ARUP

Cork City County, Cork County Council and Office of Public Works

Glashaboy River (Glanmire/Sallybrook) Drainage Scheme

Construction Environmental Management Plan (Issue 2)

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1. Introduction

1.1 Introduction

Arup was appointed by Cork County Council on behalf of Cork City Council as Agents of the Commissioners of Public Works in Ireland (Office of Public Works) (OPW), to prepare the Glashaboy River (Glanmire/Sallybrook) Drainage Scheme Environmental Impact Assessment Report.

This Construction Environmental Management Plan (CEMP) summarises the overall environmental management strategy that will be implemented during the construction and maintenance phase of the Glashaboy River (Glanmire/Sallybrook) Drainage Scheme, herein referred to as 'the scheme'.

The CEMP (Issue 1) was submitted as part of EIAR (2018) and EIAR Addendum (2020) submitted for Ministerial Consent for the scheme in 2020.

This CEMP (Issue 2, August 2023) supersedes Issue 1 (2020) and provides the following additional information:

- All additional environmental mitigation and monitoring measures for the scheme as approved by the Environmental Monitoring Group (EMG) for post-confirmation changes, in compliance with Condition 2 applied to the decision to confirm the scheme by the Minister for Public Expenditure and Reform (Appendix I);
- All derogation licence applications, associated reports and issued licences to date from National Parks and Wildlife Service (NPWS) (Appendices E, J and K);
- Revised Tree Removal Drawings, XX-040-XX Series (Appendix H);
- Pre-construction Fisheries Assessment, March 2023 (Appendix L);
- Site Clearance Report and Checklists, February 2023 (Appendix M); and
- Water Quality Sampling Results, January to June 2023 (Appendix N).

1.1.1 Background

1.1.2 Environmental Monitoring Group

In a letter to the Office of Public Works (OPW), dated 14 December 2020, DPER listed the conditions which were applied to the decision to confirm the scheme and requested the Commissioners of the OPW to confirm that it would comply with the conditions.

Condition 2 relates to the establishment of an Environmental Monitoring Group (EMG) to include representatives of the OPW, Cork County Council and Cork City Council. The EMG is responsible for:

- "*Reviewing all updates to the CEMP and granting such changes subject to a formal written agreement*
- *Review all environmental audit results*
- *Ensure all remedial actions are agreed and implemented to address any environmental compliance issues on a timely basis*
- *Ensure all impacts during construction of the scheme are managed as required by this order and do not exceed the envelope of effects predicted in the EIAR and NIS including their addenda*."

Since the decision to confirm the Scheme, a number of post-confirmation design changes were proposed by the Commissioners to facilitate the construction and maintenance of the scheme. These design changes were reviewed and the 'test' for any changes proposed is whether the environmental effects of the changes would exceed the envelope of those residual effects described in the Environmental Impact Assessment Report (EIAR) and as described in the Natura Impact Statement (NIS).

This CEMP (Issue 2) has been updated with all additional mitigation measures that have been agreed by the EMG on granting of the post-confirmation changes to date, refer to Appendix I. All existing mitigation presented in this CEMP and the EIAR (EIAR 2018 and EIAR Addendum) also apply to the relevant post-confirmation changes.

A complete list of conditions pertaining to the decision to confirm the scheme is presented in Section 1.1.4 below.

1.1.3 Request for Further Information

In May 2018, the Commissioners of Public Works submitted the Glashaboy River (Glanmire/Sallybrook) Drainage Scheme to the Minister for Public Expenditure and Reform (MPER) for confirmation. The documentation included an Environmental Impact Assessment Report (EIAR) prepared by Arup, on behalf of the Commissioners for Public Works and Cork County Council, and a Natura Impact Statement (NIS). A Construction Environmental Management Plan (CEMP) was included as *Appendix 4.2* to the 2018 EIAR.

In 2020, CAAS Ltd (CAAS) was commissioned by MPER to carry out a review of the EIAR, NIS and associated documents. In its report to the Minister of its review, CAAS included a list of items of further information which the Minister could require from the Commissioners to ensure robust compliance with the applicable requirements.

In October 2020, Arup on behalf of Cork County Council on behalf of Cork City Council as Agents of the Commissioners of Public Works in Ireland (Office of Public Works), prepared an Addendum to the Glashaboy River (Glanmire/Sallybrook) Drainage Scheme Environmental Impact Assessment Report (EIAR) (2018) and revised Natura Impact Statement to address a Request for Further Information (RFI) issued by the Minister for Public Expenditure and Reform (DPER).

In relation to the Construction Environmental Management Plan (CEMP), the request for further information (RFI) was as follows:

RFI 9 – *A revised Construction and Environmental Management Plan (CEMP) clearly showing the specific procedures and measures that contractors will be required to adhere to ensure that environmental effects will be appropriately controlled so that they conform with the proposals assessed in the Environmental Impact Assessment Report. This shall clearly cover the construction stage and maintenance stages. It shall include but not be limited to:*

- *Details of the proposed works; including elements referred to in Item 3 of this request for further information.*
- *Timing of works in relation to seasonal biodiversity restrictions.*
- *Details monitoring measures including triggers and actions – to include auditing of compliance with all relevant commitments, mitigation measures and other controls contained in the EIAR and associated documents. Auditing should be ongoing throughout the construction period at appropriate frequency to demonstrate full compliance.*
- *Reporting arrangements to ensure full accessibility and transparency.*
- *Arrangements for liaison with all significant stakeholders including local residents, Inland Fisheries Ireland, the National Monuments Service and the National Parks and Wildlife Service (NPWS).*

This CEMP (Issue 2) includes all revisions made in addressing RFI 9 as part of the EIAR Addendum (2020) and revised NIS.

Table 1 indicates where the topics listed in RFI 9 have been addressed in this CEMP.

Table 1 Sections of CEMP in which RFI 9 topics are addressed.

Relevant Section	RFI 9 Topic
Section 5 - Environmental Commitments	Specific procedures and measures that contractors will be required to adhere to ensure that environmental effects will be appropriately
Section 7 – Construction and Demolition Waste management Plan	

Relevant Section	RFI 9 Topic
Section 8 - Construction Traffic Management Plan	controlled so that they conform with the proposals assessed in the Environmental Impact Assessment Report.
Section 2 and Appendix A & B	Details of the works; including elements referred to in Item 3 of this request for further information.
Section 6 – Seasonal Biodiversity Constraints	Timing of works in relation to seasonal biodiversity restrictions.
Section 10 – Environmental Management Procedures	Details monitoring measures including triggers and actions – to include auditing of compliance with all relevant commitments, mitigation measures and other controls contained in the EIAR and associated documents. Auditing should be ongoing throughout the construction period at appropriate frequency to demonstrate full compliance.
Section 12 – Reporting and Record Management	Reporting arrangements to ensure full accessibility and transparency.
Section 9 – Communication Procedure, Section 11 – Incident Response & Section 12 – Reporting and Record Management	Arrangements for liaison with all significant stakeholders including local residents, Inland Fisheries Ireland, the National Monuments Service and the National Parks and Wildlife Service (NPWS).

1.1.4 Conditions Applying to the Decision to Confirm the Scheme

In a letter to the Office of Public Works (OPW), dated 14 December 2020, DPER listed the following conditions which were applied to the decision to confirm the scheme:

The following conditions apply to the Decision to Confirm the Scheme:

1. The scheme shall be carried out in its entirety in accordance with all the plans, particulars, specifications, undertakings (both commitments and recommendations) including those contained in the Environmental Impact Assessment Report (EIAR), Natura Impact Statement (NIS) and in the supplementary information including the Response to Request for Supplementary Information document and addenda to the EIAR and NIS, save as may be required by other conditions attached hereto.

   Reason: To ensure that the development shall be carried out in accordance with the Confirmation Order and that effective control can be maintained.

2. An Environmental Monitoring Group (EMG) shall be established prior to commencement of the works and shall be in place for the full duration of scheme construction including the period of implementation of all construction stage mitigation measures. The EMG shall include representatives of the Office of Public Works, Cork County and City Councils. All updates to the CEMP will be subject to review and formal written agreement by the lead EMG representatives. The EMG shall review all environmental audit results and ensure that remedial actions are agreed and implemented to address any environmental compliance issues on a timely basis. It shall also ensure that environmental impacts during construction of the scheme are managed as required by this order and do not exceed the envelope of effects predicted in the EIAR and NIS including their addenda.

   Reason: In the interests of environmental protection and compliance.

3. The frequency of Environmental Audits shall be monthly, at least. This frequency shall be reviewed by the EMG and increased, if required, during periods of elevated potential for impacts or in response to frequency or extent of any emerging compliance issues.

   Reason: In the interests of environmental protection and compliance.

4. The EMG shall monitor liaison with relevant statutory authorities regarding aspects of construction affecting specific environmental factors, as relevant to each authority. These authorities shall include the Environment, Heritage and Planning sections of Cork County and City Councils, Inland Fisheries Ireland (IFI), the National Monuments Service and the National Parks and Wildlife Service (NPWS) sections of the Department of Housing, Local Government and Heritage.

   Reason: In the interests of environmental protection and compliance.

5. A Communication Plan shall be prepared and agreed with the EMG. This plan shall provide for the presentation of clear information on scheduled works along with obligations set out in the EIAR and NIS and proposals in the CEMP. It shall also provide for access to the full Schedule of Mitigation Measures, CEMP and Environmental Audits. It shall specify the format of environmental audit presentation to include summaries and to ensure that the information is readily accessible. This information shall be made publicly available through the project Extranet or equivalent, as well as by any other means agreed with the Cow1cils, such as newsletters for public distribution. The EMG shall monitor adherence to the communication plan.

   Reason: In the interests of making information on upcoming and ongoing works, and on environmental compliance, freely available to interested parties.

6. Following completion of the construction phase of the scheme all maintenance works shall be subject to further environmental assessment and compliance requirements as required to ensure ongoing compliance with all applicable statutory guidance and all relevant environmental legislation. This will include, but not be limited to, compliance with the mitigation measures set out in the EIAR and NIS, to ensure the maintenance works are consistent with the predicted envelope of environmental effects, as assessed during the DPER consent process.

   Reason: In the interests of clarity and the amelioration of environmental impacts.

1.2 Overview of the CEMP

This CEMP summarises the overall environmental management strategy that shall be implemented during the construction phase of the Glashaboy River (Glanmire/Sallybrook) Drainage Scheme.

Construction is considered to include all site preparation, enabling works, demolition, materials delivery, materials and waste removal, construction activities and associated engineering works. Following completion of the construction phase, periodic inspection and maintenance works will be undertaken.

Cork City Council as Agents of the Commissioners of Public Works in Ireland will employ an Employer's Representative (ER) who will have a supervising Resident Engineer (RE) team on site to oversee all aspects of the construction phase of the scheme. The supervising Resident Engineer team's role will be to ensure the Contractor and its sub-contractors will comply with all of the performance requirements set out in the tender documentation including any conditions attached to the confirmation of the scheme which may be granted by MPER. Cork County Council has retained the role of Project Coordinator.

This CEMP sets out the duties and responsibilities in relation to the environmental management of the project which will be imposed on the Contractor in the construction contract. The ER and supervising RE team will ensure compliance with the mitigation measures set out in the 2018 EIAR, the EIAR Addendum (2020), the 2020 NIS[1] and will be responsible for ensuring that the Contractor complies with all requirements of this CEMP.

This CEMP must be read in conjunction with the construction details provided in the EIAR and NIS.

Where practicable, any reference in this CEMP to a chapter in the 2018 EIAR is in *italics* to distinguish it from a chapter of the 2020 EIAR Addendum, which is in normal text format and "**bold**".

1.2.1 Purpose of the CEMP

The purpose of this CEMP is to provide a framework that describes how Cork City Council will supervise and the Contractor will implement the mitigation measures described in the 2018 EIAR, the 2020 EIAR Addendum, and the 2020 NIS in order to minimise the negative environmental effects of the construction of the scheme. This CEMP has been produced, as part of the application for confirmation, to ensure compliance with legislative requirements and the mitigation measures specified 2018 EIAR, the 2020 EIAR Addendum and the 2020 NIS, which have been prepared for the scheme.

[1] 2020 Natura Impact Statement replaces the 2018 Natura Impact Statement.

This CEMP identifies the minimum requirements with regard to the appropriate mitigation, monitoring, inspection and reporting mechanisms that need to be implemented throughout the construction phase and during maintenance works. Compliance with this CEMP will not absolve Cork City Council, and the appointed Contractor from compliance with all legislation and bylaws relating to the construction activities.

On completion of the construction phase, there will be periodic inspection and maintenance of the works. As noted in **Chapter 5 Construction Activities and Implementation of Maintenance Activities** (Appendix B), this will be the responsibility of the Office of Public Works (OPW). All OPW maintenance work is undertaken in accordance with Environmental Management Protocols and Standard Operating Procedures (OPW, 2011) along with additional measures where the Standard Operating Procedures show deficiencies, to ensure adverse impacts on the environment are considered and minimised.

1.2.2 Preparation of the CEMP

The CEMP has been prepared having regard to industry best practice guidance including:

- National Roads Authority; Guidelines for the Creation, Implementation and Maintenance of an Environmental Operating Plan; and
- CIRIA (4th Edition, 2015); Environmental Good Practice on Site Guide,

The CEMP has been prepared in conjunction with the 2018 EIAR, the 2020 EIAR Addendum and the 2020 NIS.

1.2.3 Updating the CEMP

The CEMP is a working document. Following the appointment of the Employer's Representative and the Contractor, and prior to commencing works on site, the CEMP will be further developed by the Contractor as follows:

- Section 3, which addresses Roles and Responsibilities, will be adjusted to reflect the Contractor's project team and will be populated,
- The Contractor's method statements will be appended, and
- The confirmation and any conditions attached will be included (see Section 1.1.4 for the conditions), and
- The Contractor's Environmental Management System (EMS) for the scheme, which will be devised according to the criteria of ISO 14001:2004 – Environmental Management Systems, will be appended.

The CEMP will be complemented by the Contractor's General Procedures, Work Procedures and Operations Instructions. These documents will be in place within the site administration offices and appropriate site locations during works.

The CEMP is a dynamic document, and the Contractor will ensure that it remains up to date for the duration of the construction period. The CEMP may need to be updated during the construction period to include such matters as survey and monitoring results, audit reports legislative changes and outcomes of third-party consultations. All of the requirements of the CEMP will be delivered in full by the Contractor. Updating of the CEMP by the Contractor will not affect the robustness and adequacy of the information presented here and relied upon in the EIAR and NIS.

Contract documents will require the main Contractor to submit the updated CEMP to the supervising RE team within 28 days after receiving notice of the Commencement of Works from the Employer's Representative and at defined intervals thereafter. In order to help fulfil their duties under the Contract, the Employer's Representative will carry out an audit of the CEMP at regular intervals to ensure that the Contractor is complying with the environmental provisions of the Contract.

If a Project Extranet is established, an electronic version of the CEMP will be placed on this site to allow members of staff of the Contractor, the Employer's Representative, supervising Resident Engineer team, members of the EMG, Cork City Council, Cork County Council and OPW to monitor and view the CEMP.

2. Description of the Scheme, and Construction and Maintenance Activities

Some sections of *Chapter 3 Description of the Proposed Development* of the 2018 EIAR *have* been updated by **Chapter 4 Description of the Proposed Development and Maintenance Activities** of the 2020 EIAR addendum, and *Chapter 3* and **Chapter 4** should be read together. *Chapter 4 Construction Activities* of the 2018 EIAR has been replaced by **Chapter 5 Construction Activities and Implementation of Maintenance Activities** of the 2020 EIAR addendum.

Chapter 3 and **Chapter 4** are provided in Appendix A of this CEMP. **Chapter 5** is provided in Appendix B of this CEMP.

The information provided in these chapters include a description of the key elements of the scheme, the location of construction compounds and the construction phasing and duration and included below.

2.1 Construction Compounds

A number of potential locations for the construction compounds, in the immediate vicinity of the works, were considered as part of the EIAR 2018 and 2020 EIAR addendum.

The construction compounds considered are located within the 'Indicative Extent of Works' areas as shown in Drawings GR_501 to GR_503 and are shown in Series 5 (Drawing No.'s GR_501 to GR_502) of *Appendix 3.1* of the 2018 EIAR.

The final selection of the compound(s) will be made by the Contractor in consultation with the OPW, Cork City Council, Cork County Council (including the EMG) and the project ecologist. Due to the length of channel involved, the Contractor may establish more than one compound or may choose to move a compound during the construction period, in which case the same consultation process shall apply. Site compounds will comply with the mitigation measures identified within the EIAR 2018 and 2020 EIAR addendum.

Three discrete locations have been identified for set up of construction compounds;

- To the north of Sallybrook Industrial Estate within the existing open space to the east of the proposed Sallybrook flood defence embankment. Refer to Figure 1 below.
- At the Circus Field within the existing green area located immediately north of Hazelwood Avenue. Refer to Figure 2 below.
- Within the green area at the entrance to Ashington Estate, off Brooklodge Grove. Refer to Figure 3 below.

Figure 1 Sallybrook construction compound potential location (Drawing No. GR_501).

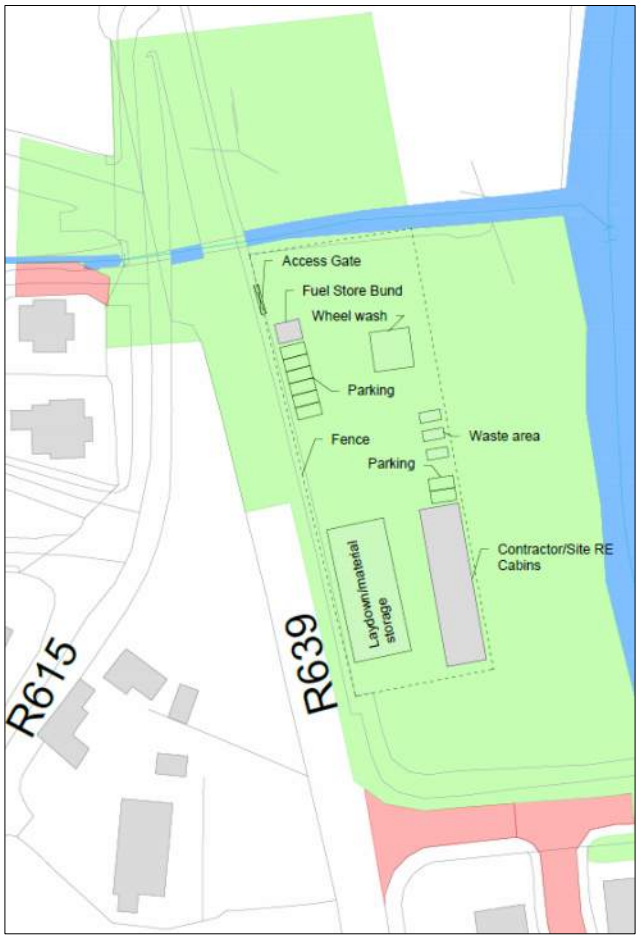

Figure 2 Circus Field construction compound potential location (Drawing No. GR_502).

Figure 3 Brooklodge Grove construction compound potential location (Drawing No. GR_502).

2.2 Construction Phasing and Duration

Construction works are expected to commence in Quarter 4 of 2023. The construction period is estimated to at circa 18-24 months and has been estimated to allow for poor weather over the winter months, mobilisation between sites and significant seasonal ecological restrictions, particularly with regard to bird nesting and fisheries windows. The estimated period for individual locations is presented in Table 2.

Table 2 Estimated Duration of Construction Works.

