6 Biodiversity

6.1 Introduction

This Ecological Impact Statement has been prepared by Pádraic Fogarty of OPENFIELD Ecological Services.

Pádraic Fogarty has worked for over 20 years in the environmental field and in 2007 was awarded an MSc from Sligo Institute of Technology for research into Ecological Impact Assessment (EcIA) in Ireland. OPENFIELD is a full member of the Institute of Environmental Management and Assessment (IEMA).

6.2 Study Methodology

The assessment was carried out in accordance with the following best practice methodology: 'Guidelines for Ecological Impact Assessment in the United Kingdom and Ireland' by the Institute of Ecology and Environmental Management (IEEM, 2016).

A site visit was carried out on the 23rd of January 2019 in fair weather. The site was surveyed in accordance with the Heritage Council's Best Practice Guidance for Habitat Survey and Mapping (Smith et al., 2010). Habitats were identified in accordance with Fossitt's Guide to Habitats in Ireland (Fossitt, 2000).

The nomenclature for vascular plants is taken from The New Flora of the British Isles (Stace, 2010) and for mosses and liverworts A Checklist and Census Catalogue of British and Irish Bryophytes (Hill et al., 2009).

January lies outside the optimal survey period for general habitat surveys (Smith et al., 2010) but it was possible to classify all habitats on the site to Fossitt level 3. January lies outside the season for surveying breeding birds and amphibians but is optimal for surveying large mammals (especially Badgers).

6.3 The Existing Environment (Baseline)

Zone of Influence

Best practice guidance suggests that an initial zone of influence be set at a radius of 2km for non-linear projects (IEA, 1995). However, some impacts are not limited to this distance and so sensitive receptors further from the project footprint may need to be considered as this assessment progresses. This is shown in figure 6.1.

There are a number of designations for nature conservation in Ireland including National Park, National Nature Reserve, RAMSAR site, UNESCO Biosphere reserves, Special Protection Areas (SPA – Birds Directive), Special Areas of Conservation (SAC – Habitats Directive); and Natural Heritage Areas. The mechanism for these designations is through national or international legislation. Proposed NHAs (pNHA) are areas that have yet to gain full legislative protection. They are generally protected through the relevant County Development Plan. There is no system in Ireland for the designation of sites at a local, or county level. No such areas were found to lie within the zone of influence of the development site.

Figure 6.1 - Site location (red cross) in South Dublin with local water courses. There are no areas for nature conservation in this view (from www.epa.ie).

The NPWS web site (www.npws.ie) contains a mapping tool that indicates historic records of legally protected species within a selected Ordnance Survey (OS) 10km grid square. The Cornelscourt site is located within the square O22 and six species of protected flowering plant are highlighted. These species are detailed in Table 6.1. It must be noted that this list cannot be seen as exhaustive as suitable habitat may be available for other important and protected species. In summary, it can be seen that of the five species none remains current according to the Botanical Society of the British Isles.

Water quality in rivers, canals and estuaries is monitored on an on-going basis by the Environmental Protection Agency (EPA). They assess the pollution status of a stretch of river by analysing the invertebrates living in the substrate as different species show varying sensitivities to pollution. They arrive at a 'Q-Value' where Q1 = grossly polluted and Q5 = pristine quality (Toner et al., 2005). The subject lands are not in the catchment of any significant water course. The Cabinteely Stream runs to the south-east of the site. This is a short stream that joins the Carrickmines Stream to the south-east and enters the Irish Sea between Killiney and Dalkey. The Kill-O-the Grange Stream flows to the north of the N11 road. These rivers are highly modified and are likely to be culverted for much of their length. The EPA have a monitoring points at the N11 overpass and here Q3-4 (slight pollution) was recorded in 2015. Overall, the Carrickmines Stream and its tributaries have been assessed as 'moderate' under the Water Framework Directive (WFD). These data are taken from the ENVision mapping tool on www.epa.ie.

