ESTUARY
Park & Ride
SEATOWN
SWORDS CENTRAL
FOSTERSTOWN
DUBLIN AIRPORT
DARDISTOWN
NORTHWOOD
BALLYMUN
COLLINS AVENUE
GRIFFITH PARK
GLASNEVIN
MATER
O'CONNELL STREET
TARA
ST STEPHEN'S GREEN
CHARLEMONT

15 Biodiversity

Contents

List of Abbreviations

Acronym	Meaning
BBS	British Biological Society
BCI	Bat Conservation Ireland
BCT	Bat Conservation Trust
BoCCI	Birds of Conservation Concern in Ireland
BoD	Biochemical Oxygen Demand
BS	British Standards
BSBI	Botanical Society of Britain & Ireland
BTO	British Trust for Ornithology
CBS	Countryside Bird Survey
CEC	Commission of the European Communities
CIEEM	Chartered Institute of Ecology and Environmental Management
CPUE	Catch Per Unit Effort
CSZs	Core Sustenance Zones
DANP	Dublin Airport North Portal
DASP	Dublin Airport South Portal
DC	Direct Current
DCC	Dublin City Council
DECC	Department of the Environment, Climate and Communications
EC	European Commission
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EPA	Environmental Protection Agency
ESBN	Electricity Supply Board Network
EU	European Union
FCC	Fingal City Council
FEM	Finite Element Method
FRAM	Flood Risk Assessment and Management
GE	General Employment
GoA4	Grade of Automation 4
GSWR	Great Southern and Western Railway
HA	High Amenity
HT	High Technology
IFI	Inland Fisheries Ireland
ILP	Institute of Lighting Professionals
KER	Key Ecological Receptor
LOD	Limits of Deviation
MGWR	Midland Great Western Railway
NBDC	National Biodiversity Database
NHA	Natural Heritage Area
NIS	Natura Impact Statement
NPWS	National Parks and Wildlife Services

Acronym	Meaning
NRA	NRA
OCC	Operations Control Centre
OCR	Overhead Contact Rail
OS	Open Space
OSI	Ordnance Survey Ireland
PRF	Potential Roost Feature
RBMP	River Basin Management Plan
RPA	Root Protection Area
RU	Rural
SAC	Special Area of Conservation
SCI	Special Conservation Interests
SNH	Scottish Natural Heritage
SPA	Special Protection Area
SUDS	Sustainable Drainage Systems
TBM	Tunnel Boring Machine
TII	Transport Infrastructure Ireland
TPO	Tree Preservation Order
UV	Ultraviolet
WWTP	Wastewater Treatment Plant
ZoI	Zone of Influence

15. Biodiversity

15.1 Introduction

This Chapter of the Environmental Impact Assessment Report (EIAR) assesses the impact of the MetroLink Project (hereafter referred to as the proposed Project), on Biodiversity during the Construction Phase and Operational Phase. In accordance with the requirements of Directive 2011/92/EU, as amended by Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 on the assessment of the effects of certain public and private projects on the environment (i.e. the EIA Directive), it describes and assess the likely direct and indirect significant effects of the proposed Project on Biodiversity, with particular attention to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC. This Chapter also provides a characterisation of the receiving environment within the proposed Project and within a wider study area in the vicinity of the proposed Project.

The EIA Directive does not provide a definition of biodiversity. The Convention on Biological Diversity, however, gives a formal definition of biodiversity in its article 2: "*biological diversity means the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems*". Alongside the term "*biodiversity*" the terms "*ecology*" and "*ecological*" are also used throughout this Chapter as a broader term to consider the relationships of biodiversity receptors to one another and to their environment.

This Chapter should be read in conjunction with the following Chapters, and their Appendices, which present related impacts arising from the proposed Project and proposed mitigation measures to ameliorate the predicted impacts:

- Chapter 13 (Airborne Noise & Vibration);
- Chapter 16 (Air Quality);
- Chapter 18 (Hydrology);
- Chapter 19 (Hydrogeology); and,
- Chapter 27 (Landscape & Visual).

Limits of deviation have been set for the proposed Project and this is addressed in the Wider Effects Report annexed at Appendix A5.19.

This Chapter also refers to the Appropriate Assessment Screening Report (hereafter referred to as the AA Screening Report) and the Natura Impact Statement (hereafter referred to as the NIS) which have also been prepared and submitted with the application for approval, so as to enable the Board, as competent authority, to carry out the assessments required pursuant to Article 6(3) of Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (hereafter referred to as "the Habitats Directive" documents).

The assessment presented in this Chapter identifies, describes and assesses the likely direct and indirect significant effects arising from the proposed Project as described in Chapters 4 to 6. The proposed Project description is based on the design prepared to inform the planning stage of the project and to allow for a robust assessment as part of the Environmental Impact Assessment (EIA) Process.

In the event where it is required to make assumptions as to the basis of the assessment presented here, these assumptions are based on advice from competent project designers and are clearly outlined within the Chapter.

The chapter is set out as follows:

- Section 15.2 presents the methodology;
- Section 15.3 describes the existing baseline environment;

- Section 15.4 evaluates the predicted impacts of the proposed Project on biodiversity;
- Section 15.5 describes the measures proposed to mitigate these impacts;
- Section 15.6 describes the residual impacts;
- Section 15.7 describes the difficulties encountered in compiling information;
- Section 15.8 describes the compensatory measures proposed to address the residual impacts;
- Section 15.9 provides a summary of the Chapter; and
- Section 15.11 are the references quoted throughout the chapter.

Table 15.1 presents an outline of where the various groupings of ecological receptors are discussed in this chapter, for ease of reference.

Table 15.1 Ecological Receptors Presented within this Chapter

Ecological Receptor	Information Presented	Section Reference
Designated Areas for Nature Conservation	Receiving Environment	15.3.3
	Evaluation of Impacts	15.4.2.1 and 15.4.3.1
	Mitigation Measures	15.5.1.1 and 15.5.2.1
	Residual Impacts	15.6.1
	Compensation	n/a
Habitats	Receiving Environment	15.3.4
	Evaluation of Impacts	15.4.2.2 and 15.4.3.2
	Mitigation Measures	15.5.1.2 and 15.5.2.2
	Residual Impacts	15.6.2
	Compensation	n/a
Rare and protected plant species	Receiving Environment	15.3.5
	Evaluation of Impacts	15.4.2.3 and 15.4.3.3
	Mitigation Measures	15.5.1.3 and 15.5.2.3
	Residual Impacts	15.6.3
	Compensation	n/a
Non-native invasive plant species	Receiving Environment	15.3.6
	Evaluation of Impacts	n/a
	Mitigation Measures	n/a
	Residual Impacts	n/a
	Compensation	n/a
Otter	Receiving Environment	15.3.7.1
	Evaluation of Impacts	15.4.2.4.1 and 15.4.3.4.1
	Mitigation Measures	15.5.1.4 and 15.5.2.4
	Residual Impacts	15.6.4.1
	Compensation	n/a
Bats	Receiving Environment	15.3.7.2
	Evaluation of Impacts	15.4.2.4.2 and 15.4.3.4.2
	Mitigation Measures	15.5.1.5 and 15.5.2.5
	Residual Impacts	15.6.4.2
	Compensation	n/a
Badgers	Receiving Environment	15.3.7.3
	Evaluation of Impacts	15.4.2.4.3 and 15.4.3.4.3
	Mitigation Measures	15.5.1.6

Ecological Receptor	Information Presented	Section Reference
	Residual Impacts	15.6.4.3
	Compensation	n/a
Other Mammal Species	Receiving Environment	15.3.7.4
	Evaluation of Impacts	15.4.2.4.4 and 15.4.3.4.4
	Mitigation Measures	15.5.1.7 and 15.5.2.6
	Residual Impacts	15.6.4.4
	Compensation	n/a
Aquatic macro-invertebrates, including white-clawed crayfish	Receiving Environment	15.3.8
	Evaluation of Impacts	15.4.2.5 and 15.4.3.5
	Mitigation Measures	15.5.1.8 and 15.5.2.7
	Residual Impacts	15.6.5
	Compensation	n/a
Breeding Birds	Receiving Environment	15.3.9.1
	Evaluation of Impacts	15.4.2.6.1 and 15.4.3.6.1
	Mitigation Measures	15.5.1.9 and 15.5.2.8
	Residual Impacts	15.6.6.1
	Compensation	n/a
Wintering Birds	Receiving Environment	15.3.9.2
	Evaluation of Impacts	15.4.2.6.2 and 15.4.3.6.2
	Mitigation Measures	15.5.1.10 and 15.5.2.9
	Residual Impacts	15.6.6.2
	Compensation	n/a
Amphibians	Receiving Environment	15.3.10
	Evaluation of Impacts	15.4.2.7 and 15.4.3.7
	Mitigation Measures	15.5.1.11 and 15.5.2.10
	Residual Impacts	15.6.7
	Compensation	n/a
Reptiles	Receiving Environment	15.3.11
	Evaluation of Impacts	15.4.2.8 and 15.4.3.8
	Mitigation Measures	15.5.1.12
	Residual Impacts	15.6.8
	Compensation	n/a
Fish	Receiving Environment	15.3.12
	Evaluation of Impacts	15.4.2.9 and 15.4.3.9
	Mitigation Measures	15.5.1.13 and 15.5.2.11
	Residual Impacts	15.6.9
	Compensation	n/a

Along with baseline surveys that were carried out , this Chapter also refers to relevant information gathered during the alignment options study for the proposed Project to inform the biodiversity impact assessment. Sections 4.2.2.2, 4.3.2.2, 4.4.2.2, 7.2, 7.3 and 7.4 of the Alignment Options Report examined the biodiversity constraints within the scheme study area and compared the potential biodiversity impacts of the respective alignment corridors. These sections of the Alignment Options Report contributed to the design of the proposed Project which this chapter assesses. Following on from this, a

scoping exercise undertaken for the proposed Project identified numerous key ecological receptors within the study area that could potentially be impacted by the proposed Project. These key ecological receptors are examined in detail in this chapter.

A full description of the proposed Project is provided in the following chapters of this EIAR:

- Chapter 4 (Description of the MetroLink Project);
- Chapter 5 (MetroLink Construction Phase); and
- Chapter 6 (MetroLink Operations and Maintenance).

Table 15.2 presents an outline description of the key proposed Project elements which are appraised in this Chapter. Diagram 15.1 presents an outline of the main elements of the proposed Construction Phase that are appraised in this Chapter and

Diagram 15.2 presents an outline of the main elements of the Operational Phase of the proposed Chapter that are appraised in this Chapter.

Table 15.2: Outline Description of the Principal Project Elements which have potential to impact on Biodiversity

Project Elements	Outline Description
Permanent Project Elements	
Tunnels	It is proposed to construct two geographically separate, single-bore tunnels, using a Tunnel Boring Machine (TBM). Each section of tunnel will have a 9.2m outside diameter and will contain both northbound and southbound rail lines within the same tunnel. These tunnels will be located as follows: ▪ The Airport Tunnel: Running south from Dublin Airport North Portal (DANP) under Dublin Airport and surfacing south of the airport at Dublin Airport South Portal (DASP); and ▪ The City Tunnel: Running south from Northwood Portal and terminating underground south of Charlemont Station.
Tunnel Portals	The openings at the end of the tunnel are referred to as portals. They are concrete and steel structures designed to provide the commencement or termination of a tunnelled section of route and provide a transition to adjacent lengths of the route which may be in retained structures or at the surface. There are three proposed portals, which are: ▪ DANP; ▪ DASP; and ▪ Northwood Portal. This portal will be used during the Construction Phase to provide a launching position for the TBM. Following completion of this phase, it will be connected to Northwood Station. There will be no portal at the southern end of the proposed Project, as the southern termination and turnback would be underground.

Project Elements	Outline Description
Stations	There are three types of stations: surface stations, retained cut stations and underground stations: ▪ Estuary Station will be built at surface level, known as a 'surface station'. ▪ Seatown, Swords Central, Fosterstown Stations and the future Dardistown Station will be in retained cutting, known as 'retained cut stations'. ▪ Dublin Airport Station and all 10 stations along the City Tunnel would be underground.
Intervention Shaft	An intervention shaft will be required to provide adequate emergency egress from the tunnel and support tunnel ventilation at Albert College Park. This is because the distance between the consecutive stations at Collins Avenue and Griffith Park is too long to safely support evacuation/emergency service access in the event of an incident. In other locations, ventilation shafts and emergency access will be incorporated into the stations and portals.
Intervention Tunnel	South of Charlemont station and north of DASP, a parallel tunnel is required to the main tunnel to provide emergency access and egress from the main tunnel. The City Tunnel will extend 320m south of Charlemont Station. A parallel evacuation and ventilation tunnel is required from the end of the city tunnel back to Charlemont Station to support emergency evacuation of maintenance staff and ventilation for the tunnel section south of Charlemont. An intervention tunnel is required to provide emergency access and egress from the Airport Tunnel under Dublin Airport and emerge to the south and outside the airport grounds, as the length of the tunnel south from the Dublin Airport tunnel exceeds 1km and it is not safe for railway passengers to be evacuated landside of the airport runways.
Park and Ride Facility	The proposed Park and Ride Facility next to Estuary Station will include provision for up to 3,000 parking spaces.
Broadmeadow and Ward Viaduct	A 260m long viaduct is proposed between Estuary and Seatown Stations, in order to cross the Broadmeadow and Ward Rivers and their floodplains.
Proposed Grid Connections	Grid Connections will be provided via cable routes and new 110kV substations at DANP and Dardistown. (Approval for the proposed grid connections to be applied for separately, but are assessed in the EIAR having regard to cumulative impacts)
Dardistown Depot	A maintenance depot will be located at Dardistown. It will house: ▪ Vehicle stabling; ▪ Maintenance workshops and pits; ▪ Automatic vehicle wash facilities; ▪ A test track; ▪ Sanding System for rolling stock; ▪ The Operations Control Centre for the proposed Project; ▪ A substation; and ▪ Other staff facilities and a carpark.
Operations Control Centre	The main OCC will be located at Dardistown Depot and a back-up OCC will be provided at Estuary.
M50 Viaduct	A 100m long viaduct to carry the proposed Project across the M50 between the Dardistown Depot and Northwood Station.
Operational Stage Discharge Points	The proposed Project will have eight main outfalls to receiving watercourses either directly or indirectly through existing storm sewers. Details of these outfall locations are available in Chapter 18, Section 18.5.4.3. In brief, the outfalls/discharge points will be in the following locations: ▪ A1 (Swords Western Distributor Road)- Unnamed Watercourse ▪ A2 + Estuary Station Parking- Broadmeadow River ▪ B + Existing Road- Ward River ▪ C1- Unnamed Watercourse ▪ C2-D1- Sluice River ▪ D2- Sluice River

Project Elements	Outline Description
	▪ E1 + Depot- Mayne River ▪ E2- Santry River
Temporary Project Elements	
Construction Compounds	There will be 34 Construction Compounds including 20 main Construction Compounds and 14 satellite Construction Compounds required during the Construction Phase of the proposed Project. The main Construction Compounds will be located at each of the proposed station locations, the portal locations and the Dardistown Depot Location (also covering the Dardistown station) with satellite compounds located at other locations along the alignment. Outside of the Construction Compounds there will be works areas and sites associated with the construction of all elements of the proposed Project including an easement strip along the surface sections.
Logistics Sites	The main logistics sites will be located near Pinnock Hill east of the R132 Swords Bypass and north of Saint Margaret's Road at the Northwood Compound.
Tunnel Boring Machine Launch Site	There will be two TBM launch sites. One will be located at DASP which will serve the TBM boring the Airport Tunnel and the second will be located at the Northwood Construction Compound which will serve the TBM boring the City Tunnel.

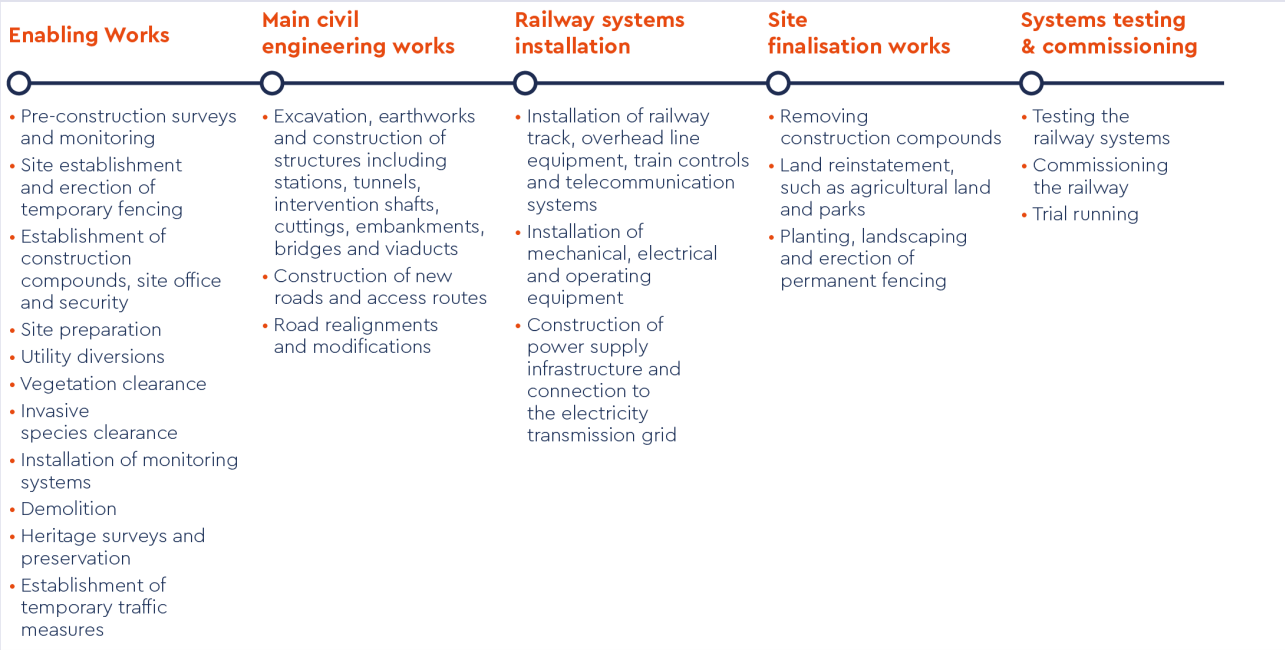

Diagram 15.1: Summary of Key Activities during the Construction Phase of the Proposed Project

Diagram 15.2: Summary of Key Activities during the Operation Phase of the Proposed Project

15.1.1 Proposed MetroLink Grid Connections

Power for the operation of the proposed Project will be provided by Electricity Supply Board Networks Ltd (ESBN). Grid connections will be provided via 110kV underground cable routes, which requires the installation of a number of new transmission cable circuits, and two new Gas Insulated Switchgear (GIS) transmission power substations which will be constructed at DANP and Dardistown. In addition, minor works will be required at two existing utility transmission substations. Planning approval for the proposed grid connections will be applied for separately by ESBN but the agreed grid connections proposal is assessed in this EIAR under the relevant sections.

A detailed project description of the proposed MetroLink Grid Connections (hereafter referred to as the proposed Grid Connections) and associated methodologies can be found in the ESB Advanced Work Package (ESB, 2021) and the Technical Note provided by Mott MacDonald (Mott MacDonald, 2021) The main construction components of the proposed Grid Connections relevant to this Chapter are as follows:

- Cable installation within the existing road corridor: The majority of cable installation works will take place within the existing road corridor. Wherever possible, the underground cable will be pulled into pre-installed ducts laid within a trench. The standard trench dimensions for a 110kV cable are approximately 0.6m wide x 1.25m deep and for a 220kV cable are approximately 1.1m wide and 1.25m deep. Additional space will be required at joint bays and sites of engineering. There may also be a requirement to remove vegetation such as trees in the on-road sections of the cable routes where joint bays and link boxes are required. Following duct installation, the road above the trench will be reinstated to match the environment in which it is installed to the standard required by the relevant authority at that location, in this case Fingal County Council (FCC)/Transport Infrastructure Ireland (TII).
- Cable installation along off-road areas: In some instances, it will be required to install cables in off-road areas. The construction of the cable trench in off-road areas will follow the same principle as cable trenching along road corridors, however, typically a wider working area is used. The trench dimensions for cable installation within the existing road corridor are based on a standard arrangement within the public roadway. For off-road routes, additional space may be required for route alignment to avoid underground objects such as tree roots or other unidentified obstructions that cannot be removed. Vegetation clearance may also be required. As Following cable installation, the site will then be reinstated to its original condition or to the requirements of the relevant authority at that location should these be different.
- Watercourse/bridge crossings: As described under Chapter 18 (Hydrology), existing road bridges over watercourses cannot always accommodate high voltage cables and in such cases, it shall be necessary to pass underneath the watercourse. Crossings of smaller ditches and drains shall be carried out by open trench using damming and overhead pumping. The crossing of streams and rivers shall be carried out by open trench method or trenchless methods. Appropriate measures shall be put in place by the contractor to prevent ground damage on the access routes to watercourse crossings on both banks, particularly where the ground is soft or slopes steeply toward a crossing. This shall prevent solids reaching a watercourse from damaged access tracks. The method adopted shall be implemented only with the approval of Inland Fisheries Ireland (IFI) prior to the commencement of the construction works. Where applicable, the construction shall take place outside the salmon spawning period from October to April, unless otherwise agreed with IFI. The ESB Advanced Work Package (ESB, 2021) contains detailed project specific methodology and associated design measures on each methodology albeit open cut crossing or trenchless installation. The design measures of each methodology will ensure the protection of the watercourse and that there will be no adverse impacts to the receiving environment.
- Horizontal Directional Drilling: As described in a Technical Note provided by Mott MacDonald (Mott MacDonald, 2021), there may be a requirement for horizontal directional drilling (HDD) to avoid utilities and for the crossing of the M1 Motorway. For HDD, the launch and reception pits for the drilling rig typically requires the temporary installation of a level hardstanding area on a geotextile base; the footprint of this working area can vary from site to site but on average is typically 10m x 10m. On completion of the works, the stone and geotextile will be carefully removed off-site to an appropriately permitted waste facility. The site will then be reinstated to its

original condition or to the requirements of the relevant authority at that location should these be different.

- Construction of two new GIS transmission power substations: The new substations will be constructed at DANP and Dardistown. The proposed GIS buildings are likely to be two storeys, c. 15m in height, 15m in width and 50m in length, and will house the GIS plant and contain auxiliary services equipment such as control and telecommunications equipment, an emergency diesel generator, batteries and welfare facilities (i.e., toilets and washing facilities). During the Operational Phase, the proposed GIS substation will generally be unmanned and remotely monitored/operated by ESBN. It is likely that the facility will connect to a foul sewer or alternatively a proprietary wastewater holding tank will be installed. The lighting plan for the proposed GIS buildings will minimise light spill within the surrounding area. Lighting will not be a continuous feature of the operational substation and will be manually operated by an activation switch located within the GIS substation. All temporary lighting associated with the construction works will be placed strategically such that illumination beyond the works area is controlled. Lighting will be cowled and directional to reduce significant light spill.

15.2 Methodology

15.2.1 Introduction

The methodologies used to collate information on the baseline biodiversity environment and assess the potential impacts of the proposed Project are detailed in the following sections.

15.2.2 Zone of Influence

The Zone of Influence (ZoI), or distance over which a likely significant effect may occur will differ across the key ecological receptors, depending on the predicted impacts and the potential impact pathway(s). The results of both the desk study and the suite of ecological field surveys undertaken have established the habitats and species present along the proposed Project and the proposed Grid Connections. The ZoI is then informed and defined by the sensitivities of each of the ecological receptors present, in conjunction with the nature and potential impacts associated with the proposed Project.

The ZoI of the proposed Project and the proposed Grid Connections in relation to terrestrial habitats is generally limited to the footprint of the proposed Project/Grid Connections, and the immediate environs (to take account of shading or other indirect impacts, such as air quality). Hydrogeological/hydrological linkages (e.g. rivers or groundwater flows) between impact sources and wetland/aquatic habitats can often result in impacts occurring at some distance.

With regards to hydrological impacts, the distances over which water-borne pollutants are likely to remain in sufficient concentrations to have a likely significant effect on receiving waters and associated wetland/terrestrial habitats are difficult to quantify, are highly site-specific and are related to the predicted magnitude of any potential pollution event. Evidently, it will depend on volumes of discharged waters, concentrations, and types of pollutants (in this case sediment, hydrocarbons, and heavy metals), volumes of receiving waters, and the ecological sensitivity of the receiving waters. In the case of the proposed Project and the proposed Grid Connections, the receiving waters include all freshwater habitat downstream of the proposed watercourse crossings and the estuarine environment of the Broadmeadow Water, Mayne Estuary, North Bull Island, Tolka Estuary and Lower Liffey Estuary transitional waterbodies, and marine environment of Malahide Bay, Irish Sea Dublin and Dublin Bay.

The ZoI of air quality effects on ecological features is not greater than a distance of c. 200m from the proposed Project or the proposed Grid Connections edge or an impacted road i.e. a road that experiences a significant change in traffic numbers, road alignment or speed band due to the proposed Project (see Chapter 16 – Air Quality for more details).

The ZoI for aquatic plant and animal species includes all freshwater habitat downstream of the proposed watercourse crossings and the estuarine environment of the Broadmeadow Water, Mayne Estuary, North Bull Island, Tolka Estuary and Lower Liffey Estuary transitional waterbodies, and marine environment of Malahide Bay, Irish Sea Dublin and Dublin Bay. The disturbance ZoI in relation to small mammal species,

such as the pygmy shrew, would be expected to be limited to no more than c. 100m from the proposed Project and the proposed Grid Connections boundary due to their small territory sizes (e.g. c.530m^2 to 1860m^2 for pygmy shrew[1]) and sedentary lifecycle. The disturbance ZoI in relation to otters, badgers, stoat, and hedgehogs may extend over greater distances[2] than small mammal and bird species due to their ability to disperse many kilometres from their natal site; however, the ZoI of significant disturbance impacts to badger and otter breeding/resting places (including impacts associated with elevated noise levels) is likely to be no more than c. 150m from the proposed Project and the proposed Grid Connections boundary[3].

The ZoI of potential impacts to bat roosts are dependent on many factors (such as species, roost type, surrounding habitat and commuting routes), this is assessed on a case-by-case basis and the ZoI may increase/decrease from this distance accordingly. Given the large foraging ranges for some species[4], the effect of potential landscape scale impacts, such as habitat loss and severance, could extend for several kilometres from the proposed Project and the proposed Grid Connections but the most significant effects are likely to occur within a 3km core sustenance zone associated with roosts of the following bat species which are known to occur in the area; Leisler's bat, Nathusius' pipistrelle, soprano pipistrelle and brown long-eared bat. As per the Bat Conservation Trusts' Guidelines[5], core sustenance zones are defined as the area surrounding a communal bat roost within which habitat availability and quality will have a significant influence on the resilience and conservation status of the colony using the roost.

The ZoI of the proposed Project and the proposed Grid Connections in relation to likely significant effects on most breeding bird species is generally limited to habitat loss within the footprint of the proposed Project/Grid Connections, and disturbance/displacement during construction and disruption in territorial singing due to noise during operation. Disturbance effects may extend for several hundred metres from the proposed Project and the proposed Grid Connections, specifics of which are assessed in the impacts sections.

The ZoI in relation to direct impacts to wintering birds could extend up to c. 300m from the proposed Project and the proposed Grid Connections for general construction activities, as many species (such as waterbirds) are highly susceptible to disturbance from loud and unpredictable noise during construction[6]. However, as many estuarine bird species use inland habitat areas at distances from the coast, the effect of for *ex-situ* impacts could extend a considerable distance from the proposed Project. In the case of the proposed Project and the proposed Grid Connections, impacts to wintering birds within this 300m band could affect the use of potential *ex-situ* sites for bird species listed as Special Conservation Interests (SCI) of the nearby European sites, including Malahide Estuary Special Protection Area (SPA), Baldoyle Bay SPA, North Bull Island SPA and South Dublin Bay and River Tolka SPA.

[1] McDevitt, A. (2016) Pygmy shrew (*Sorex minutus*). Pp 65-66. In Lysaght, L. and Marnell, F. (Eds) (2016) Atlas of Mammals in Ireland 2010-2015, National Biodiversity Data Centre, Waterford.

2 Otter territory size from Ó Néill L. (2008) Population dynamics of the Eurasian otter in Ireland. Integrating density and demography into conservation planning. PhD thesis. Trinity College, Dublin; Badger territory size from NRA (2006a) Guidelines for the Treatment of Badgers Prior to the Construction of National Road Schemes ; Irish stoat territory size from Sleeman, P.D (2016) Irish Stoat (*Mustela erminea hibernica*) Pp 102-103 In Lysaght, L. and Marnell, F. (Eds) (2016) Atlas of Mammals in Ireland 2010-2015, National Biodiversity Data Centre, Waterford; Pine marten territory size from O'Mahony, D. (2016) Pine marten (*Martes martes*) Pp. 100-101 In Lysaght, L. and Marnell, F. (Eds) (2016) Atlas of Mammals in Ireland 2010-2015, National Biodiversity Data Centre, Waterford and Hedgehog territory size from Haigh, A. (2011). The Ecology of the European hedgehog (*Erinaceus europaeus*) in rural Ireland. PhD Thesis, UCC.

[3] This ZoI (i.e. *c.* 150m from the proposed Project/Grid Connections boundary) for badgers and otters has been defined in accordance with TII guidelines i.e. Guidelines for the Treatment of Badgers Prior to the Construction of National Road Schemes (NRA, 2006a), and Guidelines for the Treatment of Otters prior to the Construction of National Road Schemes (NRA, 2008c), and is considered to be of a precautionary distance. During construction-related disturbance, the screening effect provided by surrounding vegetation and buildings would likely reduce the actual distance of the ZoI for badgers and otters.

[4] Leisler's bats have been recorded foraging up to 13km from maternity roost sites (Shiel *et al.*, 1999)

[5] Collins, J. (2016) *Bat Surveys for Professional Ecologists: Good Practice Guidelines* (3rd edn) The Bat Conservation Trust, London.

[6] Current understanding of construction related noise disturbance to wintering waterbirds is based on the research presented in Cutts *et al.* (2009) and Wright *et al.* (2010). In terms of construction noise, levels below 50dB would not be expected to result in any response from foraging or roosting birds. Noise levels between 50dB and 70dB would provoke a moderate effect/level of response from birds, i.e. birds becoming alert and some behavioural changes (*e.g.* reduced feeding activity), but birds would be expected to habituate to noise levels within this range. Noise levels above 70dB would likely result in birds moving out of the affected zone or leaving the site altogether. At *c.* 300m, typical noise levels associated with construction activity (BS 5228) are generally below 60dB or, in most cases, are approaching the 50dB threshold.

The ZoI in relation to amphibian species is likely to be limited to direct habitat loss and severance with the proposed Project and the proposed Grid Connections boundary and/or indirect impacts to water quality in wetland habitats hydrologically connected to the proposed Project/Grid Connections.

The ZoI in relation to the common lizard is likely to be limited to direct habitat loss and severance with the proposed Project and the proposed Grid Connections boundary and disturbance/displacement effects in the immediate vicinity during construction.

The ZoI for impacts to aquatic species, such as Atlantic salmon *Salmo salmar* and lamprey species *Lampetra* spp., is limited to those watercourses crossed by the proposed Project and the proposed Grid Connections or waterbodies to which runoff from the proposed Project/Grid Connections could drain to during Construction or Operational Phases. However, impacts could occur at significant distances downstream depending on the magnitude and duration of any pollution event; potentially even affecting species in Malahide Bay, Irish Sea Dublin and Dublin Bay.

15.2.3 Study Area

Surveys were carried out for each of the biodiversity receptors listed in Table 15.3, within specific geographical areas, and focussed on assessing potential impacts within the ZoI of the proposed Project. The geographical extent of each survey area was informed by the ZoI of the proposed Project for the respective biodiversity receptor (see Section 15.2.2 for more detail on the ZoI of the proposed Project as it relates to each biodiversity receptor). These surveys were designed based upon the characteristics of the proposed Project and its likely significant effects on the receiving environment during construction and/or operation. The study area of each biodiversity receptor encompasses the relevant survey areas and, in some cases, also includes the lands beyond this survey area extent that are located within the ZoI of the proposed Project. These survey areas are described below in Table 15.3.

Table 15.3: Study and Survey Areas for Each Ecological Receptor

Ecological Receptor	Study Area/Survey Area Description
Habitats (including rare and/or protected flora, aquatic macrophyte plant species and non-native invasive plant species[7])	The study area includes all habitats within and immediately adjacent to the proposed Project. This encompasses the survey area corridor, which comprised a 100m buffer from aboveground sections of the proposed alignment and from all the proposed station locations. In terms of aquatic macrophyte plant species, this included all watercourses crossed by the proposed Project apart from the River Liffey[8].
Fauna species (other than bats, i.e. otter *Lutra lutra*, badger *Meles meles*, amphibians and reptiles)	The study area includes all lands suitable for fauna species within and adjacent to the proposed Project. This encompasses the survey area corridor, which comprised a 250m buffer from aboveground sections of the proposed alignment and from proposed station locations where suitable mammal, amphibian and/or reptile habitat was located.
Bats	The study area includes all lands suitable for bats within and adjacent to the proposed Project. This encompasses the survey area, which includes areas of suitable bat roosting, foraging and/or commuting habitats, such as buildings/structures, hedgerows, treelines, woodland and watercourses, along the proposed Project where works are proposed.
Breeding birds	The study area includes all lands suitable for breeding birds within and adjacent to the proposed Project. This encompasses the survey area, which comprised a 150m buffer from aboveground sections of the proposed alignment and from proposed station locations where suitable breeding bird habitat was located.
Wintering birds	The study area includes all lands suitable for wintering birds within a 300m buffer from the proposed alignment and proposed station locations.

[7] Non-native invasive plant species are not considered as KERs, as they can result in negative effects on biodiversity, and it is in that context they are included within the impact assessment.

[8] It was not feasible to access and survey the River Liffey at the crossing point of the proposed Project due to the river's depth (i.e. between *c.* 4-5m deep) and width (i.e. *c.* 46m wide) at this location. To address this limitation, a detailed desk study of protected, rare and non-native invasive flora and fauna at this location was undertaken for the River Liffey and a precautionary approach to the interpretation of these results, as part of the impact assessment, was adopted.

Ecological Receptor	Study Area/Survey Area Description
Fish	The study area includes all watercourses within or adjacent to the proposed Project. This encompasses the survey area, which comprised the watercourse crossing points of the proposed Project, apart from the River Liffey, Grand Canal and Royal Canal, as the standard backpack electrofishing methodologies were not feasible at these locations[9].
Aquatic macroinvertebrates (including white-clawed crayfish *Austropotamobius pallipes*)	The study area includes all watercourses within or adjacent to the proposed Project. This encompasses the survey area, which comprised watercourse crossing points of the proposed Project, apart from the River Liffey, which is tidal at the proposed crossing point location and as such not suitable for white-clawed crayfish.

Similarly, surveys were carried out for the proposed Grid Connections for certain ecological receptors listed in Table 15.3. These included surveys of habitats (including rare and/or protected flora, aquatic macrophyte plant species and non-native invasive plant species) and fauna species (including otter, badger, potential bat roost features in trees, amphibians and reptiles). The survey area for these surveys comprised 50m buffer from the proposed Grid Connection route alignments. This was deemed a suitable buffer given the nature of the proposed Grid Connections works (minimal temporary disturbance during works with work sites being reinstated to the original condition).

15.2.4 Relevant Guidelines, Policy and Legislation

The collation of ecological baseline data and the preparation of this Chapter have had regard to the following guidance documents, policy and planning documents and legislation. Whilst this is not an exhaustive list of all guidance documents, policy and planning documents and legislation, it does contain those that are most relevant for the purposes of preparing this chapter of the EIAR.

Guidance Documents:

- Environmental Impact Assessment of Projects, Guidance on the preparation of the Environmental Impact Assessment Report (European Commission, 2017);
- Advice notes for Preparing Environmental Impact Statements (Environmental Protection Agency [EPA], Draft September 2015);
- Guidelines on the information to be contained in Environmental Impact Assessment Reports (EPA, 2022);
- Guidance document on the strict protection of animal species of Community interest under the Habitats Directive (European Commission, 2021)
- Advice Notes on Current Practice in the Preparation of Environmental Impact Statements (EPA, 2003);
- Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment (European Union, 2013);
- Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine (CIEEM, 2018);
- Environmental Guidelines Series for Planning and Construction of National Roads (NRA, 2005-2009);
- Guidelines for Assessment of Ecological Impacts of National Road Schemes (NRA (NRA), 2009);
- Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes (NRA, 2008a);
- Environmental Impact Assessment of National Road Schemes – A Practical Guide (NRA, 2008b);
- The Management of Invasive Alien Plant Species on National Roads - Technical Guidance (Transport Infrastructure Ireland, 2020a);

[9] It was not feasible to undertake electro-fishing surveys at the River Liffey, Royal Canal and Grand Canal at the crossing points of the proposed Project due to the depth of these watercourses at these locations. To address this limitation, a detailed desk study of protected, rare and non-native invasive fauna at these locations was undertaken for the River Liffey, Royal Canal and Grand Canal and a precautionary approach to the interpretation of these results, as part of the impact assessment, as adopted.

- The Management of Invasive Alien Plant Species on National Roads – Standard (Transport Infrastructure Ireland, 2020b); Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters (Inland Fisheries Ireland, 2016)
- Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edn) (Collins, (ed.) 2016);
- The Bat Workers' Manual, 2nd Edition (Mitchell-Jones & McLeish, 1999);
- Bat mitigation guidelines for Ireland v2. Irish Wildlife Manuals, No. 134. National Parks and Wildlife Service, Department of Housing, Local Government and Heritage, Ireland (Marnell, Kelleher & Mullen, 2022).
- The Irish Bat Monitoring Programme 2015-2017. Irish Wildlife Manuals, No. 103. (Aughney *et al.*, 2018);
- Design Manual for Roads and Bridges (Highways Agency 2001a, 2001b, 2005 and 2020);
- Circular NPW 1/10 & PSSP 2/10 Appropriate Assessment under Article 6 of the Habitats Directive: Guidance for Planning Authorities (National Parks & Wildlife Service, 2010);
- Circular Letter NPWS 2/07 Guidance on compliance with Regulation 23 of the Habitats Regulations 1997 – strict protection of certain species/applications for derogation licences (National Parks & Wildlife Service, 2007a);
- Circular Letter PD 2/07 and NPWS 1/07 Compliance Conditions in respect of Developments requiring (1) Environmental Impact Assessment (EIA); or (2) having potential impacts on Natura 2000 sites (National Parks & Wildlife Service, 2007b);
- The monitoring and assessment of three EU Habitats Directive Annex I grassland habitats. Irish Wildlife Manuals, No. 102 (Martin *et al.*, 2018); and,
- The Irish semi-natural grasslands survey 2007-2012. Irish Wildlife Manuals, No. 78 (O'Neill *et al.*, 2013).

Policy and Planning Documents:

- National Biodiversity Plan 2017-2021 (Department of Culture, Heritage and the Gaeltacht, 2017);
- Fingal Development Plan 2017-2023 (Fingal County Council, 2017);
- Draft Fingal Biodiversity Action Plan 2018-2023 (Fingal County Council, 2018);
- Dublin City Development Plan 2016-2022 (Dublin City Council, 2016);
- Dublin City Biodiversity Action Plan 2015-2020 (Dublin City Council, 2015).;
- Biodiversity Action Plan for Ballymun (Ballymun Regeneration Ltd., 2008);
- Forest of Fingal, A Tree Strategy for Fingal (Fingal County Council, 2021); and,
- Dublin City Tree Strategy 2016-2020 (Dublin City Council, 2016).

Legislation:

- Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora, hereafter referred to as the Habitats Directive;
- Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds, hereafter referred to as the Birds Directive;
- European Communities (Birds and Natural Habitats) Regulations, 2011 (S.I. No. 477 of 2011), as amended, hereafter referred to as the Birds and Habitats Regulations;
- Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment, as amended by Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014, hereafter referred to as the EIA Directive;
- Planning and Development Acts 2000 to 2021, hereafter referred to as the Planning Acts[10];
- Wildlife Acts 1976 to 2020, hereafter referred to as the Wildlife Acts;
- Flora (Protection) Order, 2022 (S.I. No. 235 of 2022); and
- Inland Fisheries Acts 1959 to 2017, hereafter referred to as the Fisheries Acts[11].

[10] Updated to 2017 by virtue of Planning and Development (Amendment) Act 2017, s. 2(2).
[11] Updated to 2017 by virtue of Inland Fisheries (Amendment) Act 2017, s. 5(3).

15.2.5 Data Collection and Collation

A desktop study was carried out to inform the initial scope of the ecological surveys required to inform the environmental impact assessment. The desktop study involved collection and review of relevant published and unpublished sources of data, collation of existing information on the ecological environment and consultation with relevant statutory bodies.

15.2.5.1 Desk Study

The following sources were consulted during the desk study to inform the scope of the ecological surveys:

- Online data available on Natura 2000 network of sites (hereafter referred to as European sites)[12] and on Natural Heritage Areas (NHAs) or proposed Natural Heritage Areas (pNHAs) as held by the National Parks and Wildlife Service (NPWS, 2021);
- Online data records available on National Biodiversity Data Centre Database (NBDC, 2021);
- Ordnance Survey Ireland (OSI) orthophotography (from 1995 to 2012) for the scheme study area;
- Records of rare and protected species for the 10km grid squares O12, O13 and O14, held by the NPWS;
- Habitat and species GIS datasets provided by the NPWS;
- Bat records from Bat Conservation Ireland's (BCI) database;
- Information contained with the Alignment Options Report (National Transport Authority, 2017) of the proposed Project;
- Environmental Impact Statements for previous metro proposals and other developments located along the alignment of the proposed Project;
- Records from the Botanical Society of Britain & Ireland (BSBI);
- Information contained within the Flora of County Dublin (Doogue *et al.*, 1998);
- Environmental information/data for the study area available from the Environmental Protection Agency website (EPA, 2022, including information on water quality, river catchments and noise levels; and
- Information on the status of EU protected habitats and species in Ireland (National Parks & Wildlife Service, 2019a, 2019b and 2019c).

15.2.5.2 Field Surveys

This section describes the various ecological survey methodologies used to collate baseline ecological information in the preparation of this chapter. The surveys carried out are summarised below in Table 15.4.

Table 15.4: Ecological Surveys for the proposed Project and Survey Dates between 2018, 2019, 2020 and 2021

Survey	Survey Date(s)	Section Reference
Habitat survey (including invasive plant species and detailed aquatic survey of Royal Canal basin)	May, June and September 2018 July and September 2019 June, July and October 2020 February 2021 June and July 2021	Scott Cawley Ltd. Triturus Environmental Services Ltd.
Mammal surveys (specifically for badger, however, field signs for all mammal species were recorded when encountered, including species protected under the Wildlife Acts)	April 2018 February and March 2020 February and March 2021 June and July 2021	Scott Cawley Ltd.
Otter survey	April 2018 February and March 2020 June 2021	Scott Cawley Ltd.

[12]

Survey	Survey Date(s)	Section Reference
Bat surveys: Building surveys Walked transect activity surveys Static detector activity surveys Identification of potential bat tree roosts	July, August and September 2018 July, August, September, November 2019 July, August and September 2020 June, July and August 2018 July, August and September 2019 July and August 2020 June, July and August 2018 August 2019 April 2018 March 2020 July 2021	Scott Cawley Ltd.
Breeding bird surveys	April, May and June 2018 April, May and June 2019 May and June 2020	Scott Cawley Ltd.
Wintering bird survey	November and December 2018 January and March 2019 January, February, March, November and December 2020 January, February and March 2021	Scott Cawley Ltd. Jacobs Engineering Ireland Ltd.
Amphibian habitat suitability assessment	April 2018 February and March 2020 February 2021 June and July 2021	Scott Cawley Ltd.
Reptile habitat suitability assessment	May, June and September 2018 July and September 2019 June, July and October 2020 February 2021 June and July 2021	Scott Cawley Ltd.
Fisheries surveys (including survey of macrophytes and assessment of biological water quality status)	September 2018	Triturus Environmental Services Ltd.
Aquatic macroinvertebrate survey of Royal Canal basin	June 2021	Triturus Environmental Services Ltd.
White-clawed crayfish survey	September 2018	Triturus Environmental Services Ltd.

Ecological surveys were also carried out for the proposed Grid Connections in June and July 2021. These included habitat surveys (including invasive plant species) and mammal surveys (specifically for badger, otter and potential bat roost features in trees, however, field signs for all mammal species were recorded when encountered, including species protected under the Wildlife Acts), as well as amphibian and reptile habitat suitability surveys. All surveys carried out along the proposed Grid Connections were carried out as part of a multidisciplinary walkover survey within a 50m buffer of the proposed works. Additional/updated surveys will have to be carried out as part of the planning application for the proposed Grid Connection when planning permission is sought by the ESBN but for the purpose of assessing the proposed Grid Connection is this EIAR, baseline data was collected through the aforementioned 2021 surveys.

15.2.5.2.1 Habitats Survey

Habitat surveys were carried out on the 28 May 2018, 13 to the 15 June 2018, the 4 September 2018, 5 and 15 July 2019, 19 and 20 September 2019, the 26 and 30 June, the 2 July 2020, the 22 October 2020 and 26 February 2021, 15, 28 and 29 June 2021 and 31 July 2021. Instream aquatic habitats were surveyed by Triturus Environmental Services on the 28 and 29 September 2018. In addition, a detailed aquatic plant survey of the Royal Canal Basin located directly east of Cross Guns Bridge between Lock 6 and Lock 5 was undertaken by Triturus Environmental Services on the 17 June 2021 (see Appendix A15.9 for full details). The aim of this survey was to confirm the presence/absence of the Flora (Protection) Order, 2022 species opposite-leaved pondweed *Groenlandia densa*. All habitats located within the survey area of the proposed Project and where accessible were surveyed and mapped to level three of the Heritage Council's habitat codes, after Fossitt (2000) and in accordance with *Best Practice Guidance for Habitat Survey and Mapping* (Smith *et al.*, 2011). The level of field data quality (as per Smith *et al.*, 2011) was also recorded. Plant species present that were either representative of a habitat or considered to be of conservation interest were recorded, along with their relative abundances. The habitat's extent was mapped onto an aerial photograph, with GPS points taken where a habitat's extent could not be clearly identified from the aerial photograph. Any non-native invasive plant species listed on the Third Schedule of the Birds and Habitats Regulations were also recorded during the habitat surveys. A dedicated invasive species survey was undertaken on the 19 March 2020 by an Ecologist from Jacobs Engineering Ireland Ltd. at lands within and immediately surrounding the Glasnevin railway junction (i.e. comprising the embankment of the existing railway line and lands in close proximity to the proposed Glasnevin Station). Full details of this survey are presented in Appendix A15.1.

Relevés (i.e. sampling points of a defined size) were also taken within areas of species-rich calcareous grassland to inform the determination as to whether or not it conformed to the Annex I habitat semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) (* important orchid sites) [6210]. The relevé size was $2m^2$ and information collected included the following:

- A list of all plant species present along with their associated percentage cover;
- A habitat condition assessment based on criteria which were drawn from the national surveys of this Annex I habitat conducted on behalf of NPWS (i.e. Martin *et al.*, 2018 and O'Neill *et al.*, 2013); and,
- Notes on the threats and/or management of the overall surrounding area. Where applicable, the Annex I habitat was also assigned to a vegetation community.

Vascular plant nomenclature follows that of the *New Flora of the British Isles 4th Edition* (Stace, 2019); bryophyte nomenclature follows the *Checklist of British and Irish bryophytes* (BBS, 2009).

15.2.5.2.2 Mammals (excluding bats)

Protected species – Otter and Badger

A corridor of c. 500m along the alignment of the proposed Project, as shown on Figure 15.1, was surveyed for badger *Meles meles* and otter *Lutra lutra* activity as part of the multi-disciplinary walkover survey, undertaken on the 6 April 2018 and from the 10 April 2018 to the 12 April 2018, the 18, 20 and 21 February and 11 March 2020 and 26 February and 4 March 2021. Survey methodology followed the guidance outlined in *Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes* (NRA, 2006). The Royal Canal was also surveyed for otter activity on the 27 March 2020. The status and activity of any badger sett or otter holt was recorded along with any evidence of activity, including paths, tracks, feeding signs, latrines or couches (otter resting places).

An infra-red motion-activated camera was deployed (under NPWS Licence No. 007/2020) at the entrance of a small burrow located on the southern bank of the Santry River c. 210m downstream of the proposed crossing point location to confirm whether it was being actively used by otter. It was deployed for a period of 10 nights between the 18 February 2020 and the 28 February 2020.

No species-specific surveys were undertaken for other protected mammal species for which field signs are less frequent and/or less reliable than other larger mammals, such as pine marten *Martes martes*,

Irish stoat *Mustela erminea hibernica* and Irish hare *Lepus timidus*. Nevertheless, during all surveys, attention was paid to search for activity signs such as searching soft muds for tracks, and to look for droppings. Potential presence of these species in suitable habitat was determined based on the habitat preferences outlined in current published literature, for example in *Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes* (NRA, 2006) and *Exploring Irish Mammals* Hayden & Harrington (2000).

15.2.5.2.3 Bats

The following sections describe the methodologies employed to carry out the various bat surveys undertaken to inform the EIA, based on guidance outlined in Collins, 2016. The bat surveys were carried out under the following licences, issued by the NPWS:

- DER/BAT 2017-06 (amended) – Derogation licence to disturb bat roosts throughout the State;
- DER/BAT 2019-02 – Derogation licence to disturb bat roosts throughout the State;
- DER/BAT 2019-07 – Derogation licence to disturb bat roosts throughout the State; and;
- DER/BAT 2022-02 (Amended 10/05/22) – Derogation licence to disturb bat roosts throughout the State.

Bats - Building Surveys

Buildings/structures located within or immediately adjacent to the proposed Project that were identified as having potential to support roosting bats (as guided by Collins, 2016) (i.e. buildings with an obvious, or high, likelihood to support roosting bats due to their size, shelter, protection, conditions and surrounding habitat) were surveyed (see Table 15.5 for list of buildings/structures surveyed). Daytime building inspections and post-dusk and/or pre-dawn activity surveys were conducted between the 18 July 2018 and the 4 September 2018, between the 6 July 2019 and 11 November 2019, and between the 2 July 2020 and the 29 September 2020. The locations of all buildings surveyed are shown on Figure 15.2.

The daytime building inspections involved a full examination of the internal (where accessible) and external areas of the structures to search for the presence of bats and identify potential roost sites. The physical characteristics (i.e. construction material, roofing material and estimated age) and a photograph of each building was taken. Bat activity is usually detected by the following signs:

- Bat droppings (these will accumulate under an established roost or under access points);
- Insect remains (under feeding perches);
- Oil (from fur) and urine stains;
- Scratch marks; and
- Bat corpses.

For bat activity surveys, bat activity around buildings was monitored using the hand-held bat detector *Elekon BatLogger M* to determine if bats were exiting/entering buildings. Post-dusk activity surveys were conducted between one and a half hours to two hours after sunset, while pre-dawn surveys were conducted two hours before sunrise. At least one internal survey and one or more post-dusk and/or pre-dawn survey were conducted. Where internal access was not possible, up to two activity surveys were conducted on a building, subject to accessibility.

A post-dusk emergence roost count was undertaken at St. Anne's private dwelling, where the only bat roost was identified within the study area of the proposed Project, on the 29 August 2018.

All bat calls were analysed using *Elekon BatExplorer* software. Calls were manually identified against species descriptions provided within *British Bat Calls: A Guide to Species Identification* (Russ, 2012).

Table 15.5: Buildings/Structures Surveyed for the Presence/Absence of Bats

Building/Structure Code	Building/Structure Name	Internal Inspection	Post-Emergence and/or Re-Entry Survey
BS01	Farm buildings at Estuary	✓	✓
BS02	Residential House - Lissenhall Great	✓	✓
BS03	Lissenhall Bridge	✓	✓
BS04	Balheary Bridge	✓	✓
BS05	Footbridge at Balheary Park	✓	N/A
BS06	Residential House - Seaview Bungalow	No access permitted	No access permitted
BS07	Residential House – Seaview House	✓	✓
BS08	Mantua Lane – Footbridge	✓	N/A
BS09	Chapel Lane – Footbridge	✓	N/A
BS10	Malahide Roundabout – Footbridge	✓	N/A
BS11	Stables south of R132	✓	✓
BS12	Swords Veterinary Hospital	✓	✓
BS13	Airside - ESB buildings	✓	✓
BS14	Airside – Smiths Toy store	✓	N/A
BS15	Residential house – Nevinstown West	✓	✓
BS16	Residential house – Nevinstown West	No access permitted	No access permitted
BS17	Residential house adjacent Boland's Car Yard	✓	✓
BS18	Residential house adjacent Boland's Car Yard	No access permitted	✓
BS19	McGuinness West of R132	No access permitted	✓
BS20	Whitehall Rangers – clubhouse	✓	✓
BS21	Ballystruan Lane – one storey warehouse	✓	N/A
BS22	St Anne's Private Dwelling	No access permitted	✓
BS23	Santry Demense – Derelict 2 story house	✓	✓
BS24	Santry Demesne – derelict 2 story house at entrance to Santry Lodge	✓	✓
BS25	Northwood – derelict bungalow	Not safe to enter	✓
BS26	Tony's Stables	Not safe to enter	✓
BS27	Ballymun Shopping Centre	No access permitted	✓
BS28	Brian Boru	✓	✓
BS29	Coke Oven Cottage	✓	✓
BS30	Bridge OBD221 (Bridge 1)	✓	✓
BS31	Bridge OBD222 (Bridge 2)	✓	✓
BS32	Bridge OBO11 (Bridge 3)	✓	✓
BS33	Prospect House	✓	✓
BS34	Des Kelly Interiors	✓	✓
BS35	Dublin Central Site 2	✓	✓

Building/Structure Code	Building/Structure Name	Internal Inspection	Post-Emergence and/or Re-Entry Survey
BS36	Ashford House Tara Street	N/A	N/A
BS37	Poolbeg Street	N/A	N/A
BS38	Markievicz Leisure Centre	✓	✓
BS39	22 Luke Street	✓	✓
BS40	24 Townsend Steet	✓	✓
BS41	26-32 Townsend Street	No access permitted	✓
BS42	Hines Buildings Charlemont; 19-25 Dartmouth Rd; 19a Dartmouth Rd	✓	✓

Bats - Walked transect surveys

Walked transect surveys comprised two visits, the first of which was undertaken between the 19 June 2018 and the 28 June 2018 or the 24 July 2019 and 31 July 2019 or the 21 July 2020 and the 25 August 2020, while the second was undertaken between the 18 July 2018 and the 1 August 2018 or the 14 August 2019 and 20 August 2019 or the 11 August 2020 and the 28 September 2020. Sixteen survey sites were selected to cover all areas of suitable bat foraging and/or commuting habitat that may be impacted by the proposed Project (i.e. those located in the aboveground sections of the proposed Project boundary) and a transect route was designed within these to encompass a representative sample of the habitats within the survey site. These walked transect routes are shown on Figure 15.2. Due to accessibility issues, private lands owned by Irish Rail located north of the Royal Canal and lands within Na Fianna, St Vincent's School were only surveyed once (i.e. as part of Transect_10) and lands at Transect_4 were partially surveyed during the first visit. In order to address this, a precautionary approach was adopted with respect to the assessment of the usage of habitats along these particular transect routes by bats. No bats were recorded during either visit at the proposed O'Connell Street Station (i.e. Transect_11).

Surveys were conducted on nights with potential for high levels of bat flight activity (i.e. warm, dry, calm conditions). Surveying commenced 30 minutes after sunset. Bat activity was recorded using *Elekon BatExplorer M* bat detectors. Each transect was walked once. During the second visit the transect survey was walked in the reverse direction, where possible, to that of the first visit.

All bat calls were analysed using *Elekon BatExplorer* software. Calls were manually identified against species descriptions provided within *British Bat Calls: A Guide to Species Identification* (Russ, 2012).

Bats - Static detector activity surveys

Static detector surveys of bat activity in selected locations within the boundary of the proposed Project were conducted from the 19 June 2018 to the 17 August 2018 and from the 26 July 2019 to the 29 August 2019 for a minimum of eight nights per static detector. Twenty-nine sites for static detector deployment were selected across the proposed Project, in areas of habitat suitable to support commuting and foraging bats, such as treelines, hedgerows, and woodland. The aim of this was to survey the presence of bat species at the different locations, as well as to collect comparative data on species richness and general levels of bat activity. The locations of the static detectors are shown on Figures 15.2. These locations were selected to cover a range of habitat types likely to be suitable for bats and within the ZoI of effects from the proposed Project.

The static detectors used were *SM2+* bat detectors (Wildlife Acoustics) and *SMZC* bat detectors (Wildlife Acoustics). Detectors were set to record in WAC format from half-an-hour before sunset to half-an-hour after sunrise set to automatically trigger in response to potential bat calls.

Bat calls were analysed using the *Kaleidoscope* auto-identification software (Wildlife Acoustics) and were all manually verified to ensure the software identified calls correctly.

Bats - Tree surveys

Trees located within the alignment of the proposed Project (see Figure 15.2) were assessed for their potential to support roosting bats (i.e. their capacity to contain Potential Roost Features [PRFs]) as part of the multi-disciplinary walkover survey, undertaken on the 6 April 2018 and from the 10 April 2018 to the 12 April 2018 and during dedicated surveys on the 11 March 2020 and the 13, 15 and 31 July 2021. These surveys were carried out in accordance with BCT guidelines on preliminary ground level roost assessment for trees (Collins, 2016).

15.2.5.2.4 Invertebrates - White-clawed Crayfish

The White-clawed crayfish surveys were undertaken by Triturus Environmental Services Ltd. on the 28 and 29 September 2018 (under NPWS Licence No. C82/2018). The watercourses surveyed are presented in Table 15.6 below and shown on Figure 15.3.

The larger watercourses, namely the Broadmeadow River and River Tolka, were trapped using six 51cm X 20cm, 19mm mesh polypropylene "*Trappy*" crayfish traps (following Gallagher, 2006 and O'Connor *et al.*, 2009). Sweep netting (following Reynolds *et al.*, 2010) was employed at survey sites where the small, shallow nature of the channels precluded effective trapping, i.e. the Staffordstown Stream, Sluice River, Cuckoo Stream, Mayne River and Santry River. A riparian walkover survey was also undertaken at these same watercourses. This involved the examination of any spraint from mustelid species (i.e. otter and American mink *Mustela vison*) present along the riparian corridor for the presence of crayfish remains.

All equipment and PPE used during the survey was disinfected with Virkon® disinfectant prior to and post-survey completion, and best practice precautions were employed to prevent the potential spread of invasive species and water-borne pathogens, according to best practice biosecurity protocols (Macklin & Brazier, 2018).

15.2.5.2.5 Breeding Birds

Breeding bird surveys were conducted as three visits per season in April, May and June 2018, April, May and June 2019, and May and June 2020 using a methodology adapted from the Breeding Bird Survey (Gilbert et al., 1998). The survey season in 2020 coincided with the imposition of emergency restrictions on citizen's movement by the Irish Government, in connection with the early stages of the COVID-19 pandemic. Scott Cawley did not undertake field surveys between late March and mid-May 2020 due to these restrictions. Therefore, three surveys were conducted in 2020 between late May and late June. The timing of these surveys was late in the season, however given the completion of surveys across multiple years, the timing of the surveys in 2020 have not imposed any limitations on the survey outcomes or this assessment. Surveys were carried out on the following dates: 2, 3, 4, 9, 29, 30 and 31 May 2018, 1, 26, 27, 28 and 29 June 2018, 16 and 17 April 2019, 3 May 2019 and 5 and 26 June 2019 and 21 and 22 May 2020 and 4, 5, 18, 19 and 30 June 2020. All suitable breeding bird habitat located within c. 150m of the proposed Project were slowly walked in a manner allowing the surveyor to come within 50m of all habitat features (see Figure 15.1 for survey corridor). Birds were identified by sight and song, and general location and activity were recorded using the British Trust for Ornithology (BTO) species and activity codes. The conservation status of the bird species was recorded as per:

- Birds of Conservation Concern in Ireland (BoCCI) lists which classify bird species into three categories: Red List – birds of high conservation concern; Amber List – birds of medium conservation concern; and Green List – birds not considered threatened (Gilbert *et al.*, 2021);
- Bird species listed on Annex I of the EU Birds Directive (2009/147/EC); and
- SCI species of SPAs within the ZoI of the proposed Project.

A habitat suitability assessment for nesting kingfisher *Alcedo atthis* was undertaken on the 26 and 30 June 2020 along banks of the Broadmeadow River and Ward River, c. 500m upstream and downstream of the proposed crossing points. Following the identification of suitable kingfisher nesting habitat, an activity survey was undertaken on the 2 July 2020 at two vantage points for c. 45 minutes at each location. These vantage points were located on the bankside near the confluence of the Broadmeadow

River and Ward River and on Spittal Hill Road bridge (i.e. c. 70m and 220m downstream of the proposed Project).

15.2.5.2.6 Wintering Birds

All potential suitable inland feeding and/or roosting sites for winter birds located within c. 300m of the proposed Project were identified as part of a desk study exercise, which involved a review of recent aerial photography and known inland feeding sites for the SCI species light-bellied brent goose *Branta bernicla hrota* (Scott Cawley Ltd., 2017). The survey sites are shown on Figure 15.1. Winter bird field surveys were conducted by Scott Cawley Ltd. and Jacobs Engineering Ireland Ltd. ecologists. Each site was surveyed during four visits across the wintering bird season, i.e. 5, 6 and 8 November 2018, 11 and 12 December 2018, 29, 30 and 31 January 2019, 2 February 2019 and 4, 5 and 6 March 2019 or the 10 January 2020, 3, 27 and 28 February 2020 and 11, 12, 18 and 24 March 2020 or the 1 and 17 December 2020, 22 January 2021, 26 February 2021 and 5 and 25 March 2021. Sites 46, 64, 67, 124-128 and 130-137 at Dardistown were surveyed eight times over three wintering bird seasons, i.e. 2018-2019 and 2019-2020/2020-2021.

In general, the approach was a "look-see" methodology (based on Gilbert *et al.* 1998). All birds present within a site were identified with reference to Collins Bird Guide (Svensson, 2009) to confirm identification (where necessary), and were recorded using the BTO species codes. The total flock size of birds present, their general location within the site and any activity exhibited were also recorded.

Additional data were also collected at aboveground sites that are intersected by the alignment of the proposed Project, as there is potential for direct habitat loss within these particular sites. These data were collected at ten 1m x 1m sampling points located equidistant from each other along pre-assigned transect line [13]. The length of the transect line varied per site. Transect lines were only completed at sites where no bird species were present, to avoid any potential disturbance. Environmental variables recorded at each sampling point included:

- Presence or absence of goose or swan droppings, in particular those of light-bellied brent goose;
- Height of the grass sward;
- Percentage cover of bare ground;
- Percentage cover of grass species present; and,
- Percentage cover of forb species present.

In order to describe the site and its surrounding features, the presence/absence of the following site characteristics was also noted:

- A hedgerow/treeline vegetated boundary surrounding the site;
- Scattered vegetation along the boundary of the site; and,
- The presence of standalone trees/shrubs across the site.

The site was also assessed in terms of its accessibility to dogs and whether or not it is open to the public. These site characteristics were considered likely to provide an indication of the level of disturbance at the site to birds.

15.2.5.2.7 Amphibians

An assessment of the suitability of surface water features, such as watercourses, drainage ditches and ponds for amphibian species (common frog and smooth newt), within c. 250m of the proposed Project was carried out during the multi-disciplinary walkover undertaken on the 6 April 2018 and from the 10 April 2018 to the 12 April 2018.

[13] For example, at a transect line with a length of *c.* 100m, data was collected at 10 sampling points located at every 10m interval

15.2.5.2.8 Reptiles

The suitability of habitats, located within c. 100m of the proposed Project, were assessed for breeding and/or hibernating reptile species common lizard *Lacerta vivipara*, as part of the habitat surveys undertaken on the 28 May 2018, 13 to the 15 June 2018 and on the 4 September 2018.

15.2.5.2.9 Fish

All electro-fishing surveys were undertaken by Triturus Environmental Services Ltd. on the 28 and 29 September 2018 at the proposed crossing locations of eight watercourses (see Table 15.6 below and Figure 15.3). These surveys were completed using an anode *Smith-Root LR24* backpack (12V DC input; 300V, 100W DC output), which was operated under the conditions of the Department of the Environment, Climate and Communications (DECC) licence. Both river and holding water temperature were monitored before and during each survey efforts made to ensure temperatures of 20°C were not exceeded, thus minimising stress to the captured fish due to low dissolved oxygen levels.

Table 15.6: Watercourses Surveyed as Part of Aquatic Surveys

Watercourses Crossed by Proposed Project	Electro-fishing Undertaken	Q-sampling Undertaken	White-clawed Crayfish Surveys Undertaken
Staffordstown Stream	Yes	Yes	Yes – Sweep netting
Broadmeadow River	Yes	Yes	Yes - Trapping
Ward River	Yes	Yes	Yes - Trapping
Sluice River	Yes	Yes	Yes – Sweep netting
Cuckoo Stream	Yes	Yes	Yes – Sweep netting
Mayne River	Yes	Yes	Yes – Sweep netting
Santry River	Yes	Yes	Yes – Sweep netting
Tolka River	Yes	Yes	Yes - Trapping
Royal Canal	No	No	Yes - Trapping
River Liffey	No	No	No
Grand Canal	No	No	Yes - Trapping

For Salmonidae species (*e.g.* brown trout, Atlantic salmon) and European eel, as well as other incidental fish species, electro-fishing was carried out in an upstream direction for a 10-minute catch per unit effort (CPUE). A total of eight sites were surveyed via electro-fishing to provide a better representation of the overall fisheries habitat in the vicinity of the proposed crossing points. Relative conductivity of the water was checked *in-situ* with a conductivity meter and the backpack energised with the appropriate voltage and frequency to provide enough draw to attract salmonids and European eel to the anode without harm. For the relatively high conductivity waters of the survey sites (due to local geology and general pollution gradients) a voltage of 200-225V, frequency of 40Hz and pulse duration of 4ms was utilised to draw fish to the anode without causing physical damage.

Electro-fishing for lamprey ammocoetes across the ten riverine sites were conducted using targeted $1m^2$ box quadrat-based electro-fishing (as per Harvey & Cowx, 2003) in areas of subjectively suitable marginal sand/silt (i.e. Type 1 and Type 2 substrate; Applegate 1950; Slade *et al.*, 2003), where encountered.

As lamprey ammocoetes take longer to emerge from silts than other species they were targeted at low frequency (i.e. 20-30Hz) settings that also allowed detection of European eel, if present. Settings for lamprey followed those recommended and used by Harvey & Cowx (2003), APEM (2004) and Niven & McAuley (2013). Using this approach, the anode was placed under the water surface, c. 10cm to 15cm above the sediment, to prevent immobilising lamprey ammocoetes within the sediment. The anode was energised with 100V of pulsed DC for 15-20 seconds and then turned off for approximately five seconds to allow ammocoetes to emerge from their burrows. The anode was switched on and off in this way for approximately two minutes. Immobilised ammocoetes (if captured, as with other fish) were collected in

a secondary fine-mesh, fish-friendly hand net. All fish species were transferred to a container with oxygenated river water following capture.

Fish were anaesthetised using 0.5ml/l clove oil solution (emulsified in ethanol at a ratio of 1:9) and measured to the nearest millimetre. Lamprey species would be identified to species level, where possible, with the assistance of a hand lens, through external pigmentation patterns and trunk myomere counts as described by Potter & Osborne (1975) and Gardiner (2003). Following measurement, lamprey and other species incidentally captured were released following a suitable recovery period in oxygenated containers of fresh river water.

Length frequency and species composition graphs for all species captured are illustrated in the reporting.

All equipment and PPE used during these surveys was disinfected with Virkon® disinfectant prior to and post-survey completion, and best practice precautions were employed to prevent the potential spread of invasive species and water-borne pathogens, according to best practice biosecurity protocols. Surveys were strictly conducted in an upstream direction to avoid the potential spread of pathogens.

Fisheries habitats were also evaluated for salmonids using the Life Cycle Unit method (as per Kennedy, 1984; O'Connor & Kennedy, 2002) and lamprey species using a modified version of the Life Cycle Unit method developed specifically for lamprey species (Macklin & Brazier, 2018). Each watercourse was assigned a quality score with respect to salmonids and lamprey species habitats. River habitat and general fisheries habitat for other species was also assessed (as per Environment Agency, 2003; O'Grady, 2006).

15.2.5.2.10 Aquatic Macro-invertebrate Survey (Kick-Sampling)

Macro-invertebrate samples were collected by Triturus Environmental Services Ltd. at eight watercourses crossed by the proposed Project between the 28 and 29 September 2018 (see Table 15.6 above) and at the Royal Canal Basin located directly east of Cross Guns Bridge between Lock 6 and Lock 5 on the 17 June 2021 (see Appendix A15.9 for full details). All Q-samples were taken with a standard kick sampling net (i.e. 250mm in width and with a 500µm mesh size) from riffle/glide habitat, utilising a three minute per sample approach. Large cobble was also washed at each site where present and samples were elutriated and fixed in 70% ethanol for laboratory identification. Any rare invertebrate species were identified from the NPWS Red List publications for beetles, stoneflies, mayflies and other relevant taxa. Macro-invertebrate samples were converted to Q-value ratings as per Toner *et al.* (2005). The reference classes for Q-value rating are shown on Table 15.7 below.

Table 15.7: Description of Reference Classes for Each EPA Q-value Ratings (Q1 to Q5) (after Toner *et al.*, 2005)

Q-Value	Water Framework Directive Status	Pollution Status	Condition
Q5 or 4-5	High Status	Unpolluted	Satisfactory
Q4	Good Status	Unpolluted	Satisfactory
Q3-4	Moderate Status	Slightly Polluted	Unsatisfactory
Q3 or 2-3	Poor	Moderately Polluted	Unsatisfactory
Q2, 1-2 or 1	Bad	Seriously Polluted	Unsatisfactory

15.2.6 Consultations

The following organisations with relevance to ecology were consulted:

- The National Parks & Wildlife Service (NPWS) section of the Department of Housing, Local Government and Heritage.
- Biodiversity Officer Fingal County Council (FCC)
- Biodiversity Officer at Dublin City Council (DCC)
- Inland Fisheries Ireland (IFI)
- Waterways Ireland

- Bat Conservation Ireland (BCI)
- Botanical Society of Britain & Ireland (BSBI)

Full details of consultations carried out for the proposed Project are provided in Appendix A8.19 of Chapter 8 (Consultation). A summary of consultation meetings with NPWS, FCC, DCC and IFI that related to biodiversity are provided below. Flora or fauna species records are included under the relevant headings in Section 15.3 Baseline Environment.

15.2.6.1 Department of Housing, Local Government and Heritage (NPWS)

A meeting was held with NPWS on 13 November 2020. NPWS made the following comments/observations relevant to the preparation of the EIAR:

- Use of grassland sites by SCI bird species of SPAs and the potential for habitat loss (Addressed in the NIS accompanying this application, and in Sections 15.4.2.1.1 European Sites and 15.4.3.1.1 European Sites).
- Consideration of the passage of wildlife across the aboveground sections of the alignment of the proposed Project and how to maintain it. (Addressed throughout this Chapter, under the relevant species headings)

Consideration for the presence of hare species *Lepus* spp. (Addressed throughout this Chapter under the 'Other Mammal Species' headings) Provision of Ecological Clerk of Works during the construction of the proposed Project. (Addressed in Section 15.5 Mitigation Measures)

These observations and comments have been taken on board and implemented throughout the EIAR.

15.2.6.2 Fingal County Council (FCC)

FCC responded to the EIA Scoping consultation request on the 2 August 2019. Their response included the following observations:

- Consideration of potential noise impacts on habitats and species within Malahide/Broadmeadow Estuary at Swords (i.e. within which Malahide Estuary Special Area of Conservation (SAC) and Malahide Estuary SPA are located) during construction and/or operation of the proposed Project. (Addressed in the NIS accompanying this application with regard to QI/SCI habitats and species associated with the Malahide Estuary SAC and Malahide Estuary SPA. Noise impacts are assessed more generally under the relevant species headings.)
- Ensure that European sites located within 15km of the proposed alignment (i.e. "linear site") are fully reviewed and analysed and that sites in excess of this 15km distance are effectively screened in or out as appropriate. (Addressed in the NIS accompanying this application)
- Consideration of sites utilised by birds for feeding, especially overwintering birds and that overwintering surveys are undertaken as part of the EIAR and Natura Impact Statement (NIS) especially where there are indications that overwintering birds use existing fields or green spaces that may be impacted by construction or operation – i.e. a desk study may not be sufficient and therefore field survey is recommended. (Results of wintering bird surveys are outlined in Section 15.3.9.2)
- Consultation with FCC biodiversity officer is recommended.
- Consideration of potential permanent habitat severance effect especially with respect to impacts on bats and hedgerow/trees. (Addressed throughout this Chapter under the relevant species headings)

A biodiversity meeting was held on 25 August 2020 with FCC and included the attendance of FCC Biodiversity Officer. FCC made the following comments/observation relevant to the preparation of this Chapter of the EIAR:

- Ecological baseline (as presented in Section 15.3) is consistent with FCC records.
- Atlantic salmon are known to spawn in the Ward River.
- Consideration of the scale of habitat loss.

These observations and comments have been taken on board and implemented throughout the EIAR.

15.2.6.3 Dublin City Council (DCC)

DCC responded to the EIA scoping consultation request on the 4 July 2019. Their response included the following observations:

- Consultation with DCC Biodiversity Officer is recommended.

A biodiversity meeting was held on 21 May 2020 with DCC and included the attendance of DCC Biodiversity Officer. DCC made the following comments/observation relevant to the preparation of this Chapter of the EIAR:

- Consideration and examination of the Ballymun Biodiversity Action Plan.
- Consideration of the ancient hedgerows near the M50 Motorway, hedgerow connectivity, importance of hedgerows as a corridor for birds (in particular birds of prey), farmland habitat near Silloge Park Golf Club and presence of buzzard, peregrine falcon and owl species in the general area near Silloge Park Golf Club. (Addressed throughout this Chapter under the relevant habitats and species headings)
- Consideration of bats present in general Ballymun area. (Addressed throughout this Chapter under the 'bat' headings)
- Consideration of Santry River:

- Its hydrological connectivity to North Bull Island (Addressed throughout this Chapter under the European Sites headings, and in the NIS accompanying this application).
- Numerous bird surveys have been undertaken by DCC on the Santry River.
- Issues with respect to illegal poaching along the Santry River.
- Potential for impacts due to proposed works located north-west of Santry Demesne (Addressed throughout this Chapter under the relevant impact headings).
- Protection of woodland at Santry Demesne as it provides an important flightpath for light-bellied brent goose (a species that seasonally retreats inland due to the depletion of eelgrass Zostera sp. in Dublin Bay) (No works are proposed within Santry Demesne as part of the proposed Project).
- Plans to restore/rehabilitate the Santry River.

- General decline/loss of breeding and feeding habitat for bats and butterflies and how this relates to habitat loss as a result of the proposed Project (Addressed throughout this Chapter under the relevant habitats and species headings).
- Presence of Indian balsam *Impatiens glandulifera* in Ballymun (The study area was surveyed for non-native invasive plant species and are addressed under the 'non-native invasive plant species' headings.
- Presence of coot *Fulica atra* in Darndale Park. This species was noted as being uncommon and DCC is gathering information on it.
- Consideration of the avoidance of habitat loss through design, compensation/offsetting of habitat loss and potential for enhancement.
- Consideration of No Net Loss with respect to the EU Biodiversity Strategy for 2030.
- Requirement for post-construction monitoring.
- Engagement with local Ballymun environmental group, the Ballymun Wildlife Group as well as the Tolka Branch Birdwatch Ireland.
- Consideration for the DCC updated Biodiversity Action Plan.
- Consideration of Local Area Plans and Park Strategy.

These observations and comments have been taken on board and implemented throughout the EIAR.

15.2.6.4 Inland Fisheries Ireland (IFI)

IFI provided fish records for the proposed crossing points on the 27 July 2018.

The IFI responded to the EIA Scoping consultation request on the 5 June 2019. Their response included the following observations generally relevant to Appropriate Assessment:

- There are known records of the Annex II qualifying interest fish species Atlantic salmon in the Turvey river system, the lower reaches of the Broadmeadow River and Ward River system, the River Tolka and the River Liffey systems;
- With regards to the River Tolka, it is noted that it has "*a particularly important nursery function for salmonid species throughout… [and that] salmon were recorded in the Glasnevin area in 2011*";
- The River Tolka is also known to support populations of the Annex I qualifying interest species Lamprey *Lampetra* sp.;
- With regards to the Liffey, it is noted that it "*supports a regionally significant population of Atlantic salmon*" and that it "*serves as the natural linkage for species such as salmon… providing the necessary habitat for their transition*"; and,
- It is also noted that "*previous surveys in Dublin city area of the Liffey have recorded… river lamprey [L. fluviatilis]*"; and,
- It is noted that whilst both the Cuckoo River and Mayne River are non-salmonid systems, the "*IFI are currently assessing the viability of a salmonid reintroduction programme*".

With regards to water protection measures, the IFI has recommended that the *Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters* (IFI, 2016) is consulted for any proposed works undertaken near any of the relevant rivers and streams and that the "*maintenance of habitat integrity (both in-stream and riparian) is essential in safeguarding the ecological value of this important urban natural resource*". They have also recommended that "*A comprehensive and integrated approach for achieving estuary and river protection during construction and operation should be implemented through environmental construction management planning*".

A biodiversity and hydrology meeting was held on 31 August 2020 with IFI and included the attendance of DCC Biodiversity Officer. DCC made the following comments/observation relevant to the preparation of this Chapter of the EIAR:

- Requirement for IFI to see detailed documentation on the design of culverts.
- Requirement to translocate fish from impacted river channel prior to any temporary diversion works occurring and that this activity must be undertaken by licensed contractors authorised under Section 14 of the Fisheries (Consolidation) Act, 1959.
- Implementation of Sustainable Drainage Systems (SUDS) to reduce amounts of surface water being discharged into watercourses as well as the use of hydrocarbon petrol interceptors.
- Requirement for protective measures during construction especially in the context of management of silt.

These observations and comments have been taken on board and implemented throughout the EIAR.

15.2.7 Appraisal Method for the Assessment of Impacts

15.2.7.1 Valuing the Ecological Receptors

Biodiversity receptors (including identified sites of biodiversity importance) have been valued with regard to the ecological valuation examples set out in the Transport Infrastructure Ireland (TII) guidelines (NRA, 2009) and advice on how to determine the importance of ecological features provided in Chartered Institute of Ecology and Environmental Management (CIEEM) guidelines (CIEEM, 2018).

Annex I habitats that lie outside of European sites have been valued on a case-by-case basis, with regard to the TII guidelines (NRA, 2009). As these habitats are of high conservation concern, they are valued as being of national importance at a minimum. All areas of priority Annex I habitat types are valued as being of international importance given that they are of the highest conservation concern at a European level (i.e. natural habitat types in danger of disappearance[14]).

[14] From the definition of "*priority natural habitat types*" in Article 1(d) of the Habitats Directive.

Habitat areas within SACs are considered in the context of assessing impacts on the conservation objectives and site integrity of a given European site with regard to the Appropriate Assessment tests set out in Article 6(3) of the Habitats Directive. All European sites are valued as internationally important.

In accordance with TII Guidelines (NRA, 2009), biodiversity features within the ZoI of the proposed Project which are "*both of sufficient value to be material in decision making and likely to be affected significantly*" are deemed to be "*Key Ecological Receptors*" (KERs). These are the biodiversity receptors which may be subject to likely significant effects from the proposed Project, either directly or indirectly. KERs are those biodiversity receptors with an ecological value of Local Importance (Higher Value) or greater.

15.2.7.2 Characterising and Describing the Impacts

The parameters considered in characterising and describing the potential impacts of the proposed Project are outlined in Table 15.8.

Table 15.8: Parameters Used to Characterise and Describe the Magnitude or Scale of Potential Impacts (CIEEM, 2018)

Parameter	Categories
Type of Impact	Positive/Neutral/Negative May also include Cumulative Effects, 'Do Nothing Effects', 'Do Minimum Effects', Indeterminable Effects, Irreversible Effects, Residual Effects, Synergistic Effects, Indirect Effects and/or Secondary Effects
Extent	The size of the affected area/habitat and/or the proportion of a population affected by the effect
Duration	The period of time over which the effect will occur[15].
Frequency and Timing	How often the effect will occur; particularly in the context of relevant life-stages or seasons
Reversibility	Permanent/Temporary Will an impact reverse; either spontaneously or as a result of a specific action

The likelihood of an impact occurring, and the predicted effects, are also an important consideration in characterising impacts. The likelihood of an impact occurring is assessed as being certain, likely or unlikely; in some cases it may be possible to definitively conclude that an impact will not occur.

Professional judgement is used in considering the contribution of all relevant criteria in determining the overall magnitude of an impact.

15.2.7.3 Impact Significance

In determining impact significance, the NRA (2009) and CIEEM (2018)[16] guidelines were followed, which requires examination of the following two key elements:

- Impact on the integrity of the ecological feature; and
- Impact on its conservation status within a given geographical area.

Integrity

[15] The following terms/definitions for describing the duration of impacts are provided in the Environmental Protection Agency guidelines (Draft August 2017): Momentary Effects - effects lasting from seconds to minutes; Brief Effects - effects lasting less than a day; Temporary Effects - effects lasting less than a year; Short-term Effects - effects lasting one to seven years; Medium-term Effects - effects lasting seven to fifteen years; Long-term Effects - effects lasting fifteen to sixty years; Permanent Effects - effects lasting over sixty years.

[16] According to CIEEM (2018), for the purpose of EcIA, a 'significant effect' is an effect that either supports or undermines biodiversity conservation objectives for 'important ecological features' or for biodiversity in general. Effects can be considered significant at a wide range of scales from international to local. A significant effect is an effect that is sufficiently important to require assessment and reporting so that the decision maker is adequately informed of the environmental consequences of permitting a project.

The term "*integrity*" should be regarded as the coherence of ecological structure and function, across the entirety of a site that enables it to sustain all of the biodiversity or ecological resources for which it has been valued (NRA, 2009).

The term "*integrity*" is most often used when determining impact significance in relation to designated areas for nature conservation (*e.g.* SACs, SPAs or pNHA/NHAs) but can often be the most appropriate method to use for non-designated areas of biodiversity value where the component habitats and/or species exist with a defined ecosystem at a given geographic scale.

An impact on the integrity of an ecological site or ecosystem is considered to be significant if it moves the condition of the ecosystem away from a favourable condition: removing or changing the processes that support the sites' habitats and/or species; affect the nature, extent, structure and functioning of component habitats; and/or, affect the population size and viability of component species.

15.2.7.4 Conservation Status

The definitions for conservation status given in the EU Habitats Directive 92/43/EEC, in relation to habitats and species, are also used in the CIEEM (2018) and NRA (2009) guidance:

- For natural habitats, conservation status means the sum of the influences acting on the natural habitat and its typical species, that may affect its long-term distribution, structure and functions as well as the long-term survival of its typical species, at the appropriate geographical scale.
- For species, conservation status means the sum of influences acting on the species concerned that may affect the long-term distribution and abundance of its populations, at the appropriate geographical scale.

An impact on the conservation status of a habitat or species is considered to be significant if it will result in a change in conservation status.

After the definitions provided in the EU Habitats Directive 92/43/EEC, the conservation status of a habitat is favourable when:

- Its natural range and areas it covers within that range are stable or increasing;
- The specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future; and
- The conservation status of its typical species is favourable as defined below under species.

And the conservation status of a species is favourable when:

- Population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats;
- The natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future; and
- There is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

According to the TII/CIEEM methodology, if it is determined that the integrity and/or conservation status of an ecological feature will be impacted on, then the level of significance of that impact is related to the geographical scale at which the impact will occur (i.e. local, county, national, international). In some cases, an impact may not be significant at the geographic scale at which the ecological feature has been valued but may be significant at a lower geographical level. For example, a particular impact may not be considered likely to have a negative effect on the overall conservation status of a species which is considered to be internationally important. However, an impact may occur at a local level on this internationally important species. In this case, the impact on an internationally important species is considered to be significant at only a local, rather than international level.

This is the preferred approach to determining the scale of significant impacts on ecological receptors. The more generalised degrees of impact significance that apply to other environmental factors are not

relevant to biodiversity and do not explain accurately explain potential biodiversity scales of impact, instead the TII/CIEEM guidance is more appropriate (EPA 2017; EPA, 2003).

15.3 Baseline Environment

The following section describes the receiving ecological environment and biodiversity within the ZoI of the proposed Project and the proposed Grid Connections (as outlined above in Section 15.2.2).

The below provides an overview of the geographical assessment zones (AZ's):

- **AZ1 Northern Section -** Estuary Station to DANP. It includes the railway crossing on a viaduct over the Broadmeadow and Ward Rivers and associated flood plains. This section will include open, retained cut, and cut and cover sections. Section AZ1 includes the Park and Ride Facility (P&R) at Estuary Station as well as stations at Seatown, Swords Central and Fosterstown.
- **AZ2 Airport Section -** Includes the proposed Grid Connections and new substations, the DANP, the tunnel underneath Dublin Airport, Dublin Airport Station and DASP and associated intervention and ventilation tunnels.
- **AZ3 Dardistown to Northwood -** Covers from south of DASP to the Northwood Portal. Section AZ3 includes Dardistown station, the Dardistown Depot, ESBN connection and substations, the M50 Viaduct, Northwood Station and the TBM launch site at Northwood. This section will include open, retained cut, and cut and cover sections of the alignment.
- **AZ4 Northwood to Charlemont -** Section AZ4 extends from a location south of the Northwood Portal to the tunnel termination located south of Charlemont Station, ten underground stations, and the Albert College Park Intervention shaft.

EstuaryEstuaryA full description of the proposed Project is presented in Chapter 4 (Description of the MetroLink Project*)*.

The local receiving environment is dominated by:

- Areas of hardstanding, including Dublin Airport, the R132, the R108, the M50 Motorway and the existing railway lines and associated permanent way fit at Glasnevin;
- Agricultural fields primarily cultivated with arable crops;
- Areas of public amenity (including parkland) and open space; and
- Private residential, commercial and industrial properties and residential gardens and landscaped areas associated with commercial and industrial estates.

The proposed alignment crosses 11 watercourses, including the Broadmeadow River, Royal Canal, River Tolka, River Liffey and Grand Canal.

A detailed description of the proposed Grid Connections route is presented in the ESB Advanced Work Package (ESB, 2021). The local receiving environment for the proposed Grid Connections is dominated by existing roads as the majority of the works will take place within the footprint on existing roads. The proposed Grid Connections alignment will potentially cross several watercourses including the Dunbro Stream, Barberstown Stream, Cuckoo Stream and Mayne River.

Section 15.3.2 summarises the results of the desk study and consultations undertaken in the preparation of this Chapter. Section 15.3.3 to Section 15.3.13 describe the ecological baseline as it relates to the ecological receptors recorded, or known from, the study area under the following headings: designated areas for nature conservation, habitats, rare and protected plant species, non-native invasive plant and animal species, mammals (excluding bats), bats, invertebrate species, bird species, amphibian species, reptiles and fish. Section 15.3.14 provides a summary of the ecological valuation of each ecological receptor potentially affected by the proposed Project and the proposed Grid Connections and identifies those which are KERs and subject to impact assessment.

15.3.1 Desk Study

The results of the desktop review are provided in Appendix A15.2 and are incorporated into the sections below under the relevant headings, as relevant.

15.3.2 Local Biodiversity Areas

Fingal Biodiversity Action Plan 2010-2015 highlights a number of areas considered to be of biodiversity value present within the boundaries of FCC. These areas that are located within the ZoI of the proposed Project are provided below:

- Malahide and Baldoyle estuaries, which are located downstream of the proposed Project and support a variety of waterbirds, waders and fish species, and the surrounding terrestrial grasslands;
- Sandy and shingle beaches, which are located downstream of the proposed Project and support a variety of estuarine bird species and plant species that are rare in Dublin such as yellow horned-poppy *Glaucium flavum*, sea-holly *Eryngium maritimum* and sea-kale *Crambe maritima*;
- Sand dunes, which are located downstream of the proposed Project and support a number of rare and protected species such as the legally protected hairy violet *Viola hirta* and Red List species spring vetch *Vicia lathyroides*;
- Cliffs and rocky shores, which are located downstream of the proposed Project and support numerous breeding seabird species and rare plant species such as rock samphire *Crithmum maritimum*, golden-samphire *Inula crithmoides* and sea wormwood *Artemisia maritima*;
- Habitats considered to be of importance, such as arable land, semi-natural calcareous grassland, hedgerows and woodlands, which support a range of species and act as important ecological links/corridors across the wider landscape;
- Network of rivers and streams, including the Broadmeadow River, Ward River, River Tolka, Santry River, Sluice River and Mayne River, all of which are crossed by the proposed Project. These watercourses support a range of riverine bird species, such as kingfisher, and fish species;
- Wetlands such as the Sluice River marsh and Mayne marsh, both of which are located downstream of the proposed crossing points in close proximity to Baldoyle Estuary;
- Parkland and gardens associated with houses, parks, playing fields, churchyards, cemeteries and brown field sites, all of which contain valuable wildlife habitats; and
- European and national sites designated for conservation (i.e. SAC, SPA and pNHA) and the lands surrounding these sites that are of key importance as stepping stones in particular for birds as feeding or roosting grounds.