Area of Works	General Location	Overview of Works	Estimated Construction Period (weeks)
1	Sallybrook Industrial Estate	Culvert replacement along Bleach Hill stream at Cúil Chluthair, direct defences (embankment & flood defence walls) along Glashaboy River, pumping station to the rear of Sallybrook Industrial Estate and provision of a new culvert at the Sallybrook stream. Flow control structure at Mill race at Grandons Garage.	50 - 60 weeks
2	Hazelwood	Culvert replacements at Cois na Gleann Stream (R615 & R639), flood defence wall along R639 and onto Hazelwood Avenue and across Hazelwood Avenue bridge. Flood relief channel and culvert parallel to Glashaboy river under Hazelwood Avenue, bridge replacement at Hazelwood Shopping Centre and flood wall along Glashaboy River, road re-grading and pumping station to the rear of the funeral home. Gas main diversion underneath Glashaboy River	32 – 40 weeks
3	Meadowbrook	Flood Walls along Glashaboy River, culvert replacement and extension along the Springmount stream (R639) and road re-grading works along Riverstown Bridge and approaches, removal of existing manhole from the bridge arch including surface water and foul pumping stations	32 – 40 weeks
4-1	Butlerstown Stream	Minimal landscaping and re-grading of ground levels, to facilitate overland flow from the Butlerstown stream back into the Glenmore Stream	3-4 weeks
4-2	Glenmore Stream	Culvert upgrades, road re-grading and new flood defence walls, channel modification flood walls along Glenmore Stream, re-grading of small area of land adjacent to Glenmore stream to facilitate overland flow	20-25 weeks
5	O'Callaghan Park to Glanmire Bridge	Flood wall repair and replacement, and new embankment along R369 and The Grove. Works include new foul pipe construction, road reinstatement, and installation of safety barrier.	28-33 weeks
6	Downstream of Glanmire Bridge	No construction works proposed in this location. Only channel maintenance within this extent as indicated on the Confirmation drawings.	n/a

As discussed above, the construction works themselves will last approximately 18 to 24 months and will be subject to the following programme constraints:

- In-stream works (including preparatory work) on the Glashaboy River and its tributaries will be undertaken in a window from July to September (inclusive) and in consultation with Inland Fisheries Ireland (IFI) to avoid accidental damage or siltation of spawning beds. In-stream works associated with the drainage scheme will be carried out under the supervision of a suitably qualified and experienced ecologist. Further details are provided in *Chapter 6 Biodiversity* of the 2018 EIAR and **Chapter 6 Biodiversity** of the EIAR addendum.
- To avoid impacting on bird nesting sites, all vegetation clearance and site preparatory works will be conducted outside of the bird nesting season (1 March to 31 August inclusive) where possible. However, in the event that vegetation clearance works and/or site preparatory works are required during the bird nesting season, these will only be carried out once an advance survey has been carried out to establish whether there is any evidence of nests, and the area proposed for clearance has been approved by a suitably qualified and experienced ecologist. Specific details on removal of vegetation and trees are provided in the locations below where necessary.
- There are a number of otter holts in the vicinity of Sallybrook, Hazelwood and Meadowbrook on the Glashaboy River. Otter activity has been observed both on the Glashaboy River and on the Glenmore Stream. Consultation is ongoing with the NPWS in relation to a specific otter mitigation strategy in the form of a derogation licence for disturbance, temporary closure of holts, installation of artificial holts and seasonal restrictions of works. A derogation licence for otters from the NPWS is provided in *Appendix 6.3* of 2018 EIAR. A derogation licence for bats from the NPWS is also provided in *Appendix 6.4* of 2018 EIAR. Further details are provided in *Chapter 6 Biodiversity* of the 2018 EIAR **Chapter 6 Biodiversity** of the EIAR addendum.

The co-ordination of people and materials on site will be one of the key activities throughout the construction phase. In order to ensure that construction workers do not create undue disruption, there will be a requirement that the Contractor provide adequate site supervision to co-ordinate, monitor and implement site regulations.

Normal construction working hours will be observed. These are 08.00 – 19.00 Monday to Friday; 09.00 – 16.00 on Saturday. It may be necessary to work outside these hours, including at weekends and at night, at certain stages. Working outside normal hours may be necessitated through consideration of safety or weather and sub-contractor availability. Heavy or noisy construction activities will be avoided outside normal hours and the amount of work outside normal hours will be strictly controlled. Approval from Cork City Council and Cork County Council will be obtained for works outside normal hours.

The average number of construction personnel on site will be circa 30 personnel but this will vary depending on the construction activities required and seasonal constraints and will likely peak during the summer months when up to 50 construction personnel will be on site.

3. Roles and Responsibilities

3.1 CEMP Implementation Team

To ensure the successful implementation of the CEMP, Cork City Council as Agents of the Commissioners of Public Works in Ireland (Office of Public Works), have appointed an Employer's Representative (ER), who will oversee the construction of the scheme and supervise the implementation of the CEMP. The Contractor will be responsible, under the contract, to implement the CEMP.

The roles and responsibilities of the ER and the Contractor and their staff, in relation to the CEMP and the environmental management of the scheme, are set out in Table 2. When the ER and Contractor have been appointed, Table 2 will be further developed with the names of the individuals appointed to the senior roles.

Table 3 Roles and responsibilities in relation to the CEMP

Role	Responsibility
Employer's Project Director	• Implement the scheme on behalf of the Employer, Cork City Council as Agents of the Commissioners of Public Works in Ireland (Office of Public Works)
Employer's Representative (Note 1)	
Employer's Representative	• Oversee all aspects of the construction project, including programme, commercial, quality, health and safety, and compliance with environmental requirements. • Ensure compliance with the CEMP.
Supervising Resident Engineer onsite	• Undertake the day-to-day supervision of the construction Contractor; • Review and approve Contractor's plans, method statements and risk assessments; • Manage resident engineer team • Monitor implementation of CEMP; • Liaise with statutory stakeholders re ongoing activities and incidents; • Liaise with residents and general community to ensure that any disturbance is kept to a minimum and all anticipated nuisances are minimised; • Ensure complaints from local community are addressed.
Resident Engineer team on site	• Oversee the physical works, to ensure that they are undertaken in compliance with the contract plans and method statements; • Supervise implementation of the CEMP.
Resident Engineer's Ecologist (ECOW)	• Supervise the environmental mitigation measures as described in the CEMP; • Liaise with Cork City Council Heritage Officers, IFI and NPWS; • Ensure compliance with derogation licences.
Contractor (Note 1) (Note 2)	
Contracts Director	• Overall responsibility to ensure the contract conditions and requirements are fully implemented • Comply with the CEMP
Contracts Manager / Construction Manager/ Site Agent	• Comply with the CEMP • Manager on site with day-to-day responsibility for the construction project including resourcing, programme, commercial, quality and compliance with environmental requirements; • Overall responsibility for environmental management on the site; • Ensure there is regular communication with the Employer and relevant statutory and non-statutory bodies on environmental matters as necessary. • Liaise with Employer's Representative and supervising Resident Engineer • Advise the construction team and workforce on best practice to minimise the impact of the works on the environment; • Ensure the environmental procedures are adequate and appropriate and are adhered to on site; • First point of contact for the Employer in relation to Environmental aspects; • Chair regular meetings of the site team; • Keep stakeholders informed of ongoing activities that may affect them; • Log stakeholder enquiries/complaints and dealing with them directly or passing to the relevant party for action; • Ensure adequate environmental protection measures are included in method statements; • Ensuring there is a regular review of the environment commitments with the Field Engineers and Foremen; • Ensure adequate environment briefings are carried out prior to all activities; • Ensure appropriate Toolbox Talks are given to the workforce as required; • Ensure implementation of the Construction Traffic Management Plan; • Manage waste on site and updating of the Construction and Demolition Waste Management Plan.
Safety, Health, Environment and Quality Manager (SHEQ)	• Comply with the CEMP • Onsite environmental co-ordinator, acting as the focal point of contact for all environmental issues on site; • Deliver environmental training, as necessary to the workforce; • Manage environmental specialist sub-contractors; • Update and review the CEMP throughout the construction period;

Role	Responsibility
	• Monitor compliance of construction activities with the CEMP and environmental legislation/licences.
SHEQ Compliance Officer	• Comply with the CEMP • Assist the SHEQ manager in the above
Field Engineers	• Comply with the CEMP • Prepare detailed method statements and risk assessments, including producing and managing method statements and work plans in relation to environment aspects, as required by the CEMP; • Ensure that method statements and control measures are implemented; • implement any on-site actions required from audits or other environmental observations; • Monitor and supervise construction activities;
Foremen	• Comply with the CEMP • Support SHEQ Manager in delivery of the environmental components of the works; • Record the progress of environmental works; • Monitor/supervise construction activities; • Carry out audits as required by the CEMP.
Waste Manager	• Ensure compliance with the CEMP, particularly in relation the Construction and Demolition Waste Management Plan • Waste Duty Holders will be trained and appointed for the duration of the project. Their responsibilities include: • Correct handling of all waste management documentation; • Where appropriate, ensure sub-contractors method statements include waste disposal methods; • Make him/herself aware of legislation, codes of practice, guidance notes and good environmental working practice relevant to his work; • Take advice from the SHEQ manager on the requirements; • Carry out audits on sub-contractor's waste management practices; • Ensure waste on site is stored and handled correctly; • Ensure waste is segregated and skips labelled correctly; • Carry out checks on waste carriers and disposal sites; • Source to Destination checks on waste; • Retain Waste Transfer Notes (WTN) and Hazardous Waste Consignment Notes (HWCN) in waste file for requisite period post-construction; • Ensure completion of the project waste register;
Employees	• Comply with the CEMP • Comply with directions and requirements given in the site induction; • Proactively approach environmental issues whilst on site; • Report any environmental incidents/near misses immediately to the SHEQ Manager; • Carry out all activities in line with the environmental procedures and requirements detailed in the CEMP.
General sub-contractors	• Comply with the CEMP • Comply with directions and requirements given in the site induction; • Follow control procedures as instructed; • Carry out all activities in line within environmental procedures and requirements detailed in the CEMP; • Report any environmental incidents/near misses immediately to the Contracts Manager or SHEQ Manager.
Environmental specialist sub-contractors e.g. Contractor's Ecologist and Contractor's Archaeologist	• Comply with the CEMP • As above for general sub-contractors; • Ensure that all mitigation measures used to protect the environment are in place and are maintained during the works. • Undertaking and reporting on weekly monitoring and undertaking weekly site inspections. • Revising the mitigation measures if the monitoring evidence indicates that the measure is not effectively protecting the environment

Role	Responsibility
	• Undertaking an invasive species survey in advance of any soil being excavated for disposal off-site. • Supervising of any excavation; and • Provide toolbox talks to all sub-contractors before they start on site. • Carry out surveys and monitoring as detailed in the CEMP, the EIAR and NIS.
Community Liaison Officer	• Comply with the CEMP • Liaise with the contracts manager and supervising resident engineer in relation to community engagement; • Keep community in general, and neighbouring residents in particular, informed of ongoing activities that may affect them; • Log stakeholder enquiries/complaints and deal with them directly or pas to the relevant party for action.

Note 1: The managers and staff of the employer's representative and the Contractor have other duties, which are not indicated here.

Note 2: The site management structure may be different in detail, depending on the Contractor appoint, but all of the tasks listed will be undertaken.

3.2 Contact Details

When the roles listed above have been assigned, contact details for the relevant personnel will be included in the CEMP. The contact details are required primarily in order to ensure a rapid response to, and the efficient reporting of, environmental incidents. The contact details will be maintained up to date. The contact details may be broken down into three categories: (i) Contractor's personnel, (ii) Employer's Representative contacts and (iii) statutory and third-party contacts. The contact details will include the organisation, position title, name, mobile phone number and email address of relevant personnel.

4. Reference Documents

This section is included in the CEMP to provide an overview of the reference documents of relevance to the environmental management of the scheme. Reference documents are divided into two categories: project specific reference documentation and general reference and guidance documentation.

4.1 Project Specific Reference Documents

The project specific reference documents are:

- Glashaboy River (Glanmire/Sallybrook) Drainage Scheme Environmental Impact Assessment Report, September 2018.
- Glashaboy River (Glanmire/Sallybrook) Drainage Scheme Environmental Impact Assessment Report Addendum, October 2020.
- Glashaboy River (Glanmire/Sallybrook) Drainage Scheme Natura Impact Statement, October 2020.

Other project specific reference documents will be included in this section when the Contractor further develops the CEMP. These will include reference to documents such as the Contract Documents, MPER's confirmation and any conditions attached, Health and Safety Plan, Quality Plan and any other relevant project specific reference documentation.

4.2 General Reference and Guidance Documentation

The general reference and guidance documents, listed below, indicate best practice approaches to addressing potential significant environmental impacts during the construction. The list is non-exhaustive and will be updated by the Contractor as some of the standards and documents may be revised or additional new guidance published prior to construction.

- British Standard Institute *BS 4428:1989* Code of practice for general landscape operations (1989)
- British Standard Institute BS 5228 – 1: 2009 +A1 2014: Code of Practice for Noise and Vibration Control on Construction and Open Sites – Noise.UK Environment Agency PPGs including PPG1, PPG2, PPG5, PPG6 and PPG21 (2009, 2014)
- British Standard Institute BS5837:2012, Trees in relation to design, demolition and construction. Recommendations.
- British Standards Institution PAS 2080:2016 Carbon Management in Infrastructure (2016)
- Construction Industry, Task Force B4 Report - *Recycling of Construction and Demolition Waste* (2001)
- CIRIA SP156 Control of water pollution from construction sites – guide to good practice (2002)
- CIRIA C532 Control of Water Pollution from Construction Sites. Guidance for consultants and Contractors (2001)
- CIRIA C584: Coastal and Marine Environmental Site Guide (2003)
- CIRIA C624 Development and Flood Risk – guidance for the construction industry (2004);
- CIRIA C648 Control of Water Pollution from Linear Construction Projects - Site Guide (2006)
- CIRIA C649 Control of water pollution from linear construction project - Technical guidance (2006)
- CIRIA C741 Environmental good practice on site guide (4th edition) (2015)
- CIRIA C750 Groundwater control – design and practice (2016)
- Department of Transport, Tourism and Sport *Guidelines for Managing Openings in Public Roads* (April 2017).
- Department of Transport, Tourism and Sport Traffic Signs Manual – Chapter 8 Temporary Traffic Measures and Signs for Roadworks (August 2019)
- Environmental Protection Agency (2021) Best practice guidelines for the preparation of resource and waste management plans for construction and demolition projects.
- Inland Fisheries Ireland Guidance on Protection of Fisheries during Construction Works in and adjacent to waters (2016)
- Local Government Management Services Board and Department of Transport Guidance for the Control and Management of Traffic at Roadworks – Second Edition (2010)
- National Roads Authority Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes (2008)
- National Roads Authority Guidelines on the Management of Noxious Weeds and Non-Native Invasive Plant Species on National Road Schemes, Rev 1 (2010)
- National Roads Authority Guidelines for the Protection and Preservation of Trees, Hedgerows and Scrub Prior to, During and Post Construction of National Road Schemes
- National Roads Authority Guidelines for the Treatment of Bats during to the Construction of National Road Schemes (2008)
- National Roads Authority Guidelines for the Treatment of Otters prior to the Construction of National Road Schemes (2008)

5. Environmental Commitments

5.1 Introduction

The mitigation measures specified in the 2018 EIAR, the 2020 addendum to the EIAR and the 2020 NIS, to reduce the impacts on the environment to a practical minimum are compiled below. This chapter provides a comprehensive list of the environmental protection measures which will be implemented for the duration of the construction works.

Following confirmation of scheme in 2020, additional surveys have been carried out in relation to biodiversity, hydrology and archaeology. These surveys have been included appended as outlined below:

- Additional mitigation measures, included in each of the following relevant sections (and Appendix I);
- Post-confirmation Ecological and archaeological surveys for Area 4 additional works, see Section 5 of the EMG Additional Mitigation Measures (Appendix I);
- All derogation licence applications, associated reports and issued licences to date from NPWS (for bats and otters), see Appendices E, J and K;
- Revised Tree Removal Drawings, XX-040-XX Series (Appendix H);
- Pre-construction Fisheries Assessment, March 2023 (Appendix L); and
- Water Quality Sampling Results, January to June 2023 (Appendix N).

5.2 Biodiversity

5.2.1 Natura Impact Statement - Mitigation Measures

This section describes the avoidance and mitigation measures required to prevent or reduce impacts on Cork Harbour SPA and Great Island Channel SAC.

5.2.1.1 General

All of the works and mitigation measures will be designed and implemented by the Contractor's Ecologist and supervised by the Resident Engineer's (RE) Ecologist during the construction period, who will report to the Heritage Officer of Cork City Council. The reporting format and programme will be agreed with Cork City Council prior to commencement of works and at least 4 weeks prior to site clearance.

- The following mitigation measures will be implemented:
- No construction works will take place downstream of Glanmire Bridge.
- Localised temporary piling during the construction phase of the scheme will not take place downstream of Glanmire Bridge, which carries road L2999.
- Temporary piling will not take place during the hours of darkness.
- Vibratory piling methods will be used as a low noise alternative to impact piling.
- Piling methods will use a 'soft-start' approach to piling.
- The permanent works (i.e. the flood defence walls) will not encroach into Cork Harbour SPA and Glanmire Wood pNHA. The closest part of Cork Harbour SPA to the southern – works in the scheme is approximately 470m.
- Even though the works will not encroach into Cork Harbour SPA, wherever possible works on the flood defence walls will be conducted from the dry side to limit damage to riverine/estuarine and intertidal habitats along the toe of the walls and works.

5.2.1.2 Water Quality - Mitigation Measures

Appropriate mitigation measures will be implemented prior to the construction phase to ensure that water quality of the Glashaboy River is not adversely affected through pollution incidents and silt and nutrient mobilisation.

Baseline water quality monitoring has been carried out (January to June 2023) and the Contractor will be responsible fulfilling all water quality monitoring responsibilities and maintaining the current standard of water quality.

Mitigation measures will include:

- Appropriate sediment control measures will be employed. Refer to Section 5.2.1.3 and 5.2.1.4 for mitigation measures.
- Any chemical, fuel and oil stores will be located on an impervious base within a secured bund with a storage capacity 110% of the stored volume.
- Biodegradable oils and fuels will be used where possible.
- Drip trays will be placed underneath any standing machinery to prevent pollution by oil/fuel leaks. Where practicable, refuelling of vehicles and machinery will be carried out on an impermeable surface in one designated area well away from any watercourse or drainage (at least 20m).
- Emergency spill kits will be available on site and staff will be trained in their use.
- Operators will check their vehicles on a daily basis before starting work to confirm the absence of leakages. Any leakages will be reported immediately.
- Checks will be carried out by the Contractor and records kept on a weekly basis and any items that have been repaired/replaced/rejected noted and recorded. Any items of plant machinery found to be defective will be removed from site immediately or positioned in a place of safety until such time that it can be removed. All items of plant will be checked prior to use before each shift for signs of wear/damage.
- All washing out of grout pumps will be carried out in designated areas well away from any watercourse or drainage (at least 20m), such as in the lined compound area. At no point will grout pumps be washed out at the worksite.
- All structures must be designed by a competent person, be constructed of appropriate materials and take account of site conditions (i.e. depth of water, available space, bed substrate, flow velocities, flow patterns, duration of works, accessibility and potential ingress of water).

General mitigation will specify the following key measures:

- Works will be carried out in accordance with the following, but not limited to, best practice and guidelines where possible and where appropriate;
  - CIRIA C532 Control of Water Pollution from Construction Sites. Guidance for consultants and Contractors (2019)
  - CIRIA C648 Control of Water Pollution from Linear Construction Projects - Site Guide (2006)
  - CIRIA C649 Control of water pollution from linear construction project - Technical guidance (2006)
  - CIRIA C750 Groundwater control – design and practice (2016)
  - Inland Fisheries Ireland Guidance on Protection of Fisheries During Construction Works in and Adjacent to Waters (2016)
  - National Roads Authority Guidelines for the Crossing of Watercourses During the Construction of National Road Schemes (2008).

5.2.1.3 Bankside Works- Mitigation Measures

The key areas of bankside works included in the scope of the construction phase of the scheme are listed as follows:

- Sallybrook pumping station
- Sallybrook embankment
- Vegetation clearance works at Sallybrook and other locations
- Hazelwood flood relief channel
- Pumping station and associated works at Meadowbrook
- Removal of pumping station in the vicinity of Copper Valley Vue
- Vegetation removal at Glenmore stream walls

The key mitigation approaches to address bankside works are as follows:

- Adoption of surface water controls including appropriate erosion and silt controls, as described below, to prevent any flow of surface water from the work site into the adjacent watercourses. Silt traps/ settlement ponds / silt fences or other forms of containment and treatment will be constructed at locations that will intercept construction run-off to streams and rivers.
- The Sallybrook embankment is a good example of where a multi-faceted approach will be implemented; using the following techniques:
  - Use geotextile (e.g.: Nilex™ erosion control blankets) to cover any areas of bare soil.
  - Disturb only the areas necessary for immediate construction. This is the best way to limit the amount of erosion and sediment control that is required throughout the project. Keep natural vegetation in place and leave topsoil undisturbed as much as possible.
  - Use silt fencing (e.g.: Terrastop™ geotextile fencing) coupled with a silt trap/ sump, to interrupt the pathway along the slope towards the river and intercept any fine sediment.
  - Segment the site into manageable sediment storage areas for using multiple silt fence runs. The drainage area above any fence will not exceed a quarter of an acre.

