground.

Field grip with rushes, most closely attributable to MG10 rush pasture

Table 6. Quadrat data for MG10 *Holcus lanatus Juncus effusus* rush pasture

Species	25	28	29	30	37	42	43	53	59	60	65	Freq.
Agrostis stolonifera	4	4	8	4	4	2	5		8	4	6	V
Juncus effusus	8	8	4	2	4	4	4	9	4	4	2	V
Carex hirta	4	4	5	6		A	7		3	4	2	IV
Ranunculus repens	3	3	1	3			1		6	8		IV
Holcus lanatus	4	2		5			2			2	4	III
Lotus pedunculatus					3		2	2	1	2		III
Persicaria amphibia		1				2	A	2	4	6	4	III
Phleum pratense			4	1		5	8		A	1	2	III
Agrostis capillaris	7	4	5	2								II
Elytrigia repens		2	2		2						4	II
Epilobium ciliatum					1			2	1			II
Juncus acutiflorus						3	1		2			II
Juncus inflexus	A	2		8	8						1	II
Lolium perenne			2				2		A	2		II
Rumex acetosa	2	3		1								II
Rumex crispus					1	1			2			II
Alopecurus pratensis					4						5	I
Anthoxanthum odoratum		4										I
Brachythecium rutabulum		2										I
Calliergonella cuspidata								2				I
Cardamine pratensis					2				2			I
Carex cf riparia		A				5						I
Centaurea nigra					2	A	1					I
Cerastium fontanum		2										I
Cirsium arvense	2		A									I
Cynosurus cristatus							2		A	A		I
Eleocharis palustris									2			I
Festuca arundinacea						4						I
Festuca rubra				2								I
Glyceria fluitans											5	I
Hypochaeris radicata						2			1			I
Iris pseudacorus						4						I
Juncus conglomeratus							1					I
Lathyrus pratensis			2									I
Lotus corniculatus			2									I
Lythrum salicaria						A		2	2			I
Odontites vernus									1	2		I
Phragmites australis		A				4		A				I
Plantago lanceolata					2	1						I
Plantago major									1			I
Poa trivialis										4		I
Polygonum aviculare									2			I
Potentilla reptans		3			2							I
Pulicaria dysenterica									1	2		I
Ranunculus flammula									4			I
Rumex conglomeratus										2		I
Rumex obtusifolius		1										I
Senecio erucifolius								2				I
Senecio jacobaea								1				I
Silene flos-cuculi						1						I
Urtica dioica		2										I
Heracleum sphondylium		A										
Ranunculus acris						A			A			
Scorzoneroides autumnalis									A			
Trifolium pratense										A		
Vicia cracca						A						
Species total	8	16	10	10	12	13	12	8	18	13	10	
Height (cm)	20	30	15	40	50	100	30	70	25	50	40	
Cover (%)	95	100	100	100	100	100	100	100	100	100	100	
Dead vegetation thatch (%)	5	0	0	0	0	0	0	0	0	0	0	

MG1: Arrhenatherum elatius grassland

Several old fields in the eastern part of Hendre Lake Park do not appear to have been grazed for several years and are now dominated by a low diversity of coarse grasses and tall herbs. Where the main species are the tussocky grasses Cock's-foot, False Oat-grass, Couch and Timothy the vegetation can be classified as MG1 grassland. However, the continued presence of Common Knapweed, Creeping Bent, Red Fescue and Common Bent indicate that the grassland is still in transition from a sward more typical of the damp MG5/ MG6 grazed pastures nearby. Species typical of damp ground that are also still frequent in this community include Amphibious Bistort, Hairy Sedge, Greater Bird's-foot trefoil. Local prominence of Creeping Thistle, Nettle and Bindweed also show that there are transitions towards tall-herb communities.

Table 7. Quadrat data for MG1 *Arrhenatherum elatius* grassland

Species	**5**	**6**	**7**	**9**	**10**	**12**	**Frequency**
Agrostis stolonifera	5	2	4	4	2		V
Centaurea nigra	4	2		4	1	1	V
Arrhenatherum elatius	4	4	8		4		IV
Cirsium arvense	2	A	4	A	5	4	IV
Dactylis glomerata	9	6	4		A	9	IV
Elytrigia repens		2	1	7	9		IV
Phleum pratense	4	7	A	5	2	A	IV
Carex hirta			2	1	2	A	III
Festuca rubra	2	A	1	5			III
Lotus pedunculatus	2	1	A			1	III
Persicaria amphibia		4			2	2	III
Potentilla reptans	2				2	2	III
Ranunculus repens	4	6		1			III
Calystegia sepium	5	7				A	II
Epilobium hirsutum	A	A		A	1	4	II
Heracleum sphondylium		1			A	1	II
Lathyrus pratensis				1	A	1	II
Rumex acetosa			A	3	1		II
Senecio erucifolius					2	1	II
Vicia tetrasperma	1	A	2			A	II
Agrostis capillaris			2				I
Cirsium palustre			1				I
Equisetum arvense						1	I
Galium aparine			4				I
Holcus lanatus		4					I
Juncus effusus				2		A	I
Juncus inflexus						4	I
Potentilla anserina						1	I
Quercus robur	A					1	I
Urtica dioica					A	1	I
Vicia cracca	A					1	I
Agrimonia eupatoria	A						
Cirsium vulgare			A				
Filipendula ulmaria	A	A	A				
Juncus acutiflorus		A					
Rubus fruticosus		A	A				
Taraxacum sp.						A	
Torilis japonica						A	
Species total	12	12	11	10	12	16	
Height (cm)	100	50	80	60	100	110	
Cover (%)	100	100	100	100	100	100	

MG1 grassland

Transitional grassland in unmanaged fields: MG1/ MG5/ MG9 mosaic

Some damper parts of the recently unmanaged fields east of Hendre Lake have not reverted to MG1 grassland, and in the absence of grazing still appear to be in transition from MG5, MG6 and MG10, to patchy MG9 *Holcus lanatus Deschampsia cespitosa* grassland. The vegetation is generally species-poor, due to the loss of many of the low-growing species from the former pasture as a few vigorous species have become dominant. There are few clearly defined boundaries between the various patches of the vegetation mosaic, and scattered scrub is frequent. Locally uncommon species in these unmanaged fields also include small quantities of Sneezewort, Trailing Tormentil and Devil's-bit Scabious, often in association with Sharp-flowered Rush, showing an affinity with M23 rush pasture in a few places. Quadrat 8 was an example of vegetation where Sneezewort and Trailing Tormentil were recorded, indicating that this community is also present in the field immediately adjacent to the formal study area.

Transitional grassland mosaic in old field east of Hendre Lake. This patch with abundant Tufted Hair grass is closest to MG9.

Table 8. Quadrat data for transitional grassland, MG1, MG5 & MG9 mosaic

Species	8	13	15	16	22	Frequency
Phleum pratense	2	2	2	1	2	V
Ranunculus repens	2	2	4	2	4	V
Agrostis stolonifera	6		7	8	4	IV
Carex hirta	2	1	4	A	2	IV
Holcus lanatus		9	4	4	7	IV
Rumex acetosa	2	2	A		3	III
Anthoxanthum odoratum	4			1		II
Centaurea nigra	A	A		5	1	II
Deschampsia cespitosa	A	A	4	5		II
Juncus acutiflorus		A	2	5	A	II
Juncus conglomeratus	2			2		II
Juncus effusus	A		4	6		II
Lathyrus pratensis	2				2	II
Rumex conglomeratus	1		1			II
Urtica dioica		4	1			II
Achillea ptarmica				4		I
Agrostis capillaris	6					I
Arrhenatherum elatius					5	I
Cerastium fontanum		1		A		I
Cirsium arvense		2				I
Festuca rubra	7					I
Galium aparine		2				I
Galium palustre				2		I
Heracleum sphondylium					1	I
Lotus corniculatus	2					I
Persicaria amphibia					4	I
Persicaria hydropiper			1			I
Plantago lanceolata	1					I
Potentilla anglica	A			2		I
Potentilla reptans					2	I
Potentilla x mixta					1	I
Quercus robur	A	1				I
Ranunculus acris		1				I
Rumex crispus			1			I
Rumex obtusifolius			1			I
Stellaria graminea		1				I
Cirsium palustre	A					
Epilobium hirsutum		A				
Rubus fruticosus		A				
Succisa pratensis					A	
Torilis japonica		A				
Vicia tetrasperma				A		
Species total	13	12	13	13	13	
Height (cm)	80	50	60	100	20	
Cover (%)	100	100	100	100	100	

Tall herb vegetation: OV25/ OV26 mosaic

Some parts of the neglected fields east of Hendre Lake have become dominated by species-poor tall herb vegetation, dominated to varying degrees by Creeping Thistle, Nettle, Greater Willowherb and Meadowsweet. These most closely resemble the OV25 *Urtica dioica - Cirsium arvense* community and OV26c *Epilobium hirsutum* community *Filipendula ulmaria - Angelica sylvestris* sub-community. The vegetation forms a patchy mosaic with other transitional communities, S6 *Carex riparia* swamp, and Bramble scrub. Of the quadrats recorded, Q1 is closest to OV26c, Q2 is closest to OV25 and Q11 is transitioning towards S6.

