Dodder Greenway

Ecological Impact Assessment

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ROD
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Údarás Náisiúnta Iompair
National Transport Authority

Comhairle Cathrach Bhaile Átha Cliath
Dublin City Council

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dlr
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Dodder Greenway
Ecological Impact Assessment (EcIA)

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1. INTRODUCTION

1.1 Background

Roughan & O'Donovan (ROD) Environmental was commissioned by Dublin City Council and South Dublin County Council to undertake an Ecological Impact Assessment (EcIA) to inform a planning application for the proposed River Dodder Greenway, hereafter referred to as "the Greenway", which comprises a shared cyclist/pedestrian facility loosely following the River Dodder from Grand Canal Dock in Dublin City Centre to Bohernabreena near Glenasmole.

This EcIA provides an assessment of the baseline ecological conditions in the area likely to be impacted by the Greenway and of the nature, magnitude and significance of those impacts. This EcIA also proposes appropriate mitigation measures to eliminate those impacts or, where this has not been possible, to minimise their effects as to no longer be considered significant.

1.2 Requirement for Ecological Impact Assessment (EcIA): Summary

Ireland's national biodiversity action plan Actions for Biodiversity 2011–2016 (DAHG, 2011), in accordance with the Convention on Biological Diversity, is a framework for the conservation and protection of Ireland's biodiversity, with an overall objective to secure the conservation, including, where possible, the enhancement and sustainable use of biological diversity in Ireland and to contribute to collective efforts for conservation of biodiversity globally. The plan is implemented through legislation and statutory instruments concerned with nature conservation. The Planning and Development Acts, 2000 to 2015 and the European Communities (Environmental Impact Assessment) Regulations, 1989 (as amended) are particularly important in that regard and include a number of provisions directly concerned with the protection of natural heritage and biodiversity. A Heritage and Biodiversity Plan for South Dublin County Council 2016 – 2020 is current being progressed, however there are a number of Local Authority Plans that have relevance to the Greenway, notably the Biodiversity Action Plan for Dublin City 2015 – 2020 and the Dublin City Invasive Alien Species Action Plan 2016 – 2020.

The Wildlife Acts, 1976 to 2012 are the principle mechanism for the legislative protection of wildlife in Ireland and outline strict protection for species that have significant conservation value. In summary, the Wildlife Acts protect species from injury, disturbance and damage to breeding and resting sites. All species listed in the Wildlife Acts must, therefore, be a material consideration in the planning process. The Flora (Protection) Order, 2015 is an important piece of national legislation for the protection wild flora, *i.e*. vascular plants, mosses, liverworts, lichens and stoneworts, , which makes it illegal to cut, uproot or damage a listed species in any way or to alter, damage or interfere in any way with their habitats. This protection applies wherever the species listed in the Schedules of the Order are found.

The European Communities (Birds and Natural Habitats) Regulations, 2011 transpose into Irish law Directive 2009/147/EC (the Birds Directive) and Council Directive 92/43/EEC (the Habitats Directive), which list priority habitats and species of international (European Union) conservation importance and that require protection. This protection is afforded in part through the designation of areas that represent significant populations of listed species within a European context, *i.e*. Natura 2000 sites. An area designated for bird species is classed as a Special Protection Area (SPA), and an area designated for other protected species and habitats is classed as a Special Area of Conservation (SAC). Birds listed on Annex I of the Birds Directive in SPAs and habitats and species listed on Annexes I and II, respectively, of the Habitats Directive in SACs in which they are designated features have full European protection. Species listed on Annex IV of the Habitats Directive are strictly protected wherever they occur, whether inside or outside the Natura 2000 network. Annex I habitats outside of SACs are still considered of national and international importance and, under Article 27(4)(b) of the European Communities (Birds and Natural Habitats) Regulations, 2011, public authorities have a duty to strive to avoid the pollution or deterioration of Annex I habitats and habitats integral to the functioning of SPAs.

Sites of national importance for nature conservation are afforded protection under planning policy and the Wildlife Acts, 1976 to2012. Natural Heritage Areas (NHAs) are sites that are designated under statute for the protection of flora, fauna, habitats and geological interest. Proposed NHAs (pNHAs) are published sites identified as of similar conservation interest but have not been designated under statute.

The International Union for the Conservation of Nature (IUCN) provides a global approach for evaluating the conservation status of species to inform and catalyse action for biodiversity conservation through the Red List of Threatened Species. The Red List is a therefore an important reference in identifying species under threat that do not necessarily have strict protected under specific nature conservation legislation.

1.3 Approach and Objectives

A habitat is the environment in which an animal or plant lives, generally defined in terms of vegetation and physical structures. Features of ecological significance occurring or likely to occur within the zone of influence of the Greenway are classified as Key Ecological Receptors (KERs). Features of ecological significance are designations for nature conservation, habitats and species protected through provision of Council Directive 92/43/EEC (the Habitats Directive); Directive 79/409/EEC (the Birds Directive); the Wildlife Acts, 1976 to 2012; the Flora Protection Order 2015; species subject to restrictions as listed on the Third Schedule of the EC (Birds & Natural Habitats) Regulations 2011(Invasive Alien Species (IAS)); and, any other features deemed to be of ecological importance based on recent declines or rarity. A KER can therefore be defined as any site, habitat, ecological feature, vegetative assemblage, community, species or individual:

- occurring within the zone of influence of the Project;
- considered likely to be impacted upon by the Project; and,
- requiring further survey in order to more accurately predict the nature, magnitude and significance of those impacts.

This EcIA quantifies the potential impacts on KERs and identifies the mitigation measures required to avoid and reduce any likely significant impacts. Identification of impacts and specific mitigation measures have been devised following a collaborative approach by a multidisciplinary team at Roughan & O'Donovan comprising Ecologists, Hydrologists, Hydrogeologists, Environmental scientists and Engineers. The results of the ecological surveys informed the Greenway design, thereby addressing potential impacts on habitats and species of conservation interest.

Determining the ecological issues to be addressed in the EcIA was informed by early engagement with relevant parties/stakeholders who were provided key information about the Greenway. During this scoping process, selected consultees were provided the opportunity to input into the scheme through preliminary discussions on ecological features that could be affected; potential strategies to avoid negative impacts; and, possible compensation or enhancement measures.

On completion of scoping, a desk study was undertaken to review all available published data on European and nationally designated sites for nature conservation, other ecologically sensitive sites and habitats and species of interest within the zone of influence. Published data describing ecological conditions was then cross-referenced with publicly available maps and aerial orthophotography from Ordnance Survey Ireland (OSi), the National Parks & Wildlife Service (NPWS) and the Environmental Protection Agency (EPA) to identify important ecological features. During preparation of this EcIA, the statutory consultee, the NPWS, provided data on designations of habitats and species of conservation interest. The baseline information obtained from the desk study was the first stage in defining the zone of influence of the Greenway.

Following the scoping and desk study, multidisciplinary ecological walkover surveys were conducted along the entire preferred route option adhering to *Ecological Survey Techniques for Protected Flora and Fauna during the Planning of National Road Schemes* (TII/NRA, 2009b) and *Best Practice Guidance for Habitat Survey and Mapping* (Smith *et al.*, 2011). The walkovers classified habitats according to *A Guide to Habitats in Ireland* (Fossitt, 2000) and identified corresponding habitats listed on Annex I of the Habitats Directive. Multidisciplinary surveys also included watercourse assessments; Bat roost suitability assessments; specialist non-volant terrestrial protected mammal surveys (*e.g.* Otter, Badger) and Bat, surveys. The surveys provided vital baseline information regarding ecological conditions on the route corridor, identifying KERs and the need for specialist surveys, licensing and mitigation in specific locations.

Using the comprehensive assessment of the existing environment (baseline conditions), it has been possible to accurately predict the likely impacts of the Project on the KERs and correctly assign an ecological significance to them.

Where detrimental impacts have been identified, they have been examined and specific mitigation measures developed in accordance with the hierarchy of options suggested by the European Commission in *Managing Natura 2000 sites: The Provisions of Article 6 of the Habitats Directive 92/43/EEC* (EC, 2000). The adopted approach was:

- Avoid at source;
- Reduce at source;
- Abate on site; and, finally,
- Abate at receptor.

The information provided in this EcIA accurately and comprehensively describes the baseline ecological environment, provides an accurate prediction of the likely ecological impacts of the Project, prescribes mitigation as necessary and describes the residual ecological impacts. The specialist studies, analysis and reporting have been undertaken in accordance with the appropriate best practice guidelines for EcIA, as described in Section 2. For ease of reference, a summary map detailing the route of the proposed Greenway and the areas of constraint and opportunity is presented in Appendix B. The findings of the habitat surveys are presented in contemporary thematic maps for ease of geospatial reference and interpretation in Appendix C. Invasive Alien Plant Species (IAPS) surveys were undertaken as part of the multidisciplinary walkover surveys and the results are shown as constraints (risk of spread during construction) and opportunities (scope for eradication) in Appendix B. An IAPS Management Plan is provided in Appendix D.

2. DESCRIPTION OF PROPOSED DEVELOPMENT

2.1 Overview

The proposed Dodder Greenway Route commences at Grand Canal Dock in Dublin's city centre and follows the River Dodder as far as Bohernabreena, south of Glenasmole valley in the Dublin/Wicklow Mountains. A site location map showing the proposed route of the Greenway is given in Figure 1 in Appendix A.

The route for the Greenway passes between three Local Authority administrative areas: Dublin City Council, Dún Laoghaire–Rathdown County Council and South Dublin County Council. A Section 85 (Local Government Act as amended, 2001) agreement is in place between the Local Authorities and in this regard and for the purposes of advancing the project in a timely manner, the project comprises two sections which will each be subject to separate Part VIII applications. The route of the proposed Greenway (described below) is shown in Appendix B.

Section 1: South Dublin County Council will advance design and planning in the section of the project between Orwell Park (Dodder Road Lower) and Glenasmole valley at Bohernabreena.

Section 2: Dublin City Council will advance design and planning between Grand Canal Dock and Orwell Park (Dodder Road Lower).

A single Screening for Appropriate Assessment (AA); Screening for Environmental Impact Assessment; and Ecological Impact Assessment (EcIA) have been carried out as per the requirements of the statutory consultee, the National Parks & Wildlife Service (NPWS) of the Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs (DAHRRG).

2.2 General Description of the Proposed Development

The function of the proposed Greenway is manifold while the main elements of the proposed Greenway can be summarised as follows:

- The Greenway route passes along the Dodder Valley from the River Liffey at Sir John Rogerson's Quay to the entrance to the Bohernabreena reservoirs at Glenasmole.
- It connects the existing cycle and pedestrian facilities in Dublin city centre such as the Sutton to Sandycove (S2S) Cycleway and Walkway and the Grand Canal Green Route with the Dublin Mountain Way at Bohernabreena.
- It will provide for improved connectivity to communities, facilities and local business along the Dodder Valley corridor with a dedicated signage strategy.
- Where commuting currently exists and demand is anticipated to continue, the scheme either ensures it is facilitated in a pedestrian priority environment with additional capacity for safe use at junctions or provide an alternative route for commuting cyclists where required.
- The Greenway will generally consist of a shared 3-4m wide bound surface on the off road sections, tying into suitable bound surfacing for the on road sections. It is proposed to utilise enhanced variations to reflect local context.
- Works will include widening and upgrade to existing paths, construction of new paths, the construction of a number of new bridges, upgrade of existing bridges and underpasses, cantilever boardwalk structures, junction upgrades, etc.
- The upgrade and creation of new entrances to the Greenway.
- Improved landscape treatment to provide a coherent and legible Greenway along the proposed Greenway.
- Ecological enhancements including species rich grassland management, the planting of native trees and the provision of bat boxes.
- Bat friendly public lighting will be provided both in new areas and in upgrading sections of existing lighting.
- CCTV will be provided at a number of locations including each of the bridges.
- Drainage measures including swales, signage, markings and ancillary works.

2.3 Detailed Description of the Project

2.3.1 Section 1 – Grand Canal Dock to Orwell Park

The development of the proposed Greenway through Section 1 will require varying degrees of intervention to existing conditions depending on the proposed location. In some areas, relatively minor works will be required to enhance existing shared surface or cycleway already in place. Elements of the design will require more significant interventions including the provision of cantilevered boardwalks and a number of pedestrian/cycle bridges. In order to limit the impact of the proposed scheme on the receiving environment, ecological enhancements are proposed in a number of areas to increase biodiversity and also amenity value along the route. Unless otherwise stated, it is proposed to provide a 4m wide shared footpath/cycletrack. A reduced width is proposed in a number of areas where constraints exist which limit the ability for widening works. More than one route option is still under consideration in a number of areas and therefore for the purposes of this assessment all options still under consideration will be presented and assessed to ensure that any likely environmental impacts of the scheme are considered. A summary of the route and the interventions proposed are given below. This summary should be read in conjunction with Appendix B.

- Sir John Rogerson's Quay – proposed two-way cycletrack with existing pedestrian footpaths utilised for pedestrian traffic – this will be accommodated on existing paved areas.
- Hanover quay – the route will connect from Sir John Rogerson's Quay either from Benson Street or Forbes Street. If the Forbes Street option is chosen a link to Hanover quay will be provided along Misery Hill – this will be accommodated on existing paved areas.
- Grand Canal Crossing – a new crossing over the canal at Grand Canal Dock is proposed. This will consist of a new opening bridge to the central lock and fixed bridges to the outer locks. The final design of the proposed of a crossing at this point is subject to agreement from Waterways Ireland with consultations ongoing.
- South Dock Road – the proposed route then progresses along South Dock Road utilising a shared surface accommodated on existing paved areas.
- Ringsend Bridge – the route will then link with Ringsend Road via a new ramped section and will cross the River Dodder over a new structure adjacent to the existing Ringsend Bridge.
- Fitzwilliam Quay – the route will continue along Fitzwilliam Quay which will require existing parking to be reconfigured at a number of locations. This will be accommodated on existing paved areas.
- Bath Avenue – continuing along the River Dodder on the eastern bank and past Bath Avenue, it is proposed to widen the existing 2.4m wide footpath using a cantilever boardwalk to accommodate the footpath/cycleway.
- Between Lansdowne Road Bridge and the east coast railway line, it is proposed to widen the existing 3m cantilever footpath with a cantilever boardwalk to accommodate the footpath/cycleway.
- Railway underpass – it is proposed to widen the existing 1.7m wide underpass at Lansdowne Railway Bridge to 5m and increase the available headroom.
- Lansdowne Railway Bridge – Ballsbridge – between Lansdowne Railway Bridge and Ballsbridge it is proposed to utilise the existing footpath along the Dodder and widen where required.
- Ballsbridge – a new Toucan crossing is proposed at Ballsbridge to facilitate crossing Merrion Road.

- Herbert Park – beyond Ballsbridge the route is proposed along the Northern bank of the River Dodder. This will require the provision of a new shared footpath/cycletrack in lands adjacent to the Herbert Park Hotel. A shared surface is proposed immediately adjacent to the hotel to the existing Hotel Bridge. The route would then continue through Herbert Park utilising the existing upper route footpath which will be upgraded and widened into existing grass verges.
- Eglinton Terrace – the route will then pass Eglinton Terrace, Bective Rangers Football Club and the Bective lawn Tennis Club. It is proposed the Greenway will be constructed on the proposed flood defence works. Ecological enhancements are proposed in this area by the provision of additional planting and vegetation.
- Donnybrook Road – through existing DCC lands adjacent to the River Dodder to a new crossing of the N11 Stillorgan / Donnybrook Road at the Eglinton Road junction: DCC are currently preparing a Part 8 application for a modification to the approved flood defence wall at this location and the design of the wall will allow for the future development of the Dodder Greenway at this location. Further ecological enhancements are proposed at the approach to the crossroads.
- Brookvale Road – Revised junction layout at Eglinton Road / Brookvale Road. The route then continues along Brookvale Road where it is proposed to widen the existing 1.7m wide footpath.
- Riverside Walk – at the end of Brookvale Road the route enters Riverside Walk. In this area it is proposed that a partial cantilever Boardwalk will be required to accommodate the footpath/cycletrack. An area of ecological enhancement may also be provided in lands opposite Riverside Walk.
- The route will then continue adjacent to the river utilising a proposed boardwalk included as part of a planned redevelopment of the former Smurfit Paper Mill site. This will link to Clonskeagh Bridge, via the back of the petrol station. A potential on-road solution is still being investigated along Beech Hill Road and Beaver Row, to link between Brookvale Road and Clonskeagh Bridge. Clonskeagh Bridge (which was also assessed as part of this EIA screening)– it is proposed to provide a new cantilever bridge adjacent to the existing Clonskeagh Bridge to facilitate the footpath/cycletrack.
- Clonskeagh Bridge – it is proposed to provide a new cantilever bridge adjacent to the existing Clonskeagh Bridge to facilitate the footpath/cycletrack.
- Clonskeagh to Milltown – the route will then continue along the existing track on the south bank of the river which will be upgraded to accommodate the footpath/cycletrack.
- Dodderbank Apartments – the existing footpath adjacent to the south bank of the river will be upgraded to accommodate the footpath/cycletrack as far as Dundrum Road, passing the Dodderbank Apartments. The route may also split and cross the river via a new bridge near Strand Terrace on the western bank and continue on the existing footpath which would be upgraded to accommodate the footpath/cycletrack. The route option on the western side of the river at Milltown Bridge would avail of the existing 2.2m wide underpass with the eastern route option crossing Dundrum Road at grade. Regrading of the approaches to Dundrum Road will be required in both cases.
- Milltown – Exsting pathways/cycletracks to be upgraded.
- Luas Line – both the northern and southern route options pass beneath the Luas line at the nine arches viaduct. The southern option would cross Churchtown Road Lower via a proposed toucan crossing and continue along the boundary of the Milltown Golf Course. The northern option would cross beneath Churchtown Road Lower via the existing path under Classon's Bridge existing underpass and would require upgrading the existing path continuing through Dartry Park East. This option would require a new bridge over the River Dodder at the weir at the north-western end of Dartry Park East.
- Milltown Golf Course – the two route options meet at the corner of Milltown Golf Course opposite Dartry Park East and continue along the boundary of the golf course crossing the river at Dartry Cottages on either the existing access bridge of a new structure just upstream.
- Dartry Park West - The route continues through Dartry Park West, on existing footpaths in the park which would be widened to accommodate the footpath/cycletrack.
- Dartry Park West to Orwell Park – There are route options on both sides of the river along this section. The southern option would require widening the existing footbridge and replacing the steps on each side with new ramps. The route then follows existing pathways / roadways to Orwell Road. The northern option would require a section of existing pathway to be widened by the construction of a small cantilever. The cantilever may be omitted locally creating short pinchpoints to accommodate existing vegetation.
- Orwell Road – Both options pass beneath Orwell Road via existing underpasses on either side of the river. And continue along existing paths which would be widened. The northern option through Orwell Park would require a new bridge across the river to Dodder Park Road.

2.3.2 Section 2 – Orwell Park to Fortbridge

The development of the proposed Greenway through Section 2 will require varying degrees of intervention to existing conditions depending on the proposed location. In some areas very little works will be required due to the presence of an existing shared surface or cycleway already being in place. Elements of the design will require more significant interventions including the provision of pedestrian/cycle bridges at a number of locations. Unless otherwise stated it is proposed to provide a 3.5-4m wide shared footpath/cycletrack. A reduced width is proposed in a number of areas where constraints exist which limit the ability for widening works. A summary of the route and the interventions required are given below. `

- Orwell Park - Section 2 of the proposed route joins with the Section 1 in Orwell Park. The existing and upgraded footpath in the park will be realigned towards a new ramped section of pedestrian/cycle path and clear span bridge over the River Dodder adjacent to Dodder Road Lower. The proposed bridge will comprise a 4.4m wide structure over spanning the River Dodder for a distance of 21.5m. Two further 15.78m spanned sections will bring the structure back to the level of a ramped section which will tie in with the pedestrian/cycle path in Orwell Park. The existing footbridge located a short distance upstream will be removed following completion of the works.
- Dodder Road Lower – an existing pedestrian/cyclist shared surface is in place along Dodder Road Lower which will be upgraded as necessary to progress the project - all works within existing paved areas.
- Dodder Road Lower/Dodder Park Drive – the existing shared surface along Dodder Road Lower between Dodder Park Drive and Rathfarnham Road will be upgraded where necessary. The 4m wide shared footpath/cycle track will be continued along Dodder Park Drive to Dodder Park Road to the Rathfarnham Road junction – all works within existing paved areas.
- Dodder Park Road/Rathfarnham Road Junction – all arms of this junction will be improved with pedestrian and cyclist facilities – all works within existing paved areas.
- Springfield Avenue – along Springfield Avenue there is a proposed 4m shared footpath/cycletrack with separate 2m cycle track on western side of road with 2m footpath and 2m cycletrack on eastern side of road as far as the bend in the road adjacent to the River Dodder where the road narrows – all works within existing paved areas.
- Springfield Avenue – from where the road narrows there is an existing 3.9m shared footpath/cycletrack on the western side of the roadway which will be upgraded where necessary and retained. On the eastern side of the roadway a proposed 4.2m shared footpath/cycletrack will be provided – see Plate 2.2.1 below. All works will be completed within existing paved areas with the removal of the existing central reservation to provide additional space.

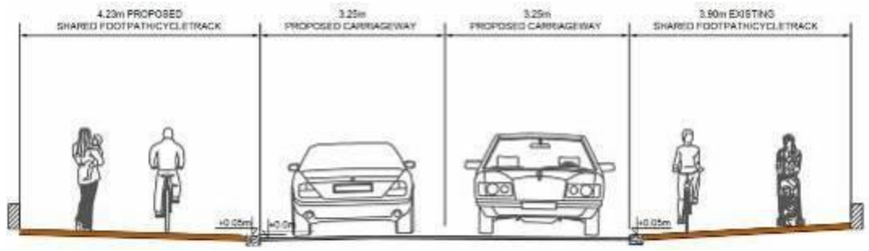


Plate 2.2.1: Typical Cross-section at Springfield Avenue

- Springfield Avenue/Woodview Cottages – a proposed new bridge with ramped sections connecting the proposed Greenway to Bushy Park is proposed on the northern side of the roadway at this location. A new 4m shared footpath/cycletrack is proposed through open space on the southern side of the roadway connecting to Church Lane.
- A wide shared street connection to Rathfarnham Main Street will be provided via Church Lane – all works within existing paved areas.
- Springfield Avenue/Owendoher River – the 4m shared footpath/cycletrack will continue along the north-western side of Springfield Avenue with the existing 3.3m shared footpath/cycletrack along the south-eastern side of the roadway upgraded as required. The existing parking bay will be realigned to accommodate the 4m shared footpath/cycletrack.
- Springfield Avenue/Fairways – the 4m shared footpath/cycletrack will continue along the northern side of Springfield Avenue with the existing 3.2m shared footpath/cycletrack along the southern side of the roadway upgraded as required as a far as the junction with Fairways.
- Dodder Valley Park – at Fairways the route turns southwards and enters Dodder Valley Park. The 4m shared footpath/cycletrack running from Bushy will link via an existing underpass beneath Springfield Avenue. Through Dodder Valley Park it is proposed to incorporate a 4m shared footpath/cycletrack utilising existing footpaths. This will require works widening the existing footpaths into the verge – a typical section through the shared footpath/cycletrack through Dodder Valley Park is shown in Plate 2.2.2.

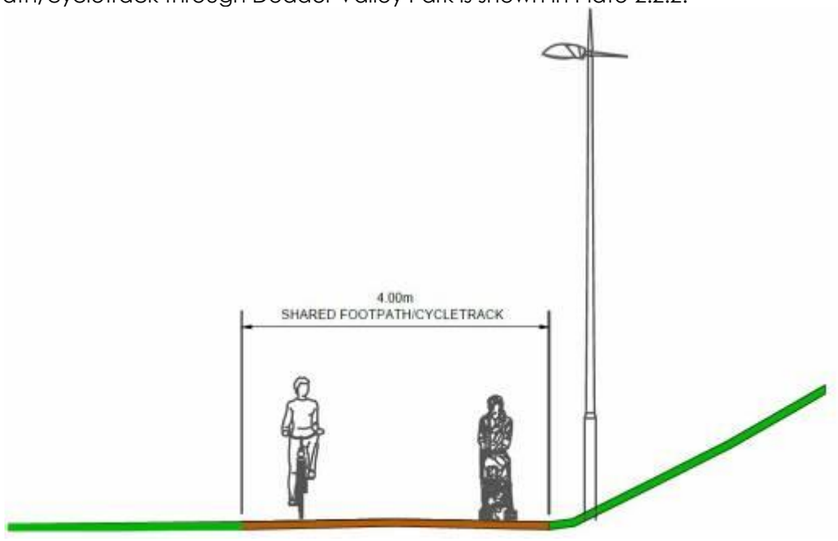


Plate 2.2.2: Typical Cross-section through Dodder Valley Park

- Riverside Cottages – it is proposed to provide a new bridge over the River Dodder to connect the 4m shared footpath/cycletrack to the northern bank and extend the route through a green area at Riverside cottages through a shared street to Templeogue Road. The new bridge will consist of a 4.44m structure spanning 21m over the river with a ramped section on the northern section spanning 15.8m over an existing footpath. The new shared footpath/cycletrack will be through an existing green area at Riverside Cottages as the route leaves the existing footpath along the River Dodder.
- Kilvere – the proposed 4m shared footpath/cycletrack continues along the route of the existing footpath through Dodder Valley Park to Kilvere. Through Kilvere and as far as Butterfield Avenue the route continues as a shared wide street. This will be completed on existing paved surfaces with road marking provided as required – see Plate 2.2.3 below.

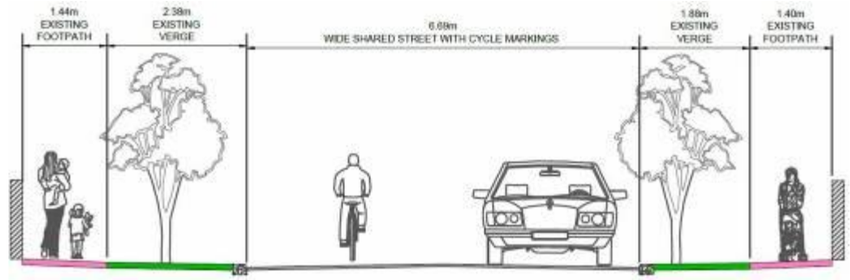


Plate 2.2.3: Typical Cross-section at Kilvere

- Butterfield Avenue – along Butterfield Avenue the route proceeds westward and consists a 2m off road cycletrack on both sides with a 2 – 3m footpath on the verge-side. This will be completed on existing paved surface with the existing road carriageways reduced as required.
- Ballyroan Road/Old Bridge Road – the route continues along Firhouse road through the junction with the Ballyroan and Old Bridge Roads with local realignments and kerb adjustments at the junction as required.
- Firhouse Road – the route continues along Firhouse Road making use of existing footpaths and existing cycle lanes as far as Dodder Valley Park.
- Dodder Valley Park – the route enters Dodder Valley Park at Firhouse Road before the junction with Knocklyon Road. Once the Greenway route enters Dodder Valley Park a 4m footpath/cycletrack continues utilising existing footpaths in the park. This will require works widening the existing footpaths into the verge at both sides – a typical section through the shared footpath/cycletrack through Dodder Valley Park similar to that shown in Plate 2.2.2. Portions of the route through Dodder Valley Park will reduce to a 3.5m shared footpath/cycletrack.
- Ballycullen Road/Firhouse Road – a shared street connection will be provided from the route through Dodder Valley Park to the Ballycullen Road/Firhouse Road junction - this will be completed on existing paved surfaces.
- M50 – the 3.5/4m shared footpath/cycletrack continues through Dodder Valley Park as far as the M50 which it passes beneath utilising an existing underpass and enters Dodder Riverbank Park. There will be a requirement for significant regarding of the ground profile through this section.
- Dodder Riverbank Park – the 4m shared footpath/cycletrack continues through Dodder Riverbank Park – this will require works widening the existing footpaths into the verge at both sides. No widening is required further into Dodder Riverbank Park where existing wide paths/maintenance tracks can accommodate the 4m shared surface.
- Avonmore Road link – a new bridge is proposed to link the route with Avonmore Road through a shared street adjacent to Bolbrook Enterprise Centre. The proposed bridge

consists a 23.2m structure overspanning the River Dodder with two 13.7m ramped sections on the eastern side of the river.

- Dodder Valley Park Cycle Scheme – the route continues with 4m shared footpath/cycletracks following the route of existing park footpaths which will require widening into the grass verges. A portion of the route has already be constructed comprising the Dodder Valley Park Cycle Scheme. This included a 52m clear span cabled stayed bridge over the Dodder River and a 20m clear span bridge over the Ballycullen Stream.
- Old Bawn Road – the route leaves Dodder Valley Park at Old Bawn Road and continues as a 5m shared street with traffic calming measures along Kiltipper Road turning south along an existing access lane as a shared street to Kiltipper Woods Clinic.
- Kiltipper Woods Clinic to Fortbridge – the final section of the Greenway route continues along existing footpaths between the Kiltipper Woods Clinic and Fortbridge (Friarstown Upper) at the entrance to Glenasmole Reservoir. A small portion of the route will be located adjacent to Ballinascorney Road requiring a new shared footpath/cycletrack on the southern side of the carriageway to facilitate a safe crossing point.
- Car Park at entrance to Glenasmole Reservoir – minor upgrade works in the form of surfacing and line markings will be undertaken to the existing car park at the entrance to Glenasmole Reservoir.

2.3.3 Existing Land Use

The footprint of the proposed route is almost entirely along existing footpaths and cycletracks which will be upgraded and widened. The existing land use along the route is predominantly parkland as summarised in Table 2.2.1 below. The remaining sections of the route are through existing built areas of the city and suburbs, primarily either constructed as shared surfaces on existing roads or along realigned sections of roads as combined footpath/cycletracks. A small portion of the route is proposed as a cantilevered boardwalk over the River Dodder itself.

Table 2.2.1 Route Sections

Approximate Length (km)	Location	Existing Land Use
3	Ringsend / Landsdowne / Ballsbridge / Clonskeagh	Urban/built
0.4	Herbert Park (Ballsbridge)	Parkland
0.4	Linear Park (Scully's Field)	Parkland
1.1	Linear Park (Milltown Rd.)	Parkland
0.4	Dartry Park East	Parkland
0.4	Dartry Park West	Parkland
0.4	Orwell Park	Parkland
0.4	Bushy Park	Parkland
1.0	Dodder Valley Park	Parkland
3.7	Dodder Riverbank Park	Parkland
1.0	Linear Park (Kiltipper Rd.)	Parkland
2.1	Kiltipper Rd. to Fortbridge	Greenfield

2.4 Water Courses

A number of watercourses exist within the extents of the scheme and are located as follows:

2.4.1 River Dodder

Topography varies significantly across the study area. Elevations range from 200m OD (Ordnance Datum / sea level) near the source of the Dodder River in the Dublin Mountains to 0m OD at the river mouth in Ringsend. Steep elevations dominate in the upper reaches of the Dodder River as its course descends rapidly towards Old Bawn. The steep nature of the river's decent from the mountains has historically given rise to sudden flooding downstream and contributes to the flashy nature of the river's response to rainfall.

The river is located in a sloped valley along the majority of its middle and upper reaches which is less pronounced in its lower sections. The upper portion of the catchment is mainly rural while the lower catchment is heavily urbanised with residential and industrial adjacent land uses. Large swathes of lands that adjoin the river's course are in use as linear parks and green areas and it is anticipated that sufficient width will be available along the full route to facilitate the construction of cycling and pedestrian facilities. In more urbanised areas, the extent of lands available may be more restricted. Other watercourses within the study area are summarised below:

- Ballymaice stream – Discharges into Dodder below Glenasmole reservoir although the majority of flow is now redirected to the reservoir.
- Ballycullen Stream – Dodder Valley Park. Bridged in 2014 as part of the Tallaght to Ballyboden Cycle Route Scheme. The stream is culverted to the south of the Knocklyon Road as it passes through the Carriglea housing estate.
- The Tallaght / Whitestown Stream – Passes under the Old Bawn Road located to the south of the N81 Tallaght Bypass – Old Bawn Road junction. Rises south of Jobstown. Discharges into Dodder east of Tallaght.
- The River Orlagh Rises in Woodstown / Orlagh. The river is culverted for majority of length. Discharges into Dodder north of Firhouse / Knocklyon.
- Owendoher River – The Ownedoher River runs adjacent to the Edmondstown and Ballyboden Roads and passes under Taylors Lane to the west of the Taylors Lane – Ballyboden Road roundabout. Discharges into Dodder adjacent to Bushy Park.
- Little Dargle – Rising in South County Dublin, flowing north. Discharges into Dodder at Orwell Park.
- Dundrum Slang – Runs parallel to R117 for much of its course. It is culverted for large sections including the stretch in Milltown Park where it discharges into the Dodder.

2.5 Material Assets

The proposed route is 17km in length. The majority of the route is proposed within the curtilage of existing parks and road ways; with the accompaniment of carriageway, surface drainage, public lighting, underground utilities, existing footpaths, grass verges, trees etc. On some sections of the road an existing cycle track or cycle lane exists (e.g. Dodder Rd. Lower, Milltown Park). Other sections of the proposed route have discontinuous lengths of cycle track (e.g. R114). Where the route is proposed through parklands it follows the line of the existing footpaths where possible. Sections of the proposed route in the Dodder Valley Park have been completed or require only minor alterations to markings. The bridge at Old Bawn is a Recorded Monument (ref: 021-037 & 022-047). The route will remain within the curtilage of the existing roadway at this location.

Plate 2.4.1: Proposed Route of the Greenway

3. ESTABLISHING A BASELINE

3.1 Scope of the Assessment

This section describes the methodologies followed in the compilation of this EcIA. Recognised guidelines were followed in relation to every aspect of the scoping; survey; and, assessment.

The assessment methodology is based primarily upon the Transport Infrastructure Ireland (TII)/National Roads Authority (NRA) *Guidelines for Assessment of Ecological Impacts of National Road Schemes Rev 2* (TII/NRA, 2009a) (referred to hereafter as the "TII/NRA Ecological Impact Assessment Guidelines"). The survey methodology is based on the TII/NRA *Guidelines on Ecological Surveying Techniques for Protected Flora and Fauna on National Road Schemes* (TII/NRA, 2009b).

In addition, other recognised guidance in Environmental and Ecological Impact Assessment regard provided direction in the preparation of the scope, structure and content of the assessment:

- *Guidelines for Ecological Impact Assessment in the UK and Ireland. Terrestrial, Freshwater and Coastal* (CIEEM, 2016).
- *Draft Revised guidelines on the information to be contained in Environmental Impact Statements* (EPA, 2015).
- *Transport Infrastructure Ireland Design Manual for Roads and Bridges* (TII/NRA, 2013).
- *Transport Infrastructure Ireland 2010 Project Management Guidelines* (TII/NRA, 2010).
- *Environmental Impact Assessment of National Road Schemes – A Practical Guide* (TII/NRA, 2009a).
- *Guidelines for Assessment of Ecological Impacts of National Road Schemes* (TII/NRA, 2009a).
- *Environmental Assessment and Construction Guidelines* (TII/NRA, 2006).
- *Advice Notes on Current Practice (in preparation of Environmental Impact Statements)* (EPA, 2003).

3.1.1 Establishing the 'Zone of Influence'

The key variables determining whether important ecological features will be subject to impacts through development are: the physical distance of the proposed Greenway development to the KERS identified by the desk study and multidisciplinary walkover surveys; the sensitivities of the any other ecological receptors within the receiving natural environment; and the potential for in-combination effects. The zone of influence was derived, reviewed and amended as the route corridor evolved through consultation with public authorities and on the basis of identified potential ecological and biophysical changes caused by the construction and operation of the Greenway. The Zone of Influence in this case has been defined to incorporate important ecological features and ecosystem functions and includes a 3km buffer from the footprint of the proposed works. This zone was also applied for the "likely zone of impact" used to inform the Screening for Appropriate Assessment for the proposed Greenway.

3.1.2 Establishing the 'Study Area'

The extent of the study area is defined by the ecological features likely to occur within an 'effects distance' to the proposed Greenway development. This is informed by the findings of desk study (presence/absence of protected habitats, flora or fauna within the receiving environment) and relevant best practice methodology for assessing impacts on those ecological features. The study area in this case included a 100m buffer of Greenway and also included species specific survey buffer zones (e.g. derogation limits for Badger, Otter etc).

3.2 Previous Environmental Studies of the Dodder

A substantial number of reports and studies have been carried along the River Dodder, both prior to and contributing to this present assessment. The following is a list of the relevant previous environmental studies along the River Dodder corridor that were consulted when establishing the baseline:

(i) River Dodder Habitat Management Plan – Report to Dublin City Council (M. Tubridy & Associates, 2007);
(ii) River Dodder Knotweed Management Plan - MSc. Thesis (E. Donnelly, 2008);
(iii) Strategic Environmental Assessment; Scoping Report (RPS, 2008);
(iv) Species Inventory Invasive Flora of the Major Waterways of the Dublin City Council Area (EcoServe, 2009);
(v) The development of a Gully Woodland Restoration Plan for the Upper River Dodder Catchment and the Identification and Assessment of Generic Issues of Relevance for Future Similar Projects in Ireland (F. Wilson *et al*., 2009) ;
(vi) River Dodder Biodiversity Study and Management Plan (M. Tubridy & Associates, 2010);
(vii) Strategic Environmental Assessment for the Dodder Catchment Flood Risk Management Plan; Environmental Report (RPS, 2010a);
(viii) Habitats Directive Article 6 Assessment for the Dodder Catchment Flood Risk Management Plan; Appropriate Assessment Report (RPS, 2010b);
(ix) Water Framework Directive Fish Stock Survey of Rivers in the Eastern River Basin District (Inland Fisheries Ireland, 2011);
(x) Ecological Survey and Assessment of the Dodder Valley (Firhouse Weir to Rathfarnham Bridge) (Scott Cawley, 2012);
(xi) Dodder Valley Park Habitat Mapping Study (M. Tubridy, 2012);
(xii) Ecological Survey of a Section of the River Dodder Valley (Blackthorn Ecology, 2012);
(xiii) Dodder Flood Alleviation Works 2C-2E Environmental Report (ARUP, 2012);
(xiv) Invertebrate and Fish Biodiversity Assessment of the River Dodder between Fort Bridge and Oldbawn Bridge (Conservation Services, 2012);
(xv) Dodder Valley Linear Park Old Bawn to Fort Bridge, Badger and Otter Survey (Wild Ocean, 2012);
(xvi) An Assessment of the Trees Located Along the "Proposed Cycle and Walking Route" from Tallaght to Ballyboden via Dodder Valley Park. (Arborist Associates Ltd., 2012);
(xvii) Dodder Valley Park Old Bawn Bridge to Fort Bridge Bat Survey (F. Wilson, 2012a);
(xviii) Dodder Valley Park Bat Survey (F. Wilson, 2012b);
(xix) Dodder Valley Park Survey of Large Mammal Activity –Otters & Badgers (F. Wilson, 2012c);
(xx) A Condition Assessment of Trees located along the proposed River Dodder Green Route (Arborist Associates Ltd., 2013);
(xxi) Bat Survey Assessment of Impacts of Proposed River Dodder Pedestrian and Cycle Path (Scott Cawley, 2013);
(xxii) Dodder Valley Park Cycle Scheme - Badger Otter and Breeding Bird Survey along the Dodder from Spawell Link Road down-river to Orwell Park (Scott Cawley, 2014a);
(xxiii) Bat Survey of Property at Ladywelll House, Corybeg, Templeogue, Co Dublin (Scott Cawley, 2014b);
(xxiv) Dodder Valley Park Cycle Scheme Preconstruction Ecological Survey (Scott Cawley, 2014c);
(xxv) Dodder Greenway Landscape Constraints Study (Cunnane Stratton Reynolds, February 2015);
(xxvi) Dodder Greenway Baseline Bat Survey (F. Wilson, August 2015);
(xxvii) River Dodder Greenway Ecological Surveys (EirEco, September 2015a);

(xxviii) Dodder Greenway Invasive Species Report (EirEco, October 2015b); and,

(xxix) Survey for High Nature Value Areas in South Dublin County: Park Grassland Areas – Phase 1 (F. Wilson & Joanne Denyer, October 2015).

3.3 Consultation

Statutory and non-statutory consultees were contacted at various stages of scheme development. Non-statutory consultees were contacted requesting input on sensitive ecological receptors within the Dodder Corridor and invited to submit any other observations in March 2016. Consultees were also provided with a map of the Preliminary Route Option. The purpose of the consultations was to:

- Identify any relevant information that consultees held, including the presence of data on protected species, e.g. red listed plants;
- Identify any concerns that consultees may have about the proposed Greenway; and,
- Identify any issues that the consultees would like to see addressed during the ecological impact assessment process.

Organisations or individuals consulted in relation to ecology and nature conservation, together with a summary of responses are listed in Table 3.3.1. In each case only the responses relevant to the Ecology of the scheme have been reproduced.

Table 3.3.1 Consultation Responses

Statutory Consultee	Date Correspondence Received	Summary of Response
Statutory Consultees		
National Parks & Wildlife Service	8th March 2016	Principal concern for NPWS was that the River Dodder Corridor is an exceptionally important corridor for variety of flora and fauna. Protected species of particular concern include Kingfisher, Otter, and various Bat species and fisheries. Protected and rare plant species also occur along the Dodder Protected Species – Requested adequate ecological surveys are carried out to confirm/deny presence of protected species. Recent research shows certain Bat species show marked negative response to lighting and cumulative impacts on Bats should be a material consideration within the EcIA. Rare and Protected Species records were provided on the 13th June 2016.
Inland Fisheries Ireland	21st April 2016	IFI's main observation was that riparian buffers should be managed in a way that lessens the impacts on the River Dodder and its tributaries. They noted that the necessary width of the riparian zones to intercept sediment and pesticides depends on lands use and slope in the area. The use of unsuitable crossing structures is also highlighted as a concern with regard to preventing the migration of fish to spawning grounds.
Non statutory Consultees		
Planning & Environmental Policy Officer, An Taisce	N/A	No response.
Planning Officer, BirdWatch Ireland	N/A	No response.
County Recorder for Dublin, Botanical Society for Britain and Ireland	3rd April 2016	Declined.
Development Officer, Irish Wildlife Trust	24th June 2016	Provided Otter survey data from 2012.
Monitoring Co-ordinator, Bat Conservation Ireland	25th June 2016	Provided detailed inventory of Bat records for the zone of influence spanning 2000 to 2015.
Monitoring Officer, Irish Raptor Study Group	23rd July 2016	Provided detailed inventory data of Raptor breeding locations and sightings within the zone of influence from 1994 to 2015.
Non statutory Consultees		
Project Support Officer, Vincent Wildlife Trust	N/A	No response.

3.4 Updated Desk Study

A desktop study was carried out to collate information on the ecology of the ZOI that will potentially be impacted by the proposed Greenway development. Information on species listed on Annex II of Council Directive 92/43/EEC (the Habitats Directive); the Wildlife Acts, 1976 to 2012; the Flora Protection Order 2015; Bird species listed on Annex I of Directive 79/409/EEC (the Birds Directive); and, Third Schedule of the EC (Birds & Natural Habitats) Regulations 2011(Invasive Alien Species (IAS) subject to restrictions) were sourced from the statutory consultee National Parks & Wildlife Service (NPWS) and the National Biodiversity Data Centre (NBDC). NPWS online interactive map-viewer provided information relating to designated sites of conservation importance within the ZOI of the Greenway. The study area overlaps eleven 2 km squares. Spatial queries of these 1km squares were undertaken using data provided by NBDC. Additionally, data sources specific to the aquatic status and ecology of the Dodder were examined to determine the likely impact of the scheme and the eventual effects of other projects which may have an in-tandem effect on the aquatic ecology and geomorphology of the river. The desk study undertaken for the EcIA included a thorough review of available ecological data including from the following sources:

- Review of online web-mappers: National Parks and Wildlife Service (NPWS), Teagasc, Environmental Protection Agency (EPA), Water Framework Directive (WFD), Geological Survey of Ireland (GSI), Inland Fisheries Ireland (IFI) & Irish Wetland Bird Survey (I-WeBS);
- Review of Bird Atlases: (Sharrock, 1976; Lack, 1986; Gibbons *et al*., 1993; Balmer *et al*., 2013);
- Review of Birds of Conservation Concern (BoCCI) in Ireland 2014-2019 (Colhoun & Cummins, 2013);
- Review of Data issued by the Bat Conservation Ireland (BCI)Database;
- Review of the National Biodiversity Data Centre (NBDC) web-mapper; and,
- Records from the NPWS web-mapper and review of specially requested records from the NPWS Rare and Protected Species Database for the hectads which overlap with the ZOI.
- Review of fisheries report: Water Framework Directive Fish Stock Survey of Rivers in the Eastern River Basin District, 2011
- Review of the Dodder Flood Alleviation Phase 2C -2E Environmental Report (Arup 2012)
- Review of the Invertebrate and Fish Biodiversity Assessment between Fort Bridge and Old Bawn Bridge (Conservation Services, 2012)
- Review of Framework Directive data for the Dodder (catchements.ie website)

3.5 Habitats, Flora and Fauna

The following sections give an overview of the desk study sources consulted and results obtained during the detailed assessment.

National Parks and Wildlife Service Data

NPWS online records were searched to see if any rare or protected species of flora or fauna were recorded in the 10 km grid squares (Hectads) in which the study area falls (O02, O12, O13). Table 3.5.1 lists the species protected under the Wildlife Acts 1976 to 2012 and the Flora (Protection) Order 2015 recorded within the hectads pertaining to the current study area.

Table 3.5.1 Species Protected Under the Wildlife Acts, 1976 to 2012 and the Flora (Protection) Order 2015 (NPWS)

Common Name	Scientific Name	Status	Grid Square
Red hemp Nettle	*Galeopsis angustifolia*	WA 1976-2012, FPO 2015	O02, O12, O13
Narrow-leaved Helleborine	*Cephalanthera longifolia*	WA 1976-2012, FPO 2015	O02
Bog Orchid	*Hammarbya paludosa*	WA 1976-2012, FPO 2015	O02, O12
Small-white Orchid	*Pseudorchis albida*	WA 1976-2012, FPO 2015	O12
Hairy Violet	*Viola hirta*	WA 1976-2012, FPO 2015	O02, O13
Lesser Snapdragon	*Misopates orontium*	WA 1976-2012, FPO 2015	O12
Great Burnet	Sanguisorba officinalis	WA 1976-2012, FPO 2015	O12
Meadow Barley	*Hordeum secalinum*	WA 1976-2012, FPO 2015	O13
Tufted Salt-marsh Grass	*Puccinellia fasciculata*	WA 1976-2012, FPO 2015	O13
Opposite-leaved Pondweed	*Groenlandia densa*	WA 1976-2012, FPO 2015	O13
Hairy St. John's Wort	*Hypericum hirsutum*	WA 1976-2012, FPO 2015	O13

Biodiversity Ireland Database

The National Biodiversity Ireland Database (NBDC) was accessed prior to conducting the multi-disciplinary walkover surveys and was rechecked for updates on the 22nd March 2016. Table 3.5.2 lists the rare and protected species recorded within the hectads pertaining to the current study area. To avoid replication all records of species represented in the NPWS dataset have been removed from the displayed NBDC data. Table 3.5.3 lists the Invasive Alien Species (IAS) recorded within these hectads.

Table 3.5.2 NBDC Records for the Relevant Hectads

Common Name	Scientific Name	Status	Grid Square
Mammals			
Otter	*Lutra lutra*	Annex II, IV, WA 1976-2012	O02, O12, O13
Daubenton's Bat	*Myotis daubentonii*	Annex IV, WA 1976-2012	O02, O12, O13
Leisler's Bat	*Nyctalus leisleri*	Annex IV, WA 1976-2012	O12, O13
Soprano Pipistrelle	*Pipistrellus pygmaeus*	Annex IV, WA 1976-2012	O12, O13
Pipistrellus	*Pipistrellus pipistrellus sensu lato*	Annex IV, WA 1976-2012	O12, O13
Brown Long-eared Bat	*Plecotus auritus*	Annex IV, WA 1976-2012	O12
Amphibians			
Common Frog	*Rana temporaria*	Annex V, WA 1976-2012	O02, O12, O13
Birds			
Kingfisher	*Alcedo atthis*	Annex I, WA 1976-2012	O12, O13
Eurasian Teal	*Anas crecca*	Annex I, II, WA 1976-2012	O12
Black-headed Gull	*Larus ridibundus*	WA 1976-2012	O12
Spotted Flycatcher	*Muscicapa striata*	WA 1976-2012	O12
House Sparrow	*Passer domesticus*	WA 1976-2012	O02, O12
Sand Martin	*Riparia riparia*	WA 1976-2012	O02, O12
House Martin	*Delichon urbicum*	WA 1976-2012	O12
Common Starling	*Sturnus vulgaris*	WA 1976-2012	O02, O12
Great Cormorant	*Phalacrocorax carbo*	WA 1976-2012	O12, O12, O13
Mute Swan	*Cygnus olor*	WA 1976-2012	O02, O12
Common Kestrel	*Falco tinnunculus*	WA 1976-2012	O12

Table 3.5.3 Invasive Alien Species (IAS) Listed on the Third Schedule Recorded Within the Relevant Hectads (NBDC)

Common Name	Scientific Name	Grid Square
Japanese Knotweed	*Fallopia japonica*	O12, O13
Japanese Knotweed Hybrid	*F. × bohemica*	O12, O13
Himalayan Knotweed	*Persicaria wallichii*	O12
Giant Hogweed	*Heracleum mantegazzianum*	O13
Himalayan Balsam	*Impatiens glandulifera*	O12, O13
American Mink	*Neovison vison*	O12, O13
Eastern Grey Squirrel	*Sciurus carolinensis*	O12, O13

Bat Conservation Ireland Database

A search for records of bat activity and roosts within the ZOI was conducted. A number of identified roosts and survey results are available for the relevant hectads. The results of the database search, per hectad, is provided below in Table 3.5.4. There were no additional surveys, roosts or transects listed on the database.