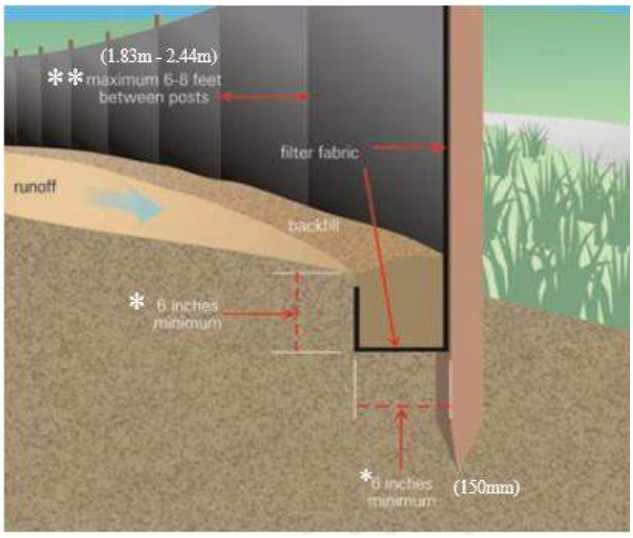

Figure 4 Schematic of silt fencing arrangement for sediment control

* 6 inches is equivalent to 150mm; ** 6-8 feet is equivalent to 1.83 – 2.44m

- Use of straw bales and Sedi-mats™ downstream of works. Straw bale cages can also be used whereby bales are placed into a cage or net to keep them together and placed downstream of the works area to act as a filter for suspended sediment. This method can be enhanced through use of Sedi-mats™ placed

slightly up-stream to trap any settled sediment. The Contractor's Ecologist will provide advice on type and positioning at bank works set up e.g. prior to set up and during works

- Landscaping of banks near watercourses will be carried out during a period of dry weather. Rainfall will be monitored and works carried out ideally during consecutive dry days. Silt control measures to include use of straw bales and Sedi-mats™ downstream of works area.
- During construction of the embankments, works will be undertaken on a phased basis of shorter more manageable sections to mitigate the risk from sediment run off. In addition:
  - Bare areas will be covered with geotextile and fixed in place to minimise any run-off if adverse conditions occur. This will be implemented in advance of any forecast rainfall events.
  - Silt traps/silt fences will be installed downgradient of the embankment to intercept run-off.
  - Low permeability imported material used to construct the core of the embankment will be stored within a controlled buffer zone a minimum distance (at least 20m) away from the river edge to prevent overland run off during stockpiling.
  - No in-channel works will be required for the construction of the embankment.
- Re-seeding of bank will take place immediately after construction. Recommended suppliers of native Irish wildflowers will be approved by the Contractors' Ecologist.
- A buffer zone will remain between the silt trap/ or silt fence and watercourse with natural vegetation left intact, or imported materials such as geotextile, straw bales, coarse to fine gravel will be used either separately or in combination to remove any excess suspended matter.
- Excavations that arise from the removal and root balling of trees along the riverbank will adhere to the following measures to prevent run-off of fines from the excavation into the watercourse:
  - Root balls of trees located 2m or less from the edge of the river channel will not be removed but will be cut to ground level instead.
  - Prior to removal of the root ball a silt fence will be installed downgradient of the excavation area to intercept any run-off to the river channel.
  - Excavated areas where root balls have been removed will be backfilled and reinstated on the same day to limit the exposure of soils and potential run-off.
  - Landscaping of banks near watercourses will be carried out during a period of dry weather. Rainfall will be monitored and works carried out ideally during consecutive dry days.
- All bankside works to be overseen by the Contractor's Ecologist, who will also be responsible for the design and implementation of the mitigation measures as described above. The Contractor's Ecologist will ensure that such control measures are effective and sufficient.

5.2.1.4 Instream Works- Mitigation Measures

Instream works are divided into those which (i) require flow diversion or 'working in the dry' techniques, coupled with over pumping or fluming, and (ii) those where machinery is required to track within the channel due to constraints in access.

Areas requiring stream diversion or 'working in the dry' include;

- Bleach- Hill / Cúil Cluthair Culvert
- Cois na Gleann culvert
- Gas Diversion Works at Hazelwood Avenue
- New wall above Hazelwood
- Riverstown Bridge regrading works

- Glenmore river regrading works
- Brook Lodge & Copper Valley Vue bridge
- M8 New line Bridge

Work areas requiring machinery entering watercourse:

- Sallybrook piling works near Eurofins
- Riverstown Bridge and Meadowbrook flood defence walls

Mitigation for instream works are described below.

- All instream works will be carried out in accordance with the following method and in consultation with IFI.
- All instream works will be undertaken during summer period of July to September inclusive (unless a derogation licence is in place). After this, the river is effectively 'closed' to protect the spawning activity of resident salmon and trout, which occurs during the period October to May. Works shall be programmed to ensure there is a minimal risk to delays. However, where delays in the work programme occur, due to unforeseen circumstances, the Contractor will apply for a derogation licence which will be subject to agreement with IFI.
- All instream works will be completed by end September with re-established bed and bank profiles left with no risk of silt mobilisation.
- All construction machinery operating instream will be mechanically sound to avoid leaks of oils, hydraulic fluid etc. Machinery will be steam-cleaned and checked prior to commencement of instream works (NRA, 2008).
- Silt pollution caused by working in surface water will be minimised or prevented by working in a 'dry' works area and by using appropriate isolation techniques, such as cofferdams and by-pass channels.
- Where dewatering and pumping of water is required the works will be assessed by the Contractor's Ecologist to establish if a fish salvage operation via electrofishing under licence from the Department of Communications, Climate Action and Environment and in consultation with IFI, will be required.
  - If a short-term by-pass channel is required, it will be sized to accommodate surface water flow that might reasonably be expected over the period in question and provide for passage of fish and macroinvertebrates.
  - All instream works will be capable of being made safe in the event of a storm event.
  - IFI personnel are advised to be on site when watercourses are initially diverted (NRA, 2008). The Contractor shall notify and consult IFI with at least 4 weeks' notice prior to undertaking any Works which affect the existing watercourses or the construction of any surface water outfalls.
  - All pumped water to be passed through settlement ponds or tanks to remove sediments.
- If used, abstraction points will be screened to ensure that fish and aquatic plants are not removed from waters in the abstraction process (IFI, 2016). If required, fish populations which become isolated, will be salvaged via electrofishing under licence from the DoCCAE.
- All instream works will be designed and overseen by the Contractor's Ecologist, under the supervision of the RE Ecologist and in consultation with the IFI and in accordance with the IFI (2016) *Guidelines on protection of fisheries during construction works in and adjacent to waters*.

5.2.1.5 Instream Diversion Works

Where culvert installation, bridge construction and flood relief channel construction are, isolation of a dry instream area, through cofferdam construction is required. The following steps will be adopted by the Contractor on appointment.

- Temporary bunding will divert the river around individual works areas thereby allowing for continued flow through the majority of the channel. This will minimise disturbance to the flow regime. Bunding will consist of cobble stone and sandbags covered with impermeable sheeting. The exterior of the bunds will be supported by rock armour laid in layers.
- Pumping of excavations will be directed away from the river and into settling pools or through a filtration system (depending on the volume of water involved) to a location which meets the approval of the RE Ecologist, Employer's Representative and IFI/NPWS.
- Overpumping pipe will contain a filter on the intake to prevent fish being sucked into the system. The outfall of the pipe will flow into a filtration bag and a settlement pond or tanks, employed to allow settlement of all fine sediment prior to release back to the river.
- Suitable locations for settlement facilities at key works areas requiring this technique are described in Table 4.

Table 4 Potential placement locations for settlement tanks/ ponds at instream diversion works area

Flow Diversion Location	Potential placement of settlement facility
Bleach- Hill / Cúil Cluthair Culvert	Field to the north of culvert, adjacent to L2973 Road
Cois na Gleann culvert	Field to north of the culvert – on east side of R639 Road
Gas Diversion Works at Hazelwood Ave	Residential Car park near Grandons GR207
New wall above Hazelwood (C01 L03)	Field on right bank of river by Hazelwood Ave
Riverstown Bridge- regrading works	Parkland/Playground in the north of O'Callaghan Park
Brook Lodge & Copper Valley Vue bridge (Glenmore stream regrading works)	Residential amenity land close to 'the Acres' -either side of stream. Grid ref: 51.930097, -8.377784
M8 - New line Bridge	Field at Corbally North, adjacent to M8 coordinates: 51.926580, -8.374876

- Completion of the cofferdams/ bunds may isolate certain life stages of species of conservation concern from the main river channel such as Atlantic Salmon and River Lamprey. Prior to dewatering, the area within the bunds will be electro-fished and all specimens will be translocated to suitable conditions downstream of the work area. Such works will be undertaken by the holder of an electrofishing licence with IFI approval (and supervision if required). A small sump will be excavated within the bund (c.1m x 0.5m depth) and pumped continuously. A mini excavator will be lifted into the dewatered bunded area.
- Following the completion of diversion works, the bunding and its supports will be the last works elements to be removed/ lifted from the river channel.

5.2.1.6 Instream Tracking

The following mitigation measures will be implemented for instream activities where machinery enters the water course (Sallybrook piling and Riverstown Bridge).

- Fording of the watercourse at Meadowbrook is required to facilitate the flood defence piled wall on the eastern bank. Such works will be carried out following approval from the IFI, and National Parks and Wildlife Service (NPWS) where species protected under the Wildlife Act, Habitats Directive or the Freshwater Fish Directive occur in significant numbers.
- Operation of machinery instream will be kept to an absolute minimum.
- Any instream area which will be accessed by machinery will be effectively isolated prior to commencement of works. This includes works that run parallel to the riverbank on the 'wet side' as well as the temporary crossing at Riverstown. Where required, the temporary crossing will:
  - Include the provision of instream and bank-side preparation, and rehabilitation of the area once the works are complete.

  - Allow for safe crossing of the widest items of plant and equipment without cover material being dislodged and entering waters.
  - Prevent the erosion of stream beds and banks.
  - Natural bank and riverbed stabilisation techniques such as willow-faggoting, stone armour, logs, conifer tops or composite protection using products such as coir-matting or geoweb will be used. Concrete will not be used.
  - Instream crossings will be composed of suitable material both clean and inert, that will allow water to pass through and not give rise to silt run-off. The crossing will be fenced with geotextile or similar material to prevent wind blow carrying dusts etc. to water.
  - Where instream bed material is to be removed, coarse aggregates, if present, will be stockpiled for replacement in the reformed or new channel.
  - Provide for passage of fish and macroinvertebrates (where fording of river is required), as well as prevent erosion and sedimentation.
  - Have capacity to convey the river flows expected without the crossing being overtopped.
  - Restrict to one crossing point and where feasible, traffic movements are limited.
- Where trench excavations into the riverbed are required (for example to access services), these works will be completed in the dry whereby water will be diverted from upstream to downstream through water diversion techniques.
- Following completion of backfilling after excavation, riverbed and banks will be reformed to match their original profile, with the exception of limited sections of riverbank which will be augmented for flood conveyance.
- Channel modifications, which will occur at Glenmore Stream at Brooklodge Grove and de-silting, which will occur at Riverstown Bridge, will follow the mitigation measures as described above.
- As part of the installation of new culverts, some minor regrading and widening of channels are required. To minimise run-off of soil into watercourses a multifaceted approach will be taken whereby;
  - Silt pollution caused by working in surface waters will be minimised or prevented by working in dry conditions with water diverted during the construction period. Surface water will be managed using appropriate isolation techniques as previously outlined.
  - Measures to prevent the release of sediment due to run-off, will include (but not limited to) use of the use of silt fences, silt curtains, settlement lagoons, and filter materials.
  - Excavated material will be transported off site to a licenced facility or stored for reuse on site where appropriate.
  - For the installation of culverts, machinery access to the watercourse will be confined to a single bank, where possible to limit disturbance of ground.
  - Instream floating vegetation (e.g. Ranunculs sp., Callitriche sp.), to be retained wherever possible, and any disturbance to stands of river plant life minimised.

5.2.1.7 Non-native Invasive Species

In order to mitigate the possible spread of non-native invasive species, the following mitigation measures will be implemented:

- All works will be conducted according to the NRA Guidelines 'The Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads'.

- Avoid working in areas where invasive species are present - in particular Japanese Knotweed[2], Himalayan Balsam and Winter Heliotrope and all areas within 7m of visible above-ground growth will be avoided, where possible and clearly demarcated.
- Where works are required in areas infested with Japanese Knotweed, Himalayan Balsam and Winter Heliotrope (including any area within 7m of visible above-ground growth) the *Invasive Species Management Plan* (Appendix C) will be adhered to and implemented in full.
- Prior to commencement, all works areas, site compounds and access routes will be re-surveyed to ensure that stands of non-native invasive species have not become established. Where non -native invasive species are encountered, mitigation strategies as described in Appendix C –*Invasive Species Management Plan* will be implemented by the Contractor.
- Appendix C –*Invasive Species Management Plan* has been developed to address any areas that may affect the scheme prior to the commencement of works. Advance treatment works have commenced in order to address both the treatment and/or removal of Japanese Knotweed, Himalayan Balsam and Winter Heliotrope.
- All Contractors and staff will adhere to Biosecurity Protocols for invasive species.
- Biosecurity measures will be implemented in areas infested with non-native invasive species to prevent the spread of these plants further within the catchment or beyond.
- Himalayan Balsam will be treated prior to the commencement of works. Since only a small stand was observed within the footprint of the scheme it is likely that the hand pulling technique during Spring 2021, prior to flowering, will be used to contain the spread of this plant. Periodic monitoring will be carried out for re-emergence of non-native invasive species such as Japanese knotweed, which is currently undergoing treatment.
- The approaches on eradication and biosecurity are incorporated into Appendix C *Invasive Species Management Plan*.
- The infested areas will be fenced off prior to and during construction works where possible in order to avoid spreading seeds or plant fragments around or off the construction site. In relation to knotweed plant species, a 10m buffer around the area will be provided where possible.
- The rhizome extent in the fenced off areas will be clearly marked.
- Use of machinery with tracks will be avoided if possible, in infested areas.
- Soil, which is contaminated with rhizomes, will be stockpiled on site and clearly identified and marked. These temporary stockpiling areas will not be within 50m of any watercourse or within a flood zone. Contaminated soil will be removed from site (a license to transport the material will be sought from NPWS) and brought to a permitted landfill which can accept such material.
- Designated entry and exit points will be created for operators on foot and for small mobile equipment. A delineated access track to be maintained free of Japanese knotweed will be established through the site to minimise the spread of Japanese knotweed by permitted vehicles accessing the site.
- A dedicated footwear and vehicular wheel wash down facility will be installed within the site.
- Vehicles leaving the site will be inspected for any plant material and washed down into a contained area.
- Vehicles used in the transport of contaminated material will be visually checked and washed down into a contained area before being used for any other work, either on the same site or at a different site.
- Material gathered in the dedicated wash down contained areas will be appropriately treated along with other contaminated soil on site.

[2] Where the term Japanese Knotweed is used, it is understood to include other knotweed variants

- For any material entering the site, the supplier will be required to provide an assurance that it is free of Japanese Knotweed.
- All site users will be made aware of measures to be taken and the requirements of the *Invasive Species Management Plan* (Appendix C).
- Site hygiene signage in relation to the management of non-native invasive material, will be installed where required on site.

5.2.2 Habitats and Flora

The main risk associated with the scheme in relation to habitats is silt delivery to the watercourse. Details on pollution prevention measures to be implemented to ensure the water quality of the Glashaboy River is not adversely affected through pollution incidents and silt and nutrient mobilisation are described in Section 5.2.1.2. Additional mitigation measures to be implemented during bank side works and instream works are described in Section 5.2.1.3 and Section 5.2.1.4 respectively.

In order to mitigate identified construction and operational impacts on the habitats and flora of the scheme, the following mitigation measures will be implemented:

- In-channel working will be minimised, wherever possible;
- Sympathetic and suitably extensive erosion control measures will be installed at key changes in flow regime, such as at culvert entrances and exits, so that local erosion does not precipitate a disruption or acceleration of the sediment regime. A transition from hard to soft erosion control measures will be included at all culverts and hard defences.
- Upon completion of the works, instream (aquatic) vegetation will be allowed to re-colonise naturally, however, this will be monitored and if deemed necessary additional planting of suitable aquatic plant species will be undertaken;
- Upon completion of in-channel works, in-channel sediment features will be reinstated. This may be in the form of placing boulders at intervals along sections of channel where the natural riverbank is being altered by hard structures;
- A silt fence will be installed at the base of the new embankment at Sallybrook. This silt fence will be installed prior to the exposure of unvegetated overburden. Sections of embankment will be appropriately covered at the end of each workday to ensure unvegetated overburden is left exposed;
- It is anticipated that any alteration of the sediment transport processes will be local to the main in channel works, such as bridges and culverts. It is important that a review of the construction works to capture immediate local channel geomorphological response is undertaken by a qualified Geomorphologist. Erosion control measures may be extended further downstream.
- Upon completion of the works the new embankment, and in any other grassland areas disturbed during the construction works, will be re-sown with an appropriate species-rich grass and/or native wildflower seed mix option.
- Hedgerow/tree planting will be undertaken to address the loss of hedgerow/treeline to accommodate the new drainage scheme. As outlined in the *Planting Plan* (Appendix D) replanting will be as close to the existing alignment and location as possible and will use native, locally sourced species appropriate to the locality.

5.2.2.1 Site clearance and demobilisation of plant and equipment

- No cementitious, oils or lubricants will be left on site. Contaminated materials such as oil barriers will be safely disposed of to a toxic waste facility.
- Fencing and geotextile matting will be removed and public access will be reinstated.

- The RE's Ecologist will conduct an inspection of the post-work site to ascertain if the Contractor has met the standards as outlined by the Employer's Representative. The RE's Ecologist will produce a report of their findings for the Employer's Representative.
- The Contractor will notify IFI and NPWS within 7 days of completion of the works and the RE's Ecologist and Contractor's Ecologist will visit the site with the IFI, NPWS and Employer's Representative (if requested) to ensure satisfactory completion of the works.

5.2.3 Birds

In order to mitigate identified construction and operational impacts on birds, not including the overwintering waterbird populations in the SPA which are discussed in the NIS, the following mitigation measures will be implemented:

- All vegetation clearance works, and site preparatory works will be conducted outside of the bird nesting season (March to August inclusive). If this is not possible, a breeding bird survey will be undertaken by the Contractor's Ecologist in advance of the works to ensure that there will be no impacts on nesting birds. If nests are found, they will be safeguarded, with an appropriate buffer, until the chicks have successfully fledged.
- Seasonal windows with respect to bank-nesting birds, Kingfisher and Dipper, will be adhered to. The bird nesting season runs from 01st March to 31stAugust and there are areas of the works specifically within the Meadowbrook area of the scheme which hold potential nesting habitat for these species.
- With regards to the Kingfisher nests, where active piling works are in proximity to the identified Kingfisher nests (e.g. at Meadowbrook), a minimum buffer of 150m will be maintained up and downstream of the Kingfisher nesting river banks location during the nesting season.
- Neither clearance nor construction works to be undertaken in this area until after the 31st of August. If there is need to work in the Meadowbrook area within the August time period, checks for occupancy of nesting burrow will be carried out by the Contractor's Ecologist and if found unoccupied, works to proceed.
- Also, as the fisheries closure season is deemed to start in October this leaves a relatively narrow window for works in these steep bank areas to be completed. Any flexibility within this timeline in this area will need to be agreed on consultation with IFI (for work within the fisheries Autumn window) or NPWS (for works within the nesting bird summer window).
- Impacts on Kingfisher have been mitigated through the scheme design, by moving the flood wall to avoid the Kingfisher embankment and placing the flood defence wall behind the existing wall within Meadowbrook housing estate in order to further minimise impacts to Kingfisher.
- With respect to Kingfisher at Meadowbrook, no temporary piling or construction of the reinforced concrete wall will take place during the breeding bird season (March to August inclusive). Nesting activity will be monitored by the Contractor's Ecologist. If nesting activity is not observed, ensuring the allowance for a late clutch and/or double clutch, works may proceed during the later months of the breeding bird season.
- The Kingfisher embankment in the Kingfisher nesting area at Meadowbrook will be physically screened off from works.
- Hedgerow/tree planting will be undertaken to mitigate for habitat loss during the construction phase. Hedgerows will be replanted as close to the existing alignment and location as possible and will use native, locally sourced species appropriate to the locality. The planting of unstable banks will be carried out to assist the re-establishment of habitat cover to the river corridor.
- Works to existing walls and bridge structures will require a breeding bird survey prior to the commencement of works to ensure there will be no impacts on Dipper and Grey wagtail. If nests are found, they will be safeguarded, with an appropriate buffer, until the chicks have successfully fledged.

If nesting areas of Dipper and Grey wagtail, identified in the breeding bird survey, will be damaged or lost through the scheme, enhancement measures to wall and bridge structures will involve the installation of nest boxes for Dipper and Grey wagtail in these areas. This will be undertaken in consultation with the UCC Ornithology Group, School of Biological, Earth and Environmental Sciences research department which currently run a Dipper project on the Glashaboy River and which have provided information to JBA's ecologists throughout this project. Consultation will be undertaken by the Contractor prior to the installation of nest boxes.