Dublin City Biodiversity Action Plan 2015-2020 highlights a number of areas considered to be of biodiversity value present within the boundaries of DCC. These areas that are located within the ZoI of the proposed Project are provided below:

- North Bull Island, which is noted to support nine different Annex I habitats, a range of legally protected species under the EU Habitats Directive and six legally protected plant species under the Flora Protection Order. It is also located within the European sites of North Dublin Bay SAC and North Bull Island SPA and the UNESCO Dublin Bay Biosphere Reserve;
- River Liffey and River Tolka, which are noted as being highly significant regional salmonid catchments for species of Atlantic salmon and brown trout. It is noted that the River Liffey supports Atlantic salmon, brook lamprey, river lamprey and white-clawed crayfish;
- Royal Canal and Grand Canal, which support coarse fish species, including pike *Esox* species, rudd *Scardinius erythrophthalmus*, bream *Abramis brama* and tench *Tinca tinca*, and the legally protected Flora Protection Order species opposite-leaved pondweed *Groenlandia densa* as well as the endangered Red List freshwater snail species glutinous snail *Myxas glutinosa*;
- Riparian zones, which support a range of legally protected and rare species;
- Network of parks and public green spaces, such as Tolka Valley Park and St Stephen's Green, and private gardens, which support a variety of species and is considered to be a valuable biodiversity resource; and
- European sites, which are located downstream of the proposed Project in Dublin Bay.

Local biodiversity areas listed above are considered under the relevant flora and/or fauna KERs that rely on these areas in the overall EIAR biodiversity assessment.

15.3.3 Designated Areas for Nature Conservation

15.3.3.1 European Sites

The proposed Project does not overlap with any European sites. The nearest European site is Malahide Estuary SAC, which is located c. 370m downstream of the proposed Project or c. 235m east as the crow flies. There are 24 European sites (SACs or SPAs) located within the vicinity of the proposed Project (see Figure 15.4). As a starting point, all European sites within 15km of the proposed Project were considered (as per *Appropriate Assessment of Plans and Projects in Ireland - Guidance for Planning Authorities.* (Department of Environment, Heritage and Local Government, 2010 revision). However, all European sites within the ZoI of the proposed Project, which was determined using the source-pathway-receptor model (as per *OPR Practice Note PN01. Appropriate Assessment Screening for Development Management* (Office of the Planning Regulator, 2021)), were considered in the assessment. The following potential source-pathway-receptor were identified and examined in relation to the proposed Project:

- Habitat loss and fragmentation. The zone of influence of this potential impact is likely to be confined to the proposed area of works.
- *Ex situ* habitat loss – SCI bird species. Bird SCIs of several European sites may forage up to several tens of kilometres outside of the European site boundary.
- Disturbance and displacement – SCI bird species. Disturbance and displacement effects can potentially extend to up to 300m from the source of disturbance.
- Mortality risk – SCI bird species. The potential ZoI of mortality risk could extend to European sites in the surrounding area which have been designated for SCI bird species that routinely travel to foraging areas outside of the European site network.
- Habitat degradation as a result of pollution/contamination of receiving waterbodies. Theoretically, the ZoI for pollution/contamination effects could extend to any European sites downstream of the proposed development that are designated for aquatic, estuarine or marine QIs SCIs.
- Habitat degradation as a result of changes to the hydrogeological regime of watercourses. Theoretically, the ZoI for pollution/contamination effects could extend to any European sites downstream of the proposed development that are designated for aquatic, estuarine or marine QIs SCIs.
- Habitat degradation as a result of changes to the hydrogeological regime. Theoretically the ZoI for changes to the hydrogeological regime could extend to any European sites in the same groundwater body as the proposed Project that have been designated for groundwater-dependent terrestrial habitats, or species which depend on these groundwater-dependent terrestrial habitats.
- Habitat degradation as a result of the introduction and/or spread of non-native invasive species. Theoretically, the ZoI for spread of non-native invasive species could extend to any European sites downstream of the proposed development that are designated for terrestrial habitats that are generally above the high tide mark.
- Habitat degradation as a result of air quality impacts. The ZoI for air quality impacts depends on the concentration and source of emissions, background air quality, and the sensitivity of QIs to air quality impacts. The Air Quality ZoI could theoretically extend several kilometres from a project.

The sites that were determined to be within the vicinity and potential zone of influence of the proposed Project, in consideration of the aforementioned impacts are listed in Table 15.9.

All European sites are valued as being of International Importance.

Table 15.9: European Sites (SACs and SPAs) Located within the ZoI (highlighted in grey), and those in the Wider Area, of the Proposed Project Boundary

Site Name	Distance[17]	Reasons for Designation – Qualifying Interest (QIs) or Special Conservation Interests (SCIs)
Special Areas of Conservation		
Malahide Estuary SAC [000205]	c. 370m downstream of the proposed crossing point on the Broadmeadow River or c. 235m east of proposed Project as the crow flies	Annex I Habitats: ▪ Mudflats and sandflats not covered by seawater at low tide [1140] ▪ *Salicornia* and other annuals colonising mud and sand [1310] ▪ *Spartina* swards (*Spartinion maritimae*) [1320] ▪ Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330] ▪ Mediterranean salt meadows (*Juncetalia maritimi*) [1410] ▪ Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) [2120] ▪ Fixed coastal dunes with herbaceous vegetation (grey dunes) [2130] * Source: Conservation Objectives: Malahide Estuary SAC 000205. Version 1. (NPWS, 2013a)
Rogerstown Estuary SAC [000208]	c. 2.5km north-east of proposed Project as the crow flies	Annex I Habitats: ▪ Estuaries [1130] ▪ Mudflats and sandflats not covered by seawater at low tide [1140] ▪ Salicornia and other annuals colonising mud and sand [1310] ▪ Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330] ▪ Mediterranean salt meadows (*Juncetalia maritimi*) [1410] ▪ Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) [2120] ▪ Fixed coastal dunes with herbaceous vegetation (grey dunes) [2130] * Source: Conservation Objectives: Rogerstown Estuary SAC 000208. Version 1. (NPWS, 2013b)
South Dublin Bay SAC [000210]	c. 5.6km downstream of the nearest proposed crossing point, i.e. at the River Liffey or c. 2.8km east of proposed Project as the crow flies	Annex I Habitats: ▪ Mudflats and sandflats not covered by seawater at low tide [1140] ▪ Annual vegetation of drift lines [1210] ▪ *Salicornia* and other annuals colonizing mud and sand [1310] ▪ Embryonic shifting dunes [2110] Source: Conservation Objectives: South Dublin Bay SAC 000210. Version 1. (NPWS, 2013c)

[17] Distance in km/m from the proposed Project

Site Name	Distance[17]	Reasons for Designation – Qualifying Interest (QIs) or Special Conservation Interests (SCIs)
North Dublin Bay SAC [000206]	c. 6.1km downstream of the nearest proposed crossing point, i.e. at the River Tolka or c. 5km east of proposed Project as the crow flies	Annex I Habitats: ▪ Mudflats and sandflats not covered by seawater at low tide [1140] ▪ Annual vegetation of drift lines [1210] ▪ *Salicornia* and other annuals colonizing mud and sand [1310] ▪ Atlantic salt meadows (*Glauco - Puccinellietalia maritimae*) [1330] ▪ Mediterranean salt meadows (*Juncetalia maritimi*) [1410] ▪ Embryonic shifting dunes [2110] ▪ Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) [2120] ▪ * Fixed coastal dunes with herbaceous vegetation (grey dunes) [2130] ▪ Humid dune slacks [2190] Annex II Species: ▪ Petalwort Petalophyllum ralfsii [1395] Source: Conservation Objectives: North Dublin Bay SAC 000206. Version 1. (NPWS, 2013d)
Baldoyle Bay SAC [000199]	c. 8.6km downstream of the proposed crossing point on the Sluice River or c. 6km east of proposed Project as the crow flies	Annex I Habitats: ▪ Mudflats and sandflats not covered by seawater at low tide [1140] ▪ *Salicornia* and other annuals colonizing mud and sand [1310] ▪ Atlantic salt meadows (*Glauco - Puccinellietalia maritimae*) [1330] ▪ Mediterranean salt meadows (*Juncetalia maritimi*) [1410] Source: Conservation Objectives: Baldoyle Bay SAC 000199. Version 1. (NPWS, 2012)
Rockabill to Dalkey Island SAC [003000]	c. 9km east of the proposed Project as the crow flies	Annex I Habitats: ▪ Reefs [1170] Annex II Species: ▪ Harbour porpoise *Phocoena phocoena* [1351] Source: Conservation Objectives: Rockabill to Dalkey Island SAC 003000. Version 1. (NPWS, 2013e)
Wicklow Mountains SAC [002122]	c. 18.6km upstream of the proposed Tara Station via the River Liffey, river Dodder and Owendoher River	Annex I Habitats: ▪ Oligotrophic waters containing very few minerals of sandy plains (*Littorelletalia uniflorae*) [3110] ▪ Natural dystrophic lakes and ponds [3160] ▪ Northern Atlantic wet heaths with *Erica tetralix* [4010] ▪ European dry heaths [4030] ▪ Alpine and Boreal heaths [4060] ▪ Calaminarian grasslands of the *Violetalia calaminariae* [6130] ▪ Species-rich *Nardus* grasslands, on siliceous substrates in mountain areas (and submountain areas, in Continental Europe) [6230] *

Site Name	Distance[17]	Reasons for Designation – Qualifying Interest (QIs) or Special Conservation Interests (SCIs)
	or c. 10.2km south of proposed Project as the crow flies	▪ Blanket bogs (* if active bog) [7130] ▪ Siliceous scree of the montane to snow levels (*Androsacetalia alpinae* and *Galeopsietalia ladani*) [8110] ▪ Calcareous rocky slopes with chasmophytic vegetation [8210] ▪ Siliceous rocky slopes with chasmophytic vegetation [8220] ▪ Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles [91A0] Annex II Species: ▪ Otter *Lutra lutra* [1355] Source: Conservation Objectives: Wicklow Mountains SAC 002122. Version 1. NPWS (2017b)
Glenasmole Valley SAC [001209]	c. 10.7km south of proposed Project as the crow flies	Annex I Habitats: ▪ Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) (* important orchid sites) [6210] ▪ *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) [6410] ▪ Petrifying springs with tufa formation (*Cratoneurion*) [7220] * Source: Conservation Objectives: Glenasmole Valley SAC [001209]. Version 1. NPWS (2021a)
Howth Head SAC [000202]	c. 10.7km east of the proposed Project as the crow flies	Annex I Habitats: ▪ Vegetated sea cliffs of the Atlantic and Baltic coasts [1230] ▪ European dry heaths [4030] Source: Conservation Objectives: Howth Head SAC 000202. Version 1. (NPWS, 2016)
Ireland's Eye SAC [002193]	c. 10.7km east of proposed Project as the crow flies	Annex I Habitats: ▪ Perennial vegetation of stony banks [1220] ▪ Vegetated sea cliffs of the Atlantic and Baltic coasts [1230] Source: Conservation Objectives: Ireland's Eye SAC 002193. Version 1. NPWS (2017a)
Lambay Island SAC [000204]	c. 11.5km north-east of proposed Project as the crow flies	Annex I Habitats: ▪ Reefs [1170] ▪ Vegetated sea cliffs of the Atlantic and Baltic coasts [1230] Annex II Species: ▪ Grey seal Halichoerus grypus [1364] ▪ Harbour seal Phoca vitulina [1365] Source: Conservation Objectives: Lambay Island SPA [000204]. Version 1.0. NPWS (2013f)
Knocksink Wood SAC [000725]	c. 13.4km south-east of proposed Project as the crow flies	Annex I Habitats: ▪ Petrifying springs with tufa formation (*Cratoneurion*) [7220] * ▪ Oak sessile oak woods with *Ilex* and *Blechnum* in the British Isles [91A0] ▪ *Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*) [91E0] Source: Conservation Objectives: Knocksink Wood SAC [000725]. Version 1. NPWS (2021b)

Site Name	Distance[17]	Reasons for Designation – Qualifying Interest (QIs) or Special Conservation Interests (SCIs)
Rye Water Valley/Carton SAC [003198]	c. 13.6km west of the proposed Project as the crow flies	Annex I Habitats: ▪ Petrifying springs with tufa formation (*Cratoneurion*) [7220] * Annex II Species: ▪ *Vertigo angustior* (Narrow-mouthed Whorl Snail) [1014] ▪ *Vertigo moulinsiana* (Desmoulin's Whorl Snail) [1016] Source: Conservation Objectives: Rye Water Valley/Carton SAC [003198]. Version 1. (NPWS, 2021c)
Ballyman Glen SAC [000713]	c. 14.8km south-east of proposed Project as the crow flies	Annex I Habitats ▪ Petrifying springs with tufa formation (*Cratoneurion*) [7220] * ▪ Alkaline fens [7230] Source: Conservation Objectives: Ballyman Glen SAC [000713]. Version 1. NPWS (2019d)
Special Protection Areas		
Malahide Estuary SPA [004025]	c. 750m downstream of the proposed crossing point on the Broadmeadow River or c. 490m east of proposed Project as the crow flies	▪ Great Crested Grebe *Podiceps cristatus* [A005] [wintering] ▪ Light-bellied Brent Goose *Branta bernicla hrota* [A046] [wintering] ▪ Shelduck *Tadorna tadorna* [A048] [wintering] ▪ Pintail *Anas acuta* [A054] [wintering] ▪ Goldeneye *Bucephala clangula* [A067] [wintering] ▪ Red-breasted Merganser *Mergus serrator* [A069] [wintering] ▪ Oystercatcher *Haematopus ostralegus* [A130] [wintering] ▪ Golden Plover *Pluvialis apricaria* [A140] [wintering] ▪ Grey Plover *Pluvialis squatarola* [A141] [wintering] ▪ Knot *Calidris canutus* [A143] [wintering] ▪ Dunlin *Calidris alpina* [A149] [wintering] ▪ Black-tailed Godwit *Limosa limosa* [A156] [wintering] ▪ Bar-tailed Godwit *Limosa lapponica* [A157] [wintering] ▪ Redshank *Tringa totanus* [A162] [wintering] ▪ Wetland and Waterbirds [A999] Sources: Conservation Objectives: Malahide Estuary SPA 004025. Version 1. (NPWS, 2013g) and Natura 2000 – Standard Data Form (NPWS, 2009a)
South Dublin Bay and River Tolka Estuary SPA [004024]	c. 3.2km downstream of the nearest proposed crossing point, i.e. at the River Tolka or c. 2.1km east of the proposed Project as	▪ Light-bellied Brent Goose *Branta bernicla hrota* [A046] ▪ Oystercatcher *Haematopus ostralegus* [A130] ▪ Ringed Plover *Charadrius hiaticula* [A137] ▪ Grey Plover *Pluvialis squatarola* [A141] ▪ Knot *Calidris canutus* [A143] ▪ Sanderling *Calidris alba* [A144] ▪ Dunlin *Calidris alpina* [A149] ▪ Bar-tailed Godwit *Limosa lapponica* [A157] ▪ Redshank *Tringa totanus* [A162] ▪ Black-headed Gull *Croicocephalus ridibundus* [A179] ▪ Roseate Tern *Sterna dougallii* [A192] ▪ Common Tern *Sterna hirundo* [A193] ▪ Arctic Tern *Sterna paradisaea* [A194] ▪ Wetlands & Waterbirds [A999] Source: Conservation Objectives: South Dublin Bay and River Tolka Estuary SPA 004024. Version 1. (NPWS, 2015a) and Natura 2000 – Standard Data Form (NPWS, 2009d)

Site Name	Distance[17]	Reasons for Designation – Qualifying Interest (QIs) or Special Conservation Interests (SCIs)
	the crow flies	
North Bull Island SPA [004006]	c. 6.5km downstream of the nearest proposed crossing point, i.e. at the River Tolka or c. 5km east of the proposed Project as the crow flies	▪ Light-bellied Brent Goose *Branta bernicla hrota* [A046] ▪ Shelduck *Tadorna tadorna* [A048] ▪ Teal *Anas crecca* [A052] ▪ Pintail *Anas acuta* [A054] ▪ Shoveler *Anas clypeata* [A056] ▪ Oystercatcher *Haematopus ostralegus* [A130] ▪ Golden Plover *Pluvialis apricaria* [A140] ▪ Grey Plover *Pluvialis squatarola* [A141] ▪ Knot *Calidris canutus* [A143] ▪ Sanderling *Calidris alba* [A144] ▪ Dunlin *Calidris alpina* [A149] ▪ Black-tailed Godwit *Limosa limosa* [A156] ▪ Bar-tailed Godwit *Limosa lapponica* [A157] ▪ Curlew *Numenius arquata* [A160] ▪ Redshank *Tringa tetanus* [A162] ▪ Turnstone *Arenaria interpres* [A169] ▪ Black-headed Gull *Croicocephalus ridibundus* [A179] ▪ Wetlands & Waterbirds [A199] Source: Conservation Objectives: North Bull Island SPA 004006. Version 1. (NPWS, 2015b) and Natura 2000 – Standard Data Form (NPWS, 2009c)
Baldoyle Bay SPA [004016]	c. 8.6km downstream of the proposed crossing point on the Sluice River or c. 6km east of proposed Project as the crow flies	▪ Light-bellied Brent Goose *Branta bernicla hrota* [A046] [wintering] ▪ Shelduck *Tadorna tadorna* [A048] [wintering] ▪ Ringed Plover *Charadrius hiaticula* [A137] [wintering] ▪ Golden Plover *Pluvialis apricaria* [A140] [wintering] ▪ Grey Plover *Pluvialis squatarola* [A141] [wintering] ▪ Bar-tailed Godwit *Limosa lapponica* [A157] [wintering] ▪ Wetlands & Waterbirds [A999] Sources: Conservation Objectives: Baldoyle Bay SPA 004016. Version 1. (NPWS, 2013h) and Natura 2000 – Standard Data Form (NPWS, 2009b)
Rogerstown Estuary SPA [004015]	c. 3km north-east of the proposed Project as the crow flies	▪ Greylag Goose *Anser anser* [A043] [wintering] ▪ Light-bellied Brent Goose *Branta bernicla hrota* [A046] [wintering] ▪ Shelduck *Tadorna tadorna* [A048] [wintering] ▪ Shoveler *Anas clypeata* [A056] [wintering] ▪ Oystercatcher *Haematopus ostralegus* [A130] [wintering] ▪ Ringed Plover *Charadrius hiaticula* [A137] [wintering] ▪ Grey Plover *Pluvialis squatarola* [A141] [wintering] ▪ Knot *Calidris canutus* [A143] [wintering] ▪ Dunlin *Calidris alpina* [A149] [wintering] ▪ Black-tailed Godwit *Limosa limosa* [A156] [wintering] ▪ Redshank *Tringa totanus* [A162] [wintering] ▪ Wetland and Waterbirds [A999]

Site Name	Distance[17]	Reasons for Designation – Qualifying Interest (QIs) or Special Conservation Interests (SCIs)
		Source: Conservation Objectives: Rogerstown Estuary SPA 004015. Version 1. (NPWS, 2013i) and Natura 2000 – Standard Data Form (NPWS, 2017e)
Dalkey Islands SPA [004172]	c. 12.1km east of the proposed Project	▪ Roseate Tern *Sterna dougallii* [A192] [breeding] ▪ Common Tern *Sterna hirundo* [A193] [breeding] ▪ Arctic Tern *Sterna paradisaea* [A194] [breeding] Source: Conservation Objectives for Dalkey Islands SPA [004172]. Generic Version 9.0. (NPWS, 2022a) and Natura 2000 – Standard Data Form (NPWS, 2009e)
Ireland's Eye SPA [004117]	c. 10.4km east of the proposed Project as the crow flies	▪ Cormorant *Phalacrocorax carbo* [A017] [breeding] ▪ Herring Gull *Larus argentatus* [A184] ▪ Kittiwake *Rissa tridactyla* [A188] [wintering] ▪ Guillemot *Uria aalge* [A199] [breeding]/[wintering] ▪ Razorbill *Alca torda* [A200] [breeding]/[wintering] Source: Conservation objectives for Ireland's Eye SPA [004117]. Generic Version 9.0. NPWS (2022b)
Lambay Island SPA [004069]	c. 11.5km north-east of the proposed Project as the crow flies	▪ Fulmar *Fulmarus glacialis* [A009] [breeding] ▪ Cormorant *Phalacrocorax carbo* [A017] [wintering] ▪ Shag *Phalacrocorax aristotelis* [A018] ▪ Greylag Goose *Anser anser* [A043] [wintering] ▪ Lesser Black-backed Gull *Larus fuscus* [A183] [breeding] ▪ Herring Gull *Larus argentatus* [A184] ▪ Kittiwake *Rissa tridactyla* [A188] [breeding] ▪ Guillemot *Uria aalge* [A199] [breeding] ▪ Razorbill *Alca torda* [A200] [breeding] ▪ Puffin *Fratercula arctica* [A204] [breeding] Source: Conservation objectives for Lambay SPA [004069]. Generic Version 9.0. NPWS (2022c)
Howth Head Coast SPA [004113]	c. 12.5km east of the proposed Project as the crow flies	▪ Kittiwake Rissa tridactyla [A188] [breeding] Source: Conservation objectives for Howth Head Coast SPA [004113]. Generic Version 9.0. NPWS (2022d)
Skerries Islands SPA [004122]	c. 13km north-east of the proposed Project as the crow flies	▪ Cormorant *Phalacrocorax carbo* [A017] [breeding] ▪ Shag *Phalacrocorax aristotelis* [A018] ▪ Light-bellied Brent Goose *Branta bernicla hrota* [A046] [wintering] ▪ Purple Sandpiper *Calidris maritima* [A148] [wintering] ▪ Turnstone *Arenaria interpres* [A169] [wintering] ▪ Herring Gull *Larus argentatus* [A184] Source: Conservation objectives for Skerries Islands SPA [004122]. Generic Version 9.0. NPWS (2022e)
Rockabill SPA [004014]	c. 14km north-east of the proposed Project as the crow flies	▪ Purple Sandpiper *Calidris maritima* [A148] [breeding] ▪ Roseate Tern *Sterna dougallii* [A192] [breeding] ▪ Common Tern *Sterna hirundo* [A193] [breeding] ▪ Arctic Tern *Sterna paradisaea* [A194] [breeding] Source: Conservation Objectives: Rockabill Island SPA [004014]. Version 1.0. NPWS (2013j)

15.3.3.2 Natural Heritage Areas and Proposed Natural Heritage Areas

NHAs are designations under Section 16 of the Wildlife Acts to protect habitats, species or geology of national importance.

In addition to NHAs there are pNHAs, which are also sites of significance for wildlife and habitats and were published on a non-statutory basis in 1995 but have not since been statutorily proposed or designated. pNHAs are offered protection in the interim period under the county or city development plans which requires that planning authorities give due regard to their protection in planning policies and decisions[18].

Many of the pNHA sites, and some of the NHAs, in Ireland overlap with the boundaries of European sites.

The proposed Project is located near to:

- Malahide Estuary pNHA, which are located downstream of the proposed crossing points at the Broadmeadow River, Ward River and Staffordstown Stream;
- Baldoyle Bay pNHA, which are located downstream of the proposed crossing points at the Sluice River, Cuckoo stream and Mayne River;
- Santry Demesne pNHA, which is located downstream of the proposed crossing point at the Santry River;
- Royal Canal pNHA, which is at a proposed crossing point; and
- Grand Canal pNHA, which is at a proposed crossing point.

There is one NHA and eighteen pNHAs within the ZoI of the proposed Project, ten of which are located downstream of the proposed Project (Figure 15.5). Table 15.10 below lists these NHAs and pNHAs sites, their distance from the Project Boundary, and the ecological features for which the sites are designated/proposed.

These pNHAs are valued as being of National Importance.

Table 15.10: Natural Heritage Areas and Proposed Natural Heritage Areas located within the ZoI of the proposed Project boundary (highlighted in grey), and those in the wider area, of the proposed Project boundary

Site Name	Distance[19]	Description
Natural Heritage Areas		
Skerries Islands NHA [001218]	c. 13km north-east of the proposed Project as the crow flies	See above under Skerries Islands SPA
Proposed Natural Heritage Areas		
Royal Canal pNHA [002103]	At the proposed crossing on the Royal Canal	Diversity of species canal supports and presence of legally protected plant species, opposite-leaved pondweed *Groenlandia densa*
Grand Canal pNHA [002104]	c. 13.5m north of the proposed Project	Diversity of species canal supports and presence of legally protected plant species, opposite-leaved pondweed *Groenlandia densa*
Santry Demesne pNHA [000178]	c. 300m, downstream of the proposed crossing point on the Santry River or	Presence of legally protected plant species, hairy St John's-wort *Hypericum hirsutum*, and woodland

[18] For example, Objective NH17 of the *Fingal Development Plan 2017-2023* includes a commitment to "*ensure that development does not have a significant adverse impact on proposed Natural Heritage Areas (pNHAs)*" and Policy LHB19 of the *Dún Laoghaire-Rathdown County Development Plan 2016-2022* includes a commitment to "*protect and conserve the environment including…proposed Natural Heritage Areas*".
[19] Distance in km/m from the proposed Project

Site Name	Distance[19]	Description
	c. 256m east of proposed Project as the crow flies	
Malahide Estuary pNHA [000205]	c. 285m downstream of the proposed crossing point of the Broadmeadow River or c. 230m east of proposed Project as the crow flies	See above under Malahide Estuary SAC and Malahide Estuary SPA
Feltrim Hill pNHA [001208]	c. 1.7km east of the proposed Project as the crow flies	Good example of knoll-reef phenomenon. Previously known to contain two rare plant species, namely spring squill *Scilla verna* and long-stalked crane's-bill *Geranium columbinum*
Rogerstown pNHA [000208]	c. 2.5km north-east of proposed Project as the crow flies	See above for Rogerstown Estuary SAC and Rogerstown Estuary SPA
North Dublin Bay pNHA [000206]	c. 2.9km downstream of the nearest proposed crossing point, i.e. at the River Tolka or c. 1.8km east of proposed Project as the crow flies	See above under North Dublin Bay SAC, North Bull Island SPA and South Dublin Bay and River Tolka Estuary SPA
Dolphins, Dublin Docks pNHA [000201]	c. 3.8km downstream of the nearest proposed crossing point i.e. at the River Liffey or c. 3.6km east of proposed Project as the crow flies	See above under South Dublin Bay and River Tolka Estuary SPA
Booterstown Marsh pNHA [001205]	c. 4.2km south-east of the proposed Project as the crow flies	See above under South Dublin Bay and River Tolka Estuary SPA
Liffey Valley pNHA [000128]	c. 4.7km west of the proposed Project as the crow flies	Presence of legally protected plant species, hairy St John's-wort *Hypericum hirsutum*, rare Red List plant species green figwort *Scrophularia umbrosa* and yellow archangel *Lamiastrum galeobdolon* and the diversity of habitat present.
Portraine Shore pNHA [001215]	c. 6.1km south-east of proposed Project as the crow flies	See above for Rogerstown Estuary SAC and Rogerstown Estuary SPA
Dodder Valley pNHA [000991]	c. 6.5km south-west of proposed Project as the crow flies	The last remaining stretch of natural riverbank vegetation on the River Dodder in the built-up Greater Dublin Area.
Fitzsimon's Wood pNHA [001753]	c. 6.8km south of proposed Project as the crow flies	Birch woodland, which is very rare in County Dublin.
Sluice River Marsh pNHA [001763]	c. 6.4km downstream of the proposed crossing point on the Sluice River	Freshwater marsh

Site Name	Distance[19]	Description
	c. 5km east of the proposed Project as the crow flies	
South Dublin Bay pNHA [000210]	c. 8km downstream of the nearest proposed crossing point, i.e. at the River Liffey or c. 2.8km east of proposed Project as the crow flies	See above under South Dublin Bay SAC and South Dublin Bay and River Tolka Estuary SPA
Baldoyle Bay pNHA [000199]	c. 7.9km downstream of the proposed crossing point on the Sluice River or c. 6km east of proposed Project as the crow flies	See above under Baldoyle Bay SAC and Baldoyle Bay SPA
Dalkey Coastal Zone and Killiney Hill pNHA [001206]	c. 9.4km south-east of the proposed Project as the crow flies	Good example of a coastal system with habitats ranging from sub-littoral to coastal heath. Flora is well developed and includes some scare species. The islands are important bird sites. See Rockabill to Dalkey Island SAC and Dalkey Islands SPA
Glenasmole Valley pNHA [001209]	c. 10.7km south-east of proposed Project as the crow flies	See above under Glenasmole Valley SAC
Howth Head pNHA [000202]	c. 10.5km south-east of proposed Project as the crow flies	See above under Howth Head SAC and Howth Head Coast SPA
Bog of the Ring pNHA [001204]	c. 10.7km north of the proposed Project as the crow flies	Botanical and bird value in the context of County Dublin
Dingle Glen pNHA [001207]	c. 11km south-east of the proposed Project as the crow flies	Variety of habitat present, including woodland
Ireland's Eye pNHA [000203]	c. 10.6km east of proposed Project as the crow flies	See above under Ireland's Eye SAC and Ireland's Eye SPA
Lambay Island pNHA [000204]	c. 11.5km north-east of the proposed Project as the crow flies	See above under Lambay Island SAC and Lambay Island SPA
Knock Lake pNHA [001203]	c. 11.5km north of proposed Project as the crow flies	Artificial lake, which has attained the character of a natural lake. Presence of otter and variety of birds.
Ballybetagh Bog pNHA [001202]	c. 12km south-east of the proposed Project as the crow flies	Marshland
Loughshinny Coast pNHA [002000]	c. 12.3km north-east of proposed Project as the crow flies	Coastal grassland and shingle/rocky shore. Presence of legally protected plant species green-winged orchid *Orchis morio*.
Loughlinstown Woods pNHA [001211]	c. 12.3km south-east of proposed Project as the crow flies	Demesne-type mixed woodland

Site Name	Distance[19]	Description
Knocksink Wood pNHA [000725]	c. 13.3km south-east of proposed Project as the crow flies	See above under Knocksink Wood SAC
Slade of Saggart and Crooksling Glen pNHA [000211]	c. 14.3km south-west of proposed Project as the crow flies	Wooded river valley and small wetland system. Presence of rare plant species (yellow archangel *Lamium galeobdolon*), rare invertebrate (*Halticoptera patellana*) and a variety of wildfowl species.
Rye Water Valley/Carton pNHA [001398]	c. 13.7km west of the proposed Project as the crow flies	See above under Rye Water Valley/Carton SAC
Ballyman Glen pNHA [000713]	c. 14.8km south-east of proposed Project as the crow flies	See above under Ballyman Glen SAC
The Murrough pNHA [000730]	c. 27km south-east of the proposed Project as the crow flies	See above for the Murrough SPA
Rockabill pNHA [000207]	c. 18.9km north-east of the proposed Project as the crow flies	See above for Rockabill SPA and Rockabill to Dalkey Island SAC

15.3.3.3 Other Designated Sites

Other designations recognised in the Greater Dublin Area, include Ramsar wetland sites, the UNESCO Dublin Bay Biosphere and three Special Amenity Area Orders. Biodiversity receptors in these other designated sites are assessed with the European sites where they overlap, and the other individual impact assessment headings, as relevant.

Ramsar Sites

The Convention on Wetlands is an intergovernmental treaty adopted on 2 February 1971 in the Iranian city of Ramsar. The official name of the treaty is 'The Convention on Wetlands of International Importance, Especially as Waterfowl Habitats' reflects the emphasis on the protection of wetlands primarily as habitat for waterbirds.

There are a number of Ramsar sites within the vicinity of the proposed Project, namely:

- Rogerstown Estuary (Site code 412);
- Broadmeadow Estuary (Site code 833);
- Baldoyle Bay (Site code 413);
- North Bull Island (Site code 406); and
- Sandymount Strand/Tolka Estuary (Site code 832).

The assessment of these Ramsar sites, which are encompassed within European sites and pNHAs, is captured in full under the assessment of European sites, NHAs and pNHAs in Section 15.4.2.1; therefore, no further discussion is provided.

UNESCO Dublin Bay Biosphere

Dublin Bay was initially recognised by the United Nations Education, Scientific and Cultural Organisation (UNESCO) for its rare and internationally important habitats and species. The North Bull Island supports a variety of plants and wildlife including an internationally significant population of light bellied brent goose that overwinters in the bay. 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. The Dublin Bay Biosphere now extends to over 300 km^2 of marine and terrestrial habitat encompassing North Bull Island and ecologically significant habitats such as the Tolka and Baldoyle Estuaries, Howth Head, Dalkey Island, Killiney Hill and Booterstown Marsh. Over 300,000 people live within the newly enlarged Biosphere.

While the Biosphere designation does not strictly add any specific new legal protection to Dublin Bay, it does contribute to improving the co-ordination and management of its functions in a holistic and integrated way. The assessment of the UNESCO Dublin Bay Biosphere, which overlaps with European sites and pNHAs, is captured in full under the assessment of European sites, NHAs and pNHAs in Section 15.4.2.1.

Special Area Amenity Order

The objective of the Special Amenity Area Order is primarily to protect outstanding landscapes, nature and amenities and were originally placed on a statutory footing under the Local Government (Planning and Development) Act 1963, as amended, and re-enacted under section 202 of the Planning and Development Act 2000. The areas that have been designated are owing to the outstanding beauty needing nature conservation. The designations re-enforce protection for green belts via land plans and objectives contained therein.

Two such SAAO areas have been recognised in the vicinity of the proposed Project. They include:

- North Bull Island; and
- Howth Head.

The assessment of these SAAO areas which overlap with European sites and pNHAs, is captured in full under the assessment of European sites, NHAs and pNHAs in Section 15.4.2.1.

15.3.4 Habitats

15.3.4.1 Overview

The results of the habitat surveys along the alignment of the proposed Project are described below by habitat type, after Fossitt (2000), and where relevant include a description of any corresponding Annex I habitat types that were present after Commission of the European Communities (CEC) (2013) and NPWS (2019b)[20] (see also Appendix A15.3 for results of habitat surveys). The habitats described below relate to habitat polygons and polylines within or adjacent to the proposed Project, as shown on Figures 15.6 along with the full habitat survey results. Full species lists for each habitat type are provided in Appendix A15.3. The results and summary of the findings of the aquatic habitat surveys have been incorporated into the relevant habitat descriptions below. In general, habitats are described from north to south along the proposed Project under the headings below.

The habitat types recorded along and adjacent to the alignment of the proposed Project, as discussed in this section, are presented in Table 15.11.

The proposed Grid Connections lie predominantly along the existing local road network. Alongside those local roads, and in the few locations where the Grid Connections leave the road corridor, the surrounding habitats comprise mainly of a mosaic of Improved agricultural grassland (GA1) and arable crops (BC1) amongst a network of hedgerows (WL1) and treelines (WL2). Some ungrazed and uncut grassland fields, along with linear grassland strips along the roadside verges, correspond with dry meadows and grassy verges (GS2) habitat. Sections of the proposed Grid Connections also pass by residential and urban development, agricultural building complexes, large car parks associated with Dublin Airport, and Fingal Burial Ground. Small, and often narrow linear, woodland areas also border the local road network in a few locations (e.g. at Kinsealy and north of the Naul Road near Forrest Little Golf Club).

[20] The classification and naming of Annex I habitats follow that of *Interpretation manual of European Union Habitats EUR28* (CEC, 2013) and *The Status of EU Protected Habitats and Species in Ireland.* Habitat Assessments Volume 2 (NPWS, 2019b). The Natura 2000 code for the Annex I habitats is after *Interpretation manual of European Union Habitats EUR28* (2013).

Table 15.11: Habitats (Fossitt, 2000) Recorded within the Survey Area, the Footprint of the Proposed Project and within the Assessment Zones AZ1, AZ2, AZ3 and AZ4

Habitat Type Within Survey Area	Within Footprint	AZ1	AZ2	AZ3	AZ4
Arable crops (BC1)	✓	✓	✓	✓	-
Flower beds and borders (BC4)	✓	✓	✓	-	✓
Stone walls and other stonework (BL1)	✓	✓	-	-	-
Earth banks (BL2)	✓	✓	✓	✓	-
Buildings and artificial surfaces (BL3)	✓	✓	✓	✓	✓
Tidal rivers (CW2) including the Annex I habitat Estuaries [1130]	-	-	-	-	✓
Exposed sand, gravel or till (ED1)	-	✓	-	-	-
Spoil and bare ground (ED2)	✓	✓	✓	✓	-
Recolonising bare ground (ED3)	✓	✓	✓	✓	✓
Refuse and other waste (ED5)	✓	✓	-	✓	-
Other artificial lakes and ponds (FL8)	-	✓	-	-	✓
Reed and large sedge swamps (FS1)	✓	-	-	-	✓
Tall-herb swamps (FS2) including the Annex I habitat Hydrophilous tall-herb swamp [6430]	✓	✓	-	-	✓
Depositing/lowland rivers (FW2)	✓	✓	-	✓	✓
Canals (FW3)	✓	-	-	-	✓
Drainage ditches (FW4)	✓	✓	✓	✓	✓
Improved agricultural grassland (GA1)	✓	✓	✓	✓	-
Amenity grassland (improved) (GA2)	✓	✓	✓	✓	✓
Dry calcareous and neutral grassland (GS1)	✓	✓	✓	✓	✓
Dry meadows and grassy verges (GS2)	✓	✓	✓	✓	✓
Wet grassland (GS4)	✓	✓	-	✓	-
(Mixed) broadleaved woodland (WD1)	✓	✓	-	✓	✓
(Mixed) conifer woodland (WD3)	✓	✓	-	✓	-
Scattered trees and parkland (WD5)	✓	✓	-	-	✓
Hedgerows (WL1)	✓	✓	✓	✓	✓
Treelines (WL2)	✓	✓	✓	✓	✓
Scrub (WS1)	✓	✓	✓	✓	✓
Immature woodland (WS2)	✓	✓	✓	✓	-
Ornamental/non-native shrub (WS3)	✓	✓	✓	✓	✓

15.3.4.2 Arable Crops (BC1)

This habitat type was relatively widespread from Estuary in Swords to lands north of the M50 Motorway. It consisted of relatively large fields north and south of Dublin Airport, fields in the centre of Swords and one field located north of the Broadmeadow River. Arable crops present included monocultures of bread wheat *Triticum aestivum*, oat *Avena sativa*, potato *Solanum tuberosum*, root beet *Beta vulgaris subsp. vulgaris* and six-rowed barley *Hordeum vulgare*.

A variety of other plant species, some of which are typically found in field margins, were present. These included grass species such as annual meadow-grass *Poa annua*, barren brome *Anisantha sterilis*, false oat-grass *Arrhenatherum elatius* and wild-oat *Avena fatua*, and forb species such as American willowherb *Epilobium ciliatum*, common fumitory *Fumaria officinalis*, cut-leaved crane's-bill *Geranium dissectum*,

fern-grass *Catapodium rigidum*, field forget-me-not *Myosotis arvensis*, germander speedwell *Veronica chamaedrys*, hedge woundwort *Stachys sylvatica*, long-headed poppy *Papaver dubium*, oil-seed rape *Brassica napus subsp. oleifera,* purple-loosestrife *Lythrum salicaria*, redshank *Persicaria maculosa*, shepard's-purse *Capsella bursa-pastoris* and yarrow *Achillea millefolium*.

This habitat type is of Local Importance (Lower Value) as it is a heavily modified habitat with a generally low flora species diversity.

15.3.4.3 Flower Beds and Borders (BC4)

This habitat type was widespread within the study area of the proposed Project and included ornamental planting associated with residential gardens, commercial developments or industrial complexes/business parks. The majority of this habitat type is captured on the habitat map by the "Residential" classification (see Section 15.3.4.31 below).

This habitat type is of Local Importance (Lower Value) as it is a heavily modified habitat that is dominated by non-native ornamental plant species of low biodiversity value.

15.3.4.4 Stone Walls and other Stonework (BL1)

This habitat type consisted of the stone walls of Lissenhall Bridge (located at ITM 718682 748268) and Balheary Bridge (located at ITM 718667 748160), which is located directly west of the R132 above the Broadmeadow River.

This habitat type is of Local Importance (Lower Value) due to the general absence of any significant plant cover and it being man-made.

15.3.4.5 Earth Banks (BL2)

This habitat type was located along field boundaries at Dardistown, adjacent to arable crop fields. One earth bank was also present adjacent to a drainage ditch and the Mayne River. Typical species present included brambles *Rubus fruticosus* agg., cleavers *Galium aparine* and false oat-grass. Some tree species, such as ash *Fraxinus excelsior* and hawthorn *Crataegus monogyna* were also present, however in small numbers compared to the herbaceous and shrubby species.

This habitat type is of Local Importance (Lower Value) due to its low flora species diversity.

15.3.4.6 Buildings and Artificial Surfaces (BL3)

This classification included buildings (domestic, agricultural, commercial and industrial), roads, railway lines, Luas tram line, car parks, footpaths, artificial recreation surfaces (*e.g.* Astroturf pitches) and other concrete/hard standing areas. In the case of residential properties, the majority of this habitat type is captured on the habitat map by the "*Residential*" classification (see Section 15.3.4.31 below).

This habitat type is of no habitat importance due to the general absence of any significant plant cover and it being man-made.

15.3.4.7 Tidal Rivers (CW2)

This classification consisted entirely of the Lower Liffey Estuary/River Liffey, located at the crossing point of the proposed Project. This section of the river is c. 40m to 45m wide and has an average depth of c. 4m to 5m. There are high retaining quay walls either side of the channel, with channelled wrack *Pelvetia canaliculata* present, and a mixed sediment bed that is typical of a tidal section of a large river.

This habitat type is valued as being of National Importance as it corresponds to the Annex I habitat Estuaries [1130] (i.e. a habitat of high conservation value in Ireland) and the Lower Liffey Estuary/River Liffey forms part of the national Favourable Reference Area of this Annex I habitat against which its conservation status is assessed under Article 17 of the Habitats Directive (NPWS, 2019a).

15.3.4.8 Exposed Sand, Gravel or Till (ED1)

This habitat type consisted of a sand and gravel bar located within the channel of the Broadmeadow River, directly west of the Lissenhall Bridge.

This habitat type is of Local Importance (Lower Value) due to its low flora species diversity.

15.3.4.9 Spoil and Bare Ground (ED2)

This habitat type consisted of areas of bare ground located: south-east of farmland in Estuary, directly north of an existing halting site; at an existing laneway north of the Broadmeadow River; a small area of unmanaged land within Swords Business Park; north-eastern corner of a field of dry meadows and grassy verges (GS2) habitat type in Dardistown and at the entrances into agricultural fields at Dardistown; and, within and directly south-west St Anne's Business Park in Dardistown.

This habitat type is of Local Importance (Lower Value) due to its low flora species diversity.

15.3.4.10 Recolonising bare ground (ED3)

This habitat type comprised lands at Estuary, a small area of unmanaged land within Swords Business Park; areas within two heavily poached fields in Swords and a field located directly north of the Naul Road, within areas of disturbed ground located in Dardistown and Ballymun and areas north of the Royal Canal near of the existing railway line. These sites were generally small. However, a larger site of this habitat type, which was associated with a development site, was recorded in Ballymun, east of the R108 and north of the Royal Canal south of the existing railway line.

Grass species present included cock's-foot *Dactylis glomerata*, common couch *Elymus repens*, creeping bent *Agrostis stolonifera*, false oat-grass, fern-grass, oat species *Avena* sp., perennial rye-grass *Lolium perenne*, red fescue *Festuca rubra* and Yorkshire-fog *Holcus lanatus*. Rush species present included compact rush *Juncus conglomeratus*, hard rush *J. inflexus* and toad rush *J. bufonius*. Water bent *Polypogon viridis* was recorded in Dardistown of this habitat type located. Whilst this non-native introduced species is rare in Ireland, it is locally abundant in County Dublin. The sedge species glaucous sedge *Carex flacca* was also recorded.

A variety of forb species, commonly found on disturbed ground, were present. These included American willowherb, Bilbao's fleabane *Conyza floribunda*, black medick *Medicago lupulina*, burnet-saxifrage species *Pimpinella* species, butterfly-bush *Buddleja davidii*, Canadian fleabane *Erigeron canadensis*, colt's-foot *Tussilago farfara*, common field-speedwell *Veronica persica*, common poppy *Papaver rhoeas*, cut-leaved crane's-bill *Geranium dissectum*, dandelion *Taraxacum officinale* agg., Dog's mercury *Mercurialis perennis*, field bindweed *Convolvulus arvensis*, groundsel *Senecio vulgaris*, lesser burdock *Arctium minus*, lesser trefoil *Trifolium dubium* long-headed poppy *P. dubium*, oil-seed rape, petty spurge *Euphorbia peplus*, pineappleweed *Matricaria discoidea*, prickly sow thistle *Sonchus asper*, red valerian *Centranthus ruber*, ribbed melilot *Melilotus officinalis*, which is a non-native introduced plant species with a relatively restricted distribution in Ireland, scarlet pimpernel *Lysimachia arvensis*, scentless mayweed *Tripleurospermum inodorum*, smooth sowthistle *Sonchus oleraceus*, sun spurge *Euphorbia helioscopia* and thale cress *Arabidopsis thaliana*.

Forb species more typical of improved habitats were also present. These included broad-leaved dock *Rumex obtusifolius*, common mouse-ear *Cerastium fontanum*, common nettle *Urtica dioica*, common ragwort *Jacobaea vulgaris*, creeping buttercup *Ranunculus repens*, curled dock *Rumex crispus*, daisy *Bellis perennis*, greater plantain *Plantago major*, red clover *Trifolium pratense*, ribwort plantain *Plantago lanceolata*, spear thistle *Cirsium vulgare* and white clover *Trifolium repens*. There were also a number of forb species typical of calcareous soils, such as cat's-ear *Hypochaeris radicata*, common bird's-foot-trefoil *Lotus corniculatus*, fairy flax *Linum catharticum*, and selfheal *Prunella vulgaris*. Other forb species present included: barren strawberry *Potentilla sterilis*, brambles, bush vetch *Vicia sepium*, common ivy *Hedera helix*, dove's-foot crane's-bill *Geranium molle*, field horsetail *Equisetum arvense*, figwort

Scrophularia sp., giant hogweed *Heracleum mantegazzianum*[21], great willowherb *Epilobium hirsutum*, hedge bindweed *Calystegia sepium*, herb-robert *Geranium robertianum*, hoary willowherb *Epilobium parviflorum*, lesser burdock *Arctium minus*, meadow vetchling *Lathyrus pratensis*, rosebay willowherb *Chamaenerion angustifolium*, silverweed *Potentilla anserina*, smooth hawk's-beard *Crepis capillaris*, and wood avens *Geum urbanum* and yarrow.

Whilst a large number of species were recorded within this habitat type across the entire survey area, the actual number of species recorded at specific locations was significantly lower.

This habitat type is valued as being of Local Importance (Lower Value) as it is transient habitat artificially created as a result of disturbance and has been highly anthropogenically modified.

15.3.4.11 Refuse and other waste (ED5)

There were small patches of this habitat type located at Estuary and Dardistown, with chippings.

This habitat type is of no biodiversity value due to the general absence of any significant plant cover and it being man-made.

15.3.4.12 Other artificial lakes and ponds (FL8)

An artificial pond was present within the Swords Business Campus, Hertz Europe Service Centre, south-east of Lakeshore Drive near Barrysparks, Blessington Street Park and St Stephen's Green.

This habitat type is of Local Ecological Importance (Lower Value) due to its low flora species diversity.

15.3.4.13 Reed and large sedge swamps (FS1)

There is a narrow linear strip of this habitat type located along the banks of the Royal Canal, east of the existing R108 bridge beyond the footprint of the proposed Project. It was relatively species-poor, consisting of amphibious bistort *Persicaria amphibia*, reed canary-grass *Phalaris arundinacea* and yellow iris *Iris pseudacorus*. Other species present included hogweed *Heracleum sphondylium* and rosebay willowherb.

This habitat type is valued as being of Local Importance (Higher Value) as it is not common in the surrounding area and is relatively species-rich in the context of surrounding habitats. It is present within the boundaries of the Royal Canal pNHA and the habitat type canals (FW3) (as described in Section 15.3.4.16 below), which have been valued as being of National Importance.

15.3.4.14 Tall-herb swamps (FS2)

This habitat was recorded along the banks of the Broadmeadow River, Ward River, Royal Canal and Grand Canal. It was considered to be more species-rich in comparison to the reed and large sedge swamps, as described above. Grass species recorded included reed canary-grass and reed sweet-grass *Glyceria maxima*, while forb species recorded included amphibious bistort *Persicaria amphibia*, bittersweet *Solanum dulcamara*, branched bur-reed *Sparganium erectum*, butterbur *Petasites hybridus*, great willowherb, hedge bindweed *Calystegia sepium*, meadowsweet *Filipendula ulmaria*, water figwort *Scrophularia auriculata*, water mint *Mentha aquatica*, wild angelica *Angelica sylvestris* and Wild teasel *Dipsacus fullonum* and yellow iris.

This habitat type located along the Broadmeadow River and Ward River does not correspond with the Annex I habitat Hydrophilous tall-herb swamp fringe communities of plains and of the montane to alpine levels [6430]. In the case of this habitat type along the Broadmeadow River, it was relatively species-poor, dominated by reed canary-grass and reed sweet-grass and only contained two positive indicator species of this Annex I habitat, i.e. great willowherb and bittersweet, the latter of which was recorded

[21] This species is listed on the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations, 2011

as rare on the DAFOR scale[22] in terms of its abundance/cover. In the case of this habitat type located along the Ward River, it was present along the watercourse in a mosaic with other grassland habitats and scattered alder *Alnus glutinosa* trees. It also only contained one positive indicator species of this Annex I habitat, i.e. hedge bindweed.

However, this habitat located along the Royal Canal and Grand Canal does correspond to the Annex I habitat Hydrophilous tall-herb swamp [6430] as it contained six positive indicator species, i.e. amphibious bistort, hedge bindweed, great willowherb, meadowsweet, water mint, wild angelica and yellow iris.

The non-Annex I habitat is valued as being of Local Importance (Higher Value) as it is not common in the surrounding area and is relatively species-rich in the context of surrounding habitats, while the Annex I habitat is valued as being of National Importance as it is a habitat of high conservation concern in Ireland.

15.3.4.15 Depositing/lowland rivers (FW2)

Ten of the watercourses present within the scheme study area were classified as depositing/lowland rivers, i.e. Staffordstown Stream; Broadmeadow River; Ward River; Sluice River; Cuckoo Stream; Mayne River; Santry river; and River Tolka. The water quality values presented for each watercourse described below follow that of Toner *et al.*, 2005, i.e.: watercourses with values of: Q5, Q4-5 and Q4 are "*Unpolluted*" (Class A); Q3-4 are "*Slightly polluted*" (Class B), Q3 or Q2/3 are "*Moderately polluted*" (Class C) and Q2, Q1/2 or Q1 are "*Seriously polluted*" (Class D). For more details on depositing/lowland rivers within the scheme study area refer to Chapter 18 (Hydrology).

This habitat type is valued as being of Local Importance (Higher Value) as the watercourses provide connectivity to surrounding habitats both upstream and downstream of the proposed Project.

Staffordstown Stream

At the survey location, upstream of the R132 crossing, the channel of this stream was trapezoidal shaped, deepened and straightened and had a very limited water flow. It was a c. 1m in width and c. 0.1m in depth, with a bank height of c. 2m. Vegetation present instream included localised patches of fool's-water-cress *Helosciadium nodiflorum* and water mint along with a few isolated patches of water horsetail *Equisetum fluviatile*. Common duckweed *Lemna minor* was abundant in the channel. Water quality in this watercourse was assessed as being seriously polluted (i.e. Q2).

Broadmeadow River

At this survey location, near Lissenhall Bridge, the channel was c. 8m in width, with bank heights of up to c. 3m. The water depth was c. 2m at long, straightened pool sections, while the glide and riffle runs were significantly shallower. Vegetation present instream was abundant in common duckweed and filamentous algae. It also included blue water-speedwell *Veronica anagallis-aquatica*, fool's-water-cress and water-cress *Nasturtium officinale*. This watercourse was highly degraded, heavily enriched and suffered from gross levels of siltation. Water quality in this watercourse was assessed as being moderately polluted (i.e. Q3).

Ward River

At the survey location, west of the Balheary Bridge, the channel of this watercourse was c. 7m to 8m in width and c. 0.3m to1.5m in depth. Vegetation present instream was limited to very localised patches of water-cress and the generalist moss species greater water-moss *Fontinalis antipyretica*, which was present on boulders. Water quality in this watercourse was assessed as being moderately polluted (i.e. Q3).

[22] DAFOR is a scale of relative cover abundance for a plant species in a specified area, i.e. D = Dominant, A = Abundant, F = Frequent, O = Occasional and R = Rare.

Sluice River

At the survey location, this stream consisted of a heavily modified, deepened and straightened channel, c. 1.5m in width and c. 0.05m in depth, with bank heights of between c. 2m to 2.5m. There was no instream vegetation present. There was abundant fly-tipping of waste in the stream with tyres, car batteries and other household waste present. Water quality in this watercourse was assessed as being moderately polluted (i.e. Q2-3).

Cuckoo Stream

At the survey location, this stream consisted of a straightened and historically deepened channel, c. 1.5m in width and c. 0.15m in depth. There was no instream vegetation present. Water quality in this watercourse was assessed as being seriously polluted (i.e. Q1).

River Mayne

At the survey location, this river consisted of a very heavily modified channel with very shallow water present, c. 0.1m, or less, in depth. There was no instream vegetation present. Water quality in this watercourse was assessed as being seriously polluted (i.e. Q1).

Santry River

At the survey location, near Santry Demesne in Ballymun, this river consisted of a modified channel with some semi-natural features present. It was c. 1.5m in width and c. 0.2m in depth, with bank heights of c. 1.5m. There was no instream vegetation present. Water quality in this watercourse was assessed as being seriously polluted (i.e. Q2).

River Tolka

At the survey location, in Drumcondra, this river consisted of a heavily modified channel which was straightened and deepened with flood defence gabions and high retaining walls present. It was c. 8m to 9m wide and c. 0.5m to 0.6m deep. Instream vegetation was limited to filamentous algae growth. Water quality in this watercourse was assessed as being moderately polluted (i.e. Q2-3).

15.3.4.16 Canals (FW3)

The instream vegetation of the Royal Canal was dominated by a very high percentage cover of the Red List species whorled water-milfoil *Myriophyllum verticillatum* (as per Wyse Jackson *et al.*, 2016). Another two Red List species, horned pondweed *Zannichellia paustris* and rigid hornwort *Ceratophyllum demersum*, were also recorded in the Royal Canal. These species are considered to be of "*Least Concern*" (Wyse Jackson *et al.*, 2016). Other species present included common stonewort *Chara vulgaris* and ivy-leaved duckweed. Two non-native invasive species, listed on the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations, 2011, were present at low percentage covers, i.e. Canadian pondweed and Nuttall's pondweed.

A number of different aquatic macrophytes were present within the Grand Canal. These included yellow water-lily *Nuphar lutea*, which was frequent, along with amphibious bistort *Persicaria amphibia*, arrowhead *Sagittaria sagittifolia*, ivy-leaved duckweed *Lemna trisulca* and water-plantain *Alisma plantago-aquatica*, which was locally abundant. Fool's-water-cress and water mint were recorded as occasional species. Two non-native invasive species, listed on the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations, 2011, were present and locally abundant, i.e. Canadian waterweed *Elodea canadensis* and New Zealand pigmyweed *Crassula helmsii*, the latter of which has not been previously recorded at that location. Opposite-leaved pondweed *Groenlandia densa* was not recorded at the survey sites on the Royal Canal (including at the basin located between Lock 6 and Lock 5) or the Grand Canal near the existing Luas Green Line crossing point; however, desktop records of this species are present downstream of the proposed Project directly east of Cross Guns Bridge between Lock 5 and 4 and Lock 4 to Lock 1 on the Royal Canal (BEC Consultants, 2015;

EcoServe, 2011) and it is also known to be present immediately downstream of this site from levels one through to four of the Grand Canal (BEC, 2011; NBDC 2019).

This habitat type is valued as being of National Importance as it forms part of the nationally designated sites the Royal Canal pNHA and Grand Canal pNHA, which are designated for the canal and fringing aquatic habitats.

15.3.4.17 Drainage Ditches (FW4)

Drainage ditches were generally associated with the boundaries of agricultural fields located from Estuary to north of the M50 Motorway. They were also present along the southern boundary of Hertz Europe Service Centre, directly west of the R108 within Silloge Golf Club, along a hedgerow and treeline and adjacent to rough grassland and scrub in Ballymun and in hedgerow scrub habitat north of the Our Lady of Victories Church in Glasnevin.

The plant species assemblage recorded at each of these locations were species poor, and included common duckweed, fool's-water-cress and water horsetail.

This habitat type is valued as being of Local Importance (Higher Value) as it is uncommon in the surrounding area.

15.3.4.18 Improved Agricultural Grassland (GA1)

Improved agricultural grassland was present at the far northern end of the study area of the proposed Project in Estuary, east of the R132 south of the centre of Swords, at fields located north and south of lands at Dublin Airport and a relatively small area of land in Ballymun.

Grass species present included annual meadow-grass, cock's-foot, creeping bent, crested dog's-tail *Cynosurus cristatus*, meadow foxtail *Alopecurus pratensis*, perennial rye-grass, rough meadow-grass *Poa trivialis* and Yorkshire-fog, while forb species present included broad-leaved dock, common chickweed *Stellaria media*, common mouse-ear, common nettle, creeping buttercup, creeping thistle *Cirsium arvense*, daisy, dandelion, germander speedwell, greater plantain, red clover, ribwort plantain, silverweed *Potentilla anserina*, spear thistle, sticky mouse-ear *Cerastium glomeratum* and white clover.

This habitat type is of Local Importance (Lower Value) as it is a heavily modified habitat with a generally low flora species diversity dominated by species indicative of improved habitats.

15.3.4.19 Amenity Grassland (Improved) (GA2)

This habitat type was located across the study area of the proposed Project. It was associated with playing pitches, residential gardens, areas of green space within residential estates and public buildings and landscaped areas in commercial/industrial complexes/estates and adjacent to existing footpaths and roads. It was also located within Albert College Park, Mount Bernard Park, Berkeley Road Park and St Stephen's Green.

Grass species present included annual meadow-grass, common bent, creeping bent, crested dog's-tail, perennial rye-grass and Yorkshire-fog, along with the following forb species at lesser abundances: black medick, broad-leaved dock, common ragwort, creeping buttercup, creeping cinquefoil, creeping thistle, curled dock, daisy, dandelion, dove's-foot crane's-bill, greater plantain, prickly sow thistle, ribwort plantain, selfheal, silverweed, spear thistle, red clover and white clover.

This habitat type is of Local Importance (Lower Value) as it is a heavily modified habitat with a generally low flora species diversity dominated by species indicative of improved habitats.

15.3.4.20 Dry Calcareous and Neutral Grassland (GS1)

Three areas within the study area of the proposed Project were identified as species-rich dry calcareous and neutral grassland. These areas comprised grassland within the Hertz Europe Service Centre, a field,

located east of the R132 at Pinnock Hill, which was heavily grazed, and green space, located within the North Dublin Corporate Park in Swords.

Grass species present included: annual meadow grass, cock's-foot, creeping bent, false brome *Brachypodium sylvaticum*, false oat-grass, meadow foxtail, perennial rye-grass, quaking-grass *Briza media*, red fescue, rough meadow-grass *Poa trivialis*, soft brome *Bromus hordeaceus*, sweet vernal-grass *Anthoxanthum odoratum*, timothy *Phleum pratense* and Yorkshire fog. Rush species present included: hard rush, soft rush *Juncus effusus* and toad rush, while the sedge species common sedge *Carex nigra*, glaucous sedge *Carex flacca*, hairy sedge *C. hirta* and remote sedge *C. remota* were also recorded.

Forb species recorded, typical of calcareous soils, included cat's ear, common bird's-foot-trefoil, fairy flax, lady's bedstraw *Galium verum*, wild carrot *Daucus carota subsp. carota*, rough hawkbit *Leontodon hispidus*, selfheal, yellow-rattle *Rhinanthus minor* and yellow-wort *Blackstonia perfoliata*. Bee orchid *Ophrys apifera* was identified within the field east of the R132 at Pinnock Hill, while bee orchid and pyramidal orchid *Anacamptis pyramidalis* was identified within the green space site located within the business park. Other forb species present included black medick, brambles, bush vetch, colt's-foot, common mouse-ear, common ragwort, cowslip *Primula veris*, creeping buttercup, creeping cinquefoil *Potentilla reptans*, creeping thistle, curl dock, daisy, dandelion, groundsel, common knapweed *Centaurea nigra*, field horsetail, greater plantain, hedge mustard, herb-robert, kidney vetch *Anthyllis vulneraria*, lesser trefoil, meadow buttercup *Ranunculus acris*, meadow vetchling, oxeye daisy *Leucanthemum vulgare*, pineappleweed, red bartsia *Odontites vernus*, red clover, ribwort plantain, shepherd's-purse, silverweed, slender St John's-wort *Hypericum pulchrum*, smooth hawk's-beard, spear thistle, square-stalked St John's-wort *Hypericum tetrapterum*, trailing tormentil *Potentilla anglica*, tufted vetch *Vicia cracca*, yarrow and white clover.

Detailed botanical data were collected at these sites to confirm whether the habitats present conform to Annex I habitat Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) [6210] or Annex I habitat Lowland hay meadows (*Alopecurus pratensis*, *Sanguisorba officinalis*) (6510) (see Appendix A15.4 for full details). The data collected at each sampling point were representative of the entire area of habitat.

Indicator species of the Annex I habitat orchid-rich calcareous grassland with relatively low percentage covers were only recorded in two of the four relevés sampled in the field located east of the R132 at Pinnock Hill (i.e. two positive indicator species in relevé R6, bird's-foot trefoil and glaucous sedge, percentage cover of 5% and 10% respectively; one positive indicator species in relevé R8, bird's-foot trefoil, percentage cover 0.1%). Only one indicator species of this Annex I habitat with relatively low percentage cover was recorded in the two relevés sampled in the green space within North Dublin Corporate Park in Swords (i.e. one high quality positive indicator species in relevé R5, fairy flax, percentage cover of 5%). Indicator species of this Annex I habitat were recorded in both relevés sampled in Hertz Europe Service Centre (i.e. three positive indicator species in R1, kidney vetch, glaucous sedge and cowslip, percentage covers 5%, 1% and 15% respectively; one positive indicator species in R2, bird's-foot trefoil, percentage cover 1%). In the case of bird's-foot trefoil and glaucous sedge, they are commonly found species ubiquitous to a range of habitats. During the 2018 surveys, the orchid species bee orchid was identified within the field east of the R132 at Pinnock Hill; however, no orchids were recorded at this site in during the 2019 surveys.

Indicator species of this Annex I habitat hay meadow with relatively low percentage covers were only recorded in three of the four relevés sampled in the field located east of the R132 at Pinnock Hill (i.e. six positive indicator species and one high quality positive indicator species in relevé R6, percentage covers ranging from 0.1% to 10%, and three positive indicator species in R5, percentage covers ranging from 0.1% to 1%; and two positive indicator species in R8 with percentage covers of 0.1% and 10%).

Indicator species of this Annex I habitat hay meadow with relatively low percentage covers were recorded in both two relevés sampled in the green space within North Dublin Corporate Park in Swords (i.e. four positive indicator species in relevé R4, percentage covers ranging from 0.1% to 5%, and five positive indicator species recorded in relevé R3, percentage covers ranging from 0.1% to 5%). In the case of all of these indicator species (i.e. bird's-foot trefoil, cat's-ear, meadow buttercup, red clover, ribwort plantain, selfheal, smooth hawk's-beard and tufted vetch), they are commonly found species

ubiquitous to a range of habitats. During the 2018 survey, pyramidal orchid *Anacamptis pyramidalis* was identified within the green space site located within the business park; however only one individual bee orchid plant was recorded in the green space site located within the business park during the 2019 surveys.

Indicator species of this Annex I habitat hay meadow with relatively low percentage covers were recorded in both two relevés sampled in Hertz Europe Service Centre (i.e. two positive indicator species in R1 with percentage covers of 1% and 5% and one high quality positive indicator species at 5% and two positive indicator species in R2 with percentage covers of 1% and 5% and one high quality positive indicator species at 10%).

A total of three negative indicator species of Annex I habitat orchid-rich calcareous grassland and Annex I habitat hay meadow[23] were recorded in R6, four negative indicator species were recorded in relevés R7 and R5 and two in R8 in the field located east of the R132 at Pinnock Hill (i.e. creeping thistle, perennial rye-grass, common ragwort and white clover, with percentage covers ranging from 0.1% to 45%).

A total of five and six negative indicator species of these Annex I habitats were recorded in relevés R4 and R3 in the green space within North Dublin Corporate Park in Swords (i.e. common ragwort, cock's-foot, creeping thistle, false oat-grass, perennial rye-grass and white clover with percentage covers ranging from 0.1% to 45%). A total of three and negative indicator species of these Annex I habitats were recorded in R1 and R2 in Hertz Europe Service Centre (i.e. false-oat grass, perennial rye-grass and common ragwort, with percentage covers ranging from 0.1% to 1%).

In addition, generally, a high grass to forb ratio was recorded at each sampling point (i.e. 50:50, 60:35, 50:50 and 65:35 grass to forb ratio in the field located east of the R132 at Pinnock Hill, 70:30 and 60:30 grass to forb ratio in the green space within North Dublin Corporate Park in Swords and 55:45 and 45:55 grass to forb ratio at Hertz Europe Service Centre). The field located east of the R132 at Pinnock Hill is a relatively semi-improved agricultural grassland field that is currently heavily grazed by horses. Based on a review of aerial photography dating back to 2002, it appears that this field has been improved for a significant period of time (i.e. likely to be a minimum of 18 years). Based on a review of aerial photography, it is noted that the green space within North Dublin Corporate Park in Swords changed from what appears to be an improved agricultural land to green space within a business park sometime between 2005 and 2008 and that it may have changed from grassland into spoil and bare ground/recolonising bare ground sometime between 2008 and 2009. During the survey, the soil type was noted as possibly being infill/rubble which may have been placed in the area during the construction of the business park.

Therefore, in consideration of these factors, it was confirmed that neither of these areas of this species-rich habitat type within the proposed Project boundary conform to the Annex I habitat Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) [6210] or Annex I habitat Lowland hay meadows (*Alopecurus pratensis*, *Sanguisorba officinalis*) [6510]. However, these areas are considered to be of Local Importance (Higher Value) due to being species-rich in the context of grasslands within the local area and the presence of orchid, albeit in very low individual plant numbers.

Species-poor areas of this habitat type were also identified within the study area of the proposed Project. These areas comprised larger areas located north-west and south-east of Lakeshore Drive near Barrysparks and west of the R108 north of St Margaret's Road in Ballymun, where it was a present in a mosaic with dry meadows and grassy verges and wet grassland habitat types. It also comprised relatively small patches in a mosaic with scrub habitat type located in Swords Business Park, within an improved agricultural grassland field located north of the Naul Road and a small patch located on top of a mound of thin soil located in a rough grassland field east of the R108 in Ballymun near Junction four south bound exit of the M50 Motorway.

[23] Both these Annex I habitats have the same negative indicator species (Martin *et al.*, 2018; O'Neill *et al.*, 2013).

Grass species present included those common to more improved habitats: creeping bent, cock's-foot, perennial rye-grass and Yorkshire fog. Forb species included: common chickweed, common mouse-ear, common nettle, germander speedwell, oxeye daisy, red clover, ribwort plantain and white clover.

These species-poor areas of this habitat type are considered to be of Local Importance (Lower Value).

15.3.4.21 Dry Meadows and Grassy Verges (GS2)

This habitat type was present across the study area of the proposed Project. It comprised: agricultural fields managed for silage/hay; arable and improved agricultural field margins; areas of neglected grassland associated with residential gardens, waste ground and public spaces; uncut grass within Hertz Europe Service Centre; roadside verges off the R132, Naul Road, Airport Road and R108, some of which were uncut; railway embankment at Glasnevin; and areas along the riverbanks of the Broadmeadow River and Ward River, as a mosaic with other habitat types.

Grass species present included cock's-foot, common bent, false oat-grass, perennial rye-grass, red fescue, rough meadow-grass, sweet vernal-grass and Yorkshire-fog. One sedge species was recorded, pendulous sedge *Carex pendula*, and one rush species, hard rush.

Forb species present included black medick, brambles, broad-leaved dock, bush vetch, colt's-foot, common chickweed, common knapweed, common nettle, common ragwort, creeping buttercup, creeping cinquefoil, creeping thistle, curl dock, dandelion, goat's-beard *Tragopogon pratensis*, great willowherb, hedge bindweed, hedge woundwort, hogweed, kidney vetch, meadow buttercup, meadow vetchling, nipplewort *Lapsana communis*, oxeye daisy, prickly sowthistle, red clover, ribwort plantain, rosebay willowherb, silverweed, small burnet *Sanguisorba minor subsp. balearica*, spear thistle, tufted vetch, white clover, wild angelica, wild teasel and winter heliotrope *Petasites pyrenaicus*.

Whilst a large number of species were recorded within this habitat type across the entire survey area, the actual number of species recorded at specific locations was significantly lower.

These species-poor areas of this habitat type are considered to be of Local Importance (Lower Value) due to its relatively low flora species diversity.

15.3.4.22 Wet Grassland (GS4)

There were three relatively small areas of this habitat type identified within the study area of the proposed Project, located south of an existing drainage ditch and hedgerow, and directly north of arable grassland field, west of the R132 in Pinnock Hill, south-east of the proposed Seatown Station and in mosaics with habitat types dry calcareous and neutral grassland (GS1), dry meadows and grassy verges (GS2) and scrub (WS1) north and south of St Margaret's Road in Ballymun.

These areas comprised grass species such as creeping bent, rough meadow-grass and Yorkshire-fog. Rush species hard rush and soft rush were also present, along with false fox-sedge *Carex otrubae* and hairy sedge. Forb species present included those typical of wetter conditions, such as common fleabane *Pulicaria dysenterica*, bulrush *Typha latifolia*, field horsetail, great willowherb, meadowsweet and silverweed, as well as those more common in more improved grassland habitats, such as common nettle, common ragwort, creeping cinquefoil, curled dock and meadow buttercup. Goat willow *Salix caprea* and grey willow *S. cinerea* and were also present in the mosaic of wet grassland, dry meadows and grassy verges and scrub in Ballymun.

This habitat type is valued as being of Local Importance (Higher Value) as it is not common in the surrounding area and is relatively species-rich in the context of surrounding habitats.

15.3.4.23 (Mixed) Broadleaved Woodland (WD1)

This habitat type was located across the study area of the proposed Project within residential areas, along either side of the R132 in parts, along the Staffordstown Stream east of the R132, north of the Broadmeadow River, directly south of the Broadmeadow River and Ward River, directly west of the

Ward River adjacent to the Swords Business Campus, along the R132, within Hertz Europe Service Centre along a field boundary in Dardistown, with Silloge Park Golf Club, within the large garden of a St Anne's private dwelling, within Santry Demesne and adjacent to rough grassland and a hedgerow in Ballymun, north of the River Tolka within Griffith Park and in Mount Bernard Park south of the Royal Canal.

Broadleaved tree species present included alder, ash *Fraxinus excelsior*, beech *Fagus sylvatica*, blackthorn *Prunus spinosa*, elder *Sambucus nigra*, field maple, hazel *Corylus avellana*, hawthorn, holly, hornbeam *Carpinus betulus*, Lombardy-poplar *Populus nigra* 'Italica', oak species, sycamore *Acer pseudoplatanus* and wych elm. Other species present included alexanders, bluebell *Hyacinthoides non-scripta*, brambles, cherry laurel *Prunus laurocerasus*, common nettle, common ivy, cow parsley, false-brome, false oat-grass, flowering currant *Ribes sanguineum*, herb-robert, hogweed and rosebay willowherb. Coniferous tree species present included Leyland cypress *Cupressus x Leylandii* and yew *Taxus baccata*. This habitat type is valued as being of Local Importance (Higher Value) as it is not common in the surrounding area and is relatively species-rich in the context of surrounding habitats.

15.3.4.24 (Mixed) Conifer Woodland (WD3)

One relatively small patch of this habitat type was present within the study area of the proposed Project, located within the northern section of the private garden of St Anne's dwelling.

It was dominated by *Pinus nigra*. Other tree species present were oak species, rowan and sycamore. Grass species present in the understorey included perennial rye-grass and rough meadow-grass, while forb species present included brambles, common ivy, cleavers, dandelion herb-robert, smooth sowthistle, spear thistle and wood avens.

This habitat type is valued as being of Local Importance (Higher Value) as it is not common in the surrounding area and is relatively species-rich in the context of surrounding habitats.

15.3.4.25 Scattered Trees and Parkland (WD5)

Areas of this habitat type, identified within the study area of the proposed Project, were associated with parks and playing pitches, such as the Fingallians Balheary Pitches, Balcurris Park, Albert College Park, Griffith Park, Berkeley Road Park and St Stephen's Green, and landscaped areas within residential/commercial complexes/estates. It was also identified within the grounds of Bon Secours Hospital, Scoil Mobhí, Whitehall College of Further Education, Rotunda Hospital and the Huguenot Cemetery on Merrion Row. It was often found present in association with the habitat types ornamental/non-native shrubs and flowers beds and borders.

Typical species present included ash, beech, birch species *Betula sp.*, common lime *Tilia x europaea*, copper beech *Fagus sylvatica purpurea*, field maple *Acer campestre*, holly *Ilex aquifolium*, holm oak, hornbeam, horse-chestnut, Norway maple *Acer platanoides,* oak species, small-leaved lime *T. cordata*, sweet chestnut *Castanea sativa*, sycamore and wild cherry *Prunus avium*.

Grass species present in the understorey included annual meadow-grass, common bent, perennial rye-grass, rough meadow-grass and Yorkshire fog, while forb species present included brambles, cleavers, common ivy, creeping buttercup, curl dock, daisy, dandelion, herb-robert, hogweed, selfheal, smooth sowthistle, spear thistle, white clover and wood avens.

This habitat type is valued as being of Local Importance (Higher Value) as it is not common in the surrounding area and is relatively species-rich in the context of surrounding habitats.

15.3.4.26 Hedgerows (WL1)

This habitat type was recorded across the study area of the proposed Project. The majority of field boundaries were comprised of hedgerows, some of which were found in association with drainage ditches or watercourses. They were also present within sections of the median of the R132 and at the boundaries of landscaped areas within residential/commercial/industrial complexes/estates. Species within these particular locations were generally non-native ornamentals. Some hedgerows were also

present within parks, i.e. Albert College Park and St Stephen's Green, in association with other habitat types, i.e. scattered tree and parkland.

Broadleaved tree species present included ash, beech, blackthorn, cherry laurel, common lime, copper beech, elder, crack-willow *Salix euxina*, English elm, field maple, goat willow, grey willow, hawthorn, hazel, horse-chestnut, Lombardy-poplar, oak species, osier *Salix viminalis*, poplar species *Populus* sp., silver birch, sycamore, wych elm *Ulmus glabra* and willow species *Salix* sp. Coniferous tree species present included Leyland cypress, Monterey cypress and yew.

Other woody species present included brambles, butterfly-bush, cotoneaster species, dog rose *Rosa canina* agg., garden privet *Lucidum ovalifolium*, gorse *Ulex europaeus*, honeysuckle *Lonicera periclymenum*, New Zealand broadleaf *Griselinia littoralis*, rose species *Rosa sp.* and snowberry. Grass species present in the understorey included false oat-grass, false brome and rough meadow-grass.

Forb species present in the understorey included alexanders, American willowherb, brambles, broad-leaved dock, bush vetch, cleavers, common ivy, common nettle, common ragwort, cow parsley, creeping buttercup, creeping thistle, curl dock, field horsetail, foxglove *Digitalis purpurea*, great horsetail *Equisetum telmateia*, great willowherb, hedge bindweed, hedge mustard *Sisymbrium officinale*, hedge woundwort, hogweed, lords-and-ladies *Arum maculatum*, nipplewort, perennial sowthistle *Sonchus arvensis*, primrose *Primula vulgaris*, red clover, remote sedge *Carex remota*, ribwort plantain, rough hawkbit, spear thistle and tufted vetch.

This habitat type is valued as being of Local Importance (Higher Value) as it is not common in the surrounding area and is relatively species-rich in the context of surrounding habitats.

15.3.4.27 Treelines (WL2)

This habitat type was recorded across the study area of the proposed Project. Some of the field boundaries were comprised of treelines. A number of roads, such as O'Connell Street, were lined with treelines. This habitat type was also present within landscaped areas of residential/commercial/industrial complexes/estates. A number of treelines were located within parks, such as Albert College Park, St Stephen's Green, Griffith Park along Mobhi Road and Dartmouth Square, and near the Ward River, Tolka River, Royal Canal and Grand Canal.

Tree species present included alder, ash, aspen *Populus tremula*, beech, blackthorn, cherry laurel, common oak *Quercus robur*, common lime, hawthorn, hazel, horse-chestnut, elder, field maple, Green alkanet *Pentaglottis sempervirens* (a naturalised garden escape species), holly, Leyland cypress, Monterey cypress, wych elm, silver birch, sycamore and wild cherry. Other species present included alexanders, butterfly-bush, brambles, cherry laurel, cleavers, common ivy, cow parsley, common nettle, dog rose, greater plantain, groundsel, guelder rose *Viburnum opulus*, smooth sowthistle, rose species and wood avens.

This habitat type is valued as being of Local Importance (Higher Value) as it is not common in the surrounding area and is relatively species-rich in the context of surrounding habitats.

15.3.4.28 Scrub (WS1)

Isolated patches of scrub were identified across the study area of the proposed Project, in particular, areas of land along the southern banks of the Ward River and Broadmeadow River east of the R132 to the southern and northern banks of the existing railway lines located near the proposed Glasnevin Station and north of the Royal Canal. This habitat type was also identified as part of mosaics with other habitat types, including earth banks, dry calcareous and neutral grassland, dry meadows and grassy verges, hedgerows, treelines, ornamental/non-native shrub. Typical species present included blackthorn, brambles, gorse and dog-rose *Rosa canina* agg., while other species present included butterfly-bush, common nettle and hedge bindweed.

This habitat type is considered to be of Local Importance (Lower Value) due to its relatively low flora species diversity.

15.3.4.29 Immature Woodland (WS2)

This habitat type consisted of a fenced-off stand of tree saplings located directly north of the Naul Road within a field of improved agricultural grassland and a stand of trees located at Junction four south bound exit of the M50 Motorway. Species present included birch species *Betula sp.*, oak species *Quercus sp.* and sycamore.

This habitat type is valued as being of Local Importance (Higher Value) as it is not common in the surrounding area and is relatively species-rich in the context of surrounding habitats.

15.3.4.30 Ornamental/Non-Native Shrub (WS3)

Areas of ornamental/non-native shrub were associated with residential gardens, landscaped areas within residential/commercial/industrial complexes/estates, within parks in association with other habitat types, and one area with a dense infestation of the non-native invasive plant species Japanese knotweed *Reynoutria japonica* (invasive plant species are discussed in more detail below in Section 15.3.6). In the case of residential properties, the majority of this habitat type is captured on the habitat map by the Residential classification (see Section 15.3.4.31 below).

This habitat type is of Local Importance (Lower Value) as it is a heavily modified habitat that is dominated by non-native ornamental plant species of low biodiversity value.

15.3.4.31 Residential

This non-Fossitt classification is used to represent residential properties within the study area of the proposed Project and generally consist of a mosaic of buildings and artificial surfaces (BL3), amenity grassland (GA2), flower beds and borders (BC4) and ornamental shrubs (WS3).

This habitat type is of Local Importance (Lower Value) as it is a heavily modified habitat that is generally dominated by non-native ornamental plant species of low biodiversity value.

15.3.5 Rare and Protected Plant Species

No protected plant species listed on the Flora Protection Order (2022) were recorded within or in close proximity to the proposed Project; however, there are desktop records of the rare and protected species opposite-leaved pondweed *Groenlandia densa* present downstream of the proposed Project directly east of Cross Guns Bridge between Lock 5 and 4 and Lock 4 to Lock 1 on the Royal Canal (BEC Consultants, 2015; EcoServe, 2011). This species was not recorded during the detailed aquatic botanical survey of the Royal Canal basin between Lock 6 and Lock 5 carried out on the 17 June 2021 (see Appendix A15.9 for full details) and it has never been recorded during other aquatic surveys completed along the canal at that location (McCarthy Keville O'Sullivan Ltd., 2019; BEC, 2015; EcoServe, 2011).

The only known Irish record of the very rare charophyte species tassel stonewort *Tolypella intricata* is found between Lock 5 and Lock 4 on the Royal Canal directly east of the proposed Project at Cross Guns Bridge (NPWS, 2009f). This species is considered to be "*Vulnerable*" (Wyse Jackson *et al.*, 2016). It was also not recorded during the detailed aquatic botanical survey of the Royal Canal basin. The temporary dewatering of the Royal Canal will be confined to the basin located between Lock 6 and Lock 5 and as tassel stonewort was not recorded at this location there is no potential for impacts to occur as a result of habitat loss.

Three aquatic plant species (i.e. horned pondweed, rigid hornwort and whorled water-milfoil) contained within *Ireland Red List No. 10: Vascular Plants* (Wyse Jackson *et al.*, 2016) was recorded on the Royal Canal in relatively high abundance (i.e. 60% percentage cover). These Red List species are considered to be of "*Least Concern*" (Wyse Jackson *et al.*, 2016).

No rare plant species contained within *Ireland Red List No. 8: Bryophytes* (Lockhart *et al.*, 2012) were recorded within, or in close proximity to, the proposed Project.

15.3.6 Non-Native Invasive Plant Species

There were seven non-native invasive plant species listed on the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations, 2011 present within or in close proximity to the proposed Project. The locations of these non-native invasive plant species are summarised below in Table 15.12 and shown on Figures 15.6.

The following non-native invasive species listed in *The Management of Invasive Alien Plant Species on National Roads - Technical Guidance* (TII, 2020) were also recorded widely across the survey area:

- Winter heliotrope – in canal (FW3) and dry meadows and grassy verges (GS2) habitat types
- Butterfly-bush– recolonising bare ground (ED3), hedgerow (WL1), treeline (WL2) and scrub (WS1)

Table 15.12: Summary of Non-native Invasive Plant Species Listed in the Third Schedule of the Birds and Habitats Regulations 2011 Recorded along or adjacent to the Proposed Project

Common Name	Latin Name	Location[24]
Canadian pondweed	*Elodea canadensis*	**Survey:** ▪ Located on the Royal Canal at the 5th level, Cross Gun's Quay, Cabra ▪ Located on the Grand Canal near the existing Luas Green Line crossing point ▪ Desk Study: ▪ Located across almost the entirety of the Royal Canal and Grand Canal (Waterways Ireland, 2019a and 2019b and NBDC, 2020)
Giant hogweed	*Heracleum mantegazzianum*	**Survey:** ▪ Located on the northern and southern banks of the Broadmeadow River, east of the R132, in scattered patches ▪ Located on the southern and eastern banks of the Ward River, west of the R132 ▪ Located in Ballymun, south of Northwood Avenue, west and east of the Domville Wood Road **Desk Study:** ▪ Located on the banks of the Broadmeadow River, Ward River, and River Tolka
Indian balsam	*Impatiens glandulifera*	**Survey:** ▪ N/A **Desk Study:** ▪ Located on the banks of the River Tolka and River Liffey
Japanese knotweed	*Reynoutria japonica*	**Survey:** ▪ Located in Dardistown within the eastern section of a field to south of the existing Long-term car park at Dublin Airport ▪ Located in Dardistown within the south-western section of a field to south of the existing Long-term car park at Dublin Airport ▪ Located within Irish Rail lands along the existing railway embankments and adjacent lands north of the Royal Canal south-east of Glasnevin Cemetery ▪ Located in a private unnamed laneway adjacent to the proposed Charlemont station **Desk Study:** ▪ Located on banks of the Sluice River, River Tolka and Royal Canal, and within St Stephen's Green ▪ There are also records of Japanese knotweed along the proposed Grid Connections at Clonshaugh (near the ESB sub-station), Stockhole Lane (near the nursing home), south-west of the

[24] These records were identified during surveys. Additional to these results are records of invasive plants species found during the desk study, as specified.

Common Name	Latin Name	Location[24]
		M1/M50 Interchange, and south-east of the junction of the R108 and R122.
New Zealand pigmyweed	*Crassula helmsii*	**Survey:** ▪ Located on the Grand Canal near the existing Luas Green Line crossing point Desk Study: ▪ Located within the National Botanic Gardens
Nuttall's pondweed	*Elodea nuttalli*	**Survey:** ▪ Located on the Royal Canal at the 5th level, Cross Gun's Quay, Cabra **Desk Study:** ▪ Located across almost the entirety of the Royal Canal and Grand Canal (Waterways Ireland, 2019a and 2019b and NBDC, 2020)
Three-cornered leek	*Allium triquetrum*	**Survey:** ▪ Located on bank west of fields in Bellinstown. ▪ Located in a garden of St Anne's private dwelling off Charter School Hill Road ▪ Located along the eastern boundary of the DCU Sports Complex playing pitches ▪ Located at the north-western boundary of CLG Na Fianna playing pitches ▪ Located along the northern bank of the Grand Canal directly west of the Luas Green Line crossing point **Desk Study:** ▪ Located within the National Botanic Gardens and along the Royal Canal

15.3.7 Mammals

15.3.7.1 Otter

Otters, and their breeding and resting places, are protected under the Wildlife Acts. Otters are also listed on Annex II and Annex IV of the EU Habitats Directive and are afforded strict protection under the Habitats Directive and the European Communities (Birds and Natural Habitats) Regulations, 2011.

There are records of otter from the Broadmeadow River, Ward River, Cuckoo River, Mayne River, Santry River, Tolka River, Royal Canal, River Liffey and Grand Canal (NBDC, 2021; Waterways Ireland, 2019a; Waterways Ireland, 2019b; DCC, 2019). The following signs of otter activity were recorded during the surveys:

- Otter spraint recorded on the southern bank of the Broadmeadow River, c. 240m downstream from the proposed Project at Ch. 1620;
- Otter spraint recorded on the northern bank of the Santry River, c. 145m downstream from the proposed Project at Ch. 9960;
- Otter spraint, footprints, couch and potential slides recorded along the northern and southern banks of the Royal Canal before Broombridge, directly adjacent to and c. 80m to 685m north-west of the proposed Project; and,
- An otter couch located on the southern bank of the Royal Canal east of Lock 4 c. 120m south-east of the proposed Project at Ch. 14960.

It is considered likely that otter utilise various watercourses within the Broadmeadow River, Mayne River and River Tolka sub-catchments for breeding, foraging and commuting activities. Otters are also likely to utilise the Barberstown Stream and Dunbro Stream (part of the Ward River catchment) which are crossed by the alignment of the proposed Grid Connections.

No otters were recorded on the infra-red motion-activated camera deployed (under NPWS Licence No. 007/2020) at the entrance of a small burrow on the Santry River c. 210m downstream of the proposed crossing point location. The only species recorded using this burrow was a brown rat *Rattus norvegicus*.

The results of the otter surveys are shown on Figure 15.8.

The local otter population is valued as being of International Importance as it may be connected with the qualifying interest otter population of the Wicklow Mountains SAC[25].

15.3.7.2 Bats

Bats, and their breeding and resting places, are protected under the Wildlife Acts. All bat species are also listed on Annex IV of the EU Habitats Directive; with the lesser horseshoe bat also listed on Annex II. Bats are also afforded strict protection under the Habitats Directive and the European Communities (Birds and Natural Habitats) Regulations, 2011.

Bat surveys were carried out in the preparation of this EIAR, and the results of these are set below. The results of these surveys are also presented in Figure 15.7.

The structure of this section is such that each bat species is described in turn. The results of the various surveys are presented to allow an understanding of each species in terms of its distribution across the study area of the proposed Project.

Leisler's bat Nyctalus leisleri

The NBDC database returned records of Leisler's bat at lands located north and south of Dublin Airport, in Ballymun Village, south-west of the proposed Mater Station, west of O'Connell Street, in St Stephen's Green and along the Grand Canal. According to the BCI database, there is one Leisler's bat roosts located within c. 1km of the proposed Project, i.e. in Grand Canal Dock. There are also numerous *ad-hoc* BCI bat records of Leisler's bat located within c. 1km of the proposed Project, i.e. west of the Ward River, within the boundaries of Dublin Airport, at lands south of the airport in Dardistown, west and north of the Santry River, in the centre of Ballymun Village, west and south-west of the proposed Mater Station, west and east of the proposed O'Connell Street Station, on the River Liffey, at Grand Canal Dock, in St Stephen's Green, in the Iveagh Gardens and on the Grand Canal.

No roost sites for Leisler's bat were recorded during any of the surveys for the proposed Project.

Leisler's bat was recorded widely across the study area of the proposed Project during the walked transect surveys, in particular at vegetative boundaries at lands north and south of the Broadmeadow River and Ward River and west and east of the R132, at Santry Demesne and surrounding lands in Ballymun Our Lady of Victories Church in Glasnevin, Griffith Park near the River Tolka and Royal Canal. No Leisler's bat was recorded at Albert College Park, playing pitches at CLG Na Fianna and Home Farm F.C., O'Connell Street or at St Stephen's Green.

Leisler's bat was recorded at 27 of the 29 static bat detector deployment locations. The only two locations where this species was not recorded were at the proposed Mater Station and at Dartmouth Square (i.e. Static_24 and Static_28 respectively). Areas of particularly high levels of activity included a treeline east of the R132 south of the North Dublin Corporate Park (i.e. average number of calls per night of deployment was 215, Static_8), at a hedgerow along the Staffordstown Stream (i.e. average number of calls per night of deployment was 98, Static_1) and a treeline west of the R132 in Balheary Park (i.e. average number of calls per night of deployment was 38, Static_5).

The results of the bat surveys as they relate to the Leisler's bat are shown on Figure 15.7.

[25] A hydrological connection exists between the proposed Project and the Wicklow Mountains SAC (for which otter are a QI), which is located *c.* 18.5km upstream of the proposed Project via the River Liffey (north of the proposed Tara Station at George's Quay), the River Dodder and Owenadoher River at Tibradden Wood. It is therefore within the territorial range of male otter in Ireland albeit at the very far end of that range (*c.* 13.2km ±5.3km) (Ó'Néill *et al.*, 2008) and as such on a precautionary basis it is considered possible that otter present within the ZoI of the proposed Project may be connected with the SAC population.

Leisler's bat population is valued as being of Local Importance (Higher Value) given their conservation status of "*Least Concern*" (Marnell *et al.*, 2019) and that it is commonly found across the study area and beyond in the county.

