

Appendix 5.3. Alluvial Woodland Survey Report

Mortarstown Wastewater Treatment Plant

Assessment of River Corridor Woodland

Version: Rev3 - updated following Uisce Éireann review

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1. Introduction

Uisce Éireann is in the process of upgrading the wastewater treatment plant and associated pumping station and outfall in the vicinity of Mortarstown, Carlow Town, Co. Carlow. The existing infrastructure lies adjacent to the River Barrow (see Figure 1), which supports continuous woodland cover along the river corridor. The study area is within the River Barrow and River Nore SAC (see Figure 1), for which the Annex I priority habitat ‘*Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*)’ (code: 91E0) is a qualifying interest.

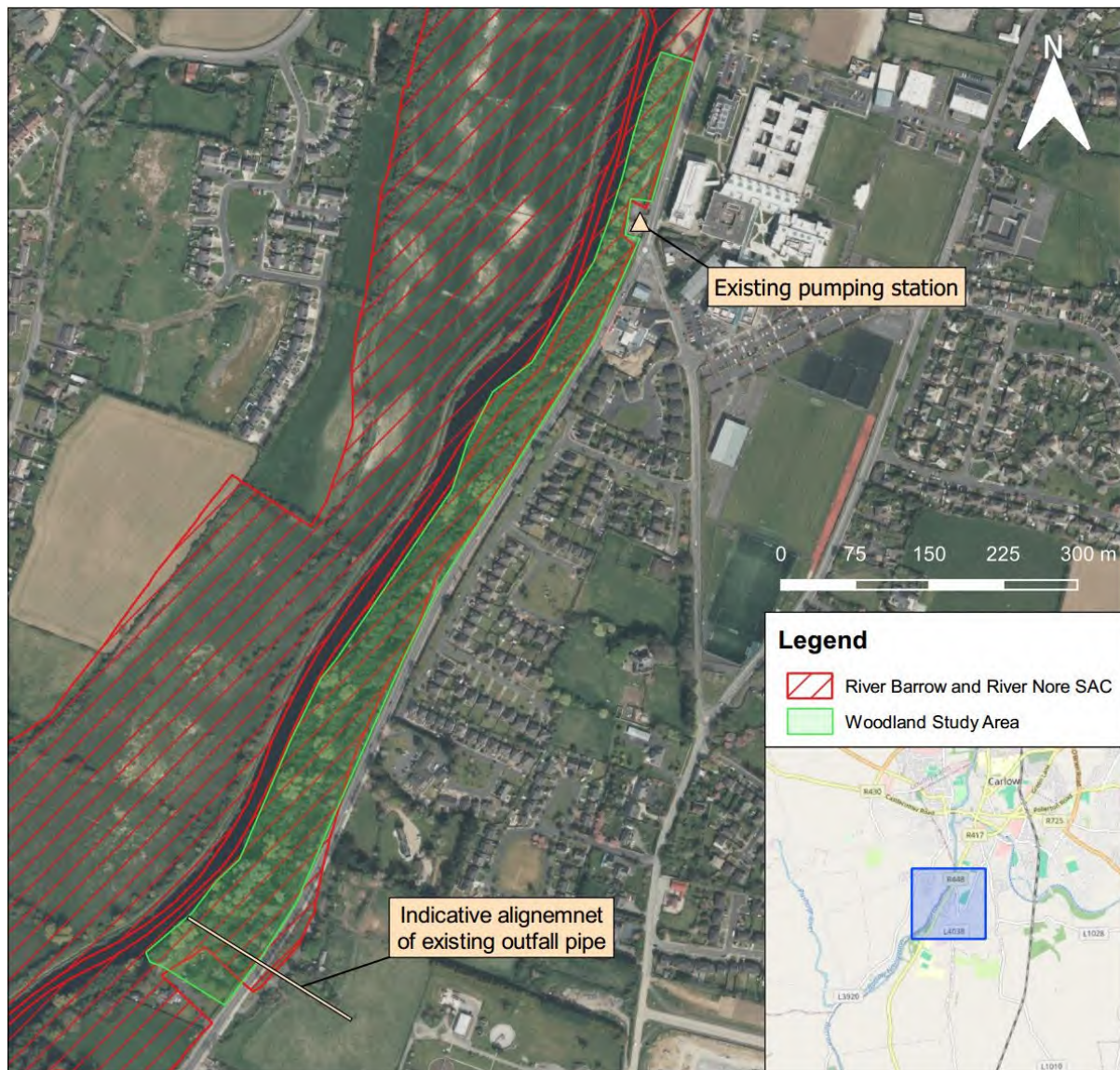


Figure 1: Study area for assessment of river corridor woodland at Mortarstown, showing overlap with the River Barrow and River Nore SAC.

AtkinsRéalis was contracted to provide environmental services in relation to the proposed project, including preparation of a Natura Impact Statement assessing the implications for the integrity of the SAC. To that end, a consultant botanical ecologist, Mary O'Connor PhD, was engaged to assess the occurrence and extent of alluvial woodland habitat in the general area of the proposed project. This habitat assessment is to support the Natura Impact Statement.

1.1. Note on Rev 2.0 and Subsequent Revisions

Following on from a project team meeting in December 2023, it was decided that classifying the vegetation composition of the alluvial woodland habitats in the study area using the Irish Vegetation Classification (IVC) would add further value to the survey data by facilitating comparison with sites of similar vegetation composition. The IVC seeks to provide a single, unified framework which describes in detail all Irish natural and semi-natural vegetation based on floristic composition alone. As such, it is not a habitat classification, but is useful in identifying habitats when used in conjunction with other information (e.g. on edaphic conditions, topography, hydrological regime and management practices) in the context of an appropriate habitat classification system. Mixed broadleaf woodland, scrub and other non-Annex I habitats were not included in the IVC classification of the site.

2. River Barrow and River Nore SAC

The Barrow River in the study area in Co. Carlow forms part of the River Barrow and River Nore SAC (Site Code: 002162). A summary of the Site Synopsis for this SAC is provided below.

‘This SAC consists of the freshwater stretches of the Barrow/Nore River catchments as far upstream as the Slieve Bloom Mountains and it also includes the tidal elements and estuary as far downstream as Creadun Head in Waterford. The larger of the many tributaries include the Lerr, Fushoge, Mountain, Aughavaud, Owenass, Boherbaun and Stradbally Rivers of the Barrow and the Delour, Dinin, Erkina, Owveg, Munster, Arrigle and King’s Rivers on the Nore. Both rivers rise in the Old Red Sandstone of the Slieve Bloom Mountains before passing through a band of Carboniferous shales and sandstones.

The upper reaches of the Barrow also run through limestone. The middle reaches and many of the eastern tributaries, sourced in the Blackstairs Mountains, run through Leinster Granite. The southern end runs over intrusive rocks poor in silica.’

The site is an SAC selected for alluvial wet woodlands and petrifying springs, priority habitats on Annex I of the E.U. Habitats Directive. The site is also selected as an SAC for old oak woodlands, floating river vegetation, estuary, tidal mudflats, *Salicornia* mudflats, Atlantic salt meadows, Mediterranean salt meadows, dry heath and eutrophic tall herbs, all habitats listed on Annex I of the E.U. Habitats Directive. The site is also selected for the following species listed on Annex II of the same directive – Sea Lamprey, River Lamprey, Brook Lamprey, Freshwater Pearl Mussel, Nore Freshwater Pearl Mussel, Crayfish, Twaite Shad, Atlantic Salmon, Otter, Desmoulin’s Whorl Snail *Vertigo moulinsiana* and the Killarney Fern. Other habitats which occur throughout the site include wet grassland, marsh, reed swamp, improved grassland, arable land, quarries, coniferous plantations, deciduous woodland, scrub and ponds.

Site-specific conservation objectives for the River Barrow and River Nore SAC were published in July 2011. The conservation objective for each qualifying interest, for which the SAC was selected, is to maintain or restore, as appropriate depending on the current conservation status of the qualifying interest, the favourable conservation condition of the Annex I habitat or Annex II species, as defined by a specific list of attributes and targets.