Table 9. Quadrat data for tall herb vegetation OV25/ OV26 mosaic

Species	1	2	11	Frequency
Cirsium arvense	2	4	4	V
Filipendula ulmaria	10	5	1	V
Urtica dioica	2	8	7	V
Rubus fruticosus	4	A	2	IV
Vicia tetrasperma	1	A	2	IV
Brachythecium rutabulum		4		II
Calystegia sepium	2	A		II
Carex cf riparia	A		9	II
Dactylis glomerata			1	II
Epilobium ciliatum		1		II
Epilobium hirsutum	7	A	A	II
Galium aparine			2	II
Heracleum sphondylium			1	II
Persicaria amphibia			2	II
Rumex obtusifolius		1	A	II
Centaurea nigra			A	
Elytrigia repens		A		
Juncus acutiflorus	A	A		
Prunus spinosa		A		
Rosa canina		A		
Salix cinerea			A	
Species total	7	6	10	
Height (cm)	140	140	120	
Cover (%)	100	100	100	

Tall herb vegetation dominated by Nettle and Meadowsweet, close to OV26c.

S6: Carex riparia swamp

All large stands of dense Greater Pond-sedge have been classified as S6 *Carex riparia* swamp. They are generally very species-poor due to the smothering effect of the dense sedges. The vegetation also typically includes common wetland plants and scattered bramble and Grey Willow scrub.

Most specimens that were checked appeared to be Greater Pond-sedge. It is possible that some Lesser Pond-sedge may have been present but overlooked, especially due to the time of year when few plants still have flowering spikes.

Table 10. Quadrat data for S6 Carex riparia swamp

Species	3	14	17	19	24	Frequency
Carex cf riparia	10	10	10	10	10	V
Persicaria amphibia		4	1	4	1	IV
Calystegia sepium	5			2		II
Cirsium arvense	2				4	II
Filipendula ulmaria	4		4			II
Solanum dulcamara		4		4		II
Carex hirta					4	I
Galium aparine	2		A			I
Galium palustre					2	I
Heracleum sphondylium			1			I
Juncus effusus					2	I
Juncus inflexus		A			4	I
Lathyrus pratensis			1		A	I
Phragmites australis				2		I
Rumex conglomeratus					1	I
Agrostis capillaris					A	
Brachythecium rutabulum					A	
Calliergonella cuspidata					A	
Dactylis glomerata					A	
Epilobium hirsutum	A					
Glyceria maxima			A			
Rubus fruticosus	A			A		
Rumex acetosa					A	
Salix cinerea				A		
Taraxacum sp.					A	
Species total	5	3	5	5	8	
Height (cm)	130	110	120	100	40	
Cover (%)	100	100	100	100	100	

An extensive stand of S6 Carex riparia swamp.

S4: Phragmites australis reedbed and swamp

Tall stands of Common Reed form reed bed patches next to several ditches. They typically support a very low diversity flora, especially in older patches where the ground flora becomes smothered by dead reeds (e.g. quadrats 20 and 21). Reed dominates some of the field grips (e.g. quadrat 70), and is also invading pasture in several areas that have not been grazed for several months (or possibly years); quadrats 51 and 57 are examples of where the flora is still in a state of transition between pasture and reed bed.

Table 11. Quadrat data for S4 Phragmites australis swamp and reed bed

Species	20	21	35	51	57	70	73	Frequency
Phragmites australis	10	10	10	10	10	5	10	V
Agrostis stolonifera			2	2	8	8	2	IV
Carex cf riparia	1			2		2		III
Juncus effusus				1	4		4	III
Calystegia sepium			2	4				II
Carex hirta			2	2	A			II
Cirsium palustre					1		1	II
Epilobium sp.			2				1	II
Juncus acutiflorus						4	4	II
Lathyrus pratensis				2	2	A		II
Lotus corniculatus					2	1		II
Persicaria amphibia		1				4		II
Potentilla reptans			1	1				II
Pulicaria dysenterica				A	1		1	II
Ranunculus repens			2			1	A	II
Urtica dioica	4	5	A					II
Vicia cracca					2	1		II
Alnus glutinosa					1			I
Anthoxanthum odoratum					2			I
Brachythecium rutabulum							2	I
Calliergonella cuspidata				2				I
Cardamine pratensis			2					I
Carex otrubae						2		I
Centaurea nigra					1	A		I
Epilobium hirsutum		2						I
Equisetum arvense			1					I
Equisetum fluviatile					1			I
Eupatorium cannabinum				1				I
Iris pseudacorus						6		I
Juncus inflexus				A		2		I
Lotus pedunculatus				1	A			I
Lysimachia vulgaris				2				I
Lythrum salicaria				A			2	I
Phleum pratense						7		I
Plantago lanceolata					1			I
Potentilla anserina				2				I
Ranunculus acris					2			I
Rumex conglomeratus						1		I
Solanum dulcamara		1						I
Trifolium pratense					1			I
Filipendula ulmaria		A						
Rosa canina				A				
Rubus fruticosus		A						
Rumex acetosa			A					
Rumex crispus				A				
Senecio erucifolius				A	A	A		
Species total	3	5	9	13	15	13	9	
Height (cm)	220	240	120	160	170	60	180	
Cover (%)	100	100	100	100	100	100	100	

S4 Phragmites australis reed bed.

Open vegetation on disturbed ground

Several areas within the study area that have been subject to recent disturbance have developed a sparse flora with a high proportion of ruderal plants. The most frequent species include Creeping Bent and Fat Hen. Locally prominent associates include Creeping Cinquefoil, Bristly Ox-tongue, Ribwort Plantain, Greater Plantain, Creeping Buttercup and Dandelions. The quadrats are taken from a varied range of situations and the vegetation is not easy to assign to a single NVC category, but most appears closest to the OV28 *Agrostis stolonifera - Ranunculus repens* community; with some patches particularly resembling the OV28b*, Poa annua - Polygonum aviculare* sub-community. The disturbed ground community on the new track formed on stone-chippings at quadrat 52 resembles a fragmentary OV19 *Poa annua - Tripleurospermum inodorum* community.

Disturbed ground vegetation adjacent to ditch (Q31).

Table 12. Quadrat data for open vegetation on disturbed ground

Species	31	34	44	52	67	Frequency
Agrostis stolonifera	4	4	6		4	IV
Chenopodium album	1	4	4		2	IV
Lolium perenne		1	2	2	4	IV
Taraxacum sp.	2	2		2	1	IV
Centaurea nigra	1	A	1	2		III
Helminthotheca echioides	2	2	A		4	III
Plantago lanceolata	A		1	3	4	III
Potentilla reptans	9	6	1	A		III
Ranunculus repens	4	2			5	III
Rumex crispus	2	5			1	III
Dipsacus fullonum	2	1				II
Elytrigia repens			2		6	II
Equisetum arvense	1		2			II
Geranium dissectum	2	2				II
Persicaria amphibia		2	2		A	II
Persicaria hydropiper		1	1			II
Phleum pratense			2		5	II
Phragmites australis			1		2	II
Plantago major	2		2		A	II
Polygonum aviculare	A	1	2		A	II
Potentilla anserina			1		4	II
Pulicaria dysenterica		1		2		II
Rumex obtusifolius	A	1	A		1	II
Trifolium pratense				1	4	II
Tripleurospermum inodorum		A	4	4	A	II
Urtica dioica	2	4			A	II
Cardamine sp.		2				I
Cirsium arvense		1				I
Conyza floribunda				1		I
Dactylis glomerata		2				I
Daucus carota				2		I
Epilobium ciliatum	1					I
Epilobium parviflorum		2				I
Fallopia japonica					2	I
Gnaphalium uliginosum			2			I
Hirschfeldia incana			1			I
Lapsana communis			1			I
Lepidium didymum			2			I
Leucanthemum vulgare				1		I
Medicago lupulina				2		I
Odontites vernus					2	I
Poa annua	1					I
Prunella vulgaris				1		I
Rumex acetosa	1					I
Senecio jacobaea	A			1		I
Senecio vulgaris	1					I
Sonchus asper	A		1			I
Sonchus oleraceus	1					I
Veronica persica			1			I
Vicia cracca					2	I
Arctium minus		A				
Artemisia vulgaris					A	
Buddleia davidii	A			A		
Calystegia sepium					A	
Carex flacca				A		
Chenopodium rubrum	A					
Cynosurus cristatus				A		
Heracleum sphondylium	A					
Hypericum perforatum				A		
Juncus inflexus				A		
Lotus corniculatus				A		

Species	31	34	44	52	67	Frequency
Lythrum salicaria	A					
Pastinaca sativa	A					
Prunus spinosa			A			
Ranunculus acris		A				
Rubus fruticosus			A	A		
Salix cinerea			A			
Scorzoneroides autumnalis				A		
Senecio erucifolius				A		
Stachys palustris		A				
Symphytum x uplandicum			A			
Species total	18	20	22	13	17	
Height (cm)	10	40	20	5	90	
Cover (%)	95	90	50	25	100	

Open vegetation in wetland scrapes

Two areas east of Hendre Lake appear to have been recently excavated as small temporary ponds or scrapes, and they support a mix of ruderal and wetland vegetation. Neither contained any standing water at the time of the survey, but they both appear likely to flood in wet weather and during the winter. The scrape at TN18 supports two locally uncommon species, namely Bogbean and Greater Spearwort. It seems likely that these have been introduced.

The vegetation in both scrapes has a high proportion of sprawling grasses, and there is little exposed soil. The disturbed margins fringing both scrapes resemble OV28 *Agrostis stolonifera - Ranunculus repens* vegetation, possibly grading towards MG11 *Festuca rubra - Agrostis stolonifera - Potentilla anserina* grassland a little higher up the banks, although the small size of the scrapes and their transitional nature makes any exact classification of the vegetation very difficult. OV28 extends into the centre of the scrape at Quadrat 4, which is largely dominated by Creeping Bent and Common Spearwort. The deepest part of the scrape at Quadrat 18 is mainly Floating Sweet-grass and Bogbean, and best classified as fragmentary S22 *Glyceria fluitans* swamp vegetation.