Table 3.5.4 BCI Data from Hectad O12

Survey Type	Hectad/ Details	Species RRecorded	Survey	Bat Species Designation
Roost	O12, yards and buildings at private house, Rathfarnham,	Leisler's bat (*Nyctalus leisleri*), Common Pipistrelle (*Pipistrellus pipistrellus*), Soprano Pipistrelle (*Pipistrellus pygmaeus*) an unidentified Pipistrelle (*Pipistrellus sp.*), an unidentified Myotis sp., a Natterer's Bat (*Myotis nattereri*) and Brown Long-eared bat (*Plecotus auritus*)	Observation	Annex IV
Roost	O12, Templeogue area	Leisler's bat (*Nyctalus leisleri*)	Observation	Annex IV
Roost	O12, Woodbrook Park, Templeogue.	Unidentified species	Observation	Annex IV
Roost	O12, private house	Soprano Pipistrelle (*Pipistrellus pygmaeus*)	Observation	Annex IV

Survey Type	Hectad/ Details	Species RRecorded	Survey	Bat Species Designation
Roost	O12, Church, Rathfarnham	Leisler's bat (*Nyctalus leisleri*)	Observation	Annex IV
Roost	O12, Church, Whitechurch	Brown long-eared bat (*Plecotus auritus*)	Observation	Annex IV

Environmental Protection Agency

The EPA Envision web-mapper was consulted on the 22nd March 2016 regarding the water quality status of the watercourses within the study area. The Biotic Index of Water Quality (BIWQ) was developed in Ireland by the Environmental Protection Agency (EPA). Q-values and water quality classes are assigned using a combination of habitat characteristics and structure of the macro invertebrate community within the waterbody. Individual macroinvertebrate species are ranked for their sensitivity to organic pollution and the Q-value is assessed based, primarily, on their relative abundance within a biological sample.

River Basin Management Plans (RBMPs) have been published for all River Basin Districts in Ireland in accordance with the requirements of the Water Framework Directive. River Basin Districts are the natural geographical and hydrological units for water management and are used instead of administrative or political boundaries. The online EPA Envision web-mapper provides access to information at individual waterbody level and at Water Management Unit level for all the River Basin Districts in Ireland. Waterbodies can relate to surface waters (these include rivers, lakes, estuaries [transitional waters], and coastal waters), or to groundwaters.

Table 3.5.5 shows the information recorded regarding water quality status at the major waterbodies within the proposed route corridor.

Table 3.5.5 EPA envision Water Quality Results

Waterbody	WFD Status 2010-2012	Q-Value Status (2004-Present)
River Dodder 010	This watercourse has been assigned *Good Status*	Q4
River Dodder 020	This watercourse has been assigned *Moderate Status*	Q3-4
River Dodder 030	This watercourse has been assigned *Good Status*	Q4
River Dodder 040	This watercourse has been assigned *Poor Status*	Q2-3
River Dodder 050	This watercourse has been assigned *Moderate Status*	Q3-4
Glenasmole Lower Lake	This watercourse has been assigned *Good Status*	Q4

3.6 Field Survey

3.6.1 Multi-disciplinary Walkover Surveys

Initial consultation with NPWS determined the scope of the ecological survey requirements and highlighted the pertinent issues of this Greenway. The Ecology of the ZOI was then assessed in the desk study of ecological data which was followed by a multi-disciplinary ecological walkover survey of the study area which incorporated the footprint of the preferred route option and a 100m buffer. The River Dodder is of ecological significance and provides important habitat for a range of sensitive protected species, for example, species listed on Annex II of the EU Habitats Directive (e.g. Otter) and species listed on Annex I of the EU Birds Directive (e.g. Kingfisher). In addition, watercourses often support a wide range of aquatic and riparian species of high conservation value. Watercourses can also act as conduits for Invasive Alien Species (IAS) and a receptor and source pathway for pollutants to any sensitive habitats located downstream. The Greenway moves away from the watercourse for sections of the route, however, the entire River Dodder was systematically surveyed.

The walkover surveys were undertaken by suitably qualified and accredited Ecologists with relevant academic qualifications and extensive professional experience in ecological survey and assessment. The Survey also aimed to identify 'Protected species and natural habitats', as defined in the Environmental Liability Directive (2004/35/EC) and European Communities (Environmental Liability) Regulations, 2008, including:

- Birds Directive – Annex I species and other regularly occurring migratory species, and their habitats (wherever they occur); and,
- Habitats Directive – Annex I habitats, Annex II species and their habitats, and Annex IV species and their breeding sites and resting places (wherever they occur).

Habitats were classified in accordance with the Heritage Council's 'Guide to Habitats in Ireland' (Fossitt, 2000). Habitat mapping was undertaken with regard to guidance set out in 'Best Practice Guidance for Habitat Survey and Mapping' (Smith et al., 2011). Plant nomenclature for vascular plants followed The Vegetative Key to the British Flora (Poland & Clement, 2009), while mosses and liverworts nomenclature follows Mosses and Liverworts of Britain and Ireland - a field guide (Atherton et al., (eds) 2010) Habitats considered to be of ecological significance and in particular having the potential to correspond to those listed in Annex I of the EU Habitats Directive 92/43/EEC were identified during the walkover survey.

The walkover survey was designed to detect evidence, or likely presence of protected species. The survey included identification of Badger setts and areas of suitable habitat; potential Bat roosts and linear features likely to be of significance to foraging and commuting Bats; and, built and natural habitat features with potential to support other protected species likely to occur in the study area. Surveys were carried out in accordance best practice guidance (TII/NRA, 2009b). The following sections outline methodologies followed when undertaking various specialist surveys.

3.7 Habitat Surveys

The aim of the survey was to identify the type, quality and extent of habitats present within an area, and to identify any habitats or features that might require more detailed field investigations. The footprint of the Project is a 5m wide corridor on largely existing built surfaces which limits potential impacts on surrounding habitats. Field surveys were conducted in July during the recognised optimal period for detailed vegetation surveys/habitat mapping, *i.e*. April to September (Smith *et al.,* 2011).

3.8 Invasive Alien Plant Species (IAPS)

Watercourses often support a wide range of aquatic and riparian species of high conservation value. Watercourses can act as conduits for Invasive Alien Species (IAS). During the multi-disciplinary walkover surveys the presence of non-native IAS listed under the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. 477 of 2015) were recorded. Regulation 49 includes legislative measures to deal with the dispersal and introduction of Invasive Alien Species (IAS) as well as the prohibition on introduction and dispersal of certain species. IAS are also addressed by EU Regulation 1143/2014, which seeks to address the problem of IAS in a comprehensive manner so as to protect native biodiversity and ecosystem services, as well as to minimize and mitigate the human health or economic impacts that these species can have.

An IAPS survey was conducted in March and April 2016. The entire Site was walked at a slow pace to accurately determine the distribution and abundance of all IAPS. Notes on site conditions were recorded and the stands were mapped in the field. Exact locations of IAPS were marked with 10 figure grid reference readings using a hand-held high sensitivity Garmin GPSMAP 64st Geographical Positioning System (GPS) and imported into a geospatially

referenced Geodatabase in ArcGIS. The survey was conducted using 1:5000 Ordnance Survey Ireland (OSI) basemaps and cross referenced with publicly available topographical maps and orthophotography.

3.9 Bats

All nine resident breeding Bat species in Ireland are protected, wherever they occur. Their roost sites (whether in use or not) are strictly protected under both European and Irish legislation. Under the Wildlife Acts, 1976 to 2012 all Bat species occurring in Ireland are listed in Schedule V of the Acts as a protected species. This legislation makes it illegal to kill or injure Bats in the wild and makes it an offence to wilfully interfere with, or to destroy, their breeding and resting places.

The Council Directive 92/43/EEC (EC Habitats Directive) offers legal protection to all nine Bat species which are currently known to occur in Ireland and lists them under Annex IV of the Directive, as species of community interest, in need of strict protection. The Lesser Horseshoe bat is additionally listed in Annex II of the Directive, requiring the designation of Special Areas of Conservation to secure its conservation and protection; however the known range of this species is restricted to the south western counties. The European Communities (Birds and Natural Habitats) Regulations, 2011(S.I. 477 of 2015) makes it an offence to deliberately capture or kill Bats in the wild, to deliberately disturb them particularly during the breeding, rearing, hibernation and migration seasons, or to cause the deterioration or destruction of their breeding and resting sites. Derogation licences can be issued to permit roost loss or disturbance and other potential offences to be committed providing the conservation status is unaffected and other tests within the legislation are met. Furthermore as a signatory to the European Bats Agreement (Agreement on the Conservation of Bats in Europe) 1993, Ireland is required to protect their habitats, requiring the identification and protection from damage or disturbance, of important feeding areas. All Irish Bat species are listed in Appendix II of the Bern Convention (1979), as species requiring strict protection.

3.9.1 Bat Suitability Assessment

The function of the Bat suitability assessment was to identify built or natural features within close proximity to the construction envelope (area in which construction or ground works will take place i.e. direct/indirect physical or noise disturbance) of the Project and which could provide moderate to high potential to support a Bat roost.

The Bat suitability assessment was conducted adhering to best practice guidance (TII/NRA, 2006a; Collins (Eds.), 2016) and involved a visual assessment and categorisation of highly suitable features on buildings and trees capable of supporting roosting Bats. Suitable entry and exit points around eaves, soffits, flashing, under tiles were examined on buildings for physical evidence of use by Bats (e.g. Bat droppings and indicative staining and scratching at holes or cracks). External visual assessment was undertaken using binoculars and torches. Trees were assessed using the recognised criteria outlined in Collins (Eds.) (2016). The locations of trees with any natural holes, cracks/splints in major limbs, loose bark, hollows/cavities, dense epicormic growth that could provide moderate to high potential were recorded with high definition Geographical Position System (GPS). Linear landscape features (e.g. mature Treelines and Hedgerows) with potential to provide important foraging and commuting habitat for Bats were also recorded and geospatially referenced.

3.9.2 Rapid Thermal Imaging Assessment

This is a highly sensitive technique which can detect minute changes in temperature potentially highlighting the presence of roosting bats. When used in combination with good bat field-craft, this equipment can greatly increase the chance of detecting roosting locations. The equipment was used to assess potential roost locations such as those identified in the Bat Suitability Assessment (e.g. riverside mature trees or bridge structures along the Greenway). Structures were selected with reference to roosting features typically used by roosting Daubenton's bats (Altringham, 2003).

3.9.3 Bat Activity Surveys

The Bat activity surveys were conducted adhering to best practice guidance (TII/NRA, 2006a; Collins (Eds.), 2016) and involved walking along the pre-determined preferred route option to observe and record Bat activity in the study area. Bat survey transects were undertaken between fifteen minutes before sunset and two hours after sunset, and from two hours before sunrise to sunrise. The length of Bat transects were devised on the basis that the recommended survey periods could be adequately covered twice per session (transect up and transect down). Bat Activity surveys of the entire Greenway were undertaken in May, June and July 2016. Where possible, dusk and dawn survey transects were carried out on successive days. Health and Safety policy dictated that surveyors operated in pairs. During each survey, the transect was walked up and down along its full length slowly using Anabat Walkabout Bat Detectors or Song Meter EM3+ Bat Detectors. Both Bat Detectors allow visual validation of echolocation recordings (species identification) in real time and all audio files are linked to a Geographical Positioning System (GPS) and digitally geospatially referenced. Over 50hrs of Bat activity surveys were conducted between May and late July in suitable weather conditions.

Table 3.9.1 Details of Bat Activity Surveys 2016 Transects

Date*	Transect	Section	Total Distance
25/05/2016	1	Old Bawn Bridge to Fort Bridge	10 km
25/05/2016	2	Old Bawn Bridge to R114 Firhouse Road	10 km
31/05/2016	3	Rathfarnham Road Weir to R114 Firhouse Road	16 km
07/06/2016	4	Donnybrook to Rathfarnham Road Weir	16 km
14/06/2016	5	Donnybrook to Grand Canal Dock	12 km
22/06/2016	1	Old Bawn Bridge to Fort Bridge	10 km
29/06/2016	2	Old Bawn Bridge to R114Firhouse Road	10 km
05/07/2016	3	Rathfarnham Road Weir to R114 Firhouse Road	16 km
06/07/2016	4	Donnybrook to Rathfarnham Road Weir	16 km
06/07/2016	5	Donnybrook to Grand Canal Dock	12 km
11/07/2016	1	Old Bawn Bridge to Fort Bridge	10 km
12/07/2016	2	Old Bawn Bridge to R114 Firhouse Road	10 km
18/07/2016	3	Rathfarnham Road Weir to R114 Firhouse Road	16 km
25/07/2016	4	Donnybrook to Rathfarnham Road Weir	16 km
26/07/2016	5	Donnybrook to Grand Canal Dock	12 km

*Date of dusk transect. Dawn transects concluded the following a.m.

Following each survey, recordings (detections) were processed using Kaleidoscope Pro Analysis software to extract information including sound recordings, sonograms, GPS coordinates, time, date and species identification confidence values. All validated detections were digitally geospatially referenced into ArcGIS Mapping Platform.

3.9.4 Targeted Survey of Daubenton's Bat (*Myotis daubentonii*)

During the scoping and initial consultation with NPWS particular concern was raised regarding the potential cumulative impacts of lighting on Bats within the River Dodder corridor. Daubenton's Bat is the species most strongly associated with freshwater habitats and sensitive to lighting, however, historical baseline data provided no roost locations and limited distribution and abundance data of this species within the catchment prior to the comprehensive Bat Activity Surveys undertaken in 2016. To better understand the patterns of site use and identify roost locations within the corridor specialist survey elements were developed and progressed.

3.9.5 Lamping Surveys

It should be noted that other species of Bat, such as Soprano Pipistrelle, can also fly low over water as part of their foraging behaviour. Therefore, positive identification of Daubenton's was only made with the confirmation of both audible and visual recognition. Lamping surveys were completed using the protocols set out by the Bat Conservation Trust National Bat Monitoring Programme Waterways Survey guidance. This methodology is also applied in the Republic of Ireland (Augney & Roche, 2007). The study area was divided into 1km sections which were then further divided into monitoring locations, which are roughly 100m apart (where safe access allowed). These locations were monitored for a period of at least 5 minutes using both Bat detectors and high powered torches (fitted with a red filter) to search for audible and visual evidence of Daubenton's foraging and commuting activity. Three lamping surveys were completed between the 15th and 17th August 2016.

3.9.6 Backtracking Surveys

To complement the work using thermal imagery and lamping/detector surveys, dawn backtracking surveys were also undertaken to target areas of greatest Daubenton's activity and follow Bats back to their roosts. This approach is supported by the Bat Conservation Trust and requires surveyors to monitor for Bat activity at dawn, communicating with colleagues via radios to plot the direction of Bat movement along the corridor. The method assumes that the closer a Bat is recorded at sunset or sunrise, the closer it is likely to be to its roost. The Bat Activity transect surveys highlighted potential roost hotspots and this data informed the location of the back tracking surveys that could these target areas of greatest activity. Three dawn back tracking surveys were completed between the 15th and 17th August 2016.

3.10 Protected Land Based Terrestrial Mammals

3.10.1 Otter (*Lutra lutra*)

Otter are listed under Annex II and Annex IV of the EU Habitats Directive and is also protected under the Irish Wildlife Acts 1976-2012 and is evaluated as being Near Threatened in the most recent Red Data list for mammals (Kingston, 2012). This species is distributed throughout Ireland and can have a home range of up to 10 or 20 km (NPWS, 2013). As per the NPWS Article 17 Reporting, the range, population, habitat and future prospects for this species in Ireland have been assessed as favourable.

The purpose of the Otter survey was to identify any sensitive features within the study area potentially of use to breeding, resting, foraging or commuting Otter and to establish presence or absence of Otter activity.

The Otter survey was conducted adhering to best practice guidance (TII/NRA, 2008a; 2009b) and involved a search of the entire River Dodder within the study area for physical evidence of Otter e.g. spraints, prints, slides, trails, couches and holts. Particular attention was given to important riverine features within the survey corridor for Otter. The survey methodology was also cognisant of the recommendations in the Otter Threat Response Plan 2009-2011 (NPWS, 2009) which recognises the importance of the riparian buffer (10m on both banks) for Otter and these areas were included in the survey corridor.

3.10.2 Badger (*Meles meles*)

Badgers and their setts are protected under the provisions of the Wildlife Acts 1976 to 2012 and are evaluated as being Least Concern in the Irish Red Data list for mammals (Marnell et al., 2009). It is an offence to intentionally kill or injure a Badger or to wilfully interfere with or destroy the breeding site or resting place of a protected wild animal. Badgers are found throughout Ireland in areas of suitable habitat (Hayden & Harrington, 2000). The badger population is in the Republic of Ireland is stable and is 84,000 (Sleeman et al., 2009).

The badger is an adaptable species of lowland grassland and woodland habitats and also occasionally in upland and suburban areas. Its group size is typically 4-5 animals (Feore, 1994; Smal, 1995). They are opportunistic foragers that exploit a broad range of prey. Earthworms are common in the diet but account for little of the bulk. Seasonally abundant food sources are important including insect larvae (beetles, noctuids and tipulids) and frogs (Cleary et al., 2009).

The Badger survey was conducted in order to determine the presence or absence of Badger within the study area. The Badger survey was conducted adhering to best practice guidance (TII/NRA, 2006b; 2009b) and involved a systematic search of all fence lines, woodland and scrub habitats for physical evidence of Badger e.g. setts, latrines, badger paths. The optimal period for Badger surveys is during seasonal peaks in territorial activity and when vegetation cover is at a minimum (February to April and less pronounced peak in October). The study area was surveyed for evidence of Badger in March and April 2016.

Badger setts were classified as Main, Annex, Subsidiary and Outlier based on recommendations given by (Harris *et al*., 1994) consistent with the convention set out in TII/NRA (2009b). Where badger setts were found, the number of entrances, activity level and sett status was recorded. Sett status categorisation is as follows:

- Main sett: used throughout the year and constitutes the main breeding sett. Where a sett exhibits much activity and appears to be the largest (normally at least five holes) and most well used sett within a badger territory it is categorised as the main sett. Main setts always have active Badger runs leading away from them and are normally marked by latrines.
- Annex sett: categorised where assumed to form a part of the main sett area but where the sett is unlikely to be directly linked by an underground passage to the main sett either due to a barrier (e.g. separated by a watercourse or ditch) or by distance. Normally linked to the main sett by a well used path and lie within 150m of a main sett entrance.
- Subsidiary sett: categorised where believed to offer an alternative large sett complex to the main sett. Subsidiary setts are normally at least 50m away and are not always obviously linked by a well used path. Subsidiary setts often exhibit moderate levels of activity, are larger than outlier setts but smaller than main setts. Often marked by latrines.
- Outlier sett: often comprise just one or two holes. Used infrequently and can be found at the extremes of a Badger group's territory.
- Disused sett: appears abandoned by the group for at least a year. Differs from 'inactive' setts which are judged to be temporarily disused. Often completely blocked with vegetation or collapsed.

Exact locations of Badger field signs and setts were marked with 10 figure grid reference readings using a hand-held high sensitivity Garmin GPSMAP 64st Geographical Positioning System (GPS) and imported into a geospatially referenced Geodatabase in ArcGIS.

Sett status can quickly change. It is not uncommon for Badgers to switch the location of their main sett to the location of a previously identified subsidiary sett, or an outlier sett to be develop into a subsidiary sett. Further intensive studies of social group territoriality was not undertaken (e.g. Bait marking) as a satisfactory evaluation of the impacts and their effects of the proposed scheme and specific mitigation has been determined without this level of detail.

3.10.3 Other Mammals

During the multi-disciplinary ecological walkover surveys the potential for the study area to support additional protected mammals listed in the Wildlife Acts, 1976 to 2012 were a material consideration. Determining the presence/absence of species such as Irish Hare, Pine Marten, Red Squirrel, Pygmy Shrew, Irish Stoat, Hedgehog, etc. was assessed and any physical evidence of presence recorded. Further detail on these species is provided in the Important Ecological Features section where relevant.

3.11 Aquatic Species

Most fish and invertebrate species are protected under the Wildlife Acts 1976 to 2012. Additionally, the Dodder is home to both lamprey and Atlantic salmon, both of which are listed in Annex II of the EU Habitats Directive.

A variety of habitats are required to ensure these species survival. In particular, the maintenance of a gravel bed river substrate which remains largely free of fine sediment is key to the survival of early salmon life stages. Other stages of the salmon life cycle such as nursery habitat will require a more cobbled bed with a range of flow types where salmon parr may forage and seek cover as needed.

Lamprey habitat is usually found in slower flowing and marginal areas, where there may be silt deposits. Young lamprey life stages (ammocetes) develop in this type of substrate but do not tolerate polluted waters. Indeed, pollution in it various forms (eg: toxic chemicals, organic sediments, deoxygenating discharges from domestic sewers) can completely eliminate lamprey populations from river systems (Docker, 2015).

Likewise, invertebrate populations within the river system are also sensitive indicators of water quality, and any change in water quality or flow regime can affect the species distribution of invertebrates, with knock-on effects for higher trophic levels such as fish, birds and mammals.

3.12 Riparian Birds

In Ireland all birds protected under the Irish Wildlife Acts 1976 to 2012. During the multidisciplinary walkover surveys visual sightings of riparian birds along with breeding behaviour and nesting sites were recorded. Birds species associated with the riverine habitat are especially sensitive to disturbance as a result of the construction and operation of the Greenway.

3.12.1 Kingfisher

The Kingfisher is listed under Annex I of the EU Birds Directive. The species is an Amber-listed (Bird of Conservation Concern in Ireland). This species experiences annual population fluctuations driven by patterns of winter weather. There are estimated to be between 368 and 1031 breeding pairs of Kingfisher in Ireland. The population declined by 45% between 1991 and 2010. BirdLife International has evaluated the European population as depleted, due to a moderate historical decline.

The Kingfisher is very distinctive when seen well with its brightly coloured plumage. The underparts are a bright orange-red, while the wings and back of the head are dark blue. The back, rump and tail are a bright, almost "electric" blue and usually draw attention to a flying bird. Despite these bright colours, can be easily overlooked perched motionless on a branch beside a stream or river on the look-out for fish. During the breeding season, females have a small red patch at the base of the bill, which is not shown by adult males.

Kingfishers are resident on Irish streams, rivers and canals. They breed in tunnels dug in vertical banks along streams and rivers. The Kingfisher is largely a sedentary species, it rarely moves from its territory. However, some may move to lakes and coasts during extended spells of poor weather. The bird feeds on various species of small fish (e.g. Stickleback, Minnow) and larger aquatic insects caught by plunge-diving from a perch.

3.12.2 Sand Martin

This species is Amber-listed in Ireland due to concerns over the European breeding population, which is regarded as Depleted. Sand Martins have undergone a large historical decline, though the population is currently considered stable. The Sand Martin is the smallest breeding Hirundine species in Ireland, being about a third smaller than both House Martin and Swallow. Adult Sand Martins have a brown head, back, rump and wings. The throat is white, as are the belly and vent except for a broad brown breast band. Juveniles have a pale yellow wash to head throat and face, as well as breast. The breast band is also noticeably narrower. In all plumages, it has only a small fork in the tail, never as long as the tail streamers of the Swallow.

The Sand Martin is a widespread summer visitor throughout Ireland from mid-March to September. Sand Martins breed in burrows dug into river banks or quarries. These breeding sites are vulnerable to predation by Mink and Red Fox. Feeding birds disperse widely, favouring wetlands and rural areas. The species is less frequently seen in urban areas. This species winters in sub-Saharan Africa, crossing the Sahara Desert in autumn and spring. Sand Martins almost exclusively feed on insects caught in flight.

3.12.3 Grey Wagtail

The Grey Wagtail is Red listed species in Ireland due to a >50% Short-term (13yr) decline in breeding population. It is a widespread resident along fast flowing streams and rivers and frequently builds its nest under bridges. Grey Wagtails feed mainly on insects caught on the ground or in flight.

3.12.4 Dipper

The Dipper is Green-listed in Ireland and it's European population has been evaluated as Secure. It is slightly smaller than a Blackbird and in appearance can be very compact and dumpy. Adult Dippers are reddish-brown with a large "bib" of white on the throat and breast. The bird is known to habitually bob up and down when perched and fly low over the water.

The Dipper is a widespread resident along rocky streams and rivers. It breeds along fast-flowing streams and rivers with plenty of exposed rocks. In Ireland, the majority of breeding pairs are found in uplands. The nests are usually sited in a hole in the river bank, behind a waterfall or under a bridge. It will also use nest boxes placed in suitable locations. It feeds on aquatic invertebrates, such as the larvae of caddis and mayflies and as such it is very sensitive to changes in water quality. Prey is caught by diving from the surface and searching the bottom of a stream or river by walking on it. The species is largely sedentary with movements largely dependent on weather conditions. Juveniles disperse soon after fledging.

3.13 Ecological Evaluation and Impact Assessment Methodology

3.13.1 Evaluation of Ecological Resources

The criteria used for assessment of the value of the ecological resources follows those set out in Section 3.3 of the TII/NRA Ecological Impact Guidelines (2009a). These guidelines set out the context for the determination of value on a geographic basis with a hierarchy assigned in relation to the importance of any particular receptor. The guidelines provide a basis for determination of whether any particular site is of importance on the following scales:

- International
- National
- County
- Local Importance (Higher Value)
- Local Importance (Lower Value)

This guidance clearly sets out the criteria by which each geographic level of importance can be assigned. For example, Locally Important (Lower Value) receptors contain habitats and species that are widespread and of low ecological significance and only of any importance in the local area. Conversely, Internationally Important sites are either designated for conservation as part of the Natura 2000 Network (SAC or SPA) or provide the best examples of habitats or internationally important populations of protected fauna.

All habitats and species within the ZOI and study area were assigned a level of significance on the above basis and KERs were established and classified on this basis.

3.13.2 Assessment of Impact Type and Magnitude

Reference is made to the following parameters wherever appropriate when characterizing impacts (Section 5):

- Magnitude relates to the quantum of impact, for example the number of individuals affected by an activity;
- Extent should also be predicted in a quantified manner and relates to the area over which the impact occurs;
- Duration is intended to refer to the time during which the impact is predicted to continue, until recovery or re-instatement;
- Reversibility should be addressed by identifying whether an impact is ecologically reversible either spontaneously or through specific action; and,
- Timing/frequency of impacts in relation to important seasonal and/or life-cycle constraints should be evaluated. Similarly, the frequency with which activities (and associated impacts) would take place can be an important determinant of the impact on receptors.

The assessment of impact takes account of construction and operational phases; direct, indirect and synergistic impacts; and, those that are temporary, reversible and irreversible. The criteria for assessment of impact magnitude, type and significance are given in Table 3.13.1 and 3.13.2. The following terms are defined when quantifying duration: (EPA, 2015)

- Temporary – up to 1 year
- Short-term – 1 to 7 years
- Medium term – 7 to 15 years
- Long term – 15 to 60 years
- Permanent – over 60 years

Table 3.13.1 Criteria for Assessing Impact Significance Based on (EPA, 2015)

Impact Magnitude	Definition
No change	No discernible change in the ecology of the affected feature
Imperceptible Impact	An impact capable of measurement but without noticeable consequences
Slight Impact	An impact which causes noticeable changes in the character of the environment without affecting its sensitivities
Moderate Impact	An impact that alters the character of the environment that is consistent with existing and emerging trends
Significant Impact	An impact which, by its character, its magnitude, duration or intensity alters a sensitive aspect of the environment
Profound Impact	An impact which obliterates sensitive characteristics

Table 3.13.2 Criteria for Assessing Impact Quality Based on (EPA, 2015)

Impact Type	Criteria
Positive	A change which improves the quality of the environment e.g. increasing species diversity, improving reproductive capacity of an ecosystem or removing nuisances
Neutral	A change which does not affect the quality of the environment
Negative	A change which reduces the quality of the environment e.g. lessening species diversity or reducing the reproductive capacity of an ecosystem

Once the potential impacts are characterised, the significance of any such impacts on the identified KERs can be predicted. An impact is considered to be ecologically significant if it results in a change in the conservation status of a KER.

3.13.3 Process of Assessing Significance

The significance of any identified impacts is determined whereby impacts are assigned significance empirically on the basis of an analysis of the factors which characterise them, irrespective of the value of the receptor. Significance is determined by effects on conservation status or integrity, regardless of geographical level at which these would be relevant.

If impacts are not found to be significant at the highest geographical level at which the resource has been valued, they may be significant at a lower level and this is determined sequentially. Similarly, impacts that do not affect the integrity of a site, may nevertheless affect the conservation status of a valuable constituent habitat or species, at a lower geographic scale. An equivalent approach has been applied to mitigation measures prescribed, which may have a significant beneficial impact, but at a higher or lower geographic scale than the receptor to which they have been applied.

3.13.4 Mitigation

The Greenway largely utilises existing built surfaces and inherently avoids many potential impacts on sensitive habitats and species. The potential impacts of the Greenway are considered and assessed to ensure that all impacts on KERs are adequately addressed and no significant residual impacts remain following mitigation. Where significant impacts on KERs are predicted, mitigation has been prescribed to address such impacts. In addition, mitigation has been employed to ensure legislative and policy compliance and in some cases to result in an enhancement of the biodiversity value of an area that is not among the identified KERs. Proposed mitigation measures are specifically set out and are realistic in terms of cost and practicality.

3.14 Survey Limitations

Standard survey methods were followed however, any biases or limitations associated with these methods could potentially affect the results collected. Whilst every effort was made to provide a full assessment and comprehensive description of the Greenway study area, it is unlikely that one survey can achieve absolute characterisation due to temporal variation. It is recognised that whenever a survey is carried out (within the defined season), it is a compromise, suitable for the vast majority of species, but possibly too early or too late for some species.

4. IMPORTANT ECOLOGICAL FEATURES

4.1 Designated Sites

For the purpose of this review the likely zone of influence for the construction and operation of the Greenway is considered to be immediately around the site (within a maximum radius of 3km).

This review highlights that the study area lies within a predominately urban setting which is significant as it is one of the last remaining natural areas located in the Greater Dublin Area and provides an important ecological corridor linking the city to the Dublin Mountains. Designated sites fall into a number of categories based on the associated level of protection afforded:

- Special Areas of Conservation (SAC) are strictly protected sites designated under the EC Habitats Directive.
- Special Protection Areas (SPA) are strictly protected sites classified in accordance with Article 4 of the EC Birds Directive.
- Natural Heritage Areas (NHA) are considered important for the habitats that are present or which hold species of plants and animals whose habitat needs protection. These areas are afforded statutory protection under the Wildlife Acts 1976 to 2012.
- Proposed National Heritage Areas (pNHA) are sites of significance for wildlife and habitats but which have not yet been statutorily proposed or designated as NHA. These areas were proposed for protection on a non-statutory list which was published in 1995.

Designated sites occurring within or adjacent to the study area are listed in Table 4.1.1 below (See Figure 2 in Appendix A).

Table 4.1.1 Designated Sites

Name	Site Code	Proximity to Greenway
Dodder Valley pNHA	000991	Within study area
Glenasmole Valley SAC	001209	Adjacent to proposed greenway (upstream)
Grand Canal pNHA	002104	Adjacent to proposed greenway
North Dublin Bay pNHA, SAC, SPA	000206	4km east (outer bay)
South Dublin Bay pNHA, SAC, SPA	000210	3km east (downstream)
South Dublin Bay & River Tolka Estuary SPA	004024	2.60km east (outer bay)
Dublin Dock Dolphins (incl. in SPA 004024)	000201	2km east (in bay)
North Bull Island SPA	004006	4km east (outer bay)

There are no designated Natura 2000 sites within the proposed greenway route, however the Glenasmole Valley SAC is situated immediately to the south of the end point of the route. In terms of natural heritage in the vicinity, the River Dodder (pNHA) falls within the study area. The nearest designated areas with biological connectivity include: The Dodder Valley pNHA; The Glenasmole Valley SAC; Grand Canal pNHA; The North Dublin Bay pNHA/ SAC/SPA; The South Dublin Bay pNHA/ SAC/ SPA; the South Dublin Bay & River Tolka Estuary SPA and the North Bull Island SPA. The following descriptions are taken from the relevant NPWS site synopsis reports.

4.1.1 Dodder Valley pNHA Site Code: 000991

This site represents the last remaining expanse of natural river bank of the Dodder in the built up Greater Dublin Area with the proposed designation extending for approximately 2km between Firhouse Bridge and Old Bawn Bridge. The Dodder Valley supports riparian woodland and scrub mainly of Willow (*Salix* spp.) Along the banks are wild flower meadows with a good diversity of plant species. The Valley also supports several riparian bird species of conservation interest.

4.1.2 Glenasmole Valley SAC Site Code: 001209

The Glenasmole Valley SAC in south Co. Dublin lies on the edge of the Wicklow uplands, approximately 5 km from Tallaght. The River Dodder flows through the valley and has been impounded here to form two reservoirs which supply water to south Dublin. The non-calcareous bedrock of the Glenasmole Valley has been overlain by deep drift deposits which now line the valley sides. They are partly covered by scrub and woodland, and on the less precipitous parts, by herb-rich grassland. There is much seepage through the deposits, which brings to the surface water rich in bases, which induces local patches of calcareous fen and, in places, petrifying springs.

4.1.3 The Grand Canal pNHA Site Code: 002124

This proposed Natural Heritage Area lies at the northern end of the greenway, where the River Dodder and the Grand Canal flow into the River Liffey. The ecological value of the canal lies more in the diversity of species that it supports along its linear habitat rather than in the presence of species within the canal itself. The area has been noted for the presence of Otter (*Lutra lutra*), Smooth newt (*Lissotriton vulgaris*) and diverse plants species; opposite–leaved pondweed (*Groenlandia densa*), Arrowhead (*Sagittaria Sagittifolia*), Watercress (*Rorippa nasturtium-aquaticum*) and Hemlock waterdropwort (*Oenanthe crocata*).

4.1.4 North Dublin Bay pNHA, SAC Site Code (000206)

The proposed Natrual Heritage Area and SAC cover the inner part of North Dublin Bay, the seaward boundary extending from the Bull Wall lighthouse across to the Martello Tower at Howth Head. The North Bull Island is the focal point of this site. North Bull Island is a sandy spit which formed after the construction of the Bull Wall in the 18th and 19th centuries. It now extends to about 5 km in length and is up to 1 km wide in places. The site possesses an excellent diversity of coastal habitats. The North Bull Island dune system is one of the most important systems on the east coast and is one of the few in Ireland that is actively accreting. It possesses extensive and mostly good quality examples of embryonic, shifting marram and fixed dunes, as well as excellent examples of humid dune slacks. Both Atlantic and Mediterranean salt marshes are well represented and a particularly good marsh zonation is shown. The salt marshes grade into mudflats and sandflats, some of which are dominated by annual *Salicornia* species. *Petalophyllum ralfsii* occurs at its only known station away from the western seaboard. The site has five Red Data Book vascular plant species and four Red Data Book bryophyte species.

4.1.5 North Bull Island SPA Site Code: 000206

The North Bull Island SPA site covers all of the inner part of North Dublin Bay, with the seaward boundary extending from the Bull Wall lighthouse across to Drumleck Point at Howth Head. The site is of international importance for waterfowl on the basis that it regularly supports in excess of 20,000 waterfowl.

The North Bull Island SPA is among the top ten sites for wintering waterfowl in the country. It supports internationally important populations of Light-bellied Brent Goose (*Branta Bernicila Hrota*) and Bar-tailed Godwit (*Limosa Lapponica*) and is the top site in the country for both species. A further 14 species have populations of national importance, with particularly notable numbers of Shelduck (*Tadorna Tadorna*) (8.5% of national total), Pintail (*Anas Acuta*) (11.6% of national total), Grey Plover (*Pluvialis Squatarola*) (6.9% of national total), and Red Knot (*Calidris Canutus)* (10.5% of national total). North Bull Island SPA is a regular site for passage waders such as Ruff (*Philomachus Pugnax*), Curlew Sandpiper (*Calidris Ferruginea*) and Spotted Redshank (*Tringa Erythropus)*. The site supports Short-eared Owl (*Asio Flammeus)* in winter. Formerly the site had an important colony of Little Tern (*Sterna Albifrons)* but breeding has not occurred in recent years. The site provides both feeding and roosting areas for the waterfowl species. Habitat quality for most of the estuarine habitats is very good. The site has a population of the rare *Petalophyllum Ralfsii* which is the only known station away from the western seaboard as well as five Red Data Book vascular plant species and four bryophyte species. It is nationally important for three insect species.

Wintering bird populations have been monitored more or less continuously since the late 1960s, and the other scientific interests of the site have also been well documented. Future prospects are good, owing to various designations assigned to site.

4.1.6 South Dublin Bay pNHA, SAC Site Code: 000210

This site lies south of the mouth of the River Liffey and extends from the South Wall to the West Pier at Dun Laoghaire. It is an intertidal site with extensive areas of sand and mudflats, a habitat listed on Annex I of the E.U. Habitats Directive.

The bed of Dwarf Eelgrass (*Zostera Noltii*) found below Merrion Gates is the largest stand on the east coast. Green algae (*Enteromorpha* Spp. and *Ulva Lactuca*) are distributed throughout the area at a low density. Fucoid algae occur on the rocky shore in the Maretimo to Dún Laoghaire area. Species include *Fucus Spiralis, F. Vesiculosus, F.* Serratus*, Ascophyllum Nodosum* and *Pelvetia Canaliculata.*

Drift line vegetation occurs in association with the embryonic and incipient fore dunes. A small area of pioneer saltmarsh now occurs in the lee of an embryonic sand dune just north of Booterstown Station. Lugworm (*Arenicola Marina*), Cockles (*Cerastoderma Edule*) and Annelids and other bivalves are frequent throughout the site and the small gastropod *Hydrobia Ulvae* occurs on the muddy sands off Merrion Gates.

The site possesses a fine and fairly extensive example of intertidal flats. Sediment type is predominantly sand, with muddy sands in the more sheltered areas. A typical macro-invertebrate fauna exists. In addition the site has the largest stand of Eelgrass on the east coast and supports part of the important wintering waterfowl populations of Dublin Bay.

4.1.7 South Dublin Bay and River Tolka SPA Site Code: 004024

The South Dublin Bay and River Tolka Estuary SPA comprises a substantial part of Dublin Bay. It includes the intertidal area between the River Liffey and Dun Laoghaire, and the estuary of the River Tolka to the north of the River Liffey, as well as Booterstown Marsh. A portion of the shallow marine waters of the bay is also included. The site possesses extensive intertidal flats which support wintering waterfowl which are part of the overall Dublin Bay population. It regularly has an internationally important population of Light-bellied Brent Geese, which feed on Dwarf Eelgrass in the autumn. It has nationally important numbers of a further 6 species: Oystercatcher (*Haematopus ostralegus*), Ringed Plover (*Charadrius hiaticula*), Red Knot, Sanderling (*Calidris alba*), Dunlin (*Calidris Alpina*) and Bar-tailed Godwit. It is an important site for wintering gulls, especially Black-headed Gull (*Larus ridibundus)* and Common Gull (*Larus canus*). South Dublin Bay is the premier site in Ireland for Mediterranean Gull (*Larus melanocephalus*), with up to 20 birds present at times. In addition the area is a regular autumn roosting ground for significant numbers of terns, including Roseate Tern (*Sterna dougallii*), Common Tern (*S. hirundo*) and Arctic Tern (*S. paradisaea*).

4.1.8 Dublin Bay IBA Site Code: IE 109

Dublin bay is designated as an International Bird Life Area (IBA). IBA's are monitored using a simple, practical and robust framework. This involves regular assessments in which each IBA is scored using populations of IBA's trigger species. Population species estimates for previous monitoring are given as good for this site.

4.1.9 UNESCO Biosphere Reserve

In 1981, UNESCO recognised the importance of Dublin Bay by designating North Bull Island as a Biosphere Reserve because of its rare and internationally important habitats and species of wildlife. To support sustainable development, UNESCO's concept of a Biosphere has evolved to include not just areas of ecological value but also the areas around them and the communities that live and work within these areas. There have since been additional international and national designations, covering much of Dublin Bay, to ensure the protection of its water quality and biodiversity. To fulfil these broader management aims for the ecosystem, the Biosphere was expanded in 2015. The Biosphere now covers Dublin Bay, reflecting its significant environmental, economic, cultural and tourism importance, and extends to over 300 km^2.

4.2 Habitats

Habitats recorded in the study area are summarised in Table 4.2.1 below. Each habitat is described in detail in the following sections.

Table 4.2.1 Habitats Recorded Within the Study Corridor Along with their Respective Codes. The Habitat Classifications and Codes Correspond to Fossitt (2000)

Habitat Name	Fossitt Code
Artificial Lakes and Ponds	FL8
Eroding/Depositing Rivers	FW1/FW2
Drainage Ditches	FW4
Calcareous Springs - Outside Study Area	FP1
Reed and Large Sedge Swamp	FS1
Tall Herb Swamp	FS2
Agricultural Grassland	GA1
Amenity Grassland	GA2
Dry Neutral and Calcareous Grassland	GS1
Dry Meadows and Grassy Verges	GS2
Wet Grassland	GS4
Marsh	GM1
Riparian Woodland	WN5
Wet willow-alder-ash Woodland	WN6
Mixed Broadleaved Woodland	WD1
Mixed Broadleaved / Conifer Woodland	WD2
Scattered Trees and Parkland	WD5
Scrub	WS1
Hedgerows	WL1
Treelines	WL2
Recolonising Bare Ground	ED3
Refuse and other Waste	ED5
Stone walls and other Stonework	BL1
Buildings and Artificial Surfaces	BL3

Freshwater

Artificial Lakes and Ponds (FL8)

This category should be used for artificial or ornamental bodies of standing water that may be found in parks, demesnes, gardens or golf courses. Flooded quarries, tailings ponds and water treatment plants (with open water) should also be included. The nutrient status of these artificial water bodies is variable and may be high as in the case of hypertrophic lakes in urban parks. Moats can also be included here if there is no obvious connection to a wider drainage network.

Ponds provide a wetland habitat (FL8) in Bushy and Herbert Parks. Although artificial in origin and heavily shaded, ponds in woodlands in Bushy Park are of particular biodiversity value as they have mainly natural banks and wetland vegetation is found around them. Management of vegetation is light in the vicinity of the ponds.

As a result shrubberies have not been cleared and timber is allowed to decay naturally. The lower pond in Bushy Park is more open and is fed at its western edge by an artificial channel from the River Dodder. No algal growth was noted, but the presence of high density aquatic Common Duckweed (*Lemna minor)* and occasional Fennel-leaved Pondweed (*Potamogeton pectinatus)* indicate moderately nitrogen-rich, neutral conditions. Aquatic vegetation is absent in the densely shaded eastern end. Other artificial ponds are of lesser value, such as in Herbert Park as their sides are artificial, planting is mainly of non-native species and disturbance by people and dogs is greater.

Eroding/Depositing Rivers (FW1/FW2)

Eroding/Upland Rivers FW1

This category includes natural watercourses, or sections of these, that are actively eroding, unstable and where there is little or no deposition of fine sediment. Eroding conditions are typically associated with the upland parts of river systems where gradients are often steep, and water flow is fast and turbulent. Rivers in spate are included. For some rivers on the seaward side of coastal mountains, particularly in the west of Ireland, eroding conditions persist to sea level because of comparatively steep gradients over short distances, and high rainfall. Small sections of other lowland rivers may also be eroding where there are waterfalls, rapids or weirs. The beds of eroding/upland rivers are characterised by exposed bedrock and loose rock. Pebbles, gravel and coarse sand may accumulate in places, but finer sediments are rarely deposited. These rivers vary in size but are usually smaller and shallower than depositing/lowland rivers - FW2. Small mountain streams that dry out periodically can be included if an obvious channel persists or wetland plants are present. The unstable rocky channels of eroding/upland rivers usually support little vegetation cover. Submerged rocks and boulders may be colonised by aquatic mosses such as *Fontinalis* spp. and *Racomitrium aciculare*. Exposed rocks and wet shaded banks may also support extensive cover of lichens and liverworts. Higher plants are generally rare or absent except in places where fine sediments are trapped. Typical species include water- 21 crowfoots (*Ranunculus penicillatus*, *R. aquatilis*), Alternate Water-milfoil (*Myriophyllum alterniflorum*) and the aquatic form of Bulbous Rush (*Juncus bulbosus*). Plant and animal communities of eroding/upland rivers are influenced by a range of factors including bedrock and substratum type, nutrient status, water force, water quality, shade and human impact. Habitat conditions also vary along different stretches of a river where there are riffles, runs, pools, waterfalls and backwaters.

Depositing/Lowland Rivers FW2

This category includes watercourses, or sections of these, where fine sediments are deposited on the river bed. Depositing conditions are typical of lowland areas where gradients are low and water flow is slow and sluggish. These rivers vary in size but are usually larger and deeper than those above. In a natural state these rivers erode their banks and meander across floodplains. Because of this, most have been modified to some extent to control water flow, facilitate navigation or prevent flooding and erosion. Canalised or walled sections of rivers are included here, as are natural watercourses that have been dredged or deepened, and those with artificial earth banks. If channels have been excavated to divert water away from the main watercourse, these should be considered under canals – FW3. Tidal sections of rivers with brackish water influence are excluded (see tidal rivers – CW2). Rejuvenated sections of lowland rivers associated with rapids, waterfalls and weirs should be considered under eroding/upland rivers - FW1 if eroding conditions predominate. Plant and animal communities are influenced by numerous factors including substratum type, water force, nutrient status, water quality, channel size, water depth, human impact, disturbance and shade. Within a river channel there may be deep pools, backwaters, banks or mid-channel bars of gravel, sand or mud, in addition to vegetated islands and fringing reedbeds. The substratum of depositing/lowland rivers comprises mainly fine alluvial or peaty sediments. Vegetation may include floating and submerged aquatics, with fringing emergents in shallow water or overgrowing the banks. Floating aquatics can include water-lilies (*Nuphar lutea*, *Nymphaea alba*), pondweeds (*Potamogeton* spp.), water-starworts (*Callitriche* spp.) and Unbranched Bur-reed (*Sparganium emersum*). Tall emergents such as Common Club-rush (*Schoenoplectus lacustris*), Common Reed (*Phragmites australis*) and Yellow Iris (*Iris pseudacorus*) may also be present.

The River Dodder is an Eroding/upland river from Fort Bridge to Old Bawn Road and a Depositing/lowland river within the rest of the study area. Although the natural gradient is slight, the river is primarily eroding, due to the rapid flow below boulders and below weirs. Substrates are mixed but generally of coarse gravels and larger cobbles and boulders. Deposited sandy alluvium is particularly abundant at the bends in Kiltipper Park, the Dodder Valley Park and Kilvere, but occurs elsewhere. In-stream vegetation within the Dodder is limited by the frequently rapid flow, and/or the replacement of natural bank substrates with concrete or natural stone at bridges and S bends to protect against scour. Emergent vegetation is very limited, restricted to clay banks along sluggish glides or on in-stream fluvial cobble/gravel beds. There are several tributaries of the River Dodder within the study area (The Jobstown (or Tallaght) Stream, the Owendoher River and its tributary the Whitechurch Stream, the Little Dargle River (with Castle Stream and other tributaries), the Slang or Dundrum River, the Swan River, and the small Muckross Stream). The river supports spawning Trout and Brook Lamprey, and shady tree-lined banks provide invertebrate prey for fish, and shelter to otter and kingfisher. Many of the tributaries have been heavily modified and offer little in terms of supporting biodiversity.

Plate 4.2.1: An example of depositing / Lowland River (FW2) at the Dodder Riverbank Park

Drainage Ditches (FW4)

This category includes linear water bodies or wet channels that are entirely artificial in origin, and some sections of natural watercourses that have been excavated or modified to enhance drainage and control the flow of water. Drainage ditches are generally not used for navigation and are typically narrower than canals – FW3, but there may be exceptions. To be included here, drainage ditches should either contain water (flowing or stagnant) or be wet enough to support wetland vegetation. Dry ditches that lack wetland plants are not included. As with canals – FW3, drainage ditches must be maintained and cleared in order to keep them open. Those that are overgrown with vegetation are likely to be cleared intermittently. Note that water levels are also likely to undergo seasonal fluctuations.