This report looks in more detail at the alluvial wet woodland habitat, Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*)’ (code: 91E0) which occur in an area of proposed wastewater infrastructure works, south of Carlow town centre.

2.1. Alluvial Woodland in the Barrow Nore SAC

‘*Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*)’ (code: 91E0), or “alluvial woodland” for short, is a natural habitat type listed on Annex I to the Habitats Directive (92/43/EEC) and covers a number of different woodland types, including the following as described for the River Barrow and River Nore SAC (NPWS 2011):

- Gallery woodland dominated by tree willows, principally *Salix triandra*, *S. alba*, *S. fragilis* and *S. viminalis*. This community consists of small, narrow stands on the riverbanks and islands where the trees are subject to frequent flooding and/or have their roots permanently in water. It occurs principally in the lower reaches of the rivers where there is tidal influence. The vegetation is typically characterised by a tangle of fallen and sprawling trees and shrubs and a luxuriant tall herb layer, which includes nettle, reed canary-grass and bindweed.

- Ash-ivy woodland with wood avens and wood speedwell. This community occurs further back from the river where flooding is less frequent, and the soils normally dry out in the summer. Typically, it is species-rich with a rich shrub and field layer, often including abundant geophytes, e.g. celandine, bluebell, wild garlic.
- Alder-meadowsweet woodland. Communities of wet, gleyed soils which are either frequently inundated or have a permanently high-water table. Three sub-types are recognised, depending on the hydrology. Typically, they occur in depressions within the ash woodlands or are associated with seepage zones or springs.

Many of the alluvial woodlands, especially the gallery woodlands, are relatively narrow stands.

Non-annexed ash woodlands and conifer plantations often provided continuity of woodland cover.

Alluvial woodland is a qualifying interest of the River Barrow and River Nore SAC, with its conservation objective being to restore its favourable conservation condition in the SAC.

A target specified in the River Barrow and River Nore SAC *Conservation objectives supporting document – woodland habitats* (NPWS 2011) should be to increase native woodland size to 3ha for small woods and 25ha for large woods, based on the recommendations of Peterken (1993). However, the topography, land ownership and surrounding land use may constrain these targets.

3. Understanding the Alluvial Woodland Habitat

In *Irish Wildlife Manual No. 146: Monitoring and assessment of four Annex I woodland habitats*, Daly et al. (2023) describe alluvial woodland as being widespread but localised in Ireland, sometimes occurring as part of a mosaic with other woodland types. Hydrology is the main factor determining the vegetation, with Daly et al. (2023) stating that “*Flooding may occur frequently (annually or more often) or infrequently (at intervals of several years)*”. The IVC shows affinities between all communities in the WL3 ‘*Alnus glutinosa – Filipendula ulmaria* group’ with the Annex I priority habitat ‘*Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*)’ (91E0) and Daly et al. (2023) states that “*Where a vegetation type is assigned to the WL3 group and conforms to the criteria above regarding hydrological conditions, it should be classified as 91E0*”.

The alluvial woodland in the study area is also considered to broadly correspond to the British National Vegetation Classification type W6 *Alnus glutinosa-Urtica dioica* (as defined in Rodwell 1991). These are also known as sequential successional, or mosaic forests and typically comprise fast-growing, early successional woody species in the overstorey (e.g. willow, alder, and or birch as is found in many areas of the River Barrow corridor, including the woodland corridor south of Carlow Town) and as such, rely on periodic disturbances for the replacement of suitable regeneration sites for these species. The pioneer woodland species making up residual alluvial forests often do not survive more than 60-80 years (Rood & Mahoney, 1990; Décamps, 1996) and thus, medium to high-magnitude floods are needed at least every circa 50 years for forest renewal (Cordes et al., 1997). According to Brinson's conceptual model (1990), where the frequency and magnitude of floods are inversely proportional, low-frequency high magnitude floods affect the whole floodplain and significantly alter the landscape (e.g. create oxbow lakes). Extensive regeneration of riparian communities can be associated with these flooding events (Cordes et al., 1997). Medium-power intermediate-frequency floods are also important for the creation of suitable sites for regeneration. For example, 1-in-20-year floods are necessary to maintain riparian regeneration; these medium-sized floods act to clear away vegetation and contribute fine sediments to create regeneration niches (Cordes et al., 1997). Low magnitude, high frequency floods do not play a significant role in terms of the creation of regeneration sites but are important for the replenishment of underground water sources, sediment deposits and for the maintenance of the establishment sites of pioneer communities (e.g. removal of aggressive competitors) (Stromberg & Patten, 1990). Where the timing, intensity, frequency and (or) duration of flood disturbances are disrupted and become insufficient to maintain typical early successional woody riparian species assemblages, there will either be a gradual transformation of the floodplain woodland towards a climax hardwood community, regenerated through autogenic processes (e.g. competition and gap formation) (Amoros et al., 1987a).

The woodland vegetation communities within a river basin are naturally diverse reflecting the patterns in valley morphology and the dynamics of fluvial metamorphosis (Piegay et al., 2000). A typical floodplain should exhibit patch-scale variation ordered along a gradient from species-poor pioneer communities on frequently disturbed ground to more diverse riparian woodland with species such as alder and willow on older stable deposits which, in time, is invaded by species such as ash or oak. In poorly drained areas the disturbance-dependant alder communities will persist. However, on better drained alluvial soils where flooding has become infrequent due to stabilisation of the river channel, terrestrial succession will lead to mixed broadleaved woodland, including oak, ash and sycamore. In addition to this natural diversity, anthropogenic pressures have altered the course of natural succession and vegetation development can be interrupted.

It is therefore important to consider the mosaic and continuum nature of the riparian/alluvial woodland habitat which generally displays a vegetation which follows a gradient from areas of standing water through areas of frequent to infrequent flooding and dry areas where naturally oak/ash woodlands become dominant. The woodland cannot be considered to follow a single hydrological regime but to contain sites of many hydrological and ecological niches. It is therefore not possible to draw boundary lines on vegetation which is by its nature a mosaic type, including wet, damp and dry facies as part of a complex mosaic which should be considered together as an ecological unit.

The *Interpretation Manual of EU Habitats* (DG Env, 2013) definition of the priority Annex I habitat ‘*Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*)’ (91E0) is presented in Appendix 4. This definition focusses on vegetation composition and the interaction of hydrological regime and edaphic factors.

4. Site Investigation

4.1. Field Survey

A site visit was carried out in June 2023 as part of site assessment.

This survey involved a walk-over of the site. An inventory of the occurrence of habitat and species of conservation importance at the site was carried out in the field. Habitats were classified using the standard nomenclature from *A Guide to Habitats in Ireland* (Fossitt 2000) and the constituent species were recorded in these habitats; a full species list is presented in Appendix 1. The floristic composition of riparian woodland areas was also classified using the IVC.

In tandem with this habitat assessment a topographical survey of the site was also carried out which showed in detail elevation levels at the site; see Appendix 2.

4.2. Habitats, following the Fossitt (2000) Classification, and Woodland Communities, following the IVC

4.2.1. North and West of the Existing Pumping Station

Dry Meadows and Grassy Verges (GS2), Scrub (WS1) and Riparian Woodland (WN5)

‘Dry meadows and grassy verges’ (GS2) occurs in an area where there is occasional vehicle access, north of the existing pumping station where the grasses had not recently been cut and had grown tall and become rank. Typical species included Cock’s Foot (*Dactylis glomerata*), Yorkshire Fog (*Holcus lanatus*), False Oat Grass (*Arrhenatherum elatius*), Creeping Buttercup (*Ranunculus repens*), Meadow Vetchling (*Lathyrus pratensis*), Bush Vetch (*Vicia sepium*), Ribwort Plantain (*Plantago lanceolata*), Hogweed (*Heracleum spondylium*), Knapweed (*Centaurea nigra*) and Nettle (*Urtica dioica*). The habitat forms a mosaic with ‘Scrub’ (WS1) dominated by Bramble (*Rubus fruticosus* agg.). There are areas of prolific Hedge Bindweed (*Calystegia sepium*) growing through the bramble layer.