Creeping Bent and Lesser Spearwort in scrape at quadrat 4.

Table 13. Quadrat data for wetland scrapes

Species	4	18	Frequency
Agrostis stolonifera	9	4	V
Carex hirta	4	1	V
Galium palustre	1	3	V
Glyceria fluitans	4	7	V
Juncus effusus	1	2	V
Ranunculus flammula	6	2	V
Calliergonella cuspidata		2	III
Calystegia sepium	3	A	III
Eleocharis palustris	2		III
Juncus acutiflorus	1		III
Kindbergia praelonga		1	III
Mentha aquatica		1	III
Menyanthes trifoliata		9	III
Persicaria amphibia	3	A	III
Phleum pratense	2		III
Potentilla anserina		2	III
Potentilla reptans	2	A	III
Pulicaria dysenterica		1	III
Rubus fruticosus	1	A	III
Agrimonia eupatoria	A		
Carex cf riparia	A		
Cirsium arvense	A		
Deschampsia cespitosa	A	A	
Epilobium hirsutum	A		
Eupatorium cannabinum	A		
Festuca rubra	A	A	
Juncus inflexus	A		
Phalaris arundinacea	A		
Ranunculus lingua		A	
Ranunculus repens	A	A	
Rumex obtusifolius	A		
Senecio aquaticus	A		
Senecio erucifolius	A		
Solanum dulcamara		A	
Vicia cracca	A		
Species total	13	12	
Height (cm)	30	35	
Cover (%)	95	95	

Wetland vegetation (mostly Bogbean) in scrape at quadrat 18.

2.2 Reen flora survey

The reen flora survey sheets in Appendix 2 provide summary data for each of the reen sections that were sampled. They also include an overview and species list for Hendre Lake.

The various reens included a good variety of aquatic plant species. A summary of the records of the most significant species i.e. those listed as notable in Winder *et al* (1991), or as Primary or Contributory species in Wales Biodiversity Partnership (2008) is provided in Table 14.

Table 14: Summary of notable species recorded during the reen flora survey

	2N	2S	3	7	8N	8S	10	18	26	30	32	39	Hendre Lake
Butomus umbellatus	✓	✓				✓		✓		✓	✓		✓
Ceratophyllum demersum	✓	✓		✓	✓	✓			✓		✓	✓	✓
Hydrocharis morsus-ranae	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓	✓
Potamogeton berchtoldii	✓								✓	✓			
Potamogeton pectinatus	✓												
Potamogeton trichoides		✓		✓	✓				✓	✓	✓	✓	
Rumex hydrolapathum													✓
Sagittaria sagittifolia								✓				✓	
Spirodela polyrhiza	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Veronica catenata		✓											

It is possible that some species were overlooked because the banks of some reens had been mown shortly before the survey. Also, due to the time of year the leaves of some submerged aquatic plants had begun to break down, so some species might not have been easily recognisable.

Seed head of Flowering Rush (reen 18)

4. Evaluation

This section evaluates the nature conservation significance of the plant communities in a geographical context, based on the approach set out in 'Guidelines for Ecological Impact Assessment' (CIEEM, 2018). The criteria used to assist in the evaluation are summarised in Table 15.

Table 15: Evaluation criteria

Level of Value	Habitats
International	Areas designated as Special Areas of Conservation (SAC), Special Protection Areas (SPA) or Ramsar sites in response to European Directives and International Conventions.
National	Areas designated as Sites of Special Scientific Interest (SSSI), National Nature Reserve (NNR), or equivalent for key areas, habitats and plant communities.
Regional	Areas of habitat of suitable size and quality to be considered for notification as SSSI (based on Guidelines for the Selection of Biological SSSIs, JNCC 1998). Extensive areas of Environment (Wales) Act (2016) Section 7 habitats, listed as 'habitats of principal importance for the purpose of maintaining and enhancing biodiversity in relation to Wales.
County	Areas meeting Wildlife Sites Guidelines selection criteria; areas of Section 7 habitats; areas of Ancient woodland.
District/Local value	Areas of LBAP habitat. Important hedgerows classified under The Hedgerow Regulations 1997. Any non-designated habitat assemblage of moderate biodiversity value.

In this case the whole study area lies within the Rumney and Peterstone SSSI, which is a Nationally Important protected site, mainly designated for its diverse reen flora and invertebrate fauna. For the purposes of this assessment the individual plant communities within the current study area are considered separately from the SSSI.

Grassland and terrestrial wetland plant communities

The NVC study confirmed that there is a wide variety of vegetation types within the study area. The main grassland habitat is MG5 grassland, and the examples found within the study area vary between moderately species-rich MG5 (particularly in the Marshfield SINC and fields immediately north of the railway line) to species-poor MG5 grading to MG6. Several of the fields have not been grazed in recent months, and in some cases years, and these are undergoing a succession to coarser and taller vegetation types that are generally species-poor.

The species composition of the plant communities examined in the NVC study is mostly limited to common and widespread species. None of the plant species recorded are subject to special statutory protection under the Wildlife and Countryside Act, nor included in the Environment (Wales) Act 2016 Section 7 lists of species of 'principal importance for the purpose of maintaining and enhancing biodiversity in relation to Wales'. However, three species were found that are listed as being locally notable in the Wildlife Sites Guidelines (Wales Biodiversity Partnership, 2008). Under these guidelines a site is considered significant in a county context if it supports one or more Primary Species or five or more Contributory Species. In this case the notable species recorded are summarised below:

- Corky-fruited Water-dropwort (Primary Species). A patch with over a hundred plants in the Marshfield SINC (at Quadrat 47).
- Greater Spearwort (Primary Species). In shallow scrape at Quadrat 18. However, this is probably planted rather than native in this location.
- Meadow Barley (Contributory Species). Frequent in most of the MG5 fields.

Two other SINC Contributory Species have been recorded at the Marshfield SINC (by the same surveyor) in 2009, namely Pepper Saxifrage and Stone Parsley. It is possible that these are both still present, but they may have been overlooked during the present survey because of the relatively late time of year and/ or if the plants only occur at a low density.

Greater Spearwort leaves beside scrape at Quadrat 18.

In addition to the plants noted for their rarity, several two species were found that are significant because of their listing on Schedule 9 of the Wildlife and Countryside Act as non-native invasive species, namely Japanese Knotweed and Giant Knotweed. These both appear to have been introduced to the site through fly-tipped refuse (their locations are shown in Figure 1). The presence of these species should also be taken into account during any future development works in this area as it would be unlawful to cause them to spread in the wild.

Giant Knotweed by the track, west of Quadrat 44

Small plant of Japanese Knotweed at Quadrat 67

The Marshfield SINC supports a significant population of Corky Fruited Water-dropwort, which is a feature of county importance that would justify the site's continued protection. It is possible that other locally important plants are still present at a low density.

The presence of Meadow Barley in the grazed fields, and the Devil's-bit Scabious and Trailing Tormentil in the western fields are of local interest, and it is possible that the timing of the survey may have resulted in some other species being overlooked. The Greater Spearwort and Bogbean appear likely to have been planted in the scrape at Q18, so are not afforded any special nature conservation significance in this case because they could easily be replaced.

The spread of Common Reed within several fields appears to be a recent phenomenon in response to cessation of grazing. It is feasible that without management intervention these fields might eventually develop into a large reedbed of value for birds and invertebrates, but they are unlikely to develop any special value from a botanical perspective.

If considered in isolation, most of the grassland and terrestrial wetland plant communities that were examined during the NVC study did not appear to be especially species-rich, or likely to support many uncommon plants. The majority of the grassland is assessed as having moderate botanical value in a local context. However, the Marshfield SINC should continue to be regarded as having botanical value in a county context. Recommendations are made to clarify this assessment by a follow-up survey at a time of year when more species of plants are visible.

Reen flora

Several of the species recorded during the reen surveys are listed as Primary or Contributory species within the wildlife sites guidelines. These are summarised below:

- Arrowhead (Primary Species): Only observed in 2 reens south of the railway: occasional in reen 39, and rare in reen 18.
- Flowering Rush (Primary Species): seen in reens 2N, 2S, 8S, 18, 30 32 and Hendre Lake, but only in small quantities.
- Frogbit (Primary Species): seen in reens 2N, 2S, 7, 8N, 8S, 18, 26, 30, 32, 39 and Hendre Lake. Locally frequent, but mostly occurring as scattered plants at low density.

- Hair-like Pondweed (Primary Species): seen in reens 2S, 7, 8N, 26, 30, 32 and 39. Locally frequent, but mostly occurring at low density.
- Fennel Pondweed (Contributory Species): Only seen in small quantity in reen 2N, although it had presumably been more frequent prior to the ditch management that had apparently taken place a few days before the survey.
- Rigid Hornwort (Contributory Species): seen in reens 2N, 2S, 7, 8N, 8S, 26, 32, 39 and Hendre Lake; locally frequent, but mostly only present in small quantity.
- Great Water-dock (Contributory Species): Several plants observed in the conservation area at Hendre Lake.
- Greater Duckweed (Contributory Species): Present in every reen surveyed, usually frequent, but sometimes only very small amounts.
- Pink Water-speedwell (Contributory Species). Only one plant noted on bank of reen 2S.

On the basis of the occurrence of Primary Species, all of the larger reens/ ditches would qualify as being of nature conservation importance in at least a county context. The two field ditches would not qualify under this criterion.