Common pipistrelle bat Pipistrellus pipistrellus

The NBDC database returned no records of common pipistrelle within or in close proximity to the proposed Project. According to the BCI database, there is one common pipistrelle roost located within c. 1km of the proposed Project, i.e. west of Grand Canal Dock. There are also numerous *ad hoc* BCI bat records of common pipistrelle located within c. 1km of the proposed Project, i.e. west of the Ward River, within the boundaries of Dublin Airport, at lands south of Dublin Airport in Dardistown, north of the Santry River, near Ballymun Village centre, north of Griffith Avenue, west and south-west of the proposed mater station, west and east of O'Connell Street Station, in St Stephen's Green, directly east of Iveagh Gardens and in Grand Canal Dock.

No roost sites for common pipistrelle bat were recorded during any of the surveys for the proposed Project.

Common pipistrelle bat was recorded widely across the study area of the proposed Project during each walked transect surveys, in particular at lands north and south of the Broadmeadow River and Ward River, at vegetative features west and east of the R132, fields near Pinnock Hill, Griffith Park near the River Tolka and at the Royal Canal. No common pipistrelle was recorded on O'Connell Street.

Common pipistrelle bat was recorded at 26 of the 29 static bat detector deployment locations. The only three locations where this species was not recorded were at the Albert College Park, Griffith Park north of the River Tolka and at the Grand Canal (i.e. Static_19, Static_21 and Static_27 respectively). Areas of particularly high levels of activity included a treeline east of the R132 south of the North Dublin Corporate Park (i.e. average number of calls per night of deployment was 343, Static_8), at a hedgerow located south-west of Swords Veterinary Hospital (i.e. average number of calls per night of deployment was 187, Static_10) and at Berkley Road Park (i.e. average number of calls per night of deployment was 152, Static_24).

The results of the bat surveys as they relate to the common pipistrelle bat are shown on Figure 15.7.

Common pipistrelle bat population is valued as being of Local Importance (Higher Value) given their conservation status of "*Least Concern*" (Marnell *et al.*, 2019) and that it is commonly found across the study area and beyond in the county.

Nathusius' pipistrelle bat Pipistrellus nathusii

The NBDC database returned records of Nathusius' pipistrelle within or in close proximity to the proposed Project located east of O'Connell Street at Connolly Station and along the Grand Canal. According to the BCI database, there are no Nathusius' pipistrelle roosts located within or in the wider environs of the proposed Project. According to Roche *et al.* (2014), there are records of five Nathusius' pipistrelle roosts in the entire country. There are also numerous *ad-hoc* BCI bat records of Nathusius' pipistrelle located within c. 1km of the proposed Project, i.e. east of the proposed Connolly Street station and proposed St Stephen's Green Station.

No roost sites for Nathusius' pipistrelle bat were recorded during any of the surveys for the proposed Project.

Nathusius' pipistrelle bat was recorded at one location during the first walked transects, i.e. Griffith Park near the River Tolka.

Nathusius' pipistrelle bat was recorded at two of the 29 static bat detector deployment locations. The only two locations where this species was recorded were a hedgerow in Estuary and a treeline east of the R132 south of the North Dublin Corporate Park (i.e. average number of calls per night of deployment 3, Static_3 and 1, Static_8).

Nathusius' pipistrelle bat population is valued as being of County Importance due to its restricted distribution in County Dublin as based on records obtained from BCI and NBDC (2021).

Soprano pipistrelle bat Pipistrellus pygmaeus

The NBDC database returned records of soprano pipistrelle within or in close proximity to the proposed Project located at the Broadmeadow River; to the north and south of Dublin Airport; in Ballymun village centre; near St Stephen's Green; and, along the Grand Canal. According to the BCI database, there are two soprano pipistrelle roost located within c. 1km of the proposed Project, i.e. Iveagh Gardens. There are also numerous *ad-hoc* BCI bat records of soprano pipistrelle located within c. 1km of the proposed Project, i.e. west of the Ward River, within the boundaries of Dublin Airport, at lands south of the airport in Dardistown, north of the Santry River, near to Ballymun Village Centre, west of the proposed Mater Station, on the River Liffey, in St Stephen's Green, in and directly east of the Iveagh Gardens and along the Grand Canal.

One roost was identified within the study area of the proposed Project, i.e. at a private dwelling named "*St Anne's*", north-east of the Charter School Hill Road in Ballymun. This roost contained only one bat.

Soprano pipistrelle bat was recorded widely across the study area of the proposed Project during the walked transect surveys, in particular at lands north and south of the Broadmeadow River and Ward River, lands at Dardistown, along the Santry River, at the boundaries of playing pitches at CLG Na Fianna and Home Farm F.C. and Griffith Park near the River Tolka and Royal Canal. No soprano pipistrelle bats were recorded at lands located north of Dublin Airport, Our Lady of Victories Church in Glasnevin or on O'Connell Street.

Soprano pipistrelle bat was recorded at 26 of the 29 static bat detector deployment locations. The only three locations where this species was not recorded were a treeline east of the R132 south of Seatown Road, at St Stephen's Green and the Grand Canal (i.e. Static_7, Static_26 and Static_27 respectively). Areas of particularly high levels of activity included two hedgerows in Estuary (i.e. average number of calls per night of deployment was 140, Static_2, and 87, Static_3) and a hedgerow in Dardistown (i.e. average number of calls per night of deployment was 44, Static_15).

The results of the bat surveys as they relate to the soprano pipistrelle bat are shown on Figure 15.7.

Soprano pipistrelle bat population is valued as being of Local Importance (Higher Value) given their conservation status of "*Least Concern*" (Marnell *et al.*, 2019) and that it is commonly found across the study area and beyond in the county.

Unidentified pipistrelle species

Common pipistrelle bats have their peak echolocation call strength at 45kHz and soprano pipistrelle bats at 55kHz. Pipistrelle bat species that echolocate between 48kHz and 52kHz cannot be accurately identified by their calls and are described as "*unidentified*" pipistrelle bat species. According to the BCI database, there is one known roost of an unidentified pipistrelle bat within c. 1km of the proposed Project boundary, located near Forrest Little Golf Club. There were *ad-hoc* BCI records for unidentified pipistrelle bat within c. 1km of the proposed Project, i.e. at lands south of the airport in Dardistown, near Ballymun village centre and along the Grand Canal [26].

Pipistrelle species bat calls that could not be classified as either characteristic of common or soprano pipistrelle bats were recorded relatively widely across the study area of the proposed Project during the walked transect surveys, in particular at lands north and south of the Broadmeadow River and Ward River, lands at Dardistown, Albert College Park, the boundaries of playing pitches at CLG Na Fianna and Home Farm F.C., Griffith Park near the River Tolka and Royal Canal. Unidentified pipistrelle bat species

[26] With reference to other pipistrelle species, the NBDC database returned one record of Nathusius' pipistrelle *Pipistrellus nathusii* located on the Grand Canal downstream of the proposed Project. The BCI database returned one record of Nathusius' pipistrelle within c. 1km of the proposed Project on the Grand Canal.

calls were not recorded at lands north of Dublin Airport, O'Connell Street, St Stephen's Green or the Grand Canal.

Unidentified pipistrelle bats were recorded at 22 of the 29 static bat detectors deployed. The seven locations where this species was not recorded were hedgerows in Estuary (i.e. Static_2 and Static_3), at a treeline located directly west of the R132 in Balheary Park (i.e. Static_5), a treeline east of the R132 south of Seatown Road (i.e. Static_7), a hedgerow east of the R132 near Pinnock Hill (i.e. Static_11), Griffith Park north of the River Tolka (i.e. Static_21) and at the Grand Canal (i.e. Static_27). Areas of particularly high levels of activity included a hedgerow in Dardistown (i.e. average number of calls per night of deployment was 189, Static_15) and at Dartmouth Square Park (i.e. average number of calls per night of deployment was 22, Static_28).

The results of the bat surveys as they relate to the pipistrelle bats, not identified to species level, are shown on Figure 15.7.

Brown long-eared bat Plecotus auritus

The NBDC database returned one record of brown long-eared bat within or in close proximity to the proposed Project along the Grand Canal. According to the BCI database, there are no known brown long-eared bat roosts located within c. 1km of the proposed Project. There were *ad-hoc* BCI records for brown long-eared bat located within c. 1km of the proposed Project, i.e. west of the Ward River and on the Grand Canal.

No roost sites for brown long-eared bat were recorded during any of the surveys for the proposed Project.

Brown long-eared bat was recorded at two locations during the walked transects, i.e. the fields in Estuary and CLG Na Fianna and Home Farm F.C./in Griffith Park near the River Tolka. This species was also recorded at Lissenhall Bridge during the bat re-entry survey.

Brown long-eared bat was only recorded at two of the 29 static bat detectors deployed. These locations were at a treeline in Estuary and on the Royal Canal (i.e. average number of calls per night of deployment was 1, Static_3, and 2, Static_22). This low detection rate of this species may be explained by the relatively limited availability of suitable foraging habitat present within the study area of the proposed Project[27].

The results of the bat surveys as they relate to the brown long-eared bat are shown on Figure 15.7.

Brown long-eared bat population is valued as being of Local Importance (Higher Value) given their conservation status of "*Least Concern*" (Marnell *et al.*, 2019) and that it is likely to be relatively common in the local area and beyond in the county.

Myotis bat species

The NBDC database returned records of Daubenton's bat *Myotis daubentonii* within or in close proximity to the proposed Project near to the Broadmeadow River. According to the BCI database, there are no roost records for Daubenton's bat located within c. 1km of the proposed Project. There are *ad-hoc* BCI bat records of Daubenton's bat located west of the Ward River. The NBDC database returned no records of whiskered bat *Myotis mystacinus* within or in close proximity to the study area. According to the BCI database, there are no known whiskered bat roosts located within c. 1km of the proposed Project. There is one *ad-hoc* BCI record for whiskered bat located in St Stephen's Green. The NBDC database returned no records of Natterer's bat within or in close proximity to the study area. According to the BCI database, there are no known Natterer's bat roosts located within c. 1km of the proposed

[27] This species is strongly associated with tree cover, preferring woodland with cluttered understorey including native species, particularly deciduous (Collins, 2016). The woodland habitat present within the study area is generally very limited in extent, i.e. comprising: small patches of planted woodland along the boundaries of amenity grassland near the R132; woodland located north of the Broadmeadow River, east of the R132; woodland within the garden of St Anne's private dwelling; an area of woodland located within Santry Demesne park and, a small patches of woodland located within Albert College Park and Griffith park north of the River Tolka.

Project. There are no ad-hoc BCI records for Natterer's bat within c. 1km of the proposed Project. The NBDC database returned no records of *Myotis* species within or in close proximity to the study area. According to the BCI database, there are no known *Myotis sp.* roosts located within c. 1km of the proposed Project. There are no *ad-hoc* BCI records for *Myotis sp.* within c. 1km of the proposed Project.

No roost sites for *Myotis* bat species were recorded during any of the surveys for the proposed Project.

Daubenton's bat *Myotis daubentonii* and whiskered bat *Myotis mystacinus* were the only two confirmed *Myotis* bat species recorded during the walked transect surveys. The former species of which was recorded along the Broadmeadow River during the first visit, while the latter was recorded along the Broadmeadow River and Royal Canal during the first visit. Unidentified *Myotis* species was recorded north and south of the Broadmeadow River, at the boundaries of playing pitches at CLG Na Fianna and Home Farm F.C. and Griffith Park near the River Tolka during the second visit. *Myotis* species was also recorded at Lissenhall Bridge, Balheary Bridge, St Anne's private dwelling and Santry Demesne – derelict 2 storey house during the bat surveys.

Myotis species bat was only recorded at four of the 29 static bat detectors deployed. These locations were two hedgerows in Estuary (i.e. average number of calls per night of deployment was 4, Static_2, and 2, Static_3), south of Lissenhall Bridge/Broadmeadow River (i.e. average number of calls recorded per night of deployment was 1, Static_4) and at Santry Lodge by Charter School Hill Road (i.e. average number of calls recorded per night of deployment was 1, Static_17).

The results of the bat surveys as they relate to the *Myotis* bat species are shown on Figure 15.7.

Myotis species bat population are valued as being of Local Importance (Higher Value) given their conservation status of "*Least Concern*" (Marnell *et al.*, 2019) and that it is likely to be relatively common in the local area and beyond in the county.

Potential Roost Features

The trees identified as having potential to support roosting bats (i.e. PRFs) are listed in Table 15.13 below and shown on Figures 15.2. Each tree, or grouping of homogenous trees, was classified with regard to their potential to support roosting bats after Collins (2016). Trees with negligible suitability for roosting bats are not described or mapped as they are assessed as not having potential to support roosting bats.

Table 15.13: Potential Roost Features along or Immediately Adjacent to the Alignment of the proposed Project

Ref. No.	Description of Tree Species and Potential Roost Feature[28] (PRF)	Retain/Fell
PRF1	Two mature beech trees with broken limbs, knot-holes and tear-outs	Retain
PRF2	A treeline of four mature ash tree with broken limbs and dense ivy cover	Fell
PRF3	Mature beech tree with broken limbs, knot-holes and dense ivy cover	Fell
PRF4	Mature group of beech and lime trees with scattered limbs, cavities, broken limbs and dense ivy cover	Fell
PRF5	A relatively tall dead tree stump with broken limbs, cracks and dense ivy cover	Fell
PRF6	Group of mature beech and horse-chestnut teres with knot-holes and damaged limbs	Retain
PRF7	Mature horse-chestnut with flaking bark and knot-holes	Retain
PRF8	Mature alder tree with dense ivy	Retain
PRF9	Mature sycamore with shallow, double-leader near its base	Retain
PRF10	Mature ash and hawthorn trees with broken limbs and dense ivy cover	Fell
PRF11	Treeline of mature lime, sycamore and horse-chestnut trees with knot-holes	Retain
PRF12	Relatively young and mature horse-chestnut and sycamore trees with tear-out, knot-hole and flaking bark, respectively	Retain

[28] A description of each different type of PRF, as referred to in Table 15.13, is provided in Andrews (2018).

Ref. No.	Description of Tree Species and Potential Roost Feature[28] (PRF)	Retain/Fell
PRF13	Mature treeline of Monterrey cypress with flaking bark, knot-holes and double-leaders	Retain
PRF14	Mature oak tree with cankers and broken limbs	Retain
PRF15	Mature tree with flaking bark and broken limbs	Retain
PRF16	Mature beech trees with knot-holes	Retain
PRF17	Mature ash tree with knot-holes and broken limbs	Retain
PRF18	Mature ash tree with knot-holes and cavities	Retain
PRF19	Mature treeline of Monterrey cypress with flaking bark, tear-outs, double-leaders, broken limbs and dense ivy cover	Retain
PRF20	Mature sycamore tree with dense ivy cover	Fell
PRF21	Mature horse-chestnut and sycamore trees with knot-holes	Fell
PRF22	Mature horse-chestnut and Acer species trees, scattered among unsuitable trees, with large cankers, tear-outs and double-leaders	Fell

15.3.7.3 Badger

Badger, and their breeding and resting places, are protected under the Wildlife Acts.

The desktop review found that badgers have been recorded north-west of Estuary, on the R132 east of Dublin Airport, near the Ballymun exit of Junction 4 on the M50 Motorwat, near Santry Demesne, in Albert College Park and in Phoenix Park (NBDC, 2019).

The following badger setts were identified within the study area of the proposed Project:

- Outlier sett with one single entrance, being activity used, located c. 230m from the proposed Project boundary at Ch. 1000;
- Subsidiary sett with four entrances being actively used, located c. 280m from the proposed Project boundary at Ch. 1620 within a woodland of Lissenhall Demesne;
- Outlier sett with one single entrance, being actively used, with bedding material at its entrance and numerous mammal paths present in the surrounding fields, located c. 290m from the proposed Project boundary at Ch. 4400; and
- Annex badger sett with seven entrances, being actively used, spoil and badger latrine present, located c. 24m from the proposed MetroLink grid connections, north of the R139 at Belcamp.

The results of the mammal survey are shown in Figures 15.8.

Badger is valued as being of Local Importance (Higher Value) due to the known presence of populations within the study area, and the protection afforded to badgers under the Wildlife Acts.

15.3.7.4 Other Mammal Species

Irish hare *Lepus timidus hibernicus* are protected under the Wildlife Acts.

Irish hare was recorded within the boundary of the proposed Project in an improved grassland field located west of the R132 in the centre of Swords.

There are existing records of this species on the NBDC online database from the wider environs of the study area at the following locations:

- North of the Broadmeadow River;
- Within Dublin Airport and its QuickPark Car Park; and
- North-east of Albert College Park

The local Irish hare population is valued as being of Local Importance (Higher Value) due to the known presence of Irish hare populations within the study area, and the protection afforded to Irish hare under the Wildlife Acts.

Other mammal species protected under the Wildlife Acts, such as Irish stoat *Mustela erminea*, hedgehog *Erinaceus europaeus* and pygmy shrew *Sorex minutus*, are likely to be present and widespread within the areas of suitable habitat located within the study area of the proposed Project (i.e. agricultural fields bordered by hedgerows, treelines, scrub and/or woodland, vegetated riverbanks and parkland with dense tree and shrub cover). There are existing records of the two former species on the NBDC online database from the wider environs of the proposed Project. There is also an existing record on the NBDC online database of pine marten *Martes martes* in close proximity to the proposed Project in the centre of Swords. In addition, there are desktop records of the following marine mammals downstream of the proposed Project: common porpoise *Phocoena phocoena*, grey seal *Halichoerus grypus*, sperm whale *Physeter macrocephalus* and striped dolphin *Stenella coeruleoalba*, the former two of which are qualifying interest Annex II species of European sites located within the ZoI of the proposed Project (namely: Rockabill to Dalkey Island SAC and Lambay Island SAC).

Evidence of fox *Vulpes vulpes* and rabbit *Orytolagus cuniculus* were also recorded across the study area within areas of suitable habitat. Although these species are not afforded legal protection under the Wildlife Acts, they form part of the local biodiversity resource and are noted here in that context.

Both common porpoise and grey seal are valued as being of International Importance, as they are qualifying interest species of European sites located within the ZoI of the proposed Project. All other mammal species that are protected under the Wildlife Acts are valued as being of Local Importance (Higher Value).

15.3.8 Invertebrates

15.3.8.1 White-clawed Crayfish

No white-clawed crayfish were recorded at any of the riverine or canal survey sites within the ZoI of the proposed Project. No other evidence of the presence of this species within the study area of the proposed Project was observed (i.e. otter spraints will commonly contain crayfish remains, if present locally).

Both the Cuckoo Stream and Mayne River are considered unsuitable for this species due to the grossly polluted conditions at these sites (i.e. both classified as "*Bad*" status under the Water Framework Directive), which in turn makes them physically and chemically incapable of supporting white-clawed crayfish. Likewise, the seriously polluted status of the Staffordstown Stream, Sluice River and Santry River would preclude the presence of white-clawed crayfish. The Broadmeadow River and River Liffey are both tidal at the proposed crossing point location, making them unsuitable for white-clawed crayfish downstream of the proposed Project.

There are no known records of white-clawed crayfish within the boundaries of the existing M50 Motorway. The nearest known records for this species are from the Camac River in Clondalkin, which adjoins the River Liffey near Heuston Station, as well as the upper reaches of the Liffey and its tributaries, upstream of Leixlip Reservoir (NBDC, 2019).

15.3.8.2 Freshwater Molluscs

The rare freshwater mollusc species glutinous snail *Myxas glutinosa* was recorded in the Grand Canal. This species is listed as "*endangered*"[29] on the *Ireland Red List No. 2 Non-Marine Molluscs* (Byrne *et al.*, 2009) and, according to the IUCN Red List, accessed 05 May 2022, the species is in the "*data deficient*" category. This species is declining particularly due to habitat degradation as a result of eutrophication (Byrne *et al.*, 2009).

[29] When used in the context of the IUCN Red List, a taxon is classified as 'Endangered' when there is very high risk of extinction in the wild in the immediate future (IUCN, 2001)

The local population of Glutinous snail is valued as being of National Importance due to its very restricted distribution in Ireland where it is found mainly in the Royal Canal, Grand Canal, Lough Ree and Lough Corrib (NBDC, 2021) and its endangered conservation status in Ireland.

The rare freshwater mollusc species false orb pea mussel *Pisidium pseudosphaerium* was also recorded in the Grand Canal. This species is also listed as "*endangered*" on the *Ireland Red List No. 2 Non-Marine Molluscs* (Byrne *et al.*, 2009) and, according to the IUCN Red List accessed 17 December 2018, the species is in the "*least concern*" category. This species is declining particularly due to the dredging of watercourses where it is present (Byrne *et al.*, 2009).

The local population of false orb pea mussel is valued as being of National Importance due to its very restricted distribution in Ireland where it is found mainly in the Royal Canal and Grand Canal (NBDC, 2021) and its endangered conservation status in Ireland.

During the detailed aquatic survey of the Royal Canal basin between Lock 6 and Lock 5 on the 17 June 2021, no species with a Red List conservation status greater than "*Least Concern*" were recorded (see Appendix A15.9 for full details). The following eight species of "*Least concern*" were recorded: *Bithynia tentaculata*, *B. leachii*, *Galba truncatula*, *Theodoxus fluviatilis*, *Planorbis planorbis*, *Pisidium spp.* (not *P. Pseudosphaerium*) and *Sphaerium corneum*. The non-Red list caddis species *Leptocerus tineiformis* was recorded within the basin. Whilst this species is not rare, it is considered to be regionally uncommon (O'Connor, 2020).

The freshwater mollusc populations associated with the Royal Canal are valued as being of Local Importance (Higher Value) due to the collective species diversity but absence of any Red Data Book species.

15.3.9 Birds

15.3.9.1 Breeding Birds

All wild birds, and their nests and eggs, are protected under the Wildlife Acts. Some bird species are also listed on Annex I of the EU Birds Directive.

The results of the breeding bird surveys carried out to inform this assessment are summarised below.

The breeding bird surveys recorded a total of 55 species across the study area, including; four species listed as SCIs for SPAs, one Birds Directive Annex I species, five Red list[30], 19 Amber list and 23 Green list bird species.

Table 15.14 below provides a summary of the findings of the breeding bird surveys with respect to those species which are of conservation concern and are considered to be KERs:

- SCIs, for a breeding population, of SPAs;
- Species listed under Annex I of the Birds Directive (2009/147/EC); and
- Red and Amber BoCCI species listed for their breeding populations.

The results of the breeding bird surveys are shown on Figure 15.9 with the full list of bird species recorded provided in Appendix A15.5. The full results of the desktop review are presented in Appendix A15.2.

[30] Birds of Conservation Concern in Ireland (BoCCI) after Gilbert *et al.* (2021)

Table 15.14: Breeding Birds of Conservation Concern Recorded during the Breeding Bird Survey

Common Name/Latin Name/BoCCI Code	Distribution in the Study Area	Conservation Importance		
		BoCCI (B – Breeding/W - Wintering)	Annex I (✓ - Yes)	SCI species (✓ - Yes)
Coot *Fulica atra* (CO)	Observed at Blessington Street Park during first and second visits and Stephen's Green during second and third visits	Amber (B/W)	-	✓
Cormorant *Phalacrocorax carbo* (CA)	Observed on the River Tolka and the Royal Canal during first visit	Amber (B/W)	-	✓
Goldcrest R*egulus regulus* (GC)	Observed in Swords during first and second visits, in Silloge Park Golf Club during second visit, once in Ballymun during the second visit and twice in Albert College Park during the first and third visits	Amber (B)	-	-
Greenfinch C*arduelis chloris* (GR)	Observed in Swords, Dardistown and lands near the Royal Canal during all three visits, and in Ballymun during second and third visit	Amber (B)	-	-
Grey wagtail *Motacilla cinerea* (GL)	Observed on the Royal Canal and Stephen's Green during the first visit. This species was also recorded on the Ward River and River Tolka during habitat surveys undertaken in 2018 and 2020.	Red (B)	-	-
Herring gull *Larus argentatus* (HG)	Relatively widespread; observed in Ballymun and Blessington Street Park during first and second visits; Dardistown, Silloge Park Golf Club, north-west of the proposed Griffith Park station Glasnevin near the Royal Canal and along the Grand Canal during the second and third visits; St Stephen's Green during all three visits	Amber (B/W)	-	✓
House martin *Delichon urbicum* (HM)	Observed once south of Swords during the second visit and near the Royal Canal during the first visit	Amber (B)	-	-
House sparrow *Passer domesticus* (HS)	Relatively widespread; observed in Swords and near the Royal Canal during all three visits, Ballymun during the second visit and Dardistown and Drumcondra during the last two visits	Amber (B)	-	-
Kingfisher *Alcedo atthis* (KF)	Observed flying east within the Broadmeadow River corridor, during the second visit. Also recorded twice during the vantage point survey undertaken on the Broadmeadow River, at the confluence of the Broadmeadow River and Ward River and further downstream on the Broadmeadow River west of the existing Spittal Hill Road bridge (i.e. c. 70m and 220m downstream of the proposed Project).	Amber (B)	✓	✓
Lesser black-backed gull *Larus fuscus* (LB)	Observed at Blessington Street Park during first and second visits and Stephen's Green Park during first visit	Amber (B/W)	-	✓

Common Name/Latin Name/BoCCI Code	Distribution in the Study Area	Conservation Importance		
		BoCCI (B – Breeding/W - Wintering)	Annex I (✓ - Yes)	SCI species (✓ - Yes)
Linnet *Carduelis cannabina* (LI)	Observed east of the R132 in Swords and in Dardistown during all three visits and in Ballymun during the third visit	Amber (B)	-	-
Mallard *Anas platyrhynchos* (MA)	Relatively widespread; observed in Swords, north and south of Dublin Airport, north of the River Tolka, near the Royal Canal, at Blessington Street Park and Stephen's Green during numerous visits	Amber (B/W)	-	✓
Meadow pipit *Anthus pratensis* (MP)	Observed in Dardistown and near the Royal Canal during the first visit and once in Swords during first and second visits and Ballymun during the third visit and in Blessington Street Park and Stephen's Green during first and second visits	Red (B)	-	-
Mute swan *Cygnus olor* (MS)	Observed on the Royal Canal during all three visits	Amber (B/W)	-	-
Sand Martin *Riparia riparia* (SM)	Observed over the River Tolka during the third visit	Amber (B)		
Skylark *Alauda arvensis* (S.)	Observed in Dardistown during the first and second visits	Amber (B)	-	-
Snipe *Gallinago gallinago* (SN)	Observed in Ballymun during the first visit	Red (B/W)		
Starling *Sturnus vulgaris* (SG)	Widespread; observed across the entire study area during all three visits	Amber (B)	-	-
Swallow *Hirundo rustica* (SL)	Observed in Swords, Dardistown and Ballymun during all three visits, in Silloge Park Golf Club during the first visit, over the River Tolka during the third visit and at the Royal Canal during second visit	Amber (B)	-	-
Swift *Apus apus* (SI)	Observed in Swords, Ballymun, Glasnevin and Drumcondra during the third visit and at St Stephen's Green and Dartmouth Square during the second visit	Red (B)	-	-
Tree sparrow *Passer montanus* (TS)	Observed in Dardistown during all three visits and near the Royal Canal during the third visit	Amber (B)	-	-
Tufted duck *Aythya fuligula* (TU)	Observed near the Royal Canal during the first visit, in Blessington Street Park during first and third visits and in Stephen's Green during the first and second visits	Amber (B/W)		✓
Willow warbler *Phylloscopus trochilus* (WW)	Observed once in private garden north of Santry River during third visit	Amber (B)	-	-
Yellowhammer *Emberiza citrinella* (Y.)	Observed in Swords and in Dardistown during all three visits	Red (B)	-	-

Breeding bird species which are likely to support SCI populations of an SPA are valued as being of International Importance.

Four of the SCI bird species recorded within the study area are not considered to support any SCI population: mallard, tufted duck, coot and kingfisher. The nearest European site designated for mallard is Dundalk Bay SPA, c. 42.5km north of the proposed Project. Breeding mallards in Ireland are largely sedentary, and Dundalk Bay SPA is designated for wintering populations of mallard, which are increased by migratory individuals from Europe[31]. Therefore, mallard recorded within the study area are not likely to support breeding populations of any SPA. Mallard are a Green BOCCI species, therefore, the valuation for this species is included within the valuation for Green BOCCI species below.

The closest European site which includes tufted duck as a designating feature is Lough Derravarragh SPA, c. 71.4km west of the proposed Project. Tufted duck populations are widely distributed in urban areas in Ireland. Therefore, tufted duck recorded within the study area are not likely to support the breeding populations of any SPA. Tufted duck are an Amber BOCCI species, therefore the valuation for this species is included within the valuation for Amber BOCCI species below.

The nearest European site designated for coot is Lough Derravaragh SPA, located 71.4km west of the proposed Project. Coot are resident at ponds and lakes throughout Ireland, including in urban areas[32]. Therefore, coot recorded within the study area are not considered to be part of any European site population. Coot are an Amber BOCCI species, therefore the valuation for this species is included within the valuation for Amber BOCCI species below.

The nearest European site designated for kingfisher is the River Boyne and Blackwater SPA, located c. 28.4km away and in a different catchment to the proposed Project. Therefore, kingfisher recorded within the study area are not considered to be part of any European site population. Kingfisher is valued as being of National Importance due to its status as an Annex I bird species.

Yellowhammer is valued as being of County Importance. This is due to the frequency of occurrence of this species during the surveys, the sighting of pairs (in particular at Estuary and Dardistown), the numbers of individual birds recorded within the study area in the context of the known records of this species in the county and the potential for suitable habitat in north County Dublin to become increasingly under threat.

Due to their particularly threatened conservation status, all Red BoCCI species[33] are valued as being of County Importance.

All other Amber[34] and Green[35] BoCCI species are valued as being of Local Importance (Higher Value).

15.3.9.2 Wintering Birds

The wintering bird surveys recorded a wide range of bird species at sites across the study area. The results of the wintering bird surveys carried out to inform this assessment are summarised below.

The wintering bird surveys recorded a total of 38 species across the study area, including; 16 species listed as SCIs for SPAs, three Birds Directive Annex I species, eight Red list[36], 17 Amber list and 12 Green list bird species.

Table 15.15 below provides a summary of the findings of the wintering bird surveys with respect to those species which are of highest conservation concern, and were recorded within wintering bird survey sites:

[31] NPWS (2011) Conservation Objectives Supporting Document for Dundalk Bay SPA (Site Code 4026). Version 1.
[32] From information on coot *Fulica atra* published on the BirdWatch Ireland website https://birdwatchireland.ie/birds/coot/. Accessed 5th May 2022.
[33] i.e. grey wagtail, meadow pipit, snipe, swift, yellowhammer
[34] i.e. coot, cormorant, goldcrest, greenfinch, herring gull, house martin, house sparrow, kingfisher, lesser black-backed gull, linnet, mallard, mute swan, sand martin, skylark, starling, swallow, tree sparrow, tufted duck, willow warbler
[35] i.e. blackbird, blackcap, blue tit, bullfinch, buzzard, chaffinch, chiffchaff, coal tit, collared dove, common whitethroat, dunnock, goldfinch, great tit, grey heron, hooded crow, jackdaw, long-tailed tit, magpie, mistle thrush, moorhen, pied wagtail, reed bunting, robin, rook, sedge warbler, song thrush, stonechat, treecreeper, wood pigeon, wren

[36] Birds of Conservation Concern in Ireland (BoCCI) after Gilbert *et al.* (2021)

- SCIs, for a wintering population, of nearby SPAs;
- Species listed under Annex I of the Birds Directive (2009/147/EC); and
- Red and Amber BoCCI species listed for their wintering populations.

The full results of the wintering bird surveys are provided in Appendix A15.6. The full results of the desktop review are presented in Appendix A15.2.

Table 15.15: Wintering Birds of Conservation Concern Recorded during the Winter Bird Survey

Common Name/Latin Name/BoCCI Code	Distribution in the Study Area (Peak Count Recorded and Location)	Peak Count/Site/Date	Conservation Importance		
			BoCCI (Breeding)	Annex I	SCI
Black-headed gull Chroicocephalus ridibundus (BH)	Widespread; observed across the entire study area during all four visits and during five visits to lands at Dardistown	170 birds, west of the M1 Motorway bridge over the Malahide Estuary (site code: 112), fourth visit	Amber (B/W)	-	✓
Black-tailed godwit Limosa limosa (BW)	Observed at site in Barrysparks, south-east of the R132 (site code: 115), during two visits	84 birds, site in Barrysparks south-east of the R132 (site code: 115), third visit	Red (W)	-	✓
Coot Fulica atra (CO)	Observed in Blessington Street Park during the second, third and fourth visit (peak count - 11)	11 birds, Blessington Street Park (site code: 89), third visit	Amber (B/W)	-	-
Common gull Larus canus (CM)	Observed at Newbury Park (site code: 144) and Glin Park (site code: 146) during one visit	2 birds, Glin Park (site code: 146), second visit	Amber (B)	-	✓
Cormorant Phalacrocorax carbo (CA)	Observed on the Broadmeadow Estuary directly west of the M1 Motorway bridge (site code: 112) during two visits	1 bird, west of the M1 Motorway bridge over the Malahide Estuary (site code: 112)	Amber (B/W)	-	✓
Curlew Numenius arquata (CU)	Observed: in eastern fields in Dardistown (site code: 126) during the first visit in 2018-2019; playing pitch at the Royal College of Surgeons Sports Grounds (site code: 133) during the first visit; playing pitches at DCU (site code: 23) during the first, second and fourth visit; Scoil Chaitríona (site code: 160) during the fourth visit; Na Fianna, St Vincent's School (site code: 11) during first and second visit; and at Belcamp Park (site code: 149) during second visit	165 birds, playing pitch at Royal College of Surgeons Sportsground (site code: 133), first visit in 2018-2019	Red (B/W)	-	✓
Golden plover Pluvialis apricaria (GP)	Observed in a south-eastern field in Dardistown (site code: 132) during the first and second visit	33 birds, south-eastern field in Dardistown (site code: 132), first visit 2018-2019	Red (B/W)	✓	✓

Common Name/Latin Name/BoCCI Code	Distribution in the Study Area (Peak Count Recorded and Location)	Peak Count/Site/Date	Conservation Importance		
			BoCCI (Breeding)	Annex I	SCI
Grey heron Ardea cinereal (H.)	Observed in a playing pitch in Home Farm (site code: 72) during third visit and at pond in Darndale Park (site code: 147) during third visit	1 bird, Home Farm (site code: 72), third visit and 1 bird, Darndale Park (site code: 147) third visit	Green (B/W)	-	✓
Herring gull Larus argentatus (HG)	Widespread; observed across the entire study area during all four visits and during six visits to lands at Dardistown	115 birds, south-eastern field in Dardistown (site code: 132), 12th March 2020	Amber (B/W)	-	✓
Kestrel Falco tinnunculus (K.)	Observed flying and hunting field in Ballymun (site code: 122) during third visit	1 bird flying over, rough grassland in Ballymun (site code: 122), third visit 28th February 2020	Red (B)	-	-
Kingfisher Alcedo atthis (KF)	Observed flying along the Broadmeadow River during the second visit	1 bird, Broadmeadow River (no site code)	Amber (B)	✓	✓
Lesser black-backed gull Larus fuscus (LB)	Observed during the second and fourth visit: agricultural fields located the Broadmeadow Estuary directly west of the M1 Motorway bridge (site code: 112); at a playing pitch in St Colmcille's Girls National School (site code: 50); at a playing pitch in Santry (site code: 102); rough grassland located south of Ikea in Ballymun (site code: 123); areas of amenity grassland in Ballymun north of Gateway Crescent (site code: 138) and south of Shangan Road (site code: 141); and, Blessington Street Park (site code: 89)	6 birds, amenity grassland in Ballymun south of Shangan Road (site code: 141), fourth visit	Amber (B)	-	✓
Light-bellied brent goose Branta bernicla (BG)	Observed in: Belcamp Park (site code: 149) on the second visit; Darndale Park (site code: 147) on the second and third visits; amenity grassland west of Newtown Court (site code: 161) on 3rd February 2020; and amenity grassland north of Moatview Drive (site code: 148) on 27th February 2020	113 birds, Darndale Park (site code: 147), 3rd February 2020	Amber (W)	-	✓
Little grebe Tachybaptus ruficollis (LG)	Observed on the Broadmeadow Estuary directly west of the M1	3 birds, Broadmeadow Estuary directly west of the	Green (B/W)	-	✓

Common Name/Latin Name/BoCCI Code	Distribution in the Study Area (Peak Count Recorded and Location)	Peak Count/Site/Date	Conservation Importance		
			BoCCI (Breeding)	Annex I	SCI
	Motorway bridge (site code: 112) during the last visit	M1 Motorway bridge (site code: 115), during two visits			
Mallard Anas platyrhynchos (MA)	Observed: in agricultural fields located the Broadmeadow Estuary directly west of the M1 Motorway bridge (site code: 112); at ponds located south of Barrysparks (adjacent to southern boundary of site code: 115); on the Sluice River during third visit (site code: 39); at a pond within Darndale Park during three visits (site code: 147); and, at Blessington Street Park during three visits (site code: 89)	26 birds, at Blessington Street Park (site code: 89) during third visit	Amber (B/W)	-	✓
Meadow pipit Anthus pratensis (MP)	Observed: in fields north of Swords (site codes: 14 and 29) during second visit, in Barrysparks, south-east of the R132 (site code: 115) during first and third visits, in a field west of Pinnock Hill (site code: 69) during second visit and in Dardistown (site code: 126) during second visit	7 birds, field north of Sword (site code: 29) during second visit	Red (B)	-	-
Mute swan Cygnus olor (MS)	Observed in Broadmeadow Estuary directly west of the M1 Motorway bridge (site code: 112), during first, second and fourth visits, Broadmeadow Estuary directly west of the M1 Motorway bridge (site code: 115) during the third visit and Blessington Street Park (site code: 89) during second and fourth visit	2 birds, at multiple sites	Amber (B/W)	-	-
Oystercatcher Haematopus ostralegus (OC)	Observed: in areas of amenity grassland in the centre of Swords (site code: 154) during the third visit; at playing pitches at DCU (site code: 23) during the first, second and fourth visit; and, at playing pitches in Leinster Cricket Club (site code: 45) during second visit	38 birds, Fingallians GAA Club (site code:4) in Swords, third visit	Red (B/W)	-	✓

Common Name/Latin Name/BoCCI Code	Distribution in the Study Area (Peak Count Recorded and Location)	Peak Count/Site/Date	Conservation Importance		
			BoCCI (Breeding)	Annex I	SCI
Redwing Turdus iliacus (RE)	Observed in fields north of Swords (site codes: 36 and 78) during second and third visit respectively and in Barrysparks (site code: 115)	15 birds, field north of Swords (site code: 78) during third visit	Red (W)	-	-
Skylark Alauda arvensis (S.)	Observed: in field north of Swords (site code: 14) during the second visit; and fields at Dardistown (site code: 132) during the second visit	30 birds, field in Dardistown (site code: 132) during second visit	Amber (B)	-	-
Snipe Gallinago gallinago (SN)	Observed: in fields in the centre of Swords (site codes: 88, 74, 54 and 115) during the second, third and fourth visit; fields north of the airport (site code: 70) during the third visit; and fields in Dardistown (site codes: 126, 131, 67 and 132) during the first, second and fourth visit; and in Ballymun (site code: 123) during first visit	6 birds, field in Swords south of Pinnock Hill (site code: 54) during first visit 10th January 2020	Red (B/W)	-	-
Sparrowhawk Accipiter nisus (SH)	Observed: flying over fields north of Swords during the second visit; flying over fields in Dardistown and perched in Silloge Park Golf Club (site code: 121) during third visit	1 bird, Silloge Park Golf Club (site code: 121) on 28th February 2020	Green (B)	-	-
Starling Sturnus vulgaris (SG)	Observed in Swords (site codes: 111, 113 and 114) during first, second and third visit, in Silloge Golf Club (site code: 121) during second and third visit and in amenity grassland sites in Darndale (site codes: 151, 148, 147 and 146) during second and fourth visits.	120 birds, Silloge Park Golf Club (site code: 121) on second visit 12th March 2020	Amber (B)	-	-
Stonechat Saxicola torquata (SC)	Observed on the Broadmeadow Estuary directly west of the M1 Motorway bridge (site code: 112) during third visit	1 bird, Broadmeadow Estuary directly west of the M1 Motorway bridge (site code: 112) on 27th February 2020	Green (B)	-	-
Teal Anas crecca (T.)	Observed on the Broadmeadow Estuary directly west of the M1 Motorway bridge (site code: 112) during two visits	14 birds, Broadmeadow Estuary directly west of the M1 Motorway bridge (site code: 112), 3rd February 2020	Amber (B/W)	-	✓

Common Name/Latin Name/BoCCI Code	Distribution in the Study Area (Peak Count Recorded and Location)	Peak Count/Site/Date	Conservation Importance		
			BoCCI (Breeding)	Annex I	SCI
Tufted duck Aythya fuligula (TU)	Observed in Blessington Street Park (site code: 89) during the second, third and fourth visit	61 birds, Blessington Street Park (site code: 89), third visit	Amber (W)	-	✓
Whooper Swan Cygnus cygnus (WS)	Observed flying west over fields located north of Swords during the first visit (peak count - 7)	7 birds, flying over lands north of the Broadmeadow River, first visit	Amber (W)	✓	✓
Yellowhammer Emberiza citrinella (Y.)	Observed in fields in Dardistown (site codes: 131 and 132) during first and fourth visit	17 birds, field in Dardistown (site code: 132) fourth visit 2018-2019	Red (B)	-	-

Wintering bird species which are likely to support SCI wintering populations of an SPA are valued as being of International Importance.

Eight of the SCI bird species recorded within the study area are not considered to support any SCI population: coot, common gull, grey heron, kingfisher, little grebe, mallard, tufted duck and whooper swan. Wetland bird species are mobile and can regularly travel up to 20km between roosting and feeding sites (Scottish Natural Heritage, 2016). For this reason, it is considered that SCI bird species for which there are no designated SPAs within 20km are not associated with SCI populations of any SPA[37]. These species are valued according to their BOCCI list status below. Due to their particularly threatened conservation status, all Red BoCCI species[38] are valued as being of County Importance.

All other non-SCI wintering bird populations, Amber[39] and Green BoCCI species are valued as being of Local Importance (Higher Value).

15.3.10 Amphibians

The desktop review found that two amphibian species have been recorded within or in close proximity to the proposed Project, i.e. smooth newt *Triturus vulgaris*, recorded north of the existing railway line in Broombridge (NBDC, 2021), and common frog *Rana temporaria*, recorded at various locations across the proposed Project (NBDC, 2021). Both these species are legally protected under the Wildlife Acts (including their breeding and resting places).

Suitable amphibian habitat (i.e. surface water/drainage features with stagnant, relatively unpolluted water and well vegetated banks) was identified at four locations within the study area of the proposed Project. This included: drainage ditches located north and west of the Staffordstown Stream in Estuary; a drainage ditch located along a treeline, east of the R132 in Nevinstown West; drainage ditches along field boundaries in Dardistown, where common frog was previously recorded; and, an area of wet grassland, with temporary pooling of stagnant water where common frog was previously recorded, and a drainage ditch within a rough grassland field in Ballymun, west of the R108. These locations are shown on Figures 15.11.

[37] The nearest European site designated for common gull and mallard is Dundalk Bay SPA, *c.* 42.5km north of the proposed Project.
The nearest European site designated for coot, tufted duck and whooper swan is Lough Derravarragh SPA, c. 71.4km west of the proposed Project.
The nearest European site designated for kingfisher is the River Boyne and Blackwater SPA, located *c.* 28.4km away and in a different catchment to the proposed Project.
The nearest European site designated for little grebe and grey heron is Wexford Harbour and Slobs SPA, located *c.* 95.4km away
[38] i.e. black-tailed godwit, curlew, golden plover, kestrel, meadow pipit, redwing, snipe, yellowhammer
[39] i.e. black-headed gull, common gull, coot, cormorant, greenfinch, herring gull, kingfisher, lesser black-backed gull, light-bellied brent goose, mallard, mute swan, skylark, snipe, starling, teal, tufted duck, whooper swan

The common frog and smooth newt populations are valued as being of Local Importance (Higher Value) as these species are common widespread species of "*Least concern*" (King *et al.*, 2011).

15.3.11 Reptiles

The desktop review found one recent record of common lizard *Zootoca vivipara* located within or in close proximity to the proposed Project, i.e. in Donabate c. 1.9km east of the proposed Project boundary. This species is legally protected under the Wildlife Acts (including their breeding and resting places). No common lizards were recorded during the surveys; however, some suitable breeding and hibernating habitat for this species was identified within the study area of the proposed Project (i.e. semi-natural grassland, scrub, hedgerows, earth banks and areas of spoil and bare ground/recolonising bare ground, which may provide suitable basking habitat). This species is strongly associated with heathland and coastal habitats; neither habitat types were identified within the proposed Project boundary (Marnell, 2002 and Farren *et al.*, 2010).

Common lizard is valued as being of Local Importance (Higher Value) as this species is a common widespread species of "*Least concern*" (King *et al.*, 2011).

15.3.12 Fish

The results of the various fisheries surveys carried out on the 28 and 29 September 2018, along with the findings of the desktop study, are summarised below. The locations of sampling points/areas are shown on Figure 15.3, with the full results (including the macro-invertebrate species lists) provided in Appendix A15.7.

Fish species are protected under the Fisheries Acts and by fishing by-laws. Atlantic salmon, river lamprey and the brook lamprey are listed on Annex II of the EU Habitats Directive.

15.3.12.1 Salmonid Species

No Atlantic salmon *Salmo salar* were recorded during the fisheries survey. Brown trout *Salmo trutta* were the only salmonid species recorded in the River Tolka, Ward River and Broadmeadow River. Brown trout were recorded in modest densities at these sites (i.e. 21, 11 and 2 respectively), while only two adult fish were recorded within the tidal reaches of the Broadmeadow River. There was a noticeable pattern across these salmonid-containing sites of a deficiency of juveniles with the number of adults appreciably greater. This is indicative of poor recruitment, at least in recent years. Brown trout were observably introduced/farmed fish and not of wild progeny. The River Tolka, as well as several other Dublin rivers, are regularly stocked with large, farmed trout to supplement recreational angling and bolster declining wild stocks.

The overall salmonid habitat quality (according to the salmonid Life Cycle Unit method, as per Kennedy, 1984; O Connor & Kennedy, 2002) across all watercourses was considered to be moderate with only two of the watercourses surveyed achieving a "*good quality*" score in terms of spawning, nursery and holding habitat of salmonid species, i.e. Ward River and River Tolka. Despite this score, the quality of spawning gravels at these rivers was considered to be moderate at best due to the overall levels of siltation, the bedded nature of the substrate and overall threat from water quality issues in particular enrichment. The salmonid habitat quality of the Broadmeadow River was also "*moderate*" due to the high levels of siltation and poor spawning opportunities as well as sub-optimal nursery and holding habitat. The salmonid habitat quality of all other watercourses was "*poor*" apart from at the Sluice River where the habitat was considered to be of "*moderate quality*". The poor water quality of all these watercourses, including the Sluice River, would also likely preclude the presence of salmonid species.

There are records of Atlantic salmon on the Staffordstown Stream, Broadmeadow River, Ward River, River Tolka and River Liffey (Kelly *et al.*, 2012).

The population of Atlantic salmon is valued as being of National Importance as it is listed on Annex II of the Habitats Directive, and as such it is considered to be a species of high conservation concern, and the IFI have confirmed that the River Liffey system supports a regionally significant Atlantic salmon

population and therefore this population contributes to a significant proportion of the national population.

Brown trout are valued as being of Local Importance (Higher Value) as this species is a common widespread species.

15.3.12.2 Lamprey Species

No lamprey ammocoetes were captured during this survey, despite electro-fishing beds of silt and sand in the channel margins. These areas were, however, sub-optimal due to evident compaction, shallow depth (<5cm) and also apparent anoxic conditions (i.e. black silt). There was limited suitability overall with all watercourses considered to be "*moderate*" at best (according to the Lamprey Habitat Quality Index scoring system as devised by Ross Macklin and Bill Brazier adapted from Kennedy, 1984). Nursery habitat was sub-optimal in all cases with soft sediment areas either too shallow and compacted for ammocoete burrowing (i.e. at the Ward River and River Tolka) or subject to poor water quality and highlight anoxic in nature (i.e. at the Broadmeadow River, Ward River and Santry River). Several sites, namely the Staffordstown Stream, Cuckoo Stream, Mayne River and Santry River, had such poor water quality that they were incapable of supporting lamprey species.

There are records of lamprey species on the River Tolka and River Liffey (in the case of river *Lamprey Lampetra fluviatilis* only) (Kelly *et al.*, 2012 and IFI, 2010).

15.3.12.3 European Eel

European eel was recorded at three watercourses *(*i.e. Broadmeadow River, Ward River and River Tolka) with the highest density of eels recorded at the Broadmeadow River (i.e. 18 in total, 17 adults and one juvenile). Given the accessibility and proximity of this site to the sea (<1km), the Broadmeadow River acts as a valuable migration corridor for the species. These three watercourses offered the best eel habitat in terms of both prey resources and diurnal refugia such as large boulders, cracks in bedrock and submerged structure.

This species is the most threatened fish in Irish freshwaters (King *et al.*, 2011) and the alarming decline of the species in recent decades has resulted in a classification of "*critically endangered*" (Jacoby & Gollock, 2014).

There are records of this species on the Broadmeadow River, Ward River and River Tolka. These are all located upstream of the crossing points of the proposed Project (NBDC, 2019). European eel populations are valued as being of International Importance as they are an internationally critically endangered fish species both in Ireland and internationally.

15.3.12.4 All Other Fish Species

Three-spined stickleback *Gasterosteus aculeatus* was recorded at all the sites apart from the Cuckoo Stream and River Mayne. This species is widely known to be a highly pollution-tolerant species, capable of establishing and sustaining populations in a wide variety of low-quality waters where other fish cannot persist (Ostlund-Nilsson *et al.*, 2006). Stone loach *Barbatula barbatula* and minnow *Phoxinus phoxinus* were both recorded in the Broadmeadow River, Ward River and River Tolka. Minnow was the most abundant fish species recorded in the Ward River. The occurrence of both these species is indicative of enrichment as they tend to proliferate in rivers which are more enriched. Overall, species such as stone loach, as well as three-spined stickleback were more abundant compared to brown trout. A number of species typical of brackish waters were recorded in the Broadmeadow River in relatively small numbers, namely sand goby *Pomatoschistus minutus* and flounder *Platichthys flesus*. Flounder was also recorded in the Ward River, indicating some estuarine accessibility at especially high tides.

These other species are valued as being of Local Importance (Higher Value) as they common widespread species.

15.3.13 Summary Ecological Valuation and Identification of Key Ecological Receptors (KERs)

Table 15.16 below summarises the ecological evaluation of all receptors taking into consideration legal protection, conservation status and local abundance. KERs are highlighted in grey in the table. Species, habitats and features not qualifying as KERs are not subjected to impact assessment in line with current best practice of assessing the impacts on what are determined to be important ecological or biodiversity features: CIEEM and TII Guidelines (CIEEM, 2016 and NRA, 2009).

All designated areas for nature conservation that lie within the ZoI of the proposed Project are considered to be KERs given that they are sites selected specifically for biodiversity conservation and are potentially at risk of impacts from the proposed Project. Those designated areas for nature conservation that lie beyond the ZoI of the proposed Project are not considered to be at risk of impact and are therefore, not considered to be KERs.

In all cases, habitat and species valued as being of Local Importance (Higher Value), or higher, are considered to be KERs as they are important contributors to the local biodiversity resource and are of conservation concern, at least locally.

Habitats valued as being of a Local Importance (Lower Value) are not considered to be KERs in this assessment. This is not to say that they are of no biodiversity value, but that impacts on these habitat types in their local context are not likely to result in a significant effect on biodiversity. It should be noted that this relates to the impact on the habitat itself as distinct from considering the role these habitat types play in supporting KER fauna species – impacts of the proposed Project in that sense are captured and assessed under the relevant species' headings in Section 15.4.

These lower biodiversity value habitats include built or artificially created habitats, transient habitats as a result of disturbance, or those that have been highly anthropogenically modified (*e.g.* BL1, BL2, BL3, ED1, ED2, ED3 and ED5, FL8, GA1, GA2 and WS3). These habitat types tend to be associated with residential, commercial or industrial development, roads and highly managed amenity areas. It also includes grassland habitats that are relatively species poor and improved.

In some cases, Local Importance (Lower Value) habitat can be associated with, or develop into, higher value habitats and where this is the case it is captured in valuing and considering whether a particular habitat type is a KER for this assessment.

Non-native invasive plant species are not considered as KERs, as they can result in negative effects on biodiversity, and it is in that context they are included within the impact assessment.

Local biodiversity areas include a variety of habitats within and immediately adjacent to the proposed Project, as well as downstream habitats which are hydrologically connected to the proposed Project via watercourses. Local biodiversity areas contribute to the green infrastructure network in the local authority areas of Dublin City and Fingal and provide connectivity of habitat for a range of species (See Section 15.3.2 for details). These local biodiversity areas include designated European and national sites, as well as undesignated habitats associated with watercourses, local parks, community gardens and allotments. The receptors within these local biodiversity areas are valued as being between Local Importance (Lower Value) and International Importance.

Table 15.16: Ecological Evaluation and Identification of KERs[28]

Ecological Receptor	Ecological Valuation	KER
Designated Areas for Nature Conservation		
Malahide Estuary SAC	International Importance	Yes
Baldoyle Bay SAC	International Importance	Yes
North Dublin Bay SAC	International Importance	Yes
South Dublin Bay SAC	International Importance	Yes

Ecological Receptor	Ecological Valuation	KER
Designated Areas for Nature Conservation		
Rye Water Valley/Carton SAC	International Importance	No, as beyond the ZoI of the proposed Project. See Section 5.1.2 of the accompanying NIS for details
Wicklow Mountains SAC	International Importance	Yes
Malahide Estuary SPA	International Importance	Yes
Baldoyle Bay SPA	International Importance	Yes
North Bull Island SPA	International Importance	Yes
South Dublin Bay and River Tolka SPA	International Importance	Yes
Rogerstown Estuary SPA	International Importance	Yes
Ireland's Eye SPA	International Importance	Yes
Lambay Island SPA	International Importance	Yes
Skerries Islands SPA	International Importance	Yes
Dalkey Islands SPA	International Importance	Yes
Howth Head Coast SPA	International Importance	Yes
Rockabill SPA	International Importance	Yes
The Murrough SPA	International Importance	Yes
Malahide Estuary pNHA	National Importance	Yes
Sluice River Marsh pNHA	National Importance	Yes
Baldoyle Bay pNHA	National Importance	Yes
Santry Demesne pNHA	National Importance	Yes
North Dublin Bay pNHA	National Importance	Yes
Royal Canal pNHA	National Importance	Yes
Dolphins, Dublin Docks pNHA	National Importance	Yes
Grand Canal pNHA	National Importance	Yes
South Dublin Bay pNHA	National Importance	Yes
Booterstown Marsh pNHA	National Importance	Yes
Rogerstown Estuary pNHA	National Importance	Yes
Howth Head pNHA	National Importance	Yes
Ireland's Eye pNHA	National Importance	Yes
Lambay Island pNHA	National Importance	Yes
Skerries Islands NHA	National Importance	Yes
The Murrough pNHA	National Importance	Yes
Rockabill pNHA	National Importance	Yes
Liffey Valley pNHA	National Importance	Yes
Bog of the Ring pNHA	National Importance	Yes
Other designated areas for nature conservation	International – National Importance	No, as beyond the ZoI of the proposed Project

Ecological Receptor	Ecological Valuation	KER
Designated Areas for Nature Conservation		
Habitats (Outside of Designated Areas for Nature Conservation)		
Arable crops (BC1)	Local Importance (Lower Value)	No
Flower beds and borders (BC4)	Local Importance (Lower Value)	No
Stone walls and other stonework (BL1)	Local Importance (Lower Value)	No
Earth banks (BL2)	Local Importance (Lower Value)	No
Buildings and artificial surfaces (BL3)	No importance	No
Tidal rivers (CW2) (corresponding to Annex I habitat Estuaries [1130])	National Importance	Yes
Exposed sand, gravel or till (ED1)	Local Importance (Lower Value)	No
Spoil and bare ground (ED2)	Local Importance (Lower Value)	No
Recolonising bare ground (ED3)	Local Importance (Lower Value)	No
Refuse and other waste (ED5)	No importance	No
Other artificial lakes and ponds (FL8)	Local Importance (Lower Value)	No
Reed and large sedge swamps (FS1)	Local Importance (Higher Value)	Yes
Tall-herb swamps (FS2) (corresponding to Annex I habitat Hydrophilous tall-herb swamp [6430])	National Importance	Yes
Tall-herb swamps (FS2) (non-Annex I habitat)	Local Importance (Higher Value)	Yes
Depositing/lowland rivers (FW2)	Local Importance (Higher Value)	Yes
Canals (FW3)	National Importance – see Royal Canal pNHA and Grand Canal pNHA	Yes
Drainage ditches (FW4)	Local Importance (Higher Value)	Yes
Improved agricultural grassland (GA1)	Local Importance (Lower Value)	No
Amenity grassland (improved) (GA2)	Local Importance (Lower Value)	No
Dry calcareous and neutral grassland (GS1) (species-rich areas)	Local Importance (Higher Value)	Yes
Dry calcareous and neutral grassland (GS1) (species-poor areas)	Local Importance (Lower Value)	No
Dry meadows and grassy verges (GS2)	Local Importance (Lower Value)	No
Wet grassland (GS4)	Local Importance (Higher Value)	Yes
(Mixed) broadleaved woodland (WD1)	Local Importance (Higher Value)	Yes

Ecological Receptor	Ecological Valuation	KER
Designated Areas for Nature Conservation		
(Mixed) conifer woodland (WD3)	Local Importance (Higher Value)	Yes
Scattered trees and parkland (WD5)	Local Importance (Higher Value)	Yes
Hedgerows (WL1)	Local Importance (Higher Value)	Yes
Treelines (WL2)	Local Importance (Higher Value)	Yes
Scrub (WS1)	Local Importance (Lower Value)	No
Immature woodland (WS2)	Local Importance (Higher Value)	Yes
Ornamental/non-native shrub (WS3)	Local Importance (Lower Value)	No
Residential	Local Importance (Lower value)	No
Flora Species		
Opposite-leaved pondweed *Groenlandia densa*	National Importance	Yes
Tassel stonewort *Tolypella intricata*	National Importance	Yes
Horned pondweed *Zannichellia palustris*	Local Importance (Higher Value)	Yes
Rigid hornwort *Ceratophyllum demersum*	Local Importance (Higher Value)	Yes
Whorled water-milfoil *Myriophyllum verticillatum*	Local Importance (Higher Value)	Yes
Non-native invasive plant species	N/A	No
Fauna Species		
Otter	International Importance	Yes
Nathusius' pipistrelle	County Importance	Yes
All other bat species	Local Importance (Higher Value)	Yes
Badger	Local Importance (Higher Value)	Yes
Marine mammal species	International Importance	Yes
Other mammal species protected under the Wildlife Acts (incl. Irish hare)	Local Importance (Higher Value)	Yes
White-clawed crayfish	N/A	No, as not within ZoI of proposed Project
Glutinous snail	National Importance	Yes
False orb pea mussel	National Importance	Yes
Annex I bird species kingfisher	National Importance	Yes
All other Red listed breeding bird species (non-SCI breeding populations)	County Importance	Yes
All other Amber listed breeding bird species (non-SCI breeding populations)	Local Importance (Higher Value)	Yes

Ecological Receptor	Ecological Valuation	KER
Designated Areas for Nature Conservation		
Any other Green listed breeding bird species (non-SCI breeding populations)	Local Importance (Higher Value)	Yes
All other Red listed wintering bird species (non-SCI breeding populations)	County Importance	Yes
All other Green and Amber listed wintering bird species (non-SCI wintering populations)	Local Importance (Higher Value)	Yes
Smooth newt	Local Importance (Higher Value)	Yes
Common frog	Local Importance (Higher Value)	Yes
Common lizard	Local Importance (Higher Value)	Yes
Atlantic salmon	National Importance	Yes
Brown trout	Local Importance (Higher Value)	Yes
European eel	International Importance	Yes
All other fish species	Local Importance (Higher Value)	Yes
Local Biodiversity Areas		
Local biodiversity areas encompass a wide range of habitats which are located within and adjacent to, and downstream of the proposed Project. These areas range from small, undesignated sites to designated national and European sites.	The value of the biodiversity receptors recorded across the local biodiversity areas, in the vicinity of the proposed Project, range from Local Importance (Lower Value) to internationally Important	Yes

15.4 Predicted Impacts

The following section presents the assessment of impacts on biodiversity within the ZoI of the proposed Project. As outlined in Section 15.2.7, this is focussed on the KERs identified in Section 15.3.13. The assessment is based on the preliminary design of the proposed Project. A full description of the proposed Project is presented in Chapter 4 (Description of the MetroLink Project), while a full description of its construction and operation stages is presented in Chapter 5 (MetroLink Construction Phase) and Chapter 6 (MetroLink Operations and Maintenance). This assessment also includes consideration of the "*Do-Nothing impact*" scenario – i.e. existing and future trends with the potential to affect biodiversity in the absence of the proposed Project.

Potential impacts on biodiversity as a result of the proposed Grid Connections are outlined in Section 15.4.2.10 (Construction Phase impacts) and Section 15.4.3.10 (Operational Phase impacts). As previously noted, planning permission for the proposed Grid Connections will be applied for separately by ESBN and a detailed impact assessment will be prepared as part of this application. For the purpose of this report, the KERs that are relevant to the proposed Grid Connections in Section 15.3.14 are assessed.

15.4.1 Do Nothing Impact

The "*Do Nothing Impact*" scenario is assessed as the evolution of the baseline environment at lands within and adjacent to the study area (as described in Section 15.3) if the proposed Project does not proceed and no associated development occurs (EPA, 2017). This evolution is influenced by both the existing and future trends in land-use and other associated activities that may impact on biodiversity. It

also considers the conservation status of any rare and/or protected species and habitats present within the study area and their future trends where available (NPWS, 2019a; NPWS, 2019b; Nelson *et al.*, 2019). The interaction between the existing and future trends, other plans/projects and the proposed Project are considered and assessed further in Chapter 30 (Cumulative Impacts of Interaction between other Projects and MetroLink).

Following a review of aerial photography[40] to identify the existing trends in the type, extent and distribution of habitats within and adjacent to the proposed Project, it is considered likely that habitats present in the current baseline environment will generally remain the same as they currently, are however some degree of habitat change is likely to occur. This is based on the fact that a small number of locations have been subject to habitat change since 2002 to the present day and that these changes have been somewhat limited in their geographical extent, i.e. the majority are mainly confined to Ballymun and its environs. These areas include:

- North Dublin Corporate Park in Swords – the land-use at this location changed between the years of 2005 and 2008 from agricultural grassland and hedgerow to commercial buildings and road, with a small proportion of retained grassland in the western section near the R132;
- Lands at the far eastern section of Dardistown – the land-use at this location changed between May 2008 and July 2008 from agricultural grassland to hardstanding (i.e. to the existing Quick Park Dublin Airport car park);
- Lands at Santry, east of the R108 and Old Ballymun Road – the land-use at this location changed between the years of 2005 and 2008 from agricultural grassland and hedgerow to the existing Gulliver's Retail Park, additional commercial/residential buildings, car parks and roads. This development extended further into grassland, hedgerow and woodland habitats over multiple years from 2017 to the present day;
- Lands at Ballymun, west of the R108 north and south of St Margaret's Road – the land use at this location changed between the years of 2005 and 2008 from agricultural grassland, rough grassland and hedgerow to hardstanding associated with the Ikea Dublin building, its car park and St Margaret's Road; and,
- Lands at the centre of Ballymun west and east of the R108 – the land use at this location changed between the years of 2008 and 2012 from residential buildings to amenity grassland. A small section of amenity grassland changed to commercial buildings and a car park between the years of 2018 and 2019.

Over the last 20 years to the present day, the study area has been generally dominated by built land comprising of roads, pathways, residential, commercial, and industrial buildings (including Dublin Airport); agricultural farmland with hedgerow/treeline boundaries; fragmented areas of woodland; watercourses (including the Royal Canal and Grand Canal); and, golf courses, parkland and playing pitches.

Future trends in the context of the "*Do Nothing Impact*" scenario are likely to result in some changes in the baseline environment as a result of proposals set out in statutory and non-statutory land-use plans and associated land-use zonings. The following plans are relevant to the study area:

- Fingal Development Plan 2017-2023 (FCC, 2017)
- Dublin City Development Plan 2016-2022 (DCC, 2016)
- Estuary West Masterplan (FCC, 2019)
- Barrysparks and Crowcastle Masterplan (FCC, 2019)
- Fosterstown Masterplan (FCC, 2019)
- Fosterstown Local Area Plan (FCC, 2010)
- Dublin Airport Local Area Plan 2020 (FCC, 2020)
- Dardistown Local Area Plan (FCC, 2013)
- Ballymun Local Area Plan 2017 (DCC, 2017)
- George's Quay Local Area Plan 2012 (DCC, 2012)

[40] Sources of aerial photography examined as part of this assessment included: Google Earth 2002-2005, 2008, 2009 and 2013-2021.

The following locations are likely to be subject to habitat change as a result of future trends associated with proposals set out in the relevant land-use plans:

- Lands at Lissenhall located north and north-west of the proposed P&R Facility, north and south of the Broadmeadow River and east of the R132 that are currently zoned as "*ME – Metro Economic Corridor*"[41] (FCC, 2017) and lands located north-east of the proposed Park and Ride (P&R) Facility are currently zoned as "*HT – High Technology*"[42] (FCC, 2017);
- Lands at Barrysparks located east of the R132 that are currently zoned as both "*ME – Metro Economic Corridor*" and "*HT – High Technology*" (FCC, 2017);
- Lands at Fosterstown located west of the R132 that are currently zoned as "*MC – Major Town Centre*"[43] and "*RA – Residential Area*"[44] (FCC, 2017);
- Lands at Dardistown located south and east of the proposed depot that are currently zoned as "*HT – High Technology*" and "*GE – General Employment*"[45] (FCC, 2017);
- Lands at Santry located east of the R108 that are currently zoned as "*ME – Metro Economic Corridor*" (FCC, 2017) as well as lands located west of the R108 north and south of St Margaret's Road that are zoned as "*ME – Metro Economic Corridor*" and "*HT – High Technology*" (FCC, 2017); and,
- Lands at CLG Na Fianna in Drumcondra that are currently zoned as "*Zone Z15: Community and Institutional Resource Lands (Education, Recreation, Community, Green Infrastructure and Health)*"[46] (DCC, 2016).

These areas zoned are likely to have the greatest effects on local biodiversity as a result of habitat loss and/or modification and any associated effects on fauna species.

The following locations are unlikely to be subject to habitat change due to the protective land-use zonings:

- Lands located along the Broadmeadow River corridor that are currently zoned as "*OS – Open Space*"[47] and "*HA – High Amenity*"[48] (FCC, 2017);
- Lands located north of Dublin Airport, north and south of the Sluice River that are currently zoned as "*OS – Open Space*" and "*GC – Green Belt*"[49] (FCC, 2017); and,
- Lands located in the various parklands within the adjacent to the boundary of proposed Project (i.e. Santry Demesne, Albert College Park and Stephen's Green) and along the Royal Canal that are currently zoned as "*Zone Z9: Amenity/Open Space Lands/Green Network*"[50] (DCC, 2016).

Due to the absence of a robust historical baseline for fauna species in the study area, it is not possible to establish accurate existing and future trends for fauna species at a local level; however, it is considered likely that the changes in habitats associated with existing and future trends (as described above) have impacted fauna biodiversity and distributions locally and will continue to do so. Any effects on biodiversity associated with the existing and future trends in the study area are likely to be managed to some degree by the environmental protective policies and objectives contained in the *Fingal Development Plan 2017-2023* (FCC, 2017), *Dublin City Development Plan 2016-2022* (DCC, 2016) and the

[41] The land zoning objective of "*ME – Metro Economic Corridor*" is to "*facilitate opportunities for high-density mixed-use employment generating activity and commercial development, and support the provision of an appropriate quantum of residential development within the Metro Economic Corridor*" (FCC, 2017).
[42] The land zoning objective of "*HT – High Technology*" is to "*provide for office, research and development and high technology/high technology manufacturing type employment in a high quality built and landscaped environment*" (DCC, 2017).
[43] The land zoning objective of "*MC – Major Town Centre*" is to "*protect, provide for and/ or improve major town centre facilities*" (FCC, 2017).
[44] The land zoning objective of "*RA – Residential Area*" is to "*provide for new residential communities subject to the provision of the necessary social and physical infrastructure*" (FCC, 2017).
[45] The land zoning objective of "GE – General Employment" is to "*provide opportunities for general enterprise and employment*" (FCC, 2017).
[46] The land zoning objective of "Zone Z15: Community and Institutional Resource Lands (Education, Recreation, Community, Green Infrastructure and Health)" is "*to protect and provide for institutional and community uses*" (DCC, 2016).
[47] The land zoning objective of "*OS – Open Space*" is to "*preserve and provide for open space and recreational amenities*" (FCC, 2017).
[48] The land zoning objective of "*HA – High Amenity*" is to "*protect and enhance high amenity areas*" (FCC, 2017).
[49] The land zoning objective of "*GB – Green Belt*" is to "*protect and provide for a greenbelt*" (FCC, 2017).
[50] The land zoning objective of "*Zone Z9: Amenity/Open Space Lands/Green Network*" is "*to preserve, provide and improve recreational amenity and open space and green networks*" (DCC, 2016).

various local area plans described above as well as by the overarching pollution control objectives in the *River Basin Management Plan 2018 – 2021* (RBMP) (DoHPLG, 2018).

With regards to the proposed Grid Connections, the majority of the works will take place along existing roads and as such, if the proposed Grid Connections did not proceed there would be no predicted change to the existing environment. In the case of any off-road works, the works sites will be reinstated to their original condition.

15.4.2 Construction Phase

15.4.2.1 Designated Areas for Nature Conservation

This section describes and assesses the potential for the proposed Project to result in likely significant effects on designated areas for nature conservation: SACs, SPAs or NHAs/pNHAs[51]. In the context of European sites this is focused on the habitats and species for which the sites are selected, i.e. qualifying interests (QIs) for SACs and SCI species for SPAs, and the conservation objectives supporting their conservation condition in each site. This assessment is directly related to the assessment methodology for European sites required under the Habitats Directive, which is presented in the Natura Impact Statement (NIS) for the proposed Project.

In the case of NHAs and pNHAs the assessment considers whether the integrity[52] of any such site would be affected by the proposed Project with reference to the ecological features for which the site is designated or is proposed.

15.4.2.1.1 European Sites

In the context of assessing whether the proposed Project would be likely to result in an impact on the integrity of any European sites, the tests and assessment presented in the NIS fulfil this role. The NIS considers whether the proposed Project will affect the conservation objectives supporting the favourable conservation condition of any European sites' QIs/SCIs and as a result presents an assessment of whether the integrity of any European sites would be affected – i.e. if the proposed Project would adversely affect the integrity of a European site, this would constitute a likely significant effect in the context of the EIA Directive.

The nature and scale of the proposed Project, the identified potential impacts and their relationship to European sites were considered in order to determine which European sites were located within the ZoI of the proposed Project, in view of best scientific knowledge and in view of conservation objectives, and therefore potentially at risk of the proposed Project affecting their conservation objectives. The potential impacts associated with the proposed Project are discussed below in relation to those European sites within its ZoI (see also Section 5 and Section 6 of the NIS).

Considering the ZoI, in the absence of mitigation measures, the proposed Project was assessed as having the potential to adversely affect the integrity of the following 17 European sites (refer to Section 5 and Section 6 of the NIS):

- Baldoyle Bay SAC [000199];
- Malahide Estuary SAC [000205];
- North Dublin Bay SAC [000206];
- South Dublin Bay SAC [000210];
- Wicklow Mountains SAC [002122];
- Baldoyle Bay SPA [004026];
- Dalkey Islands SPA [004172];
- Howth Head Coast SPA [004113];
- Ireland's Eye SPA [0040117];
- Lambay Island SPA [004069];

[51] There are no NHAs located within the ZoI of the proposed Project.
[52] Refer to Section 15.2 for definition and impact assessment methodology

- Malahide Estuary SPA [004025];
- North Bull Island SPA [004006];
- Rockabill to SPA [004014];
- Rogerstown Estuary SPA [004015];
- Skerries Islands SPA [004122];
- South Dublin Bay and River Tolka Estuary SPA [004024]; and
- The Murrough SPA [004186].

The locations of these European sites relative to the proposed Project, and the predicted ZoI, are shown on Figure 15.4.

The following potential impacts on European sites have been examined for the Construction Phase of the proposed Project based on the existing ecological environment and the extent and characteristics of the proposed Project:

- Habitat loss and fragmentation: It has been determined that there is no possibility of habitat loss effects adversely affecting the integrity of any European sites due to the absence of any overlap between the project and any European sites;
- *Ex-situ* habitat loss - SCI bird species: Although 15 no. bird species for which European sites have been designated were observed during surveys to inform this assessment, there is no possibility of *ex situ* habitat loss adversely affecting the integrity of any European sites. In all cases, the birds observed during surveys represented less than 1% of their national or international flyway populations, and therefore none of the areas utilised by these species in the proposed Project are important *ex situ* sites with respect to the European site network.
- Disturbance and displacement: Although otter in the Royal Canal, and SCI wetland bird species of several European sites occur within the potential disturbance ZoI of the proposed Project, there is no possibility of the proposed Project adversely affecting the integrity of any European sites for the following reasons:

- The foraging territory of otter on the Royal Canal adjacent to the proposed Glasnevin Station falls within the potential disturbance ZoI of the project. Nonetheless, significant effects are not predicted on this species arising from disturbance due to the relatively small proportion of foraging territory (c. 500m length of canal) that could be affected, the absence of any otter holts along the affected section of canal, and since the local otter population is likely to already be habituated to a range of human activities, including building work which occur already in the vicinity.
- With regards to wintering wetland bird species which forage in lands in the vicinity of the proposed Project, significant effects are not predicted to arise from disturbance and displacement, as the noise levels generated are generally not anticipated to be significantly greater than the existing baseline noise levels in the urban environment, and birds are habituated to existing levels of human activity in the context of the locality.

- Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies. Several European sites are located downstream of the proposed Project in the Malahide Estuary, Baldoyle Bay, and Liffey Estuary/Dublin Bay. The population of otter in the downstream receiving environment has also precautionary been treated as potentially part of the Wicklow Mountains SAC QI population. In the absence of adoption of mitigation, namely controls for the prevention of pollutants or contaminants entering the downstream environment via surface or groundwaters, there is potential for negative effects on water quality in Malahide Estuary, Baldoyle Bay, water quality impacts could negatively affect the QIs or SCIs of the following European sites: Baldoyle Bay SAC, Baldoyle Bay SPA, Dalkey Islands SPA, Howth Head Coast SPA, Ireland's Eye SPA, Lambay Island SPA, Malahide Estuary SAC, Malahide Estuary SPA, North Bull Island SPA, North Dublin Bay SAC, Rockabill SPA, Rogerstown Estuary SPA, Skerries Islands SPA, South Dublin Bay and River Tolka Estuary SPA, South Dublin Bay SAC, Wicklow Mountains SAC, and The Murrough SPA, such that conservation objectives of these European sites are undermined.
- Habitat degradation as a result of a change in the existing hydrological regime of watercourses: It is acknowledged that the proposed Project includes the diversion and changes to several watercourses that discharge via the surface water network to downstream European sites.

Nonetheless, based on the Finite Element Method (FEM) Flood Risk Assessment and Management (FRAM) modelling study presented in Section 18.5 of Chapter 18 Hydrology, the hydrological regime of watercourses crossed or culverted by the Project will not be altered significantly. Therefore, there is no possibility of the proposed Project undermining the conservation objectives of any QIs or SCIs of any European sites;

- Habitat degradation as a result of changes to the hydrogeological regime: Habitat degradation as a result of changes to the hydrogeological regime in the vicinity of the project could theoretically arise from drawdown/dewatering during construction, arising from active dewatering or barrier effects. Based on the results of modelling presented in Chapter 19 (Hydrogeology), there are no European sites within the hydrogeological zone of influence of the Proposed project. Therefore, there is no possibility of the proposed Project adversely affecting the integrity of any European sites arising from changes to the hydrogeological regime.
- Habitat degradation as a result of the introduction and/or spread of non-native invasive species: Several species of invasive alien plant species that are listed on the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011 (as amended) were identified in the study area, including along watercourses that discharge downstream to European sites. Adopting the precautionary principal, the possibility of construction activities facilitating the downstream spread of these invasive species to suitable habitats (including terrestrial and coastal QI habitats that are largely above the high-tide line) in downstream European sites cannot be ruled out, without relying on mitigation measures.
- Habitat degradation as a result of air quality impacts: Temporary dust emissions generated during construction theoretically have the potential to degrade sensitive habitats located in the vicinity of the proposed works. Whilst potential impacts on vegetation and habitats arising from air pollution associated with a project of this nature is generally greatest within c. 50-100m; impacts may also occur beyond this to a maximum distance of c. 200m from the road development and haul routes construction vehicles (NRA, 2011; Natural, 2016; Bignal *et al.*, 2004). However no European sites are located within this potential ZoI of air quality impacts. Therefore, there is no possibility of the proposed Project adversely affecting the integrity of any European sites arising from air quality impacts.

The potential impacts of the proposed Project in the context of European sites are explored in more detail in Section 5 of the NIS which accompanies this report.

Summary

The direct and/or indirect impacts by which the proposed Project could (in the absence of mitigation measures) potentially affect the conservation objective attributes and targets supporting the conservation condition of the qualifying interests of Baldoyle Bay SAC, Malahide Estuary SAC, North Dublin Bay SAC, South Dublin Bay SAC, Wicklow Mountains SAC, Baldoyle Bay SPA, Dalkey Islands SPA, Howth Head Coast SPA, Ireland's Eye SPA, Lambay Island SPA, Malahide Estuary SPA, North Bull Island SPA, Rockabill SPA, Rogerstown Estuary SPA, Skerries Islands SPA, South Dublin Bay and River Tolka Estuary SPA, and The Murrough SPA are:

- Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies; and,
- Habitat degradation as a result of the introduction and/or spread of non-native invasive species;

Refer also to Table 6.2 in the NIS for details on how these impacts may affect the Site-Specific Conservation Objectives of the QI habitats and species and/or SCI bird species of these 17 European sites.

Adversely affecting the integrity of Baldoyle Bay SAC, Malahide Estuary SAC, North Dublin Bay SAC, South Dublin Bay SAC, Wicklow Mountains SAC, Baldoyle Bay SPA, Dalkey Islands SPA, Howth Head Coast SPA, Ireland's Eye SPA, Lambay Island SPA, Malahide Estuary SPA, North Bull Island SPA, Rockabill SPA, Rogerstown Estuary SPA, Skerries Islands SPA, South Dublin Bay and River Tolka Estuary SPA, and The Murrough SPA would result in significant effects at the international geographical scale.

15.4.2.1.2 Natural Heritage Areas and Proposed Natural Heritage Areas

Considering the ZoI of the proposed Project, in the absence of mitigation measures the proposed Project has the potential to have a likely significant effect on the following NHA and pNHAs:

- Malahide Estuary pNHA [000205];
- Sluice River Marsh pNHA [001763];
- Baldoyle Bay pNHA [000199];
- Santry Demesne pNHA [000178];
- North Dublin Bay pNHA [000206];
- Royal Canal pNHA [002103];
- Dolphins, Dublin Docks pNHA [000201];
- Grand Canal pNHA [002104];
- South Dublin Bay pNHA [000210];
- Booterstown Marsh pNHA [001205];
- Rogerstown Estuary pNHA [000208];
- Ireland's Eye pNHA [000203];
- Lambay Island pNHA [000204];
- Skerries Islands NHA [001218];
- Dalkey Coastal Zone and Killiney Hill pNHA [001206];
- Howth Head pNHA [000202];
- Liffey Valley pNHA [000128];
- The Murrough pNHA [000730]; and,
- Rockabill pNHA [000207].

The locations of these designated areas for nature conservation relative to the proposed Project, and the predicted ZoI, are shown on Figure 15.6.

The following objectives of the *Fingal Development Plan 2017-2023* (FCC, 2017) are relevant to the protection of nationally designated sites including NHAs and pNHAs located within the boundaries of FCC:

- Objective NH16: *"Protect the ecological integrity of proposed National Heritage Areas (pNHAs), Natural Heritage Areas (NHAs), Statutory Nature Reserves, Refuges for Fauna, and Habitat Directive Annex I sites*";
- Objective NH17: "*Ensure that development does not have a significant adverse impact on proposed Natural Heritage Areas (pNHAs), Natural Heritage Areas (NHAs), Statutory Nature Reserves, Refuges for Fauna, Habitat Directive Annex I sites and Annex II species contained therein, and on rare and threatened species including those protected by law and their habitats*".; and,
- Objective DMS167: "*Ensure ecological impact assessment is carried out for any proposed development likely to have a significant impact on proposed Natural Heritage Areas (pNHAs), Natural Heritage Areas (NHAs), Statutory Nature Reserves, Refuges for Fauna, Habitat Directive Annex I sites and Annex II species contained therein, or rare and threatened species including those species protected by law and their habitats. Ensure appropriate avoidance and mitigation measures are incorporated into development proposals as part of any ecological impact assessment*".

The following policy of the *Dublin City Development Plan 2016- 2022* (DCC, 2016) are relevant to the protection of nationally designated sites including NHAs and pNHAs located within the boundaries of DCC:

- Policy GI24: To conserve and manage all Natural Heritage Areas, Special Areas of Conservation and Special Protection Areas designated, or proposed to be designated, by the Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs.

The following potential impacts on pNHA sites have been identified based on the existing ecological environment and the extent and characteristics of the proposed Project (see information provided below for detailed description of each potential impact):

- Habitat loss and fragmentation;
- Potential impacts on relevant bird species due to habitat loss, habitat degradation and reduction in prey abundance/quality as a result of hydrological/hydrogeological impacts, disturbance and displacement, mortality and/or injury;
- Habitat degradation as a result of surface water runoff related hydrological impacts;
- Habitat degradation as a result of a change in the existing hydrological regime of watercourses;
- Habitat degradation as a result of hydrogeological impacts;
- Habitat degradation as a result of introducing/spreading non-native invasive species; and
- Habitat degradation as a result of air quality impacts.

The potential impacts on European sites arising from the proposed Project described above in Section 15.4.2.1.1 may also negatively affect the following NHA and pNHA sites, which are located within the boundaries of these European sites and are primarily designated for similar reasons: Malahide Estuary pNHA, Baldoyle Bay pNHA, North Dublin Bay pNHA, Dolphins, Dublin Docks pNHA, South Dublin Bay pNHA, Booterstown Marsh pNHA, Rogerstown Estuary pNHA, Howth Head pNHA Ireland's Eye pNHA, Lambay Island pNHA, Skerries Islands NHA, Dalkey Coastal Zone and Killiney Hill pNHA, The Murrough pNHA and Rockabill pNHA[53]. The proposed Project also has the potential to affect biodiversity in a broader sense than just the QIs/SCIs of those European sites. Where biodiversity receptors in these NHA and pNHAs do not form part of the QIs/SCIs in the NIS assessment, they are considered under the other individual impact assessment headings for each KER below. Potential impacts arising from the proposed Project on these NHA and pNHA sites could result in a likely significant negative effect at a national geographic scale, in consideration of their national designation status and the protective policies/objectives of the relevant county development plans.

The assessment of potential impacts arising from the proposed Project on both the Royal Canal pNHA and Grand Canal pNHA is provided in Section 15.4.2.1.2 below.

In the case of the Sluice River Marsh pNHA and Santry Demesne pNHA, potential impacts arising from the proposed Project on these pNHA sites may occur as a result of:

- Habitat degradation as a result of surface water runoff related hydrological impacts;
- Habitat degradation as a result of a change in the existing hydrological regime of watercourses; and
- Habitat degradation as a result of introducing/spreading non-native invasive species.

Refer to the relevant heading above in Section 15.4.2.1.1 for a description of these potential impacts.

Habitat Degradation as a Result of Air Quality Impacts

The Royal Canal pNHA, Grand Canal pNHA, Santry Demesne pNHA and Liffey Valley pNHA were modelled as part of the air quality assessment. While not all these sites experienced a 5% change in traffic flow, one of the criteria for assessment, all designated sites within the 200m of the modelled road network were included for robustness of assessment. In the case of the Royal Canal pNHA, Grand Canal pNHA, and Liffey Valley pNHA, the outputs of this model under the "*Do Something*" scenario[54] indicated that whilst there would be exceedances of the critical level of the annual mean NO_X (i.e. >30 µg/m^3)

[53] Malahide Estuary SAC and Malahide Estuary SPA in relation to Malahide Estuary pNHA; Baldoyle Bay SAC and Baldoyle Bay SPA in relation to Baldoyle Bay pNHA; North Dublin Bay SAC, North Bull Island SPA and South Dublin Bay and River Tolka Estuary SPA in relation to North Dublin Bay pNHA; South Dublin Bay SAC and South Dublin Bay and River Tolka Estuary SPA in relation to South Dublin Bay pNHA and Booterstown Marsh pNHA; Rogerstown Estuary SAC and SPA in relation to Rogerstown Estuary pNHA; Howth Head SAC and Howth Head Coast SPA in relation to Howth Head pNHA; Ireland's Eye SAC and SPA in relation to Ireland's Eye pNHA; Lambay Island SAC and SPA in relation to Lambay Island pNHA; Skerries Islands SPA in relation to Skerries Islands NHA; Dalkey to Rockabill SAC in relation to Dalkey Coastal Zone and Killiney Hill pNHA; the Murrough SPA in relation to the Murrough pNHA; and Rockabill to Dalkey Island SAC and Rockabill SPA in relation to Rockabill pNHA.

[54] This scenario models the traffic data in the relevant future year (i.e. first year of construction period of proposed Project, 2024) and includes the proposed Project

none of these were actually directly linked to the proposed Project and were instead due to the current high traffic volumes at those locations; therefore no potential impacts on these nationally designated sites are predicted as a result of the proposed Project. All predicted levels of the annual mean NO_X within Santry Demesne were below the critical level, ranging from 24.78 to 26.6 µg/m^3 and therefore no potential impacts on this nationally designated site are predicted.

The greatest potential impact on air quality during construction is associated with dust emissions, PM_{10}/$PM_{2.5}$ emissions and the potential for nuisance dust. The deposition of dust typically occurs within close proximity to its source; however potential impacts can occur within c. 350m and up to c. 500m from a construction site entrance along public roads. There are a number of construction activities associated with the proposed Project across its extent that could generate significant levels of dust. In addition, there is potential for dust to deposit and settle on adjacent watercourses, resulting in habitat degradation (i.e. the Royal Canal and the Grand Canal). In the absence of mitigation, this potential impact on nearby nationally designated sites could result in a temporary significant negative effect at a national scale, in consideration of their national designation status and the protective policies/objectives of the relevant county development plans.

Full details of the air quality assessment are provided in Section 16.5 of the Chapter 16 (Air Quality).

15.4.2.2 Habitats

This section assesses the potential impact of the proposed Project on habitats. In terms of quantifying the magnitude of effects on habitats, the estimated percentage of the local habitat resource being affected is based upon the total area of a given habitat type that was recorded within the study area of the proposed Project[55]. This provides some local context as to the magnitude of the habitat loss and whether the impact is significant or not, and at what geographic scale.

Habitat Loss and Fragmentation

The construction of the proposed Project will result in the permanent loss of habitats within the construction areas of its footprint as a result of clearance works, totalling c. 138.9ha in area and c. 3,811.9km in length (see Table 15.17 for a list of the affected habitat types and corresponding calculated extents that will be lost). These include the following habitats that are valued as being of Local Importance (Higher Value):

- Relatively small instream/bankside sections of river channel (FW2), ditches (FW4) and adjacent reed habitat (species-poor non-Annex FS2);
- Species-rich calcareous grassland (GS1);
- Wet grassland (GS4);
- Woodland and parkland (WD1, WD3, WD5 and WS2); and,
- Hedgerows (WL1) and treelines (WL2).

The overall total area of the habitat types valued as Local Importance (Higher Value) which overlaps with the proposed Project boundary and will potentially be lost as a direct impact during construction of the proposed Project is c. 14ha and c. 3.8km in length. The permanent loss of habitat types considered to be of Local Importance (Higher Value) has the potential to affect the conservation status of each of these habitat types and, therefore, result in a significant negative effect at the local geographic scale.

The remaining areas of habitat within the proposed Project boundary comprise habitats considered to be of a Local Importance (Lower Value). These include:

- Improved neutral agricultural and amenity grasslands (BC1, GA1, species poor GS1, GA2 and GS2);
- Scrub (WS1);
- Planted flowers beds (BC4) and ornamental/non-native shrub (WS3);
- Areas of disturbed ground (ED1, ED2, ED3 and ED5); and,
- Stonewalls (BL1), earth banks (BL2) and hard standing (BL3).

[55] At some locations, a habitat type was recorded in a mosaic with one or more habitat types. The area of the dominant habitat type present in these mosaics was calculated.

The overall total area of these habitat types valued as Local Importance (Lower Value) which overlaps with the proposed Project boundary and will potentially be lost as a direct impact during construction of the proposed Project is c. 124.9ha.

There will be no permanent loss of any habitat type valued as being of National Importance present within the ZoI of the proposed Project. The Lower Liffey Estuary/River Liffey, which is located in close proximity to the proposed Project c. 17m north of the proposed Tara Station, corresponds to the Annex I habitat Estuaries [1130] and as such is valued as being of National Importance. The species-rich habitat type tall-herb swamp (FS2), which is present directly west of the Royal Canal Basin at Lock 6 and along the southern bank of the Grand Canal directly north of the boundary of the proposed Project at the proposed Charlemont Station, corresponds to the Annex I habitat Hydrophilous tall-herb swamp [6430] and as such is valued as being of National Importance. Whilst these Annex I habitats may be indirectly impacted by the proposed Project, as a result of severe habitat degradation that may occur in absence of mitigation (see relevant section below), they will not be directly impacted as a result of habitat loss.