Drainage ditches may be intimately associated with hedgerows and should be recorded as a separate habitat if they meet the criteria outlined above

The well drained Dodder Valley in addition to the urbanisation of much of the Dodder catchment has probably reduced the number of drainage ditches in the study area. Drainage ditches are occasionally found in the upper reaches of the Dodder along field boundaries and along the borders of amenity grasslands in the linear parks along the river. The most pronounced drainage ditch is west of the Kilsaran plant, the Whitestown Steam.

Calcareous Springs (FP1)

This category is used for springs that are irrigated and kept permanently moist by water that is calcareous and oligotrophic. These springs may be associated with shallow peaty or skeletal mineral soils. There may be some precipitation of marl, or tufa formation. Calcareous springs are typically dominated by mosses, and by *Cratoneuron* spp. in particular; *Bryum pseudotriquetrum* is also characteristic. Other common components of the vegetation include grasses (*Festuca rubra*, *Briza media*), sedges (*Carex dioica*, *C. pulicaris*, *C. flacca*, *C. nigra*), Common Butterwort (*Pinguicula vulgaris*) and Marsh Horsetail (*Equisetum palustre*). The relatively rare Yellow Saxifrage (*Saxifraga aizoides*) can occur in calcareous springs and is diagnostic of this habitat.

This habitat is found at a number of sites in the study area. A series of nine spring's run from Bohernabreena pitch and putt club upstream to Fort Bridge where the river narrows with steep walls and here the springs appear from the steep banks. South of the care home in Kiltipper Park there are springs found within riparian woodland. The springs are active with visible formations of tufa present.

There is one spring in Firhouse west of the Kilsaran plant. As its flow rate was low, neither distinctive mosses nor tufa were present. However the presence of this water supply had led to the development of wetland conditions on an otherwise dry bank (Mary Tubridy, & Associates, 2007)

The most easterly is located north of the study area above the Duck Pond at Bushy Park (Rathfarnham). The habitat is described as follows by Mary Tubridy & Associates (2007): "a small spring emerges from the escarpment. Around the spring there is a deposit of 'tufa'.

Reed and Large Sedge Swamp (FS1)

This category includes species-poor stands of herbaceous vegetation that are dominated by reeds and other large grasses or large, tussock-forming sedges. Most reed and large sedge swamps are overwhelmingly dominated by one or a small number of species, as in the case of reedbeds. Stands of vegetation can range from very dense to open. Typical components include Common Reed (*Phragmites australis*), Common Club-rush (*Schoenoplectus lacustris*), Reed Sweet-grass (*Glyceria maxima*), Branched Bur-reed (*Sparganium erectum*), Reed Canary-grass (*Phalaris arundinacea*), Great Fen-sedge (*Cladium mariscus*), Greater Tussock-sedge (*Carex paniculata*), Bulrush (*Typha latifolia*) and Water Horsetail (*Equisetum fluviatile*). Stands of Sea Club-rush (*Bolboschoenus maritimus*) may also occur in brackish waters. Note that a number of the possible dominants have a late growing season and their full extent may be difficult to determine before mid-May. Unlike tall-herb swamps – FS2 below, the broadleaved herb component is minor. Vegetation typically lacks stratification as there is little or no development of an understorey element. In some situations there may be a mixture of other species such as Common Marsh-bedstraw (*Galium palustre*), Water Mint (*Mentha aquatica*), forget-menots (*Myosotis* spp.), Bogbean (*Menyanthes trifoliata*), Marsh Cinquefoil (*Potentilla palustris*), Wild Angelica (*Angelica sylvestris*), Meadowsweet (*Filipendula ulmaria*) or Fool's Water-cress (*Apium nodiflorum*).

This habitat only occurs in rare isolated patches (<c. 10m2) on permanently wet river margins where clay or sandy banks affords rooting opportunities, either in sluggish waters or on deposited boulders by faster flowing waters. It is mostly found above weirs, or (rarely) below them on alluvial gravel/boulder beds. It is characterised by species-poor grassy communities, dominated by the non-native invasive Sweet Grass *Glyceria maxima* and Reed Canary-grass *Phalaris arundinacea*. Great Willowherb (*Epilobium hirsutum)* takes over in the transition to drier riparian habitats. This habitat forms mosaics with FS2.

Tall Herb Swamp (FS2)

Tall-herb swamps are comparatively species-rich stands of herbaceous vegetation that occur in wet areas where the water table is above the ground surface for most of the year, or where water levels fluctuate regularly as in the case of tidal sections of rivers. Tall or robust broadleaved herbs dominate and common components include Lesser Waterparsnip (*Berula erecta*), Fool's Water-cress (*Apium nodiflorum*), Gipsywort (*Lycopus europaeus*), Brooklime (*Veronica beccabunga*), Hemlock Water-dropwort (*Oenanthe crocata*), Hemp-agrimony (*Eupatorium cannabinum*) and Water Forget-me-not (*Myosotis scorpioides*). These swamps may also support Yellow Iris (*Iris pseudacorus*), Water-plantain (*Alisma plantago-aquatica*) and Water Horsetail (*Equisetum fluviatile*), in addition to occasional reeds, large grasses (*Glyceria maxima*, *Festuca arundinacea*) and sedges.

This occurs in similar situations to FS1, with which it shares several species (Sweet Grass and Reed Canary-grass). Fool's Parsley *Apium nodiflorum* dominates with frequent Wavy Bitter-cress (*Cardamine flexuosa*), and occasional Water Parsnip (*Berula erecta*). The highly poisonous Hemlock Water-dropwort *(Oenanthe crocata)* and invasive Himalayan Balsam (*Impatiens glandulifera*) also occur. Wild Angelica (*Angelica sylvestris*) dominates the transition to drier riparian habitats.

Grassland and Marsh

Agricultural Grassland (GA1)

This category is used for intensively managed or highly modified agricultural grassland that has been reseeded and/or regularly fertilised, and is now heavily grazed and/or used for silage making. It includes regularly-reseeded monoculture grasslands and rye-grass leys that are planted as part of an arable rotation. These differ significantly from areas of permanent grassland. Improved agricultural grassland is typically species-poor. Sward quality varies depending on soil type, fertility, drainage and management. Rye-grasses (*Lolium* spp.) are usually abundant and may entirely dominate the sward, often in association with White Clover (*Trifolium repens*). Many improved varieties or cultivars of 27 these plants are now widely sown. Other grasses that may be prominent include meadow-grasses (*Poa* spp.), Timothy (*Phleum pratense*), Crested Dog's-tail (*Cynosurus cristatus*) and Yorkshire-fog (*Holcus lanatus*). Among the more frequently occurring 'agricultural' herbs are Dandelion (*Taraxacum* spp.), Creeping Buttercup (*Ranunculus repens*), plantains (*Plantago* spp.), Nettle (*Urtica dioica*), thistles (*Cirsium arvense*, *C. vulgare*) and docks (*Rumex* spp.). Some reseeded but poorly-drained fields may support abundant rushes.

This habitat is only found in fields to the east side of the Dodder at Killtipper Park.

Amenity Grassland (GA2)

This type of grassland is improved, or species-poor, and is managed for purposes other than grass production. It includes amenity, recreational or landscaped grasslands, but excludes farmland. Most areas of amenity grassland have been reseeded and are regularly mown to maintain very short swards. Fertilisers and herbicides are often applied but there is rarely any grazing by livestock. The sward may comprise a variety of grasses, including some that also occur in improved agricultural grassland – GA1, but rye-grasses (*Lolium* spp.) are rarely abundant. Broadleaved herbs such as Daisy (*Bellis perennis*), Dandelion (*Taraxacum* spp.), clovers (*Trifolium* spp.) and plantains (*Plantago* spp.) are common. Amenity grassland is typically associated with lawns and other managed grassland areas in gardens, parks, grounds of various buildings or institutions, golf course fairways, grassy sports fields and race courses.

Ornamental flower beds and borders – BC4 should be excluded and, if trees are a prominent feature, the category scattered trees and parkland – WD5 should be considered. Note that amenity areas that support unimproved or semi-natural grassland should be considered elsewhere in the grassland section. If a playing field occurs on machair – CD6, for example, it should be considered as amenity grassland only if it has been heavily modified or reseeded.

Amenity grassland is commonly associated with almost all parklands which are mown regularly, thus preventing plant species flowering and setting seed. It is of low biodiversity value (for plants, insects and birds). The most species poor example was found in intensively managed parts of Merrion Cricket Grounds. Elsewhere in parks more diversity was seen, under trees, or in areas with poorer soils. Despite its low value to most groups, it provides a foraging area for bat species.

Plate 4.2.2: An example of Amenity Grassland (GA1) and, in the background, Dry Calcareous and Neutral Grassland (GS1) at Kilvere

Dry Calcareous and Neutral Grassland (GS1)

This category is used for unimproved or semi-improved dry grassland that may be either calcareous or neutral, but not acid. It is associated with low intensity agriculture and typically occurs on free-draining mineral soils of various depths. Calcareous grassland is restricted in its distribution and is now largely confined to the steep slopes of esker ridges and moraines in the midlands, and to other areas with shallow and rocky limestone soils. Management and fertiliser use makes calcareous grasslands more like neutral grasslands in character and these have a wider distribution. Most old permanent pastures and less intensively managed lowland grasslands fit into this category. Grazing is a characteristic feature; unimproved dry meadows which are rarely grazed should be excluded.

Dry calcareous and neutral grassland may comprise a wide range of grasses and broadleaved herbs. Species richness varies and can be high (up to 45 species per m^2. Common grasses include bents (*Agrostis* spp.), meadow-grasses (*Poa* spp.), Meadow Foxtail (*Alopecurus pratensis*), Timothy (Phleum *pratense*), fescues (*Festuca* spp.), Sweet Vernal-grass (*Anthoxanthum odoratum*), Crested Dog's-tail (*Cynosurus cristatus*), Cock's-foot (*Dactylis glomerata*) and Yorkshire-fog (*Holcus lanatus)*. Grasses that are indicative of strongly calcareous soils include Downy Oat-grass (*Avenula pubescens*), Yellow Oat-grass (*Trisetum flavescens*), Blue Moor-grass (*Sesleria caerulea*) and Quaking-grass (*Briza media*). Perennial Rye-grass (*Lolium perenne*) may also be present but should not dominate the sward. Common broadleaved herbs include clovers (*Trifolium* spp.), Yarrow (*Achillea millefolium*), Common Knapweed (*Centaurea nigra*), Selfheal (*Prunella vulgaris*), Common Bird's-foot Trefoil (*Lotus corniculatus*), Cat's-ear (*Hypochoeris radicata*), Lady's Bedstraw (*Galium verum*) and Oxeye Daisy (*Leucanthemum vulgare*). The more calcareous grasslands are characterised by broadleaved herbs such as Field Scabious (*Knautia arvensis*), Kidney Vetch (*Anthyllis vulneraria*), Mountain Everlasting (*Antennaria dioica*), Yellow-wort (*Blackstonia perfoliata*), Salad Burnet (*Sanguisorba minor*) and Carline Thistle (*Carlina vulgaris*), and may also be important for orchids, including *Ophrys* and *Orchis* spp. Areas that are contaminated with heavy metals, mainly from old lead and zinc mines, and which support a type of calcareous grassland with abundant Bladder Campion (*Silene vulgaris*), Thrift (*Armeria maritima*) and the eyebright, *Euphrasia micrantha*, should be included in this category. Dry calcareous and neutral grassland may grade into, or contain elements of dry calcareous heath – HH2 or scrub vegetation, characterised by heathers (*Calluna vulgaris*, *Erica cinerea*), Juniper (*Juniperus communis*), gorse (*Ulex* spp.), Blackthorn (*Prunus spinosa*), Hawthorn (*Crataegus monogyna*) or Hazel (*Corylus avellana*). To be considered as grassland, total cover of dwarf shrubs should not exceed 25% and, while trees and shrubs may be present, they should not be abundant.

There are three high biodiversity value extensively-managed grassland sites. These are on neutral to base-rich soils containing species-rich hay meadow communities. Two areas of GS1 calcareous grassland occur in amenity grasslands currently managed by the SDCC Parks department under an experimental mowing late summer regime that allows meadow grasses to set seed (Dodder Valley Park at Kilvere and Cherryfield at Firhouse). The third site occurs on private land in a neglected garden at Ladywell, Templeogue where the habitat is threatened by encroaching scrub and horticulture. All occur on base rich glacial till derived from limestone bedrock as evidenced by occurrence of Lady's Bedstraw (*Galium verum)* and other calcareous indicator species. Species common to all sites include Common Bent (*Agrostis capillaries)*, Knapweed (*Centaurea nigra)* Lady's Bedstraw, Red Clover (*Trifolium pratense)*, Pignut (*Conopodium majus)*, and Autumn Hawkbit (*Leontodon autumnalis)*. Quaking Grass (*Briza media)* occurs in drier areas at Spawell and Ladywell, but is apparently absent from the damp grasslands at Kilvere.

At Kilvere, there is an intricate mosaic of dry calcareous grassland interspersed with wet grassland (GS4) due to the influence of permanent base-rich flushes that create damp or waterlogged soil conditions even in high summer. Some areas have been intensely mown while others are ranker with higher diversity. The boundary between wet and dry grasslands is more easily distinguished at Cherryfield (the largest of the three sites), which is of greatest biodiversity value as the largest and most species-rich of the three sites (several sedges and two orchid species occur here), and its strong calcareous influence as evidenced by abundant Lady's Bed Straw (*Galium verum)*, frequent Pyramidal Orchid (*Anacamptis pyramidals)* and Common Spotted Orchid *Dactyorhiza fuchsia)* and an Eyebright (*Euphrasia arctium)*. The third site at Ladywell is the smallest, is highly calcareous, and is the driest of the three as shown by the prevalence of Quaking Grass. Kilvere is home to Broad-leaved Helleborine (*Epipactis Helleborine)* orchids which occur in adjacent woodlands. A population known from the Ladywell (FERS, 2011) could not be relocated. No sites contain any Red-listed or Flora Protection Order species.

Dry Meadows and Grassy Verges (GS2)

Dry meadows that are rarely fertilised or grazed, and are mown only once or twice a year for hay are now rare in Ireland. Most have been improved for agriculture and this type of grassland is now best represented on grassy roadside verges, on the margins of tilled fields, on railway embankments, in churchyards and cemeteries, and in some neglected fields or gardens. These

areas are occasionally mown (or treated with herbicides in the case of some railway embankments), and there is little or no grazing or fertiliser application. This pattern of management produces grasslands with a high proportion of tall, coarse and tussocky grasses such as False Oat-grass (*Arrhenatherum elatius*) and Cock's-foot (*Dactylis glomerata*). Other grasses may include Yorkshire-fog (*Holcus lanatus*), Smooth Meadow-grass (Poa pratensis), Barren Brome (*Anisantha sterilis*) and Meadow Foxtail (*Alopecurus pratensis*). The broadleaved herb component is characterised by a range of species that either grow tall, such as Cow Parsley (*Anthriscus sylvestris*), Hogweed (*Heracleum sphondylium*), Goat's-beard (*Tragopogon pratensis*), Nettle (*Urtica dioica*) and Common Knapweed (*Centaurea nigra*), or climb the stems of others, as in the case of Bush Vetch (*Vicia sepium*) and Meadow Vetchling (*Lathyrus pratensis*). Grassy verges may support other smaller broadleaved herbs such as Pignut (*Conopodium majus)*, Creeping Cinquefoil (*Potentilla reptans*) and clovers (*Trifolium* spp.).

GS2 is characterised by species which are good competitors and can colonise a wide range of habitats. Good examples are found beside the river near the Dropping Well Pub in Milltown Rd and east of the pedestrian bridge in Dartry Park. Species diversity is high. As soil fertility is high, thus plants grow to considerable heights c.1.5m. This is an unstable community comprised mostly of weedy species, including Butterbur (*Petasites hybridus*), Winter heliotrope (*Petasites fragrans*), Hogweed (*Heracleum sphondylium*), Mugwort (*Artemesia vulgaris*), Nettle (*Urtica dioica*), Hedge mustard (*Sisymbrium officinale*), Rye grass (*Lolium perene*), False oat grass (*Arrhenatherum elatius*), Comfrey (*Symphytum officinale*), Rose-bay willowherb (*Chamaenerion angustifolium*), with Cleavers (*Galium aparine*) and Bindweed (*Calystegia sepium*) scrambling up stems of taller species. Where long established this vegetation may contain Bramble (*Rubus fruticosus agg.*), Butterfly bush (*Buddleja davidii*) and occasionally Japanese knotweed (*Fallopia japonica*). This vegetation is valuable as it is associated with high insect diversity. By allowing plants to flower, set seed and remain standing over the winter food is provided for seed eating birds and hibernation sites for insects. The cover is also valuable for small mammals.

Wet Grassland (GS4)

This type of grassland can be found on flat or sloping ground in upland and lowland areas. It occurs on wet or waterlogged mineral or organic soils that are poorly-drained or, in some cases, subjected to seasonal or periodic flooding. On sloping ground, wet grassland is mainly confined to clay-rich gleys and loams, or organic soils that are wet but not waterlogged. This category includes areas of poorly-drained farmland that have not recently been improved, seasonally-flooded alluvial grasslands such as the River Shannon callows, and wet grasslands of turlough basins. Species composition varies considerably. Wet grassland often contains abundant rushes (*Juncus effusus*, *J. acutiflorus*, *J. articulatus*, *J. inflexus*) and/or small sedges (*Carex flacca*, *C. hirta*, *C. ovalis*), in addition to grasses such as Yorkshire-fog (*Holcus lanatus*), Creeping Bent (*Agrostis stolonifera*), Marsh Foxtail (*Alopecurus geniculatus*), Rough Meadow-grass (*Poa trivialis*) and Tufted Hair-grass (*Deschampsia caespitosa*). Purple Moor-grass (*Molinia caerulea*) may also be present but should not dominate. The proportion of broadleaved herbs is often high; those that commonly occur in wet grassland include Creeping Buttercup (*Ranunculus repens*), Marsh Thistle (*Cirsium palustre*), Silverweed (*Potentilla anserina*), Meadowsweet (*Filipendula ulmaria*), Water Mint (*Mentha aquatica*), Common Marsh-bedstraw (*Galium palustre*), Devil's-bit Scabious (*Succisa pratensis*), Lesser Ribwort Plantain *Plantago lanceolata* (R. T. Mills) Spearwort (*Ranunculus flammula*) and Cuckooflower (*Cardamine pratensis*). Other common broadleaved herbs that occur on drier grasslands may also be present, depending on the degree of wetness. Wet grassland may be important for orchids such as Spotted-orchid (*Dactylorhiza maculata*). Horsetails (*Equisetum* spp.), Yellow Iris (*Iris pseudacorus*), Floating Sweet-grass (*Glyceria fluitans*) and clumps of tall reeds may be locally abundant. Wet grassland frequently grades into marsh - GM1 and there are many similarities in the range of species present in both habitats. To be included in the wet grassland category, the cover of grasses should exceed 50%, except in areas where rushes or small sedges predominate, and the total cover of reeds, large sedges and broadleaved herbs should be less than 50%. Among the suite of broadleaved herbs that are present, there should be a significant proportion of drier grassland species in addition to those that are more commonly associated with wetlands.

This habitat occurs exclusively in mosaics with GS1 at Kilvere and Cherryfield, although wet woodland and carr habitats include wet grassland communities. Rushes and sedges dominate, primarily Hard Rush (*Juncus inflexus)* and Jointed Rush (*J. articulates)*, although Soft Rush (*J. effuses)* and Toad Rush (*J. bufonious)* also occur. Glaucous Sedge (*Carex flacca)* is the most common sedge, although False Fox Sedge (*Carex otrubae)* is frequent. One rank unmown area at Kilvere is almost entirely dominated by Great Willowherb (*Epilobium hirsutum*) save for frequent Hedge Bindweed (*Calystegia sepium)* and occasional Marsh Willowherb (*Epilobium palustre)*. Frequent species throughout include Creeping Buttercup (*Ranunculus repens)*, Spear Thistle (*Cirsium vulgaris)*, Creeping Bent (*Agrostis stolonifera),* Marsh cinquefoil (*Potentilla palustris) and* Yorkshire Fog (*Holcus lanatus)*. Base-rich flushes are recognised by high bryophyte cover, particularly of (*Pseudoscleropodium purum)*.

Marsh (GM1)

Marsh is found on level ground near river banks, lakeshores, and in other places where mineral or shallow peaty soils are waterlogged, and where the water table is close to ground level for most of the year. Unlike swamps, standing water is not a characteristic feature except, perhaps, during very wet periods or in winter months. Marsh is comparatively species-rich and supports a high proportion of wetland species in addition to the typical dominants: rushes (*Juncus* spp.), sedges (*Carex* spp.) and Meadowsweet (*Filipendula ulmaria*). Grasses such as Creeping Bent (*Agrostis stolonifera*), Tall Fescue (*Festuca arundinacea*) and Purple Moor-grass (*Molinia caerulea*) may be present but not abundant. To be considered as marsh, the proportion of sedges and grasses should not exceed 50%. The broadleaved herb component may include Water Mint (*Mentha aquatica*), Marsh Thistle (*Cirsium palustre*), Wild Angelica (*Angelica sylvestris*), Marsh Pennywort (*Hydrocotyle vulgaris*), Marshmarigold (*Caltha palustris*), Common Valerian (*Valeriana officinalis*), Ragged-robin (*Lychnis flos-cuculi*), Purple loosestrife (*Lythrum salicaria*), Marsh Woundwort (*Stachys palustris*) and Marsh Cinquefoil (*Potentilla palustris*). Marsh may also support horsetails (*Equisetum* spp.), Yellow Iris (Iris pseudacorus), reeds and other large grasses and sedges but these should not dominate. Herbs that are characteristic of drier ground are rare or absent in marshes. Mosses, particularly *Calliergon* and *Climacium* spp., may be plentiful. Yellow Iris (*Iris pseudacorus*) Marsh differs from swamps in that the vegetation is usually more species-rich, standing water is absent for much of the year, and reeds and other tall or bulky grasses and sedges, and tall herbs are not overwhelmingly dominant in the former. The distinction between marsh and wet grassland - GS4 is less clear but, in marsh, wetland herbs should be prominent, and species of drier ground should generally be absent. If there is greater than 50% cover of grasses and sedges, the habitat should be considered under grassland or, if it is a peat-forming system, under fens and flushes. Marsh is not a peat forming habitat.

Marsh habitat is found scattered along flat riverbanks and is fed by surface waters or by local aquifers via upwelling springs trickling from calp bedrock or gravel subsoils. Marshes occur both in the open and in the shade of riparian woodland. The best example of this is in Bushy Park adjacent to three ponds in the woodland. Although subject to shade this vegetation contains a greater diversity of wetland grasses and herbs, with some signs of marsh habitat (GM1).

Woodland and Scrub

Riparian Woodland (WN5)

This category includes wet woodlands of river margins (gallery woodland) and low islands that are subject to frequent flooding, or where water levels fluctuate as a result of tidal movement (in the lower reaches of rivers). Riparian woodland is dominated by stands of willows that may include native (*Salix cinerea*, *S. purpurea*, *S. triandra*) and nonnative (*Salix fragilis*, *S. alba*, *S. viminalis*) species. Alder (*Alnus glutinosa*) is occasional.

The field layer is characterised by broadleaved herbs such as Nettle (*Urtica dioica*), Creeping Buttercup (*Ranunculus repens*), Wood Dock (*Rumex sanguineus*), Meadowsweet (*Filipendula ulmaria*), Wild Angelica (*Angelica sylvestris*), Hemlock Water-dropwort (*Oenanthe crocata*) and Hedge Bindweed (*Calystegia sepium*). Stands of Reed Canary-grass (*Phalaris arundinacea*) are common. Indian Balsam (*Impatiens glandulifera*), an introduced species, is locally abundant.

These woodlands often reveal an accumulation of river borne debris, including dead vegetation and plastic, when water levels are low. A fine coating of grey mud on vegetation and tree bases that are regularly submerged and immersed is also characteristic. Willows were widely coppiced and used for basket-making in the past; old Osier (*Salix viminalis*) beds are included in this category but any actively coppiced areas should be considered under short rotation coppice - WS4.

Riparian woodland (WN5) is commonly found on more natural section of the riverbank including Kiltipper Park, the Dodder Valley Park and Kilvere. Invasive species including Japanese knotweed (*F. Japonica*) and Himalayan balsam (*Impatiens glandulifera*) are common in this habitat which is likely to have resulted in the loss of the rare Broad-leaved Helleborine through shading from the riparian woodlands at Kilvere.

Wet Willow-alder-ash Woodland (WN6)

This broad category includes woodlands of permanently waterlogged sites that are dominated by willows (*Salix* spp.), Alder (*Alnus glutinosa*) or Ash (*Fraxinus excelsior*), or by various combinations of some or all of these trees. It includes woodlands of lakeshores, stagnant waters and fens, known as carr, in addition to woodlands of spring-fed or flushed sites. Carr is dominated by Rusty Willow (*Salix cinerea* ssp. *oleifolia*) and Alder (*Alnus glutinosa*). The field layer comprises Creeping Bent (*Agrostis stolonifera*), Meadowsweet (*Filipendula ulmaria*), Common Marsh-bedstraw (*Galium palustre*), Purpleloosestrife (*Lythrum salicaria*) and Skullcap (*Scutellaria galericulata*). Mosses such as *Climacium dendroides*, *Calliergon cordifolium* and *Homalia trichomanoides* are characteristic. Carr occurs on organic soils and fen peats that are subject to seasonal flooding but remain waterlogged even when flood waters recede. Woodlands of flushed or spring-fed sites are typically dominated by Alder (*Alnus glutinosa*) or Ash (*Fraxinus excelsior*) and the ground flora is often 'grassy' in appearance with abundant Remote Sedge (*Carex remota*) and Creeping Bent (*Agrostis stolonifera*). Other common components of the field layer include Bramble (*Rubus fruticosus* agg.), Creeping Buttercup (*Ranunculus repens*), Meadowsweet (Filipendula ulmaria), Common Marsh-bedstraw (*Galium palustre*), Yellow Pimpernel (*Lysimachia nemorum*) and Lady-fern (*Athyrium filix-femina*). This type of woodland occurs on mineral soils or fen peats, and may occasionally be associated with river banks or lakeshores. Note that riparian woodland – WN5 is treated as a separate category. Also included in this category are woodlands of calcareous spring-fed hollows that are characterised by a mixture of trees including willows (*Salix* spp.), Alder (*Alnus glutinosa*), 52 Ash (*Fraxinus excelsior*) and Downy Birch (*Betula pubescens*). Greater Tussock-sedge (*Carex paniculata*) dominates the field layer and tussocks may support species of drier land. Common Reed (*Phragmites australis*) may be abundant in open wet areas. The ground surface is often treacherous and water-filled hollows and channels typically support aquatic plants.

Two distinct types of this habitat occur. The first is a tiny tract of permanently waterlogged woodland measuring not more than 20m^2 on the northern shore of the lower lake in Bushy Park. Crack Willow (*Salix fragilis*) and Grey Willow (*Salix cinerea)* are the dominant canopy species, with invasive Dogwood (*Cornus sericea)* the sole understorey component. Hemlock Water-dropwort (*Oenanthe crocata)*, Wild Angelica (*Angelica sylvestris*), and Pendulous Sedge (*Carex pendula*) form a tall dense field sward, which includes Broad-leaved Helleborine (*E. helleborine*) at the transition to dry WD1 woodland. At Spawell, abandoned agricultural land is in succession to a much drier type of WN6. Here Scattered Willow copses dominated by Grey Willow (*S. cinerea)* are forming, and shaded bryophyte carpets of Pointed Spear Moss (*Caligeronella cuspidata)* are fed by permanent groundwater flushes. The ground layer is dominated by a Creeping bent and Hard Rush field layer with occasional Jointed Rush and False Fox sedge.

Mixed Broadleaved Woodland (WD1)

This general category includes woodland areas with 75-100% cover of broadleaved trees, and 0-25% cover of conifers. It should be used in situations where woodland stands cannot be classified as semi-natural. Trees may include native and non-native species. Plantations of broadleaved trees are included if the canopy height is greater than 5 m, or 4 m in the case of wetland areas. Stands of immature or sapling trees are excluded (see immature woodland - WS2). If a number of different broadleaved tree species contribute significantly to the canopy, the term 'mixed' should be used in the habitat title.

These plantings have replaced much of the original riparian woodland (WN5) in the Park between Herbert Park and the Dodder Valley Park. Hawthorn (*Crataegus monogyna)* Elder (*Sambucus nigra)* and Brambles (*Prunus fruticosa*) dominate the understorey. Hazel (*Corylus avellana)* and Holly (*Ilex aquifolium*) occur occasionally, the latter on more acidic alluvial soils. Some mature Hazel occurs, and was likely historically coppiced. Common invasive undershrubs include Red Osier (*Cornus sericea)*, Cherry Laurel (*Prunus laurocerasus*), and Snowberry *Sympharicarpos albus*, but Cherry Laurel is surprisingly uncommon. The field layer includes the usual Nettles (*Urtica dioica*) and Ivy (*Hedera helix*) with abundant False Wood Brome (*Brachypodium sylvaticum)* and Wood Dock (*Rumex sanguineus)*, frequent Lords and Ladies (*Alium maculatum*), Tutsan (*Hypericum androsaemum)*, Hogweed (*Heracleum sphondylium*), Wild Angelica, Cow Parsely (*Anthriscus sylvestris)* and several common fern species. Japanese Knotweed and Himalayan Balsam are both frequent, and the less invasive Traveller's Joy (*Clematis vitalba)* also occurs. Stands in amenity areas set back from the River Dodder are of lower biodiversity value, as they are generally young to semi-mature and lack a layered structure or woodland ground flora, but include Dwarf Cherry (*Prunus cerasus)* and Wild Cherry (*Prunus padus)* which are not found elsewhere. Ancient indicator species of woodland flora such as Bluebells (*Hyacinthoides* spp.), and Wood Sorrell (*Oxalis acetosella)* were not be identified but are likely to occur in the more mature stands.

Mixed Broadleaved / Conifer Woodland (WD2)

This general category includes woodland areas with mixed stands of broadleaved trees and conifers, where both types have a minimum cover of 25%, and a maximum of 75%. Trees may be either native or non-native species. Mixed broadleaved/conifer plantations are included if the canopy height is greater than 5m, or 4m in the case of wetland areas. Stands of immature or sapling trees are excluded.

This is found in Bushy Park and in occasional parkland plantations such as near Firhouse. At Bushy Park the canopy is composed of mature spreading Pedunculate Oak (*Quercus robur)* to 30m, Yew (*Taxus baccata)*, Scot's Pine (*Pinus sylvestris)* and Leyland's Cypress (*Cuprocyparis leylandii)*, mature Ash and self-seeded Sycamore on a steep slope. The dense understory is of Snowberry, Cherry Laurel, and Elder and the field layer is highly shaded and sparsely vegetated with Ivy, Brambles, Lords and Ladies, Herb Robert (*Geranium robertianum)* and Adder's Tongue (*Ophioglossum vulgatum)*. In damp shaded conditions at Bushy Park, Pendulous Sedge, Wood Sedge (*Carex sylvatica),* occasional Enchanter's Nightshade (*Circaeaa lutetiana)* and Great Wood-rush (*Luzula sylvatica)* also occur.

Plate 4.2.3: An example of Mixed Broadleaved/ Conifer Woodland (WD2) in Bushy Park

Scattered Trees and Parkland (WD5)

This category can be used in situations where scattered trees, standing alone or in small clusters, cover less than 30% of the total area under consideration but are a prominent structural or visual feature of the habitat. This usually occurs in areas of cultivated grassland, particularly amenity areas. In the case of parkland or parks which originate from former planting and landscaping, the proportion of non-native trees is typically high. This category can also be used for scattered fruit trees in orchards but commercial orchards with heavily pruned trees should be considered under horticultural land - BC2.

This habitat has been created for amenity use along the River Dodder, notably in Herbert Park, on the southern riverbank around Rathfarnham and in the Dodder Valley Park. Common trees include Lime (*Tilia platyphyllos),* Beech (*Fagus sylvatica)*, and Horse Chestnut (*Aesculus hippocastanum)*, with occasional Pedunculate Oak.

Scrub (WS1)

This broad category includes areas that are dominated by at least 50% cover of shrubs, stunted trees or brambles. The canopy height is generally less than 5m, or 4m in the case of wetland areas. Scrub frequently develops as a precursor to woodland and is often found in inaccessible locations, or on abandoned or marginal farmland. In the absence of grazing and mowing, scrub can expand to replace grassland or heath vegetation. Trees are included as components of scrub if their growth is stunted as a result of exposure, poor soils or waterlogging. If tall trees are present, these should have a scattered distribution and should not form a distinct canopy. This category does not include areas that are dominated by young or sapling trees.

Scrub (WS1) was identified in areas dominated by Blackthorn (*Prunus spinosa*) and Brambles (*Rubus fruticosus agg*). Its largest extent was in Scully's field and along the northern bank of the Dodder Valley Park. This habitat dominates overgrown riverbanks, the margins of woodlands and neglected grasslands. It contains woodland, hedgerow, and grassland communities but is generally species poor and lacks any ground flora. Brambles and Nettles dominate and Butterfly Bush *Buddleija davidii* and Dog Rose occur throughout. Butterbur *Petasites hybridus,* Bush vetch *Vicia sepium*, Common Vetch *Vicia cracca*, Hedge bindweed are common throughout.

Hedgerows (WL1)

Linear strips of shrubs, often with occasional trees, that typically form field or property boundaries. Most hedgerows originate from planting and many occur on raised banks of earth that are derived from the excavation of associated drainage ditches. Dimensions of hedgerows vary considerably, depending largely on management and composition, and are taken here as being mainly less than 5m high and 4m wide. When wider or taller than this, or dominated by trees, the habitat should be considered as a narrow strip of scrub or woodland, or as a treeline - WL2. Some hedgerows may be overgrown or fragmented if management has been neglected, but they should still be considered in this category unless they have changed beyond recognition. Linear strips of low scrub are included in this category if they occur as field boundaries. Species composition varies with factors such as age, management, geology, soils and exposure. Hedgerows commonly support a high proportion of spinose plants such as Hawthorn (*Crataegus monogyna*), Blackthorn (*Prunus spinosa*), Gorse (*Ulex europaeus*), Holly (*Ilex aquifolium*), Dog-rose (*Rosa canina*) or Bramble in addition to many other native and non-native trees and shrubs including, for example, Ash (*Fraxinus excelsior*), Hazel (*Corylus avellana*), Beech (*Fagus sylvatica*), Elder, Elms (*Ulmus* spp.) and willows (*Salix* spp.). Some of these may occur as scattered tall trees. Fuchsia (*Fuchsia magellanica*), an introduced shrub, is a common component of hedgerows in parts of the south and west of Ireland. Hedgerows frequently support climbing plants such as Ivy, Honeysuckle (*Lonicera periclymenum*), Hedge Bindweed (*Calystegia sepium*), Cleavers (*Galium aparine*) and Bush Vetch (*Vicia sepium*). Tall grasses, including False Brome (*Brachypodium sylvaticum*) and Hairy-brome (*Bromopsis ramosa*), ferns, and woodland herbs are characteristic.

Hedges are very limited within the study area, and are dominated by Brambles or Hawthorn with occasional Rowan (*Sorbus acuparia)* and Dog Rose. Hedgerows occasionally mark roadside and pathside boundaries. Remnants of hedgerows were identified in Scully's Field. The field layers include Hedge bindweed *(Convolvulus arvensis*), Herb Robert (*G. Robertianum*), Tutsan (*Hypericum androsaemum)*, Honeysuckle *(Lonicera periclymenum),* Field Woundwort (*Stachys arvensis),* and Traveller's Joy (*Clematis vitalba*), Mint (*Mentha spp),* Black Nightshade (*Solanum dulcamara) and* the non-native Keeled Garlic (*Allium triquetrum*) occur at Rathfarnham. Scrub and rank grassland species also occur.

Treelines (WL2)

A treeline is a narrow row or single line of trees that is greater than 5 m in height and typically occurs along field or property boundaries. This category includes tree-lined roads or avenues, narrow shelter belts with no more than a single line of trees, and overgrown hedgerows that are dominated by trees. Most treelines are planted and trees are often regularly spaced. They commonly comprise a high proportion of non-native 57 species such as Beech (*Fagus sylvatica*), Horse Chestnut, Sycamore (*Acer pseudoplatanus*), Limes, some poplars (*Populus spp*.) and conifers. Trees may occur on level ground or on banks of earth. The presence or absence of hedgerow or scrub at the base should be noted. If treelines are greater than 4m wide at the base they should be considered as narrow stretches of woodland.

Treelines are found occasionally in Kiltipper Park, east of the M50 in the Dodder Valley Park and in Donnybrook.

Exposed Rock and Disturbed Ground

Recolonising Bare Ground (ED3)

This category is used for any areas where bare or disturbed ground, derelict sites or artificial surfaces of tarmac, concrete or hard core have been invaded by herbaceous plants. Vegetation cover should be greater than 50% for inclusion in this category. Most of the typical

colonisers are ruderals, or weed plants. Common examples include Colt's Foot (*Tussilago farfara*), Nettle (*Urtica dioica*), Dandelion (*Taraxacum* spp.), willow-herbs 63 (*Epilobium* spp.) and ragworts (*Senecio* spp.). Grasses are usually also present but should not dominate. Ground that is regularly trampled or driven over is usually characterised by Greater Plantain (*Plantago major*), Knotgrass (*Polygonum aviculare*), Pineappleweed (*Matricaria discoidea*) and Shepherd's-purse (*Capsella bursa-pastoris*). In urban areas, recolonising bare ground can be important for wildlife and may support a diverse flora, typically with a high proportion of nonnative species, including Butterfly-bush (*Buddleja davidii*), Japanese Knotweed (*Reynoutria japonica*) and many other garden escapes. Note that if shrubs or grasses dominate, the habitat should be considered under the appropriate scrub/transitional woodland or grassland category.

Revegetating ground on abandoned hardstanding, or stony spoil heaps occur occasionally. Hedge Mustard (*Sisymbrium officinale)*, Hybrid Poppy, and Hoary Plantain (*Plantago media)* are frequent along with Red Clover and other GS1/GS2 species.

Refuse and Other Waste (ED5)

This category is used for any areas where domestic, industrial, agricultural and other waste is stored, treated or disposed. It includes rubbish dumps, tip heads, landfill sites, sewage plants, slurry pits and heaps of manure or spent mushroom compost. These areas are usually characterised by high nutrient levels and/or the presence of scavengers.

There is a small open area in use as storage for wood chippings and horticultural clippings at Firhouse Dodder Valley Park. The vegetation is bushy, and in transition to scrub on the less disturbed side. Species composition includes abundant Willowherbs (*Epilobium spp*.), and Hogweed (*Heracleum sphondylium*), with some recolonising bare ground and GS2 communities.

Cultivated and Built Land

Stone Walls and Other Stonework (BL1)

This category incorporates stone walls and most other built stone structures in rural and urban situations, apart from intact buildings (see buildings and artificial surfaces – BL3) and coastal constructions made of stone (see sea walls, piers and jetties - CC1). It includes dry stone and old mortar walls that occur as field or property boundaries; retaining walls against banks of soil; stone walls that rise from rivers, canals or moats; stone bridges, viaducts and aqueducts; stone jetties or piers in lakes or rivers; derelict or ruinous buildings made of stone; and old stone monuments, fortifications or ruins. Note that modern or intact buildings made of stone are excluded, as are any structures made of bricks, cement blocks or mass concrete (see buildings and artificial surfaces - BL3). Stone walls and other types of stonework differ in terms of physical structure and composition (type of stone, presence of mortar), age and the degree of maintenance. Older and more neglected structures are generally the most important for wildlife. Stone walls may support a diverse flora with abundant lichens, mosses and ferns (particularly 67 Retaining wall (L.Lysaght) *Asplenium trichomanes*, *A. ruta-muraria* and *A. ceterach*). Other common components include Ivy (*Hedera helix*) and other creepers, grasses (*Aira* and *Catapodium* spp.), stonecrops (Sedum spp.), Herb-robert (*Geranium robertianum*) and Navelwort (*Umbilicus rupestris*). Non-native species such as Red Valerian (*Centranthus ruber*), Wallflower (*Erysimum cheiri*) and Ivy-leaved Toadflax (*Cymbalaria muralis*) are often prominent. Stone walls that are overgrown by trees, shrubs or brambles should be considered in the woodland section under hedgerows – WL1 or treelines – WL2. Bridges and derelict buildings can be important habitats for birds or bats in particular.

Limestone is the predominant substrate on weirs, bridges stone walls, and occasional derelict buildings (such as the Victorian tea house in the grounds at Bushy Park), and this affords rooting opportunities to lime-loving pioneer species and some ferns. Habitats of note include stone walls (BL3) east of the Luas Bridge which bear a dense cover or Ivy and those in the vicinity of Ballsbridge and Donnybrook which provide a niche for native plants.

Plate 4.2.4: An example of Stone Walls and Other Stonework (BL1) at the Packhorse Bridge in Milltown

Buildings and Artificial Surfaces (BL3)

This broad category incorporates areas of built land that do not fit elsewhere in the classification. It includes all buildings (domestic, agricultural, industrial and community) other than derelict stone buildings and ruins (see stone walls and other stonework – BL1). It also includes areas of land that are covered with artificial surfaces of tarmac, cement, paving stones, bricks, blocks or astroturf (e.g. roads, car parks, pavements, runways, yards, and some tracks, paths, driveways and sports grounds). Unpaved areas are excluded (see spoil and bare ground – ED2). Any other built structures that are not made of natural stone, including walls made of bricks, cement blocks and mass concrete, should be considered here. Note that greenhouses and polythene tunnels are excluded (see horticultural land - BC2), as are refuse dumps (see refuse and other waste - ED5). Plant cover should not exceed 50%.

This habitat is common along the river Dodder corridor, primarily closer to Dublin City. There is no notable vegetation on these structures

4.3 WFD Water Bodies

The Water Framework Directive is a European Directive that was implemented by all European Union Member States in 2000. The purpose of the Directive is to establish a framework for the protection of inland surface waters (rivers and lakes), transitional waters (estuaries), coastal waters and groundwater. Its aim is to ensure that all aquatic ecosystems and, with regard to their water needs, terrestrial ecosystems and wetlands meet 'good status'.

The Directive is transposed in Ireland into river sub-basin management plans which provides a framework for monitoring and improving water quality in all of the 4,933 waterbodies in Ireland. Waterbodies are evaluated according to 5 statuses: High, Good, Moderate, Poor and Bad. Waterbody quality for each status in assessed under the following characteristics:

Biological Quality, Physico-chemical quality, Chemical quality for specific pollutants, Fish, Benthic Invertebrates, Aquatic Plants and Hydromorphological Quality.

The waterbodies which are in the immediate vicinity of the proposed works are 4 sections of the river Dodder (Dodder 020, Dodder 030, Dodder 040, Dodder 050) and the transitional water body Liffey – Dublin Bay (09).

The current and historical statuses for these waterbodies as reported by the EPA since 2007 are as follows. The lowest scoring element – which defines the overall WFD status for each of the water bodies is also reported in Table 4.3.1 below:

Table 4.3.1 WFD Status of the Affected Waterbodies (Dashes Indicate Where Data is Not Available or Sampling Programme Not in Place)

WFD Water Body	WFD Status 2007-2009	Lowest Scoring Element	WFD Status 2010-2012	Lowest Scoring Element	Present Status	Lowest Scoring Element
Dodder 020	Good	Invertebrates	Moderate	Invertebrates	Moderate	Invertebrates
Dodder 030	Good	Invertebrates	Good	Invertebrates	Good	Invertebrates
Dodder 040	Moderate	Invertebrates	Poor	Invertebrates	Poor	Invertebrates
Dodder 050	Poor	Invertebrates	Moderate		Moderate	Invertebrates
Liffey-Dublin Bay	-	-	-	-	Moderate	Biological

The general objective of the WFD is to achieve 'Good Status' (or Good Potential for heavily Modified Water Bodies) of all waterbodies by 2021. Good Status in this context means the achievement of good Ecological Status and Good Chemical status. Any deterioration in status is counter to the obligations of the Directive unless they comply with the very specific conditions which may allow deterioration in status.

4.4 Annex I Habitats

The study area supports three Annex I habitats as identified in the EU Habitats Directive, which are of nature conservation concern and are described below.

4.4.1 Calcareous Springs - *Petrifying Springs with Tufa Formation (Cratoneurion) (7220)

The River Dodder flows through a steep sided valley from Fort Bridge downstream to Old Bawn. The valley cuts through glacial till which is exposed in many places along the river and forms steep banks. The river bed and lower banks have exposed bedrock in many places and there are numerous springs and seepages along the interface of the till and bedrock. Most of these springs occur within the first kilometre downstream of Fort Bridge. Calcareous springs are a Priority Annex I listed habitat under the EU Habitats Directive and are a priority habitat where tufa formation occurs. The various springs that occur along the stretch of river downstream of Fort Bridge to Old Bawn all represent good examples of this habitat type. In addition the Glenasmole Valley SAC commences a short distance upstream of Fort Bridge and petrifying springs are listed as a qualifying interest for this SAC. There is one a spring in Firhouse west of the Kilsaran plant. As its flow rate was low, neither distinctive mosses nor tufa were present. However the presence of this water supply had led to the development of wetland conditions on an otherwise dry bank. The most easterly is located north of the study area above the Duck Pond at Bushy Park (Rathfarnham). The habitat is described as follows by Mary Tubridy & Associates (2007): "a small spring (PF1) occurs in the escarpment above the Duck Pond. Calcareous springs are listed in the Habitats Directive". The closest proximity of this habitat to the works is 30m and no impacts are anticipated.

4.4.2 Dry Calcareous Grassland Neutral Grassland – Semi-natural Dry Grasslands and Scrub Facies on Calcareous Substrates (Festuco-Brometea) (*Important Orchid Sites) (6510)

Downstream of Old Bawn Bridge in the Dodder Valley Park, grassland is located on the upper slopes and appears to be maintained by annual mowing. The plant community present contains a variety of calcicole species. No evidence of orchids was recorded on this site, however, orchids are known to flower intermittently so the potential of the area to support orchid species remains. The GS1 areas have affinity to the priority Annex I habitat 6210* and the Annex I habitat 6510, with slightly higher affinity to 6210*. Overall the grassland (GS1 & GS2) would fail the standard condition assessment, due to tall vegetation and high graminoid cover, but the smaller areas (GS1) would be likely to pass the assessment, as they are locally species-rich. Further downstream at Cherryfield Park, a meadow along the dodder has affinity to the priority Annex I habitat 6210*. Indicator species are frequent throughout the sward and three orchid species have been recorded. The Greenway will not impact Annex I GS1 habitat in Cherryfield as it is >10m from this habitat and the grassland along the path is maintained as amenity grassland.

4.4.3 Riparian (Alluvial) Woodland – *Alluvial Forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion Albae) (91EO)

Two areas along the River Dodder were identified as Riparian Woodland conforming to the Annex I listed priority habitat. These areas are located downstream of Fort Bridge at Bohernabreena and the Dodder Riverbank Park at Firhouse. The associated canopy vegetation is dominated by alder (*Alnus Glutinosa*), willows (*Salix* Spp.) with some ash (*Fraxinus Excelsior*) and Sycamore (*Acer Pseudoplatanus*). The Greenway occurs >30m from areas of Annex I alluvial woodland and outside areas that this type of woodland could potentially occur.

4.5 Flora Overview

The River Dodder corridor was once host to a number of rare plant species which have not been recorded in the most recent surveys of corridor. The disappearance of such species is indicative of the gradual impact of urbanisation on flora along the river.

Red-hemp Nettle (*Galeopsis angustifolia*) was last recorded in 1980s near the Old Bawn Bridge. The species is listed as vulnerable in the Irish Red Data Book (Wyse Jackson *et al.,* 2016) and is protected under the Flora (Protection) Order 2015. It is classified as Endangered by the IUCN. The plant is an annual of arable land, waste places and open ground on calcareous substrates. There are also Dodder valley records for Spiked Sedge (*Carex spicata*). Spiked Sedge is a perennial herb of moist, neutral or slightly base-rich, heavy soils. Green Figwort (*Scrophularia umbrosa*) is a plant of river banks which has a very limited distribution in Ireland being confined to the east and north of the country. It has been recorded from the Dodder Valley Linear Park though most recent records on the BSBI website are from the River Liffey Valley. None opf these species were recorded during recent botanical surveys.