- Following the 2020 survey, it was determined that additional nesting boxes for Dipper will be installed, particularly in the area around Meadowbrook, where activity was noted along the river.
- The Contractor shall specify in the CEMP where all additional nesting boxes are installed, including coordinates and photographs of the additional nesting boxes.

5.2.4 Otter

A number of mitigation measures have been implemented to date as summarised below.

Prior to the confirmation of the scheme derogation licences were granted for the temporary closure of holts on the Glenmore Stream and Glashaboy River:

- Glenmore Stream (Licence No. DER-OTTER-2017-137 (amended)), refer to Appendix E4; and
- Glashaboy River (Licence No. DER-OTTER 2017-170), refer to Appendix E1.

As part of the holt closure on the Glashaboy River, two artificial holts were proposed on the main channel of the Glashaboy River were proposed, refer to Appendix E4. The location of the artificial holts are presented in Appendix E2 and Figure 5 below.

In April 2021, a baseline otter survey of the Glashaboy River and tributaries was undertaken by Triturus Environmental Ltd to identify the presence of otters relative to the planned works areas and to map the species distribution within the works footprint by identifying the occurrence of otter field signs. This report is presented in Appendix J4.

In 2022, a derogation licence (DER-OTTER-2022-09) was granted for the temporary disturbance of otters during the advanced tree felling works and the construction of an artificial holt, refer to Appendix J). During the tree felling works, to ensure no significant impacts on the otter, the duration and direct encroachment on the holt areas and were minimised. The holt areas were demarcated by hazard tape and the arborists were informed of these locations and works were monitored by a trail camera before and after felling to confirm activity at holts before and after tree felling. Refer Appendix J for further information.

These otter derogation licences are summarised below in Table 5.

Table 5 NPWS derogation licences for otters.

NPWS Derogation Licence No.	Summary
DER-OTTER 2017-170	Holt closure on the Glashaboy River for works between 1 January to 28 February 2018. • NPWS Licence No. DER-OTTER-2017-170, refer to Appendix E1. • Proposed Artificial Otter Holt Locations, refer to Appendix E2. Licence issued 22 December 2017.
DER-OTTER-2017-137 (amended)	Holt Closure Glenmore Stream in 2017 • Triturus Environmental Services (2017) Glenmore Otter Holt Closure, Derogation Reporting, November 2017. Refer to Appendix E4. Note: The licence (DER-OTTER-2017-137 (amended)) is included in Appendix A of the above report.

NPWS Derogation Licence No.	Summary
	Licence issued 9 January 2018
025/2017	Licence to photograph/film wild animals for educational, scientific or other purposes on the Glenmore Stream for 3 April 2017 to 31 December 2017. • Triturus Environmental Services (2017) Trail Camera Survey of Otter Lutra lutra on the Glenmore River, Co. Cork, refer to Appendix E5. Note: The licence (025/2017) is included in Appendix A of the above report. Issued 3 April 2017
DER-OTTER-2022-09	Tree felling works in conjunction with the Glanmire/Sallybook Drainage Scheme for works between 31 January 2022 to 31 March 2022. • Licence No. DER-OTTER-2022-09 (Tree felling works 31 January 2022 - March 2022). Refer to Appendix J1. • Glashaboy Flood Relief Scheme Otter Derogation Report, Triturus Environmental Ltd. for NPWS, April 2022. Refer to Appendix J2 • Letter from Triturus Environmental Services to NPWS (22 January 2021). Refer to Appendix J3 • Triturus Environmental Services (2021) Glashaboy Flood Relief Scheme Otter Survey 2021, for NPWS, December 2021. Refer to Appendix J4 Licence issued 31 January 2022.
3/22	Licence to photograph/film wild animals for educational, scientific or other purposes on the Glashaboy River. The 'live' surveillance monitoring using cellular trail cameras helped elucidate patterns of activity by otter and establish the occupancy of the holts areas before, during and after tree felling. Licence issued on 30 January 2022.

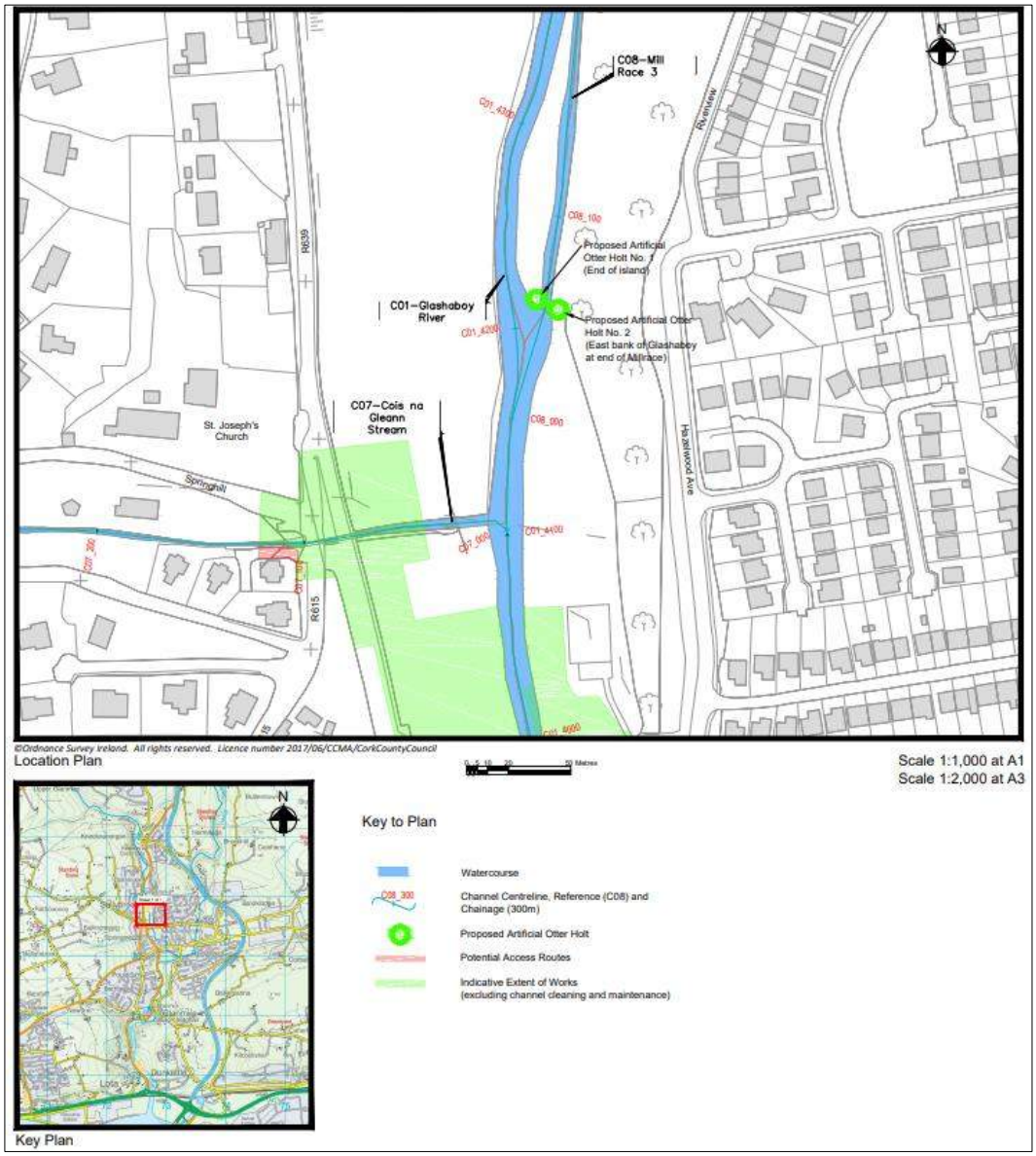

Figure 5 Location of artificial holts. Source Appendix E2.

- The design of new structures will include the provision of ledges for the movement and passage of otters in accordance with 'Guidelines for the treatment of otters prior to the construction period of national road schemes' (NRA, 2008) and 'Guidelines for the crossing of watercourses during the construction of national road schemes' (NRA, 2008). Ledges will tie into the adjoining riverbanks, or riverbed where practicable. A 500mm wide ledge will be constructed from concrete with its top at 150mm above the 1 in 5-year flood event. It will be on one side of the bridge/culvert structure only. These ledges will be provided at the following culverts:
  - Shopping centre bridge at Hazelwood
  - All three new structures on the Glenmore Stream
- A 20m buffer will be provided for any holt in the vicinity of the construction compound at Circus Field. Physical delineation of the 20m buffer will be provided with solid screening. This compound area will be used for the storage of materials. The lighting for the compound will be directional and will prevent unnecessary light spillage and light pollution. Lighting will be controlled by a timeclock/ sensor.
- Night-time working will be avoided if possible, within 20m of known otter holts and resting places, or any identified as part of the pre-works otter survey. If night-time work is required within 20m of an otter holt, this will be detailed in the revised derogation licence, the appropriate mitigation measure strategy, and any additional requirements of the derogation licence will be implemented.

- To minimise the potential for otters becoming trapped in an excavation, all excavations will be left open for the minimum possible time, and not over-night. If excavations have to be left open over-night, they will be fitted with an escape ramp (at a slope of no more than 45°) to allow accidentally trapped animals to escape. Materials to cover excavations or create escape ramps will be on site at all times so that all excavation areas can be made safe before leaving site.
- All materials stored on site will be stacked securely so as to prevent accidental collapse if investigated by an otter, or any other large mammals.

5.2.5 Badger

No badger setts were recorded within the working areas of the scheme. However, given the high mobility of this species and the suitable habitat offered by the works area with respect to commuting and foraging activities, the following mitigation measures will be implemented:

- Prior to commencement, a pre-works survey will be undertaken to locate any active setts. If setts are found, which are likely to be damaged/ disturbed by the works, a derogation licence application will be made to the NPWS.
- To minimise the potential for badgers becoming trapped, all excavations will be left open for the minimum possible time, and not over-night. If excavations have to be left open over-night, they will be fitted with an escape ramp (with a slope of no more than 45°) to allow accidentally trapped animals to escape. Materials to cover excavations or create escape ramps will be on site at all times so that all excavation areas can be made safe before leaving site.
- All materials stored on site will be stacked securely so as to prevent accidental collapse if investigated by badger, or any other large mammals.

5.2.6 Bats

In order to mitigate identified construction impacts on bats, the mitigation measures listed below will be implemented.

Prior to the commencement of works activity surveys will be undertaken. If new areas of bat activity are found, which are likely to be disturbed by the works, an application will be made to the NPWS for an update of the derogation licence.

The following measures will be put in place to avoid or lessen the degree of construction impacts on bats.

5.2.6.1 Mitigation by Avoidance

- Do not remove trees and shrubs along waterway banks adjacent to the bridge structures, where feasible. Protect this habitat from any potential damage as a result of the works associated with the scheme.
- Treelines and shrubs to remain in-situ, where possible, and remain protected from potential disturbance.
- Minimise damage to the woodland habitat adjacent to the bridges/walls/ culverts and along the rivers.
- Ensure that all equipment and construction materials are stored within the construction compounds.

5.2.6.2 Priority Mitigation Measures for Bats – Riverstown Bridge

Riverstown Bridge is the only bridge within the scheme that has potential to be used by bats as a roosting site. A derogation licence (No. DER/BAT 2017 (amended) – 168) was obtained from NPWS for the bat mitigation works on Riverstown bridge (See Appendix E3). The licence was granted on 9 January 2018 to for works between 1 August 2018 and 31 July 2019.

An updated licence may be required in advance of works at Riverstown Bridge.

The mitigation measures outlined below are those contained in the derogation licence application.

- A Bat Specialist will examine the arch prior to works. If crevices are not used by bats, they will be filled temporarily with bubble wrap. This will prevent the bats using the crevice during works. Once works are

finished, the bubble wrap will be removed allowing the bats to use the crevices post works. However, at the section where the pedestrian foot bridge meets the stone bridge, there are gaps suitable for roosting bats. There is also evidence of nesting birds. This, where possible, is to remain open.

- The above mitigation measures contained in the derogation licence application will be undertaken outside the main maternity season (May-July/August) and the main hibernation season (Dec/Jan – this is weather dependent). The works as part of this derogation licence will be avoided during freezing conditions, where possible.
- Crevices that remain open will be daily checked prior to filling in unless the canvas sheeting procedure, as recommended below, in undertaken.

Photograph 1 Example of a bat-suitable crevice filled/blocked with bubble wrap to prevent bat occupancy during works (Photograph courtesy of Caroline Shield

Due to the number of open crevices found in Riverstown Bridge, a bat inspection of the bridge will be undertaken the night before works are due to be undertaken. In preparation for this survey, two sheets of canvas that will close the arches (post bat survey), will be in place (i.e. canvas sheeting to be erected from the top of the bridge and held in place). When the sheeting is unfurled, the length of it will reach the water level. The width of the sheeting will ensure that entire opening of the arches are covered to prevent bats accessing the bridge for the duration of the works.

Once the bat inspection and survey determine that there are no bats within the bridge, the canvas sheets will be released. While the canvas sheeting can be opened during the daytime to allow works to be undertaken, it is of paramount importance that each evening, the canvas sheets are released to close the arches during the night for the duration of the works under the arches. Once the works are finalised and a bat inspection is completed, the crevices blocked to be retained are unblocked and the canvas sheets removed.

Photograph 2 Example of canvas sheets used to close off the bridge arches once they have been declared bat free by a Bat Specialist.

5.2.6.3 Removal of Trees

The 2018 EIAR referred to Potential Bat Roosting (PBR) values. This term has since been superseded by Bat Roosting Potential (BRP) and the equivalent terms are shown in Table 6 below:

Table 6 Conversion of bat roosting ratings from superseded guidance to current guidance.

2018 EIAR Ch 6 Biodiversity Rating system by: Bat Eco Services (superseded)	EIAR Addendum (2020) Ch 7 Biodiversity Rating system by: Bat Conservation Trust 2016
Potential Bat Roosting (PBR) value	Bat Roosting Potential (BRP)
A	High
B	Moderate
C	Low

- The removal of mature trees with bat roost potential, i.e. BRP trees, will be minimised where possible.
- Where BRP trees are to be removed, felling will be undertaken during the months of September and October, (potentially November – weather dependent), and February and March during mild weather conditions. *Note: the breeding bird season is March to August inclusive. Thus, tree removal during March will be only conducted if a breeding bird survey has undertaken by a Contractor's Ecologist in advance of the works.*
- Tree felling of BRP trees may take place in December and January in mild conditions (i.e. >8 ºC daytime temperature).
  This will be undertaken in consultation with the Bat Specialist. New planting will mitigate tree removal. Planting will be in accordance with the *Planting Plan* (Appendix D) and will comprise of native species.

An assessment of trees according to their BRP value will determine the methodology of felling. Trees with a 'Moderate' rating have a medium suitability for roosting bats and require more intensive procedures prior to felling, for example:

- Any trees showing crevices, hollows, *etc*., will be removed while a Bat Specialist is present to deal with any bats found (i.e. BRP High or Moderate).

  Such animals will be retained in a box until dusk and released on-site. Large mature trees will be felled carefully, essentially by gradual dismantling by Tree Surgeons, under supervision of a Bat Specialist.

Care will be taken when removing branches as removal of loads may cause cracks or crevices to close, crushing any animals within. These cracks will be wedged open prior to load removal.

The dead branches will be lowered to the ground using ropes to avoid impacts which may injure or kill bats within. This measure refers to BRP Moderate rated trees. These trees will be marked with spray paint prior to felling in order for them to be felled correctly in relation to the method described above.

- A Bat Specialist will survey all trees due for removal prior to construction works commencing once there is a consensus on what trees are to be removed and there is a clear access to all of the trees on-site.
- Any ivy-covered trees, which require felling, will be left to lie for 24 hours after felling to allow any bats beneath the cover to escape (i.e. BRP Low).

5.2.6.4 Alternative roosting sites – Bat Boxes

As part of tree felling works in 2022, Bat Eco Services carried out a number of duties, including surveys of trees in the Hazelbrook area and Sallybrook area and erecting bat boxes, described in detail in Appendix K (Letter: Bat Duties).

The report notes that 40 no. bat boxes are to be erected as part of the scheme. To date, 30 bat boxes have been erected at John O' Callaghan Park (12 no. boxes), Brooklodge (pedestrian path along the river – 10 no. boxes), and Hazelbrook (woodland tracks along the river north of the shopping centre – 8 no. boxes). The locations of all bat boxes erected are set out in the report.

A further ten boxes will be erected at Sallybrook and North of Glanmire Bridge (once a site is confirmed for Sallybrook).

The bat box design which will be used is:

- 'Schwegler' woodcrete bat box designs – 1FF design (flat box, self-cleaning).

This type of bat box will be suitable for brown long-eared bats, pipistrelles and Leisler's bat.

The bat tube designs recommended for use are:

- 'Schwegler' 1FR bat tubes and 'Schwegler' 1WI Summer and Winter Bat Box, which is designed for year-round occupation.

The 1FR bat tube, for best results, will be used where it is inserted into the fabric of structures. The 1WI is an insulated version which is more suitable for attaching to external surfaces of structures such as flood defence walls. Therefore, this type of bat tube will be used where it is not possible to build the standard bat tube into the fabric of a structure.

The bat tubes will be inserted into walls or attached to bridges and other suitable structures. Any wall approximately 2m or higher is suitable for the tubes. They are approximately the size of a concrete block with an opening to allow bats to enter into the internal space of the tube. They will be built into walls with the opening at the bottom and facing out onto the waterway to allow bats to enter and exit freely over water. The exit point needs to be 1.5m above the normal water level to ensure that they are not flooded.

Bat tubes will be inserted in walls during construction. The locations of bat boxes and bat tubes will be identified by a Bat Specialist prior to construction works commencing in that area.

To ensure that bats use the bat boxes, the bat boxes will be sited carefully. Some general points, which will be to be followed include:

- Straight limb trees (or telegraph pole) with no crowding branches or other obstructions for at least 3 metres above and below position of bat box.
- Diameter of tree will be wide and strong enough to hold the required number of boxes.
- Locate bat boxes in areas where bats are known to forage or adjacent to suitable foraging areas. Locations will be sheltered from prevailing winds.

- Bat boxes will be erected at a height of 4-5 metres to reduce the potential of vandalism and predation of resident bats.
- A number of bat boxes will be erected on one tree at an array of aspects. South facing boxes will receive the warmth of the sun, which is necessary for maternity colonies. In large bat box schemes, it is generally recommended to have three bat boxes arranged at the same height facing North, South-East and South-West. This ensues a range of temperatures are available all day. If the South facing boxes become warm, bats can safely remove to the cooler North facing box.

Mitigation measures for the removal of trees are described in Section 5.2.8 below.

5.2.6.5 Enhancement work – tree planting

A large array of trees will be felled as part of the flood relief works. It is therefore recommended to plant tree species in adjacent public lands to mitigate for such habitat loss.

Bats utilise trees as they develop tree holes, splits etc. in reaction to the aging process or weather damage. Different tree species develop different features at different ages. Tree species such as alder and birch grow quickly and also develop suitable roosting sites for bats quickly, while slow growing tree species develop suitable roosting sites for bats at a slower rate. Therefore, it is recommended to plant a mix of Irish native trees species such as alder, birch, oak with undershrub layer of hawthorn, blackthorn and holly. Further details are provided in the *Planting Plan* (Appendix D).

5.2.6.6 Lighting

- Open areas required to facilitate works will be limited, where feasible, to areas where tree and hedgerows are not present. Lighting of such workspaces can also disrupt traditional foraging grounds for bats and therefore will be limited, as far as is practical, having regard for workplace health and safety, particularly during the foraging period (30 minutes prior to sunset to 30 minutes after sunrise).
- Temporary construction lighting may be required at some locations especially during the winter months where daylight hours are short. Site lighting will generally be provided by tower mounted 1000W metal halide floodlights, which will be angled downwards to minimise spillage of light from the site.

5.2.7 Fisheries

In order to mitigate identified construction and operational impacts on fisheries the following mitigation measures will be implemented:

- All instream and bankside works must comply with measures as outlined in Section 5.2.1.3 and Section 5.2.1.4.
- IFI Guidance on the Protection of Fisheries During Construction Works in and adjacent to Water (IFI, 2016) will be followed and consultation with IFI will be carried out prior to works.
- In-channel working will be minimised, wherever possible. Where in-channel working is unavoidable, works will be preferentially done in the dry wherever possible, through the use of temporary coffer dams and dewatering, following a fish rescue from any wetted channel area within the coffer dam. Fish rescues will be undertaken by an appropriately experienced fisheries Contractor in possession of the relevant permits and consents from the regulator.
- In-channel works will only occur during the instream working window, i.e. July – September inclusive. Extension of the July – September working window will be in consultation with IFI.
- During the construction phase it will be ensured that fish can migrate past areas of in-channel working.
- Where piling is required, a presumption against the use of percussive piling will be made. Where possible, a press-in piling technique will be used, with a presumption to use vibration piling, using a variable moment vibrator, where press-in techniques are not appropriate due to ground conditions.
- Any pumps used for over-pumping/de-watering will be fitted with appropriate screens.