Adjoining this habitat and down the slope, there is a thin strip of mature ‘Riparian woodland’ (WN5) on the banks of the River Barrow, dominated by Willow (*Salix* spp., including *Salix alba*), Alder (*Alnus glutinosa*) and Poplar (*Populus* spp.) trees, with some Hawthorn (*Crataegus monogyna*). Herb species in this habitat include Creeping Bent (*Agrostis stolonifera*), Water Mint (*Mentha aquatica*), Reed Canary-grass (*Phalaris arundinacea*), Wood Dock (*Rumex sanguineus*) and Nettle (*Urtica dioica*). This vegetation composition corresponds to the IVC community ‘*Salix cinerea* – *Urtica dioica* / Grey Willow – Common Nettle woodland’ (code: WL3D). The full IVC synopsis for this community type is presented in Appendix 3. As per this synopsis, stands of this woodland type occurring along rivers and subject to periodic inundation, as is the case here, qualify as priority Annex I alluvial woodland. Similarly, the *Interpretation Manual of EU Habitats* (DG Env, 2013) states that the priority Annex I habitat occurs “on heavy soils (generally rich in alluvial deposits) periodically inundated by the annual rise of the river (or brook) level, but otherwise well-drained and aerated during low-water”, which is also the case here. Therefore, given the vegetation composition, hydrological regime and edaphic conditions, the narrow strip of riparian woodland north and west of the existing pumping station qualifies as priority Annex I alluvial woodland. This area is indicated as zone A in Figure 2 below.

There is some occurrence of the invasive species Himalayan Balsam (*Impatiens glandulifera*) along the riverbank and Water fern (*Azolla filiculoides*) in the shallow water occurring in the shallows water.

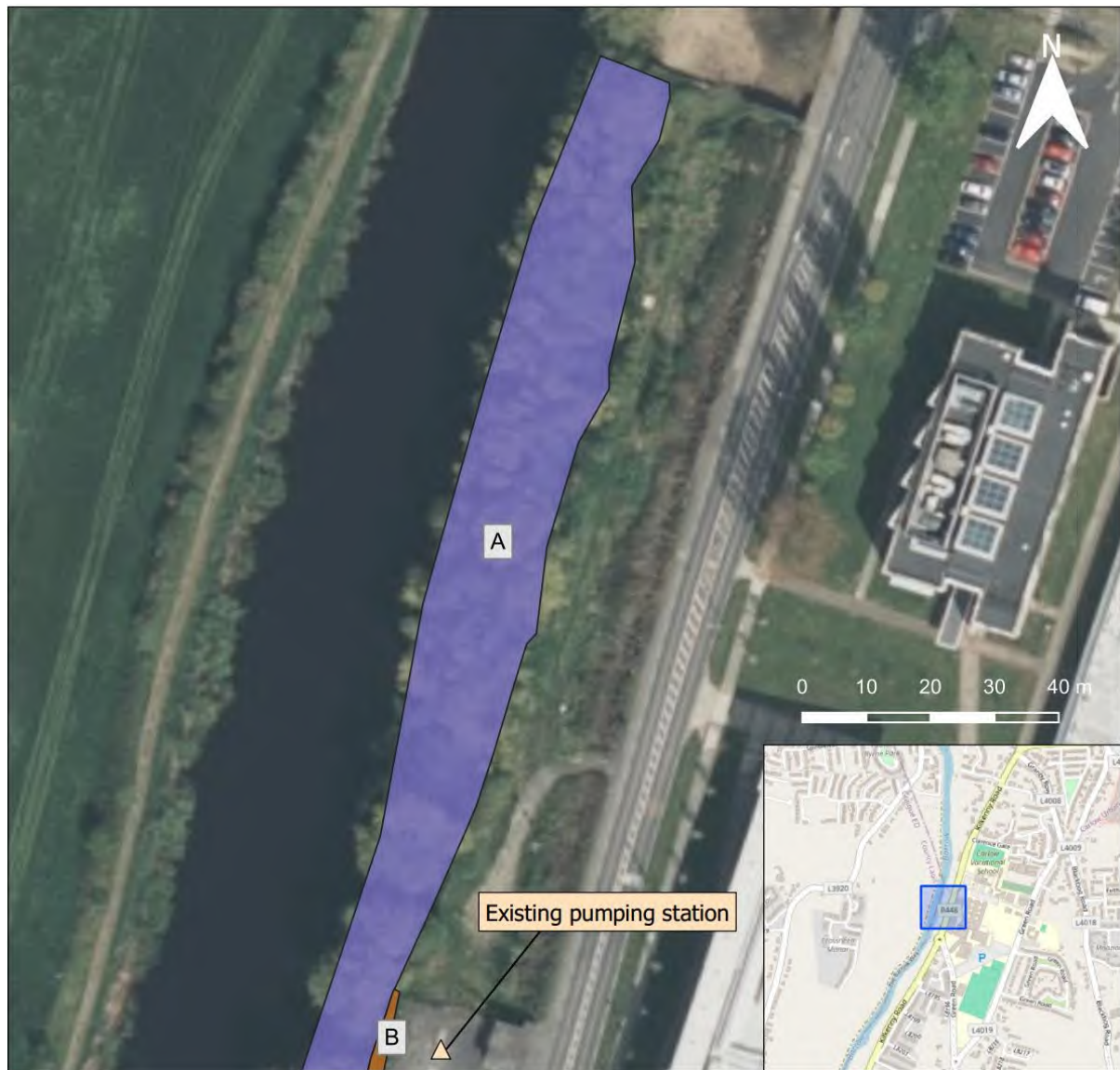


Figure 2: Extent of woodland habitats north of the existing pumping station.



Photos 1 and 2: Dry meadow (GS2), scrub (WS1) and a thin strip of riparian woodland (WN5) north of the existing pumping station.



Photo 3: 'Salix cinerea – Urtica dioica / Grey Willow – Common Nettle woodland community' (WL3D) north of the existing pumping station.



Photo 4: 'Salix cinerea – Urtica dioica / Grey Willow – Common Nettle woodland community' (WL3D) west of the existing pumping station.

4.2.2. South of the Existing Pumping Station

Scrub (WS1)

Immediately south of the pumping station is an area of early successional-stage scrub dominated by bramble (*Rubus fruticosus* agg.) with abundant weedy species including nettle (*Urtica dioica*), hedge bindweed (*Calystegia sepium*), false oat-grass (*Arrhenatherum elatius*), great willowherb (*Epilobium hirsutum*), with some immature willow (*Salix* spp.) spreading and sycamore (*Acer pseudoplatanus*). There is no canopy development and very low woody component. This vegetation composition and structure is indicative of past disturbance to the site.



Photos 5 and 6: 'Scrub' (WS1) immediately south of the existing pumping station.

This area is indicated as zone D in Figure 3 below. The ground level in zone D is almost entirely above the 1-in-100-year flood level, and the small portion below this level is still above the 1-in-10-year level. As zone D has no canopy, it is not a woodland, and as it is not regularly flooded (nor is there any groundwater flushing), the hydrological regime is not suitable for alluvial woodland. Furthermore, zone D does not provide any significant supporting function to adjacent woodland.



Figure 3: Distribution and extents of woodland habitats south of the existing pumping station.

Mixed Broadleaved Woodland (WD1) with elements of Willow-Alder-Ash Woodland (WN6)

The woodland habitats in zones A, B and C support canopy species including willows (*Salix* spp.), Alder (*Alnus glutinosa*) and Ash (*Fraxinus excelsior*), mixed with other species such as Sycamore (*Acer pseudoplatanus*), Hawthorn (*Crataegus monogyna*), Birch (*Betula pubescens*) and Elder (*Sambucus nigra*). Meadowsweet (*Filipendula ulmaria*), Remote Sedge (*Carex remota*) and Creeping Bent (*Agrostis stolonifera*) occur in damper areas. Other common components of the field layer include Bramble (*Rubus fruticosus* agg.), Ivy (*Hedera helix*), Creeping Buttercup (*Ranunculus repens*), Meadowsweet (*Filipendula ulmaria*), Nettle (*Urtica dioica*), and Lady-fern (*Athyrium filix-femina*).