4.6 Vascular Plants

4.6.1 Broad-leaved Helleborine (*Epipactis helleborine*)

Broad-leaved Helleborine is not protected or listed on the Irish Red Data Book (Wyse Jackson *et al.,* 2016). It is a rhizomatous perennial herb of calcareous to slightly acidic soils. Habitats include coniferous and deciduous woodland, hedgerows, shady banks, streamsides, roadsides, *Alnus* carr, dune-slacks, limestone pavement and screes. It may colonise secondary woodland and also occurs in urban habitats, particularly abandoned gardens. It is a relatively widespread species in Ireland (168 10km squares), but described in the Irish Flora (Parnell & Curtis, 2012) as "frequent in parts of the north and west, and rather rare elsewhere". Populations of Broad-leaved Helleborine were recorded at Rathfarnham Shopping Centre (20 plants recorded), Bushy Park (1 plant recorded) and between Clonskeagh Road and Beaver Row (9 plants recorded). Recent records of this species also exist at Kilvere and at Ladywell in Templeogue (FERS, 2011).

Plate 4.6.1: Broad-leaved Helleborine photographed near Rathfarnham Shopping Centre

4.6.2 Ivy Broomrape (*Orobanche Hederae*)

Ivy broomrape is a relatively uncommon native annual or perennial parasitic plant belonging to the family *Orobancheae* which grows on the roots of ivy (*Hedera helix)*, especially subsp. *hibernica*, and, rarely, on other cultivated Araliaceae (Ivy). It is not protected or listed on the Irish Red Data Book (Wyse Jackson *et al.,* 2016) however given its relative scarcity in Dublin this species is considered as a species of interest. It is an upright plant with a slender purplish stem up to about 40cm high. The tubular flowers (10-20mm long) are cream with purple veins, and bloom from May to July. Its habitat is that of its host and includes coastal cliffs, open rocky woodland, quarries, hedge banks and other similar habitats. A population was recorded along the River Dodder between Clonskeagh Road and Herbert Park. A population was also recorded between the Dart Bridge and New Bridge (Mary Tubridy & Associates, 2007).

Plate 4.6.2: Ivy Broomrape photographed near Beaver Row

4.7 Alien Invasive Plant Species (IAPS)

During the multi-disciplinary walkover surveys the presence of non-native invasive species listed under the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. 477 of 2015) were recorded. Regulation 49 of these Regulations includes legislative measures to deal with the dispersal and introduction of Invasive Alien Species (IAS) and deals with the *Prohibition on introduction and dispersal of certain species*.

4.7.1 Japanese Knotweed (*Fallopia japonica*)

Japanese knotweed is a non-native invasive, perennial plant with hollow, bamboo-like stems. Its leaves are approximately the size of a human hand and plants form yellow cream flowers in late June to August. The plant consists of hollow bamboo-like stems which are green with red spots during summer and turn brown during winter. During growth red side shoots form off the main stem and its leaves are arranged in a zig-zag pattern. Japanese knotweed is on the 'most unwanted' list by Invasive Species Ireland; a joint project between the Northern Ireland Environment Agency (NIEA) and the National Parks and Wildlife Service (NPWS). Japanese knotweed is a threat in open and streamside areas. It can spread rapidly through underground stems (rhizomes) and fragmentation to form dense stands, excluding native vegetation and reducing species diversity. Japanese Knotweed does not produce viable seed in Ireland. Rhizomes may spread up to 7m horizontally and 3m deep from above ground plant. Once stands become established, they are extremely persistent and difficult to remove. This plant has the ability to grow through tarmac and concrete (in some cases within dwellings). Failure to manage Japanese Knotweed on a development site may result in eventual structural damage.

Japanese knotweed is widespread and common along the banks of the River Dodder and is likely spread by flood events which disperse plant material downstream. It has been recorded between Bohernabreena to Ballsbridge.

Plate 4.7.1: Japanese Knotweed canes at Milltown

4.7.2 Spanish Bluebell (and hybrids) (*Hyacinthoides hispanica*)

Spanish Bluebell is a non-native, herbaceous perennial species. It is similar in appearance to the native bluebell but has the flowers arranged all around the stem (not only hanging to one side), and has broader leaves, and shorter, wider flowers. The hybrid bluebell has combinations of characteristics intermediate between the Spanish and native Irish species. Flower colour in hybrid populations is usually blue but can vary depending on the colour of the Spanish bluebell grown in gardens. The Spanish bluebell hybridises with the native bluebell and the resulting hybrid is invasive in areas where the native bluebell is common. As a result of hybridisation the native bluebell is regarded as threatened. Spanish bluebell has a sparse distribution in the study area.

4.7.3 Himalayan Balsam (*Impatiens glandulifera*)

Himalayan balsam is an invasive terrestrial plant species that was first introduced in 1839 as an ornamental garden plant. It can grow up to 3m in height and produces large purple to pink flowers from June to October. The seed pods can disperse seeds up to 6m away. The stems are hexagonal, hollow and red in colour and the leaves are dark green, lance-shaped leaves and have serrated edges. Since it was introduced, it has spread throughout Ireland. It is a tall annual plant which due to its rapid growth, shades out most native species. It also competes with native riparian plants for pollinators. In the autumn, plants die back, leaving watercourse banks bare and vulnerable to erosion, leading to secondary effects including sedimentation of fish spawning grounds and higher flood risk. Himalayan balsam is widespread and common along the banks of the River Dodder between Bohernabreena and Ballsbridge.

4.7.4 Giant Rhubarb (*Gunnera tinctoria*)

Giant Rhubarb is a large herbaceous perennial, which can grow up to 2 m tall, with leaves of up to 2 m in diameter. It is a rhizatomous plant with the rhizomes of mature plants can be up to 1.5-2 m long growing above ground. It is deciduous with the leaves dying off in autumn (October) leaving the large brown rhizomes exposed. Growth starts in early spring (March), prior to the emergence of native species. It can reproduce by both sexual (seed) and asexual (vegetative) means. Inflorescence development occurs early in the spring, with the fruits maturing in late summer/early autumn. Large numbers (up to 250 000 seeds per mature plant) of drupe like, red or orange seeds are produced. Small fragments of the rhizome have the potential to establish new plants. The impacts of concern are colonisation of peat bog and waterside vegetation where large dense colonies can rapidly dominate and displace important native species. Colonisation of agricultural and amenity areas can lead to these areas being unusable due to the dense stands of Giant rhubarb. Giant rhubarb was identified on the island of the lower pond in Bushy Park, in Milltown Park opposite Scully's Field and previously at one other location on the bank of the River Dodder below Milltown (Donnelly, 2008).

4.7.5 American Skunk Cabbage (*Lysichiton americanus*)

American Skunk Cabbage is a perennial herbaceous plant native to North America. It has large green leaves which surround a yellow spathe within which is a green/yellow spadix (a spike of inflorescence). As the name suggests, the plant emits a foul smelling odour when damaged/crushed or when dying back. It can grow up to 1.5m tall. The flowers produce green berries in late summer. In Ireland the species has a sparse distribution but is locally abundant in some places. The species forms dense stands which can shade out native species. Its preference for wet soils means that the seed can easily be dispersed via waterbodies. American Skunk Cabbage was identified at one location on the eastern bank of the lower Bohernabreena reservoir.

4.8 Bats

Seven species of Bat were recorded during transects, lamping and back tracking surveys undertaken between May and August 2016. Species accounts and results of the surveys are presented in the following sections. The figure opposite shows the locations of all Bats detected during the Bat Activity Surveys, highlighting the importance of the entire River corridor for commuting and foraging Bats. The Ecological significance of the Greenway operational impacts (e.g. lighting) on Bats if unmitigated would constitute a Long-term Moderate-Significant Negative Impact to a Bat population considered to be of County level importance.

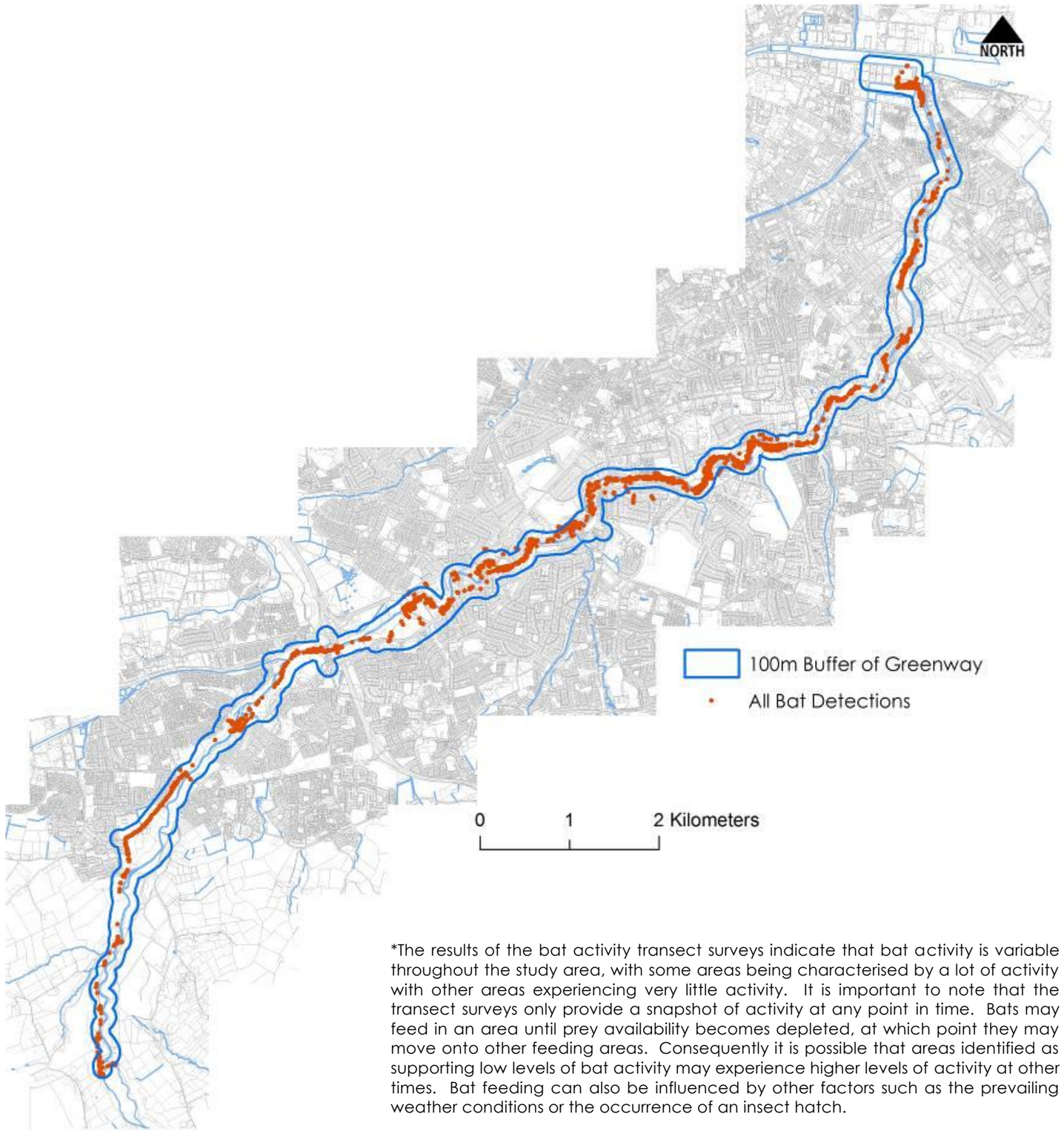
Roost Characterisation and Habitat Assessment

Data gathered during the daytime multidisciplinary surveys, thermal imaging camera assessments, dusk emergence and dawn re-entry surveys and back-tracking surveys, highlighted a number of potential roosting features and important foraging locations within the survey area. These locations included a number of bridge structures, weirs, mature riverside trees and other structures (such as an old lime kiln and bridge buttress). These features were subsequently assessed using the thermal imaging cameras to look for heat signatures that could indicate the potential presence of roosting bats. As a result, eight structures within the survey area are considered to have a moderate or high potential to either support roosting Bats and were subject to passive monitoring. None of the riverside trees assessed were considered to be of sufficient potential roosting value to warrant additional targeted survey.

The results of the bat activity transect surveys indicate that bat activity is variable throughout the study area, with some areas being characterised by a lot of activity with other areas experiencing very little activity. However, it is important to note that the transect surveys only provide a snapshot of activity at any point in time. Bats may feed in an area until prey availability becomes depleted, at which point they may move onto other feeding areas. Consequently it is possible that areas identified as supporting low levels of bat activity may experience higher levels of activity at other times. Bat feeding can also be influenced by other factors such as the prevailing weather conditions or the occurrence of an insect hatch.

Key Potential Roost Structures

- Big Bridge (Pearse Bridge)
- The buttress about 50m to the north-west of Bridge R112
- 'Lime Kiln' near Orwell Park
- Rathfarnham Weir
- Firhouse Weir
- L4023 Spawell Bridge
- Luas Bridge (Nine Arches)
- Packhorse Bridge (footbridge Milltown Road)



*The results of the bat activity transect surveys indicate that bat activity is variable throughout the study area, with some areas being characterised by a lot of activity with other areas experiencing very little activity. It is important to note that the transect surveys only provide a snapshot of activity at any point in time. Bats may feed in an area until prey availability becomes depleted, at which point they may move onto other feeding areas. Consequently it is possible that areas identified as supporting low levels of bat activity may experience higher levels of activity at other times. Bat feeding can also be influenced by other factors such as the prevailing weather conditions or the occurrence of an insect hatch.

4.8.1 Daubenton's Bat (*Myotis daubentonii*)

Daubenton's Bats are a small to medium sized species. They have medium to dark brown dorsal fur while the ventral fur is silvery or brownish grey. The face is hairy with a pinkish brown colour with very short rounded ears which are the smallest for a Bat species of this genus. Its average weight (as given by Greenaway & Hutson, 1990) is 6-12 g.

Daubenton's Bats mate from September through to April. The gestation period is usually 5-7 weeks but the precise timing is weather dependent (Speakman, 1991). In Europe one young is born in June or July (Schober & Grimmberger, 1989). Maximum age recorded in Britain is 18 years (Speakman, 1991) but on average Daubenton's bats in Europe only live 4-4.5 years (Schober & Grimmberger, 1989).

Summer roosts are in tree hollows, caves, buildings and other artificial structures (e.g. bridges, cellars) in mixed sex colonies. It winters in a wide range of underground habitats. Seasonal movements between winter and summer roosts are mostly within a distance of 100-150km (Hutterer *et al*., 2005). Daubenton's Bat emerge from their roosts to hunt later than other Bat species, usually thirty minutes to one hour after sunset to avoid daytime predatory birds. They are heavily dependent on aquatic insects and often feed over water, gaffing insects floating on or just above the water surface, and sometimes in woodland or scrub (Rydell *et al*., 1999).

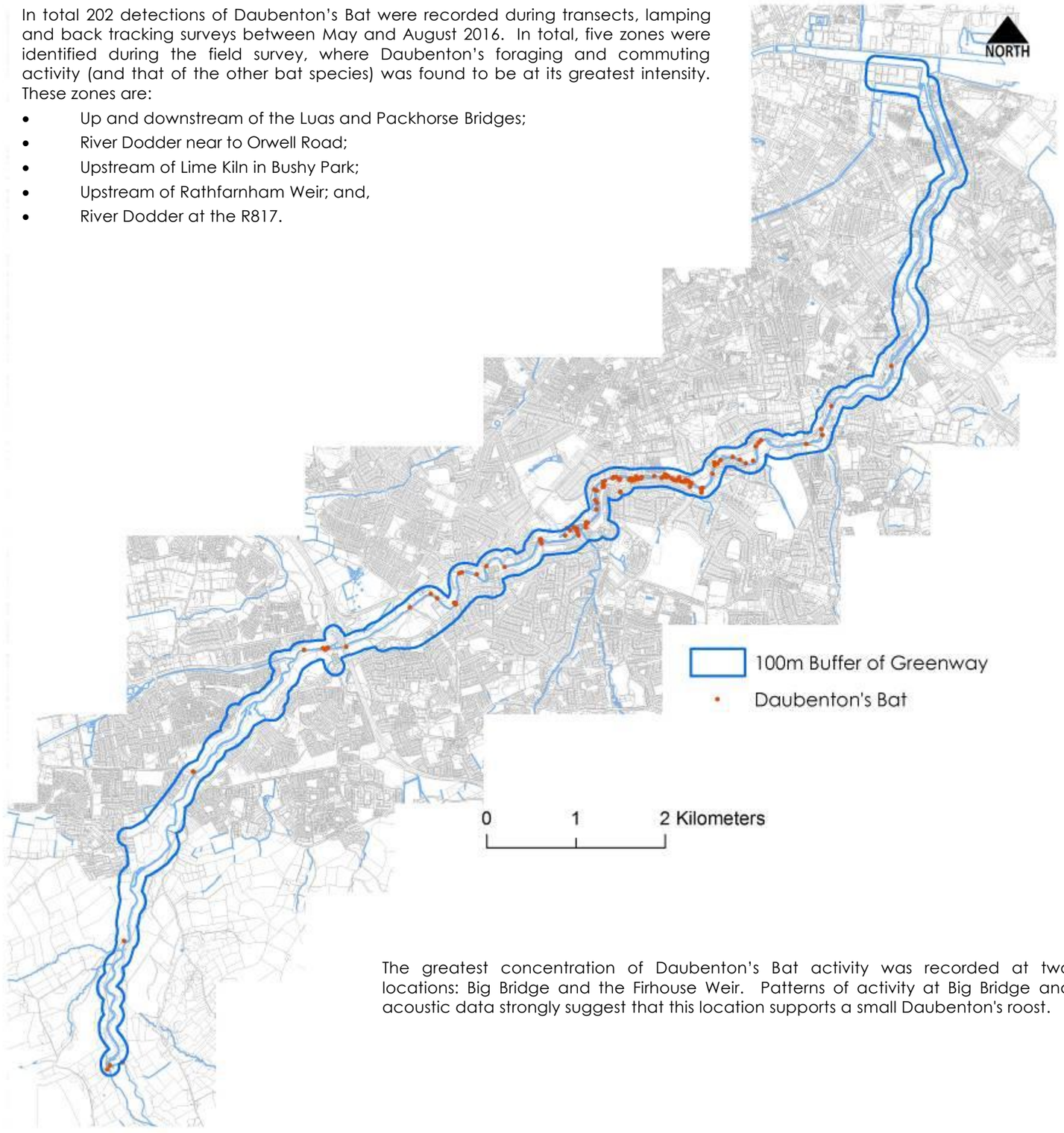
Daubenton's Bat is widespread in Ireland and found in all counties (Aughney et al., 2009). The increase in the creation of artificial water bodies in Ireland like canals and recreational lakes has increased availability of preferred habitat for this species. The population in Ireland is thought to be stable, and is estimated to comprise 10,000+ mature individuals (Marnell *et al*., 2009). The species has been classed as Least Concern by the IUCN (Hutson *et al*., 2007).

Daubenton's bat was predominantly recorded in the middle section of the Greenway, along the stretch of river from the Templeogue Bridge to Orwell Road, downstream of which it was not recorded. Daubenton's Bat was also recorded at Glenasmole Reservoir and above the Firhouse Weir. The highest densities of detections were found at the Firhouse Weir, in Bushy Park and in the vicinity of the Rathfarnham Weir.

The greatest abundance of Daubenton's Bats was recorded close to the R817 road bridge with a peak count of 6 Daubenton's Bats (recorded simultaneously). The greatest number of passes by Daubenton's bat was recorded in August at a location just to the south of the Templeogue Road, between Bushy Park and Dodder Valley Park. On this occasion 40 separate Bat passes were recorded during the three minute monitoring period. (*it should be noted that separate passes can sometimes be hard to estimate because of difficulties seeing Bats, which varies depending upon the feeding strategies).

In total 202 detections of Daubenton's Bat were recorded during transects, lamping and back tracking surveys between May and August 2016. In total, five zones were identified during the field survey, where Daubenton's foraging and commuting activity (and that of the other bat species) was found to be at its greatest intensity. These zones are:

- Up and downstream of the Luas and Packhorse Bridges;
- River Dodder near to Orwell Road;
- Upstream of Lime Kiln in Bushy Park;
- Upstream of Rathfarnham Weir; and,
- River Dodder at the R817.



The greatest concentration of Daubenton's Bat activity was recorded at two locations: Big Bridge and the Firhouse Weir. Patterns of activity at Big Bridge and acoustic data strongly suggest that this location supports a small Daubenton's roost.

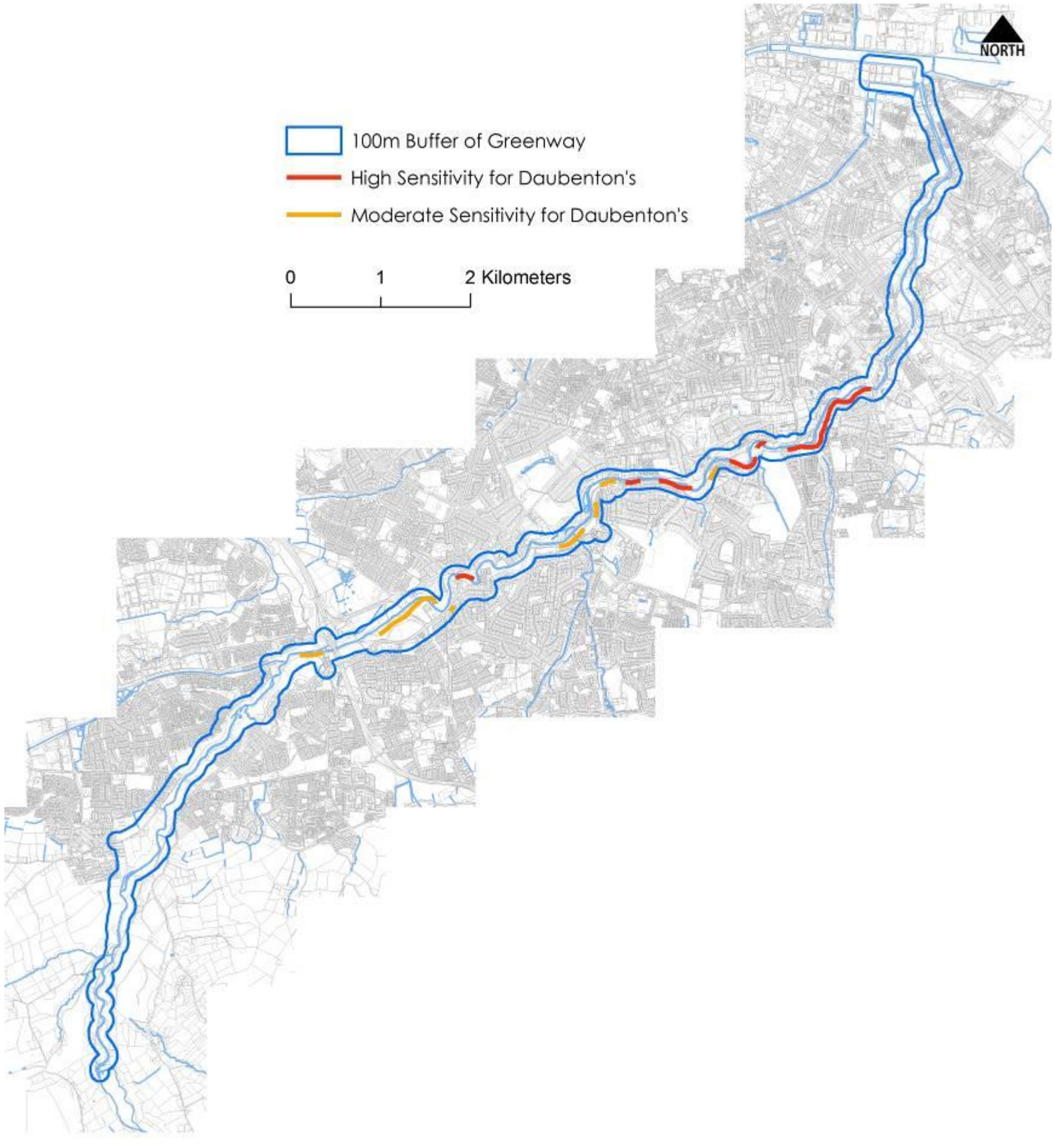
Daubenton's bat was the mostly frequently encountered species during the passive monitoring, being confirmed at 43.5% of the monitoring locations. It was also the most frequently detected species at the eight structure locations, accounting for 35.5% of total bat passes recorded.

The zones of greatest intensity are broadly characterised by being away from main roads and areas of development, located within areas of mature natural greenspace and with generally low levels of artificial lighting.

Daubenton's bat is known to modify its flight behaviour to take advantage of darker areas of foraging and commuting habitat (Rydell & Racey, 1993). It is therefore likely that the species is actively seeking areas where riparian vegetation is mature, and therefore reduces the effect of ambient street lighting. The implications of this behaviour, in relation to potential increase in ambient lighting installed as part of the Greenway project are discussed in more detail 'lighting design code'.

Consultation with the most recently available data on light pollution levels in the Dublin area: (http://www.lightpollutionmap.info/#zoom=11&lat=7039072&lon=-698140&layers=B0TFFFF accessed 8 August 2016) indicates that the five areas identified as important for Daubenton's Bat are within areas with generally low levels of artificial lighting. As might be expected, the level of artificial light increases as the River Dodder flows closer to the centre of Dublin and the port area.

Given the known sensitivity of Daubenton's bat (and other species such as Leisler's) to changes in artificial lighting levels, there is considered to be a risk that should levels of lighting increase along the River Dodder corridor, Bats may be negatively affected. The figure opposite indicates the areas (in red) where this potential impact is likely to be most significant if artifical lighting levels are increased as part of the Greenway.



4.8.2 Natterer's Bat (*Myotis nattereri*) / Unidentified *Myotis spp*.

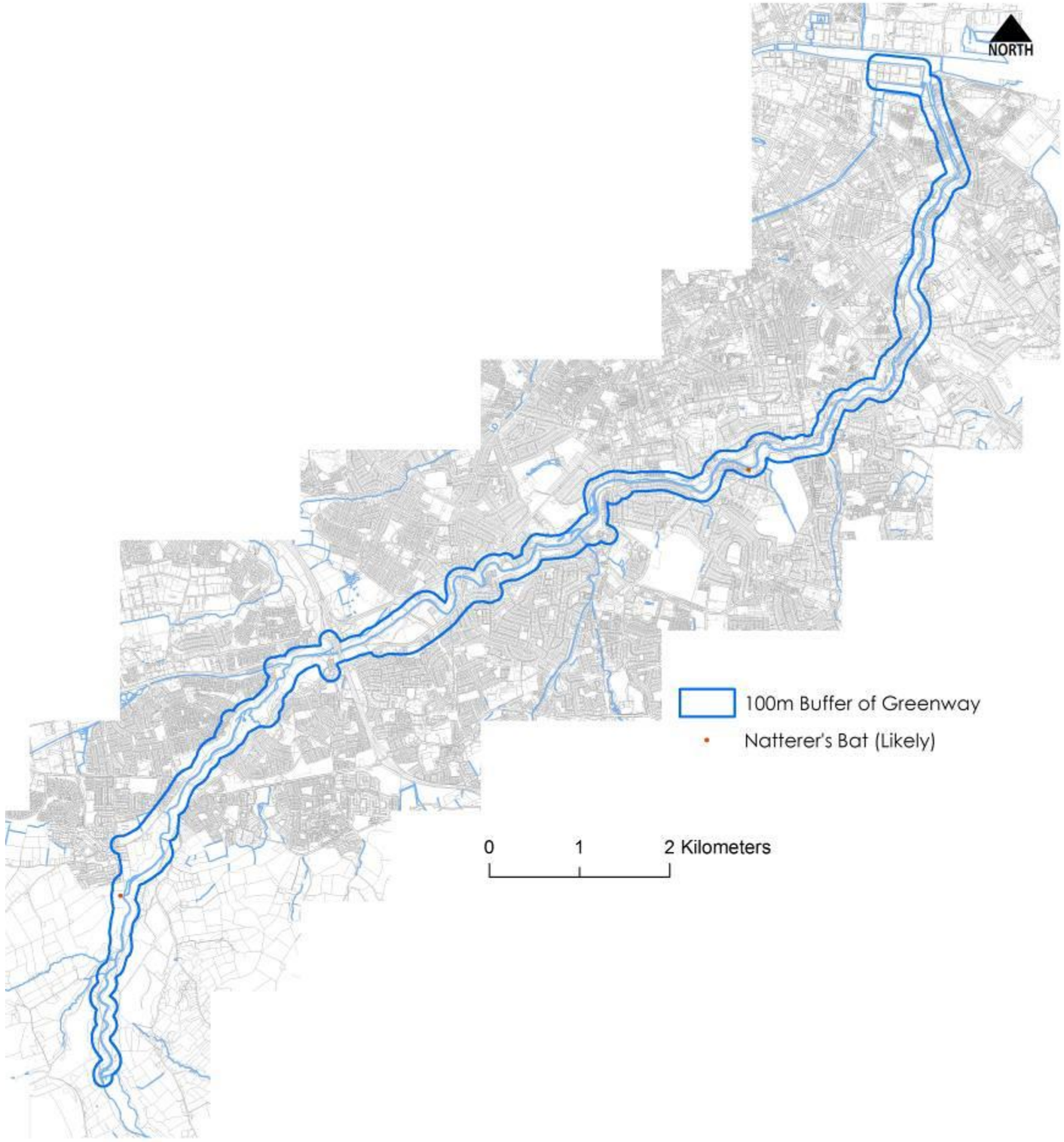
Natterer's Bats are a medium sized species but they are one of the smaller bats found in Ireland. They have a grey-brown back and whitish fur to the underside. The face is long and pink with little fur covering the ears. The ears are long and narrow and can extend below the nose when folded forward during sleep and hibernation. Natterer's Bat has a wingspan of 245 - 300mm and a body length of 4 - 5cm. It weighs 7 - 12g on average.

The species mates from autumn through to spring. One pup is born between the end of June and the beginning of July (Stebbings, 1991b). The maximum age recorded in Europe is 20 years (Schober & Grimmberger, 1989). Summer roosts are in hollow trees, buildings and occasionally underground sites. It hibernates in underground habitats (caves, cellars and mines). It is a sedentary species, with movements between summer, autumn and winter roosts up to 120km (Hutterer *et al.* 2005). Nursery roosts contain 30-200 females and sometimes some males (Greenaway & Hutson, 1990).

The species emerges at late dusk and returns to the roost one or two hours before sunrise (Stebbings, 1991b). Median emergence time is 75 minutes after sunset (Jones & Rydell, 1994). Natterer's bat tends to forage in semi-natural broad-leaved woodland and along tree-lined rivers and ponds (Smith & Racey, 2002). They may also use grassland habitats, flying very low over the ground.

Natterer's Bat is widespread in Ireland, but seldom recorded; with no records from the western seaboard or from Donegal (McAney, 2006). The population in Ireland is thought to be stable, and is estimated to comprise 5,000+ mature individuals (Marnell et al., 2009). The species has been classed as Least Concern by the IUCN (Hutson et al., 2008).

Detections and sound recordings alone are not sufficient to accurately separate the *Myotis* species. A number of *Myotis* bats that were not flying low over water (i.e. Daubenton's bat) with large bandwidth frequency-modulated echolocation calls were recorded during transects and were considered likely to be Natterer's Bat. These recorded large bandwidth calls were sparsely distributed and detected in only two locations. No clear pattern of occurrence was established. No roost locations were identified.



4.8.3 Leisler's Bat (*Nyctalus leisleri*)

The Leisler's Bat is a medium sized species but it is the largest Bat found in Ireland. It has golden-brown dorsal fur and yellow-brown ventral fur. Juveniles are darker than the adults. Facial skin and ears are dark, sometimes appearing black. The wing design is long, narrow and pointed reflecting the bat's fast flying style. Its average weight is 11-20g (Greenaway & Hutson, 1990).

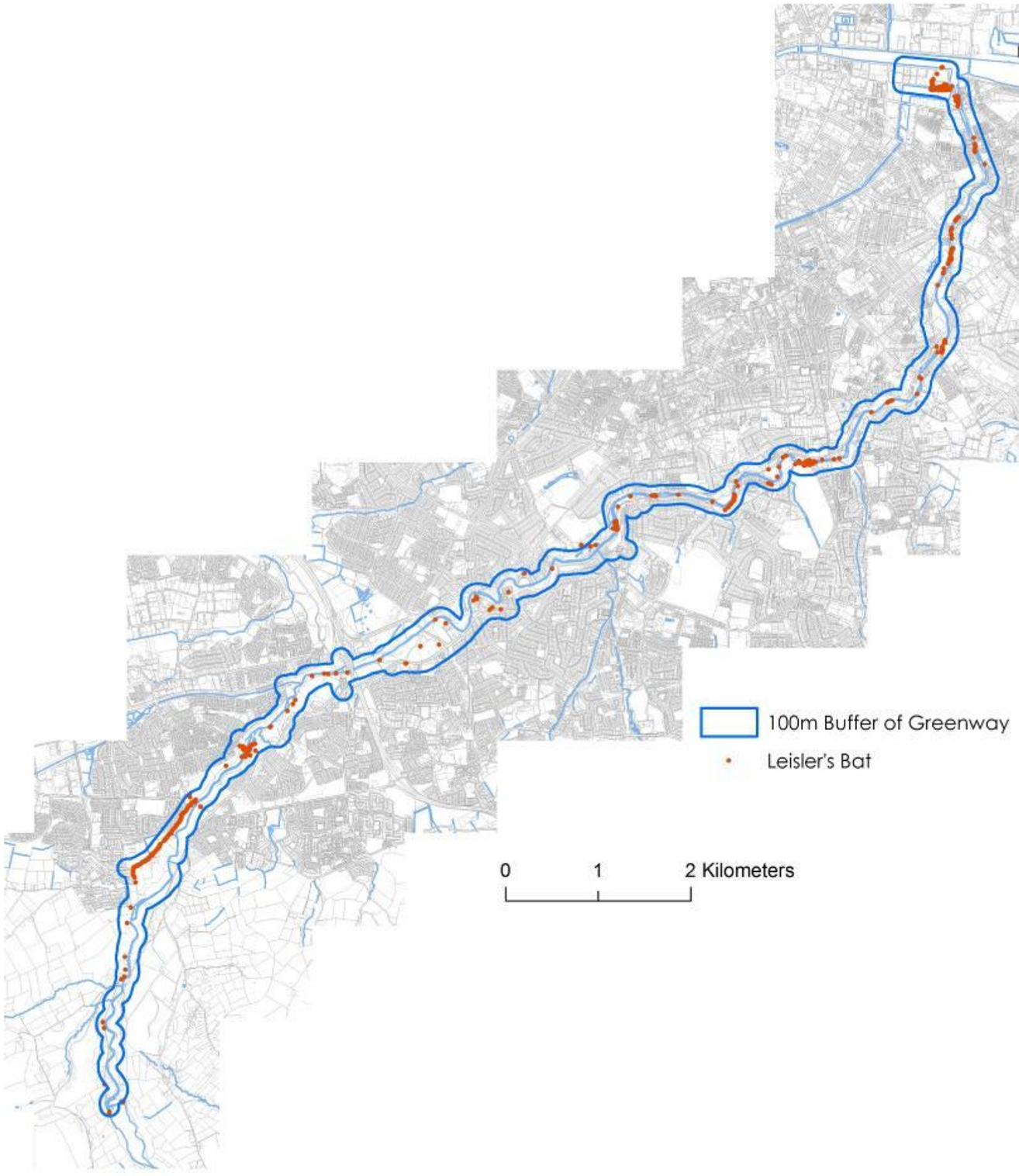
Leisler's Bats mate from the end of August. A single pup is born in mid-June. Work by Shiel *et al*. (1999) into the foraging behaviour of Leisler's Bats in Ireland found that their foraging behaviour varied with reproductive stage. During pregnancy the Bats fly farthest from their roost, and may make a second or third flight towards dawn on warmer nights. Pregnant Bats also tend to vary the habitat they visit more than bats in different stages of reproduction. After birth the number of flights taken per night increases and the distance to the foraging site decreases up to the point of weaning due to increased energy demands of the young. The maximum age recorded in Europe is 9 years (Schober & Grimmberger, 1989).

Summer nursery roosts are located in tree holes, but also in buildings and Bat boxes. Nursery colonies usually number 20-50 females, but occasionally up to 1,000 (e.g., in Ireland: Stebbings & Griffith, 1986). In winter this species hibernates mainly in tree holes, or occasionally in underground sites or buildings and often in large groups. Females migrate over distances up to 1,567km (Ohlendorf *et al.* 2000).

Leisler's Bats emerge from their roosts to feed early in the evening or just before sunset. They can remain active all night but generally feeding activity peaks at dusk and again just before dawn. The Bat species forages over woodland, pasture, and river valleys, where it feeds on flies (including mosquitoes), moths and beetles.

Ireland is considered to be the world stronghold for the species (Mitchell-Jones *et al*., 1999). It occurs throughout the country and is probably the third most common bat species (Roche *et al*., 2009). The population in Ireland is thought to be stable, and is estimated to comprise 20,000+ mature individuals (Marnell *et al*., 2009). The species is classed as near threatened in Ireland with accidental and deliberate exclusion of nursery roosts from buildings being the main threat to this species. Unsympathetic woodland management is also of concern (McAney, 2006).

In total 463 detections of Leisler's Bat were recorded during surveys between May and August 2016. Recordings of Leisler's Bat were made between Kiltipper Park and Grand Canal Dock with noticeable concentrations over the open water at Grand Canal Basin and the mouth of the Dodder, at Bushy Park and between Kiltipper Park and Old Bawn Bridge. The species was recorded frequently across most of the scheme. No roost locations were identified.



4.8.4 Nathusius' Pipistrelle (*Pipistrellus nathusii*)

Nathusius' Pipistrelle is the largest Pipistrelle species in Europe. They have reddish-brown dorsal fur and the ventral fur is a lighter shade of brown. Juveniles are dark brown. Nathusius' Pipistrelles have broader and longer wings than the other two Irish species of pipistrelle which allow for more manoeuvrable flight especially in confined areas. Irregular flight paths are used by this species with deep wing beats employed when flying in a straight line. It's average weight (as given by Greenaway & Hutson, 1990) is 6-15 g.

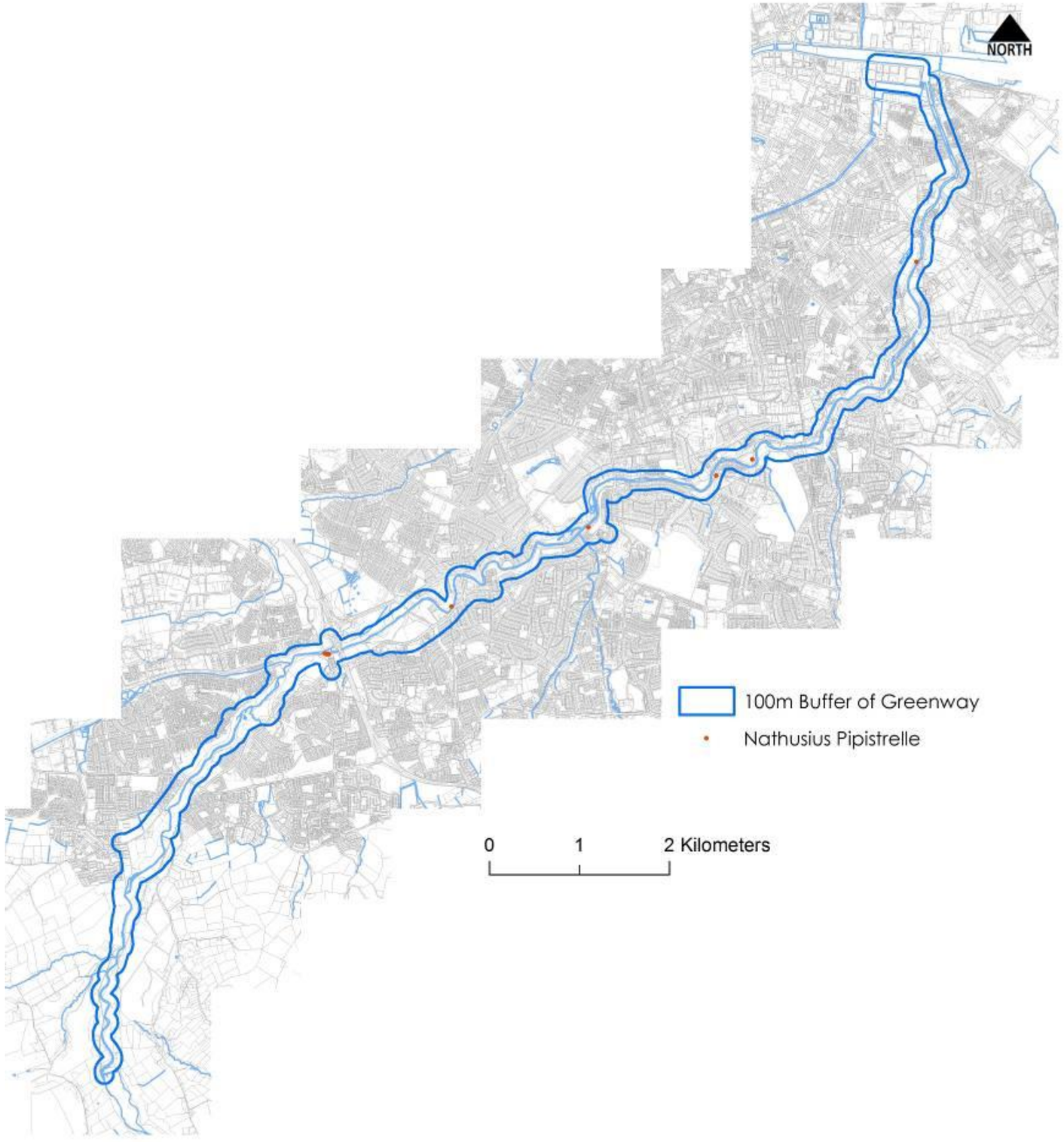
Young are born in June and July. The species mates from the end of July to the start of September. Nathusius' Pipistrelles are polygynous, with one male typically associated with a harem of females in the mating season. The mating season is short and early in comparison to other species of Bats. This may be an adaptive solution to allow the Bats to migrate in September.

Summer roosts are located in tree holes, buildings, and Bat boxes, mainly in woodland areas. Winter roost sites include crevices in cliffs, buildings and around the entrance of caves, often in relatively cold, dry, and exposed sites. It is a migratory species, with movements of up to 1,905 km recorded (Petersons 2004). Migrations typically follow a NE-SW route (Bogdanowicz, 1999).

Nathusius' Pipistrelles normally emerge from their roosts within half an hour of dusk each evening. They forage in a wide number of different habitat types but are known to favour hunting along a particular regularly used route. Nathusius' Pipistrelle forages over a range of habitats including woodland, edge, wetlands (among which natural ones are preferred, Flaquer *et al.,* 2009), and open parkland. They hunt for small to medium sized flying insects such as flies, moths, caddis flies, midges and mosquitoes.

The species was first recorded in Ireland in 1996. A maternity colony was located in 1997 in Co. Antrim (Russ *et al*., 1998), confirming the species as a resident here. It has since reported from many other counties (Roche *et al.,* 2009). The species showed rapid spread in 2006, but this has not continued and most recent data suggest numbers have dropped again (Roche *et al*., 2009). Occasional records of the species continue to be collected by the car-based monitoring scheme (Roche *et al*., 2009). In Ireland, where the winters are mild, normal migratory behaviour may give way to sedentary lifestyle (Russ *et al*., 1998). Resident bats may be supplemented during winter by migratory individuals returning from the north-east of the species range (Russ *et al*., 2001).

Detections of Nathusius' Pipistrelle were recorded at seven locations along the Dodder. No roost locations were identified.



4.8.5 Common Pipistrelle (*Pipistrellus pipistrellus*)

The Common Pipistrelle is the second smallest Bat in Ireland but the most numerous and widespread. It is has dark to chestnut brown while the ventral fur is paler. Ears are short and triangular with a rounded tip. The wingspan ranges from 20 to 25cm in length with the wing design being narrow and pointed allowing for fast agile flight. Body length ranges from 3 to 5.2cm. Its average weight is 4-8g (as given by Greenaway & Hutson, 1990).

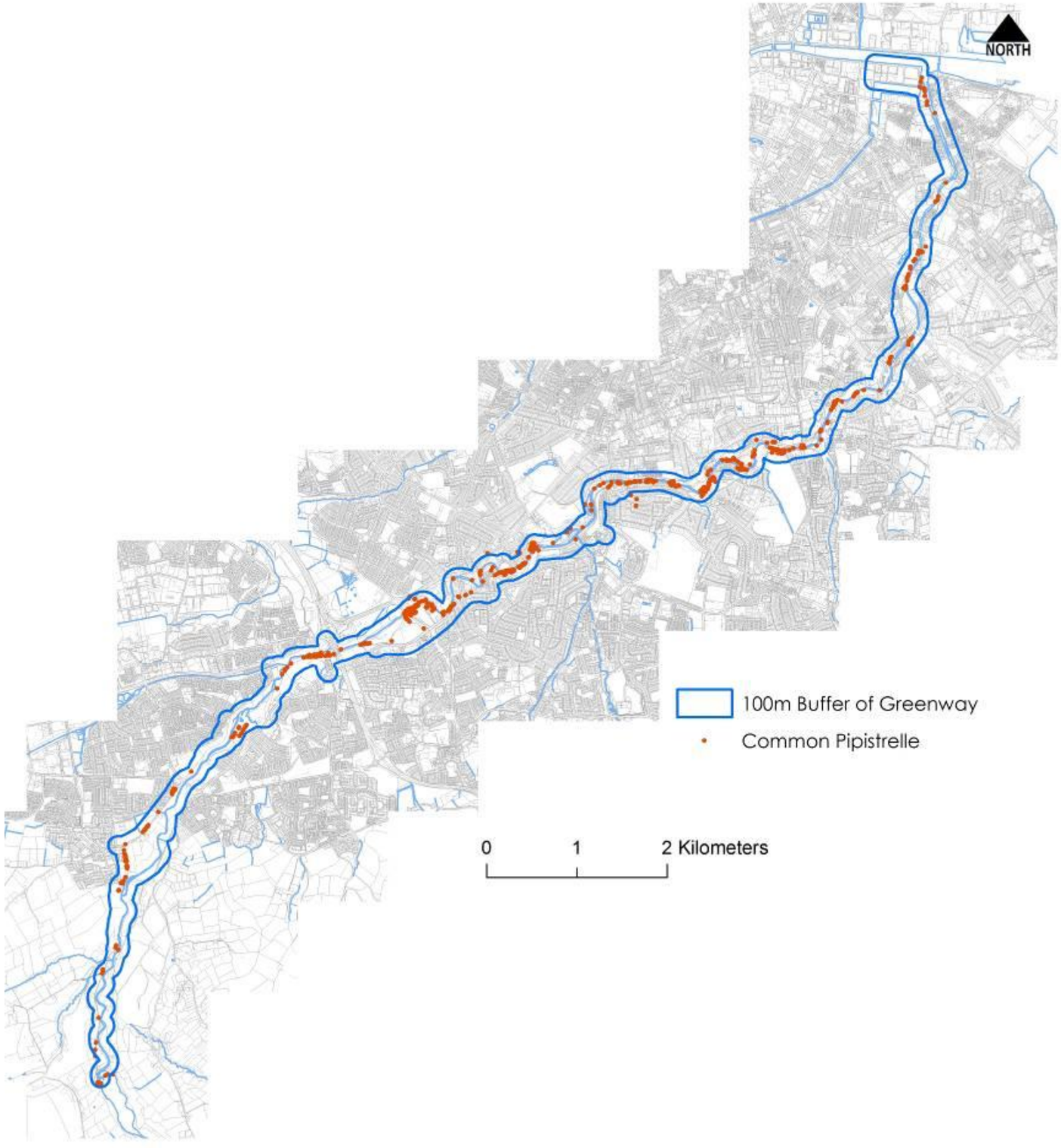
Common Pipistrelle mate from the spring through to autumn, but mainly in September and November. Females may undergo torpor during pregnancy or lactation depending on feeding conditions. A single offspring is born at the end of June or the beginning of July. Maximum age recorded in Europe is 12 years (Schober & Grimmberger, 1989).

Summer roosts are mainly found in buildings and trees, and individuals frequently change roost site through the maternity period. Most winter roost sites are located in crevices in buildings, although cracks in cliffs and caves and possibly holes in trees may also be used. It is not especially migratory in most of its range, but movements of up to 1,123 km have been recorded (Buresh 1941 in Hutterer *et al*., 2005). In at least parts of its range it seems to benefit from urbanisation.

Common Pipistrelle emerge from the roost to hunt thirty minutes to one hour after sunset. Their preferred prey are less active at this time but so too are predatory birds. It forages in a variety of habitats including open woodland and woodland edges, farmland, rural gardens and urban areas. The diet of the Common Pipistrelle in Ireland is comprised of numerous small insects such as midges, caddis flies, moths and mosquitoes.

The Common Pipistrelle is Ireland's most widespread bat species and can be found in all counties except for on offshore islands. It was the most frequently encountered species during Irish car based monitoring. This monitoring suggests it may be most abundant in south and east and absent from extreme west (Roche *et al*., 2009). The population in Ireland is thought to be stable, and is estimated to comprise 100,000+ mature individuals (Marnell *et al*., 2009). The species is listed as Least Concern by the IUCN (Hutson *et al*., 2008).

