Carrickmines-Shanganagh River Flood Relief Scheme

Preliminary CEMP

Final Report

February 2025

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Contract

This report relates to the Carrickmines-Shanganagh River Flood Relief Scheme commissioned by Dun Laoghaire-Rathdown County Council (DLRCC), on behalf of the Office of Public Works (OPW). Justin Nangle, Conor O'Neill and Bernadette O'Connell of JBA Consulting compiled this report. This report draws on the EIAR for the proposed development, which was prepared by the competent experts listed in Table 1-1 of Chapter 1, EIAR Volume 2.

Purpose

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Abbreviations

AA	Appropriate Assessment
AEP	Annual Exceedance Probability
CEMP	Construction Environmental Management Plan
CFRAM	Catchment Flood Risk Assessment and Management
CIEEM	Chartered Institute of Ecology and Environmental Management
CMP	Construction Management Plan
ECoW	Ecological Clerk of Works
EIAR	Environmental Impact Assessment Report
EPA	Environmental Protection Agency
FRS	Flood Relief Scheme
GHS	Geological Heritage Site
GIS	Geographic Information System
GSI	Geological Survey Ireland
EIS	Environmental Impact Statement
EIA	Environmental Impact Assessment
MCA	Multi-Criteria Assessment
NHA	Natural Heritage Area
NIAH	National Inventory of Architectural Heritage
NIS	Natura Impact Assessment
NPWS	National Parks and Wildlife Service
OPW	Office of Public Works
PCD	Public Consultation Day
PE	Population Equivalent
pNHA	Proposed Natural Heritage Area
QI	Qualifying Interest
RBMP	River Basin Management Plan
SAC	Special Areas of Conservation
SFRA	Strategic Flood Risk Assessment
SPA	Special Protection Areas
UWWTP	Urban Wastewater Treatment Plant
WFD	Water Framework Directive
WWTP	Wastewater Treatment Plant
ZoI	Zone of Influence

1 Introduction

1.1 General

JBA Consulting and Egis have developed a preliminary Construction Environmental Management Plan (CEMP) in relation to the proposed Carrickmines-Shanganagh River Flood Relief Scheme (FRS) (the 'proposed development').

The proposed development will comprise of a series of flood defences positioned along the banks of the Carrickmines-Shanganagh river system as it flows from the R117 Enniskerry Road towards the sea between Killiney and Shankill. The defences comprise new and upgraded flood walls, culvert adjustments, and instream works outlined in detail in Section 3.2.

1.2 Background

Dún Laoghaire Rathdown County Council (DLRCC) intends to apply for planning permission for a Flood Relief Scheme along the Carrickmines-Shanganagh River, in the vicinity of Sandyford, Kilgobbin, Loughlinstown, and Shankill. The proposed development, which will be submitted under Part 10 of the Planning and Development Act (2000) as amended, consists of development of a flood relief scheme to minimise the risks currently posed to people, the community, social amenity, environment and landscape.

There is a history of fluvial flooding in the catchment at various locations, the most recent significant flood event occurring in October 2011. Areas such as Commons Road in Shankill, Glenamuck Road in Carrickmines as well as the M50 and N11 roads, critical transport routes, have been frequently impacted by fluvial flooding from the river system.

An Environmental Impact Assessment Report (EIAR), produced by JBA and a team of environmental experts, has been submitted with this preliminary CEMP as part of the planning application.

The EIAR should be read in full to ascertain the ecological and environmental constraints that may be applicable to the construction works for this project.

1.3 Objective of the CEMP

The objective of this document is to inform all personnel (Main Contractor and sub-contractors) of their obligations with regards to environmental protection. The CEMP seeks to:

- Provide a basis for implementing construction-related mitigation measures to safeguard identified environmental issues;
- Comply with all relevant planning conditions, environmental legislation and statutory consents; and
- Promote best construction and environmental on-site practices for the duration of the works.

This CEMP defines the project-specific environmental measures that are to be put in place and procedures to be followed for the scope of construction works, both temporary and permanent, for the project. This plan and methodology seek to demonstrate how works on the project can be delivered in a logical, sensible and safe sequence with the incorporation of specific measures to mitigate the impact on people, property and the environment.

This should be viewed as a 'live' document, to be adapted and updated by the Main Contractor for implementation throughout the project in response to changing conditions on site. This review of construction activities covers a description of:

- Duration and phasing
- Site preparation
- Construction methods

- Materials source and transportation
- Employment and accommodation
- Dust, noise, and traffic
- Construction safety
- Waste disposal
- Services Requirements.

Proposed environmental measures that will be installed on site during construction are included in this CEMP. This document will be updated to include any additional conditions proposed by the relevant local authority as a result of their review of the CEMP.

The CEMP is an integral part of the site health, safety, environmental and quality management system and constitutes a component of the Construction Health and Safety Plan documentation. The CEMP is also subject to the requirements of the site quality management system with respect to documentation control, records control and other relevant measures.

In the event of an accident or emergency on site during the construction period, the CEMP will be reviewed, and procedures amended if necessary. All personnel and sub-contractors will be made aware of the CEMP during the toolbox talks. The site manager or his environmental manager will be responsible for maintaining and updating the approved document.

The Main Contractor will be required to produce a Contractor's CEMP, which will ensure that their construction activities are planned and will meet the environmental requirements outlined in this preliminary CEMP. The procedures agreed in this CEMP will be audited regularly throughout the construction phase to ensure compliance.

2 Legislation and Guidance

Relevant legislation and best practice guidance that have been considered includes but is not limited to the following:

2.1 National and International Legislation

- European Communities (Water Policy) Regulations 2003 (S.I. No. 722 of 2003) which brings into effect the EU Water Framework Directive (2000/60/EC);
- European Communities Environmental Objectives (Surface Waters) Regulations, 2009 (S.I. No. 272 of 2009;
- Local Government (Water Pollution) Acts 1977-1990.

2.2 Environment Liability Regulations

The Regulations supplement existing National and European Legislation to achieve the prevention and remediation of environmental damage. Environmental damage under the Environmental Liability Regulations 2008 means:

- Water damage that has significant adverse effects on water status under the Water Framework Directive (2000/60/EC);
- Land damage that creates a significant risk to human health as a result of the direct or indirect introduction, in, on or under land, of substances, preparations, organisms or micro-organisms; and
- Damage to protected species and natural habitats.

The Regulations represent an overarching piece of legislation that can be used together with all the Agency's existing powers but will only be used in the appropriate circumstances when environmental damage has occurred as a result of an incident.

2.3 Best Management Guidelines

The following Guidelines will be used, as a minimum, by the contractor to prepare their Method Statements and Environmental Management Plan:

- Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters. Inland Fisheries Ireland, (IFI, 2016);
- Inland Fisheries Ireland - Planning for Watercourses in the Urban Environment. A Guide to the Protection of Watercourses through the use of Buffer Zones, Sustainable Drainage Systems, Instream Rehabilitation, Climate / Flood Risk and Recreational Planning (IFI, 2020)
- Fishery guidelines for Local Authority works. Department of Marine and Natural Resources 1998;
- CIRIA – Guideline Document C532 – Control of Water Pollution from Construction Sites;
- CIRIA – Guideline Document C642 – Development and Flood Risk – Guidance for the Construction Industry;
- CIRIA Guidance C515: 'Control of groundwater for temporary works' (Somerville et al., 1986);
- CIRIA Guidance C741: Environmental good practice on site guide (Charles & Edwards, 2015);
- CIRIA Guidance C750D: 'Groundwater control: design and practice' (Preene et al., 2016);
- CIRIA - Control of water pollution from construction sites - guide to good practice (SP156);
- CIRIA - C648 Control of water pollution from linear construction projects & Site Guide C649;
- NetRegs Guidance for Pollution Prevention for works and maintenance in or near water (NetRegs, 2017);
- Environment Agency Pollution Prevention Guidelines for construction and demolition sites (EA, 2012);
- NRA (2005) Guidelines for the crossing of watercourses during the construction of National Road Scheme.

3 Proposed Development

3.1 Site Location

The Proposed Development spans across several areas in the Dún Laoghaire-Rathdown (DLR) County Council district. There is a variety of major transport links broadly serving the Proposed Development area including the M50 Southeastern Motorway, the N11, the Green Luas Line, and the DART Figure 3-1. The Dublin Mountains lie to the south, the Irish Sea lies to the east, and Dublin suburbs including Killiney, Dalkey, Lucan, and Dún Laoghaire lie to the north.

The urban environment across the Scheme is largely comprised of pockets of residential areas interspersed with industrial areas or large green spaces. To the north lands are increasingly urban and to the south lands are increasingly rural. The proposed development is mostly within built-up areas which are on the urban-rural fringe.

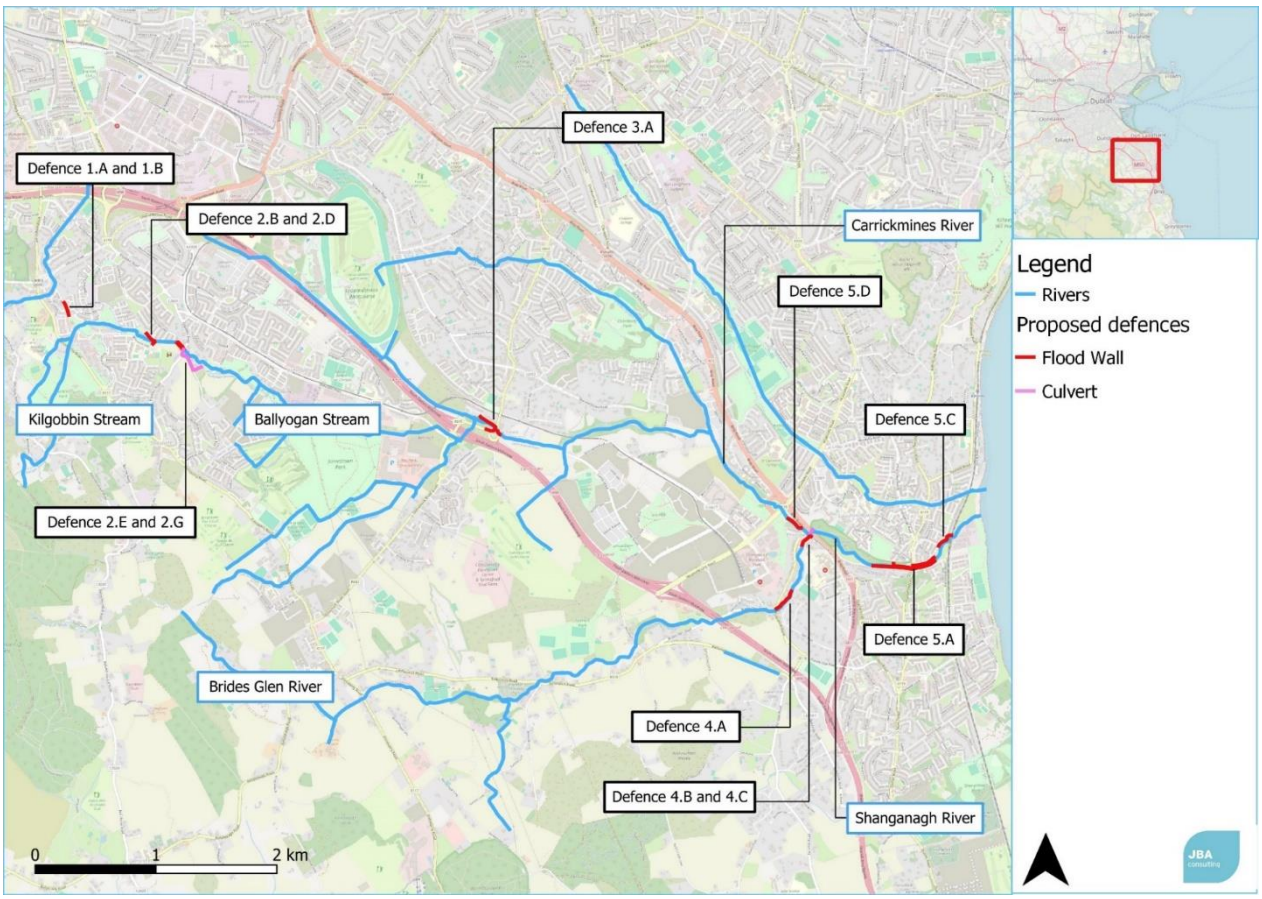

Figure 3-1: Carrickmines-Shanganagh FRS Overview

3.2 Proposed Development

A description of the proposed development comprises the following, from west to east (upstream to downstream). References to the areas are as shown in Figure 3-1.

3.2.1 Clon Brugh

Clon Brugh (Figure 3-1, 1.A and 1.B) is a residential estate situated just east of the R117 Enniskerry Road. It comprises a mix of 3-4 storey apartment blocks and houses, with small green areas, car parking, and footpaths. The proposed works in this area will be located along an area of linear green space and footpath. The area surrounding Clon Brugh is also primarily residential, with green space to the west and south in the Dublin mountains foothills.

The proposed measures at Clon Brugh will protect from flood overflows from the Carysfort-Maretimo stream. This watercourse is not within the Carrickmines-Shanganagh catchment, however during flood events, flood water from this watercourse overflows into the Clon Brugh housing development. The measures as described below will be constructed along an open green space area, with a stretch of existing flood wall that will be realigned.

- Construction of c. 113m of new flood defence walls up to 1.35m high, along the southeastern part of Clon Brugh adjacent to the existing overland flow path from the Carysfort Maretimo Stream.
- Demolition of c. 16m of existing masonry walls and realignment works to the existing footpath.

