Ove Arup and Partners

# Cardiff International Sports Village, Cardiff Bay

## Vegetation survey

June 2023

Sturgess Ecology

# Contents



Document reference: C285/D1/V1

Cover photographs: Left: Sparse grassland and scattered scrub, with Cardiff International Pool and Ice Arena Wales in background; Right: Bee Orchid.

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# 1. Introduction

Ove Arup and Partners have commissioned Sturgess Ecology to undertake vegetation surveys of land at Cardiff Bay (approximate central grid reference ST181729). The study comprises 5 separate plots of brownfield land that has been left largely unmanaged for the last few years. The survey is required to support proposed development as part of the Cardiff International Sports Village and Cardiff Point Development project and associated ecological mitigation.

# 2. Survey method

The objective of the study was to map and describe the plant communities using National Vegetation Classification (NVC) methods. The study area is shown on an aerial photo background outlined in red in Figure 1.


**Figure 1. Location of NVC study area**

The survey was undertaken using a simple walk-through method, walking the site to examine and map the various vegetation types. The main plant communities were plotted by eye onto an aerial photograph base plan. No quadrats or detailed descriptions were made of the scrub communities, and these were only mapped and described very broadly because they were considered to have a relatively low value for nature conservation.

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 by using quadrat sampling and target notes, aiming to classify them in terms of the published NVC communities (Rodwell, 1991, etc.).

A total of 45 quadrats were recorded. These involved recording every species within 2x2m sample areas. The quadrats were 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 |

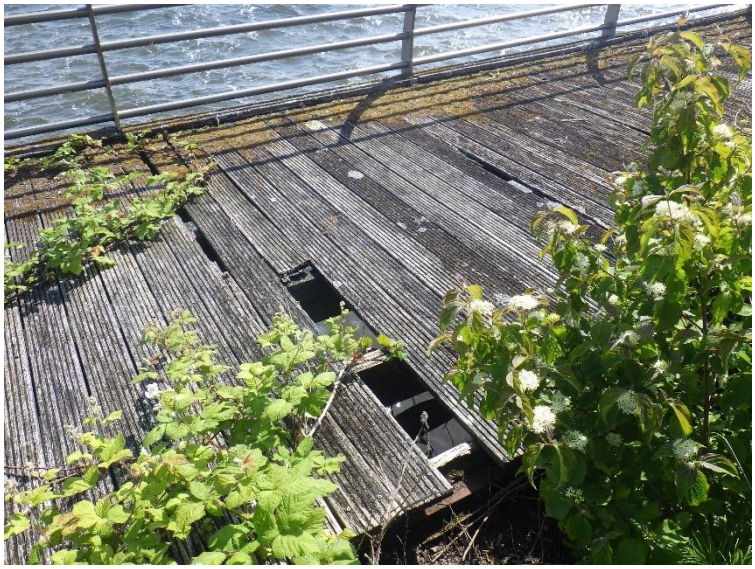
The quadrats recorded from each broadly similar plant community were grouped together into floristic tables. The occurrence of each species within the group of quadrats was then assigned a constancy score as indicated in Table 2. The species within each table are listed in order of their constancy score. Once the tables were completed, they were compared with the communities within the published NVC classification. The comparisons have mostly been made on the basis of the author's judgement, rather than use of 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 NVC survey work was carried out on 26 and 29 May 2023. On both days the weather was warm and dry, with a moderate breeze. This time of year is optimal for botanical survey, although some late-flowering plants were not yet in flower, and a few very early species had already died back. Many plant species were in flower and readily identifiable, but a small number were not in flower, or had shrivelled in the dry conditions, and a proportion of these could not be confirmed to species.

Access was permitted to all parts of the survey area. Scrub patches and areas of ornamental shrub planting were not examined. The western margin of the study area comprises a wooden board-walk and this was considered too dangerous to access.



*The broken boardwalk along the eastern boundary was considered too dangerous to access during the survey but was unlikely to have supported any significant plant species.*

The fieldwork and assessment were undertaken by Dr Peter Sturgess CEnv MCIEEM. He is an experienced botanist and familiar with the NVC and the flora of the Cardiff area.

# 3. Survey findings

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

The vegetation mapping is presented in Figure 2. 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 approximate. In addition, many of the vegetation types merge into one another, forming patchy mosaics and gradual transitions. Notes on the variations and mosaics are included in the plant community descriptions.

The locations of the quadrats are also shown in Figure 2. Where possible, quadrats were sampled from communities dispersed widely through the site to give an indication of the range of variation within each community and across the site. Only one or two quadrats were sampled to represent some of the more restricted communities, (e.g. the very small area of short-mown grass).

The vegetation descriptions and quadrat data are presented below. A few attempts have been made to relate the vegetation in terms of the published NVC communities. However, it has not been possible to match much of it with the published types very precisely, which is probably a reflection on the patchy nature of the substrata and varying states of transition and successional processes. Some of the communities have elements of sand-dune and maritime grassland flora, in addition to the open vegetation types that one might expect on brownfield land. The community descriptions are presented together with the quadrat data, 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 2. Vegetation plan**

### *Sparse dry grassland*

Most of the large central parts of the plots support a sparse vegetation over a substratum of concrete or stone chippings. The parts that appear relatively well drained generally fall into this grouping. They typically have a high proportion of annual species, but very few that make up a significant proportion of the ground cover. The most frequent species include Creeping Bent, Rat's-tail Fescue, Fern Grass and Butterfly Bush seedlings. Small acrocarpous mosses are often present but were not included in the survey due to time constraints and because they were all very dried up in the hot weather. Locally notable species occurring in this vegetation include Hawkweed Oxtongue and Yellow-wort.

The vegetation does not appear to conform well with any published NVC community and is probably a mix of several fragmentary types. It is probably closest to OV23, but also has similarities to maritime grassland communities such as MC11.

*Sparse dry grassland with abundant Rat's-tail Fescue, patchy mosses and a small amount of Kidney Vetch and composite seedings.*