During the construction of the proposed Project, the Royal Canal basin located between Lock 6 and Lock 5 (i.e. c. 0.27ha in area and c. 215m in length) will be completely dewatered for two periods of c. three months (i.e. six months in total) to facilitate the installation and removal of a temporary working platform at this location. Whilst this will result in a short-term impact on the canal (FW3) habitat type (by affecting the vegetation present), it will not result in a significant effect at any geographic scale. Routine maintenance works are regularly undertaken by Waterways Ireland along and within the Royal Canal to maintain its function as a man-made waterway and to ensure the safe passage of boats along its channel. These include significant instream works, such as repair works to the locks, jetties, quay walls, supply and overflow structures and bridge parapets, that often require the dewatering of the canal to completed.

Habitat loss may also lead to habitat fragmentation or isolation, i.e. creating new divisions of existing habitat blocks and/or contributing to an existing trend of fragmenting semi-natural habitat blocks; however, considering the habitat types to be lost, their extents and the surrounding habitats beyond the proposed Project boundary, this potential impact will not result in a significant effect at any geographic scale.

The mitigation measures that have been designed to avoid or reduce the effects of direct impacts to habitats are in Section 15.5.1.2.

Table 15.17: Habitat Types within the Boundary of the Proposed Project that will be Impacted on as a Result of Direct Permanent Habitat Loss, or Temporary Habitat Loss in the Case of the Habitat Type Canals (FW3)

Habitat Type	Extent[56]
National Importance	
Canals (FW3)	Short term habitat loss of c. 0.27ha of Royal Canal Basin
Local Importance (Higher Value)	
Depositing/lowland rivers (FW2)	Temporary habitat loss as a result of temporary bridges during construction: ▪ c. 435m^2 of Broadmeadow River ▪ c. 275m^2 of Ward River ▪ c. 350m^2 of Mayne River ▪ c. 215m^2 of Santry River Permanent habitat loss as a result of permanent culverts, diversions and channel straightening: ▪ c. 226m^2 of Sluice River ▪ c. 650m^2 of Turnapin Stream, a tributary of the Mayne River ▪ c. 150m^2 of Santry River

[56] This includes either a measure of habitat area (ha) or linear length of habitat lost (m/km), as appropriate.

Habitat Type	Extent[56]
	Permanent habitat loss of 20m² to facilitate permanent discharge outfalls at each of the following eight locations: ▪ Broadmeadow River ▪ Ward River ▪ two unnamed watercourses ▪ Sluice River and its tributary ▪ Mayne River ▪ Santry River
Drainage ditches (FW4)	c. 3.22km
Species-rich dry calcareous and neutral grassland (GS1)	c. 3.2ha
Wet grassland (GS4)	c. 0.95ha
(Mixed) broadleaved woodland (WD1)	c. 4.4ha
(Mixed) conifer woodland (WD3)	c. 0.43ha
Scattered trees and parkland (WD5)	c. 0.95ha
Hedgerows (WL1)	c. 385m
Treelines (WL2)	c. 77m
Immature woodland (WS2)	c. 1.19ha
Local Importance (Lower Value)	
Improved agricultural grassland (GA1)	c. 17.2ha
Amenity grassland (GA2)	c. 12.32ha
Species-poor dry calcareous and neutral grassland (GS1)	c. 2.72ha
Dry meadows and grassy verges (GS2)	c. 8.25ha
Scrub (WS1)	c. 6.08ha
Ornamental/non-native shrub (WS3)	c. 0.45ha
Spoil and bare ground (ED2)	c. 0.13ha
Recolonising bare ground (ED3)	c. 1.98ha
Arable crops (BC1)	c. 51.3ha
Flower beds and borders (BC4)	c. 0.02ha
Earth banks (BL2)	c. 0.62ha
Residential	c. 1.65ha

Habitat Degradation – Surface Water Quality

During construction, contaminated surface-water runoff and/or an accidental spillage or pollution event into any surface water feature has the potential to have a significant negative impact on water quality and consequently affect aquatic and wetland habitats in the receiving environment. The effects of frequent and/or prolonged pollution events have the potential to be extensive and far-reaching and could potentially have significant long-term effects. In a worst-case scenario, estuarine and coastal habitats downstream could also be affected.

All water discharges (including foul waters) from construction areas will be attenuated and treated prior to approved discharge to defined sewers. Such discharges from construction areas are likely to be high in sediment and have an elevated alkalinity where cement works are undertaken; therefore in absence of appropriate treatment and attenuation, the discharge of this groundwater into nearby surface water features could result in significant negative effects (as a result of changes in water quality and/or flow) on watercourses that they are discharged to and on any sensitive habitats present at the discharge point and/or downstream (including sensitive intertidal, coastal and estuarine habitats present within

downstream European sites). Habitat degradation as a consequence of construction effects on surface water quality has the potential to affect the conservation status of tidal rivers (CW2)/Annex I habitat Estuaries [1130], reed and large sedge swamps (FS1), tall-herb swamps (FS1), including Annex I habitat hydrophilous tall-herb swamp [6430], depositing/lowland rivers (FW2), canals (FW3) and drainage ditches (FW4) habitats and therefore, has the potential to result in a significant negative impact at a National scale in the case of the aquatic/wetland Annex I habitats, Royal Canal and Grand Canal located within close proximity of the proposed Project boundary or downstream within the boundaries of European sites and/or at a local geographic scale in the case of affected habitats valued as being of Local Importance (Higher Value).

However, it is considered unlikely that a pollution event of such a magnitude would occur during construction or, if it did occur, it would be temporary in nature. Nevertheless, a precautionary approach has been adopted in the assessment of potential risk of impacts on water quality. Consequently, detailed mitigation measures are required to further minimise the risk of the proposed Project having any perceptible effect on water quality during construction.

The mitigation measures that have been designed to avoid or reduce the potential impacts of the proposed Project on surface water quality are presented in Section 15.5.2.1.2.

Habitat Degradation – Hydrological Regime

Construction works at the proposed watercourse crossings of the proposed Project can have a temporary impact on the local flow and flooding regime. None of these are predicted to have any long-term effects that would give rise to a likely significant negative effect on any aquatic habitats or species through effects on the hydrological regime (for more detail refer to Section 18.5.3 of Chapter 18 (Hydrology).

Habitat Degradation – Groundwater

There is potential for groundwater to be encountered during the excavation works required to construct the following elements of the proposed Project:

- The proposed two single-bore twin-track tunnel sections;
- The retained cut stations at Seatown, Swords Central, Fosterstown and Dardistown;
- All of the underground stations at Dublin Airport, Northwood, Ballymun, Collins Avenue, Griffith Park. Glasnevin, Mater, O'Connell Street, Tara Street, St Stephen's Green and Charlemont;
- The proposed viaduct over the Broadmeadow River and Ward River and other bridge structures;
- DASP (the first of two TBM launch sites);
- Second TBM launch site at the proposed Northwood compound;
- Dardistown Depot and future station; and,
- The proposed intervention/ventilation shaft at Albert College Park.

There are no deep excavation works required to construct the proposed Estuary Station and P&R Facility, which are located at grade and as such there is no potential for groundwater to be encountered. At those locations where groundwater is likely to be encountered during construction, there is potential for impacts to occur on the groundwater level and flow patterns, as a result of dewatering and the subsequent groundwater drawdown, and on groundwater/surface water quality as a result of contamination arising from accidental spillages of potentially polluting substances. These impacts would likely be temporary (i.e. for the duration of construction), localised and reversible as the groundwater body would replenish its supply after construction. In the case of groundwater drawdown, the maximum extent of these impacts is dependent on the groundwater discharge rate likely to be encountered at each specific location (as determined by factors that influence the behaviour of groundwater ingress such as subsoil and rock type). These potential impacts could indirectly affect groundwater dependent terrestrial ecosystems if present as such ecosystems and the habitats and species they support rely on the adequate supply, flow and quality of groundwater to maintain their structure, function and processes.

The predicted ZoI at each station (including the proposed P&R Facility and proposed depot) has been modelled to determine the extent (or the "*radius of influence*") of these impacts from the centre of the excavation footprint (i.e. the maximum distance at which groundwater drawdown effects can be detected) (see Section 19.5.3.5 'Groundwater Zone of Influence' of Chapter 19 Hydrogeology for more details). This has been based on a conservative modelled outflow value of groundwater discharges into the base of each station footprint. The extent for each station differs slightly depending on the depth and scale of excavation required (i.e. the extent is more confined at the retained cut stations compared to the underground station; as it relates to the approximate depth of these excavations, i.e. 6.5mBGL at retained cut and between 26mBGL to 29mBGL at underground stations). At all locations, the extent decreases substantially following the excavation and the completion of the final sealed structure/station box that will ensure full watertight conditions. There are no groundwater dependent terrestrial habitats (and by consequence no groundwater dependent species) present within or adjacent to any of these extents[57]. The habitats present in areas with the largest extents (i.e. the underground stations) are dominated by the presence of buildings and areas of hardstanding. No potential for impacts on any habitats will occur as a result of the groundwater drawdown effect of the proposed Project during construction.

Dewatering (i.e. either drawdown and/or water quality effects) may potentially impact on the baseflow of nearby watercourses that are also fed by groundwater sources. There is only one location where this potential impact on receiving watercourses is anticipated to be greater than imperceptible/not significant – i.e. at the proposed Tara Station for which the predicted impact on the River Liffey is considered to be temporary not significant to slight in absence of mitigation. This potential impact is not considered likely to extend further east towards any European site and will be restricted to the radius of effect of dewatering at this location (i.e. c. 176.45m from station location). The River Liffey at this location (also referred to as the Lower Liffey Estuary) corresponds to the Annex I habitat Estuaries [1130] and although this location is not located within any European site, it is located within the favourable reference range of this Annex I habitat (NPWS, 2019a). Potential changes to the hydrological of the estuary could potentially impact on the intertidal and subtidal aquatic fauna communities indicative of this Annex I habitat and in turn negatively affect its favourable conservation condition. Therefore, in absence of mitigation, impacts on this Annex I habitat as a result of indirect impacts on surface water arising from changes in groundwater have the potential to result in significant negative effects at a national geographic scale.

The construction of underground elements of the proposed Project could result in the crosscutting of regional/local groundwater flow and in turn cause a barrier effect (or damming) of groundwater (i.e. the TBM, cut sections, shallow and deep station excavation as described above). This has the potential to impact on the baseflow to watercourses that are fed by groundwater sources and as such the associated changes in hydrological could impact on the habitats present and the discharge location and/or downstream. Watercourses potentially vulnerable to barrier effect of groundwater are:

- Broadmeadow River and Ward River
- Mayne River at Dardistown
- River Liffey

In the case of the Broadmeadow River and Ward River, the aboveground/at grade section works will negate any potential barrier effects on groundwater flow. In the case of the Mayne River, barrier effect is considered to be irrelevant as the proposed D-Wall installations at Dardistown will not cut into the permeable BoD layer. Therefore, no potential impacts on aquatic habitats as a result of indirect impacts on surface water arising from changes in groundwater are predicted.

All water discharges from construction areas will be attenuated and treated prior to approved discharge to defined sewers. Such discharges from construction areas (including stormwater and groundwater) are likely to be high in sediment and have an elevated alkalinity where cement works are undertaken; therefore in absence of appropriate treatment and attenuation, the discharge of this groundwater into

[57] The extents of drawdown at the following stations are located beyond the survey area for habitats: Collins Avenue, Glasnevin, Mater, O'Connell Street, Tara Street and St Stephen's Green. Following a review of aerial photography, it has been confirmed that no groundwater dependent terrestrial habitats are likely to be present at these locations given that these areas are dominated by buildings and hardstanding.

nearby surface water features could result in significant negative effects (as a result of changes in water quality and/or flow) on watercourses that they are discharged to and on any sensitive habitats present at the discharge point and/or downstream (including sensitive intertidal, coastal and estuarine habitats present within downstream European sites). The scale of this impact could range from local (i.e. in the case of the aquatic habitat depositing/lowland rivers (FW2) and fringe aquatic habitats reed and large sedge swamps (FS1) and non-Annex I tall-herb swamps (FS2) habitat types) to national (i.e. in the case of potential impacts on Annex I habitats Estuaries [1130] and Hydrophilous tall-herb swamp [6430] located outside European sites downstream of the proposed construction discharge points).

There is also potential for drainage to ground related pollution to occur as a result of hydrocarbons and/or alkaline runoff generated from construction works (*e.g.* cement works, grouting and wheel wash water) as well as runoff from temporarily stockpiled material on site entering the local groundwater. However, the mobility of any construction-related pollutants to ground is likely to be limited to the footprint of the proposed Project and as there are no groundwater dependent habitats present within the footprint of the proposed Project, no potential impacts are predicted.

Full details of the hydrogeological assessment are provided in Section 19.5 of the Chapter 19 (Hydrogeology).

Habitat Degradation – Air Quality

As discussed above in Section 15.4.2.1.1 and 15.4.2.1.2 (and in section 16.5 of Chapter 16 (Air Quality)), the proposed Project has the potential to generate dust during construction works which could affect vegetation in habitat areas adjacent to the proposed Project boundary. This potential impact of habitat degradation as a consequence of a reduction in air quality has the potential to affect the conservation status of these habitats and therefore, has the potential to result in a significant negative impact at a National scale in the case of the aquatic/wetland Annex I habitats, Royal Canal and Grand Canal located within the proposed Project boundary and at a local geographic scale in the case of affected habitats valued as being of Local Importance (Higher Value). Mitigation measures have been designed to contain dust emissions during construction (see Section 15.5.1.2).

The modelling of road traffic for impacts on ecological receptors (as outlined in Chapter 16 (Air Quality)) found no significant impacts with respect to the modelling of emissions during the Construction Phase.

Habitat Degradation – Non-native Invasive Plant Species

Planting, dispersing, or allowing/causing the dispersal, spread or growth of certain non-native plant species is controlled under Article 49 of the European Communities (Birds and Natural Habitats) Regulations, 2011; and refers to plant or animal species listed on the Third Schedule of those regulations (see also Section 15.3.6).

The accidental spread of such non-native invasive plant species or any other problematic non-native invasive plant species as a result of construction works has the potential to impact on terrestrial and/or aquatic habitats[58]; potentially affecting plant species composition, diversity and abundance over the long-term. This is not only confined to habitats within and immediately adjacent to the proposed Project boundary but includes habitat areas along the network of proposed haul routes associated with the proposed Project.

The effects of introducing such non-native invasive plant species to highly sensitive and ecologically important habitat areas (*e.g.* designated area for nature conservation or areas of Annex I habitat) have the potential to result in a likely significant negative effect, at geographic scales ranging from local to national. Mitigation measures have been designed to avoid this potential impact (see Section 15.5.1.2.6).

[58] Non-native invasive aquatic plant species Canadian pondweed and Nuttall's pondweed were recorded in Grand Canal; however, there are no proposed works at the Grand Canal and therefore there is no risk of the spread and/or introduction of these species at this specific location as a consequence of the proposed Project.

Habitat Degradation – Tunnelling/Excavation

Tunnelling works or deep excavations have the potential to affect the structural integrity of the ground above a tunnel excavation, or that of the ground immediately adjacent to a deep cutting/excavation. None of the habitats present above the tunnelling/excavation works are particularly sensitive to increases in ground vibrations that may arise from the tunnelling during construction. Considering this, no potential impacts are predicted.

15.4.2.3 Rare and Protected Plant Species

Habitat Loss

No protected plant species listed on the Flora (Protection) Order, 2022 were recorded within or in close proximity to the proposed Project; however, there are desktop records of the rare and protected species opposite-leaved pondweed *Groenlandia densa* present downstream of the proposed Project directly east of Cross Guns Bridge between Lock 5 and 4 and Lock 4 to Lock 1 on the Royal Canal (BEC Consultants, 2015; EcoServe, 2011). This species was not recorded during the detailed aquatic botanical survey of the Royal Canal basin between Lock 6 and Lock 5 completed on the 17 June 2021 and it has never been recorded during any other aquatic surveys completed along the canal at that location (McCarthy Keville O'Sullivan Ltd., 2019; BEC, 2015; EcoServe, 2011). The temporary dewatering of the Royal Canal will be confined to the basin located between Lock 6 and Lock 5 and as opposite-leaved pondweed was not recorded at this location there is no potential for impacts to occur as a result of habitat loss.

The only known Irish record of the very rare charophyte species tassel stonewort *Tolypella intricata* is found between Lock 5 and Lock 4 on the Royal Canal directly east of the proposed Project at Cross Guns Bridge (NPWS, 2009f). This Red list species is considered to be "*Vulnerable*" (Wyse Jackson *et al.*, 2016). It was also not recorded during the detailed aquatic botanical survey of the Royal Canal basin. The temporary dewatering of the Royal Canal will be confined to the basin located between Lock 6 and Lock 5 and as tassel stonewort was not recorded at this location there is no potential for impacts to occur as a result of habitat loss.

Only three rare plant species were recorded during the aquatic surveys across the survey area, i.e. the Red list species horned pondweed, rigid hornwort and whorled water-milfoil, which are considered to be of "*Least Concern*" (Wyse Jackson *et al.*, 2016) and were recorded in the Royal Canal. The dewatering of the Royal Canal basin located between Lock 6 and Lock 5 for a total period of six months will result in the temporarily removal of these species' aquatic habitat, negatively impacting on the survival of individual plants present at that basin. According to the BSBI database[59]:

- Horned pondweed is relatively widely distributed across Ireland, with numerous records in County Dublin, County Limerick, County Clare and at Lough Neagh in Northern Ireland;
- There are records of rigid hornwort along the Grand Canal;
- There are records of whorled water-milfoil along the length of the Royal Canal in County Dublin, from Lock 11 to Lock 2 and at Clonsilla.

Considering their general extensive distribution in the Royal Canal and that these species are considered to be of "*Least Concern*"[60], it is considered unlikely that the proposed dewatering and subsequent habitat removal would result in a significant negative effect on these Red list species at a local geographic scale.

However, despite this, mitigation measures that have been designed to avoid or reduce any potential impacts of the proposed Project on whorled water-milfoil are presented in Section 15.5.1.3.

[59] This is based on records of horned pondweed, rigid hornwort and whorled water-milfoil from 2010 to 2019 displayed on the BSBI online distribution maps, accessed 5 July 2021 at:
https://bsbi.org/maps

[60] A taxon is considered to be of "*Least Concern*" when it has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category (Wyse Jackson *et al.*, 2016).

Habitat Degradation – Surface Water Quality

During construction, contaminated surface water runoff and/or an accidental spillage or pollution event into any surface water feature, such as the Royal Canal where the rare Red list species horned pondweed, rigid hornwort and whorled-water-milfoil was recorded and where there are desktop records for opposite-leaved pondweed and tassel stonewort located downstream of the proposed Project, has the potential to have a significant negative impact on water quality and consequently affect aquatic and wetland habitats in the receiving environment. The effects of frequent and/or prolonged pollution events in a watercourse could potentially have significant long-term effects on the aquatic vegetation present, including the rare and protected species opposite-leaved pondweed and the Red List species horned pondweed, rigid hornwort whorled water-milfoil and tassel stonewort.

All water discharges (including foul waters) from construction areas will be attenuated and treated prior to approved discharge to defined sewers. Such discharges from construction areas are likely to be high in sediment and have an elevated alkalinity where cement works are undertaken; therefore in absence of appropriate treatment and attenuation, the discharge of this groundwater into nearby surface water features could result in significant negative effects (as a result of changes in water quality and/or flow) on watercourses that they are discharged to. However, it is considered unlikely that a pollution event of such a magnitude would occur during construction or, if it did occur, it would be temporary in nature. Nevertheless, a precautionary approach has been adopted in the assessment of potential risk of impacts on water quality. Consequently, detailed mitigation measures are required to further minimise the risk of the proposed Project having any perceptible effect on water quality during construction.

Habitat degradation as a consequence of construction effects on surface water quality has the potential to affect the conservation status of opposite-leaved pondweed, horned pondweed, rigid hornwort, whorled water-milfoil and tassel stonewort, and therefore has the potential to result in a significant negative impact at a national geographic scale (in the case of the rare and nationally protected opposite-leaved pondweed and the very rare Red list species tassel stonewort, for which the only known location in Ireland is the Royal Canal downstream of the proposed Project) and a local geographic scale (in the case of the Red List species horned pondweed, rigid hornwort and whorled water-milfoil, a species of "*Least Concern*" that is abundant in the Royal Canal). The mitigation measures that have been designed to avoid or reduce the potential impacts of the proposed Project on surface water quality are presented in Section 15.5.1.2.

Habitat Degradation –Groundwater

The construction of the proposed Project has the potential to impact on groundwater levels, flow and/or quality. These impacts in turn have the potential to indirectly affect the quality and flow of surface water features; however no potential impacts on the Royal Canal are predicted given that there is no potential impact pathway. Groundwater will not be discharged to the Royal Canal during construction and as the Royal Canal is entirely sealed it is not susceptible to impacts associated with drawdown effects or barrier effects. As there will be no indirect impacts on the Royal Canal, there is no potential for subsequent impacts on the opposite-leaved pondweed, tassel stonewort, horned pondweed, rigid hornwort or whorled water-milfoil.

15.4.2.4 Mammals

15.4.2.4.1 Otter

This section of the impact assessment examines the potential for the proposed Project to impact on otter that are not connected with the qualifying interest Annex I species of the Wicklow Mountains SAC. The assessment of the impacts on the SAC population is presented in Section 15.4.2.1 above and Section 6 of the NIS (Scott Cawley Ltd., 2022).

Although it cannot be predicted if otter will establish new holt or couch sites within the ZoI of the proposed Project before construction works commence, it is a possibility, and this scenario has been taken into account in the mitigation strategy (refer to Section 15.5.1.4).

Loss of breeding/resting sites

Based on the findings of the field surveys carried out, as there were no otter breeding or resting places, holt or couch sites, present within the footprint of the proposed Project boundary, there will not be any loss of holt or couch sites as a result of construction works. Therefore, the proposed Project will not have a likely significant effect on the conservation status of otter, as there will be no loss of breeding/resting sites, and will not have a likely significant negative effect, at any geographic scale.

Foraging and/or Commuting Habitat Loss

Evidence of otter was recorded along the Broadmeadow River, Santry River and Royal Canal and there are known records of otter on the Broadmeadow River, Ward River, Cuckoo River, Mayne River, Santry River, Tolka River, Royal Canal, River Liffey and Grand Canal (NBDC, 2021; Waterways Ireland, 2019a; Waterways Ireland, 2019b; Dublin City Council, 2019). Although there are no records of otter along the Sluice River, it is likely that otter use this watercourse to commute and/or forage along as there are records of this species present downstream in the Mayne Estuary transitional waterbody. The proposed Project will result in direct impacts on the Broadmeadow River, Ward River, Sluice River, Mayne River, Santry River and Royal Canal.

In the context of river systems, the *Threat Response Plan Otter Lutra lutra 2009-2011* document (Department of the Environment, Heritage and the Gaeltacht, 2011) defines terrestrial Otter habitat as a 10m zone of riparian habitat along the riverbanks. The proposed Project will result in the permanent loss of such habitat (i.e. instream and/or bankside habitat) where otter have been recorded as a consequence of the following construction works:

- Proposed temporary bridges to facilitate access over the following watercourses during construction, for approximately 4 weeks in each location:

- Broadmeadow River located between Ch. 1520 and Ch. 1560, resulting in a total loss of c. 435m2 instream and/or bankside habitat;
- Ward River, located between Ch. 1620 and Ch. 1660, resulting in a total loss of c. 275m2 instream and/or bankside habitat;
- Mayne River at two locations near Ch. 8680 and Ch. 8900, resulting in a total loss of c. 350m2 instream and/or bankside habitat;
- Santry River, located directly west of the Old Ballymun Road between Ch. 9980 and Ch. 10000, resulting in a total loss of c. 215m2 instream and/or bankside habitat; and,
- Royal Canal, located directly east of the existing Lock 6 abutment between Ch. 14920 and Ch. 14960, resulting in a total loss of c. 375m2 of bankside habitat. To note that there is a temporary road bridge proposed in this location and only grass bank will be lost.

- Proposed permanent discharge outfalls to eight watercourses: the Broadmeadow River, Ward River, two unnamed watercourses, Sluice River and its tributary, Mayne River and the Santry River, resulting in a minimal loss of instream and/or bankside habitat of c. 20m^2 at each location;
- Two proposed permanent culverts on the Sluice River and one of its tributaries, at Ch. 5 + 765 and Ch. 5 + 963, resulting in a loss of c. 52m^2 and c. 174m^2 of instream habitat and/or bankside;
- Proposed permanent diversion of the Turnapin Stream, a tributary of the Mayne River, between around Ch. 8 + 600, resulting in a loss of c. 650m of river channel; and
- Proposed minor alteration works to straighten the channel of the Santry River and provide scour protection, located immediately downstream of the existing culvert outlet, resulting in a loss of c. 150m^2 of instream habitat and/or bankside.

The Royal Canal basin located between Lock 6 and Lock 5 (i.e. c. 0.27ha in area and c. 215m in length) will be completely dewatered for two periods of c. three months (i.e. six months in total) to facilitate the installation and removal of the temporary working platform at this location.

The construction of the proposed permanent 13 clear span viaduct over the Broadmeadow River and Ward River between Ch. 1 + 500 – Ch. 1 + 760 will not result in any loss of instream habitat as it is a clear span structure that will consist of precast concrete beams over the proposed Broadmeadow River and

proposed Ward River crossing point. The support piers of the proposed viaduct will be set back from the bankside habitat, located c. 10m north and c. 4m south of the Broadmeadow River bankside within amenity grassland, dry meadows and grassy verges and hedgerow habitat types and c. 4.5m and c. 4m south of the Ward River bankside within amenity grassland, dry meadows and grassy verges, reed swamp, scattered trees and parkland and woodland habitat types. Therefore, there will be no loss of instream and/or bankside habitat within and/or along the Broadmeadow River or Ward River as a result of the construction of the proposed viaduct.

It is likely that some vegetation cutting/removal may be required to facilitate the construction works. In addition, some effects to any remaining vegetation underneath the bridge structure would also be expected as a result of shading effects; however, this is likely to be limited to a very small extent along the river corridors and therefore insignificant (i.e. 286.2m^2 in the case of habitats located beneath the proposed Broadmeadow River crossing point and 227.9m^2 in the case of habitats located beneath the proposed Ward River crossing point). Habitat losses of such a comparatively small scale, in the context of the instream and riparian habitat resource in all surface water catchments crossed by the proposed Project which support otter, would not constitute a significant decline in the extent of available otter foraging and/or commuting habitat and will not affect the local otter population's ability to maintain itself, even in the short-term. Even in a case where it would be partially converted to hard surfaces, such as where a precast concrete culvert is installed, otter are known to routinely use highly modified habitat within culverts and beneath bridges (Chanin, 2003).

Habitat loss associated with the construction of the proposed Project will not have a likely significant effect on the conservation status of otter and will not have a likely significant negative effect, at any geographic scale.

Habitat degradation – Groundwater

The construction of the proposed Project has the potential to impact on groundwater levels, flow and/or quality. In the absence of mitigation these impacts in turn have the potential to indirectly affect the quality and flow of surface water features in the event of an accidental discharge of groundwater to surface water features. In addition, there are a number of watercourses located within the ZoI of the proposed Project that are fed by groundwater sources and as such they are susceptible to impacts arising from drawdown effects and/or barrier effect associated with the construction of the proposed Project. These potential impacts as they relate to aquatic habitats (such as those utilised by otter within the ZoI of the proposed Project) are described in full in section 15.4.2.2 Habitats under *Habitat degradation – Groundwater*.

The dewatering associated with the proposed Tara Station, which is likely to impact on the River Liffey, could negatively impact on otter as there are known records of this species along this watercourse; however, as these impacts will be very localised (i.e. it will be restricted to the radius of effect of dewatering at this location, c. 176.45m from station location), no significant effects on otter population utilising the wider River Liffey corridor are predicted. In absence of proper treatment and attenuation, the discharge of groundwater to surface water features has the potential to degrade habitats that otter may use and in turn could potentially negatively impact on otter at a county scale.

Habitat degradation - Water Quality

During construction, contaminated surface water runoff and/or an accidental spillage or pollution event into any surface water feature has the potential to have a significant negative impact on water quality and consequently an impact on otter; either directly (*e.g.* acute or sub-lethal toxicity from pollutants) or indirectly (*e.g.* affecting their food supply or supporting habitats). The effects of frequent and/or prolonged pollution events in a river system have the potential to be extensive and far-reaching and could potentially have significant long-term effects.

All water discharges (including foul waters) from construction areas will be attenuated and treated prior to approved discharge to defined sewers. Such discharges from construction areas are likely to be high in sediment and have an elevated alkalinity where cement works are undertaken; therefore in absence of appropriate treatment and attenuation, the discharge of this groundwater into nearby surface water

features could result in significant negative effects (as a result of changes in water quality and/or flow) on watercourses that they are discharged to. However, it is considered unlikely that a pollution event of such a magnitude would occur during construction or be any more than temporary in nature. Nevertheless, a precautionary approach is being taken in assuming a level of risk of water quality impacts and detailed mitigation measures are required to further minimise the risk of the proposed Project having any perceptible effect on water quality during construction.

There are a number of construction activities associated with the proposed Project across its extent that could generate significant levels of dust. Temporary dust emissions generated during construction have the potential to degrade sensitive habitats located in the ZoI of the proposed works, including those that otter may potentially utilise and/or their prey species may utilise. On a precautionary basis, it is considered possible that potential impacts may arise on otter in absence of mitigation.

Habitat degradation as a result of effects on surface water quality during construction has the potential to affect the species' conservation status and result in a likely significant negative effect, at a county geographic scale. The scale of this potential impact is precautionary given the temporary nature and scale of the proposed impact, the availability of suitable habitat for otter upstream of the proposed crossing points and the large number of records of otter across the study area.

Mitigation measures have been designed to protect water quality during construction (see Section 15.5.1.2.4).

Habitat Severance/Barrier Effect

The physical disturbance to the river channels and the associated riparian margins will result in the severance of river habitat, at least temporarily, during construction. This may also result in some level of barrier effect during construction works on all watercourses where works are proposed.

The construction activities associated with the proposed Project that are considered most likely to result in such impacts are the proposed works to be completed instream and/or along the bankside of any watercourses, such as those works described above under habitat loss (i.e. the construction of the proposed temporary/permanent bridges, outfalls on various watercourses and culverts on the Sluice River, the permanent diversion of the Turnapin Stream, a tributary of the Mayne River, the minor channel alternation works along the Santry River and the dewatering of the Royal Canal). The majority of these construction activities will be completed during normal day-time hours and generally their duration would be very short-term, apart from along the Royal Canal (e.g. the Broadmeadow and Ward Rivers viaduct is anticipated to be completed within 16 weeks) and as such they are considered unlikely to result in any significant effects on commuting and/or foraging otter as a result of habitat severance and/or barrier effect as otter are likely to become habituated to the altered landscape at these very localised sections of the affected watercourses. However, the only exception to this would be the temporary dewatering of the Royal Canal basin located between Lock 6 and Lock 5, which is required to facilitate the installation and removal of a temporary working platform. This is due to the extent of the affected area at this basin (i.e. c. 0.27ha in area and c. 215m in length), the magnitude and duration of the proposed dewatering (i.e. 6 months) and the relatively high level of otter activity recorded along the Royal Canal (based on surveys undertaken to inform this assessment as well as previous otter surveys undertaken along the canal (McCarthy Keville O'Sullivan Ltd., 2019; EcoServe, 2011; Flynn, Furney Environmental Consultants, 2009) compared to the other impacted watercourses. These proposed works may result in a temporary barrier effect as a result of habitat severance along the canal, which may impact the local otter population that utilise the canal for foraging and/or commuting along.

Whilst no signs of breeding otter were recorded c. 500m upstream and downstream of the Cross Guns Bridge during the survey, there is a known active otter holt present c. 3.3km downstream of the Cross Guns Bridge on the North Wall Quay near the MV Cill Airne floating restaurant downstream of where the Royal Canal flows into the River Liffey (Macklin *et al.*, 2019). It is possible that otter using this holt may utilise the Royal Canal for foraging/commuting along as it is located within the standard territorial

ranges of both female and male otter in Ireland[61]. If this is the case, otter would have to navigate around the existing canal Lock gate located north of the Scherzer rolling lift bridge at the mouth of the Royal Canal. Otter are known to regularly navigate around the existing Lock gates of the Royal Canal by going up on the bankside, around the Lock gate and down to the water (Eamon Horgan Waterways Ireland pers. comm., 2021) and therefore, it is possible that they may exhibit a similar behaviour at this location. In addition to this confirmed holt, a single potential otter holt was recorded c. 1.4km upstream of the Lock 6 near the existing Broome Bridge Railway Station in 2009 (Flynn, Furney Environmental Consultants, 2009). Considering this and the abundance of signs of otter along the Royal Canal, it is likely that breeding otter regularly utilise the extent of the Royal Canal as part of their territory, including the affected basin between Lock 6 and Lock 5.

The proposed dewatering of the Royal Canal basin for a six-month period could impact on the local otter population as a result of habitat severance and associated barrier effect. Whilst it is possible that otter could move from Lock 6 to Lock 5 on land along the existing towpath to the south of the proposed Project (Phibsborough Road), it is considered very unlikely that they would then attempt to cross the Cross Guns Bridge on Prospect Road in order to get to the Royal Canal east/west of Lock 5 due to the high volumes of traffic and general high levels of human-related disturbance (including during night-time hours) at that location. There is ample alterative suitable habitat available to the local otter population located upstream of Lock 6 (i.e. the Royal Canal is c. 145km in its total length and as such there is potentially c. 141.7km of alternative suitable habitat upstream of Lock 6 to the River Shannon in Longford where the Royal Canal ends). Similarly, if otter can navigate the existing canal Lock gate at the mouth of the Royal Canal, there is ample alternative suitable habitat available along the River Liffey.

This impact however could potentially to be significant if otter cannot navigate the existing canal Lock gate at the mouth of the Royal Canal and therefore are unable to access the River Liffey. Any otter breeding within that section of the canal between Lock 5 and Lock 1 could potentially be isolated to a territory of only c. 3.3km (i.e. from Cross Guns Bridge to the mouth of the Royal Canal), which is significantly less than the normal territorial ranges in riverine habitats in Ireland of c. 7.5km ±1.5km for female otter and c. 13.2km ±5.3km for male otter (Ó'Néill *et al.*, 2008). In absence of mitigation, the proposed dewatering of the Royal Canal as a result of the construction of the proposed Project and the subsequent severance of habitat and associated barrier effect could potentially impact on the local population resulting in a temporary significant negative effect on otter at a county geographic scale.

Habitat severance and barrier effect may also occur as a result of increased levels of disturbance. This potential impact on otter as a result of the proposed Project is examined below.

The mitigation measures that have been designed to avoid or reduce the effects of impacts to otter are in Section 15.5.1.4.

Disturbance/Displacement

There were no otter breeding places (i.e. holts) present within the ZoI of the proposed Project; however, two resting otter places (i.e. couches) were recorded on the northern and southern banks of the Royal Canal outside of the footprint of the proposed Project boundary however within its ZoI with respect to potential disturbance to otter. Signs of otter were recorded along the Broadmeadow River, Santry River and Royal Canal and there are known records of otter along the following watercourses located within the study area of the proposed Project: Broadmeadow River, Ward River, Cuckoo River, Mayne River, Santry River, Tolka River, Royal Canal, River Liffey and Grand Canal. An increase in human presence, noise, vibration and/or lighting associated with construction works at these locations has the potential to (at least temporarily) disturb and/or displace resting, commuting and/or foraging otter. No potential impacts on breeding otter as a result of disturbance and/or displacement are predicted as there are no holts present within the ZoI of the proposed Project.

[61] In Ireland, the territory of female otter in rivers is *c.* 7.5km ±1.5km in length (Ó'Néill *et al.*, 2008) and 6.5km ±1km in length in coastal environments (de Jongh *et al.*, 2010), while the territory of male otter in rivers is *c.* 13.2km ±5.3km in length with a high degree of variability due to territorial males responding quickly to social perturbation (Ó'Néill *et al.*, 2008).

Otter are known to tolerate human disturbance under certain circumstances (Bailey & Rochford, 2006, The Environment Agency, 2010, Irish Wildlife Trust, 2012). There are numerous records of otter within the urban Dublin area, which suggests a certain level of habituation to disturbance by otter (Macklin *et al.*, 2019). This is also demonstrated by the relatively high level of otter activity recorded along the Royal Canal during surveys undertaken to inform this assessment as well as previous otter surveys undertaken along the canal (McCarthy Keville O'Sullivan Ltd., 2019; EcoServe, 2011; Flynn, Furney Environmental Consultants, 2009). Similarly high levels of otter activity have been recorded in other urban environments, *e.g.* Glasgow city in Scotland where signs of otter (including breeding otter) were recorded within highly disturbed parts of the city which had been recently urbanised, again suggesting a certain degree of habituation to disturbance by otter in urban environments (Green & Green, 1997). Otter have been recorded in 80 cities and towns in England and their occurrence has been described as frequent or resident in 49 of those cities and towns (Chanin, 2003).

Otter are generally nocturnal in habit and as such any construction works undertaken during the hours of darkness that may alter the existing environmental conditions at the watercourses have the potential to impact on this species. Whilst the majority of construction works associated with the proposed Project will be undertaken during day light hours (i.e. from 07:00 to 19:00), there are specific elements of the construction located within the aboveground sections of the proposed Project that will involve night-time work and are likely to result in increased levels of disturbance at these specific locations. These include:

- Track installation along the entire alignment of the proposed Project, which will be undertaken 24 hours a day seven days a week;
- Construction compound at P&R Facility/Estuary station;
- Construction works at the DANP and DASP;
- Construction of the proposed Dardistown Depot, including its fit out;
- Construction compound at Northwood, which will be operational 24 hours a day seven days a week;
- Proposed works associated with the Glasnevin Interchange, north of the Royal Canal, including the proposed track lowering works along the Sligo/Maynooth line (i.e. the old MGWR) and GSWR (as described below with respect to impacts on resting otter); and,
- Main construction compound at the Griffith Park Station.

The installation of the track along the aboveground sections of the proposed Project will be undertaken over the Broadmeadow River, Ward River, Sluice River and Mayne River and within c. 21m of the Santry River. These works will be undertaken 24 hours a day seven days a week and therefore will include night-time working. Whilst there is potential for the disturbance and the associated displacement of otter from sections of these watercourses located adjacent to the proposed track installation works due to the associated higher levels of disturbance (in particular, at night-time), this impact will be very temporary and localised and as such no significant effects on any otter population at any geographic scale are predicted. The proposed track installation will be completed at a rate of c. 50m per day and therefore these works are likely to be completed within a period of three to six days – i.e. based on the ZoI of otter with respect to the proposed Project, which is c. 150m upstream and downstream of proposed crossing points of the Broadmeadow River, Ward River, Sluice River, Mayne River and Santry River.

The proposed construction compound at the Estuary Station is located c. 175m north of the Broadmeadow River and the proposed construction compound at Northwood is located c. 245m west/south-west of the Santry River directly west of the R108; therefore, proposed works at these locations are beyond the ZoI of potential impacts on otter. The proposed construction works at the underground Glasnevin Station will be undertaken during normal working hours (aside from the MEP[62] station works) and therefore no potential impacts on otter are predicted. The proposed track lowering works at the Glasnevin Interchange along the MGWR have the potential to impact on resting, commuting and/or foraging otter due to an increase in disturbance and displacement. The proposed lowering works will include night-time work, which will result in increased levels of disturbance potentially along the extent of the Royal Canal that is located within c. 150m of the MGWR (i.e. from east

[62] The MEP (mechanical, electrical and plumbing) station works will be generally confined to the interior of the built station.

of Lock 7 to east of Lock 4, c. 1.7km in length). Commuting and/or foraging otter may be temporary displaced from this section of the Royal Canal during these works.

Two otter couches were recorded at the following locations on the northern and southern banks of the Royal Canal, respectively:

- West of Lock 6 c. 80m south-west of the proposed lowering works along the Sligo/Maynooth line (i.e. the old Midland Great Western Railway, hereafter referred to as MGWR) at 14960c. 588m from the proposed construction site at the proposed Glasnevin Station located north-west of the Prospect Road, south of the Royal Canal Way; and,
- East of Lock 4 c. 120m south-east of the proposed lowering works along the MGWR at Ch. 14960 and c. 360m from the proposed construction site at the proposed Glasnevin Station.

These otter couches are therefore within the ZoI of the proposed Project with respect to the proposed lowering works along the MGWR and as such there is potential for the temporary disturbance and displacement of resting otter as a consequence of the proposed track lowering works along the MGWR during the construction of the proposed Project. These proposed lowering works will be undertaken over a series of 29 weekend possessions, 56 hours per possession and will include night-time work. Lighting will be required at night-time during these works; however, it will be confined to the immediate footprint of the construction works along the existing railway track, which is located c. 7.5m below the level of the Royal Canal at that location and is surrounded by walls c. 6.5m in height. The lighting will be directional and the existing high walls surrounding the track will provide screening, as such there is no potential for light spill on the Royal Canal (including these otter couches) to occur. Whilst there will be an increased level of human activity associated with these works, it will also be confined to the existing railway track and will be screened by the high walls surrounded the track and as such it will not be significant. The proposed track lowering works will result in a temporary increase in existing noise levels.

The proposed construction compound at the Griffith Park Station is located c. 40m north of the River Tolka and therefore within the ZoI of the potential impacts on otter. Whilst no signs of otter were recorded during surveys, there are records of otter spraint along the River Tolka, directly south of the proposed construction compound and confirmed otter holts located c. 6km upstream of this location at Ashtown (Macklin *et al.*, 2019). Considering the proximity of the proposed construction compound to the River Tolka and requirement for night-time works as the compound will be operational 24 hours a day seven days a week, there is potential for some level of disturbance to foraging and/commuting otter within that short section of River Tolka as a result of increases in noise, lighting and/or human activity during night-time hours. Whilst there may be some potential impacts on otter as a result of the increases in existing levels of disturbance associated with the proposed track lowering works and proposed construction compound at the proposed Griffith Park Station, no significant effects on resting, commuting and/or foraging otter are predicted at any geographic scale as otter are considered to be very flexible, including with regards to their usage of resting sites. For instance, otter resting sites have been recorded under roads, in industrial buildings, close to quarries and at other sites close to high levels of human activity, which suggests that they do not necessarily avoid or are significantly perturbed by disturbance associated with noise and/or human activity (Chanin, 2003). In addition, there is ample alternative suitable foraging and/or commuting habitat present along both the Royal Canal and River Tolka that may be utilised by any displaced otter.

The majority of the proposed construction works will be typically undertaken during normal daylight working hours when otter are at their least active due to their nocturnal habit. The proposed construction works which will require night-time work will either be located at a significant distance beyond the ZoI of the proposed Project on otter (*e.g.* Northwood Construction Compound) or will be very localised and short in their duration (*e.g.* track installation works). Low level lighting will be required to provide a safe environment for security personnel and pedestrians during the Construction Phase however, this will not increase the baseline light levels along features (i.e. watercourses) suitable for commuting and foraging otter. Therefore, considering these points and the ability of otter to tolerate certain levels of human presence and disturbance in urban environments, disturbance during construction is not likely to have a significant effect on the species' conservation status and will not result in a likely significant negative effect, at any geographic scale.

The proposed dewatering of the Royal Canal basin between Lock 6 and 5 is also likely to result in a temporary disturbance to otter. These proposed works are assessed above with regards to potential impacts on otter arising due to habitat severance and barrier effect.

Habitat Degradation – Hydrological Regime

Construction works at the proposed watercourse crossings of the proposed Project can have a temporary impact on the local flow and flooding regime. None of these are predicted to have any long-term effects that would give rise to a likely significant negative effect on otter through effects on the hydrological regime (for more detail refer to Section 18.5.3 of Chapter 18 (Hydrology).

15.4.2.4.2 Bats

Roost Loss

One bat roost was identified within the study area of the proposed Project, i.e. a private dwelling named "*St Anne's*" located north-east of the Charter School Hill Road in Ballymun c. 20m east of the Project Boundary at Ch. 9860 and c. 53m east of the proposed alignment at this location (see Figure 15.7 for location of this roost). This roost contained only one soprano pipistrelle bat and is likely to be a transitional/occasional bat roost. This roost is not located within the proposed Project boundary and therefore will not be demolished; however, it is located in close proximity of the proposed Project and as such there is potential for indirect impacts to occur during the Construction Phase arising from severance of connecting features and/or disturbance/displacement as a result of light spill (as discussed below).

A total of 22 trees within the proposed Project boundary were identified as having the potential to support roosting bats. Eight of these trees/tree groups will be felled (i.e. PRF2, PRF3, PRF4, PRF5, PRF10, PRF20, PRF21, PRF22), see Figure 15.7 for location of these trees). The potential impact of the permanent loss of these eight potential roost features is considered to be significant at a local geographic scale due to the likely relatively low number of bats utilising these structures and the availability of other such structures containing potential roost features in the wider area.

The majority of bats recorded across the survey area were common Irish species, i.e. common pipistrelle bat, soprano pipistrelle bat and Leisler's bat. In the case of both common pipistrelle bat and soprano bat, the identification of their hibernacula is extremely rare with only two confirmed hibernacula of common pipistrelle bat recorded in Ireland and only one of soprano pipistrelle bat (Roche *et al.*, 2014). The hibernacula of these species are often very difficult to identify as they are typically located within inaccessible areas of a building/structure. A study of common pipistrelle bat hibernacula in the city of Tilburg in the Netherlands used the swarming behaviour of this species in late summer to identify the general locations of their hibernacula, which typically comprised large apartment blocks with large (air-insulated) cavity walls and/or deep expansion crevices. Despite the identification of these general locations, it was found to be very difficult to confirm the actual location of the hibernacula within these buildings. Where roosts were identified, it was typically within expansion crevices between balcony floors and outer balcony walls (Korsten *et al.*, 2016).

Therefore, it is possible that hibernating bats may utilise buildings/structures that will be demolished as part of the proposed Project and as such, potential impacts on hibernating bats cannot be completely ruled out. Given the uncertainty as to the actual presence of hibernacula it is impossible to accurately assess the scale of this potential impact; however, it is considered likely that it will be no more than a local geographic scale impact on the basis that no other bat roosts were recorded within the footprint of the proposed Project (i.e. often common bat species hibernate in the crevices of buildings that they summer roost in).

A precautionary approach has been applied and mitigation measures to avoid or reduce any potential impacts to hibernating bats as a result of the construction of the proposed Project have been provided in Section 15.5.1.5.

Foraging and/or Commuting Habitat Loss

Bats rely on suitable semi-natural habitats which support the insect prey upon which they feed. The proposed Project will result in the loss of such habitats used for feeding by all bat species recorded in the study area.

Suitable habitat for foraging and/commuting bats within the study area of the proposed Project includes woodland, hedgerows and treelines, areas of mature trees including parkland, scrub, open grassland, rivers and drainage ditches. The loss of these habitats may result in a significant negative effect on local bat populations in the long-term due to the associated reduction in food resources and impacts on their commuting habitat.

A reduction in these feeding resources could potentially in turn result in a decline in the usage of a roost by bats located in the environs of the proposed Project boundary as they tend to feed close to their roost especially prior to giving birth when they need to save energy.

The UK Bat Conservation Trust (BCT) has published research results on the identification of Core Sustenance Zones (CSZs) for different bat species. A CSZ refers to the area surrounding a communal bat roost within which habitat availability and quality will have a significant influence on the "*resilience and conservation status*" of the colony using the roost. The 2016 guidance states that:

"With reference to planning and development the core sustenance zone is:

- *The area surrounding the roost within which development work can be assumed to impact the commuting and foraging habitat of bats using the roost, in the absence of information on local foraging behaviour. This will highlight the need for species-specific survey techniques where necessary.*
- *The area within which mitigation measures should ensure no net reduction in the quality and availability of foraging habitat for the colony, in addition to mitigation measures shown to be necessary following ecological survey work."*

The CSZs for the bat species recorded during the surveys and bat species of known roosts from the BCI database located within the ZoI of the proposed Project are listed below in Table 15.18 with an indication of the level of confidence attached to the zone size.

Table 15.18: Bat Species Recorded during Surveys and their Respective CSZ (Bat Species of Known Roosts from the BCI Database Located within the ZoI of the Proposed Project are Highlighted in Grey) (BCT, 2016)

Species	CSZ Radius (km)	Confidence in Zone Size
Common pipistrelle bat	2	Poor. Data available from multiple colonies but only from a single study.
Nathusius' pipistrelle bat	3	Poor. Calculation based on small sample size.
Soprano pipistrelle bat	3	Good. Calculation based on a reasonable sample size from multiple colonies and studies.
Leisler's bat	3	Moderate. Calculation based on multiple colonies and studies, but overall sample size is small.
Brown long-eared bat	3	Poor. No data on mean-maximum foraging distances available from the literature. In addition, the calculated weighted average (based on the number of bats used to calculate the CSZ) (3.45km) lies just below the threshold where it was rounded down to give a CSZ size of 3km.
Daubenton's bat	2	Poor. Data available from two studies but for a limited number of individuals. Also the weighted average mean-maximum foraging distance (1.78km), calculated using data from two studies, is less than the weighted average mean foraging distance (2.3km) calculated using data from four studies. This disparity suggests that CSZ size

Species	CSZ Radius (km)	Confidence in Zone Size
		is currently underestimated and additional data on mean-maximum foraging distances could increase the CSZ for this species.
Whiskered bat	1	Poor. Data available from multiple colonies but only for a single study for *M. mystacinus*.

Only one confirmed roost was identified during surveys undertaken to inform this assessment, i.e. one individual soprano pipistrelle bat located at St Anne's private dwelling located north-east of the Charter School Hill Road in Ballymun. This roost is located beyond the footprint of the proposed Project and will not be removed; however, its CSZ (with a radius of 3km and an area of c. 2,827ha) overlaps with the footprint of the proposed Project and as such it may be indirectly impacted on due to a reduction in the availability of suitable foraging habitat within its CSZ. According to the BCI database, there are 15 additional bat roosts with CSZs that overlap with the boundary of the proposed Project and are therefore potentially within the ZoI of the proposed Project. A reduction in the availability of suitable foraging habitat within these CSZ as a result of habitat loss arising from the proposed Project has the potential to indirectly impact on these bat roosts. These bat roosts include the following species: common pipistrelle (one roost[63]), soprano pipistrelle (three roosts), unidentified pipistrelle species (three roosts), Leisler's bat (four roosts), brown long-eared bat (one roost) and unidentified bat species (four roosts). There are no known roosts of Nathusius' pipistrelle bat in County Dublin and the nearest whiskered bat roost is located in Phoenix Park, c. 2.3km west of the proposed Project and therefore beyond its ZoI. A description of the relevant bat roosts, the amount of suitable foraging habitat to be lost as a result of the proposed Project located that is located within their theoretical CSZ and likelihood of significant impacts occurring is presented in Table 15.19 below.

The CSZ is a generic radial distance from a bat roost. Not all the habitats present within the CSZ of roosts described in Table 15.19 would provide suitable foraging habitat for bats. Bats will therefore not use all lands within the CSZ; they will selectively feed in the most resource-rich areas. This is considered in the assessment of the scale of significance with respect to habitat loss within the CSZ presented in Table 15.19, which is described in terms of impacts on individual roosts and then on the patterns of bat foraging according to bat activity data. The scale of significance of habitat loss during construction was therefore influenced by:

- The nature of the roost;
- Records of bats within the CSZ that may indicate concentrations of feeding within the CSZ which could suggest some areas being more important than others;
- Proportion of suitable habitat within CSZ; and,
- Potential for the proposed Project to form a barrier to reaching the remaining portions of the CSZ (i.e. whilst the loss of CSZ may be very small bats may not be able to reach it and consequently a larger proportion of the CSZ may actually be unavailable).

The habitat loss within these CSZ for the bat roosts is less than 1% of the overall area of the CSZ for 13 of the 17 roosts (for one roost it is 0%) and for the remaining four roosts the percentage of the total area of the CSZ is between 1.33% to 2.46%, which is still relatively low even in the context of a proportion of these CSZs being comprised of unsuitable foraging habitat for bats. As outlined in Table 15.19, there is no potential for impacts to occur as a result of habitat loss within the CSZ of any bat roost within the ZoI of the proposed Project at any geographic scale.

[63] Note that this roost is also a Leisler's bat roost.

Table 15.19: Extent of Direct Habitat Loss within the Theoretical CSZ Relating to Roosts Located within the ZoI of the Proposed Project

Species/No. of roosts	Location	Area of Habitat Loss within CSZ[64] /Location/Types of Habitats	% of CSZ[65]/Commentary on Suitability of Habitats Present within CSZ for Foraging Bats	Likely Significance of Impact of Habitat Loss
Confirmed Bat Roost Identified During Surveys				
Soprano pipistrelle (1 roost)	St Anne's Private Dwelling	c. 64.45ha Dardistown, Santry, Ballymun, Glasnevin and Albert College Park Habitat types include agricultural fields, the Mayne River, ditches, unimproved grassland, mature/immature woodlands, hedgerows, treelines, scrub and planted shrubs	c. 2.27% CSZ of this roost is dominated by both suitable habitats, such as woodland, hedgerows, treelines, parkland, and unsuitable artificial habitats, such as buildings and roads	The extent of habitat loss is somewhat low compared to the overall area of the CSZ. Whilst the CSZ contains both suitable and unsuitable habitat, the presence of the M50 Motorway to the north of the roost may restrict bats from utilising suitable habitat in Dardistown and Silloge Park Golf Club as bats are known to be perturbed by roads (Berthinussen & Altringham, 2012) and the M50 Motorway is lit at this location. Therefore, bats from the roost may be somewhat limited in the availability of suitable habitat, which would be restricted to Santry Demesne (and along the Santry River), unimproved grassland/ scrub along Oscar Traynor Road and Albert College Park in the south to south-east and Poppintree Park to the south-west. This roost only contained one bat and is likely to be a transitional/occasional bat roost; therefore, considering this and the availability of other suitable habitat south of the M50 Motorway, no likely significant effects are predicted at any geographic scale.
Bat Roosts (Records from BCI Database)				
Common pipistrelle bat (1 roost)	Grand Canal Dock, Dublin 2	c. 0.31ha Stephen's Green Park Habitat types include parkland,	c. 0.02% CSZ of this roost is dominated by unsuitable habitat, such as buildings and roads; however, there are areas of	The extent of habitat loss is extremely small especially in comparison to the extent of available suitable habitat in the CSZ even despite the CSZ being generally dominated by unsuitable habitat.

[64] The following habitat types were excluded from these calculations: buildings and artificial surfaces (BL3), spoil and bare ground (ED2), recolonising bare ground (ED3), refuse and other waste (ED5) and residential. The former four habitat types lack suitability for foraging bats, while residential may have suitable habitat it also contains built land and therefore this habitat type has been excluded.

[65] The percentage of the CSZ that the area of habitat loss corresponds to. The overall areas of the CSZs are as follows: CSZ with a radius of 1km is 314ha; CSZ with a radius of 2km is 1,257ha; CSZ with a radius of 3km is 2,827ha; and CSZ with a radius of 4km is 5,027ha.

Species/No. of roosts	Location	Area of Habitat Loss within CSZ[64] /Location/Types of Habitats	% of CSZ[65]/Commentary on Suitability of Habitats Present within CSZ for Foraging Bats	Likely Significance of Impact of Habitat Loss
		treelines and scattered trees	parkland (including Ringsend Park, Stephen's Green Park, Iveagh Gardens and Herbert Park), as well as the River Liffey and Grand Canal, which would provide suitable foraging habitat	Given the very urban nature of the CSZ it is considered unlikely that the area of habitat loss, which is located in the far south-western section of the roost's CSZ, would result in any severance in foraging/commuting habitat. Therefore, no likely significant effects are predicted at any geographic scale.
Soprano pipistrelle bat (2 roosts)	Earlsfort Terrace, Dublin 2	c. 1.31ha St Stephen's Green Park Habitat types include parkland, treelines and planted shrubs	c. 0.05% CSZ of this roost is dominated by unsuitable habitat, such as buildings and roads; however, there are areas of parkland (including Stephen's Green Park, Iveagh Gardens, Herbert Park, Eamonn Ceannt Park and Ringsend Park), as well as the River Liffey, Grand Canal, River Dodder and Royal Canal, which would provide suitable foraging habitat	The extent of habitat loss is extremely small especially in comparison to the extent of available suitable habitat in the CSZ even despite the CSZ being generally dominated by unsuitable habitat. Given the very urban nature of the CSZ it is considered unlikely that the area of habitat loss, which is located in relatively close proximity of the roost, would result in any severance in foraging/commuting habitat Therefore, no likely significant effects are predicted at any geographic scale.
Soprano pipistrelle bat (1 roost)	Clonskeagh, County Dublin	c. 0.27ha Stephen's Green Park Habitat types include parkland and treelines.	c. 0.01% CSZ of this roost is dominated by unsuitable habitat, such as buildings and roads; however, there are large areas of improved grassland such as playing pitches at UCD and various other second level education facilities. In addition, there are several golf clubs (e.g. Elm Park, Milltown and Castle Golf Clubs) and the River Dodder which	The extent of habitat loss is extremely small especially in comparison to the extent of available suitable habitat in the CSZ even despite the CSZ being generally dominated by unsuitable habitat. Given the suburban nature of the CSZ it is considered unlikely that the area of habitat loss, which is located at the edge of the CSZ boundary, would result in any severance in foraging/commuting habitat Therefore, no likely significant effects are predicted at any geographic scale.

Species/No. of roosts	Location	Area of Habitat Loss within CSZ[64] /Location/Types of Habitats	% of CSZ[65]/Commentary on Suitability of Habitats Present within CSZ for Foraging Bats	Likely Significance of Impact of Habitat Loss
			would provide suitable foraging habitat	
Soprano pipistrelle bat (1 roost)	Phoenix Park, Dublin 8	c. 1.95ha Lands at Royal Canal Habitat types include scrub, unimproved grassland, hedgerows and treelines	c. 0.07% CSZ of this roost is dominated by both suitable habitats, such as woodland and parkland (in particular, Phoenix Park), agricultural grassland, rivers and the Royal Canal, hedgerows and treelines, and unsuitable artificial habitats, such as buildings and roads (including Dublin Industrial Estate)	The extent of habitat loss is extremely small especially in comparison to the extent of available suitable habitat in the CSZ. The area of habitat loss (and the footprint of the proposed Project) is restricted to the far eastern extents of the CSZ beyond areas dominated by unsuitable habitat (i.e. a high-density residential area) and as such its removal is unlikely to result in any severance in foraging/commuting habitat. Therefore, no likely significant effects are predicted at any geographic scale.
Unidentified pipistrelle bat (1 roost)	North of Turvey Avenue, Turvey, County Dublin	c. 8.35ha Estuary, north of the Broadmeadow River Habitat types include agricultural grassland, unimproved grassland, cultivated lands, hedgerows and treelines	c. 0.66% CSZ of this roost is dominated by suitable habitat, such as woodland (in particular, at Newbridge Park), grassland fields with hedgerow/treeline boundaries, rivers and estuaries. There are some areas of unsuitable habitat (i.e. built ground), however these are relatively limited in their extent compared to the areas of suitable habitat. To note that as the species of pipistrelle is not known, the larger CSZ figure (i.e. 3km) was used to calculate the %.	The extent of habitat loss is extremely small especially in comparison to the extent of available suitable habitat in the CSZ. The area of habitat loss (and the footprint of the proposed Project) is restricted to the far south-western extent of the roost's CSZ beyond the existing M1 Motorway and as such its removal is unlikely to result in any severance in foraging/commuting habitat. Therefore, no likely significant effects are predicted at any geographic scale.

Species/No. of roosts	Location	Area of Habitat Loss within CSZ[64] /Location/Types of Habitats	% of CSZ[65]/Commentary on Suitability of Habitats Present within CSZ for Foraging Bats	Likely Significance of Impact of Habitat Loss
Unidentified pipistrelle bat (1 roost)	South of Turvey Avenue Turvey, County Dublin	c. 16.72ha Estuary, north of the Broadmeadow River Habitat types include agricultural grassland, unimproved grassland, cultivated lands, hedgerows and treelines	c. 1.33% CSZ of this roost is dominated by suitable habitat, such as woodland (in particular, at Newbridge Park), grassland fields with hedgerow/treeline boundaries, rivers and estuaries. There are some areas of unsuitable habitat (i.e. built ground), however these are relatively limited in their extent compared to the areas of suitable habitat. To note that as the species of pipistrelle is not known, the larger CSZ figure (i.e. 3km) was used to calculate the %.	The extent of habitat loss is extremely small especially in comparison to the extent of available suitable habitat in the CSZ. The area of habitat loss (and the footprint of the proposed Project) is restricted to the far south-western extent of the roost's CSZ beyond the existing M1 Motorway and as such its removal is unlikely to result in any severance in foraging/commuting habitat. Therefore, no likely significant effects are predicted at any geographic scale.
Unidentified pipistrelle bat (1 roost)	Forrest Little Golf Club, Swords, County Dublin	c. 30.97ha Swords, east and west of the R132, and in Dardistown Habitat types include agricultural grassland, unimproved grassland, amenity grassland, ditches, woodland, cultivated lands, hedgerow, treelines, scrub and planted shrubs	c. 2.46% CSZ of this roost is dominated by both suitable habitats, such as woodland (in particular, the Ward River Valley Park in Swords), agricultural grassland, rivers, hedgerows, treelines and parkland, and unsuitable artificial habitats, such as buildings and roads (including Dublin Airport) To note that as the species of pipistrelle is not known, the larger CSZ figure (i.e. 3km) was used to calculate the %.	The extent of habitat loss is extremely small especially in comparison to the extent of available suitable habitat in the CSZ. The area of habitat loss is generally located east of the centre of Swords along the R132 and in close proximity to the existing built-up urban environment generally dominated by buildings and hardstanding. The only exception to this is south-west of Pinnock Hill at lands located north and south of the Sluice River, which are more rural in nature compared to those located east of the centre of Swords. Given the availability of other suitable habitat, it is considered unlikely that its removal would

Species/No. of roosts	Location	Area of Habitat Loss within CSZ[64] /Location/Types of Habitats	% of CSZ[65]/Commentary on Suitability of Habitats Present within CSZ for Foraging Bats	Likely Significance of Impact of Habitat Loss
				result in any severance in foraging/commuting habitat. Therefore, no likely significant effects are predicted at any geographic scale.
Leisler's bat (1 roost)	Ratra House, Phoenix Park, Dublin 8	c. 0.68ha Lands at the Royal Canal Habitat types include treelines and scrub	c. 0.02% CSZ of this roost is dominated by both suitable habitats, such as woodland and parkland (in particular, Phoenix Park and the Tolka Valley Park), agricultural grassland, rivers and the Royal Canal, hedgerows and treelines, and unsuitable artificial habitats, such as buildings and roads (including Dublin Industrial Estate and the M50 Motorway)	The extent of habitat loss is extremely small especially in comparison to the extent of available suitable habitat in the CSZ. The area of habitat loss (and the footprint of the proposed Project) is restricted to the far eastern extent of the roost's CSZ beyond areas dominated by unsuitable habitat (i.e. a high-density residential area) and as such its removal is unlikely to result in any severance in foraging/commuting habitat. Therefore, no likely significant effects are predicted at any geographic scale.
Leisler's bat (1 roost)	Phoenix Park, Dublin 8	c. 3.35ha Lands at the Royal Canal Habitat types include Royal Canal, unimproved grassland, rivers and scrub	c. 0.11% CSZ of this roost is dominated by both suitable habitats, such as woodland and parkland (in particular, Phoenix Park and the Tolka Valley Park), agricultural grassland, rivers and the Royal Canal, hedgerows and treelines, and unsuitable artificial habitats, such as buildings and roads (including Dublin Industrial Estate)	The extent of habitat loss is extremely small especially in comparison to the extent of available suitable habitat in the CSZ. The area of habitat loss (and the footprint of the proposed Project) is restricted to the far north-eastern and eastern extents of the CSZ beyond areas dominated by unsuitable habitat (i.e. a high-density residential area) and as such its removal is unlikely to result in any severance in foraging/commuting habitat. Therefore, no likely significant effects are predicted at any geographic scale.
Leisler's bat (1 roost)	Rathfarnham, Dublin 6	c. 0.65ha Stephen's Green Park	c. 0.02% CSZ of this roost is dominated by	The extent of habitat loss is extremely small especially in comparison to the extent of available suitable habitat in the CSZ even despite the CSZ being

Species/No. of roosts	Location	Area of Habitat Loss within CSZ[64] /Location/Types of Habitats	% of CSZ[65]/Commentary on Suitability of Habitats Present within CSZ for Foraging Bats	Likely Significance of Impact of Habitat Loss
		Habitat types include parkland, treelines and planted shrubs	unsuitable habitat, such as buildings and roads; however, there are areas of suitable habitats, such as woodland and parkland (in particular, Phoenix Park, Stephen's Green Park and Herbert Park), and the Grand Canal and River Liffey which would provide suitable foraging habitat	generally dominated by unsuitable habitat. Given the urban nature of the CSZ it is considered unlikely that the area of habitat loss, would result in any severance in foraging/commuting habitat Therefore, no likely significant effects are predicted at any geographic scale.
Leisler's bat (1 roost)	Grand Canal Dock, Dublin 2	c. 0.65ha Stephen's Green Park Habitat types include parkland, treelines and amenity grassland	c. 0.02% CSZ of this roost is dominated by unsuitable habitat, such as buildings and roads; however, there are areas of parkland (including Ringsend Park, Stephen's Green Park, Iveagh Gardens and Herbert Park), as well as the River Liffey, Grand Canal, River Dodder, River Tolka and Royal Canal, which would provide suitable foraging habitat	The extent of habitat loss is extremely small especially in comparison to the extent of available suitable habitat in the CSZ even despite the CSZ being generally dominated by unsuitable habitat. Given the very urban nature of the CSZ it is considered unlikely that the area of habitat loss, which is located in the far south-western section of the roost's CSZ would result n any severance in foraging/commuting habitat. Therefore, no likely significant effects are predicted at any geographic scale.
Brown long-eared bat (1 roost)	Áras an uachtarain Phoenix Park, Dublin 8	c. 1.95ha Lands at the Royal Canal Habitat types include Royal Canal, hedgerow, grassland, treeline and scrub	c. 0.07% CSZ of this roost is dominated by both suitable habitats, such as woodland and parkland (in particular, Phoenix Park and the Tolka Valley Park), agricultural grassland, rivers and the Royal Canal, hedgerows and treelines, and unsuitable artificial habitats, such as	The extent of habitat loss is extremely small especially in comparison to the extent of available suitable habitat in the CSZ. The area of habitat loss (and the footprint of the proposed Project) is restricted to the far eastern extent of the roost's CSZ beyond areas of dominated by unsuitable habitat (i.e. a high-density residential area) and as such its removal is unlikely to result in any severance in foraging/commuting habitat.

Species/No. of roosts	Location	Area of Habitat Loss within CSZ[64] /Location/Types of Habitats	% of CSZ[65]/Commentary on Suitability of Habitats Present within CSZ for Foraging Bats	Likely Significance of Impact of Habitat Loss
			buildings and roads (including M50 Motorway)	Therefore, no likely significant effects are predicted at any geographic scale.
Unidentified bat species (1 roost)	Malahide, County Dublin	c. 9.39ha Swords, east and west of the R132 Habitat types include agricultural grassland, unimproved grassland, ditches, woodland, parkland, hedgerow, treelines, scrub and planted shrubs	c. 0.33% CSZ of this roost is dominated by suitable habitat, such as woodland (in particular, at Malahide Castle and in Kinsealy), grassland fields with hedgerow/treeline boundaries, rivers and estuaries. There are some areas of unsuitable habitat (i.e. built ground such as the M1 Motorway), however these are relatively limited in their extent compared to the areas of suitable habitat To note that as the species of bat is not known, the most common CSZ figure for bat species recorded in the study area (i.e. 3km) was used to calculate the %.	The extent of habitat loss is extremely small especially in comparison to the extent of available suitable habitat in the CSZ. The area of habitat loss (and the footprint of the proposed Project) is restricted to the far western extent of the roost's CSZ beyond the existing M1 Motorway and as such its removal is unlikely to result in any severance in foraging/commuting habitat. Therefore, no likely significant effects are predicted at any geographic scale.
Unidentified bat species (1 roost)	Santry Court, County Dublin	c. 64.45ha Dardistown, Santry, Ballymun and Albert College Park Habitat types include agricultural fields, the Mayne River, ditches, unimproved grassland, mature/immature woodlands,	c. 2.28% CSZ of this roost is dominated by both suitable habitats, such as woodland, hedgerows, treelines, parkland (including Santry Demesne), and unsuitable artificial habitats, such as buildings and roads (including Dublin Airport)	The extent of habitat loss is relatively low compared to the overall area of the CSZ. Whilst the CSZ contains both suitable and unsuitable habitat, the presence of the M50 Motorway to the north of the roost may restrict bats from utilising suitable habitat in Dardistown and Silloge Park Golf Club as bats are known to be perturbed by roads (Berthinussen & Altringham, 2012) and the M50 Motorway is lit at this location.

Species/No. of roosts	Location	Area of Habitat Loss within CSZ[64] /Location/Types of Habitats	% of CSZ[65]/Commentary on Suitability of Habitats Present within CSZ for Foraging Bats	Likely Significance of Impact of Habitat Loss
		parkland, hedgerows, treelines, scrub and planted shrubs	To note that as the species of bat is not known, the most common CSZ figure for bat species recorded in the study area (i.e. 3km) was used to calculate the %.	Whilst bats may not utilise these lands, there is ample suitable habitat located south of the M50 Motorway within the roost's CSZ that would be available to foraging bats from this roost, i.e. Santry Demesne (and along the Santry River) in the south to south-east, Poppintree to the south-west, lands surrounding Elmhurst Day Hospital and Nursing Home to south and Ellenfield Park to the south-east. Therefore, no likely significant effects are predicted at any geographic scale.
Unidentified bat species (2 roosts)	Clanbrassil Street, Dublin 8	c. 0.65ha Berkeley Road Park and St Stephen's Green Park Habitat types include amenity grassland, parkland and treelines	c. 0.02% CSZ of this roost is dominated by unsuitable habitat, such as buildings and roads; however, there are areas of parkland (including Stephen's Green Park, Iveagh Gardens and Herbert Park), as well as the River Liffey and Grand Canal, which would provide suitable foraging habitat To note that as the species of bat is not known, the most common CSZ figure for bat species recorded in the study area (i.e. 3km) was used to calculate the %.	The extent of habitat loss is extremely small especially in comparison to the extent of suitable habitat in the CSZ even despite the CSZ being generally dominated by unsuitable habitat. Given the very urban nature of the CSZ it is considered unlikely that the area of habitat loss, which is located in relatively close proximity of the roost, would result in any severance in foraging and/or commuting habitat. Therefore, no likely significant effects are predicted at any geographic scale.
Unidentified bat species (1 roost)	Rathgar, Dublin 14	0ha There will be no loss of suitable foraging bat habitat within the area of overlap between this bat roost's CSZ and the boundary of the	0% CSZ of this roost is dominated by unsuitable habitat, such as buildings and roads; however, there are areas of parkland and various	As there will be no loss of suitable foraging habitat within this CSZ of this roost as a result of the proposed Project, no potential impacts are predicted at any geographic scale.

Species/No. of roosts	Location	Area of Habitat Loss within CSZ[64] /Location/Types of Habitats	% of CSZ[65]/Commentary on Suitability of Habitats Present within CSZ for Foraging Bats	Likely Significance of Impact of Habitat Loss
		proposed Project. The habitat types to be lost at that location (i.e. at the proposed Charlemont station) include recolonising bare ground, buildings and artificial surfaces and residential.	golf courses, as well as the River Dodder corridor and Grand Canal, which would provide suitable foraging habitat. To note that as the species of bat is not known, the most common CSZ figure for bat species recorded in the study area (i.e. 3km) was used to calculate the %.	

Fragmentation of Foraging Habitat and Commuting Routes and Areas used by Bats for other Non-Roosting Activities[66]

Given that there is evidence of bats foraging and commuting within/across the study area of the proposed Project at multiple locations, and that a large portion of the aboveground sections of the proposed Project which contain suitable habitat are likely to be within the CSZ of at least one bat roost, there is the potential for the proposed Project to act as a barrier to flight paths for all species (with the exception of Leisler's bats which have been shown to fly at greater altitudes so as not to be affected by ground level features) and in all above ground locations.

The barrier effect can manifest itself as soon as the site clearance phase commences and the barrier itself is in the form of the cleared lands. Removal of hedgerows, treelines, woodland and scrub will take place across the length of the aboveground sections of the proposed Project. Whilst it is not proposed to remove all the vegetation within the proposed Project boundary, it has been assumed that intervention of some kind in the landscape may occur within the boundary such that it could affect bat behaviour, thereby assessing the worst-case scenario.

Interpretation of the patterns of bat activity records has indicated that potential barrier effects would be most significant albeit at a very local level at those areas located within the aboveground sections of the proposed Project which contain suitable foraging and/or commuting habitat for bats and at which relatively high levels of bat activity were recorded, i.e. at the proposed P&R Facility located north of the Broadmeadow River in Estuary and along the Broadmeadow River and Ward River corridors.

Mitigation to preserve flight paths across construction areas are detailed in Section 15.5.1.5.

Disturbance/Displacement

Bats are nocturnal in habit and as such any construction works undertaken during the hours of darkness that may alter the existing environmental conditions in areas of suitable habitat (including such habitat within the CSZ of bats roosts within the ZoI of the proposed Project) have the potential to impact on bats. Whilst the majority of construction works associated with the proposed Project will be undertaken during day light hours (i.e. from 07:00 to 19:00), there are specific elements of the construction located

[66] As fragmentation of feeding habitat has the potential to disturb normal bat behavioural patterns, and thus adversely affect the ability of local bat populations to persist and reproduce, impacting on their local distribution and/or abundance and thereby conflicting with Regulation 51(b) of S.I. 477.

within the aboveground sections of the proposed Project that will involve night-time work and are likely to result in increased levels of disturbance on bats as a result of increases in existing light levels. Additionally, hoarding lighting will be required to provide a safe environment for pedestrians and security personnel during night-time hours.

Disturbance to bats arising from lighting may result in changes to a bat's normal roosting, foraging and/or commuting behaviour. Lighting can impact on a bat's vision resulting in their disorientation. This impact is particularly significant when a bat is emerging from a roost post-dusk to feed as they tend to use sight rather than echolocate when exiting a roost. Therefore, lighting at an entrance of a roost may result in the delayed emergence of bats from it, which in turn may result in reduced periods of feeding. This is compounded by the fact that the peak abundance of nocturnal insects occurs at and/or soon after dusk and as such a delay in the emergence of bats at this vital time may significantly impact on their reproductive success and survival. In addition, lighting may also impact on flightpaths of bats to and from a roost, potentially resulting in bats taking my circuitous routes and in turn depleting energy reserves. Ultimately, these factors may result in a bat abandoning a roost. Lighting in a previously unlit area causes insects to congregate at the introduced light source (in particular, Ultraviolet [UV] emitting light sources) which in turn can alter the feeding behaviour of bats and may put bat species particularly sensitive to lighting at a significant competitive disadvantage compared to more tolerant species (such as Leisler's bat). Increased light levels may also increase a bat's vulnerability to predation and as such bats modify their behaviour to respond to this treat and in turn potentially reducing their reproductive success and survival (BCI, 2010; ILP & BCT, 2018).

All bat species found in Ireland have a low tolerance of light, however those species that were recorded during the surveys that have particularly low tolerance levels to light include brown-long eared, whiskered bat and Daubenton's bat (BCI, 2010). The occurrence of these species within the study area was very limited – both in terms of numbers and extent, i.e.: brown-long eared bat was recorded only at two locations (at fields in Estuary and CLG Na Fianna and Home Farm FC/in Griffith Park near the River Tolka); Daubenton's bat was recorded along the Broadmeadow River; and whiskered bat was only recorded along the Broadmeadow River and Royal Canal.

The proposed construction works that will require night-time work, and as such artificial lighting, include the following:

- Track installation along the entire alignment of the proposed Project, which will be undertaken 24 hours a day seven days a week;
- Construction compound at P&R Facility/Estuary Station
- Construction works at the DANP and DASP;
- Construction of the proposed Dardistown Depot, including its fit out;
- Construction compound at Northwood, which will be operational 24 hours a day seven days a week;
- Proposed works associated with the Glasnevin Interchange, north of the Royal Canal, including the proposed track lowering works along the MGWR) and GSWR; and,
- Main construction compound at the Griffith Park Station.

There are a number of areas located across the study area (including one roost at St Anne's private dwelling) that are considered to be particularly sensitive with respect to potential impacts on bats based on: the number of bat species and level of bat activity recorded during the surveys; the presence of suitable bat habitat; and the connectivity of this habitat to other areas of suitable bat habitat beyond the ZoI of the proposed Project. Often this habitat (especially south of the M50 Motorway) is surrounded by a highly urban environment and is somewhat fragmented and isolated from other areas of suitable habitat. Therefore, bats in the locality may be particularly vulnerable to any further disturbance and/or displacement impacts.

These sensitive areas are as follows:

- Lands at and adjacent to the proposed P&R Facility (i.e. along hedgerows/treelines), north and south of the Broadmeadow River and Ward River and adjacent to planted woodland within Balheary Park.

- River corridors and adjacent lands crossed by the proposed Project at the aboveground sections, in particular: Broadmeadow River, Ward River, Sluice and Mayne River;
- Hedgerow and treelines habitats within Dardistown;
- St Anne's private dwelling located north-east of the Charter School Hill Road in Ballymun and Santry Demesne (including the Santry River);
- Albert College Park;
- Griffith Park (including the River Tolka); and,
- St Stephen's Green

Potential impacts on bats present in these sensitive areas may occur as a result of disturbance associated within increased levels of lighting during construction. The proposed lighting within the construction compounds (i.e. at Estuary Station, Dardistown, Northwood and Griffith Park) is necessary for the duration of the Construction Phase (i.e. 9.25 years) to ensure safe working conditions during night-time hours and for security purposes. The proposed lighting will be designed such that it is positioned and directed away from any sensitive ecological features located beyond the construction compound, therefore avoiding any potential light spill. A Lighting Management Plan will be prepared by the contractor for each relevant location, and this will include details on how the lighting will be managed to avoid light spill. In absence of these design measures, likely significant effects on local bat populations could occur, at a local geographic scale.

The installation of track along the aboveground section of the proposed Project will occur through these sensitive areas, i.e. north and south of the Broadmeadow River, over the Ward River, Sluice River and Mayne River, through hedgerow and treeline habitat in Dardistown and in close proximity to St Anne's private dwelling and the Santry River. These works will be undertaken 24 hours a day seven days a week and therefore will include night-time working. Whilst there is potential for the disturbance and the associated displacement of bats from the immediate footprint of these works within these sensitive areas (with the exception of St Anne's private dwelling) as a result of the night-time work and increased lighting levels, this impact will be very temporary and localised and as such no significant effects on any bat population at any geographic scale are predicted. The proposed track installation will be completed at a rate of c. 50m per day and therefore these works are likely to be completed within a period of nights rather than weeks within these sensitive areas. In the case of St Anne's private dwelling, the proposed track installation is located at a distance from this sensitive area (i.e. c. 53m east of the proposed alignment) and the retained woodland located between the St Anne's private dwelling and the footprint of the proposed Project will provide screening for any potential indirect impacts arising from increased lighting associated with the proposed construction works at this location; therefore, no likely significant effects will occur.

The proposed construction compound at the P&R Facility/Estuary Station is located c. 175m north of the Broadmeadow River and as such it is located at a significant distance from these river corridors and adjacent woodlands such that no potential impacts are likely to occur. Bats (i.e. common pipistrelle, soprano pipistrelle, Leisler's bat and brown long-eared bat) were recorded foraging along the field boundaries located at the proposed P&R Facility, in particular along the hedgerow to the south-west along the existing road and the hedgerow within the field, and the level of activity was relatively high compared to elsewhere in the study area. Bats (i.e. common pipistrelle, soprano pipistrelle and Leisler's bat) were recorded foraging in the field boundaries at Dardistown, in particular along hedgerows and scrub at the southern and south-eastern end of Starlights GAA grounds, however the level of activity compared to elsewhere in the study area was relatively low. The proposed construction compound at Northwood is located c. 154m east of Santry Demesne and c. 245m west/south-west of the Santry River directly west of the R108 and therefore beyond the ZoI of potential impacts on bats at that location. Bats (i.e. common pipistrelle, soprano pipistrelle and Leisler's bat) were recorded foraging in close proximity to the proposed construction compound location, in particular along the treeline and scrub habitats to the far west and south of the proposed compound beyond its footprint, however the level of activity compared to elsewhere in the study area was relatively low. It is likely that bats foraging and/or commuting along habitats present within or immediately adjacent to the proposed P&R Facility/Estuary Compound, proposed Depot at Dardistown and the proposed Northwood Compound will be temporarily displaced due to associated increased levels of disturbance during construction (in particularly lighting). Whilst this impact will be reversible, its duration will be long-term as the

construction duration of the proposed Project at these locations is around nine years, an average lifespan of a bat species in Ireland.

It is unlikely though that this potential impact would be of such a magnitude that it would negatively affect the conservation status of the local bat species that were recorded at these locations (i.e. common pipistrelle, soprano pipistrelle and Leisler's bat are all considered to be of "*Least concern*" (Marnell *et al.*, 2019). This is due to the following reasons:

- All bat species present are very common species, that are of "*Least concern*" in terms of their conservation status, and included Leisler's bat, which is known to tolerate certain levels of light disturbance compared to other bat species (BCI, 2010);
- The overall level of bat activity was generally low compared to other locations within the study area. The only exception to this were the hedgerows located at the proposed P&R Facility;
- The availability of suitable alternative habitat beyond these locations that would provide suitable foraging habitat for any displaced bat (*e.g.* along the Broadmeadow River and Ward River corridors, west of Dardistown at Silloge Park Golf Club and within Santry Demesne, along the Santry River corridor);
- The existing levels of light disturbance at these locations, in particular at Dardistown and Northwood (i.e. Dublin Airport, QuickPark Dublin Airport carpark, the R108 (north and south of the M50 Motorway), at the and St Margaret's Road in Ballymun are all lit), which may explain the lower levels of bat activity at these locations; and,
- The proposed lighting will be designed such that it directed towards the construction yard rather than beyond its boundaries and it avoids light spill onto any nearby sensitive features (such as hedgerows used by bats).

The proposed lowering works at the Glasnevin Interchange along the MGWR have the potential to impact on commuting and/or foraging bats due to an increase in disturbance and displacement. Lighting will be required at night-time during these works; however, it will be confined to the immediate footprint of the construction works along the existing railway track, which is located c. 7.5m below the level of the Royal Canal at that location and is surrounded by walls c. 6.5m in height. The lighting will be directional and the existing high walls surrounding the track will provide screening, as such there is no potential for light spill on the Royal Canal to occur.

There will be no additional lighting which will increase the baseline light levels along features suitable for commuting and foraging bats at the following locations: Albert College Park and St Stephen's Green. Low level lighting may be required in these locations to provide a safe environment for security personnel and pedestrians; however, works will not be undertaken during night-time hours in these locations. Therefore, there is no potential for likely significant effects to occur.

15.4.2.4.3 Badger

A total of four badger setts were recorded across the survey area. None of which are located within the proposed Project boundary and only one (i.e. an annex badger sett located c. 24m south-west of the proposed ESBN cable north of the R139 at Belcamp) is located within the ZoI of the general construction activities (i.e. within 50m) based upon the impact distance bands described in the TII guidance (NRA, 2006a). All other setts are located more than 150m from the proposed Project and therefore beyond the ZoI of any potential pile driving or blasting works and any other construction activities. Piling and blasting works will only be required at the proposed underground stations, i.e. the Northwood Station to the Charlemont Station. Habitats within 150m of these locations are generally dominated by hardstanding of roads and buildings with relatively small areas of parkland and amenity grassland and as such are limited in terms of their suitability for breeding, foraging and/or commuting badger.

Although it cannot be predicted if badger will establish new setts within the ZoI of the proposed Project before construction works commence, it is a possibility, and this scenario has been taken into account in the mitigation strategy (refer to Section 15.5.1.6).

Loss of Foraging Habitat

Construction is likely to result in the permanent loss of foraging habitat within the territories of up to four badger groups across the study area (i.e. the loss of grassland, hedgerows, treelines, scrub and planted woodland located at lands north-west and east of Lissenhall, Fosterstown and north of the R139 at Belcamp). The extent of this direct habitat loss is relatively small in comparison to the extent of alternative available habitat in the local environment, which is likely to form part of the territorial ranges of these four badger populations. The territorial ranges of low to high density populations of badger in Ireland are between 0.26km^2 to 22km^2[67] (Kowalczyk *et al.*, 2006; Woodrooffe *et al.*, 2016). The loss of habitat is likely to affect each of the four badger groups to some degree, at least in the short-term as it will somewhat reduce the foraging area and feeding resource available within their existing territories. This reduction in resources may also result in increased conflict with neighbouring badger groups in competition for resources - although this territorial behaviour is a natural dynamic between neighbouring badger groups in response to many other factors that affect population numbers, territorial behaviour, and dispersion of individuals.

There is an abundance of alternative suitable foraging habitat locally which is likely to be sufficient to maintain the local population in the long-term. Although the actual effect of foraging habitat loss cannot be quantified in terms of any threshold value that could be predicted, each of the affected badger groups would be expected to adapt to the changed landscape. It is therefore predicted that, despite any short-term effects, the loss of foraging habitat associated with the proposed Project is unlikely to affect the conservation status of the local badger population and will not result in a likely significant negative effect, at any geographic scale.

Loss of Breeding/Resting Sites

The proposed Project will not result in the permanent loss of any badger sett identified during the surveys and therefore there is no potential for this impact to occur.

Disturbance/Displacement

In conjunction with any displacement effects associated with habitat loss, increased human presence, lighting and/or noise and vibration associated with construction works, has the potential to displace badgers from both breeding/resting places and from foraging habitat.

All identified badger setts are located outside of the proposed Project boundary and three of the four badger setts are located beyond the ZoI of the proposed Project (i.e. beyond c. 150m), there is one (i.e. an annex badger sett located c. 24m south-west of the proposed MetroLink grid connection north of the R139 at Belcamp) that is located within 50m of construction works and therefore, likely to be subject to temporary disturbance/displacement effects. Any disturbance/displacement impact is likely to be more significant during the badger breeding season (i.e. December to June inclusive) if the sett is in use at that time. If construction works are undertaken during the breeding season, this could result in the displacement of badgers from occupied setts, potentially affecting breeding success.

Badger are nocturnal animals and as such are most sensitive to disturbance during the hours of darkness. The majority of construction works undertaken within areas of suitable foraging habitat will be completed during normal daylight working hours with the exception of the proposed P&R Facility/Estuary station compound and the installation of track along the aboveground sections of the proposed Project, which will be undertaken 24 hours a day seven days a week and will require appropriate lighting to be completed safely. During the proposed track installation works, a portal type crane/gantry machine will lift the pieces of track and transport them to the laying point and a welding machine will join the tracks together. A noise barrier will also be required to reduce noise impacts. These proposed works are both located beyond the ZoI of badger setts identified within the survey area (i.e. the nearest sett to the proposed P&R Facility is c. 180m north and the nearest sett to the proposed track installation works is located at Fosterstown, c. 250m west of the alignment); however, they will take place in areas of suitable foraging habitat (i.e. agricultural fields, hedgerows, treelines, scrub and

[67] The territorial ranges of badger vary depending on the season and population size. It has been found that badger often move beyond their territorial ranges during all seasons (Byrne *et al.*, 2014); sometimes moving up to 8km beyond their home territory (Sleeman, 1992; Sleeman and Mulcahy, 1993)

planted woodland along the aboveground sections of the proposed Project). There is potential for a temporary displacement of badger from areas of suitable foraging habitat adjacent to these proposed works (i.e. outside of areas where foraging habitat will be lost as a result of the proposed Project), due to the increased levels of disturbance (including increased light and noise levels). In the case of the proposed track installation works this potential for significant impacts on local badger populations is considered to be very low due to the temporary localised nature of the proposed track installation, which will be completed at a rate of c. 50m per day as the crane/gantry gradually moves along the alignment (*e.g.* c. 1km of track may be installed over a 20-day period).

In addition to the track installation, the proposed construction compound at Fosterstown will be active 12 hours a day from 07:00 to 19:00 and therefore appropriate lighting will be required at these locations during the winter months only to safely complete the works (i.e. during the months when sunrise occurs after 07:00 and sunset occurs before 19:00). This lighting will be restricted to the perimeters of the construction compound and construction works. Hoarding lighting required to provide a safe environment for pedestrians and security personnel during the Construction Phase of the proposed Project will not increase the baseline light levels along features suitable for badger.

A recent six-and-a-half-year study examining the disturbance impacts of the N11 major road upgrade and realignment constructions on the movement of badger[68] in mixed farmland habitat in Co. Wicklow using GPS-tracking collars found that the construction roadworks had a very limited effect on the normal ranging behaviour of badger and that badger can adapt to considerable environmental disturbance resulting from major roadworks. While there was a small increase in nightly distance during works (i.e. a median increase of 197m), which suggests badger were disturbed to some extent by the construction works, it did not result in an increase in home range size or increase in distance or frequency of extraterritorial excursions during works. It also found that the measures implemented to mitigate impacts on badger (*e.g.* continuous badger-proof fencing and underpasses) were successful and key to the badger populations maintaining access to all parts of their territories (Gaughran *et al.*, 2020).

On a precautionary basis and in absence of mitigation, it is considered likely that the disturbance/displacement effects during construction could have the potential to negatively affect the conservation status of local badger groups/populations (at least in the short-term) and could result in a likely significant negative effect, at a local geographic scale.

Given the legal protection afforded to badgers under the Wildlife Acts, which prohibits their intentional killing or injury, or the wilful interference with their breeding or resting places, a mitigation strategy has been developed (see Section 15.5.1.6).

Severance/Barrier Effect

It is considered likely that the physical disturbance to the existing landscape during site-clearance and construction will result in some initial temporary severance of badger territories through which the proposed Project traverses.

However, given that badgers are nocturnal in habitat and works will be generally carried out during normal daylight working hours, affected badger groups would be expected to habituate to the altered landscape (as per the findings of the study by Gaughran *et al.* (2020)). In addition, there are significant existing barriers present within the aboveground sections of the proposed Project boundary, i.e. the R132, and in the surrounding environment of the proposed Project, i.e. the M1 Motorway, Dublin Airport and the M50 Motorway.