Species	Habitat[1]	Current status[2]
Cinopodium acinos Basil Thyme	Field margins and sandy or gravelly places	Record pre-1970
Galeopsis angustifolia Red Hemp-nettle	Calcareous gravels	
Puccinellia fasciculata Borrer's salt-marsh grass	Muddy inlets on the coast	
Misopates orontium Lesser Snapdragon	Arable fields	
Viola hirta Hairy Violet	Sand dunes, grasslands, limestone rocks	
Cervus nippon Sika Deer	Coniferous woodland and adjacent heaths	Current
Lutra lutra Otter	Rivers, coasts and wetlands	Current
Sciurus vulgaris Red Squirrel	Woodlands	Current

Table 6.1 - Known records for protected species within the O22 10km square

Stakeholder Consultation

Because of the low ecological sensitivity of the subject lands, third party observations were not sought.

Site Survey

Aerial photography from the OSI and historic mapping shows that this area has been within the urban fabric of Dublin since historical times.

Flora

The site can best be described as **dry meadow – GS2** along with a patch of **bare soil – ED2** (approximately 10% of the total areas). Grassy areas are dominated by typical species such as False Oat *Arrhenatherum elatius,* Common Couch *Elytrigia repens* and Cock's-foot *Dactylis glomerata* along with Creeping Buttercup *Ranunculus repens,* Docks *Rumex sp.* and Thistles *Cirsium sp.*

The boundary to the north-west and north is characterised by an **earth bank – BL2** with Winter Heliotrope *Petasites fragrans,* Butterfly-bush *Buddleja davidii* and Brambles *Rubus fruticosus agg.* Other boundaries are concrete walls with Ivy *Hedera helix* and occasional Elder *Sambucus nigra.*

There are no water courses on, or immediately adjacent to the site boundary.

To the east there is a stand of Japanese Knotweed *Fallopia japonica* (which is an alien invasive species). Three-cornered Garlic *Allium triquetrum* and Spanish Bluebell *Hyacinthoides hispanica* area also present. These are listed in SI No. 477 of 2011 as alien invasive.

There are no habitats which are examples of those listed in Annex II of the Habitats Directive and no habitat suitable for protected species of plants.

[1] Parnell et al., 2012
[2] www.bsbi.com

Fauna

The site survey included incidental sightings or proxy signs (prints, scats etc.) of faunal activity, while the presence of certain species can be concluded where there is suitable habitat within the known range of that species. Table 6.2 details those mammals that are protected under national or international legislation in Ireland. Cells are greyed out where suitable habitat is not present or species are outside the range of the study area.

Species	Level of Protection	Habitat[3]
Otter *Lutra lutra*	Annex II & IV Habitats Directive; Wildlife (Amendment) Act, 2000	Rivers and wetlands
Lesser horseshoe bat *Rhinolophus hipposideros*		Disused, undisturbed old buildings, caves and mines
Grey seal *Halichoerus grypus*	Annex II & V Habitats Directive; Wildlife (Amendment) Act, 2000	Coastal habitats
Common seal *Phocaena phocaena*		
Whiskered bat *Myotis mystacinus*	Annex IV Habitats Directive; Wildlife (Amendment) Act, 2000	Gardens, parks and riparian habitats
Natterer's bat *Myotis nattereri*		Woodland
Leisler's bat *Nyctalus leisleri*		Open areas roosting in attics
Brown long-eared bat *Plecotus auritus*		Woodland
Common pipistrelle *Pipistrellus pipistrellus*		Farmland, woodland and urban areas
Soprano pipistrelle *Pipistrellus pygmaeus*		Rivers, lakes & riparian woodland
Daubenton's bat *Myotis daubentoniid*		Woodlands and bridges associated with open water
Nathusius' pipistrelle *Pipistrellus nathusii*		Parkland, mixed and pine forests, riparian habitats
Irish hare *Lepus timidus hibernicus*	Annex V Habitats Directive; Wildlife (Amendment) Act, 2000	Wide range of habitats
Pine Marten *Martes martes*		Broad-leaved and coniferous forest
Hedgehog *Erinaceus europaeus*	Wildlife (Amendment) Act, 2000	Woodlands and hedgerows
Pygmy shrew *Sorex minutus*		Woodlands, heathland, and wetlands
Red squirrel *Sciurus vulgaris*		Woodlands