- Method statement will be drafted and approved with IFI for in-channel works relating to fitting of all non-return drainage outlets to new flood defence walls.
- Hard engineering of the riverbed will be avoided.
- Any riverbed materials removed or disrupted as part of the works will be replaced and any areas where new bed materials will be installed (i.e., wall footings, bed armour to prevent scour), will be designed to replicate natural bed conditions. Existing bed material will be used to cover new bed materials, wherever possible. Bed material removed from the river will be stored on the bankside. The storage facility will be such that there will be no loss of sediments from the material stored and no external contamination (e.g. a bunded plastic sheet or sealed plastic container). Once excavations are complete, and any new material has been introduced, the stored material will be replaced over the bed. Once normal flows are restored after demobilisation, the replaced material will be redistributed by the currents. These measures will ensure no net loss of material and no significant changes to bed sediment morphology or composition.
- All culverts and trash screens have been designed and will be installed in line with published best practice on fish passage (e.g. CIRIA 2010; Armstrong et al 2010; Turnpenny& O'Keefe 2005).
- The existing timber weir and remnants of an older hydropower wheel will be removed as part of the works. The removal of the timber weir will facilitate fish passage and improve the conveyance of the channel.
- Certain locations have been identified as being of excellent or good spawning habitat quality. These areas, which will also require instream works are identified in Table 7.

Table 7 Key areas of optimum salmonid spawning habitat within the scheme footprint.

Location	Fisheries Survey Site #Note 1	Spawning Habitat quality	Relevant Works Area
Culvert at Mill race and downstream	Site #3B	Good	Sallybrook (and downstream)
Hazelwood Avenue – near Flood Relief Culvert	Site #5B	Excellent	Hazelwood FR Culvert (and Downstream)
Hazelwood Centre bridge, Glashaboy River	Site #6B	Excellent	Hazelwood Centre bridge (and Downstream)
Meadowbrook	Site #8B	Excellent	Meadowbrook (Riverstown bridge)

Note 1 – The fisheries site numbering system is presented in Section 6.4.2.1 of Chapter 6 Biodiversity of the 2018 EIAR.

- In key sections of bankside and instream works where release of silt is of highest risk to spawning gravels, upstream facing paired silt curtains will be installed into banks to create a flushing flow through the mid-stream section so that in this area the gravel habitat is kept 'clean' and it will be less likely for fine sediment infiltration to occur due to increased velocities through these sections. Placement of the silt curtains will be installed on the advice of the Contractor's Ecologist and IFI.
- Gravel cleaning will be used on suitable spawning habitat, in particular around Hazelwood and Meadowbrook. The methodology to be used is a 1-inch (25.4mm) nozzle low power water jet technique as per Environment Agency (UK) current technique which has been provided to IFI.
- The impact on fisheries due to the scheme may be mitigated in part by enhancements instream. For example, the works involving lowering of the Glenmore stream bed could benefit from features that create sinuosity through the low-flow channel, or stepped pools, to create increased flow diversity and habitat opportunities for fish within this reach. Similarly, the reach at Hazelwood at the downstream exit of the flood relief culvert would benefit from increased flow diversity through strategic placement of small boulders on the bed of the channel. These measures are also addressed within the *Geomorphic Audit* (Appendix F).

5.2.8 Tree Removal Works

A number of trees require removal to facilitate the construction of the scheme. The root systems of trees within a minimum of a 2m buffer from the channel edge will be left in-situ and will not be removed. Areas infested with non-native invasive species will the management in accordance with Section 5.2.1.5 above.

The *Tree Removal Report & Drawings* which were included as *Appendix 3.2 of the Chapter 4 of the 2018 EIAR* are also included in Appendix G for information.

Hedgerow/tree planting will be undertaken as outlined in the *Planting Plan* (Appendix D). This plan addresses the loss of hedgerow/treeline to accommodate the scheme. Hedgerows and trees will be replanted close to the existing alignment and location where feasible and will use native, locally sourced species appropriate to the locality.

The *Planting Plan* (Appendix D) will be further developed prior to the commencement of works by a landscaper in consultation with an Arborist and the Contractor's Ecologist.

Refer to Section 5.2.6.3 for tree removal mitigation measures in relation to Bats.

5.2.9 Additional Mitigation for Post-Confirmation Changes

A number of post-confirmation changes were proposed and reviewed by the EMG in accordance with Condition 2 of the confirmation of the scheme, refer to Section 1.1.4.

Where deemed necessary, additional mitigation measures were applied to the proposed works, as described below where relevant.

5.2.9.1 Tree Felling Works

Post confirmation of the scheme, the tree removal drawings were revised and assessed by the EMG. Refer to *Appendix H* for the *Revised Tree Removal Drawings* for the 'XX-040-XX' series scheme drawings.

No additional mitigation measures were proposed for this change as the existing mitigation measures included in the EIAR addressed the works including Section 5.2.6.3 for tree removal mitigation measures in relation to bats.

These tree removal works were carried out in 2022. A derogation licence for otters in relation to the works was sought and granted by NPWS, refer to Licence No. DER-OTTER-2022-09, in Appendix J.

5.2.9.2 Post-Confirmation Design Changes

No additional mitigation measures have been proposed, however, Table 8 notes measures already outlined in the EIAR 2018 and EIAR Addendum 2020 for several design changes.

Table 8 Additional mitigation measures for post-confirmation design changes

Drawing No.	Post-confirmation change	Additional mitigation and monitoring measures and features of note
1-050-04	Pumping station relocation at Sallybrook industrial estate	No additional mitigation or monitoring measures. Note for Biodiversity and NIS: • Biodiversity: Section 7.4.11 of the EIAR Addendum (2020) sets out mitigation for such works, therefore the same mitigation measures in the EIAR will apply. Note for Archaeology, Architectural, and Cultural Heritage: • Sallybrook House is listed in the National Inventory of Architectural Heritage (NIAH), Reg. No. 20906332.
1-050-04	New domestic wastewater treatment system at Sallybrook house to	No additional mitigation or monitoring measures.

Drawing No.	Post-confirmation change	Additional mitigation and monitoring measures and features of note
	replace existing historic septic tank.	<u>Note for Biodiversity and NIS:</u> • Biodiversity: The existing outfall pipe to be removed from the river which can be done so by construction staff entering the river. It is not anticipated that plant or machinery will be required for this particular task. The main installation works will be set back from the river. • Mitigation measures to be implemented during instream works are described in Section 5.2.1 of the CEMP, Section 7.4 and 7.5.1 of the EIAR Addendum (2020) and Section 6.8 of the EIAR (2018). <u>Note for Hydrology:</u> • Mitigation measures to be implemented for water quality works are described in Section 5.8.1 of the CEMP, Section 12.7.1.1 of the EIAR (2018) and Section 6.3 and Section 6.4.1 of the EIAR Addendum (2020). <u>Note for Noise and Vibration:</u> • The contractor will be responsible for engaging with the landowner through the Community Liaison Officer. Section 9.6.1 of the EIAR (2018) states that "*works in proximity to sensitive receptors, such as the Eurofins facility will be carried out at an optimum time to minimise disturbance and potential impacts*." <u>Note for Archaeology, Architectural, and Cultural Heritage:</u> • Sallybrook House is listed in the National Inventory of Architectural Heritage (NIAH), Reg. No. 20906332. The distance of the pumping station from the house will not change.
1-050-05	Increase in the height of flood defence wall around channel chainage 5075 by 120mm.	No additional mitigation or monitoring measures.
1-080-06	Flood defence wall construction changed from reinforced concrete to sheet pile wall (for a 44m length section).	No additional mitigation or monitoring measures. <u>Note for Biodiversity and NIS:</u> • Mitigation measures to be implemented during instream works are described in Section 5.2.1 of the CEMP, Section 7.4 and 7.5.1 of the EIAR Addendum (2020) and Section 6.8 of the EIAR (2018). <u>Note for Hydrology:</u> • Mitigation measures to be implemented for water quality works are described in Section 5.8.1 of the CEMP, Section 12.7.1.1 of the EIAR (2018) and Section 6.3 and Section 6.4.1 of the EIAR Addendum (2020). <u>Note for Noise and Vibration:</u> • The contractor will be responsible for engaging with the landowner through the Community Liaison Officer. Section 9.6.1 of the EIAR (2018) states that "*works in proximity to sensitive receptors, such as the Eurofins facility will be carried out at an optimum time to minimise disturbance and potential impacts*."
1-080-07	Increase in the height of the flood defence wall by 50mm around channel chainage 4875.	No additional mitigation or monitoring measures.
2-080-10	Realignment of wall to accommodate road widening (Hazelwood Avenue) and junction	No additional mitigation or monitoring measures. <u>Note for Biodiversity and NIS:</u>

Drawing No.	Post-confirmation change	Additional mitigation and monitoring measures and features of note
	works and increase to the length of the flood relief culvert to accommodate Local Infrastructure Housing Activation Fund (LIHAF) works.	• Mitigation measures to be implemented during instream works are described in Section 5.2.1 of the CEMP, Section 7.4 and 7.5.1 of the EIAR Addendum (2020) and Section 6.8 of the EIAR (2018). <u>Note for Archaeology, Architectural, and Cultural Heritage:</u> • The contractor will apply all mitigation measures including archaeological monitoring as described in Section 13.5.1 of the EIAR (2018). <u>Note for Hydrology:</u> • Mitigation measures to be implemented for water quality works are described in Section 5.8.1 of the CEMP, Section 12.7.1.1 of the EIAR (2018) and Section 6.3 and Section 6.4.1 of the EIAR Addendum (2020).
2-080-40	Widening Hazelwood Avenue bridge at the by the addition of a new section to the upstream face to accommodate the LIHAF works.	No additional mitigation or monitoring measures. <u>Note for Biodiversity and NIS:</u> • Mitigation and monitoring measures to be implemented during instream works are described in Section 5.2.1 of the CEMP, Section 7.4 and 7.5.1 of the EIAR Addendum (2020) and Section 6.8 of the EIAR (2018). <u>Note for Archaeology, Architectural, and Cultural Heritage:</u> • The contractor will apply all mitigation measures including archaeological monitoring as described in Section 13.5.1 of the EIAR (2018). <u>Note for Hydrology:</u> • Mitigation and monitoring measures to be implemented for water quality works are described in Section 5.8.1 of the CEMP, Section 12.7.1.1 of the EIAR (2018) and Section 6.3 and Section 6.4.1 of the EIAR Addendum (2020). <u>Note for Noise and Vibration:</u> • The contractor will be responsible for engaging with the landowner through the Community Liaison Officer. Section 9.6.1 of the EIAR (2018) states that "*works in proximity to sensitive receptors, such as the Eurofins facility will be carried out at an optimum time to minimise disturbance and potential impacts*."
2-050-02	Pumping station relocated to channel chainage 3894 from 3805 to facilitate easier maintenance and less interference with property owner.	No additional mitigation or monitoring measures.
2-050-05	Removal of foul sewer pumping station from Meadowbrook Estate.	No additional mitigation or monitoring measures.
2-050-04 and **2-050-05**	Provision of new storm water sewer in Meadowbrook Estate.	No additional mitigation or monitoring measures.
3-070-02	Removal of surface water pumping station from Copper Valley Vue Estate	No additional mitigation or monitoring measures.
3-070-02	Widening of property entrance (T45 HF53) to improve sight lines at Brooklodge Grove.	No additional mitigation or monitoring measures.

Drawing No.	Post-confirmation change	Additional mitigation and monitoring measures and features of note
4-090-01 and 4-080-02	Increase in the height of the flood defence wall (by 100mm) over an 84m long section of wall.	No additional mitigation or monitoring measures.
4-080-02	Additional section of flood defence wall (12m) to be added to northern extent to cater for minor increase in defence level in this reach.	No additional mitigation or monitoring measures. <u>Note for Biodiversity and NIS:</u> • The contractor will be obliged to carry out vegetation removal works as described in Section 5.7 of EIAR Addendum (2020) Chapter 5.6.2.2 C*onstruction Activities and Implementation of Maintenance Activities*, whereby the timing of the vegetation clearing works is described: "*all vegetation clearance and site preparatory works will be conducted outside of the bird nesting season (1 March to 31 August inclusive) where possible. However, in the event that vegetation clearance works and/or site preparatory works are required during the bird nesting season, these will only be carried out once an advance survey has been carried out to establish whether there is any evidence of nests present, and the area proposed for clearance has been approved by a suitably qualified and experienced ecologist*." • Section 6 of the CEMP sets out the seasonal biodiversity constraints for the scheme.
3-070-01	Provision of a new section of vehicle restraint system (Armco barrier) to an overland flow path to direct water from the road into the Glenmore Stream.	No additional mitigation or monitoring measures. <u>Note for biodiversity:</u> • The contractor will be obliged to carry out vegetation removal works as described in Section 5.7 of EIAR Addendum (2020) Chapter 5.6.2.2 C*onstruction Activities and Implementation of Maintenance Activities*, whereby the timing of the vegetation clearing works is described: "*all vegetation clearance and site preparatory works will be conducted outside of the bird nesting season (1 March to 31 August inclusive) where possible. However, in the event that vegetation clearance works and/or site preparatory works are required during the bird nesting season, these will only be carried out once an advance survey has been carried out to establish whether there is any evidence of nests present, and the area proposed for clearance has been approved by a suitably qualified and experienced ecologist*." • Section 6 of the CEMP sets out the seasonal biodiversity constraints for the scheme.
3-080-20 and **3-070-07**	Addition of step pools upstream of the new planned bridge at the New Line junction.	No additional mitigation or monitoring measures. <u>Note for biodiversity:</u> • Section 5.6.2.3 of EIAR Addendum Chapter 5 *Construction Activities and Implementation of Maintenance Activities*, includes specific mitigation measures regarding the in-stream works including the works window (July to September, inclusive) and the supervision by a suitably qualified and experienced ecologist. • Mitigation and monitoring measures to be implemented during instream works are described in Section 5.2.1 of the CEMP, Section 7.4 and 7.5.1 of the EIAR Addendum (2020) and Section 6.8 of the EIAR (2018). <u>Note for Hydrology:</u> • Mitigation and monitoring measures to be implemented for water quality works are described in Section 5.8.1 of the CEMP, Section 12.7.1.1 of the EIAR (2018) and Section 6.3 and Section 6.4.1 of the EIAR Addendum (2020).

5.2.9.3 Change to the Period for In-Stream Works

- Fish rescue to be undertaken in advance of dry zone/ isolated area for culvert replacement work.
- Pumping from the dry area will be with the use of filtration system attached to discharge end of the pipe (e.g., 'Silt buster' or similar). The precise arrangement via use of the Circus Field for filtration and clarification of pumped water to be agreed in advance of work on consultation with the project ECoW and Inland Fisheries Ireland.
- Duration of the isolation works is to be kept as short as possible.
- Screen the intake: Any pumps used for over-pumping must be 'fish-friendly' and fitted with appropriate screens to prevent fish being drawn into the pipe/pump.
- Material that has accumulated upstream of the flow barrier should be carefully removed and properly disposed of e.g., by spreading over the adjacent field. The barrier should be removed as soon as possible after it is no longer needed.

5.2.9.4 Area 4 Additional Works

Bats

One mature oak tree to the north of the site, at the site entrance adjacent to the R639 holds medium-high bat roosting potential and as such requires retention. The Mature woodland on the western side of the R639 also holds some mature specimen trees which have bat roosting potential. It is assumed that the oak tree to the north of the site as well as all mature trees on the western site boundary will be retained. Any proposal for tree removal in these areas during works will require consultation with the on-site ECoW and an assessment of whether it meant the impact may fall outside the envelope of effects for the scheme.

Mammals

The mammal hole identified to the south-centre of the site (see habitat map) will require pre-works checks to ascertain activity status and species,

Invasive Species

Several stands of non-native invasive species occur within and at the site boundary to include a stand of Japanese knotweed, snowberry, Winter Heliotrope, Cherry Laurel, Himalayan Honeysuckle, Traveller's joy / Old Mans Beard and Buddleia. Full eradication of all Japanese knotweed is required prior to commencement of works. It is also recommended that all other above-mentioned species are safely removed in advance of works to ensure minimal risk of spreading to other areas. Likewise, strict biosecurity protocols are required at the location - to be implemented by the site manager in consultation with the project ecologist (ECoW). Those involved in the control of invasive species eradication shall obtain the advice of a Registered Pesticide Advisor on the register established by the Minister for Agriculture, Food and the Marine pursuant to Regulation 4 of the Sustainable Use of Pesticides Regulations. All pesticide users must be registered and have the appropriate training necessary to carry out the proposed method of control.

5.2.10 Monitoring During Construction

Earthworks will be undertaken by the Contractor and the sub-contractors in accordance with good construction management practices and will be monitored by a Resident Engineer's team to ensure that they conform to the methodologies described in the EIAR and subsequent addendum.

During instream works the Employer's Representative / Resident Engineer will complete daily checks to ensure that work is progressing as designed. All instream works will be overseen by the Contractor's Ecologist and supervised by the RE Ecologist, as required.

5.2.10.1 Fine Sediment and Water Quality

- All instream works for construction and maintenance activities will be advised and overseen by Contractor's Ecologist. Additionally, the Contractor's Ecologist will be responsible for assuring that ecological and water quality mitigation measures are implemented onsite and that maintenance activities

are legally compliant and that all the necessary paperwork (e.g. licences) are complied with. The Contractor's Ecologist will also provide on-site ecological advice to teams completing the works.

- Monitoring of fine sediment (suspended solids) and turbidity is proposed in order to ensure that the levels of fine sediment are not elevated above those which would be deleterious to aquatic life.
- Two instream water quality sondes will be installed in the river, one upstream of the works and the second not more than 100m downstream in the river where works are taking place. The sondes will be capable of recording at minimum pH, temperature, electrical conductivity, dissolved oxygen and suspended solids with real time data available via telemetry system.
- The telemetry system will include alarm trigger levels as outlined below (note that this impact will be measured through disparities in upstream and downstream water quality rather than due to the effects of weather events):
  - The level of suspended solids in any discharges to fisheries waters as a consequence of construction works (i.e. difference in concentration from upstream to downstream**)** will not exceed 25 mg/l nor result in deposition of silts on gravels (IFI, 2016).
  - The pH from all discharges made from and during construction works will be in the range 6.0 to 9.0[3] units and will not alter the pH of any receiving fisheries waters by more than +/- 0.5 pH units (IFI, 2016).
- In the event that either a water quality alarm is triggered by the instream monitoring system or if the Resident Engineer or RE Ecologist observe unacceptable impacts on water quality, the works will cease until the cause of the issue has been identified. Following a site visit by the RE and/or RE Ecologist the appropriate mitigation measures will be implemented or where these measures are deemed insufficient additional site-specific mitigation measures will be put in place. In addition, the downstream river water quality will be assessed to determine if there has been any significant impact using the trigger levels set out above. Appropriate remedial measures will be designed by the Contractor's Ecologist in conjunction with the RE Ecologist based on the nature and scale of any impact identified to restore the river water quality and aquatic habitat.

5.2.10.2 Hydromorphology

- Hydromorphology walkovers will be undertaken following major high-flow events and on an annual or bi-annual basis.
- Such walkovers will document any change in the sediment and flow dynamics in the system, as a result of the scheme construction.
- Any points of note will be communicated to the Employer's Representative and recommendation for remedial action (such as bank reinforcement, in channel feature installation or others, where appropriate) will be made.
- Further details are provided in the *Geomorphic Audit* (Appendix F), which recommends a number of measures to reduce the impact of the scheme. The follow construction phases mitigation measures are required:
  1. Use of appropriate mitigation measures for new culverts and fish passage, as detailed in the CIRIA C689 Culvert Design and Operation Guide and IFI (2016) Guidelines on Protection of Fisheries During Construction Works in and Adjacent of Waters will be required;
  2. A review of the effectiveness of these measures will be undertaken towards the end of the construction programme and any adjustments made to manage any potential erosion activity adjacent to new culverts and bank works.

[3] Assuming water within the river body upgradient of the works is naturally within this range.

5.2.10.3 Invasive Species

- Monitoring for re-emergence of non-native invasive species will be undertaken by the Contractor's Ecologist or a suitably qualified Ecologist.
- Any new sighting will be reported the Employer's Representative during the construction phase and Cork City Council post construction and recommendations for treatment and eradication proposed.

5.2.10.4 Bats

Acceptance of boxes by bats is less predictable than those for birds. Therefore, it is essential to monitor their use over a period of time.