In total 735 detections of Common Pipistrelle were recorded during transects between May and August 2016. Common Pipistrelle were recorded throughout the scheme regularly with some gaps associated with areas lacking vegetation and/or linear habitat features.



4.8.6 Soprano Pipistrelle (*Pipistrellus pygmaeus*)

The Soprano Pipistrelle is almost impossible to distinguish from the Common Pipistrelle. Both are small for European Bats however the Soprano Pipistrelle is slightly smaller and is perhaps Europe's smallest bat species. It has chestnut brown dorsal fur while the Ventral fur is paler. The faces of Soprano Pipistrelles are darker than Common Pipistrelles. Ears are short and triangular with a rounded tip. Their wingspans are rarely longer than 25cm and are of a narrow pointed design which reflects their fast agile flight style. Its average weight (as given by Greenaway & Hutson, 1990) is 4-8g.

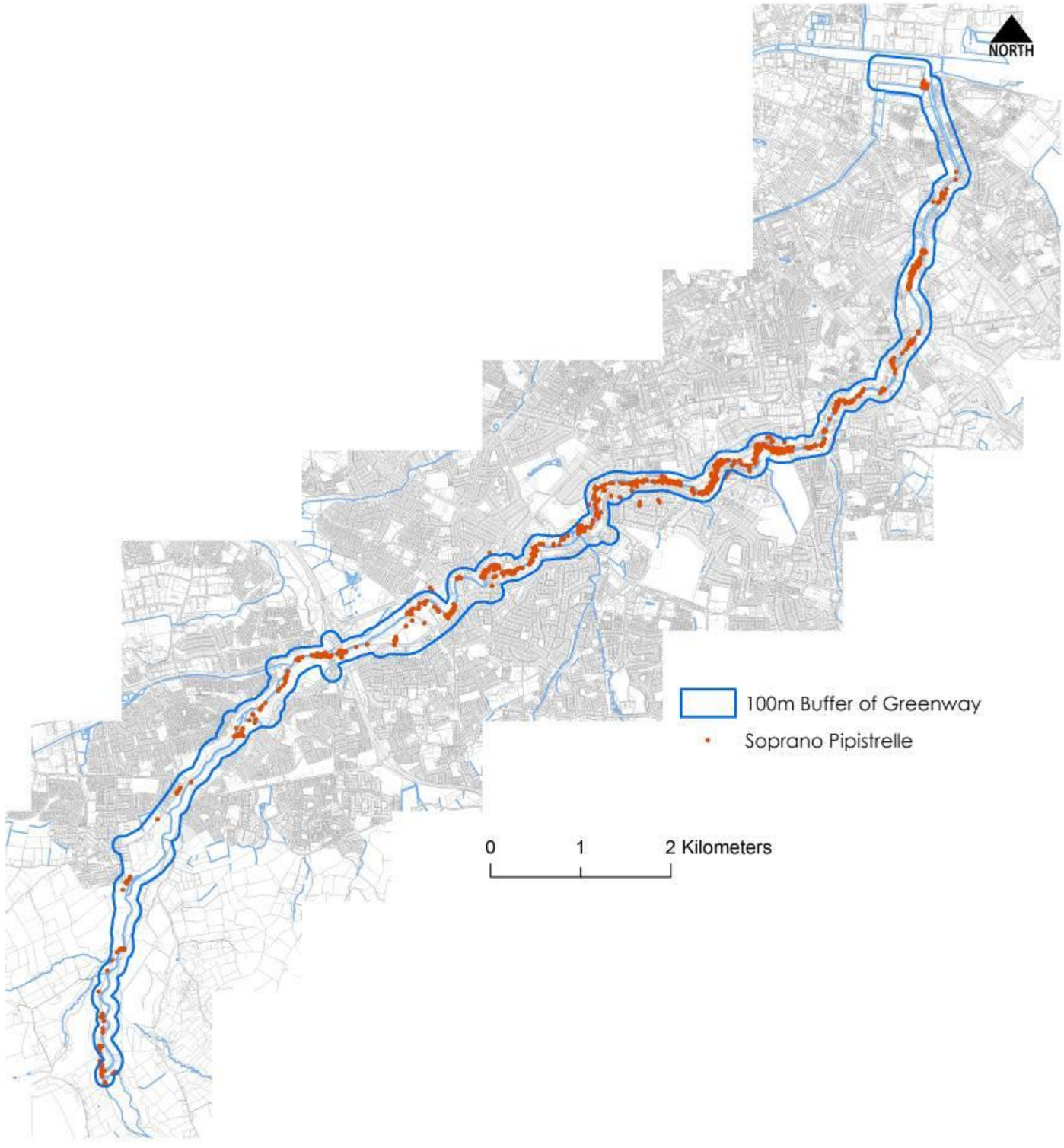
Soprano Pipistrelles mate from the spring through to autumn, but mainly in September and November. Females may undergo torpor during pregnancy or lactation depending on feeding conditions. A single offspring is born at the end of June or the beginning of July. Maximum age recorded in Europe is 12 years (Schober & Grimmberger, 1989).

Soprano Pipistrelles favoured insects are at their most plentiful just before dusk each evening. They emerge from their roosts just after dusk and feed for up to four hours each night. It forages around woodland and wetlands, and is more closely associated with water more than the Common Pipistrelle. Their food of choice consists of insects which have softer bodies than the prey of the Common Pipistrelle and includes moths, gnats and aquatic flying insects.

Maternity colonies are located in hollow trees, rock crevices and buildings (which provide warmer sites) (Michaelsen *et al*., 2014). Summer roosts are generally composed of mature breeding females, their off spring and young non breeding females and can contain up to several hundred individuals. Winter roosts are established inside small cracks and crevices within cavity walls or tree hollows where small groups will form clusters. Soprano Pipistrelles will not share their roost with other Bat species. Soprano Pipistrelles do not enter a deep hibernation like other bats in Ireland and may be active throughout the winter period if weather conditions are suitable.

Soprano Pipistrelles are abundant and widespread in Ireland, occurring in all counties (NPWS, 2008; Roche et al., 2009). Recent monitoring suggests it may be most abundant in the western half of the country (Roche et al., 2009). The population in Ireland is thought to be stable, and is estimated to comprise 100,000+ mature individuals (Marnell et al., 2009). The species is listed as Least Concern by the IUCN (Benda & Paunović, 2016).

Soprano Pipistrelles were the most common Bat species recorded during the transect surveys. In total 1373 detections of Soprano Pipistrelles were recorded during surveys between May and August 2016. Soprano Pipistrelles were recorded throughout the scheme regularly with some gaps associated with but not restricted to areas lacking vegetation and/or linear habitat features. No roost locations were identified.



4.8.7 Brown Long-eared Bat (*Plecotus auritus*)

The Brown Long-eared Bat (*Plecotus auritus*) is a medium sized Irish bat species. The dorsal fur is light buff whilst the ventral fur which is paler and may have a yellow tinge. Its ears are up to three quarters the size of the total head and body length measuring 2.5cm. Its average weight (as given by Greenaway & Hutson, 1990) is 6-12 g.

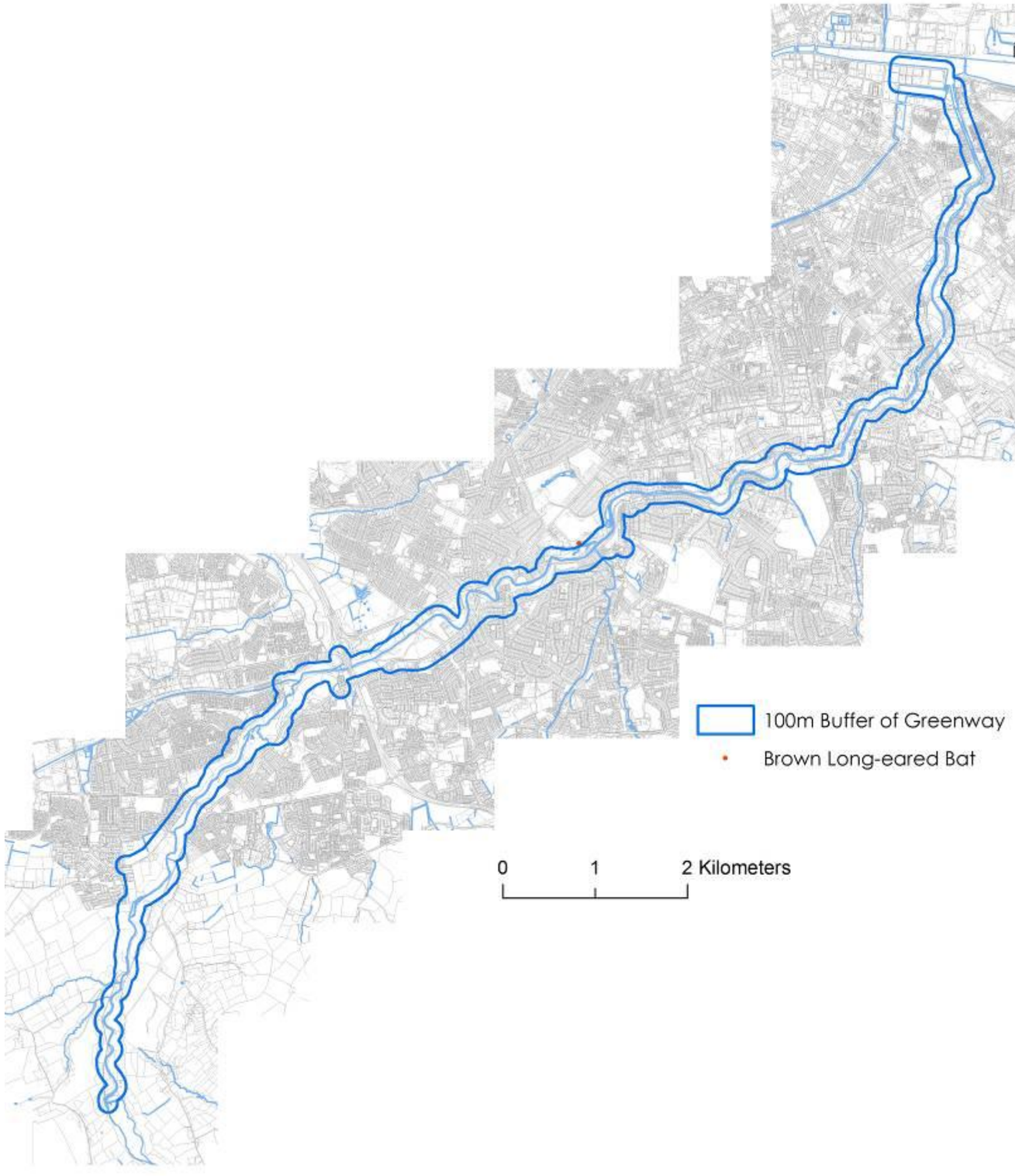
Mating occurs from October through to April. One young is born between mid-June and the end of July (Swift, 1991a). Maximum age recorded in Europe is 22 years but on average brown long-eared bats only live four and half years (Schober & Grimmberger, 1989) .

In summer it roosts in colonies in buildings (attics, barns, churches, drainage channels), tree holes, and bat boxes. Solitary animals also roost in underground sites. In winter it hibernates in caves, mines, buildings and occasionally trees. A sedentary species, its longest recorded movement is 88 km (Gaisler *et al.,* 2003).

Brown Long-eared Bats generally emerge within an hour of sunset. They usually make a series of short flights within the roost before emerging to hunt for up to one hour with intermittent flights throughout the night. They forage in the vicinity of the roost in deciduous and coniferous woodlands, along hedgerows, and in isolated trees in parks and gardens. It feeds mainly on moths and flies gleaned from foliage.

Considered by O'Sullivan (1994) as the second most abundant Bat species in Ireland (prior to the separation of Soprano and Common Pipistrelles), it is widely distributed throughout Ireland (Hayden & Harrington, 2000; Richardson, 2000). It has also been recorded on several off-shore islands, and at Tuskar Lighthouse, Co. Wexford (Fairley, 2001). The population in Ireland is thought to be stable, and is estimated to comprise 10,000+ mature individuals (Marnell *et al*., 2009).

One detection of Brown Long-eared bat was recorded during the transect surveys in July. No roost locations were identified.



4.9 Otter (*Lutra lutra*)

During dedicated Otter surveys, signs of Otter activity within the study area were recorded. Evidence of Otter activity included spraints, slides and prints. Eleven potential holts and two couches were identified within the study area. It is also considered that the species is likely to utilise the River Dodder and its tributaries within proximity to Greenway.

Plate 4.9.1: Otter spraint along the Dodder in Dartry Park

Development projects by their nature can negatively impact on Otter by creating barriers to connectivity and disturbance. In-stream works can lead to significant impacts on Otter through holt/couch or habitat destruction, disturbance. The Ecological significance of the Greenway construction and operational impacts on Otter if unmitigated would constitute a Temporary Moderate Significant Impact. This species is likely to be impacted upon and has been included among the KERs of the Greenway.

Further details, including notes and other recorded field signs of each otter shelter identified during the 2016 surveys are presented in Table 4.9.1. The level of impact associated with each shelter is indicated. The locations of otter shelters obtained during the surveys are illustrated in the confidential version of this report.

Table 4.9.1 Potential Otter Shelters and Predicted Impact

Shelter Type	Notes	Predicted Impact
Couch 1	This shelter is behind a section of collapsed concrete bank reinforcement. The soil is exposed and spans the concrete to the natural bank making a sheltered area. The cavity extends back to where a plastic pipe is visible. A large pile of spraint was on the concrete near the water indicating the recent presence of Otter.	Potential Disturbance
Couch 2	This couch consists of a cavity under a Sycamore tree extending 2 m deep and up to 1 m high inside. A spraint recorded on a stone on the floor of the cavity. The floor level was 0.5 m above the water level at the time of survey.	Potential Disturbance
Potential Holt 3	Holt identified in 2012 by Scott Cawley but was not located in 2016. The description is as follows: "*This hole was in a belt of riparian woodland, with a compacted, unvegetated muddy entrance and a clear hole (higher than wide, and therefore unlikely to be badger). The clear entrance indicates recent use, but there were no footprints or associated spraints*".	No Disturbance
Potential Holt 4	One hole 2 m above water level. The entrance is large and a very faint path suggesting no recent use. There are no evident linked paths from the hole on a steep bank to the land behind.	Potential Disturbance
Potential Holt 5	Single entrance on raised bank on the north side of the river channel. The hole went into the roots of a large coppiced Sycamore tree on the northern side of the trunk. The tree has c. ten 0.8 m diameter main branches. There were cobwebs over the hole during the survey. An old path was still visible although not used recently. There were two roots growing across the entrance although there was still enough room for an Otter to enter.	Potential Disturbance
Potential Holt 6	This hole had an Otter print on the spoil heap however debris/leaves in the entrance indicate no recent use. The spoil heap was bare indicating excavation in the recent past.	Potential Disturbance
Potential Holt 7	A Concrete pipe which has the appearance of an artificial holt. The pipe slopes downwards away from the outflow indicating it is not a drain. No signs of water running from entrance and there is a worn depression around the entrance and a path running past the entrance.	Potential Disturbance
Potential Holt 8	There is a path leading directly to the water. There is recent digging close by and a Badger sett further up the bank. The potential holt is among a stand of Japanese Knotweed.	Potential Disturbance
Potential Holt 9	Potential holt on south bank. The bank is very steep and could not be surveyed adequately. Fresh spoil was visible approximately 1 m above the water level.	Potential Disturbance
Potential Holt 10	Potential Holt on the Northern Bank. The entrance was well worn and there was a path leading to the river. There was no spraints or prints recorded.	Potential Disturbance
Potential Holt 11	An artificial holt next consisting of a single plastic pipe entrance. The entrance was filled with dead vegetation at the time of survey.	Potential Disturbance
Potential Holt 12	An artificial holt constructed by the OPW on south bank of river.. The two entrances are made of orange plastic pipes. There were no signs of use by Otter.	Potential Disturbance
Potential Holt 13	An artificial holt identified during consultation but inaccessible during the survey.	Potential Disturbance

4.10 Badger (Meles meles)

Badger activity was observed throughout the study area. Evidence recorded included active setts, latrines, prints, trails and snuffle holes. During the multidisciplinary walkover survey seventeen Badger setts were recorded within the study area. They were: two main setts, one annex sett, two subsidiary setts and twelve outlier setts. Six of these setts were identified in 2012 in previous surveys. Thirteen of these setts will be subject to disturbance due to impacts of construction/operation of the Greenway.

Development projects by their nature can negatively impact on Badger by creating barriers to connectivity, disturbance and sett destruction. The Ecological significance of the Greenway construction and operational impacts on Badger if unmitigated would constitute a Short-term Slight-Significant Negative Impact. This species is likely to be impacted upon and has been included among the KERs of the Greenway.

Plate 4.10.1: A Badger sett entrance along the Dodder at Milltown

Further details, including notes and other recorded field signs of each sett identified during the 2016 surveys are presented in Table 4.10.1. The level of impact associated with each sett is indicated. The locations of badger setts obtained during the surveys are illustrated in the confidential version of this report.

Table 4.10.1 Type and Description of Setts and Predicted Impact

Sett ID	Sett Type	Notes	Predicted Impact
Sett1	Outlier (Active)	Strong paths led through the vegetation. One hole found with fresh spoil and a badger print. There was likely to be other holes within the vegetation that could not be reached because vegetation is too thick or too steep. A latrine was recorded 300m upstream in woodland.	Sett Disturbance
Sett2	Annex (Active)	An old sett with seven holes including some collapsed tunnels. There were strong mammal paths in the area, although no badger signs were recorded. The sett had the characteristic shape to classify it as badger. One spoil heap had recent scratch marks.	Sett Disturbance
Sett3	Subsidiary (Active)	Three holes 1m above water level and 2-3m apart. Smooth spoil heaps but no evidence of badger other than the size and shape of the holes. There was an old path to the water.	Sett Disturbance
Sett4	Main (Active)	Former main sett, four holes with large and well established spoil heaps. Two of the holes were clear and two were filled with leaves and debris. The sett was back from the water on top of an earth bank. Two holes were likely used but no recent signs of excavation. The sett was above an old wire mesh fence by a gate.	Sett Disturbance
Sett5	Outlier (Active)	This sett was identified in 2012 by Neil Harmey (Scott Cawley, 2012). Strong mammal paths indicated possible sett in the scrub. The area was partially searched however significant areas were not searched because of dense vegetation.	Sett Disturbance
Sett6	Outlier (Inactive)	The sett has been unused for a long time. There was more recently used rabbit hole that may connect to it.	No disturbance
Sett7	Outlier (Active)	This sett was identified in 2012 as an active sett. In 2016 the disused sett had two entrances under a dead hawthorn tree. There was a worn down spoil heap and the entrances were filled with leaves. There were no signs of paths leading from the entrances. Both entrances extended at least 2 metres underground.	No disturbance
Sett 8	Main (Active)	The sett was identified in 2012 and in 2014. A large active sett with five active and two disused entrances and a series of well marked latrines were also present. This appeared to be a long used sett which extended for approximately 30m along a wooded bank. Foraging signs of badger were also observed in this general area (Wilson, F. 2012). The sett was outside the 2016 survey area on the opposite side of the river valley to the proposed Greenway.	No disturbance
Sett 9	Outlier (Inactive)	This sett was identified in 2012 (Scott Cawley, 2012) .A sett with three entrances with large spoil heaps. The area had many rabbit holes. All of the holes were inactive and overgrown.	Sett Disturbance
Sett 10	Subsidiary (Active)	This sett was identified by Neil Harmey in Scott Cawley 2012. In 2016 the area was too dense to survey.	No disturbance
Sett 11	Outlier (Active)	This sett was recorded in Scott Cawley 2012 but not in 2016. The sett is on the opposite side of the river to the proposed Greenway. "Large single entrance sett in dense woodland by Spawell Motor Company on the north bank of the river. The sett had a clear spoil heap and strong path leading from the sett under nearby scrub".	Sett Disturbance
Sett 12	Outlier (Active)	Likely Fox earth on north bank of river. One hole with another small hole or collapsed tunnel 5m downstream. Recent Digging but no signs of badger.	Sett Disturbance
Sett 13	Outlier (Inactive)	North bank of river, old sett with faint spoil heap visible but the entrance is blocked with leaves and debris and it likely hasn't been used in a long time.	Sett Disturbance
Sett 14	Outlier (Inactive)	South bank of river, single entrance with spoil heap. Big enough for badger but no direct evidence of badger activity or path leading to entrance.	Sett Disturbance

Sett ID	Sett Type	Notes	Predicted Impact
Sett 15	Outlier (Inactive)	Single entrance sett on south side of the river in the embankment with no signs of recent activity.	Sett Disturbance
Sett 16	Outlier (Active)	Single entrance sett on south side of the river in the embankment a large entrance and signs of recent digging. The tunnel shape suggests this is used by badger.	Sett Disturbance
Sett 17	Outlier (Active)	Single entrance sett on south side of the river in the embankment with signs of recent digging. Entrence small for a badger but setts close by indicate potential future use.	Sett Disturbance

4.11 Aquatic Species

No aquatic surveys were undertaken as no in-stream works will be undertaken for the construction of the proposed Greenway (TII/NRA, 2008c). The desk study identified Lamprey and Salmonids throughout the River Dodder and these have been included as KERs with the River Dodder pNHA.

4.12 Riparian Birds

4.12.1 Kingfisher (*Alcedo atthis*)

Kingfisher was recorded along the River Dodder between Milltown and Fort Bridge. Two possible nests were identified during the surveys. The locations of three historical nests have been included in the results for the purposes of due diligence. Works will be undertaken within 30m of Nest 2 which may result in disturbance. If works are to be undertaken during the breeding season (February-October inclusive) a pre-construction survey should be undertaken to establish if the nest is active. This species is likely to be impacted upon and has been included among the KERs of the Greenway.

Further details are presented in Table 4.12.1. The level of impact associated with each nest is indicated. The locations of Kingfisher nests obtained during the surveys are illustrated in the confidential version of this report.

Table 4.12.1 Type and Description of Potential Nests and Predicted Impact

Nest ID	Notes	Predicted Impact
Nest 1	Upstream of Riverside cottages. 8m tall bank with a hole 1m from the top. Very likely to be used by Kingfisher in breeding season. About 12cm max diameter.	None
Nest 2	Right bank c. 300 m upstream from M50 bridge. One hole 1.5m up 2m earth bank with bramble overhang. Two other holes are in disrepair. Would need to be checked during the breeding season for use.	Disturbance
Nest 3	In the left bank of the river upstream of the Orwell Road Bridge. This record was not identified during the 2016 surveys.	None
Nest 4	A historical record of a nest inside a hollow log on the banks of the bushy park pond.	None
Nest 5	A historical record of a nest downstream of Rathfarnham Road Bridge (Niall Harmey pers comm.)	None

4.12.2 Sand Martin (*Riparia riparia*)

No Sand Martin were recorded during the multidisciplinary surveys, however there are records of an active colony in the walls of the Luas Bridge in Milltown and a historical colony on the that supported up to 100 breeding pairs downstream of the foot bridge in the Dodder Valley Park (ITM 710225 726935). The colony is reportedly no longer occupied due to vegetation encroachment covering the entrances. An artificial Sand Martin colony was construced close to the footbridge bridge in the Dodder Valley Park but there are no records of occupation. There is also a steep bank that would appear suitable for a Sand Martin colony at Kilvere although no evidence of the species was found at this location. Due to at least one colony being present, the prospects of cutting back vegetation and reopening the historical colony as well as the occupation of the artificial colony, this species has been included among the KERs of the Greenway.

4.12.3 Grey Wagtail (*Motacilla cinerea*)

Grey Wagtail was recorded frequently along the river from Herbert Park to Fort Bridge. No nests were identified however there is extensive suitable nesting habitat along the banks of the river.

4.12.4 Dipper (*Cinclus cinclus*)

Dipper was recorded frequently along the river from Ballsbridge to Fort Bridge. Dipper nest boxes were recorded underneath Orwell Road Bridge (ITM 0715504 0729799).

5. ECOLOGICAL IMPACT ASSESSMENT

This section of the report provides details of the Key Ecological Receptors that were identified during the desk study and the subsequent field surveys. The desk study provided information on designated sites of conservation interest in relation to the proposed Greenway. This included an assessment of European Sites with the potential to be impacted by the proposed Greenway and also a study of sites that are designated under national legislation (NHAs). Proposed Natural Heritage Areas (pNHAs) were also considered within the study area.

5.1 European Designated Sites

With regard to European Sites, an Appropriate Assessment (AA) Screening was carried out by Dublin City Council and South Dublin County Council, as the competent authorities, for the proposed Greenway development in compliance with Part XAB of the Planning and Development (Amendment) Act 2010 and Article 6(3) of the Habitats Directive. As part of this assessment, the potential for the proposed Greenway to have an effect on any European sites in the Zone of Influence was considered. The AA Screening concluded as follows:

"*On the basis of the screening assessment and application of the precautionary principle, indicators of significance show that there is no potential for localised short term or long term interference on any Natura 2000 site. It has been concluded that potentially significant effects likely to arise from construction and operation of the Dodder Greenway have been entirely screened out due to Project distance from Qualifying Interests / Special Conservation Interests and in view of their respective Conservation Objectives*".

Based on this conclusion no European designated Sites have been considered as KERs of the Greenway.

5.2 Nationally Designated Sites

There are two pNHAs within the Zone of Influence; the Grand Canal pNHA (Site Code: 002104) located adjacent to the Greenway and the Dodder Valley pNHA (Site Code: 000991) which lies adjacent to the Greenway for much of its entire length. Designations are described in more detail Section 4.2.

Pathways of risk were deemed to exist between both the Grand Canal pNHA and the River Dodder pNHA and both have been included as separate KERs.

5.3 Key Ecological Receptors Identified during desk studies and field surveys

The Key Ecological Receptors identified are described in detail in Table 5.3.1 and an ecological valuation for each Key Ecological Receptor is also provided. The location of each Key Ecological Receptor is provided in Appendix B.

Table 5.3.1 Key Ecological Receptors Identified During Field Surveys

Key Ecological Receptor & Chainage	Description	Importance/Ecological Valuation (TII/NRA, 2009a)
KER1 River Dodder including the Dodder Valley pNHA	A section of the Dodder valley between Firhouse and Oldbawn is designated as a proposed Natural Heritage Area (pNHA) from Firhouse Bridge to Oldbawn Bridge due to evidence of species including: Early purple orchid along with a diversity of other plant species; Forty-eight bird species including Little Grebe, Kingfisher, Dipper and Grey Wagtail; Active Otter holts; Badgers; Bat roosts, Habitats included dry calcareous grasslands, dry meadows and woodlands; Tufa forming calcareous springs along the northern bank of the Dodder. The entire river valley provides an important wildlife corridor for species such as otter, kingfisher and salmonids.	**National Importance** on the basis that part of the river is proposed as a Natural Heritage Area and the river valley supports habitats and species listed on Annexes I and II of the Habitats Directive and Annex I of the Birds Directive. In addition the river valley provides important habitat connectivity between the sea and the Dublin Mountains.
KER2 Grand Canal pNHA	The Grand Canal proposed Natural Heritage Area (pNHA) comprises the canal channel and the banks on either side of it. A number of different habitats are found within the canal boundaries - hedgerow, tall herbs, calcareous grassland, reed fringe, open water, scrub and woodland. The rare and legally protected Opposite-leaved Pondweed (*Groenlandia densa*) (Flora Protection Order 2015) is present at a number of sites in the eastern section of the Main Line, between Lowtown and Ringsend Basin in Dublin. The ecological value of the canal lies more in the diversity of species it supports along its linear habitats than in the presence of rare species.	**National Importance** on the basis that the canal is proposed as a Natural Heritage Area.
KER3 Hedgerows and tree-lines	Hedgerows and tree-lines have been selected as Key Ecological Receptors for the proposed Greenway as they form an integral part of the local network of wildlife corridors. Hedgerows and tree-lines are particularly important for Bats and Birds (especially breeding birds).	**Local Importance (Higher Value)** on the basis that these habitats support species of conservation of importance and provide local corridors for wildlife between areas of higher ecological value
KER4 Species-rich grassland	There are three high biodiversity value extensively-managed grassland sites. These are on neutral to base-rich soils containing species-rich hay meadow communities. Two areas of GS1 calcareous grassland occur in amenity grasslands currently managed by the SDCC Parks department under an experimental mowing late summer regime that allows meadow grasses to set seed (Dodder Valley Park at Kilvere and Cherryfield at Firhouse).	**County Importance** on the basis that these areas have a high biodiversity value in a local context.
KER5 Bats	Bats are protected wherever they occur and have been selected as a Key Ecological Receptor owing to the occurrence of a diversity of Bat species throughout the study area. The three species of Pipistrelle occurring in Ireland, Leisler's Bat, Daubenton's Bat, Brown Long-eared and another, Natterer's Bat/unidentified *Myotis* species were recorded during surveys.	**County Importance (Higher Value)** on the basis that these species are listed on Annex IV of the Habitats Directive and protected under the Wildlife Acts are present within the study area.
KER6 Otter (*Lutra lutra)*	Otter are protected wherever they occur and have been selected as a Key Ecological Receptor owing the frequent occurrence along the River Dodder. Eleven potential holts and two couches were recorded during the survey and otter with cubs have been recorded on the river at Milltown.	**County Importance** on the basis that this species listed on Annex II and IV of the Habitats Directive and protected under the Wildlife Acts is present within the study area, however not occurring in nationally important numbers.
KER7 Badger (*Meles meles*)	Seventeen Badger setts were recorded within the study area. Suitable foraging and setting habitat was found to occur along the River Dodder corridor.	**Local Importance (Higher Value)** on the basis that population within the study area contains more than 1% of the local population.
KER8 Kingfisher (*Alcedo atthis)*	Kingfisher has been selected as a Key Ecological Receptor because of its presence along the River Dodder Corridor. No confirmed nesting sites were confirmed however a number of areas were deemed to have suitable nesting habitat.	**County Importance** on the basis that this species listed on Annex I of the Birds Directive and protected under the Wildlife Acts is present within the study area, however not occurring in nationally important numbers.
KER9 Invasive Alien Plant Species (IAPS)	IAPS has been selected as a Key Ecological Receptor because of the presence of Japanese Knotweed, Himalayan balsam and Giant Rhubarb within the study area.	IAPS has the potential to impact negatively on native species diversity and structures. Risk of spread.
KER10 Rare Plants	Broad-leaved Helleborine (*Epipactus helleborine*) and Ivy Broomrape (*Orobanche hederae*) were identified along the route of the proposed Greenway. Both of these species are listed as *Least Concern* and are not protected or listed on the Irish Red Data Book (Wyse Jackson, M. et al., 2016), *however, both* have been selected as a KER because they are uncommon locally and add value to the biodiversity of the River Dodder corridor.	**Local Importance (Higher Value)** on the basis that both species have been identified in a Local Biodiversity Action Plan (LBAP) and are uncommon in the local area.

5.4 Description of Likely Impacts (Unmitigated)

5.4.1 Impacts on Designated areas

The proposed Greenway development runs adjacent to two proposed Natural Heritage Areas (pNHA), namely the Dodder Valley pNHA and the Grand Canal pNHA. No European designated sites will be impacted by the construction or operation of the proposed Greenway.

This EcIA proposes mitigation to minimise these effects such that the residual effect on the Dodder Valley pNHA and the Grand Canal pNHA will not be significant.

5.4.2 General Impacts on Key Ecological Receptors

General impacts on biodiversity that are typical of a riverside greenway development are described in this section. These potential negative effects are considered with reference to the previously defined Key Ecological Receptors.

The majority of the route has been identified as being of Local Importance (Higher Value) from an ecological perspective (Table 5.3.1); however a number of Key Ecological Receptors close to the route are described as being of County or National Importance.

5.4.3 Habitat Loss

The Greenway construction will result in some loss of habitat within the land take of the proposed development. The majority of the 17km of the proposed Greenway is ojn existing ootpaths and roadways. Over 87% of the orute will be along existing roads, existing paths or require marginal widening of existing paths with less than 13% requiring new path construction.

The Ecological significance of habitat loss during construction if unmitigated would constitute a Long-term Slight Negative Impact. The permanent loss of amenity grasslands and areas of is not considered to be of ecological significance as these habitats are relatively species-poor, support limited biodiversity and are widespread throughout Ireland. Where areas were deemed important for nature conservation, such as species rich grasslands and hedgerows, these were classified as Key Ecological Receptors.

The permanent loss of hedgerows and treelines which currently provide species diversity in the otherwise managed agricultural lands and good habitat and refuge for fauna is considered of ecological significance. Hedgerows support a variety of species included as Key Ecological Receptors such as Badger and Bat species. In most cases in the study area, sections of grassland; hedgerows and treelines to be impacted will be cut back to allow for the widening or construction of the proposed Greenway. These have been classified as being of County Importance and Local Importance (Higher Value) respectively to wildlife and thus their loss in these areas is not considered to be a significant ecological impact at the international or national scales.

The chief concerns to aquatic the aquatic ecology are listed below, along with the main impacts on the species highlighted.

Fine sediment delivery as a result of works is most likely in areas which require more extensive construction than the existing hard standing footprint, such as reaches which are proposed for path widening and bridge construction. These areas carry a higher risk of fine sediment delivery to the watercourse as a result of the disturbance of earth due to construction works.

Fine sediment is a concern for a range of species as it covers the river bed and interrupts the proper functioning of a range of species, from aquatic plants to invertebrates and fish.

The introduction of fine sediment into a river system affects aquatic organisms across all trophic levels, through mechanisms that include: (1) modification of habitat availability and suitability for some taxa; (2) increases in turbidity and reduction of primary production, (3) impairment of feeding due to a reduction in the energetic value of periphyton (aquatic plants) and prey density; and (4) impairment of respiration due to low oxygen concentrations in sediment deposits. Trout and salmon are particularly vulnerable as the early life stages of these species takes place within the gravel beds of rivers. Infiltrated fine sediment within these spawning gravels results in oxygen depletion and reduced embryonic survival and recruitment rates for both species (Greig, 2007). The effects of sediment on stream invertebrates has also been shown to have negative result, varying in impact from reduced feeding to slower growth and an overall change in species assemblage (Jones *et al.,* 2012). In addition, the introduction of fine sediment to water courses increases turbidity in the water column and reduces both oxygen availability and visibility for a range of species, both of which are vital to survival (Kemp *et al*., 2011).

The introduction of other pollutants to the water course is a concern chiefly in areas where new conduits to the river are created where outfalls are constructed, or in areas where additional work is proposed such as path widening and additional river crossings, where a change in topography may create a new 'overland' pathway for runoff to the river.

Reduction in tree cover as a result of the works should be avoided where possible as riparian vegetation is important to maintain stable water temperatures, particularly during the summer season where low flow coupled with high temperature can result in lower water oxygen concentrations, with knock-n effect for in stream biota. Additionally, riparian cover provides refuge opportunities for juvenile fish which may use these areas to evade predators (Allouche, 2002)

Lighting is a concern for the aquatic environment and particular for juvenile salmonids such as brown trout and Atlantic salmon. There is evidence to suggest that artificial lighting disrupts the timings and success of juvenile fish emerging from the gravel bed at the end of the larval period of development (Riley *et al*., 2015). Light is a directive factor for these fish and natural light pattern influence their behaviour. This is especially pertinent during the early life stage when young emerge from the larval gravel bed and attempt to feed within the water column for the first time. T his period between fry emergence and dispersal and the establishment of feeding territories is a vulnerable time when mortality can be high. Any disruption of this process can have fitness consequence for the emergent fry (Armstrong *et al*., 2003).

A change in flow patterns may have knock on impacts for aquatic species. Flows may be affected by an increased level of urban runoff, thereby increasing flood peaks in those areas. This can affect the stream bedload (grain-size) distribution and thus change the distribution of species dependant on specific habitat types.

5.4.4 Lighting

Light pollution is a key biodiversity threat. It is listed within the top ten emerging issues in biodiversity conservation and has important implications for policy development and strategic planning (Holker et al., 2010). "*Given the effects of light on living organisms, it is plausible, and even probable, that introduction of artificial light into the natural light regime will disturb the normal routines of many plants and animals*"(The Royal Commission on Environmental Pollution, 2009). The Royal Commission on Environmental Pollution states "*Whilst poor lighting design is a major cause of light pollution, the sheer quantity of lighting installations in industrialised countries is a major problem, regardless of the quality of the scheme design. Even if every lighting installation was designed to the highest standards (in terms of downward cut-off and lack of light projected above the horizontal), considerable light pollution would still occur because of the effects of indirect reflection from road and building surfaces-all of which, unless they are completely matt black, have some degree of reflectance*".

There is an increasing awareness of the ecological impacts of light pollution, and being nocturnal bats are amongst the species most likely to be impacted by lighting (Stone, 2013).

Whilst the survey work undertaken along the River Dodder has focussed on identifying key areas of Daubenton's bat activity, it should be noted that all bat species using the riparian corridor have the potential to experience negative impacts caused by lighting.

In order to predict the potential impacts that lighting may have on bats it is important to consider the following:

Impacts may be Cumulative

Lighting is just one anthropogenic impact on bats, so the context of the lighting on the species or colony should be considered. For example the impact of a small amount of lighting on a colony that is already subject to a high level of disturbance may be more significant than for a colony that is not subject to the same levels of disturbance. So whilst bats may seem to be tolerating lighting, an increase may reach tipping point and lead to long-term avoidance of any area.

Impacts will Vary According to Site, Species and Behaviour

The impacts of lighting can vary between sites and species and will vary according to the behaviour being affected.

Impacts May Occur Over Different Temporal Scales

Some impacts may be short-term and obvious, for example bats may move to a different foraging area whilst the lights are in use; or lighting could affect bat behaviour in the longer term through a decrease in breeding success.

Impacts May Occur at Both the Individual or Population Level

Lighting could affect individuals in a colony, for example a shift in foraging area; or could affect the whole colony through delayed emergence times of the whole roost caused by lighting.

Impacts May be Indirect

Lighting may lead to a competitive advantage for some species which benefit from increased foraging opportunities provided by moths that are attracted to lights with a high UV content. Lighting can also have an impact on the bats prey, moving insects from dark areas to light areas, causing direct mortality of insects and changing the composition of insect species.

Research undertaken by Emma Stone (2013) provides guidance on the impacts that lighting may have on various bat species according to bat behaviour. A high impact is predicted on all maternity, hibernation and swarming roost sites. A high impact is predicted on Lesser Horseshoe Bats, Myotis and Long-eared species at night roosts and at foraging and commuting sites. A medium impact is predicted on night roosts of Pipistrelle and Nyctalus species. A low impact is predicted on foraging and commuting areas of Pipistrelle and Nyctalus. The following provides a summary of the relative impacts on different types of lighting on bats:

High Negative Impact

- Broad spectrum lights (particularly blue-white light) with high UV
- Metal halide and mercury
- Uplights-which light above the horizontal plane, illuminating trees and foraging habitat

Medium Negative Impact

- Broad spectrum lights with low/no UV
- White LED, high pressure sodium

Low Negative Impact

- Narrow spectrum lights with no UV content
- Low pressure sodium and warm white LED
- Directional downlights-illuminating below the horizontal plane which avoids light trespass into the environment.

5.4.5 Habitat Fragmentation

The proposed Greenway development will result in some fragmentation as it bisects certain areas of habitat including 14 crossings of the River Dodder. Sensitive features such as watercourses and networks of hedgerows and tree-lines have been identified as Key Ecological Receptors and potential impacts on these areas are discussed in Table 5.5.1.

5.4.6 Run-off of Pollutants

Best practice methods have been incorporated into the design of the proposed Greenway development to avoid the run-off of pollutants to the wider environment outside the construction footprint. Therefore, no likely significant effects are predicted on surface waters, habitats or species within the Zone of Influence outside of those Key Ecological Receptors identified in Section. Chapter 10 of this volume provides hydrological analyses of the runoff and impacts predicted as a result of the proposed road project.

5.4.7 Hydrological Impact on Habitats

It is unlikely there will be any significant hydrological impacts on surface waters of local importance (lower value) or higher as a result of the proposed Greenway development.

5.4.8 Displacement/Disturbance of Fauna

The proposed Greenway development will result in habitat loss, disturbance and displacement to the fauna that reside along the proposed development. Where fauna of ecological significance or potential habitat for such species was recorded, these were included as Key Ecological Receptors and are described in Table 5.5.1.

5.4.9 Dispersal of Invasive Alien Plant Species

The risk of spread of Invasive Alien Pant Species (IAPS) within and outside the site boundary is present, and there is a possibility that IAPS may be inadvertently spread during construction through the movement of contaminated soil to, from or within the site in the absence of control measures. This species is described in Section 4.8 and has been included as a Key Ecological Receptor in Section 5.3.

5.5 Impacts on Key Ecological Receptors

Impacts on the key ecological receptors as defined in the preceding sections are described in Table 5.5.1.

Table 5.5.1 Impacts on Key Ecological Receptors

Key Ecological Receptor	Construction-Phase Impacts	Operational Phase Impacts	Ecological Significance if Unmitigated
KER1 River Dodder including the Dodder Valley pNHA	The proposed Greenway is designed to cross the river Dodder at a number of locations using new clear span structures. No channel diversion or other works within the river are proposed. Habitat fragmentation and barrier effect may occur if Otter and other aquatic species are unable to or are discouraged from migrating along the watercourses following the construction of the Greenway as a result of increased disturbance and light pollution. This impact could also affect birds and bats that may use the river as a commuting route. Fish and species that migrate in the water itself are not likely to be impacted as the bridge is short and the bed and flow of the river is not going to be altered. Impacts may also include the run off of silt and other pollutants during the construction phase of the development from the construction site to the river.	Fragmentation and barrier effect are potential ongoing direct impacts during the operational phase.	The potential for habitat fragmentation and barrier effect is considered to constitute a **Medium-term Slight-Moderate Negative Impact** as it applies to the sensitive species such as Otter and Bats that are likely to use the watercourse for commuting to wider areas within their ranges. The potential for pollution of the river during the construction phase is considered to constitute a **potential Temporary Slight-Moderate-Significant Negative Impact** as it has the potential to alter sensitive receptors such as salmonids and lamprey habitat over a short period of time and over a wide area. Lamprey juveniles (ammocoetes) which will be present in marginal silts would also be sensitive to changes in water quality as a result of pollution delivery to the river.
KER2 Grand Canal pNHA	The proposed Greenway is designed to cross the grand canal between the Grand Canal Basin and it's confluence with the River Liffey Estuary using a new clear span structure. No channel diversion or other works within the river are proposed. Habitat fragmentation and barrier effect may occur if Otter and other aquatic species are not able to migrate between the Grand Canal Basin, the River Liffey and the River Dodder following the construction of the bridges. Fish and species that migrate in the water itself are not likely to be impacted as the bridge will be constructed on the existing quay walls. Impacts may also include the run off of silt and other pollutants during the construction phase of the development from the construction site to the river.	Fragmentation and barrier effect are potential ongoing direct impacts during the operational phase.	The potential for habitat fragmentation and barrier effect is considered to constitute a **Medium-term Slight Negative Impact** as it applies to the sensitive species such as Otter that are likely to use the watercourse for commuting to wider areas within their ranges. The potential for pollution of the Grand Canal and Navigation Channel due to proposed works is highly unlikely due the location of the designation upstream of the proposed works. No Change is expected.
KER3 Hedgerows and tree-lines	Direct Impacts include Habitat Loss within the footprint of the proposed Greenway leading to the loss of some tree line and hedgerow habitat. Indirect impacts include a reduction in habitat quality, habitat fragmentation and barrier effect for foraging and commuting species such as birds and bats.	No further direct impacts are likely to be associated with the operation of the proposed road.	The proposed Greenway will result in a **Short-term Slight Negative Impact** on a resource of Local Importance (Higher Value). Significant impacts on Hedgerows and Tree-lines are not anticipated at the National or County Level.
KER4 Species-rich grassland	Direct Impacts include Habitat Loss within the footprint of the proposed Greenway. Indirect impacts include a reduction in the extent of habitat which supports pollinator species.	No direct or indirect impacts are likely to be associated with the operation of the proposed Greenway.	The proposed Greenway will result in a **Long-term Slight Negative Impact** on a resource of Local Importance (Higher Value). Significant impacts on Species-rich grassland are not anticipated at the National or County Level.
KER5 Bats (all Irish species except Lesser Horseshoe Bat Rhinolophus hipposideros)	Bat species are considered to be a KER of Local Importance (Higher Value) as the study area is widely used by a range of species. One bat roost was identified although it is outside the derogation limit of the Greenway and there will not be any significant impacts on the roost as a result of construction. Indirect impacts may include deterioration of habitat quality following vegetation clearance of the footprint.	Reduction in habitat quality is a potential ongoing indirect impact during the operational phase. No direct impacts are likely to be associated with the operation of the proposed Greenway.	It is considered that indirect impacts on bats are likely to be **Long-term Moderate Negative Impacts** resulting from loss or reduction in quality of foraging habitat. The loss of woodland habitat associated with the proposed Greenway is considered to be minor given the available habitat in the area and limited requirement to remove treelines for path widening; however the loss of riparian and freshwater habitat as a result of artificial lighting is considered more significant given the lack of similar habitat in the surrounding area. It is considered that there is the potential for **Permanent Moderate Negative Impacts on a resource of County Importance (Higher Value)** associated with the displacement of Bats away from existing commuting and foraging routes along the river channels and tree-lines due to artificial lighting of the proposed development. Significant impacts on Bats are not anticipated at the National or County Level.

Key Ecological Receptor	Construction-Phase Impacts	Operational Phase Impacts	Ecological Significance if Unmitigated
KER6 Otter (*Lutra lutra)*	Otter are considered to be a KER of County Value as the study area contains a significant resident and breeding population. Eleven potential holts and two couches were recorded during the surveys. It is considered unlikely that there will be any significant direct impact on Otter as a result of the Greenway as none of the habitat at the crossing points of the rivers was considered to be of particular significance to Otter.	No direct impacts are likely to result from the operation of the Greenway. Indirect impacts are likely to include fragmentation of habitat and habitat deterioration as a result of disturbance.	No significant direct impacts are anticipated on this species given the nature of the habitats at the crossing points and given that no confirmed holts were recorded in their vicinity. In terms of indirect impacts, the Greenway will allow access for Otter both along and across the carriageway as well as under the bridges. In this regard the development will not cause the fragmentation of territories or habitat. The potential for pollution of watercourses during the construction phase is considered to constitute a potential **Temporary Moderate-Significant Negative Impact** as it has the potential to alter a sensitive receptor over a short period of time and over a far wider area than the site itself. Construction of the Greenway may lead to disturbance related impacts. This is considered to be a Potential **Short-term Moderate Negative impact** at the local scale. Given the nature of the habitats recorded and lack of active shelters, disturbance impacts are not considered likely to be significant. It is considered that the Greenway does not have the potential to result in significant impacts on this KER at the National or County level.
KER7 Badger (*Meles meles*)	Seventeen Badger setts were recorded within the study area. Thirteen of these occur within 50m of the proposed Greenway. Construction of the Greenway may result in the disturbance of setts including death or injury to Badgers within setts. There will be some loss of foraging and commuting habitat directly within the 4m carriageway.	Operation of the Greenway may result in sett abandonment as a result of disturbance. No direct impacts are likely to be associated with the operation of the Greenway.	The disturbance of active setts within the land-take boundary, primarily the two main setts and annex sett, are considered to be a **Short-term Slight Negative Impact**. The main and annex setts are likely to be used for breeding. Four outlier setts were recorded outside the land take at varying distances. Setts within 30m may be subject to disturbance during construction. In terms of indirect impacts, the Greenway will allow access for Badgers both along and across the carriageway. In this regard the development will not cause the fragmentation of territories. It is considered that impacts could be reversible through appropriate design and mitigation. Given the nature and scale of the Greenway, disturbance impacts are not considered likely to be significant. It is considered that the Greenway does not have the potential to result in significant impacts on this KER at the National or County level.
KER8 Kingfisher (*Alcedo atthis)*	No direct impacts on nest sites are expected. Indirect impacts on Kingfisher are likely to include disturbance, which in persistent and excessive cases could cause barrier effects, fragmentation of habitat between areas of foraging habitat and nesting sites.	Indirect impacts are considered limited to background noise and disturbance events (traffic / pedestrians) within a visual disturbance distance.	It is considered that indirect impacts could potentially include **Temporary Slight Negative Impacts** in excessive cases of continuous construction borne noise, resulting in barrier effects and habitat fragmentation. Significant impacts on Kingfisher are not anticipated at the National, County or Local Level.
KER9 Invasive Alien Plant Species (IAPS)	Several of the IAPS recorded are subject to restrictions under Regulation 49 of the European Communities (Birds and Natural Habitats) Regulations, 2011. It was found at five locations within the construction envelope of the Greenway. IAPS may be inadvertently spread during the construction of the Greenway through the movement of contaminated soil to, from or within the site.	The operation of the proposed Greenway is considered unlikely to facilitate the spread of IAPS.	Construction of the development may lead to the spread of Japanese Knotweed. This is considered to be a **Long-term Severe Negative impact** at a local scale. An Invasive Species Management Plan, which will seek to eradicate IAPS from the site prior to works, will be developed as part of the Part VIII application.
KER10 Rare Plants	Direct Impacts include Habitat Loss within the footprint of the proposed Greenway leading to the loss of some tree line and hedgerow habitat.	No direct or indirect impacts are likely to be associated with the operation of the proposed Greenway.	The proposed Greenway will result in a **Long-term Slight Negative Impact** on a resource of Local Importance (Higher Value). Significant impacts on these rare plants are not anticipated at the National, County or Local Level.