[3] Harris & Yalden, 2008

Irish stoat *Mustela erminea hibernica*		Wide range of habitats
Badger *Meles meles*		Farmland, woodland and urban areas
Red deer *Cervus elaphus*		Woodland and open moorland
Fallow deer *Dama dama*		Mixed woodland but feeding in open habitat
Sika deer *Cervus nippon*		Coniferous woodland and adjacent heaths

Table 6.2 – Protected mammals in Ireland and their known status within the O22 10km grid square[4]. Those that are greyed out indicate either that there are no records of the species from the National Biodiversity Data Centre. Since the site is not coastal the two Seal species are greyed out.

The habitats on the site are unsuitable for most of these species and no direct evidence of any mammal activity was recorded. There is no evidence that Badger use the site and no sett is present. There was no evidence that Irish Hare is present while habitat is considered too isolated from other woodland areas to support Deer, Pine Marten or Red Squirrel. Small mammals such as the Irish Stoat, Hedgehog and Pygmy Shrew are considered more or less ubiquitous in the Irish countryside, including on land in suburban areas (Lysaght & Marnell, 2016). While Rabbits Oryctolagus cuniculus and Fox Vulpes vulpes are common in Dublin along with Brown Rat Rattus norvegicus, House Mouse Mus domesticus and Field Mouse *Apodemus sylvaticus,* these species are not protected.

There are no features on the site suitable for roosting bats and surrounding vegetation provides little by way of foraging resources (Hundt, 2012). A bat survey is not considered to be necessary.

January lies outside the optimal season for surveying breeding birds. The following list of birds from the site is indicative however, and species here can be assumed to be breeding: Wren *Troglodytes troglodytes* and Robin *Erithacus rubecula*. These species are of low conservation concern/green list (Colhoun & Cummins, 2013). Suitable nesting habitat is available for common garden birds in small patches of Brambles and Ivy.

There is no suitable habitat for breeding Common Frog *Rana temporaria* or Smooth Newt *Lissotriton vulgaris* as there are no wetlands. There are no habitats on the site suitable for fish. The Cabinteely Stream is of low fisheries value and it is not suitable for migratory fish such as salmonids, European Eel *Anguilla Anguilla* or Lamprey *Lampetra sp.* species.

Most habitats, even highly altered ones, are likely to harbour a wide diversity of invertebrates. In Ireland only one insect is protected by law, the Marsh Fritillary butterfly Euphydryas aurinia, and this is not to be found in this area. Other protected invertebrates are confined rare to freshwater and wetland habitats which are not present on this site.

Overall Evaluation of the Context, Character, Significance and Sensitivity of the Proposed Development Site

In summary, it has been seen that the application site is composed of highly modified habitats within a built-up area. There are no examples of habitats listed on Annex I of the Habitats Directive or records of rare or protected plants. There is a stand of Japanese Knotweed, a species listed as alien invasive as per SI 477 of 2011. Spanish Bluebell *Hyacinthoiodes hispanica* and Three-cornered Garlic *Allium triquetrum* were also identified by Invasive Plant Solutions.

[4] From the National Biodiversity Data Centre, excludes marine cetaceans

Significance criteria are available from guidance published by the National Roads Authority (NRA, 2009). These are reproduced in table 6.3. From this an evaluation of the various habitats and ecological features on the site has been made and this is shown in table 6.4.