**Table 3. Quadrat data for sparse dry grassland**

| Species | 1 | 8 | 10 | 18 | 21 | 22 | 24 | 28 | 29 | 30 | 35 | 36 | 40 | Frequency |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Agrostis stolonifera* | 4 | 3 | | 2 | | 2 | | 2 | | 3 | 2 | 3 | 4 | IV |
| *Catapodium rigidum* | 4 | 1 | 2 | 3 | | 2 | | 3 | | 3 | | 2 | 2 | IV |
| Indeterminate mosses | | 1 | 1 | 5 | | | 3 | 2 | 4 | 4 | | 4 | | IV |
| *Vulpia myuros* | 5 | | 6 | 4 | 1 | 2 | | 4 | 4 | 3 | | 3 | | IV |
| *Buddleia davidii* | A | | 1 | 1 | | A | 1 | 1 | 3 | 4 | A | A | | III |
| *Crepis vesicaria* | 2 | 2 | 2 | | | | | A | 2 | 2 | | 2 | 2 | III |
| *Daucus carota* | 4 | 2 | 2 | A | | A | A | 2 | 3 | A | A | 2 | 3 | III |
| *Holcus lanatus* | | | | | | 2 | 1 | 1 | 4 | 3 | | 2 | | III |
| *Lotus corniculatus* | 2 | 4 | 4 | | | | | 2 | | 5 | | 3 | | III |
| *Trifolium dubium* | 4 | 6 | | | | 2 | A | 2 | 5 | 5 | | | 3 | III |
| *Trifolium repens* | 2 | 2 | | | | | | 2 | | | 1 | 2 | 2 | III |
| *Blackstonia perfoliata* | 2 | | 2 | | | 1 | | | | | | 2 | | II |
| *Bromus hordeaceus* | 1 | | 4 | | | | | 4 | | | | | A | II |
| *Conyza cf bilbaoana* | | | | 1 | | 3 | 1 | | | | | | | II |
| *Dactylis glomerata* | 1 | | 2 | | | | | 1 | 4 | | | | | II |
| *Festuca rubra* | 2 | | | | | | 2 | | 2 | | | | | II |
| *Helminthotheca echioides* | | 3 | | A | 2 | | | | 2 | | | | | II |
| *Hypericum perforatum* | | A | 2 | A | | | 2 | | | | | 2 | A | II |
| *Medicago lupulina* | 2 | | 2 | | | | 2 | | | | | | | II |
| *Plantago lanceolata* | 4 | 3 | 2 | | | | | | | | | 2 | 2 | II |
| *Sagina apetala* | | | | | A | 1 | | 3 | | | | | 2 | II |
| *Trifolium pratense* | 2 | 2 | | | | | | | | | | | 2 | II |
| *Vicia sativa* | 2 | | | 1 | | 1 | 2 | A | | | | | | II |
| *Anthyllis vulneraria* | | | | | | | 2 | | | | | | | I |
| *Arenaria serpyllifolia* | | | | 2 | | | | | | | | | | I |
| *Arrhenatherum elatius* | | | | | | | 1 | | | | | | | I |
| *Brachypodium sylvaticum* | | | 1 | | | | | | A | | | | | I |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Brachythecium rutabulum* | | | | | | | | | 2 | | | | | I |
| *Calliergonella cuspidata* | 3 | | 3 | A | | | | | | | | | | I |
| *Carex pendula* | | | 1 | | | | | | | | | | | I |
| *Centaurium erythraea* | | | | | | | 1 | | | | | 2 | | I |
| *Cerastium fontanum* | | | | | | | 2 | | | | | | | I |
| *Cerastium semidecandrum* | | 1 | | | | | | 2 | | | | | | I |
| *Cratoneuron filicinum* | | | | | | | | 4 | | | | 2 | | I |
| *Cynosurus cristatus* | | | | | | | 2 | | | | | | | I |
| *Epilobium ciliatum* | | | | | A | 1 | | | | | | | | I |
| *Epilobium parviflorum* | | | | | | 2 | | | | | | | | I |
| *Epilobium sp.* | | | | | | | | 1 | | | | | | I |
| *Erophila verna* | | | | | | | | | | | | | 1 | I |
| *Ervilia hirsuta* | | | 2 | | | | | | | | | | | I |
| *Galega officinalis* | 2 | | A | | | | | | | | | | | I |
| *Geranium dissectum* | | | 2 | | | | | | | | | | | I |
| *Geranium robertianum* | 1 | | | | | | | | | | | | | I |
| *Geranium rotundifolium* | | | | 1 | | | | | | | | | | I |
| *Hieracium sp.* | | | | | | | 1 | | | | | | | I |
| *Homalothecium lutescens* | | | 1 | | | | | 2 | | | | | | I |
| *Hypochaeris radicata* | | | | | | | 1 | | | | | | | I |
| *Juncus bufonius* | | | | | | | | | | | | 2 | | I |
| *Leontodon hispidus* | | | | | | | | | | | | 1 | | I |
| *Leucanthemum vulgare* | 2 | | 2 | | | | | | | | | | | I |
| *Melilotus altissimus* | | 1 | | | | | | 1 | | | | | | I |
| *Pastinaca sativa* | | | | | | | 1 | | | | | | | I |
| *Phragmites australis* | | | | | | | 2 | | | | | | | I |
| *Picris hieracioides* | | | | | | | | 1 | 1 | A | | | | I |
| *Plantago coronopus* | | 1 | | | | | | | | | 1 | | A | I |
| *Plantago major* | | | | | | | | | | | 2 | | | I |
| *Poa annua* | | | | | | | | | | | 2 | | | I |
| *Polypogon viridis* | | | | | 2 | | | | | | | | | I |
| *Potentilla reptans* | 1 | | A | | | | | | | | | | | I |
| *Pulicaria dysenterica* | | | | | | A | | | | | | 1 | | I |
| *Rosa canina* | | | 1 | | | | | | | | | | | I |
| *Rubus fruticosus (agg)* | 2 | | A | A | | | | 1 | | | A | | | I |
| *Salix cinerea* | | | | | | | 1 | | | | | | | I |
| *Salix sp.* | | | | | A | | | | | | | 1 | | I |
| *Senecio jacobaea* | 2 | | | | A | 1 | | | | | | | | I |
| *Taraxacum* sp. | 2 | | | | | A | | | | | | | | I |
| *Trifolium campestre* | | | A | 2 | | A | | | | | | | A | I |
| *Tripleurospermum inodorum* | | 2 | | | | | | | | | | | | I |
| *Veronica arvensis* | | | | | | | | | 2 | | | | | I |
| *Clematis vitalba* | | | | A | | | | | | | | | | |
| *Hirschfeldia incana* | A | | | | | | | A | A | | | | | |
| *Lolium perenne* | | | | | | A | | | | | | | | |
| *Poa trivialis* | | | A | | | | | | | | A | | | |
| *Senecio erucifolius* | | | | A | | | | A | | | | | | |
| *Sonchus oleraceus* | | | | | A | | | | | | | | | |
| Total species | 24 | 15 | 21 | 10 | 3 | 12 | 18 | 20 | 13 | 9 | 5 | 18 | 10 | |
| Height (cm) | 20 | 15 | 30 | 20 | 10 | 10 | 10 | 10 | 15 | 20 | 5 | 15 | 10 | |
| Cover (%) | 40 | 20 | 70 | 40 | 5 | 15 | 50 | 45 | 60 | 60 | 5 | 90 | 15 | |

### *Closed sward dry grassland*

This grouping generally comprises flower-rich swards on well-drained calcareous substrata. Locally abundant Beaked Hawksbeard, Bird's-foot Trefoil and Ox-eye Daisy made this a relatively colourful community during the May survey. Much of this grassland probably represents a later successional stage of the open grassland described previously, but some also appears to have developed on a slightly deeper soil that has been subject to grass cutting or disturbance (e.g. Quadrat 4). Most of the Bee Orchids that were found were generally associated with this more mature grassland, but they were not seen in large numbers. Wildflower seed may be the origin of the locally notable Wild Clary and Viper's Bugloss seen in the grassland adjoining Ice Arena Wales, as these were only found in this location. This

was also the area where most Kidney Vetch and Lady's Bedstraw was recorded, and these are a frequent component of many seed mixes. The closed sward grassland in the north of the survey area intergraded with patches of scrub and Goat's Rue.

*Closed sward dry grassland with abundant beaked Hawk's-beard and Bird's-foot Trefoil.*