The significance of the flora in the ditch sections that were sampled has been evaluated using the methods set out by Winder et al (1991), to provide an indication of their context within the Gwent Levels. The diversity score is a simple count of all species with their shoot bases in the water. The rarity score gives a score to notable wetland species, depending on their relative rarity within the Gwent Levels. In both cases the totals are assessed as Low (0-10), Moderate (11-20) or High (21-30). The results of these analyses are set out in Tables 16 and 17 below. Hendre Lake is not included in the tables as it was not sampled using the 20m ditch survey method.

Table 16: Diversity scores for ditches recorded during reen flora survey (count for 20m section only, not including filamentous algae)

	2N	2S	3	7	8N	8S	10	18	26	30	32	39
Total	**12**	**22**	**7**	**9**	**13**	**14**	**3**	**8**	**11**	**9**	**12**	**14**
Evaluation (L/M/H)	**M**	**H**	**L**	**L**	**M**	**M**	**L**	**L**	**M**	**L**	**M**	**M**

Table 17: Rarity score analysis of notable species recorded during reen flora survey (in 20m section only)

	2N	2S	3	7	8N	8S	10	18	26	30	32	39
Butomus umbellatus	1					1				1	1	
Ceratophyllum demersum	3	3			3	3			3		3	3
Hydrocharis morsus-ranae	4	4		4	4	4		4	4	4	4	4
Potamogeton berchtoldii	2								2	2		
Potamogeton trichoides		8		8	8				8	8	8	8
Sagittaria sagittifolia												4
Spirodela polyrhiza	4	4		4	4	4			4	4	4	4
Veronica catenata		1										
Total	**14**	**20**	**0**	**16**	**19**	**12**	**0**	**4**	**21**	**19**	**20**	**23**
Evaluation (L/M/H)	**M**	**M**	**L**	**M**	**M**	**M**	**L**	**L**	**H**	**M**	**M**	**H**

The tables show that most of the ditches are of moderate value for both their rarity and diversity, so would seem to be fairly typical of ditches within the SSSI. The highest botanical diversity and rarity scores were seen in ditches 2S, 8N, 26, 30, 32 and 39. The two field ditches (3 and 10) were both assessed as having low diversity and rarity. The scores are only the result of sampling at particular sections, so some species have not been taken into account (e.g. Arrowhead, Flowering Rush and Greater Duckweed were present in Reen 18, but not in the 20m section used for the detailed search).

The diversity and range of plant species in Gwent Levels ditches are subject to wide variation as a result of natural succession and management. The score in any particular ditch could feasibly be very different from year to year, or after events such as mowing, dredging or re-casting. Even apparently low-diversity field ditches such as those in the current study can be rejuvenated by appropriate management. As such, all of the ditches should be considered important in the context of the Gwent Levels, and contributing to the overall SSSI designation. The time of year that this study was carried out is likely to have influenced the survey findings, and a survey in mid-summer may have been able to record additional species (in particular, before the submerged aquatic plants have begun to break down, and before management work had removed any vegetation).

If examined in isolation, the flora of the surveyed reen sections on this particular site would be considered of nature conservation value in at least a county context, while the field ditches would be evaluated as significant in a local context. However, their nature conservation value would undoubtedly be higher than this if examined in the wider geographical context of the Gwent Levels, and taking account of the aquatic invertebrates.

Arrowhead in reen 39

One species of aquatic plants was found that is listed as a non-native invasive species on Schedule 9 of the Wildlife and Countryside Act. This is Water Fern, which is a floating aquatic plant that can form a dense blanket on the water surface. In this case it appeared to be limited to the Faendre Reen, mainly at section 2S. However, it should be taken into account during any future ditch management or development works at this location, because it would be unlawful to cause it to spread in the wild.

Water Fern at reen section 2S

5. Recommendations

The following recommendations are limited to very broad suggestions for accommodating botanical diversity within the proposed new development. They are made with no knowledge of the proposals, and without discussion with Natural Resources Wales (NRW). A key recommendation is that consultation must be carried out with NRW, who will be able to advise on matters relating to the SSSI. They will also be able to provide detailed guidance on practical matters such as ditch design and management. NRW would need to give their consent to any potentially damaging activities within the SSSI.

It is strongly recommended that an ecologist is involved in the project design process, and an Ecological Clerk of Works should be employed to monitor the development and provide advice on minimising ecological impacts and preventing pollution throughout the construction phase of the works.

Grassland habitats

The proposed Cardiff Parkway development is likely to require large areas of land to be built on or significantly modified, so there will inevitably be a loss of grassland habitat.

A key recommendation would be to retain the best examples of species-rich grassland *in situ* where possible, and ensure that the habitat is managed to maintain the botanical diversity in the long term. The largest block of diverse grassland within the study area lies within the Marshfield SINC and the field immediately west of the SINC. Retaining a large block of habitat might mean that it is still feasible to manage the area by grazing, but this may not be viable if only a small area is retained.

If grazing retained grassland is not possible, it may be possible to maintain some of the grassland diversity by mowing, with removal of a hay cut in summer. However, this could be difficult if the fields are open to the public, particularly as the presence of dogs may mean that the hay is trampled before cutting, and may not be saleable due to the presence of dog faeces (this has been a problem at other sites in the Cardiff area). Mowing and disposal of the hay would therefore require significant resources in the long term.

If the existing species-rich grassland cannot be retained, consideration could be given to transplanting some of the best examples / key species into nearby areas of grazed land that can be enhanced and managed for nature conservation in the long term.

It may be possible to integrate mown urban grassland within the new development, although this will unavoidably be different in character from the current grassland habitat. If new grassland is being planned, it is recommended that a species-rich grass-seed mix is used, made up of locally sourced seed with plant species appropriate to the Gwent Levels. Urban grassland would probably have to be mown regularly, but it would be best if the plants are allowed to flower and set seed, and the cuttings removed to maintain low soil fertility levels.

The new design might also consider integrating grassland as part of a sustainable drainage system; with vegetated areas set aside to help control surface water flows. Temporarily inundated grass areas could feasibly support many of the species that currently exist on the site.

Amphibious Bistort in flower at Hendre Lake

Reens and ditches

It is unlikely that any new development will be able to fit around the existing ditches, and so there would be a loss of wetland habitat. The new design should aim to retain as much of the reen network as possible, prioritising the ditches with the greatest wetland species diversity.

Where ditches would be lost to development, compensation habitat must be provided. Guidance on creation of new / compensatory ditches is likely to be available from Natural Resources Wales. New ditches should be at least as long, deep and wide as the ones being lost, and must incorporate an access strip for heavy machinery to carry out ditch maintenance work. Where space is limited, it might be feasible to offset loss of ditch length by creating a higher quality of ditch, subject to discussion with NRW (for example, constructing one large ditch to replace two small ones, and/ or enhancing the nature conservation value of a ditch by cutting a shelf at or just below water level to maximise the potential for wetland plants (this would also benefit aquatic insects and Water Voles).

The connectivity of the reen network should be retained as far as possible, even within the new infrastructure. Culverts should be avoided, but where new crossings are unavoidable they should be by bridges or ditch-wide box-culverts rather than round pipes.

The water quality of the reens should be maintained by careful segregation of foul water from surface water drainage. Surface water draining from roads or car-parking areas

should only enter the ditches via pollution interceptors, or some form of vegetated sustainable drainage system.

There may be opportunities to integrate wetland habitats as landscape features with the new urban infrastructure. However, any ornamental wetlands should still maintain native flora and must not be planted with non-native species.

The ditch habitat should be protected through the construction phase, and special care must be taken to avoid pollution by silt, chemicals or nutrient enrichment at all stages when works are taking place. Provision should be made for avoiding spills, and if necessary for isolating sections of ditch from the main reen network while works are in progress. Potentially hazardous materials should be stored well away from ditches, and preferably in bunded areas.

Invasive species

It is strongly recommended that the non-native invasive species that are currently present on the site should be eradicated before any development work commences. At the moment they are limited to a few small areas, but they could potentially be spread by construction machinery. Consent from NRW is likely to be required for treatment of non-native species in the SSSI.

Eradication of Japanese and Giant Knotweed should be undertaken well in advance of any construction because it may require several years of treatment if using herbicide. It would be advisable to contact a Knotweed specialist to carry out the work. Treatment of Water Fern in small quantity might be feasible by manual or biological methods, but it would be best to seek advice from NRW due to the presence of this species in one of the more diverse reen sections.

Tipped materials

A notable feature of the site in its present condition is the presence of fly-tipped refuse. Some of this appears to include harmful materials such as asbestos and oils, and some has introduced invasive plants. Many items of plastic litter are also present in the ditches, especially adjacent to the road along the eastern boundary. It is recommended that these tipped materials should be removed from the site, whether or not it is developed.

In the long term the potential for littering is likely to increase because of the presence of many more people. It is therefore recommended that the site managers should provide litter bins around the site, and make provision for periodic litter collections from all ditches and other areas of wildlife habitat in the long term.

Further survey

A follow up survey is recommended, to be undertaken during the summer when more species of plants would be easily visible. This could be limited to a targeted search for notable species. In particular, it would help to clarify whether Pepper Saxifrage and Stone Parsley still occur in the Marshfield SINC where they have been recorded previously. It would also provide an opportunity to find any additional plant species that might not have been detectable during late September.

The field immediately west of the NVC study area (where Quadrat 8 was recorded) was identified in passing as an area of possible botanical interest, and it is therefore recommended that this should be included in any follow up botanical survey (unless it would not be affected by the proposed development).

6. References

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Devil's-bit Scabious at Quadrat 22.