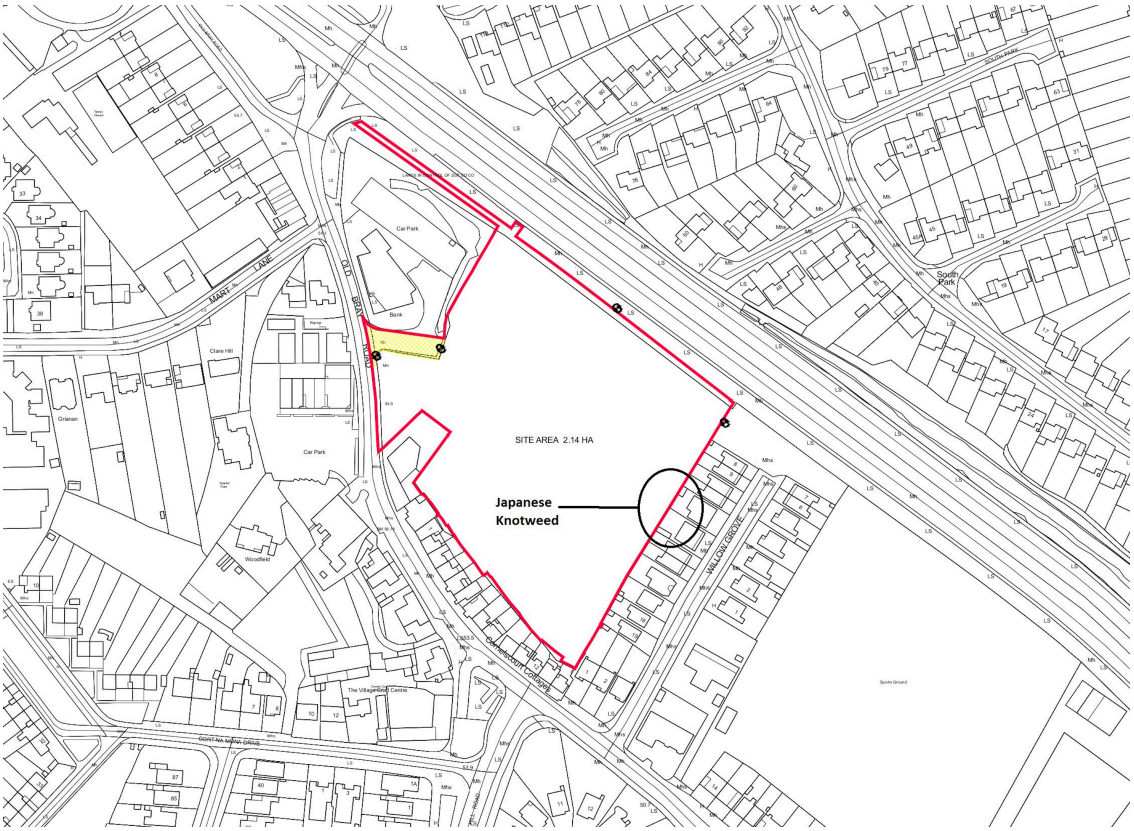

Figure 6.2 – Development boundary of the subject lands superimposed on an aerial photograph and showing the location of the stand of Japanese Knotweed (photo from www.google.com)