3.2.2 Belarmine Park

Belarmine Park (Figure 3-1, 2.B and 2.D) is a small public park surrounded by residential areas to the north, east, west, and southwest, and a school to the southeast. The Kilgobbin Stream flows through the park from roughly west to east through a wooded area, with grassy areas to the north and south. A small pond or wetland is also within the park. The stream enters a culvert at the eastern end of the park and emerges approx. 80m upstream of Kilgobbin Road. Works will be taking place at the boundary wall between the park and houses to the north in Sandyford Hall Grove and Sandyford Hall Crescent. Mature trees are present in the area of works.

- Replacement of c. 100m of the Sandyford Hall boundary wall with a new concrete flood defence wall up to 2.6m high
- Construction of c. 36m of new flood defence wall in Belarmine Park tying into the existing culvert inlet
- Minor upgrade works to the existing inlet structure.

3.2.3 Kilgobbin Road

Kilgobbin Road (Figure 3-1, 2.E and 2.G) is a small road lined with trees and stone walls, with a narrow footpath on one side for much of its length. The works in this area will take place along the boundaries of two houses on the western side of the road, before running beneath the road and turning east down a narrow laneway, finally running across an area of open space to join back with the river approx. 220m downstream. The houses in this area are all detached, on large plots of land. Kilgobbin House is a protected structure (RPS No.1684) whose stone wall boundary will be removed and reconstructed as a flood wall. The stone walls in this area are of cultural heritage value, and are discussed in Chapter 13, Cultural Heritage of the EIAR.

- Replacement of c.69m of existing stone boundary wall to a protected structure Kilgobbin House (RPS Ref: 1684) and construction of c.100m of stone finished flood defence walls up to c.1.7m upstream of Kilgobbin Bridge.
- Installation of c.298m of culvert from a proposed flow control weir at Kilgobbin Bridge to a discharge point adjoining Meadowbrook downstream.

3.2.4 Glenamuck Road North

The works at 3.A (Figure 3-1) are centred around the Glenamuck Road North Roundabout, Ballyogan Grove, and Priorsland. Works will be in close proximity to Carrickmines Castle (NMS - DU026-005001 /RPS 026-005005) and in view of houses along Ballyogan Grove and Priorsland. Glenamuck Road North is a busy link road between Carrickmines and the M50 Junction 15, with access also to the Carrickmines Luas Park and Ride, and Leopardstown Racecourse. The proposed works along the northern side of the roundabout are adjacent to an existing footpath and segregated two-way cycle lane, while those along Ballyogan Grove are adjacent to the existing road surface, and will replace an existing low stone wall.

- Demolition and removal of c. 128m of existing masonry walls.
- Construction of c. 259m of stone finished flood defence walls up to 1.9m high and upstream face of the bridge adjoining Glenamuck Road North.
- Construction of c. 90m of wall up to 1.5m high adjacent to the river immediately downstream of Glenamuck Road roundabout
- Installation of a new in-channel debris screen immediately upstream of the existing bridge.

3.2.5 Cherrywood Road

Cherrywood Road (Figure 3-1, 4.A) is a tree-lined local road with detached houses on either side. It is situated between the M50 to the west and the N11 to the east, with the Cherrywood SDZ to the north. Land use in this area is primarily residential, with large green spaces separating individual houses. The proposed works will take place within the property of three houses, adjacent to the river. The river has a riparian corridor here consisting of mature trees and other vegetation. Immediately downstream of this point, the river flows beneath the Cherrywood Viaduct, which is a protected structure (RPS No. 1783).

- Construction of c. 178m of a new concrete finished flood defence wall up to 2.7m high, including demountable barriers and railings, along the bank of the Brides Glen River adjoining existing properties at Cherrywood Road, upstream of the existing viaduct (RPS Ref. 1783).

3.2.6 Bray Road

The works at 5.D (Figure 3-1) will take place on the Carrickmines River, between a green field to the west and the rear of buildings on Bray Road to the east. Bray Road is a cul-de-sac adjacent to the N11 with a mix of commercial and residential buildings. The buildings back on to the river which flows south before crossing under the N11 in a culvert. A mix of trees line the river, with an open green field on its western side.

- Construction of c. 133m of concrete flood defence wall up to 3.4m high, including flood gate, along the bank of the Carrickmines River to the rear of existing properties at Bray Road.
- Circa 75m of river channel realignment, replacement of the existing access bridge and strengthening works to the existing masonry arch.

3.2.7 Lower Brides Glen

Approximately 100m southeast of the Bray Road works at Lower Brides Glen (Figure 3-1, 4.B), works will take place within the garden of a private residence called Waterfall Cottage,

- Construction of c. 129m of flood defence walls up to 2m in height above river channel level of the Shanganagh River adjoining existing properties upstream of the N11 culvert. Works include demountable barriers and decorative railings.

3.2.8 N11 Overflow Culvert

Installation of an overflow culvert to the Loughlinstown River South under the N11 to alleviate flooding immediately upstream of the current culvert under the N11 (Figure 3-1, 4.C). The N11 culvert overflow works are within Loughlinstown Woods, a densely wooded area which is also designated as a proposed Natural

Heritage Area (pNHA), the pNHA is discussed in Chapter 8 of the EIAR, Biodiversity. The works will consist of the following elements, including the removal of several trees.

- Installation of c. 53m of new 2.4m diameter overflow pipe beneath the N11 dual carriageway including inlet structure at Lower Brides Glen, and outlet structure at Loughlinstown Park.

3.2.9 Commons Road and Brookdene

Works at 5.A (Figure 3-1) will take place along the Shanganagh River as it flows from west to east along Commons Road, under the Shanganagh Road Bridge, and between Shanganagh Wood and Brookdene. Upstream of the bridge, Commons Road has residential development along its south side, with the river adjacent to the north. The northern side of the river at this point is wooded, with one house and a bridge providing access at roughly the midway point of the works. North of the wooded area is housing. Shanganagh Road Bridge is a protected structure (RPS No. 1772) and is a narrow two-lane stone arch bridge. Downstream of the bridge, Shanganagh Wood and Brookdene are both residential roads, with a footpath adjacent to the river along Shanganagh Wood, and a riparian strip and tree line on the left (north) bank at Brookdene.

- Construction of c.209m of flood defence walls up to 2.4m high on Commons Road adjoining the river.
- Structural works to upgrade c. 324m of existing flood defence walls upstream of Shanganagh Road Bridge to an overall height of up to c.3.6m.
- Structural remedial works to the existing Protected Structure, Shanganagh Bridge (RPS Ref: 1773) including underpinning, scour protection and reinforcement of the masonry parapet.
- Upgrading of c.113m of existing flood defence wall on River Lane to a height of up to c.1.8m and construction of c.185m of flood defence wall to a height of up to c.1.2m in in the Brookdene Estate.

3.2.10 Bayview

Bayview (Figure 3-1, 5.C) is a residential area bound to the east by the railway line and a green area through which the Shanganagh River flows. Bayview comprises semi-detached and detached houses with front and rear gardens. Downstream of this point, the river flows beneath the railway line and past Shanganagh Wastewater Treatment Plant to the south, before discharging into the sea at Killiney Bay.

- Construction of c. 95m stone finished flood defence walls up to c.1.8m high in the green area adjacent to Bayview Grove/Lawns.
- Replacement of c.17m of existing boundary wall at 20 Bayview Lawns with a new flood defence wall to match existing wall height and finishes and
- Replacement of remaining c.10m of fence and wall tying into the culvert under the railway with a concrete flood defence wall.

3.3 Receiving Environment

The Carrickmines-Shanganagh River catchment is approximately 36km^2 and encompasses a wide variety of land uses ranging from rural mountainous areas in the west, to urban residential areas in the east. The proposed development will be situated primarily in the built-up residential parts of the catchment.

3.4 Invasive Non-Native Species

Several high-impact invasive non-native species (INNS) were recorded in the area including Japanese Knotweed, Cherry Laurel, Giant Hogweed, Rhododendron and Sika Deer. Other INNS of medium impact include three-cornered Garlic, and Sycamore species. There is potential for working machinery to get contaminated with fragments of invasive non-native species and spread it elsewhere within the site or outside of the site boundary. Excavation and movement of soil has the potential to spread INNS across the area; any spoil removed from site has the potential to introduce INNS along the roads and at the receiving environment. Mitigation measures related to biosecurity are outlined in Section 6.11.

3.5 Watercourses in the Vicinity of the Proposed Site

The proposed development is located in the Ovoca-Vartry WFD catchment, Dargle_SC_010 sub-catchment, and Carrickmines Stream_010 and Shanganagh_010 sub-basins. The entirety of the scheme is located within the Wicklow groundwater body Figure 3 14. The Wicklow groundwater body currently holds "Good" WFD status (2016-2021); and is considered to be 'At Risk'.

The Carrickmines-Shanganagh river catchment comprises a number of streams and tributaries, in the upper reaches of the catchment, the Kilgobbin Stream flows east into the Ballyogan Stream. The Glenamuck Stream joins further downstream, before a confluence with the Racecourse Stream. This meets the Cabinteely Stream and becomes the Carrickmines River. At Cherrywood, the Carrickmines River meets the Shanganagh River, which continues to flow east, passing Shanganagh Wastewater Treatment Plant to the north before draining into the Irish Sea.

4 Roles and Responsibilities

The Main Contractor is responsible for ensuring that all employees and sub-contractors follow the requirements of the CEMP. The Contractor will be required to provide training and supervision to ensure that the requirements are adhered to.

It is anticipated that the main environmental responsibilities for the key staff will be as set out below.

4.1 Director of the Contracting Company

The director of the contracting company will be responsible for the overall strategic direction and decision making.

- Ensure all departments work towards project goals,
- Ensure the company complies with all legal, regulatory, and contractual obligations,
- Maintain relationships with key stakeholders including clients, regulatory bodies, and the community.

4.2 Contracts Manager

The contracts manager will:

- Oversee the project contracting process from start to finish,
- Manage contracts with clients, sub-contractors, and suppliers ensuring compliance with terms and conditions of contracts,
- Ensure all contractual obligations are met,
- Prepare regular progress reports for stakeholders.

4.3 Site Manager

The site manager will be required to:

- Prepare the Contractor's CEMP. This will include the key elements as outlined in this preliminary CEMP;
- Be responsible for ensuring that adequate equipment, adequate control measures and adequate resources are made available to meet the requirements of the CEMP;
- Manage the preparation of the methods statements and will be responsible for implementing these on-site;
- Retain all training records; and
- Retain all records on the quantities of material that leaves the site for disposal, and all disposal records.

4.4 Ecological Clerk of Works

- Act as the contact for the Planning Authority and agree the frequency and number of site inspections and monitoring programme for the implementation of the biodiversity related mitigation of the EIAR and CEMP;
- Act as the primary on-site ecological contact for the main contractor and site manager regarding implementation of the biodiversity-related mitigation of the EIAR and CEMP;
- Ensure compliance with all biodiversity-related mitigation of the EIAR and CEMP;
- Request relevant records and documentation from the site manager where necessary;
- Attend routine meetings with the site manager;
- Keep detailed records of any ecological incidents and the remedies required and implemented. Report these to the main contractor and Planning Authority;

- The ECoW shall produce the staged monitoring reports in agreement with the Planning Authority on the implementation of biodiversity-related mitigation of the EIAR and CEMP. The ECoW shall submit these directly to the Planning Authority and to the main contractor;
- The ECoW shall also act as overall technical advisor to the main contractor and site manager regarding the implementation of all biodiversity-related mitigation of the EIAR and CEMP.

4.5 Health and Safety Manager

The health and safety manager will be required to:

- Formulate a Health and Safety Plan as required by the Safety, Health, and Welfare at Work (Construction) Regulations, 2013,
- Manage the provision of PPE and ensure proper implementation,
- Prepare risk assessments,
- Establish medical protocol,
- Prepare escape and evacuation procedures,
- Implement appropriate communications with site staff including toolbox talks and daily briefings with respect to health and safety
- Maintain a record of the location and contact information for the nearest emergency services and facilities including:
    - Accident and Emergency (A&E)
    - Ambulance Service
    - Fire Services
    - Local Garda station, district and divisional headquarters

4.6 Waste Manager

The waste manager will be responsible for waste management during the construction phase and will be required to:

- Implement the waste management procedures contained in the CEMP prepared by the contractor;
- Ensure that waste management procedures and methods comply with local and national regulations
- Track waste generation, handling and disposal and report on performance of waste management regularly;
- Promote and implement waste reduction;
- Update the CEMP's waste management procedures as needed as the program progresses;

4.7 Liaison Officer

The Liaison Officer will act as the primary point of contact between the project team, relevant stakeholders and the community. They will be required to arrange for liaison with:

- Dún Laoghaire-Rathdown County Council;
- Statutory and regulatory bodies;
- Property owners temporarily affected by proposed works; and
- Community members.

4.8 Staff, Operators, and Sub-Contractors

Staff and operators will be responsible for:

- Ensuring that mitigation measures are in place before the work commences;

- Reporting any environmental incidents to the site manager and the ECoW;
- All site personnel will undertake site induction prior to carrying out any activity. Induction topics to be covered include:
  - Duties and responsibilities;
  - Emergency response procedure;
  - Site rules;
  - Environmental best practice; and
  - Waste management and housekeeping

4.9 Continuous Monitoring

Continuous monitoring of the site will be performed by the site manager.

5 Construction Operations

The construction of the scheme will lead to employment by direct construction work, and indirectly by the requirement for other local support services during the works. The numbers employed are unknown at this stage and are also likely to vary over the construction period.