The severance/barrier effect of construction works will be temporary in nature and is not likely to affect the local population, over even the short-term, and will not result in a likely significant negative effect, at any geographic scale.

[68] The effects of disturbance caused by road construction on behaviour of badgers was considered by looking at each parameter of ranging behaviour, nightly distance travelled, home range size and distance and frequency of extra-territorial ranging. The construction works were three-and-a-half years in duration.

15.4.2.4.4 Other Mammal Species

Habitat Loss

The construction of the proposed Project will result in the permanent loss of mammal habitat within the boundary of the proposed Project. Given the relatively low numbers of individuals of each species that are likely to be affected (i.e. Irish hare, pine marten, wood mouse, red squirrel, Irish stoat, hedgehog, pygmy shrew, fox, rabbit and bank vole), and the abundance of alternative suitable habitat available locally, the effects of habitat loss associated with construction works are unlikely to affect the long-term viability of their local populations. Therefore, habitat loss is unlikely to affect the species' conservation status or result in a significant negative effect, at any geographic scale.

Mortality Risk

Site clearance works have the potential to result in the mortality of mammal species. The potential for impact would be expected to be greater during the breeding season when juveniles would be present in nests, or in the case of hedgehog impacts may be greater during their hibernation period. Given the relatively low numbers of individuals of each species that are likely to be affected, and that they are highly mobile species, site clearance is unlikely to result in a level of mortality that would affect the species' conservation status, and result in a significant negative effect, even at a local geographic scale.

Habitat Severance/Barrier Effect

As discussed above in relation to badgers, the presence of a new railway line at the aboveground sections of the proposed Project and the proposed P&R Facility and proposed depot has the potential to act as a permanent barrier to many other terrestrial mammal species by either acting as a physical barrier that mammals cannot cross or a behavioural barrier that mammals avoid and in turn resulting in the reduced mobility of local populations of each species.

The elevated sections of the proposed Project (*e.g.* the proposed bridge at the Broadmeadow River and Ward River and at the proposed overbridge and farm underpass at the entrance to McComish Ltd. industrial property) will serve to maintain habitat connectivity. Nevertheless, there will be lengths of the proposed Project that may act as a barrier to the movements of other terrestrial mammal species within the study area. This has the potential to have a long-term impact on local mammal population dynamics, affecting both local foraging behaviour and competition for resources and larger scale movements associated with dispersal and/or with breeding behaviour and genetic exchange between populations.

The habitat severance/barrier effect to these other terrestrial mammal species associated with the proposed Project has the potential to affect local mammal populations over the long-term and result in a significant negative effect, at a local geographic scale. Mitigation measures have been designed to minimise the long-tern effects of any barrier effect posed by the proposed Project (see Section 15.5.2.6).

Disturbance/Displacement

In conjunction with any displacement effects associated with habitat loss, increased human presence and/or noise and vibration associated with construction works, has the potential to displace mammal species from both breeding/resting places and from foraging habitat.

However, as disturbance will be intermittent and temporary (in the majority of locations) it is extremely unlikely to result in any long-term effects on the local mammal population or their conservation status. In addition, there is an existing relatively high level of human, noise and light disturbance within the immediate environment of the proposed Project (i.e. R132, Swords, Dublin Airport, M50 Motorway and Ballymun) and as such it is likely that mammal species present are habituated to a certain degree of disturbance. Therefore, disturbance/displacement during construction is unlikely to result in a significant negative effect, at any geographic scale.

Habitat Degradation - Water Quality

During construction, contaminated surface water runoff and/or an accidental spillage or pollution event into any surface water feature has the potential to have a significant negative impact on water quality in the Broadmeadow Water transitional waterbody, Mayne transitional waterbody and/or Dublin Bay and consequently an impact upon marine mammals located downstream; either directly (*e.g.* acute or sub-lethal toxicity from pollutants) or indirectly (*e.g.* affecting their food supply or supporting habitats).

However, it is considered unlikely that a pollution event of such a magnitude would occur during construction that would have any perceptible effect on water quality in the marine environment or be any more than temporary in nature. Nevertheless, a precautionary approach is being taken in assuming a level of risk of water quality impacts and detailed mitigation measures have been designed to further minimise the risk of the proposed Project having any perceptible effect on water quality during construction or affecting the conservation status of the marine mammal species in Broadmeadow Water transitional waterbody, Mayne transitional waterbody and/or Dublin Bay (see Section 15.5.1.2), resulting in a significant negative effect at a local to international geographic scale, in the case of marine mammals such as common porpoise, grey seal and harbour seal.

15.4.2.5 Invertebrates

15.4.2.5.1 White-clawed Crayfish

As the white-clawed crayfish is not present within the ZoI of the proposed Project, no potential impacts are predicted.

15.4.2.5.2 Freshwater Molluscs

Habitat Loss/Mortality Risk

Two rare freshwater mollusc species (i.e. glutinous snail and false orb pea mussel) were recorded in the Grand Canal. There is no potential for impacts on these two species to occur as a result of habitat loss and/or increased risk of mortality as the proposed Project at this location is underground.

Habitat Degradation – Water Quality

During construction, in particular the construction of the proposed Charlemont Station located directly south of the Grand Canal, contaminated surface water runoff and/or an accidental spillage or pollution event into any surface water feature has the potential to have a significant negative impact on water quality in the Grand Canal and impact on these rare mollusc species either directly (*e.g.* acute or sub-lethal toxicity from pollutants) or indirectly (*e.g.* affecting their food supply or supporting habitats).

All water discharges (including foul waters) from construction areas will be attenuated and treated prior to approved discharge to defined sewers. Such discharges from construction areas are likely to be high in sediment and have an elevated alkalinity where cement works are undertaken; therefore in absence of appropriate treatment and attenuation, the discharge of this groundwater into nearby surface water features could result in significant negative effects (as a result of changes in water quality and/or flow) on watercourses that they are discharged to. However, it is considered unlikely that a pollution event of such a magnitude would occur during construction or be any more than temporary in nature. Nevertheless, a precautionary approach is being taken in assuming a level of risk of water quality impacts and detailed mitigation measures are required to further minimise the risk of the proposed Project having any perceptible effect on water quality during construction.

Habitat degradation as a result of effects on surface water quality during construction has the potential to affect the species' conservation status and result in a likely significant negative effect, at a county geographic scale. The scale of the impact has been evaluated to be significant at the county geographic scale due to the presence of both glutinous snail and false orb pea mussel upstream of the proposed Project, i.e. maximum distances of c. 3.4km and c. 1.8km respectively (NBDC, 2021), and that any such impact is likely to occur only within the immediate vicinity of the proposed Project or downstream of it;

therefore it is likely to only impact on a proportion of the populations present on the Grand Canal. Mitigation measures have been designed to protect water quality during construction (see Section 15.4.1.2).

Habitat Degradation –Groundwater

The construction of the proposed Project has the potential to impact on groundwater levels, flow and/or quality. These impacts in turn have the potential to indirectly affect the quality and flow of surface water features; however no potential impacts on the Grand Canal are predicted given that there is no potential impact pathway. Groundwater will not be discharged to the Grand Canal during construction and as the Grand Canal is entirely sealed it is not susceptible to impacts associated with drawdown effects or barrier effects. As there will be no indirect impacts on the Grand Canal, there is no potential for subsequent impacts on the glutinous snail and false orb pea mussel.

Habitat Degradation – Hydrological Regime

Construction works at the proposed watercourse crossings of the proposed Project can have a temporary impact on the local flow and flooding regime. None of these are predicted to have any long-term effects that would give rise to a likely significant negative effect on freshwater molluscs through effects on the hydrological regime (for more detail refer to Section 18.5.3 of Chapter 18 (Hydrology).

15.4.2.6 Birds

15.4.2.6.1 Breeding Birds

The assessment carried out in the NIS for the proposed Project considered the potential for the proposed Project to affect the bird species listed as SCIs of European sites for their breeding populations. That assessment concluded that there was no possibility of likely significant effects on any breeding population to arise from the proposed Project. Therefore, for these species, the proposed Project will not affect the conservation status of the breeding bird populations and will not result in a likely significant negative adverse effect on the integrity of any European site and as such no likely significant effects at any geographic scale.

Habitat Loss and Loss of Breeding/Resting Sites (except that relevant to Annex I species kingfisher, and Red list species grey wagtail, meadow pipit, snipe, swift and yellowhammer, which are discussed separately below)

The proposed Project will result in the loss of breeding bird nesting and foraging habitat across the study area. The majority of bird species likely to be impacted by this direct habitat loss are common passerine bird species, such as those recorded during the breeding bird surveys across the entire study area. These species would be typically found in gardens and areas of planting and landscaping in urban/suburban environments. The areas of habitat loss within the proposed Project boundary are provided in Section 15.4.2.2 and tabulated in Table 15.17 for all KER habitat types. These areas comprise: a total area of c. 6.02ha of woodland, parkland and semi-natural grassland habitats; a total length of c. 462m of hedgerows and treelines habitat; and a total area of c. 1,275m^2 of temporary and 1,186m^2 of bankside/instream riverine habitats. In addition, there are areas of scrub, ornamental/non-native shrub, improved agricultural grassland, rough grassland, amenity grasslands, arable crops and earth banks habitats (c. 95.62ha in total area[69]) within the proposed Project boundary that will be lost. These habitat types are not KERs in their own right due to their limited botanical value, however, they may provide nesting and/or foraging habitat for birds. These areas will be removed during construction of the proposed Project resulting in a loss of breeding bird nesting and/or foraging habitat that is likely to be used by common passerine bird species. In summary, the habitats suitable for breeding and/or foraging birds that may be lost comprise:

[69] This does not include residential areas, which would comprise both suitable habitat (i.e. vegetation associated with a garden) and unsuitable built land habitat.

- Agricultural and semi-improved fields with hedgerow, treeline and/or scrub boundaries located north and south of the Broadmeadow River, at the proposed Seatown, Swords Central and Northwood stations, at the proposed crossing point on the Sluice River, at the proposed depot in Dardistown;
- Amenity grassland and parkland with hedgerow and/or treeline boundaries, mature woodland and/or ornamental shrubs located at the proposed Collins Avenue, Griffith Park, Mater and St Stephen's Green stations and the proposed ventilation shaft at Albert College Park; and
- Hedgerow, treeline and/or scrub habitat located along the proposed crossing points on the Broadmeadow River, Ward River, Sluice River, Mayne River and Santry River and at the proposed works at the Glasnevin Interchange.

The primary consequence of habitat loss will be increased competition for resources (*e.g.* nesting habitat or prey/food source) both between and amongst breeding bird species. The magnitude of this effect will be largely defined by many unquantifiable factors such future land-use changes and whether the local habitat resource has currently reached its carrying capacity or not in terms of breeding bird species.

The habitat areas that will be lost as a result of the proposed Project, in particular those areas located from the proposed P&R Facility to lands north of Dublin Airport and lands at the proposed depot in Dardistown, form a relatively small part of larger expanses of similar habitat types and mosaics in the wider locality. These large areas of suitable breeding bird nesting and/or foraging habitat available in the wider locality of the proposed Project (i.e. from c. 0.3km to 2km from these existing sites located within the footprint of the proposed Project) include:

- Agricultural fields with hedgerow, treeline and/or scrub boundaries located at lands beyond the Broadmeadow River, west of Fosterstown (including the Forrest Little Golf Club), east of Barrysparks, south of the Broadmeadow Estuary east of the M1 Motorway, and in the wider area near Dardistown, both east of the M1 Motorway and beyond Silloge Park Golf Club to the west; and
- Areas of scrub and woodland located upstream of the proposed crossing point on the Broadmeadow River and east of the R132 in Lissenhall Demesne, north of Broadmeadow Estuary, west of Swords along the Ward River Valley Park and within Santry Demesne downstream of the Santry River.

The extent of these areas of suitable habitat in the wider environment (i.e. between c. 300m to 2km from the aboveground sections of the proposed Project) is c. 2,464ha in total area, which is significantly greater than the total area of suitable habitat to be lost as a result of the proposed Project.

The following protective land-use zonings currently apply to the majority of these areas of suitable habitat located in the wider environment, as set out in *Fingal Development Plan 2017-2023* (FCC, 2017) and *Dublin City Development Plan 2016-2022* (DCC, 2016), and as such it is anticipated that the habitats present within these areas will remain unchanged and will continue to provide suitable alternative habitat for local populations of breeding birds:

- "*OS – Open Space*" [70] (FCC, 2017)
- "*HA – High Amenity*" [71] (FCC, 2017)
- "*GC – Green Belt*" [72] (FCC, 2017)
- "*RU – Rural*" [73] (FCC, 2017)
- "*Zone Z9: Amenity/Open Space Lands/Green Network*" [74] (DCC, 2016)

The majority of birds recorded during the breeding bird surveys were common species that typically utilise a range of habitat types for breeding and foraging and are therefore considered to be less

[70] The land zoning objective of "*OS – Open Space*" is to "*preserve and provide for open space and recreational amenities*" (FCC, 2017).
[71] The land zoning objective of "*HA – High Amenity*" is to "*protect and enhance high amenity areas*" (FCC, 2017).
[72] The land zoning objective of "*GB – Green Belt*" is to "*protect and provide for a greenbelt*" (FCC, 2017).
[73] The land zoning objective of "*RU - Rural*" is to "*Protect and promote in a balanced way, the development of agriculture and rural related enterprise, biodiversity, the rural landscape, and the built and cultural heritage*" (FCC, 2017).
[74] The land zoning objective of "*Zone Z9: Amenity/Open Space Lands/Green Network*" is "*to preserve, provide and improve recreational amenity and open space and green networks*" (DCC, 2016).

sensitive to habitat loss compared to species with specific habitat requirements. None of the habitat areas to be lost are unique to the locality and, either individually or collectively, are not likely to support a significant proportion, or the only population, of any given breeding bird species locally. Although a temporary decline in overall breeding bird abundance could potentially occur at a very local level (i.e. the footprint of the proposed Project where habitat loss will occur), this is unlikely to affect the local range of the breeding bird species present nor is it likely to affect the ability of these breeding bird populations to maintain their local populations in the long-term. Mitigation measures will be implemented to reduce the effects of habitat loss on breeding bird species locally (see Section 15.5.1.9).

Habitat Loss and Loss of Breeding/Resting Sites (relevant to Annex I species kingfisher and Red list species grey wagtail, meadow pipit, snipe, swift and yellowhammer)

Kingfisher

Kingfisher was recorded along the Broadmeadow River during the breeding bird surveys and the Broadmeadow River and Ward River during the vantage point survey. There are also desktop records of this species on the Broadmeadow River and Tolka River (NBDC, 2021). Suitable kingfisher nesting habitat typically comprises tall vertical banks with soft material into which they can dig their burrows. In addition to the presence of suitable banks, the following factors also influence the overall suitability of river systems for kingfisher: water quality, availability of suitable perches and adequate fish populations (Cummins *et al.*, 2010). There is no suitable nesting habitat for kingfisher located within the footprint of the proposed Project and as such there is no potential for direct nesting habitat loss to occur. The closest area of suitable nesting habitat to the proposed Project is located directly east of the R132 on the southern banks of the Ward River and Broadmeadow River (i.e. where the Ward River flows into the Broadmeadow River, c. 38m west of the proposed Project).

Whilst there is no suitable nesting habitat, there is suitable foraging and/or commuting habitat for kingfisher located within the footprint of the proposed Project (i.e. along the Broadmeadow River and Ward River directly west of the R132, where kingfisher have been recorded). The extent of instream and bankside habitat loss along the Broadmeadow River and Ward River as a result of proposed construction works is extremely minimal (i.e. it is confined to the construction of the proposed discharge points, c. 20m^{2}per discharge point), especially in the context of the extent of suitable habitat available to foraging and/or commuting kingfisher beyond this location within the same river corridors. There are desktop records of this species along the Tolka River (NBDC, 2021); however, the Tolka River is located beyond the footprint of the proposed Project and as such direct habitat loss will not occur at this watercourse as a result of the proposed Project.

Grey wagtail

Grey wagtail was recorded at the Royal Canal basin between Lock 6 and Lock 5 and at a pond located within Stephen's Green Park west of the proposed Project during the breeding bird surveys. This species was also recorded along the Ward River and Tolka River during the habitat surveys. Grey wagtail typically nests in rock crevices/cavities present in stone walls located beside water (such as those associated with bridges and mill foundations) (Svensson, 2009). No nests of this species were recorded during the surveys; however, there is suitable habitat present at the walls of the Royal Canal and Tolka River. The Tolka River and the pond at St Stephen's Green are both located beyond the footprint of the proposed Project and as such there is no potential for direct impacts to occur. There are significant construction works proposed adjacent to and at the Royal Canal, including the dewatering of the basin where grey wagtail were recorded, however no nests were confirmed to be present and as such there is no potential for impacts to occur.

Meadow pipit

Meadow pipit were recorded in four locations across the study area during the breeding bird surveys, i.e.: a grassland field located south-east of the R132 at Barrysparks (overall total across all three visits was four individuals; recorded during two visits), along hedgerow boundaries in Dardistown (overall total across all three visits was six individuals; recorded during two visits), a rough grassland field in Ballymun located west of the R108 (overall total across all three visits was 13 individuals; recorded during one

visit), and the beyond the footprint of the proposed Project at Glasnevin Cemetery, north of the MGWR (overall total across all three visits was three individuals; recorded during one visit). This ground-nesting species typically breeds in open country, on heaths and moors coastal meadows pastures and bogs (Svensson, 2009). Dry meadows and grassy verges (rough grassland) and other grassland/pasture habitat types, which may also be suitable for nesting meadow pipit, were generally common across the entire study area. The extent of these habitat types across the study area is likely to be somewhat representative of the extent of these habitat types in the wider environment and may provide an indication regarding the availability of suitable nesting habitat for meadow pipit beyond the footprint of the proposed Project.

There will be no habitat loss at the Glasnevin Cemetery as it is located beyond the footprint of the proposed Project. There will be habitat loss at Ballymun to facilitate the proposed Northwood construction compound; however, this will not be permanent, i.e. it will be in place for the entire duration of the construction of the proposed Project (i.e. 9.25 years) and the existing habitats will be reinstated after construction. There will be permanent habitat loss west of R132 at Barrysparks to facilitate the construction of the proposed alignment and proposed Swords Central Station; however, this will be restricted to the footprint of the proposed Project (i.e. grassland, scrub and hedgerows c. 8ha in total area) where two of the four individual meadow pipits were recorded, which is only a section of the overall field and therefore c. 23.5ha of the remaining field will still be available for nesting meadow pipit (where the majority of meadow pipit where recorded)[75]. There will also be permanent habitat loss at Dardistown to facilitate the construction of the proposed depot.

Meadow pipit are considered to be one of Ireland's commonest birds, often found in rough pastures and uplands. The number of individuals recorded during the breeding bird surveys (a maximum of four, six, 13 and three individuals in the four respective locations) are somewhat comparable to peak counts of this species recorded at similar sites in north County Dublin/south-east Co. Meath surveyed as part of Birdwatch Ireland's Countryside Bird Survey[76]. Considering the relatively low numbers and infrequency of meadow pipit recorded during the surveys in the context of the wide distribution of this species across Ireland and the likely presence of similar habitat (in particular dry meadows and grassy verges) in the wider environment beyond the ZoI of the proposed Project, it has been determined that loss of habitat as a result of the proposed Project will not impact on the conservation status of this species and will therefore not result in any significant effects on this species at any geographic scale.

Snipe

Snipe were recorded at a field located west of the R108, south of St Margaret's Road in Ballymun during the breeding bird surveys. This area is where the proposed Northwood construction compound will be located and as such it will be subject to habitat loss, albeit on a temporary basis for a period of eight years after which the existing habitats will be reinstated. Snipe are a ground-nesting species that typically breed in marshes, bogs and/or damp meadows in areas of grassy dense tussocks where their nests can be well concealed (Svensson. 2009). This habitat type (i.e. wet grassland) was somewhat limited in its extent across the study area, only recorded at this location in Ballymun where snipe were recorded and at two locations in Swords (i.e. south-east of the R132 at Barrysparks and west of the R132 at Fosterstown). Dry meadows and grassy verges habitat type, which may also be suitable for nesting snipe, was generally common across the entire study area.

[75] It should be noted however that this area of suitable land located beyond the footprint that will not be subject to habitat loss is currently zoned as "*ME – Metro Economic Corridor*" and "*HT – High Technology*" (FCC, 2017) and as such it may be developed in in the future as part of separate development applications. This is considered in Chapter 30 (Cumulative Impacts of Interaction between other Projects and MetroLink).

[76] The Countryside Bird Survey (CBS) is a national monitoring programme of breeding birds in Ireland that is co-ordinated by Birdwatch Ireland and funded by NPWS. As part of CBS, multiple 1km grid squares across Ireland are surveyed for the presence of breeding birds (including their peak counts). There are four such squares located in north Co. Dublin and south-east Co. Meath (i.e. O1050, O1060, O2050 and O2060) that contain similar habitat types (i.e. agricultural/rough grasslands) to those which are being lost as a result of the construction of the proposed Project. Meadow pipit has been somewhat regularly recorded at each of these squares and relatively high peak counts ranging from a peak count of one to 12 birds recorded during a survey. For more information on CBS and the results see (accessed 2 July 2021): https://birdwatchireland.ie/our-work/surveys-research/research-surveys/countryside-bird-survey/ https://www.arcgis.com/home/webmap/viewer.html?webmap=8fa9a97fedfd4435ab4985a976326cd2&extent=-11.9357,50.9977,-0.444,54.7542

The extent of these habitat types across the study area is likely to be somewhat representative of the extent of these habitat types in the wider environment, i.e. wet grassland being not that common while rough grassland being more common and may provide an indication regarding the availability of suitable nesting habitat for snipe beyond the footprint of the proposed Project. According to the NBDC database, snipe are somewhat widely distributed across north Dublin, with records near Belcamp and Phoenix Park (NBDC, 2021); however it does not appear to be a commonly recorded species. The conservation status of this species has recently changed from an Amber list species (Colhoun & Cummins, 2013) to a Red list species (Gilbert *et al.*, 2021) due to severe declines in its breeding and wintering populations in Ireland[77] and as such it is considered to be a species of high conservation concern (Gilbert *et al.*, 2021).

During the breeding bird surveys, only two individuals of this species were flushed from the grassland during the second visit. This species was not recorded during any of the other two visits, which suggests that there are relatively low numbers of breeding snipe likely to be present at this location that will be subject to habitat loss. Considering the low numbers and infrequency of snipe recorded during the surveys in the context of the wide distribution of this species across Ireland, the likely presence of similar habitat (in particular dry meadows and grassy verges) in the wider environment beyond the ZoI of the proposed Project and that habitat loss at that specific location will not be permanent (i.e. eight years and therefore, a medium-term effect), it has been determined that loss of habitat as a result of the proposed Project will not impact on the conservation status of this species and will therefore not result in any significant effects on this species at any geographic scale.

Swift

Swift were generally recorded within parkland located adjacent to the more urban, built-up locations of the study area (i.e. Santry Demesne, Albert College Park, north of the Royal Canal, St Stephen's Green and Dartmouth Square), with the only exception of an agricultural field located west of Estuary. According to NBDC database, there are records of Swift across the study area and the wider area, including in Swords west of the R132, Santry, Phoenix Park and Mountjoy (NBDC, 2021). Swift generally nests in the ventilation shafts, cracks present in walls, under convex roof tiles and/or in church towers and they regularly use the same year after year, exhibiting strong fidelity to their nest sites (Svensson, 2009; Gilbert *et al.*, 2021) when they migrate to Ireland from tropical Africa during the months of April towards mid-August. They are commonly found in urban environments and are generally widespread across Ireland. During an extensive swift survey undertaken across the administrative area of DCC in 2014, a total of 75 nests were identified within 51 locations; the closest of which is located downstream of the proposed Glasnevin Station in Ballybough (Caffrey & Coombes, 2014). No nests were recorded during any of the surveys. The conservation status of this species has recently changed from an Amber list species (Colhoun & Cummins, 2013) to a Red list species (Gilbert *et al.*, 2021) due to severe declines in its breeding population in Ireland over the short-term[78] and as such it is considered to be a species of high conservation concern (Gilbert *et al.*, 2021).

A number of buildings/structures will be removed as a result of the proposed Project, however none of which contain nesting swifts (i.e. none were identified during the survey and there are no known swift nest records for the affected buildings). Swift generally forage for insects while in the air (Svensson, 2009). Although the proposed Project will result in the loss of habitats which support insect species, swifts forage over a wide area and therefore, there is no potential for impacts to arise as a result of loss of breeding and/or foraging habitat.

Yellowhammer

Yellowhammer were regularly recorded in hedgerows, treelines and scrub present along field boundaries in Estuary at the proposed P&R Facility (a total of eight individuals across the season recorded), along the Sluice River north of Dublin Airport (a total of four individuals across the season

[77] This decline in breeding snipe populations in Ireland has been identified in both the short-term (defined as a *c.* 25-year period, mainly from 1998 to 2018) and the longer term (defined as the entire period used for the assessment of the conservation status of birds in Ireland, i.e. since *c.* 1980) (Gilbert *et al.*, 2021).

[78] This decline in breeding swift population in Ireland has been identified in the short-term (defined as a *c.* 25-year period, mainly from 1998 to 2018) (Gilbert *et al.*, 2021).

recorded) and in Dardistown (a total of 18 individuals across the season recorded), during the breeding bird surveys across the entire season. Male and female pairs of yellowhammer were recorded at all three locations, suggesting that these areas are breeding territories of this species. These areas will be subject to habitat loss as a result of the construction of the proposed Project. The extent of habitat loss will be extensive and permanent at both the proposed P&R Facility and the proposed depot at Dardistown, while habitat loss along the Sluice River will be restricted to the treeline and therefore considered to be less significant compared to that at Estuary and Dardistown.

Yellowhammer are known to nest in farmland, bushy areas, woodland edges, wooded pasture, glades and clearings, on heaths and coastal meadows (Svensson, 2009). During the surveys, this species was recorded in hedgerows/hedge-banks, treelines and scrub generally present along improved agricultural/crop grasslands. These habitats are generally common across the study area and also beyond the ZoI of the proposed Project (as described above with respect to common passerine bird species). According to the Birdwatch Ireland website[79], the distribution of yellowhammer in Ireland is generally restricted to the east coast of Ireland where it is widespread and especially common in fields located between Balbriggan and Laytown in north County Dublin, which appears to be a strong hold for this species in Ireland. According to the NBDC database, there are records of yellowhammer in Rogerstown Estuary, Malahide Estuary and west of Forrest Little Golf Club in Swords. The conservation status of this species is Red list due to its severe declines in the long term (Gilbert *et al.*, 2021) that is generally associated with an increase in the intensification of agricultural management which has led to a more homogenous farmland landscape result in severe reductions in farmland biodiversity (Colhoun *et al.*, 2017).

The removal of breeding habitat for yellowhammer as a result of the proposed Project is considered likely to result in a significant negative effect on this species at a local geographic scale due to the following reasons:

- The extent of habitat loss arising from the proposed Project (in particular at Dardistown) in the context of the typical size of a male yellowhammer's territory[80];
- The number of individuals recorded during the breeding bird surveys (a maximum of eight, four and 18 individuals in the three respective locations), which are somewhat comparable to peak counts of this species recorded at similar sites in north County Dublin/south-east Co. Meath surveyed as part of Birdwatch Ireland's Countryside Bird Survey[81];
- The restricted national distribution of this species to the east of Ireland (in particular its strong-hold of north County Dublin); and,
- Its Red list conservation status.

The scale of this impact is considered to be not higher than local due to the availability of suitable habitat in the wider environment, beyond the ZoI of the proposed Project, and the total number of breeding pairs likely to be affected (i.e. more than likely four pairs in total as one pair was recorded in Estuary and Sluice River and two pairs in Dardistown).

Mortality Risk (Relevant to all Bird Species)

If site clearance works were to be undertaken during the bird breeding season (i.e. March to August, inclusive) it is likely that nest sites holding eggs or chicks will be destroyed and birds killed. Areas of suitable nesting habitat are described above under the assessment of habitat loss on breeding birds. Mortality of birds at the scale of the proposed Project, over what is likely to be a single breeding bird

[79] Species description of yellowhammer in Ireland (accessed on 1 July 2021): https://birdwatchireland.ie/birds/yellowhammer/
[80] The mean territory size of a male yellowhammer is c. 0.78ha (Golawski & Dombrowski, 2002).
[81] The Countryside Bird Survey (CBS) is a national monitoring programme of breeding birds in Ireland that is co-ordinated by Birdwatch Ireland and funded by NPWS. As part of CBS, multiple 1km grid squares across Ireland are surveyed for the presence of breeding birds (including their peak counts). There are four such squares located in north Co. Dublin and south-east Co. Meath (i.e. O1050, O1060, O2050 and O2060) that contain similar habitat types (i.e. agricultural lands) to those which are being lost as a result of the construction of the proposed Project. Yellowhammer has been regularly recorded at each of these squares (in the case of three of these squares yellowhammer has been recorded each year it has been surveyed) and relatively high peak counts ranging from a peak count of seven to 16 birds recorded during a survey. For more information on CBS and the results see (accessed 2 July 2021):
https://birdwatchireland.ie/our-work/surveys-research/research-surveys/countryside-bird-survey/
https://www.arcgis.com/home/webmap/viewer.html?webmap=8fa9a97fedfd4435ab4985a976326cd2&extent=-11.9357,50.9977,-0.444,54.7542

season in terms of completing site clearance works, will probably have a short-term effect on local breeding bird population abundance. However, in the longer-term this would be unlikely to affect the ranges of the breeding bird species recorded in the study area nor would it be likely to affect the long-term viability of the local populations. Mortality of birds during site clearance works is not predicted to affect the conservation status of any of the breeding bird species present within the study area at any geographic scale. Nevertheless, a precautionary approach is being taken and detailed mitigation measures are proposed to minimise the risk of breeding bird mortality during construction.

Disturbance/Displacement (Relevant to all Bird Species)

The noise, vibration, increased human presence and the visual deterrent of construction traffic associated with site clearance and construction will disturb breeding bird species and is likely to displace breeding birds from habitat areas adjacent to the proposed Project boundary. However, there is an existing relatively high level of human disturbance within the immediate environment of the proposed Project (i.e. R132, Swords, Dublin Airport, M50 Motorway and Ballymun) and as such it is likely that breed species present are habituated to a certain degree of disturbance. The magnitude of the impact will be dependent on the type of construction works and their duration; general construction activities will have a less pronounced affect than blasting, in terms of its ZoI, but will be on-going from periods of several months to several years and breeding seasons. Although it is not possible to quantify the magnitude of this potential impact (or the potential effect zone) it could potentially extend for several hundred metres from the proposed Project. Given the temporary to short-term nature of the construction works, disturbance or displacement effects will also be over the short-term and are therefore not likely to affect the conservation status of breeding bird species and will not result in a likely significant negative effect, at any geographic scale.

Habitat and Food Source Degradation – Water Quality

During construction, contaminated surface water runoff and/or an accidental spillage or pollution event into any surface water feature has the potential to have a significant negative impact on water quality and consequently an impact on breeding bird species; either directly (*e.g.* bird species coming into direct contact with pollutants) or indirectly (*e.g.* acute or sub-lethal toxicity from pollutants affecting their food supply or supporting habitats). The effects of frequent and/or prolonged pollution events in an aquatic system have the potential to be extensive and far-reaching and could potentially have significant long-term effects. Breeding bird species recorded during the surveys[82] that may be vulnerable to such a potential impact due to their habitat and feeding requirements are as follows:

- Coot, cormorant, mallard, tufted duck and mute swan;
- Herring gull and lesser black-backed gull;
- Grey wagtail; and
- Kingfisher.

All water discharges (including foul waters) from construction areas will be attenuated and treated prior to approved discharge to defined sewers. Such discharges from construction areas are likely to be high in sediment and have an elevated alkalinity where cement works are undertaken; therefore in absence of appropriate treatment and attenuation, the discharge of this groundwater into nearby surface water features could result in significant negative effects (as a result of changes in water quality and/or flow) on watercourses that they are discharged to and habitats present downstream of the discharge point. However, it is considered unlikely that a pollution event of such a magnitude would occur during construction or be any more than temporary in nature. Nevertheless, a precautionary approach is being taken in assuming a level of risk of water quality impacts and detailed mitigation measures are required to further minimise the risk of the proposed Project having any perceptible effect on water quality during construction.

Habitat degradation as a result of effects on surface water quality during construction has the potential to affect the species' conservation status and result in a likely significant negative effect, at a local

[82] To note that this section assesses potential water quality impacts on non-SCI populations of the species outlined below. Impacts on SCI populations are assessed in the NIS accompanying this application for the proposed Project.

geographic scale in the case of all the relevant species recorded during the breeding bird surveys (as listed above), apart from kingfisher, which is an Annex I species and as such this potential impact may affect its conservation status resulting in a likely significant negative effect at a national geographic scale. Mitigation measures have been designed to protect water quality during construction (see Section 15.5.1.2).

Habitat Degradation – Hydrological Regime

Construction works at the proposed watercourse crossings of the proposed Project can have a temporary impact on the local flow and flooding regime. None of these are predicted to have any long-term effects that would give rise to a likely significant negative effect on any breeding bird species through effects on the hydrological regime (for more detail refer to Section 18.5.3 of Chapter 18 (Hydrology).

15.4.2.6.2 Wintering Birds

This section of the impact assessment deals with wintering bird species, i.e. those bird species which are listed on either the BoCCI Red or Amber lists for their wintering populations. The assessment carried out in the NIS for the proposed Project considered the potential for the proposed Project to affect the bird species listed as SCIs of Malahide Estuary SPA, Baldoyle Bay SPA, North Bull Island SPA, South Dublin Bay and River Tolka Estuary SPA, Rogerstown Estuary SPA, Ireland's Eye SPA, Lambay Island SPA and Skerries Islands SPA for their wintering populations. That assessment concluded that the proposed Project would not affect their wintering bird colonies or have any long-term effects on the local wintering populations. Therefore, for these species, the proposed Project will not affect the conservation status of the wintering bird populations and will not result in a significant adverse effect on the integrity of the European site and as such no likely significant effects at any geographic scale.

Habitat Loss (Geese, Waders and Waterfowl)

Potential impacts may arise due to the direct loss of feeding and/or roosting habitat (c. 82.49ha in total area, habitats comprising improved agricultural grassland, amenity grassland, dry calcareous and neutral grassland and arable crops) as a result of the construction of the proposed Project.

The relatively low frequency of occurrence of these wintering bird species on lands located both within the footprint of the proposed Project and within the 300m study area suggests that these species do not regularly use or rely upon these lands as foraging and/or roosting habitat. The peak flocks of each respective wintering bird species recorded at these sites are also relatively low, in particular when compared to 1% of their international[83] flyway and national populations (see Table 15.20 for details on all relevant wintering bird species).

In all cases, the peak flocks of each wintering bird species recorded within the study area was significantly lower than their corresponding 1% of their international population (i.e. the peak flocks recorded range from 0.02% to 7.64% of their corresponding 1% international population). Whilst the peak flocks of wintering bird species recorded within the study area were not as significantly lower than their corresponding 1% of their national population, they were all less than 47% of their corresponding 1% national population.

[83] According to Birdwatch Ireland I-WeBS Interpretive Notes, a wetland is considered to be of international importance if it regularly supports 1% of the relevant international, or flyway, population.

Table 15.20: Peak Flock of Wintering Bird Species Recorded Within the Study Area of the Proposed Project in Comparison to the 1% of its International and National Populations (those highlighted in grey were recorded within the footprint of the proposed Project)

SCI Bird Species Recorded	Nearest European Site	Corresponding I-Webs Site	Peak Count Recorded at Site (Within Footprint/Study Area)	1% of International Population	1% of National Population	Mean Peak Count from Nearest European Site
Black-headed gull	North Bull Island SPA	0U404 Dublin Bay	28 (within footprint) 170 birds (within 300m)	20,000	n/a	2,170
Black-tailed godwit	Malahide Estuary SPA	0U408 Broadmeadow (Malahide) Estuary	84 (within footprint/300m)	610	190	229
Curlew	North Bull Island SPA	0U404 Dublin Bay	106 (within footprint) 165 (within 300m)	8,400	350	993
Golden plover	Baldoyle Bay SPA	0U403 Baldoyle Bay	33 (within footprint/300m)	9,300	1,200	366
Light-bellied brent goose	Malahide Estuary SPA	0U408 Broadmeadow (Malahide) Estuary	113 (within 300m)	400	360	4,602
Oystercatcher	Malahide Estuary SPA	0U408 Broadmeadow (Malahide) Estuary	7 (within footprint) 38 (within 300m)	8,200	690	1,171
Teal	North Bull Island SPA	0U404 Dublin Bay	14 (within 300m)	5,000	340	1,158

Table 15.21: Peak Flock of Wintering Bird SCI Species not Connected to SPA Populations Recorded within the Study Area of the Proposed Project in Comparison to the 1% of its International and National Populations (those highlighted in grey were recorded within the footprint of the proposed Project)

SCI Bird Species Recorded	Nearest European Site[84]	Corresponding I-Webs Site	Peak Count Recorded at Site (Within Footprint/Study Area)	1% Of International Population[85]	1% of National Population	Mean Peak Count from Nearest European Site
Coot	n/a	0U408 Broadmeadow (Malahide) Estuary	11 (within 300m)	15,500	190	0
Grey heron	Wexford Harbour and Slobs SPA	0O401 Wexford Harbour and Slobs	1 (within footprint)	5,000	25	12

[84] The nearest European site is provided to clarify that these wintering bird species are not connected to any European site population due to the extensive distance between where they were recorded and the nearest European site for which they are a SCI species.
[85] The mean peak count of each SCI bird species recorded in the SPA is based on the most recent 5-season period available (i.e. within the period of 2008/2009 to 2017/2018). Accessed on the 2 July 2021 via the Birdwatch Ireland website, i.e.: https://c0amf055.caspio.com/dp/f4db30005dbe20614b404564be88

SCI Bird Species Recorded	Nearest European Site[84]	Corresponding I-Webs Site	Peak Count Recorded at Site (Within Footprint/Study Area)	1% Of International Population[85]	1% of National Population	Mean Peak Count from Nearest European Site
Little grebe	Wexford Harbour and Slobs SPA	0O401 Wexford Harbour and Slobs	3 (within 300m)	4,700	20	27
Mallard duck	Dundalk Bay SPA	0Z401 Dundalk Bay	26 (within 300m)	53,000	280	881
Mute swan	n/a	0U408 Broadmeadow (Malahide) Estuary	2 (within 300m)	100	90	65
Tufted duck	Lough Derravarragh SPA	0W010 Lough Derravaragh	61 (within 300m)	8,900	270	402

There are large areas of suitable foraging and/or roosting habitat (i.e. c. 1,828ha in total area) available for these wintering bird species in the wider locality of the proposed Project (i.e. beyond the 300m study area, from c. 0.3km to 2km from these existing sites located within the footprint of the proposed Project) including:

- Predominantly agricultural fields located north-west, north, north-east and south of the Broadmeadow River, north of the Ward River and east of the M1 Motorway towards and adjacent to Malahide Estuary SPA (c. 1,295ha in total area);
- Agricultural fields located west of Fosterstown (including Forrest Little Club) and east of Barrysparks in Swords, in particular those located south of Malahide Estuary SPA, (c. 303ha in total area);
- Agricultural fields in the wider area near Dardistown, located east beyond the M1 Motorway (c. 491ha in total area) and west of the proposed Project, beyond the Silloge Park Golf Club (c. 215ha in total area); and,
- Playing pitches at Santry Demesne (c. 15ha in total area).

It is very likely that these wintering bird species currently utilise these and other suitable lands in the wider area to a similar and/or greater intensity.

Therefore, in consideration of these factors, the loss of suitable foraging and/or roosting habitat within the proposed Project boundary that is utilised by wintering birds will not affect the conservation status of any wintering bird species and will not result in a likely significant negative effect, at any geographic scale.

Habitat Loss (All other species, including Annex I species kingfisher and Red List species kestrel, meadow pipit, redwing, snipe and yellowhammer)

During the wintering bird surveys the following Red List species (that are not geese, waders or waterfowl) were recorded within the study area:

- Kestrel – one bird flying over rough grassland in Ballymun;
- Kingfisher – one bird perched by the Broadmeadow River
- Meadow pipit – numerous fields at Estuary, Barrysparks, Fosterstown and Dardistown (peak count 15 individual birds);
- Redwing – In fields at Estuary and Barrysparks (peak count 15 individual birds);
- Snipe – near Barrysparks, south of the River Sluice, within numerous fields at Dardistown and at Dardistown (peak count six individual birds); and,

- Yellowhammer – fields in Dardistown during the wintering bird surveys (peak count 17 individual birds).

In the case of kestrel, meadow pipit and yellowhammer, their conservation status relates to breeding populations and not wintering populations (Gilbert *et al.*, 2021) and as such it is considered unlikely that the loss of wintering habitat would impact on the conservation status of these species, especially considering the availability of suitable habitat in the surrounding environment.

Kingfisher was only recorded on one occasion. The extent of instream and bankside habitat loss along the Broadmeadow River as a result of proposed construction works is extremely minimal (i.e. it is confined to the construction of the proposed discharge points, c. 20m^2 per discharge point), especially in the context of the extent of suitable habitat available to foraging and/or commuting wintering kingfisher beyond this location within the same river corridor. Therefore, no potential impacts are likely to occur as a result of habitat loss.

The conservation status of redwing (a common winter visitor to Ireland) recently changed from Green List to Red List as it is now considered to be a "*European species of global conservation concern*" (BirdLife International, 2017). Redwing are known to utilise a range of different habitats during the winter (i.e. fields, woodland edges and parkland (Svensson, 2009). Considering that this species was only recorded at two locations on one occasion, the abundance of suitable habitat within the wider environment of the proposed Project and its wide distribution across Ireland (NBDC, 2021), no potential impacts are likely to occur as a result of habitat loss.

Snipe were recorded widely across the study area on numerous occasions however in relatively low numbers (i.e. average number present during a visit was one individual bird). In winter, snipe are usually found in small muddy patches, pool margins, ditches, seashores and pastures (Svensson, 2009). Despite snipe being frequently recorded across the study area, it is considered unlikely that potential impacts would occur as a result of loss in wintering habitat. This is due to the relatively low numbers present, the availability of suitable wintering habitat in the wider environment (in particular, dry meadows and grassy verges) and its wide distribution across Ireland.

Disturbance/Displacement (All Wintering Bird Species)

Disturbance and/or displacement to wintering birds may arise due to temporary increases in noise, vibration, lighting and/or human activity at foraging and/or roosting sites as a result of activities associated with the construction of the proposed Project (including blasting at proposed underground station locations). These potential impacts are most likely to occur at suitable lands located within and/or immediately adjacent to the footprint of the proposed Project and will result in the temporary displacement of wintering bird species to other suitable lands in the locality (such as those described above under habitat loss). These potential impacts are associated with general construction activities (*e.g.* visual impact of construction workers and machinery and the associated vibration and more constant/continuous noise levels and impulse noise disturbance from infrequent noise sources with a high noise level, such as blasting, which will only occur at the proposed underground station locations). Following the completion of the construction of the proposed Project, disturbance levels will likely return to the existing baseline conditions and as a result these lands, that are not subject to habitat loss, will become available again as foraging and/or roosting habitat for the wintering bird species that currently use them.

The majority of wintering bird species recorded during the surveys are likely to night-time roost either on top of existing buildings (*e.g.* herring gull) or at the downstream coastal/estuarine sites and as such it is considered unlikely that increases in lighting (as a result of night-time construction work) would result in any impacts on wintering birds as they would be located beyond the ZoI of the proposed Project. Given that the bird species present within the footprint of the proposed Project were generally recorded within or adjacent to areas with relatively high levels of human activity (i.e. Balheary playing pitches north-west of the Seatown roundabout, grassland at Barrysparks directly south-west of the R132, grassland at Dardistown directly west of the Quick Park Dublin Airport carpark and grassland at Ballymun directly west of the R108), it is likely that they are habituated to a relatively high level of disturbance from human activity and as such the increased human presence associated with the construction of the

proposed Project is unlikely to cause a significant effect on any wintering bird species present. The source of disturbance arising from the construction of the proposed Project likely to be most perturbing to wintering birds present within the ZoI of the proposed Project is increases in existing noise levels.

The current understanding of construction related noise disturbance to wintering waterbirds is based on the research presented in Cutts *et al.* (2009) and Wright *et al.* (2010). In terms of construction noise, levels below 50dB would not be expected to result in any response from foraging or roosting birds. Noise levels between 50dB and 70dB would provoke a moderate effect/level of response from birds (i.e. birds becoming alert and some behavioural changes occurring (*e.g.* reduced feeding activity), but birds would be expected to habituate to noise levels within this range. Noise levels above 70dB would likely result in birds moving out of the affected zone or leaving the site altogether. At c. 300m, typical noise levels associated with construction activity (i.e. BS 5228-1: 2009, BSI, 2008) are likely to have attenuated to generally below 60dB or, in most cases, are approaching the 50dB threshold. As such, disturbance effects for general construction activities across the majority of the proposed Project would not be expected to extend beyond a distance of c. 300m, as noise levels associated with general construction activities would attenuate to close to background levels at that distance and beyond.

There are a number of specific locations identified during the surveys that are likely to be particularly sensitive to noise impacts due to the wintering bird species recorded at these locations and presence of suitable foraging/roosting habitat. These locations and the potential for impacts to occur are as follows:

- Malahide Estuary[86] (located c. 490m east of the proposed Project) and saltmarsh habitat adjacent to the Broadmeadow Water transitional waterbody (located c. 235m east of the proposed Project). This location is sufficiently set back from the proposed Project (with adequate screening) such that noise generated from the construction of the proposed Project will not contribute in any way to the existing noise levels at this specific location (which are currently between 65-69 dB during the day and between 55-59 dB and 60-64dB during night-time[87]) and therefore no potential impacts on the wintering bird species that utilise this location will occur.
- Broadmeadow River and Ward River located directly east of the proposed Project.
- Various locations within and adjacent to the footprint of the proposed Project where flocks of wintering bird species that typically feed inland were recorded:

- Balheary playing pitches and Fingallians GAA playing pitch, located within the footprint of the proposed Project and directly east of the R132. Given the proximity of these playing pitches to the footprint of the proposed Project, it is likely that wintering bird species utilising this location will be disturbed and displaced in the medium-term as a result of the proposed construction works.
- Field at Barrysparks, located partially within the footprint of the proposed Project at the Swords Central station. Given the proximity of this field to the footprint of the proposed Project, it is likely that wintering birds utilising this location will be disturbed and displaced in the medium-term for a period of 46 months as a result of the proposed construction works. The existing noise levels at this location are significantly less compared to along the R132, where the proposed Swords Central Station is located (i.e. 50dB to 54dB compared to 60 dB to 64dB to 55 dB to 59dB). It is predicted that the proposed construction works along the R132 and at the proposed Swords Central Station will not contribute to the existing noise levels in the wider area and as such it is likely that the majority of this field will remain suitable for foraging/roosting wintering birds during the Construction Phase of the proposed Project88.
- Large field south-east of the depot at Dardistown, north of the M50 Motorway. Given the proximity of this field to the footprint of the proposed Project, it is likely that wintering birds utilising this location89 will be disturbed and temporarily displaced in the medium-term for a

[86] To note that impacts on Malahide Estuary SPA are assessed separately in the NIS accompanying the application for the proposed Project (Scott Cawley, 2022)

[87] The existing noise levels are based on EPA datasets that include modelled noise contours associated with major roads in Dublin, including the M1 Motorway, M50 Motorway, R132 and R108: "*Noise Round 3 Road – Lden*" and "*Noise Round 3 Road - Lnight*", available on the EPA MapViewer (accessed 4 July 2021): https://gis.epa.ie/EPAMaps/.

[88] It should be noted however that this area of suitable land located beyond the footprint that will not be subject to habitat loss is currently zoned as "*ME – Metro Economic Corridor*" and "*HT – High Technology*" (FCC, 2017) and as such it may be developed in in the future as part of separate development applications. This is considered in Chapter 30 (Cumulative Impacts of Interaction between other Projects and MetroLink).

[89] Species recorded within this area included: black-headed gull, curlew, golden plover, herring gull, mallard, meadow pipit, snipe and yellowhammer.

period of 81 to 97 months as a result of the proposed construction. It is possible that the existing noise levels within this section of the field will remain unchanged as a result of the proposed Project. The existing day time noise levels at this location are very high, ranging from 70dB to 74dB (directly north of M50 Motorway and directly south of Dublin Airport[90]) to 65dB to 69dB.

- Known inland feeding sites for wintering bird species (not included in the list above):

- Glasnevin/DCU playing pitches, located c. 200m west of the intervention shaft at Albert College Park. This location is sufficiently set back from the proposed Project (with adequate screening provided by the existing buildings/structures) such that noise generated from the construction of the proposed Project will not contribute in any way to the existing noise levels at this specific location and therefore no potential impacts on the wintering bird species that utilise this location will occur.
- Glasnevin/St Vincent's Primary School located directly north of Project Boundaryat Glasnevin. The construction of the proposed Glasnevin Station and the proposed track lowering works will result in the temporary increase in the existing noise levels at that location. With regards to the construction of the proposed Glasnevin Station, the predicted noise levels at this inland feeding site (with the inclusion of the standard 3m hoarding and based on the various stages of construction) are calculated as 60dB to 45dB, with predicted noise levels within the majority of the site being between 55dB to 45dB and the predicted noise levels quickly attenuated to lower levels. The nearest baseline noise monitoring locations to this area have been measured with a daytime noise level of 50dB to 52dB LAeq. The predicted noise levels are not significantly greater than existing noise levels located in close proximity to the site (i.e. at Dalcassian Downs, c. 35m east) are 55dB to 59dB and they gradually increase to 70dB to 74dB along the R108. Therefore, the predicted noise levels at this site are not significantly greater than these current existing noise levels in the general area.
- Kilmore/Oscar Traynor Football Pitches (near MetroLink grid connection routes)

- Blessington Street Basin located c. 70m south-west of the proposed Mater Station. This location is sufficiently set back from the proposed Project (with adequate screening provided by the existing buildings/structures) such that noise generated from the construction of the proposed Project will not contribute in any way to the existing noise levels at this specific location and therefore no potential impacts on the wintering bird species that utilise this location will occur.

The temporary displacement of wintering birds from the Balheary playing pitches, the Fingallians GAA playing pitch and fields at Dardistown as a result of the construction of the proposed Project causing increased levels of noise disturbance is not considered likely to result in any significant effects on any populations. This is due to:

- The relatively low frequency of occurrence of wintering birds within these lands, suggesting that they do not regularly use or rely upon these lands as important foraging and/or roosting habitat;
- The peak flocks of wintering birds recorded being somewhat low in comparison to their respective 1% of their international[91] flyway and national populations (see Table 15.20 for details); and
- The large availability of suitable foraging and/or roosting habitat for wintering birds in the wider locality (i.e. beyond the 300m study area, from c. 0.3km to 2km from the existing sites, as described above under habitat loss).

Therefore, in consideration of these factors, an increase in short-term disturbance or displacement effects will not affect the conservation status of any wintering bird species and will not result in a likely significant negative effect, at any geographic scale.

[90] The existing noise levels are based on EPA datasets that include modelled noise contours associated with major roads in Dublin, including the M1 Motorway, M50 Motorway, R132 and R108, "*Noise Round 3 Road – Lden*" and the modelled noise contours associated with Dublin Airport "*Noise Round 3 Airport - Lden*", available on the EPA MapViewer (accessed 4 July 2021): https://gis.epa.ie/EPAMaps/.

[91] According to Birdwatch Ireland I-WeBS Interpretive Notes, a wetland is considered to be of international importance if it regularly supports 1% of the relevant international, or flyway, population.

Habitat Degradation – Surface Water Quality (All wintering bird species)

During construction, contaminated surface water runoff and/or an accidental spillage or pollution event into any surface water feature has the potential to have a significant negative impact on water quality and consequently an impact on wintering birds; either directly (*e.g.* bird species coming into direct contact with pollutants) or indirectly (*e.g.* acute or sub-lethal toxicity from pollutants affecting their food supply or supporting habitats). The effects of frequent and/or prolonged pollution events in a river system have the potential to be extensive and far-reaching and could potentially have significant long-term effects.

All water discharges (including foul waters) from construction areas will be attenuated and treated prior to approved discharge to defined sewers. Such discharges from construction areas are likely to be high in sediment and have an elevated alkalinity where cement works are undertaken; therefore in absence of appropriate treatment and attenuation, the discharge of this groundwater into nearby surface water features could result in significant negative effects (as a result of changes in water quality and/or flow) on watercourses that they are discharged to and habitats present downstream of the discharge point. However, it is considered unlikely that a pollution event of such a magnitude would occur during construction or be any more than temporary in nature. Nevertheless, a precautionary approach is being taken in assuming a level of risk of water quality impacts and detailed mitigation measures are required to further minimise the risk of the proposed Project having any perceptible effect on water quality during construction.

Habitat degradation as a result of effects on surface water quality during construction has the potential to affect the species' conservation status and result in a likely significant negative effect, at a local geographic scale. Mitigation measures have been designed to protect water quality during construction (see Section 15.5.1.2).

Habitat Degradation – Groundwater (All wintering bird species)

The construction of the proposed Project has the potential to impact on groundwater levels, flow and/or quality. In the absence of mitigation, these impacts in turn have the potential to indirectly affect the quality and flow of surface water features in the event of an accidental discharge of groundwater to surface water features. In addition, there are a number of watercourses located within the ZoI of the proposed Project that are fed by groundwater sources and as such they are susceptible to impacts arising from drawdown effects and/or barrier effect associated with the construction of the proposed Project. These potential impacts as they relate to aquatic habitats (such as those utilised by wintering birds within the ZoI of the proposed Project) are described in full in Section 15.4.2.2.

In absence of proper treatment and attenuation, the discharge of groundwater to surface water features has the potential to degrade habitats that wintering birds may use and in turn could potentially negatively impact on such species at a local scale.

Mortality and/or Injury Risk as a result of Collision (All Wintering Bird Species)

The construction of the proposed Project may result in an increased risk of mortality and/or injury of wintering bird species as a result of the collisions between flocks of such birds and structures associated with the construction (*e.g.* temporary bridge, cranes and hydrofraise).

The risk of birds colliding with a bridge structure is dependent on factors such as the location and attributes of the man-made structures (Lucas *et al.* 2008), visibility and detectability of the structure (bridge strikes are more likely during poor weather conditions or at night) (Jaroslow, 1979), confusion, caused by light refracted or reflected by mist (Jaroslow, 1979) the structure of the surrounding habitat, their frequency of occurrence within the impact zone (and flight height relative to the bridge structure), and the bird species present and their species-specific characteristics such as morphology and behaviour which influence their relative susceptibility to colliding with structures (Janss, 2000). The effects of collision risk at night can be magnified by disorientation caused by artificial lighting (Molenaar *et al.,* 2006). It has also been inferred that a bird's individual experience or inexperience can influence collision risk (Barrios and Rodriguez, 2004).

The following factors can influence the likelihood of bird collision with man-made structures occurring during the construction of the proposed Project:

- The specification of the man-made structure (*e.g.* height, the type of material its composed of and its reflectivity) and its proximity to features/flight-paths used by sensitive bird species;
- General visibility (i.e. collisions are more likely to occur during poor weather conditions and/or at night when the bird's visibility is impaired) (Nilsson *et al.*, 2009);
- The habitat surrounding the man-made structure; and,
- The type of bird species present, their frequency of occurrence within the impact zone, their flight height relative to the structure and their relative susceptibility to colliding with structures (as per SNH, 2018).

A potential collision risk between man-made structures and mobile wintering bird species in-flight may arise as a result of the following construction activities associated with the proposed Project:

- The construction of the temporary bridge over the Broadmeadow River (i.e. c. 1.2m in height and c. 9m to 12m in width), located c. 57m upstream of the existing Lissenhall Bridge to the west of the proposed Broadmeadow and Ward River Viaduct, which may pose a new obstacle to any wintering bird species utilising the river corridor as a flight path to commute along and will be required for a period of 50 months (over four years);
- The construction of the proposed permanent clear-span viaduct over the Broadmeadow River and Ward River (i.e. c. 13.27m and 12.33m in height (respectively and including the Overhead Contact Rail (OCR)) and c. 11m in width, located between Ch. 1 + 500 – Ch. 1 + 760), c. 33m upstream of the existing Lissenhall Bridge and c. 25m upstream of the existing Balheary Bridge, respectively. These works (c. 16 months in duration) will involve: the installation of bridge bearings and erection of precast beams; the placement and laying *in-situ* of concrete deck using concrete pumps; the connection of the parapets to the viaduct deck with the *in-situ* concrete. These constructions works and the machinery required to complete them (*e.g.* 80T all-terrain or tracked mobile cranes to install the precast beams) may pose a new obstacle to any wintering bird species utilising the river corridor as a flight path;
- The construction of a proposed temporary access road at the existing abutments of a rail crossing located in the vicinity of the existing Lock 6 of the Royal Canal and a proposed construction working area located in the Royal Canal basin between Lock 6 and Lock 5; and,
- The installation of the proposed track and its catenary power system (i.e. its OCR, c. 4.5m in maximum height, and supporting poles and structures that are c. 10m to 12m in height) at the aboveground sections of the alignment, in particular east of Balheary playing pitches. These works will require the use of a multiuse travelling gantry (within lighting) that will span the track as it lifts and carries sections of the track during installation.

Due to the existing environment present along the R132 in Swords (i.e. from south of the existing Seatown roundabout to south of the existing Pinnock Hill roundabout), which is dominated by buildings and other elevated structures (*e.g.* footbridges), there is no potential collision risk from the construction of the track along the aboveground sections of the proposed Project along the existing R132 in Swords. In addition, the alignment of the proposed Project from north of the proposed Seatown Station to the proposed DANP is a combination of retained cut and cut and cover and as such the aboveground at grade sections are limited in their extent.

There is also no potential collision risk from the construction of the proposed three-span viaduct over the existing M50 Motorway due to the existing environment, which includes multiple tall bridges/structures over the motorway, such as the M1 Motorway junction to the east and the Ballymun, Naul R108 junction four to the west, which would make it an unsuitable flightpath for wintering birds.

With regards to the potential collision risk along the Broadmeadow River and Ward River during construction, it is considered unlikely that any potential impact would occur as a result of any birds colliding with construction machinery and/or structures present during the construction of the proposed Project. This is primarily due to the existing environment located along these watercourses, which includes five man-made structures (along a c. 620m to 875m river corridor), located downstream of the proposed construction works between the proposed Project and the Broadmeadow Water

transitional waterbody that encompasses Malahide Estuary. These structures already present an obstacle to any birds using these watercourses as a flightpath. It may also be assumed that such birds utilising this corridor are likely to be habituated to the presence of such obstacles and not perturbed by them as they would have to regularly navigate them in the event that such species regularly use this corridor as a flightpath. These five existing man-made structures include the following:

- Lissenhall Bridge, which is c. 10m in width and is located c. 33m downstream of where the proposed Broadmeadow and Ward River Viaduct will be constructed over the Broadmeadow River;
- Balheary Bridge, which is c. 41m in width and is located c. 25m downstream of where the proposed Broadmeadow and Ward River Viaduct will be constructed over the Ward River;
- The R132 bridge, which is c. 33m in width and is located c. 30m downstream of Lissenhall Bridge;
- The Spittal Hill Road bridge, which is c. 7m in width and is located c. 275m downstream of the R132 bridge and c. 130m downstream of the Balheary Bridge; and
- M1 Motorway bridge, which is c. 36m in width and is located c. 435m downstream of the Spittal Hill Road bridge.

Wetland bird species regularly fly to and from inland feeding sites located across the Dublin area (both within the boundaries of DCC and FCC) and as such are habituated to traversing an urban landscape and navigating potential obstacles that could pose a collision risk. Scottish Natural Heritage (SNH) have set out standard avoidance rates to be applied in SNH collision risk modelling undertaken to assess potential impacts of wind farms on birds (SNH, 2018). These avoidance rates provide an indication on the likely degree of successful avoidance of wind turbines by various bird species and are expressed as a percentage – i.e. the percentage of birds that would avoid a collision. The avoidance rates of various wetland waterbird species that were recorded during the wintering bird surveys in relatively large flocks within the study area are as follows:

- Curlew – 98%
- Golden plover – 98%
- Goose species – 99%
- Gull species – 98%
- Whooper swan – 98%

Therefore, it is considered unlikely that, even during poor weather conditions and limited visibility, any construction works and the use of elevated machinery (*e.g.* mobile cranes) would result in a notable increase in collision risk that would in turn significantly affect any wintering bird populations as a result of mortality and/or injury.

The assessment outlined above is supported by the consensus of existing published scientific literature is that bridges, regardless of their design and the behaviour of birds in the vicinity (flight height and level of nocturnal flight activity), although they may result in some degree of bird mortality through collision, do not pose a collision risk that would result in the deaths of large numbers of birds or have any long-term bird population level effects.

From the literature review carried out, bird collisions with man-made structures are common and well documented (Banks, 1979; Klem, 1990; Kelm, 2008; Jenkins *et al.*, 2010; Lucas *et al.*, 2008; Longcore *et al.*, 2012; Erickson *et al.,* 2001). Migratory passerine species are the most prevalent collision victim (Bing *et al.*, 2012; Longcore *et al.*, 2013), a trend that has also been recorded at bridges over large wetland areas e.g. the Oresund Bridge connecting Denmark and Sweden over the Baltic Sea (FEBI, 2013) and the Sabo Bridge over Sabo Estuary in Portugal (Godinho *et al.*, 2017). To put the latter studies into context, c. 10 million migrant birds pass the Oresund Bridge during autumn migration (Nilsson *et al.* 2009 as reported in FEBI 2013) and 27,000 bird movements (c. 83% aquatic birds) were recorded crossing the Sabo Bridge during 400 hours of observation (Godinho *et al.,* 2017), suggesting that bridges over wetlands present a relatively low collision risk to waterbirds and that in these studies mortality occurred at such low numbers that it did not represent more than a minor effect. In addition, both of the Oresund Bridge and Sabo Bridge are cablestay and bowstring structures and pose a greater collision risk than the proposed viaducts for this proposed Project.

Habitat Degradation – Hydrological Regime

Construction works at the proposed watercourse crossings of the proposed Project can have a temporary impact on the local flow and flooding regime. None of these are predicted to have any long-term effects that would give rise to a likely significant negative effect on any wintering bird species through effects on the hydrological regime (for more detail refer to Section 18.5.3 of Chapter 18 (Hydrology).

15.4.2.7 Amphibians

Habitat Loss

The construction of the proposed Project will result in the permanent loss of suitable amphibian habitat within the proposed Project boundary (i.e. c. 3.22km in length of drainage ditches and c. 0.95ha in wet grassland fields that contain temporary pools with stagnant water, all located in Ballymun west of the R108 where breeding common frog were previously recorded). Any suitable amphibian breeding habitat (i.e. any wet habitat, including drainage ditches and pools of stagnant water) could be colonised and used by common frog and/or smooth newt at the time of construction. This scenario has been taken into account in the mitigation strategy (see Section 15.5.1.11).

Given the low number of suitable habitat features (potentially supporting amphibian species) directly impacted by the proposed Project and the likely high abundance of alternative suitable habitat available locally, the effects of habitat loss associated with construction works are unlikely to affect the ability of the local common frog or smooth newt populations to maintain themselves in the long-term. Suitable habitat was identified beyond the footprint of the proposed Project within the study area and will not be subject to habitat loss, i.e. c. 2.17km in length of drainage ditches in Estuary, south of Fosterstown roundabout and west of Dardistown and six temporary pools of stagnant water, all located in Silloge Park Golf Club and Ballymun to the north-west of the proposed Project.

Therefore, habitat loss associated with the proposed Project is not likely to affect the species' conservation status or result in a likely significant negative effect, at any geographic scale.

As suitable amphibian breeding and resting habitat will be directly impacted by the proposed Project, and given the legal protection afforded to amphibian species under the Wildlife Acts (which prohibits wilful destruction or interference with an amphibian breeding or resting places), a mitigation strategy has been developed (see Section 15.5.1.11).

Disturbance and Mortality Risk

Site clearance works also have the potential to result in disturbance to and/or the direct mortality of common frog and smooth newt. The potential for direct mortality to occur, and the magnitude of any effects, would be expected to be greater where: (a) suitable habitat exists and either common frog and/or smooth newt have been previously recorded; and (b) works affecting suitable habitat are undertaken during the breeding season, when adults and/or frog spawn/newt eggs may be present, or during the winter hibernation period when individuals are in refugia.

Both airborne and groundborne noise and vibration are likely to impact on amphibian species by resulting in a change in their behaviour and/or by affecting their calling activity (i.e. mating and/or territorial calls) and in turn impacting on their breeding success (Caorsi *et al.*, 2019). Increased levels of airborne and groundborne noise and vibration during construction may result in increased levels of disturbance to both common frog and smooth newt present in suitable habitat within the ZoI of the proposed Project (i.e. c. 250m from the redline boundary). This in turn may result in a decrease in breeding success of individuals due to higher levels of energy expenditure required to manage the effects of increased disturbance and/or the displacement of individuals from these areas to other suitable habitats beyond the ZoI of the proposed Project.

Given the low number of suitable habitat features (potentially supporting amphibian species) directly and indirectly impacted by the proposed Project, it is likely that the number of individuals present is relatively low and therefore the number of individuals likely to be at risk would also be low.

As such, impacts on these individuals would be unlikely to affect the local populations of common frog and smooth newt in the long-term. There is likely to be a large amount of suitable habitat located in the immediate environs beyond the ZoI of the proposed Project where suitable amphibian habitat was recorded (i.e. at aboveground sections of the proposed Project), which will be available for any individual amphibians to utilise that have been temporarily displaced from lands adjacent to the proposed Project due to increased levels of disturbance. This includes farmland located north and north-west of Lissenhall, farmland and golf course west of Dardistown in Silloge Park Golf Club and woodland and parkland east of the alignment at Santry Demesne. Therefore, the proposed Project is not likely to affect the species' conservation status in that regard or result in a likely significant negative effect, at any geographic scale.

Regardless of above, suitable amphibian breeding and resting habitat will be directly impacted by the proposed Project and common frog has been confirmed to be breeding within the proposed Project boundary; therefore, individual amphibians are considered to be at risk of being killed, injured, or affected by construction related disturbance. Given the legal protection afforded to amphibian species under the Wildlife Acts, which prohibits their intentional killing or injury, or the wilful interference with an amphibian breeding or resting places, a mitigation strategy has been developed (see Section 15.5.1.11).

Habitat Severance/Barrier Effect

The temporary to medium-term physical disruption of the existing landscape during site clearance and construction may fragment suitable breeding or resting habitats used by amphibian species. As a temporary to medium-term impact, this is unlikely to present a significant barrier to the movement of amphibian species such that it would affect the local common frog or smooth newt populations in the long-term. Therefore, habitat severance during construction and any associated barrier effect are not predicted to result in a likely significant negative effect to amphibian species, at any geographic scale.

Habitat Degradation – Surface Water Quality

An accidental spillage or pollution event into a surface water feature supporting common frog or smooth newt may have a negative indirect impact on these species. The magnitude and significance of such an impact would be entirely dependent on the nature, scale and duration of the pollution event. Although unlikely, in a worst-case scenario this could result in extensive degradation of amphibian habitat and/or the mortality of amphibians in affected habitats. There is the potential for such impacts to have long-term effects on the local populations of both the common frog and the smooth newt and result in a likely significant negative effect, at the local geographic scale. Habitat degradation, therefore, has the potential to affect the species' conservation status and result in a likely significant negative effect, at the local geographic scale. Mitigation measures have been designed to protect water quality during construction (see Section 15.5.1.2).

15.4.2.8 Reptiles

Habitat Loss

Construction of the proposed Project will result in the permanent loss of common lizard habitat within the proposed Project boundary (see Figures 15.12). There are areas of potentially suitable breeding and hibernating lizard habitat that are directly affected by the proposed Project, i.e.: semi-natural grassland, scrub, hedgerows, earth banks and areas of spoil and bare ground/recolonising bare ground. This species favours structurally diverse habitat mosaics to provide foraging areas, refuges and hibernacula, and basking sites within their territories. Given the relatively low area of potentially suitable habitat for common lizard likely to be affected by the proposed Project (i.e. c. 19.54ha in total area) and the abundance of alternative suitable habitat available locally (i.e. c. 52.3ha of suitable habitat located immediately beyond the footprint of the proposed Project), the effects of habitat loss associated with construction works are unlikely to affect the long-term viability of the local common lizard population.

Therefore, habitat loss is not likely to affect the species' conservation status or result in a likely significant negative effect, at any geographic scale.

As common lizard habitat will be directly impacted by the proposed Project, and given the legal protection afforded to the species under the Wildlife Acts (which prohibits wilful destruction or interference with their breeding or resting places), a mitigation strategy has been developed (see Section 15.5.1.12).

Disturbance & Mortality Risk

Site clearance works have the potential to result in disturbance to, and the direct mortality of, common lizard. The potential for direct mortality to occur, and the magnitude of any effects, would be expected to be greatest where: (a) suitable habitat exists and common lizard have been previously recorded and (b) works affecting suitable habitat are undertaken during the winter hibernation period (October to mid-March) and affect potential hibernacula, when lizards are less active and therefore less able to escape any works being undertaken.

Given the relatively low area of potentially suitable habitat for common lizard, the number of individuals that would potentially be at risk is low and would be unlikely to affect the local populations in the long-term. Therefore, disturbance or mortality risk are not likely to affect the species' conservation status or result in a likely significant negative effect, at any geographic scale.

As there are potentially some areas of suitable habitat for common lizard within and immediately adjacent to the proposed Project boundary (albeit relatively limited in diversity and extent), there is potential for individuals to be killed, injured, or affected by construction related disturbance. Given the legal protection afforded to the common lizard under the Wildlife Acts (which prohibits their intentional killing or injury, or the wilful interference with their breeding or resting places) and a mitigation strategy has been developed (see Section 15.5.1.12).

Habitat Severance/Barrier Effect

The temporary to short-term physical disruption of the existing landscape during site clearance and construction will fragment habitat used by common lizard. As a temporary to short-term impact, this is unlikely to present a significant barrier to the movement of the species such that it would affect the local common lizard population in the long-term. Therefore, habitat severance during construction and any associated barrier effect are not likely to affect the species' conservation status and are not predicted to result in a likely significant negative effect to the common lizard, at any geographic scale.

15.4.2.9 Fish

Habitat Loss

The proposed Project will result in the permanent loss of instream fisheries habitat as a consequence of the following construction works (see Figure 15.6):

- Proposed temporary bridges to facilitate access over the following watercourses, for approximately 4 weeks in each location:

- Broadmeadow River located between Ch. 1520 and Ch. 1560, resulting in a total loss of c. 435m2 instream and/or bankside habitat;
- Ward River, located between Ch. 1620 and Ch. 1660, resulting in a total loss of c. 275m2 instream and/or bankside habitat;
- Mayne River at two locations near Ch. 8680 and Ch. 8900, resulting in a total loss of c. 350m2 instream and/or bankside habitat;
- Santry River, located directly west of the Old Ballymun Road between Ch. 9980 and Ch. 10000, resulting in a total loss of c. 215m2 instream and/or bankside habitat; and,

- Royal Canal, located directly east of the existing Lock 6 abutment between Ch. 14920 and Ch. 14960, resulting in a total loss of c. 375m2 of bankside habitat. To note that there is a temporary road bridge proposed in this location and only grass bank will be lost.

- Proposed permanent discharge outfalls to eight watercourses: the Broadmeadow River, Ward River, two unnamed watercourses, Sluice River and its tributary, Mayne River and the Santry River, resulting in a minimal loss of instream and/or bankside habitat of c. 20m^2 at each location;
- Two proposed permanent culverts on the Sluice River and one of its tributaries, at Ch. 5 + 765 and Ch. 5 + 963 resulting in a loss of c. 52m^2 and c. 174m^2 of instream habitat;
- Proposed permanent diversion of the Turnapin Stream, a tributary of the Mayne River, around Ch. 8 + 600, resulting in a loss of c. 650m of river channel; and,
- Proposed minor alteration works to straighten the channel of the Santry River and provide scour protection, located immediately downstream of the existing culvert outlet, resulting in a loss of c. 150m^2 of instream habitat.

A reduction in habitat availability could potentially have long-term effects on fish populations within a given river/stream catchment. The loss of habitat as a consequence of the Mayne River diversion will be offset by the construction of a new river channel, c. 780m in length. The construction of the proposed permanent bridge on the Broadmeadow River and Ward River will not result in any loss of instream habitat as it is a clear span structure.

During the construction of the proposed Project, the Royal Canal basin located between Lock 6 and Lock 5 (i.e. c. 0.27ha in area and c. 215m in length) will be completely dewatered for two periods of c. three months (i.e. six months in total) to facilitate the installation and removal of a temporary working platform at this location. The Royal Canal is known to support significant populations of coarse fish and is regularly used by anglers, in particular outside County Dublin in Leixlip and Enfield. According to the NBDC database, there are no records of European eel, Atlantic salmon, brown trout or any lamprey species in the Royal Canal. Considering this, the type of habitat present (i.e. a highly disturbed, man-made canal) and that only coarse fish are likely to be abundant, no potential significant effects on fish are likely to occur as a result of these proposed dewatering works. Potential impacts that may arise from the dewatering of the canal as a result of mortality and/or injury are described in the relevant section below.

In order to construct the permanent culvert works on the Sluice River, a temporary diversion or dam will be constructed upstream of the works and water will be pumping back into the watercourses downstream of these works. These proposed works are likely to be completed within one year.

There will be no instream habitat loss associated with at any of the other proposed crossing points as they will be all located below ground, i.e. the Cuckoo River, Tolka River, River Liffey or Grand Canal, and therefore no potential for impacts to occur.

No fish were recorded in the Mayne River or Cuckoo Stream during the surveys. Aside from three-spined stickleback, which is commonly found in polluted watercourses, no other fish species identified as KERs were recorded in the Sluice River or Santry River. These watercourses are heavily modified, polluted watercourses (i.e. "*Poor*" Water Framework Directive status in the case of Sluice River and "*Bad*" Water Framework Directive status in the case of the other watercourses) and limited in terms of their fisheries value. Therefore, the loss of instream habitat within these watercourses will not impact on any ecologically sensitive fish species.

Brown trout and European eel were recorded in the Broadmeadow River and Ward River. Both these watercourses provided some suitable habitat for brown trout and adequate prey resources and diurnal refugia (i.e. large boulders, cracks in bedrock and submerged structures) for European eel. However, the amount of habitat loss will minimal (i.e. permanent loss of a total of 40m^2) relative to the total area of suitable habitat for both these species that will be maintained, and as such will not affect the conservation status of any fish species within the Broadmeadow River sub-catchment, or any other catchment crossed by the proposed Project, and therefore will not result in a likely significant effect at any geographic scale.

Habitat Degradation – Surface Water Quality

During construction, contaminated or heavily silted surface water runoff, pump discharges and/or an accidental spillage or pollution event into any surface water feature has the potential to have a significant negative impact on water quality and consequently on aquatic habitats and fish species, and potentially also in the marine environment downstream. This could be either directly (*e.g.* acute or sub-lethal toxicity from pollutants or siltation events damaging spawning habitat downstream) or indirectly (*e.g.* affecting their food supply or supporting habitats).

All water discharges (including foul waters) from construction areas will be attenuated and treated prior to approved discharge to defined sewers. Such discharges from construction areas are likely to be high in sediment and have an elevated alkalinity where cement works are undertaken; therefore in absence of appropriate treatment and attenuation, the discharge of this groundwater into nearby surface water features could result in significant negative effects (as a result of changes in water quality and/or flow) on watercourses that they are discharged to and habitats downstream of the discharge point. The effects of frequent and/or prolonged pollution events in a river system have the potential to be extensive and far-reaching and could potentially have significant long-term effects. It is considered unlikely that a pollution event of such a magnitude would occur during construction or if such an event did occur, it would be temporary in nature. Nevertheless, a precautionary approach is being taken in assuming a level of risk of water quality impacts and detailed mitigation measures are required to further minimise the risk of the proposed Project having any perceptible effect on water quality during construction.

Habitat degradation as a result of effects on surface water quality during construction has the potential to affect the conservation status of affected fish species and result in a likely significant negative effect, at a local to international geographic scale (the latter in the case of European eel). Mitigation measures have been designed to protect water quality during construction (see Section 15.5.1.2).

Habitat Degradation – Groundwater

The construction of the proposed Project has the potential to impact on groundwater levels, flow and/or quality. In the absence of mitigation, these impacts in turn have the potential to indirectly affect the quality and flow of surface water features should there be an accidental discharge of groundwater. In addition, there are a number of watercourses located within the ZoI of the proposed Project that are fed by groundwater sources and as such they are susceptible to impacts arising from drawdown effects and/or barrier effect associated with the construction of the proposed Project. These potential impacts as they relate to aquatic habitats (such as those utilised by fish species within the ZoI of the proposed Project) are described in full in Section 15.4.2.2 Habitats under *Habitat degradation – Groundwater*.

The dewatering associated with the proposed Tara Station, which is likely to impact on the River Liffey, could negatively impact on fish species present in this watercourse; however, as these impacts will be very localised (i.e. it will be restricted to the radius of effect of dewatering at this location, c. 176.45m from station location), no significant effects on any fish population utilising the wider River Liffey corridor are predicted. In the absence of proper treatment and attenuation, the accidental discharge of groundwater to surface water features has the potential to degrade habitats that fish species may use and in turn could potentially negatively impact on fish species at a local to an international scale (depending on the fish species impacted).

Mortality Risk

The proposed construction works in the Broadmeadow River, Ward River, unnamed watercourse in Swords, Sluice River and its tributary, Mayne River, Santry River and Royal Canal outlined above under the heading *Habitat Loss* or other general construction activities (*e.g.* dewatering channels), have the potential to result in the direct mortality of fish species. This section assesses the risk associated with mortality due to species interacting with construction vehicles and machinery such as pumps. The potential effects of accidental pollution events, which can also result in fish mortality, are discussed separately under the heading *Habitat Degradation – Surface Water*.

Given the low fisheries value of Sluice River, Mayne River and Santry River, which are heavily modified, polluted watercourses, the mortality risk posed by the construction works is unlikely to affect the conservation status of any of the fish species present in the catchments of Mayne River or River Tolka sub-catchments. Despite this, potential impacts on individual fish species have been addressed in the mitigation strategy in order to avoid an offence being committed under the Fisheries Acts during construction works.

Brown trout and European eel were recorded in the Broadmeadow River and Ward River. At both these locations, instream works are limited to the construction of a proposed discharge outfall and as such are very minimal in scale and extent and do not pose a significant risk of fish mortality such that it is likely to affect the conservation status of any of the fish species present in the Broadmeadow River catchment. There are significant works proposed directly adjacent to these watercourses (including the construction of a temporary bridge over the Broadmeadow River and proposed viaduct over the Broadmeadow River and Ward River) and as such the risk of fish mortality arising from these construction activities could potentially result in a negative significant effect on local fish populations, in particular brown trout and European eel. Considering this and the legal protection afforded to all fish species under the Fisheries Acts, a mitigation strategy has been developed to avoid an offence being committed during construction works (see Section 15.5.1.13).

Disturbance/Displacement

Increased human presence, and noise and vibration associated with the proposed construction works outlined above under the heading *Habitat Loss* or other general construction activities are likely to result in the temporary displacement of fish species from the immediate vicinity within the watercourses. Whilst the construction of the proposed clear-span viaduct over the Broadmeadow River and Ward River will not result in any instream/bankside habitat loss, it may cause increased levels of temporary disturbance due to increases in noise associated with the construction activities.

Fish can be sensitive to both noise and vibration; therefore, any noisy activities associated with the proposed Project (in particular within or adjacent to a watercourse) has the potential to cause avoidance reactions in fish and possibly delay fish migration. Atlantic salmon and European eel are considered to be less sensitive to noise compared to other fish species due to their mechanism of hearing and it has been demonstrated that these species do not exhibit avoidance behaviour in response to noise produced (such as noise derived from piling) (Hawkins & Johnstone, 1978). It has also been observed that river lamprey are also not particularly sensitive to noise compared to other fish species (Maes *et al.*, 2004).

Therefore, long-term disturbance/displacement effects on the local fish populations are not likely given the short-term nature of proposed construction works relevant to potential impacts on fish described (as described above under *Habitat Loss*). With the exception of the construction of the proposed Dardistown Depot, these proposed works will be undertaken during normal working hours (i.e. a limited duration each day, from 07:00 to 19:00) and as such there will be a break in increased levels at these locations for c. 12 hours each day. No confirmed or potential spawning grounds are present at any of proposed watercourse crossing points. Disturbance/displacement during construction is not predicted to affect the conservation status of the local fish populations and therefore, will not result in a likely significant negative effect, at any geographic scale.

Habitat Severance/Barrier Effect

Instream construction works have the potential to sever fisheries habitat and result in a barrier to fish passage, at least temporarily. Restricting fish access to food resources and/or spawning grounds could have long-term effects on the local fish populations.

In the case of the Sluice River, Mayne River and Santry River, the habitat affected by and upstream of the proposed Project was considered to be of a low fisheries value primarily due to their poor water quality and their heavily modified river channels. The source of the Mayne River is within lands at Dardistown, while the sources of the Sluice River and Santry River are between c. 400m and c. 3km upstream of each respective proposed crossing points at lands located directly north and south of the Dublin Airport. It is

considered likely that the habitat present upstream of the proposed Project on all three watercourses is similar to that at the proposed crossing point, i.e. heavily modified, polluted rivers of a low fisheries value. No fish species were recorded at these watercourses during the fisheries surveys. Therefore, any temporary severance or barrier effect during construction is not likely to result in long-term effects on the local fish populations in these catchments.

The only proposed works on the Ward River is the construction of a discharge outfall. This will not result in any temporary barrier to fish passage and therefore no impact will occur. The construction of the proposed temporary bridge structure on the Broadmeadow River will require instream works and as such it may act as a barrier to fish passage, albeit on a temporary basis of 29 months during construction work, preventing their movement upstream and/or downstream on this watercourse. This may impact on local populations of fish species recorded in this watercourse, i.e. brown trout, European eel, sandy goby and flounder. In the case of the latter two species, the numbers recorded were especially small. In addition, these species are commonly found in brackish estuarine waters and therefore are considered less likely to be dependent on freshwater habitat located upstream of the proposed crossing point. In consideration of this, it is unlikely that the proposed temporary bridge would result in a significant negative effect on local sandy goby and flounder fish populations.

In the case of brown trout and European eel, however, a potential significant negative effect on local populations may occur in the short-term as a result of the severance of habitat and barrier effect associated with the proposed temporary bridge.

Habitat Degradation – Hydrological Regime

Construction works at the proposed watercourse crossings of the proposed Project can have a temporary impact on the local flow and flooding regime. None of these are predicted to have any long-term effects that would give rise to a likely significant negative effect on any fish species through effects on the hydrological regime (for more detail refer to Section 18.5.3 of Chapter 18 (Hydrology).

15.4.2.10 Proposed Grid Connections

Due to the nature of the proposed Grid Connections works which predominantly involve temporary works along existing roads (and the construction of two GIS sub-stations), with minimal disturbance to the surrounding environment, and with work sites being restored to their original condition (for both on and off-road works), any potential impacts listed below are considered to be less than those of the proposed Project which are described in detail in Sections 15.4.2.1 – 15.4.2.9. Potential impacts as a result of the proposed Grid Connections during construction include:

- Designated Areas for Nature Conservation: Habitat degradation as a result of hydrological impacts, hydrogeological impacts and the introduction/spreading of non-native invasive plant species; Potential impacts on otter and SCI bird species due to habitat loss, habitat degradation and reduction in prey abundance/quality as a result of hydrological/hydrogeological impacts and disturbance and displacement.
- Habitats: Habitat loss and fragmentation; Habitat degradation as a results of surface water quality, hydrological regimes, ground water quality, air quality and the introduction/spreading of non-native invasive plant species.
- Otter: Habitat degradation as result of surface water quality; Habitat severance/barrier effect; Disturbance/displacement.
- Bats: Roost loss (trees); Foraging and/or commuting habitat loss; Fragmentation of foraging habitat and commuting routes and areas used by bats for other non-roosting activities; Disturbance/displacement.
- Badger: Loss of foraging habitat; Loss of breeding/resting sites; Disturbance/displacement; Severance/barrier effect.
- Other Mammal Species: Habitat loss; Habitat severance/barrier effect; Disturbance/displacement; Habitat degradation as a result of surface water quality.
- Breeding Birds: Habitat loss and loss of breeding/resting sites; Disturbance/displacement.
- Wintering Birds: Habitat loss; Disturbance/displacement, Habitat degradation as a result of surface water and ground water quality.

- Amphibians: Habitat loss; Disturbance and mortality risk; Habitat degradation as a result of surface water and ground water quality.
- Reptiles: Habitat loss; Disturbance; Habitat severance/barrier effect.
- Fish: Habitat loss; Habitat degradation as a result of surface water quality and ground water quality; Mortality risk; Disturbance/displacement; Habitat severance/barrier effect.

With regards to impacts relating to invasive species, the effects of introducing non-native invasive plant species to highly sensitive and ecologically important habitat areas (*e.g.* designated area for nature conservation or areas of Annex I habitat) have the potential to result in a likely significant negative effect, at geographic scales ranging from local to national (as described above under Sections 15.4.2.1. and 15.4.2.2). Mitigation measures have been designed for the proposed Project to avoid these potential impacts, as detailed in Section 15.5.1.2.6, which can be applied to the proposed Grid Connections.

With regards to all other non-hydrologically/hydrogeologically connected impacts i.e., habitat loss (including breeding, resting, commuting and foraging habitats), habitat degradation as a result of air quality impacts (i.e. dust), habitat fragmentation and severance/barrier effect, disturbance/displacement, and mortality risk, due to the nature of the proposed Grid Connections works, impacts will be short-term, temporary in nature (i.e. limited to the duration of the Construction Phase) and will not have a likely significant negative effect, at any geographic scale.

With regards to hydrologically and hydrogeologically connected impacts i.e., habitat degradation as a results of surface water quality, ground water quality and hydrological regimes, and potential impacts on otter and SCI bird species due to habitat loss, habitat degradation, and reduction in prey abundance/quality as a result of hydrological/hydrogeological impacts, these impacts have the potential to result in a likely significant negative effect, at geographic scales ranging from local to national (as described above under Sections 15.4.2.1, 15.4.2.2, 15.4.2.4.1, 15.4.2.4.4, 15.4.2.6.2, 15.4.2.7 and 15.4.2.9). Mitigation measures have been designed for the proposed Project to avoid these potential impacts, as detailed in Sections 15.5.1.1, 15.5.1.2.4, 15.5.1.2.5, 15.5.1.4.1, 15.5.1.7.1, 15.5.1.10.1, 15.5.1.11.2, 15.5.1.13.2., which can be applied to the proposed Grid Connections.

15.4.3 Operational Phase

15.4.3.1 Designated Areas for Nature Conservation

15.4.3.1.1 European Sites

The following potential impacts on European sites have been examined for the Operational Phase of the proposed Project based on the existing ecological environment and the extent and characteristics of the proposed Project:

- Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies. Several European sites are located downstream of the proposed Project in the Malahide Estuary, Baldoyle Bay, and Liffey Estuary/Dublin Bay. The population of otter in the downstream receiving environment has also precautionary been treated as potentially part of the Wicklow Mountains SAC QI population. In the absence of adoption of mitigation, namely controls for the prevention of pollutants or contaminants entering the downstream environment via surface or groundwaters, there is potential for negative effects on water quality in Malahide Estuary, Baldoyle Bay, water quality impacts could negatively affect the QIs or SCIs of the following European sites: Baldoyle Bay SAC, Baldoyle Bay SPA, Dalkey Islands SPA, Howth Head Coast SPA, Ireland's Eye SPA, Lambay Island SPA, Malahide Estuary SAC, Malahide Estuary SPA, North Bull Island SPA, North Dublin Bay SAC, Rockabill SPA, Rogerstown Estuary SPA, Skerries Islands SPA, South Dublin Bay and River Tolka Estuary SPA, South Dublin Bay SAC, Wicklow Mountains SAC, and The Murrough SPA, such that conservation objectives of these European sites are undermined.
- Habitat degradation as a result of a change in the existing hydrological regime of watercourses: It is acknowledged that the proposed Project includes the diversion and changes to several watercourses that discharge via the surface water network to downstream European sites. Nonetheless, based on the Finite Element Method (FEM) Flood Risk Assessment and Management (FRAM) modelling study presented in Section 18.5 of Chapter 18 (Hydrology) and Section 18.5 of

Chapter 18 (Hydrology), the hydrological regime of watercourses crossed or culverted by the Project will not be altered significantly. Therefore, there is no possibility of the proposed Project undermining the conservation objectives of any QIs or SCIs of any European sites;

The potential impacts of the proposed Project in the context of European sites are explored in more detail in Section 5 of the NIS which accompanies this report.

Summary

The direct and/or indirect impact by which the proposed Project could (in the absence of mitigation measures) potentially affect the conservation objective attributes and targets supporting the conservation condition of the qualifying interests of Baldoyle Bay SAC, Malahide Estuary SAC, North Dublin Bay SAC, South Dublin Bay SAC, Wicklow Mountains SAC, Baldoyle Bay SPA, Dalkey Islands SPA, Howth Head Coast SPA, Ireland's Eye SPA, Lambay Island SPA, Malahide Estuary SPA, North Bull Island SPA, Rockabill SPA, Rogerstown Estuary SPA, Skerries Islands SPA, South Dublin Bay and River Tolka Estuary SPA, and The Murrough SPA is:

- Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies; and,

Refer also to Table 6.2 in the NIS for details on how this impact may affect the Site-Specific Conservation Objectives of the QI habitats and species and/or SCI bird species of these 17 European sites.

Adversely affecting the integrity of Baldoyle Bay SAC, Malahide Estuary SAC, North Dublin Bay SAC, South Dublin Bay SAC, Wicklow Mountains SAC, Baldoyle Bay SPA, Dalkey Islands SPA, Howth Head Coast SPA, Ireland's Eye SPA, Lambay Island SPA, Malahide Estuary SPA, North Bull Island SPA, Rockabill SPA, Rogerstown Estuary SPA, Skerries Islands SPA, South Dublin Bay and River Tolka Estuary SPA, and The Murrough SPA would result in significant effects at the international geographical scale.