The Contractor shall ensure that bat boxes are inspected by a bat licence holder (Bat Specialist), at least once within 12 months of erection at the appropriate season in order to monitor bat use and the species using the boxes.

5.2.10.5 Birds

- In relation to Kingfisher at Meadowbrook, nesting activity will be monitored by the Contractor's Ecologist. If nesting activity is not observed, ensuring the allowance for a late clutch and/or double clutch, works may proceed during the later months of the breeding bird season.

5.2.10.6 Otter

- Monitoring in advance of the commencement of work will be undertaken to establish the relative occupancy of the identified holt structures. The findings will be reported and method statements for the temporary closure of the holts in consultation with NPWS, will be prepared, if required.

5.3 Landscape and Visual

Measures have been considered to avoid, reduce and/or remediate, where possible the likely effects of the scheme and works. The mitigation measures for the design, construction and operational/ maintenance phases are outlined below.

5.3.1 Detailed Design - Mitigation Measures

General

- Retain existing trees where possible in the interest of residential amenity, public realm, and visual character of the river landscape.
- Riverbanks will be left intact and vegetated wherever possible. All disturbed areas will be re-landscaped and seeded, as soon as possible post works. On the 'wetside' of the flood wall, soil areas will be seeded with a native wildflower mix suitable for riparian environments.
- Where retention of existing trees is not an option, these will be replaced with new native species as close as possible to the original location, on the dry side of the wall**,** in the interest of residential and public amenity and visual character of the river landscape. Species to include Alder *(Alnus glutinosa),* Birch (*Betula pubescens*), Hawthorn (*Crateagus monogyna*), Blackthorn (*Prunus spinosa),* Pine *(Pinus sylvestris*), Hazel (*Corylus avellana*) and Holly (*Ilex aquifolium).* There is also evergreen native hedge (*Ilex aquifolium*) provided for around the artificial Otter holts provided for along the river.
- Galvanised powder coated finish to be applied to new railings and barriers.
- The flood defence walls have typically been aligned to be constructed along existing walls where possible, in the interest of minimising intrusion on the existing landscape character (with the exception of Meadowbrook where wall will be set back in order to retain trees).

Specific

- A 1.8m high fence and hedging will be installed along the eastern riverbank adjacent to the Multi Use Games Area in Riverstown in replacement for removed trees.

- Sandstone cladding will be provided on exposed sections of new walls in the following areas:
  - The approach road and entrance to Glanmire town (dry and wet side of the new wall).
  - Any new sections approaching Riverstown Bridge. Contemporary capping and railing is deemed appropriate to define boundary with the protected structure and avoid a pastiche approach. The finalised detailed design and colour of the railings and finishes at this location will be agreed with Cork City Council's Heritage Officer, prior to works commencing.
  - On the entrance to (including wall near the Multi Use Games Area) and within the Hazelwood Centre (on sections of exposed walls in public areas, mainly the dry side).
  - On the exposed side of any reinstated/altered sections of the existing wall opposite Copper Valley Vue.
  - At The Grove: the dry side of new wall along R639 north of Glanmire Bridge.
  - Native hedge planting, consisting of hawthorn (*Crateagus monogyna*), blackthorn *(Prunus spinose*), holly (*Ilex aquifolium*), spindle *(Euonymus europeus*) and dog rose (*Rosa canina*) will be planted at 0.45m centres along the dry side of the textured concrete wall running through Meadowbrook.
  - The quantity and extent of replacement tree planting is curtailed by the need to minimise tree planting within the flood defence measures, where it could cause blockage of the channel and/or damage the flood walls; and the amount of available space left for tree planting. However, replacement tree planting will be provided at:
    - The 'Circus Field' north of Hazelbrook, where riparian Alder tree planting will be provided along the riverbank,
    - John O'Callaghan Park, where new corpses of Oak, Birch and Alder will be provided within the park.
    - Copper Valley Vue, where new trees will be provided for within the landscape space between the road and the river.

5.3.2 Construction - Mitigation Measures

- Existing trees will be retained where possible in the interest of public realm and visual character of the river amenity. Riverbanks will be left intact and vegetated wherever possible. Coppicing and/or selective removal of trees will be considered in preference to total vegetation removal.
- Disturbance to private boundaries, gardens, etc. will be avoided wherever possible, and where it occurs, the impact will be reinstated prior to completion of the works.
- Machinery will not enter the river unnecessarily.
- All landscape, footpath, roads etc., disturbed during the course of the works will be fully reinstated prior to the completion of the construction works.
- Japanese Knotweed is particularly common along stretches of the river (e.g. on main entrance road to Hazelwood centre towards the sports pitch). Works on riverbanks will be undertaken in compliance with the *Invasive Species Management Plan* (Appendix C).
- Trees that are to be retained will be protected during the construction period will be in accordance with BS5837:2012, *Trees in relation to design, demolition and construction - recommendations* and additionally TII/NRA *'Guidelines for the protection and preservation of trees, hedgerows and scrub prior to, during and post construction of National Road Schemes'*[4]. Vertical barriers and/or ground protection must protect all trees that are being retained on site. It is essential that these provisions be put in place prior to any development work or soil excavations are carried out. The purpose of protective

[4] https://www.tii.ie/technical-services/environment/construction/Guidelines-for-the-Protection-and-Preservation-of-Trees-Hedgerows-and-Scrub.pdf

barriers is to exclude any harmful construction activity that may damage the RPA (root protection area). They also help protect the main stem of the tree.

- Where there may be a requirement to work within root protection areas during construction or in situations where vertical protection is not possible, other tree root protection measures as outlined in BS5837 (e.g. ground protection matting), will be implemented under the supervision of a qualified Arborist. Depending on the size of machinery, the following ground protection measures will be implemented to avoid compaction of the soil, which can arise from the single passage of a heavy vehicle, especially in wet conditions, so that remaining tree root functions remain unimpaired.
  - for pedestrian-operated plant up to a gross weight of 2t, proprietary, inter-linked ground protection boards placed on top of a compression-resistant layer (e.g. 150mm depth of woodchip), laid onto a geotextile membrane;
  - for wheeled or tracked construction traffic exceeding 2t gross weight, an alternative system (e.g. proprietary, cellular confinement systems over geotextile) to an engineering specification designed in conjunction with the Arborist, to accommodate the likely loading to which it will be subjected.
- Any landscape mitigation or tree remedial works will be undertaken by qualified Tree Surgeons in accordance with BS 4428:1989 *Code of practice for general landscape operations*. Where compaction has occurred, it can be alleviated by the use of compressed air injection/ airspade.
- Once any remedial works are complete and all plant equipment has evacuated the site, protective barriers and ground protection can be removed.

5.3.3 Additional Mitigation for Post-Confirmation Changes

A number of post-confirmation changes were proposed and reviewed by the EMG in accordance with Condition 2 of the confirmation of the scheme, refer to Section 1.1.4.

Where deemed necessary, additional mitigation measures were applied to the proposed works, as described below where relevant.

5.3.3.1 Tree Felling Works

No additional mitigation measures have been proposed.

5.3.3.2 Post-Confirmation Design Changes

No additional mitigation measures have been proposed.

5.3.3.3 Change to the Period for In-Stream Works

No additional mitigation measures have been proposed.

5.3.3.4 Area 4 Additional Works

No additional mitigation measures have been proposed.

5.4 Population and Human Health

5.4.1 Construction - Mitigation Measures

The design has considered, where possible, the likely construction impacts such as noise, vibration and dust emissions as well as construction traffic impacts. Where practicable, construction methodologies have been proposed which will minimise these short-term impacts.

5.4.1.1 Heritage

Mitigation measures for Heritage are dealt with in Section 5.9.

5.4.1.2 Local Amenity

Industry-standard traffic management measures will be put in place to alleviate construction-related traffic disruptions. Refer to Section 5.10 and Section 8 for further details.

Noise and vibration disturbance will be minimised. Best practice measures for noise control on construction sites will be adhered to during construction phase. Refer to Section 5.5 for detail of noise and vibration mitigation measures.

Mitigation measures in relation to dust minimisation and air emissions are addressed in Section 5.6.

In order to ensure the greatest possible access to and usage of John O' Callaghan Park during the works, the footprint of the works area will be kept to the minimum.

The boundary walls/fences in the areas of the works area that will be temporarily removed to facilitate construction access will be reinstated on completion of the works. Landscaping and replanting will also be carried out in accordance with the *Planting Plan* (Appendix D).

5.4.1.3 Tourism

The period of construction works will be approximately 18-24 months. The works programme will be designed to minimise impacts on the value of local amenities to the tourism industry. In particular, they will include provisions for protecting the river from silt and limiting working hours to avoid disruption.

Access to tourist amenities such as shops, restaurants and public houses will be maintained throughout the construction stage to ensure minimal impact on tourism. Dust and noise emissions will be controlled through dust management to ensure minimal environmental disturbance.

5.4.1.4 Population

Noise disturbance will be minimised. Best practice measures for noise control will be adhered to during construction. Refer to Section 5.5 for detail of noise and vibration mitigation measures.

A traffic management plan will be implemented to minimise disruptions to traffic. Refer to Sections 5.10 and Section 8 for further details.

Dust emissions will be controlled throughout the construction phase. Refer to Section 5.6 for details of dust mitigation measures.

5.4.1.5 Economic Activity

The impact on local economic activity will be reduced through ensuring that access to local businesses is maintained. The Construction Traffic Management Plan (Section 8) will ensure that any impacts are minimised. Traffic restrictions will be limited in duration to ensure that impacts are only felt for the shortest possible period of time. The period of works will also account for the 'high season' and busy periods, such as Christmas. Refer to Sections 5.10 and Section 8 for further information on traffic mitigation measures.

5.4.2 Additional Mitigation for Post-Confirmation Changes

A number of post-confirmation changes were proposed and reviewed by the EMG in accordance with Condition 2 of the confirmation of the scheme, refer to Section 1.1.4.

Where deemed necessary, additional mitigation measures were applied to the proposed works, as described below where relevant.

5.4.2.1 Tree Felling Works

No additional mitigation measures have been proposed.

5.4.2.2 Post-Confirmation Design Changes

No additional mitigation measures have been proposed.

5.4.2.3 Change to the Period for In-Stream Works

No additional mitigation measures have been proposed.

5.4.2.4 Area 4 Additional Works

No additional mitigation measures have been proposed.

5.5 Noise and Vibration

5.5.1 Construction - Mitigation Measures

Noise

Construction noise will be kept to a minimum. The contract documents will specify that the Contractor, undertaking the construction of the works, will be obliged to take specific noise abatement measures and will comply with the best practice outlined in British Standard BS 5228 – 1: 2009 +A1 2014: *Code of Practice for Noise and Vibration Control on Construction and Open Sites – Noise*.

The following measures will also be employed:

- construction plant and equipment to be used at the site will be modern equipment and will comply with the relevant legislation and regulations
- Regular maintenance of plant will be carried out in order to minimise noise produced by on-site operations. The regular and effective maintenance of plant can play an important role in reducing noise emissions. In particular, attention will be paid to the lubrication of bearings and the integrity of silencers. Silencers and engine covers will be maintained in good and effective working order.
- All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the contract.
- Any air compressors used on-site will be of the 'sound reduced' models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools will be fitted with suitable silencers.
- Machines, which are used intermittently, will be shut down or throttled back to a minimum during those periods when they are not in use.
- Any plant, such as generators or pumps, which are required to work outside of normal working hours, will be surrounded by an acoustic enclosure.
- smooth machinery operation/driving, and to minimise unnecessary noise generation.
- A maximum speed limit of 30 km/hr will be imposed for HGVs on the works sites, and drivers will be instructed to maintain as far as possible the distances between vehicles.
- Locating plant, as far as is reasonably practicable, away from receptors or as close as possible to any hoardings where these are located between the source and receptor;
- Use of noise-control equipment such as jackets, shrouds, hoods, and doors, and ensuring they are closed;
- Handling all materials, particularly steelwork, in a manner that minimises noise. For example, storing materials as far as possible away from sensitive receptors and using resilient mats around steel handling areas;
- A c. 2.4m hoarding of density of at least 7kg/m^2 will be provided around non transient construction works at locations where levels of noise above the limits are predicted. Hoarding of this specification will result in a reduction of 10dB at sensitive receptors if lines of sight are fully broken.
- Given the nature of the works required and the proximity of receptors to the construction works site, there may be instances where, on employing all mitigation measures outlined, these noise limits may be exceeded during a particular type of construction activity. If and when the noise limits are likely to be

exceeded as a result of the works, the Contractor will contact the affected residents/businesses through the Community Liaison Officer (CLO) as well as informing Cork City Council. As far as practical, an agreement will be reached between the Contractor, Cork City Council and affected residents/businesses which will allow the required works to proceed at a time which will minimise noise nuisance or disturbance of the affected residents/business.

Vibration

- In terms of minimising vibration levels, the Contractor will be required to select and utilise methods of working and items of plant so that the maximum measured ground vibrations do not exceed a peak particle velocity (PPV) of 8.5mm per second at any occupied property, with a lower PPV limit of 5mm per second applying to properties in poor condition or other sensitive receptors, such as the Eurofins laboratory facility. Works in proximity to sensitive receptors, such as the Eurofins laboratory facility will be carried out at an optimum time to minimise disturbance and potential impacts.
- Prior to the commencement of construction works in proximity to the Eurofins laboratory facility, discussions will be held with the management of the facility to confirm the optimum time to carry out the works.
- In relation to sheet piling additional mitigation measures will be implemented. Refer to Section 5.2.1.

5.5.2 Construction - Monitoring

Noise

- Prior to the commencement of construction works, baseline noise monitoring will be carried out by the Contractor to determine the existing noise environment. During the works, noise monitoring will take place at the nearest sensitive receptors to the works. A minimum of ten number noise monitoring locations are to be set up to monitor construction noise levels at sensitive locations throughout the scheme.
- Furthermore, noise monitoring will take place at the two nearest sensitive receptors to each of the works areas. In the event of elevated noise levels being measured during construction, a review of the implemented mitigation measures will take place to ensure no defects have occurred, and they are functioning properly.

Vibration

- The Contractor will be required to monitor ground vibrations at selected locations to the approval of the Employer's Representative during the progress of the works. Each vibrograph will be certified as being in proper working order and will unless otherwise approved, record vibrations in three directions simultaneously with print-out showing the amplitude and frequency of the vibrations.
- Vibration measurements will be taken at the base of buildings, on the side facing the source of vibration. Where feasible, the measurements should be taken on a hard surface on the ground outside the building.
- A pre-condition survey will also be undertaken of all properties potentially affected by the works (within a 10m radius of works areas). Crack monitoring will be installed on such affected properties and monitored throughout the works.
- Regular inspections will be undertaken to ensure that the noise and vibration minimising methods, plant and mitigation identified in the specimen design stage are adopted on site and are working effectively.

5.5.3 Additional Mitigation for Post-Confirmation Changes

A number of post-confirmation changes were proposed and reviewed by the EMG in accordance with Condition 2 of the confirmation of the scheme, refer to Section 1.1.4.

Where deemed necessary, additional mitigation measures were applied to the proposed works, as described below where relevant.

5.5.3.1 Tree Felling Works

No additional mitigation measures have been proposed.

5.5.3.2 Post-Confirmation Design Changes

No additional mitigation measures have been proposed.

Note:

The contractor will be responsible for engaging with the landowner through the Community Liaison Officer. Section 9.6.1 of the EIAR (2018) states that "works in proximity to sensitive receptors, such as the Eurofins facility will be carried out at an optimum time to minimise disturbance and potential impacts."

5.5.3.3 Change to the Period for In-Stream Works

No additional mitigation measures have been proposed.

5.5.3.4 Area 4 Additional Works

No additional mitigation measures have been proposed.

5.6 Dust Management Plan

Dust arising from construction activities will be mitigated by implementation of the dust management plan.

5.6.1 Dust Management Plan - Mitigation Measures

The following dust mitigation measures will be implemented by the Contractor as part of the plan:

- During very dry control dust emissions from heavily trafficked locations;
- All vehicles exiting the site will make use of wheel wash facilities prior to entering onto public roads, to ensure mud and other wastes are not tracked onto public roads. Public roads outside the site will be regularly inspected for cleanliness and cleaned as necessary. Wheel-washing facilities will be located away from sensitive receptors;
- Topsoil and other dusty material being moved onsite will be transported in covered trucks, where the likelihood of emitting dust is high, and during dry weather conditions the area of removal will be sprayed with water from a mobile tanker on a regular basis to control dust emissions;
- Exhaust emissions from vehicles operating within the site, including trucks, excavators, diesel generators or other plant equipment, will be minimised through regular servicing;
- Surrounding roads used by trucks to access to and egress from the site will be cleaned regularly using an approved mechanical road sweeper. Roads will be cleaned subject to local authority requirements. Site roads will be cleaned on a daily basis, or more regularly, as required.
- Covering of temporary stockpiles.
- To minimise the impact of construction noise, a c. 2.4m hoarding will be provided around non transient construction works at locations where levels of noise above the limits is predicted. The hoarding will also minimise the dispersion of dust from the working areas.

5.6.2 Monitoring

- Dust monitoring will be carried out at the site boundary adjacent to the works throughout the construction phase. Dust deposition monitoring will be conducted at the nearest sensitive receptors in the vicinity of the scheme. Monitoring will be carried out using the Bergerhoff method, i.e. analysis of dust collecting jars left on-site (German Standard VDI 2119, 1972). Results will be compared to the TA Luft limit of 350 mg/m^2/day.
- In the event of elevated dust levels being measured during construction, a review of the implemented mitigation measures will take place to ensure no defects have occurred, and that they are functioning

properly or additional mitigation measures, for example more regular spraying of water, will be implemented.

5.6.3 Additional Mitigation for Post-Confirmation Changes

A number of post-confirmation changes were proposed and reviewed by the EMG in accordance with Condition 2 of the confirmation of the scheme, refer to Section 1.1.4.

Where deemed necessary, additional mitigation measures were applied to the proposed works, as described below where relevant.

5.6.3.1 Tree Felling Works

No additional mitigation measures have been proposed.

5.6.3.2 Post-Confirmation Design Changes

No additional mitigation measures have been proposed.

5.6.3.3 Change to the Period for In-Stream Works

No additional mitigation measures have been proposed.

5.6.3.4 Area 4 Additional Works

No additional mitigation measures have been proposed.

5.7 Soils, Geology and Hydrogeology

5.7.1 Construction - Mitigation Measures

The employment of good construction management practices will minimise the risk of pollution of soil, storm water run-off, adjacent watercourses and groundwater. The construction management of the site will take account of the recommendations of the CIRIA guidance *Control of Water Pollution from Construction Sites, guidance for consultants and Contractors* (Masters-Williams et al 2001) to minimise as far as possible the risk of soil, groundwater and surface water contamination.

Measures, as recommended in the guidance above, that will be implemented to minimise the risk of spills and contamination of soils and waters, will include:

- Training of site managers, foremen and workforce, including all sub-contractors, in pollution risks and preventative measures;
- Careful consideration will be given to the location of any fuel storage facilities. These will be designed in accordance with guidelines produced by CIRIA, and will be fully bunded;
- All vehicles and plant will be regularly inspected for fuel, oil and hydraulic fluid leaks. Suitable equipment to deal with spills will be maintained on site;
- Where feasible, soil excavation will be completed during dry periods and undertaken with excavators and dump trucks. Topsoil and subsoil will not be mixed together;
- Ensure that all areas where liquids are stored or cleaning is carried out are in a designated impermeable area that is isolated from the surrounding area, e.g., by a roll-over bund, raised kerb, ramps or stepped access;
- Fuel containment will be located within construction compounds which will be securely maintained to prevent vandalism.
- Fuelling and lubrication of equipment will not be carried out within 20m of any watercourse.
- Vehicles will not be left unattended during refuelling operations. Drip-trays will be placed under the fuelling point during fuelling.

- Spill kits will be available for the duration of construction and maintenance works and checked that it is fit-for purpose.
- Use collection systems to prevent any contaminated drainage entering surface water drains, watercourses or groundwater, or draining onto the land;
- Wheel wash at site entrance to clean vehicles prior to exiting onto public road network;
- Minimise the use of cleaning chemicals;
- Use trigger-operated spray guns, with automatic water-supply cut-off;
- Use settlement lagoons or suitable absorbent material such as flocculent to remove suspended solids such as mud and silt; and
- Ensure that all staff are trained and follow vehicle cleaning procedures. Post details of the procedures in the work area for easy reference.

5.7.2 Construction - Monitoring

Earthworks will be undertaken in accordance with good construction management practices and will be monitored by a Resident Engineer to ensure that they conform to the methodologies described in **Chapter 5 Construction Activities and Implementation of Maintenance Activities** of the EIAR Addendum (2020) (Appendix B) and the mitigation measures set out above in Section 5.7.1.

The construction management of the site will take account of the recommendations of the CIRIA guidance to minimise as far as possible the risk of soil, groundwater and surface water contamination.