5.1 Programme of Works

5.2.1 General Construction Methodology

A general sequence of construction activities is outlined below:

- Install temporary traffic management measures, including localised signage and advanced advertisement and site accommodation works (i.e., hoarding within the works area)
- Vegetation clearance and demolition of existing structures marked for removal
- Undertake enabling works including identification of utilities
- Excavations of existing ground surface
- Undertake ground preparation works
- Installation of concrete flood walls
- Import and compact suitable filling material
- Backfill excavated material
- Reinstate barriers, boundaries, access, and gardens where appropriate

5.2 Equipment, machinery and works.

Equipment to be used during the construction of the works will be typical of a project of this scale. The precise configuration of on-site plant will be determined by the contractor. In general, the following machinery will be used:

- Excavators;
- Dumpers;
- Pile drivers;
- Pumps;
- Concrete pumps;
- Cranes;
- Forklifts;
- Delivery vehicles for materials; and
- Generator

5.3 Site Confines

Mitigation measures associated with the proposed development site are shown in section 6 and compound locations are shown in Figure 6-1, Figure 6-2 and Figure 6-3. Site establishment by the Contractor will be limited to the following:

- Setting up of access control to the site;
- Construction traffic management and alert signage, including pedestrian management;
- On-site toilet facility, site offices and site canteen;
- Temporary fencing, hedgerow/tree protection fencing, silt (watercourse protection) fencing and site security;
- Bunded storage of fuels and refuelling area; and
- Storage of materials.

5.4 Method Statements

In advance of any operations commencing at the site the appointed contractor will be required to prepare Method Statements for approval by DLRCC. The method statement should accompany the submission to the council – along with this CEMP for approval. This may include:

- Location of site compounds, storage areas, and car parking facilities for workers;
- Site security fencing and hoarding, including fencing off of sensitive ecological features;
- Traffic management plan and Waste Disposal Plan;
- Working within private properties;
- Details on vegetation clearance and earthworks, Landscape Plan;
- Biosecurity Plan;
- Storm Water Management Plan; and
- Bunding/drip tray proposals for fuel storage & vehicles as required.

6 Environmental Impacts and Mitigation Requirements

During the construction and operational stages of the development there are potential risks to ecological features from the following;

- Potential leakage of hydrocarbon/lubricants;
- Increased surface water runoff and sediment loading;
- Concrete spills;
- Physical and noise disturbance to habitats and species;
- Dust deposition;
- Noise;
- Vibration; and
- Lighting disturbance.

Measures will be proposed in the following sections to mitigate against any potentially significant impacts on the surrounding environment in the vicinity of the site and downstream of the site. These measures were developed in and as a result of the EIAR prepared for the development.

6.1 Toolbox talks and Environmental Management

A suitably qualified ECoW will be appointed to oversee all site installation activities with respect to the environment. This shall include preparation and delivery of toolbox talks to on-site personnel. Topics covered will include spill control, working on or near watercourses, silt management, storage of waste, working around trees and hedgerows, nesting birds, protected species and invasive non-native species.

The ECoW will oversee critical activities on site that could have an impact on sensitive habitats and species. The ecologist will be responsible for ensuring that measures set out in this CEMP shall be implemented.

6.1.1 Standard Environmental Best Practice

The activities required for the proposed development's construction phase shall remain within the boundary of the proposed site, bar select compound areas, which will be located in adjacent lands for mitigation control reasons. The CEMP will also strictly adhere to best practice environmental guidance including but not limited to the following:

- CIRIA Guidance C532: Control of water pollution from construction sites. Guidance for consultants and contractors;
- CIRIA Guidance C741: Environmental good practice on site guide;
- CIRIA Guidance C750D: Groundwater control: design and practice;
- CIRIA (C512): Environmental Handbook for Building and Civil Engineering Projects;
- CIRIA (C697): The SUDS Manual;
- CIRIA (C649) Control of water pollution from linear construction projects: Site guide;
- CIRIA (C848): Control of water pollution from linear construction projects: Technical guidance;
- Inland Fisheries Ireland: Guidance on Protection of Fisheries During Construction Works In and Adjacent to Waters; and
- Inland Fisheries Ireland: A Guide to the Protection of Watercourses through the use of Buffer Zones, Sustainable Drainage Systems, Instream Rehabilitation, Climate / Flood Risk and Recreational Planning

6.2.1 Environmental Management of Site Compounds

The principal contractor will be required to ensure good environmental management within the site compounds. The below list of measures will be incorporated into site compound environmental management:

- During construction, there is potential for a flood event to occur which would result in flooding of these compound areas. As potential pollutants are likely to be stored in the compounds, this could lead to indirect negative impacts on water, biodiversity, and human health.
    - Any lubricants, oils, fuels, cement or other potentially harmful chemicals or substances will be stored in areas of the compounds outside of the flood zones shown in Figure 6-1, Figure 6-2 and Figure 6-3.
- The proposed site compounds are not located in areas of sensitive habitat, and are located on dry land and set back from watercourses;
- Lubricants, oils, fuels, cement or other chemicals will be stored in sealed containers in a bunded area. This storage area will be located in the main compound, outside the flood extent shown in Figure 6-1, Figure 6-2 and Figure 6-3.
- The contractor will only store a manageable quantity of materials in the secondary compounds at any one time. The contractor will also import and export soil continuously, to limit the quantity of soil stored on site at one time;
- Only plant and materials necessary for the construction of the works will be permitted to be stored at the compound location;
- Site establishment by the Contractor will include the following:
    - Site offices;
    - Site facilities (canteen, toilets, drying rooms, etc.);
    - Office for construction management team;
    - Secure compound for the storage of all on-site machinery and materials;
    - Temporary car parking facilities;
    - Temporary fencing; and
    - Site Security to restrict unauthorized entry;
- All sub-contractors will be given an induction toolbox talk so that they are aware of material storage arrangements;
- Construction materials within the compound will be stored in a designated area in an organised manner so as to protect them from accidental damage and deterioration as a result of exposure;
- Bunded storage of fuels and refuelling area. Bunds shall be 110% capacity of the largest vessel contained within the bunded area;
- A chemical storage plan will be in place as required, including spill kits;
- A separate container will be located in the Contractors compound to store absorbents used to contain spillages of hazardous materials. The container will be clearly labelled, and the contents of the container will be disposed of by a licenced waste contractor at a licenced site. Records will be maintained of material taken off site for disposal;
- A maintenance programme for the bunded areas will be managed by the site environmental manager. The removal of rainwater from the bunded areas will be their responsibility. Records will be maintained of materials taken off site for disposal;
- The site environmental manager will be responsible for maintaining all training records and weekly environmental inspections;
- Drainage collection system for washing area to prevent run-off into surface water system;
- Stockpiling of spoil and spoil-like materials will be appropriately located within the compounds to minimise exposure to prevailing winds and risk of runoff; and
- All refuelling of vehicles will be carried out at the fuel stores within the site compounds and only ADR trained personnel will be permitted to operate fuel bowsers.

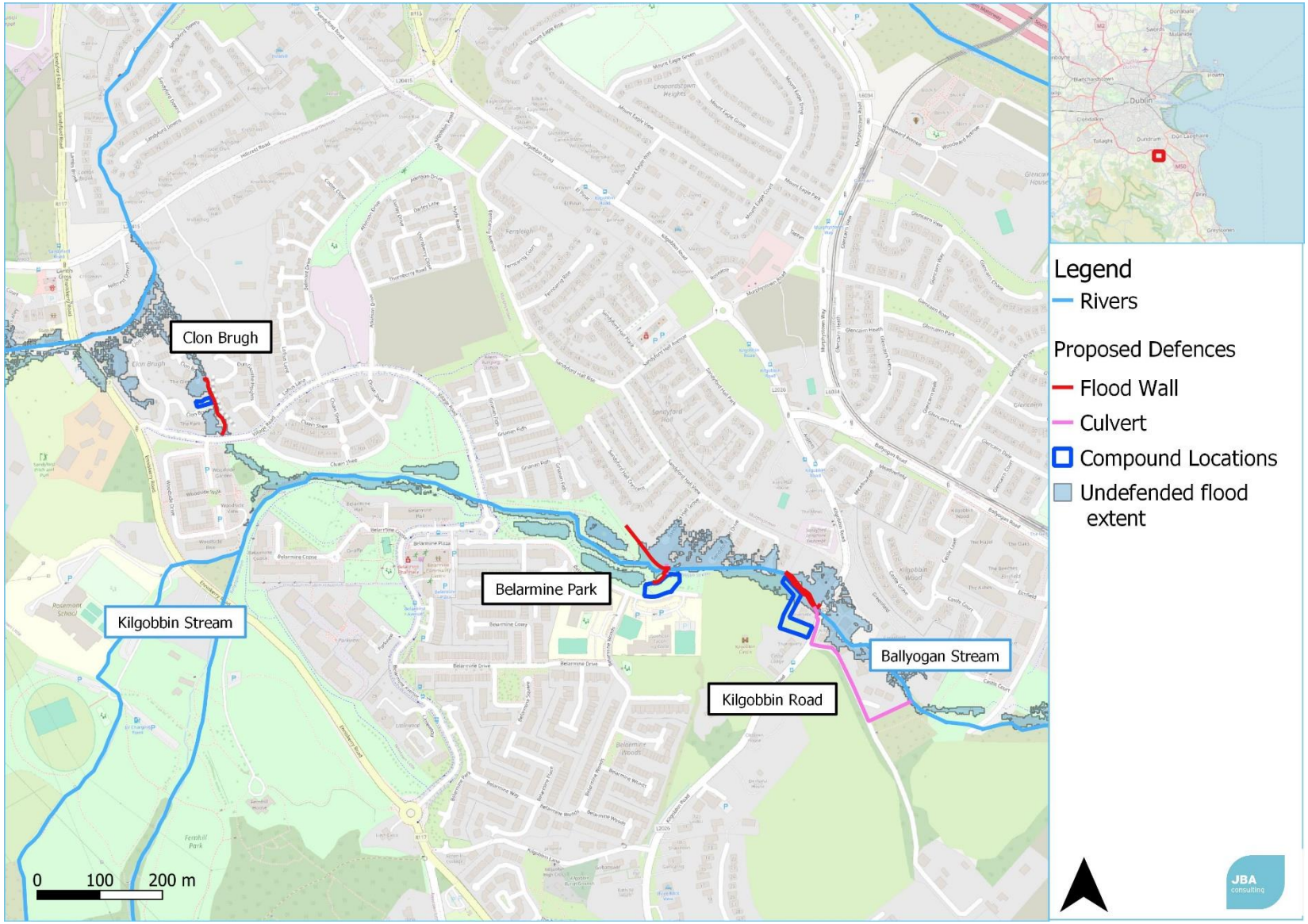

Figure 6-1 Construction compound flood risk at Clon Brugh, Belarmine Park, and Kilgobbin Road