6. CUMULATIVE IMPACTS AND IMPACT INTERACTIONS

6.1 Integrating Assessment of Cumulative Impacts into the Assessment

Cumulative impacts can be defined as the changes caused by a proposed development in conjunction with other developments or as the combined effect of a set of developments, taken together. In best practice, the terms 'effects' and 'impacts' are used interchangeably. Cumulative impacts can result from incremental changes caused by other past, present or reasonably foreseeable actions in-combination with the project.

Cumulative impacts can cover all aspects of the environment. While a single activity may itself result in a minor impact, it may, when combined with other impacts (minor or significant) in the same geographical area, and occurring at the same time, result in a cumulative impact that is collectively significant. The Cumulative Impact Assessment (CIA) needs to be proportionate and the nature of impacts considered relevant to the Dodder Greenway CIA are habitat loss and disturbance, and potential indirect post-construction effects of long-term disturbance due to increases in recreational pressure to the river corridor and surrounds.

The availability and quality of relevant data is considered important in developing the CIA. Relevant information may be available in Strategic Environmental Assessments (SEAs) or Sustainability Appraisals (SAs) that have been prepared for plans and programmes and in the EIS for completed or planned developments. Predicting the future baseline in this way enables the EIA to address cumulative impacts. This is achieved by assessing the ecological impacts of the proposed development in the context of the predicted baseline conditions, thereby assessing the cumulative impact.

Having regard to the above, it is necessary to predict the future baseline conditions within the corridor of the River Dodder with reference to:

- Environmental trends, including ecological succession and climate change;
- Completed developments that may affect the zone of influence in the future; and,
- Any other developments for which planning consent has been granted.

A review has been undertaken of the potential impacts associated with each of the distinct elements of the proposed development on adjacent designated sites in Section 6.3 below. This section will assess these impacts in the context of their interaction with other large and interconnected adjacent developments. It is considered that this will lead to a robust assessment and will meet the requirements of the stakeholders.

6.2 Requirement for a Cumulative Impact Assessment (CIA)

The rationale and requirement for undertaking a CIA is determined by the scale of the project and is also dependent on how the development will be progressed in relation to appropriate planning legislation and the legal requirement for Environmental Impact Assessment (EIA), *e.g.* either as one overall project through planning or series of separate sections.

The legal requirements for EIA of a cycleway development are defined in the Roads Acts (1993 to 2015) and the Planning and Development Acts (2000 to 2015), as well as by Regulations made under the European Communities Act, 1972 including the European Communities (Environmental Impact Assessment) (Amendment) Regulations (1989 to 2001) as well as the European Communities (Birds and Natural Habitats) Regulations (2011 to 2015).

Schedule 5 of the Planning and Development Regulations (2001 to 2015) define those developments which require mandatory EIA. As this proposed type of development cycleway/walkway is not defined as mandatory then a Screening for EIA would be required. Where a development is sub-threshold, the decision as to the requirement for EIA must be decided on a case by case basis. Article 27 (Third Schedule) of the European Communities (Environmental Impact Assessment) (Amendment) Regulations (1999) and Schedule 7 of the Planning and Development Regulations (2001) provide '*criteria for determining whether a development would or would not be likely to have significant effects on the environment*'. This includes an assessment of '*the cumulation with other proposed development*'.

Transport Infrastructure Ireland (TII) (formerly the National Roads Authroity (NRA)) have progressed and categorised similar developments through the planning process as roads developments. However, the decision on which planning legislature will apply for the Greenway will be determined by the respective competent authorities. For the Greenway, the process may fall under the Planning and Development Act (sub-threshold for EIA). In any case a Screening for EIA would be required during which any cumulative impacts of the Greenway would be examined.

In considering whether a sub-threshold proposed Greenway development is likely to have significant environmental effects, the TII/NRA and An Bord Pleanála, under Section 50(1)(e) of the Roads Act, must have regard to the criteria set out in Article 27 of the European Communities (EIA) Regulations (1989 to 2001). This article refers to the criteria for determining whether a development would or would not be likely to have significant effects on the environment set out in Annex III to the EIA Directive.

One of the aims of the sub-threshold provisions contained in EIA legislation is to address the issue of cumulation with other projects in regard to the absorption capacity of the natural environment. Particular attention to the potential likely significant effects on the coherence of the Natura 2000 network would be a key consideration. This would in turn links in with the Article 10 requirements of the Habitats Directive and is the basis for a CIA in this Ecological Impact Assessment.

6.3 Assessment of Cumulative Impacts

The main residual impacts arising from the Dodder Greenway and adjacent schemes have been assessed for their potential to interact with each other. The cumulative assessment has considered impacts arising from the construction and operation of the entire project and connected schemes, and it is considered that cumulative impacts, if any, are more likely to arise during the construction phase. Impacts arising from the operational phase of the scheme are primarily related to increased pedestrian and cyclist activity within sensitive habitats.

Cumulative impacts have been assessed in relation to potential impacts on:

- Designated sites;
- Rare and protected species;
- Invasive alien species (IAS); and,
- Sensitive habitats.

6.3.1 Scoping

A number of searches in relation to plans and projects that may have the potential to result in cumulative impacts have been undertaken. Data sources included the following:

- An Bord Pleanála Website (planning searches);
- Dublin City Council (DCC) online planning search;
- South Dublin County Council (SDCC) planning search; and,
- Dún Laoghaire-Rathdown County Council (DLRCC) planning search.

For the purposes of this CIA, small-scale and domestic developments were not considered given the urbanised nature of the route, particularly through the DCC section and the fact that these developments would be subject to stringent planning controls of the relevant local authority. A summary of relevant developments considered in the cumulative assessment is given in Table 6.3.1 below.

Table 6.3.1 Other Plans and Projects

	Key Plans Potentially Affecting Ecology in the Zone of Influence	
	Plans and Projects	**Potential Impact on Ecology**
Dublin City Council (DCC) Online Planning Search	**DCC Planning Application No. DSDZ3865/14 (Granted)** New office block building currently under construction at Hanover Quay. Potential interaction with the Greenway may occur with the development of an on-road section of the Greenway along Britain Quay and Hanover Quay. An AA screening was carried out for this development and it was concluded that significant effects on the integrity of the Natura 2000 network are not likely to arise, either alone or in combination with other plans or projects.	**No Likely Significant Impact**
	DCC Planning Application No. DSDZ2546/15 (Granted) New mixed-use development currently under construction on Britain Quay. This development is located along the River Dodder at its confluence with the River Liffey. A new green space is proposed between Britain Quay and the River Dodder with a balustrade to the river edge. The Greenway can tie in with the green space along Britain Quay presenting potential positive interactions with respect to the River Corridor. An AA Screening was carried out for this development which deemed that no European Sites are at risk of likely significant effects from construction or operation of the proposed development.	**No Likely Significant Impact**
	DCC Planning Application No. 4219/10 (Granted) Proposed development at St. Patrick's Church which involves the construction of one single-storey building with a balcony that projects 1.9 m over the existing quay wall. St. Patrick's Church is located directly adjacent to the River Dodder at Ringsend Road.	**No Likely Significant Impact**
	DCC Planning Application No. 2268/14 (Granted) Development at Marian College of a Sports Hall with all associated facilities located adjacent to the River Dodder at Lansdowne Road/Herbert Road. An AA Screening was carried out in support of this planning application. This report concluded that there are no elements of the proposed development that could, on their own or in combination with other plans or projects, lead to a risk of significant impacts on European sites.	**Potential Negative Impact**
	DCC Planning Application No. 2868/16 (Granted) This development will consist of a commercial building of 4-6 storeys over basement and all associated parking and works. The development is located along Shelbourne Road and in close proximity to the River Dodder.	**Uncertain**
	DCC Planning Application No. 4953/06 (Granted) Planning permission granted for an extension of existing detached public toilets and a two storey clubhouse with balconies overlooking the River Dodder. This development is located adjacent to the River Dodder in Ballsbridge at the corner of the junction of Anglesea Road, Ballsbridge and Merrion Road.	**Uncertain**
	DCC Planning Application No. 2219/15 (Granted) Permission granted for a two storey building serving Leinster Branch IRFU adjacent to the existing Old Wesley RFC clubhouse.	**Uncertain**
	DCC Planning Application No. 2388/15 (Granted) Planning permission granted to Old Wesley RFC adjacent to Donnybrook Rugby Club for a multipurpose development including reconfiguration of internal layouts and entrances, new single storey extension at ground level, the installation of solar panels, the provision of a new uncovered external terrace including all associated works and alterations.	**Uncertain**
	DCC Planning Application No. 2620/14 (Granted) Planning permission exists for a development at the old Smurfit Paper Mills site along Clonskeagh Road and adjacent to the River Dodder. The development includes for the provision of c. 92 apartment units with an option to provide a riverside walkway (boardwalk) along the Dodder River extending the length of the site to Clonskeagh Bridge. The Greenway development has the potential to interact with this development as one of the current preferred route options at this location would involve combining this boardwalk with the Greenway route.	**Potential Negative Impact**
	DCC Planning Application No. 2549/15 & 2308/16 (Granted) Planning permission exists at Dartry Road on the old Dartry Mills site which consists of the reconstruction of a partially collapsed building for science and technology uses. The proposed development includes a riverside boardwalk with a connection to Dartry Park East via an existing overgrown river bank trail. The proposed Greenway development has the potential to interact with this development by incorporating this proposed riverside boardwalk which would be upgraded to a sufficient standard and this is one option be considered at this location as part of the preferred route. An AA Screening was carried out for this development and it concluded that that there are no elements of the proposed development which could, on their own or in combination with other plans or projects, lead to a risk of significant effects on European sites.	**No Likely Significant Impact**
	DCC Planning Application No. 2766/16 (Granted) Planning permission for modifications to approved housing development under Planning Nos. 4126/15 3726/09, 2669/11, 3810/11, 2744/12, 2427/13, 3624/13, 3012/14, 2250/15 and 4005/15. This comprises a mixed-use development on a site adjacent to Dartry Park in Rathgar in close proximity to the River Dodder. This application for modifications is currently being considered by DCC but the development has already been granted permission.	**Uncertain**

<table>
<tr><th></th><th>Key Plans Potentially Affecting Ecology in the Zone of Influence</th><th></th></tr>
<tr><th></th><th>Plans and Projects</th><th>Potential Impact on Ecology</th></tr>
<tr><td rowspan="2">Influence of other Projects, Plans and Activities

The River Dodder is interconnected with a number of other major watercourses, including:
• The River Liffey at Grand Canal Dock;
• The Royal Canal through the River Liffey at Grand Canal Dock; and,
• The Grand Canal at Grand Canal Dock.

Given the interconnection of the River Dodder in terms of its function as an ecological corridor with these watercourses, large developments occurring adjacent to these watercourses must be considered to determine the net cumulative ecological effects. Similar cycle/pedestrian schemes are proposed along the Grand Canal, Royal Canal, River Liffey and in this regard will be considered in the CIA.</td><td>Proposed Royal Canal Greenway (Granted)
The Royal Canal Greenway will involve the construction of a Premium Cycle and Pedestrian Route along the Royal Canal from North Wall Quay to Ashtown. The overall length of the scheme is 7.1 km from Sheriff Street Upper to Ashtown. The scheme has been broken into four phases:
• Phase 1: Guild Street (North Wall Quay) to Sheriff Street Upper (completed);
• Phase 2: Sheriff Street Upper to North Strand;
• Phase 3: North Strand to Phibsborough;
• Phase 4: Phibsborough to Ashtown.
An AA Screening has been undertaken at planning stage and it was concluded that there will be no likely significant effects on any Natura 2000 site(s) either alone or in-combination with other plans or projects.

Grand Canal Blueway (Part 8 Planning in progress)
It is proposed to construct a shared walking and cycling Blueway route along the towpath of the Grand Canal for a distance of 118 km extending from Clondalkin Bridge in Dublin to Shannon Harbour on the Offaly/Galway county border. The proposed Blueway will also extend along the Milltown Feeder (12.9 km) and Naas-Corbally (11.9 km) branches of the Grand Canal. A number of sections of the proposed Blueway either have been granted planning permission or are in the process of being finalised for the planning process. The remainder of the proposed Blueway is at early stage pre-design and can be considered a more long term prospect for construction. The current status of the various design elements of sections of the proposed Blueway are listed below:
Table 6.3.1b Status of active sections of the proposed Grand Canal Blueway
<table>
<tr><th>Planning Phase</th><th>Blueway Section</th><th>Distance</th><th>Status</th></tr>
<tr><td>Phase 1</td><td>Tullamore to Lough Boora Discovery Park (Turraun)</td><td>22 km</td><td>Planning permission secured November 2015</td></tr>
<tr><td>Phase 2</td><td>Edenderry to Tullamore</td><td>33 km</td><td>Design Stage</td></tr>
<tr><td>Phase 3</td><td>Ballycommon to Kilbeggan (in conjunction with WCC)</td><td>7 km</td><td>Pre-design Stage</td></tr>
<tr><td>Phase 4</td><td>Lough Boora Discovery Park (Turraun) to Shannon Harbour</td><td>16 km</td><td>Pre-design Stage</td></tr>
</table>
An AA Screening undertaken for the entire proposed Blueway development concluded that the project will not result in likely significant effects to the future conservation status and integrity of qualify features of any European Sites.</td><td>No Likely Significant Impact

No Likely Significant Impact</td></tr>
<tr><td>Lower Dodder Flood Alleviation Scheme
Due to frequent and historic flooding on the lower reaches of the River Dodder, DCC is in the process of constructing flood defence measures along sections of both sides of the River Dodder between the Lansdowne Road railway bridge and the Lower Smurfit Weir upstream of Donnybrook Bridge at Beaver Row. These works consist primarily of flood defence walls, flood defence embankments, flood gates, infilling of bridge parapets and associated drainage and services alterations together with reinstatement and landscaping works.
The works have been divided into a number of Phases as follows:
• Phase 2C - works from the Lansdowne Road Railway Bridge to Ballsbridge;
• Phase 2D - works from Ballsbridge to Anglesea Bridge; and,
• Phase 2E - works upstream of Anglesea Bridge to Smurfit Weir (lower).
These works were subject to an AA in 2010 and Natura Impact Statement (NIS) was completed. The NIS concluded that following the implementation of mitigation the proposed works would avoid significant negative impacts to key sensitive receptors and other qualifying features of the Natura 2000 sites. The NIS provided guideline mitigation which aimed to reduce all risks to the River Dodder, particularly those associated with the release of significant sediment loads to the river and subsequent impacts on protected habitats and species. The NIS concluded that there should, therefore, be no requirement for Stage 3 and Stage 4 of the AA process.
The works are currently on-going with Phase 2D in progress and Phase 2E not yet commenced. In-stream works are currently under way at Ballsbridge with a haul route being established. An Environmental Management Plan has been completed for the works and all works are agreed with IFI prior to commencement on-site with a method statement, detailed plans and works programme all submitted for agreement in an on-going basis. The works are also being carried out in consultation with the NPWS. No in-stream works are taking place in the River Dodder during sensitive commuting and spawning periods due to the watercourse being an important salmonid resource.
A series of embankments and flood walls are proposed between Ballsbridge and the lower Smurfit Weir as per the Part VIII proposals that have been approved. A section of an existing wall which was proposed to be heightened as part of the works has become unstable in the vicinity of the RDS Arena and therefore will now need to be replaced. A separate Part VIII application is required for these works to normalise planning approval and it is anticipated that this process will take place in late 2016. The current programme of works projects completion of Phase 2E as far as Smurfit Weir by the end of 2017.</td><td>Potential Negative Impact</td></tr>
</table>

	Key Plans Potentially Affecting Ecology in the Zone of Influence	
	Plans and Projects	**Potential Impact on Ecology**
	Mount Carmel Sports Facilities Firhouse SDCC are currently progressing a preliminary design for a multi-sports facility at Dodder Valley Park at Firhouse. A portion of Dodder Valley Park is listed as a pNHA. The current proposals include a new running track and football pitch, a shared clubhouse facility, a BMX bike track and associated pedestrian footpaths. Ecological surveys and assessments have taken place at the site and the proposed development will incorporate replanting of and improvements to existing hedgerows and a new wildflower area of planting (Scott Cawley, 2016). Proposals to light the park have been removed in order to limit the impact on bat species in the area. The majority of the proposed works are located in areas of lower value grassland which are outside the area of the pNHA. It is expected that the proposed development will be progressed through the planning process in late 2016 with construction anticipated in summer of 2017. **Office of Public Works Drainage** The Office of Public Works (OPW) and DCC have developed a flood alleviation scheme for the River Dodder which involves the provision of flood defences along sections of the river. The flood defence works will include: • New flood defence embankments (approximately 0.5 m higher than existing levels); • New flood defence walls (between 1.2 m and 2.0 m higher than existing ground levels); • The extension (raising) of existing masonry quay walls by approximately 300 mm; • Infilling of the bridge parapet on the Herbert Park Hotel Bridge; • Repair and refurbishment of existing quay walls and embankments; • Provision of flood gates; and, Ancillary works, *e.g.* provision of non-return valves on drainage outfalls, diversion and sealing of utility services, demolition of structures, public lighting, river railings *etc*.	**Uncertain** **Potential Negative Impact**

7. MITIGATION

This section describes the measures to mitigate any likely harmful or negative impacts associated with the proposed Greenway on identified Key Ecological Receptors. General mitigation measures included within the design of the Greenway are described first, with more specific measures to prevent or minimise impacts on the individual Key Ecological Receptors provided subsequently. Maps showing the locations of the prescribed mitigation measures are provided in Appendix B.

7.1 General Mitigation Measures

7.1.1 Mitigation by Avoidance

The Greenway predominantly utilises existing built surfaces, pathways and roadways. The majority of the 17km of the proposed Greenway is on existing ootpaths and roadways. Over 87% of the orute will be along existing roads, existing paths or require marginal widening of existing paths with less than 13% requiring new path construction. This inherently avoids ecologically sensitive areas. The design has followed the basic principles outlined below to eliminate the potential for ecological impacts on KERs where possible and to minimise such impacts where total elimination is not possible.

- The Screening for AA report for the Project identified potential pathways for impact on four European Sites. The AA screening report concluded that the Project is not likely to have significant effects on the Conservation Objectives of any European Site.
- The potential for impacts on NHAs and pNHAs was also considered and the potential for direct or indirect impacts and was discounted.
- Indirect impacts on any designated sites have also been avoided with a full assessment of the potential for significant effects on the integrity of these sites provided in the Appropriate Assessment Screening report and Part 8 Report. There will be no direct impacts on Annex I habitats resulting from this development. The construction of the Greenway will maintain a drainage neutral situation thus there will be no indirect impacts on sensitive habitats.

Through the implementation of generic mitigation, direct or indirect impacts on receptors of International and National importance will be avoided. In addition, the proposed alignment minimizes the potential for impacts on receptors of Local Importance (Higher Value).

7.1.2 Mitigation by Design

The Project will be designed in accordance with the TII/NRA Design Manual for Roads and Streets (DMURS), the TII/NRA Environmental Assessment and Construction Guidelines, and other best practice guidelines, National and European legislation. The following is an overview of general design measures that will be employed throughout the entire length of the scheme to minimise and avoid negative impacts on the ecology of the footprint and wider environment. More specific measures are described in relation to individual receptor types in following sections.

- The Construction Method Statement will be read and approved by the Site Foreman.
- The Works Team will be inducted on the ecological considerations listed in the Construction Method Statement by the Site Foreman and a signed copy will be submitted to the District Conservation Officer of the NPWS.
- Impacts on breeding birds will be avoided by carrying out tree felling and hedge cutting outside the breeding season March 1st to August 31st. Tree felling and hedge cutting inside this period is illegal except where there is overriding reasons for an exemption including health and safety or projects of major human concern such as national or regional infrastructure.
- If vegetation removal is required within the breeding season, trees should be examined prior to felling by a suitable qualified ecologist for birds and bats.
- Bankside works should follow: 'Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites'.
- The watercourse crossings utilise existing bridges where possible.
- A Construction Erosion & Sediment Control Plan (CESCP) will be prepared in respect of the construction phase of the project as an intrinsic part of works. The potential for run off of pollutants during the construction phase of the development will be fully managed with impacts on significant receptors avoided where possible.

7.2 Specific Mitigation Measures

7.2.1 Watercourses

The proposed Greenway will cross the River Dodder at a number of existing and new crossing locations. Crossings will take place on existing bridges as much as possible. This mitigation is provided to ensure that the Project does not impact significantly on the water quality of the River Dodder and its tributaries, upstream or downstream of the crossing points. Whilst no significant habitat for any of the species listed as KERs above was recorded at the crossing point of any of the watercourses, the following mitigation will ensure that there is no significant impact on habitat for these species.

All works in proximity to watercourses shall follow the generic best practice guidance outlined in the following documents: *Guidelines for Crossing Watercourses during the Construction of National Road Schemes* (TII/NRA, 2008) and *Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters* (IFI, 2016) will avoid and minimise the potential impacts.

7.2.2 No Net Loss (SRFB 2009)

The no net loss principle is fundamental to the habitat conservation goal. The principle takes into consideration the habitat and water quality requirements of fish, in the context of site-specific evaluations, in order to avoid losses of habitats or habitat components that can limit the production of fisheries resources.

There must be no net loss of fish habitat or in the ability or potential for the fisheries and aquatic habitat to maintain fish stocks or the food of fish.

7.2.3 Crossings

Prior to Construction the Contractor shall prepare detailed method statements for maintaining the free passage of fish in any fish bearing waters likely to be affected by the works, at all times and these shall be submitted to the Employer and Inland Fisheries Ireland for approval in advance of works.

7.2.4 Pollution of Watercourses

This project has potential to cause pollution of the surrounding environment. Pollution could take a number of forms and occur during a number of the operations involved in the construction process. Listed below are the activities during which pollution may arise and the type of pollution that may occur along with prescribed mitigation measures.

7.2.5 Earthworks

Construction of the Project will involve excavation of soil. This creates the potential for sediment and/or nutrient run-off, especially if soil is stored in an unconsolidated state for a period of time. Suspended solids or nutrients resulting from the decomposition of organic material could potentially enter downstream natural habitats, via existing drainage features. It is considered unlikely that this would happen to a significant degree.

- Prior to the outset of any excavation works, the works area will be assessed and clearly delineated with temporary fencing. The minimum area necessary will be identified as part

of the works area and there will be no access to works vehicles outside the fenced off areas.

- All storage of plant, excavated material/topsoil and other materials required for construction/landscaping, will be held within the fenced area.
- Any excavated rock will be used as infill to replace excavated soil.
- Excavations will be carried out using a suitably sized excavator.
- No washing of plant, vehicles or equipment will be completed within 50m of a watercourse. Site foreman will ensure that all deliveries are required to complete wash out at their own company base, not on site.
- In all circumstances, excavation depths and volumes will be minimised and excavated material will be re-used where possible.

A Construction Erosion and Sediment Control Plan (CESCP) will be prepared for the development and the measures outlined in the document shall be strictly adhered to during the construction and operational phase.

7.2.6 Hydrocarbon usage

The use of hydrocarbons during the construction process leads to the potential for pollution to enter the wider environment, including drainage ditches and watercourses. Leaks in poorly maintained plant and machinery could lead to hydrocarbon dispersal over works areas. Leaks in fuel storage tanks and spillages during refueling operations could lead to larger releases of hydrocarbons into the environment.

The use of machinery carries the potential for accidental hydrocarbon contamination of works areas, by fuel spillages or oil leaks for example. The works will be carried out in accordance with the following measures to avoid such impacts:

- It is likely that all machinery will be refuelled from mobile tankers on the local/access roads. No refuelling is to take place within 50m of any watercourse.
- Mobile storage such as fuel bowsers will be bunded to 110% capacity to prevent spills. Tanks for bowsers and generators shall be double skinned.
- When not in use, all valves and fuel trigger guns from fuel storage containers will be locked.
- All plant refuelling will take place using mobile fuel bowsers. Only dedicated trained & competent personnel will carry out refuelling operations. Plant refuelling will take place as far as practicable from watercourses. A spill kit and drip tray shall be on site at all times and available for all refuelling operations. Equipment shall not be left unattended during refuelling. All pipework from containers to pump nozzles will have anti siphon valves fitted.
- Strict procedures for plant inspection, maintenance and repairs shall be detailed in the contractor's method statements and machinery shall be checked for leaks before arrival on site.
- All site plant will be inspected at the beginning of each day prior to use. Defective plant shall not be used until the defect is satisfactorily fixed.
- All major repair and maintenance operations will take place off site.
- Care will be taken at all times to avoid contamination of the environment with contaminants other than hydrocarbons, such as uncured concrete or other chemicals.
- Specific measures to offset potential impacts relating to surface water runoff, during the operation of the road, have been incorporated into the design of the scheme. These include the use of hydrocarbon interceptors and attenuation systems.

7.2.7 Habitats

De-vegetated sections of the proposed Greenway will be fully compensated for by replanting with native species. Mitigation and enhancement approaches and suggested locations are presented in Appendix B. This mitigation measure will benefit a variety of species including Bats and Birds.

Where strips of grassland are required to be removed as part of the proposed Greenway, the top soil from these areas will be carefully set aside. The same topsoil, containing the species-rich meadow plant assemblage, will be used to create areas requiring re-vegetation, post works.

7.3 Invasive Alien Plant Species

The IAPS Management Plan follows the guidance outlined in the following documents:

- *Guidelines on management of noxious weeds and non-native invasive plant species on national roads*. Transport Infrastructure Ireland, Dublin; and,
- *The Knotweed Code of Practice: Managing Japanese Knotweed on Development Sites (Version 3)*. Environment Agency, London.

The proposed Greenway has the potential to cause the spread of Invasive Alien Plant Species during construction. A detailed Invasive Alien Species Management Plan is provided in Appendix D.

7.4 Fauna

7.4.1 Badger

Badgers were recorded at several locations along the proposed route and are included as a KER. Indirect impacts that may occur in all areas include the loss of foraging habitat and disturbance. The nature of the Project means that there is no risk of collision as it is vehicular free. Mitigation measures that are in place to minimise the potential for these impacts are described in the following sub-sections below.

The guidance followed for mitigation measures for Badger is:

- TII/NRA (2006b) 'Guidelines for the treatment of badgers prior to the construction of National Road Schemes'.

7.4.2 Pre-construction Badger Survey

Prior to any works being carried out, a pre-construction Badger survey will be undertaken to ensure badger has not taken up residence within or close to the land take since the time of the last survey. This survey will also reassess the status of the setts recorded during the multidisciplinary walk-over survey in order to record any change in status in the intervening period between planning and construction.

7.4.3 Exclusion of Badgers Setts

Should any active setts be recorded within the development footprint during the pre-construction survey, the procedure outlined below will be followed under licence from NPWS.

Exclusion of Badgers from currently active setts will only be carried out from July to November inclusive in order to avoid the Badger breeding season. Exclusion of Badgers from disused or currently inactive setts may be completed throughout the year. Should active setts be encountered prior to construction, the TII/NRA guidelines (2006b) will be followed for the exclusion of active setts.

A buffer of 50 metres during the breeding season and 30 metres outside of breeding season should be retained between active setts and works (TII/NRA, 2006b). Exclusion of Badgers from active setts is best avoided during the breeding season as cubs may remain underground after all adults have been excluded. The destruction of a main sett requires the provision of an artificial sett within 100m of the original. One-way gates should be installed on all entrances of active setts to allow badgers to exit but not re-enter. These gates should be tied open for the first three days. Once no badger activity is observed for a period of 21 days, the sett should be destroyed. If the gates are left in place for long periods of time Badgers may attempt to dig around them or to create new entrances. Therefore, setts should be destroyed as soon as the 21 day period has elapsed.

Disused setts have been identified within the footprint of the Project. These setts, at the time of surveying, were considered to be unused by Badgers and further survey work will be required to ensure the setts are inactive at the time of construction. In the case of disused setts, initial exclusion involves lightly blocking entrances with vegetation and a light application of soil (i.e. soft blocking). Soft blocking confirms the absence or presence of Badgers. If all entrances remain undisturbed for five days, setts should be destroyed immediately under licence and supervision from National Parks and Wildlife Service (NPWS). If it is not possible to destroy the sett immediately, the entrance should be hardblocked using buried fencing material and compacted soil and destroyed as soon as possible.

7.4.4 Otter

Otter were recorded at various locations within the study area but are presumed to be present along all watercourses and on some of the larger drainage ditches. Eleven potential holts and two couches were recorded. The guidance followed for mitigation measures for Otter is:

- TII/NRA (2008b) 'Guidelines for the treatment of otters prior to the construction of National Road Schemes'.
- TII/NRA (2008c) 'Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes'.

The guidelines recommend the following mitigation measures:

7.4.5 Pre-construction Otter survey

Prior to any works being carried out, a pre-construction Otter survey will be undertaken within 2 – 3 weeks of works commencing. This survey will also reassess the status of the potential shelters recorded during the multidisciplinary walk-over surveys undertaken in 2016 in order to record any change in status in the intervening period between planning and construction. This may include a period of camera monitoring to confirm the level of usage.

7.4.6 Exclusion of Otter Shelters

It is not anticipated that any Otter holts or couches will require to be excluded as part of this Project based on the findings of the Otter surveys undertaken. However, should any holt or couch be encountered within the footprint during the pre-construction surveys, it will be subject to exclusion procedures as outlined in the TII/NRA guidelines (2008b) under NPWS licence.

7.4.7 Treatment of Otters at Watercourse crossings

The welfare of Otters will be ensured primarily through the provision of continued safe access for Otters throughout their ranges. Adequate provision for Otters at affected watercourse crossings is required to allow the species to retain continued access to their foraging areasThe number of watercourse crossings have been minimised through the use of existing bridges as much as possible thereby limiting the disturbance to Otter.

7.4.8 Birds

Kingfisher, Grey Wagtail and Dipper were identified as KERs of this development with significant populations were recorded as likely to be impacted by the proposed works. The Project will potentially result in disturbance events and machinery bourne noise during construction. The protection of bird breeding habitats during the breeding season (1st March to 31st August, inclusive), are set out in the Wildlife Acts, 1976 to 2012. There will be no direct loss of river bankside nesting habitat for these species as a result of the Greenway. However, in order to enhance the quality of breeding habitat the design of the Project will incorporate avoidance of areas marked as potential nesting habitat for Kingfisher and the inclusion of Dipper and Grey Wagtail nesting boxes at all suitable Bridge structures. A key deliverable for the Greenway should be to strip back and manage the vegetation that has grown over the historical Sand Martin colony so that is suitable for recolonisation.

7.4.9 Bats

The guidance followed in the summary of mitigation measures for Bats is

- *Guidelines for the treatment of bats during the construction of National Road Schemes* (TII/NRA, 2006a)
- *Best Practice Guidelines for the Conservation of Bats in the Planning of National Road Schemes* (TII/NRA, 2005)
- *Irish Wildlife Manual No. 25 published by NPWS Bats Mitigation Guidelines for Ireland* (Kelleher & Marnell, 2006).

7.4.10 Tree-felling and Hedgerow Removal

Vegetation will be lost in order to facilitate earthworks and construction. This will include Impoved Grassland, Wet Grassland, Coniferous Plantation and Scrub. These habitats are important for commuting and foraging Bat species. The scheme involves specific prescriptions for tree planting to ensure that habitat quality and connectivity is not reduced by the Project. Proposals include:

- Tree planting and/ or maintaining trees to provide commuting habitat along the proposed Greenway and to guide Bats to other linking tree lines, hedges, woodland or bridges.
- Planting will utilize native species as these have a greater range of insects associated with them that provide an additional source of food for Bat species.

Although no felling of trees with Bat potential is anticipated, works may have the potential to cause disturbance to roosting Bats. Whilst few trees were positively identified as having high potential to support Bat roosts, a pre-construction roost suitability assessment of any tree to be lost to the scheme will be required by a suitably qualified Bat Ecologist prior to any works being undertaken. Should any tree roosts be identified, a derogation licence from NPWS will be required to fell or undertake works in close proximity to these trees.

When felling mature trees in areas that have been identified as having higher potential for roosting bats within trees, the following TII/NRA (2006a) guidance will be followed:

- Immediately prior to felling, trees should be inspected for the presence of Bats and/or other Bat activity by a suitably qualified Bat ecologist during daylight hours and night-time using a bat detector. This survey should be carried out from dusk through the night until dawn to ensure bats do not re-enter the tree;
- Where examination of the tree has shown that Bats have not emerged or returned to a tree, felling may proceed the following day. Should a delay in felling be encountered, resurveying is required;
- In areas where Bat activity has been recorded, tree-felling must not be conducted in June to early August; and,
- Felling during winter months should be avoided as this increases risk to hibernating Bats.
- Tree-felling, if required, will be conducted from late-August to early November;

7.4.11 Built Structures & Bridges

The roosting sites identified in Section 4.9 will not be directly impacted upon by the Project. Should works be required in the vicinity of these structures further survey work including a daytime inspection and emergence/ re-entry surveys will be required to establish if Bats are present. Should any Bat roosts be identified in buildings, structures or trees, a derogation licence from NPWS will be required to fell or undertake works in close proximity to the identified roosts.

7.4.12 Options for Lighting

When designing an appropriate lighting scheme for the Greenway there are a number of key questions that need to be addressed in order to mitigate for impacts on Bats:

- Is lighting necessary?
- Where is the lighting required?

- What is the purpose of the lighting?
- How much lighting is required?
- When is the lighting required?

7.4.13 Preserving Dark Infrastructure for Bats

Current scientific evidence on the effect of lighting on insect behaviour, Bat foraging and commuting behaviour, the answer to the question 'how much artificial light onto an important feature used by bats (waterbody or treeline) is most appropriate?', the answer, according to Fure (2012) is determined to be 'none'. From a purely Bat-orientated perspective, the ideal scenario would be to have no lighting in areas that are used by Bats. This should be the starting point for any lighting scheme for the Greenway and to determine the need; e.g. whether lighting is required at all. Although the potential adverse impact of light on some species of Bats are well documented, there is little research on the actual levels of light that inhibit normal foraging behaviour and there is also little evidence of the comparative impacts of different light types on different Bat species and behaviours (Stone, 2013). Even low levels of natural night light can influence Bat behaviour, for e.g. a full moon on a clear night results in a horizontal illuminance* of about 0.25 lux[1] and such levels have been shown to result in behavioural modification in Bats and other species - probably as a response to an increased risk of predation. Research in Stone (2008) showed that even the lowest light levels (3.6 lux) can have an effect on Bat behaviour. However achieving or maintaining such low light levels of illumination may not be practical or functional for the purposes of a Greenway.

Light levels of more than 1lux have been known to prevent Daubenton's Bats from emerging from roost sites (Fure, 2006). 1lux therefore should be a precautionary maximum amount of light spillage from the Greenway onto areas of moderate to high sensitivity for Daubenton's Bats as identified in Section 4.9.1 and listed in Section 7.4.20. To achieve below 1 lux, a distance of several metres might be needed between the River Dodder and a lighting unit, depending on the height of columns, unless mitigated, by the use of louvres on existing lights, narrowband amber LEDs when replacing existing lights. There may be exceptions for operational, legal and safety reasons, however in these cases lamps should only be illuminated when the user is present, not automatically programmed to operate 365 days a year. A minamilist lighting regime should be devised throughout the entire Dodder Greenway to improve dark infrastructure along the corridor. If lighting is not needed, there should be no lighting. A description of how the negative impacts of lighting on Bats can be reduced is provided in the following sections.

7.4.14 Reduce the Existing Lighting Levels

During survey work on the River Dodder undertaken by Faith Wilson Ecological Consultant in 2015 (F. Wilson, August 2015) lighting levels were higher than expected in certain areas. The proposed Greenway should improve lighting design along the River Dodder to reduce its impacts on Bats. This will include upgrading of the existing riverside lighting to types with reduced negative impacts on Bats, notably those listed in Section 7.4.20, and where appropriate, fitting rear or front shields to minimise light trespass on areas of land that do not require illumination, fitting louvres to angle or block light in certain directions (Emery, 2008) or preferably removing lights, or turning off lights (at particular times) in all riverside areas.

7.4.15 Lighting Intensity and Type

A reduction in light intensity will reduce the amount and spread of illumination and therefore reduce impacts on bats. Light intensity can be reduced by dimming using CMS technology, changing the light source and by creating light barriers. Negative impacts on Bats can be reduced by:

- Avoiding blue-white short wavelength lights. These types of lights have a significant negative impact on insect prey. Warm-white (long-wavelength) lights should be used in preference;
- Avoiding lights with a high UV content (for example metal halide or mercury light sources) or reducing/removing the UV content of the light. UV filters or glass housings on lamps can filter out a lot of the UV content;
- Lighting should be directed only where it is required to avoid trespass. In particular there should be no upward lighting near to or above the horizontal to minimise trespass and sky glow.

7.4.16 Variable Lighting Regimes (VLR)

Lighting controlled by a Central Monitoring Systems (CMS) could be used to enable VLR to provide adequate lighting for humans that use the site but taking bats into account. CMS are electronic monitoring systems that allow two way communications with light units enabling control and programming of light units remotely. These systems can provide remote switching and brightness dimming to allow part night lighting schemes. The VLR can involve switching off or dimming lights for particular periods of the night, for example when there are particular periods of low human activity (such as 12.30-5.30am) or to coincide with Bat emergence and commuting times. Lights can also be fitted with movement sensors which switch lights on as people walk or cycle by and switch them off when people have passed. This lighting regime will reduce the overall time that the lighting is in use which could in turn reduce impacts on Bats and insects. There is a recent case study that has used this type of lighting on the Warren Footpath in Twickenham in London. Ambient levels of 20lux were achieved by installing 30 watt LED lamps. CMS was installed allowing lights to be monitored remotely and individually controlled. Bespoke dimming regimes can be installed or particular lighting units switched off or dimmed during periods of low level use.

7.4.17 Habitat Creation

Light barriers can be created to reduce light spill. This could include the erection of fences, walls or vegetation such as new hedgerows and trees. These would need to be able to grow to a sufficient height to shield areas suitable for Bat commuting and foraging. The new planting of trees along the Greenway will have the added benefit of providing areas of new habitat for insects which in turn could enhance Bat foraging resources. New planting will create dark corridors, linked to existing, known foraging and commuting routes and direct Bats away from lit areas.

7.4.18 Spacing and Height of Lights

Increasing the spacing between light units can help to reduce the intensity and spread of light to minimise the area illuminated and provide dark areas between the lights. Reducing the height of the lights keeps the light as close to the ground as possible and reduces the volume of illuminated space. This provides Bats with the opportunity to fly above the light units within the dark area.

For pedestrian and cycle paths there are a number of low level lighting options which minimise light spill and overall illumination. This could include low level bollard lighting, handrail lighting and down-lights.

Handrail lighting is at very low level and has no horizontal and upward light spill which minimises its impacts to Bats. Low level bollard lighting, if directed away from the river towards the footpath and cycle path, can provide limited light spill and again minimise impacts to bats.

7.4.19 Alternatives to Conventional Street Lighting

Hand rail LED lights can be used to illuminate foot/cycle paths which direct the light at the floor at a very low level, with no horizontal and upward spill. Lights can be full lateral cut off (i.e. directed away from a river towards the footpath), blue/white light should be avoided. Small

*Illuminance of a surface is measured in lumens/m2 (lux) and is usually expressed with regard to the light levels falling on either horizontal (e.g. the ground) or vertical (e.g. a wall or window of a building) planes. Whether horizontal or vertical illuminance should be used will depend on the design of the lighting scheme and the locations/species that may be affected. As a general reference to typical levels, pedestrian lighting can be as low as three lux, street lighting in a residential area is typically in the range 5-15 lux[1]

bollard lights can be installed which have low mounting heights. Bespoke dimming regimes can be installed or selected luminaires switched off or dimmed to1-5lux during periods of low pedestrian use.

From reviewing new products that are available that may provide an alternative to the installation of lighting, we have identified two potentially useful products:

- Starpath Pro http://www.pro-teqsurfacing.com/starpath-pro/
- EcoDisc http://nevanadesigns.com/eco-disc/roads-vehicle-surfaces/

The Starpath Pro is a photoluminescent aggregate mix and resin binder that can be applied to existing surfaces and works by absorbing UV light during the day and then releasing it at night. It involves the application of three layers. Firstly, a polyurethane base is applied to the surface. A layer of light absorbing particles is then applied. Finally, a waterproof finishing coat is used to protect the particles. This product can be applied on all solid materials and produces a subtle teal glow at night by absorbing UV radiation absorbed during the day. From discussions with the manufacturers, no specific details of the lux levels associated with these pathways is available and therefore difficult to gauge the effects on Bats that this type of product may have. It is anticipated that this product would not have any light spill associated with it and would provide very specific illumination in the required locations. This product would have the advantage of having no long-term costs that you would have associated with lighting.

The EcoDisc is made of polypropylene composites and needs only direct light to charge and supply light energy. It has a 25 year life expectancy and a glow time of up to 10 hours dependent on charge. The EcoDisc can be installed either to the road surface or can be fastened to posts or bollards. This again would provide an option that has no long-term costs associated with it and would provide illumination to the Greenway users without the potential impacts of light spill and trespass associated with lighting.

7.4.20 Greenway Lighting

The Bat survey work undertaken in 2016 has highlighted areas of high and more moderate sensitivity in relation to foraging and commuting Daubenton's Bats. The areas of highest sensitivity are again listed below and are highlighted in red on a plan within section 4.9.

- Up and downstream of the Luas and Packhorse Bridge
- River Dodder near to Orwell Road
- Upstream of Lime Kiln in Bushy Park
- Upstream of Rathfarnham Weir
- River Dodder at the R817.

For these areas it will be particularly important to fully review the different lighting options put forward earlier in this section. However, lighting options along the whole of the riparian corridor need to be carefully considered to ensure that key areas for Daubenton's foraging, and the connecting habitat between these areas, is capable of continuing to support for foraging bats; and wherever possible the existing lighting regime is improved to create enhanced areas of habitat for foraging bats.

As summarised in Section 5.4.4, current best scientific evidence shows that reduced negative impacts of Lighting on Bats can be achieved by using:

- Narrow spectrum lights with no UV content
- Low pressure sodium and warm white LED
- Directional downlights-illuminating below the horizontal plane which avoids light trespass into the environment.

7.4.21 Aquatic Environment

The prevention of sediment delivery to water courses can be limited through best practice during works, ensuring that no works-related soil or construction materials reach the river. Best practice guidance is provided in the Inland Fisheries Ireland document *Guidelines on protection of fisheries during construction works in and adjacent to waters (2016)*. Additionally, ensuring that no topographical or drainage arrangements which are created as a result of the works lead to an increased connectivity between the urban environment (roads), will help ensure a minimal impact on aquatic species.

- It is recommended that a carefully designed planting scheme is incorporated into the works design, so that riparian cover and plant diversity is maintained or enhanced. This will act to provide cover for aquatic species, regulate stream temperatures and mitigate lighting effects which can negatively affect aquatic species. Thus, a well planned planting scheme can have a three-fold benefit for stream ecology while enhancing the amenity value of the greenway,
- Mitigation measures for salmonids should include consideration for the light sensitivities of aquatic species. Ensuring that Greenway lighting is not directed toward the water course and that adequate shade exists during hours of darkness. Minimalistic lighting design as outlined in Section 7.4.20 and the presence of riparian / bank-side vegetation will facilitate shade creation adjacent to the water course.
- Ensure that no in-stream works / incorporated flood prevention measures act to reduce the flow diversity within the channel. Where there are rivers works which may reduce the in-stream complexity (such as incorporation of flood defence embankments) ensure that this is compensated by 'river restoration measures' which act to improve the hydromorphology of the river.
- An awareness of how the proposed construction and concomitant schemes such as the OPW Flood alleviation relief scheme, may affect flow regime. The proposed Greenway works in conjunction with planned drainage works by the city council will need to ensure flows are fully managed so that the river maintains its typical flow duration curve and does not become more 'flashy' as a result of increased runoff during peak flows. This is a risk factor particularly in built up areas. Construction plans should use opportunities to control flood peaks such as attenuation ponds for city drainage and river side wetlands in less urban reaches.

7.5 Species Specific Constraints

The species-specific constraints on the works are summarized in Table 7.5.1 below and are detailed according to in-stream, bankside or general works (vegetation removal) timings.

Table 7.5.1 Seasonal Constraints

Works	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Otter	30m/150m depending on status of resting / breeding place respectively											
Badger	Breeding season- No sett closure- 50m buffer						Non-breeding season- 30m buffer					
Bats- Summer	Hibernation				Summer roosts active- 30m buffer							
Birds			Nesting season - No vegetation removal									
Kingfisher			Nesting season - 30m buffer active nests									
Salmonids	Period of key sensitivity for fisheries						In-stream works					
Lamprey			Spawning period									

= Works permitted
= No works permitted
= Works permitted only under supervision of a suitably qualified Ecologist

Notes on temporal constraints:

- As stipulated by IFI, and in order to avoid potential impacts on fisheries, i.e. Salmonids and Lamprey species, in-stream works may only be undertaken during the appropriate period (**July– September, inclusive**). All site preparation and construction within proximity to the River Dodder must be appropriately monitored by a suitably qualified Ecologist for the entire duration of those work elements.
- In order to avoid potential disturbance impacts on wildlife, artificial lighting used for works should be shut off when not in use and when construction works cease each day.
- Notwithstanding the exemption granted for construction of road developments from restrictions on the removal of vegetation, any vegetation removal to take place during the period 1st March to 31st August, inclusive, will be appropriately supervised by a suitably qualified Ecologist in order to ensure that reasonable efforts are taken to comply with other provisions of the Wildlife Acts 1976- 2012.

7.6 Residual Impacts on Key Ecological Receptors

The residual impact on the Key Ecological Receptors identified following the proposed mitigation measures, are detailed in Table 7.6.1 below.

Table 7.6.1 Key Ecological Receptors Identified During Field Surveys

Key Ecological Receptor	Pre Mitigation Impacts	Ecological Significance following Mitigation
KER1 River Dodder including the Dodder Valley pNHA	It is considered that the proposed Greenway does not have the potential to result in significant impacts on this Key Ecological Receptor either at the National, County or Local level.	No likely significant effects on this Key Ecological Receptor at National, County or Local scale.
KER2 Grand Canal pNHA	It is considered that the proposed Greenway does not have the potential to result in significant impacts on this Key Ecological Receptor either at the National, County or Local level.	No likely significant effects on this Key Ecological Receptor at National, County or Local scale.
KER3 Hedgerows and tree-lines	It is considered that the proposed Greenway does not have the potential to result in significant impacts on this Key Ecological Receptor either at the National, County or Local level.	No likely significant effects on this Key Ecological Receptor at National, County or Local scale.
KER4 Species-rich grassland	It is considered that the proposed Greenway does not have the potential to result in significant impacts on this Key Ecological Receptor either at the National, County or Local level.	No likely significant effects on this Key Ecological Receptor at National, County or Local scale.
KER5 Bats (all Irish species except Lesser Horseshoe Bat *Rhinolophus hipposideros*)	It is considered that the proposed Greenway does not have the potential to result in significant impacts on this Key Ecological Receptor either at the National or County level. It is considered that the proposed Greenway does have the potential to result in significant impacts on this Key Ecological Receptor at the Local level.	With mitigation in place, this effect is considered unlikely to be significant as the loss of treelines and hedgerows will be replaced with replanting of tree-lines and hedgerows in the local area.
KER6 Otter (*Lutra lutra)*	It is considered that the proposed Greenway does not have the potential to result in significant impacts on this Key Ecological Receptor either at the National or County level. The proposed Greenway does have the potential to result in significant impacts at the Local level.	With mitigation in place, this effect is considered unlikely to be significant. Works will be timed to reduce the impact of disturbance on Otter, there will be no barriers to connectivity and the loss of habitat will be negligible.
KER7 Badger (*Meles meles*)	It is considered that the proposed Greenway does not have the potential to result in significant impacts on this Key Ecological Receptor either at the National or County level. The proposed Greenway does have the potential to result in significant impacts at the Local level.	With mitigation in place, this effect is considered unlikely to be significant. Works will be timed to reduce the impact of disturbance on Badger, there will be no barriers to connectivity and the loss of habitat will be negligible.
KER8 Kingfisher (*Alcedo atthis)*	It is considered that the proposed Greenway does not have the potential to result in significant impacts on this Key Ecological Receptor either at the National or County level. The proposed Greenway does have the potential to result in significant impacts at the Local level	With mitigation in place, this effect is considered unlikely to be significant there will be no permanent loss of foraging or nesting habitat or a reduction in habitat quality.
KER9 Invasive Alien Species (IAPS)	It is considered that the proposed Greenway does not have the potential to result in significant impacts on this Key Ecological Receptor either at the National level. The proposed Greenway does have the potential to result in significant spread of IAPS at least at the County and Local level.	No likely significant effects on this Key Ecological Receptor at National, County or Local scale. An Invasive Alien Plant Species Management Plan has been produced to treat IAPS and this will prevent their spread within and outside the site as a result of the construction of the Greenway.
KER10 Rare Plants	It is considered that the proposed Greenway does not have the potential to result in significant impacts on this Key Ecological Receptor either at the National, County or Local level.	No likely significant effects on this Key Ecological Receptor at National, County or Local scale.