Monitoring will include:

- daily site inspections; the transport of excavation materials off site to a licensed facility or reuse on site where possible;
- the stockpiling of excavated materials more than 10m away from a watercourse; the backfilling of areas which have been excavated;
- the monitoring of soil for Japanese knotweed or other invasive species; and
- the management and treatment of soils containing invasive species in in line with appropriate remediation measures.

5.7.3 Additional Mitigation for Post-Confirmation Changes

A number of post-confirmation changes were proposed and reviewed by the EMG in accordance with Condition 2 of the confirmation of the scheme, refer to Section 1.1.4.

Where deemed necessary, additional mitigation measures were applied to the proposed works, as described below where relevant.

5.7.3.1 Tree Felling Works

No additional mitigation measures have been proposed.

5.7.3.2 Post-Confirmation Design Changes

No additional mitigation measures have been proposed.

5.7.3.3 Change to the Period for In-Stream Works

No additional mitigation measures have been proposed.

5.7.3.4 Area 4 Additional Works

No additional mitigation measures have been proposed.

Note:

As noted in the EIAR and the biodiversity survey (December 2022), there are invasive plant species on site and the contractor will have to adhere to all invasive species mitigation measures described in the CEMP to ensure the appropriate bio-security and disposal (if necessary) measures are implemented.

5.8 Hydrology

5.8.1 Construction - Mitigation Measures

5.8.1.1 Water Quality

The Contractor will be required to implement the mitigation measures detailed below. These mitigation measures apply for the prevention of pollution to all waters during construction.

- The Contractor will prepare an Emergency Response Plan detailing the procedures to be undertaken in the event of flooding, a spill of chemical, fuel or other hazardous material, a fire, or non-compliance incident. This plan will contain the following information:
- Containment measures;
- List of appropriate equipment and clean-up materials;
- Maintenance schedule for equipment;
- Details of trained staff, location, and provision of 24-hour cover;
- Details of staff responsibilities;
- Notification procedures to inform the relevant environmental authorities: Cork City Council, the EPA and Inland Fisheries Ireland;
- Audit and review schedule;
- Telephone numbers of Cork City Council Drainage Services;
- List of specialised pollution clean-up companies and their telephone numbers;
- Ensure all site staff are trained in the implementation of Emergency Response Plan and the use of any spill control equipment as necessary;
- Prepare method statements for the control, treatment and disposal of potentially contaminated surface water;
- Prepare a site plan showing the location of all surface water drainage lines and proposed infiltration areas / discharge to combined sewers. This will include the location of all existing and proposed surface water protection measures, including monitoring points and treatment facilities;
- Ensure that all appropriate licences required for construction are obtained from the relevant authorities;
- The Contractor will comply with the following guidance documents:
- CIRIA SP156 Control of Water Pollution from Construction Sites – Guide to Good Practice (2002)
- CIRIA C532 Control of Water Pollution from Construction Sites. Guidance for Consultants and Contractors (2001)
- CIRIA C624 Development and Flood Risk – Guidance for the Construction Industry (2004);
- CIRIA C648 Control of Water Pollution from Linear Construction Projects - Site Guide (2006)
- CIRIA C649 Control of Water Pollution from Linear Construction Projects - Technical Guidance (2006)
- CIRIA C750 *Groundwater Control* – Design and Practice (2016)

- Inland Fisheries Ireland; Guidelines on Protection of Fisheries During Construction Works in and adjacent to Waters (2016) and
- National Roads Authority: Guidelines for the Crossing of Watercourses During the Construction of National Road Schemes, (2008).

5.8.1.2 General Works

The following construction mitigation measures will be utilised to minimise the risk of contamination during in channel works:

- Temporary oil interceptor facilities will be installed and maintained where site works involve the discharge of drainage water to receiving rivers and streams. Suitable equipment to deal with spills will be maintained on site.
- All fuel containment and treatment facilities will be regularly inspected to ensure no leakage or spills.
- Fuel containment will be located within construction compounds which will be securely maintained to prevent vandalism.
- Fuelling and lubrication of equipment will not be carried out within 20m of any watercourse.
- All cast in place concrete will be done in the dry and effectively isolated from any flowing water or water that may enter streams or rivers for a period sufficient to ensure no leachate from the concrete (IFI, 2016).
- No direct discharges will be made to waters where there is potential for cement or residues in discharges. Concrete washout waters will be collected in impermeable areas and disposed of in a suitably licenced facility.
- Repointing repair will occur along areas of existing flood defence walls. In all instances of repair works, the area of water over which works are taking place will be protected by the installation of a sealed and secure decking. The decking will extend upstream and downstream of the structure to ensure no losses to water (IFI, 2016). Approved forms of scaffolding are required to support decking.
- If repointing works are occurring too close to the river and sealed decking cannot be placed beneath the work area, appropriate isolation techniques will be used to exclude water from the work area and the work completed it completed in the dry.
- Waterproofing and other chemical treatment to structures in close proximity to watercourses will be applied by hand; and
- All pumps used for dewatering excavations will be located in sump to minimise the sediment generation.

The following construction mitigation measures will be utilised to control the interaction of wash down water from concrete and cementitious material, vehicle wash down areas and run-off from fuelling areas with surface water:

- All batching and mixing activities will be located in areas away from watercourses and drains;
- Surface water drainage around the batching plant will be controlled;
- There will be no hosing into surface water drains of spills of concrete, cement, grout or similar materials; and
- Washout from mixing plant or concrete lorries will be carried out in a designated, contained impermeable area.
- All oils and fuels will be stored in secure bunded areas and care and attention taken during refuelling and maintenance operations. Particular attention will be paid to the gradient and ground conditions which could increase the risk of discharge to waters.

- Vehicle wash down areas will be bunded and run-off channelled to a treatment area, such as a settlement pond, prior to discharge.

5.8.1.3 Bankside Works

Mitigation measures to be implemented during bankside works are described in Section 5.2.1.3.

5.8.1.4 Instream Works

Mitigation measures to be implemented during instream works are described in Section 5.2.1.4.

5.8.1.5 Flood Risk

- To mitigate the increased risk of fluvial flooding during the construction of the scheme, the Contractor will be required to ensure all temporary watercourse diversions have adequate hydraulic capacity and do not increase the risk of flooding during high fluvial flows or tidal water levels.
- Adequate overflow arrangements will be required to ensure high flows can be conveyed downstream without increasing the risk of fluvial flooding.
- The Contractor will be required to carry out risk assessments prior to undertaking any works (including instream works), which will include assessing the risk of flooding.
- To mitigate the risk of pluvial flooding during the construction stage the Contractor will be required to ensure all surface water drainage networks in the vicinity of the works remain clear and free flowing. The Contractor's Ecologist will also be required to ensure that all surface water drainage outfalls to existing watercourses are maintained or alternative outfalls are constructed.

5.8.2 Construction Monitoring

Monitoring to be carried out during the construction phase and maintenance activities are outlined in Section 5.2.10.

5.8.3 Additional Mitigation for Post-Confirmation Changes

A number of post-confirmation changes were proposed and reviewed by the EMG in accordance with Condition 2 of the confirmation of the scheme, refer to Section 1.1.4.

Where deemed necessary, additional mitigation measures were applied to the proposed works, as described below where relevant.

5.8.3.1 Tree Felling Works

No additional mitigation measures have been proposed.

5.8.3.2 Post-Confirmation Design Changes

No additional mitigation measures have been proposed.

Note:

Mitigation measures to be implemented for water quality works are described in Section 5.8.1 of the CEMP, Section 12.7.1.1 of the EIAR (2018) and Section 6.3 and Section 6.4.1 of the EIAR addendum (2020).

5.8.3.3 Change to the Period for In-Stream Works

No additional mitigation measures have been proposed.

Note:

Mitigation measures to be implemented for water quality works are described in Section 5.8.1 of the CEMP, Section 12.7.1.1 of the EIAR (2018) and Section 6.3 and Section 6.4.1 of the EIAR addendum (2020).

Refer to Table 8.

5.8.3.4 Area 4 Additional Works

No additional mitigation measures have been proposed.

Note:

The contractor shall implement all mitigation measures described in the EIAR and CEMP to minimise the risk of spills and contamination of the surface water i.e. Glashaboy River.

5.9 Archaeology

5.9.1 Construction - Mitigation Measures

Mitigation measures include for the licenced archaeological testing, metal detection and monitoring of areas of potential impact throughout the scheme. Such licences are approved by the National Monuments Service (NMS) and include detailed method statements outlining an agreed strategy for pre-construction investigations and ongoing monitoring during construction. The method statements will outline any further mitigation measures, including archaeological excavation, amendment of method statements and further consultation with the Underwater Archaeology Unit (UAU) of the NMS.

The Contractor will engage the services of an experienced underwater archaeologist (Contractor's Archaeologist) licensed by the NMS to oversee the scheme during construction. All works will be carried out under the supervision of the Contractor's Archaeologist and the OPW's Project Archaeologist. During construction the Contractor's Archaeologist will liaise with the Project Archaeologist from the OPW.

Area Specific archaeolgical testing

Advanced licenced archaeological testing will be undertaken between C01_5645 and CO1_5781 of an embankment to the north of Sallybrook Mill. Testing will be undertaken by the Contractor's Specialist Archaeologist and these works will be facilitated by the Contractor.

Following a comprehensive archaeological assessment carried out as part of the Glashaboy River (Glanmire/Sallybrook) Drainage Scheme, twenty-three cultural heritage Sites (CHS) were identified. Fourteen of these sites (CHS Nos. 01, 03, 05, 06, 07, 08, 09, 10, 11, 12, 15, 21, 22 and 23) will be directly impacted by the works.

Specific mitigation measures for these CHS are as follows;

- **CHS 01(CO 01):** Ex-situ mass of bonded brick.

  Mitigation: Record (descriptive and photographic) of this feature. Further consultation with NMS.

- **CHS 03 (CO 01):** Section of revetment wall along the eastern bank of the river and part of the curtilage of Sallybrook House (NIAH 20903332) and Sallybrook Mill (CO063-069 and RPS 00390).

  Mitigation: Archaeological record (descriptive and photographic) of the sections of wall to be impacted. Licensed archaeological monitoring by the Contractor's Archaeologist.

- **CHS 05 (CO 01):** Tailrace associated with Sallybrook Mill (CO063-069 and RPS 00390).

  Mitigation: Archaeological record (descriptive and photographic) of any features identified. Licensed archaeological monitoring by the Contractor's Archaeologist.

- **CHS 06 (CO 01):** Weir and sluice associated with Glansillagh Mill (CO063-094 and RPS 00389).

  Mitigation: Avoidance of impact to the training wall into the sluice, if possible. If avoidance is not possible, archaeological record (descriptive and photographic) of the sections of wall in advance of any impact.

  The flood defence works will be sympathetically faced with materials similar to those existing to minimise potential negative aesthetic visual impacts. Licensed archaeological monitoring of any works in this area.

- **CHS 07 (CO 08):** Headrace associated with Glansillagh Mill (CO063-094 and RPS 00389).

Mitigation: Following additional design, the pumping station (C08_P01) has been removed. Consequently, there will be no impact on the headrace associated with Glansillagh Mill and therefore no requirement for archaeological testing in this area. However, licensed archaeological monitoring will be carried out as part of future channel maintenance.

- **CHS 08 and CH 09 (CO 01):** Revetment wall on the eastern and western bank of the river.

  Mitigation: Archaeological record (descriptive and photographic) of the revetment walls (CHS 8 and CHS 9) to include both banks of the river in the northern end of Survey Area 3 in the vicinity of Circus Field, Hazelwood Bridge and Hazelwood Shopping Centre and in the southern end of Survey Area 3 in the vicinity of Riverstown Bridge in advance of impact. Licensed archaeological monitoring by the Contractor's Archaeologist.

- **CHS 10 (CO 06):** Tailrace from the flour/corn mill at Spring Hill.

  Mitigation: Archaeological record (descriptive and photographic) of any elements of the tailrace and licensed archaeological monitoring by the Contractor's Archaeologist.

- **CHS 11 (CO 01):** Intra-riverine feature immediately south of the headrace of Riverstown Mill.

  Mitigation: Avoidance if possible, if avoidance is not possible, archaeological record (descriptive and photographic) of the revetment wall in advance of any impact. The flood defence works will be sympathetically faced with materials similar to those existing to minimise potential negative aesthetic visual impacts. Licensed archaeological monitoring by the Contractor's Archaeologist.

- **CHS 12 (CO 01):** Riverstown Bridge (CO064-111, RPS 00394, NIAH 20906415) a four-arch humpback road bridge.

  Mitigation: Licensed archaeological testing in green areas in advance of construction for all works within the zone of notification of Riverstown Bridge.

  A full archaeological survey of the bridge to be undertaken prior to any construction works. Licensed archaeological monitoring by the Contractor's Archaeologist during construction including construction of flood defence walls along the eastern and western riverbanks upstream of the bridge.

  Archaeological assessment of the works on the bridge and its vicinity outlining likely impacts and proposing appropriate mitigation.

  This assessment will be carried out by the Contractor's Archaeologist and submitted to the NMS at the DCHG for consideration.

- **CHS 15 (CO 01):** Revetment wall.

  Mitigation: Archaeological record (descriptive and photographic) of the revetment wall in advance of impact and licensed archaeological monitoring by the Contractor's Archaeologist.

- **CHS 21 (CO 01):** A rectangular well structure in Cois na Gleann stream

  Mitigation: Full archaeological record (descriptive and photographic) in advance of any impact and further consultation with the NMS at the DCHG prior to any works taking place.

- **CHS 22 (CO 05):** A weir and random rubble culvert in the Glenmore stream.

  Mitigation: Archaeological record (drawn, descriptive, photographic and GIS survey) of the weir and culvert prior to any works. Licensed archaeological monitoring by any works in this area thereafter.

- **CHS 23 (CO 01):** A roofless, ruinous structure a short distance upstream of the Glanmire Bridge in the townland of Poulacurry South.

  Mitigation: Archaeological record (descriptive and photographic survey) of the structure prior to any works. Licensed archaeological monitoring of any works in this area thereafter.

Construction work on the drainage scheme will require extensive ground disturbance in multiple locations. Some of these areas have been previously disturbed, however, in situ localised subsurface deposits may survive in places.

- In areas where in situ subsurface deposits may be present licensed archaeological monitoring of ground works will be carried out.
- In areas where intra-riverine archaeological deposits may survive licensed archaeological monitoring will be carried out by the Contractor's Archaeologist.

All work will be carried out under licence to the NMS. This process includes the submission of method statements which outline further mitigation measures, including archaeological excavation, amendment of method statements and further consultation with the UAU of the NMS.

5.9.2 Additional Mitigation for Post-Confirmation Changes

5.9.2.1 Tree Felling Works

No additional mitigation measures have been proposed.

Note:

Sallybrook House is listed in the National Inventory of Architectural Heritage (NIAH), Reg. No. 20906332.

5.9.2.2 Post-Confirmation Design Changes

No additional mitigation measures have been proposed.

Note:

The contractor will apply all mitigation measures including archaeological monitoring as described in Section 13.5.1 of the EIAR (2018).

5.9.2.3 Change to the Period for In-Stream Works

No additional mitigation measures have been proposed.

Note:

Mitigation measures to be implemented for water quality works are described in Section 5.8.1 of the CEMP, Section 12.7.1.1 of the EIAR (2018) and Section 6.3 and Section 6.4.1 of the EIAR Addendum (2020).

5.9.2.4 Area 4 Additional Works

As per Construction Mitigation Measures outlined in Section 13.4.1 of the RFI (2020) the following mitigation is proposed for additional Area 4 works as follows:

- Area Specific archaeological testing: Advanced licenced archaeological testing will be undertaken of the proposed embankment footprint in Area 4.
- Archaeological Record (descriptive and photographic) of the impacted section of wall in advance of being removed.

As per Remedial Actions outlined in Section 13.5 of the RFI (2020) any archaeological features identified during testing will be fully resolved to professional standards of archaeological practice. Such material will be preserved in situ or preserved by record, as appropriate, as outlined in Policy and Guidelines on Archaeological Excavation – Department of Arts, Heritage, Gaeltacht and the Islands.

5.9.3 Construction - Monitoring

- All construction works, i.e. construction of flood defence walls along the riverbanks; construction and replacement of culverts; removal and replacement of bridges; construction of embankments and pumping stations; conveyance improvements (river channel widening and deepening), and localised regrading of ground levels will be subject to archaeological monitoring.

- A monitoring method statement will be agreed with the UAU of the NMS for all works carried out during construction to include licenced archaeological monitoring, testing and metal detection and any further mitigation measures required. The monitoring program will be reviewed in consultation with the NMS and modified depending on the quantity of archaeological material recovered. If quantities of archaeological material recovered are small, scaling back of monitoring at particular locations will be recommended.
- All monitoring works will be carried out under the supervision of a professional underwater archaeologist. This includes preparatory or temporary works in advance of full works and includes the clearance of topsoil and subsoil stripping of riverbanks, green field areas, areas for works compounds etc.
- Similarly, the excavation for all culverts that will impact subsurface levels beneath the existing culvert, will be subject to archaeological monitoring.
- Any archaeological features identified during archaeological testing/monitoring will be fully resolved to professional standards of archaeological practice. Such material will be preserved in situ or preserved by record, as appropriate, as outlined in Policy and Guidelines on Archaeological Excavation[5] – Department of Arts, Heritage, Gaeltacht and the Islands (1999).

5.10 Roads and Traffic

5.10.1 Construction Traffic – Mitigation Measures

All construction works will be subject to industry-standard traffic management measures, including the Construction Traffic Management Plan (refer to Section 8). Following consultation with Cork City Council and An Garda Síochána, the detail of the CTMP will be further developed and agreed with the relevant parties in advance of any works commencing. The CTMP will include the sourcing of construction materials, agreement of appropriate haul routes, etc.

These traffic management measures will be designed in accordance with the 'Guidance for the Control and Management of Traffic at Roadworks – Second Edition'.

Consequently, construction-related traffic flows will be subject to the traffic management plan, which may include restricted construction working hours, maintaining single-lane or two-way traffic flows and/or suitable diversion routes.

Construction working hours will be 08:00-19:00 on weekdays, and 09:00-16:00 on Saturdays. Therefore, the construction workforce traffic will arrive and depart at the working areas before the morning peak on the local road network, and after the evening peak. However, it may be necessary to work outside these hours, including at weekends and at night, at certain stages. Specific work activities may also be programmed to coincide with the summer months to avail of the lower local traffic flows during school holiday periods, etc.

Excavation and reinstatement of the culvert trenches will be carried out in consultation with the Local Authority, and will also follow the Department of Transport, Tourism and Sport published document entitled '*Guidelines for Managing Openings in Public Roads'*. These works will be supervised by the Resident Engineer's team to ensure they are carried out correctly.

Localised traffic disruptions as a result of other works throughout the scheme will be mitigated through the use of industry-standard traffic management measures. These traffic management measures will be designed in accordance with the '*Guidance for the Control and Management of Traffic at Roadworks – Second Edition'*. Where necessary, diversion routes will be developed for affected traffic due to road restrictions or closures.

[5] Department of Arts, Heritage, Gaeltacht and the Islands (1999) Policy and Guidelines on Archaeological Excavation. Available at: https://www.archaeology.ie/sites/default/files/media/publications/excavation-policy-and-guidelines.pdf

5.10.2 Local Road Network - Mitigation Measures

The construction programme for the scheme will be phased in order to ensure that certain works are not underway simultaneously in proximity to each other where one works element impacts on the mitigation measures associated with an adjacent scheme.

For example, the replacement of the internal Hazelwood Shopping Centre bridge will not occur at the same time as the construction of the adjacent culvert outside the shopping centre on Hazelwood Avenue, as this will be a diversion route for traffic displaced by the closure for replacement of the internal bridge (and vice versa).

The adjacent culvert works at Hazelwood Avenue are expected to be constructed in two phases, which will retain vehicular, pedestrian and cyclist access to a limited extent. Due to the generous road width at this location, it may be possible to retain two-way traffic.

Similarly, the culverting works on the R639 and R615 at the Springhill Stream will be phased so as to occur independently of each other in order to enable diversion routes to be incorporated on the local road network.

The timings of potential road closures or restrictions will, where possible, be arranged so as to carry out the most intensive works elements at off-peak times. Where possible, and subject to local considerations (including impacts on residents and businesses), 24-hour or night-time working will be included in construction phasing. Consultation will occur with local businesses and residents in advance of any works commencing.

Local access will be maintained throughout the works, by provision of new temporary accesses or by retention of existing accesses where possible.

The majority of the works will be undertaken in phases so that partial traffic flow can be maintained at a minimum at all times and at all locations, wherever possible. Many of the works elements will be undertaken in multiple phases so as to allow for partial road closures so as to minimise the extent of any full road closures. Depending on the commencement date of the works, it may be possible to schedule the more disruptive elements during the summer months to coincide with school holidays.