Site Rating	Qualifying criteria
A - International importance	SAC, SPA or site qualifying as such. Sites containing 'best examples' of Annex I priority habitats (Habitats Directive). Resident or regularly occurring populations of species listed under Annex II (Habitats Directive); Annex I (Birds Directive); the Bonn or Berne Conventions. RAMSAR site; UNESCO biosphere reserve; Designated Salmonid water
B - National importance	NHA. Statutory Nature Reserves. Refuge for Flora and Fauna. National Park. Resident or regularly occurring populations of species listed in the Wildlife Act or Red Data List 'Viable' examples of habitats listed in Annex I of the Habitats Directive
C - County importance	Area of Special Amenity, Tree Protection Orders, high amenity (designated under a County Development Plan) Resident or regularly occurring populations (important at a county level, defined as >1% of the county population) of European, Wildlife Act or Red Data Book species Sites containing semi-natural habitat types with high biodiversity in a county context, and a high degree of naturalness, or populations of species that are uncommon in the county
D - Local importance, higher value	Sites containing semi-natural habitat types with high biodiversity in a county context, and a high degree of naturalness, or populations of species that are uncommon in the locality Sites or features containing common or lower value habitats, including naturalised species that are nevertheless essential in maintaining links and ecological corridors between features of higher ecological value.
E - Local importance, lower value	Sites containing small areas of semi-natural habitat that are of some local importance for wildlife; Sites or features containing non-native species that are of some importance in maintaining habitat links.

Table 6.3 - Site evaluation scheme taken from NRA guidance 2009

Dry meadow - GS2 ***Earth banks - BL2***	***Low local ecological value***
Bare soil - ED2	***Negligible ecological value***

Table 6.4 - Evaluation of the importance of habitats and species on the Cornelscourt Site

6.4 Characteristics of the Proposed Development

The current proposal provides for a Build to Rent development consisting:

- 468 residential units (452 apartments and 16 houses) as follow:
    - 41 no. studio apartment units,
    - 257 no. 1 bed apartment units,
    - 136 no. 2 bed apartment units;
    - 18 no. 3 bed apartment units;
    - 10 no. 3 bed semi-detached house units; and
    - 6 no. 1 bed bungalow units.
- A café / restaurant of c. 140 sq m; office space of 149 sq m; concierge of c. 149 sq m; and a residential tenant amenity space of c. 458 sq m is also proposed.
- 274 Car Parking Spaces (273 at basement level and 1 at surface level)
- 12 Motor Cycle Spaces
- 616 Bicycle Parking Spaces
- Public Open Space
- Vehicular Access
- Basement Areas
- Sub Stations and 3 Switch Rooms
- All Associated Site Development Works

The proposed development will see site clearance and a construction phase to include all associated infrastructure as shown in figure 6.3. All semi-natural habitats on the site are to be cleared. Post construction the land will be landscaped.

Figure 6.3 - Development Overview

6.5 Potential Impact of the Proposed Development

This section provides a description of the potential impacts that the proposed development may have on flora & fauna in the absence of mitigation. Methodology for determining the significance of an impact has been published by the NRA. This is based on the valuation of the ecological feature in question (table 6.4) and the scale of the predicted impact. In this way, it is possible to assign an impact significance in a transparent and objective way. Table 6.5 summaries the nature of the predicted impacts.

Construction Stage

The following potential impacts are likely to occur during the construction phase in the absence of mitigation:

1. The removal of habitats including dry meadow, bare soil and earth banks. These are of low local ecological value. The species to be found are common and widespread and for this reason the impact to biodiversity from the loss of these habitats is considered to be minor negative. This impact will be offset by the planting of new trees as part of a landscaping programme.

2. The direct mortality of species during site clearance. This impact is most acute during the bird breeding season which can be assumed to last from March to August inclusive. This may affect a number of locally common countryside birds. Suitable areas for bird nesting are very limited but nevertheless all nests and eggs are protected under the Wildlife Act.

3. Pollution of water courses through the ingress of silt, oils and other toxic substances. As there are no water courses in this vicinity, and the catchment is not sensitive in terms of salmonid fishery value, this impact is considered to be minor negative at worst.

4. Spread of invasive species. Japanese Knotweed spreads easily through disturbance of visible stems and subterranean rhizomes, which can spread up to 7m from visible parts of the plant. The stand has been cordoned off to prevent disturbance and appropriate signage has been erected. An initially site assessment has been carried out by Invasive Plant Solutions which also identified Three-cornered Garlic on the lands. A treatment programme will commence during the 2019 growing season and a multi-annual control plan is to be prepared.