**Table 4. Quadrat data for closed sward dry grassland**

| Species | 2 | 4 | 5 | 13 | 14 | 31 | 32 | 39 | Frequency |
|---|---|---|---|---|---|---|---|---|---|
| *Calliergonella cuspidata* | 7 | 7 | 6 | 4 | 2 | | 4 | 4 | V |
| *Plantago lanceolata* | 2 | 2 | | 4 | 5 | 4 | 2 | 4 | V |
| *Daucus carota* | | 1 | 2 | 3 | 2 | A | A | 2 | IV |
| *Holcus lanatus* | 4 | 2 | | 2 | | | 2 | 2 | IV |
| *Lotus corniculatus* | | 2 | 1 | | 7 | | 2 | 2 | IV |
| *Rubus fruticosus (agg)* | 4 | | 7 | 2 | | A | 4 | 2 | IV |
| *Bromus hordeaceus* | | 5 | | 2 | | | 3 | 2 | III |
| *Dactylis glomerata* | | 2 | A | 2 | A | 1 | | 3 | III |
| *Festuca rubra* | 6 | 5 | 2 | | | 6 | | | III |
| *Leucanthemum vulgare* | 1 | 3 | 8 | | | | | 1 | III |
| *Potentilla reptans* | 5 | | 4 | | | 6 | | 5 | III |
| *Brachythecium rutabulum* | | | 4 | 2 | | 4 | | | II |
| *Buddleia davidii* | | A | A | 1 | | 1 | | | II |
| *Centaurea nigra* | 4 | 3 | | | | | | | II |
| *Cirsium vulgare* | | | 1 | 1 | | | | | II |
| *Cornus sanguinea ssp australis* | | | 1 | | | 1 | 1 | | II |
| *Crepis vesicaria* | | A | A | 2 | 3 | | | | II |
| *Cynosurus cristatus* | 1 | 6 | | | | | | | II |
| *Equisetum telmateia* | 2 | | | | | A | 3 | | II |
| *Ervilia hirsuta* | | | 2 | 3 | | 4 | | | II |
| *Galega officinalis* | 6 | 2 | | 3 | | | | | II |
| *Geranium dissectum* | 2 | | | | | 1 | A | | II |
| *Helminthotheca echioides* | 2 | 2 | A | | | | | 1 | II |
| *Lolium perenne* | 2 | | | | | 2 | | | II |
| *Pastinaca sativa* | | | 4 | 4 | | | | 2 | II |
| *Poa trivialis* | A | | | | | 2 | 3 | 4 | II |
| *Ranunculus acris* | | 2 | | | | 1 | | | II |
| *Schedonorus arundinaceus* | | 1 | | | | | 7 | | II |
| *Taraxacum* sp. | | | | | | 2 | 2 | 2 | II |
| *Trifolium pratense* | | 3 | | 3 | 2 | | | | II |
| *Vicia sativa* | 2 | 2 | 4 | | | A | | | II |
| *Vulpia myuros* | | | | | 2 | | 2 | | II |
| *Agrostis stolonifera* | | | | 2 | | | | | I |
| *Anisantha madritensis* | | | | A | 2 | | | | I |
| *Anthyllis vulneraria* | | 1 | | | | | | | I |
| *Calystegia sepium* | | | 2 | | | | | | I |
| *Carex hirta* | | | 6 | | | | | | I |
| *Carex pendula* | 4 | | | | | | | | I |
| *Catapodium rigidum* | | | | | 2 | | | | I |
| *Conyza cf bilbaoana* | | | | 3 | | | | | I |
| *Dipsacus fullonum* | | | | | | | 1 | | I |
| *Galium album* | 2 | | | | | | | | I |
| *Galium verum* | | 3 | | | | | | | I |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *Geranium robertianum* | | | 1 | | | | | | I |
| *Hirschfeldia incana* | | | | | | 1 | A | | I |
| *Hypericum perforatum* | | | | 2 | | | | | I |
| Indeterminate mosses | | | | | 3 | | | | I |
| *Knautia arvensis* | A | 1 | | | | | | | I |
| *Myosotis arvensis* | | | 2 | | | | | | I |
| *Ophrys apifera* | | | | | | | | 1 | I |
| *Pulicaria dysenterica* | A | | 1 | | | | | A | I |
| *Ranunculus repens* | | 1 | | | | | | | I |
| *Senecio jacobaea* | A | 3 | | | | | | A | I |
| *Bellis perennis* | | | | A | | | | | |
| *Brachypodium sylvaticum* | | | A | | | | | | |
| *Cirsium arvense* | | | | | | | | A | |
| *Echium vulgare* | | A | | | | | | | |
| *Eupatorium cannabinum* | | | A | | | | | | |
| *Hippophae rhamnoides* | | | | A | | | | | |
| *Poa compressa* | A | | | | | | | | |
| *Prunella vulgaris* | | | | | | | A | | |
| *Rumex crispus* | | | | | | | | A | |
| *Rumex sanguineus* | | | | | | | | A | |
| *Sonchus oleraceus* | | A | | | | | | | |
| *Trifolium campestre* | | | | | | | | A | |
| *Trifolium repens* | | A | | | | | | | |
| *Veronica persica* | | | | | | A | | | |
| Total species | 17 | 22 | 18 | 18 | 10 | 14 | 13 | 15 | |
| Height (cm) | 90 | 20 | 60 | 30 | 40 | 40 | 60 | 40 | |
| Cover (%) | 100 | 95 | 100 | 80 | 70 | 100 | 95 | 100 | |

## *Sparse damp grassland*

*An extensive area of sparse damp grassland north-west of Cardiff Bay Yacht Club.*

Much of the vegetation has developed on poorly-drained ground that appears to hold water near the surface at least during the winter. These formerly wet areas were dry at the time of the survey but often identified by cracks in dried-out mud, or remains of filamentous algae on the ground. Creeping Bent is the most constant species of this assemblage, but there are also a number of other species commonly associated with damp ground, including Hard Rush, Jointed Rush, Toad Rush, Fleabane and False Fox-sedges. Buck's-horn Plantain is locally very prominent. However, there is no clear-cut distinction between this and the sparse dry grassland community, and many of the same species are also present here, showing that there is probably a continuous gradation between the two groupings. There are elements of several fragmentary NVC communities, including MG13 *Agrostis stolonifera - Alopecurus geniculatus* grassland, and OV28 *Agrostis stolonifera - Ranunculus repens* grassland, and some dune slack vegetation, but none of these are an especially good fit. Locally notable species associated with the sparse damp grassland areas include Yellow-wort and Long-bracted Sedge.

## Table 5. Quadrat data for sparse damp grassland

| Species | 6 | 17 | 20 | 23 | 33 | 37 | 38 | 41 | 42 | 43 | 45 | Frequency |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Agrostis stolonifera* | 8 | 3 | 7 | 2 | 4 | 6 | 3 | 9 | 7 | 7 | 8 | V |
| *Calliergonella cuspidata* | 4 | | | | | 2 | | 2 | A | 2 | 5 | III |
| *Daucus carota* | 2 | 2 | | | | | 1 | 2 | | 2 | 2 | III |
| *Plantago coronopus* | 1 | | | | 3 | 3 | 1 | | 2 | 5 | | III |
| *Pulicaria dysenterica* | | A | 2 | 1 | | A | 2 | 4 | 1 | | 2 | III |
| *Trifolium pratense* | A | | 1 | | | 4 | A | 2 | A | 1 | 2 | III |
| *Crepis vesicaria* | 3 | 2 | | | | 2 | A | | | | A | II |
| Indet.mosses | | 2 | 2 | 6 | | 5 | | | | | | II |
| *Juncus articulatus* | | | | | 1 | | 3 | | A | 1 | | II |
| *Juncus bufonius* | | | 3 | 3 | | | | | | 2 | | II |
| *Lotus corniculatus* | 1 | A | | | | | | | | 1 | 2 | II |
| *Plantago lanceolata* | | | | | | 2 | | | | 1 | 2 | II |
| *Rumex crispus* | | | | | | | 1 | | 1 | 1 | A | II |
| *Trifolium dubium* | | | 6 | | | 5 | | | | 2 | 1 | II |
| *Vicia sativa* | 2 | 1 | | | | | | | | | 2 | II |
| *Acer pseudoplatanus* | | | | 1 | | | | | | | | I |
| *Alopecurus geniculatus* | | | | | | | | | 2 | | | I |
| *Anisantha madritensis* | 3 | | | | | | | | | | | I |
| *Betula pubescens* | | 1 | | | | | | | | | | I |
| *Blackstonia perfoliata* | | 2 | | | | A | | | | | | I |
| *Brachythecium rutabulum* | | | | | | | | | | 2 | | I |
| *Bromus hordeaceus* | | | 2 | | | 4 | | | | | A | I |
| *Carex otrubae* | | | | | | | A | 1 | | A | 4 | I |
| *Conyza cf bilbaoana* | | | | 2 | | A | | | | | | I |
| *Cratoneuron filicinum* | A | | | | | | | | | | 2 | I |
| *Cynosurus cristatus* | | | | 1 | | | | | | | | I |
| *Dactylis glomerata* | 4 | | | | | | | | | | A | I |
| *Epilobium ciliatum* | | | 2 | | | | | | | | | I |
| *Epilobium sp.* | | | | | | | | | 1 | A | | I |
| *Festuca rubra* | 4 | | | | | | | | | | | I |
| *Geranium dissectum* | 1 | | | | | | | | | | | I |
| *Helminthotheca echioides* | 1 | | | 2 | | | | | | | | I |
| *Holcus lanatus* | | | 2 | | | 2 | | | | | A | I |
| *Juncus inflexus* | | | | | | | | 2 | 1 | | A | I |
| *Leontodon hispidus* | | 1 | | | | | 1 | | | | | I |
| *Pastinaca sativa* | 2 | | | | | | | | | | | I |
| *Phragmites australis* | 1 | | 1 | | | | | | | | | I |
| *Picris hieracioides* | | | | | | | | A | 2 | 1 | | I |
| *Plantago major* | | | A | | | A | | A | | | 1 | I |
| *Poa annua* | | | | 1 | | | | | | | | I |
| *Polypogon viridis* | | | | 3 | | | | | | | | I |
| *Potentilla reptans* | | 2 | | | A | | | | | | | I |
| *Prunella vulgaris* | | | | | | | | 2 | | | | I |
| *Ranunculus repens* | | | | | | | 1 | | A | A | | I |
| *Rubus fruticosus (agg)* | A | 1 | | | | | | | | | | I |
| *Sagina apetala* | | | | 2 | | 2 | | | | | | I |
| *Salix cinerea* | | 1 | | | | A | | | | | | I |
| *Senecio erucifolius* | 2 | 1 | | | | | | A | | | | I |
| *Taraxacum* sp. | 2 | | | | | | | | 2 | | | I |
| *Trifolium repens* | 2 | | | | | | | | | | | I |
| *Vulpia myuros* | | 3 | | | | | | | | | | I |
| *Barbula sp.* | A | | | | | | | | | | | |
| *Buddleia davidii* | | A | | A | | | | | | | | |
| *Carex extensa* | | | | | | | A | | | | | |
| *Carex hirta* | | | | | | | A | | | | | |
| *Carex pendula* | | | A | | | | | | | | A | |
| *Crataegus monogyna* | A | | | | | | | | | | | |
| *Epilobium parviflorum* | | | | A | | | | | | | | |
| *Galium palustre* | | A | | | | | | | | | | |
| *Leucanthemum vulgare* | A | | | | | | | | | | | |
| *Medicago lupulina* | | | | A | | | | | | | | |
| *Schedonorus arundinaceus* | | | | | | | | | | | A | |
| *Senecio jacobaea* | | | | A | | | | | | | | |
| Total species | 17 | 13 | 10 | 11 | 3 | 11 | 8 | 8 | 9 | 13 | 12 | |
| Height (cm) | 40 | 40 | 10 | 10 | 5 | 20 | 10 | 30 | 20 | 20 | 20 | |
| Cover (%) | 90 | 15 | 60 | 50 | 10 | 80 | 40 | 90 | 50 | 60 | 50 | |