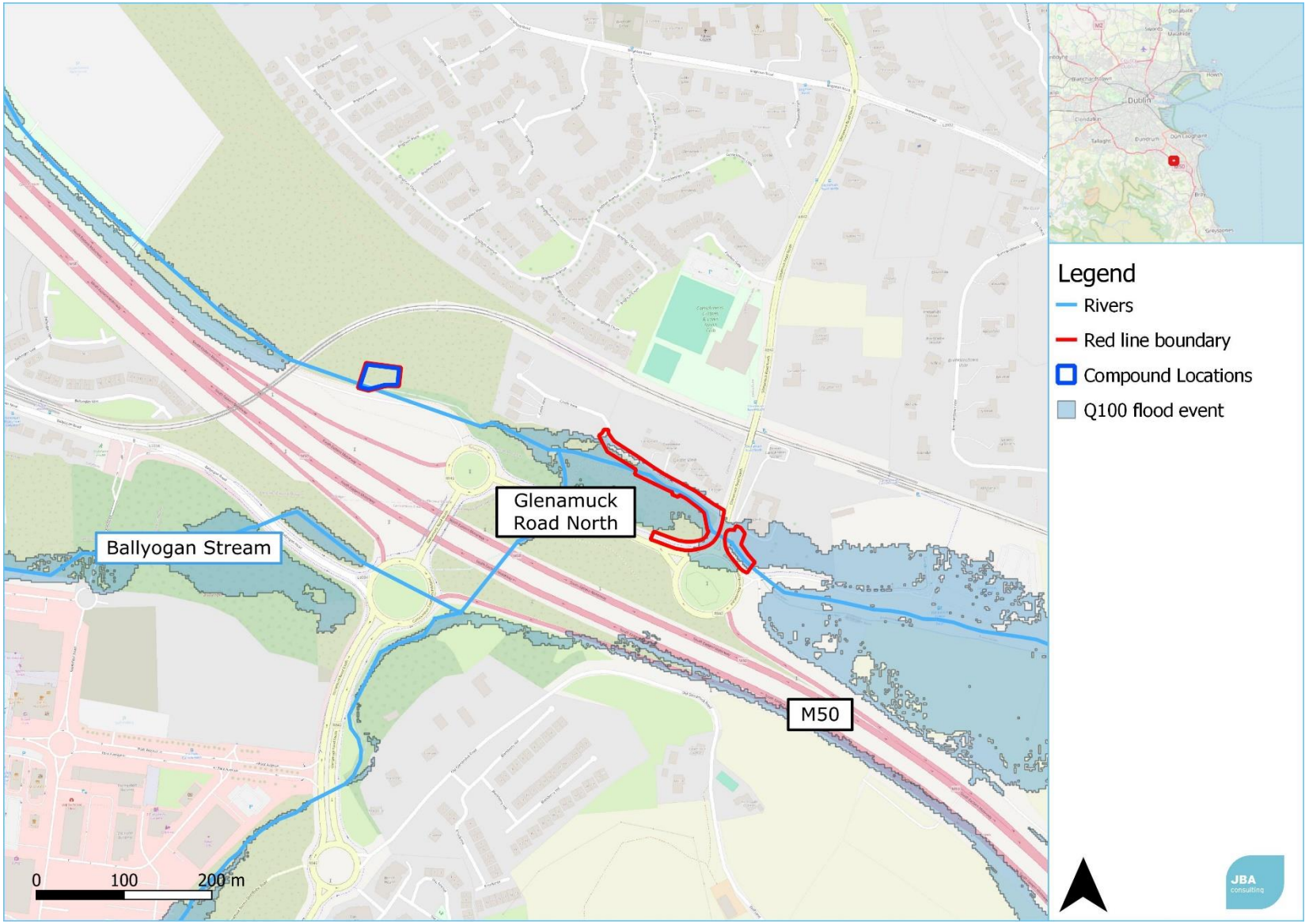

Figure 6-2: Construction compound flood risk at Glenamuck Road North

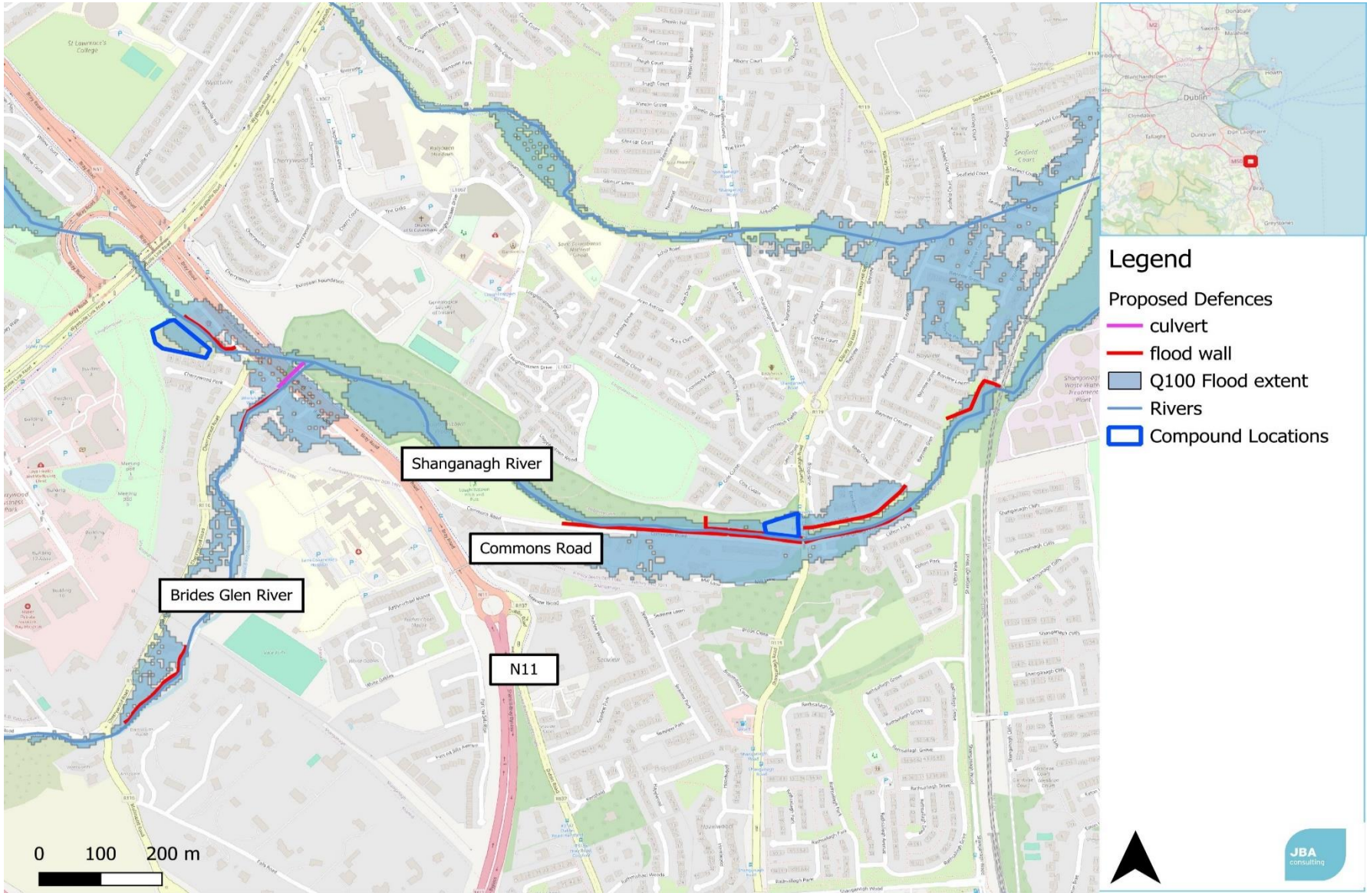

Figure 6-3: Construction compound flood risk at Bray Road and Commons Road

6.2 Planned Erosion and Sediment Control Practices

6.2.1 Protecting Water Quality - Surface Water Controls

In order to protect surface water throughout the proposed development site, the principal contractor will be required to develop and implement a Surface Water Management Plan and Pollution Control Plan.

6.2.2 Surface Water Management Plan

In order to safeguard the local surface water network, and in turn the local groundwater network, from surface water-based pollution events, the following must be strictly adhered to:

- The Principal Contractor will ensure compliance with environmental quality standards specified in the relevant legislation, namely 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 will construct a site compound at a location remote from any drains;
- Oil booms and oil soakage pads will be maintained on-site to enable a rapid and effective response to any accidental spillage or discharge. These shall be disposed of correctly and records will be maintained by the environmental manager of the used booms and pads taken off site for disposal;
- Management of silt-laden water on-site, including procedures for accidental leaks / spills to ground, as well as water quality monitoring to ensure compliance with environmental quality standards specified above;
- At no point during the construction phase will untreated water be discharged to local surface water network without the water quality meeting the statutory limits as set under the environmental quality standards specified above;
- Fail-safe site drainage and bunding through drip trays on plant and machinery will be provided to prevent discharge of chemical spillage from the sites to surface water;
- Any accidental discharge will be controlled by the use of oil booms in the water prior to construction starting;
- Washout of concrete plant will occur at a designated impermeable area with waste control facilities;
- Wherever reasonably possible, pre-cast concrete features should be utilised to minimise the risk of a concrete-based pollution event;
- Concrete delivery, concrete pours and related construction methodologies will be part of the procedure agreed with the contractor to mitigate any possibility of spillage or contamination of the local environment. Particular attention will be paid during the pouring process in order to avoid leakages or spills of concrete;
- Temporary stockpiles will be monitored for leachate generation. These stockpiles will be placed within designated areas and not located within the vicinity of watercourses, wetlands or artificial surface water drainage features;
- Excavated contaminated soils will be segregated and securely stored in a designated area where the possibility of runoff generation or infiltration to ground or surface water drainage has been eliminated through bunding and imperviable geotextile linings. The contaminated soils will then be classified as clean, inert, non-hazardous or hazardous in accordance with the EC Council Decision 2003/33/EC. Furthermore, the contractor will ensure that no cross-contamination with clean soils happens elsewhere throughout the development site;
- Silt fencing will be installed prior to the commencement of any construction works in order to enhance the protection of identified water features (Figure 6-4). An ECoW will be present during the installation of these protective measures to ensure that they are installed to best practice standard and correctly located in their assigned areas. The following sub-sections will provide greater detail on specific locations of these silt fence / trench sections;
- Silt fences will be repaired and/or replaced as necessary by the principal contractor as part of the on-going environmental monitoring programme;
- Planning of works should be conscious of available weather forecasts and avoid working during heavy rain/storm events to minimise the risk of runoff;

- Storage locations and topsoil piles will be placed in appropriate places, distant to existing drains/sewerage within site;
- All soil stockpiles shall be covered (i.e., with a tarpaulin or vegetated) to minimise the risk of rain/wind erosion. Vegetation will be established as soon as possible on all exposed soils;
- In the event of an extended dry period, stockpiles will be dampened using a water to minimise the risk of airborne particles entering watercourses;
- Silt fencing or other appropriate measures shall be put in place downstream of exposed soils or soil stockpiles; and
- Excavations will remain open for as little time as possible before the placement of fill to minimise the potential of water ingress into excavations.

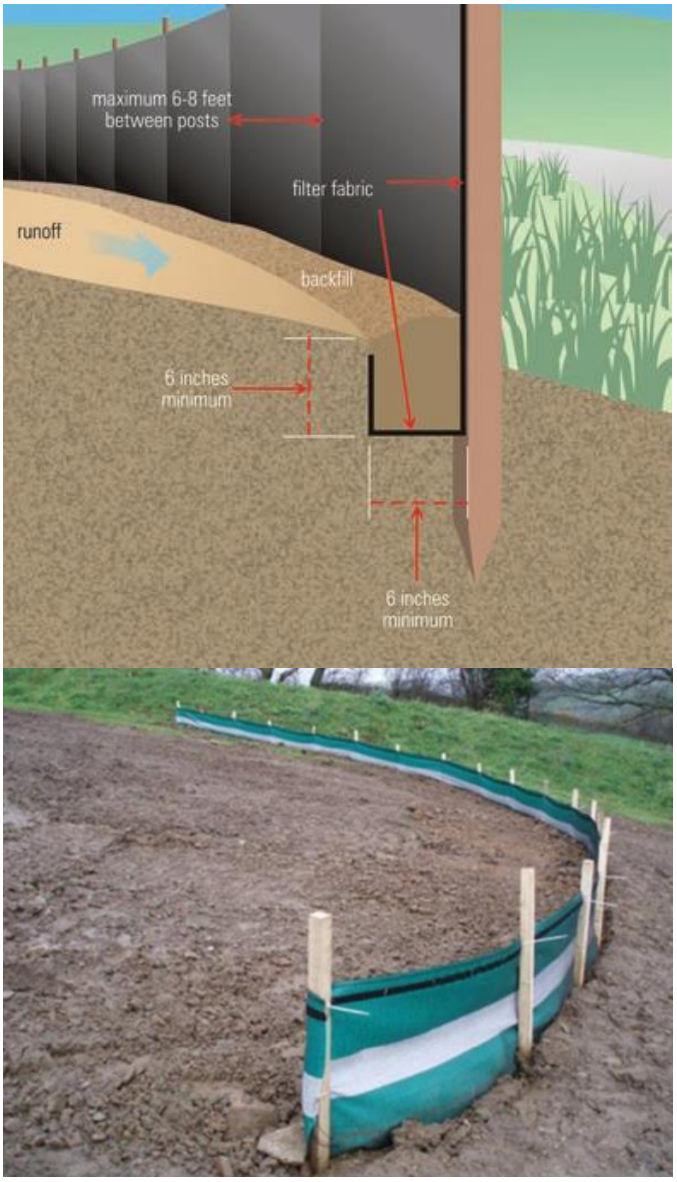

Figure 6-4: Example of suitable silt fence mitigation ensuring maximum safeguard efficiency

6.2.3 Concrete Management Procedures

A concrete management plan will be drawn up at the outset of the project to ensure safe management of concrete pours, management of concrete lorries and washing of materials used in concrete construction etc. It will cover at minimum the points below:

- Washout of concrete plant will occur at a designated impermeable area with waste control facilities.

- Concrete delivery, concrete pours and related construction methodologies will be part of the procedure agreed with the contractor to mitigate any possibility of spillage or contamination of the local environment. Particular attention will be paid during the pouring process in order to avoid leakages or spills of concrete;
- Wherever reasonably possible, pre-cast concrete features should be utilised to minimise the risk of a concrete-based pollution event; and
- Controlled release or pre-washing of installed culverts to ensure that the first release of water through culverts does not result in a washing through of concrete (and other built-up debris).

6.2.4 Pollution Control Plan

In case of accidental spills, the following will be taken into account:

- There will be no refuelling of machinery within or near the river channel. Refuelling will take place at designated locations at distances of greater than 30 metres from the watercourse;
- No vehicles will be left unattended when refuelling and a spill kit including an oil containment boom and absorbent pads will be on site at all times;
- Spill kits containing absorbent pads, granules and booms will be stored in the site compound with easy access for delivery to site in the case of an emergency;
- A minimum stock of spill kits will be maintained at all times and site foremen's vehicles will carry large spill kits at all times;
- Absorbent material will be used with pumps and generators at all times and used material disposed of in accordance with the Waste Management Plan;
- All used spill materials e.g., absorbent pads, will be placed in a bunded container in the contractor's compound. The material will be disposed of by a licenced waste contractor at a licenced facility;
- Records will be maintained by the ECoW and/or an environmental site manager; and
- Regular inspections and maintenance of plant and machinery checking for leaks, damage or vandalism will be made on all plant and equipment.