15.4.3.1.2 Natural Heritage Areas and Proposed Natural Heritage Areas

The potential impacts on European sites arising from the proposed Project outlined above in Section 15.4.3.1.1 may also negatively affect the following NHA and pNHA sites, which are located within the boundaries of European sties and designated for similar reasons: Malahide Estuary pNHA, Baldoyle Bay pNHA, North Dublin Bay pNHA, Dolphins, Dublin Docks pNHA, South Dublin Bay pNHA, Booterstown Marsh pNHA, Rogerstown Estuary pNHA, Howth Head pNHA, Ireland's Eye pNHA, Lambay Island pNHA, Skerries Islands NHA, Dalkey Coastal Zone and Killiney Hill pNHA, The Murrough pNHA and Rockabill pNHA[92]. The proposed Project also has the potential to affect biodiversity in a broader sense than just the QIs/SCIs of those European sites. Where biodiversity receptors in these NHA and pNHAs do not form part of the QIs/SCIs in the NIS assessment, they are considered under the other individual impact assessment headings for each KER below. Potential impacts arising from the proposed Project on these NHA and pNHA sites would result in a likely significant negative effect at a national geographic scale.

In the case of the Sluice River Marsh pNHA and Santry Demesne pNHA, potential impacts arising from the proposed Project on these pNHA sites may occur as a result of (as per the descriptions provided above under Section 15.4.3.1.1):

- Habitat degradation as a result of surface water runoff related hydrological impacts;
- Habitat degradation as a result of a change in the existing hydrological regime of watercourses;
- Habitat degradation as a result of hydrogeological impacts; and,
- Habitat degradation as a result of introducing/spreading non-native invasive species.

[92] Malahide Estuary SAC and Malahide Estuary SPA in relation to Malahide Estuary pNHA; Baldoyle Bay SAC and Baldoyle Bay SPA in relation to Baldoyle Bay pNHA; North Dublin Bay SAC, North Bull Island SPA and South Dublin Bay and River Tolka Estuary SPA in relation to North Dublin Bay pNHA; South Dublin Bay SAC and South Dublin Bay and River Tolka Estuary SPA in relation to South Dublin Bay pNHA and Booterstown Marsh pNHA; Rogerstown Estuary SAC and SPA in relation to Rogerstown Estuary pNHA; Howth Head SAC and Howth Head Coast SPA in relation to Howth Head pNHA; Ireland's Eye SAC and SPA in relation to Ireland's Eye pNHA; Lambay Island SAC and SPA in relation to Lambay Island pNHA; Skerries Islands SPA in relation to Skerries Islands NHA; Dalkey to Rockabill SAC in relation to Dalkey Coastal Zone and Killiney Hill pNHA, The Murrough SPA in relation to The Murrough pNHA; and Rockabill to Dalkey Island SAC and Rockabill SPA in relation to Rockabill pNHA.

Additional to the above impacts, there is also potential for impacts on these European sites as a result of air quality impacts which are discussed below.

In the case of the Royal Canal pNHA, potential impacts arising from the proposed Project on this pNHA site may occur as a result of:

- Habitat degradation as a result of surface water runoff related hydrological impacts (see Section 15.4.3.2);
- Impacts on rare and protected plant species arising from habitat degradation as a result of hydrological impacts (see Section 15.4.3.3);
- Habitat degradation as a result of air quality impacts (see below in this Section);
- Habitat degradation as a result of introducing/spreading non-native invasive species (see Section 15.4.3.2);
- Impacts on otter arising from disturbance/displacement (see Section 15.4.3.4.1);
- Impacts on bats arising from disturbance of flight patterns due to operational lighting (See Section 15.4.3.4.2); and,
- Impacts on freshwater molluscs arising from habitat degradation as a result of hydrological impacts (See Section 15.4.3.5.2).

In the case of the Grand Canal pNHA, potential impacts arising from the proposed Project on this pNHA site may occur as a result of:

- Habitat degradation as a result of surface water runoff related hydrological impacts (see Section 15.4.3.2);
- Habitat degradation as a result of air quality impacts (see below in this Section);
- Habitat degradation as a result of introducing/spreading non-native invasive species (see Section 15.4.3.2);
- Impacts on otter arising from disturbance/displacement (see Section 15.4.3.4.1);
- Impacts on bats arising from disturbance of flight patterns due to operational lighting (See Section 15.4.3.4.2); and,
- Impacts on freshwater molluscs arising from habitat degradation as a result of hydrological impacts (See Section 15.4.3.5.2).

Habitat Degradation as a Result of Air Quality Impacts

The proposed Project is powered by electricity and therefore is not predicted to have significant tailpipe air quality emissions during its operation. The most significant potential impact of the Operational Phase of the proposed Project with respect to air quality is the alterations to DM traffic flow patterns. The *'Do Something'* model for the Operational Phase models the traffic data in the relevant future year and includes the proposed Project and includes private vehicle redistribution on the road network as a consequence of the proposed Project. Air quality impacts associated with the proposed Project were modelled according to two Operational Phase Scenarios (A and B), see Chapter 16 (Air Quality) for details.

In Operational Phase Scenario A, the following national sites (excluding those associated with European sites which are assessed above in Section 15.4.3.1.1) are located within the 200m assessment zone of air quality impacts of an impacted road: Bog of the Ring pNHA, Royal Canal pNHA and Santry Demesne pNHA. In the case of the Bog of the Ring pNHA and the Royal Canal pNHA, the outputs of the model under the *'Do Something'* scenario indicated that whilst there would be exceedances of the critical level of the annual mean NO_X (i.e. >30 µg/m^3) none of these were actually directly linked to the proposed Project and were instead due to the current high traffic volumes at those locations; therefore no potential impacts on these nationally designated sites are predicted as a result of the proposed Project. Predicted levels of the annual mean NO_X within Santry Demesne were below the critical level, at 29.1µg/m^3 and therefore no potential impacts on this nationally designated site are predicted.

In Operational Phase Scenario B, the following national sites (excluding those associated with European sites which are assessed above in Section 15.4.3.1.1) are located within the 200m assessment zone of air quality impacts of an impacted road: Royal Canal pNHA, Bog of the Ring pNHA, Liffey Valley pNHA and

Grand Canal pNHA. In the case of all aforementioned national sites the outputs of the model under the *'Do Something'* scenario indicated that whilst there would be exceedances of the critical level of the annual mean NO_X (i.e. >30 µg/m^3) none of these were actually directly linked to the proposed Project and were instead due to the current high traffic volumes at those locations; therefore no potential impacts on these nationally designated sites are predicted as a result of the proposed Project.

Full details of the air quality assessment are provided in Section 16.5 of the Chapter 16 (Air Quality).

15.4.3.2 Habitats

Habitat Degradation – Surface Water Quality

During operation surface water runoff generated from the proposed Project will discharge to the receiving watercourses either directly via permanent discharge outfalls or indirectly via the existing storm water sewer network. There are proposed permanent discharge outfalls located on the: Broadmeadow River, Ward River, unnamed watercourse in Swords, Sluice River and its tributary and the Santry River, details of which are outlined in Chapter 18 (Hydrology), Section 18.5.4.3 and displayed on Figure 4.1 – Overview of MetroLink. Surface water runoff generated along the track will drain to a main channel located within the centre of the track, which will convey the flow to an assigned discharge point. Transverse grated channels located immediately upstream of the tunnel portals will stop any surface water runoff generated from rainfall from entering the tunnel; therefore, only firewater flows will be discharged from the tunnelled sections of the proposed Project. At the aboveground sections of the proposed Project, both surface water runoff or firewater flows from the track will be conveyed and discharged. Runoff from the tunnelled sections and any other foul discharges associated with the proposed Project will then be discharged to the existing public foul drainage system and eventually to Ringsend WWTP prior to discharge into Dublin Bay.

An accidental pollution event of a sufficient magnitude during operation of the proposed Project and an increase in the concentration of pollutants in surface water run-off during operation has the potential to negatively affect the water quality of downstream waterbodies. Such a pollution event may include: the release of sediment into receiving waters and the subsequent increase in mobilised suspended solids; and the accidental spillage and/or leaks of contaminants (*e.g.* fuel, oils, lubricants, paints, bituminous coatings, preservatives, weed killer, lime and concrete) into receiving waters. The associated effects of a reduction of surface water quality could impact on habitats located within and immediately adjacent to the proposed discharge points and could potentially extend to habitats located further downstream.

The potential risk of an accidental release of chemicals to ground is considered to be limited given that the vehicles are electric and there will be minimal bulk chemical storage required (i.e. chemicals will be required for maintenance works only and where required will be stored within sealed bunds). All onsite bulk chemical storage in maintenance yards (*e.g.* at Dardistown Depot) will be fully contained within sealed bunds to ensure no seepage to ground. These bunds will be regularly monitored to ensure that they are functioning effectively, in accordance with the approved long-term operational requirements for each site. In addition, all sites where such chemicals will be stored will be generally covered in hardstanding with effective drainage design measures (*e.g.* petrol interceptors) in place to properly contain and treat an accidental release of chemicals in the unlikely event of it occurring. The proposed drainage design incorporates pollution control measures (i.e. petrol interceptors) followed by either infiltration ponds (where discharging to ground) or attenuation ponds (where drainage will be discharged to the existing surface water/storm sewer), as described in detail in Chapter 4 (Description of the MetroLink Project). These design measures will ensure that there is no potential for impacts on surface quality to occur during the Operational Phase of the proposed Project. In the absence of these measures that are incorporated into the design of the proposed Project, there is potential for impacts on habitats located within and immediately adjacent to the proposed discharge points and could potentially extend to habitats located further downstream. Habitat degradation as a consequence of operational surface water runoff has the potential to affect the conservation status of tidal rivers (CW2)/Annex I habitat Estuaries [1130], reed and large sedge swamps (FS1), tall-herb swamps (FS1), including Annex I habitat hydrophilous tall-herb swamp [6430], depositing/lowland rivers (FW2), canals (FW3) and drainage ditches (FW4) habitats and therefore, has the potential to result in a significant negative impact at a National scale in the case of the aquatic/wetland Annex I habitats located within

close proximity of the proposed Project boundary or downstream and/or at a local geographic scale in the case of affected habitats valued as being of Local Importance (Higher Value). Full details of the hydrological assessment are provided in Section 18.5 of the Chapter 18 (Hydrology).

Habitat Degradation – Groundwater

Long-term discharge of surface water runoff to groundwater during operation of the proposed Project may result in a reduction in groundwater quality and/or quantity in the receiving environment, also resulting in the degradation of groundwater dependent terrestrial habitats that they may support. There are no such habitats located within the study area (as defined in Section 15.2.3).

Potential impacts on groundwater could occur if the existing groundwater level was lowered due to potential dewatering and/or raised by impeding or impounding groundwater through permanent barrier effects; however, no such effects on the groundwater flow patterns are predicted due to the size of the underground elements of the project in the context of overall groundwater body (i.e. the proposed Project is located within the Dublin groundwater body and the Swords groundwater body, further details of these relevant groundwater bodies are available in Chapter 19 (Hydrogeology)) and that they would not act as a significant barrier to groundwater flow. The only exception to this is the proposed D-walls at the Seatown to Fosterstown area, where the barrier effect during operation is possible where mitigation is not implemented; however, this is unlikely to impact on any surface water features. As all underground structures are fully sealed and there is no requirement for dewatering during operation, there is no potential for any long-term drawdown effects at any location to occur. Following the completion of the Construction Phase of the proposed Project, groundwater levels will re-stabilise to preconstruction patterns and any potential impacts during construction as a result of dewatering activities will fully dissipate, and groundwater levels will recharge. Therefore, as there is no potential for impacts on the hydrogeological regime (either level or flow) during operation than there is no potential for indirect impacts to occur on any habitat.

During operation, there will be no direct discharge of surface water runoff to ground within any of the below ground sections of the proposed Project (i.e. tunnel, retained cut stations, underground stations and/or the intervention and/or ventilation shaft) and therefore, as there is no potential for such discharges to interact with the existing hydrogeological regime, there is no potential for a reduction in the groundwater body status. Whilst there will be no direct discharges to ground, there will be passive drainage of surface water runoff to ground at the aboveground sections of the proposed Project. The potential risk of an accidental release of chemicals to ground is considered to be limited given that the vehicles are electric and there will be minimal bulk chemical storage required (i.e. chemicals will be required for maintenance works only and where required will be stored within sealed bunds). All onsite bulk chemical storage in maintenance yards (*e.g.* at Dardistown Depot) will be fully contained within sealed bunds to ensure no seepage to ground. These bunds will regularly be monitored to ensure that they are functioning effectively, in accordance with the approved long-term operational requirements for each site. In addition, all sites where such chemicals will be stored will be generally covered in hardstanding with effective drainage design measures (*e.g.* petrol interceptors) in place to properly contain and treat an accidental release of chemicals in the unlikely event of it occurring. These design measures will ensure that there is no potential for impacts on groundwater quality to occur during operation of the proposed Project. In absence of these measures that are incorporated into the design of the proposed Project, there is potential for impacts on the quality of the groundwater body to occur and as a number of watercourses are fed by groundwater sources, there is potential for impacts on aquatic habitats (including sensitive intertidal, coastal and estuarine habitats present within downstream European sites) to occur as a result of habitat degradation associated with a reduction in surface water quality. The scale of this impact could range from local (i.e. in the case of the aquatic habitat depositing/lowland rivers (FW2) and fringe aquatic habitats reed and large sedge swamps (FS1) and non-Annex I tall-herb swamps (FS2) habitat types) to national/international (i.e. in the case of potential impacts on Annex I habitats Estuaries [1130] and Hydrophilous tall-herb swamp [6430] downstream of the proposed Project).

Full details of the hydrogeological assessment are provided in Section 19.5 of the Chapter 19 (Hydrogeology).

Habitat Degradation – Shading

Shading effects include both a reduction in sunlight and a reduction in direct precipitation reaching plants beneath a bridge structure, affecting species communities, diversity and distribution. This potential impact will only arise in situations where habitats are being retained beneath a structure, as opposed to where habitats will be permanently lost as a result of construction works.

The following permanent operational elements of the proposed Project are likely to result in shading of habitats located beneath their footprint:

- The proposed permanent clear-span viaduct over the Broadmeadow River and Ward River (i.e. c. 260m in length, c. 13.27m and 12.33m in height (respectively and including the OCR) and c. 11m in width, located between Ch. 1 + 500 – Ch. 1 + 760); and
- The proposed permanent three span viaduct over the M50 Motorway (i.e. c. 100m in length, 16.1m in height and c. 11m in width, located between Ch. 9+656 to Ch. 9+755).

Given the nature and scale of the construction works at the proposed viaduct location, the majority of habitats present in the existing environment beneath the proposed viaduct will be removed as part of vegetation clearance works. The only exception to this is the instream/bankside habitats located at both these watercourses as no instream construction works will be required and the support piers of the proposed viaduct will be set back from the bankside habitat, located c. 10m north and c. 4m south of the Broadmeadow River bankside and c. 4.5m and c. 4m south of the Ward River bankside. Therefore, the only habitats subject to the potential impacts of shading as a result of the viaduct are:

- Depositing/lowland (FW2) – c. 0.01ha will be subject to shading from the proposed Broadmeadow and Ward River Viaduct;
- Amenity grassland (GA2) – c. 0.003ha will be subject to shading from the proposed Broadmeadow and Ward River Viaduct;
- Dry meadows and grassy verges (GS2) – c. 0.02ha will be subject to shading from the proposed Broadmeadow and Ward River Viaduct; and,
- Broadleaved woodland (WD1) – c. 0.002ha will be subject to shading from the proposed Broadmeadow and Ward River Viaduct; and
- In the case of all these habitat types (in particular with regards to amenity grassland and broadleaved woodland) the extent of loss is extremely minimal, especially in the context of the extent of these common habitat types in the wider area, and as such no potential impacts on any of these habitat types as a result of shading and associated habitat degradation are predicted at any geographic scale.

The majority of habitat types present beneath the proposed M50 Viaduct comprise of hardstanding (i.e. buildings and artificial surfaces (BL3)). Other habitats present that may be subject to potential impacts of shading as a result of the proposed Broadmeadow and Ward River Viaduct; are:

- Dry meadows and grassy verges (GS2) – c. 0.008ha will be subject to shading from the proposed Broadmeadow and Ward River Viaduct; and;
- Scrub (WS1) – c. 0.02ha will be subject to shading from the proposed Broadmeadow and Ward River Viaduct.

In the case of both these habitat types (considered to be of Local Importance (Lower Value) only) the extent of loss is extremely minimal, especially in the context of the extent of these common habitat types in the wider area, and as such no potential impacts on any of these habitat types as a result of shading and associated habitat degradation are predicted at any geographic scale.

Habitat Degradation – Non-native Invasive Plant Species

Given the presence of non-native invasive plant species listed on the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations, 2011 and two additional non-native plant species listed in *The Management of Invasive Alien Plant Species on National Roads – Technical Guidance* (TII, 2020) in the immediate vicinity of the proposed Project, there is the potential that these species will

recolonise vegetated areas within the proposed Project post-construction. As such, there is a risk that routine maintenance works may inadvertently spread contaminated vegetation cuttings.

The effects of introducing such non-native invasive plant species to highly sensitive and ecologically important habitat areas (*e.g.* designated areas for nature conservation or areas of Annex I habitat) have the potential to result in a significant negative effect, at geographic scales ranging from local to international. Mitigation measures have been designed to avoid this potential impact (see Section 15.5.2.2).

Habitat Degradation – Air Quality

The proposed Project is powered by electricity and therefore is not predicted to have significant tailpipe air quality emissions during its operation. Air quality modelling for the proposed Project concluded that all ambient air pollutants will remain in compliance with the ambient air quality standards and the proposed Project has negligible impacts at all modelled receptors, including ecological receptors.

Full details of the air quality assessment are provided in Chapter 16 (Air Quality).

Habitat Degradation – Hydrological Regime

It is acknowledged that the proposed Project includes the diversion and changes to several watercourses that discharge via the surface water network to downstream European sites. Nonetheless, based on the Finite Element Method (FEM) Flood Risk Assessment and Management (FRAM) modelling study presented in Section 18.5 of Chapter 18 (Hydrology) and Section 18.5 of Chapter 18 (Hydrology), the hydrological regime of watercourses crossed or culverted by the Project will not be altered significantly. Therefore, there are no likely significant effects on habitats through effects on the hydrological regime.

15.4.3.3 Rare and Protected Plant Species

Habitat Degradation – Surface Water Quality

There will be no impact during the Operational Phase as there are no proposed discharge points to the Royal Canal and therefore there is no potential for negative impacts on the opposite-leaved pondweed, tassel stonewort, horned pondweed, rigid hornwort and whorled water-milfoil to occur.

15.4.3.4 Mammals

15.4.3.4.1 Otter

Habitat Severance/Barrier Effect

Evidence of otter was recorded along the Broadmeadow River, Santry River and Royal Canal and there are known records of otter on the Broadmeadow River, Ward River, Cuckoo River, Mayne River, Santry River, Tolka River, Royal Canal, River Liffey and Grand Canal (NBDC, 2021; Waterways Ireland, 2019a; Waterways Ireland, 2019b; DCC, 2019). Although there are no records of otter along the Sluice River, it is likely that otter use this watercourse to commute and/or forage along as there are records of this species present downstream in the Mayne Estuary transitional waterbody.

The two proposed permanent culverts on the Sluice River and one of its tributaries, at Ch. 5 + 765 and Ch. 5 + 963, have the potential to create a permanent barrier to otter movement. Particularly during periods of spate/rapid flow or flooding, where increased water volumes and flow rates may render the structure impassable by otter. According to the EPA Map Viewer, the source of the Sluice River is located c. 1.9km upstream of the proposed culvert directly west of Forrest Little Golf Club and therefore the culvert could impede the movement of any otter within this watercourse to habitat downstream or upstream of the culvert. This habitat severance could have significant effects if it resulted in an otter population upstream of the culvert being confined to a territory of only 1.9km which is significantly less

than the typical territorial ranges of both female and male otter in Ireland (i.e. c. 7.5km ±1.5km and 13.2km ±5.3km, respectively, (Ó'Néill *et al.*, 2008)[93]. The proposed permanent viaduct over the Broadmeadow River and Ward River will not create a barrier to otter movement as this structure is a clear-span structure and will not affect the existing hydrological regime or functioning of the floodplain.

The habitat severance/barrier effect to otter associated with the proposed Project has the potential to affect local otter populations over the long-term, potentially affecting the species' conservation status, and result in a likely significant negative effect at the county geographic scale.

Mitigation measures to maintain mammal passage along watercourses used by otter have been designed (see Section 15.5.2.4).

Disturbance/Displacement

As discussed above in relation to construction impacts in Section 15.4.3.4.1, otter populations in an urban environment can be relatively tolerant of disturbance. Any increased level of disturbance associated with the operation of the proposed Project is therefore extremely unlikely to result in any perceptible disturbance/displacement of otter from their habitat.

Otter are generally nocturnal in habit and as such any operational works undertaken during the hours of darkness that may alter the existing environmental conditions at the watercourses have the potential to impact on this species. The following operational elements of the proposed Project will involve night-time work and are likely to result in increased levels of disturbance at these specific locations:

- The proposed Dardistown Depot will be operational 24 hours a day in order to facilitate rolling stock movements within the proposed commercial timetable and for wayside and maintenance of vehicles (including cleaning) outside of normal working hours;
- Routine maintenance activities along the rail line that will be undertaken at night outside the commercial train service (i.e. potentially during a five-hour period from 00:30 to 05:30); and,
- The proposed P&R Facility and all stations will be operational from the hours of 05:30 to 00:30 and as such there will be a requirement for lighting during periods of darkness, which will differ in summer and winter.

Additionally, the proposed floodlighting of playing pitches proposed as part of the proposed Project will result in increased levels of disturbance as a result of lighting in several locations i.e. Fingallians pitch at Balheary, Starlights pitch at Dardistown and Na Fianna pitches on St Moibhi Road.

Whilst the existing depot is located c. 245m north-west from the Mayne River, it will be located adjacent to the new proposed diversion of the Turnapin Stream, which will follow its western and northern boundaries. No signs of otter were recorded on the Mayne River during the surveys at Dardistown and the nearest records of otter are located c. 4.4km downstream of the proposed depot (Macklin *et al.*, 2019). The proposed lighting at this depot could reduce the suitability of the surrounding habitats for commuting and foraging otter. Given that there are no records of otter in the vicinity of this proposed depot, and the tolerance of urban otter populations to human disturbance, the proposed Project is not likely to affect the conservation status of otter. However, the mitigation measures proposed for bats (Section 15.5.2.5) will further reduce the potential for disturbance to otter.

The proposed routine maintenance activities along the rail line are likely to be very temporary in their duration and as the activities will comprise scheduled checks and visual inspections or, if necessary, track monitoring their magnitude will be very low; therefore, no potential impacts are predicted.

The proposed P&R Facility and all stations will be operational from the hours of 05:30 to 00:30 and as such there will be a requirement for lighting during periods of darkness, which will differ in summer and winter. During the longest day of the year, the duration of the requirement of lighting could be for c. two and a half hours, while during the shortest day of the year, the duration of the required lighting

[93] In Ireland, the territory of female otter in rivers is c. 7.5km ±1.5km in length (Ó'Néill *et al.*, 2008) and 6.5km ±1km in length in coastal environments (de Jongh *et al.*, 2010), while the territory of male otter in rivers is c. 13.2km ±5.3km in length with a high degree of variability due to territorial males responding quickly to social perturbation (Ó'Néill *et al.*, 2008).

could be for c. 11 and a half hours. The proposed P&R Facility/Estuary Station is located c. 175m north of the Broadmeadow River and as such no potential impacts are predicted. The footprint of a number of other stations are similarly set back from nearby watercourses, with the exception of the following proposed stations: Griffith Park (located c. 35m north of the Tolka River); Glasnevin (c. 18m north of the Royal Canal); Tara Street (c. 82m south of the River Liffey); and, Charlemont (c. 42m south of the Grand Canal). At all these stations, there is already existing levels of disturbance at night-time, i.e. including high levels of lighting, noise and human activity (including traffic). Given the existing urban environment environments at these locations and that there will be a minimum period of darkness of five hours per night, no potential impacts are predicted.

Disturbance or displacement associated with the operation of the proposed Project is not likely to affect the conservation status of otter and therefore, will not result in a likely significant negative effect, at any geographic scale.

Habitat Degradation - Water Quality

As described above for habitats in Section 15.4.3.2, during operation, contaminated surface water runoff and/or an accidental spillage or pollution event into any surface water feature has the potential to have a significant negative impact on water quality and consequently an impact on otter; either directly (*e.g.* acute or sub-lethal toxicity from pollutants) or indirectly (*e.g.* affecting their food supply or supporting habitats). In addition to surface water runoff, potential impacts on the quality of groundwater as a result of passive drainage of contaminated surface water runoff to ground could in turn impact on the water quality of watercourses which are fed by groundwater sources. The effects of frequent and/or prolonged pollution events in a river system have the potential to be extensive and far-reaching and could potentially have significant long-term effects. However, it is considered unlikely that a pollution event of such a magnitude would occur during operation or be any more than temporary in nature. Nevertheless, a precautionary approach is being taken in assuming a level of risk of water quality impacts and detailed mitigation measures are required to further minimise the risk of the proposed Project having any perceptible effect on water quality during operation.

Habitat degradation as a result of effects on surface water quality during operation has the potential to affect the species' conservation status and result in a likely significant negative effect at the county geographic scale. The scale of this potential impact is precautionary given the temporary nature and scale of the proposed impact, the availability of suitable habitat for otter upstream of the proposed crossing points and the large number of records of otter across the study area.

Mitigation measures have been designed to protect water quality during operation (see Section 15.5.2.2).

Mortality and/or Injury Risk

During operation, the alignment of the proposed Project will cross multiple watercourses that are known to be used by otter (i.e. Broadmeadow River, Ward River, Sluice River and Santry River); however, an increase in the risk of mortality and/or injury of otter during operation (as a result of collision) is considered unlikely due the type of watercourse crossings proposed where the potential for interaction with otter is negligible and the likelihood that local otter populations are habituated to the existing highly disturbed urban environment present in the vicinity of the proposed Project and that they would similarly become habituated to the proposed Project.

The Broadmeadow River and Ward River will be crossed by a clear-span viaduct elevated above the flood risk zone of these rivers and as such there is no potential for otter to be present on or near the track where the rail vehicles will be moving along. The Sluice River will be culverted at the proposed crossing point and as such any otter present will be directed through the culvert along the provided otter ledge. The proposed Project will cross the Santry River over an existing culvert and as such no potential collision risk with otter is predicted.

The proposed Project has been designed to meet the Grade of Automation 4 (GoA4) operation to ensure a safe, reliable, and efficient metro system. It will therefore be fully segregated from other

transport modes and the surrounding area, except at the proposed stations. A secure, robust mammal-resistant fence/boundary treatment will be installed along the length of the alignment to ensure complete segregation, to prevent any unauthorised access to the rail corridor and to prevent any objects from falling on the rail corridor. This fence/boundary treatment will also ensure that no otter enter onto the rail corridor and are potentially injured and/or killed as a result of a collision with a moving train during the operation of the proposed Project.

Collision risk to otter due to the proposed Project during operation is considered to be negligible and therefore it will not result in any potential significant effect to otter at any geographic scale.

Habitat Degradation – Hydrological Regime

It is acknowledged that the proposed Project includes the diversion and changes to several watercourses that discharge via the surface water network to downstream European sites. Nonetheless, based on the Finite Element Method (FEM) Flood Risk Assessment and Management (FRAM) modelling study presented in Section 18.5 of Chapter 18 (Hydrology) and Section 18.5 of Chapter 18 (Hydrology), the hydrological regime of watercourses crossed or culverted by the Project will not be altered significantly. Therefore, there are no likely significant effects on habitats through effects on the hydrological regime.

15.4.3.4.2 Bats

Direct Mortality Through Collisions

The proposed Project may pose a mortality risk to bats as a result of collisions with new buildings, trains and/or the collision/electrocution with the OCRsystem. A potential collision risk between man-made structures and bat species in-flight may arise as a result of the following specific elements of the proposed Project:

- The proposed track and its catenary power system (i.e. its OCR, c. 4.5m in maximum height, and supporting poles and structures that are c. 10m to 12m in height) at the aboveground sections of the alignment, in particular east of Balheary playing pitches;
- Buildings associated with the proposed P&R Facility, with a height of between c. 12m to 16m, and the proposed depot, with a height of c. 12.5m; and
- Proposed permanent clear-span viaduct over the Broadmeadow River and Ward River (i.e. c. 13.27m and 12.33m in height (respectively and including the OCR) and c. 11m in width, located between Ch. 1 + 500 – Ch. 1 + 760), c. 33m upstream of the existing Lissenhall Bridge and c. 25m upstream of the existing Balheary Bridge, respectively.

However, this collision risk is likely to be low. The potential collision with trains will be restricted to the aboveground sections of the proposed Project and between the hours of 05:30 to 00:30 when the trains will be in operation. During the summer months when bats are most active (i.e. from May to August), the likelihood of potential collisions with trains occurring is restricted to the operational night time hours when bats have emerged from the roost and the trains are still running - i.e. between 20:16 (sunset on the 31 August) to 00:30 hours (a duration of c. four hours 14 minutes) to between 21:57 (sunset on the 21 June) to 00:30 (a duration of c. two hours 33 minutes). The majority of the proposed alignment and associated OCR system at the aboveground sections of the proposed Project are either retained cut or cut and cover and as these sections are not elevated, they will not pose any potential significant risk to commuting bats and as such there is no potential for any significant effects at any geographic scale.

The potential for collision risk of bats and buildings is often due to the building material used and that smooth vertical surfaces such as glassy exteriors and windows can be particularly problematic (Greif *et al.*, 2017; Timm, 1989). The proposed Depot will be operational 24 hours a day and as such the activity may perturb bats from the buildings during night-time hours. The buildings associated with the proposed P&R Facility exterior will be vertical profiled glass panels, while the buildings associated with the proposed depot comprise a metallic envelope.

Irish bat species navigate largely by echolocation and as such fixed structures (such as the proposed viaducts, track OCR system and buildings) are unlikely to pose any significant collision risk to bats.

Therefore, it is considered unlikely that the proposed new structures would result in a notable increase in collision risk that would in turn significantly affect any bat populations at any geographic scale, as a result of mortality and/or injury.

Barrier/Severance effects

The existing landscape at the aboveground sections of the proposed Project will be altered; however, the potential for habitat severance and barrier effect to negatively impact on local bat populations is considered to be negligible due to the nature of the existing environment located adjacent to the proposed Project. The existing environment includes numerous existing man-made structures that are likely to already influence the movements of bats in the wider area to some degree (i.e. R132, R108, Swords town centre and Dublin Airport located in the immediate environment and the M1 Motorway and M50 Motorway located in the wider surrounding environment).

Given the proximity of the proposed Project to these existing features in the landscape, it is considered unlikely that any of the aboveground elements of the proposed Project (i.e. proposed P&R Facility, viaducts, alignment, stations and depot) would impede the movement of bats, which are already habituated to commuting around these existing features. This is especially the case for the commonly recorded species Leisler's bat, which is known to fly at significantly higher levels compared to other bat species (Russ, 1999).

Therefore, the potential for severance/barrier effect during operation is not likely to affect any local bat population and will not result in a likely significant negative effect, at any geographic scale.

Indirect Disturbance of Flight Patterns Due to Operational Lighting

Bats are nocturnal in habit and as such any operational works undertaken during the hours of darkness that may alter the existing environmental conditions in areas of suitable habitat have the potential to impact on bats. As discussed under construction impacts in Section 15.4.2.4.2, bats are particularly sensitive to light disturbance and as such any changes in existing light levels as a result of the proposed Project could impact on local bat populations, including their roosting, foraging and/or commuting behaviours.

One bat roost was identified within the study area of the proposed Project, i.e. a private dwelling named "*St Anne's*" located north-east of the Charter School Hill Road in Ballymun c. 20m east of the Project Boundary at Ch. 9860 and c. 53m east of the proposed alignment at this location (see Figure 15.7 for location of this roost). This roost contained only one soprano pipistrelle bat and is likely to be a transitional/occasional bat roost. This roost is not located within the proposed Project boundary and therefore it will not be demolished. There will be no direct illumination of this roost as a result of the proposed operational lighting. Whilst the existing lighting on Charter School Hill Road will be upgraded, it will not result in any increase in light levels at or immediately adjacent to this roost as it is located significantly set back form the roost and remaining vegetation (mature planted woodland) present will provide screening. Therefore, there will be no indirect impacts on this roost during operation as a result of lighting. There are no other roosts that will be directly illuminated by the proposed operational lighting to the extent that any likely significant effects are predicted.

The following operational elements of the proposed Project will involve night-time work and are likely to result in increased levels of disturbance as a result of lighting:

- The proposed Dardistown Depot will be operational 24 hours a day in order to facilitate rolling stock movements within the proposed commercial timetable and for wayside and maintenance of vehicles (including cleaning) outside of normal working hours;
- Routine maintenance activities along the rail line that will be undertaken at night outside the commercial train service (i.e. potentially during a five-hour period from 00:30 to 05:30); and,

- The proposed P&R Facility and all stations will be operational from the hours of 05:30 to 00:30 and as such there will be a requirement for lighting during periods of darkness, which will differ in summer and winter.

Additionally, the proposed floodlighting of playing pitches proposed as part of the proposed Project will result in increased levels of disturbance as a result of lighting in several locations i.e. Fingallians pitch at Balheary, Starlights pitch at Dardistown and Na Fianna pitches on St Moibhi Road.

The aboveground sections of the proposed alignment will only be lit in the event of an emergency using motion sensor and as this is likely to be very infrequent and short in duration, no potential impacts on bats are predicted. The proposed stations will only be lit at their entrances and plazas, while the proposed depot will only require lighting at its parking area.

The following of elements of the operational lighting design will ensure minimal impacts on bats from light disturbance:

- All proposed lighting will be from a LED light source, which is a more bat-friendly light source as it contains very little/no ultra-violet (UV) frequency lighting that bats are particularly sensitive to (BCI, 2010);
- Lighting will include an automatic dimming and switching off mechanism in order to reduce the duration of light disturbance as much as possible;
- Lighting will be directional, i.e. there will be no upward light projection and lighting will not be projected behind lighting columns in order to reduce any backward lighting and any obtrusive lighting into adjacent areas.
- Where possible, the shortest lighting columns will be used to further reduce any light spill.

There are a number of sensitive bat areas located across the study area that would be vulnerable to disturbance as a result of increased lighting.

These areas of the proposed Project are as follows:

- Lands at the proposed P&R Facility and Estuary Station (i.e. along hedgerows/treelines)
- Broadmeadow River and Ward River corridors and planted woodland within Balheary Park
- Sluice River corridor
- Mayne River corridor and field boundaries at Dardistown
- Santry River corridor and Santry Demesne
- Albert College Park
- Griffith Park and Tolka River corridor
- Royal canal and adjacent lands
- Stephen's Green Park
- Dartmouth Square
- Grand Canal

Given that the above areas in the vicinity of the proposed Project have been identified as being sensitive for bats, in the absence of mitigation, there is potential for operational lighting to result in a significant negative effect on bat populations at the local geographic scale.

15.4.3.4.3 Badger

Habitat Severance/Barrier Effect

The aboveground sections of the proposed Project comprise cut and cover and retained cut and includes for a mammal-proof fence along its alignment for safety. Therefore, the existing landscape at the aboveground sections of the proposed Project will be altered; however, the potential for habitat severance and barrier effect to negatively impact on local badger populations is considered to be negligible due to:

- The existing environment, located adjacent to the proposed Project where badger have been recorded, includes numerous existing man-made barriers to badger movement (including the R132, R108, Swords town centre and Dublin Airport in the immediate environment and the M1 Motorway and M50 Motorway in the surrounding environment);
- The location of the badger setts recorded during the surveys and the existing barriers present near to those setts and the proposed Project, i.e.:

- The proposed P&R Facility is located directly adjacent to the R132, an existing barrier to badger movement in the Estuary/Lissenhall area and therefore, badger movement within that general location would already be restricted somewhat to lands to the north and west of the proposed P&R Facility;
- The existing R132 and Spittal Hill Road are located west of the badger sett recorded in Lissenhall Demesne and as such the proposed P&R Facility further west of the R132 is unlikely to pose any impact to that sett; and,
- The existing R132 is located directly east of the badger sett recorded at Fosterstown and the proposed alignment at that location is located east of the R132; therefore, badger utilising this sett are already somewhat restricted in their movements due to the R132.

- The provision of a farm underpass at the existing entrance into McComish's lands, required to maintain access for the landowner at that specific location, will also provide passage for any individual badgers in that locality; and,
- The availability of suitable habitat in the wider area beyond the footprint of the proposed Project and existing barriers (i.e. R132). This includes the Ward River Valley, located north of the existing sett at Fosterstown, which is already restricted to the north-east due to the presence of the R132 and the Fosterstown Roundabout.

The badger sett located north of the R139 at Belcamp is in close proximity to the proposed MetroLink grid connection route, which will be located underground and therefore no impacts on badger during operation are predicted.

In addition to above, it is considered likely that badger groups will habituate to the altered landscape (Gaughran *et al.*, 2020). Therefore, the severance/barrier effect during operation is not likely to affect the local population and will not result in a likely significant negative effect, at any geographic scale.

Mortality and/or Injury Risk

The proposed Project has been designed to meet the GoA4 operation to ensure a safe, reliable, and efficient metro system. It will therefore be fully segregated from other transport modes and the surrounding area, except at the proposed stations. A secure, robust mammal-resistant fence/boundary treatment will be installed along the length of the alignment to ensure complete segregation, to prevent any unauthorised access to the rail corridor and to prevent any objects from falling on the rail corridor. This fence/boundary treatment will also ensure that no badger enter onto the rail corridor and are potentially injured and/or killed as a result of a collision with a moving train during the operation of the proposed Project.

There are other aboveground elements of proposed Project that could pose a potential risk to badger, such as traffic associated with the proposed P&R Facility at Estuary/Lissenhall and with the proposed depot; however the potential for significant effects on local badger populations is considered negligible given the type of structures present and that it is likely that local badger populations are habituated to the existing disturbed urban environment present in the vicinity of the proposed Project and that they would similarly become habituated to the proposed Project.

The proposed P&R Facility is located adjacent to the R132 and contains boundary fencing/treatments around its perimeter. Similarly, the proposed depot contains boundary fencing/treatments around its perimeter. In addition, during the surveys, no signs of badger were recorded within the Dardistown area, and the nearest known record of badger is c. 540m south-east on the M50 Motorway (NBDC, 2021). This suggests a very low level of badger activity at this location and as such the potential for impacts on badger as a result of collision risk is considered to be negligible.

Light Spill

Nocturnal mammals, such as the badger, are likely to be disturbed by the introduction of artificial light into established breeding and foraging areas (Rich & Longcore, 2005). The following operational elements of the proposed Project will involve night-time work and are likely to result in increased levels of disturbance as a result of lighting:

- The proposed depot will be operational 24 hours a day in order to facilitate rolling stock movements within the proposed commercial timetable and for wayside and maintenance of vehicles (including cleaning) outside of normal working hours;
- Routine maintenance activities along the rail line that will be undertaken at night outside the commercial train service (i.e. potentially during a five-hour period from 00:30 to 05:30); and,
- The proposed P&R Facility and all stations will be operational from the hours of 05:30 to 00:30 and as such there will be a requirement for lighting during periods of darkness, which will differ in summer and winter.

Additionally, the proposed floodlighting of playing pitches proposed as part of the proposed Project will result in increased levels of disturbance as a result of lighting in several locations i.e. Fingallians pitch at Balheary, Starlights pitch at Dardistown and Na Fianna pitches on St Moibhi Road.

The aboveground sections of the proposed alignment will only be lit in the event of an emergency (or routine maintenance works described above) using motion sensor and as this is likely to be very infrequent and short in duration. The proposed stations will only be lit at their entrances and plazas, while the proposed depot will only require lighting at its parking area.

There are no badger setts, or areas of high badger activity located within or beyond the proposed Project boundary in the vicinity of the proposed operational lighting for the proposed Project. Therefore, lighting associated with the proposed Project is unlikely to disturb or displace badgers from habitat areas beyond the proposed Project boundary, and therefore, would not affect the species conservation status in that regard and would not result in a likely significant negative effect, at any geographic scale. However, the mitigation proposed for bats (Section 15.5.2.5) will further reduce the potential for disturbance effects on badger.

15.4.3.4.4 Other Mammal Species

Habitat Severance/Barrier Effect

The existing landscape at the aboveground sections of the proposed Project will be altered; however, the potential for habitat severance and barrier effect to negatively impact on local mammal populations is considered to be negligible due to the existing environment, located adjacent to the proposed Project where mammals have been recorded (i.e. Irish hare) and where there are desktop records of mammal species, includes numerous existing man-made barriers to mammal movement (including the R132, R108, Swords town centre and Dublin Airport in the immediate environment and the M1 Motorway and M50 Motorway in the surrounding environment). Whilst the aboveground sections of the proposed Project that are retained cut include a mammal-proof fence, this is unlikely to impede the movement of smaller mammals (*e.g.* pygmy shrew and stoat). In addition, it is considered likely that mammals will habituate to the altered landscape. Therefore, the severance/barrier effect during operation is not likely to affect the local population and will not result in a likely significant negative effect, at any geographic scale.

Disturbance/Displacement

The operation of the proposed Project is likely to have some level of long-term effects on mammal usage of habitat in the vicinity of the proposed Project i.e. for breeding, commuting and foraging (Benítez-López *et al.* 2010). However, this is not likely to affect the species' conservation status nor result in a likely significant negative effect, at any geographic scale.

Habitat Degradation - Water Quality

As described above for habitats in Section 15.4.3.2, there will be outfall points to surface water features from the proposed Project drainage network during operation and therefore, a potential impact pathway to affect water quality in Broadmeadow Water transitional waterbody, Mayne transitional waterbody and/or Dublin Bay. This in turn could affect the marine mammal species therein.

During operation, contaminated surface water runoff and/or an accidental spillage or pollution event into any surface water feature has the potential to have a significant negative impact on water quality and consequently an impact on marine mammals; either directly (*e.g.* acute or sub-lethal toxicity from pollutants) or indirectly (*e.g.* affecting their food supply or supporting habitats). In addition to surface water runoff, potential impacts on the quality of groundwater as a result of passive drainage of contaminated surface water runoff to ground could in turn impact on the water quality of watercourses which are fed by groundwater sources. The effects of frequent and/or prolonged pollution events in a river system have the potential to be extensive and far-reaching and could potentially have significant long-term effects. However, it is considered unlikely that a pollution event of such a magnitude would occur during operation or be any more than temporary in nature. Nevertheless, a precautionary approach is being taken in assuming a level of risk of water quality impacts and detailed mitigation measures are required to further minimise the risk of the proposed Project having any perceptible effect on water quality during operation. Habitat degradation as a result of effects on surface water quality during operation has the potential to affect the species' conservation status and result in a likely significant negative effect, at a local geographic scale.

Mitigation measures have been designed to protect water quality during operation (see Section 15.5.2.3).

Mortality Risk

The mammal-proof fencing of the aboveground sections of the proposed Project are likely to be inaccessible for larger mammals such as Irish hare; however, this fencing is unlikely to impede the movement of smaller mammals such as pygmy shrew and stoat. For some smaller species, such as rodents, the risk may be higher as many such species forage in rough grassland and scrub habitats and may be attracted to foraging along the railway margins (*e.g.* at areas of rough grassland and scrub located adjacent to the alignment at North Dublin Corporate Park, Barrysparks, Fosterstown and Ballymun). However, the hard surfaces of the proposed railway line offer little in the way of potential foraging habitat for mammal species, other than opportunistic scavenging by larger mammal species. In addition, there are numerous existing man-made barriers present within/adjacent to the footprint of the proposed Project (including the R132, R108, Swords town centre and Dublin Airport in the immediate environment and the M1 Motorway and M50 Motorway in the surrounding environment) that are likely to already impede the movement of such small mammals and therefore prevent them from encountering the proposed alignment. Therefore, it is considered unlikely that the proposed Project has the potential to affect the local conservation status of any mammal species, and result in a significant negative effect, at any geographic scale.

15.4.3.5 Invertebrates

15.4.3.5.1 White-clawed Crayfish

As white-clawed crayfish is not present within the ZoI of the proposed Project, no impacts are predicted.

15.4.3.5.2 Freshwater Molluscs

Habitat Degradation – Water Quality

There will be no impact during operation as there are no proposed discharge points to the Royal Canal or Grand Canal and therefore there is no potential for negative impacts on the glutinous snail or false orb pea mussel to occur.

15.4.3.6 Birds

15.4.3.6.1 Breeding Birds

Mortality Risk and Disturbance/Displacement

The proposed Project will pose a mortality risk to breeding birds; however, this risk is likely to be lower compared to the mortality risks associated with the Construction Phase of the proposed Project. It will also be restricted to the aboveground sections of the proposed Project. The mortality risk is associated with potential collision with trains and/or the collision/electrocution with the overhead wires. In addition, small birds have been found to become trapped in uncapped catenary poles, which they have nested in, but cannot escape from (Barrientos *et al.*, 2019).

Increases in noise levels may also have a negative effect on bird abundance and occurrence in the locality. Whilst the noise levels associated with railways may be greater compared to road traffic, the disturbance would be of shorter durations and not continuous. Airborne noise modelling of the aboveground sections at AZ1 (Estuary to the Naul Road) and AZ3 (Dardistown to Ballymun) indicates that peak noise levels will occur during daytime hours. Operational noise levels will be a maximum of 75dB during the day and 70dB at night along, and immediately adjacent to the track. Noise levels arising from the proposed Project will reduce to existing baseline levels within several hundred metres of the track. Both aboveground locations are already subject to similarly high levels of noise from the existing road network i.e. between 55dB and 75dB during the day and between 50dB and 69dB at night[94]. The magnitude of the potential impact is related to the interaction between a multitude of factors such as species and railway traffic (which influences noise levels and mortality risk) and is also influenced by habitat type.

There may also be positive impacts on local breeding bird populations as a result of the habitat creation along the aboveground sections of the proposed Project (*e.g.* the wetland feature north of the Broadmeadow River), which would provide suitable nesting and/or foraging habitat for birds; however, the presence of such habitat in close proximity to the proposed Project may also increase the risk of mortality.

It is likely that the abundance of breeding bird species will permanently decline near to the aboveground section of the alignment of the proposed Project as a consequence of increased disturbance and mortality from railway traffic; the effects of which will reduce to a neutral impact with increasing distance from the alignment. Although it is not possible to quantify the magnitude of the potential impact based upon the available literature for most breeding bird species, in general it could potentially extend for several hundred metres from the proposed Project. However, where the proposed Project crosses a landscape which is generally already highly disturbed (i.e. lands west and east of the existing R132, north and south of Dublin Airport and in Ballymun) or of low habitat quality for breeding birds (e.g. planted species-poor treelines along the R132), the extent of the potential effects will likely be minimal.

The displacement of breeding birds from the proposed Project boundary is likely to result in a permanent increase in competition for resources (*e.g.* nesting habitat or prey/food sources) both between and amongst breeding bird species, which in turn would have negative impacts on local breeding bird populations in the long-term.

Although the proposed Project is predicted to have a long-term effect on local breeding bird populations, even at a local level this is not predicted to affect the ability of local breeding bird species to persist within their current ranges or to maintain their populations long-term. Therefore, the proposed Project is not likely to affect the conservation status of breeding bird species and will not result in a likely significant negative effect, at any geographic scale.

[94] The existing noise levels are based on EPA datasets that include modelled noise contours associated with major roads in Dublin, including the M1 Motorway, M50 Motorway, R132 and R108: "*Noise Round 3 Road – Lden*" and "*Noise Round 3 Road - Lnight*", available on the EPA MapViewer (accessed 23 June 2022): https://gis.epa.ie/EPAMaps/.

Habitat Degradation – Water Quality

As described above for habitats in Section 15.4.3.2, during operation, contaminated surface water runoff and/or an accidental spillage or pollution event into any surface water feature has the potential to have a significant negative impact on water quality and consequently an impact on breeding bird species; either directly (*e.g.* acute or sub-lethal toxicity from pollutants) or indirectly (*e.g.* affecting their food supply or supporting habitats). In addition to surface water runoff, potential impacts on the quality of groundwater as a result of passive drainage of contaminated surface water runoff to ground could in turn impact on the water quality of watercourses which are fed by groundwater sources. The effects of frequent and/or prolonged pollution events in a river system have the potential to be extensive and far-reaching and could potentially have significant long-term effects. However, it is considered unlikely that a pollution event of such a magnitude would occur during operation or be any more than temporary in nature. Nevertheless, a precautionary approach is being taken in assuming a level of risk of water quality impacts and detailed mitigation measures are required to further minimise the risk of the proposed Project having any perceptible effect on water quality during operation.

Breeding bird species[95] recorded during the surveys that may be vulnerable to such a potential impact due to their habitat and feeding requirements are as follows:

- Coot, cormorant, mallard, tufted duck and mute swan;
- Herring gull and lesser black-backed gull;
- Grey wagtail; and
- Kingfisher.

Habitat degradation as a result of effects on surface water quality during operation has the potential to affect the species' conservation status and result in a likely significant negative effect, at a local geographic scale in the case of all the relevant species recorded during the breeding bird surveys (as listed above), apart from kingfisher, which is an Annex I species and as such this potential impact may affect its conservation status resulting in a likely significant negative effect at a national geographic scale.

Mitigation measures have been designed to protect water quality during operation (see Section 15.5.2.3).

Habitat Degradation – Hydrological Regime

It is acknowledged that the proposed Project includes the diversion and changes to several watercourses that discharge via the surface water network to downstream European sites. Nonetheless, based on the Finite Element Method (FEM) Flood Risk Assessment and Management (FRAM) modelling study presented in Section 18.5 of Chapter 18 (Hydrology) and Section 18.5 of Chapter 18 (Hydrology), the hydrological regime of watercourses crossed or culverted by the Project will not be altered significantly. Therefore, there are no likely significant effects on breeding birds through effects on the hydrological regime.

15.4.3.6.2 Wintering Birds

This section of the impact assessment deals with wintering bird species, i.e. those bird species which are listed on either the BoCCI Red or Amber lists for their wintering populations. The assessment carried out in the NIS for the proposed Project considered the potential for the proposed Project to affect the bird species listed as SCIs of European sites for their wintering populations. That assessment concluded that there was no possibility of likely significant effects on any wintering population to arise from the proposed Project. Therefore, the proposed Project will not affect the conservation status of the wintering bird populations and will not result in a likely significant negative effect at any geographic scale.

[95] To note that this section assesses potential water quality impacts on non-SCI populations of the species outlined below. Impacts on SCI populations are assessed in the NIS accompanying this application for the proposed Project.

Disturbance/Displacement

During operation, the proposed Project has the potential to disturb and displace wintering bird species from habitat near the proposed Project boundary due to an increase in noise, human activity and visual disturbance associated with rail traffic. Although the operational disturbance/displacement effect cannot be quantified it would be expected to be much less than the 300m ZoI associated with construction works (as described in detail in Section 15.4.2.6.2 with respect to noise impacts). Most species of wintering birds are likely to habituate to the presence of a new railway, particularly when there is a barrier in place. Airborne noise modelling of the aboveground sections at AZ1 (Estuary to the Naul Road) and AZ3 (Dardistown to Ballymun) indicates that peak noise levels will occur during daytime hours. Operational noise levels will be a maximum of 75dB during the day and 70dB at night along, and immediately adjacent to the track. Noise levels arising from the proposed Project will reduce to existing baseline levels within several hundred metres of the track. Both aboveground locations are already subject to similarly high levels of noise from the existing road network i.e. between 55dB and 75dB during the day and between 50dB and 69dB at night[96].. Any operational noise increases are not likely to alter the existing baseline effect on wintering birds using the habitats locally.

Although there is still likely to be some level of displacement effect, a perceptible effect would be expected to be limited to habitats immediately adjacent to the footprint of the proposed Project. Although it is likely to add to the effect of habitat loss, in terms of additional habitat area being unavailable or unlikely to be used by wintering birds, it is not predicted to have a detrimental population level effect, particularly given:

- The relatively infrequent and/or low numbers of wintering bird species generally recorded at the winter bird sites located within close proximity to the footprint of the proposed Project; all of which had significantly lower peak flocks compared to 1% of their international and national populations and the mean peak flocks of the respective bird species (see Section 15.4.2.6.2, Table 15.20 for more details);
- The availability of suitable foraging and/or roosting habitat in the wider area (c. 1,828ha in total area), c. 300m-2km from the footprint of the proposed Project (see Section 15.4.2.6.2 for more details on available areas of suitable habitat), i.e.:

- Predominantly agricultural fields located north-west, north, north-east and south of the Broadmeadow River, north of the Ward River and east of the M1 Motorway towards and adjacent to Malahide Estuary (c. 1,295ha in total area);
- Agricultural fields located west of Fosterstown (including Forrest Little Club) and east of Barrysparks in Swords, in particular those located south of Malahide Estuary, (c. 303ha in total area);
- Agricultural fields in the wider area near Dardistown, located east beyond the M1 Motorway (c. 491ha in total area) and west of the proposed Project, beyond the Silloge Park Golf Club (c. 215ha in total area); and,
- Playing pitches at Santry Demesne (c. 15ha in total area).

In addition to above, the bird species present within the footprint of the proposed Project were generally recorded within or in close proximity to areas with relatively high levels of human activity and noise (i.e. Balheary playing pitches north-west of the Seatown roundabout, grassland at Barrysparks directly south-west of the R132, grassland at Dardistown directly west of the Quick Park Dublin Airport carpark and grassland at Ballymun directly west of the R108). The existing noise levels within these locations are up to 65dB to 69dB[97]. Therefore, it is likely that wintering birds utilising these locations are already habituated to a relatively high level of disturbance typical of an urban environment (such as noise associated with such road traffic and air traffic from Dublin Airport) and as such the increase in

[96] The existing noise levels are based on EPA datasets that include modelled noise contours associated with major roads in Dublin, including the M1 Motorway, M50 Motorway, R132 and R108: "*Noise Round 3 Road – Lden*" and "*Noise Round 3 Road - Lnight*", available on the EPA MapViewer (accessed 23 June 2022): https://gis.epa.ie/EPAMaps/.

[97] The existing noise levels are based on EPA datasets that include modelled noise contours associated with major roads in Dublin, including the M1 Motorway, M50 Motorway, R132 and R108, "*Noise Round 3 Road – Lden*" and the modelled noise contours associated with Dublin Airport "*Noise Round 3 Airport - Lden*", available on the EPA MapViewer (accessed 23 June 2022): https://gis.epa.ie/EPAMaps/.

disturbance associated with the operation of the proposed Project is unlikely to cause a significant negative effect on any wintering bird species present.

Therefore, any displacement of birds from areas of suitable habitat located immediately adjacent to the footprint of the proposed Project as a result of increased levels of disturbance is not likely to affect the conservation status of wintering bird species and will not result in a likely significant negative effect, at any geographic scale.

Mortality and/or Injury Risk as a Result of Collision

The operation of the proposed Project may result in an increased risk of mortality and/or injury of wintering bird species as a result of the collisions between flocks of such birds and structures (i.e. permanent bridges and the OCR system at the aboveground sections of the proposed Project).

The risk of birds colliding with a bridge structure is dependent on factors such as the location and attributes of the man-made structures (Lucas *et al.* 2008), visibility and detectability of the structure (bridge strikes are more likely during poor weather conditions or at night) (Jaroslow, 1979), confusion, caused by light refracted or reflected by mist (Jaroslow, 1979) the structure of the surrounding habitat, their frequency of occurrence within the impact zone (and flight height relative to the bridge structure), and the bird species present and their species-specific characteristics such as morphology and behaviour which influence their relative susceptibility to colliding with structures (Janss, 2000). The effects of collision risk at night can be magnified by disorientation caused by artificial lighting (Molenaar *et al.*, 2006). It has also been inferred that a bird's individual experience or inexperience can influence collision risk (Barrios and Rodriguez, 2004).

The following factors can influence the likelihood of bird collision with man-made structures occurring during the construction of the proposed Project:

- The specification of the man-made structure (*e.g.* height, the type of material its composed of and its reflectivity) and its proximity to features/flightpaths used by sensitive bird species;
- General visibility (i.e. collisions are more likely to occur during poor weather conditions and/or at night when the bird's visibility is impaired) (Nilsson *et al.*, 2009);
- The habitat surrounding the man-made structure; and,
- The type of bird species present, their frequency of occurrence within the impact zone, their flight height relative to the structure and their relative susceptibility to colliding with structures (as per SNH, 2018).

A potential collision risk between man-made structures and mobile wintering bird species[98] in-flight may arise as a result of the following elements of the proposed Project:

- Buildings associated with the proposed P&R Facility, with a height of between c. 12m to 16m, and the proposed depot, with a height of c. 12.5m;
- Proposed permanent clear-span viaduct over the Broadmeadow River and Ward River (i.e. c. 13.27m and 12.33m in height (respectively and including the OCR) and c. 11m in width, located between Ch. 1 + 500 – Ch. 1 + 760), c. 33m upstream of the existing Lissenhall Bridge and c. 25m upstream of the existing Balheary Bridge, respectively. This new structure may pose a new obstacle to any wintering bird species utilising the river corridor as a flight path;
- The proposed track and its catenary power system (i.e. its OCR, c. 4.5m in maximum height, and supporting poles and structures that are c. 10m to 12m in height) at the aboveground sections of the alignment, in particular east of Balheary playing pitches.

Due to the existing environment present along the R132 in Swords (i.e. from south of the existing Seatown roundabout to south of the existing Pinnock Hill roundabout), which is dominated by buildings and other elevated structures (*e.g.* footbridges), there is no potential collision risk from the track along the aboveground sections of the proposed Project along the existing R132 in Swords. In addition, the alignment of the proposed Project from north of the proposed Seatown Station to the proposed DANP is

[98] Wintering bird species recorded in the vicinity of the proposed Project are outlined in Section 15.3.9.2

a combination of retained cut and cut and cover and as such the aboveground at grade sections are limited in their extent.

There is also no potential collision risk from the proposed viaduct (c. 16.1m in height) over the existing M50 Motorway due to the existing environment, which includes multiple tall bridges/structures over the motorway, such as the M1 Motorway junction to the east and the Ballymun, Naul R108 junction four to the west, which would make it an unsuitable flightpath for wintering birds.

With regards to the potential collision risk along the Broadmeadow River and Ward River during operation, it is considered unlikely that any potential impact would occur as a result of any birds colliding with the new viaduct. This is primarily due to the existing environment located along these watercourses, which includes five man-made structures (along a c. 620m to 875m river corridor), located downstream of the proposed viaduct between the proposed Project and the Broadmeadow Water transitional waterbody that encompasses Malahide Estuary. These structures would already present an obstacle to any birds using these watercourses as a flightpath. It may also be assumed that such birds utilising this corridor are likely to be habituated to the presence of such obstacles and not perturbed by them as they would have to regularly navigate them in the event that such species regularly use this corridor as a flightpath. These five existing man-made structures include the following:

- Lissenhall Bridge, which is c. 10m in width and is located c. 33m downstream of where the proposed Viaduct will be located over the Broadmeadow River;
- Balheary Bridge, which is c. 41m in width and is located c. 25m downstream of where the proposed Viaduct will be located over the Ward River;
- The R132 bridge, which is c. 33m in width and is located c. 30m downstream of Lissenhall Bridge;
- The Spittal Hill Road bridge, which is c. 7m in width and is located c. 275m downstream of the R132 bridge and c. 130m downstream of the Balheary Bridge; and,
- M1 Motorway bridge, which is c. 36m in width and is located c. 435m downstream of the Spittal Hill Road bridge.

Wetland bird species regularly fly to and from inland feeding sites located across the Dublin area (both within the boundaries of DCC and FCC) and as such are habituated to traversing an urban landscape and navigating potential obstacles that could pose a collision risk. SNH have set out standard avoidance rates to be applied in SNH collision risk modelling undertaken to assess potential impacts of wind farms on birds (SNH, 2018). These avoidance rates provide an indication on the likely degree of successful avoidance of wind turbines by various bird species and are expressed as a percentage – i.e. the percentage of birds that would avoid a collision. The avoidance rates of various wetland waterbird species that were recorded during the wintering bird surveys in relatively large flocks within the study area are as follows:

- Curlew – 98%
- Golden plover – 98%
- Goose species – 99%
- Gull species – 98%
- Whooper swan – 98%

Therefore, it is considered unlikely that, even during poor weather conditions and limited visibility, the proposed new structures would result in a notable increase in collision risk that would in turn significantly affect any wintering bird populations as a result of mortality and/or injury.

The assessment outlined above is supported by the consensus of existing published scientific literature is that bridges, regardless of their design and the behaviour of birds in the vicinity (flight height and level of nocturnal flight activity), although they may result in some degree of bird mortality through collision, do not pose a collision risk that would result in the deaths of large numbers of birds or have any long-term bird population level effects. For full details of this literature review, refer to Section 15.4.2.6.2 above.

Habitat Degradation – Surface Water

As described above for habitats in Section 15.4.3.2, during operation, contaminated surface water runoff and/or an accidental spillage or pollution event into any surface water feature has the potential to have a significant negative impact on water quality and consequently an impact on the aquatic environment and supported bird species; either directly (*e.g.* acute or sub-lethal toxicity from pollutants) or indirectly (*e.g.* affecting their food supply or supporting habitats). In addition to surface water runoff, potential impacts on the quality of groundwater as a result of passive drainage of contaminated surface water runoff to ground could in turn impact on the water quality of watercourses which are fed by groundwater sources. The effects of frequent and/or prolonged pollution events in a river system have the potential to be extensive and far-reaching and could potentially have significant long-term effects. However, it is considered unlikely that a pollution event of such a magnitude would occur during operation or be any more than temporary in nature. Nevertheless, a precautionary approach is being taken in assuming a level of risk of water quality impacts and detailed mitigation measures are required to further minimise the risk of the proposed Project having any perceptible effect on water quality during operation.

Habitat degradation as a result of effects on surface water quality during operation has the potential to affect the winter bird species' conservation status and result in a likely significant negative effect, at a local geographic scale.

Mitigation measures have been designed to protect water quality during operation (see Section 15.5.2.2.1).

Habitat Degradation – Hydrological Regime

It is acknowledged that the proposed Project includes the diversion and changes to several watercourses that discharge via the surface water network to downstream European sites. Nonetheless, based on the Finite Element Method (FEM) Flood Risk Assessment and Management (FRAM) modelling study presented in Section 18.5 of Chapter 18 (Hydrology) and Section 18.5 of Chapter 18 (Hydrology), the hydrological regime of watercourses crossed or culverted by the Project will not be altered significantly. Therefore, there are no likely significant effects on wintering birds through effects on the hydrological regime.

15.4.3.7 Amphibians

Habitat Severance/Barrier Effect

The existing landscape at the aboveground sections of the proposed Project will be altered; however, the potential for habitat severance/barrier effect and resultant population isolation effects to negatively impact on local amphibian (i.e. common frog and smooth newt) populations will be negligible for the following reasons:

- The existing environment, located adjacent to the proposed Project where suitable amphibian habitat was recorded, includes numerous existing man-made barriers to amphibian movement (including the R132, R108, Swords town centre and Dublin Airport in the immediate environment and the M1 Motorway and M50 Motorway in the surrounding environment);
- The location of suitable amphibian habitat and the existing barriers present near to these areas and to the proposed Project such that the proposed Project will not impose a new barrier to amphibians in the locality, i.e.:

- Suitable drainage ditches located north-west of the proposed P&R Facility beyond the footprint of the proposed Project – the proposed park and Ride facility is located directly west of the R132, an existing barrier to amphibian movement in the Estuary/Lissenhall area and therefore, amphibian movement within that general location would already be restricted somewhat to lands to the north and west of the proposed P&R Facility, beyond the footprint of the proposed Project where suitable habitat exists;

- Suitable drainage ditches to the east of the R132 in Nevinstown west beyond the footprint of the proposed Project – the proposed alignment at this location follows the existing R132, which already is an existing barrier to amphibian movement within that general location;
- Suitable drainage ditches and ponds located west of Dardistown within Silloge Park Golf Club – the R108 at this location already presents an existing barrier to amphibian movement to and from the golf course and therefore the presence of the depot further east of the R108 is not likely to impede amphibian movement in the area;
- Suitable drainage ditch located east of Dardistown, directly north of the Quick Park Car Park Dublin Airport – this drainage ditch is already isolated due to the presence of the Old Airport Road to the north and the Quick Park Car Park Dublin Airport to the south and as such the proposed Depot is insignificant; and,
- Areas of wet grassland and pooling of stagnant water at Ballymun – suitable habitat within this area will be removed as part of the construction of the proposed Project and will be reinstated following completion of the project.

In consideration of the points above, the presence of the aboveground sections of the proposed Project during operation are considered not likely to result in severance/barrier effect on local populations of amphibians and therefore no likely significant negative effects at any geographic scale are predicted.

Mortality Risk

Amphibian species are vulnerable to train mortality and the presence of the proposed Project would pose a permanent mortality risk to common frog and smooth newt. This risk maybe increased during periods of high rainfall (Barrientos *et al.*, 2019). Although it is not possible to quantify the magnitude of this impact, it is unlikely to have long-term effects that would result in a decline of the local common frog and smooth newt populations, particularly given the relatively low cover of suitable amphibian habitat present adjacent to the proposed Project. In addition, as the aboveground alignment of the proposed Project will be fully segregated with a fence/boundary treatment present along its entirety and therefore access to the rail corridor itself (i.e. the source of the highest risk of mortality) is likely to be somewhat limited.

Therefore, mortality risk is not likely to affect the species' conservation status or result in a likely significant negative effect, at any geographic scale.

Habitat Degradation – Surface Water Quality

As described above for habitats in Section 15.4.3.2, during operation, contaminated surface water runoff and/or an accidental spillage or pollution event into any surface water feature suitable for amphibians has the potential to have a significant negative impact on water quality and consequently an impact on the aquatic environment and supported amphibian species; either directly (*e.g.* acute or sub-lethal toxicity from pollutants) or indirectly (*e.g.* affecting their food supply or supporting habitats). The effects of frequent and/or prolonged pollution events in an aquatic system have the potential to be extensive and far-reaching and could potentially have significant long-term effects. However, it is considered unlikely that a pollution event of such a magnitude would occur during operation or be any more than temporary in nature. Nevertheless, a precautionary approach is being taken in assuming a level of risk of water quality impacts and detailed mitigation measures are required to further minimise the risk of the proposed Project having any perceptible effect on water quality during operation.

Habitat degradation as a result of effects on surface water quality during operation has the potential to affect the amphibian species' conservation status and result in a likely significant negative effect, at a local geographic scale.

Mitigation measures have been designed to protect water quality during operation (see Section 15.5.2.3).

15.4.3.8 Reptiles

Habitat Severance/Barrier Effect

The existing landscape at the aboveground sections of the proposed Project will be altered; however, the potential for habitat severance and barrier effect to negatively impact on local common lizard populations will be negligible for the following reasons:

- The existing environment, located adjacent to the proposed Project where suitable common lizard habitat was recorded, includes numerous existing man-made barriers to common lizard movement (including the R132, R108, Swords town centre and Dublin Airport in the immediate environment and the M1 Motorway and M50 Motorway in the surrounding environment);
- The location of the majority of suitable common lizard habitat and the existing barriers present near to these areas and to the proposed Project such that the proposed Project will not impose a new barrier to common lizard in the locality, i.e.:

- Rough grassland, hedgerow and scrub north and south of the Broadmeadow River, located directly west and east of the existing R132;
- Dry calcareous and neutral grassland, scrub, hedgerow and recolonising bare ground located within Hertz Europe Service Centre facility, at Barrysparks and near the Fujitsu Ireland Limited, all located directly east of the R132;
- Rough and wet grassland, hedgerow and scrub located in Fosterstown, directly west of the R132; and,
- Areas of rough/wet grassland, hedgerow and scrub at Ballymun – suitable habitat within this area will be removed as part of the construction of the proposed Project and will be reinstated following completion of the project.

The only exceptions to these areas are at the Sluice River, both west and east of the proposed crossing, and at Dardistown, around the perimeter of the footprint of the proposed Project. These locations are not directly adjacent to an existing barrier and as such it is possible the proposed Project will present a new barrier to common lizard in the immediate locality; however, given the somewhat limited extent of suitable habitat present, the numbers of common lizard likely to be present at these locations is considered to be very small. In addition, the proposed fencing along the alignment is unlikely to be completely inaccessible to common lizard.

In consideration of the points above, the presence of the aboveground sections of the proposed Project during operation are not likely to result in severance/barrier effect to such a degree that it would impact on the movement of local common lizard populations and therefore no likely significant negative effects at any geographic scale are predicted.

Mortality Risk

Common lizard are vulnerable to mortality and the presence of the proposed Project would pose a permanent mortality risk to the species. Although it is not possible to quantify the magnitude of this impact, it is unlikely to have long-term effects that would result in a decline of the local common lizard population.

Therefore, mortality risk is not predicted to affect the species' conservation status or result in a likely significant negative effect to reptiles, at any geographic scale.

15.4.3.9 Fish

Habitat Degradation – Surface Water

As described above for habitats in Section 15.4.3.2, during operation, contaminated surface water runoff and/or an accidental spillage or pollution event into any surface water feature has the potential to have a significant negative impact on water quality and consequently an impact on fish species; either directly (*e.g.* acute or sub-lethal toxicity from pollutants) or indirectly (*e.g.* affecting their food supply or

supporting habitats). In addition to surface water runoff, potential impacts on the quality of groundwater as a result of passive drainage of contaminated surface water runoff to ground could in turn impact on the water quality of watercourses which are fed by groundwater sources. The effects of frequent and/or prolonged pollution events in a river system have the potential to be extensive and far-reaching and could potentially have significant long-term effects. However, it is considered unlikely that a pollution event of such a magnitude would occur during operation or be any more than temporary in nature. Nevertheless, a precautionary approach is being taken in assuming a level of risk of water quality impacts and detailed mitigation measures are required to further minimise the risk of the proposed Project having any perceptible effect on water quality during operation.

Habitat degradation as a result of effects on surface water quality during operation has the potential to affect fish species' conservation status and result in a likely significant negative effect, at a local to international geographic scale.

Mitigation measures have been designed to protect water quality during operation (see Section 15.5.2.3).

Habitat Severance/Barrier Effect

The structures have been designed in consultation with IFI and the design criteria set out in Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes (NRA, 2008d) and the Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters (IFI, 2016). This will maintain fish passage during the operation of the proposed Project and therefore, will result in a neutral impact to fish species.

The proposed permanent bridge over the Broadmeadow River and Ward River is a clear span bridge that will not require any instream works and/or permanent instream structures; therefore, no impact arising from habitat severance/ will occur.

15.4.3.10 Proposed Grid Connections

The only potential impact of the proposed Grid Connections during operation relate to Operational Phase lighting at the two GIS sub-stations, as listed below:

- Otter: Disturbance/displacement (as a result of increased artificial lighting)
- Bats: Disturbance/displacement (as a result of increased artificial lighting)
- Badger: Disturbance/displacement (as a result of increased artificial lighting)
- Other Mammal Species: Disturbance/displacement (as a result of increased artificial lighting)
- Breeding Birds: Disturbance/displacement (as a result of increased artificial lighting)

Mitigation measures to reduce light spill/impacts at the proposed Grid Connections GIS sub-stations has been proposed as described in Section 15.5.2.12. Additionally, mitigation measures have been designed for the proposed Project to avoid potential disturbance/displacement of bats as a result of increased artificial lighting (i.e., operational lighting design measurements to ensure minimal impacts on bats from light disturbance) as detailed in Section 15.5.1.2.6, which can be applied to the proposed Grid Connections.

Habitat Degradation – Hydrological Regime

It is acknowledged that the proposed Project includes the diversion and changes to several watercourses that discharge via the surface water network to downstream European sites. Nonetheless, based on the Finite Element Method (FEM) Flood Risk Assessment and Management (FRAM) modelling study presented in Section 18.5 of Chapter 18 (Hydrology) and Section 18.5 of Chapter 18 (Hydrology), the hydrological regime of watercourses crossed or culverted by the Project will not be altered significantly. Therefore, there are no likely significant effects on fish through effects on the hydrological regime.

15.4.4 Summary of Potential Impacts

Table 15.22 below presents an overall summary of the likely significant effects of the proposed Project on biodiversity, in the absence of mitigation measures.

Table 15.22: Summary of Likely Significant Effects of the Proposed Project on Biodiversity (Pre-Mitigation)

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance
Designated Areas for Nature Conservation			
Malahide Estuary SAC (including Malahide Estuary pNHA)	International Importance (National Importance)	**Construction** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies; and, Habitat degradation as a result of the introduction and/or spread of non-native invasive species; **Operation** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies.	Likely significant effect at the international geographic scale
Malahide Estuary SPA (including Malahide Estuary pNHA)	International Importance (National Importance)	**Construction** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies; and, Habitat degradation as a result of the introduction and/or spread of non-native invasive species. **Operation** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies.	Likely significant effect at the international geographic scale
Baldoyle Bay SAC (including Baldoyle Bay pNHA)	International Importance (National Importance)	**Construction** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies; and, Habitat degradation as a result of the introduction and/or spread of non-native invasive species. **Operation** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies.	Likely significant effect at the international geographic scale
Baldoyle Bay SPA (including Baldoyle Bay pNHA)	International Importance (National Importance)	**Construction** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies; and, Habitat degradation as a result of the introduction and/or spread of non-native invasive species. **Operation** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies.	Likely significant effect at the international geographic scale
North Dublin Bay SAC (including North Dublin Bay pNHA)	International Importance (National Importance)	**Construction** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies; and, Habitat degradation as a result of the introduction and/or spread of non-native invasive species. **Operation** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies.	Likely significant effect at the international geographic scale
North Bull Island SPA	International Importance (National Importance)	**Construction** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies; and,	Likely significant effect at the international geographic scale

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance
(including North Dublin Bay pNHA)		Habitat degradation as a result of the introduction and/or spread of non-native invasive species. **Operation** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies.	
South Dublin Bay SAC (including South Dublin Bay pNHA)	International Importance (National Importance)	**Construction** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies; and, Habitat degradation as a result of the introduction and/or spread of non-native invasive species. **Operation** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies.	Likely significant effect at the international geographic scale
South Dublin Bay and River Tolka SPA (including North Dublin Bay pNHA, South Dublin Bay pNHA, Dolphins, Dublin Docks pNHA and Booterstown Marsh pNHA)	International Importance (National Importance)	**Construction** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies; and, Habitat degradation as a result of the introduction and/or spread of non-native invasive species. **Operation** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies.	Likely significant effect at the international geographic scale
Wicklow Mountains SAC	International Importance	**Construction** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies. **Operation** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies.	Likely significant effect at the international geographic scale
Rogerstown Estuary SPA (including Rogerstown Estuary pNHA)	International Importance	**Construction** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies; and, Habitat degradation as a result of the introduction and/or spread of non-native invasive species. **Operation** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies.	Likely significant effect at the international geographic scale
Ireland's Eye SPA (including Ireland's Eye pNHA)	International Importance	**Construction** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies; and, Habitat degradation as a result of the introduction and/or spread of non-native invasive species. **Operation** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies.	Likely significant effect at the international geographic scale
Lambay Island SPA	International Importance	**Construction** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies; and,	Likely significant effect at the

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance
(including Lambay Island pNHA)		Habitat degradation as a result of the introduction and/or spread of non-native invasive species. **Operation** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies.	international geographic scale
Skerries Islands SPA (including Skerries Islands NHA)	International Importance	**Construction** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies; and, Habitat degradation as a result of the introduction and/or spread of non-native invasive species. **Operation** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies.	Likely significant effect at the international geographic scale
Dalkey Islands SPA (including Dalkey Coastal Zone and Killiney Hill pNHA)	International Importance	**Construction** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies; and, Habitat degradation as a result of the introduction and/or spread of non-native invasive species. **Operation** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies.	Likely significant effect at the international geographic scale
Howth Head Coast SPA (including Howth Head pNHA)	International Importance	**Construction** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies; and, Habitat degradation as a result of the introduction and/or spread of non-native invasive species. **Operation** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies.	Likely significant effect at the international geographic scale
Rockabill SPA (including Rockabill pNHA)	International Importance	**Construction** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies; and, Habitat degradation as a result of the introduction and/or spread of non-native invasive species. **Operation** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies.	Likely significant effect at the international geographic scale
The Murrough SPA (including The Murrough pNHA)	International Importance	**Construction** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies; and, Habitat degradation as a result of the introduction and/or spread of non-native invasive species. **Operation** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies.	Likely significant effect at the international geographic scale
Royal Canal pNHA	National Importance	**Construction** Habitat degradation – surface water quality Habitat degradation – air Habitat degradation – non-native invasive plant species Disturbance/displacement - lighting **Operation**	Likely significant effect at the national geographic scale

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance
		Habitat degradation – surface water quality Habitat degradation – non-native invasive plant species Disturbance/displacement - lighting	
Grand Canal pNHA	National Importance	**Construction** Habitat degradation – surface water quality Habitat degradation – air Habitat degradation – non-native invasive plant species Disturbance/displacement - lighting **Operation** Habitat degradation – surface water quality Habitat degradation – non-native invasive plant species Disturbance/displacement - lighting	Likely significant effect at the national geographic scale
Santry Demesne pNHA	National Importance	**Construction** Habitat degradation – surface water quality Habitat degradation – groundwater Habitat degradation – air Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – surface water quality Habitat degradation – groundwater Habitat degradation – non-native invasive plant species	Likely significant effect at the national geographic scale
Sluice River Marsh pNHA	National Importance	**Construction** Habitat degradation – surface water quality Habitat degradation – groundwater Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – surface water quality Habitat degradation – groundwater Habitat degradation – non-native invasive plant species	Likely significant effect at the national geographic scale
Habitats (outside of designated areas for nature conservation)			
Tidal rivers (CW2) (corresponding to Annex I habitat Estuaries [1130])	National Importance	**Construction** Habitat degradation – surface water quality Habitat degradation – groundwater Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – surface water quality Habitat degradation – groundwater Habitat degradation – non-native invasive plant species	Likely significant effect at the national geographic scale
Tall-herb swamps (FS2) (corresponding to Annex I habitat Hydrophilous tall-herb swamp [6430])	National Importance	**Construction** Habitat degradation – surface water quality Habitat degradation – groundwater Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – surface water quality Habitat degradation – groundwater Habitat degradation – non-native invasive plant species	Likely significant effect at the national geographic scale

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance
Reed and large sedge swamps (FS1)	Local Importance (Higher Value)	**Construction** Habitat degradation – surface water quality Habitat degradation – groundwater Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – surface water quality Habitat degradation – groundwater Habitat degradation – non-native invasive plant species	Likely significant effect at the local geographic scale
Tall-herb swamps (FS2) (non-Annex I habitat)	Local Importance (Higher Value)	**Construction** Habitat degradation – surface water quality Habitat degradation – groundwater Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – surface water quality Habitat degradation – groundwater Habitat degradation – non-native invasive plant species	Likely significant effect at the local geographic scale
Depositing/ lowland rivers (FW2)	Local Importance (Higher Value)	**Construction** Habitat loss Habitat degradation – surface water quality Habitat degradation – groundwater Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – surface water quality Habitat degradation – groundwater Habitat degradation – non-native invasive plant species	Likely significant effect at the local geographic scale
Canals (FW3)	National Importance – see Royal Canal pNHA and Grand Canal pNHA	**Construction** Temporary habitat loss Habitat degradation – surface water quality Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – surface water quality Habitat degradation – non-native invasive plant species	Likely significant effect at the national geographic scale
Drainage ditches (FW4)	Local Importance (Higher Value)	**Construction** Habitat loss Habitat degradation – surface water quality Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – surface water quality Habitat degradation – hydrogeology Habitat degradation – non-native invasive plant species	Likely significant effect at the local geographic scale
Species-rich dry calcareous and neutral	Local Importance (Higher Value)	**Construction** Habitat loss Habitat degradation – air quality	Likely significant effect at the local geographic scale

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance
grassland (GS1)		Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – non-native invasive plant species	
Wet grassland (GS4)	Local Importance (Higher Value)	**Construction** Habitat loss Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – non-native invasive plant species	Likely significant effect at the local geographic scale
(Mixed) broadleaved woodland (WD1)	Local Importance (Higher Value)	**Construction** Habitat loss Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – non-native invasive plant species	Likely significant effect at the local geographic scale
(Mixed) conifer woodland (WD3)	Local Importance (Higher Value)	**Construction** Habitat loss Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – non-native invasive plant species	Likely significant effect at the local geographic scale
Scattered trees and parkland (WD5)	Local Importance (Higher Value)	**Construction** Habitat loss Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – non-native invasive plant species	Likely significant effect at the local geographic scale
Hedgerows (WL1)	Local Importance (Higher Value)	**Construction** Habitat loss Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – non-native invasive plant species	Likely significant effect at the local geographic scale
Treelines (WL2)	Local Importance (Higher Value)	**Construction** Habitat loss Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – non-native invasive plant species	Likely significant effect at the local geographic scale
Immature woodland (WS2)	Local Importance (Higher Value)	**Construction** Habitat loss Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – non-native invasive plant species	Likely significant effect at the local geographic scale
Flora Species			
Opposite-leaved	National Importance	Construction Habitat degradation – surface water quality	Likely significant effect at the

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance
pondweed Groenlandia densa		**Operation** Habitat degradation – surface water quality	national geographic scale
Tassel stonewort Tolypella intricata	National Importance	**Construction** Habitat degradation – surface water quality **Operation** Habitat degradation – surface water quality	Likely significant effect at the national geographic scale
Horned pondweed Zannichellia palustris	Local Importance (Higher Value)	**Construction** Habitat degradation – surface water quality **Operation** Habitat degradation – surface water quality	Likely significant effect at the local geographic scale
Rigid hornwort Ceratophyllum demersum	Local Importance (Higher Value)	**Construction** Habitat degradation – surface water quality **Operation** Habitat degradation – surface water quality	Likely significant effect at the local geographic scale
Whorled water-milfoil Myriophyllum verticillatum	Local Importance (Higher Value)	**Construction** Habitat degradation – surface water quality **Operation** Habitat degradation – surface water quality	Likely significant effect at the local geographic scale
Fauna Species			
Otter	International Importance	**Construction** Habitat degradation –water quality Habitat degradation – groundwater Habitat severance/barrier effect **Operation** Habitat severance/barrier effect Habitat degradation – hydrology	Likely significant effect at the county geographic scale
Nathusius' pipistrelle	County Importance	**Construction** Roost loss (tree/hibernation roosts) Disturbance/Displacement- lighting Habitat loss/fragmentation **Operation** Disturbance/Displacement- lighting	Likely significant effect at the local geographic scale
All other bat species	Local Importance (Higher Value)	**Construction** Roost loss (tree/hibernation roosts) Disturbance/Displacement- lighting Habitat loss/fragmentation **Operation** Disturbance/Displacement- lighting	Likely significant effect at the local geographic scale
Badger	Local Importance (Higher Value)	**Construction** Disturbance/displacement **Operation** n/a	n/a
Other mammal species protected	Local Importance (Higher Value)	**Construction** Habitat degradation - water quality Barrier/severance effects **Operation** Habitat degradation - water quality	Likely significant effect at the local geographic scale

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance
under the Wildlife Acts			
Marine mammals e.g. common porpoise, harbour seal and grey seal	International Importance	**Construction** Habitat degradation - water quality **Operation** Habitat degradation - water quality	Likely significant effect at the international geographic scale
Glutinous snail	National Importance	**Construction** Habitat degradation – water quality **Operation** n/a	Likely significant effect at the county scale
False orb pea mussel	National Importance	**Construction** Habitat degradation – water quality **Operation** n/a	Likely significant effect at the county scale
Breeding Red BoCCI species	County Importance	**Construction** Mortality/injury risk Habitat and food source degradation – water quality **Operation** Habitat and food source degradation – water quality	Likely significant effect at the local geographic scale
Breeding Green and Amber BoCCI species	Local Importance (Higher Value)	**Construction** Mortality/injury risk Habitat and food source degradation – water quality **Operation** Habitat and food source degradation – water quality	Likely significant effect at the local geographic scale
Kingfisher	National Importance	**Construction** Mortality/injury risk Habitat and food source degradation – water quality **Operation** Habitat and food source degradation – water quality	Likely significant effect at the local to national geographic scale
Yellowhammer	County Importance	**Construction** Habitat loss Mortality/injury risk **Operation** n/a	Likely significant effect at the local geographic scale
Wintering Red BoCCI species	Local Importance (Higher Value)	**Construction** Habitat degradation - water quality **Operation** Habitat degradation - water quality	Likely significant effect at the local geographic scale
Wintering Green and Amber BoCCI species	Local Importance (Higher Value)	**Construction** Habitat degradation - water quality **Operation** Habitat degradation - water quality	Likely significant effect at the local geographic scale
Smooth newt Common frog	Local Importance (Higher Value)	**Construction** Habitat degradation – surface water quality **Operation** Habitat degradation – surface water quality	Likely significant effect at the local geographic scale

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance
Common lizard	Local Importance (Higher Value)	**Construction** n/a **Operation** n/a	n/a
Atlantic salmon	National Importance	**Construction** Habitat degradation – surface water quality Habitat degradation – groundwater Mortality risk Habitat severance/barrier effect **Operation** Habitat degradation – surface water quality	Likely significant effect at the national to international geographic scale
European eel	International Importance		
All other fish species recorded (incl. brown trout)	Local Importance (Higher Value)	**Construction** Habitat degradation – surface water quality Habitat degradation – groundwater Mortality risk Habitat severance/barrier effect **Operation** Habitat degradation – surface water quality	Likely significant effect at the local geographic scale
Local Biodiversity Areas			
Local biodiversity areas (See Section 15.3.2)	The value of the biodiversity receptors recorded in the vicinity of the proposed Project, across the local biodiversity areas, range from Local Importance (Lower Value) to Internationally Important	Combination of all of the potential impacts noted above The specific impacts are related to and dependent upon the potential impacts of the proposed Project on each of the individual ecological receptors that make up the biodiversity resources within a given local biodiversity area	Likely significant effects from local up to the international geographic scale

15.5 Mitigation Measures

This section presents the mitigation measures to avoid or reduce the potential impacts of the proposed Project on biodiversity. Section 15.5.1.1 and Section 15.5.2.1 summarise the mitigation measures that relate to the protection of European sites. All other mitigation measures are described in Sections 15.5.1.2 to 15.5.1.13 and Sections 15.5.2.2 to 15.5.2.11 below. All of these mitigation measures are included in the Schedule of Environmental Commitments which will be implemented by the contractor under supervision of both the Project Ecologist (employed by the Employer) and the Ecological Clerk of Works (employed by the Contractor).

15.5.1 Construction Phase

15.5.1.1 Designated Areas for Natura Conservation

15.5.1.1.1 European Sites

The mitigation measures that are specifically required to ensure that the proposed Project will not result in a likely significant effect on (i.e. adversely affect the integrity of) the European sites within its ZoI (i.e. Baldoyle Bay SAC, Malahide Estuary SAC, North Dublin Bay SAC, South Dublin Bay SAC, Wicklow Mountains SAC, Baldoyle Bay SPA, Dalkey Islands SPA, Howth Head Coast SPA, Ireland's Eye SPA, Lambay Island SPA, Malahide Estuary SPA, North Bull Island SPA, Rockabill SPA, Rogerstown Estuary SPA, Skerries Islands SPA, South Dublin Bay and River Tolka Estuary SPA, and The Murrough SPA) are presented below and in Section 6 of the NIS that accompanies this report. Following a consideration and assessment of the proposed Project on the identified relevant European sites, mitigation measures were developed to address the following potential impacts that were identified:

- Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies; and,
- Habitat degradation as a result of the introduction and/or spread of non-native invasive species;

A site-specific outline Construction Environmental Management Plan (CEMP) (Appendix A5.1) and outline Invasive Species Management Plan (ISMP) (Appendix A15.8) are included with the applicant's planning documentation submitted to the competent authority. The Principal Contractor and all construction contractors are required to comply with the outline CEMP and ISMP.

These measures have been developed in consideration of the following standard best international practice including but not limited to:

- Construction Industry Research and Information Association (CIRIA) (2015) *Environmental Good Practice on Site (C741)*;
- CIRIA (2001) *Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors (C532)*;
- CIRIA (2000) *Environmental Handbook for Building and Civil Engineering Projects (C512)*;
- CIRIA (2007) *The SUDS Manual (C697)*;
- CIRIA (2006a) *Control of water pollution from linear construction projects: Technical guidance (C848)*;
- CIRIA (2006b) *Control of water pollution from linear construction projects: Site guide (C649)*;
- IFI (2016) *Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters*;
- *UK Pollution Prevention Guidelines (PPG)* UK Environment Agency, 2004; and
- BPGCS005, *Oil Storage Guidelines*.

Good Housekeeping

The contractor(s) will always ensure good housekeeping practices on site to prevent accidents. The following requirements relate to protection of watercourses specifically and are a subset of items listed in Section 5.4 of the outline CEMP:

- General maintenance of working areas and cleanliness of welfare facilities and storage areas;
- All contractors will be made aware of material storage arrangements at induction and through toolbox talks. Materials will be stored in a designated area in an organised manner so as to protect them from damage, deterioration and loss;
- Provision of a site layout map showing key areas such as first aid posts, material storage, spill kits, material and waste storage and welfare facilities;
- Weekly environmental inspections;
- Maintenance of all construction plant, material and equipment and ensure these are in good order, clean and tidy;
- Keep construction compounds, access routes and designated parking areas free and clear of excess dirt, scrap wood and rubbish piles at all times;

- Details of site managers contact numbers and public information signs (including warning signs) will be provided at the boundaries of the working areas. Any complaints from the public regarding waste and housekeeping will be entered in the complaints register and actioned as required;
- Provision of appropriate welfare facilities for site personnel at all main compounds. The facilities will include canteens, toilets, showers, locker rooms and first aid posts. The facilities will be connected to the mains services and drainage, where reasonably practicable;
- Installation of appropriate security, lighting, fencing and hoarding at each working area;
- Effective prevention of oil, grease or other objectionable matter being discharged from any working area;
- Provision of appropriate waste management facilities at each working area and regular collections to be arranged;
- Maintenance of wheel washing facilities and other contaminant measures as required in each working area;
- No discharge of site runoff or water discharge without agreements of the relevant authorities;
- Installation of fencing and signage around any known invasive species;
- Protection of any historical heritage on site;
- Maintenance of public rights of way, diversions and entry/exit areas around working areas for pedestrians and cyclists where practicable; and
- Material handling and/or stockpiling of materials/spoil, where permitted, will be appropriately located to minimise exposure to wind. Water misting or sprays will be used as required if particularly dusty activities are necessary during dry or windy periods.