Lower in the woodland (indicated as zone A in Figure 3 above), there are open areas of bare exposed soil evidently associated with more frequent inundation from river water and areas of slightly higher elevation where wetland herbaceous species occur such as Meadowsweet (*Filipendula ulmaria*), Creeping Bent (*Agrostis stolonifera*), Water Mint (*Mentha aquatica*), Wood Dock (*Rumex sanguineus*) and species indicative of disturbance such as Nettle (*Urtica dioica*) and enrichment such as Creeping buttercup (*Ranunculus repens*). These species are common elements of alluvial woodland habitat. As

per the woodland north of the pumping station, the floristic composition of zone A is reflective of IVC community type WL3D and the habitat qualifies as priority Annex I alluvial woodland.

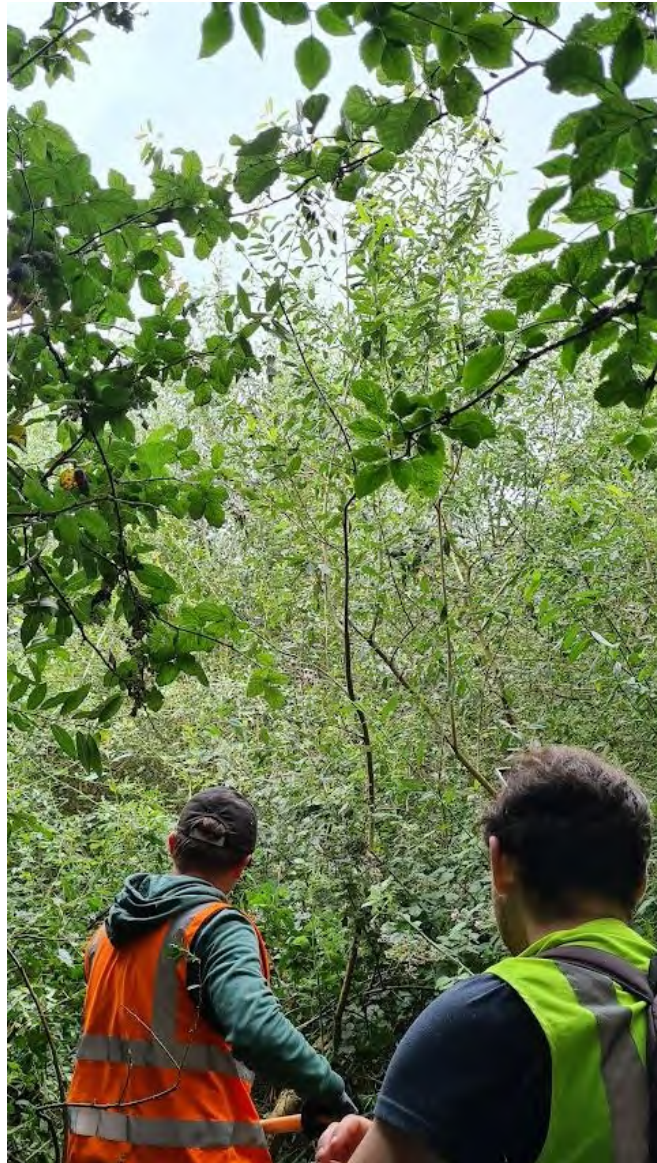


Photo 7: 'Salix cinerea – Urtica dioica / Grey Willow – Common Nettle woodland community' (WL3D) south of the existing pumping Station.

In the area indicated as zone B in Figure 3 above, there is a narrow band of woodland which reflects a transitional woodland community, with some characteristics of priority Annex I alluvial woodland in terms of canopy composition, but the soil is lower in alluvium and less frequently inundated. Above the 1-in-10-year flood level, the combination of floristic composition, hydrological regime and edaphic conditions were observed to no longer meet the criteria for priority Annex I alluvial woodland, while still being broadly reflective of the IVC community type WL3D and providing continuity of canopy cover and source of regenerative capacity for the adjoining priority Annex I alluvial woodland in zone A following flooding or other disturbance.

As the change in habitat type from zone A to zone B is gradual, the boundary between the zones as mapped in Figure 3 above indicates the upper edge of this continuum, thus the area mapped as zone A indicated the maximum extent of the priority Annex I habitat.

Further up the slope from the river, above the 1-in-100-year flood level, in the area indicated as zone C in Figure 3 above, species such as Ivy (*Hedera helix*), Herb-Robert (*Geranium robertianum*), Lesser Celandine (*Ficaria verna* subsp. *verna*) become more common as the woodland floor becomes drier and more stable. The vegetation in zone C represents 'Mixed broadleaved woodland' (WD1) with elements of 'Wet willow-alder-ash woodland' (WN6). Canopy species also reflect drier conditions (flooded only very infrequently), with species such as Horse Chestnut (*Aesculus hippocastanum*) occurring here. This strip of woodland does not correspond to any Annex I habitat and unlikely provides any supporting function (for the priority Annex I alluvial woodland in zone A) other than continuity of high-canopy cover and as a buffer from non-woodland habitats.

The invasive alien species Himalayan Balsam (*Impatiens glandulifera*), Winter Heliotrope (*Petasites pyrenaicus*) and Traveller's Joy (*Clematis vitalba*) also occur in zones A, B, C and D south of the existing pumping station site. During a site visit on 10th April 2024, it was evident that most of the part of zones C and D in this area had recently been disturbed, likely during the installation of a new surface water outfall in this area.



Photos 8 and 9: Transitional area of high-canopy woodland south of the existing pumping station - 'Mixed broadleaved woodland' (WD1) with elements of 'Wet willow-alder-ash woodland' (WN6), note bare ground in lower areas of woodland with more frequent inundation and ivy cover on the woodland floor upslope from river.



Photos 10 and 11: Transitional area of high-canopy woodland south of the existing pumping station - 'Mixed broadleaved woodland' (WD1) with elements of 'Wet willow-alder-ash woodland' (WN6), note bare ground in lower areas of woodland with more frequent inundation and ivy cover on the woodland floor upslope from river.

4.2.3. Woodland Associated with the Outfall Pipe

Scrub (WS1) and high-canopy Riparian Woodland (WN5)

At the time of survey, along the line of the outfall was an area of low-canopy¹ willow and bramble scrub with abundant weedy species nettle, hedge bindweed, false oat-grass, great willowherb, with some grey willow spreading, sycamore, elder and hazel. This area is mapped as zone E in Figure 4 below. The ground level here was artificially raised in the past and is well above the 1-in-100-year flood level, with little to no alluvium content in the soil. Zone E does not qualify as priority Annex I alluvial woodland habitat and does not provide suitable hydrological regime or soil conditions for this habitat. This scrub provides limited supporting function for the adjoining priority Annex I alluvial woodland in zone A, i.e. continuity of woodland canopy and a source of willow regeneration following damage. This

¹ The canopy in zone E is low (<5m above ground level) but is at a similar level to the adjoining high-canopy alluvial woodland in zone A as the ground level is raised significantly.

vegetation composition and structure in zone E is indicative of past disturbance. Furthermore, during a site visit on 10th April 2024, it was evident that most of the willow and bramble scrub along the outfall line had recently been clear and the ground levelled, leaving only one small stand of low-growing willows immediately adjacent to the outfall alignment through zone E (see Photo 12 below).



Photo 12: Recent clearance and ground levelling over outfall alignment (indicative alignment shown in red).

The artificially raised ground in zone E falls sharply into an area dominated by White Willow (*Salix alba*) on the banks of the River Barrow; indicated as zone A in Figure 4 below. This vegetation composition of woodland here corresponds to the IVC community type WL3D. This woodland is contiguous with the priority Annex I alluvial woodland to the north, dominated by White Willow (*Salix alba*). Other species occurring here which are positive indicator species for alluvial woodland habitat include Alder (*Alnus glutinosa*), Hawthorn (*Crataegus monogyna*), Ash (*Fraxinus excelsior*), Grey Willow (*Salix cinerea*) and other willows (*Salix* spp.), and herbaceous species Creeping Bent (*Agrostis stolonifera*), Wild Angelica (*Angelica sylvestris*), Meadowsweet (*Filipendula ulmaria*), Marsh Bedstraw (*Galium palustre*), Flag Iris (*Iris pseudacorus*), Water Mint (*Mentha aquatica*), Reed Canary-grass (*Phalaris arundinacea*), Wood Dock (*Rumex sanguineus*) and Nettle (*Urtica dioica*).