Following an assessment of the treatment options, it has been concluded that material contaminated with Japanese Knotweed should be removed and disposed of off-site.

Operational Stage

The following potential impacts are likely to occur during the operation phase in the absence of mitigation:

5. Pollution of water from foul wastewater arising from the development. Wastewater will be sent to the municipal treatment plant at Ringsend. Upgrade works are needed as the plant is not currently meeting its requirements under the Urban Wastewater Treatment Directive. Pollution effects are most acute in freshwater systems where the capacity for dilution is low and the consequent risk of eutrophication is high. The Ringsend WWTP discharges into Dublin Bay which is currently classified as 'unpolluted' by the EPA despite long-running compliance issues at the plant. A separate screening report for Appropriate Assessment specifically examines the impacts of this project on Natura 2000 areas in Dublin Bay however there is currently no evidence that non-compliance issues at the WWTP are having negative effects to features of high ecological value (e.g. wading birds or intertidal habitats). It is understood that Irish Water is to undertake upgrading works on a phased basis and that compliance issues will comprehensively addressed by 2023.

6. Pollution of water from surface water run-off. The Greater Dublin Strategic Drainage Study (2005) identified issues of urban expansion leading to an increased risk of flooding in the city and a deterioration of water quality. This arises where soil and natural vegetation, which is permeable to rainwater and slows its flow, is replaced with impermeable hard surfaces. A new surface water drainage system is to be installed in accordance with the GDSDS. No negative effect arising to the

quantity or quality of surface run-off will occur. This will include SUDS approaches including attenuation storage, green roofs, infiltration trenches and discharge to an existing surface water sewer.

7. Impacts to protected areas. Natura 2000 areas (SACs or SPAs) in Dublin Bay are not predicted to occur, principally due to the separation distance between the site and these areas. A full assessment of potential effects to these areas is contained within a separate Screening Report for Appropriate Assessment. There are no pathways to other designated area for nature conservation.

	Impact	*Significance*
	Construction Phase	
1	***Loss of dry meadow/earth bank and bare soil***	***Imperceptible***
2	***Mortality to animals during construction, including nesting birds***	***Moderate effect – permanent impacts to species of high local value/or species with legal protection***
3	***Pollution of water during construction phase***	***Imperceptible***
4	***Spread of Japanese Knotweed***	***Moderate effect***
	Operation Phase	
5	***Wastewater pollution***	***Neutral effect***
6	***Surface water pollution***	***Neutral effect***
7	***Protected areas***	***Neural effects***

Table 6.5 - Significance level of likely impacts in the absence of mitigation

Overall it can be seen that two potential moderate negative effects are predicted to occur as a result of this project in the absence of mitigation.

6.6 Potential Cumulative Impacts

A number of the identified impacts can also act cumulatively with other impacts from similar developments in this area of Dublin. These primarily arise through the additional loading to the Ringsend Wastewater Treatment Plant. It is considered that this effect is not significant due to the planned upgrading works that will bring it in line with the requirement of the Urban Wastewater Treatment Directive.

In this instance, the incorporation of SUDS attenuation measures will result in not negative effect to surface water quality.

Increasing urbanisation of Dublin, and in particular land use change from agricultural to urban uses, is resulting in the loss of habitat for common species of plants and animals. In this case, there are no high value habitats while post-construction landscaping will provide additional resources for wildlife.

6.7 Do Nothing Scenario

In the absence of the development proposal little change to the biodiversity value of the site can be expected. While Japanese Knotweed is persistent, it does not spread unless disturbed (it does not set viable seeds). Without intervention therefore, the plant will remain in place for the foreseeable future.

6.8 Risks to Human Health

There are no aspects from biodiversity which are a risk to human health.