Appendix 1. Plant species list

The following species list presents the scientific and common names of all the plant species identified during the vegetation surveys. Due to the size of the site and nature of the sampling, and the time of year the work was undertaken this should not be considered a comprehensive list of every plant species within the study area.

Species	Common Name
VASCULAR PLANTS	
Acer campestre	Field Maple
Acer pseudoplatanus	Sycamore
Achillea millefolium	Yarrow
Achillea ptarmica	Sneezewort
Agrimonia eupatoria	Agrimony
Agrostis capillaris	Common Bent
Agrostis stolonifera	Creeping Bent
Alisma plantago-aquatica	Water Plantain
Alnus glutinosa	Alder
Alopecurus geniculatus	Marsh Foxtail
Alopecurus pratensis	Meadow Foxtail
Anagallis arvensis	Scarlet Pimpernel
Angelica sylvestris	Angelica
Anthoxanthum odoratum	Sweet Vernal-grass
Anthriscus sylvestris	Cow Parsley
Apium nodiflorum	Fool's Water-Cress
Arctium minus	Lesser Burdock
Arrhenatherum elatius	False Oat-grass
Artemisia vulgaris	Mugwort
Asplenium scolopendrium	Hart's-tongue Fern
Athyrium filix-femina	Lady Fern
Azolla filiculoides	Water Fern
Bellis perennis	Daisy
Berula erecta	Lesser Water-parsnip
Buddleia davidii	Buddleia
Butomus umbellatus	Flowering Rush
Callitriche sp.	Water Starwort
Calystegia sepium	Hedge Bindweed
Capsella bursa-pastoris	Shepherd's Purse
Cardamine pratensis	Cuckoo Flower
Carex flacca	Glaucous Sedge
Carex hirta	Hairy Sedge
Carex otrubae	False Fox-sedge
Carex remota	Remote Sedge
Carex riparia	Greater Pond-sedge
Centaurea nigra	Common Knapweed
Cerastium fontanum	Common Mouse-ear
Ceratophyllum demersum	Rigid Hornwort
Chaerophyllum temulum	Rough Chervil
Chamerion angustifolium	Rose-Bay Willowherb
Chenopodium album	Fat Hen
Chenopodium rubrum	Red Goosefoot

Species	Common Name
Cirsium arvense	Creeping Thistle
Cirsium palustre	Marsh Thistle
Cirsium vulgare	Spear Thistle
Conyza floribunda	Bilbao Fleabane
Cornus sericea	Red-osier Dogwood
Corylus avellana	Hazel
Crataegus monogyna	Hawthorn
Cynosurus cristatus	Crested Dog's-tail
Dactylis glomerata	Cock's-foot Grass
Daucus carota	Wild Carrot
Deschampsia cespitosa	Tufted Hair-grass
Dipsacus fullonum	Teasel
Dryopteris dilatata	Broad Buckler-fern
Dryopteris filix-mas	Male Fern
Eleocharis palustris	Common Spike-rush
Elodea nuttallii	Nuttall's Waterweed
Elytrigia repens	Couch
Epilobium ciliatum	American Willowherb
Epilobium hirsutum	Greater Willowherb
Epilobium parviflorum	Hoary Willowherb
Equisetum arvense	Field Horsetail
Equisetum fluviatile	Water Horsetail
Equisetum palustre	Marsh Horsetail
Eupatorium cannabinum	Hemp Agrimony
Euphorbia helioscopia	Sun Spurge
Fallopia japonica	Japanese Knotweed
Fallopia sachalinensis	Giant Knotweed
Festuca rubra	Red Fescue
Filipendula ulmaria	Meadowsweet
Fraxinus excelsior	Ash
Galium aparine	Cleavers
Galium palustre	Marsh Bedstraw
Geranium dissectum	Cut-leaved Crane's-bill
Geranium robertianum	Herb Robert
Geum urbanum	Wood Avens
Glyceria fluitans	Floating Sweet-grass
Gnaphalium uliginosum	Marsh Cudweed
Hedera helix	Ivy
Helminthotheca echioides	Bristly Ox-tongue
Heracleum sphondylium	Hogweed
Hirschfeldia incana	Hoary Mustard
Holcus lanatus	Yorkshire Fog
Hordeum secalinum	Meadow Barley
Hydrocharis morsus-ranae	Frogbit
Hypericum androsaemum	Tutsan
Hypericum perforatum	Perforate St. John's-wort
Hypericum tetrapterum	Square-Stalked St. John's-Wort
Hypochaeris radicata	Common Cat's-Ear
Ilex aquifolium	Holly
Iris pseudacorus	Yellow Flag
Juncus acutiflorus	Sharp-flowered Rush

Species	Common Name
Juncus articulatus	Jointed Rush
Juncus conglomeratus	Compact Rush
Juncus effusus	Soft Rush
Juncus inflexus	Hard Rush
Lactuca serriola	Prickly Lettuce
Lapsana communis	Nipplewort
Lathyrus pratensis	Meadow Vetchling
Lemna minor	Common Duckweed
Leontodon saxatilis	Lesser Hawkbit
Lepidium didymum	Lesser Swine-cress
Leucanthemum vulgare	Ox-eye Daisy
Linaria vulgaris	Toadflax
Lolium perenne	Perennial Rye-grass
Lotus corniculatus	Common Bird's-foot Trefoil
Lotus pedunculatus	Greater Bird's-foot Trefoil
Luzula campestris	Field Woodrush
Lycopus europaeus	Gypsywort
Lysimachia nummularia	Creepy Jenny
Lysimachia vulgaris	Yellow Loosestrife
Lythrum salicaria	Purple Loosestrife
Medicago lupulina	Black Medick
Mentha aquatica	Water Mint
Menyanthes trifoliata	Bogbean
Myosotis scorpioides	Water Forget-me-not
Odontites vernus	Red Bartsia
Oenanthe crocata	Hemlock Water-dropwort
Oenanthe pimpinelloides	Corky-fruited Water-dropwort
Persicaria amphibia	Amphibious Bistort
Persicaria hydropiper	Water-pepper
Persicaria maculosa	Redshank
Phalaris arundinacea	Reed Canary-Grass
Phleum pratense	Timothy
Phragmites australis	Common Reed
Plantago lanceolata	Ribwort Plantain
Plantago major	Greater Plantain
Poa annua	Annual Meadow-grass
Poa trivialis	Rough Meadow-grass
Polygonum aviculare	Knotgrass
Potamogeton berchtoldii	Small Pondweed
Potamogeton natans	Broad-leaved Pondweed
Potamogeton pectinatus	Fennel Pondweed
Potamogeton trichoides	Hair-like Pondweed
Potentilla anglica	Trailing Tormentil
Potentilla anserina	Silverweed
Potentilla reptans	Creeping Cinquefoil
Potentilla x mixta	Hybrid Cinquefoil
Prunella vulgaris	Self-Heal
Prunus spinosa	Blackthorn
Pulicaria dysenterica	Fleabane
Quercus robur	Pedunculate Oak
Ranunculus acris	Meadow Buttercup

Species	Common Name
Ranunculus flammula	Lesser Spearwort
Ranunculus lingua	Greater Spearwort
Ranunculus repens	Creeping Buttercup
Rhinanthus minor	Yellow Rattle
Rorippa nasturtium-aquaticum	Water Cress
Rosa canina	Dog Rose
Rubus fruticosus	Bramble
Rumex acetosa	Common Sorrel
Rumex conglomeratus	Clustered Dock
Rumex crispus	Curled Dock
Rumex hydrolapathum	Water Dock
Rumex obtusifolius	Broad-Leaved Dock
Rumex sanguineus	Wood Dock
Sagittaria sagittifolia	Arrowhead
Salix alba	White Willow
Salix cinerea	Grey Willow
Salix fragilis	Crack Willow
Salix viminalis	Osier
Sambucus nigra	Elder
Schedonorus arundinaceus	Tall Fescue
Scorzoneroides autumnalis	Autumn Hawk-bit
Scrophularia auriculata	Water Figwort
Scrophularia nodosa	Common Figwort
Senecio erucifolius	Hoary Ragwort
Senecio jacobaea	Ragwort
Senecio vulgaris	Groundsel
Silene dioica	Red Campion
Silene flos-cuculi	Ragged Robin
Solanum dulcamara	Bittersweet
Sonchus asper	Prickly Sow-thistle
Sonchus oleraceus	Smooth Sow-thistle
Sparganium erectum	Branched Bur-reed
Spirodela polyrhiza	Greater Duckweed
Stachys palustris	Marsh Woundwort
Stellaria graminea	Lesser Stitchwort
Succisa pratensis	Devil's-bit Scabious
Symphytum x uplandicum	Russian Comfrey
Tamus communis	Black Bryony
Taraxacum sp.	Dandelion
Torilis japonica	Upright Hedge-parsley
Trifolium pratense	Red Clover
Trifolium repens	White Clover
Tripleurospermum inodorum	Scentless Mayweed
Tussilago farfara	Colt's Foot
Typha latifolia	Bulrush
Ulmus minor	Small-leaved Elm
Urtica dioica	Nettle
Verbena officinalis	Vervain
Veronica beccabunga	Brooklime
Veronica catenata	Pink Water-Speedwell
Veronica persica	Common Field-speedwell

Species	Common Name
Viburnum opulus	Guelder Rose
Vicia cracca	Tufted Vetch
Vicia hirsuta	Hairy Tare
Vicia sativa	Common Vetch
Vicia tetrasperma	Smooth Tare
BRYOPHYTES	
Brachythecium rutabulum	Rough-stalked Feather-moss
Calliergonella cuspidata	Pointed Spear-moss
Kindbergia praelonga	Common Feather-moss
Fissidens taxifolius	Common Pocket-moss
Rhytidiadelphus squarrosus	Springy Turf-moss

Appendix 2. Reen flora survey sheets

The survey sheets are all presented in the same format for consistency.