There is a very small remnant population of the invasive alien species Japanese Knotweed (*Fallopia japonica*) in zone E and this part of zone A. This infestation has undergone treatment and is now under effective control, but ongoing monitoring is required.



Figure 4: Distribution and extents of woodland habitats in the vicinity of the existing outfall pipe.



Photos 13 and 14: Willow and bramble scrub (WS1) (left) and riparian woodland (WN5) (right).

5. Linking to the Topographic Survey

A topographic map of the survey area was prepared; see Appendix 2. This, in conjunction with flood heights provided by the OPW, allowed for the identification of areas where 1-in-10-year flood and 1-in-100-year flooding occurred on the site; indicated by the contours in Figures 5 and 6 below.

Figures 5 and 6 show that much of the study area is regularly inundated from the River Barrow and this is reflected in the vegetation composition and soil conditions which were observed on site. Parts of the study area which are above the level of regular inundation, but which still contain a continuum of woodland habitat and some alluvial substratum, were observed to be generally between the 1-in-10-year and 1-in-100-year flood contours, and this is reflected in the mapping of zone B in Figures 3 and 4 above.

As such, the topographical survey results provided a useful basis for accurate mapping of the ecological zonation observed within the woodland study area during the botanical survey.

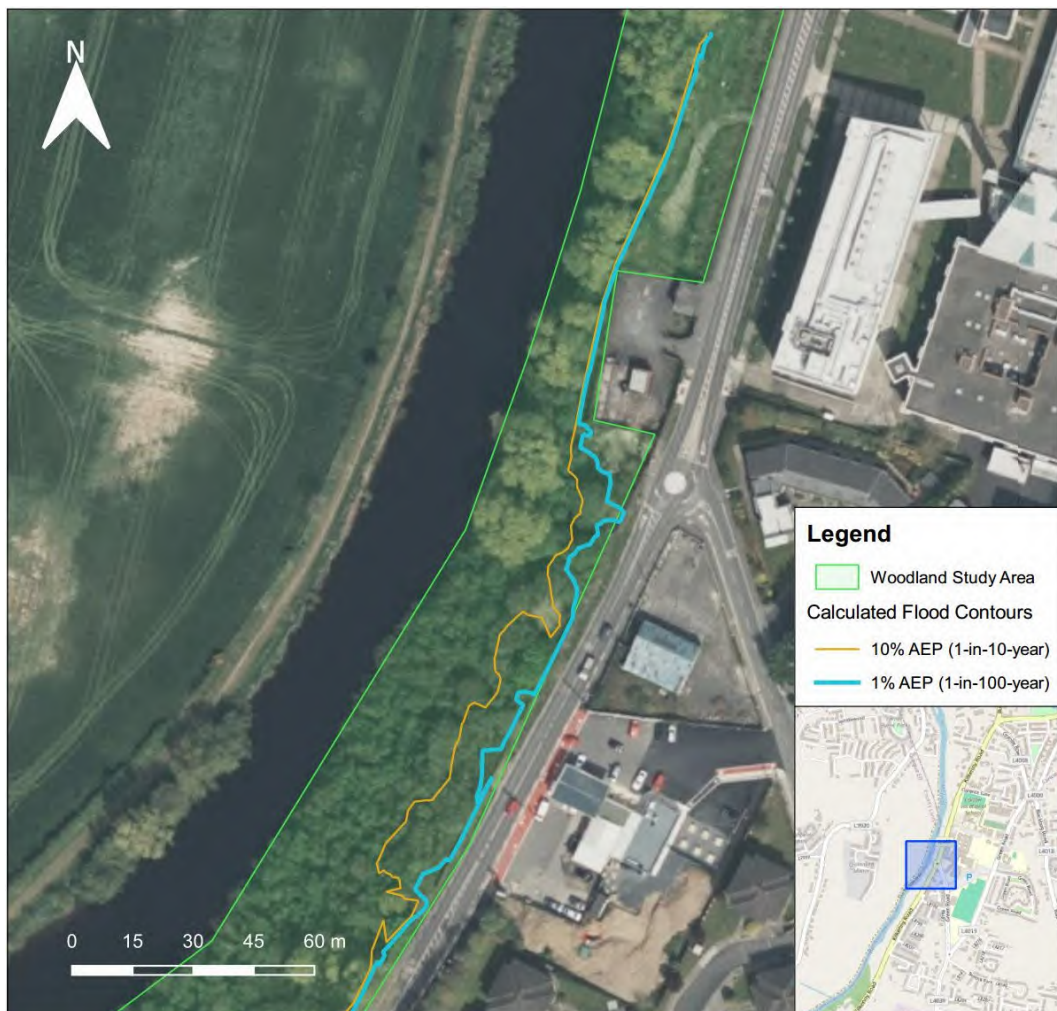


Figure 5: Calculated flooding contours for the northern part of the study area.



Figure 6: Calculated flooding contours for the southern part of the study area.

6. Conclusion

In conclusion, it is clear that the high-canopy woodland which occurs along the River Barrow within the study area (mapped as zone A) falls under the definition of priority Annex I alluvial woodland (91E0*), which is listed as a qualifying interest for the River Barrow and Nore SAC. While containing some non-native species in the canopy, the general vegetation composition, hydrological regime and soil conditions conform to the description of 91E0* in the Interpretation Manual of EU Habitats.

The area of transitional woodland (mapped as zone B) provides a high-canopy buffer and source of regenerative capacity to the to the priority Annex I alluvial woodland and it is therefore important to conserve these areas where possible to provide ecological resilience to the qualifying interest habitat.

The different woodland types in the study area have been defined as follows:

- Zone A, between the river and the 1-in-10-year flood contour (precautionary), represents the priority Annex I alluvial woodland habitat.
- Zone B, between the 1-in-10-year and 1-in-100-year flood contours, represents a transitional area with some elements of alluvial woodland, not corresponding to the priority Annex I habitat but providing an important supporting function.
- Zone C, above the 1-in-100-year flood contour (i.e. only inundated in extreme events), represents a mixed broadleaved woodland with very few elements of alluvial woodland, not corresponding to the priority Annex I habitat and providing only a limited supporting function.
- Zone D, immediately south of the existing pumping station, represents immature scrub, not corresponding to the priority Annex I habitat and not providing any supporting function.
- Zone E, which is on made ground and almost never inundated, represents willow scrub, not corresponding to the priority Annex I habitat and providing only a limited supporting function, and much of this zone has recently been cleared.

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Appendix 1 - Botanical species list

Trees, shrubs and other woody species

Acer pseudoplatanus Sycamore
Aesculus hippocastanum Horse Chestnut
Alnus glutinosa Alder
Betula pubescens Downy Birch
Corylus avellana Hazel
Crataegus monogyna Hawthorn
Euonymus europaeus Spindle
Fraxinus excelsior Ash
Hedera helix Ivy
Ilex aquifolium Holly
Malus sylvestris Crab Apple
Pinus sylvestris Scots Pine
Populus alba White Poplar
Quercus robur Pedunculate
Rubus fruticosus agg. Bramble
Salix alba White Willow
Salix cinerea Grey Willow
Salix fragilis Crack Willow
Salix purpurea Purple Osier
Salix viminalis Osier
Sambucus nigra Elder
Ulmus glabra Wych Elm

Herbaceous species

Achillea millefolium Yarrow
Agrostis stolonifera Creeping Bent
Alisma plantago-aquatica Water Plantain (river fringe)
Alopecurus pratensis Meadow Foxtail
Angelica sylvestris Angelica
Anthoxanthum odoratum Sweet Vernal Grass
Anthriscus sylvestris Cow Parsley
Apium nodiflorum Fool's Watercress (river fringe)
Arctium minus Burdock
Arrhenatherum elatius False Oat Grass
Asplenium ceterach Rustyback Fern (on stone wall)