### *Closed sward damp grassland*

Several areas of poorly drained ground on deeper soils supported a taller sward, mostly characterised by Creeping Bent, Pointed Spear-moss, with patchy Hard Rush, Bird's-foot Trefoil and Hairy Sedge. This vegetation is often mixed with scattered Willow and Bramble scrub, and one patch has frequent Common Reed (Quadrat 9). Part of the northern plot also mixed with locally abundant Goat's Rue (Quadrats 12 and 15). This is a diffuse grouping that is best described as a mix of several transitional plant communities. There are elements resembling fragmentary NVC MG10b *Juncus inflexus* rush pasture and others resembling sand dune slack communities, with frequent transitions into drier grassland and tall herb vegetation. Bee Orchids were occasionally found in this grassland.

*Closed sward damp grassland mosaic, with scattered Goats Rue, Hard Rush and Common Reed.*

**Table 6. Quadrat data for closed sward damp grassland**

| Species | 3 | 7 | 9 | 12 | 15 | 16 | Frequency |
|---|---|---|---|---|---|---|---|
| *Calliergonella cuspidata* | 8 | 4 | 9 | | 2 | 2 | V |
| *Agrostis stolonifera* | 5 | 4 | 1 | | | 4 | IV |
| *Vicia sativa* | 1 | 2 | | 1 | | 2 | IV |
| *Juncus inflexus* | 2 | | | 2 | 2 | | III |
| *Lotus corniculatus* | 4 | 6 | | | A | 6 | III |
| *Plantago lanceolata* | A | 2 | | | 2 | 2 | III |
| *Potentilla reptans* | A | 2 | 2 | | | 2 | III |
| *Brachythecium rutabulum* | | | | 3 | 4 | | II |
| *Carex hirta* | | | | 8 | 8 | | II |
| *Cynosurus cristatus* | 3 | 2 | | | | | II |
| *Dactylis glomerata* | | A | | 4 | 2 | | II |
| *Festuca rubra* | A | 2 | | | | 4 | II |
| *Galega officinalis* | A | | A | 4 | 9 | | II |
| *Geranium dissectum* | 1 | 2 | | A | | | II |
| *Holcus lanatus* | 3 | | | | 2 | | II |
| *Hypericum perforatum* | | | 1 | | | 1 | II |
| *Ophrys apifera* | | 1 | | | | 1 | II |
| *Pastinaca sativa* | | | | 1 | 2 | | II |
| *Poa trivialis* | A | | | 2 | 4 | | II |
| *Rumex sanguineus* | | | A | | 1 | 1 | II |
| *Senecio erucifolius* | | | 1 | 2 | | | II |
| *Trifolium pratense* | 2 | 1 | | | | | II |
| *Anisantha madritensis* | | 5 | | | | | I |
| *Brachypodium sylvaticum* | | | | | | 1 | I |
| *Cardamine cf hirsuta* | | | | 3 | | | I |
| *Carex pendula* | A | | | A | 1 | | I |
| *Carex remota* | | | | | | 1 | I |
| *Cratoneuron filicinum* | 2 | | | | | | I |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| *Crepis vesicaria* | | A | | | | 2 | I |
| *Daucus carota* | | A | | | | 2 | I |
| *Dipsacus fullonum* | | | A | A | 1 | | I |
| *Equisetum telmateia* | | | 2 | | | | I |
| *Helminthotheca echioides* | 5 | A | | | | | I |
| *Leucanthemum vulgare* | | 4 | | | | | I |
| *Phragmites australis* | A | | 6 | | | | I |
| *Plantago major* | | | | | | 1 | I |
| *Potentilla anserina* | 8 | | | | | | I |
| *Pulicaria dysenterica* | | | 7 | | A | | I |
| *Rubus fruticosus (agg)* | | 2 | | | | | I |
| *Rumex crispus* | | | | 2 | | | I |
| *Salix cinerea* | | | 1 | | | | I |
| *Scrophularia auriculata* | | | | | 1 | | I |
| *Senecio jacobaea* | | | | 1 | | | I |
| *Trifolium dubium* | | 2 | | | | | I |
| *Vicia cracca* | | | | | 1 | | I |
| *Vulpia myuros* | | 2 | | | | | I |
| *Bellis perennis* | | | | | | A | |
| *Bromus hordeaceus* | A | | | | | A | |
| *Centaurea nigra* | A | | | | | | |
| *Cirsium vulgare* | | | | | A | | |
| *Foeniculum vulgare* | | | | | | A | |
| *Geranium robertianum* | | | | A | | | |
| *Melilotus altissimus* | A | | | | | | |
| *Prunella vulgaris* | A | | | | | | |
| *Ranunculus acris* | | | | A | | | |
| *Ranunculus repens* | A | | | | | | |
| *Rosa canina* | | | A | | | | |
| Total species | 12 | 16 | 9 | 12 | 15 | 15 | |
| Height (cm) | 30 | 35 | 100 | 90 | 90 | 35 | |
| Cover (%) | 90 | 100 | 100 | 100 | 100 | 100 | |

### *Low diversity dry grassland*

A few areas of grassland on deeper soil appear to be close to the NVC category MG1 *Arrhenatherum elatius* grassland. These mostly have a relatively low species diversity and are characterised by frequent tall grasses. Some may have derived from formerly mown grassland that has been abandoned (e.g. Quadrat 27 appears to have been a former road verge). However, they are generally limited to small patches and merge with other closed sward grassland and scattered scrub.

*Low diversity dry grassland, with locally abundant False Oat-grass.*

## Table 7. Quadrat data for low diversity dry grassland

| Species | 19 | 27 | 34 | 44 | Frequency |
|---|---|---|---|---|---|
| *Plantago lanceolata* | 4 | 2 | 2 | 2 | V |
| *Agrostis stolonifera* | 4 | | 4 | 2 | IV |
| *Dactylis glomerata* | 4 | 7 | | 2 | IV |
| *Daucus carota* | | 1 | 1 | 5 | IV |
| *Geranium dissectum* | 2 | 2 | 1 | A | IV |
| *Holcus lanatus* | 2 | | 2 | 2 | IV |
| *Arrhenatherum elatius* | 7 | | 2 | | III |
| *Brachythecium rutabulum* | 4 | | 2 | | III |
| *Bromus hordeaceus* | | 7 | 4 | | III |
| *Crepis vesicaria* | | 2 | 1 | A | III |
| *Festuca rubra* | 2 | | | 7 | III |
| *Lolium perenne* | | 2 | 4 | | III |
| *Lotus corniculatus* | | | 1 | 2 | III |
| *Poa trivialis* | | 4 | 4 | | III |
| *Ranunculus repens* | A | | 1 | 2 | III |
| *Calliergonella cuspidata* | | | 2 | | II |
| *Calystegia sepium* | | | | 2 | II |
| *Carex flacca* | 1 | | | | II |
| *Carex hirta* | 1 | A | | | II |
| *Ervilia hirsuta* | 2 | | | | II |
| *Geranium rotundifolium* | | | | 1 | II |
| *Helminthotheca echioides* | | 6 | | | II |
| *Hyacinthoides hispanica* | | | | 1 | II |
| *Hypochaeris radicata* | | | | 1 | II |
| *Lotus pedunculatus* | 2 | | | | II |
| *Rubus fruticosus (agg)* | A | | 2 | | II |
| *Rumex crispus* | | | | 1 | II |
| *Taraxacum* sp. | | | 2 | | II |
| *Trifolium campestre* | | | 1 | | II |
| *Trifolium pratense* | A | | 2 | A | II |
| *Veronica serpyllifolia* | 1 | | | | II |
| *Vicia sativa* | | 2 | | A | II |
| *Carex pendula* | | | | A | |
| *Cerastium fontanum* | | | | A | |
| *Cynosurus cristatus* | | | A | | |
| *Hirschfeldia incana* | | A | A | | |
| *Hypericum perforatum* | | | A | | |
| *Rumex obtusifolius* | A | | | A | |
| *Salix caprea* | A | | | | |
| *Senecio jacobaea* | A | | | A | |
| Total species | 13 | 10 | 18 | 13 | |
| Height (cm) | 50 | 80 | 50 | 40 | |
| Cover (%) | 100 | 95 | 100 | 100 | |