Plants listed as notable in Winder *et al* (1991), and as Primary or Contributory species in Wildlife Sites Guidance Wales (Wales Biodiversity Partnership, 2008) are shown in bold text in the species lists.

Reen section 2N (Faendre Reen): photographs

2N (Faendre Reen): looking north -west.

2N (Faendre Reen): Typical view of channel

Reen section 2N (Faendre Reen): survey data

Date of survey visit	27/9/2018
Height from water level to top of bank	1.2m
Approximate width at water-level	6m
Approximate depth of water	1m
Turbidity (1 =clear to 5 = turbid)	2
Shading	Approx 10% shaded by mature tree
Flow	None evident, but apparently draining to south
Adjacent land-use / vegetation	East bank: grazed pasture, vegetation on bank recently mown. West bank: ungrazed track bordered by coarse grasses and tall herbs. Vegetation on lower bank recently mown
Other comments	Bank and channel vegetation recently cut (apparently just a week or so before the survey).

Aquatic vegetation

Sparganium erectum	A	*Azolla filiculoides*	R
Ceratophyllum demersum	**F**	Filamentous algae	R
Elodea nuttallii	O	***Hydrocharis morsus-ranae***	**R**
Lemna minor	O	*Potamogeton natans*	R
Persicaria amphibia	O	***Butomus umbellatus***	**X**
Potamogeton berchtoldii	**O**	*Equisetum fluviatile*	X
Potamogeton pectinatus	**O**	*Mentha aquatica*	X
Solanum dulcamara	O	*Rorippa nasturtium-aquaticum*	X
Spirodela polyrhiza	**O**		

Bank vegetation

Dactylis glomerata	A	*Alnus glutinosa*	X
Filipendula ulmaria	F	*Carex cf riparia*	X
Achillea millefolium	O	*Crataegus monogyna*	X
Cardamine pratensis	O	*Galium palustre*	X
Oenanthe crocata	O	*Juncus effusus*	X
Rumex conglomeratus	O	*Phragmites australis*	X
Dryopteris filix-mas	R	*Prunus spinosa*	X
Fraxinus excelsior	R	*Salix cinerea*	X
Rosa canina	R	*Scrophularia auriculata*	X
Stachys palustris	R		

Reen section 2S (Faendre Reen): photographs

2S (Faendre Reen): looking north.

2S (Faendre Reen): Typical view of channel

Reen section 2S (Faendre Reen): survey data

Date of survey visit	26/9/2018
Height from water level to top of bank	1m west side/ 60cm east side
Approximate width at water-level	10m
Approximate depth of water	>1m
Turbidity (1 =clear to 5 = turbid)	2
Shading	Unshaded
Flow	None evident, but apparently draining to south
Adjacent land-use / vegetation	East bank: grazed pasture. West bank: ungrazed track bordered by coarse grasses and tall herbs.
Other comments	A cattle-poached shelf/ berm is present just above water level on the east side (up to approx. 50cm wide).

Aquatic vegetation

Elodea nuttallii	D	*Typha latifolia*	O
Ceratophyllum demersum	**A**	*Equisetum palustre*	R
Azolla filiculoides	F	*Galium palustre*	R
Hydrocharis morsus-ranae	**F**	*Juncus articulatus*	R
Lemna minor	F	*Persicaria hydropiper*	R
Mentha aquatica	F	***Potamogeton trichoides***	**R**
Sparganium erectum	F	*Ranunculus flammula*	R
Apium nodiflorum	O	*Solanum dulcamara*	R
Berula erecta	O	***Veronica catenata***	**R**
Carex otrubae	O	***Butomus umbellatus***	**X**
Eleocharis palustris	O	*Glyceria fluitans*	X
Phragmites australis	O	*Potamogeton natans*	X
Spirodela polyrhiza	**O**		

Bank vegetation

Juncus effusus	A	*Senecio erucifolius*	O
Agrostis stolonifera	F	*Trifolium pratense*	O
Juncus inflexus	F	*Vicia cracca*	O
Lolium perenne	F	*Alnus glutinosa*	R
Phleum pratense	F	*Bellis perennis*	R
Pulicaria dysenterica	F	*Hypericum tetrapterum*	R
Ranunculus repens	F	*Odontites vernus*	R
Angelica sylvestris	O	*Rubus fruticosus*	R
Calystegia sepium	O	*Rumex conglomeratus*	R
Cardamine pratensis	O	*Achillea millefolium*	X
Carex hirta	O	*Crataegus monogyna*	X
Cerastium fontanum	O	*Phalaris arundinacea*	X
Epilobium hirsutum	O	*Ranunculus acris*	X
Filipendula ulmaria	O	*Rumex acetosa*	X
Lycopus europaeus	O	*Salix cinerea*	X
Persicaria amphibia	O	*Stachys palustris*	X
Plantago lanceolata	O		

Reen section 3 (field ditch): photographs

3 (field ditch): looking south-west.

3 (field ditch): Typical view of channel

Reen section 3 (field ditch): survey data

Date of survey visit	27/9/2018
Height from water level to top of bank	80cm
Approximate width at water-level	2m
Approximate depth of water	30cm (becoming dry towards western end)
Turbidity (1 =clear to 5 = turbid)	1
Shading	75% shaded by dense hedge along south side
Flow	None evident
Adjacent land-use / vegetation	South, hedge and arable field. North: Recently reseeded Rye-grass ley, fringed by coarse grasses and tall herbs on bank.
Other comments	Probably dries out from time to time.

Aquatic vegetation

Equisetum fluviatile	A	*Solanum dulcamara*	O
Galium palustre	F	*Scrophularia auriculata*	R
Sparganium erectum	F	*Berula erecta*	X
Apium nodiflorum	O	***Spirodela polyrhiza***	**X**
Lemna minor	O	*Typha latifolia*	X

Bank vegetation

Crataegus monogyna	D	*Athyrium filix-femina*	R
Lolium perenne	D	*Cirsium arvense*	R
Persicaria amphibia	A	*Oenanthe crocata*	R
Arrhenatherum elatius	F	*Prunus spinosa*	R
Brachythecium rutabulum	F	*Vicia cracca*	R
Calystegia sepium	F	*Anthriscus sylvestris*	X
Dactylis glomerata	F	*Asplenium scolopendrium*	X
Elytrigia repens	F	*Carex remota*	X
Ranunculus repens	F	*Dryopteris dilatata*	X
Rubus fruticosus	F	*Galium aparine*	X
Epilobium hirsutum	O	*Hedera helix*	X
Juncus effusus	O	*Helminthotheca echioides*	X
Kindbergia praelonga	O	*Lysimachia vulgaris*	X
Rosa canina	O	*Phalaris arundinacea*	X
Rumex conglomeratus	O	*Phragmites australis*	X
Stachys palustris	O	*Torilis japonica*	X
Urtica dioica	O		

Reen section 7 (Greenlane Reen): photographs

7 (Greenlane Reen): looking north-west.

7 (Greenlane Reen): Typical view of channel

Reen section 7 (Greenlane Reen): survey data

Date of survey visit	27/9/2018
Height from water level to top of bank	90cm
Approximate width at water-level	3m
Approximate depth of water	>1m
Turbidity (1 =clear to 5 = turbid)	1
Shading	None.
Flow	None evident, presumably draining to south.
Adjacent land-use / vegetation	West: reed-dominated bank, adjoining species-poor semi-improved grassland. East: Coarse grasses and tall herbs on bank, adjacent to road (Heol Las).
Other comments	Channel and banks with many items of litter and tipped debris from adjacent road. Recently cut banks (probably a week or so before survey).

Aquatic vegetation

Phragmites australis	A	***Potamogeton trichoides***	**O**
Filamentous algae	F	***Spirodela polyrhiza***	**O**
Elodea nuttallii	O	*Sparganium erectum*	O
Equisetum fluviatile	R	*Potamogeton natans*	R
Hydrocharis morsus-ranae	**O**	***Ceratophyllum demersum***	**X**
Lemna minor	R		

Bank vegetation

Phragmites australis	A	*Rumex acetosa*	O
Filipendula ulmaria	A	*Rumex obtusifolius*	O
Arrhenatherum elatius	F	*Taraxacum* sp.	O
Dactylis glomerata	F	*Calystegia sepium*	R
Elytrigia repens	F	*Potentilla reptans*	R
Galium aparine	F	*Rumex conglomeratus*	R
Anthriscus sylvestris	O	*Rumex crispus*	R
Carex cf riparia	O	*Urtica dioica*	R
Heracleum sphondylium	O	*Oenanthe crocata*	X
Lolium perenne	O	*Scrophularia auriculata*	X
Rubus fruticosus	O	*Stachys palustris*	X

Reen section 8N (Ty Ffynnon Reen): photographs

8N (Ty Ffynnon Reen): looking north-west.

8N (Ty Ffynnon Reen): Typical view of channel

Reen section 8N (Ty Ffynnon Reen): survey data

Date of survey visit	26/9/2018
Height from water level to top of bank	1m
Approximate width at water-level	4m
Approximate depth of water	80cm
Turbidity (1 =clear to 5 = turbid)	1
Shading	None
Flow	None evident, presumably draining south-west
Adjacent land-use / vegetation	North-west: arable field, with fringe of bramble, coarse grasses and tall herbs on bank. South-east: grazed pasture, with coarse grasses and reeds on bank.
Other comments	Narrow shelf at approx 50cm from water-level on south side.