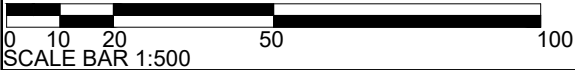
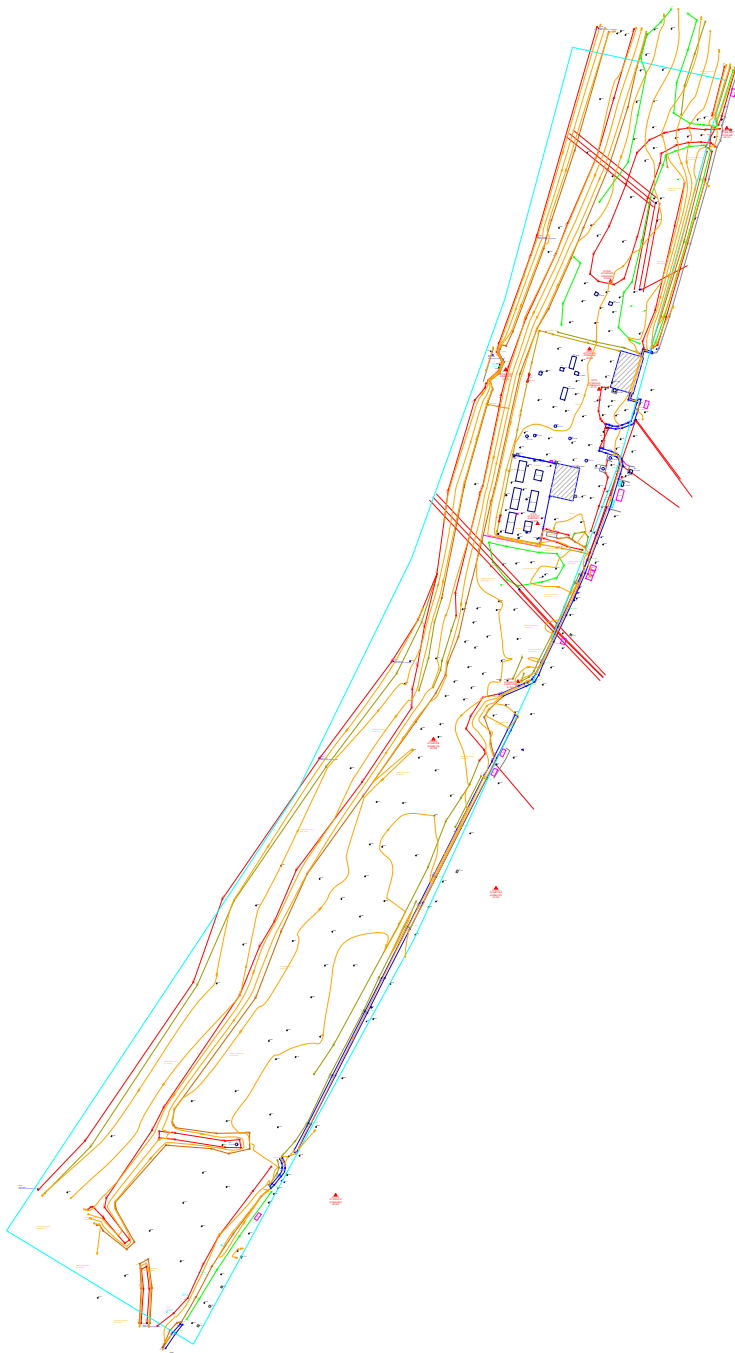
Asplenium ruta-muraria Wall Rue (on stone wall)
Asplenium scolopendrium Hart's-tongue
Asplenium trichomanes Maidenhair spleenwort
Bellis perennis Daisy
Brachypodium sylvaticum False Brome
Callitriche sp. Water Starwort (river fringe)
Calystegia sepium Hedge Bindweed
Capsella bursa-pastoris Shepherds Purse
Cardamine pratensis Cuckoo Flower
Carex nigra Common Sedge
Carex remota Remote Sedge
Carex sylvatica Wood Sedge
Centaurea nigra Black Knapweed
Centranthus ruber Red Valarian (on wall)
Cirsium arvense Creeping Thistle
Cirsium vulgare Spear Thistle
Cynosurus cristatus Crested Dogs Tail Grass
Dactylis glomerata Cock's-foot Grass
Daucus carota Wild Carrot
Dryopteris filix-mas Male Buckler Fern
Elytrigia repens Couch-grass
Epilobium hirsutum Great Willowherb
Epilobium montanum Broad-leaved Willowherb
Epilobium parviflorum Hoary Willowherb
Equisetum spp. Horsetail
Eupatorium cannabinum Hemp Agrimony
Festuca rubra Red Fescue
Ficaria verna ssp verna Lesser Celandine
Filipendula ulmaria Meadowsweet
Galium aparine Cleavers
Galium palustre Marsh Bedstraw
Geranium robertianum Herb-Robert
Glechoma hederacea Ground Ivy
Glyceria fluitans Floating Sweet-grass (river fringe)
Glyceria maxima Reed Sweet-grass
Holcus lanatus Yorkshire Fog
Heracleum sphondylium Common Hogweed
Iris pseudacorus Flag Iris

Mentha aquatica Water Mint
Phalaris arundinacea Reed Canary-grass
Polystichum setiferum Soft Shield Fern
Rumex crispus Curly Dock
Rumex obtusifolius Broadleaved Dock
Rumex sanguineus Wood Dock
Senecio jacobaea Common Ragwort
Urtica dioica Nettle
Vicia spp. Vetches

Invasive alien species

Azolla filiculoides Water Fern
Clematis vit alba Traveller's Joy
Fallopia japonica Japanese Knotweed
Impatiens glandulifera Himalayan Balsam
Petasites pyrenaicus Winter Heliotrope

Appendix 2 - Topographical survey results



Street Furniture and Services

- ### Natural Features

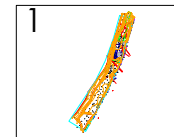
- ### Built Features, Roads and Road Markings

- ### Railway Features

- ## Survey Features

- BRIDGEWAY
 SURVEY STATION CHECK
 CONTROL STATION POINT

Sheet Layout



C			
B			
A	ORIGINAL DRAFT	RR	20/07/23
REV:	DESCRIPTION:	BY:	DATE:
REV/STATUS:			



Unit 2G, Fingal Bay Business Park P:+353 (0) 1 9065734
Harry Reynolds Road E: info@iogeomatics.ie
Balbriggan, County Dublin. W: www.iogeomatics.ie

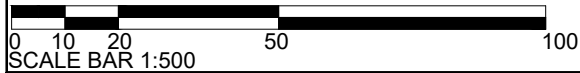
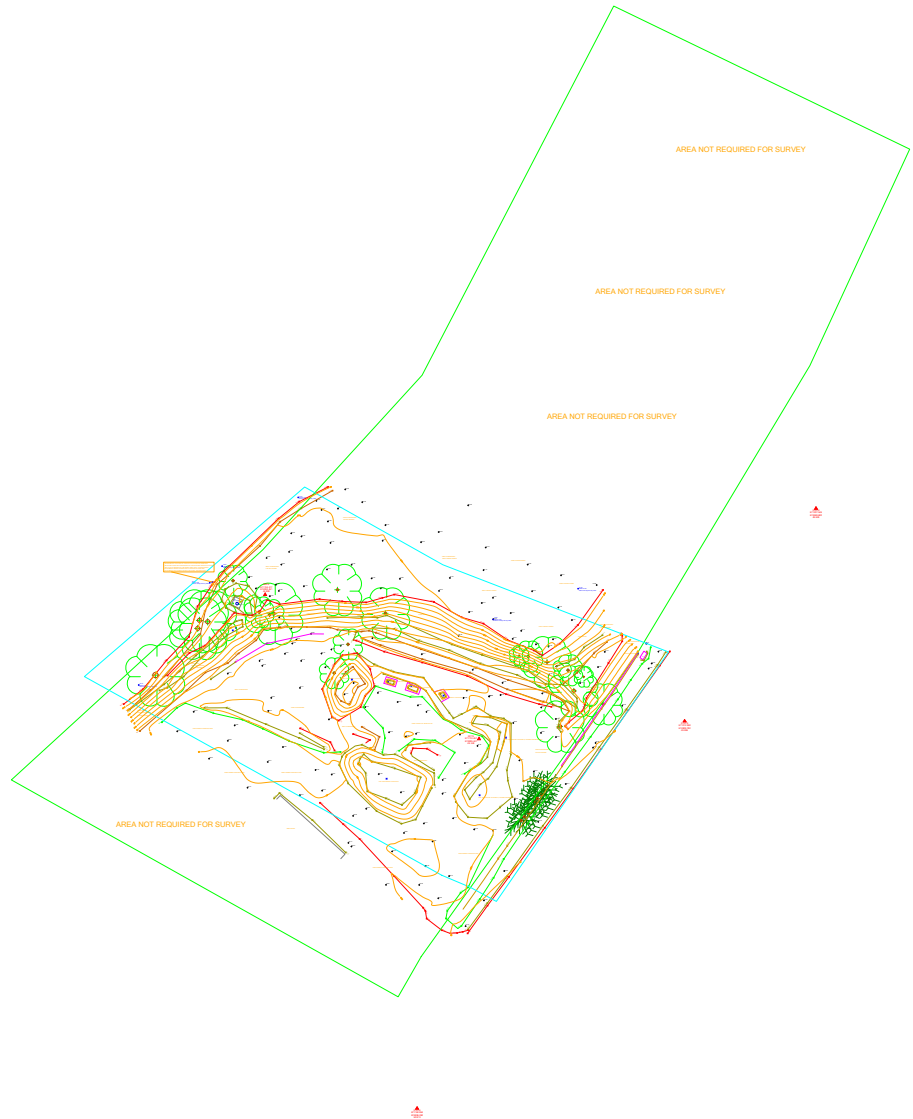
CLIENT	ATKINS
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PROJECT	TOPOGRAPHICAL SURVEY
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SITE: Mortarstown ,Carlow
AREA1