In the event of a spill the principal contractor will ensure that the following procedure are in place:

- Emergency response awareness training for all Project personnel on-site works;
- Appropriate and sufficient spill control materials will be installed at strategic locations within the site. Spills kits for immediate use will be kept in the cab of mobile equipment;
- Refuelling will take place at designated locations at distances of greater than 30 metres from the watercourse;
- Vehicles should not be left unattended when refuelling;
- Any fuel needed to be stored on the site will be stored appropriately and at a location that is set back from the river. All other construction materials will be stored in this compound. The compound will also house the site offices and portable toilets. This compound will either be located on ground that is not prone to flooding or will be surrounded by a protective earth bund to prevent inundation;
- All vehicles will be regularly maintained and checked for fuel and oil leaks;
- Spill kits will be stored in the site compound with easy access for delivery to site in the case of an emergency. A minimum stock of spill kits will be maintained at all times and site vehicles will carry spill kits at all times. Spill kits must include suitable spill control materials to deal with the type of spillage that may occur and where it may occur. Typical contents of an on-site spill kit will include the following as a minimum:
    - Absorbent granules;
    - Absorbent mats/cushions;
    - Absorbent booms;
    - Track-mats, geotextile material and drain covers.
- All potentially polluting substances such as oils and chemicals used during construction will be stored in containers clearly labelled and stored with suitable precautionary measures such as bunding within the site compound;

- All tank and drum storage areas on the site will, as a minimum, be bunded to a volume not less than the following:
  - 110% of the capacity of the largest tank or drum within the bunded area, or
  - 25% of the total volume of substances which could be stored within the bunded area.
- All hydrocarbons to be utilised during construction are to be 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'[1];
- The site compound fuel storage areas and cleaning areas will be rendered impervious and will be constructed to ensure no discharges will cause pollution to surface or ground waters.
- Designated locations for refuelling are within site compound;
- Potentially contaminated run off from plant and machinery maintenance areas will be managed within the site compound surface water collection system;
- Damaged or leaking containers will be removed from use and replaced immediately;
- The use of settling lagoons, settling tanks, or equivalent, with outflow control measures may be used for the interception of surface water or groundwater pumped from an active working area;
- If a spillage of a hazardous material to groundwater occurs, the groundwater will be contained and pumped to a tank or holding vessel prior to shipment off site for disposal. The contractor will maintain disposal records. The contractor will identify the cause of the spillage and mitigation measures and controls will be put in place to prevent a repeat. The CEMP for the site will be updated and contractors and sub-contractors will be made aware of the amendments;
- The Contractor will clean equipment prior to delivery to the site. The Contractor will avoid using any equipment which leaks fuel, hydraulic oil, or lubricant. The Contractor will maintain equipment to ensure efficiency and to minimise emissions. Where possible, the contractor should maximise the use of biofuels;
- Management/Response plans will be implemented to identify mobilisation of soil particles/pollution and initiate the interception and treatment of pollution/silt runoff;
- The use of precast elements should be maximised to avoid wet concreting in close proximity to water.

6.2.5 Flooding During Construction

There is a possibility that a flood will occur during the construction phase. To ensure that the Carrickmines-Shanganagh area does not become vulnerable to floods during construction, the contractor will be required to monitor conditions that may cause inundation. In the event of a storm event, temporary flood barriers will be erected at the exposed locations. All works undertaken near the banks will be fully consolidated to prevent scour and run-off of silt. Consolidation may include use of protective and biodegradable matting or geotextiles on the banks and the sowing of grass seed on bare soil. Earth works will be aimed to take place during the driest season to ensure that any flooding during the wet season does not result in mobilisation of significant quantities of unconsolidated material.

[1] NRA (2008) Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes, available: https://www.tii.ie/tii-library/environment/construction-guidelines/Guidelines-for-the-Crossing-of-Watercourses-during-the-Construction-of-National-Road-Schemes.pdf.

6.3 Ecological Mitigation Measures - Construction Phase

6.2.1 Construction of the Walls

There are proposed walls running along sections of the Carrickmines Stream, or on lands setback from the banks. These sections include within stretches where trenched silt fencing is not feasible in some of these locations due to the presence of trees nearby. Construction works will take place as follows:

If demolition of an existing wall takes place first, a light silt fence with shallow stakes will be placed between the existing wall and the adjacent habitats (woodlands or rivers) in advance of deconstruction. This light silt fence will be lined with terram/geotextile material which will be held down with geotextile sandbags, the fence itself can also be reinforced with geotextile sandbags to the rear. This lightweight silt fence will sit on the surface of adjacent habitats and can be manoeuvred around vegetation, limiting damage to trees and particularly their roots. This method will be used instead of normal silt fencing which requires a shallow trench to be dug. The silt fence will prevent any silt or debris created during the deconstruction of the wall from entering the adjacent habitats.

After the wall is demolished/disassembled, excavations for the new wall foundations can be constructed. Once this work is complete, any sand and silt build up in the silt fencing will be removed in the direction away from the adjacent habitats. Any silt will be carefully disposed away from watercourses.

Protection of water from cement leachate: It is expected that the flood wall and foundations will be constructed in-situ using poured concrete however, there may be scope to propose pre-cast concrete units following the detailed design site investigations. The newly excavated space to facilitate the wall foundations should be lined with an impermeable geotextile to create a sealed working space with a fenced buffer between any works involving concrete or cement. Once this area is lined the foundation and wall can be constructed.

Once the wall is constructed the silt fencing will be carefully removed so as to not introduce any trapped pollutants into any adjacent habitat. This will be completed by hand with silt fencing transported out of the area by wheelbarrow. Alternatively, the silt fencing can be placed in a suitable container and lifted over the wall using machinery placed on the opposite site of vulnerable habitats

6.2.2 Culvert design

There will be installation of new culverts throughout the scheme, and construction of these culverts should follow best practice guidance outlined in:

- OPW (2021) ‘Design guidance For Fish Passage On Small Barriers’.

The OPW document is the preferred best practice document for engineering reference however a concise description of preferred culvert design and headwall is also described in the TII, IFI and Loughs Agency Documents:

- TII (2015) Design of Outfall and Culvert Details
- IFI (2016) - Guidelines on protection of fisheries during construction works in and adjacent to waters which includes
- Loughs Agency (2011) - Guidelines for Fisheries Protection during Development Works (Foyle and Carlingford areas)

Mitigation must be put in place to ensure its positioning and length is not an obstacle to fish passage. The culvert must meet the following criteria:

- A gradient of 5% should never be exceeded, with 3% being the preferred upper limit

- Be positioned such that both the upstream and downstream invert shall be 500mm below the upstream and downstream riverbed invert levels respectively.
- Piped culverts should be avoided wherever possible, with inverted U shape or box culverts over the existing stream bed being the preferred option. A piped culvert should be avoided wherever possible. If a piped culvert is the only option at detailed design, IFI must be consulted in advance of works, and the piped culvert must be buried deeper than bed level so that the natural bed material can be retained. This is to maintain natural roughness throughout the culvert.
- Pools should be formed at each end of the culvert to provide transition from the shape of the opening to the shape of the river downstream. Pools should, ideally, be built in natural rock and be designed to provide take-off conditions for upstream migrants entering/ leaving the culvert.
- The areas around the inlet and outlet should be planted with transitional planting (Willow or Alder) so that there is not a stark difference in lighting between the open channel and culvert.
- Flow velocity should be as slow as possible with water depth through the culvert kept as deep as possible. Maximum flow velocities during standard flow should not exceed 1.2m/sec. Power densities should not exceed 150Wm^3.
- Head drops should be avoided during detailed design, but if absolutely required a maximum head drop of 0.1m can be permitted.
- If trash screens are required, they should be adequately spaced to approximately 230mm to allow for fish passage. Mesh screens should be avoided.

The construction and improvement of integrated precast headwalls at the upstream end of the Clontygar diversion should take environmental considerations into place, which would include the allowance of lighting to pass into the culverts.

6.2.3 Mammals

Bats

Construction will take place within daylight hours, outside of bat activity hours (i.e., one hour pre-sunset) to minimise the risk of disturbance to commuting and foraging bats.

Mitigation measures are required to minimise the risk of disturbance to roosting bats, including those potentially roosting in trees scheduled for removal:

- A suitably qualified ecologist (ECoW) will be present during the removal of any trees with bat roost potential, to monitor for bats during felling;
- Any clearing of vegetation/trees with the potential for bat roosting should be completed in September/October (i.e., before the hibernation period begins, so that bats have the opportunity to move on from the site while conditions are still favourable to find new roosts) and can be carried out without a licence;
- Soft-felling techniques will be employed, with trees left to lie for 24 hours before removal, in order to allow any roosting bats to escape; and
- Lighting will not shine directly onto any roosts identified within the works area.

Badger

A toolbox talk will be given to all site staff on the identification of and protected status of Badger. There are no Badger setts present within the footprint of the works at present. A pre-works check will be undertaken to check if any new setts have been created ahead of the construction works and suitable mitigation will be put in place in this instance. In addition, the general avoidance measures outlined below in Section 6.2.6 will be followed.

Otter

A toolbox talk will be given to all site staff on the identification of and protected status of Otter. There are no Otter resting sites present within the footprint of the works at present. A pre-works check will be undertaken

to check if any new holts have been created ahead of the construction works and suitable mitigation will be put in place in this instance. In addition, the general avoidance measures outlined below in Section 6.2.6 will be followed.

Nesting birds

Where possible, all vegetation clearance will take place outside of the main breeding season for birds (March to Sept). Where this is not possible, any clearance will be preceded by a nesting bird check by a suitably experienced ecologist. Any active nests will be safeguarded until the chicks have fledged. Amphibians

Amphibians

Clearance of any of the pond-edge vegetation outside of the winter months at Belarmine Park or of the dry ditch that runs through Clon Brugh will be subject to a two-stage cut in order to allow for any amphibians to displace to other habitats and reduce the risk of killing and injuring. This will involve first cutting the vegetation to approximately 150mm, before cutting again to ground level within 48 hours after a check to ensure that all amphibians have moved on.

6.2.4 Invasive species management plan

Due to the high risk of spreading INNS during the construction phase, an INNS management plan has been written and will be included within the contractor's CEMP. This includes enhanced biosecurity measures, and a plan for either removal of any contaminated soils or burial where appropriate. In addition, all machinery, equipment and PPE entering a channel will have been subject to biosecurity measures such as the 'check, clean, dry' approach before they arrive on site to ensure no new INNS or pathogens are spread to the site. The Invasives Management Plan is also included in the EIAR Volume 3 for the proposed development, Appendix 8.5.

Liaison with the NPWS may be required depending on species encountered.

6.2.5 Fish

Fish in the area will likely leave through disturbance. Where possible, all-in channel works will be undertaken in dry working conditions. Any over pumping or dewatering works will use fish friendly pumps and a section of channel will open to flow wherever possible. Where dewatering works are required, a fish rescue will be undertaken.

Translocation efforts will follow guidelines for standard electrofishing surveys as set out in Harvey and Cowx (2003)[2]. To successfully translocate fish (and Lamprey ammocoetes), this work should be carried out following the criteria below:

This work is conducted by an electrofishing team which is led by a qualified aquatic ecologist and/or ECoW under license - Section 14 of the Fisheries (Consolidation) Act, 1959 as substituted by Section 4 of the Fisheries (Amendment) Act, 1962.

- The precise location of the proposed in channel works must be communicated with the Electrofishing lead who will conduct the translocation work in tandem with the piling efforts. Stop nets reaching to the river bottom will be erected around affected areas.
- The electrofishing lead will assess the substrate conditions to determine if appropriate habitat is present before be fishing the areas using a zigzag pulse and draw manner with a minimum effort of 1 minutes fishing per sq. m.

2 Harvey J & Cowx I (2003). Monitoring the River, Brook and Sea Lamprey, Lampetra fluviatilis, L. planeri and Petromyzon marinus. Conserving Natura 2000 Rivers Monitoring Series No. 5, English Nature, Peterborough.

- Captured fish will be quickly removed using a dip net (not the electrofishing anode) and placed in a storage tank with aeration system. Lamprey will be spread out across appropriate habitat at a density of <10 sq. m.
- If adult salmon/trout and other coarse fish are trapped and subsequently recovered, they should be returned to the river as soon as they are caught. Others that may be caught during fishing efforts should be moved to an aeration system before being transported to a section of the Shanganagh River with appropriate habitat. Fish should not be kept within the aeration system for more than 2 hours.
- Fishing efforts should continue until it there is successive efforts with no catch return.
- Works should not take place if the water temperature exceeds 20°C to avoid thermal stress in fish. Dissolved oxygen levels should also be kept to 90% or above. If there is a significant reduction in oxygen level or if significant stress/mortality s observed fishing efforts should be suspended.
- Fishing efforts should be described in detail within the Construction Methodology and project CEMP. This methodology should be approved by IFI in advance of works.

6.2.6 General Avoidance Measures

General avoidance measures that should be incorporated by the contractors working on site include:

- Limit the hours of working to daylight hours, to limit disturbance to nocturnal and crepuscular animals;
- Due to the potential presence of; Red Squirrel, Hedgehog, Badger, Pine Marten and Pygmy Shrew and the confirmed presence of bats, the use of lighting at night should be avoided. If the use of lighting is essential, then a directional cowl should be fitted to all lights to prevent light spill and to be directed away from all treelines / wooded areas.
- Contractors must ensure that no harm comes to wildlife by maintaining the site efficiently and clearing away materials which are not in use, such as wire or bags in which animals can become entangled; and
- Any pipes should be capped when not in use (especially at night) to prevent local fauna becoming trapped. Any excavations should be covered overnight to prevent animals from falling and getting trapped. If that is not possible, a strategically placed plank should be placed to allow animals to escape.

6.2.7 Vegetation

Protection of Trees and Hedgerows

The following mitigation measures will be implemented for retained trees:

- Appointment of an arboricultural consultant to be available to provide expertise and advice throughout the duration of the works;
- Preparation of a Tree Protection Plan through liaison between the arboricultural consultant, local authority and the site manager will include details of tree protection measures;
- All tree works will be carried out by a reputable arboricultural contractor in accordance with the recommendations given in BS 3998:2010 – Tree Work Recommendations;
- All tree works should be carried out in accordance with Section 40 of the Wildlife Act 1976 and Section 46 of the Wildlife (Amendment) Act 2000.
- A map of Root Protection Areas will be outlined in the Tree Protection Plan;

Tree Protection Plan

A Tree Protection Plan will be prepared and will outline detailed mitigation measures for the protection of retained trees and hedgerows. The Plan will include the following mitigation measures:

- A pre-commencement meeting with site manager and local authority will be agreed upon to confirm location of tree protection measures.
- Protective fencing will be constructed and installed in accordance with BS5837:2012. Alternatives to those shown must be agreed in advance by the client and approved by the arboricultural consultant. See Figure 6-5.