### *Mown amenity grassland*

Several areas of amenity grassland between Empire Way and the International Pool are managed by regular mowing as amenity grassland. The main grass species were Perennial Rye-grass and Red Fescue, which were probably derived by seeding turf, but a moderate frequency of typical associated lawn species are also present, including Dandelion, Ribwort Plantain, White Clover and Daisy, as well as species typical of disturbed ground such as Bristly Ox-tongue. Unfortunately the grass had been cut shortly before the survey making the survey difficult. Surprisingly a Bee Orchid was in flower in this grassland, presumably having put up its flower spike just after the mowing. In terms of the NVC this vegetation appears to lie somewhere between the MG7 *Lolium perenne* lawn and OV23 *Lolium perenne – Dactylis glomerata* weedy grassland community.

*Mown amenity grassland beside Empire Way.*

### Table 8. Quadrat data for mown amenity grassland

| Species | 25 | 26 | Frequency |
|---|---|---|---|
| *Festuca rubra* | 6 | 2 | V |
| *Helminthotheca echioides* | 1 | 1 | V |
| *Lolium perenne* | 8 | 8 | V |
| *Plantago lanceolata* | 4 | 4 | V |
| *Taraxacum* sp. | 2 | 1 | V |
| *Trifolium dubium* | 2 | 3 | V |
| *Trifolium repens* | 2 | 1 | V |
| *Bellis perennis* | 4 | | III |
| *Bromus hordeaceus* | 4 | | III |
| *Calliergonella cuspidata* | 4 | | III |
| *Crepis vesicaria* | A | 1 | III |
| *Daucus carota* | 1 | | III |
| *Plantago major* | A | 2 | III |
| *Poa annua* | | 4 | III |
| *Ophrys apifera* | A | | |
| *Poa pratensis* | A | | |
| *Sonchus oleraceus* | | A | |
| Total species | 11 | 10 | |
| Height (cm) | 5 | 5 | |
| Cover (%) | 95 | 80 | |

### *Tall herbs at scrub margin*

Dense Bramble and Butterfly Bush scrub is present around several of the margins, and some of these areas have a fringe of tall herb vegetation, often forming a mosaic with the adjacent grassland and scrub and generally too narrow to map. Species recorded in the tall herb vegetation are typically indicative of deeper soils with higher nutrient status, including Bramble, Nettle, Creeping Thistle and Cleavers. It appears to have its closest affinities to the NVC OV25 *Urtica dioica Cirsium arvense* community and W24 *Rubus fruticosus – Holcus lanatus* underscrub. One quadrat was recorded as an example of this vegetation.

*Tall herb vegetation merging with dense Bramble.*

**Table 9. Quadrat data for tall herbs at scrub margin**

| Species | Quadrat 11 |
|---|---|
| *Carex pendula* | 5 |
| *Galega officinalis* | 5 |
| *Galium aparine* | 5 |
| *Bromus hordeaceus* | 4 |
| *Rubus fruticosus (agg)* | 4 |
| *Symphytum x uplandicum* | 4 |
| *Urtica dioica* | 4 |
| *Hirschfeldia incana* | 2 |
| *Buddleia davidii* | A |
| *Geranium dissectum* | A |
| *Plantago lanceolata* | A |
| Total species | 8 |
| Height (cm) | 100 |
| Cover (%) | 100 |

### *Scrub*

The scrub communities were not examined thoroughly as part of the survey. However, incidental observations showed that there are several different dominant species, often distributed patchily around the plot boundaries. Some areas have developed by natural succession, particularly the scattered plants of Butterfly Bush and Bramble beside many fences. Others appear to have originated as landscape planting e.g. the dense planting of Birch and Italian Alder beside the A4055, or the Southern Dogwood along the eastern margin beside Cardiff Bay. Sea Buckthorn occurs patchily within the study area and may also have been introduced with landscape planting. The ground flora in all of the scrub areas appears to be species poor, often including Bramble, Ivy and Nettle, but merging with the adjacent grassland communities. A few herb species, such as Wild Strawberry and Herb Robert, appear to be mainly associated with the scrub margins. Gorse, Broom and Dog Rose are relatively rare within the site, and only occur as scattered scrub. A few tree species including Hawthorn and Sycamore were mostly limited to seedlings among sparse vegetation. It is possible that they may be limited by occasional drought conditions on the shallow soil.

*Willow scrub with species-poor ground flora near western boundary.*

# 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 10.

**Table 10: 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 | 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. |

The flora of the study area comprises a mosaic of sparse grassland, scrub and tall herbs, including a mix of open vegetation communities, and with some elements of coastal vegetation types such as sand-dunes. The vegetation bears limited resemblance to the published NVC communities, but this does not mean that it has low ecological value. In particular, the open vegetation supports a number of locally scarce plants, and much of the

grassland is rich in flowering herbs and therefore likely to be a valuable resource for bees and possibly other insects with value for nature conservation.

The scrub communities appear to be of less conservation significance and mostly limited to relatively young habitats with a low diversity of common species. However, these are still likely to provide useful cover for birds, insects and other wildlife (for example, a dead Hedgehog was noted during the survey).

The vegetation mostly comprises common plant species, but a few are present that are listed as being rare or scarce in the Wildlife Sites Guidelines. The species recorded during the survey are listed below.

- *Blackstonia perfoliata* (Yellow-wort)
- *Carex extensa* (Long-bracted Sedge)
- *Echium vulgare* (Viper's Bugloss)
- *Geranium rotundifolium* (Round-leaved Crane's-bill)
- *Linum bienne* (Pale Flax)
- *Ophrys apifera* (Bee Orchid)
- *Picris hieracioides* (Hawkweed Oxtongue)
- *Salvia verbenacea* (Wild Clary)
- *Sison amomum* (Stone Parsley)
- *Valerianella carinata* (Keeled-fruited Cornsalad)

These are all listed as 'Contributory species' in the guidelines. Sites supporting 5 or more Contributory Species are considered significant for nature conservation in a county context. In this case there are 10 Contributory Species so the site easily exceeds this criterion.

The approximate locations of these species are included in Figure 3. This must be regarded as a minimum distribution because individual plants could easily have been overlooked if they occur at a low density, hidden within other vegetation, or were not in flower at the time of the survey. In the case of Hawkweed Ox-tongue, which was locally frequent, only the main concentrations of the plants have been shown to avoid cluttering the map. Photographs of most species are shown below. (No photograph was taken of the Keeled-Fruited Cornsalad because it is relatively widespread in the Cardiff area).

It is feasible that other locally uncommon plants may be present but missed; particularly if they are very small plants at a low density, or had died back or been mown before the survey. On a disturbed, exposed site like this it is also possible that some plants might only be present for a short time, colonising briefly then dying out as conditions change.

*Yellow-wort is widespread through the areas of sparse vegetation. It was not in flower at the time of the survey so some plants would probably have been missed.*

*Long-bracted Sedge was found in dried out mud north-west of the Cardiff Bay Yacht Club. Only three plants were seen in a very localised area, but it may occur in other areas of sparsely vegetated damp ground.*

*Two plants of Viper's Bugloss were found near the Ice Arena.*

*Round-leaved Crane's-bill was found in several places; mostly in disturbed ground at sunny scrub margins*

*Two small patches of Pale Flax were recorded. Both were in sparsely vegetated ground sheltered by scrub.*

*Bee Orchids were seen in a variety of contexts, in grasslands and scrub margins, but only in small numbers.*

*Hawkweed Ox-tongue was widespread and locally frequent through the study area but was not in flower at the time of the survey.*

*Only two plants of Wild Clary were recorded, in grassland near the Ice Arena, but others could easily have been overlooked.*

*One plant of Stone Parsley was found in the shade of scrub at the south of the study area.*

No non-native invasive plants were recorded that are included on Schedule 9 of the Wildlife and Countryside Act (but it is possible that some may have been hidden in dense scrub). A few non-native plants with invasive tendencies were recorded, but these would not be regarded as a legal constraint to any proposed redevelopment on the site. Examples include Sea Buckthorn, Red-Osier Dogwood and Mexican Fleabane.