GRID: GRIDSYSTEM:ITM
Height Datum: OSGM15/ Malinhead

SCALE AT A1: 1:500	DATE: 20/07/23	DRAWN: RR	CHECKED: CM
PROJECT NO: 2356	DRAWING NO: 2356_A1_I_3D_Rev0		SHEET: 1 OF 1



Legend

Street Furniture and Services



Natural Features



Built Features, Roads and Road Markings



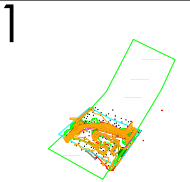
Railway Features



Survey Features



Sheet Layout



C			
B			
A	ORIGINAL DRAFT	RR	26/07/23
REV:	DESCRIPTION:	BY:	DATE:
REV/STATUS:			



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Ballynagar, County Dublin W: www.iogeomatics.ie

CLIENT ATKINS

PROJECT TOPOGRAPHICAL SURVEY

SITE: Mortarstown, Carlow
AREA2

GRID: GRIDSYSTEM: ILM
Height Datum: OSGM15/ Meanhead

SCALE AT A1: 1:500	DATE: 26/07/23	DRAWN: RR	CHECKED: CM
PROJECT NO: 2356	DRAWING NO: 2356_A2_T_3D_Rev0	SHEET: 1 OF 1	

Appendix 3 - Irish Vegetation Classification community synopsis for WL3D

Scientific name	<i>Salix cinerea</i> – <i>Urtica dioica</i> woodland
Common name	Grey Willow – Common Nettle woodland
Community code	WL3D

Vegetation

This rather variable community comprises wet woodland dominated by *Salix* spp. There is usually a low canopy (mean canopy height = 12.4 m, $n = 32$) in which *Fraxinus excelsior* typically accompanies the willows while *Alnus glutinosa* and *Acer pseudoplatanus* are also frequent. In the diverse field layer *Rubus fruticosus* agg., *Hedera helix*, *Filipendula ulmaria*, *Angelica sylvestris*, *Urtica dioica* and *Dryopteris dilatata* are constants while frequently found plants include *Ranunculus repens*, *Galium aparine*, *Cardamine flexuosa*, *Agrostis stolonifera*, *Carex remota*, *Galium palustre*, *Chrysosplenium oppositifolium* and *Mentha aquatica*. The bryophyte layer is composed mostly of *Kindbergia praelonga*, *Brachythecium rutabulum* and *Hypnum cupressiforme*. Further variation is discussed under 'Sub-communities' below.

Ecology

This community mainly occurs on wet gley soils but also on basin peats and well-drained mineral soils (mean organic content = 40.5%, $n = 33$). It is found almost always on flat ground in the lowlands (mean slope = 0.5°, $n = 33$; mean altitude = 51 m, $n = 33$). Conditions are relatively base-rich and quite fertile.

Sub-communities

Two quite distinct sub-communities have been described for this community. The *Salix fragilis* – *Calystegia sepium* sub-community (WL3Di) differs chiefly in the presence of one or more species of willow that are regarded as archaeophytes in Ireland (*Salix fragilis*, *Salix alba*, *Salix viminalis* or *Salix triandra*), although *Salix cinerea* is still frequent. The field layer is usually a dense tangle including *Calystegia sepium*, *Iris pseudacorus*, *Oenanthe crocata*, *Rumex sanguineus*, *Phalaris arundinacea*, *Valeriana officinalis* and *Solanum dulcamara*. This sub-community is rare in Ireland and restricted to periodically inundated lowland river islands and banksides. In the more common *Crataegus monogyna* – *Dryopteris dilatata* sub-community (WL3Dii), *Salix cinerea* is usually the only willow present and *Crataegus monogyna* sometimes occurs in a scanty understorey. The field layer differs in the occurrence of species less tolerant of inundation such as *Geum urbanum*, *Geranium robertianum*, *Dryopteris dilatata*, *Athyrium filix-femina* and *Circaea lutetiana*.

Similar communities

Sub-community WL3Dii is related to the willow woodlands of WL3E and WL3F (c.f.)

Records and distribution

Number of records (all)

Clearly assigned:	40
Transitional:	17
Total:	57

Number of records (mapped)

2001-2015:	50
1986-2000:	7
1971-1985:	0
Pre-1971:	0
Total:	57

Number of hectads (most recent records)

2001-2015:	38
1986-2000:	3
1971-1985:	0
Pre-1971:	0
Total:	41

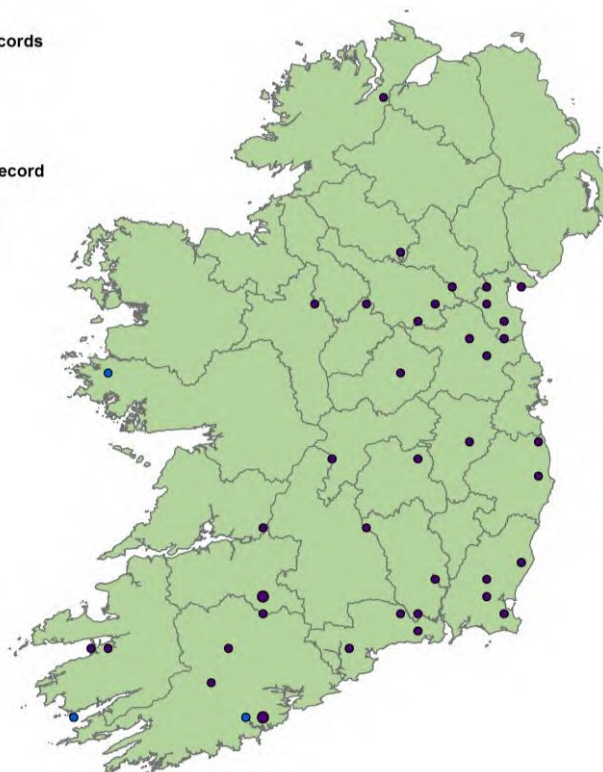
Number of hectads (all mapped records)

2001-2015:	38
1986-2000:	4
1971-1985:	0
Pre-1971:	0

Number of records



Most recent record



Synoptic table (n = 39)