Aquatic vegetation

Elodea nuttallii	F	***Potamogeton trichoides***	**O**
Carex cf riparia	O	*Phragmites australis*	O
Ceratophyllum demersum	**O**	*Sparganium erectum*	O
Filamentous algae	O	***Spirodela polyrhiza***	**O**
Glyceria fluitans	O	*Callitriche sp.*	R
Lemna minor	O	***Hydrocharis morsus-ranae***	**R**
Potamogeton natans	O	*Iris pseudacorus*	R

Bank vegetation

Phragmites australis	D	*Carex remota*	R
Juncus inflexus	A	*Helminthotheca echioides*	R
Rubus fruticosus	A	*Hypericum tetrapterum*	R
Urtica dioica	A	*Lotus corniculatus*	R
Agrostis stolonifera	F	*Rhinanthus minor*	R
Lathyrus pratensis	F	*Rosa canina*	R
Phleum pratense	F	*Rumex acetosa*	R
Calystegia sepium	O	*Salix cinerea*	R
Carex otrubae	O	*Senecio erucifolius*	R
Dactylis glomerata	O	*Trifolium pratense*	R
Epilobium hirsutum	O	*Lysimachia vulgaris*	X
Equisetum arvense	O	*Persicaria amphibia*	X
Filipendula ulmaria	O	*Potentilla anserina*	X
Oenanthe crocata	O	*Quercus robur*	X

Reen section 8S (Ty Ffynnon Reen): photographs

8S (Ty Ffynnon Reen): looking north-east.

8S (Ty Ffynnon Reen): Typical view of channel

Reen section 8S (Ty Ffynnon Reen): survey data

Date of survey visit	26/9/2018
Height from water level to top of bank	1m
Approximate width at water-level	4m
Approximate depth of water	80cm
Turbidity (1 =clear to 5 = turbid)	1
Shading	None
Flow	None evident, presumably draining south-west
Adjacent land-use / vegetation	North-west: semi-improved pasture, with reeds and tall herbs on bank. South-east: semi-improved pasture and track, with reeds and tall herbs on bank.
Other comments	Shelf at approx 40cm from water-level on north side.

Aquatic vegetation

Spirodela polyrhiza	**D**	*Sparganium erectum*	O
Phragmites australis	A	*Apium nodiflorum*	R
Ceratophyllum demersum	**F**	***Butomus umbellatus***	**R**
Elodea nuttallii	F	*Equisetum palustre*	R
Berula erecta	O	*Galium palustre*	R
Carex cf riparia	O	*Ranunculus flammula*	R
Filamentous algae	O	*Eleocharis palustris*	X
Hydrocharis morsus-ranae	**O**	*Equisetum fluviatile*	X
Potamogeton natans	O	*Glyceria fluitans*	X

Bank vegetation

Phragmites australis	A	*Cardamine pratensis*	R
Agrostis stolonifera	F	*Epilobium ciliatum*	R
Carex hirta	F	*Epilobium hirsutum*	R
Cirsium arvense	F	*Helminthotheca echioides*	R
Juncus effusus	F	*Lathyrus pratensis*	R
Juncus inflexus	F	*Lysimachia nummularia*	R
Phleum pratense	F	*Lythrum salicaria*	R
Rubus fruticosus	F	*Ranunculus acris*	R
Urtica dioica	F	*Salix cinerea*	R
Carex otrubae	O	*Vicia sativa*	R
Hypericum tetrapterum	O	*Cerastium fontanum*	X
Lolium perenne	O	*Crataegus monogyna*	X
Lotus corniculatus	O	*Persicaria amphibia*	X
Lycopus europaeus	O	*Persicaria hydropiper*	X
Pulicaria dysenterica	O	*Potentilla anserina*	X
Ranunculus repens	O	*Potentilla reptans*	X
Senecio erucifolius	O	*Quercus robur*	X
Vicia cracca	O	*Rosa canina*	X
Alnus glutinosa	R	*Stachys palustris*	X

Reen section 10 (field ditch): photographs

10 (field ditch): looking south-west.

10 (field ditch): Typical view of channel

Reen section 10 (field ditch): survey data

Date of survey visit	27/9/2018
Height from water level to top of bank	90cm
Approximate width at water-level	1m
Approximate depth of water	30cm
Turbidity (1 =clear to 5 = turbid)	1
Shading	75% shaded by dense hedge along south side
Flow	None evident (dry at west end of channel)
Adjacent land-use / vegetation	North-west: arable field, with coarse grasses, bramble and tall herbs on bank. South-east: dense hedge, with semi-improved pasture beyond.
Other comments	Herbicide treatment evident on bank vegetation adjacent to arable field.

Aquatic vegetation

Phalaris arundinacea	F	*Berula erecta*	X
Sparganium erectum	O	*Lemna minor*	X
Glyceria fluitans	R	***Spirodela polyrhiza***	**X**

Bank vegetation

Arrhenatherum elatius	A	*Quercus robur*	R
Rubus fruticosus	D	*Rosa canina*	R
Urtica dioica	D	*Salix fragilis*	R
Galium aparine	F	*Brachythecium rutabulum*	X
Elytrigia repens	O	*Dryopteris dilatata*	X
Epilobium hirsutum	O	*Dryopteris filix-mas*	X
Lolium perenne	O	*Equisetum arvense*	X
Oenanthe crocata	O	*Filipendula ulmaria*	X
Ranunculus repens	O	*Fissidens taxifolius*	X
Asplenium scolopendrium	R	*Kindbergia praelonga*	X
Athyrium filix-femina	R	*Lathyrus pratensis*	X
Carex remota	R	*Prunus spinosa*	X
Cirsium arvense	R	*Rumex obtusifolius*	X
Crataegus monogyna	R	*Rumex sanguineus*	X
Hedera helix	R	*Tamus communis*	X
Holcus lanatus	R		

Reen section 18 (Railway Reen): photographs

18 (Railway Reen): looking north-east.

18 (Railway Reen): Typical view of channel

Reen section 18 (Railway Reen): survey data

Date of survey visit	27/9/2018
Height from water level to top of bank	1m (west) / 70cm (east)
Approximate width at water-level	3m
Approximate depth of water	90cm
Turbidity (1 =clear to 5 = turbid)	3
Shading	None
Flow	None evident, presumably draining south-west
Adjacent land-use / vegetation	North-east: sheep and cattle-grazed semi-improved pasture. South-west: sheep-grazed semi-improved pasture.
Other comments	Narrow shelf at approx 40cm from water-level on north-east side. Swans present, stirring up water and feeding on vegetation.

Aquatic vegetation

Filamentous algae	A	*Berula erecta*	R
Elodea nuttallii	F	*Lemna minor*	R
Hydrocharis morsus-ranae	**F**	*Alisma plantago-aquatica*	X
Phragmites australis	F	***Butomus umbellatus***	**X**
Carex cf riparia	O	***Sagittaria sagittifolia***	**X**
Potamogeton natans	O	***Spirodela polyrhiza***	**X**
Sparganium erectum	O		

Bank vegetation

Carex cf riparia	A	*Heracleum sphondylium*	R
Agrostis stolonifera	F	*Lathyrus pratensis*	R
Phleum pratense	F	*Lycopus europaeus*	R
Urtica dioica	F	*Potentilla reptans*	R
Carex hirta	O	*Rumex obtusifolius*	R
Juncus inflexus	O	*Solanum dulcamara*	R
Crataegus monogyna	R	*Cirsium arvense*	X
Epilobium hirsutum	R	*Hypericum tetrapterum*	X

Reen section 26 (Greenlane Reen): photographs

26 (Greenlane Reen): looking north-west.

26 (Greenlane Reen): Typical view of channel

Reen section 26 (Greenlane Reen): survey data

Date of survey visit	27/9/2018
Height from water level to top of bank	70cm (south) / 2m (north).
Approximate width at water-level	3m
Approximate depth of water	>1m
Turbidity (1 =clear to 5 = turbid)	2
Shading	None.
Flow	None evident, presumably draining east.
Adjacent land-use / vegetation	South: arable field. North: steep bank with coarse grasses and tall herbs, and road (with parked cars) and business park.
Other comments	Recently cut banks (probably a week or so before survey). Channel and banks with many items of litter and other tipped debris from adjacent road.

Aquatic vegetation

Hydrocharis morsus-ranae	**F**	*Apium nodiflorum*	R
Lemna minor	F	*Callitriche sp.*	R
Phragmites australis	F	*Elodea nuttallii*	R
Spirodela polyrhiza	**F**	***Potamogeton berchtoldii***	**R**
Ceratophyllum demersum	**O**	*Equisetum fluviatile*	X
Potamogeton trichoides	**O**	*Persicaria amphibia*	X
Sparganium erectum	O	*Potamogeton natans*	X

Bank vegetation

Calystegia sepium	A	*Phragmites australis*	O
Dactylis glomerata	A	*Potentilla reptans*	O
Elytrigia repens	A	*Ranunculus repens*	O
Rubus fruticosus	F	*Rumex conglomeratus*	O
Urtica dioica	F	*Helminthotheca echioides*	R
Cirsium arvense	O	*Rumex obtusifolius*	R
Epilobium hirsutum	O	*Sparganium erectum*	R
Filipendula ulmaria	O	*Cardamine pratensis*	X
Galium aparine	O	*Phalaris arundinacea*	X
Oenanthe crocata	O		

Reen section 30 (Ty Ffynnon Reen): photographs

30 (Ty Ffynnon Reen): looking north-east.