8. ENHANCEMENT

The Biodiversity Officers of the relevant Local Authorities through consultation with Parks staff should facilitate the adoption of these guidelines through discussion and site visits. Within the River Dodder corridor the aim of management should be either the protection of natural type habitats (areas with native plants), the establishment of such habitats or/and the management of existing habitats to make them more natural and increase biodiversity. Green Infrastructure (GI) can provide substantial added value and contribute to the objectives of Article 3(3) and 10 of the EU Habitats Directive by ensuring the ecological coherence of protected sites; reconnecting existing fragmented natural areas and restoring degraded habitats.

Article 10 of the EU Habitats Directive requires: '*land-use and development policies… to manage features of the landscape which are of major importance for wild fauna and flora and which by virtue of their linear and continuous structure… or their function as stepping stones …are essential for migration, dispersal and genetic exchange of wild species*'

Implementing the following enhancement measures can further support the aims of the improving green linear infrastructure in Dublin.

8.1 The Green in the Greenway - Native Planting

The historically well wooded corridor of the River Dodder has been increasingly fragmented through development and river modification etc., and there is considerable scope to reinstate the riparian woodland elements on the margins of the river during/post construction of the Greenway. Landscaping or planting with non-native species is not compatible with the aims of developing and enhancing the green infrastructure and biodiversity of the River Dodder. Alder and Ash should be planted abundantly on all available margins of the river corridor. Oak-ash-hazel woodland (WN2) type woodland should be planted on drier soils. All planted woodlands should be surrounded by tall shrub like vegetation, and adjacent grass (within 1m) should be left unmown. Native hawthorn (*Crataegus monogyna*) and fruit bearing tree species are best for wildlife along transitional edge habitats grading wooded to open amenity areas. Shrub cover should be established beside the river along the access road from Dartry Road to Dartry Park. Gaps are acceptable where appropriate to allow views and access.

8.2 Species Rich Grassland Management Plan

8.2.1 Location and Objectives

Areas of species rich grassland management (See Appendix B) have been selected based on the availability of existing grassland habitat and the requirement for amenity grassland. S pecies rich grassland management is proposed in the following locations:

- The Dodder Park at the Dropping Well on the north-facing slope between Patrick Doyle Road and Dundrum Road;
- Three areas of existing grassland between Rathfarnham Shopping Centre and Kilvere;
- The Dodder Valley Park adjacent to the R114 and east of the M50 Bridge;
- Areas of the Dodder Riverbank Park between the Firhouse Weir and the Old Bawn Bridge; and,
- Kiltipper Park adjacent to Ellensborough Rise.

8.2.2 Mowing and Cutting

Where cutting is undertaken, it should be carried out as late in the summer as possible. This will have two main benefits. Firstly, mowing must be timed to avoid conflict with ground-nesting birds. Secondly it will provide a good flowering period before cutting, and therefore provide a source of nectar and pollen for many insects. Later cutting will also provide some plants with enough time to set seed and regenerate. The pattern of cutting is important. Cutting in a wildlife-friendly pattern, from the inside towards the outside, will help to push wildlife out of the field, rather than trap them in the centre. This significantly reduces wildlife casualties. A 2m uncut strip should be retained to provide a refuge for the species displaced by the cutting. This strip will also be valuable habitat for invertebrates. Grass cuttings should always be baled and removed from the site. Cuttings which are left in situ will smother out areas of grassland, add to the fertility of the site and result in the loss of much of the species richness.

Grassland establishment typically takes 3 to 5 years. During this period a regime of cutting is required; exact requirements will be site specific. Typically, first-year cutting regimes may be required for richer sites to keep the sward shorter than 10cm. Mowing encourages tillering; it also reduces competition from rank species and the encroachment of scrub. After mowing, cuttings should be removed from the site. If the sward has seed available, this may be used for hay strewing on other sites. The grassland should be mowed once in the second and third years after the flowers and grasses have set seed.

Where cutting is undertaken, it should be carried out as late in the summer as possible. This will have two main benefits. Firstly it will avoid destroying the egg/chicks of breeding birds and killing leverets. Secondly it will provide a good flowering period before cutting, and therefore provide a source of nectar and pollen for many insects.

Later cutting will also provide some plants with enough time to set seed and regenerate. The pattern of cutting is important. Cutting in a wildlife-friendly pattern, from the inside towards the outside, will help to push wildlife out of the field, rather than trap them in the centre. This significantly reduces wildlife casualties. A 2m uncut strip should be retained to provide a refuge for the species displaced by the cutting. This strip will also be valuable habitat for invertebrates.

Grass cuttings should always be baled and removed from the site. Cuttings which are left in situ will smother out areas of grassland, add to the fertility of the site and result in the loss of much of the species richness.

Mowing and cutting are methods of managing grasslands for hay (hay meadows). As well as in locations where it is traditional, mowing can be considered as an alternative to use of livestock in situations where grazing, while preferred, is not a practicable option (Crofts & Jefferson, 1999). Like grazing, regular mowing prevents the dominance of robust competitive grasses, herbs and the establishment of shrubs and trees, maintaining a grassland community in perpetuity (Crofts and Jefferson 1999). The maintenance of greater structural diversity in grassland may be necessary for conserving particular assemblages or rare species of invertebrate (Kirby, 1992). Mowing does not create the same mosaic of habitat conditions as grazing. Mown grassland has little structural variety and so is of less value for invertebrates than a well-grazed area (Crofts & Jefferson, 1999).

Cutting dates for hay made from semi-natural grasslands without the use of artificial fertilizers are likely to be later than those for more productive meadows to ensure reasonable crop yields and to maintain their nature conservation value. Management of meadows for nature conservation normally involves a single late cut for hay. The dates will substantially vary according to location and the nature of the wildlife interest (Crofts & Jefferson, 1999). Late cutting can be useful (Pearson et al. 2006): - to protect animal species that need a highly structured vegetation for feeling and refuge, in particular birds and insects - so that late-flowering plants can set seed Early cutting can be useful: - where there is a rich vegetation, that would otherwise start to decompose - to slow down the development of alien species 21 Sustained early hay cutting is known to reduce species richness in meadows (Smith, 1994). Cutting should not take place before breeding birds have hatched or populations of "desirable" characteristic plant species, which depend on seed production for regeneration, have set seed. Furthermore occasional late hay cut (late August/September) (e.g. 1 year in 5) is practical on sites, which support late-flowering species (Crofts & Jefferson 1999).

The Mesobromion grasslands are generally mown once a year-sometimes even once every two years - due to their low productivity (Pearson *et al.* 2006), although more mesic and productive grasslands can stand two cuts (Rodwell et al. 2007). More than one cut in a year may be

necessary to simulate the former grazing management where this is no longer possible. Wells & Cox (1993) demonstrate that cutting more than once a year maximises the species diversity of chalk grassland. In contrast, a single cut, while maintaining species-richness, produces coarser grassland where upright brome (*Bromopsis erecta*) are abundant and calcareous grassland herbs are at reduced frequencies. It is stressed that the above study concentrates on the botanical interest of chalk grassland (Crofts & Jefferson 1999). As a general rule, therefore, the mowing should not be carried out more than once or at the most twice, because more frequent mowing limits the possibilities of development for many animal and botanical species (Essl, 2005).

It is advisable to avoid cutting the whole of a grassland area at one time, but to spread the timing of the operation so as to avoid damaging the microfauna. Spread cutting dates also prolong the pollination phase of plants and the availability of nectar and pollen. For that reason it is sensible to exclude from cutting a small proportion (ca 5-10%) of the total area, cutting it in the following summer. This should be done every year with a different part of the surface, on rotation, going back to any particular uncut patch of land every 4-6 years (Pearson *et al.* 2006).

If possible it would be better to use cutter bar mowers. The use of rotary mowers kills many more animals, which have to way to escape. The use of rotary mowers needs to be combined with a change in the usual height of cutting (8 - 10cm) and a shift to cutting from the inside towards the outside if the escape of animals from the meadow is to be facilitated (Pearson et al. 2006). Very low cutting heights should be avoided, as there is a likelihood of excessive "scalping" resulting in the creation of bare patches in the grassland. These provide favourable areas for the invasion of undesirable species. Conversely, some small-scale disturbance may be necessary for seed germination and may be beneficial for invertebrates. It is advisable to avoid using forage press machines, which cause great damage to the fauna (at least 30 to 60% mortality of bees). Where a grass crop is cut but there is no intention to use it for winter feed, or when cutting is undertaken purely for nature conservation purposes, cut material should nevertheless generally be removed to avoid nutrient enrichment of the grassland. Some authors also considered that smothering by unremoved cuttings will depress species-richness (Crofts & Jefferson, 1999).

8.2.3 Equipment

The type of cutting tools required will naturally depend on the size of grassland and what si available to the Parks Department. On a small meadow, hand scythes or a power strimmer can be used. On larger areas long grass can be cut for hay using a power scythe or a tractor drawn grass cutter. It is good practice to mow from the centre of the meadow outwards (or from one side to the other) to give any ground nesting birds or small mammals the opportunity to escape into adjacent land. Before cutting, all rocks and obstructions which could damage equipment should be removed.

8.2.4 Seeding

Seeding can be undertaken using seed collected from a local donor site. Care must be taken not to deplete the donor site of seed by over-harvesting. Alternatively, an appropriate seed mix may be purchased. A reputable seed house will supply seed mixtures suited to the principal soil conditions. Wildflowers and grasses are normally sown together as grasses help to stabilise the soil and provide important cover in winter. Seed is normally sown in September/October, either by hand or using agricultural machinery such as slot seeders and seed drills, which maximise the area sown for the amount of seed used (Crofts and Jefferson, 1999). If sowing by hand, mix with damp sand to help ensure the seed is evenly distributed and lightly roll or tread the soil surface. Raking should be avoided as it can concentrate seed distribution or bury the seed too deep. If there is a prolonged dry period, the seeded area may be lightly watered.

8.2.5 Weed Control

A weed may be defined as a species, which is undesirable to the purpose/objective of grassland management. Under certain conditions some plants species (e.g. thistle, bracken, ragwort, etc.) can excessively multiply, quickly replacing communities that have a greater conservation value (Pearson *et al.* 2006). These plants are highly competitive, often toxic, and once established they produce a heavy shade in the growing season, which discourages other plant species (including orchids) to establish (Crofts & Jefferson, 1999). For this reason, the removal of the weeds should be carried out at an early stage of development when it takes little effort and can obtain easily good results. Good management practices are the most important measure to prevent infestation by weeds. One of these measures, for instance, is to avoid large areas of bare land, which provide opportunities for invasion and spread of weed species. After their establishment the following measures can be implemented (Crofts & Jefferson, 1999): - hand control techniques: 'spudding' or cutting (not suitable for ragwort) at just below ground level, or/and hand-pulling (this is only really suitable on small areas), just before target weed flowers open; hand pulling needs to be undertaken over a period of several years if it is to have any effect; - mechanical pulling or cutting: for thistles and ragwort, pulling should take place after maximum extension of the flower stalk but before seeding. Pulling will be required in successive years to reduce the extent of perennial target species. Bacon & Overbury (1998) report that in trials, this method dramatically reduced the vigour and number of flowering stems of thistle after two years. Repeated cutting (topping) may prevent seeding and reduce the vigour of weeds but it does not kill the plants and they may regenerate vigorously from the stem base. As with mown grass, cuttings should be removed from the site (Crofts and Jefferson 1999). - targeted grazing control; - chemical control: although manual control methods are usually most desirable, and the use of chemical products is not generally allowed, targeted herbicidal control (spot treatment, weedwiping) of such species will often be acceptable on nature conservation sites particularly where continued grazing/meadow management is essential for meeting nature conservation objectives. Finally, it is important to stress that some of the species may also have positive qualities from a nature conservation perspective in certain situations. Weed species can support in fact diverse invertebrate faunas and may contribute to desirable habitat structure for fauna, e.g. breeding birds, or provide a food source, e.g. seeds for passerine birds (Crofts & Jefferson, 1999; Pearson *et al.* 2006). Control programmes should be accurately planned, considering also the possibility to do not completely eliminate weed species: in certain cases total eradication, even if possible to achieve, would be damaging from a wildlife perspective.

Species-rich grasslands can become seriously infested with perennial weeds such as creeping thistle, nettles, ragwort and docks. If left untreated, these weeds can result in significant deterioration of the grasslands. In order to protect the wildflowers within the grassland, it is essential to avoid boom spraying the grassland with a broadleaved herbicide. Ideally, spot treatment of the weeds should be undertaken before the weed problem becomes too widespread. If used carefully an all terrain vehicle mounted weed-wipe can be an option, but extreme care is required to protect the species-rich grassland. Before any weed wiping is contemplated the grassland should be grazed down to a height of <10cm, leaving the perennial weeds standing well clear of the grassland. Using a 'non-drip' weed wipe, and a selective herbicide, the weeds can then be wiped. However, if this is not undertaken using extreme care, it can be very damaging, and many of the wildflowers will be lost. Where ragwort is present, sheep grazing in the spring and early summer can prevent it flowering and spreading.

8.2.6 Monitoring

Monitoring of the vegetation allows a reorientation of the habitat management strategy, according to the presence of the *Festuco Brometalia* characteristic plants (Calaciura & Spinelli, 2008). The quality of the habitat and the validity of management measures can also be assessed by using some insects and bird species as performance indicators of good quality, as they depend on the flora, the type of soil and the vegetation linked to this habitat (Piazzini, 2006). The initiation of a monitoring programme would be valuable in demonstrating the effectiveness of management measures.

8.3 River Restoration Potential

The Dodder has undergone numerous modifications to its planform and flow regime due to urbanisation and flood control measures. Since the mid-19th Century, the stabilisation of banks and control of flooding by the construction of embankments has affected the natural planform and function of the river. These works have been accompanied by the appearance of roads

adjacent to the river, which further constrain the channel and reduce floodplain connectivity which previously would have accommodated spate flows and flood events during wet weather periods. Infrastructure for the city's drainage system was also subsequently built along the Dodder. The river also receives surface water run-off and the overflow from combined sewers (sewers plus surface water outfalls) at many points along its course. As part of a river improvement programme, it is important to consider its hydromorphology which forms the basis of the river biodiversity and ecosystem function, since the channel pattern provides habitat for the biota and a physical framework for ecosystem processes. For example, features within the river will create a range of flow based on proximity to the feature and thus provide a gradient of flow velocities in which in-stream biota need during different activities and life stages.

Current approaches to restoring heavily modified rivers include measures which act to increase the complexity of flow types and habitats within the channel itself and the adjoining riparian zones.

Some potential measures which the various Local Authorities could consider at some stage in the future and may be applicable to the Dodder are as follows:

- Increase river planform diversity through introduction of flow deflectors and artificial shoals at bank sides. These measures act to create flow gradients in the vicinity of the new feature and provide refuge opportunities for in-stream biota such as invertebrates and juvenile fish.
- The creation of sinuous low-flow channels within straightened sections of the river would help to provide habitat diversity during periods of lower flow.
- Where the channel is fully constrained - such as in an entirely industrial or urban context, the use of 'Floating Ecosystem' technologies which can provide natural biological treatment of water and improves circulation while providing habitat opportunities for birds and other wildlife on the floating 'islands' would be beneficial.
- The creation of wetland features may be proposed where there are opportunities to reconnect the river with the floodplain – perhaps in the upper reaches of the Dodder. The provision of wetland scrapes and backwaters simultaneously provides habitat and refuge opportunities for wildlife while increasing the natural flood capacity of the river.
- Outfalls which discharge into the river may be altered in order to limit negative effects on the flow and water quality of the receiving water course. Alterations can include the addition of 'outfall chambers' which trap silt prior to entry into the watercourse. Dip plates also ensure that oil, petrol and floating sewage items are also retained in the chamber. The outfall pipes are generally discharged below water levels, which reduces scour effects and improves visual amenity value.
- Where feasible, the removal of weirs and other obstructions to fish passage could be removed. This would open up the upper parts of the catchment affording free upstream passage for all species of fish and invertebrates, thus improving longitudinal connectivity and overall hydromorphological value of the river. A more connected river may thus give rise to an increase in fish (and invertebrate) biodiversity throughout the catchment and potentially improve WFD status.

Physical restoration measures which may be applicable to the Dodder would rely on sound assessment of the potential of the site on a reach by reach basis. Assessments should be undertaken by geomorphologists and river restoration practitioners, in consultation with Inland Fisheries Ireland who can progress tailored solutions based on the catchment characteristics and the extent of the modifications imposed within the discrete river reaches.

9. POST CONSTRUCTION MONITORING

Post construction monitoring is required to determine the effectiveness of mitigation for sensitive ecological receptors, specifically Otter and Daubenton's Bat. The provision of post-construction monitoring should be stipulated in the Employer's Requirements. This section details the methodology that should be used to determine any change in distribution of these receptors following the construction of the River Dodder Greenway. The need for further monitoring after the initial three years will be decided in consultation with NPWS. Additional mitigation measures may be required as a result of these monitoring surveys. Following the period of post-construction monitoring, a report detailing any change in distribution of Otter and Daubenton's Bat should be provided.

9.1 Otter

The success of the mitigation measures for Otter will be monitored for a minimum period of three years after construction is completed. The first monitoring will take place in year two followed by a repeat in year three.

The following are recommended for monitoring:

Spraints will be used to determine the presence and distribution of Otter on the River Dodder. It should be noted that spraint numbers cannot be used to accurately determine population numbers (Yoxon & Yoxon, 2014). The survey will include the entire length of the Greenway between Glenasmole Reservoir and the Grand Canal Basin. All spraints will be recorded using GPS. The post construction monitoring will culminate with a report detailing the locations and numbers of spraints and a comparative analysis to the baseline data (See confidential version of this report)

Any reduction in the distribution of Otter on the River Dodder could be considered as an indicator of a short-term to long-term impact of the Greenway construction and operation.

9.2 Daubenton's Bats

The distribution of Daubenton's Bat will be monitored for a minimum period of three years after construction is completed. The first monitoring will take place in year two followed by a repeat in year three. Section 4.9.1 details the locations of Daubenton's Bats identified during the Bat activity surveys.

The following are recommended for monitoring:

Surveys will be undertaken by a suitably qualified and experienced Ecologist using a handheld Bat detector. The survey will include the entire length of the Greenway between Glenasmole Reservoir and the Grand Canal Basin.

The survey should consist of 5 minute stops every 100m where practicable along the River Corridor, paying particular attention to dark areas of the river. The survey timing should follow guidelines set out in Collins (Eds., 2016) with regard to the time of year and weather conditions and also taking the late emergence of this species into account.

The results of the post construction monitoring should be compared to the distribution of Daubenton's Bat described in Section 4.9.1 of this EcIA to determine the effectiveness of the mitigation.

10. CONCLUSIONS

Following consideration of the residual impacts (post mitigation) it is noted that the proposed Greenway development will not result in any significant impacts on any of the identified Key Ecological Receptors. No potential for impacts on receptors of International Importance were identified. No significant impacts on receptors of National Importance were identified following mitigation.

No potential for impacts on receptors of International Importance were identified. The potential for impacts on the European designated sites that were identified is fully described in the Screening for Appropriate Assessment.

This concluded, in view of best scientific knowledge and on the basis of objective information that the Greenway, either individually or in combination with other plans or projects, would not be likely to have significant effects on designated sites.

Other than the identified Key Ecological Receptors, the ecological impacts on floral and faunal receptors of Local Importance (Lower Value) are not considered to be significant in the medium to long term.

Provided that the proposed Greenway is constructed and operated in accordance with the design, best practice and mitigation that is described within this document, significant impacts on ecology are not anticipated at the international, national county or local scales or on any of the identified Key Ecological Receptors.

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APPENDIX A
Site Location and Zone of Influence

N

0 2 4 km

Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

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LEGEND

Proposed Dodder Greenway

ROD ROUGHAN & O'DONOVAN

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e-mail : info@rod.ie
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Project Title	DODDER GREENWAY
Drawing Title	LOCATION OF PROJECT

Designed:	POS	Checked:	RWP	Approved:	BC	Status:	Planning

Date:	June 2017	Job No:	14.223	Drawing No:	Rev:
Scale:	1:60,000 @ A3	Drawn:	MM	Figure 1	

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North Bull Island SPA

North Dublin Bay SAC

South Dublin Bay SAC

South Dublin Bay and River Tolka Estuary SPA

Glenasmole Valley SAC

N

0 2 4 Km

Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

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LEGEND

- Proposed Dodder Greenway
- Zone of Impact 3 km Buffer
- Special Protection Areas
- Special Area of Conservation

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Designed: POS | Checked: RWP | Approved: SMG | Status: Planning

Project Title: DODDER GREENWAY

Drawing Title: NATURA 2000 SITES WITHIN THE ZONE OF INFLUENCE

Date: June 2017 | Job No: 14.223 | Drawing No: Figure 2 | Rev:

Scale: 1:70,000 @ A3 | Drawn: MM

Document Path: J:\2014\14223\ArcGIS\Mxd Files\EcIA Figures\Ecological Impact Assessment\14223 - Figure 2 - Natura 2000 Sites within the Zone of Influence .mxd

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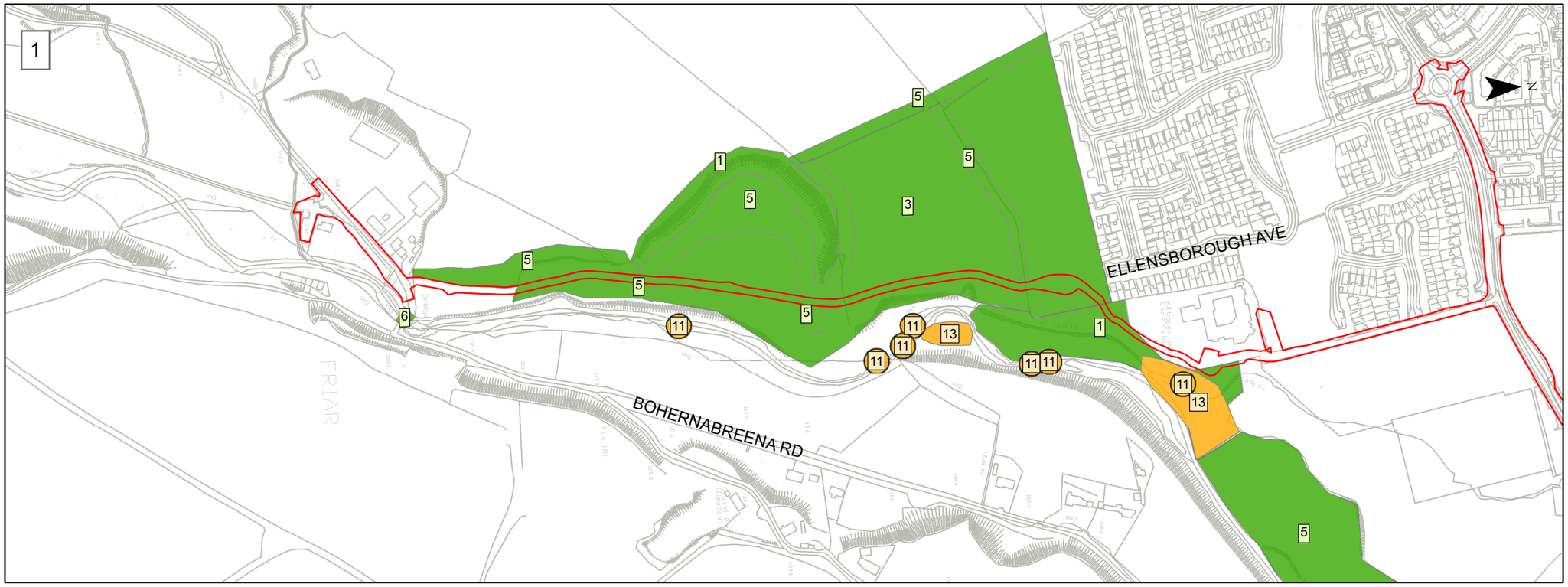
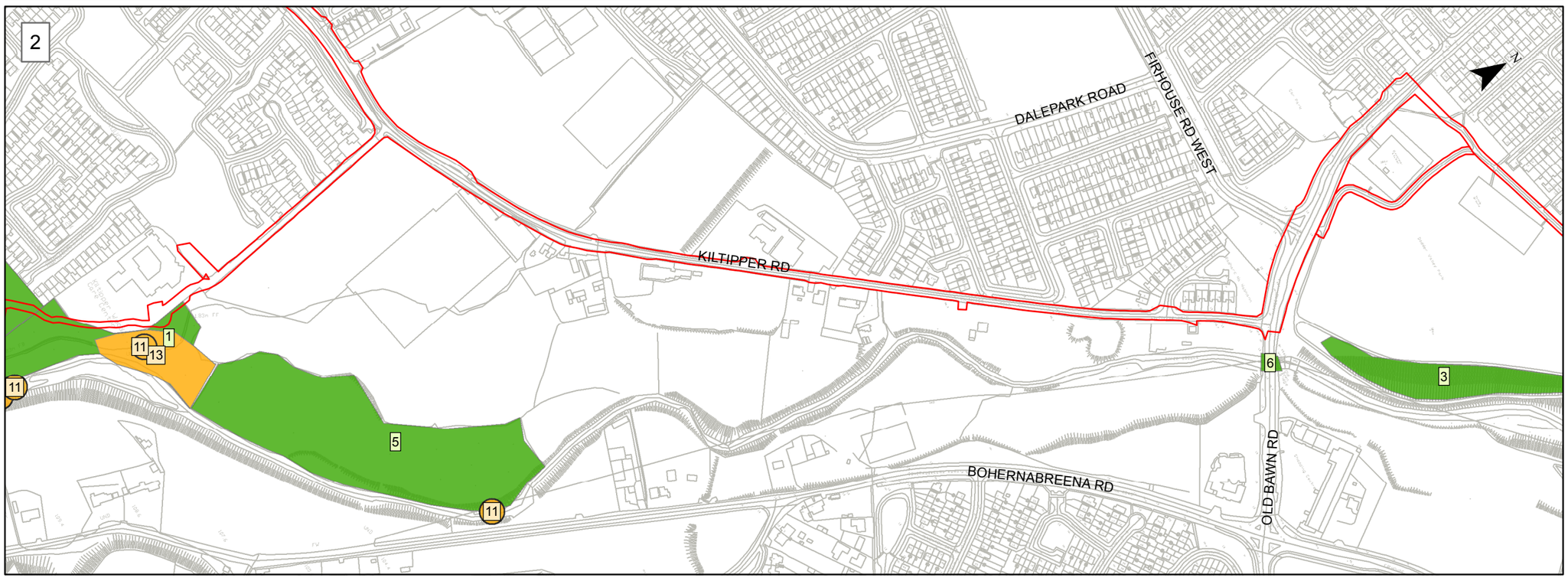
APPENDIX B
Proposed Greenway Route and Ecological Constraints and Opportunities





LEGEND:

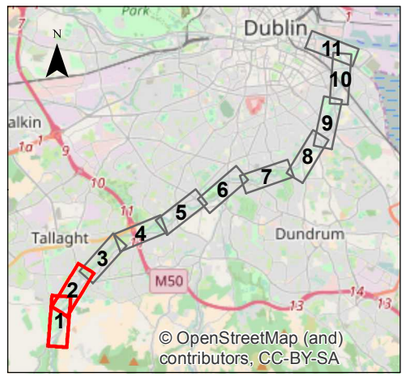
Proposed Dodder Greenway Route

Area of Opportunity

1. Proposed area for bat boxes
2. Proposed area for bat boxes & Proposed area for planting of native tree species
3. Proposed area for managed species rich grassland
4. Proposed area for planting of native tree species & Proposed area for managed species rich grassland
5. Proposed area for planting of native tree species
6. Proposed sites for dipper boxes
7. Sand Martin Colony

Area of Constraints

8. Japanese Knotweed
9. Japanese Knotweed & Spanish Bluebell
10. Himalayan Balsam
11. Petrifying springs (7720)
12. Dry calcareous grasslands
13. Alluvial forests (910EO)
14. Risk of tree root damage
15. See Confidential Appendix E



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0 150 300 m

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Project Title: DODDER GREENWAY

Drawing Title: ECOLOGICAL CONSTRAINTS AND OPPORTUNITIES SHEET 1 OF 6

Designed: POS	Checked: RWP	Approved: BC	Status: Planning	Date: May 2017	Job No: 14.223	Drawing No: Figure 3	Rev:

Scale: 1:2500 @ A1 - 1:5000 @ A3 Drawn: MM

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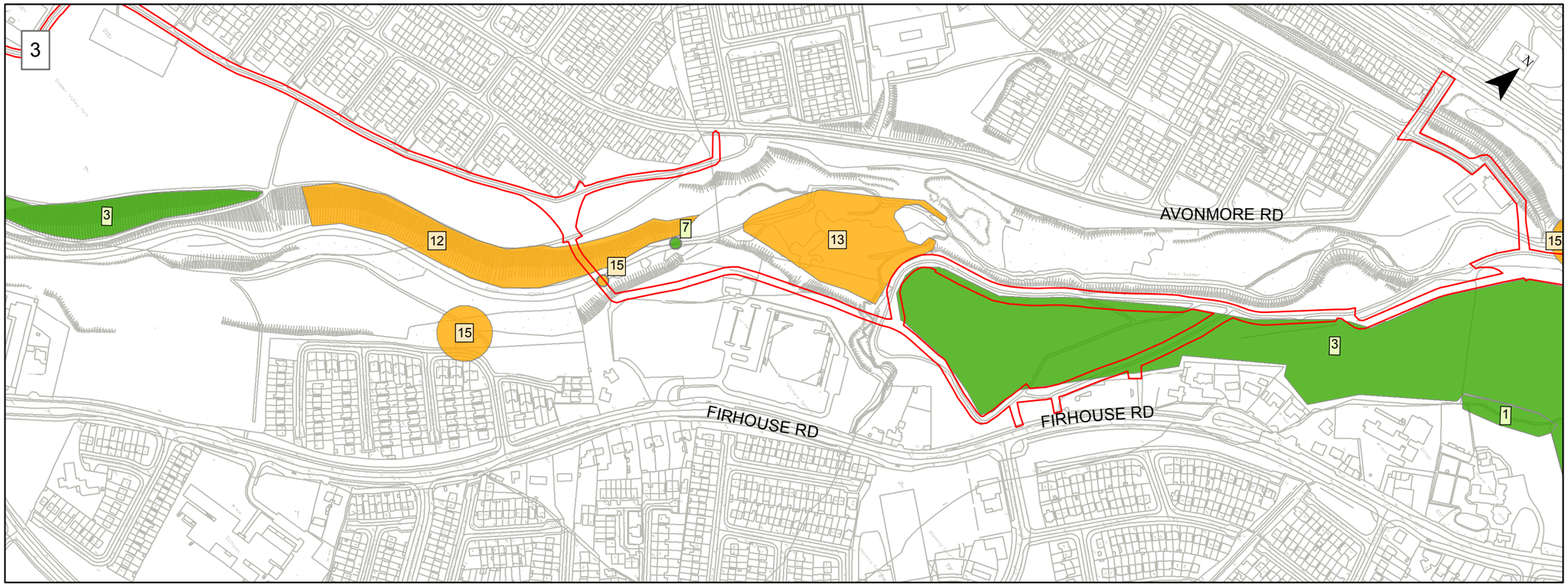

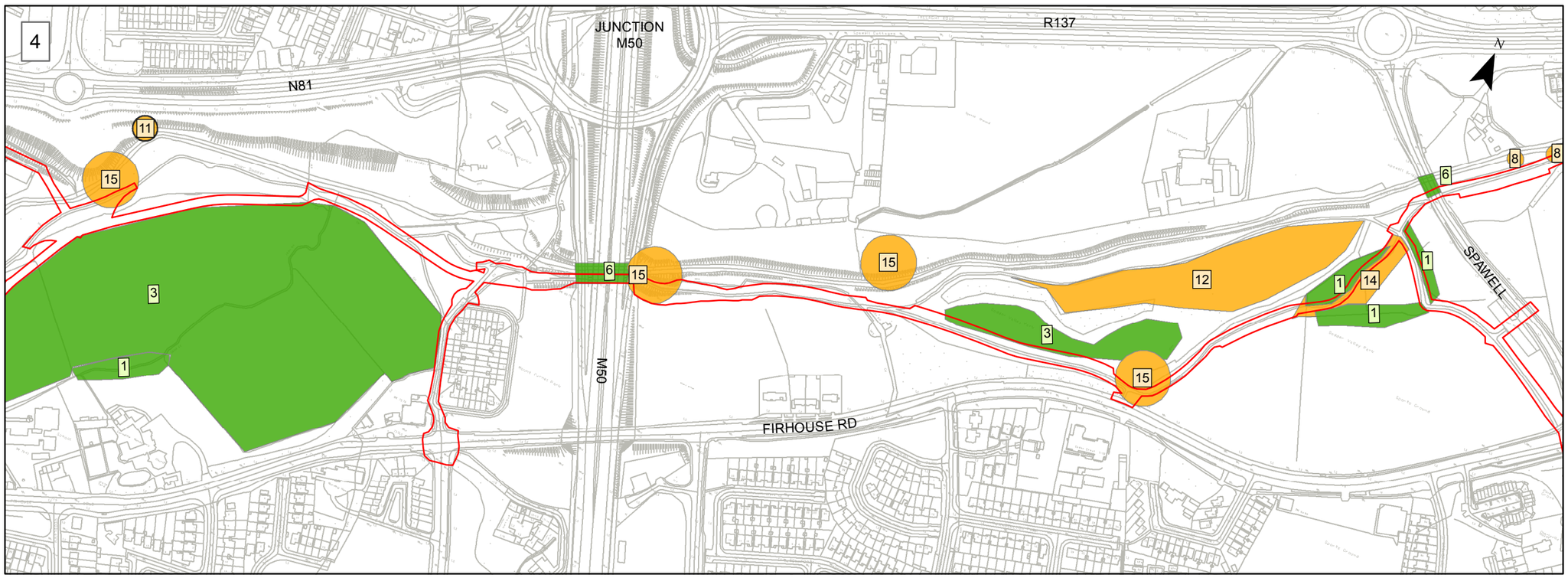

LEGEND:

- Proposed Dodder Greenway Route

Area of Opportunity

1. Proposed area for bat boxes
2. Proposed area for bat boxes & Proposed area for planting of native tree species
3. Proposed area for managed species rich grassland
4. Proposed area for planting of native tree species & Proposed area for managed species rich grassland
5. Proposed area for planting of native tree species
6. Proposed sites for dipper boxes
7. Sand Martin Colony

Area of Constraints

8. Japanese Knotweed
9. Japanese Knotweed & Spanish Bluebell
10. Himalayan Balsam
11. Petrifying springs (7720)
12. Dry calcareous grasslands
13. Alluvial forests (910EO)
14. Risk of tree root damage
15. See Confidential Appendix E

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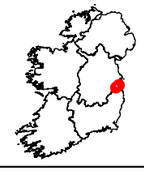

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Project Title: DODDER GREENWAY

Drawing Title: ECOLOGICAL CONSTRAINTS AND OPPORTUNITIES
SHEET 2 OF 6

Designed:	Checked:	Approved:	Status:	Date:	Job No:	Drawing No:	Rev:
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Scale: 1:2500 @ A1 - 1:5000 @ A3 Drawn: MM

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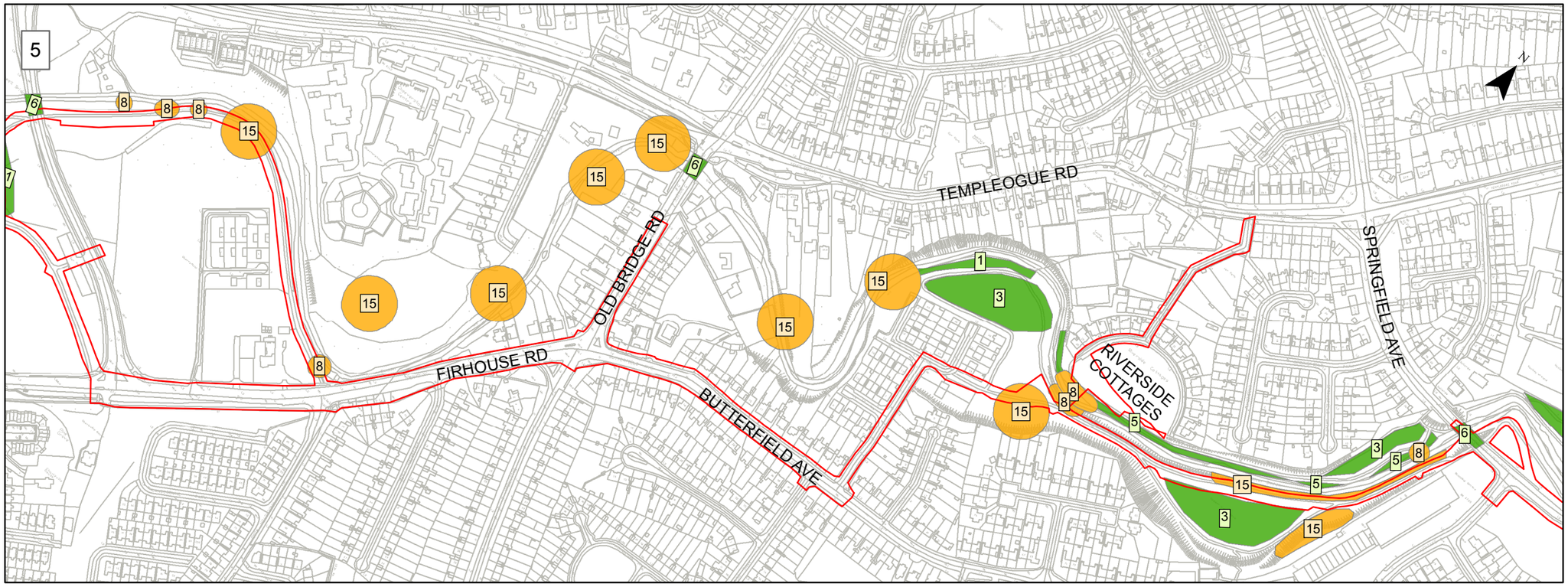
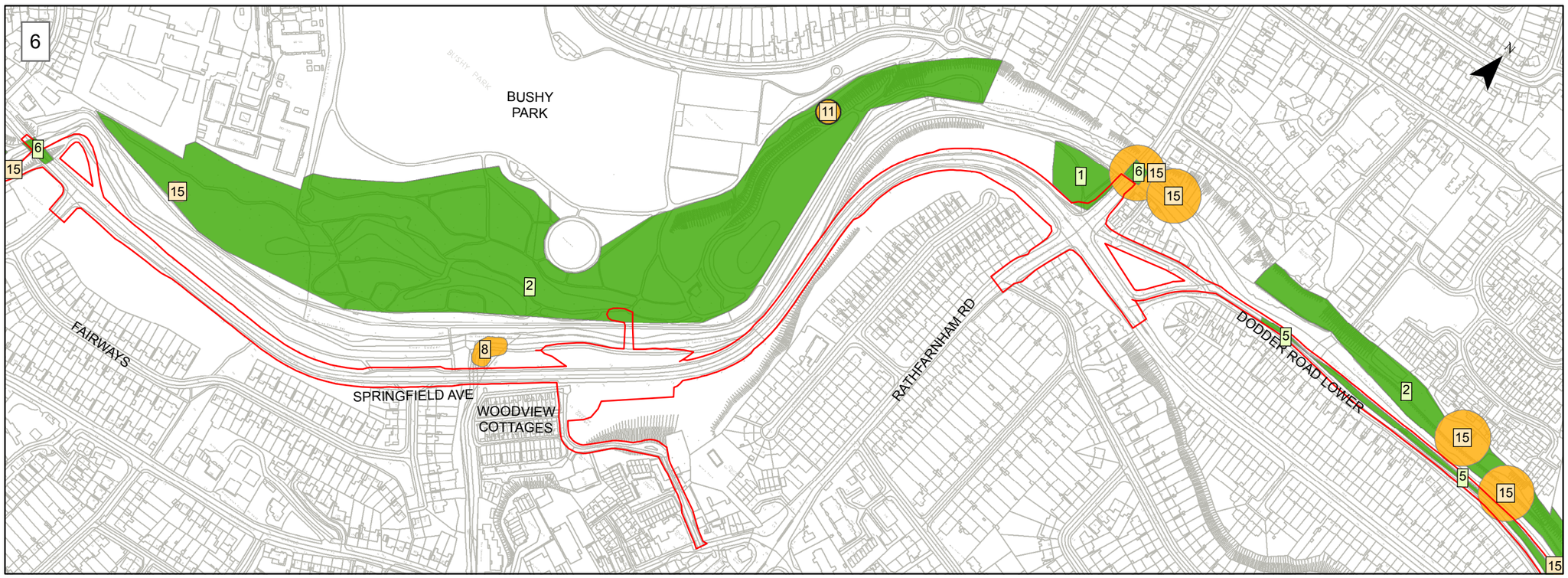




LEGEND:

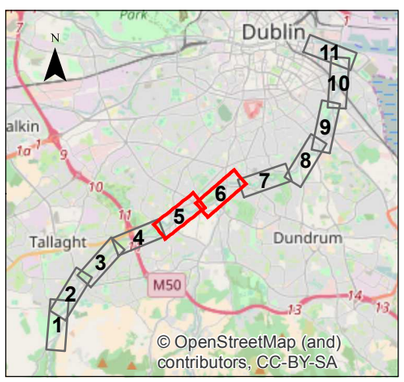
Proposed Dodder Greenway Route

Area of Opportunity

1. Proposed area for bat boxes
2. Proposed area for bat boxes & Proposed area for planting of native tree species
3. Proposed area for managed species rich grassland
4. Proposed area for planting of native tree species & Proposed area for managed species rich grassland
5. Proposed area for planting of native tree species
6. Proposed sites for dipper boxes
7. Sand Martin Colony

Area of Constraints

8. Japanese Knotweed
9. Japanese Knotweed & Spanish Bluebell
10. Himalayan Balsam
11. Petrifying springs (7720)
12. Dry calcareous grasslands
13. Alluvial forests (910EO)
14. Risk of tree root damage
15. See Confidential Appendix E



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Project Title: DODDER GREENWAY

Drawing Title: ECOLOGICAL CONSTRAINTS AND OPPORTUNITIES
SHEET 3 OF 6

Designed:	Checked:	Approved:	Status:	Date:	Job No:	Drawing No:	Rev:
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7

8

WALDRONS BRIDGE

DARTRY PARK WEST

DARTRY PARK WEST

ORWELL ROAD

ORWELL PARK

MILLTOWN GOLF COURSE

CLASSONS BRIDGE

CHURCHTOWN RD LOWER

LUAS LINE

MILLTOWN ROAD

MILLTOWN BRIDGE

SCULLY'S FIELD

DODDER VALLEY PARK

DUNDRUM RD

N

LEGEND:

- Proposed Dodder Greenway Route

Area of Opportunity

1. Proposed area for bat boxes
2. Proposed area for bat boxes & Proposed area for planting of native tree species
3. Proposed area for managed species rich grassland
4. Proposed area for planting of native tree species & Proposed area for managed species rich grassland
5. Proposed area for planting of native tree species
6. Proposed sites for dipper boxes
7. Sand Martin Colony

Area of Constraints

8. Japanese Knotweed
9. Japanese Knotweed & Spanish Bluebell
10. Himalayan Balsam
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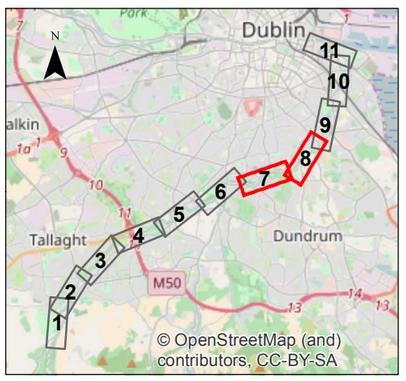
14. Risk of tree root damage
15. See Confidential Appendix E



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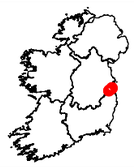

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Designed:	Checked:	Approved:	Status:	Date:	Job No:	Drawing No:	Rev:
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9

10

CLONSKEAGH RD

ANGLESEA BRIDGE

ANGLESEA RD

N11

HERBET PARK

RDS SHOWGROUNDS

BALLBRIDGE

MERRION RD

LANSDOWNE RAILWAY BRIDGE

LANSDOWNE RD

AVIVA STADIUM

BATH AVE

LONDON BRIDGE

LANSDOWNE ROAD BRIDGE

N

LEGEND:

Proposed Dodder Greenway Route

Area of Opportunity

1 Proposed area for bat boxes

2 Proposed area for bat boxes & Proposed area for planting of native tree species

3 Proposed area for managed species rich grassland

4 Proposed area for planting of native tree species & Proposed area for managed species rich grassland

5 Proposed area for planting of native tree species

6 Proposed sites for dipper boxes

7 Sand Martin Colony

Area of Constraints

8 Japanese Knotweed

9 Japanese Knotweed & Spanish Bluebell

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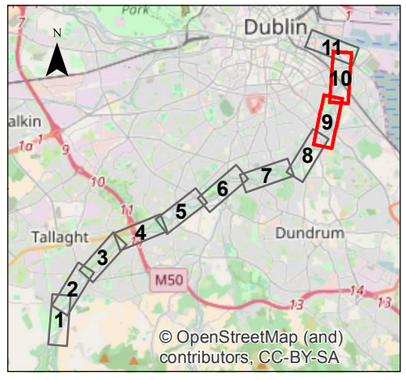

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Project Title: DODDER GREENWAY

Drawing Title: ECOLOGICAL CONSTRAINTS AND OPPORTUNITIES
SHEET 5 OF 6

Designed:	Checked:	Approved:	Status:	Date:	Job No:	Drawing No:	Rev:
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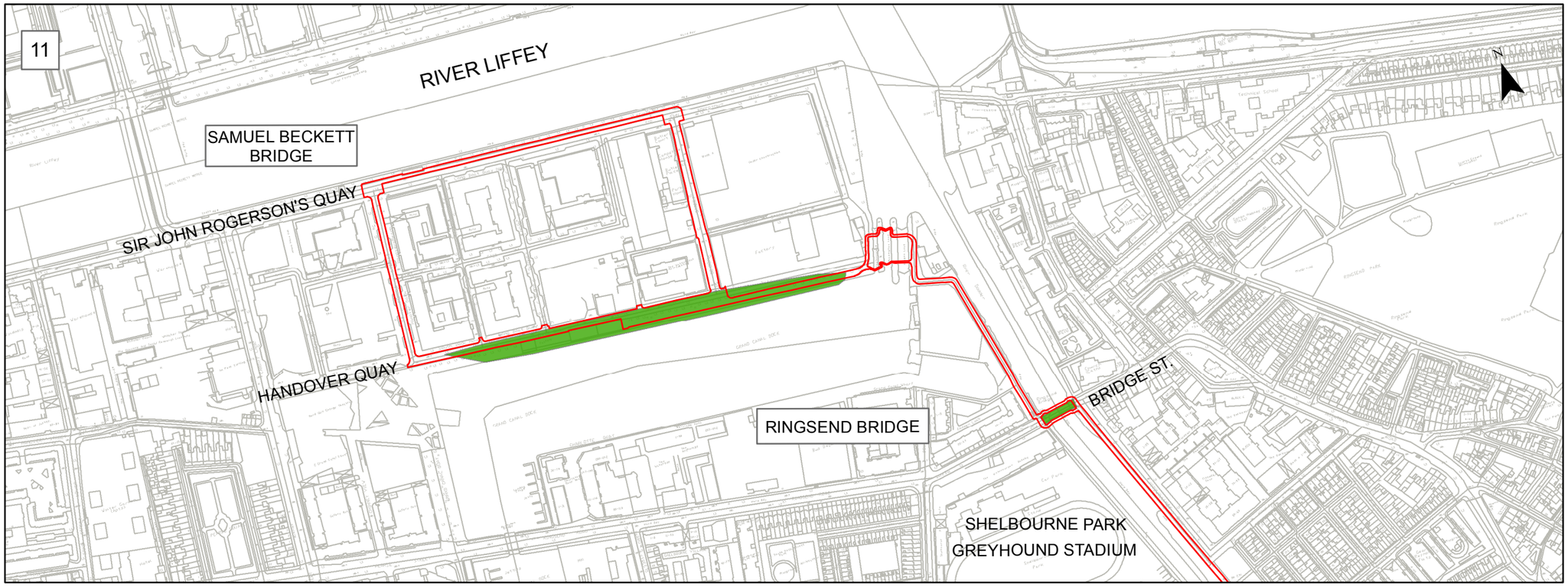