Measures to Protect Surface Water Quality during Construction

The contractor(s) are required to implement at a minimum the measures listed in Table 15.24 in relation to water during construction. This will require the development of a Water Management Plan, Sediment Erosion and Pollution Control Plan, Groundwater Monitoring Plan and Construction Flood Protection Plan. The measures contained within Table 15.23 are sufficient for the protection of water quality in European sites.

Table 15.23: Measures to Protect Surface Water Quality during Construction

Topic	Environmental Control Measure
Compliance and Best Practice H1, H2 & HG8	The contractor(s) will implement suitable control measures to ensure compliance with environmental quality standards specified in the relevant legislation (i.e., European Communities (Environmental Objectives (Surface Waters)) Regulations, 2009 (S.I. No. 272 of 2009 and amendments), and the European Communities (Quality of Salmonid Waters) Regulations, 1988 (S.I. No. 293 of 1988). The contractor(s) will adhere to best practices including, but not limited to: • Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes published by NRA, (NRA 2009); • Transport Infrastructure Ireland - Road Drainage and the Water Environment (TII, 2015); • Use of temporary construction methods from the following CIRIA publications (including C532: Control of water pollution from construction sites, C648: Control of water pollution from linear construction projects: technical guidance (CIRIA, 2006a) and C649: Control of water pollution from linear construction projects: site guide (CIRIA, 2006b); • Office of Public Works (OPW) Guidelines for Planning Authorities: The Planning System and Flood Risk Management (November, 2009). Further guidance is outlined in Section 5.8 of the outline CEMP
Water Management Plan H1	The contractor(s) will produce a Water Management Plan that includes, at a minimum, the objectives outlined in this table and in Appendix A5.11 (Water Management) in Volume 5 of the EIAR, namely: ▪ The activities requiring water and the anticipated peak water demand for each site; ▪ Where the water for each site will be sourced; ▪ Strategies for minimising water use; ▪ Strategies for conserving water;

Topic	Environmental Control Measure
	▪ Treatment of wastewater; and ▪ Means of disposal of wastewater.
Sediment Erosion and Pollution Control Plan H1 & HG8	A Sediment Erosion and Pollution Control Plan will be implemented for all construction works. This will include measures to manage soil and silt-laden water on site, accidental leaks/spills to ground and water quality monitoring to ensure compliance with environmental quality standards specified in the relevant legislation (i.e. European Communities (Environmental Objectives (Surface Waters)) Regulations, 2009 (S.I. No. 272 of 2009 and amendments), and the European Communities (Quality of Salmonid Waters) Regulations, 1988 (S.I. No. 293 of 1988). The plan will include relevant control measures detailed in other sections of this table.
Management of Run-Off and Water Quality H1, H2 & HG8	▪ All construction staff will be suitably trained to respond to accidental discharge/leaks and appropriate spill management kits will be in place to allow rapid response on site. An Incident Response Plan will be in place detailing the procedures to be undertaken in the event of spillage of chemical, fuel or other hazardous substances or wastes, logging of non-compliance incidents and any such risks that could lead to a pollution incident at any point along the proposed alignment. · ▪ Site-specific constructability reports prepared for the Project will clearly specify how water emanating from site activities will be managed from source to final approved discharge point. Under no circumstances will treated water be discharged to a water course without the respective water quality meeting the statutory limits as set under the relevant EU Environmental Objectives for surface water. ▪ As with any below ground construction, pumping will be required to manage both stormwater collection and/ or any inflows of groundwater into the cut section/ station box within each site boundary. Water will be pumped through a temporary construction site attenuation tank , prior to discharging through a series of treatment tanks with storage (i.e., typically 900m3 attenuation volume equivalent to one day's discharge where a conservative inflow of ~10l/sec is assumed) as required. There will be regular checks on the treatment system as well as continuous monitoring equipment to measure, but not limited to, pH, temperature, conductivity, Total Suspended Solids and Totals Dissolved Solids. All treated water will be discharged to the nearby sewer. ▪ Under no circumstances will treated water be discharged to a watercourse without the respective water quality meeting the statutory limits as set under the relevant EU Environmental Objectives for surface water. ▪ The provision of boundary treatments such as silt fencing and berms will be installed prior to the commencement of any construction works in order to enhance the protection of identified water features (for example Broadmeadow River, Ward River and Santry River) during the full Construction Phase. A silt fence along the relevant boundary line of the construction works area in the context of the identified surface water feature will be required, this will be constructed of a suitable geotextile membrane to ensure water can pass through, but that silt will be retained. Typically, an interceptor trench will be required in front of this silt fence. The silt fence should be capable of preventing 425micron and above sediment from passing through. It should also be resistant to damage during deformation resulting from loading by entrapped sediment and repaired / replaced as necessary by the contractor(s) as part of the on-going monitoring programme. · ▪ Temporary stockpiles are required during the Proposed Project works and these will be located outside of the buffer zone; leachate generation will be prohibited. Refuelling of construction vehicles and the addition of hydraulic oils or lubricants to vehicles, will take place in a designated and controlled area away the buffer zone(s) applied. On-going consultation with IFI and NPWS will be undertaken prior to and during these works. Furthermore, temporary stockpiles of excavated material will be managed on a site-per-site basis and designated areas will be suitably sized and isolated from open excavations as well as identified [storm/ combined] sewers in the area.

Topic	Environmental Control Measure
	▪ If any potentially contaminated material is encountered, it will need to be segregated from clean/inert material, tested and classified as either non-hazardous or hazardous in accordance with the EPA publication entitled 'Waste Classification: List of Waste & Determining if Waste is Hazardous or Non-Hazardous' using the HazWasteOnline application (or similar approved classification method). The material will then need to be classified as clean, inert, non-hazardous or hazardous in accordance with the EC Council Decision 2003/33/EC, which establishes the criteria for the acceptance of waste at landfills. ▪ If it is not possible to immediately remove contaminated material, then it will be stored on, and ensure necessary bunding or containment is in place around stockpiles or storage. The time frame between excavation and removal of all [natural or contaminated] excavated material will be recorded and kept to an absolute minimum. ▪ All excavated material will, where possible, be reused within the project for the construction of embankments, in backfill, for bunding and landscaping requirements (such as Dardistown Depot, viaduct embankments). The overall approach to spoil management will be in accordance with the Eastern-Midlands Region Waste Management Plan for 2015-2021 (EMWR 2015) as well as the County Council Development Plans. This plan will include the application of the Waste Hierarchy and highlight potential methods and sites for reuse, recovery, recycling and disposal of the excavated material with the aim of minimising disposal as waste. ▪ The appointed contractor(s) will ensure acceptability of the material for reuse for the Proposed Project with appropriate handling, processing and segregation of the material. This material would have to be shown to be suitable for such use and subject to appropriate control and testing according to the appropriate earthworks specification(s). These excavated soil materials will be stockpiled using an appropriate method to minimise the impacts of weathering. Care will be taken in reworking this material to minimise dust generation, groundwater infiltration and generation of runoff. ▪ Excavated contaminated soils will be segregated and stored in an area where there is no possibility of runoff generation or infiltration to ground or surface water drainage. Care will be taken to ensure no cross-contamination with clean soils elsewhere throughout the site. ▪ Surplus suitable material excavated that is not required elsewhere for the Proposed Project, will be used for other projects where possible, subject to appropriate approvals/notifications. · ▪ Earthwork's haulage will be along agreed predetermined routes along existing national, regional and local routes (outlined in the STMP, Appendix A9.5 of the EIAR). Where compaction occurs due to truck movements and other construction activities on unfinished surfaces, remediation works will be undertaken to reinstate the ground to its original condition. ▪ Protection measures will be put in place to ensure that all hydrocarbons used during the Construction Phase are appropriately handled, stored and disposed of in accordance with the TII document 'Guidelines for the crossing of watercourses during the construction of National Road Schemes', (NRA, 2008). All chemical and fuel refilling locations will be contained within effectively bunded areas and set back a minimum of 10m from water courses. ▪ Foul drainage from all site offices and construction facilities will be contained and disposed of in an appropriate manner to prevent pollution or alternatively discharged to foul sewer in agreement with Irish Water. Some construction work areas will need temporary site connections to foul sewer (for office and welfare facilities) or in some cases this will be collected on site and disposed of appropriately. It is likely that any 'grey water' from site works will be collected and prior assessed for potential re-use, requiring appropriate cleaning and storage tanks.
Spillages of Oils, Chemicals and Polluting Materials	▪ The design of each treatment train will depend on the activity at each construction compound. Stormwater and any dewatering will be collected and stored (if required) prior to discharge to the site-specific treatment plant. There will be no

Topic	Environmental Control Measure
H3	direct discharge to any identified watercourse without adequate attenuation and discharge will be controlled by a hydrobrake to mimic greenfield runoff rates as per Surface Water Drainage & Flood Risk Assessment Report (Jacobs/IDOM, 2021). ▪ Where excavations include significant placement of concrete and/or bentonite, there is potential for alkaline discharges to occur. When this concreting is being carried out, the discharge water will require additional treatment including pH neutralisation. ▪ A continuous pH monitor will be installed on the discharged water from the treatment plant. It is proposed that discharge water pumped out during the concrete works where it exceeds a pH of 6-9 pH units is either re-circulated for further treatment, removed off site for appropriate treatment and disposal, or treated on site and discharged into the foul sewer, with due permission from Irish Water. ▪ Where used, any sedimentation system and/or pond capacity and treatment plant will allow adequate settlement of suspended sediment. However, daily visual inspection will be undertaken by the contractor at the outfall(s) to ensure adequate internal settlement is occurring. Where the visual assessment highlights elevated suspended sediments higher than expected, the water will be re-circulated for further treatment. ▪ Samples will be taken at regular intervals and suspended solid levels checked and recorded for inspection. Detailed monitoring requirements will depend on discharge permit agreements put in place prior to any works commencing. The installation of continuous monitoring equipment may be required as part of the temporary discharge permit and/or licence. This would include the installation field monitoring probes connected to telemetry system to continuously monitor parameters such as temperature, pH, TOC (Total Organic Carbon), TSS (Total Suspended Solids), TDS (Total Dissolved Solids) and EC (Electrical Conductivity). ▪ The use and management of concrete in or close to identified watercourses will be carefully controlled to avoid spillage potential. Where on-site batching is proposed, for example at the north of the development at Estuary, this activity will be carried out at a significant safe distance from the nearby watercourses. Washout from such mixing plants will be carried out only in a designated contained and impermeable area and washing out of associated vehicles will only be authorised in designated contained areas.
Water Quality Management – excavation and contamination H1, H2, H4 & HG9	▪ Temporary stockpiles are required during the proposed Project works and these will be located outside of specific buffer zones. Leachate generation from the stockpiles will be prohibited. ▪ Stockpiling of excavated material will be managed on a site-per-site basis and designated areas will be suitably sized and isolated from open excavations as well as identified storm/combined sewers in the area. ▪ If any potentially contaminated material is encountered, it will be segregated from clean/inert material, tested and classified as either non-hazardous or hazardous in accordance with the EPA publication entitled 'Waste Classification: List of Waste & Determining if Waste is Hazardous or Non-Hazardous' using the HazWasteOnline application (or similar approved classification method). The material will then be classified as clean, inert, non-hazardous or hazardous in accordance with the EC Council Decision 2003/33/EC, which establishes the criteria for the acceptance of waste at landfills. ▪ If it is not possible to immediately remove contaminated material, then it will be stored on, and covered by, medium to heavy gauge polythene sheeting to prevent rainwater infiltrating through the material. The time frame between excavation and removal of all natural or contaminated excavated material will be recorded, and volumes kept to an absolute minimum. ▪ All excavated material will, where possible, be reused within the proposed Project for the construction of embankments, in backfill, for bunding and landscaping requirements (such as Dardistown Depot, viaduct embankments). The overall approach to spoil management will be in accordance with the Eastern-Midlands Region Waste Management Plan for 2015-2021 (EMWR 2015) as well as the County

Topic	Environmental Control Measure
	Council Development Plans. This plan will include the application of the Waste Hierarchy and highlight potential methods and sites for reuse, recovery, recycling and disposal of the excavated material with the aim of minimising disposal as waste. ▪ The contractor(s) will ensure acceptability of the material for reuse for the proposed Project with appropriate handling, processing and segregation of the material. This material would have to be shown to be suitable for such use and subject to appropriate control and testing according to the Earthworks Specification(s). These excavated soil materials will be stockpiled using an appropriate method to minimise the impacts of weathering. Care will be taken in reworking this material to minimise dust generation, groundwater infiltration and generation of runoff. ▪ Excavated contaminated soils will be segregated and stored in an area where there is no possibility of runoff generation or infiltration to ground or surface water drainage. Care will be taken to ensure no cross-contamination with clean soils elsewhere throughout the site. ▪ Surplus suitable material excavated that is not required elsewhere for the proposed Project, will be used for other projects where possible, subject to appropriate approvals/notifications. ▪ Earthworks haulage will be along agreed predetermined routes along existing national, regional and local routes (outlined in the STMP). Where compaction occurs due to truck movements and other construction activities on unfinished surfaces, remediation works will be undertaken to reinstate the ground to its original condition.
Management of Discharges H5	▪ Prior to commencement of construction, the contractor(s) will prepare method statements for discharge of construction water discharges. Further discussions will take place with the relevant authority to determine the required permit licence agreements to permit the discharge of water during the Construction Phase to either sewer or to ground. Where applicable, it is proposed that all water will be discharged to sewer. A treatment train and monitoring will be undertaken to meet the requirements of the permit licence operation. The monitoring program will be set by the Local Authority and will be abided by the works contractor(s). ▪ The design of each treatment train will depend on the activity at each construction compound. Stormwater and any dewatering will be collected and stored (if required) prior to discharge to the site-specific treatment plant. There will be no direct discharge to any identified watercourse without adequate attenuation and discharge will be controlled by a hydrobrake to mimic greenfield runoff rates as per Flood Risk Assessment Report (Appendix A18.5). ▪ Where excavations include significant placement of concrete and/or bentonite, there is potential for alkaline discharges to occur. When this concreting is being carried out, the discharge water will require additional treatment including pH neutralisation. A continuous pH monitor will be installed on the discharged water from the treatment plant. It is proposed that discharge water pumped out during the concrete works where it exceeds a pH of 6-9 pH units is either re-circulated for further treatment, removed off site for appropriate treatment and disposal, or treated on site and discharged into the foul sewer, with due permission from Irish Water. ▪ Where used, any sedimentation system and/or pond capacity and treatment plant will allow adequate settlement of suspended sediment. However, daily visual inspection will be undertaken by the contractor(s) at the outfall(s) to ensure adequate internal settlement is occurring. Where the visual assessment highlights elevated suspended sediments higher than expected, the water will be re-circulated for further treatment. Samples will be taken at regular intervals and suspended solid levels checked and recorded for inspection. ▪ Detailed monitoring requirements will depend on discharge permit agreements put in place prior to any works commencing. The installation of continuous monitoring equipment may be required as part of the temporary discharge permit and/or licence. This would include the installation field monitoring probes connected to telemetry system to continuously monitor parameters such as temperature, pH,

Topic	Environmental Control Measure
	TOC (Total Organic Carbon), TSS (Total Suspended Solids), TDS (Total Dissolved Solids) and EC (Electrical Conductivity). ▪ The use and management of concrete in or close to identified watercourses will be carefully controlled to avoid spillage potential. Where on-site batching is proposed, for example at the north of the development at Estuary, this activity will be carried out at a significant safe distance from the nearby watercourses. Washout from such mixing plants will be carried out only in a designated contained and impermeable area and washing out of associated vehicles will only be authorised in designated contained areas.
Management of Flood Risk H6	In terms of managing the potential for flood risk, the following will apply: ▪ Construction compounds will not be set up on lands designated as Flood Zone A or B in accordance with the OPW 'Planning System and Flood Risk Management Guidelines' (November 2009). ▪ All watercourses within compound areas will be fenced off at a minimum distance of 5m, unless there is direct construction within the watercourse i.e., for construction of culverts. The following responsibilities will apply to the contractor(s): ▪ Obtaining updated modelled water levels from the OPW as well as updated information on the required standard of protection for flood defences; ▪ The contractor(s) will ensure that flood risk is managed safely throughout the Construction Phase and that all designs comply with the flood risk assessed in the EIAR and include provision of a safe refuge for flood events; ▪ A flood risk compliance procedure will be included in the Water Management Plan/ Flood Protection Plan. This will take a risk-based precautionary approach, using the source-pathway-receptor concept, and will apply to temporary and permanent works; ▪ Temporary mitigation measures will be employed to mitigate the risk of flooding to structures on a construction site. These can be installed for the duration of the works or at time where flood risk has increased; ▪ Sheet piling and cofferdams: will be required at the piers situated adjacent the Broadmeadow and Ward Rivers and anywhere where construction activities are to occur on or near flood zones; ▪ Sandbags: used for temporary flood protection typically a short-term measure; ▪ Mobile and inflatable barriers; ▪ Existing flood defences will be monitored for stability for surface construction, tunnelling, dewatering, filtration, and river works. ▪ Materials on a construction site are a significant risk to the environment and should be managed for flood events. Materials carried away may also come into contact with structures, causing them damage. The flood risk for materials can be mitigated by: - Keep materials on site in a flood barriered area or at higher levels, such as raised ground or platforms. - Keep materials away from flood plains and flood risk areas. - Only bring materials onto site when needed. - Keep onsite material storage to a minimum, such as daily requirement, with larger quantities kept off site. - Only remove existing ground and topsoil when work requires. - Remove materials offsite prior to a forecasted flood event. - Keep materials in watertight containers where possible. - Anchor down materials that may float away. - Ensure site hoarding can contain materials that may float away. - Covering of storage areas for material which has been stockpiled, to prevent silt runoff. ▪ Flood protection and mitigation measures set out in the pre-construction works need to be supported in the Construction Phase to be effective. This is done by monitoring the Environmental Protection Agency alerts and guidance, monitoring weather and monitoring water levels of nearby watercourses. This is particularly

Topic	Environmental Control Measure
	important for sites located on or near flood plains, such as the Broadmeadow and Ward Rivers Viaduct and the nearby Broadmeadow River and Ward Rivers. The monitoring will give advance warning allowing for temporary flood protection to be deployed and material mitigation measures to be adopted. ▪ If a flood event during construction occurs, safety and mitigation measures need to be in place to allow for a response. These measures will add to the protection of structures, workforce and responders. ▪ Drainage, silt and water management is to be inspected during a flood event. Site fencing should be secured, and any access points closed. This will prevent buoyant materials and equipment from being washed away from the site causing damage to the environment. It will also prevent items being carried into the site and impacting construction works. ▪ Site utilities and isolations points should be situated in areas that are easily accessible and protected from flood waters. In the event of a flood, utilities should be isolated, particularly generators and mains connections, to reduce the dangers. If utilities and conduits are sufficiently protected and not impacted by flood waters, they can remain operational. ▪ Plant and equipment should be relocated during a flood event. The plant and equipment should be moved to areas that are protected through barriers or elevated above the flood waters. Plant and equipment should be isolated from their connections and if they hold significant fluids and hazardous materials, such as water treatment plants, they should be sealed and emptied where possible. ▪ Implementing the necessary measures will reduce the impact of the flood on the site and the impact that the site has on the local environment. ▪ If flood waters only partially impact the site, construction activities may be able to continue. The continuation of works should consider that waters may rise further and ensure safe access and egress. ▪ If a flood event occurs during construction, the correct procedures and legislation need to be followed during site clean-up and reinstatement. ▪ Flood waters carry germs, bacteria and diseases that are hazardous to health and environment and may be further contaminated by sewage or materials and chemicals during the flood event. ▪ PPE that provides adequate protection for dealing with contaminated waters should be stocked on site. This will provide sufficient protection to workers whenin the event of dealing with flood clean-up. Suitable and sufficient procedures should also be in place, such as method statements and risk assessments, to further protect the workforce carrying out clean-up works. ▪ Any flood waters that have collected on site will also need to be suitably and sufficiently managed. Due to their contaminated nature, they may not be able to be discharge without further settlement or treatment. Any discharge into a sewer will require a discharge permit from the Local Authority. The permit will stipulate that the water achieves specific quality standards. It may also refuse discharge, resulting in water being treated and removed offsite for further treatment or disposal. If disposed of via the usual methods, it is important to ensure that any additional treatment is given as the water on site may be of a different quality than that usual treated and may not achieve the quality standards for discharge with the usual treatment. There are no discharges of water during the Construction Phase to any watercourses. ▪ The start of the route to Seatown crosses the Broadmeadow and Ward Rivers and their flood plains. These sections will need to make use of: - Heights of sheet piles extended for sheet piles excavations; - Raised capping beam for retained cuttings; - Permanent flood mitigation measures programmed to be done in advance; - The use of sheet piles and cofferdams for protection of viaduct piers; - Inflatable barriers to protect haul roads; - Plant and materials not to be left on the flood plain.

Topic	Environmental Control Measure
	▪ Shafts and box structures are exposed to unexpected flood events through burst watermains and surface water flooding. The flood risk to these structures can be mitigated through the construction of an upstand wall and material mitigation. ▪ Retained cut and cover structures can mitigate their flood risk through the use a raised capping beam and material mitigation. Earthworks structures such as open cuts and embankments have a flood risk from surface water flooding. This can be mitigated against through the use of material mitigation and inflatable barriers.
Management of Fire Water H7	In the event of an emergency contaminated water will be tankered from each site to an approved facility for disposal. The management of the potential water that is contaminated with fire products will be detailed in the final CEMP.
Groundwater Inflow into Tunnel Section HG1	▪ To counteract groundwater pressure, the TBM will be advanced in a pressurized earth pressure balance (EPB) mode. This tunnelling technique will maintain ground stability and avoid/limit the degree of groundwater inflow. The use of EPB will therefore minimise the negative impact on tunnel excavation associated with dewatering of high pressurized groundwaters in the Boulder Clay/BoD/QTR/UWR units. ▪ Groundwater ingress control measures for tunnelling will also include grouting of the tunnel eyes before/ after the passage of the TBM. ▪ Prior to the TBM passing through the station, the area outside the two tunnel eyes normally requires grouting to prevent ground or groundwater flowing into the station when the TBM breaks in or out. As the tunnel eye is within the boulder clay and interface between the BoD/QTR and the UWR in the case of O'Connell Street, grouting will be required. ▪ The Waulsortian Limestone (near Dublin Airport Station) may contain karst solution/water inflow features which can potentially create face stability problems with the TBM, albeit no significant features were proven in recent boreholes. Forward probing can be used to identify these risk areas and they can then be stabilised by grouting.
Groundwater inflow into Tunnel Section - Settlement Risk HG2	▪ When the tunnel is excavated in rock, the proposed design will ensure, where practicable, a minimum crown pillar of five metres of rock is maintained (i.e. coverage above the top of the tunnel ring). This crown pillar of unweathered rock will reduce the incidence of groundwater inflow and therefore reduce settlement risk as well as collapse risk above the tunnel. ▪ In terms of TBM projection, face instability and potential increased settlement and/or collapse as a result of the tunnel intercepting fault zones, adverse dipping and large weathered shale beds within the Calp Limestone then grouting and the use of pre-support methods may be employed to increase stability where these features are detected. The use of 'forward probing' can be used to identify their presence during the tunnelling process.
Groundwater inflow into Tunnel Section – Ground settlement HG3	▪ Conventional ground settlement treatments accomplished in order to mitigate the induced settlement in tunnel excavations (but which can also be applied to deep excavations), and which represent viable mitigation measures for the proposed Project, include the following: ▪ Jet grouting (soil treatment technique for stabilizing soft ground by mixing cement slurry with in-situ soil -can also be applied to deep excavations) ▪ Compaction grouting (injection of a low slump, mortar grout to densify and stiffen soil or to fill subsurface voids; typically performed in loose/ weak soils to mitigate settlements or increase the bearing capacity of the terrain) ▪ Pile and micropile walls (long, slender, columnar elements typically made from reinforced concrete; these can be closely spaced contiguous pile walls or secant pile walls. Micro piles are small-diameter structural columns, constructed by drilling a borehole, placing steel pipe reinforcement, and grouting the hole drilled. They provide a wall of high stiffness to the terrain that cut and reduce the settlement trough).

Topic	Environmental Control Measure
	▪ Soil grouting (injection of pumpable materials into a soil/ rock formation to change its physical characteristics; typically performed to mitigate settlements, decrease permeability and increase the safety factor at the excavation face. ▪ Compensation grouting (material injected is forced into soil/ rock fractures thereby causing an expansion to take place counteracting the settlement of structures). ▪ The degree of 'ground loss' will be controlled within the tunnel excavation using a maximum value of 1%. An estimate of the lost ground can be obtained by comparing the weight of material excavated by the EPB and the theoretical design for that section. In general, for shallow tunnels - like those proposed for MetroLink with an assumed ground loss value less than 1% - the settlement is estimated to be less than 5mm. Importantly, it will be necessary to further study the existing buildings along the tunnel alignment in more detail at final design stage and confirm the current database on same including data on year of construction, type of construction and artistic value. ▪ In problematic zones, it is possible to manage the 'anticipated' or modelled subsidence with jet-grouting injections or similar compensating methods as discussed above. ▪ Maintain the phreatic level at its original/ natural position. In granular subsoil aquifers and in compressible material, any dewatering that might take place will likely cause a reduction in compaction pore water pressure. ▪ To control these key parameters, i.e. 'ground loss' and a 'stable water table', it will be necessary to implement an appropriate and effective monitoring programme to include a series of piezometers, extensometers, inclinometers and topographic points located along the proposed Project alignment.
Groundwater Inflow into Cut Sections and Within Deep Station Excavations HG4	▪ To manage the risk of settlement, the excavation of the cut sections and deep stations must avoid affecting the phreatic water levels as much as possible. In order to maintain the existing phreatic levels during such excavation stations it will be necessary to excavate within a water-resistant 'closed box', i.e. the excavation of the cuts/underground stations is designed with a water retaining, sealed enclosure which will be formed by employing the use of either secant pile or diaphragm walls. This methodology will allow any inflow of groundwater into the excavation to be managed by pumping [dewatering] or other appropriate and effective means. ▪ The vertical height of the perimeter secant pile/D-wall will be calculated to avoid pressurised flow. The thickness of the wall and the number and position of the anchors and/or other retaining systems will be calculated according to details collated on geotechnical ground parameters, depth of the excavation and size of the station box. ▪ To control the possible variations in the phreatic level a perimeter of vertical bored holes will be used with two principal functions, namely; (1) to monitor the piezometric level outside the excavation footprint, and (2) to maintain and stabilise the phreatic level by injecting pressurised water where deemed feasible. The perimeter boreholes will be designed according to pumping test analysis and hydraulic modelling (Plaxis-2D) already performed for the cut sections and stations on the proposed Project. Periphery borehole spacing, liner diameter and depth, and screened geology will be specifically designed for each works area with boreholes extending to a minimum depth of 5m below the lowest level of the cut/ station excavation. ▪ The main geological layer for groundwater transmission is recognised as the interface between the Boulder Clay and the bedrock, i.e. BoD/QTR and UWR. To restrict flow from this layer into the base of the excavation beneath the toes of the D-walls along fissures in the rock, permeation grouting will be undertaken at the toe of the D-walls. The permeation grouting consists of the drilling of holes through reservation tubes cast into the D-walls during construction. ▪ In order to confirm the adequacy of the cut-off achieved by toe grouting, one or more pumping tests will be carried out in advance of excavation. Deep wells will be installed as discussed above to lower the groundwater level within the footprint of the box, and piezometers inside and outside the footprint will be monitored to

Topic	Environmental Control Measure
	determine the drawdown of the groundwater level and hence the adequacy of the cut-off. ▪ In the event of an inadequate cut-off being achieved, then further permeation grouting will be undertaken. This may involve drilling of additional grout injection holes within or outside the box footprint. The results of further grouting activities will be checked by further deep well pumping checks. ▪ Should karst features be encountered during construction works, for example within the Waulsortian (CWA) limestone near Dublin Airport, these will be assessed by a suitably qualified hydrogeologist and an engineering geologist. It will be necessary to delineate fully the extent of these features and characterise them at the relevant chainage of the proposed Project, i.e. identify the structural control of the karstic porosity, the size of the voids and the potential water inflow in the karstic system. ▪ In the case of excavations (cuts, stations, portals, shafts, bridge abutment excavations) the karst feature will be excavated and backfilled with clean coarse, non-calcareous, fill material to ensure a continued high permeable zone and effectively sealed over this. This will prevent runoff draining into the feature and therefore protect against accidental construction site spillages. On this basis, construction run-off will not discharge to a potential karst pathway and will receive natural attenuation and dilution within the aquifer. ▪ With specific regard to karst features being intercepted in excavations for earthworks and infiltration basins/soakaways it is vital to ensure the hydraulic connectivity of the feature using imported, clean granular material as engineered fill and then seal the feature from the excavation using a liner (geotextile and/or concrete depending on the site specifics). This will ultimately prevent any pollutant linkage between the excavation and the karst feature/bedrock aquifer. In the event that the feature cannot be excavated for whatever reason, the main mitigation measure will then be to fill the karstic tube(s) and the ground porosity with grouting and/or aqua-reactive foam.
Drawdown Effects and Zone of Influence (ZOI) HG5	▪ Dewatering of the [LI, PI] bedrock aquifer will be necessary and the ZOI has been determined by modelling (following outputs of [Plaxis2D and MODFLOW] modelling) undertaken for the proposed Project. ▪ It is planned to undertake additional further site-specific data collection prior to commencement of works to allow site specific additional mitigation measures (such as monitoring) if required. As such, further [advance] groundwater level monitoring will be undertaken in boreholes installed as part of the current proposed Project to define the contemporary groundwater levels in the area of interest at the time of construction and allow monitoring of groundwater levels pre, during and post construction. ▪ Where other periphery wells may need to be installed (for example where previously access to drilling sites was not feasible) these will be drilled before commencement of construction/during the Construction Phase and will be monitored. This data will be added to the current database for hydraulic testing completed to date for the proposed Project in areas of cuts and deep excavation boxes in particular. ▪ Mitigation of the conservatively modelled impacts associated with interpreted ZOI may include re-charge to ground through existing boreholes or newly drilled re-injection wells strategically placed and designed. This is achievable where the local ground conditions have been assessed as suitable for effective recharge to ground and there is sufficient surface area available for the re-injection and monitoring wells in addition to the necessary cleaning plant required to treat the water to permitted discharge standards prior to re-injection.
Substantial Water Inflows Under Pressure HG6	▪ To mitigate impacts of dewatering of highly pressurised groundwaters both during deep excavation and during TBM advance works that will be undertaken in the Boulder Clay and also within base of drift and top of weathered rockhead (BoD/QTR) and upper weathered rock (UWR) units, the groundwater control measures will consist of D-wall/secant pile wall perimeter pumping wells which will assist in maintaining dry working conditions during construction, and advance probing ahead of the tunnel face as discussed

Topic	Environmental Control Measure
	▪ To minimise this negative impact on the tunnel excavation, it will be essential to maintain a pressurized front, with a pressure higher than the interpreted groundwater flow pressure at the TBM front.
Wells Intercepted by/or in the Vicinity of the Tunnel Excavation HG7	▪ Other general risks related to tunnelling along the route will be duly addressed in the outline CEMP procedures and emergency and contingency plans for the proposed Project. These include mitigating against historical, i.e. unknown or unrecorded groundwater abstraction and/ or monitoring wells, disused wells as well as unknown shafts, encountered along the route. ▪ In addition, mitigation measures will be in place for identified un-grouted and poorly grouted/ backfilled boreholes such as the Well Drilling Guidelines produced by the Institute of Geologists of Ireland (IGI 2007) for effective borehole decommissioning. ▪ In advance of Detailed Design (and despite the low probability of encountering groundwater supply wells in an urban setting as indicated in this assessment), the assessed risks associated with the interception of unknown wells by the tunnelling works will be further considered through more in-depth studies into the prevalence of historical/active wells (however few in number) within the study area. ▪ The use of surface geophysics (electrical tomography, GPR [Ground Penetrating Radar]) will be considered in areas where the likelihood of unknown wells is foreseen. There is also the possibility of installing some 'geophysical tools' within the cutter head of the TBM which could be precise enough to detect wells at the tunnel face and indicate same in advance of contact. ▪ With regard to known groundwater well locations, where these are intercepted by the proposed Project they will be duly recorded by an experienced Hydrogeologist and tested to confirm existing yield rates in advance of being decommissioned which will follow good practice [IGI] guidelines as mentioned. Subsequently, a replacement supply well will be sited accordingly, designed, drilled, installed and tested prior to follow-on commissioning or the supply replaced by a connection to public supply. ▪ Specific regard is made to groundwater supply wells identified as lying outside of the proposed Project Boundary/alignment but within the drawdown ZOI which may be impacted by reduced groundwater levels during construction dewatering activities at station boxes/cut sections. ▪ All identified operational wells within 150m of the proposed Project boundary (or 50m from the calculated drawdown ZOI, if greater) will be monitored for water level on a monthly basis for 12 months before construction, during construction and for a nominal period of 12 months after construction is completed. If the level monitoring indicates that the proposed Project has impacted on a supply or geothermal well (for example wells within Trinity College Dublin grounds) then appropriate mitigation will be applied such as replacement well installation or deepening of wells as appropriate. ▪ To ensure the protection of quality of identified groundwater potable supplies, all abstraction wells were identified as lying within 150m of the proposed Project boundary will be monitored for water quality on a monthly basis. This will include for standard drinking water quality parameters on a monthly basis for 12 months before construction, during construction and for a nominal period of 12 months after construction. If the monitoring indicates that the proposed Project has negatively impacted on a water supply source, then appropriate further mitigation measures will be applied such as well replacement or connection to public supply mains.

An Ecological Clerk of Works (ECoW) shall be present during construction, where appropriate, to monitor and ensure the effective implementation of the mitigation measures described above.

Measures to Prevent the Introduction and/or Spread of Non-native Invasive Species Giant Hogweed, Japanese Knotweed and Himalayan Balsam

The mitigation strategy in relation to invasive plant species is in accordance with the following guidance documents, where relevant. The objectives of this mitigation strategy is permanently removing all

invasive plant species from the working area and preventing the spread of any established populations present with the boundary of the proposed development:

- The Management of Invasive Alien Plant Species on National Roads – Technical Guidance (TII 2020a);
- The Management of Invasive Alien Plant Species on National Roads – Standard (TII 2020b);
- The Environment Agency (EA) Managing Japanese knotweed on development sites - the Knotweed Code of Practice (Version 3, amended in 2013, withdrawn from online publication in 2016) (EA 2013). (This document, although no longer supported by the EA, is nonetheless a practical document in determining the approach and control mechanisms for Japanese knotweed);
- Managing Invasive Non-Native Plants in or near Freshwater (EA 2010);
- Invasive Species Ireland (ISI) Best Practice Management Guidelines for Japanese knotweed (ISI 2008a);
- Best Practice Management Guidelines for Himalayan balsam (ISI 2008b);
- Best Practice Management Guidelines for Giant hogweed (ISI 2008c);
- Non-Native Species Secretariat (NNSS) Allium triquetrum [Online] (Three-cornered garlic) Great Britain non-native species organism risk assessment scheme. Risk assessment information page Version 1.2 (NNSS 2011);
- Countryside Management Publications, Giant hogweed (Department of Agriculture and Rural Development (Northern Ireland) (2016);
- Good Practice management, New Zealand pigmyweed (Crassula helmsii) Version 1, August 2018 (Animal and Plant Health Agency et al. 2018);
- Management Measures for Widely Spread Species (WSS) in Northern Ireland Nuttall's waterweed (Elodea nutallii) (Northern Ireland Environment Agency 2021);
- Aquatic and Riparian Plant Management: Controls for Vegetation in Watercourses, Technical Guide (EA 2014); and
- Biosecurity Protocol for Field Survey Work (Inland Fisheries Ireland 2010).

An Outline ISMP has been prepared (Appendix A15.8) and will be implemented sufficiently far in advance of the proposed construction works commencing so as to allow time to adequately control all invasive species populations within the ZoI of the proposed development, having regard to the specific timing/seasonal constraints that apply in relation to each individual species.

In brief, the Outline ISMP includes the following:

- A pre-construction survey of non-native invasive plant species. As species may have spread, or their distribution may have changed, between the habitat surveys carried out for this NIS and the EIA and the commencement of construction works, the implementation of the Outline ISMP will include a pre-construction re-survey within the proposed Project boundary. In accordance with the TII guidance (TII, 2020) this survey will include accurate mapping for the precise location of invasive species. The pre-construction surveys will be undertaken by suitable experts with competence in identifying the species concerned.
- The update of the Outline ISMP to a Final ISMP. The Outline ISMP will need to be revised and finalised by the appointed Principal Contractor(s) once precise methods of control identified in the Outline ISMP are determined. The final ISMP will assist the construction contractor in implementing the specific mitigation measures required in relation to individual invasive plant species.
- General measures to avoid spread of non-native invasive species, including:

- Site Establishment – the demarcation of identified invasive species during advance works and prior to commencement of construction;
- Biosecurity and site hygiene – the adherence to a set of biosecurity and site hygiene measures, including fencing off/demarcating invasive species, communicating the location, risk and hazards associated with invasive species to construction personnel, identifying dedicated access points into and out of fenced-off areas, the installation of designated decontamination facilities (where appropriate), and protocols around the storage of infested soils.

- Soil excavation – Best practice measures for the treatment of invasive species contaminated soils, to prevent the inadvertent spread of invasive species.
- Disposal of material – Commitment to attaining licences and using licensed facilities, as legally required, for the disposal of materials.
- Measures to be implemented during the application of herbicides – Commitment to the appointment of a suitably qualified/registered/licensed pesticides advisor for any works requiring the use of pesticides, and safety precautions for consideration in the use of pesticides near watercourses.
- Importation of soil and other material – Commitment to utilising traceable topsoil for landscaping that does not contain invasive species propagules.
- Post-construction monitoring – A commitment to ongoing monitoring of treated invasive species and completion of remedial measures as appropriate during post-construction monitoring.

- Finally, the Outline ISMP contains a comprehensive suite of species-specific control measures for Japanese knotweed (Table 2, pp 11-13), giant hogweed (Table 3, pp 14-15), Himalayan balsam (Table 4, pp 16-17), three-cornered garlic (Table 5, p. 18), New Zealand pygmyweed (Table 6, pp 19-20), and Canadian and Nuttall's Pondweed (Table 7, pp 21-22), which will be referenced/brought forward for inclusion in the final ISMP for the proposed Project.

15.5.1.1.2 Natural Heritage Areas and Proposed Natural Heritage Areas

As discussed in Section 15.4.2.1.2, the potential for the proposed Project to significantly affect Malahide Estuary pNHA, Baldoyle Bay pNHA, North Dublin Bay pNHA, Dolphins, Dublin Docks pNHA, South Dublin Bay pNHA, Booterstown Marsh pNHA, Rogerstown Estuary pNHA, Howth Head pNHA, Ireland's Eye pNHA, Lambay Island pNHA and Skerries Islands NHA, Dalkey Coastal Zone and Killiney Hill pNHA, The Murrough pNHA and Rockabill pNHA is as per the corresponding European sites[99]. Therefore, the mitigation measures outlined above in Section 15.5.1.1, and as detailed in Section 6 of the NIS, will prevent the proposed Project resulting in a significant negative effect on these pNHAs at the national geographic scale.

The mitigation measures required to ensure that the proposed Project will not significantly affect other pNHAs (i.e. Royal Canal pNHA, Grand Canal pNHA, Sluice River Marsh pNHA, Santry Demesne pNHA, and Liffey Valley pNHA) are as follows:

- Measures to control dust emissions during construction to prevent impacts to vegetation/habitats within these pNHAs – see Section 15.5.1.2.3 below and Section 16.6 and Appendix A16.4 of Chapter 16 (Air Quality). In summary, these measures include:

- Material handling systems and site stockpiling of materials will be designed and laid out to minimise exposure to wind. Water misting or sprays will be used as required if particularly dusty activities are necessary during dry or windy periods;
- Any blasting will be completed by specialised contractors with a specific blasting dust management plan;
- Hoarding will be provided around the construction compounds;
- It is anticipated that methods of collecting rainwater and recycling for general site use, will be adopted where practical. Requirements for dewatering installations at deep station and tunnel portals can also provide a valuable source of water for general site use;
- At all times, these procedures will be strictly monitored and assessed. In the event of dust nuisance occurring outside the site boundary, movements of materials likely to raise dust will be curtailed and satisfactory procedures implemented to rectify the problem before the resumption of construction operations; and,

[99] Malahide Estuary SAC and Malahide Estuary SPA in relation to Malahide Estuary pNHA; Baldoyle Bay SAC and Baldoyle Bay SPA in relation to Baldoyle Bay pNHA; North Dublin Bay SAC, North Bull Island SPA and South Dublin Bay and River Tolka Estuary SPA in relation to North Dublin Bay pNHA; South Dublin Bay SAC and South Dublin Bay and River Tolka Estuary SPA in relation to South Dublin Bay pNHA and Booterstown Marsh pNHA Rogerstown Estuary SAC and SPA in relation to Rogerstown Estuary pNHA; Howth Head SAC and Howth Head Coast SPA in relation to Howth Head pNHA; Ireland's Eye SAC and SPA in relation to Ireland's Eye pNHA; Lambay Island SAC and SPA in relation to Lambay Island pNHA; Skerries Islands SPA in relation to Skerries Islands NHA; Dalkey to Rockabill SAC in relation to Dalkey Coastal Zone and Killiney Hill pNHA; The Murrough SPA in relation to the Murrough pNHA; and Rockabill to Dalkey Island SAC and Rockabill SPA in relation to Rockabill pNHA.

- In addition, a Demolition Dust Management Plan will be prepared by the contractor outlining measures to ensure that dust pollution from demolition activities will be limited.

- Measures to avoid the introduction or spread of non-native invasive plant species to these pNHAs during construction. These are detailed in the outline ISMP (Appendix A15.8) which forms part of the outline CEMP – (Appendix A5.1);
- Measures to control surface water runoff from the construction site to prevent an accidental pollution event affecting sensitive habitats within these pNHAs – see section 18.6 of Chapter 18 (Hydrology); and,
- Measures to manage and treat groundwater discharges to surface water during construction – see section 19.6 of Chapter 19 (Hydrogeology).

15.5.1.2 Habitats

15.5.1.2.1 Mitigation Measures to Minimise Habitat Loss

To minimise the loss of ecologically valuable habitats identified in Section 15.3.5, areas of these habitat types within the proposed Project boundary but which are not required to construct the Project will be retained and fenced off for the duration of construction. This will prevent damage to these habitats as a result of construction vehicles/works. These areas will also not be directly impacted during the operation of the proposed Project. These are shown on Figures 15.13.

To minimise the loss of habitat associated with the proposed Project, there are also areas within the proposed Project boundary which are included for mitigation planting where general construction works will not be undertaken. These are shown on Figure 15.13.

Woodland, scrub, treelines and hedgerows which lie within, or along the proposed Project boundary that are not directly impacted by the proposed Project alignment or drainage will be retained. These areas will be protected for the duration of construction works and fenced off at an appropriate distance. Vegetation to be retained is shown on Figure 15.13. An Arboricultural Impact Report has been prepared for the proposed Project (CMK Horticulture & Arboriculture Ltd., 2022). This report outlines the trees which are proposed for retention within the study area.

Areas of river channel and bankside vegetation which lie within or along the boundary of the proposed Project, but which are not directly impacted by the proposed Project alignment or drainage, will be retained. These areas will be protected for the duration of construction works and fenced off at a distance of c. 5m from the stream/riverbank.

15.5.1.2.2 Measures to Reduce the Potential for Impacts on Vegetation to be retained

Any vegetation (including trees, hedgerows or scrub adjacent to, or within, the proposed Project) which is to be retained shall be afforded adequate protection during the Construction Phase in accordance with the *Guidelines for the Protection and Preservation of Trees, Hedgerows and Scrub Prior to, During and Post Construction of National Road Schemes* (NRA, 2006c). Additional details on the measures required to protect specific trees are provided in the Arboricultural Impact Report accompanying this application (CMK Horticulture & Arboriculture Ltd., 2022). The mitigation measures are as follows:

- All trees along the proposed Project that are to be retained, both within and adjacent to the proposed Project boundary (where the Root Protection Area (RPA) of the tree extends into the proposed Project boundary), will be fenced off at the outset of works and for the duration of construction to avoid structural damage to the trunk, branches or root systems of the trees. Where feasible, temporary fencing will be erected at a sufficient distance from the tree so as to enclose the RPA of the tree. The RPA will be defined based upon the recommendation of a qualified arborist.
- Where fencing is not feasible due to insufficient space, protection for the tree/hedgerow will be afforded by wrapping hessian sacking (or suitable equivalent) around the trunk of the tree and strapping stout buffer timbers around it to protect the vegetation from machinery strikes.

- The area within the RPA will not be used for vehicle parking or the storage of materials (including soils, oils and chemicals). The storage of hazardous materials (*e.g.* hydrocarbons) or concrete washout areas will not be undertaken within 10m of any retained trees, hedgerows and treelines.
- A qualified arborist shall assess the condition of, and advise on any repair works necessary to, any trees which are to be retained or that lie outside of the proposed Project boundary but whose RPA is impacted by the works. Any remedial works required will be carried out by a qualified arborist.
- Where feasible, a buffer zone of at least 5m will be maintained between construction works and retained hedgerows and trees to ensure that the root protection areas are not damaged.

15.5.1.2.3 Measures to Reduce the Potential for Air Quality Impacts during Construction

To control dust emissions during construction works standard mitigation measures shall include:

- Material handling systems and site stockpiling of materials will be designed and laid out to minimise exposure to wind. Water misting or sprays will be used as required if particularly dusty activities are necessary during dry or windy periods;
- Any blasting will be completed by specialised contractors with a specific Blasting Dust Management Plan; Hoarding will be provided around the construction compounds;
- It is anticipated that methods of collecting rainwater and recycling for general site use, will be adopted where practical. Requirements for dewatering installations at deep station and tunnel portals can also provide a valuable source of water for general site use; and,
- At all times, these procedures will be strictly monitored and assessed. In the event of dust nuisance occurring outside the site boundary, movements of materials likely to raise dust will be curtailed and satisfactory procedures implemented to rectify the problem before the resumption of construction operations.

In addition, a Demolition Dust Management Plan will be prepared by the contractor outlining measures to ensure that dust pollution from demolition activities will be limited. A Pollution Prevention Plan will also be prepared by the contractor to management any potential sources of pollution.

These measures are detailed further in Section 16.6 and Appendix A16.4 of Chapter 16 (Air Quality) and in the outline CEMP in Appendix A5.1.

15.5.1.2.4 Mitigation Measures to Reduce the Potential for Impacts to Water Quality in Receiving Watercourses

The measures documented in Section 15.4.2.1.1 page 82 of this report with respect to the prevention of pollution/contamination of European sites are applicable with respect to reducing potential impacts to water quality in receiving watercourses. The mitigation measures to protect surface water during construction are also detailed in Section 18.6 of Chapter 18 (Hydrology).

As is normal practice the outline CEMP included in Appendix A5.1 will be finalised by the Contractor in advance of the commencement of construction and the following will be implemented as part this plan:

- An Emergency Incident Response Plan detailing the procedures to be undertaken in the event of spillage of chemical, fuel or other hazardous wastes, logging of non-compliance incidents and any such risks that could lead to a pollution incident, including flood risks (refer to Section 4.3 and 5.9 of the outline CEMP in Appendix A5.1).
- A Sediment Erosion and Pollution Control Plan (refer to Section 6.4 of the outline CEMP in Appendix A5.1). This shall include water quality monitoring and method statements to ensure compliance with environmental quality standards specified in the relevant legislation (i.e. surface water regulations and Salmonid Regulations 1988).

In addition, a Pollution Prevention Plan, Water Management Plan and Construction Flood Protection Plan will be prepared by the contractor outlining measures to ensure protection of surface water during construction.

Refer to Section 18.6 of Chapter 18 (Hydrology) for further mitigation measure details.

15.5.1.2.5 Measures to Protect Groundwater Quantity and Groundwater Quality

The mitigation measures to manage and treat groundwater discharges to surface water during construction are detailed in Section 19.6 of Chapter 19 (Hydrogeology).

A Pollution Prevention Plan, Groundwater Monitoring Plan and Pollution Incident Control Plan will be prepared by the contractor outlining measures to ensure protection of ground water during construction.

Refer to Section 19.6 of Chapter 19 (Hydrogeology) for further mitigation measure details.

15.5.1.2.6 Measures to Control and Prevent the Spread of Non-native Invasive Plant Species

The mitigation strategy in relation to non-native invasive plant species is based on the *The Management of Invasive Alien Plant Species on National Roads – Technical Guidance* (TII, 2020) with the objectives of managing non-native invasive plant species within the working area and preventing the spread of any established populations present with the boundary of the proposed Project (a legal requirement for species such as Canadian pondweed, giant hogweed, Japanese knotweed, New Zealand pigmyweed, Nuttall's pondweed and three-cornered leek).

A outline ISMP has been prepared (see Appendix A15.8) and included in the outline CEMP (see Appendix A5.1) and will be implemented sufficiently far in advance of the proposed construction works commencing so as to allow time to adequately control all target non-native invasive plant species populations within the ZoI of the proposed Project, having regard to the specific timing/seasonal constraints that apply in relation to each individual species. The outline ISMP will direct the construction contractor in implementing the specific mitigation measures required in relation to individual non-native invasive plant species.

As species may have spread, or their distribution may have changed, between the habitat surveys carried out for this EIAR and the commencement of construction works, the implementation of the Outline ISMP will include a pre-construction re-survey within the proposed Project boundary. This survey will include accurate 1:5,000 scale mapping for the precise location of non-native invasive plant species. The pre-construction surveys will be undertaken by suitable experts with competence in identifying the species concerned.

In accordance with the TII, 2020 guidelines, where cut, pulled or mown noxious weed or non-native invasive plant species material arises, its disposal will not lead to a risk of further spread of the plants. Care will be taken near watercourses as water is a fast medium for the dispersal of plant fragments and seeds. Material that contains flower heads or seeds will be disposed of either by composting or burial at a depth of no less than 0.5m in the case of noxious weeds, or by incineration (at a licenced facility having regard to relevant legislation) or disposal to licensed landfill in the case of non-native invasive plant species.

The taproots of docks and roots of creeping thistle are not suitable for composting or shallow burial, requiring disposal to landfill, incineration or burying at a depth of no less than 1.5m (practical only during the Construction Phase). Where burial is being used to dispose of Japanese knotweed, the material will be buried to a depth of 5m and overlain with a suitable geotextile membrane. All disposals will be carried out in accordance with the Waste Management Acts 1996-2011.

In relation to aquatic non-native invasive plant species all construction works, and any aquatic survey work that may be carried out (*e.g.* electrofishing), will comply with best practice biosecurity protocols for aquatic work – for example *IFI Biosecurity Protocol for Field Survey Work* (IFI, 2010).

15.5.1.3 Rare and Protected Plant Species

15.5.1.3.1 Habitat Degradation - Water Quality

The mitigation measures relating to the protection of water quality in receiving watercourses during construction are outlined in Section 15.5.1.2.4 (detailed in Section 18.6 of Chapter 18 (Hydrology)).

15.5.1.4 Otter

Otter are listed on Annex II and Annex IV of the EU Habitats Directive. Otter are strictly protected under the Birds and Habitats Regulations. Otter, and their breeding and resting places, are also protected under the Wildlife Acts and it is an offence under that legislation to intentionally kill or injure an otter or to wilfully interfere with or destroy their breeding or resting places (holts/couches).

15.5.1.4.1 Habitat Degradation - Water Quality

The measures documented in Section 15.4.2.1.1 page 82 of this report with respect to the prevention of pollution/contamination of European sites are applicable with respect to reducing potential impacts to water quality in receiving watercourses and the effects on otter.

15.5.1.4.2 Loss of Breeding/Resting Sites

Based on the findings of the field surveys carried out, as there were no otter breeding or resting places, holt or couch sites, present within the footprint of the proposed Project boundary, there will not be any loss of holt or couch sites as a result of construction works.

As otter could potentially establish new holt or couch sites within the ZoI of the proposed Project in the future, a pre-construction check of all suitable otter habitat will be required within 12 months of any constructions works commencing. The presence of any new holt/couch sites will be treated and/or protected in accordance with the *Guidelines for the Treatment of Otters prior to the Construction of National Road Schemes* (NRA, 2008c).

15.5.1.4.3 Habitat Severance/Barrier Effect

During construction of the proposed Project, the Royal Canal basin located between Lock 6 and Lock 5 will be dewatered for a period of six months to facilitate the installation and removal of a temporary working platform. These proposed works could potentially result in a temporary barrier effect on the local otter population that regularly use the canal.

In order to mitigate any potential impacts and to maintain connectivity during the dewatering period, it is proposed that temporary mammal-resistant fencing is erected at the dewatered basin, which will provide a safe path for commuting otter, guiding them from west of Lock 6 towards Lock 5, where they would be expected to navigate around the lock gate (given their current known commuting behaviour along the canal), under the Cross Guns Bridge over Prospect Road and move towards Lock 4.

This location and design of this temporary fencing/path will be agreed by the contractor in consultation with a suitably qualified ecologist. It will be installed in accordance with the specification outlined in *Guidelines for the Treatment of Otters prior to the Construction of the National Road Schemes* (NRA, 2008c) and TII's mammal resistant fencing specification. It will also be regularly inspected by an ecologist over the six-month period to ensure its effectiveness and if necessary, adjustments will be made to maintain functioning.

15.5.1.5 Bats

Bats are listed on Annex IV of the EU Habitats Directive and are therefore, strictly protected under the Birds and Habitats Regulations. Bats, and their breeding and resting places (i.e. roosts), are also protected under the Wildlife Acts and it is an offence under that legislation to intentionally kill or injure bats or to wilfully interfere with or destroy their breeding or resting places. It is an offence under Section

23 of the Wildlife Acts 1976-2012 and under Regulation 51 of the European Communities (Birds and Natural Habitats) Regulations, 2011 to kill a bat or to damage or destroy the breeding or resting place of any bat species. Under the European Communities (Birds and Natural Habitats) Regulations it is not necessary that the action should be deliberate for on offence to occur. This places an onus of due diligence on anyone proposing to carry out works that that might result in such damage or destruction. Under Section 54 of S.I. 477 of 2011, a derogation may be granted by the Minister where there is no satisfactory alternative, and the derogation is not detrimental to the maintenance of the populations of the species to which the Habitats Directive relates at a favourable conservation status in their natural range.

Two buildings to be demolished (i.e. BS06 and BS16) were not surveyed for bats as access was not permitted by the owner. On a precautionary basis, it is recommended that the following actions are implemented at these buildings prior to demolition works taking place in order to ensure no impacts on any roosting bats:

- Any suitable roosting space within the buildings are examined by a suitably qualified ecologist for the presence/absences of bats;
- Post-emergence and/or re-entry surveys are undertaken by a suitably qualified ecologist at the buildings to confirm presence/absences of bats (as per guidelines set out in BCT, 2016); and
- Depending on the results of these surveys, suitable mitigation measures may be devised by a suitably qualified ecology and implemented to ensure no potential impacts on bats.

15.5.1.5.1 Roost Loss – Trees

The following mitigation measures are proposed in relation to those trees identified as having potential to support roosting bats as they contain potential bat roost features (see Figure 15.2 for location of trees). Bats could occupy suitable roosting features at any time prior to the commencement of works. Therefore, there is an inherent risk that bats could be affected by the proposed felling works. The following mitigation procedures will be followed:

- Felling of confirmed trees containing potential roost features will be undertaken during the period September – October as during this period bats are capable of flight and may avoid the risks from tree felling if proper measures are undertaken, but also are neither breeding nor in hibernation;
- Use of detectors alone may not be sufficient to record bat emergence and re-entry in darkness. Therefore, prior to felling of confirmed and potential trees containing potential roost features, a dusk emergence and/or dawn re-entry survey using infra-red illumination and video camera(s) or thermal imaging units, and bat detectors will be carried out on the night immediately preceding the felling operation to determine if bats are present;
- Where it is safe and appropriate to do so for both bats and humans, such trees may be felled using heavy plant to push over the tree. In order to ensure the optimum warning for any roosting bats that may still be present, the tree will be pushed lightly two to three times, with a pause of approximately 30 seconds between each nudge to allow bats to become active. The tree should then be pushed to the ground slowly and should remain in place until it is inspected by a bat specialist;
- Trees will only be felled "*in section*" where the sections can be rigged to avoid sudden movements or jarring of the sections; and,
- Where remedial works (*e.g.* pruning of limbs) is to be undertaken to trees deemed to be suitable for bats, the affected sections of the tree will be checked by a bat specialist (using endoscope under a separate derogation licence held by that individual) for potential roost features before removal. For limbs containing potential roost features high in the tree canopy, this will necessitate the rigging and lowering of the limb to the ground (with the potential roost feature intact) for inspection by the bat specialist before it is cut up or mulched. If bats are found to be present, they will be removed by a bat specialist licenced to handle bats and released in the area in the evening following capture.

As part of the landscape design of the proposed Project, woodland and treelines will be created across the study area. In order to mitigate for the loss of trees that may be potential bat roosts due to the presence of potential bat roost features, a total of 30 of 2F Schwegler bat boxes will be erected on

retained trees that are located within close proximity to the trees being felled. These bat boxes should be installed in groups of three per tree and it is preferable that each faces a slightly different aspect from south-east to south-west facing, to provide a range of slightly differing temperature regimes. They should also be located at least 3m above ground level to minimise the risk of interference by humans or predation.

15.5.1.5.2 Roost Loss – Hibernating bats

It is possible that hibernating bats may utilise buildings/structures that will be demolished as part of the proposed Project. In order to avoid any potential impacts, it is recommended that where possible the demolition of suitable buildings/structures for hibernating bats is avoided during the hibernation period (i.e. optimal period November to March) (BCT, 2016). Where this is not an option suitable buildings/structures will be checked by a suitably qualified ecologist for the presence of hibernating bats prior to and during demolition and if encountered bats are moved to a suitable bat hibernation box.

15.5.1.5.3 Disturbance/displacement - Lighting

Any lighting required during construction will be designed in such a way that it is positioned and directed away from any sensitive ecological features located beyond the construction compound (such as those sensitive bat areas described in Section 15.4.2.4), therefore avoiding any unnecessary light spill and disturbance. Lux levels at suitable habitats for bats will not be increased above baseline levels as a result of the construction of the proposed Project. A Lighting Management Plan will be prepared by the contractor for each relevant location, and this will include details on how the lighting will be managed to avoid light spill and potential impacts. A suitably qualified bat ecologist will review and input into this Lighting Management Plan, which will be designed in accordance with following best practice guidance with regards to bats and lighting:

- Guidance Notes for the Reduction of Obtrusive Light GN01 (Institute of Lighting Professionals, 2011)
- Bats & Lighting - Guidance Notes for Planners, Engineers, Architects and Developers (Bat Conservation Ireland, 2010)
- Bats and Lighting in the UK – Bats and the Built Environment Series (Bat Conservation Trust, 2008)

15.5.1.6 Badger

Badger, and their breeding and resting places, are protected under the Wildlife Acts and it is an offence under that legislation to intentionally kill or injure a badger or to wilfully interfere with or destroy their breeding or resting places (setts).

There is only one badger sett located within the ZoI of the proposed Project (i.e. c. 24m west of the proposed MetroLink grid connections route, north of the R139). Whilst there will be no direct loss of this sett as a result of the proposed Project, potential impacts could still occur as a result of disturbance (as described in relevant section below).

The mitigation measures described below follow the recommendations set out in the *Guidelines for the Treatment of Badgers during the Construction of National Road Schemes* (NRA, 2006a). These guidelines set out the best practice approach in considering and mitigating impacts on badger during construction works.

As the usage of setts by badgers can change over time, a pre-construction check of the activity status of all setts will be required within 12 months of any constructions works commencing within the ZoI of the setts discussed below. This will include a pre-construction survey for the presence of any new setts located within the ZoI of the proposed Project for potential impacts on badger. The presence of any sett will be treated and/or protected in accordance with the *Guidelines for the Treatment of Badgers during the Construction of National Road Schemes* (NRA, 2006c). This document provides guidance on the following:

- Exclusion of badgers from development sites;

- Badger evacuation procedures;
- Badger sett destruction;
- Artificial setts;
- Badger underpasses;
- Badger resistant fencing;
- Guidelines for site works in the vicinity of badger setts; and,
- Post-construction monitoring and mitigation.

15.5.1.6.1 Disturbance/Displacement

In order to prevent any disturbance to badger setts not directly affected by the proposed Project, no heavy machinery shall be used within 30m of badger setts at any time. The only exception to this may be the proposed MetroLink grid connection works proposed north of the R139 located within c. 24m of a badger sett. No works shall be undertaken within 50m of active setts during the breeding season. Lighter machinery (generally wheeled vehicles) shall not be used within 20m of a sett entrance. Neither blasting nor pile driving shall be undertaken within 150m of active setts during the breeding season (December to June inclusive).

Prior to works commencing, a non-interference zone of a minimum of 20m will be established around each of the badger setts within the ZoI of the proposed Project. If the sett is active, a non-interference zone will be extended to 50m during the breeding season (December to June inclusive). The fencing shall be of a sufficient durability to maintain the exclusion zone throughout the Construction Phase or, if required, until such time as the sett in question is excluded/removed.

A suitably qualified ecologist will inspect the excavation of the trenches required to lay the MetroLink grid connections, located north of the R139, to ensure that there are no impacts on the badger sett, locate c. 24m west of the proposed Project.

15.5.1.7 Other Mammal Species

15.5.1.7.1 Habitat Degradation - Water Quality

The mitigation measures relating to the protection of water quality in receiving watercourses during construction are outlined in Section 15.5.1.2.4 and detailed in Section 18.6 of Chapter 18 (Hydrology) and Section 15.5.1.2.5 (detailed in section 19.6 of Chapter 19 (Hydrogeology).

15.5.1.8 Invertebrates

15.5.1.8.1 Freshwater Molluscs

Habitat Degradation - Water Quality

The mitigation measures relating to the protection of water quality in receiving watercourses during construction are outlined in Section 15.5.1.2.4 and detailed in Section 18.6 of Chapter 18 (Hydrology).

15.5.1.9 Breeding Birds

15.5.1.9.1 Habitat Loss, Disturbance and Destruction of Breeding Habitat

Where feasible, vegetation (*e.g.* hedgerows, treelines, parkland, woodland, scrub and grassland) will not be removed, between 1 March and 31 August, to avoid direct impacts on nesting birds. Where the construction programme does not allow this seasonal restriction to be observed, then these areas will be inspected by a suitably qualified ecologist for the presence of breeding birds prior to clearance. Areas found not to contain nests will be cleared within three days of the nest survey, otherwise repeat surveys will be required.

15.5.1.9.2 Habitat Degradation - Water Quality

The measures documented in Section 15.4.2.1.1 page 82 of this report with respect to the prevention of pollution/contamination of European sites are applicable with respect to reducing potential impacts to water quality in receiving watercourses and the effects on breeding birds.

15.5.1.10 Wintering Birds

15.5.1.10.1 Habitat Degradation - Water Quality

The measures documented in Section 15.4.2.1.1 page 82 of this report with respect to the prevention of pollution/contamination of European sites are applicable with respect to reducing potential impacts to water quality in receiving watercourses and the effects on wintering birds.

15.5.1.11 Amphibians

15.5.1.11.1 Habitat Loss, Disturbance & Mortality Risk

As suitable amphibian breeding and resting habitat will be directly impacted by the proposed Project, and given the legal protection afforded to amphibian species under the Wildlife Acts (which prohibits wilful destruction or interference with an amphibian breeding or resting places), mitigation has been provided.

If works to clear any of the habitat features suitable to support amphibian species are to begin during the season where frogspawn or tadpoles may be present (i.e. February to mid-summer), or where breeding adult newts, their eggs or larvae may be present (i.e. mid-March to September), a pre-construction survey will be undertaken to determine whether breeding amphibians are present.

In the case of common frog, any frog spawn, tadpoles, juvenile or adult frogs present will be captured and removed from affected habitat by hand net and translocated to the nearest area of available suitable habitat, beyond the ZoI of the proposed Project.

In the case of smooth newt, individuals will be captured and removed from affected habitat either by hand net or by trapping and translocated to the nearest area of available suitable habitat, beyond the ZoI of the proposed Project. If used, the type and design of traps shall be approved by the NPWS. This is a standard and proven method of catching and translocating smooth nest.

If the size or depth of the habitat feature is such that it cannot be determined whether all amphibians have been captured, it will be drained under the supervision of a suitably qualified ecologist to confirm that no amphibian species remain before it is destroyed or infilled. Any mechanical pumps used to drain the habitat feature will have a screen fitted, and be sited, such that no amphibian species can be sucked into the pump mechanism.

Any capture and translocation works shall be undertaken immediately in advance of site clearance/construction works commencing.

15.5.1.11.2 Habitat Degradation – Surface Water Quality

The measures documented in Section 15.4.2.1.1 page 82 of this report with respect to the prevention of pollution/contamination of European sites are applicable with respect to reducing potential impacts to water quality in receiving watercourses and the effects on amphibians.

15.5.1.12 Reptiles

15.5.1.12.1 Habitat Loss, Disturbance and Mortality Risk

As common lizard habitat will be directly impacted by the proposed Project, and given the legal protection afforded to the species under the Wildlife Acts (which prohibits wilful destruction or interference with their breeding or resting places), mitigation has been provided.

There are small areas of suitable breeding and hibernating habitat for lizard that will be removed as a result of the proposed Project, i.e.: semi-natural grassland, scrub, hedgerows, earth banks and areas of spoil and bare ground/recolonising bare ground; therefore, it is possible that site clearance works at any time of year in suitable habitat may encounter the species, cause disturbance and have the potential to kill or injure individuals.

In order to minimise the risk of site clearance and construction works disturbing, or causing the mortality of, common lizard, the following schedule of site clearance works will be followed in the areas highlighted on Figure 15.12, where there is suitability for common lizard:

- Grass or scrub vegetation will be removed during the winter period, where possible, avoiding potential common lizard hibernacula sites (dry sites which provide frost-free conditions *e.g.* stone walls, underground small mammal burrows, piles of dead wood or rubble).
- Where this is not possible and clearance will be undertaken during the active season (i.e. March through to September, inclusive), vegetation will be cut first to c. 15cm, and then to the ground, under supervision of an ecologist. This will allow the opportunity for lizards to be displaced by the disturbance and leave the affected area.
- Potential hibernacula sites (*e.g.* areas of rubble, wood and/or soil located close to vegetated areas) will be removed during the active season (i.e. March through September, inclusive) under the supervision of an ecologist, when they are less likely to be in use by torpid lizards

15.5.1.13 Fish

15.5.1.13.1 Habitat Loss

The structures have been designed in consultation with IFI and in accordance with the design criteria set out in *Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes (NRA*, 2008d) and the *Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters* (IFI, 2016). These measures, which include, in broad terms replicating the existing channel profile and substrate, will likely minimise the effects of habitat loss to a degree but it is acknowledged that this will be limited by the fact that they are artificial channels within a light limiting box structure. In addition, the proposed new section of the Mayne River will be designed in accordance with the principles outlined in *Channels & Challenges. Enhancing Salmonid Rivers* (O'Grady, 2006).

To minimise the effects of habitat loss on fish species, all sections of river/stream channel within the proposed Project boundary, but not within the footprint of the proposed Project and associated infrastructure, will be protected from site clearance and construction works. Rivers/streams will be fenced off at a minimum distance of 5m from the riverbank and within this zone the natural riparian vegetation will be retained.

15.5.1.13.2 Habitat Degradation –Water Quality

The measures documented in Section 15.4.2.1.1 page 82 of this report with respect to the prevention of pollution/contamination of European sites are applicable with respect to reducing potential impacts to water quality in receiving watercourses and the effects on fish.

15.5.1.13.3 Mortality Risk and Disturbance/Displacement

To minimise the potential effects of construction works on fish species the following mitigation measures will be implemented:

- No instream works will be carried out between the months of October and June (inclusive) to avoid the most sensitive time for fish species and fish species movements;
- Immediately prior to rivers/streams being diverted into a newly constructed river channel or culvert, they will be electro-fished (if required) to capture and transfer fish from the original channel to the new one. Once the watercourse has been diverted this will be followed by a manual search of the original watercourse to transfer any remaining fish to the new river/stream channel; and
- Any water abstraction points required for dust suppression will be agreed with IFI and the suction head shall be screened to ensure that fish are not removed during the abstraction process.

15.5.1.13.4 Habitat Severance/Barrier Effect

All temporary crossing structures used to cross watercourses during construction and the proposed diversion of the Mayne River will be designed in accordance with the *Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters* (IFI, 2016) and *Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes* (NRA, 2008d) to maintain fish passage, and to prevent sedimentation and erosion.

15.5.1.14 Proposed Grid Connections

Potential Construction Phase impacts as a result of the proposed Grid Connections are outlined in Section 15.4.2.10.

With regards to impacts relating to invasive species (i.e, habitat degradation as a result of the introduction/spreading of non-native invasive plant species), the mitigation measures detailed in Section 15.5.1.2.6 have been designed to ensure that the proposed Project will not have any likely significant negative effects, as a result of the introduction/spread of non-native invasive plant species, at any geographic scale. Given that the potential impacts of the proposed Grid Connection would be no greater than that of the proposed Project, if equivalent mitigation measures were applied to the proposed Grid Connections (as outlined in Section 15.5.1.2.6 and the outline CEMP (see Appendix A5.1)) it is extremely unlikely that there would be any significant effects as a result of the introduction/spread of non-native invasive plant species at any geographic scale.

With regards to hydrological and hydrogeological impacts, mitigation measures have been designed for the proposed Project for all relevant impacts (i.e., habitat degradation as a results of surface water quality, ground water quality, hydrological regimes, and potential impacts on otter and SCI bird species due to habitat loss, habitat degradation and reduction in prey abundance/quality as a result of hydrological/hydrogeological impacts as detailed under Sections 15.5.1.1, 15.5.1.2.4, 15.5.1.2.5, 15.5.1.4.1, 15.5.1.7.1, 15.5.1.10.1, 15.5.1.11.2, 15.5.1.13.2. Given that the potential impacts of the proposed Grid Connection would be no greater than that of the proposed Project, if equivalent mitigation measures were applied to the proposed Grid Connections it is extremely unlikely that there would be any significant effects as a result of hydrological or hydrogeological impacts at any geographic scale.

Additionally, as outlined in Chapter 18 (Hydrology), with regards to water crossings for the proposed Grid Connections, the ESB Advanced Work Package (ESB, 2021) contains detailed project specific methodology and associated design measures on each water crossing methodology, and the design measures of each methodology will ensure the protection of the watercourse and that there will be no adverse impacts to the receiving environment.

15.5.2 Operational Phase

15.5.2.1 Designated Areas for Natura Conservation

15.5.2.1.1 European Sites

The mitigation measures that are specifically required to ensure that the proposed Project will not result in a likely significant effect on (i.e. adversely affect the integrity of) the European sites within its ZoI (i.e. Baldoyle Bay SAC, Malahide Estuary SAC, North Dublin Bay SAC, South Dublin Bay SAC, Wicklow

Mountains SAC, Baldoyle Bay SPA, Dalkey Islands SPA, Howth Head Coast SPA, Ireland's Eye SPA, Lambay Island SPA, Malahide Estuary SPA, North Bull Island SPA, Rockabill SPA, Rogerstown Estuary SPA, Skerries Islands SPA, South Dublin Bay and River Tolka Estuary SPA, and The Murrough SPA) are presented in Section 6 of the NIS. Following a consideration and assessment of the proposed Project on the identified relevant European sites, mitigation measures were developed to address the following potential impact that was identified:

- Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies.

Measures to Protect Surface Water Quality during Operation

Given the potential interaction between groundwater and surface water with respect to influencing surface water quality, the measures included in this section relate to both ground and surface water.

According to the Section 18.6.2 of Chapter 18 (Hydrology) and Section 19.6.3 of Chapter 19 (Hydrogeology), the nature of the proposal is such that there are limited opportunities for water quality impacts on surface or groundwater receptors during operation. Mitigation through design to avoid impacts on water quality include the following:

- There is no requirement for bulk chemical storage other than storage at the Dardistown Depot. All chemicals will be stored on impermeable hardstand and under cover within designed maintenance compounds. A programme of regular inspection of operational design discharges will be undertaken as part of the long-term operation and maintenance programme.
- Oil and petrol interceptors will be included prior to outfalls for water collected at the Dardistown Depot, the Park & Ride area, maintenance areas, track drainage and along surface water routes.
- All wastewater arising from the tunnel alignment (including from the tunnel itself, emergency access and ventilation shafts, portals) and foul water from Station boxes will ultimately be discharged to public foul sewer under formal consent by Irish Water. No wastewater will be discharged to ground or surface waters during operation.
- On-going inspection (at a minimum three- to five-year frequency) and maintenance will occur to ensure that the swales/wetland ponds/ infiltration basins continue to operate as intended for the design life of the proposed development, with particular emphasis on areas AZ1 to AZ3. Design of all attenuation features will include for specific catchment and containment area, hydrocarbon interceptor and hydrobrake to mitigate any impact on receiving water features, including where these potentially interact with groundwater.
- Care will be taken in reworking acceptable and certified as suitable for re-use excavated subsoil material post Construction Phase. Where this occurs for example during landscaping works in order to minimise the potential for groundwater infiltration and generation of runoff to ground.

The following measures for the prevention of waters contaminated by firefighting operations are included in Section 18.6.2 of Chapter 18 (Hydrology):

- In the case of fire in the above ground structures, any water contaminated by firefighting operations will be contained within a fit-for-purpose attenuation pond/ tank (for example Park & Ride and Dardistown Depot) discharged safely in agreement with the EPA, Irish Water and any other relevant stakeholders.
- In the case that a fire breaks out in an underground station or along the track, the drainage system will be designed with an automatic shut off valve. This shut off valve will be activated in the event of a fire. The firewater will then be contained within the drainage system prior to pumping it out for appropriate disposal off-site.

15.5.2.1.2 Natural Heritage Areas and Proposed Natural Heritage Areas

As discussed in Section 15.4.2.1.1, the potential for the proposed Project to significantly affect Malahide Estuary pNHA, Baldoyle Bay pNHA, North Dublin Bay pNHA, Dolphins, Dublin Docks pNHA, South Dublin Bay pNHA, Booterstown Marsh pNHA, Rogerstown Estuary pNHA, Howth Head pNHA, Ireland's Eye pNHA, Lambay Island pNHA, Skerries Islands NHA, Dalkey Coastal Zone and Killiney Hill pNHA, The

Murrough pNHA and Rockabill pNHA is as per the corresponding European sites[100]. Therefore, the mitigation measures outlined above in Section 15.5.1.1, and as detailed in Section 6 of the NIS, will prevent the proposed Project resulting in a significant negative effect on these pNHAs at the national geographic scale.

The mitigation measures required to ensure that the proposed Project will not significantly affect Sluice River Marsh pNHA, Santry Demesne pNHA, Royal Canal pNHA, and Grand Canal pNHA:

- Measures to avoid the introduction or spread of non-native invasive plant species to these pNHAs during operation- see the Outline ISMP (Appendix A15.8);
- Measures to control surface water runoff during operation to prevent an accidental pollution event affecting sensitive habitats within these pNHA – see Section 18.6 of Chapter 18 (Hydrology); and,
- Measures to manage and treat groundwater discharges to surface water during operation – see Section 19.6 of Chapter 19 (Hydrogeology).

15.5.2.2 Habitats

15.5.2.2.1 Mitigation Measures to Reduce the Potential for Impacts to Water Quality in Receiving Watercourses

The measures documented in Section 15.5.2.1.1 page 199 of this report with respect to the prevention of pollution/contamination of European sites are applicable with respect to reducing potential impacts to water quality in receiving watercourses and the effects on habitats.

15.5.2.2.2 Measures to Control and Prevent the Spread of Non-native Invasive Plant Species

The mitigation in relation to ensuring no spread of non-native invasive plant species is primarily based on the guidance on *The Management of Invasive Alien Plant Species on National Roads (Technical Guidance)* (TII 2020) with the objective of managing non-native invasive plant species within the operational corridor. Where non-native invasive plant species are present within or in close proximity to the proposed Project, routine maintenance works could potentially result in the spread of contaminated vegetation cuttings both within the Proposed Scheme boundary and within the immediate vicinity.

Mitigation measures to prevent the spread of non-native invasive plant species are outlined in the Outline ISMP (see Appendix A15.8). Ongoing operational monitoring will be undertaken for the presence and/or absence of non-native invasive species identified within the ZoI of proposed Project. If any non-native species are confirmed to be present, they will be treated accordingly to ensure they are eradicated and do not spread.

15.5.2.3 Rare and Protected Plant Species

15.5.2.3.1 Habitat Degradation - Water Quality

It was concluded that there will be no impact during the Operational Phase as there are no proposed discharge points to the Royal Canal. Additionally, the mitigation measures relating to the protection of water quality in receiving watercourses during operation are outlined in Section 15.5.1.2.4 and detailed in Section 18.6 of Chapter 18 (Hydrology) and Section 15.5.1.2.5 (detailed in Section 19.6 of Chapter 19 (Hydrogeology).

[100] Malahide Estuary SAC and Malahide Estuary SPA in relation to Malahide Estuary pNHA; Baldoyle Bay SAC and Baldoyle Bay SPA in relation to Baldoyle Bay pNHA; North Dublin Bay SAC, North Bull Island SPA and South Dublin Bay and River Tolka Estuary SPA in relation to North Dublin Bay pNHA; South Dublin Bay SAC and South Dublin Bay and River Tolka Estuary SPA in relation to South Dublin Bay pNHA and Booterstown Marsh pNHA; Rogerstown Estuary SAC and SPA in relation to Rogerstown Estuary pNHA; Howth Head SAC and Howth Head Coast SPA in relation to Howth Head pNHA; Ireland's Eye SAC and SPA in relation to Ireland's Eye pNHA; Lambay Island SAC and SPA in relation to Lambay Island pNHA; Skerries Islands SPA in relation to Skerries Islands NHA; Rockabill to Dalkey Island in relation to Dalkey Coastal Zone and Killiney Hill pNHA; The Murrough SPA in relation to The Murrough pNHA; and Rockabill to Dalkey Island SAC and Rockabill SPA in relation to Rockabill pNHA.

15.5.2.4 Otter

Otter are listed on Annex II and Annex IV of the EU Habitats Directive. Otter are strictly protected under the Birds and Habitats Regulations. Otter, and their breeding and resting places, are also protected under the Wildlife Acts and it is an offence under that legislation to intentionally kill or injure an Otter or to wilfully interfere with or destroy their breeding or resting places (holts/couches).

15.5.2.4.1 Habitat Degradation - Water Quality

The measures documented in Section 15.5.2.1.1 page 199 of this report with respect to the prevention of pollution/contamination of European sites are applicable with respect to reducing potential impacts to water quality in receiving watercourses and the effects on otter.

15.5.2.4.2 Habitat Severance/Barrier Effect

Otter use many of the watercourses crossed by the proposed Project.

The two proposed permanent culverts on the Sluice River and one of its tributaries, at Ch. 5 + 765 and Ch. 5 + 963, have the potential to create a permanent barrier to otter movement in the locality. In order to maintain connectivity, these culverts have been designed to include a raised mammal ledge suitable for otter to move along and allowing them to access the watercourse both upstream and downstream of the proposed crossing point. This will be constructed in accordance with the Guidelines for the Treatment of Otters prior to the Construction of National Road Schemes (NRA, 2008c).

15.5.2.5 Bats

Bats are listed on Annex IV of the EU Habitats Directive and are therefore, strictly protected under the Birds and Habitats Regulations. Bats, and their breeding and resting places, are also protected under the Wildlife Acts and it is an offence under that legislation to intentionally kill or injure bats or to wilfully interfere with or destroy their breeding or resting places.

15.5.2.5.1 Disturbance/Displacement - Lighting

A detailed operational lighting design will be prepared for each sensitive bat area within the proposed Project and the proposed floodlit pitches, and these will include details on how the lighting will be managed to avoid light spill and potential impacts. Lux levels at the sensitive bat areas will not be increased above baseline levels as a result of the proposed Project. A suitably qualified bat ecologist will review and input into this detailed lighting design.

The sensitive bat areas within the proposed Project are as follows:

- Lands at the proposed P&R Facility and Estuary Station (i.e. along hedgerows/treelines)
- Broadmeadow River and Ward River corridors and planted woodland within Balheary Park
- Sluice River corridor
- Mayne River corridor and field boundaries at Dardistown
- Santry River corridor and Santry Demesne
- Albert College Park
- Griffith Park and Tolka River corridor
- Royal canal and adjacent lands
- Stephen's Green Park
- Dartmouth Square
- Grand Canal

The playing pitches which are proposed to be floodlit as part of the proposed Project are as follows:

- Fingallians pitch at Balheary
- Starlights pitch at Dardistown
- Na Fianna pitches on St Mobhi Road.

The following of elements of the operational lighting design will ensure minimal impacts on bats from light disturbance:

- All proposed lighting will be from a LED light source, which is a more bat-friendly light source as it contains very little/no UV frequency lighting that bats are particularly sensitive to (BCI, 2010);
- Lighting will include an automatic dimming and switching off mechanism in order to reduce the duration of light disturbance as much as possible;
- Lighting will be directional, i.e. there will be no upward light projection and lighting will not be projected behind lighting columns in order to reduce any backward lighting and any obtrusive lighting into adjacent areas; and,
- Where possible, the shortest lighting columns will be used to further reduce any light spill.

15.5.2.6 Other Mammal Species

15.5.2.6.1 Habitat Degradation - Water Quality

The measures documented in Section 15.5.2.1.1 page 184 of this report with respect to the prevention of pollution/contamination of European sites are applicable with respect to reducing potential impacts to water quality in receiving watercourses and the effects on other mammal species.

15.5.2.7 Invertebrates – Freshwater Molluscs

15.5.2.7.1 Habitat Degradation – Surface Water

There are no impacts on freshwater molluscs predicted during the operation of the proposed Project as there are no discharge points to the Royal Canal or Grand Canal. However, the mitigation measures relating to the protection of water quality in receiving watercourses during operation are outlined in Section 15.5.2.2 and detailed in Section 18.6 of Chapter 18 (Hydrology).

15.5.2.8 Breeding Birds

15.5.2.8.1 Habitat loss, Habitat Severance/Barrier Effect and Mortality Risk

Planting of woodland, hedgerow, grassland and wetland habitats within the proposed Project boundary as detailed in the landscape drawings (Refer to Chapter 27 (Landscape & Visual) for details) will provide suitable habitat for the breeding bird species recorded within the study area.

Many species may not nest in close proximity to the above-ground sections of the rail line due to disturbance (*e.g.* drowning out of bird song by train noise). Whilst the planting is not likely to fully offset the loss of breeding habitat (due to the proximity of train traffic disturbance on the operational alignment) it is likely to provide additional foraging habitat for some species. However, as outlined in Section 15.4.3.6, the disturbance associated with the proposed Project is not likely to affect the conservation status of breeding bird species at any geographic scale.

To further minimise the effects of breeding-habitat loss, a total of 250 nest boxes will be erected under the guidance of a suitably qualified ecologist in suitable locations away from the aboveground sections of the proposed Project. The siting and type of nest boxes will be decided on by an ecologist at locations where trees will be planted or retained along the proposed Project. It is recommended that a range of nest boxes suitable to support a wide range of breeding bird species are selected, and that the siting of the boxes is determined based on the areas of greatest habitat loss i.e. Estuary Park & Ride, at Pinnock Hill Roundabout, Northwood Station, Collins Avenue Station, Albert College Park, Griffith Park Station, St Stephen's Green Station and Charlemont Station.

15.5.2.8.2 Habitat Degradation - Water Quality

The measures documented in Section 15.5.2.1.1 page 199 of this report with respect to the prevention of pollution/contamination of European sites are applicable with respect to reducing potential impacts to water quality in receiving watercourses and the effects on breeding birds.

15.5.2.9 Wintering Birds

15.5.2.9.1 Habitat Degradation – Surface Water

The measures documented in Section 15.5.2.1.1 page 199 of this report with respect to the prevention of pollution/contamination of European sites are applicable with respect to reducing potential impacts to water quality in receiving watercourses and the effects on wintering birds.

15.5.2.10 Amphibians

15.5.2.10.1 Habitat Degradation – Surface Water

The measures documented in Section 15.5.2.1.1 page 199 of this report with respect to the prevention of pollution/contamination of European sites are applicable with respect to reducing potential impacts to water quality in receiving watercourses and the effects on amphibians.

15.5.2.11 Fish

15.5.2.11.1 Habitat Degradation – Surface Water

Th The measures documented in Section 15.5.2.1.1 page 199 of this report with respect to the prevention of pollution/contamination of European sites are applicable with respect to reducing potential impacts to water quality in receiving watercourses and the effects on fish.

15.5.2.11.2 Habitat Severance/Barrier Effect

The structures have been designed in consultation with IFI and the design criteria set out in *Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes* (NRA, 2008d) and the *Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters* (IFI, 2016). This will maintain fish passage during the operation of the proposed Project and therefore, will result in a neutral impact to fish species.

15.5.2.12 Proposed Grid Connections

Potential Operational Phase impacts as a result of the proposed Grid Connections are outlined in Section 15.4.3.10.

With regards to lighting impacts, as outlined in Technical Note provided by Mott MacDonald (Mott MacDonald, 2021), the lighting plan for the proposed Grid Connections GIS substations will minimise light spill within the surrounding area. Lighting will not be a continuous feature of the operational substations and will be manually operated by an activation switch located within the GIS substation.

Additionally, mitigation measures have been designed for the proposed Project to avoid potential disturbance/displacement of bats as a result of increased artificial lighting (i.e. operational lighting design measurements to ensure minimal impacts on bats from light disturbance) as detailed in Section 15.5.1.2.6. Given that the potential light impacts of the proposed Grid Connection would be no greater than that of the proposed Project, if equivalent mitigation measures were applied to the proposed Grid Connections it is extremely unlikely that there would be any significant effects as a result of lighting impacts at any geographic scale.

15.6 Residual Impacts

15.6.1 Designated Areas for Nature Conservation

15.6.1.1 European Sites

The assessment, presented in the NIS, of the potential for the proposed Project to impact upon the European sites within its ZoI (i.e. Baldoyle Bay SAC, Malahide Estuary SAC, North Dublin Bay SAC South

Dublin Bay SAC, and Wicklow Mountains SAC, or the special conservation interests of the Baldoyle Bay SPA, Dalkey Islands SPA, Howth Head Coast SPA, Ireland's Eye SPA, Lambay Island SPA, Malahide Estuary SPA, North Bull Island SPA, Rockabill SPA, Rogerstown Estuary SPA, Skerries Islands SPA, South Dublin Bay and River Tolka Estuary SPA, and the Murrough SPA) concluded that, with the implementation of the mitigation measures proposed, the proposed Project does not pose a risk of adversely affecting (either directly or indirectly) the integrity of any European site, either alone or in combination with other plans or project.

The proposed Project will not result in any residual impact, either during construction or operation, on any European site as the potential impact pathways connecting the proposed Project to these European sites are fully mitigated, as assessed in the NIS (and throughout this chapter).

Therefore, the proposed Project will not result adverse effects on any European site.

15.6.1.2 Natural Heritage Areas and Proposed Natural Heritage Areas

The residual impacts of the proposed Project on Malahide Estuary pNHA, Baldoyle Bay pNHA, North Dublin Bay pNHA, Dolphins, Dublin Docks pNHA, South Dublin Bay pNHA, Booterstown Marsh pNHA, Rogerstown Estuary pNHA, Howth Head pNHA, Ireland's Eye pNHA, Lambay Island pNHA, Skerries Islands NHA, Dalkey Coastal Zone and Killiney Hill pNHA, The Murrough pNHA and Rockabill pNHA is as per the corresponding European sites[101] in Section 15.6.1.1.

Mitigation measures will be implemented to ensure that these pNHAs and NNA, as well as Sluice River Marsh pNHA, Santry Demesne pNHA, Royal Canal pNHA, and Grand Canal pNHA, will not be affected by the proposed Project during construction or operation.

Therefore, the proposed Project will not affect the integrity of, or result in a likely significant negative residual effect on any NHAs or pNHAs.

15.6.2 Habitats

Mitigation measures will be implemented during construction and operation to minimise the effects of habitat loss and habitat degradation on biodiversity (see Sections 15.5.1.2 and 15.5.2.2).

Despite these mitigation measures, the proposed Project will result in the permanent area loss of a number of habitats valued as being of Local Importance (Higher Value). This loss is covered to be a significant negative residual effect at a local geographic scale. These habitats are as follows:

- Depositing/lowland rivers (FW2) – c. 1,186m^2
- Drainage ditches (FW4) - c. 3.22km
- Species-rich dry calcareous and neutral grassland (GS1) - c. 3.2ha
- Wet grassland (GS4) - c. 0.95ha
- (Mixed) broadleaved woodland (WD1) - c. 4.4ha
- (Mixed) conifer woodland (WD3) - c. 0.43ha
- Scattered trees and parkland (WD5) - c. 0.95ha
- Hedgerows (WL1) - c. 385m
- Treelines (WL2) - c. 77m
- Immature woodland (WS2) - c. 1.19ha

[101] Malahide Estuary SAC and Malahide Estuary SPA in relation to Malahide Estuary pNHA; Baldoyle Bay SAC and Baldoyle Bay SPA in relation to Baldoyle Bay pNHA; North Dublin Bay SAC, North Bull Island SPA and South Dublin Bay and River Tolka Estuary SPA in relation to North Dublin Bay pNHA; South Dublin Bay SAC and South Dublin Bay and River Tolka Estuary SPA in relation to South Dublin Bay pNHA and Booterstown Marsh pNHA; Rogerstown Estuary SAC and SPA in relation to Rogerstown Estuary pNHA; Howth Head SAC and Howth Head Coast SPA in relation to Howth Head pNHA Ireland's Eye SAC and SPA in relation to Ireland's Eye pNHA; Lambay Island SAC and SPA in relation to Lambay Island pNHA; Skerries Islands SPA in relation to Skerries Islands NHA; Rockabill to Dalkey Island SAC in relation to Dalkey Coastal Zone and Killiney Hill pNHA; The Murrough SPA in relation to The Murrough pNHA; and, Rockabill to Dalkey Island SAC and Rockabill SPA in relation to Rockabill pNHA.