*Mexican Fleabane is a non-native species with invasive tendencies. Only a small number of plants were found but it has the potential to spread quickly within the survey area. It is not listed in Schedule 9 of the Wildlife and Countryside Act.*

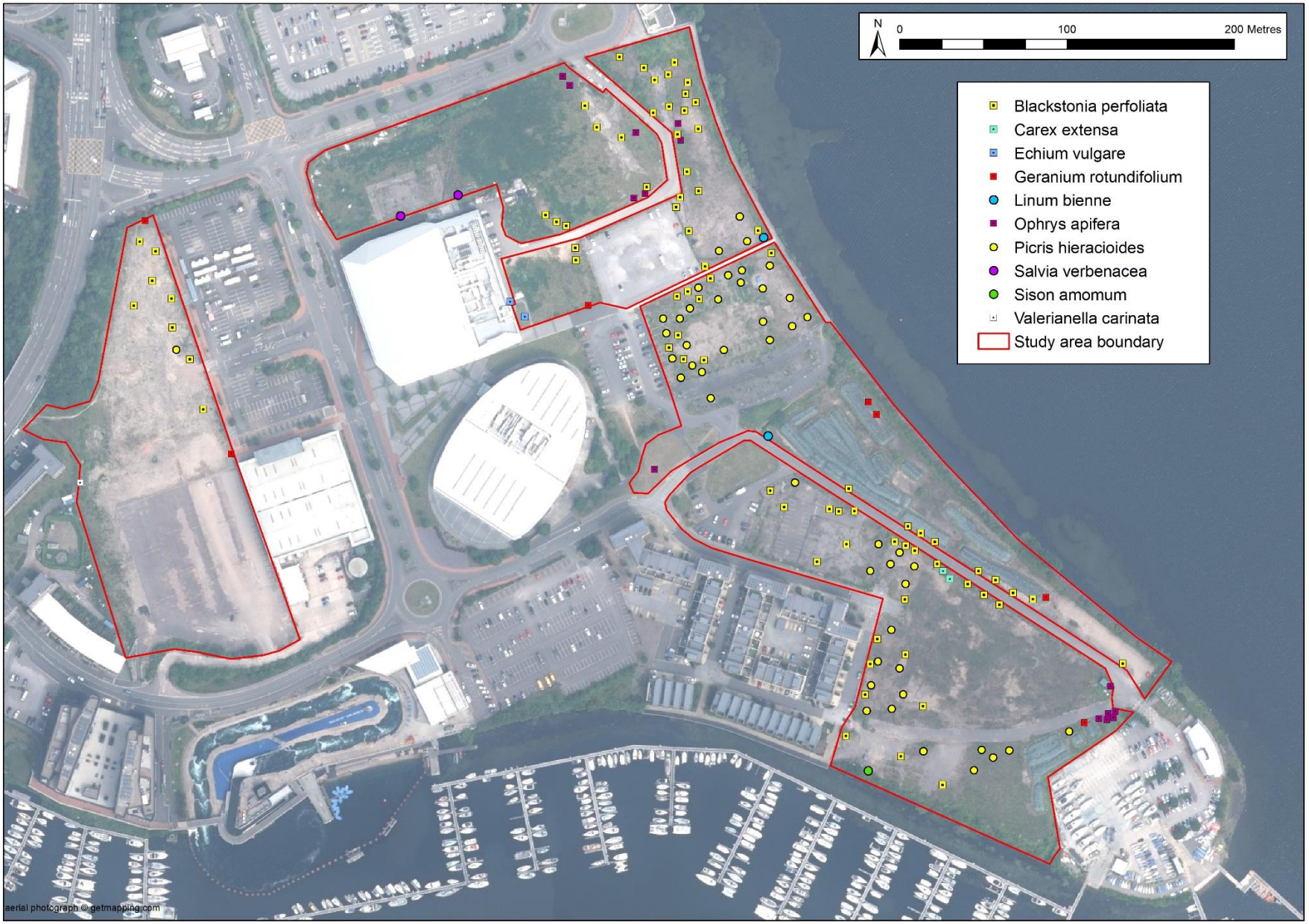



**Figure 3. Approximate locations of locally scarce plant species.**

The habitat was also assessed as a possible example of 'Open Mosaic Habitat on Previously Developed Land'. This is a habitat category included in the Environment (Wales) Act 2016 Section 7 'List of the Habitats of Principal Importance for the Purpose of Maintaining and Enhancing Biodiversity in Relation to Wales'. The area was evaluated against the requirements for Open Mosaic Habitat as set out in the Biodiversity Action Plan (BAP) criteria (Biodiversity Reporting and Information Group, 2010), and also in Wildlife Sites Guidelines Wales (Wales Biodiversity Partnership, 2008).

The evaluation against BAP criteria is set out in Table 11.

**Table 11. Assessment of Open Mosaic Habitat using BAP criteria**

| BAP Criterion | Determination |
|---|---|
| 1. The area of open mosaic habitat is at least 0.25ha in size. | The study area is 9ha, and at least 7ha of this is potentially qualifying mosaic habitat (excluding roads and amenity grassland). |
| 2. Known history of disturbance at the site or evidence that soil has been removed or severely modified by previous use(s) of the site. Extraneous materials/substrates such as industrial spoil may have been added. | The site has a history of industrial activity, most of it supporting railway sidings associated with docks by the river Ely and the Victoria Petroleum Works. There is no evidence of original topsoil or topography. Much of the current substratum appears to comprise crushed / compacted aggregate, or hardstanding, reprofiled into level areas. |
| 3. The site contains some vegetation. This will comprise early successional communities consisting mainly of stress-tolerant species (e.g. indicative of low nutrient status or drought). Early successional communities are composed of (a) annuals, or (b) mosses/liverworts, or (c) lichens, or (d) ruderals, or (e) inundation species, or (f) open grassland, or (g) flower-rich grassland, or (h) heathland. | The survey area contains a varied mix of early successional habitats, including good examples of open flower-rich grassland. Annuals, tall ruderals and patches of mosses form the majority of the vegetation. Drought and nutrient-stress appears to be key factors in limiting the plant species composition. Inundation communities are present, but poorly represented. There do not appear to be any heath or lichen-rich communities. |
| 4. The site contains unvegetated, loose bare substrate and pools may be present. | Unvegetated and sparsely vegetated substrata occur patchily through the site. Early successional pools are present (as evidenced by dried out mud with algae/ stoneworts) but these had dried out at the time of the survey. The soil over most of the area has minimal organic matter accumulation. |
| 5. The survey area shows spatial variation, forming a mosaic of one or more of the early successional communities (a)–(h) above (criterion 3) plus bare substrate, within 0.25ha. | The habitat is very patchy, with small scale mosaics of wet and dry ground throughout, often interspersed with young scrub. The maturing grassland habitats all still support patches of bare soil. |

The criteria set out in the Wildlife Sites Guidance for Wales state that an open mosaic habitat on previously developed land could be considered for Wildlife Site selection, if 20 or more plant species from certain lists of habitat indicator species are present. In this case there are at least 40 indicator species present, and these are listed below:

*Anthyllis vulneraria*
*Blackstonia perfoliata*
*Carex divulsa*
*Carex flacca*
*Carex otrubae*
*Catapodium rigidum*
*Centaurea nigra*
*Centaurium erythraea*
*Dactylorhiza fuchsii*
*Daucus carota*
*Dipsacus fullonum*
*Echium vulgare*
*Erophila verna*
*Galium verum*
*Helminthotheca echioides*
*Hypericum perforatum*
*Hypochaeris radicata*
*Knautia arvensis*
*Lactuca serriola*
*Leucanthemum vulgare*
*Lotus corniculatus*
*Medicago lupulina*
*Ophrys apifera*
*Pastinaca sativa*
*Picris hieracioides*
*Plantago coronopus*
*Poa compressa*
*Ranunculus bulbosus*
*Rumex acetosa*
*Senecio erucifolius*
*Sison amomum*
*Tanacetum vulgare*
*Trifolium campestre*
*Trifolium pratense*
*Tussilago farfara*
*Valerianella carinata*
*Veronica arvensis*
*Vicia cracca*
*Vulpia myuros*
*Homalothecium lutescens*

The habitat over much of the site meets both sets of Open Mosaic Habitat criteria. However, the structural and species diversity are not spread equally, so some parts across the study area would not qualify. For example, the large area of mostly bare ground in the western block is not sufficiently variable or diverse to qualify in its present condition.