- No materials or equipment other than those required to install tree protection will be delivered to the site until all fencing is in place.
- Post holes will be carefully positioned as far away from the stem of trees as possible (minimum 50 cm) to minimise contact with tree stems and significant tree roots.
- Holes will be manually excavated with the use of hand tools only and where roots greater than 25mm in diameter or large fibrous roots are present, the position of the hole will be slightly altered to avoid potential root damage.
- If the position of the hole cannot be altered, roots greater than 25mm in diameter or large fibrous roots will be protected with flexible plastic pipes and retained within the pit.
- Once the required depth has been excavated, the hole will be lined using 1000-gauge polythene and filled with the appropriate concrete mix.
- In cases where individual roots less than 25mm in diameter require pruning, a suitable sharp sterile tool will be used (e.g. secateurs or hand saw).
- Signs will be fixed to every third fencing panel stating, 'Tree Protection Area Keep Out – Any incursion into the protected area must be with the agreement of the local authority or arboricultural consultant'. See Figure 6-6.
- The main contractor will inform the local authority and the arboricultural consultant that tree protection is in place before site clearance works commence.
- Inspection of all tree works and tree protection measures prior to the commencement of works.
- Any machinery / site operative within tree RPAs must operate on the appropriate ground protection at all times, this will include the installation and removal of ground protection.
- Supervision during the excavation works within the RPAs of retained trees.
- Supervision during the installation of all services/wall within tree RPAs.
- Supervision during any other works that may affect retained trees.
- No alteration, removal or repositioning of the tree protection will take place during construction without the prior consent of the arboricultural consultant
- All new service runs should be located outside the RPAs of retained trees to avoid impacting their condition. If it is found necessary to locate services within tree RPAs, it is recommended that these works are carried out under arboricultural supervision. Methods of work should follow the recommendations in the NJUG guidance. BS5837 (2012) recommends the NJUG guidance as a normative reference to be used in these circumstances.
- Any liquid materials spilled on site will be immediately cleared up and removed from the site. If liquid fuel or cement products are spilled within 2m of the tree protection zone, the contractor will report the incident to the arboricultural consultant immediately.
- No fires will be permitted within 20m of the crown of any tree.
- The principle of avoiding soil disturbance or changes in levels within the RPAs of retained trees should be followed unless arboricultural advice has been sought.
- Inspection upon completion. Following the completion of the development, a tree condition assessment may be required on all retained trees for health and safety purposes.

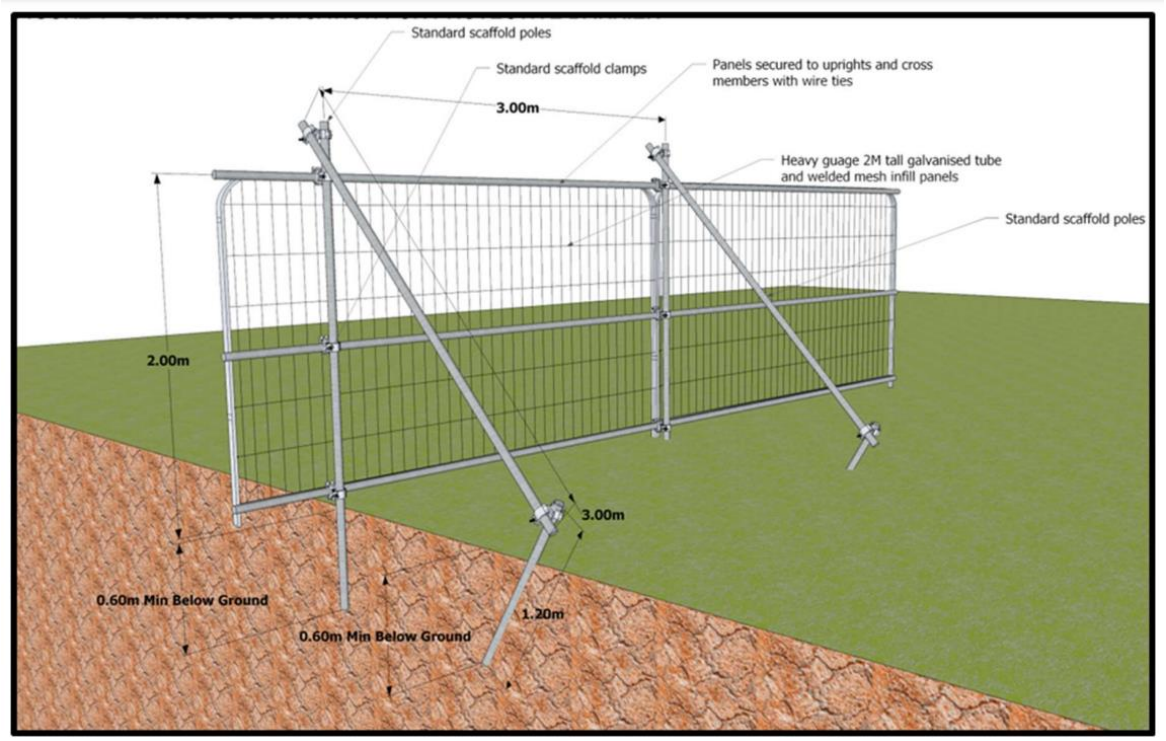

Figure 6-5 Standard specification for tree protection barrier fencing in accordance with BS5837:2012

Figure 6-6 Example warning signage to be placed on protective fencing

Reseeding of grassy verges

In the areas where grassy verges are damaged from the access of machinery, reseeding of flora using locally sourced grass and wildflower mixes will rejuvenate the damaged habitat after the works.

Remedial Planting / enhancement

Any trees or scrub that are removed or damaged will be replaced after the works with native plant species, such as Alder, Birch and Pedunculate Oak that currently exist throughout the Scheme area. Any replacement trees will help enhance floral diversity within the site and improve the area for terrestrial invertebrates, mammals, bats, and birds. The selection of tree species when planting new trees should consider their value for wildlife and similarity to the existing native vegetation. Where possible, riparian trees will be cut to ground level and allowed to regrow on completion of the works.

Root compaction and limb damage avoidance

In order to avoid the damage and compaction of roots and vegetation, storage and movement of machinery should be avoided in rooting zones adjacent to the trees, and fences should be in place in the areas of the of trees and hedges that are not scheduled for maintenance works. Mitigation should follow the recommendations provided in the scheme's AIA.

6.4 Dust and Air Quality

Construction activities have the potential to generate some dust emissions. The extent of dust generation is dependent on the nature of the material (soils, peat, sands, gravels, silts etc.) and the location of the construction activity. In addition, the potential for dust dispersion depends on the local meteorological factors such as rainfall, wind speed and wind direction.

During construction, dust could be generated by activities such as:

- Site fencing;
- Excavation works;
- Construction work;
- Hauling surplus material to other areas within the site; and
- Movement of vehicles on site during construction.
- Temporary storage of soil.

A plan for dust minimisation will be included in the Health and Safety plan in order to minimise production of dust to preserve air quality and also to provide safe and favourable conditions for those working on site and living nearby.

Generally, there is a risk that dust may cause an impact on sensitive receptors within 25m of the source of the dust generated.

Significant dust emissions could arise during dry weather. The use of water suppressants will therefore be used during any dry weather conditions (if required). Where temporary stockpiles are required, the material will be stored in designated areas and will be covered with tarpaulins and/or regularly dampened during dry weather periods. Movement of material within the site and to and from the site will be kept to a minimum. The temporary stockpile of infill will be covered to avoid dust emissions

The following mitigation measures are to be implemented during the construction phase:

6.2.1 General Measures

Communications

- Develop and implement a stakeholder communications plan that includes community engagement before work commences on site;
- Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site manager;
- Display the head or regional office contact information; and
- Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions, approved by the Local Authority. The DMP may include monitoring of dust deposition, dust flux, real-time PM10 continuous monitoring and/or visual inspections.

Site Management

- Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken;
- Make the complaints log available to the local authority when asked;
- Record any exceptional incidents that cause dust and/or air emissions, either on- or offsite, and the action taken to resolve the situation in the logbook;
- If applicable, hold regular liaison meetings with other high risk construction sites within 500 m of the site boundary, to ensure plans are co-ordinated and dust and particulate matter emissions are minimised. It is important to understand the interactions of the off-site transport/ deliveries which might be using the same strategic road network routes.

Monitoring

- Undertake daily on-site and off-site inspection, where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the local authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and windowsills within 100 m of site boundary, with cleaning to be provided if necessary;
- Carry out regular site inspections to monitor compliance with the recommended mitigation measures, record inspection results, and make an inspection log available to the local authority when asked; and
- Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.

Preparing and maintaining the site

- Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible;
- Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site;
- Fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period;
- Avoid site runoff of water or mud;
- Keep site fencing, barriers and scaffolding clean using wet methods;
- Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below; and
- Cover, seed or fence stockpiles to prevent wind whipping.

Operating vehicle/machinery and sustainable travel

- Ensure all vehicles switch off engines when stationary - no idling vehicles;
- Avoid the use of diesel- or petrol-powered generators and use mains electricity or battery powered equipment where practicable;

- Impose and signpost a maximum-speed-limit of 15 mph on surfaced and 10 mph on unsurfaced haul roads and work areas; and
- Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials.

Operations

- Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g., suitable local exhaust ventilation systems;
- Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate;
- Use enclosed chutes and conveyors and covered skips;
- Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate; and
- Ensure equipment is readily available on site to clean any dry spillages and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.

Waste Management

- Waste Material to be disposed of at an appropriately licensed facility

6.2.2 Measures specific to demolition

- Ensure effective water suppression is used during demolition operations. Handheld sprays are more effective than hoses attached to equipment as the water can be directed to where it is needed. In addition, high volume water suppression systems, manually controlled, can produce fine water droplets that effectively bring the dust particles to the ground;
- Avoid explosive blasting, using appropriate manual or mechanical alternatives; and
- Bag and remove any biological debris or damp down such material before demolition.

6.2.3 Measures specific to earthworks

- Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable;
- Use Hessian, mulches or tackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable; and
- Only remove the cover in small areas during work and not all at once.

6.2.4 Measures specific to construction

- Avoid scabbling (roughening of concrete surfaces) if possible;
- Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place;
- Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery; and
- For smaller supplies of fine power materials ensure bags are sealed after use and stored appropriately to prevent dust.

6.2.5 Measures specific to trackout

- Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being continuously in use;
- Avoid dry sweeping of large areas;
- Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport;
- Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable;
- Record all inspections of haul routes and any subsequent action in a site logbook;
- Install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems, or mobile water bowsers and regularly cleaned;

- Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable);
- Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits;
- Access gates to be located at least 10 m from receptors where possible.

If a programme of air quality monitoring shall be implemented at the site boundaries for the duration of construction phase activities to ensure that the air quality standards relating to dust deposition and PM10 are not exceeded, the following limits are recommended;

- Dust Deposition Rate limit = 350 mg/m2/day (averaged over a 30+/-2-day period using Bergerhoff Gauge Method);
- Dust Deposition Rate limit affecting sensitive ecological receivers = 1,000 mg/m2/day;
- PM10 24 Hour Mean concentration limit = 50 µg/m3 not to be exceeded more than 35 times a calendar year;
- PM10 Annual Mean concentration limit = 40 µg/m3; and
- PM2.5 Annual Mean concentration limit = 25 µg/m3

Where levels exceed specified air quality limit values, dust generating activities shall immediately cease and alternative working methods shall be implemented. A complaints log shall be maintained by the construction site manager and in the event of a complaint relating to dust nuisance, an investigation shall be initiated.

6.5 Noise and Vibration

Appropriate mitigation measures have been identified to ensure the Construction Phase target noise limits are not exceeded. The contractor will be required to implement the control measures recommended in BS 5228 and apply the appropriate measures where applicable. Other measures will include:

- Working hours during site construction operations will be restricted to daytime hours from 07:30 hours to 16:30 hours (Monday to Friday) and, as may be required, from 08.00 hours to 13.00 hours (Saturdays). Evening and night-time work is not expected to take place although it is possible that limited 24 hours working may be required to take place on occasion. This will only take place with the prior agreement of DLRCC;
- An on-site speed limit will be enforced for all traffic. Drivers of vehicles will be advised of the speed limits through the erection of signs i.e. a typically recommended on site speed limit is 10 km/hr;
- Where practicable, the use of quiet working methods and the most suitable plant will be selected for each activity having due regard to the need for noise control;
- Best practicable means will be employed to minimise noise emissions and will comply with the general recommendations of BS 5228. To this end operators will use “noise reduced” plant and/or will modify their construction methods so that noisy plant is unnecessary;
- By positioning potentially noisy plant as far as possible from noise sensitive receivers the transmission of sound can be minimised. Earth mounds and/or stockpiles of material or perimeter hoarding on site can be used as a physical barrier between the source and the receiver;
- Mechanical plant used on site will be fitted with effective exhaust silencers. Vehicle reverse alarms will be silenced appropriately in order to minimise noise breakout from the site while still maintaining their effectiveness;
- All plant will be maintained in good working order. Where practicable, machines will be operated at low speeds and will be shut down when not in use;
- Compressors will be of the “noise reduced” variety and fitted with properly lined and sealed acoustic covers;
- In all cases engine and/or machinery covers will be closed whenever the machines or engines are in use;
- All pneumatic percussive tools will be fitted with mufflers or silencers as recommended by the equipment manufactures. Where practicable, all mechanical static plant will be enclosed by acoustic sheds or screens;

- Employees working on the site will be informed about the requirement to minimise noise and will undergo training on the following aspects:
  - The proper use and maintenance of tools and equipment.
  - The positioning of machinery on-site to reduce the emission of noise to the noise sensitive receivers.
  - Avoidance of unnecessary noise when carrying out manual operations and when operating plant and equipment.
  - The use and maintenance of sound reduction equipment fitted to power pressure tools and machines.
- Cognisance will also be taken of the Environmental good practice site guide 2005 compiled by CIRIA and the UK Environment Agency. This guide provides useful and practical information regarding the control of noise at construction sites;
- Where excessive noise levels are recorded, further mitigation measures will be employed which may include temporary wooden hoarding / acoustic screening to be installed to a height of no less than 2m around areas of construction where loud noise levels occur;
- The contractor will ensure that the TII Guidelines which identify limits for protection against cosmetic damage as a function of vibration frequency are not exceeded through the use of the selected low vibration piling method;
- Responsible Person – The Contractor will appoint a responsible and trained person who will be present on site and who will be willing to answer and act upon complaints and queries from the local public; and
- Night-time Working - If there are items of plant (*e.g.*, dewatering pumps and similar) in use during night-time hours they will be chosen, sited and enclosed such that levels at the nearest properties do not exceed the measured background noise levels.