6.9 Mitigation Measures

Construction Stage

1. Disturbance of birds' nests and bats (if present)

Deliberate disturbance of a bird's nest is prohibited unless under licence from the National Parks and Wildlife Service (NPWS). If possible, site clearance works should proceed outside the nesting season, i.e. from September to February inclusive. If this is not possible, vegetation must first be inspected by a suitably qualified ecologist. If a nest is encountered then works must stop, until such time as nesting has ceased. Otherwise, a derogation licence must be sought from the NPWS to allow the destruction of the nest.

2. Japanese Knotweed/Three-cornered Garlic/Spanish Bluebell

The stand of Japanese Knotweed has already been cordoned off, labelled and all site workers have been informed of its presence. It has received a first treatment with herbicide by Invasive Plant Solutions (www.knotweed.ie). A management plan has been prepared in order to eradicate the plant and to ensure that site works do not result in its spread. This plan includes measures to control Three-cornered Garlic and Spanish Bluebell. Preliminary herbicide treatment took place during the growing season in 2019. The following measures are taken from the invasive species management plan:

Isolate infested areas and implement bio-security measures

- *Carry out a test trenching programme to establish the extent of infested soils.*
- *Excavate knotweed-contaminated soils from the footprint of proposed works, as part of a bio-secure management programme, to ensure the safe, off-site, disposal of all Japanese Knotweed infested soil and I.A.P.S. plant material to a licenced land fill facility or to an overseas processing facility.*
- *Use a proprietary vertical root-barrier membrane system along vulnerable site boundaries, to protect the property from the potential re-introduction of viable Japanese Knotweed and other I.A.P.S. plant growth from adjoining properties.*
- *Develop a construction stage monitoring programme for inadvertent plant regrowth or spread, and future control using herbicide treatment or further physical remediation.*

Full details are contained within the Construction Stage Invasive Species Management Plan prepared by Invasive Plant Solutions and which is included as part of the EIAR under separate cover.

Operational Stage

3. Japanese Knotweed

Japanese Knotweed can regenerate from small fragments and continued vigilance will be required for signs of regrowth. The following measure is taken from the invasive species management plan:

Implement a monitoring programme as an integral and mandatory part of the post development property management plan, to run for a period of at least 5 years following the completion of the development.

6.10 Predicted Impacts of the Proposed Development

This section allows for a qualitative description of the resultant specific direct, indirect, secondary, cumulative, short, medium and long-term permanent, temporary, positive and negative effects as

well as impact interactions which the proposed development may have, assuming all mitigation measures are fully and successfully applied.

Construction Stage

After mitigation, no significant residual effects are likely to arise to biodiversity arising from this project during the construction phase.

Operational Stage

After mitigation, no significant residual effects are likely to arise to biodiversity arising from this project during the operation phase.

6.11 Monitoring

Monitoring is required where the success of mitigation measures is uncertain or where residual impacts may in themselves be significant.

Construction Stage

Monitoring will be required during the construction phase to ensure that measures in the invasive species plant are fully implemented.

Operational Stage

Monitoring for Japanese Knotweed will be required to ensure it does not re-emerge. A schedule of monitoring has been included in the Japanese Knotweed management plan.

6.12 Reinstatement

No reinstatement is required to off set negative effects arising to biodiversity arising from this development. New landscape planting will provide some habitat for locally common flora and fauna.

6.13 Interactions

There are interactions between the biodiversity chapter and the landscaping and water chapters.

New planting for aesthetic and/or ornamental purposes will provide some additional habitat for common plants and animals which are already present in this locality. Landscaping has been designed for multiple benefits and includes a range of native and non-native species. Given that there are no semi-natural features of wildlife value on the site currently, this represents a net benefit for biodiversity.

The management of surface water run-off from the development site has been designed to incorporate Sustainable Drainage Systems and which will prevent pollution or excessive pulse flows of run-off during flood events. While the development site is not in the catchment of any river or water body of significant fisheries value, these measures will ensure that not negative impacts occur to water bodies in freshwater or marine ecosystems.