Species	Frequency (from I-V)	Cover min (med) max	Species	Frequency (from I-V)	Cover min (med) max
<i>Rubus fruticosus</i> agg.	V	1-(3)-8	<i>Acer pseudoplatanus</i>	III	+- (3)-6
<i>Hedera helix</i>	V	2-(4)-8	<i>Plagiomnium undulatum</i>	III	+- (2)-6
<i>Kindbergia praelonga</i>	V	+- (3)-7	<i>Carex remota</i>	III	+- (2)-6
<i>Salix cinerea</i>	V	5-(7)-9	<i>Chrysosplenium oppositifolium</i>	III	+- (3)-8
<i>Filipendula ulmaria</i>	IV	1-(3)-6	<i>Rumex sanguineus</i>	III	+- (2)-3
<i>Angelica sylvestris</i>	IV	1-(2)-5	<i>Galium palustre</i>	III	1-(2)-3
<i>Fraxinus excelsior</i>	IV	+- (4)-8	<i>Mentha aquatica</i>	III	+- (2)-4
<i>Urtica dioica</i>	IV	+- (2)-7	<i>Frullania dilatata</i>	II	+- (+)-1
<i>Dryopteris dilatata</i>	IV	+- (3)-5	<i>Cardamine pratensis</i>	II	+- (2)-4
<i>Brachythecium rutabulum</i>	III	+- (2)-5	<i>Eurhynchium striatum</i>	II	1-(3)-4
<i>Ranunculus repens</i>	III	+- (2)-5	<i>Oenanthe crocata</i>	II	2-(3)-8
<i>Galium aparine</i>	III	+- (2)-3	<i>Ulota bruchii/crispa</i>	II	+- (+)-2
<i>Cardamine flexuosa</i>	III	+- (2)-5	<i>Thamnobryum alopecurum</i>	II	+- (2)-4
<i>Hypnum cupressiforme</i>	III	+- (2)-3	<i>Athyrium filix-femina</i>	II	1-(3)-4
<i>Agrostis stolonifera</i>	III	1-(3)-5	<i>Circaea lutetiana</i>	II	+- (2)-5
<i>Lophocolea bidentata</i>	III	+- (+)-3	<i>Iris pseudacorus</i>	II	1-(3)-6
<i>Geum urbanum</i>	III	+- (2)-5	<i>Thuidium tamariscinum</i>	II	+- (2)-8
<i>Geranium robertianum</i>	III	+- (3)-7	<i>Hypnum resupinatum</i>	II	+- (1)-2
<i>Alnus glutinosa</i>	III	3-(5)-8	<i>Poa trivialis</i>	II	2-(3)-7
<i>Crataegus monogyna</i>	III	+- (3)-4	<i>Isoetium myosuroides</i>	II	1-(2)-3

Affinities

GHI: WN6 Wet willow-alder-ash woodland (54.5%) / WN5 Riparian woodland (33.3%) (n = 33)

ZM: Salicion cinereae / Salicion albae

EUNIS: F9.211 Western grey willow carrs / G1.1111 Western European white willow forests

NVC: W7a *Alnus glutinosa*-*Fraxinus excelsior*-*Lysimachia nemorum* woodland *Urtica dioica* sub-community (56.1%)

Annex I: 91E0 Residual alluvial forests* (57.6%) (n = 33)

Proxy environmental data

Light: 5.9 Reaction: 6.1 Wetness: 7.0 Fertility: 5.5 Salinity: 0.1

Conservation value

This is quite a species-rich woodland community (total species/100 m² = 39.2, n = 33) with a reasonable bryophyte flora (bryophyte species/100 m² = 10.7, n = 33). Stands along rivers and lakes which are subject to periodic inundation qualify as EU Annex I habitat 91E0 Residual alluvial forests*. These include stands of sub-community GL3Dii which are dominated by non-native willow species and might otherwise be deemed to be of lower conservation value.

Management

The main threats to these woodlands include changes to hydrological regimes, overgrazing by livestock (usually cattle), woodland clearance and invasion by non-native species such as *Impatiens glandulifera*.

Key references

Perrin, P.M., Martin, J.R., Barron, S.J., O'Neill, F.H., McNutt, K.E., Delaney, A. (2008) National Survey of Native Woodlands 2003-2008. Unpublished report submitted to National Parks & Wildlife Service

Synopsis version: V1.0

Synopsis date: December 2016

Synopsis author(s): P.M. Perrin



Photo 1. WL3D *Salix cinerea* – *Urtica dioica* woodland, Grove Island, Meath (S. Barron/P. Perrin, July 2005)



Photo 2. WL3D *Salix cinerea* – *Urtica dioica* woodland, Doonass Demesne, Clare (P. Perrin/G. Smith, August 2008)

Appendix 4 - Interpretation Manual of EU Habitats definition of 91E0*

91E0

* Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*)

PAL.CLASS.: 44.3, 44.2 and 44.13

- 1) Riparian forests of *Fraxinus excelsior* and *Alnus glutinosa*, of temperate and Boreal Europe lowland and hill watercourses (44.3: *Alno-Padion*); riparian woods of *Alnus incanae* of montane and sub-montane rivers of the Alps and the northern Apennines (44.2: *Alnion incanae*); arborescent galleries of tall *Salix alba*, *S. fragilis* and *Populus nigra*, along medio-European lowland, hill or sub-montane rivers (44.13: *Salicion albae*). All types occur on heavy soils (generally rich in alluvial deposits) periodically inundated by the annual rise of the river (or brook) level, but otherwise well-drained and aerated during low-water. The herbaceous layer invariably includes many large species (*Filipendula ulmaria*, *Angelica sylvestris*, *Cardamine* spp., *Rumex sanguineus*, *Carex* spp., *Cirsium oleraceum*) and various vernal geophytes can occur, such as *Ranunculus ficaria*, *Anemone nemorosa*, *A. ranunculoides*, *Corydalis solida*.
This habitat includes several sub-types: ash-alder woods of springs and their rivers (44.31 - *Carici remotae-Fraxinetum*); ash-alder woods of fast-flowing rivers (44.32 - *Stellario-Alnetum glutinosae*); ash-alder woods of slow-flowing rivers (44.33 - *Pruno-Fraxinetum*, *Ulmo-Fraxinetum*); montane grey alder galleries (44.21 - *Calamagrosti variaie-Alnetum incanae* Moor 58); sub-montane grey alder galleries (44.22 - *Equiseto hyemalis-Alnetum incanae* Moor 58); white willow gallery forests (44.13 - *Salicion albae*). The Spanish types belong to the alliance *Osmundo-Alnion* (Cantabric atlantic and southeast Iberia peninsula).
- 2) Plants: Tree layer - *Alnus glutinosa*, *Alnus incanae*, *Fraxinus excelsior*; *Populus nigra*, *Salix alba*, *S. fragilis*; *Betula pubescens*, *Ulmus glabra*; Herb layer - *Angelica sylvestris*, *Cardamine amara*, *C. pratensis*, *Carex acutiformis*, *C. pendula*, *C. remota*, *C. strigosa*, *C. sylvatica*, *Cirsium oleraceum*, *Equisetum telmateia*, *Equisetum* spp., *Filipendula ulmaria*, *Geranium sylvaticum*, *Geum rivale*, *Lycopus europaeus*, *Lysimachia nemorum*, *Rumex sanguineus*, *Stellaria nemorum*, *Urtica dioica*.
- 3) Corresponding categories
United Kingdom classification: "W5 *Alnus glutinosa*-*Carex paniculata* woodland", "W6 *Alnus glutinosa*-*Urtica dioica* woodland" and "W7 *Alnus glutinosa*-*Fraxinus excelsior*-*Lysimachia nemorum* woodland".
German classification: "43040401 Weichholzaeuwald mit weitgehend ungertörter Überflutungsdynamik", "43040402 Weichholzaeuwald ohne Überflutung", "430403 Schwarzerlenwald (an Fließgewässern)", "430402 Eschenwald (an Fließgewässern)", "430401 Grauerlenauwald (montan, Alpenvorland, Alpen).
Nordic classification: "2234 *Fraxinus excelsior*-typ" and "224 Alskog".
- 4) Most of these forests are in contact with humid meadows or ravine forests (*Tilio-Acerion*). A succession towards *Carpinion* (*Primulo-Carpinetum*) can be observed.
- 5) **Brunet, J. (1991)**. Vegetation i Skånes alm- och askskogar. *Sven. Bot. Tidskr.* 85:377-384.