6.6 Traffic

A detailed Construction Traffic Management Plan for the proposed works will be prepared prior to the commencement of construction by the contractor to ensure the safety of road users and construction personnel and to facilitate access to properties where proposed works will temporarily limit access. All vehicles entering and exiting the site, including (material and equipment deliveries) and cars/vans (Contractor's personnel, client staff and Visitors) will do so via the agreed route which will be outlined in the Strategy.

6.2.1 Construction Phase for Proposed Scheme

Proposed Haulage Route

Access to and egress from the sites is envisaged to be along dedicated construction vehicle routes. It is assumed that all national roads and regional roads in the immediate vicinity of the proposed Scheme will be used by construction vehicles.

The following National Roads are expected to be used as construction vehicle access routes during the construction phase:

- N11;
- M50 Motorway; and
- M11 Motorway.

The following Regional Roads are expected to be used as construction vehicle access routes during the construction phase:

- R113;
- R117;
- R842 - Glenamuck Road North;
- R118;

- R116; and
- R119.

Additionally, as part of the proposed Scheme is located at / adjacent to local roads, the following Local Roads are expected to be used as access routes during the construction phase:

- Village Road;
- Clon Brugh;
- Belarmine Vale;
- Kilgobbin Road;
- Castle View;
- Ballyogan Grove;
- Bray Road;
- Commons Road;
- Brookdene; and
- Bayview Lawns.

Construction Traffic Trip Generation

Construction traffic and future staff numbers associated with the proposed works were estimated. The exact programme and sequence of works will be determined by the appointed Contractor to ensure that traffic impacts as a result of the works are kept to a minimum. It has been estimated that maximum daily construction trip generation per site will not be greater than 7 HGV arrivals and 7 HGV departures, and will evenly distribute throughout a day. In order to provide a robust assessment of the impact of the proposed Scheme, it has been assumed that these daily arrivals and departures occur in the AM and PM peak hours.

Throughout the construction phase, the construction workforce numbers will vary. However, it is anticipated that maximum 10 staff will be required per site to facilitate the construction works. It has been conservatively estimated that all staff will arrive on site in single occupancy vehicle. The combined maximum AM peak hour trip generation for HGVs and staff for each site is presented in Table 6.1.

Table 6.1: Maximum AM peak trip generation for each site during construction

	HGVs	Staff	Total
Arrivals	7	10	17
Departures	7	1	8
Total	**14**	**11**	**25**

The PM peak hour is assumed to be the inverse of the AM peak hour presented in Table 6.1**,** with 10 staff departures and 1 staff arrival for each site.

The Construction Traffic Management Plan (CTMP) will be agreed between the Contractor, local authorities and client's Representative. The CTMP will include the following:

- Adherence to relevant laws, regulations, and standards governing construction activities and traffic management. Key aspects will be adherence to traffic regulations, permitting and licensing, environmental regulations, health and safety standards, local authority requirements, emergency response plans, and public consultation;
- Deliveries will be limited to working hours (08:00 to 19:00 Monday to Friday, 08:30 to 14:00 Saturday, and none on Sundays or public holidays, or as determined by the County Council);

- Either a temporary traffic signals or a STOP/GO traffic management system will be utilised to maintain two-way traffic flow on the affected roads, including but not limited to Clon Brugh, Kilgobbin Road, Castle View, Commons Road and Shanganagh Road, etc.;
- Temporary traffic management at Kilgobbin Road, Castle View, Commons Road and Shanganagh Road will be implemented during the off-peak hour (i.e. 10:00-16:00). The aforementioned roads will re-open for public use outside the working hours.
- All construction works at N11 Crossing Site shall be carried out at night-time (i.e., 20:00-05:00) only. N11 and Bray Road will re-open for public use outside the working hours.
- All construction related traffic will be outside the morning and evening peak hours so as to minimise impact to the operation of the adjoining junctions;
- The construction programme and sequence for the proposed Scheme shall be co-ordinated and planned. If there are any significant cumulative impacts to public arising from different sites, the proposed works at concerned sites shall not be progressed concurrently in order to mitigate the risk of cumulative impacts in the key junctions;
- Good construction management practices will be employed such as fencing the Site off from the public and neighbouring sites, adequate external/internal signage, secure internal site offices, dedicated construction access points all to ensure the safety construction staff and the public;
- Appropriate levels of staff parking and compounding will be provided to ensure no potential overflow or haphazard parking in the area. The Site will be able to accommodate employee and visitor parking throughout. Contractor's, subcontractor's or supplier's vehicles or staff vehicles, or any vehicles associated with the works are not permitted to park, idle or queue on the public road network;
- Construction traffic routes to/from the Site will be agreed with DLRCC prior to the commencement of constructions activities on sites. The time of day permittable for such routes will also be agreed upon and outside of the AM and PM peak hours;
- Tracked excavators will be moved to/from the site on low-loaders and will not be permitted to drive on the street pavements;
- Wheel washers / judder bars will be placed at all site access points to minimise the migration of detritus onto the public roads. The roads will be inspected and cleaned on a regular basis;
- Haul vehicles will be covered after loading to ensure there is no risk of construction material falling; and
- Where possible, abnormal load movements will be restricted to evening or night-time to minimise disruption to local traffic and traffic on strategic routes.
- All necessary traffic safety precautions shall be undertaken by the Contractor to ensure the safety of all traffic and pedestrians using the existing roads adjacent to the site and connecting minor roads during the execution and completion of the Works, and all precautions shall be taken to minimise disruption to the local residents.

6.7 Archaeology and Architecture

6.2.1 Built Heritage

Project Conservation Engineer

As recommended by the National Built Heritage Unit (NBHS) a project conservation engineer architect will be retained during the detailed design, construction and reinstatement stages of the FRS scheme. The conservation engineer will ensure that the specifications and methodologies outlined in Appendix 12.8 of the EIAR are carried out in full, and that the work is of the highest standards.

The methodologies will be submitted to the NBHS in advance of the works for discussion and approval. The NBHS may make additional recommendations and comments.

The proposed bridge reinforcement measure will have the positive effect of protecting the bridge from future flood damage. The flood measures that occurred in the 1990's both upstream and downstream of the works have already altered the setting of the bridge structure; the proposed flood walls will be similar and, as such, will not cause any additional setting impacts. The bridge represents the site of an important fording point

and routeway that have connected Dublin and Wicklow since at least the early medieval period up to the present. The public realm at the bridge crossing is run-down and uninviting; and as discussed with the NBHS the bridge's repairs and flood relief work may present an opportunity to improve this area. It is recommended that a public realm plan for the enhancement of Shanganagh Bridge is developed, this should include the reinstatement of the granite stone kerb stones that survive intermittently on the approach footpaths to the bridge and the cleaning of the bridge and historic date plaque, which have suffered environmental damage from the passing traffic.

Recording

The upstanding walls to be replaced and reinstated as part of the proposed flood relief scheme will be recorded in advance of construction. This will include a written and photographic record and scaled drawings and will serve to provide a record of the past. The record will note the capping stones, the coursing of the original masonry, where it exists or is preserved. Random rubble masonry will require the retention of all pinning stones so that the rhythm and texture of the original may be replicated and where it is built to courses the same attention to coursing is essential. The dismantling will be carried out by hand. When construction is complete the boundary walls will be rebuilt to match the original wall construction. The project engineer will provide a detailed methodology for this work and will review and advise on the works as they are being carried out.

6.2.2 Project Archaeologist

As recommended in the NMS 'Archaeology and Flood Relief Scheme Guidelines', Dun Laoghaire Rathdown County Council and OPW will engage a Project Archaeologist (PA) to advise on the archaeological aspects of the FRS. This role will continue into the construction stage of the FRS where they will advise on archaeological mitigations, including surveys, archaeological monitoring, the assessment of potential on archaeological discoveries, archaeological excavations, and reporting requirements. This may include inspections of archaeological heritage (both terrestrial and underwater). They will also advise the contracting authority on post-excavation progress, requirements, and archiving and finally the publication and dissemination of results of archaeological works.

The PA will provide a consistent, independent approach to the portfolio of individual work packages and to manage a centralised framework for the development of all archaeological, architectural and cultural heritage considerations. The PA will advise on compliance with relevant legislation (including the Planning and Development Act, 2000, as amended), the implications of local authority listing of Protected Structures and ACAs, and compliance with the National Monuments Acts.

6.2.3 Archaeological Testing

Archaeological Testing

Archaeological testing was not suitable for much of the proposed scheme, owing to restricted space, and the obstacles of the existing walls, roads and services. Archaeological test excavation is recommended to take place in the following places:

- At the Bray Road compound area to test the veracity of the geophysical survey;
- At the Glenamuck Road North Roundabout Measure in the vicinity of Carrickmines Castle as soon as it can be facilitated; and
- Along the watercourse and proposed overflow pipe in Kilgobbin within the Riverside property.

The testing should take place well in advance of the construction phase of the development to inform. The highest archaeological risk to large flood relief projects are delays to the construction programme, it is recommended that the archaeological testing is carried out as soon as it is feasible, well in advance of construction and site enabling works. The results of the testing will inform detailed design and construction stage programme and will allow for the appropriate timing of the archaeological resolution (excavation) to take place in advance of construction.

Mitigation of the impact of development on the archaeological resource can take the form of 'preservation by record' (full hand excavation, i.e., sterilisation of archaeological area); and 'preservation in situ' (excluded from development, i.e., avoidance through design in a location where the future protection and interpretation of the site can be assured) or a combination of both.

Where archaeological features revealed by the test-trenching, are directly impacted by the proposed works and cannot be avoided (preserved in-situ), they will be preserved by record by means of archaeological excavation, recording and publication of results. Archaeological excavation ensures that the removal of any archaeological soils, features, finds and deposits is systematically and accurately recorded, drawn and photographed, providing a paper and digital archive and adding to the archaeological knowledge of a specified area (i.e., preservation by record). As archaeological excavation involves the removal of the archaeological soils, features, finds and deposits, following this mitigation measure there is no further impact on the archaeological heritage.

An archaeological testing strategy will be developed in consultation with the OPW Project Archaeologist and will be submitted to the National Monuments Service for approval. A method statement and licence or consent applications will then be submitted to the NMS for review and approval

Archaeological Excavation

The features identified in the compound area associated with the Kilgobbin flood relief measure (AP1) will be stripped of topsoil under archaeological supervision and the exposed features be persevered by record through archaeological excavation. Archaeological excavation should be carried out in well in advance of the construction at the Kilgobbin Measure. The excavated area should be cordoned off and the remainder of the field be excluded from all activities including parking, storage etc.

6.8 Waste Management

A Resource Waste Management Plan (RWMP) will be prepared by the appointed contractor which will outline precautions, procedures, and methods to help manage, reduce, and dispose of waste arising during the construction phase. The RWMP will outline waste reduction techniques, guidelines to be followed, compliance measures and the waste disposal streams to be used during the development. The document will be a working document subject to revision, when necessary, as the programme progresses. All construction waste will be segregated and removed to an approved location.

A key waste reduction strategy will be reuse of material where feasible. Over one third of excavated soil will be reused as backfill on site. Stone material from existing stone walls will be reused as cladding material for new reinforced concrete flood walls where feasible. This will reduce waste while also reducing potential impacts on Cultural Heritage.

The contractor will also explore other reuse options off-site, such as reuse as a by-product under Article 27. These strategies will reduce the amount of material being exported off-site as a waste.

When all other options have been explored, the contractor will dispose of unused materials as waste. All waste material will be sorted and segregated into the relevant waste stream. Dedicated waste receptacles or storage areas will be established in site compounds and will be properly labelled. All workers on-site will be trained on waste segregation and management as part of site induction talks.

During construction, waste generated on site poses potential risks to the health and safety of construction personnel. A comprehensive Health and Safety Programme will be prepared in accordance with the requirements of the Safety, Health and Welfare at Work (Construction) Regulations 2013 (S.I. No. 291 of 2013) which outlines that waste disposal methods shall not occur in a manner that is injurious to health and safety. The programme will be implemented on the site prior to commencement of construction and maintained for the duration of the works to minimise any risks to site personnel and visitors. A Construction

Stage Traffic Management Plan will be developed and agreed with Dún Laoghaire Rathdown County Council and the relevant property owners prior to commencement of the works.

6.9 Pest Control

It is recommended that a rodent and pest control plan is put in place to manage and limit any potential disturbance to populations that may utilise the site. The pest control plan should be in accordance with the following guidelines:

- Chartered Institute of Environmental Health (CIEH) "Pest minimisation: Best practice for the construction industry" or a similar appropriate standard.

A Pest Control Plan for the construction phase shall be completed and included in the Contract specific CEMP written by the Contractor.