Overall, using the criteria set out in Table 10, the flora of this area is assessed as being important for nature conservation in a county context.

*Several weeks of hot, dry weather had dried out most of the site, but the remains of stoneworts and filamentous algae in some areas shows that there are pools of standing water during wet periods.*

# 5. Recommendations

The following recommendations are made for conserving the key botanical features of nature conservation value if the site were to be developed.

The main suggestion is to set aside some parts of the site for wildlife. These could also have public recreation and landscaping functions. When planning wildlife areas within any new development it is important to remember that the plant species at this site that are most valuable for nature conservation will do best on a low nutrient substratum, rather than deep, nutrient rich topsoil. Any new wildlife areas should include as much of the range of habitat diversity as is currently found on the site, i.e. sparse vegetation, species rich grassland, damp and dry conditions, and ideally with some wetland features.

Ideally any areas set aside for nature conservation should be managed according to a management plan. Much of the vegetation is also at a relatively early stage of succession, and in time will naturally develop to scrub. Therefore any attempt to maintain the range of species currently on the site in the long term will require sufficient resources for occasional vegetation management. Occasional scrub control and cut-and-collect mowing are likely to be important management methods for maintaining this type of vegetation in the long term. A distinctive feature of this vegetation is its patchiness, so any future vegetation management should not be applied uniformly across the whole area, but carried out in small areas, perhaps on a rotation basis to cut back a different section each year. Damp areas are likely to require more frequent management than dry areas because the vegetation will grow more quickly.

Many of the plant species characteristic of this type of drought-stressed open vegetation are well adapted to green roofs. If incorporating green roofs on any new buildings it would be preferable to use a diverse mix of native species, rather than a simple 'Sedum roof' mix.

No Schedule 9 non-native invasive species were recorded during the survey, but several plants were found that could become locally dominant and lower the botanical diversity in any future wildlife areas in this location. These include Mexican Fleabane, Sea Buckthorn, Goat's Rue, Butterfly Bush and non-native Dogwood Species. These should ideally not be included in planting plans and removed from wildlife areas (although it may not be practical to completely eradicate them).

No further botanical survey is proposed at present. However, further vegetation checks may be appropriate prior to starting any construction works, to ensure that examples of significant flora can be retained or translocated. The project ecologists should look out for additional notable / rare species, or Schedule 9 non-native invasive plants, in case there are any that only occur at low density or were undetectable during the current survey. Periodic botanical monitoring would be appropriate in the longer term, to help evaluate the success of any ecological mitigation measures.

# 6. References

CIEEM (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine. Chartered Institute of Ecology and Environmental Management, Winchester.

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Biodiversity Reporting and Information Group (2010). Open Mosaic Habitats on Previously Developed Land. In A. Maddock, ed. UK Biodiversity Action Plan; Priority Habitat Descriptions. Peterborough: Joint Nature Conservation Committee.

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Wales Biodiversity Partnership (2008). Guidelines for the Selection of Wildlife Sites in Wales.

# Appendix 1. Plant species list

The following species list presents the scientific and common names of the plant species identified on 26 and 29 May 2023. Due to the size of the site, the time of year and nature of the sampling, this should not be considered a comprehensive list of every plant species within the study area. In particular, some early flowering species may have already died back, and later-flowering plants may have evaded detection or not been confirmed to species.

An approximate indication of frequency of each species is given using the DAFOR scale (Dominant/ Abundant/ Frequent/ Occasional/ Rare, sometimes using the prefix L = Local e.g. LA = Locally abundant).

| Species | Common Name | Frequency |
|---|---|---|
| **VASCULAR PLANTS** | | |
| *Acer pseudoplatanus* | Sycamore | R |
| *Achillea millefolium* | Yarrow | R |
| *Agrostis capillaris* | Common Bent | R |
| *Agrostis gigantea* | Black Bent | R |
| *Agrostis stolonifera* | Creeping Bent | A |
| *Alnus cordata* | Italian Alder | O |
| *Alopecurus geniculatus* | Marsh Foxtail | O |
| *Anagallis arvensis* | Scarlet Pimpernel | R |
| *Anisantha madritensis* | Compact Brome | F |
| *Anisantha sterilis* | Barren Brome | R |
| *Anthoxanthum odoratum* | Sweet Vernal-grass | R |
| *Anthyllis vulneraria* | Kidney Vetch | O |
| *Arenaria serpyllifolia* | Thyme-Leaved Sandwort | O |
| *Armeria maritima* | Thrift | R |
| *Arrhenatherum elatius* | False Oat-grass | LO |
| *Barbarea vulgaris* | Winter-cress | R |
| *Bellis perennis* | Daisy | O |
| *Betula pendula* | Silver Birch | O |
| *Betula pubescens* | Downy Birch | R |
| *Blackstonia perfoliata* | Yellow-wort | O |
| *Brachypodium sylvaticum* | False Brome | O |
| *Bromus hordeaceus* | Soft Brome | A |
| *Buddleia davidii* | Butterfly Bush | A |
| *Calamagrostis epigejos* | Wood Small-reed | R |
| *Calystegia sepium* | Hedge Bindweed | O |
| *Cardamine cf hirsuta* | Hairy Bittercress | LF |
| *Carex binervis* | Green-ribbed Sedge | R |
| *Carex divulsa* | Grey Sedge | O |
| *Carex extensa* | Long-bracted Sedge | R |
| *Carex flacca* | Glaucous Sedge | O |
| *Carex hirta* | Hairy Sedge | F |
| *Carex otrubae* | False Fox-sedge | F |
| *Carex pendula* | Pendulous Sedge | F |
| *Carex remota* | Remote Sedge | R |
| *Carex riparia* | Greater Pond-sedge | R |
| *Carex sylvatica* | Wood Sedge | R |
| *Carex sp.* | Sedge (indet. ornamental) | R |
| *Catapodium rigidum* | Fern-grass | A |
| *Centaurea nigra* | Common Knapweed | LO |

| Species | Common Name | Frequency |
|---|---|---|
| *Centaurium erythraea* | Common Centaury | O |
| *Centranthus ruber* | Red Valerian | O |
| *Cerastium fontanum* | Common Mouse-ear | R |
| *Cerastium glomeratum* | Sticky Mouse-ear | O |
| *Cerastium semidecandrum* | Little Mouse-ear | F |
| *Cirsium arvense* | Creeping Thistle | LO |
| *Cirsium palustre* | Marsh Thistle | R |
| *Cirsium vulgare* | Spear Thistle | R |
| *Clematis vitalba* | Traveller's Joy | O |
| *Conyza cf bilbaoana* | Bilbao Fleabane | O |
| *Cordyline australis* | Cabbage-palm | R |
| *Cornus sanguinea ssp australis* | Southern Dogwood | F |
| *Cornus sericea* | Red-osier Dogwood | R |
| *Cortaderia selloana* | Pampas Grass | LO |
| *Crataegus monogyna* | Hawthorn | O |
| *Crepis vesicaria* | Beaked Hawkbit | F |
| *Cymbalaria muralis* | Ivy-leaved Toadflax | R |
| *Cynosurus cristatus* | Crested Dog's-tail | O |
| *Cytisus scoparius* | Broom | R |
| *Dactylis glomerata* | Cock's-foot Grass | F |
| *Dactylorhiza fuchsii* | Common Spotted-orchid | R |
| *Daucus carota* | Wild Carrot | F |
| *Dipsacus fullonum* | Teasel | O |
| *Echium vulgare* | Viper's Bugloss | R |
| *Elytrigia repens* | Couch | LO |
| *Epilobium ciliatum* | American Willowherb | O |
| *Epilobium hirsutum* | Greater Willowherb | R |
| *Epilobium parviflorum* | Hoary Willowherb | O |
| *Epilobium sp.* | Willowherb | O |
| *Equisetum arvense* | Field Horsetail | O |
| *Equisetum telmateia* | Giant Horsetail | O |
| *Erigeron karvinskianus* | Mexican Fleabane | O |
| *Erophila verna* | Common Whitlowgrass | O |
| *Ervilia hirsuta* | Hairy Tare | F |
| *Eupatorium cannabinum* | Hemp Agrimony | O |
| *Euphorbia peplus* | Petty Spurge | R |
| *Festuca rubra* | Red Fescue | A |
| *Foeniculum vulgare* | Fennel | O |
| *Fragaria vesca* | Wild Strawberry | O |
| *Galega officinalis* | Goats Rue | LA |
| *Galium album* | Hedge Bedstraw | O |
| *Galium aparine* | Cleavers | O |
| *Galium palustre* | Marsh Bedstraw | R |
| *Galium verum* | Lady's Bedstraw | LO |
| *Geranium dissectum* | Cut-leaved Crane's-bill | F |
| *Geranium molle* | Dove's-foot Crane's-bill | R |
| *Geranium robertianum* | Herb Robert | O |
| *Geranium rotundifolium* | Round-leaved Crane's-bill | R |
| *Griselinia littoralis* | New Zealand Broad-leaf | R |
| *Hedera helix sl* | Ivy | R |
| *Helminthotheca echioides* | Bristly Ox-tongue | O |