LEGEND:

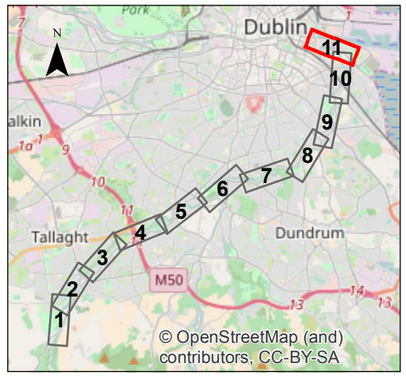
- Proposed Dodder Greenway Route

Area of Opportunity

1. Proposed area for bat boxes
2. Proposed area for bat boxes & Proposed area for planting of native tree species
3. Proposed area for managed species rich grassland
4. Proposed area for planting of native tree species & Proposed area for managed species rich grassland
5. Proposed area for planting of native tree species
6. Proposed sites for dipper boxes
7. Sand Martin Colony

Area of Constraints

8. Japanese Knotweed
9. Japanese Knotweed & Spanish Bluebell
10. Himalayan Balsam
11. Petrifying springs (7720)
12. Dry calcareous grasslands
13. Alluvial forests (910EO)
14. Risk of tree root damage
15. See Confidential Appendix E



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Project Title: DODDER GREENWAY

Drawing Title: ECOLOGICAL CONSTRAINTS AND OPPORTUNITIES
SHEET 6 OF 6

Designed:	Checked:	Approved:	Status:	Date:	Job No:	Drawing No:	Rev:
POS	RWP	BC	Planning	May 2017	14.223	Figure 8	

Scale: 1:2500 @ A1 - 1:5000 @ A3 Drawn: MM

Document Path: J:\2014\14223\ArcGIS\Mxd Files\EcIA Figures\Ecological Impact Assessment\14223 - Figure 3-8 Ecological Constraints and Opportunities -Public.mxd

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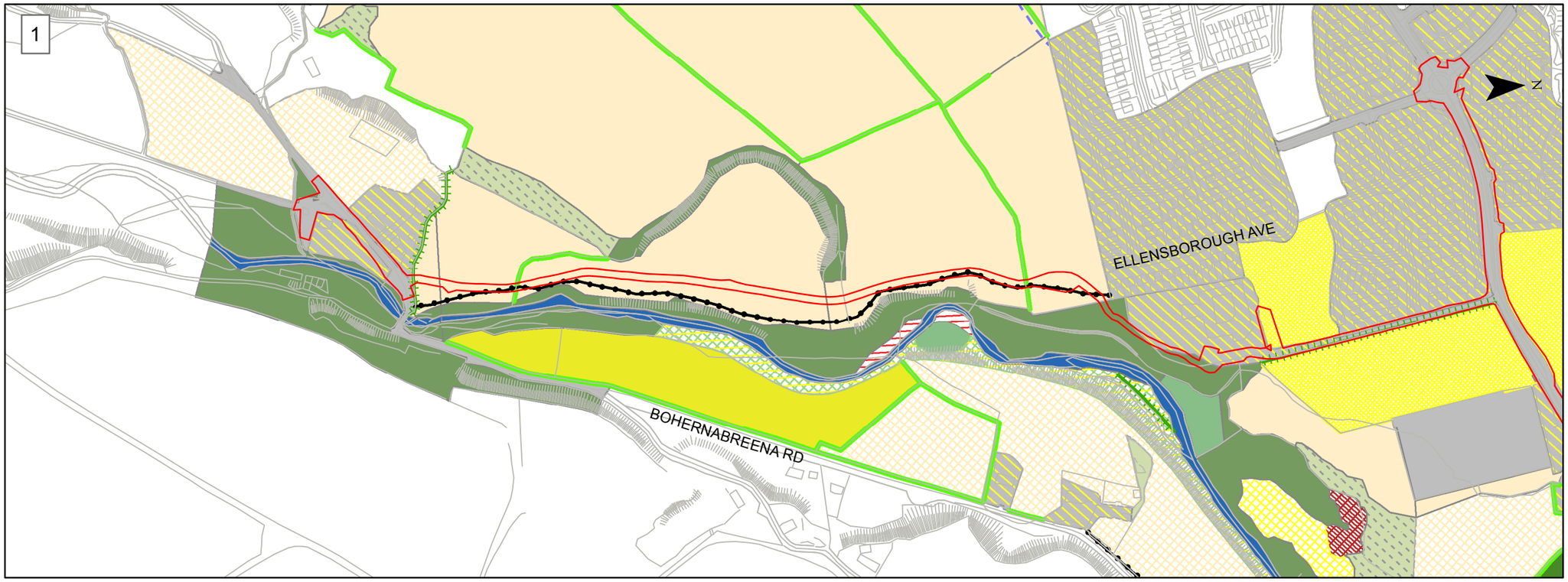
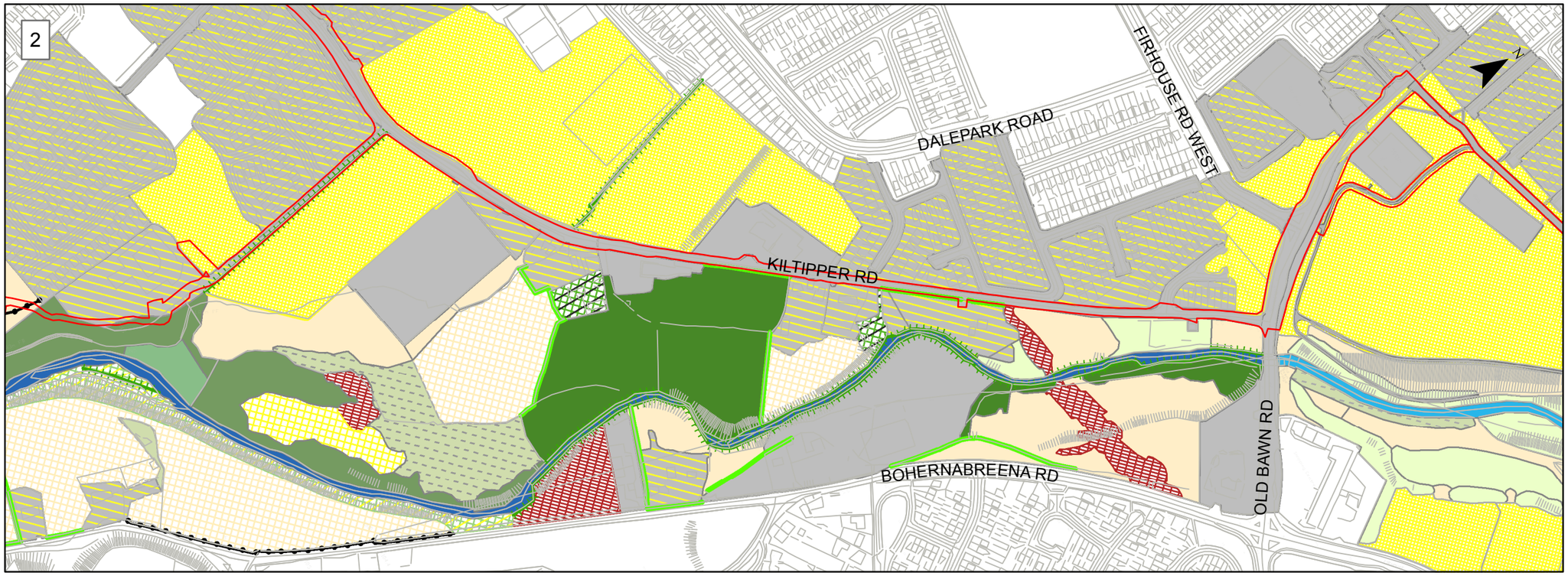
APPENDIX C
Habitat Mapping





LEGEND:

Linear Features
- Proposed Dodder Greenway Route
- BL1 - Stone walls and other stonework
- BL2 - Earth banks
- BL3 Buildings and artificial surfaces
- FW4 - Drainage Ditch
- WL1 - Hedgerows
- WL2 - Treelines

Cultivated and Built land
- BL2 - Earth bank
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- BL3 \ GA2 - Buildings and gardens

Exposed rock and disturbed ground
- ED1 - Exposed sand, gravel or till
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- ED5 - Refuse and other waste
- ER1 - Exposed siliceous rock

Freshwater
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- FL8 - Artificial Ponds
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- GS1 - Dry calcoreous and neutral grassland
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- GS4 - Wet Grassland

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- WD1 - WS1
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- WD2 - Mixed broadleaved/conifer woodland
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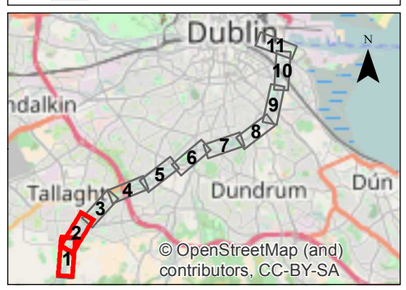

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Project Title: DODDER GREENWAY

Drawing Title: HABITAT MAPPING
SHEET 1 OF 6

Designed:	Checked:	Approved:	Status:	Date:	Job No:	Drawing No:	Rev:
POS	RWP	BC	Planning	May 2017	14.223	Figure 9	

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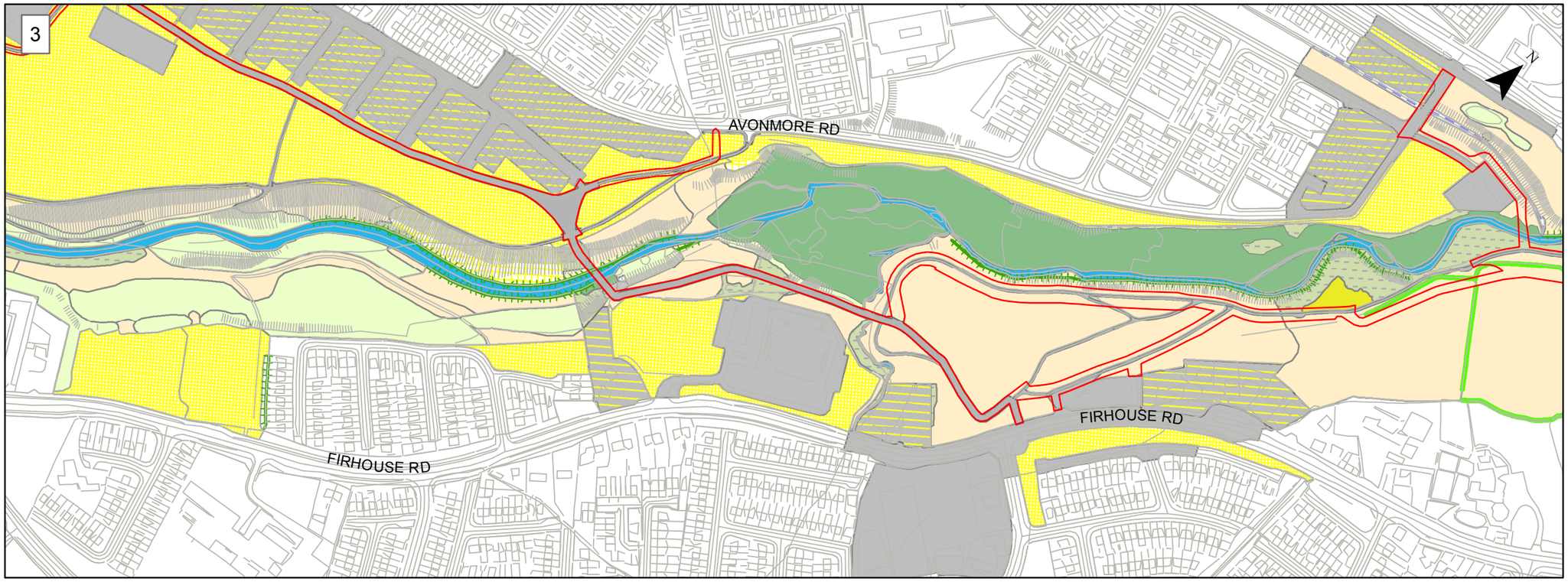

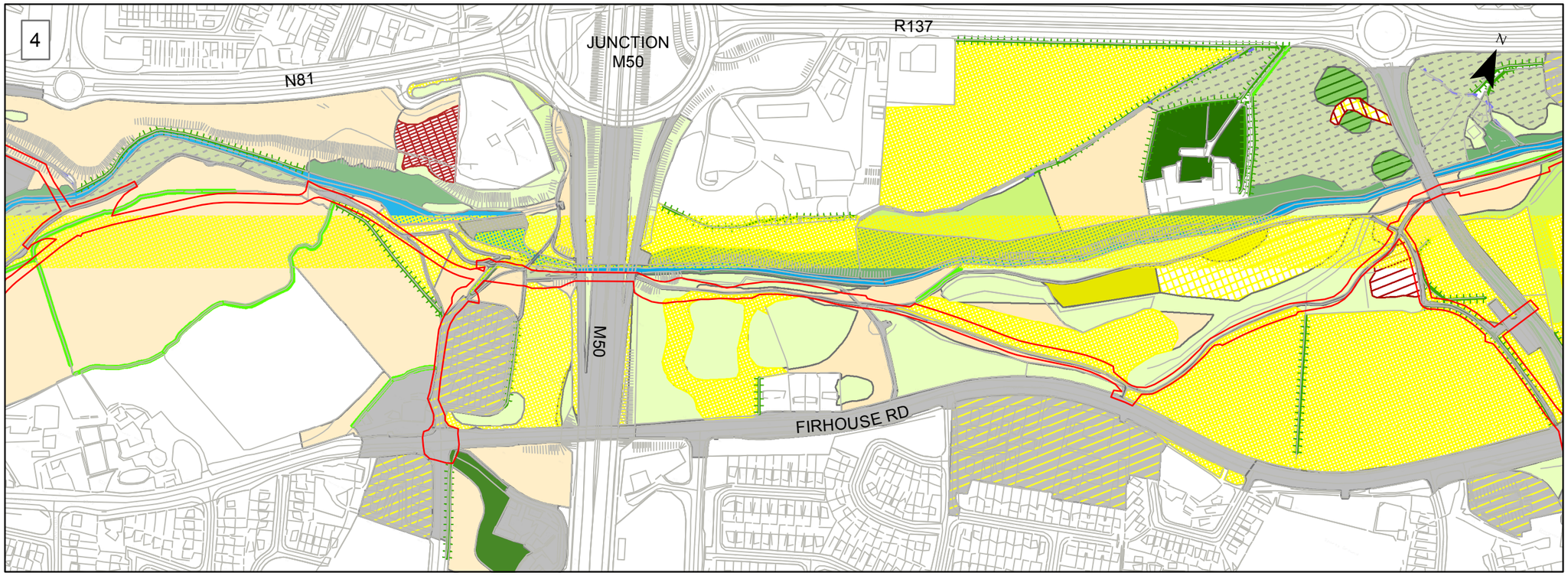

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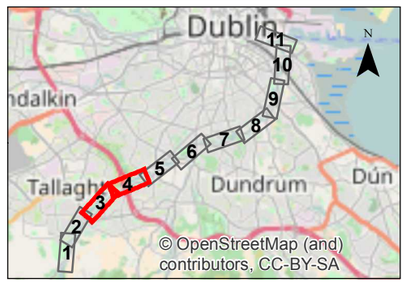

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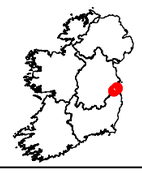

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Project Title: DODDER GREENWAY

Drawing Title: HABITAT MAPPING
SHEET 2 OF 6

Designed:	Checked:	Approved:	Status:	Date:	Job No:	Drawing No:	Rev:
POS	RWP	BC	Planning	May 2017	14.223	Figure 10	
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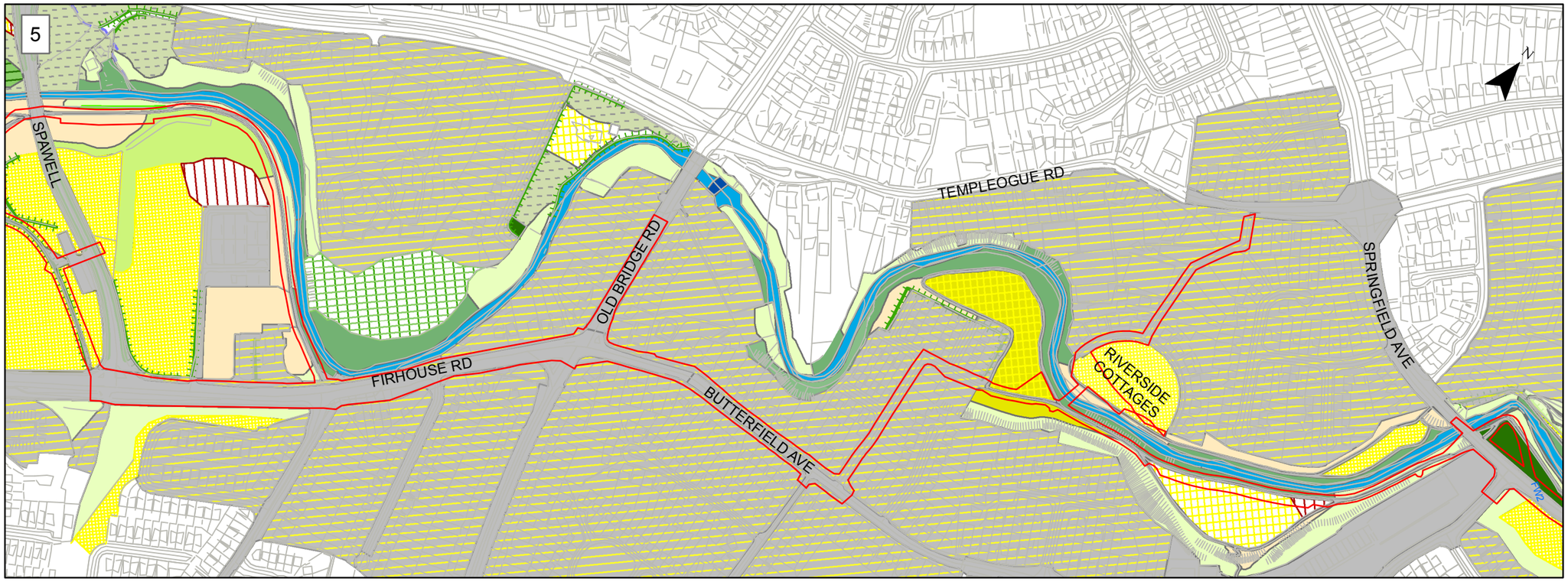

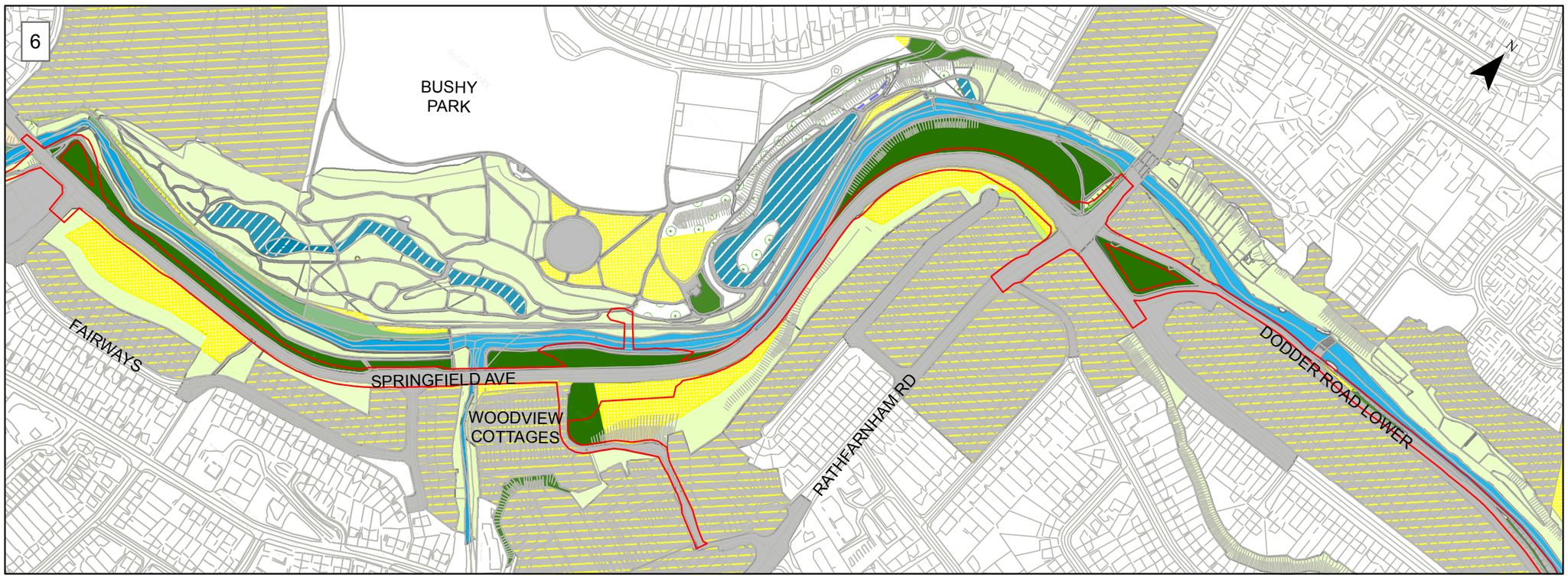

LEGEND:

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- WL1 - Hedgerows
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- FW1 - Eroding/upland rivers
- FW2 - Depositing/lowland River
- FW3 - Canals

Grassland and Marsh
- GA1 - Improved agricultural grassland
- GA2 - Amenity Grassland
- GA2 - WS3
- GM1 - Marsh
- GS1 - Dry calcoreous and neutral grassland
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- GS4 - Wet Grassland

Woodland and Scrub
- WD1 - Broadleaved Plantation
- WD1 - WS1
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- WD2 - Mixed broadleaved/conifer woodland
- WD3 - (Mixed) Conifer Woodland
- WD5 - Scattered trees and parkland
- WD5 \ BL3
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- WN2 - Oak-ash-hazel woodland
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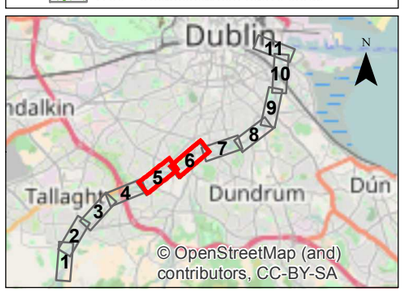

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Project Title: DODDER GREENWAY

Drawing Title: HABITAT MAPPING
SHEET 3 OF 6

Designed	Checked	Approved	Status	Date	Job No	Drawing No	Rev
POS	RWP	BC	Planning	May 2017	14.223	Figure 11	

Scale: 1:5000 @ A3 Drawn: MM

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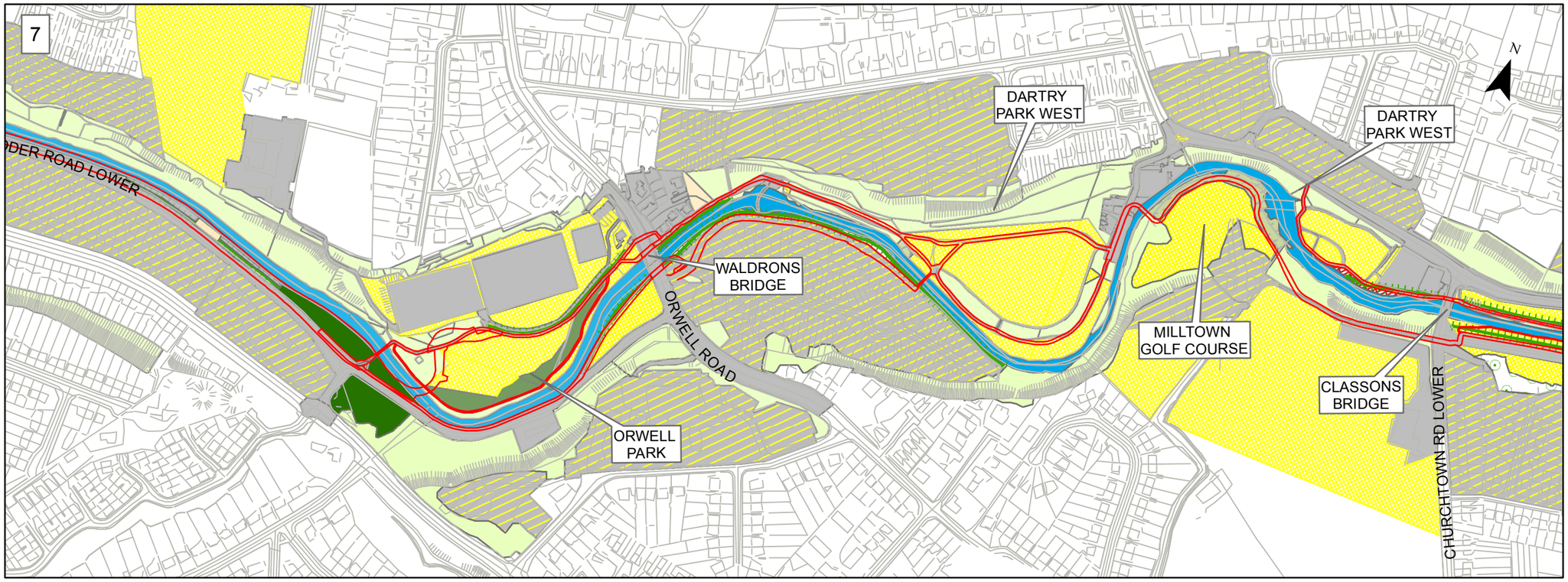

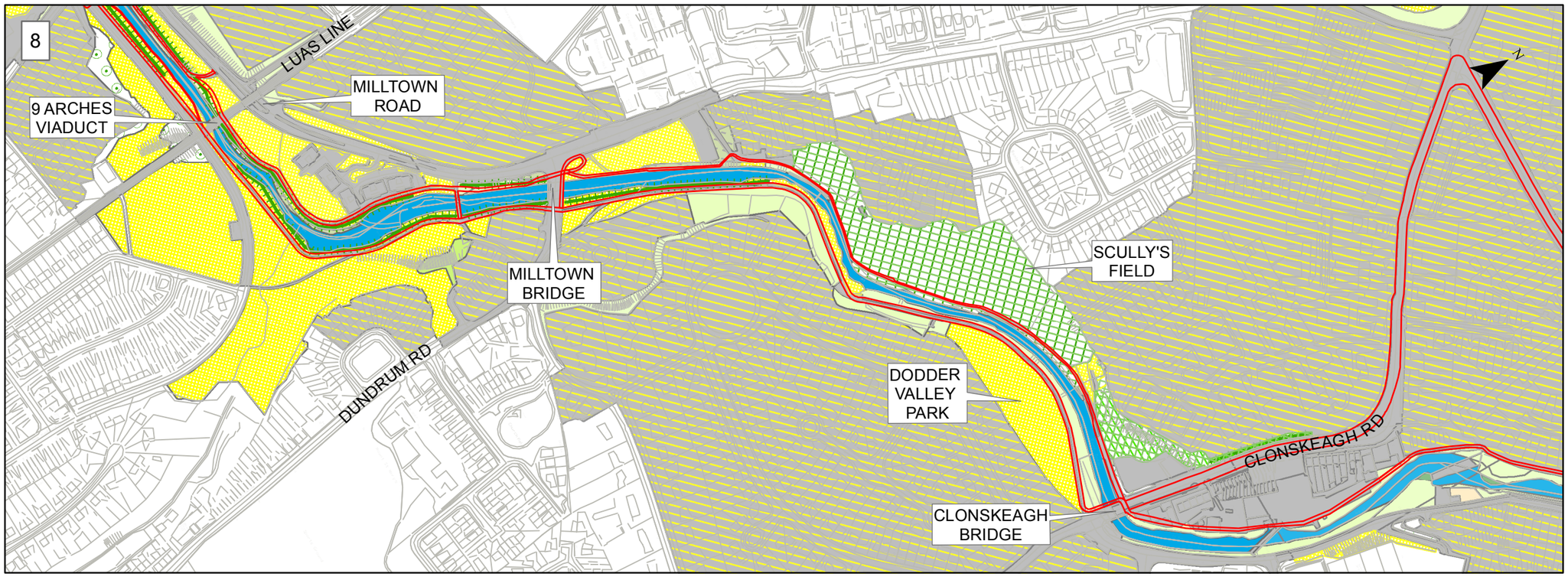

LEGEND:

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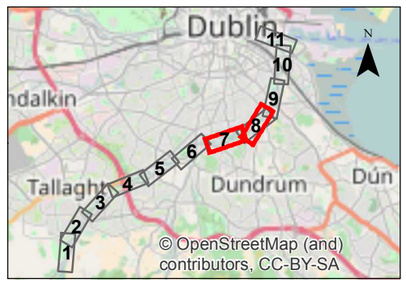

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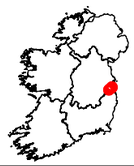

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Project Title: DODDER GREENWAY

Drawing Title: HABITAT MAPPING
SHEET 4 OF 6

Designed:	Checked:	Approved:	Status:	Date:	Job No:	Drawing No:	Rev:
POS	RWP	BC	Planning	May 2017	14.223	Figure 12	

Scale: 1:5000 @ A3 Drawn: MM

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9

CLONSKEAGH RD

HERBET PARK

N11

ANGLESEA BRIDGE

ANGLESEA RD

RDS
SHOWGROUNDS

N

10

BALLBRIDGE

MERRION RD

LANSDOWNE
RAILWAY
BRIDGE

LANSDOWNE RD

AVIVA
STADIUM

BATH AVE

LONDON
BRIDGE

LANSDOWNE
ROAD BRIDGE

N

LEGEND:

Linear Features

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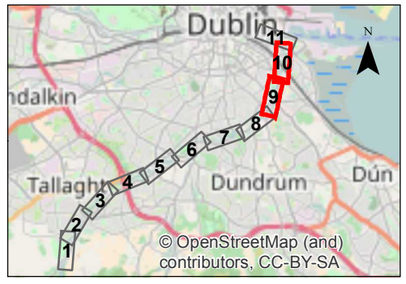

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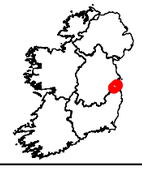

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Project Title: DODDER GREENWAY

Drawing Title: HABITAT MAPPING
SHEET 5 OF 6

Designed: POS	Checked: RWP	Approved: BC	Status: Planning

Date:	Job No:	Drawing No:	Rev:
May 2017	14.223	Figure 13	
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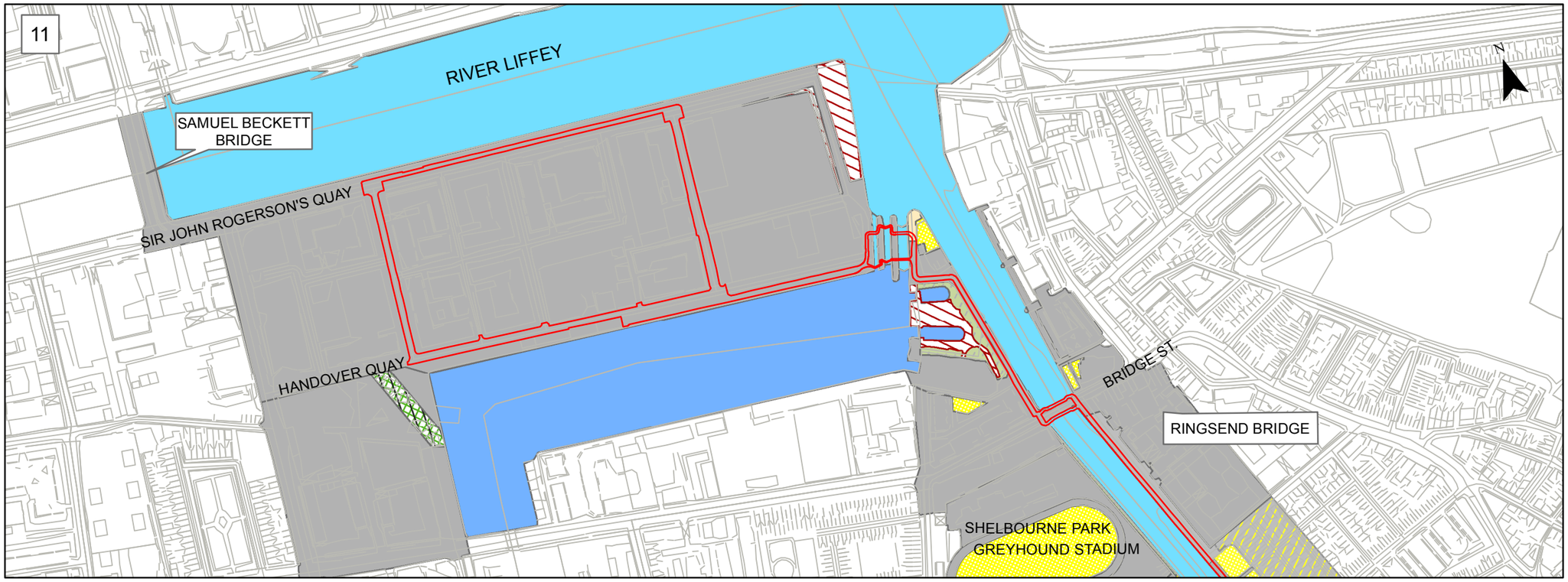

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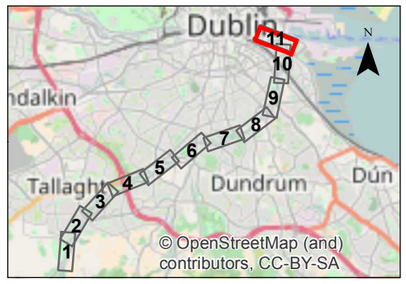

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Comhairle Contae County Council

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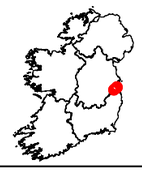

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Project Title: DODDER GREENWAY

Drawing Title: HABITAT MAPPING
SHEET 6 OF 6

Designed:	Checked:	Approved:	Status:	Date:	Job No:	Drawing No:	Rev:
POS	RWP	BC	Planning	May 2017	14.223	Figure 14	

Scale: 1:5000 @ A3 Drawn: MM

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APPENDIX D
Invasive Alien Plant Species (IAPS) Management Plan

Dodder Greenway

Ecological Impact Assessment (EcIA)

Appendix D - RIVER CORRIDOR IAPS MANAGEMENT PLAN

June 2017

Client:
South Dublin County Council
Civic Offices
Tallaght
Dublin 24

Consulting Engineer:
Roughan & O'Donovan
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Dodder Greenway
Ecological Impact Assessment (EcIA)
RIVER CORRIDOR IAPS MANAGEMENT PLAN

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1.1 Introduction

Between March and August 2016, an invasive species survey was undertaken along the river corridor and the route of the Greenway to identify species listed under the Third Schedule Parts 1 and 3 of the European Communities (Birds and Natural Habitats) Regulations 2011-2015 (SI 477/2011, as amended.

A key concern of the development of the Greenway is the potential risks associated with certain invasive species and the spread as a result of construction. To that end, this report provides an Invasive Species Management Plan for the Site.

This report presents the findings of an invasive species desk study and survey of the Site undertaken to inform the Management Plan. The objectives for this assessment are:

- To review publicly available records on invasive species that may be present within the Site;
- To identify and map invasive species extent and broadly describe the associated habitats within the Site impacts and environmental sensitivities;
- To evaluate the risk that invasive species pose to the Site (including re-infestation from surrounding land); and,
- To provide clear instruction and timeline on effective invasive species control measures.

The survey identified the following invasive species:

- Japanese Knotweed (*Fallopia japonica*)
- Himalayan Balsam (*Impatiens glandulifera*)
- Spanish Bluebell and hybrids (*Hynacinthoides hispanica*)
- Giant Rhubarb (*Gunnera tinctoria*)
- American Skunk Cabbage (*Lysichiton americanus*)

The results of the surveys are illustrated in Appendix B.

1.2 Legislative Context

In the course of devising and implementing the most effective eradication methods, the Invasive Alien Plant Species (IAPS) Management Plan must comply with all legislation regulating the treatment and management of IAPS. The relevant standards and legislation that will dictate how eradication is undertaken include:

- European Communities (Plant Protection Products) Regulations, 2012 (S.I. No.159 of 2012);
- European Communities (Sustainable Use of Pesticides) Regulations, 2012, (S.I. No.155 of 2012);
- Waste Management Acts, 1996 to 2013, and related legislation;
- Safety, Health and Welfare at Work Act, 2005;
- Safety, Health and Welfare at Work (Construction) Regulations, 2013;
- Safety, Health and Welfare at Work (General Application) Regulations, 2007;
- Safety, Health and Welfare at Work (Chemical Agents) Regulations, 2001;
- European Communities (Birds and Natural Habitats) Regulations, 2011 to 2015; and,
- Wildlife Acts 1976-2012.

To comply with Sustainable Use of Pesticides Legislation, the application of herbicide should only be undertaken by registered professional users. Only a Registered Pesticide Advisor (RPA) should approve procedures prior to Works commencing. All professional users should demonstrate proper use, ensuring only authorised products are used and all treatments are catalogued and documented pursuant to the requirement of Plant Protection Products Regulations.

In scenarios where disturbance, movement and disposal of invasive species material is required, the RPA will review applications submitted to the relevant licensing authorities prior to Works.

1.3 Brief Description of Corridor Management Plan

The purpose of the Management Plan is to prevent further spread of IAPS within and outside of the Site. The measures outlined in this management plan are based on the following best practice guidelines:

- EA (2006) The Knotweed Code of Practice: Managing Japanese knotweed on development Sites. Environment Agency (England & Wales), Bristol;
- Kelly, J., Maguire, C.M. and Cosgrove, P.J. (2008) Best Practice Management Guidelines Himalayan balsam Impatiens glandulifera. Prepared by Invasive Species Ireland for the NIEA and the NPWS; and,
- Armstrong, C., Osborne, B., Kelly, J. and Maguire, C.M. 2009. Giant Rhubarb (*Gunnera tinctoria*) Invasive Species Action Plan. Prepared for NIEA and NPWS as part of Invasive Species Ireland.

The Knotweed Code of Practice was published by the Environment Agency for the England & Wales. The code of practice has been developed by experts in the control of knotweeds, and has been informed by the successes and failures of hundreds of knotweed management plans. Therefore, it is widely accepted to represent the current best practice in the treatment of Japanese knotweed in the British Isles.

The *Best Practice Management Guidelines* for Himalayan balsam and Giant Rhubarb were produced by Invasive Species Ireland for the NIEA and the NPWS and represent the most widely accepted guidance on the treatment and management of those species in Ireland. Spanish Bluebell and American Skunk Cabbage occurred intermittently and can be dug out and composted.

1.4 Control and Management Measures for Invasive Species

This section contains a description of the most suitable control measures for Japanese Knotweed, Himalayan Balsam and Giant Rhubarb. As part of the Management Plan different methods can be used for each species, the most appropriate available measures for each species are outlined below.

1.4.1 Management Options for Japanese Knotweed

Main Options for Japanese Knotweed Control:

- Chemical control;
- Excavation and burying;
- Excavation and disposal to licensed landfill / incinerator;
- Bunding and treatment; and,
- Soil Screening

The appropriate management strategy will be determined by site conditions and in consultation with South Dublin County Council, Dublin County Council, Dún Laoghaire-Rathdown County Council and National Parks & Wildlife Service in terms of the most suitable management strategy from a programme perspective. There are a number of issues which will affect the management strategy on the Site including the following:

- Accessibility and space available
- Transboundary (local planning authority) issues
- Proximity to the River Dodder and open water
- Proximity to environmentally sensitive areas
- Proximity to areas used by the general public and/ or defined vulnerable groups.

1.4.2 Chemical Control Option

This option involves application of herbicides in situ until there is no re-growth of plant material. This may take c.3-5 years and would require repeated survey and re-treatment each year until the Japanese Knotweed has been eradicated from the Corridor. If highly persistent herbicides are used, it may be possible to eradicate the plant within one or two years. However, since this will not be appropriate given the ecological significance of the River Dodder, the use of less-persistent herbicides (e.g. Glyphosphate) will be necessary to re-treat regularly in years two and three, and then to conduct annual spot-checks in May-June of subsequent years to identify and retreat any re-growth. Japanese Knotweed does not produce viable seed in Ireland.

The current most widely recommended chemical for Japanese Knotweed control is Glyphosate which breaks down in the soil relatively quickly. Glyphosate is potentially damaging to non-target plants. Great care is therefore necessary during application of this herbicide and should be used in compliance with the product label in accordance with Good Plant Protection Practice as prescribed in the European Communities (Authorization, Placing on the Market, Use and Control of Plant Protection Products) Regulations, 2003 (S.I. No. 83 of 2003).

As the majority of herbicides rely on the presence of living foliage for them to be effective, it is important to consider whether the Knotweed is in leaf or is dormant when choosing a suitable herbicide. As the majority of herbicides are not effective during the winter dormant stage, the most effective time to apply a non-persistent herbicide, such as Glyphosate, is ideally between May and September when the plant is in leaf. This will stunt the growth of the plant, consequently reducing the amount of viable above ground material and the height of the stand.

For infestations, products containing 2,4-D Amine can be used. 2,4-D Amine has the advantage of being selective and specific to broadleaved plants. However, in general, it has a greater persistency when compared to Glyphosate. Products containing 2,4-D Amine should be applied in May with a follow up treatment in late September or early October. Care is required in the selection of the appropriate product and method of application.

In making the selection of which herbicide to use, regard should be had to, inter alia: the abundance of the Japanese Knotweed; the location of the stand(s); the proximity and nature of sensitive receptors; and, the season.

1.4.3 Non-Chemical Control

These options are applied in situations where eradication is required within a short space of time. Non-chemical methods typically involve excavation and disposal of infected top soils and/or plant material via a licensed landfill and the use of both vertical and horizontal root barrier membranes. The best practice management recommendations for a corridor wide long term IAPS management plan therefore should involve in situ treatment.

1.4.4 Limitations and Threats to Control Measures

The primary Site management objective is to eradicate and prevent the spread of the IAPS as a result of the Works. The primary risk is during the Site preparation and construction phases when the excavation of materials and movement of vehicles potentially transporting contaminated material can facilitate the spread of IAPS such as Japanese Knotweed. The presence of Japanese Knotweed in particular may result in limitations to overall Site management objectives during the construction process in particular, through the following:

- Delays in scheduling of works, due to treatment of identified locations.
- Structural damage or future potential damage caused by the plant.
- Potential for spread of Japanese Knotweed from within and outside the Site boundary (e.g. within the Site or from adjacent land).

The type of herbicide applied and the timing of treatment should be cognisant of members of the public, children and animals in the vicinity. The Japanese Knotweed should be treated with a non-persistent herbicide (certain plant protection products containing glyphosate are non-persistent). It is important to note that certain plant protection products have a specified period of 'activity,' which will be described on the product label and which will dictate when the product can be applied.

1.4.5 Recommended Management Measures

Herbicide should be applied to the above ground stems in situ using an approved herbicide. The most effective time to apply herbicides is from July to October (or before cold weather causes leaves to discolour and fall). Spring treatment is acceptable, but less effective.

Stem injection is recognised as an effective treatment method for Japanese Knotweed in environmentally sensitive areas, i.e. within protected sites, or where risks of spray drift to horticultural crops, amenity plantings, gardens and waterbodies are identified. This method can only be undertaken with a registered product consistent with its label. At present Barclay Gallup Biograde 450 (PCS No 02434) and Glyphos Supreme

(PCS No 02832) are products that make provision for this application technique and this method should be implemented within this Management Plan.

Following treatment, dead canes should be cut and removed during winter for subsequent incineration or disposal off site. It will be necessary to ensure that the removed canes are carefully set aside on a suitable membrane surface until they have dried to a deep brown colour and are certain to be dead. Alternatively in the case where disposal is an option, the canes can be double-bagged and disposed of at a licensed waste facility where: (a) the facility have been informed in advance of the nature of the waste material; (b) the facility is licensed to accept this material; and, (c) the facility is prepared to accept the material; Apply herbicide according to the manufacturer's guidelines; and, check for new growth at 4 - 6 week intervals after treatment and re-treat accordingly.

1.4.6 Management of Himalayan balsam

Himalayan balsam is found almost continuously along the river bank of the River Dodder, including within the works area. The large extent of the infestation makes eradication of Himalayan balsam from the Site impractical.

If works are to take place during the period in which Himalayan balsam is in seed, removal of all Himalayan balsam from the works area before the plants go to seed is recommended as the most effective method to avoid dispersal of seeds within the Site. This will entail pulling by hand all Himalayan balsam in the works area and leaving them in a pile to rot. This work should be carried out in April or in early May (when shoots are visible but have not yet gone to seed).

Movement of soil and equipment within the Site also poses a risk of spread Himalayan balsam seeds, which can survive in the seedbank for up to 18 months. All equipment shall be washed using a hard brush or power washer to ensure no soil leaves the works area.

1.4.7 Management of Giant Rhubarb

Giant Rhubarb was record on the island in the lower lake in Bushy Park and along the river bank in Milltown Park. This is not in the immediate vicinity of the works and therefore only herbicide treatment is considered. It is liable to spread downstream by seed. The most effective way to treat Giant Rhubarb is with the Injection of herbicides.

This involves using a drill to make small wells in the rhizome that are then filled with herbicide. Several wells should be made along the rhizome as translocation can be slow and the herbicide may only penetrate small sections of the rhizome. This method is labour intensive, but the effects on the neighbouring environment are minimised.

1.5 Herbicide Preparation and Use

While Glyphosate does not absorb easily through the skin, it is good practice to use gloves, protective eye wear and appropriate water resistant work clothing during application. To prevent accidental ingestion, Glyphosate should be stored in its original labelled container and when not in use should be stored under lock and key under conditions specified by the manufacturer. Hands should always be thoroughly washed before eating or smoking to prevent ingestion. As it takes approximately 6 hours for Glyphosate to be taken up by plants, children and animals can touch and accidentally ingest Glyphosate.

While using Glyphosate it is paramount that clearly visible signs stating the use of pesticide and its risk to children and dogs are in place until treated plants are dry. Symptoms of ingestion by humans and animals consist of: burns to the mouth and throat, salivating, nausea, vomiting and diarrhoea. Animals may also go off food and appear sleepy. If pesticide ingestion is suspected medical treatment should be sought immediately.

Glyphosate has a low known toxic effect on aquatic life, however water for mixing of a 10% solution should be sourced from a private source (pre-collected and stored). It is very important that the Safety, Health and Welfare at Work (Chemical Agents) Regulations, 2001 as well as the European Communities (Authorisation, Placing on the Market, Use and Control of Plant Protection Products) Regulations, 2003 are consulted.

1.6 How Actions will be Evaluated

The success of the management plan will be based on the eradication of the invasive species from the works area. This will be ascertained by pre-construction surveys.

1.7 Training and Operative Competency

To comply with the Quality Control procedures for Sustainable Use of Pesticides Legislation, the application of herbicide can only ever be undertaken by registered professional users. Registered Pesticide Advisors (RPA) can provide Quality Control by approving procedures prior to Works. Professional users will also demonstrate proper use, ensuring only authorised products are used and all Works are catalogued and documented pursuant to the requirement of Plant Protection Products Regulations. These documents and practices will also need to be reviewed by the RPA.

It is advised that the developer/contractor should refer to the following documents, which provides detailed recommendations for the control of invasive species and noxious weeds:

- Chapter 6 and Appendix 3 of the TII Publication *The Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads* (TII, 2008a)
- *Invasive Species Ireland Best Practice Management Guidelines for Japanese Knotweed* [Available online at http://invasivespeciesireland.com/toolkit/invasive-plant-management]
- *The Knotweed Code of Practice: Managing Japanese Knotweed on development Sites* (UK Environment Agency ,2006)

These documents include measures to aid the identification of relevant species, with details for the timing, chemicals and methodology for chemical control, and for measures to avoid environmental damage during the use of herbicides. It is recommended that all contractors should prepare a specific plan in accordance with the relevant guidelines.

1.8 Health & Safety

An appropriate risk assessment, which includes Health & Safety considerations, should be carried out before any control or survey work is undertaken. Protective clothing must be worn when attempting control. All works to be compliant with the Safety, Health and Welfare at Work Act, 2005 as well as the Safety, Health and Welfare at Work (General Application) Regulations, 2007; 6).

Chainsaws should only be used by those with appropriate training and skill. The use of chainsaws should adhere to the 'Guide to Safe Working with Timber and Chainsaws'. Chainsaws and equipment should be maintained and correct protective equipment should be used at all times (HSA, 2010).

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