6.14 Difficulties Encountered

No difficulties were encountered in compiling this assessment.

6.15 References

Bullock C., Kretch C. & Candon E. 2008. *The Economic and Social Aspects of Biodiversity*. Stationary Office.

Clabby, K.J., Bradley, C., Craig, M., Daly, D., Lucey, J., McGarrigle, M., O'Boyle, S., Tierney, D. and Bowman, J. 2008. *Water Quality in Ireland 2004 – 2006.* EPA.

Colhoun K. & Cummins S. 2013. *Birds of Conservation Concern in Ireland 2014 – 2019.* Irish Birds. Volume 9 Number 4 pg523-541.

Cooney R. & Dickson B. 2005. *Biodiversity and the Precautionary Principle.* Earthscan.

Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora.

Council Directive 97/11/EEC of 3rd March 1997 amending Directive 85/337/EEC on the assessment of the effects of certain public and private projects on the environment

Council Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy – more commonly known as the Water Framework Directive

Department of Arts, Heritage and the Gaeltacht. 2011. *Actions for Biodiversity 2011 – 2016. Ireland's National Biodiversity Plan.*

DG Environment. 2010. *Natura 2000 European Commission Nature and Biodiversity Newsletter.* Number 28. June 2010. ISSN: 1026-6151.

EPA. 2002. *Guidelines on the information to be contained in Environmental Impact Statements.*

EPA, 2003. *Advice Notes on Current Practice (in the preparation of Environmental Impact Statements)*

Fitter R., Fitter A. & Farrer A. 1984. *Grasses, sedges, rushes and ferns of Britain and Northern Europe.* Collins.

Fossitt J. 2000. *A Guide to Habitats in Ireland*. Heritage Council.

Harris S. & Yalden D.W. 2008. *Mammals of the British Isles: Handbook, 4th Edition.* The Mammal Society.

Hill M.O., Blackstock T.H., Long D.G. and Rothero G.P 2008. *A Checklist and Census Catalogue of British and Irish Bryophytes.* British Bryological Society.

Hundt L. 2012. *Bat Surveys: Good Practice Guidelines. 2nd Edition.* Bat Conservation Trust.

IEEM. 2016. *Guidelines for Ecological Impact Assessment in the United Kingdom.* Institute of Ecology and Environmental Management.

Institute of Environmental Assessment, 1995. *Guidelines for Baseline Ecological Assessment*'

Johnson O. & More D., 2004. *Tree Guide*', Collins

Lewis L., Burke B. & Crowe O. 2016. *Irish Wetland Bird Survey: Results of Waterbird Monitoring in Ireland in 2014/15.*

Mason C.F. 1996. *Biology of Freshwater Pollution.* Longman.

Morris P. & Therivel R., 2001. *Methods of Environmental Impact Assessment,* Spon Press

NRA. 2009. *Guidelines for Assessment of Ecological Impacts of National Road Schemes.* National Roads Authority.

Parnell J. & Curtis T. 2012. *Webb's An Irish Flora.* Cork University Press.

Preston C.D., Pearman D.A. & Dines T.D. 2002. *New Atlas of the British & Irish Flora.* Oxford University Press.

Rich C. & Longcore T. Editors. 2006. *Ecological Consequences of Artificial Night Lighting.* Island Press.

Sargent G. & Morris P. 2003. *How to Find & Identify Mammals.* The Mammal Society.

Smith G. F., O'Donoghue P., O'Hora K. and Delaney E. 2010. *Best Practice Guidance for Habitat Survey and Mapping.* Heritage Council.

Stace C. 2010. *New Flora of the British Isles.* Cambridge University Press

Statutory Instrument No. 94 of 1999. Flora (Protection) Order

Treweek J., 1999. *Ecological Impact Assessment'*, Blackwell Science.

United Nations. 1992. *Convention on Biological Diversity*