| Species | Common Name | Frequency |
|---|---|---|
| *Hieracium sp.* | Hawkweed | R |
| *Hippophae rhamnoides* | Sea Buckthorn | R |
| *Hirschfeldia incana* | Hoary Mustard | F |
| *Holcus lanatus* | Yorkshire Fog | F |
| *Hyacinthoides hispanica* | Spanish Bluebell | R |
| *Hylotelephium spectabile* | Butterfly Stonecrop | R |
| *Hypericum androsaemum* | Tutsan | R |
| *Hypericum perforatum* | Perforate St. John's-wort | F |
| *Hypochaeris radicata* | Common Cat's-Ear | O |
| *Iris pseudacorus* | Yellow Flag | R |
| *Isolepis setacea* | Bristle Club-rush | R |
| *Juncus articulatus* | Jointed Rush | LF |
| *Juncus bufonius* | Toad Rush | O |
| *Juncus effusus* | Soft Rush | R |
| *Juncus inflexus* | Hard Rush | LF |
| *Knautia arvensis* | Field Scabious | LO |
| *Kniphofia sp.* | Red-hot Poker | R |
| *Lactuca serriola* | Prickly Lettuce | R |
| *Lathyrus pratensis* | Meadow Vetchling | O |
| *Leontodon hispidus* | Rough Hawk-bit | O |
| *Leucanthemum vulgare* | Ox-eye Daisy | LF |
| *Linaria purpurea* | Purple Toadflax | R |
| *Linum bienne* | Pale Flax | R |
| *Lolium perenne* | Perennial Rye-grass | O |
| *Lonicera nitida* | Wilson's Honeysuckle | R |
| *Lonicera pileata* | Box-leaved Honeysuckle | R |
| *Lotus corniculatus* | Common Bird's-foot Trefoil | F |
| *Lotus pedunculatus* | Greater Bird's-foot Trefoil | R |
| *Lycopus europaeus* | Gypsywort | R |
| *Lysimachia nummularia* | Creepy Jenny | R |
| *Lysimachia punctata* | Dotted Loosestrife | R |
| *Medicago lupulina* | Black Medick | O |
| *Melilotus albus* | White Melilot | R |
| *Melilotus altissimus* | Tall Melilot | R |
| *Mentha cf spicata* | Spearmint | R |
| *Myosotis arvensis* | Field Forget-me-not | O |
| *Oenothera sp.* | Evening Primrose | R |
| *Ophrys apifera* | Bee Orchid | O |
| *Papaver rhoeas* | Common Poppy | R |
| *Pastinaca sativa* | Wild Parsnip | F |
| *Phragmites australis* | Common Reed | LF |
| *Picris hieracioides* | Hawkweed Ox-tongue | LF |
| *Pilosella aurantiaca* | Fox-and-cubs | R |
| *Plantago coronopus* | Buck's-horn Plantain | F |
| *Plantago lanceolata* | Ribwort Plantain | O |
| *Plantago major* | Greater Plantain | O |
| *Poa annua* | Annual Meadow-grass | O |
| *Poa compressa* | Flattened Meadow-grass | R |
| *Poa pratensis* | Smooth Meadow-grass | R |
| *Poa trivialis* | Rough Meadow-grass | LF |
| *Polypogon viridis* | Water Bent | R |

| Species | Common Name | Frequency |
|---|---|---|
| *Populus alba* | White Poplar | R |
| *Potentilla anserina* | Silverweed | LO |
| *Potentilla reptans* | Creeping Cinquefoil | F |
| *Prunella vulgaris* | Self-Heal | O |
| *Prunus lusitanica* | Portugal Laurel | R |
| *Pulicaria dysenterica* | Fleabane | F |
| *Ranunculus acris* | Meadow Buttercup | O |
| *Ranunculus bulbosus* | Bulbous Buttercup | R |
| *Ranunculus repens* | Creeping Buttercup | O |
| *Reseda luteola* | Weld | R |
| *Rorippa austriaca* | Austrian Yellow-cress | O |
| *Rosa canina* | Dog Rose | O |
| *Rubus fruticosus (agg)* | Bramble | F |
| *Rumex acetosa* | Common Sorrel | R |
| *Rumex conglomeratus* | Clustered Dock | R |
| *Rumex crispus* | Curled Dock | O |
| *Rumex obtusifolius* | Broad-Leaved Dock | R |
| *Rumex sanguineus* | Wood Dock | R |
| *Sagina apetala* | Annual Pearlwort | F |
| *Sagina procumbens* | Procumbent Pearlwort | R |
| *Salix caprea* | Goat Willow | R |
| *Salix cinerea* | Grey Willow | LF |
| *Salix sp.* | Willow (indet. hybrid) | R |
| *Salvia verbenacea* | Wild Clary | R |
| *Sambucus nigra* | Elder | R |
| *Schedonorus arundinaceus* | Tall Fescue | F |
| *Scrophularia auriculata* | Water Figwort | O |
| *Senecio erucifolius* | Hoary Ragwort | O |
| *Senecio inaequidens* | Narrow-leaved Ragwort | R |
| *Senecio jacobaea* | Ragwort | O |
| *Sison amomum* | Stone Parsley | R |
| *Solanum dulcamara* | Bittersweet | R |
| *Sonchus oleraceus* | Smooth Sow-thistle | R |
| *Sorbus aucuparia* | Rowan | R |
| *Symphytum x uplandicum* | Russian Comfrey | R |
| *Tanacetum vulgare* | Tansy | R |
| *Taraxacum* sp. | Dandelion | O |
| *Trifolium campestre* | Hop Trefoil | O |
| *Trifolium dubium* | Lesser Trefoil | F |
| *Trifolium hybridum* | Alsike Clover | O |
| *Trifolium pratense* | Red Clover | F |
| *Trifolium repens* | White Clover | F |
| *Tripleurospermum inodorum* | Scentless Mayweed | O |
| *Tussilago farfara* | Colt's Foot | O |
| *Typha cf latifolia* | Bulrush | R |
| *Ulex europaeus* | Common Gorse | R |
| *Ulex gallii* | Western Gorse | R |
| *Urtica dioica* | Nettle | R |
| *Valerianella carinata* | Keel-fruited Cornsalad | R |
| *Veronica arvensis* | Wall Speedwell | O |
| *Veronica chamaedrys* | Germander Speedwell | R |

| Species | Common Name | Frequency |
|---|---|---|
| *Veronica persica* | Common Field-speedwell | O |
| *Veronica serpyllifolia* | Thyme-leaved Speedwell | R |
| *Vicia cracca* | Tufted Vetch | R |
| *Vicia sativa* | Common Vetch | F |
| *Vulpia myuros* | Rat's-tail Fescue | A |
| **ALGAE** (prominent species only) | | |
| *Chara vulgaris* | Stonewort | R |
| **BRYOPHYTES** (prominent species only) | | |
| *Barbula sp.* | Bird's-claw Beard-moss | F |
| *Brachythecium rutabulum* | Rough-stalked Feather-moss | O |
| *Bryum sp.* | Thread-moss | F |
| *Bryum argenteum* | Silver-moss | R |
| *Calliergonella cuspidata* | Pointed Spear-moss | A |
| *Cratoneuron filicinum* | Fern-leaved Hook-moss | F |
| *Fissidens sp.* | Pocket-moss | R |
| *Homalothecium lutescens* | Yellow Feather-moss | O |
| *Kindbergia praelonga* | Common Feather-moss | R |