15.6.3 Rare and Protected Plant Species

Mitigation measures will be implemented to ensure that there are no impacts on rare and protected plant species (i.e. opposite-leaved pondweed, horned pondweed, rigid hornwort and whorled water-milfoil) during the construction or operation of the proposed Project (see Sections 15.5.1.3 and 15.5.2.3).

Therefore, the proposed Project will not result in a likely significant negative residual effect on any rare and protected plant species at any geographic scale.

15.6.4 Mammals

15.6.4.1 Otter

Mitigation measures will be implemented (and monitored) to minimise the risk of the proposed Project affecting water quality in the receiving watercourses/waterbodies during construction and operation which will ensure that there is not a likely significant negative residual effect on the local otter population (see Sections 15.5.1.4 and 15.5.2.4).

Mitigation measures will be implemented (and monitored) to ensure that during construction the proposed Project does not result in a significant negative effect on the local otter population as a result of severance/barrier effects associated with the proposed dewatering of the Royal Canal, i.e. the provision of mammal resistant fencing/mammal passage facilities (Sections 15.5.1.4).

Therefore, the proposed Project will not result in a likely significant negative residual effect on otter at any geographic scale.

15.6.4.2 Bats

Mitigation measures will be implemented (and monitored) prior to and during construction to minimise the risk of direct harm to bats during demolition and tree felling activities associated with the proposed Project, to provide alternative bat habitat (i.e. bat boxes) and to avoid any indirect impacts arising from light disturbance either during construction and/or operation of the proposed Project.

Therefore, the proposed Project will not result in a likely significant negative residual effect on any bat species at any geographic scale.

15.6.4.3 Badger

Mitigation measures will be implemented (and monitored) to minimise the risk of the proposed Project impacting on badger due to increased disturbance and/or displacement during construction which will ensure that there is not a likely significant negative residual effect on the local badger population (see Section 15.5.1.6).

15.6.4.4 Other Mammal Species

Mitigation measures will be implemented to minimise the risk of the proposed Project affecting water quality in receiving watercourses/waterbodies during construction and operation which will ensure that there is not a significant negative effect on local aquatic or marine mammal populations (see Sections 15.5.1.7 and 15.5.2.7).

Therefore, the proposed Project will not result in a likely significant negative residual effect on any other mammal species at any geographic scale.

15.6.5 Invertebrates

15.6.5.1 White-clawed crayfish

As white-clawed crayfish is not present within the ZoI of the proposed Project, no impacts are predicted. Therefore, no mitigation measures are required, and no residual impacts are predicted.

15.6.5.2 Freshwater Molluscs

Mitigation measures will be implemented (and monitored) to minimise the risk of the proposed Project affecting water quality in the receiving watercourses/waterbodies during construction and operation which will ensure that there is not a likely significant negative residual effect on the local populations of glutinous snail and false orb pea mussel (see Sections 15.5.1.8 and 15.5.2.8).

Therefore, the proposed Project will not result in a likely significant negative residual effect on glutinous snail and false orb pea mussel at any geographic scale.

15.6.6 Birds

15.6.6.1 Breeding Birds

Mitigation measures will be implemented during construction and operation to minimise the mortality risk and the effects of habitat loss and disturbance to breeding birds which will ensure that there is not a likely significant negative residual effect on any breeding bird population (see Sections 15.5.1.9 and 15.5.2.9). The only exception to this is yellowhammer. Despite these mitigation measures, the proposed Project during construction will result in the permanent loss of yellowhammer territory and as this potential impact is unmitigable, it will result in a significant negative residual effect on yellowhammer at a local geographic scale.

Mitigation measures will be implemented (and monitored) to minimise the risk of the proposed Project affecting water quality in the receiving watercourses/waterbodies during construction and operation which will ensure that there is not a likely significant negative residual effect on any breeding bird population as a result of an accidental pollution event (see section 15.5.1.4 and 15.5.2.4).

15.6.6.2 Wintering Birds

Mitigation measures will be implemented (and monitored) to minimise the risk of the proposed Project affecting water quality in the receiving watercourses/waterbodies during construction and operation which will ensure that there is not a likely significant negative residual effect on any wintering bird population as a result of an accidental pollution event (see Sections 15.5.1.4 and 15.5.2.4).

Therefore, the proposed Project will not result in a likely significant negative residual effect on any wintering bird population at any geographic scale.

15.6.7 Amphibians

As suitable amphibian breeding and resting habitat will be directly impacted by the proposed Project, and given the legal protection afforded to amphibian species under the Wildlife Acts (which prohibits wilful destruction or interference with an amphibian breeding or resting places), mitigation has been provided. Mitigation measures will be implemented (and monitored) to minimise any effects on amphibians associated with habitat loss, disturbance and/or mortality/injury risk as well as the risk of the proposed Project affecting water quality in the receiving watercourses/waterbodies during construction (see Section 15.5.1.11 and 15.5.2.10).

As there is no potential for significant effects on amphibian populations, no significant residual effects will occur.

15.6.8 Reptiles

As common lizard habitat will be directly impacted by the proposed Project, and given the legal protection afforded to the species under the Wildlife Acts (which prohibits wilful destruction or interference with their breeding or resting places), mitigation has been provided. Mitigation measures will be implemented (and monitored) to minimise any effects on common lizard associated with habitat loss, disturbance and/or mortality/injury risk during construction (see Section 15.5.1.12).

As there is no potential for significant effects on common lizard populations, no significant residual effects will occur.

15.6.9 Fish

Mitigation measures will be implemented (and monitored) to minimise the risk of the proposed Project affecting water quality in the receiving watercourses/waterbodies during construction and operation which will ensure that there is not a likely significant negative residual effect on the local populations of any fish species (see Sections 15.5.1.13 and 15.5.2.11).

Therefore, the proposed Project will not result in a likely significant negative residual effect on any fish species at any geographic scale.

15.6.10 Proposed Grid Connections

Given that the potential impacts of the proposed Grid Connections would be no greater than that of the proposed Project, if equivalent mitigation measures were applied, it is extremely unlikely that there would be any significant negative residual impacts as a result of the proposed Grid Connections at any geographic scale.

15.6.11 Local Biodiversity Areas

The local biodiversity areas impacted by the proposed Project will be affected to some degree by the likely significant effects associated with the proposed Project on the KERs that have been identified in each of those areas. These likely significant effects are accounted for and described separately above. This section provides some context for these residual impacts with respect to the following local biodiversity areas identified within the relevant Biodiversity Action Plans (Fingal County Council 2010 & Dublin City Council 2015): *Fingal Biodiversity Action Plan 2010-2015*

- The residual impact of the loss of arable land, calcareous grassland, hedgerows and woodland habitats as a result of the proposed Project will have a residual impact on '*Habitats considered to be of importance, such as arable land, semi-natural calcareous grassland, hedgerows and woodlands, which support a range of species and act as important ecological links/corridors across the wider landscape*';
- The residual impact of the loss of depositing/lowland rivers habitat as a result of the proposed Project will have a residual impact on '*Network of rivers and streams, including the Broadmeadow River, Ward River, River Tolka, Santry River, Sluice River and Mayne River, all of which are crossed by the proposed Project. These watercourses support a range of riverine bird species, such as kingfisher, and fish species*'; and,
- The residual impact of the loss of habitats outlined above in Section 15.6.2 will have a residual impact on *'Parkland and gardens associated with houses, parks, playing fields, churchyards, cemeteries and brown field sites, all of which contain valuable wildlife habitats*', where these habitat types are associated with the aforementioned property types.

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- The residual impact of the loss of depositing/lowland rivers habitat as a result of the proposed Project will have a residual impact on *'Riparian zones, which support a range of legally protected and rare species*'; and,

- The residual impact of the loss of habitats outlined above in Section 15.6.2 will have a residual impact on *'Network of parks and public green spaces, such as Tolka Valley Park and St Stephen's Green, and private gardens, which support a variety of species and is considered to be a valuable biodiversity resource*', where these habitat types are associated with parks and public green spaces, e.g. Albert College Park and St Stephen's Green.

15.6.12 Summary of Residual Impacts

Table 15.24 below presents an overall summary of the likely significant effects of the proposed Project on biodiversity, in consideration of the mitigation measures.

Table 15.24: Summary of Likely Significant Residual Effects of the Proposed Project on Biodiversity (Including Mitigation)

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance
Designated Areas for Nature Conservation					
Malahide Estuary SAC (including Malahide Estuary pNHA)	International Importance (National Importance)	**Construction** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies; and, Habitat degradation as a result of the introduction and/or spread of non-native invasive species; **Operation** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies.	Likely significant effect at the international geographic scale	**Construction** Good housekeeping, Measures to Protect Surface Water Quality during Construction and Measures to Prevent the Introduction and/or Spread of Non-native Invasive Species Giant Hogweed, Japanese Knotweed and Himalayan Balsam documented in Section 15.5.1.1.1, page 176 **Operation** Measures to Protect Surface Water Quality during Operation documented in Section 15.5.2.1.1, page 199. See also section 6 of the NIS, the outline CEMP and the ISMP accompanying this report.	No likely significant residual effect
Malahide Estuary SPA (including Malahide Estuary pNHA)	International Importance (National Importance)	Construction Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies; and, Habitat degradation as a result of the introduction and/or spread of non-native invasive species; Operation Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies.	Likely significant effect at the international geographic scale	**Construction** Good housekeeping, Measures to Protect Surface Water Quality during Construction and Measures to Prevent the Introduction and/or Spread of Non-native Invasive Species Giant Hogweed, Japanese Knotweed and Himalayan Balsam documented in Section 15.5.1.1.1, page 176 **Operation** Measures to Protect Surface Water Quality during Operation documented in Section 15.5.2.1.1, page 199.	No likely significant residual effect

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance
				See also section 6 of the NIS, the outline CEMP and the ISMP accompanying this report.	
Baldoyle Bay SAC (including Baldoyle Bay pNHA)	International Importance (National Importance)	**Construction** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies; and, Habitat degradation as a result of the introduction and/or spread of non-native invasive species. **Operation** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies.	Likely significant effect at the international geographic scale	**Construction** Good housekeeping, Measures to Protect Surface Water Quality during Construction and Measures to Prevent the Introduction and/or Spread of Non-native Invasive Species Giant Hogweed, Japanese Knotweed and Himalayan Balsam documented in Section 15.5.1.1.1, page 176 **Operation** Measures to Protect Surface Water Quality during Operation documented in Section 15.5.2.1.1, page 199. See also section 6 of the NIS, the outline CEMP and the ISMP accompanying this report.	No likely significant residual effect
Baldoyle Bay SPA (including Baldoyle Bay pNHA)	International Importance (National Importance)	**Construction** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies; and, Habitat degradation as a result of the introduction and/or spread of non-native invasive species; **Operation** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies.	Likely significant effect at the international geographic scale	International Importance (National Importance)	**Construction** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies; and, Habitat degradation as a result of the introduction and/or spread of non-native

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance
					invasive species; **Operation** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies.
North Dublin Bay SAC (including North Dublin Bay pNHA)	International Importance (National Importance)	**Construction** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies; and, Habitat degradation as a result of the introduction and/or spread of non-native invasive species; **Operation** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies.	Likely significant effect at the international geographic scale	International Importance (National Importance)	**Construction** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies; and, Habitat degradation as a result of the introduction and/or spread of non-native invasive species; **Operation** Habitat degradation as a result of Pollution/Contamination of

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance
					Receiving Waterbodies.
North Bull Island SPA (including North Dublin Bay pNHA)	International Importance (National Importance)	**Construction** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies; and, Habitat degradation as a result of the introduction and/or spread of non-native invasive species; **Operation** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies.	Likely significant effect at the international geographic scale	**Construction** Good housekeeping, Measures to Protect Surface Water Quality during Construction and Measures to Prevent the Introduction and/or Spread of Non-native Invasive Species Giant Hogweed, Japanese Knotweed and Himalayan Balsam documented in Section 15.5.1.1.1, page 176 **Operation** Measures to Protect Surface Water Quality during Operation documented in Section 15.5.2.1.1, page 199. See also section 6 of the NIS, the outline CEMP and the ISMP accompanying this report.	No likely significant residual effect
South Dublin Bay SAC (including South Dublin Bay pNHA)	International Importance (National Importance)	**Construction** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies; and, Habitat degradation as a result of the introduction and/or spread of non-native invasive species; **Operation** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies.	Likely significant effect at the international geographic scale	**Construction** Good housekeeping, Measures to Protect Surface Water Quality during Construction and Measures to Prevent the Introduction and/or Spread of Non-native Invasive Species Giant Hogweed, Japanese Knotweed and Himalayan Balsam documented in Section 15.5.1.1.1, page 176 **Operation** Measures to Protect Surface Water Quality during Operation documented in Section 15.5.2.1.1, page 199.	No likely significant residual effect

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance
				See also section 6 of the NIS, the outline CEMP and the ISMP accompanying this report.	
South Dublin Bay and River Tolka SPA (including North Dublin Bay pNHA, South Dublin Bay pNHA, Dolphins, Dublin Docks pNHA and Booterstown Marsh pNHA)	International Importance (National Importance)	**Construction** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies; and, Habitat degradation as a result of the introduction and/or spread of non-native invasive species; **Operation** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies.	Likely significant effect at the international geographic scale	**Construction** Good housekeeping, Measures to Protect Surface Water Quality during Construction and Measures to Prevent the Introduction and/or Spread of Non-native Invasive Species Giant Hogweed, Japanese Knotweed and Himalayan Balsam documented in Section 15.5.1.1.1, page 176 **Operation** Measures to Protect Surface Water Quality during Operation documented in Section 15.5.2.1.1, page 199. See also section 6 of the NIS, the outline CEMP and the ISMP accompanying this report.	No likely significant residual effect
Wicklow Mountains SAC	International Importance	**Construction** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies; **Operation** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies.	Likely significant effect at the international geographic scale	**Construction** Good housekeeping, Measures to Protect Surface Water Quality during Construction documented in Section 15.5.1.1.1, page 176 **Operation** Measures to Protect Surface Water Quality during Operation documented in Section 15.5.2.1.1, page 199. See also section 6 of the NIS, the outline CEMP and the ISMP accompanying this report.	No likely significant residual effect

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance
Rogerstown Estuary SPA (including Rogerstown Estuary pNHA)	International Importance	**Construction** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies; and, Habitat degradation as a result of the introduction and/or spread of non-native invasive species; **Operation** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies.	Likely significant effect at the international geographic scale	**Construction** Good housekeeping, Measures to Protect Surface Water Quality during Construction and Measures to Prevent the Introduction and/or Spread of Non-native Invasive Species Giant Hogweed, Japanese Knotweed and Himalayan Balsam documented in Section 15.5.1.1.1, page 176 **Operation** Measures to Protect Surface Water Quality during Operation documented in Section 15.5.2.1.1, page 199. See also section 6 of the NIS, the outline CEMP and the ISMP accompanying this report.	No likely significant residual effect
Ireland's Eye SPA (including Ireland's Eye pNHA)	International Importance	**Construction** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies; and, Habitat degradation as a result of the introduction and/or spread of non-native invasive species; **Operation** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies.	Likely significant effect at the international geographic scale	**Construction** Good housekeeping, Measures to Protect Surface Water Quality during Construction and Measures to Prevent the Introduction and/or Spread of Non-native Invasive Species Giant Hogweed, Japanese Knotweed and Himalayan Balsam documented in Section 15.5.1.1.1, page 176 **Operation** Measures to Protect Surface Water Quality during Operation documented in Section 15.5.2.1.1, page 199. See also section 6 of the NIS, the outline CEMP and the ISMP accompanying this report.	No likely significant residual effect

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance
Lambay Island SPA (including Lambay Island pNHA)	International Importance	**Construction** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies; and, Habitat degradation as a result of the introduction and/or spread of non-native invasive species; **Operation** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies.	Likely significant effect at the international geographic scale	**Construction** Good housekeeping, Measures to Protect Surface Water Quality during Construction and Measures to Prevent the Introduction and/or Spread of Non-native Invasive Species Giant Hogweed, Japanese Knotweed and Himalayan Balsam documented in Section 15.5.1.1.1, page 176 **Operation** Measures to Protect Surface Water Quality during Operation documented in Section 15.5.2.1.1, page 199. See also section 6 of the NIS, the outline CEMP and the ISMP accompanying this report.	No likely significant residual effect
Skerries Islands SPA (including Skerries Islands NHA)	International Importance	**Construction** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies; and, Habitat degradation as a result of the introduction and/or spread of non-native invasive species; **Operation** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies.	Likely significant effect at the international geographic scale	**Construction** Good housekeeping, Measures to Protect Surface Water Quality during Construction and Measures to Prevent the Introduction and/or Spread of Non-native Invasive Species Giant Hogweed, Japanese Knotweed and Himalayan Balsam documented in Section 15.5.1.1.1, page 176 **Operation** Measures to Protect Surface Water Quality during Operation documented in Section 15.5.2.1.1, page 199. See also section 6 of the NIS, the outline CEMP and the ISMP accompanying this report.	No likely significant residual effect

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance
Dalkey Islands SPA (including Dalkey Coastal Zone and Killiney Hill pNHA)	International Importance	**Construction** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies; and, Habitat degradation as a result of the introduction and/or spread of non-native invasive species; **Operation** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies.	Likely significant effect at the international geographic scale	**Construction** Good housekeeping, Measures to Protect Surface Water Quality during Construction and Measures to Prevent the Introduction and/or Spread of Non-native Invasive Species Giant Hogweed, Japanese Knotweed and Himalayan Balsam documented in Section 15.5.1.1.1, page 176 **Operation** Measures to Protect Surface Water Quality during Operation documented in Section 15.5.2.1.1, page 199. See also section 6 of the NIS, the outline CEMP and the ISMP accompanying this report.	No likely significant residual effect
Howth Head Coast SPA (including Howth Head pNHA)	International Importance	**Construction** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies; and, Habitat degradation as a result of the introduction and/or spread of non-native invasive species; **Operation** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies.	Likely significant effect at the international geographic scale	**Construction** Good housekeeping, Measures to Protect Surface Water Quality during Construction and Measures to Prevent the Introduction and/or Spread of Non-native Invasive Species Giant Hogweed, Japanese Knotweed and Himalayan Balsam documented in Section 15.5.1.1.1, page 176 **Operation** Measures to Protect Surface Water Quality during Operation documented in Section 15.5.2.1.1, page 199. See also section 6 of the NIS, the outline CEMP and the ISMP accompanying this report.	No likely significant residual effect

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance
Rockabill SPA (including Rockabill pNHA)	International Importance	**Construction** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies; and, Habitat degradation as a result of the introduction and/or spread of non-native invasive species; **Operation** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies.	Likely significant effect at the international geographic scale	**Construction** Good housekeeping, Measures to Protect Surface Water Quality during Construction and Measures to Prevent the Introduction and/or Spread of Non-native Invasive Species Giant Hogweed, Japanese Knotweed and Himalayan Balsam documented in Section 15.5.1.1.1, page 176 **Operation** Measures to Protect Surface Water Quality during Operation documented in Section 15.5.2.1.1, page 199. See also section 6 of the NIS, the outline CEMP and the ISMP accompanying this report.	No likely significant residual effect
The Murrough SPA (including The Murrough pNHA)	International Importance	**Construction** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies; and, Habitat degradation as a result of the introduction and/or spread of non-native invasive species; **Operation** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies.	Likely significant effect at the international geographic scale	**Construction** Good housekeeping, Measures to Protect Surface Water Quality during Construction and Measures to Prevent the Introduction and/or Spread of Non-native Invasive Species Giant Hogweed, Japanese Knotweed and Himalayan Balsam documented in Section 15.5.1.1.1, page 176 **Operation** Measures to Protect Surface Water Quality during Operation documented in Section 15.5.2.1.1, page 199. See also section 6 of the NIS, the outline CEMP and the ISMP accompanying this report.	No likely significant residual effect

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance
Royal Canal pNHA	National Importance	**Construction** Habitat degradation – surface water quality Habitat degradation – air Habitat degradation – non-native invasive plant species Disturbance/displacement - lighting **Operation** Habitat degradation – surface water quality Habitat degradation – non-native invasive plant species Disturbance/displacement - lighting	Likely significant effect at the national geographic scale	Air quality during construction – Section 15.5.1.1.3 Water quality during construction– Section 15.5.1.2.4 and Section 15.5.1.2.5 Non-native invasive plant species during construction and operation – Section 15.5.1.2.6 and 15.5.2.2.2 Measures to protect bats during construction and operation – Section 15.5.1.5 and Section 15.5.2.5	No likely significant residual effect
Grand Canal pNHA	National Importance	**Construction** Habitat degradation – surface water quality Habitat degradation – air Habitat degradation – non-native invasive plant species Disturbance/displacement - lighting **Operation** Habitat degradation – surface water quality Habitat degradation – non-native invasive plant species Disturbance/displacement - lighting	Likely significant effect at the national geographic scale	Air quality during construction – Section 15.5.1.1.3 Water quality during construction– Section 15.5.1.2.4 and Section 15.5.1.2.5 Non-native invasive plant species during construction and operation – Section 15.5.1.2.6 and 15.5.2.2.2 Measures to protect bats during construction and operation – Section 15.5.1.5 and Section 15.5.2.5	No likely significant residual effect
Santry Demesne pNHA	National Importance	**Construction** Habitat degradation – surface water quality Habitat degradation – groundwater Habitat degradation – air Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – surface water quality Habitat degradation – groundwater Habitat degradation – non-native invasive plant species	Likely significant effect at the national geographic scale	Water quality during construction and operation – Section 15.5.1.2.4, Section 15.5.1.2.5 and Section 15.5.2.2.1 Non-native invasive plant species during construction and operation – Section 15.5.1.2.6 and 15.5.2.2.2	No likely significant residual effect

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance
Sluice River Marsh pNHA	National Importance	**Construction** Habitat degradation – surface water quality Habitat degradation – groundwater Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – surface water quality Habitat degradation – groundwater Habitat degradation – non-native invasive plant species	Likely significant effect at the national geographic scale	Water quality during construction and operation – Section 15.5.1.2.4, Section 15.5.1.2.5 and Section 15.5.2.2.1 Non-native invasive plant species during construction and operation – Section 15.5.1.2.6 and 15.5.2.2.2	No likely significant residual effect
Habitats (outside of designated areas for nature conservation)					
Estuaries [1130]	National Importance	**Construction** Habitat degradation – surface water quality Habitat degradation – groundwater Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – surface water quality Habitat degradation – groundwater Habitat degradation – non-native invasive plant species	Likely significant effect at the national geographic scale	Air quality during construction – Section 15.5.1.2.3 Water quality during construction and operation – Section 15.5.1.2.4, Section 15.5.1.2.5 and Section 15.5.2.2.1 Non-native invasive plant species during construction and operation – Section 15.5.1.2.6 and 15.5.2.2.2	No likely significant residual effect
Tall-herb swamps (FS2) (corresponding to Annex I habitat Hydrophilous tall-herb swamp [6430])	National Importance	**Construction** Habitat degradation – surface water quality Habitat degradation – groundwater Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – surface water quality Habitat degradation – groundwater Habitat degradation – non-native invasive plant species	Likely significant effect at the national geographic scale	Air quality during construction – Section 15.5.1.2.3 Water quality during construction and operation – Section 15.5.1.2.4, Section 15.5.1.2.5 and Section 15.5.2.2.1 Non-native invasive plant species during construction and operation – Section 15.5.1.2.6 and 15.5.2.2.2	No likely significant residual effect
Reed and large sedge swamps (FS1)	Local Importance	**Construction** Habitat degradation – surface water quality Habitat degradation – groundwater	Likely significant effect at the local	Air quality during construction – Section 15.5.1.2.3	No likely significant residual effect

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance
	(Higher Value)	Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – surface water quality Habitat degradation – groundwater Habitat degradation – non-native invasive plant species	geographic scale	Water quality during construction and operation – Section 15.5.1.2.4, Section 15.5.1.2.5 and Section 15.5.2.2.1 Non-native invasive plant species during construction and operation – Section 15.5.1.2.6 and 15.5.2.2.2	
Tall-herb swamps (FS2) (non-Annex I habitat)	Local Importance (Higher Value)	**Construction** Habitat degradation – surface water quality Habitat degradation – groundwater Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – surface water quality Habitat degradation – groundwater Habitat degradation – non-native invasive plant species	Likely significant effect at the local geographic scale	Air quality during construction – Section 15.5.1.2.3 Water quality during construction and operation – Section 15.5.1.2.4, Section 15.5.1.2.5 and Section 15.5.2.2.1 Non-native invasive plant species during construction and operation – Section 15.5.1.2.6 and 15.5.2.2.2	No likely significant residual effect
Depositing/ lowland rivers (FW2)	Local Importance (Higher Value)	**Construction** Habitat loss Habitat degradation – surface water quality Habitat degradation – groundwater Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – surface water quality Habitat degradation – groundwater Habitat degradation – non-native invasive plant species	Likely significant effect at the local geographic scale	Measures to reduce scale of habitat loss during construction – Section 15.5.1.2.1 and 15.5.1.2.2 Air quality during construction – Section 15.5.1.2.3 Water quality during construction and operation – Section 15.5.1.2.4, Section 15.5.1.2.5 and Section 15.5.2.2.1 Non-native invasive plant species during construction and operation – Section 15.5.1.2.6 and 15.5.2.2.2	Likely significant residual effects at a local geographic scale as a result of habitat loss – Section 15.6.2
Canals (FW3)	National Importance – see Royal Canal pNHA and Grand Canal pNHA	**Construction** Habitat degradation – surface water quality Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation**	Likely significant effect at the national geographic scale	Air quality during construction – Section 15.5.1.2.3 Water quality during construction and operation – Section 15.5.1.2.4, Section 15.5.1.2.5 and Section 15.5.2.2.1	No likely significant residual effect

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance
		Habitat degradation – surface water quality Habitat degradation – non-native invasive plant species		Non-native invasive plant species during construction and operation – Section 15.5.1.2.6 and 15.5.2.2.2	
Drainage ditches (FW4)	Local Importance (Higher Value)	**Construction** Habitat loss Habitat degradation – surface water quality Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – surface water quality Habitat degradation – hydrogeology Habitat degradation – non-native invasive plant species	Likely significant effect at the local geographic scale	Measures to reduce scale of habitat loss during construction – Section 15.5.1.2.1 and 15.5.1.2.2 Air quality during construction – Section 15.5.1.2.3 Water quality during construction and operation – Section 15.5.1.2.4, Section 15.5.1.2.5 and Section 15.5.2.2.1 Non-native invasive plant species during construction and operation – Section 15.5.1.2.6 and 15.5.2.2.2	Likely significant residual effects at a local geographic scale as a result of habitat loss – Section 15.6.2
Species-rich dry calcareous and neutral grassland (GS1)	Local Importance (Higher Value)	**Construction** Habitat loss Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – non-native invasive plant species	Likely significant effect at the local geographic scale	Measures to reduce scale of habitat loss during construction – Section 15.5.1.2.1 and 15.5.1.2.2 Air quality during construction – Section 15.5.1.2.3 Non-native invasive plant species during construction and operation – Section 15.5.1.2.6 and 15.5.2.2.2	Likely significant residual effects at a local geographic scale as a result of habitat loss – Section 15.6.2
Wet grassland (GS4)	Local Importance (Higher Value)	**Construction** Habitat loss Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – non-native invasive plant species	Likely significant effect at the local geographic scale	Measures to reduce scale of habitat loss during construction – Section 15.5.1.2.1 and 15.5.1.2.2 Air quality during construction – Section 15.5.1.2.3 Non-native invasive plant species during construction and operation – Section 15.5.1.2.6 and 15.5.2.2.2	Likely significant residual effects at a local geographic scale as a result of habitat loss – Section 15.6.2

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance
(Mixed) broadleaved woodland (WD1)	Local Importance (Higher Value)	**Construction** Habitat loss Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – non-native invasive plant species	Likely significant effect at the local geographic scale	Measures to reduce scale of habitat loss during construction – Section 15.5.1.2.1 and 15.5.1.2.2 Air quality during construction – Section 15.5.1.2.3 Non-native invasive plant species during construction and operation – Section 15.5.1.2.6 and 15.5.2.2.2	Likely significant residual effects at a local geographic scale as a result of habitat loss – Section 15.6.2
(Mixed) conifer woodland (WD3)	Local Importance (Higher Value)	**Construction** Habitat loss Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – non-native invasive plant species	Likely significant effect at the local geographic scale	Measures to reduce scale of habitat loss during construction – Section 15.5.1.2.1 and 15.5.1.2.2 Air quality during construction – Section 15.5.1.2.3 Non-native invasive plant species during construction and operation – Section 15.5.1.2.6 and 15.5.2.2.2	Likely significant residual effects at a local geographic scale as a result of habitat loss – Section 15.6.2
Scattered trees and parkland (WD5)	Local Importance (Higher Value)	**Construction** Habitat loss Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – non-native invasive plant species	Likely significant effect at the local geographic scale	Measures to reduce scale of habitat loss during construction – Section 15.5.1.2.1 and 15.5.1.2.2 Air quality during construction – Section 15.5.1.2.3 Non-native invasive plant species during construction and operation – Section 15.5.1.2.6 and 15.5.2.2.2	Likely significant residual effects at a local geographic scale as a result of habitat loss – Section 15.6.2
Hedgerows (WL1)	Local Importance (Higher Value)	**Construction** Habitat loss Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – non-native invasive plant species	Likely significant effect at the local geographic scale	Measures to reduce scale of habitat loss during construction – Section 15.5.1.2.1 and 15.5.1.2.2 Air quality during construction – Section 15.5.1.2.3	Likely significant residual effects at a local geographic scale as a result of

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance
				Non-native invasive plant species during construction and operation – Section 15.5.1.2.6 and 15.5.2.2.2	habitat loss – Section 15.6.2
Treelines (WL2)	Local Importance (Higher Value)	**Construction** Habitat loss Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – non-native invasive plant species	Likely significant effect at the local geographic scale	Measures to reduce scale of habitat loss during construction – Section 15.5.1.2.1 and 15.5.1.2.2 Air quality during construction – Section 15.5.1.2.3 Non-native invasive plant species during construction and operation – Section 15.5.1.2.6 and 15.5.2.2.2	Likely significant residual effects at a local geographic scale as a result of habitat loss – Section 15.6.2
Immature woodland (WS2)	Local Importance (Higher Value)	**Construction** Habitat loss Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – non-native invasive plant species	Likely significant effect at the local geographic scale	Measures to reduce scale of habitat loss during construction – Section 15.5.1.2.1 and 15.5.1.2.2 Air quality during construction – Section 15.5.1.2.3 Non-native invasive plant species during construction and operation – Section 15.5.1.2.6 and 15.5.2.2.2	Likely significant residual effects at a local geographic scale as a result of habitat loss – Section 15.6.2
Flora Species					
Opposite-leaved pondweed *Groenlandia densa*	National Importance	**Construction** Habitat degradation – surface water quality **Operation** Habitat degradation – surface water quality	Likely significant effect at the national geographic scale	Water quality during construction and operation – Section 15.5.1.3 and Section 15.5.2.3	No likely significant residual effect
Tassel stonewort Tolypella intricata	National Importance	**Construction** Habitat degradation – surface water quality **Operation** Habitat degradation – surface water quality	Likely significant effect at the national geographic scale	Water quality during construction and operation – Section 15.5.1.3 and Section 15.5.2.3	No likely significant residual effect

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance
Horned pondweed Zannichellia palustris	Local Importance (Higher Value)	**Construction** Habitat degradation – surface water quality **Operation** Habitat degradation – surface water quality	Likely significant effect at the local geographic scale	Water quality during construction and operation – Section 15.5.1.3 and Section 15.5.2.3	No likely significant residual effect
Rigid hornwort Ceratophyllum demersum	Local Importance (Higher Value)	**Construction** Habitat degradation – surface water quality **Operation** Habitat degradation – surface water quality	Likely significant effect at the local geographic scale	Water quality during construction and operation – Section 15.5.1.3 and Section 15.5.2.3	No likely significant residual effect
Whorled water-milfoil Myriophyllum verticillatum	Local Importance (Higher Value)	**Construction** Habitat degradation – surface water quality **Operation** Habitat degradation – surface water quality	Likely significant effect at the local geographic scale	Water quality during construction and operation – Section 15.5.1.3 and Section 15.5.2.3	No likely significant residual effect
Fauna Species					
Otter	International Importance	**Construction** Habitat degradation –water quality Habitat degradation – groundwater Habitat severance/barrier effect **Operation** Habitat severance/barrier effect Habitat degradation – hydrology	Likely significant effect at the county geographic scale	Measures to protect otter during construction and operation – Section 15.5.1.4 and Section 15.5.2.4	No likely significant residual effect
Nathusius' pipistrelle	County Importance	**Construction** Roost loss (tree/hibernation roosts) Disturbance/Displacement- lighting Habitat loss/fragmentation **Operation** Disturbance/Displacement- lighting	Likely significant effect at the local geographic scale	Measures to protect bats during construction and operation – Section 15.5.1.5 and Section 15.5.2.5	No likely significant residual effect

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance
All other bat species	Local Importance (Higher Value)	**Construction** Roost loss (tree/hibernation roosts) Disturbance/Displacement- lighting Habitat loss/fragmentation **Operation** Disturbance/Displacement- lighting	Likely significant effect at the local geographic scale	Measures to protect bats during construction and operation – Section 15.5.1.5 and Section 15.5.2.5	No likely significant residual effect
Badger	Local Importance (Higher Value)	**Construction** Disturbance/displacement **Operation** n/a	Likely significant effect at the local geographic scale	Measures to protect badger during construction and operation – Section 15.5.1.6	No likely significant residual effect
Other mammal species protected under the Wildlife Acts	Local Importance (Higher Value)	**Construction** Habitat degradation - water quality Barrier/severance effects **Operation** Habitat degradation - water quality	Likely significant effect at the local geographic scale	Measures to protect other mammals during construction and operation – Section 15.5.1.7 and Section 15.5.2.7	No likely significant residual effect
Marine mammals e.g. common porpoise, harbour seal and grey seal	International Importance	**Construction** Habitat degradation - water quality **Operation** Habitat degradation - water quality	Likely significant effect at the international geographic scale	Measures to protect other mammals during construction and operation – Section 15.5.1.7 and Section 15.5.2.6	No likely significant residual effect
Glutinous snail	National Importance	**Construction** Habitat degradation – water quality **Operation** n/a	Likely significant effect at the county scale	Water quality during construction and operation – Section 15.5.1.8 and Section 15.5.2.7	No likely significant residual effect

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance
False orb pea mussel	National Importance	**Construction** Habitat degradation – water quality **Operation** n/a	Likely significant effect at the county scale	Water quality during construction and operation – Section 15.5.1.8 and Section 15.5.2.7	No likely significant residual effect
Breeding Red BoCCI species	County Importance	**Construction** Mortality/injury risk Habitat and food source degradation – water quality **Operation** Habitat and food source degradation – water quality	Likely significant effect at the local geographic scale	Measures to protect breeding bird species during construction and operation – Section 15.5.1.9 and Section 15.5.2.8	No likely significant residual effect
Breeding Green and Amber BoCCI species	Local Importance (Higher Value)	**Construction** Mortality/injury risk Habitat and food source degradation – water quality **Operation** Habitat and food source degradation – water quality	Likely significant effect at the local geographic scale	Measures to protect breeding bird species during construction and operation – Section 15.5.1.9 and Section 15.5.2.8	No likely significant residual effect
Kingfisher	National Importance	**Construction** Mortality/injury risk Habitat and food source degradation – water quality **Operation** Habitat and food source degradation – water quality	Likely significant effect at the local to national geographic scale	Measures to protect breeding bird species during construction and operation – Section 15.5.1.9 and Section 15.5.2.8	No likely significant residual effect
Yellowhammer	County Importance	**Construction** Habitat loss Mortality/injury risk **Operation** n/a	Likely significant effect at the local geographic scale	Measures to protect breeding birds during construction and operation - Section 15.5.1.9	Likely significant residual effects at a local geographic scale as a result of permanent loss of yellowhammer territory – Section 15.6.6.1

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance
Wintering Red BoCCI species	Local Importance (Higher Value)	**Construction** Habitat degradation - water quality **Operation** Habitat degradation - water quality	Likely significant effect at the local geographic scale	Measures to protect wintering bird species during construction and operation – Section 15.5.1.10 and Section 15.5.2.9	No likely significant residual effect
Wintering Green and Amber BoCCI species	Local Importance (Higher Value)	**Construction** Habitat degradation - water quality **Operation** Habitat degradation - water quality	Likely significant effect at the local geographic scale	Measures to protect wintering bird species during construction and operation – Section 15.5.1.10 and Section 15.5.2.9	No likely significant residual effect
Smooth newt	Local Importance (Higher Value)	**Construction** Habitat degradation – surface water quality **Operation** Habitat degradation – surface water quality	Likely significant effect at the local geographic scale	Measures to protect amphibians during construction and operation – Sections 15.5.1.11 and 15.5.2.10	No likely significant residual effect
Common frog					No likely significant residual effect
Common lizard	Local Importance (Higher Value)	**Construction** n/a **Operation** n/a	n/a	Whilst no potential impacts are predicted, measures to protect individual common lizards during construction and operation are provided – Section 15.5.1.12	No likely significant residual effect
Atlantic salmon	National Importance	**Construction** Habitat degradation – surface water quality Habitat degradation – groundwater Mortality risk Habitat severance/barrier effect **Operation** Habitat degradation – surface water quality	Likely significant effect at the national to international geographic scale	Measures to protect fish during construction and operation – Section 15.5.1.13 and Section 15.5.2.11	No likely significant residual effect
European eel	International Importance				No likely significant residual effect
All other fish species recorded	Local Importance	**Construction** Habitat degradation – surface water quality Habitat degradation – groundwater	Likely significant effect at the		No likely significant residual effect

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance
	(Higher Value)	Mortality risk Habitat severance/barrier effect **Operation** Habitat degradation – surface water quality	local geographic scale		
Local Biodiversity Areas					
Local biodiversity areas (See Section 15.3.2)	The value of the biodiversity receptors recorded in the vicinity of the proposed Project, across the local biodiversity areas, range from Local Importance (Lower Value) to Internationally Important	Combination of all of the potential impacts noted above The specific impacts are related to and dependent upon the potential impacts of the proposed Project on each of the individual ecological receptors that make up the biodiversity resources within a given local biodiversity area	Likely significant effects from local up to the international geographic scale	All of the mitigation measures included within Section 15.5 The specific mitigation measures are related to and dependent upon the potential impacts of the proposed Project on each of the individual ecological receptors that make up the biodiversity resource within a given local biodiversity area	Likely significant residual effects at a local geographic scale arising from the residual effects on habitats and yellowhammer described above.

15.7 Difficulties Encountered in Compiling Information

The data for species records held by record centres and statutory bodies (such as NBDC and NPWS) is often provided on an *ad-hoc* basis by recorders. These records can only provide an indication of what species might be found in an area; they do not constitute full and complete species lists. Absence of certain species from these sources does not confirm absence of species in the area. These limitations are not significant and have not impacted on the findings of this assessment, which was informed primarily by data collected during the appropriate time of year for each of the respective ecological features.

Generally, all surveys were undertaken within the optimal seasonal survey windows for the various ecological receptors (as per NRA, 2008a) and without any difficulties encountered. The only exceptions to this were the following:

- While all areas subject to habitat loss were surveyed, a small number of locations beyond the footprint of the proposed Project were inaccessible (either due to permissions, dense vegetation/scrub and/or health and safety concerns, including the presence of livestock) and therefore were only surveyed from adjacent lands using binoculars. These included the following locations:

- Field located north-west of the railhead site at Lissenhall;
- Small lands dominated by scrub located at the confluence of the Broadmeadow River and Ward River, east of the R132;
- Private gardens of residential properties across the study area (excluding St Anne's private dwelling, which was fully accessed); and,
- Boarded off properties with dense scrub vegetation, located to the north-west of the R132 and L2300 junction.

This limitation is not significant and has not impacted the findings of the assessment as the habitats were identified from adjacent lands, and none of the habitats identified are valued higher than Local Importance (Higher Value).

- Mammal surveys undertaken along the proposed MetroLink grid connection routes were completed in June and July 2021, when vegetation is typically in full growth and as such may impact on visibility of mammal signs. Although these surveys were completed outside the optimal period for mammal surveys (in particular, badger), surveyors' ability to access and survey areas of suitable habitat was not impeded by dense scrub/vegetation and as such no limitations were encountered;
- Assessment of trees at some locations were completed in July 2021, when vegetation would be typically in full growth and as such may impact on visibility of some potential bat roost features. In addition, all tree assessments were undertaken from ground-level, albeit with binoculars. A precautionary approach (as described in Section 15.4.2.4.2) has been adopted with regards to the assessment of potential bat trees to ensure no limitations on the assessment and development of the mitigation strategy;
- Seven of the buildings to be demolished were not internally surveyed for bats as access was not permitted and/or it was not safe to do so (see Table 15.5 for details). Instead, a post-emergence and/or pre-dawn re-entry activity survey was undertaken at these buildings to ensure they are adequately assessed for the presence of bats;
- Two of the buildings to be demolished were not surveyed for bats as access was not permitted by the owner (see Table 15.5 for details);
- No access was permitted into the fields at McComish (i.e. sites 116, 117 and 118) for the wintering bird surveys. It was possible to survey these fields from the south (i.e. site 70) using a telescope, however visibility was somewhat restricted (in particular for site 116). A precautionary approach (as described in Section 15.4.2.6.2 and 15.4.3.6.2) has been adopted with regards to the assessment of impacts on wintering birds and as such no limitations were encountered; and,
- Dedicated amphibian or reptile species surveys were not undertaken; instead, habitat suitability assessments were completed to inform the assessment of potential impacts assessing these

species groups. This is not considered to be a limitation on the findings of the assessment, due to the relatively wide distribution of these species across the study area and County Dublin (based on desktop records) and the adoption of a precautionary approach (as described in Section 15.4.3.7) with regards to assumption of where suitable habitat present was present that these species may be present.

15.8 Compensatory Measures Proposed to Address the Residual Impacts

Where there are significant residual biodiversity impacts as a result of the proposed Project despite the mitigation measures proposed, compensatory measures are proposed to offset or reduce the predicted impacts. These are no compensatory measures in the context of the requirements of Article 6(4) of the Habitats Directive as they are not compensation for an impact that would adversely affect the integrity of any European site. As concluded in the NIS, the proposed Project will not result in an impact on any European site.

The likely significant residual effects of the proposed Project relate to habitat loss and the loss of yellowhammer territory. Each of these are discussed below with regard to whether compensatory measures are feasible and likely to succeed in compensating for the potential impacts of the proposed Project.

15.8.1 Habitat Loss

There are a number of habitat types of a local biodiversity importance that will be permanently lost as a result of the proposed Project, and where significant residual negative effects are likely:

- Depositing/lowland rivers (FW2)
- Drainage ditches (FW4)
- Species-rich dry calcareous and neutral grassland (GS1)
- Wet grassland (GS4)
- (Mixed) broadleaved woodland (WD1)
- (Mixed) conifer woodland (WD3)
- Scattered trees and parkland (WD5)
- Hedgerows (WL1)
- Treelines (WL2)
- Immature woodland (WS2)

The planting proposed in the landscape design will compensate for habitat loss by providing new areas of these habitat types, as follows:

- Woodland – 7.65ha. This is a greater area of woodland habitat than will be lost as a result of the proposed Project (i.e. the loss of 6.02ha of woodland habitats classified as local importance (higher value) or above: WD1, WD3 and WS2). Therefore, the proposed Project will not result in a likely significant negative residual effect on (mixed) broadleaved woodland (WD1), (mixed) conifer woodland (WD3) or immature woodland (WS1) at any geographic scale
- Grassland – 57.13ha. This is a greater area of grassland habitat than will be lost as a result of the proposed Project (i.e. the loss of 6.68ha of grassland habitats valued as local importance (higher value) or above: GS1 and GS4). Therefore, the proposed Project will not result in a likely significant negative residual effect on species-rich dry calcareous neutral grassland (GS1) or wet grassland (GS4) at any geographic scale
- Hedgerows – 1.13km. This is a greater length of hedgerow habitat than will be lost as a result of the proposed Project (i.e. the loss of 385m). Therefore, the proposed Project will not result in a likely significant negative residual effect on hedgerows (WL1) at any geographic scale
- Trees – 3,444 trees. The landscape plan includes the planting of 3,444 individual trees which will be organised in small copses, lines of trees and within woodland habitats. The planting of these new trees will compensate for the loss of 77m of treeline habitat as a result of the proposed Project. Therefore, the proposed Project will not result in a likely significant negative residual effect on treelines (WL2) at any geographic scale

- River/riparian habitat – new 780m long channel on the River Mayne. This is greater than the area of habitat that will be permanently lost to facilitate the permanent discharge outfalls i.e. 20m^2 for eight discharge points (i.e. 160m2) in total. It will not compensate for the loss of habitat as a result of permanent culverts, diversions and channel straightening however, these works will be completed in line with best practice guidance including backfilling the areas with appropriate substrate. While there may be a localised decrease in overall habitat quality in these locations due to the proposed Project, for all watercourses, the scale of habitat changes are relatively small in comparison to the overall catchments. Therefore, the proposed Project will not result in a likely significant negative residual effect on depositing/lowland rivers habitat (FW2) at any geographic scale.
- Scattered trees and parkland (WD5) is a habitat type comprised of planted trees and an understorey of grassland habitat. Although the landscape plan has not specifically mapped this habitat type, the planting of large areas of grassland habitats, and trees in copses and lines (as described above) will compensate for the loss of this habitat type. Therefore, the proposed Project will not result in a likely significant negative residual effect on scattered trees and parkland (WD5) at any geographic scale.

There is no new drainage ditch habitat included within the landscape plan to compensate for the loss of 3.2km of drainage ditch habitat. Wetland habitats proposed as part of the proposed Project may compensate for the loss of drainage ditch habitat to a degree, however, it is not considered to be a like-for-like compensation. Therefore, it is considered that there is potential for a significant residual negative effect on drainage ditches (FW4), at a local geographic scale.

Additionally, the proposed Project is likely to have a significant residual negative effect, at a local geographic scale, on yellowhammer as a result of the permanent loss of breeding habitat.

15.9 Summary

The proposed Project, despite the implementation of the mitigation measures proposed, and in the absence of compensation will have the following likely significant residual effects on biodiversity:

- A likely significant residual effect, at the local geographic scale, for the permanent loss of c. 1,186m^2 and of depositing/lowland rivers (FW2);
- A likely significant residual effect, at the local geographic scale, for the permanent loss of c. 3.22km of drainage ditches (FW4);
- A likely significant residual effect, at the local geographic scale, for the permanent loss of c. 5.92ha of species-rich dry calcareous and neutral grassland (GS1);
- A likely significant residual effect, at the local geographic scale, for the permanent loss of c. 0.95ha of wet grassland (GS4);
- A likely significant residual effect, at the local geographic scale, for the permanent loss of c. 4.4ha of (mixed) broadleaved woodland (WD1);
- A likely significant residual effect, at the local geographic scale, for the permanent loss of c. 0.43ha of (mixed) conifer woodland (WD3);
- A likely significant residual effect, at the local geographic scale, for the permanent loss of c. 0.95ha of scattered trees and parkland (WD5);
- A likely significant residual effect, at the local geographic scale, for the permanent loss of c. 385m of hedgerows (WL1);
- A likely significant residual effect, at the local geographic scale, for the permanent loss of c. 77m of treelines (WL2);
- A likely significant residual effect, at the local geographic scale, for the permanent loss of c. 1.19ha of immature woodland (WS2); and,
- A likely significant residual effect, at a local geographic scale, for the potential permanent loss of yellowhammer breeding territory.

These significant residual impacts will also affect the following local biodiversity areas identified in the *Fingal Biodiversity Action Plan 2010-2015*:

- Habitats considered to be of importance, such as arable land, semi-natural calcareous grassland, hedgerows and woodlands, which support a range of species and act as important ecological links/corridors across the wider landscape;
- Network of rivers and streams, including the Broadmeadow River, Ward River, River Tolka, Santry River, Sluice River and Mayne River, all of which are crossed by the proposed Project. These watercourses support a range of riverine bird species, such as kingfisher, and fish species; and,
- Parkland and gardens associated with houses, parks, playing fields, churchyards, cemeteries and brown field sites, all of which contain valuable wildlife habitats.

Additionally, these significant residual impacts will affect the following biodiversity areas identified in the *Dublin City Biodiversity Action Plan 2015-2020*

- Riparian zones, which support a range of legally protected and rare species; and
- Network of parks and public green spaces, such as Tolka Valley Park and St Stephen's Green, and private gardens, which support a variety of species and is considered to be a valuable biodiversity resource.

The compensatory measures outlined above in Section 15.8 have been designed to compensate for habitats that will be lost as a result of the proposed Project, and enhance the biodiversity value of the proposed Project. In compensating for the loss of these habitats the proposed Project is not likely to result in a significant residual effect, at any geographic scale, on depositing /lowland rivers (FW2), species-rich dry calcareous and neutral grassland (GS1), wet grassland (GS4), (mixed) broadleaved woodland (WD1), (mixed) conifer woodland (WD3), scattered trees and parkland (WD5), hedgerows (WL1), treelines (WL2) or immature woodland (WS2). Therefore, the proposed Project is also not likely to result in significant residual effects, at any geographic scale, on the local biodiversity areas identified above, which have been considered to be of importance due to the presence of the aforementioned habitats.

However, the proposed Project is likely to have a significant residual negative effect, at the local geographic scale, on drainage ditches (FW4) as there are no drainage ditches proposed for creation as part of the proposed Project, and on yellowhammer due to the permanent loss of breeding habitat.

Table 15.25 presents an overall summary of the ecological receptors, their valuation and potential impacts. It presents the proposed mitigation measures for these potential impacts, the residual impacts, proposed compensation measures where applicable and the overall residual impact significance post-compensation.

Table 15.25: Summary of Likely Significant Residual Effects of the Proposed Project on Biodiversity (Post-Compensation).

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance	Compensation	Residual Impact Significance Post-compensation
Designated Areas for Nature Conservation							
Malahide Estuary SAC (including Malahide Estuary pNHA)	International Importance (National Importance)	**Construction** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies; and, Habitat degradation as a	Likely significant effect at the international geographic scale	**Construction** Good housekeepin, Measures to Protect Surface Water Quality during Construction and Measures to Prevent the Introduction	No likely significant residual effect	n/a	n/a

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance	Compensation	Residual Impact Significance Post-compensation
		result of the introduction and/or spread of non-native invasive species; **Operation** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies.		and/or Spread of Non-native Invasive Species Giant Hogweed, Japanese Knotweed and Himalayan Balsam documented in Section 15.5.1.1.1, page 176 **Operation** Measures to Protect Surface Water Quality during Operation documented in Section 15.5.2.1.1, page 199. See also section 6 of the NIS, the outline CEMP and the ISMP accompanying this report.			
Malahide Estuary SPA (including Malahide Estuary pNHA)	International Importance (National Importance)	**Construction** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies; and, Habitat degradation as a result of the introduction and/or spread of non-native invasive species; **Operation** Habitat degradation as a	Likely significant effect at the international geographic scale	**Construction** Good housekeeping, Measures to Protect Surface Water Quality during Construction and Measures to Prevent the Introduction and/or Spread of Non-native Invasive Species Giant Hogweed, Japanese Knotweed	No likely significant residual effect	n/a	n/a

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance	Compensation	Residual Impact Significance Post-compensation
		result of Pollution/Contamination of Receiving Waterbodies.		and Himalayan Balsam documented in Section 15.5.1.1.1, page 176 **Operation** Measures to Protect Surface Water Quality during Operation documented in Section 15.5.2.1.1, page 199. See also section 6 of the NIS, the outline CEMP and the ISMP accompanying this report.			
Baldoyle Bay SAC (including Baldoyle Bay pNHA)	International Importance (National Importance)	**Construction** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies; and, Habitat degradation as a result of the introduction and/or spread of non-native invasive species; **Operation** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies.	Likely significant effect at the international geographic scale	**Construction** Good housekeeping, Measures to Protect Surface Water Quality during Construction and Measures to Prevent the Introduction and/or Spread of Non-native Invasive Species Giant Hogweed, Japanese Knotweed and Himalayan Balsam documented in Section 15.5.1.1.1, page 176 **Operation**	No likely significant residual effect	n/a	n/a

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance	Compensation	Residual Impact Significance Post-compensation
				Measures to Protect Surface Water Quality during Operation documented in Section 15.5.2.1.1, page 199. See also section 6 of the NIS, the outline CEMP and the ISMP accompanying this report.			
Baldoyle Bay SPA (including Baldoyle Bay pNHA)	International Importance (National Importance)	**Construction** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies; and, Habitat degradation as a result of the introduction and/or spread of non-native invasive species; **Operation** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies.	Likely significant effect at the international geographic scale	**Construction** Good housekeeping, Measures to Protect Surface Water Quality during Construction and Measures to Prevent the Introduction and/or Spread of Non-native Invasive Species Giant Hogweed, Japanese Knotweed and Himalayan Balsam documented in Section 15.5.1.1.1, page 176 **Operation** Measures to Protect Surface Water Quality during Operation documented in	No likely significant residual effect	n/a	n/a

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance	Compensation	Residual Impact Significance Post-compensation
				Section 15.5.2.1.1, page 199. See also section 6 of the NIS, the outline CEMP and the ISMP accompanying this report.			
North Dublin Bay SAC (including North Dublin Bay pNHA)	International Importance (National Importance)	**Construction** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies; and, Habitat degradation as a result of the introduction and/or spread of non-native invasive species; **Operation** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies.	Likely significant effect at the international geographic scale	**Construction** Good housekeeping, Measures to Protect Surface Water Quality during Construction and Measures to Prevent the Introduction and/or Spread of Non-native Invasive Species Giant Hogweed, Japanese Knotweed and Himalayan Balsam documented in Section 15.5.1.1.1, page 176 **Operation** Measures to Protect Surface Water Quality during Operation documented in Section 15.5.2.1.1, page 199. See also section 6 of the NIS, the outline CEMP and the ISMP	No likely significant residual effect	n/a	n/a

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance	Compensation	Residual Impact Significance Post-compensation
				accompanying this report.			
North Bull Island SPA (including North Dublin Bay pNHA)	International Importance (National Importance)	**Construction** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies; and, Habitat degradation as a result of the introduction and/or spread of non-native invasive species; **Operation** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies.	Likely significant effect at the international geographic scale	**Construction** Good housekeeping, Measures to Protect Surface Water Quality during Construction and Measures to Prevent the Introduction and/or Spread of Non-native Invasive Species Giant Hogweed, Japanese Knotweed and Himalayan Balsam documented in Section 15.5.1.1.1, page 176 **Operation** Measures to Protect Surface Water Quality during Operation documented in Section 15.5.2.1.1, page 199. See also section 6 of the NIS, the outline CEMP and the ISMP accompanying this report.	No likely significant residual effect	n/a	n/a
South Dublin Bay SAC (including South	International Importance (National Importance)	**Construction** Habitat degradation as a result of Pollution/Contamination of	Likely significant effect at the international geographic scale	**Construction** Good housekeeping, Measures to Protect Surface Water	No likely significant residual effect	n/a	n/a

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance	Compensation	Residual Impact Significance Post-compensation
Dublin Bay pNHA)		Receiving Waterbodies; and, Habitat degradation as a result of the introduction and/or spread of non-native invasive species; **Operation** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies.		Quality during Construction and Measures to Prevent the Introduction and/or Spread of Non-native Invasive Species Giant Hogweed, Japanese Knotweed and Himalayan Balsam documented in Section 15.5.1.1.1, page 176 **Operation** Measures to Protect Surface Water Quality during Operation documented in Section 15.5.2.1.1, page 199. See also section 6 of the NIS, the outline CEMP and the ISMP accompanying this report.			
South Dublin Bay and River Tolka SPA (including North Dublin Bay pNHA, South Dublin Bay pNHA, Dolphins, Dublin Docks	International Importance (National Importance)	**Construction** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies; and, Habitat degradation as a result of the introduction and/or spread	Likely significant effect at the international geographic scale	**Construction** Good housekeeping, Measures to Protect Surface Water Quality during Construction and Measures to Prevent the Introduction and/or Spread of Non-native	No likely significant residual effect	n/a	n/a

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance	Compensation	Residual Impact Significance Post-compensation
pNHA and Bootersto wn Marsh pNHA)		of non-native invasive species; **Operation** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies.		Invasive Species Giant Hogweed, Japanese Knotweed and Himalayan Balsam documented in Section 15.5.1.1.1, page 176 **Operation** Measures to Protect Surface Water Quality during Operation documented in Section 15.5.2.1.1, page 199. See also section 6 of the NIS, the outline CEMP and the ISMP accompanying this report.			
Wicklow Mountains SAC	International Importance	**Construction** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies; **Operation** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies.	Likely significant effect at the international geographic scale	**Construction** Good housekeeping, Measures to Protect Surface Water Quality during Construction and Measures to Prevent the Introduction and/or Spread of Non-native Invasive Species Giant Hogweed, Japanese Knotweed and Himalayan Balsam	No likely significant residual effect	n/a	n/a

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance	Compensation	Residual Impact Significance Post-compensation
				documented in Section 15.5.1.1.1, page 176 **Operation** Measures to Protect Surface Water Quality during Operation documented in Section 15.5.2.1.1, page 199. See also section 6 of the NIS, the outline CEMP and the ISMP accompanying this report.			
Rogerstown Estuary SPA (including Rogerstown Estuary pNHA)	International Importance	**Construction** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies; and, Habitat degradation as a result of the introduction and/or spread of non-native invasive species; **Operation** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies.	Likely significant effect at the international geographic scale	**Construction** Good housekeeping, Measures to Protect Surface Water Quality during Construction and Measures to Prevent the Introduction and/or Spread of Non-native Invasive Species Giant Hogweed, Japanese Knotweed and Himalayan Balsam documented in Section 15.5.1.1.1, page 176 **Operation** Measures to Protect Surface Water	No likely significant residual effect	n/a	n/a

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance	Compensation	Residual Impact Significance Post-compensation
				Quality during Operation documented in Section 15.5.2.1.1, page 199. See also section 6 of the NIS, the outline CEMP and the ISMP accompanying this report.			
Ireland's Eye SPA (including Ireland's Eye pNHA)	International Importance	**Construction** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies; and, Habitat degradation as a result of the introduction and/or spread of non-native invasive species; **Operation** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies.	Likely significant effect at the international geographic scale	**Construction** Good housekeeping, Measures to Protect Surface Water Quality during Construction and Measures to Prevent the Introduction and/or Spread of Non-native Invasive Species Giant Hogweed, Japanese Knotweed and Himalayan Balsam documented in Section 15.5.1.1.1, page 176 **Operation** Measures to Protect Surface Water Quality during Operation documented in Section 15.5.2.1.1, page 199.	No likely significant residual effect	n/a	n/a

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance	Compensation	Residual Impact Significance Post-compensation
				See also section 6 of the NIS, the outline CEMP and the ISMP accompanying this report.			
Lambay Island SPA (including Lambay Island pNHA)	International Importance	**Construction** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies; and, Habitat degradation as a result of the introduction and/or spread of non-native invasive species; **Operation** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies.	Likely significant effect at the international geographic scale	**Construction** Good housekeeping, Measures to Protect Surface Water Quality during Construction and Measures to Prevent the Introduction and/or Spread of Non-native Invasive Species Giant Hogweed, Japanese Knotweed and Himalayan Balsam documented in Section 15.5.1.1.1, page 176 **Operation** Measures to Protect Surface Water Quality during Operation documented in Section 15.5.2.1.1, page 199. See also section 6 of the NIS, the outline CEMP and the ISMP accompanying this report.	No likely significant residual effect	n/a	n/a

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance	Compensation	Residual Impact Significance Post-compensation
Skerries Islands SPA (including Skerries Islands NHA)	International Importance	**Construction** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies; and, Habitat degradation as a result of the introduction and/or spread of non-native invasive species; **Operation** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies.	Likely significant effect at the international geographic scale	**Construction** Good housekeeping, Measures to Protect Surface Water Quality during Construction and Measures to Prevent the Introduction and/or Spread of Non-native Invasive Species Giant Hogweed, Japanese Knotweed and Himalayan Balsam documented in Section 15.5.1.1.1, page 176 **Operation** Measures to Protect Surface Water Quality during Operation documented in Section 15.5.2.1.1, page 199. See also section 6 of the NIS, the outline CEMP and the ISMP accompanying this report.	No likely significant residual effect	n/a	n/a
Dalkey Islands SPA (including Dalkey Coastal Zone and Killiney Hill pNHA)	International Importance	**Construction** Habitat degradation as a result of Pollution/Contamination of Receiving	Likely significant effect at the international geographic scale	**Construction** Good housekeeping, Measures to Protect Surface Water Quality during Construction	No likely significant residual effect	n/a	n/a

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance	Compensation	Residual Impact Significance Post-compensation
		Waterbodies; and, Habitat degradation as a result of the introduction and/or spread of non-native invasive species; **Operation** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies.		and Measures to Prevent the Introduction and/or Spread of Non-native Invasive Species Giant Hogweed, Japanese Knotweed and Himalayan Balsam documented in Section 15.5.1.1.1, page 176 **Operation** Measures to Protect Surface Water Quality during Operation documented in Section 15.5.2.1.1, page 199. See also section 6 of the NIS, the outline CEMP and the ISMP accompanying this report.			
Howth Head Coast SPA (including Howth Head pNHA)	International Importance	**Construction** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies; and, Habitat degradation as a result of the introduction and/or spread of non-native invasive species;	Likely significant effect at the international geographic scale	**Construction** Good housekeeping, Measures to Protect Surface Water Quality during Construction and Measures to Prevent the Introduction and/or Spread of Non-native Invasive Species Giant	No likely significant residual effect	n/a	n/a

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance	Compensation	Residual Impact Significance Post-compensation
		Operation Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies.		Hogweed, Japanese Knotweed and Himalayan Balsam documented in Section 15.5.1.1.1, page 176 **Operation** Measures to Protect Surface Water Quality during Operation documented in Section 15.5.2.1.1, page 199. See also section 6 of the NIS, the outline CEMP and the ISMP accompanying this report.			
Rockabill SPA (including Rockabill pNHA)	International Importance	**Construction** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies; and, Habitat degradation as a result of the introduction and/or spread of non-native invasive species; **Operation** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies.	Likely significant effect at the international geographic scale	**Construction** Good housekeeping, Measures to Protect Surface Water Quality during Construction and Measures to Prevent the Introduction and/or Spread of Non-native Invasive Species Giant Hogweed, Japanese Knotweed and Himalayan Balsam documented in	No likely significant residual effect	n/a	n/a

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance	Compensation	Residual Impact Significance Post-compensation
				Section 15.5.1.1.1, page 176 **Operation** Measures to Protect Surface Water Quality during Operation documented in Section 15.5.2.1.1, page 199. See also section 6 of the NIS, the outline CEMP and the ISMP accompanying this report.			
The Murrough SPA (including The Murrough pNHA)	International Importance	**Construction** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies; and, Habitat degradation as a result of the introduction and/or spread of non-native invasive species; **Operation** Habitat degradation as a result of Pollution/Contamination of Receiving Waterbodies.	Likely significant effect at the international geographic scale	**Construction** Good housekeeping, Measures to Protect Surface Water Quality during Construction and Measures to Prevent the Introduction and/or Spread of Non-native Invasive Species Giant Hogweed, Japanese Knotweed and Himalayan Balsam documented in Section 15.5.1.1.1, page 176 **Operation** Measures to Protect Surface Water Quality during Operation	No likely significant residual effect	n/a	n/a

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance	Compensation	Residual Impact Significance Post-compensation
				documented in Section 15.5.2.1.1, page 199. See also section 6 of the NIS, the CEMP and the ISMP accompanying this report.			
Royal Canal pNHA	National Importance	**Construction** Habitat degradation – surface water quality Habitat degradation – air Habitat degradation – non-native invasive plant species Disturbance/displacement - lighting **Operation** Habitat degradation – surface water quality Habitat degradation – non-native invasive plant species Disturbance/displacement - lighting	Likely significant effect at the national geographic scale	Air quality during construction – Section 15.5.1.1.3 Water quality during construction– Section 15.5.1.2.4 and Section 15.5.1.2.5 Non-native invasive plant species during construction and operation – Section 15.5.1.2.6 and 15.5.2.2.2 Measures to protect bats during construction and operation – Section 15.5.1.5 and Section 15.5.2.5	No likely significant residual effect	n/a	n/a
Grand Canal pNHA	National Importance	**Construction** Habitat degradation – surface water quality Habitat degradation – air	Likely significant effect at the national geographic scale	Air quality during construction – Section 15.5.1.1.3 Water quality during construction– Section	No likely significant residual effect	n/a	n/a

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance	Compensation	Residual Impact Significance Post-compensation
		Habitat degradation – non-native invasive plant species Disturbance/displacement - lighting **Operation** Habitat degradation – surface water quality Habitat degradation – non-native invasive plant species Disturbance/displacement - lighting		15.5.1.2.4 and Section 15.5.1.2.5 Non-native invasive plant species during construction and operation – Section 15.5.1.2.6 and 15.5.2.2.2 Measures to protect bats during construction and operation – Section 15.5.1.5 and Section 15.5.2.5			
Santry Demesne pNHA	National Importance	**Construction** Habitat degradation – surface water quality Habitat degradation – groundwater Habitat degradation – air Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – surface water quality Habitat degradation – groundwater Habitat degradation – non-native invasive plant species	Likely significant effect at the national geographic scale	Water quality during construction and operation – Section 15.5.1.2.4, Section 15.5.1.2.5 and Section 15.5.2.2.1 Non-native invasive plant species during construction and operation – Section 15.5.1.2.6 and 15.5.2.2.2	No likely significant residual effect	n/a	n/a

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance	Compensation	Residual Impact Significance Post-compensation
Sluice River Marsh pNHA	National Importance	**Construction** Habitat degradation – surface water quality Habitat degradation – groundwater Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – surface water quality Habitat degradation – groundwater Habitat degradation – non-native invasive plant species	Likely significant effect at the national geographic scale	Water quality during construction and operation – Section 15.5.1.2.4, Section 15.5.1.2.5 and Section 15.5.2.2.1 Non-native invasive plant species during construction and operation – Section 15.5.1.2.6 and 15.5.2.2.2	No likely significant residual effect	n/a	n/a
Habitats (outside of designated areas for nature conservation)							
Estuaries [1130]	National Importance	**Construction** Habitat degradation – surface water quality Habitat degradation – groundwater Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – surface water quality	Likely significant effect at the national geographic scale	Air quality during construction – Section 15.5.1.2.3 Water quality during construction and operation – Section 15.5.1.2.4, Section 15.5.1.2.5 and Section 15.5.2.2.1 Non-native invasive plant species during construction and operation – Section 15.5.1.2.6 and 15.5.2.2.2	No likely significant residual effect	n/a	n/a

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance	Compensation	Residual Impact Significance Post-compensation
		Habitat degradation – groundwater Habitat degradation – non-native invasive plant species					
Tall-herb swamps (FS2) (corresponding to Annex I habitat Hydrophilous tall-herb swamp [6430])	National Importance	**Construction** Habitat degradation – surface water quality Habitat degradation – groundwater Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – surface water quality Habitat degradation – groundwater Habitat degradation – non-native invasive plant species	Likely significant effect at the national geographic scale	Air quality during construction – Section 15.5.1.2.3 Water quality during construction and operation – Section 15.5.1.2.4, Section 15.5.1.2.5 and Section 15.5.2.2.1 Non-native invasive plant species during construction and operation – Section 15.5.1.2.6 and 15.5.2.2.2	No likely significant residual effect	n/a	n/a
Reed and large sedge swamps (FS1)	Local Importance (Higher Value)	**Construction** Habitat degradation – surface water quality Habitat degradation – groundwater Habitat degradation – air quality Habitat degradation – non-native	Likely significant effect at the local geographic scale	Air quality during construction – Section 15.5.1.2.3 Water quality during construction and operation – Section 15.5.1.2.4, Section 15.5.1.2.5 and	No likely significant residual effect	n/a	n/a

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance	Compensation	Residual Impact Significance Post-compensation
		invasive plant species **Operation** Habitat degradation – surface water quality Habitat degradation – groundwater Habitat degradation – non-native invasive plant species		Section 15.5.2.2.1 Non-native invasive plant species during construction and operation – Section 15.5.1.2.6 and 15.5.2.2.2			
Tall-herb swamps (FS2) (non-Annex I habitat)	Local Importance (Higher Value)	**Construction** Habitat degradation – surface water quality Habitat degradation – groundwater Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – surface water quality Habitat degradation – groundwater Habitat degradation – non-native invasive plant species	Likely significant effect at the local geographic scale	Air quality during construction – Section 15.5.1.2.3 Water quality during construction and operation – Section 15.5.1.2.4, Section 15.5.1.2.5 and Section 15.5.2.2.1 Non-native invasive plant species during construction and operation – Section 15.5.1.2.6 and 15.5.2.2.2	No likely significant residual effect	n/a	n/a
Depositing / lowland rivers (FW2)	Local Importance (Higher Value)	**Construction** Habitat loss Habitat degradation – surface water quality	Likely significant effect at the local geographic scale	Measures to reduce scale of habitat loss during construction – Section	Likely significant residual effects at a local	Yes, see section 15.8	No likely significant residual effect

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance	Compensation	Residual Impact Significance Post-compensation
		Habitat degradation – groundwater Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – surface water quality Habitat degradation – groundwater Habitat degradation – non-native invasive plant species		15.5.1.2.1 and 15.5.1.2.2 Air quality during construction – Section 15.5.1.2.3 Water quality during construction and operation – Section 15.5.1.2.4, Section 15.5.1.2.5 and Section 15.5.2.2.1 Non-native invasive plant species during construction and operation – Section 15.5.1.2.6 and 15.5.2.2.2	geographic scale as a result of habitat loss – Section 15.6.2		
Canals (FW3)	National Importance – see Royal Canal pNHA and Grand Canal pNHA	**Construction** Habitat degradation – surface water quality Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – surface water quality Habitat degradation – non-native invasive plant species	Likely significant effect at the national geographic scale	Air quality during construction – Section 15.5.1.2.3 Water quality during construction and operation – Section 15.5.1.2.4, Section 15.5.1.2.5 and Section 15.5.2.2.1 Non-native invasive plant species during construction and operation – Section 15.5.1.2.6 and 15.5.2.2.2	No likely significant residual effect	n/a	n/a

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance	Compensation	Residual Impact Significance Post-compensation
Drainage ditches (FW4)	Local Importance (Higher Value)	**Construction** Habitat loss Habitat degradation – surface water quality Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – surface water quality Habitat degradation – hydrogeology Habitat degradation – non-native invasive plant species	Likely significant effect at the local geographic scale	Measures to reduce scale of habitat loss during construction – Section 15.5.1.2.1 and 15.5.1.2.2 Air quality during construction – Section 15.5.1.2.3 Water quality during construction and operation – Section 15.5.1.2.4, Section 15.5.1.2.5 and Section 15.5.2.2.1 Non-native invasive plant species during construction and operation – Section 15.5.1.2.6 and 15.5.2.2.2	Likely significant residual effects at a local geographic scale as a result of habitat loss – Section 15.6.2	No	Likely significant residual effects at a local geographic scale
Species-rich dry calcareous and neutral grassland (GS1)	Local Importance (Higher Value)	**Construction** Habitat loss Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – non-native invasive plant species	Likely significant effect at the local geographic scale	Measures to reduce scale of habitat loss during construction – Section 15.5.1.2.1 and 15.5.1.2.2 Air quality during construction – Section 15.5.1.2.3 Non-native invasive plant species during construction and operation – Section	Likely significant residual effects at a local geographic scale as a result of habitat loss – Section 15.6.2	Yes, see section 15.8	No likely significant residual effect

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance	Compensation	Residual Impact Significance Post-compensation
				15.5.1.2.6 and 15.5.2.2.2			
Wet grassland (GS4)	Local Importance (Higher Value)	**Construction** Habitat loss Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – non-native invasive plant species	Likely significant effect at the local geographic scale	Measures to reduce scale of habitat loss during construction – Section 15.5.1.2.1 and 15.5.1.2.2 Air quality during construction – Section 15.5.1.2.3 Non-native invasive plant species during construction and operation – Section 15.5.1.2.6 and 15.5.2.2.2	Likely significant residual effects at a local geographic scale as a result of habitat loss – Section 15.6.2	Yes, see section 15.8	No likely significant residual effect
(Mixed) broadleaved woodland (WD1)	Local Importance (Higher Value)	**Construction** Habitat loss Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – non-native invasive plant species	Likely significant effect at the local geographic scale	Measures to reduce scale of habitat loss during construction – Section 15.5.1.2.1 and 15.5.1.2.2 Air quality during construction – Section 15.5.1.2.3 Non-native invasive plant species during construction and operation – Section 15.5.1.2.6 and 15.5.2.2.2	Likely significant residual effects at a local geographic scale as a result of habitat loss – Section 15.6.2	Yes, see section 15.8	No likely significant residual effect
(Mixed) conifer woodland (WD3)	Local Importance (Higher Value)	**Construction** Habitat loss Habitat degradation – air quality	Likely significant effect at the local geographic scale	Measures to reduce scale of habitat loss during construction – Section	Likely significant residual effects at a	Yes, see section 15.8	No likely significant residual effect

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance	Compensation	Residual Impact Significance Post-compensation
		Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – non-native invasive plant species		15.5.1.2.1 and 15.5.1.2.2 Air quality during construction – Section 15.5.1.2.3 Non-native invasive plant species during construction and operation – Section 15.5.1.2.6 and 15.5.2.2.2	local geographic scale as a result of habitat loss – Section 15.6.2		
Scattered trees and parkland (WD5)	Local Importance (Higher Value)	**Construction** Habitat loss Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – non-native invasive plant species	Likely significant effect at the local geographic scale	Measures to reduce scale of habitat loss during construction – Section 15.5.1.2.1 and 15.5.1.2.2 Air quality during construction – Section 15.5.1.2.3 Non-native invasive plant species during construction and operation – Section 15.5.1.2.6 and 15.5.2.2.2	Likely significant residual effects at a local geographic scale as a result of habitat loss – Section 15.6.2	Yes, see section 15.8	No likely significant residual effect
Hedgerows (WL1)	Local Importance (Higher Value)	**Construction** Habitat loss Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation –	Likely significant effect at the local geographic scale	Measures to reduce scale of habitat loss during construction – Section 15.5.1.2.1 and 15.5.1.2.2 Air quality during construction – Section 15.5.1.2.3	Likely significant residual effects at a local geographic scale as a result of habitat loss –	Yes, see section 15.8	No likely significant residual effect

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance	Compensation	Residual Impact Significance Post-compensation
		non-native invasive plant species		Non-native invasive plant species during construction and operation – Section 15.5.1.2.6 and 15.5.2.2.2	Section 15.6.2		
Treelines (WL2)	Local Importance (Higher Value)	**Construction** Habitat loss Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – non-native invasive plant species	Likely significant effect at the local geographic scale	Measures to reduce scale of habitat loss during construction – Section 15.5.1.2.1 and 15.5.1.2.2 Air quality during construction – Section 15.5.1.2.3 Non-native invasive plant species during construction and operation – Section 15.5.1.2.6 and 15.5.2.2.2	Likely significant residual effects at a local geographic scale as a result of habitat loss – Section 15.6.2	Yes, see section 15.8	No likely significant residual effect
Immature woodland (WS2)	Local Importance (Higher Value)	**Construction** Habitat loss Habitat degradation – air quality Habitat degradation – non-native invasive plant species **Operation** Habitat degradation – non-native invasive plant species	Likely significant effect at the local geographic scale	Measures to reduce scale of habitat loss during construction – Section 15.5.1.2.1 and 15.5.1.2.2 Air quality during construction – Section 15.5.1.2.3 Non-native invasive plant species during construction and operation – Section	Likely significant residual effects at a local geographic scale as a result of habitat loss – Section 15.6.2	Yes, see section 15.8	No likely significant residual effect

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance	Compensation	Residual Impact Significance Post-compensation
				15.5.1.2.6 and 15.5.2.2.2			
Flora Species							
Opposite-leaved pondweed *Groenlandia densa*	National Importance	**Construction** Habitat degradation – surface water quality **Operation** Habitat degradation – surface water quality	Likely significant effect at the national geographic scale	Water quality during construction and operation – Section 15.5.1.3 and Section 15.5.2.3	No likely significant residual effect	n/a	n/a
Tassel stonewort Tolypella intricata	National Importance	**Construction** Habitat degradation – surface water quality **Operation** Habitat degradation – surface water quality	Likely significant effect at the national geographic scale	Water quality during construction and operation – Section 15.5.1.3 and Section 15.5.2.3	No likely significant residual effect	n/a	n/a
Horned pondweed Zannichellia palustris	Local Importance (Higher Value)	**Construction** Habitat degradation – surface water quality **Operation** Habitat degradation – surface water quality	Likely significant effect at the local geographic scale	Water quality during construction and operation – Section 15.5.1.3 and Section 15.5.2.3	No likely significant residual effect	n/a	n/a
Rigid hornwort Ceratophyllum demersum	Local Importance (Higher Value)	**Construction** Habitat degradation – surface water quality **Operation** Habitat degradation – surface water quality	Likely significant effect at the local geographic scale	Water quality during construction and operation – Section 15.5.1.3 and Section 15.5.2.3	No likely significant residual effect	n/a	n/a
Whorled water-milfoil	Local Importance	**Construction** Habitat degradation –	Likely significant effect at the	Water quality during construction	No likely significant	n/a	n/a

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance	Compensation	Residual Impact Significance Post-compensation
Myriophyllum verticillatum	(Higher Value)	surface water quality **Operation** Habitat degradation – surface water quality	local geographic scale	and operation – Section 15.5.1.3 and Section 15.5.2.3	residual effect		
Fauna Species							
Otter	International Importance	**Construction** Habitat degradation – water quality Habitat degradation – groundwater Habitat severance/barrier effect **Operation** Habitat severance/barrier effect Habitat degradation – hydrology	Likely significant effect at the county geographic scale	Measures to protect otter during construction and operation – Section 15.5.1.4 and Section 15.5.2.4	No likely significant residual effect	n/a	n/a
Nathusius' pipistrelle	County Importance	**Construction** Roost loss (tree/hibernation roosts) Disturbance/Displacement-lighting Habitat loss/fragmentation **Operation** Disturbance/Displacement-lighting	Likely significant effect at the local geographic scale	Measures to protect bats during construction and operation – Section 15.5.1.5 and Section 15.5.2.5	No likely significant residual effect	n/a	n/a
All other bat species	Local Importance (Higher Value)	**Construction** Roost loss (tree/hibernation roosts) Disturbance/Displacement-lighting Habitat loss/fragmentation	Likely significant effect at the local geographic scale	Measures to protect bats during construction and operation – Section 15.5.1.5 and Section 15.5.2.5	No likely significant residual effect	n/a	n/a

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance	Compensation	Residual Impact Significance Post-compensation
		Operation Disturbance/Displacement-lighting					
Badger	Local Importance (Higher Value)	**Construction** Disturbance/displacement **Operation** n/a	Likely significant effect at the local geographic scale	Measures to protect badger during construction and operation – Section 15.5.1.6	No likely significant residual effect	n/a	n/a
Other mammal species protected under the Wildlife Acts	Local Importance (Higher Value)	**Construction** Habitat degradation - water quality Barrier/severance effects **Operation** Habitat degradation - water quality	Likely significant effect at the local geographic scale	Measures to protect other mammals during construction and operation – Section 15.5.1.7 and Section 15.5.2.7	No likely significant residual effect	n/a	n/a
Marine mammals e.g. common porpoise, harbour seal and grey seal	International Importance	**Construction** Habitat degradation - water quality **Operation** Habitat degradation - water quality	Likely significant effect at the international geographic scale	Measures to protect other mammals during construction and operation – Section 15.5.1.7 and Section 15.5.2.6	No likely significant residual effect	n/a	n/a
Glutinous snail	National Importance	**Construction** Habitat degradation – water quality **Operation** n/a	Likely significant effect at the county scale	Water quality during construction and operation – Section 15.5.1.8 and Section 15.5.2.7	No likely significant residual effect	n/a	n/a
False orb pea mussel	National Importance	**Construction** Habitat degradation – water quality **Operation** n/a	Likely significant effect at the county scale	Water quality during construction and operation – Section 15.5.1.8 and Section 15.5.2.7	No likely significant residual effect	n/a	n/a

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance	Compensation	Residual Impact Significance Post-compensation
Breeding Red BoCCI species	County Importance	**Construction** Mortality/injury risk Habitat and food source degradation – water quality **Operation** Habitat and food source degradation – water quality	Likely significant effect at the local geographic scale	Measures to protect breeding bird species during construction and operation – Section 15.5.1.9 and Section 15.5.2.8	No likely significant residual effect	n/a	n/a
Breeding Green and Amber BoCCI species	Local Importance (Higher Value)	**Construction** Mortality/injury risk Habitat and food source degradation – water quality **Operation** Habitat and food source degradation – water quality	Likely significant effect at the local geographic scale	Measures to protect breeding bird species during construction and operation – Section 15.5.1.9 and Section 15.5.2.8	No likely significant residual effect	n/a	n/a
Kingfisher	National Importance	**Construction** Mortality/injury risk Habitat and food source degradation – water quality **Operation** Habitat and food source degradation – water quality	Likely significant effect at the local to national geographic scale	Measures to protect breeding bird species during construction and operation – Section 15.5.1.9 and Section 15.5.2.8	No likely significant residual effect	n/a	n/a
Yellowhammer	County Importance	**Construction** Habitat loss Mortality/injury risk **Operation** n/a	Likely significant effect at the local geographic scale	Measures to protect breeding birds during construction and operation - Section 15.5.1.9	Likely significant residual effects at a local geographic scale as a result of permanent loss of	No	Likely signfiicant residual effect at a local geographic scale

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance	Compensation	Residual Impact Significance Post-compensation
					yellowhammer territory – Section 15.6.6.1		
Wintering Red BoCCI species	Local Importance (Higher Value)	**Construction** Habitat degradation - water quality **Operation** Habitat degradation - water quality	Likely significant effect at the local geographic scale	Measures to protect wintering bird species during construction and operation – Section 15.5.1.10 and Section 15.5.2.9	No likely significant residual effect	n/a	n/a
Wintering Green and Amber BoCCI species	Local Importance (Higher Value)	**Construction** Habitat degradation - water quality **Operation** Habitat degradation - water quality	Likely significant effect at the local geographic scale	Measures to protect wintering bird species during construction and operation – Section 15.5.1.10 and Section 15.5.2.9	No likely significant residual effect	n/a	n/a
Smooth newt	Local Importance (Higher Value)	**Construction** Habitat degradation – surface water quality **Operation** Habitat degradation – surface water quality	Likely significant effect at the local geographic scale	Measures to protect amphibians during construction and operation – Sections 15.5.1.11 and 15.5.2.10	No likely significant residual effect	n/a	n/a
Common frog					No likely significant residual effect	n/a	n/a
Common lizard	Local Importance (Higher Value)	**Construction** n/a **Operation** n/a	n/a	Whilst no potential impacts are predicted, measures to protect individual common lizards during construction and operation are provided	No likely significant residual effect	n/a	n/a

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance	Compensation	Residual Impact Significance Post-compensation
				– Section 15.5.1.12			
Atlantic salmon	National Importance	**Construction** Habitat degradation – surface water quality	Likely significant effect at the national to international geographic scale	Measures to protect fish during construction and operation – Section 15.5.1.13 and Section 15.5.2.11	No likely significant residual effect	n/a	n/a
European eel	International Importance	Habitat degradation – groundwater Mortality risk Habitat severance/barrier effect **Operation** Habitat degradation – surface water quality			No likely significant residual effect	n/a	n/a
All other fish species recorded	Local Importance (Higher Value)	**Construction** Habitat degradation – surface water quality Habitat degradation – groundwater Mortality risk Habitat severance/barrier effect **Operation** Habitat degradation – surface water quality	Likely significant effect at the local geographic scale		No likely significant residual effect	n/a	n/a
Local Biodiversity Areas							
Local biodiversity areas (See Section 15.3.2)	The value of the biodiversity receptors recorded in the vicinity of the proposed Project, across the local biodiversity areas, range	Combination of all of the potential impacts noted above The specific impacts are related to and dependent upon the potential impacts of the proposed Project on each	Likely significant effects from local up to the international geographic scale	All of the mitigation measures included within Section 15.5 The specific mitigation measures are related to and dependent upon the potential	Likely significant residual effects at a local geographic scale	Yes, see Section 15.8 for details on comp ens	No likely significant residual effect

Ecological Receptor	Ecological Valuation	Impacts with the Potential to result in Likely Significant Effects	Potential Impact Significance	Mitigation Measures	Residual Impact Significance	Compensation	Residual Impact Significance Post-compensation
	from Local Importance (Lower Value) to Internationally Important	of the individual ecological receptors that make up the biodiversity resources within a given local biodiversity area		impacts of the proposed Project on each of the individual ecological receptors that make up the biodiversity resource within a given local biodiversity area		ation for the relevant habitat types	

15.10 Glossary

Term	Meaning
Alignment	Alignment refers to the three-dimensional (3D) route of the railway, considering both the horizontal and vertical alignment.
Biochemical Oxygen Demand (BOD)	The amount of dissolved oxygen needed by aerobic biological organisms to break down organic material present in a given water sample at a certain temperature over a specific time period.
Catch Per Unit Effort (CPUE)	An indirect measure of the abundance of a target species; can indicate overharvesting or sustainable harvesting.
Construction Compound	An area occupied temporarily for construction-related activities. The main construction compounds will act as strategic hubs for core project management activities (i.e. engineering, planning and construction delivery) and for office-based construction personnel. The main construction compounds will include: offices and welfare facilities, workshops and stores, and storage and laydown areas for materials and equipment (e.g. aggregate, structural steel, and steel reinforcement).
Core Sustenance Zone (CSZ)	The area surrounding a communal bat roost within which habitat availability and quality will have a significant influence on the resilience and conservation status of the colony using the roost.
Cut and Cover	Cut and cover construction involves using excavation equipment to dig a large trench or rectangular hole in the ground which is then covered by a concrete roof slab. Once the slab is in place, surface activity can largely resume as construction works continue below.
Diaphragm walls or 'D-walls'	Underground structural elements commonly used as retention systems and permanent foundation walls. Similar to secant piles, in that they are excavated from the surface and then filled with reinforcing steel and concrete. However, they are constructed as rectangular sections of trench, rather than circular piles.
Ecological Receptor (ER)	A population of flora or fauna (excluding domestic animals and cultivated plants) or an individual member of any species listed as threatened or endangered.
Environmental Impact Assessment (EIA)	The assessment of environmental consequences of a plan, policy, program or actual projects prior to the decision to move forward with the proposed action.
Finite Element Method (FEM)	A popular numerical analysis technique for numerically solving differential equations arising in engineering and mathematical modelling.
High Amenity (HA)	Something considered to benefit a location, contribute to its enjoyment, and therefore increase its value.
Hydrofraise	A reverse circulation excavation tool comprising a heavy steel frame with two drive gears attached to cutter wheels at its bottom end. It is used for the construction of diaphragm and cut-off walls in difficult conditions, typically the excavation of rock and hard layers of soil. The hydrofraise is also called a hydromill and trench cutter (or just cutter).
Intervention Shaft	A vertical shaft excavated to provide emergency access/egress and ventilation between the railway tunnel at depth and the surface.
Intervention Tunnel	A tunnel parallel to the railway tunnel to provide emergency access/egress from the tunnel to the surface.
Logistics Site	During construction logistics sites will be established to help manage the flow of materials to and from the construction sites.
Natura Impact Statement (NIS)	A report comprising the scientific examination of a plan or project and the relevant European Site(s), to identify and characterise any possible implications of the plan or project in view of the conservation objectives of the site(s).
Potential Roost Feature (PRF)	A feature of a habitat that may allow for the presence and/or roosting of bats.
Retained Cut	A section of the railway constructed primarily below ground level with vertical retaining walls either side of the alignment and no roof or enclosure overhead.

Term	Meaning
Retained Cut Station	A railway station constructed primarily below ground level with vertical retaining walls either side of the alignment to reinforce the walls. Canopies provide shelter over the platforms.
Rolling Stock	A generic term referring to all vehicles that run on rails.
Satellite Compound	A works compound usually smaller than the main compound which may provide: local office and welfare facilities, local storage for plant and materials, and limited parking for construction vehicles.
Secant Piles	A construction method used to form a retaining wall for ground retention prior to excavation. The walls are formed by boring circular sections from the surface down into the top of the bedrock and filling the resulting opening with steel reinforcing cages surrounded by concrete.
Sustainable Drainage Systems (SuDS)	Designed to manage stormwater locally, to mimic natural drainage and encourage its infiltration, attenuation and passive treatment.
Surface Station	A railway station designed at ground level
Tunnel Boring Machine (TBM)	A machine used to excavate tunnels with a circular cross section through a variety of soil and rock strata.
Underground Stations	A railway station located fully underground with a roof slab over the station to enclose it, with entrances above ground.
Ventilation Tunnel	A tunnel parallel to the railway tunnel to support the ventilation system in the Operational Phase.
Zone of Influence (ZoI)	An area or volume of surface water or ground water within which some degradation of water quality criteria is anticipated as a result of a pollutant discharge and which area is used to describe an area impacted by thermal, conventional or toxic pollutants.

15.11 References

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