30 (Ty Ffynnon Reen): Typical view of channel

Reen section 30 (Ty Ffynnon Reen): survey data

Date of survey visit	26/9/2018
Height from water level to top of bank	1m
Approximate width at water-level	4m
Approximate depth of water	>1m
Turbidity (1 =clear to 5 = turbid)	1
Shading	None
Flow	None evident, presumably draining east
Adjacent land-use / vegetation	North: semi-improved pasture, with reeds and tall herbs on bank. South: semi-improved pasture, with reeds and tall herbs on bank.
Other comments	Adjacent fields not recently grazed.

Aquatic vegetation

Hydrocharis morsus-ranae	**F**	Filamentous algae	R
Elodea nuttallii	O	***Potamogeton berchtoldii***	**R**
Potamogeton natans	O	***Potamogeton trichoides***	**R**
Sparganium erectum	O	*Apium nodiflorum*	X
Spirodela polyrhiza	**O**	*Callitriche sp.*	X
Butomus umbellatus	**R**	*Glyceria fluitans*	X
Equisetum fluviatile	R		

Bank vegetation

Phragmites australis	D	*Galium palustre*	R
Phleum pratense	F	*Oenanthe crocata*	R
Urtica dioica	F	*Persicaria amphibia*	R
Agrostis stolonifera	O	*Rumex conglomeratus*	R
Calystegia sepium	O	*Vicia cracca*	R
Juncus inflexus	O	*Carex otrubae*	X
Lathyrus pratensis	O	*Lysimachia vulgaris*	X
Cardamine pratensis	R	*Persicaria hydropiper*	X
Carex cf riparia	R	*Potentilla reptans*	X
Cirsium arvense	R	*Rubus fruticosus*	X
Cirsium palustre	R	*Salix cinerea*	X
Filipendula ulmaria	R		

Reen section 32 (Railway Reen): photographs

32 (Railway Reen): looking north-west.

32 (Railway Reen): Typical view of channel

Reen section 32 (Railway Reen): survey data

Date of survey visit	26/9/2018
Height from water level to top of bank	50cm
Approximate width at water-level	4m
Approximate depth of water	1.2m
Turbidity (1 =clear to 5 = turbid)	1
Shading	None
Flow	None evident, presumably draining south
Adjacent land-use / vegetation	East: semi-improved pasture and stone track. West: semi-improved pasture.
Other comments	Both adjacent fields have not been grazed for at least several months and are becoming encroached on by reeds from the banks.

Aquatic vegetation

Elodea nuttallii	A	*Eleocharis palustris*	O
Sparganium erectum	A	Filamentous algae	O
Spirodela polyrhiza	**A**	*Potamogeton natans*	O
Ceratophyllum demersum	**F**	*Alisma plantago-aquatica*	R
Hydrocharis morsus-ranae	**F**	*Lycopus europaeus*	R
Lemna minor	F	***Potamogeton trichoides***	**R**
Butomus umbellatus	**O**	*Apium nodiflorum*	X

Bank vegetation

Phragmites australis	D	*Senecio erucifolius*	O
Filipendula ulmaria	F	*Helminthotheca echioides*	R
Juncus inflexus	F	*Hypericum tetrapterum*	R
Phleum pratense	F	*Juncus effusus*	R
Agrostis stolonifera	O	*Odontites vernus*	R
Carex otrubae	O	*Rosa canina*	R
Cirsium arvense	O	*Alnus glutinosa*	X
Elytrigia repens	O	*Lysimachia vulgaris*	X
Epilobium hirsutum	O	*Rubus fruticosus*	X
Lathyrus pratensis	O	*Solanum dulcamara*	X
Mentha aquatica	O		

Reen section 39 (Greenlane Reen): photographs

39 (Greenlane Reen): looking east.

39 (Greenlane Reen): Typical view of channel

Reen section 39 (Greenlane Reen): survey data

Date of survey visit	27/9/2018
Height from water level to top of bank	1m (south)/ approx 2m (north)
Approximate width at water-level	3m
Approximate depth of water	1.2m
Turbidity (1 =clear to 5 = turbid)	1
Shading	None.
Flow	None evident, presumably draining east.
Adjacent land-use / vegetation	North: steep bank with coarse grasses and tall ruderal herbs, and road (to railway bridge). South: sheep-grazed semi-improved pasture.
Other comments	Vegetation on north bank is newly establishing after engineering works to bridge (probably less than 1 year ago).

Aquatic vegetation

Elodea nuttallii	D	***Potamogeton trichoides***	**O**
Sparganium erectum	A	***Sagittaria sagittifolia***	**O**
Ceratophyllum demersum	**F**	***Spirodela polyrhiza***	**O**
Filamentous algae	F	*Equisetum fluviatile*	R
Hydrocharis morsus-ranae	**F**	*Glyceria fluitans*	R
Phragmites australis	F	*Lythrum salicaria*	R
Berula erecta	O	*Mentha aquatica*	X
Lemna minor	O	*Quercus robur*	X
Potamogeton natans	O		

Bank vegetation

Galium aparine	A	*Cardamine pratensis*	R
Juncus inflexus	A	*Carex cf riparia*	R
Urtica dioica	A	*Carex otrubae*	R
Agrostis stolonifera	F	*Crataegus monogyna*	R
Eupatorium cannabinum	F	*Dipsacus fullonum*	R
Phragmites australis	F	*Equisetum arvense*	R
Buddleia davidii	O	*Hypericum tetrapterum*	R
Carex hirta	O	*Lathyrus pratensis*	R
Cerastium fontanum	O	*Lythrum salicaria*	R
Filipendula ulmaria	O	*Oenanthe crocata*	R
Linaria vulgaris	O	*Ranunculus acris*	R
Phalaris arundinacea	O	*Rumex obtusifolius*	R
Rosa canina	O	*Solanum dulcamara*	R
Stachys palustris	O	*Stellaria media*	R
Agrimonia eupatoria	R	*Taraxacum* sp.	R
Angelica sylvestris	R	*Trifolium pratense*	R

Hendre Lake: target note description.

The lake is approximately 240m diameter and approximately 4.5ha, including a small, scrub-covered island. It is fed from the east side by Faendre Reen, and from the west side by Pil-du Reen. A sluice at the south side flows into Tarwick Reen and towards the estuary. The lake is stocked with coarse fish, and there are several anglers' bases around the margins. There is public access around most of the lake, and it is bordered by footpaths and species-poor, mown amenity grassland. The main exception is a scrub-covered promontory on the north-west side, fenced off as a nature conservation area.

The lake margins are mostly fringed by a mix of scrub and emergent vegetation, with dense reed dominating most of the southern shore, and a few areas of bare earth banks on the north shore that are maintained by wave erosion. Much of the north and eastern shores appear relatively species-poor, but the protected edges in the conservation area, and some parts of the western shore support a moderately diverse mix of tall herbs, scrub, rushes and wetland plants. These include Flowering Rush, Water Dock and Frogbit.

The lake water is turbid and there does not appear to be much submerged or floating aquatic vegetation. However, Rigid Hornwort and Nuttall's Waterweed were noted at some of the margins, and a small quantity of Frogbit was seen beside the conservation area.

Hendre Lake species list

Aquatic plants

Apium nodiflorum
Berula erecta
Butomus umbellatus
Carex cf riparia
Carex otrubae
Ceratophyllum demersum
Eleocharis palustris
Galium palustre
Hydrocharis morsus-ranae
Iris pseudacorus
Lemna minor
Lycopus europaeus
Mentha aquatica
Menyanthes trifoliata
Myosotis scorpioides
Oenanthe crocata
Persicaria amphibia
Persicaria hydropiper
Phragmites australis
Rumex hydrolapathum
Sparganium erectum
Spirodela polyrhiza
Typha latifolia

Plants on bank

Agrostis stolonifera
Alnus glutinosa
Arrhenatherum elatius
Artemisia vulgaris
Brachythecium rutabulum
Calliergonella cuspidata
Calystegia sepium
Cardamine pratensis
Carex hirta
Centaurea nigra
Cirsium arvense
Cirsium vulgare
Conyza floribunda
Cornus sericea
Corylus avellana
Crataegus monogyna
Cynosurus cristatus
Dactylis glomerata
Daucus carota
Dipsacus fullonum
Epilobium hirsutum
Epilobium montanum
Eupatorium cannabinum
Filipendula ulmaria
Fraxinus excelsior
Galium aparine
Geranium dissectum
Helminthotheca echioides
Hirschfeldia incana
Holcus lanatus
Hypochaeris radicata
Juncus acutiflorus
Juncus effusus
Juncus inflexus
Lathyrus pratensis
Lolium perenne
Lotus corniculatus
Lotus pedunculatus
Phalaris arundinacea
Phleum pratense
Plantago lanceolata
Plantago major
Poa annua
Poa trivialis
Polygonum aviculare
Potentilla anserina
Potentilla reptans
Prunella vulgaris
Prunus spinosa
Pulicaria dysenterica
Quercus robur
Ranunculus acris
Ranunculus repens
Rosa canina
Rubus fruticosus
Rumex conglomeratus
Rumex obtusifolius
Salix alba
Salix cinerea
Salix fragilis
Salix viminalis
Senecio erucifolius
Senecio jacobaea
Solanum dulcamara
Stachys palustris
Taraxacum sp.
Trifolium pratense
Trifolium repens
Tussilago farfara
Ulmus minor
Urtica dioica
Viburnum opulus
Vicia cracca
Vicia hirsuta
Vicia sativa

Hendre Lake: photographs

Hendre Lake: part of west bank.

Hendre Lake: part of east bank.

Hendre Lake: View from south bank.

Hendre Lake: part of north bank.