6.10 Soil and Geology

- Temporary pathways and roads will be constructed to allow for the movement of heavy machinery and minimise the risk of soil compaction.
- Temporary storage of soil will be carefully managed in such a way as to prevent any potential negative impact on the receiving environment. Topsoil stockpiles will be covered with rapid vegetation or other means as part of the construction methodology. The material will be stored away from any surface water drains. Movement of material will be minimised in order to reduce degradation of soil structure and generation of dust.
- Stockpiles will not exceed 1.5m in height.
- Fill material will be tested and imported from a licensed facility to ensure no external contamination is introduced to the soil and geological environment.
- Oil and fuel storage tanks shall be stored in designated areas, and these areas shall be bunded to a volume of 110% of the capacity of the largest tank/container within the bunded area(s) (plus an allowance of 30 mm for rainwater ingress). Drainage from the bunded area(s) shall be diverted for collection and safe disposal.
- Re-fuelling of construction vehicles and the addition of hydraulic oils or lubricants to vehicles, will take place in a designated area (or where possible off the site) which will be away, a minimum of 10m from any existing surface water gullies or drains, or exposed ground or excavations.
- An adequate supply of spill kits and hydrocarbon adsorbent packs will be stored in any refuelling areas and site compounds. All relevant personnel will be fully trained in the use of this equipment.
- The pouring of concrete will take place within a designated area using a geo-synthetic material to prevent concrete runoff into the soil/ groundwater media. Wash down and washout of concrete transporting vehicles will take place at an appropriate facility off site.

The contractor will be required to carry out a waste characterisation of the material that will be taken off site for disposal. A waste acceptance criteria (WAC) analysis and asbestos levels should be determined on any material that will be taken off site for disposal. All wastes in the European Waste Catalogue are classified by a unique 6-digit code. In this case (waste soil/stones), two List of Wastes (LoW) Codes are applicable to material that may be taken off site for disposal during the construction phase:

- 17 05 03* - Soil and stones containing hazardous substances
- 17 05 04 - Soils and stones other than those mentioned in 17 05 03.

Any soil samples that are found to contain contaminants should be subjected to full quantification analysis. If the waste soil is sent to a waste licenced soil recovery facility, the chemical analysis of the soil must meet the requirements given in Table 3.3 (Summary of Soil Trigger Levels for Soil recovery Facilities) of the Environmental Protection Agency's Draft Publication – Waste Acceptance Criteria and Development of Soil

Trigger Values for EPA-Licenced Soil Recovery Facilities, December 2017. The acceptance of this material at a licenced soil recovery facility will be subject to the approval of the facility operator.

The National Waste Collection Permit Office maintains a register of licenced waste recovery facilities. Numerous facilities are registered for the collection of uncontaminated soil and stone (17 05 04) in the DLRCC area. The contractor will consult the register to determine the closest appropriate facilities (https://www.nwcpo.ie/permitsearch.aspx).

Any soil samples that are found to contain contaminants should be subjected to full quantification analysis. If the waste soil is sent to a waste licenced soil recovery facility, the chemical analysis of the soil must meet the requirements given in Table 3.3 (Summary of Soil Trigger Levels for Soil recovery Facilities) of the Environmental Protection Agency's Draft Publication – Waste Acceptance Criteria and Development of Soil Trigger Values for EPA-Licenced Soil Recovery Facilities, December 2017. The acceptance of this material at a licenced soil recovery facility will be subject to the approval of the facility operator. As above, the NWCPO register will be consulted by the contractor. Numerous facilities which are licenced for soil and stone containing hazardous substances (17 05 03*) are on the register and licenced in in the DLRCC area (https://www.nwcpo.ie/permitsearch.aspx).

6.11 Biosecurity

An invasive species survey was carried out in June, July 2021 and October 2022 which found the presence of American Skunk Cabbage, Butterfly Bush, Cherry Laurel, Giant Butterbur Giant Hogweed, Japanese Knotweed, Rhododendron, Sika Deer, Sycamore, Three-corner Garlic and Winter Heliotrope. Under European legislation, Regulation (EU) No 1143/2014 prohibits the introduction and dispersal of invasive non-native species (INNS) listed in the Third Schedule.

Biosecurity measures will be implemented to prevent the spread of invasive species. These measures will include:

- Toolbox talks on invasive plant species to be provided to all relevant personnel prior to access to site being permitted;
- A 3-metre buffer zone to be erected around the identified infested areas, no unauthorised personnel to be admitted within this buffer;
- All works carried out within the buffer zone will be done by suitably trained personnel;
- All machinery being brought to site must be clean and free from contaminants;
- Any machinery used within the 3-metre buffer zone must be thoroughly cleaned with hot water (at least 45°C) and checked before being removed;
- Any Giant Hogweed that is growing in the location of proposed walls should be dug up to take the root out. If it is not possible to dig up, treatment with herbicide, such as glyphosate, will be necessary.
- Any clothing and equipment that comes into contact with water or mud from riparian zones should be checked for zebra and quagga mussel juveniles and removed and left on site for appropriate cleaning or disposal;
- No vehicles are to be allowed on or off site without being thoroughly inspected and cleaned.
- Equipment should be fully drained of water and dried, disinfectant such as Virkon Aquatic or Virasure shall be employed if complete drying is not possible;
- On completion of the works all machinery must be thoroughly inspected and cleaned down before being removed from site;
- All contaminants and contaminated soils are to be disposed of in an appropriate manner;
- Removed soils need to be disposed of in an appropriate manner to a licenced facility; and
- Imported soils must be free from invasive species.

7 Monitoring

7.1 Ecological Monitoring

To determine the effectiveness of proposed measures, the site will be monitored prior to, during and for at least 5 years post construction. This is to determine how measures are performing and if management strategies are effective at maintaining the function of the area, and its ecological benefits. Suggested monitoring procedures are presented in the following sub sections, targeted toward different habitats and organisms. Monitoring methods must be approved by the relevant competent authority, have clearly defined objectives, and reports submitted to the competent authority and refined following their guidance. Data collection will be carried out in a systematic and standardised manner to allow for inter survey comparison and following established procedures to feed into national databases (e.g. EPA for water quality, I-WeBS for wintering birds, Breeding Bird Survey for bird monitoring, IFI for fish monitoring).

A copy of all data on species will be uploaded to the NBDC within 4 weeks of a survey being carried out, and all data will be made available in a public repository, in line with the Open Data Directive[3]. Data on sensitive species will have a restricted availability (e.g. Badger setts). Monitoring procedures should be carried out for a sufficient length of time (minimum 1 year) in order to assess effectiveness of the measures. At the end of the monitoring period, a review of the findings will be carried out, and if necessary, monitoring will be prolonged.

Monitoring will include the following methodologies/guidance:

- Monitoring of disturbed habitats to determine condition using indicators of disturbance and assessment of vulnerabilities, including invasive non-native species.
- Bird monitoring using I-WEBs methodology for winter birds, and countryside bird survey methodology for breeding birds, with a walk through of suitable habitat to determine presence/absence of breeding ground-nesting or non-calling birds.
- Monitoring should be carried out until it is established that the ecosystems are functioning well, and of good condition – this will allow for adjustment of management until such conditions are achieved.
- Annual post construction monitoring for a minimum of 1 to 5 years depending on ecological receptor, and to be reviewed at the end of each term until adequate outcomes are achieved.
- Water quality monitoring in conjunction with DLRCC standard water quality monitoring standards.
- Data to be submitted to National Biodiversity Data Centre (NBDC) 4 weeks post survey.

Otter monitoring should also take place to ensure the proposed works have not impacted the local population and to resurvey potential holts. Surveys should be completed once per year for two years after the construction works are complete.

All post construction monitoring should be devised and conducted by a suitably qualified ecologist in consultation with NPWS and the local county council's Biodiversity Officer.

7.2 Archaeological Monitoring

7.2.1 Earthworks

The construction phase will involve earthmoving activities including excavations for the construction of flood walls and provision of construction compounds and temporary roads. All earthmoving activities within areas

[3] EU, "Directive (EU) 2019/1024 of the European Parliament and of the Council of 20 June 2019 on Open Data and the Re-Use of Public Sector Information (Recast)," L 172/56 § (2019)

of archaeological potential (AP) will be subject to archaeological monitoring under licence from the NMS of the DHLGH. Archaeological monitoring will ensure the full recognition of, and the proper excavation and recording of, all archaeological soils, features, finds and deposits which may be disturbed below the ground surface.

The following are areas of archaeological potential as identified in the EIAR Chapter 13:

- AP1: Belarmine Park culvert inlet works
- AP2: Kilgobbin compound and works area
- AP3: Kilgobbin overflow pipeline
- AP4: Glenamuck Road North works (Carrickmines Castle Zone of Notification)
- AP5: Lower Brides Glen and N11 overflow culvert
- AP6: Cherrywood Road measure
- AP7: Bray Road measure and compound
- AP8: Commons Road and Brookdene measure
- AP9: Bayview measure

The licensed archaeologist will have provision to inspect all excavation to the formation level for the proposed works and to temporarily halt the excavation work, if and as necessary. They will be given provision to ensure the temporary protection of any features of archaeological importance identified. The archaeologist will be afforded sufficient time and resources to record and remove any such features identified.

In the event of the discovery of archaeological finds or remains, the NMS and the National Museum of Ireland (NMI) will be notified immediately. If features are revealed, the immediate area will be investigated, allowing no further development to take place until the site is fully identified, recorded and excavated the satisfaction of the statutory authorities. The provision (time and funding) will be made for the full recording and, if necessary, excavation of the archaeological material in compliance with any measures that the DHLGH and the relevant local authority deem appropriate. This possibility will be accounted for in the Project programme and budget and will be undertaken at the earliest phases of the development to allow the archaeologists sufficient time to record/excavate as required.

Dún Laoghaire Rathdown County Council will make provision to allow for, and to fund, the necessary archaeological monitoring, inspection and excavation works that will be needed on-site during and prior to construction, either directly or indirectly via the appointed contractor.

All archaeological issues will be resolved to the satisfaction of the OPW Project Archaeologist, DHLGH and the NMI.

7.2.2 Dredged material

An archaeological assessment of dredged/excavated spoil that is removed from riverbeds, streambeds, will be carried out. This material can be very rich in archaeological materials and objects, including organic materials.

In accordance with the flood relief Guidelines, all dredged spoil from areas within the Zone of Archaeological Potential (i.e., ZoN) for an historic town is assessed by means of spreading, searching for objects, and metal detection (for metal objects). This should occur during the works associated with the Glenamuck Road North Roundabout in the vicinity of the medieval settlement of Carrickmines (AP4) and Kilgobbin flood measure in the vicinity of the historic settlement of Kilgobbin (AP3). In order for artefacts to be accurately provenanced, where practicable, searching and metal detection should take place before bulk excavations occur, for instance where riverbeds have been temporarily dewatered and exposed. In the other areas of the scheme a 25% volume assessment of spoil is required. The NMS will consider the scaling up or down of this based on the on the artefactual retrieval results over an agreed time. A methodology for the spreading

of the material in a location in proximity to the works area should be developed in consultation with the contractor.

Sufficient archaeological personnel need to be on site to monitor all aspects of works for an FRS, including work in water. Suitably qualified underwater archaeological personnel should be available to carry out rapid inspections following underwater discoveries to ensure assessment and stabilisation.

The developer is aware of their responsibility to fund all necessary archaeological work. All recommendations are subject to approval by the National Monument Service of the Department of Housing Local Government and Heritage and the local authority.

7.3 Dust and Air Quality Monitoring

Monitoring of Air Quality and Dust related impacts will be required during the construction stage only of the proposed development. The monitoring activities are to:

- Undertake daily on-site and off-site inspection, where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the local authority if and when requested. This should include regular dust soiling checks of surfaces such as street furniture, cars and windowsills within 100m of site boundary, with cleaning to be provided if necessary.
- Carry out regular site inspections to monitor compliance with the dust management measures, record inspection results, and make an inspection log available to the local authority if and when requested.
- Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.
- Agree dust deposition and/or real-time PM10 continuous monitoring locations with the Local Authority. Where possible commence baseline monitoring at least three months before work commences on site.

Further guidance is provided by IAQM on monitoring during demolition, earthworks and construction.

7.4 Water Quality Monitoring

Water quality monitoring must be carried out prior to, during and post-construction in order to establish baseline water quality metrics, evaluate the impacts of the construction whilst ongoing, and how the works impact water quality once the site has been restored. Monitoring and assessment should follow EPA guidance. The protocol should be implemented so that data are collected in a standardised manner and can be integrated into EPA databases. Typical metrics that should be recorded to determine the assessment are:

- Flow (continuous monitoring using on-line flow meter with recorder);
- pH;
- Temperature;
- Conductivity;
- Biochemical Oxygen Demand;
- Chemical Oxygen Demand;
- Dissolved Oxygen;
- Suspended Solids;
- Ammonium (as N);
- Nitrate (as N);
- Total Phosphorus (as P);
- Ortho-phosphate (as P);
- Turbidity;
- Hydrocarbons; and
- Biological Quality (Q Rating)

These metrics will be collected on all streams within the construction area. This will include points located upstream of any works, and then points within the works area and at the outfall locations. At connection points, sampling should occur prior to the confluence, and at the junction point.

Monitoring during construction will be within the remit of the ECoW appointed, who will have a stop-works power to halt activity as needed. In-field/live analysis of results such as:

- pH;
- Dissolved Oxygen;
- Conductivity; and
- Turbidity/Suspended Solids.

Water quality monitoring will be undertaken by the ECoW to allow reactive management, especially during instream works, and where releasing water after working in the dry, or other high impact situations. Discharge standards will meet Surface Water Regulation Standards for all relevant parameters, or comparable to water quality standards achieved upstream, as determined by baseline.

Monitoring frequency will be at the discretion of the ECoW, but should not be less frequent than:

- Weekly, where instream works are taking place; and
- Monthly, or as necessary, in other locations.

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