Although the impact of temporary construction works is likely to be significant in localised areas, there are numerous diversion routes available within the study area due to the extensive local road network. The R615 and R639 can serve as temporary diversion routes for many of the substantial works elements, while East Cliff Road also offers a localised diversion route via Glanmire Bridge. The L3010, Brooklodge Grove and Hazelwood Avenue also offer numerous potential diversion routes.

5.10.3 Additional Mitigation for Post-Confirmation Changes

A number of post-confirmation changes were proposed and reviewed by the EMG in accordance with Condition 2 of the confirmation of the scheme, refer to Section 1.1.4.

Where deemed necessary, additional mitigation measures were applied to the proposed works, as described below where relevant.

5.10.3.1 Tree Felling Works

No additional mitigation measures have been proposed.

5.10.3.2 Post-Confirmation Design Changes

Cois na Gleann

Careful consideration by the Contractor will need to be given to the timing of the works in May and June in the construction traffic management plan in order to minimise impacts on school traffic. Any temporary lane/road closure will be for a short duration only and would take place during the summer months or at other suitable times, i.e., long weekends or mid-term school holidays to minimise the impact on traffic in the area.

Note:

Section 14.6.2.1 of Chapter 14 of the 2018 EIAR set out a number of mitigation measures to minimise impacts which included temporary diversion routes, arranging the timing of road closures to coincide with off-peak times and to schedule the more disruptive elements during the summer months to coincide with the school holidays.

Beach Hill

No additional mitigation measures have been proposed.

Springmount

- Careful consideration by the Contractor will need to be given to the timing of the works in May and June in the construction traffic management plan in order to minimise impacts on school traffic.
- Any temporary land/road closure will be for a short duration only and would take place during the summer months or at other suitable times, i.e., long weekends or mid-term school holidays to minimise the impact on traffic in the area.

Note:

- Section 14.6.2.1 of Chapter 14 of the 2018 EIAR set out a number of mitigation measures to minimise impacts which included temporary diversion routes, arranging the timing of road closures to coincide with off-peak times and to schedule the more disruptive elements during the summer months to coincide with the school holidays. With these mitigation measures in place, the conclusion was that the proposed scheme would have no significant residual impacts on traffic and the local road network.
- The increase in the period for in-stream works to include the months of May and June will coincide with the school period. There are a number of schools in close proximity to the proposed works along the Springmount stream which would be accessed via the R639.
- Should the culvert replacement works be carried out during the May-June period, the temporary lane/road closure would still take place during the summer months or at other suitable times, i.e., long weekends or mid-term school holidays to minimise the impact on traffic in the area as per the mitigation set out in the EIAR. Careful consideration by the Contractor will need to be given to the timing of the works in May and June in the construction traffic management plan in order to minimise impacts on school traffic and this will require approval with CCC and An Garda Síochána.

5.10.3.3 Change to the Period for In-Stream Works

No additional mitigation measures have been proposed.

5.10.3.4 Area 4 Additional Works

No additional mitigation measures have been proposed.

Note:

The proposed additional Area 4 works are likely to extend the duration of works beyond what was predicted in the EIAR (20 to 25 weeks). Therefore, the extent and duration of traffic management measures on the R639 may need to be extended for longer than was predicted under the confirmed scheme.

5.11 Material Assets

Mitigation measures are required only during the construction phase. Impacts will be temporary in nature and last only for the duration of the construction works.

- Standard industry practice for construction works will ensure the safety of the workers and maintain the integrity and operational functions of any service, above or underground.
- Prior to construction, drainage networks, electrical cabling, gas pipelines, and telecommunications infrastructure will be reported in detail and incorporated into the construction design to as to be avoided where possible. Planned diversions will be implemented after discussion with the relevant bodies and all affected persons including businesses and residents will be notified in advance of any disruptions.

The Contractor will be provided with all the locations of any services and will have overall responsibility for the identification and location of services, including liaison with service providers and for the execution of the works so as to avoid the risk of injury to the construction personnel as well as the risk of damage to services.

- Mitigation measures for impacts on roads and transport networks are discussed in Section 5.10.
- Standard mitigation measures for dealing with waste arising will be employed, including the implementation of the Construction and Demolition Waste Management Plan in Section 7.

5.11.1 Additional Mitigation for Post-Confirmation Changes

A number of post-confirmation changes were proposed and reviewed by the EMG in accordance with Condition 2 of the confirmation of the scheme, refer to Section 1.1.4.

Where deemed necessary, additional mitigation measures were applied to the proposed works, as described below where relevant.

5.11.1.1 Tree Felling Works

No additional mitigation measures have been proposed.

5.11.1.2 Post-Confirmation Design Changes

No additional mitigation measures have been proposed.

5.11.1.3 Change to the Period for In-Stream Works

No additional mitigation measures have been proposed.

5.11.1.4 Area 4 Additional Works

No additional mitigation measures have been proposed.

6. Seasonal Biodiversity Constraints

Table 9 Seasonal Biodiversity Constraints

Area	Activity	Structure Ref.	Seasonal Constraint	Comment
Relevant to all areas	General vegetation and site clearance	-	Must be carried out outside of the Bird Nesting Season (1 March to 31 August)	Applies to all areas
Area 1 Sallybrook Industrial Estate	Cuil Chluthair culvert	C09_B01	Must be carried out during the instream works period (July to September)	-
	Sallybrook flood defence embankment	C01_E01		Works to be undertaken from the dry side. This is to be undertaken during summer period due to nature of the works (earthworks)
	Sallybrook RC wall	C01_L01		Works to be undertaken from the dry side.
	Sallybrook Sheet Pile wall	C01_L01	Must be carried out during the instream works period (July to September). Access into the river locally required by piling rig/excavator	-
	Pumping Station	C01_P01		Works to be constructed offline / out of river
	Sallybrook Pipe (Pat O Donnell) including chamber	C10.1_B01	Must be carried out during the instream works period (July to September).	Tie in point to Glashaboy River to be undertaken during instream works period
Area 2 Hazelwood	Relocation of otter holts within vicinity of the works	N/A	If required, relocation of otter holts to be carried out in accordance with an updated derogation licence from the NPWS.	To be carried out in advance of the works. This would require person entry to the channel locally but is not envisaged to require mechanical means. To be conducted in accordance with the relevant derogation licence requirements
	Cois na Gleann culvert	C07_B01	Must be carried out during the instream works period (July to September).	Temporary flow management required either in the form of over pumping.

Area	Activity	Structure Ref.	Seasonal Constraint	Comment
	Circus Field Wall (RC flood wall)	C01_L02		No works in stream seasonal constraint. Works to be constructed offline / out of river
	Circus Field Wall (boundary wall)	C01_F01		No environmental season constraint
	Hazelwood Bridge extension	-	Must be carried out during the instream works period (July to September).	-
	Hazelwood flood relief culvert (incl. channel)	C01_B02	Must be carried out during the instream works period (July to September) – part thereof	Culvert works may be carried out outside of instream works period (July to September), however instream works upstream and downstream to tie into the main Glashaboy River channel would be required during the instream (July to September period)
	Hazelwood Shopping Centre bridge replacement (incl. locally adjoining retaining walls)	C01_B03	Must be carried out during the instream works period (July to September).	Placing of cofferdam would be required to be carried out during instream works period to facilitate the works to be carried out in the dry. This would maintain the main flow within the Glashaboy River channel during construction
	Hazelwood Shopping Centre road regrading	C01_R03	N/A	N/A
	Hazelwood SC flood defence wall	C01_L03a & C01_L03	Must be carried out during the instream works period (July to September).	Works required to isolate construction area to work in the dry. This will require installation of cofferdam (trench sheets or similar) during instream works period (July to September)
	Springmount Culvert	C06_B01	Must be carried out during the instream works period (July to September).	-
	Springmount retaining wall	C06_L02	N/A	No environmental season constraint. Works to be constructed offline / out of river
	Drainage diversion on R639	-	N/A	No environmental season constraint. Works to be constructed offline / out of river
	Pumping Station	C01_P02	N/A	No environmental season constraint. Works to be constructed offline / out of river

Area	Activity	Structure Ref.	Seasonal Constraint	Comment
	Funeral home RC wall	C01_L04	N/A	No environmental season constraint. Works to be constructed offline / out of river
	Springmount Stream RC wall	C06_L01	Must be carried out during the instream works period (July to September).	
Area 3 - Meadowbrook	Meadowbrook RC wall	C01_L05	Proximity of works to Kingfisher nests. This work must be carried out during the March to August period.	Works within the proximity of Kingfisher nests will be planned to be undertaken outside of the breeding bird season (March to August). However, if this is not possible, strict noise and vibration restrictions will be imposed on the Contractor.
	Meadowbrook Sheet pile wall	C01_L06	Kingfisher birds nesting period (This work must be carried out during the March to August period.)	It is proposed to carry out works during the 4 weeks in September, however if there is need to carry out some work in August this will be subject to a bird nesting survey and in consultation with the NPWS.
	Riverstown bridge clearing works (regrading)	C01_C01 & C01_C02	Must be carried out during the instream works period (July to September).	Temporary flow management required to allow works to be carried out in the dry.
	Riverstown bridge road regrading	C01_R04 & C01_R04a	N/A	All works offline without the requirement for instream working
	Meadowbrook pumping station (surface water)	C01_P03	N/A	All works offline without the requirement for instream working
	Meadowbrook pumping station (foul water)	C01_P04	N/A	All works offline without the requirement for instream working
Area 4-1 and 4-2: Butlerstown Stream and Glenmore Stream	Butlerstown Stream works (incl. GAA club)	C04_R02	N/A	All works offline without the requirement for instream working
	Copper Valley Vue Bridge	C05_B02	Must be carried out during the instream works period (July to September).	-

Area	Activity	Structure Ref.	Seasonal Constraint	Comment
	Brooklodge Grove Culvert	C05_B01	Must be carried out during the instream works period (July to September).	-
	Brooklodge retaining wall	C05_L01	Must be carried out during the instream works period (July to September).	-
	Brooklodge and The New Line existing wall repair	C05_L01	N/A	Works to north and south wall faces. Temporary works (scaffolding or similar) will be required to facilitate wall repair works.
	Copper Valley Vue retaining wall	C05_L11	Must be carried out during the instream works period (July to September).	Works in river required. Temporary flow management required to allow works to be carried out in the dry.
	Road regrading	C05_R01/R02	N/A	-
	The New Line bridge	C05_B03	Must be carried out during the instream works period (July to September).	-
	The New Line retaining wall	C05_L02 /L03	Must be carried out during the instream works period (July to September).	-
	New Line road regrading	C05_R05	N/A	-
Area 5 O'Callaghan Part to Glanmire Bridge	Pumping station	C01_P05	N/A	-
	The Grove retaining wall, layby and repair of existing river wall	C01_L08	Must be carried out during the instream works period (July to September).	Access to the river to carry out repairs to the existing river wall. Temporary flow management will be required.
Area 6 – Downstream of Glanmire Bridge	Maintenance only. Instream works will be carried out within the instream works period (July to September)			

7. Construction and Demolition Waste Management Plan

A Construction and Demolition (C&D) waste management plan (WMP) has been prepared to ensure that waste arising during the excavation, construction and demolition phase of the scheme will be minimised, managed and disposed of in a way that ensures compliance with the provisions of the Waste Management Acts, 1996 as amended and associated Regulations 2010, as amended, to ensure that optimum levels of reduction, re-use and recycling are achieved. This plan meets the requirements of the Best Practice Guidelines for the Preparation of Waste Management Plans for Construction and Demolition Projects (Department of Environment, Heritage and Local Government, 2006). Additionally, waste generated during the construction phase will be managed in accordance with the principles of circular economy and waste hierarchy.

This C&D WMP is a working document and will be further developed by the Contractor following appointment and prior to commencing works on site.

Surplus materials generated during the following phases are addressed in this report:

- Excavation phase;
- Demolition phase; and
- Construction phase.

7.1 Excavation Material

The most environmentally sustainable means of managing excavated material is its prevention and minimisation. Prevention and minimisation are inherent in the design of the scheme.

Excavated material as part of the construction works will generally consist of riverbank material, topsoil, subsoil and made ground.

During construction there will be considerable quantities of uncontaminated soil including riverbank material generated from excavation works for the flood defence structures. It is anticipated that the majority of the excavated material, which is expected to be uncontaminated soil will be suitable for reuse onsite.

The follow measures will be implemented to minimise the effects of excavation activities:

- Site clearance which includes the removal of trees and vegetation will be restricted to the winter months.
- Organic material, such as trees and vegetation, will be removed from site by a waste collection permit holder and delivered to an authorised composting or organic waste facility.
- Possibilities for re-use of clean non-hazardous excavation material as fill on the site or in landscaping works will be considered following appropriate testing to ensure material is suitable for its proposed end use.
- Where there is no on-site use for uncontaminated material generated on site, this material will need to be removed off site where the following options will be available to the Contractor:
  - Re-use as a by-product on other sites subject to Article 27 under the Waste Directive Regulations 2011 (S.I. No. 126 of 2011) and meeting EPA criteria;
  - Recovery/recycling at suitable waste permit facilities or licensed soil recovery facilities in accordance with relevant waste legislation; or
  - Disposal at suitable authorised waste facilities.

- The Contractor will ensure that any off-site interim storage facilities for excavated material have the appropriate waste licences or waste facility permits in place.
- In the unlikely event contaminated soil is encountered, it will be disposed of to a suitable licenced waste facility, subject to the appropriate waste acceptance criteria of the receiving facility and in accordance with relevant waste legislation.

Additionally, should soil containing Japanese Knotweed or other non-native invasive plant species be found on site, it will be treated and managed in line with the appropriate remediation measures as outlined in Section 5.2.1.5 to prevent the spread of non- native invasive species.

Where any infested material (soil containing Japanese Knotweed) is to be taken off site, a license to transport the material will need to be sought from NPWS.

A permitted landfill will need to be sourced to deposit excavated material which can accept such material. The landfill site operator will need to be informed of what the material contains.

7.2 Demolition Waste

Demolition works include the demolition of existing culverts, pipeline and an existing bridge at Copper Valley Vue Estate and Hazelwood Shopping Centre.

The Contractor will endeavour to send material for recovery or recycling so far as is reasonably practicable. Waste will be removed from site by a waste collection permit holder and delivered to an authorised facility in accordance with the relevant Irish waste legislation.

7.3 Construction Waste

In general, construction waste materials arising from the construction phase of the scheme may include general construction debris, scrap timber and steel, machinery oils and chemical cleaning solutions.

Waste generated during the construction phase will be carefully managed according to the accepted waste hierarchy which gives precedence to prevention, minimisation, reuse and recycling over disposal with energy recovery and finally disposal to landfill.

This hierarchy will be implemented by identifying opportunities to firstly prevent waste from being produced, and secondly minimise the amount of waste produced. Where prevention and minimisation will not be feasible, ways to reuse or recycle waste will be sought, preferably on-site to avoid the impacts arising from transportation. If this is not feasible, opportunities to reuse or recycle the waste off-site will be investigated. If this is not feasible, then waste will be sent to an energy recovery facility, and only where there is no alternative, will waste be disposed of to landfill. To achieve this, existing waste management programmes and networks will be used such as the National Waste Prevention Programme, which is implemented by the Environmental Protection Agency.

All waste removed from the site will be collected only by Contractors with valid waste collection permits, under the Waste Management (Collection Permit) Regulations.

All facilities to which waste will be taken will have appropriate waste licences or permits, under the Waste Management Act 1996, as amended, and the regulations thereunder, allowing them to accept the type of waste that is to be sent there. Hazardous waste generation will be minimised, and such waste will be recovered where feasible, and only disposed of if recovery is not feasible.

7.4 Hazardous Waste

All hazardous waste such as paints, sealants and chemicals will be separately stored in a bunded location in an appropriate lockable container, prior to removal from site by an appropriate waste collection holder.

Even though the quantity of hazardous waste generated during the construction phase are expected to be small and not of significance, the following steps must be taken where hazardous waste is being transported from the scheme to a hazardous waste recovery or disposal facility within the State:

- Waste transfer forms will be obtained by the waste producer from Cork City Council and/ or Cork County Council 's website and completed on-line before the waste is collected.
- A copy will be downloaded, printed and signed, accompanying the consignment of hazardous waste when it is in transit.
- On the load's arrival, the operator of the recipient disposal or recovery facility will log-in and complete the relevant details documenting the receipt of the waste.
- Export of hazardous waste from the scheme outside of the State is subject to a Europe-wide control system founded on EU Regulation 1013/2006 on the Shipments of Waste (known as the Transfrontier Shipment Regulations), as amended. This legislation is supplemented by the Waste Management (Shipments of Waste) Regulations 2007, as amended, which makes Dublin City Council responsible for the enforcement of this regulatory system throughout Ireland. Export of hazardous waste from site outside the state should comply with the procedures set out in this legislation.

7.5 Waste Management Mitigation Measures

The following mitigation measures will be implemented throughout the scheme:

- Waste disposal will be minimised so far as is reasonably practicable;
- Waste from the scheme will be transported by authorised waste collectors in accordance with the relevant Irish waste legislation;
- Storage of materials which are vulnerable to damage by rain are covered and carefully handled to avoid undue damage;
- Waste from the scheme will be delivered to authorised waste facilities in accordance with the relevant Irish waste legislation;
- Source segregation: Where possible, metal, timber, glass and other recyclable material will be segregated during construction works and removed off site to a permitted/licensed facility for recycling. Waste stream colour coding, and photographs of wastes to be placed in each container as required, will be used to facilitate segregation. Where waste generation cannot be avoided this will maximise the quantity and quality of waste delivered for recycling and facilitate its movement up the waste hierarchy away from landfill disposal and reduce its environmental effect;
- Material management: 'Just-in-time' delivery will be used so far as is reasonably practicable to minimise material wastage;
- Supply chain partners: The Contractor will engage with the supply chain to supply products and materials that use minimal packaging, and segregate packaging for reuse;
- Waste Auditing: The quantity in tonnes and types of waste and materials leaving site will be recorded during the construction phase;
- Waste fuels/oils will be generated from equipment used on-site during construction and will be classified as hazardous waste. Such wastes will be stored in a secure, bunded area on-site prior to collection by a Contractor who holds the appropriate waste collection permit;
- The site will be maintained to prevent litter and regular litter picking will take place throughout the site.
- The Contractor will record the quantity in tonnes and types of waste and materials leaving the site during the demolition works. The name, address and authorisation details of all facilities and locations to which waste and materials are delivered will be recorded along with the quantity of waste in tonnes delivered to each facility. Records will show material which is recovered and disposed of.
- Waste generated on site will be removed as soon as practicable following generation for delivery to an authorised waste facility.

8. Construction Traffic Management Plan

8.1 Introduction

Following consultation with An Garda Síochána, Cork City Council and Cork County Council, the Construction Traffic Management (CTMP) will be further developed by the Contractor to ensure that construction traffic will be managed and monitored safely and efficiently throughout the construction phase.

8.1.1 Purpose and Scope

This Construction Traffic Management Plan is a key construction contract document, the implementation of which will reduce possible impacts which may occur during the construction of the scheme.

The objectives of this CTMP are to:

- Outline minimum road safety measures to be undertaken at site access/egress locations, during the works and including approaches to such access/egress locations;
- Demonstrate to the Employer, Contractor and suppliers the need to adhere to the relevant guidance documentation for such works; and
- Provide the basis for the Contractor to further develop the details of this CTMP.

The Employer's Representative will be responsible for ensuring that the Contractor manages the construction activities in accordance with this CTMP.

Objectives and measures are also included for the management, design and construction of the project to control the traffic impacts of construction insofar as it may affect the environment, local residents and the public in the vicinity of the construction works.

The CTMP will address the requirements of any relevant conditions set by the Minister's decision to confirm the scheme, including any additional mitigation measures which are conditioned. The Contractor further development of the CTMP will require approval from the Local Authorities and An Garda Síochána.

The objective of this CTMP is to ensure that the residual impacts to the public road network during the construction phase of the scheme are minimised and that transport related activities are carried out as safely as possible and with the minimum disruption to other road users. The CTMP has also been prepared for the purpose of identifying appropriate and safe methods of access for construction traffic to the scheme.

This CTMP describes the traffic management for the transportation of construction materials, equipment and personnel along the public road network to facilitate the construction of the scheme. Light vehicles, such as cars and vans, will be used by site operatives travelling to and from the site. Heavy Construction Vehicles (HCV) will be required to deliver general construction materials, such as concrete, to the site and for the removal of excavated material that is to be disposed off-site.

This CTMP will remain a live document that will be reviewed by the Contractor and expanded upon, where necessary, throughout the construction phase.

8.1.2 Implementation

Key to the implementation of the CTMP is the dedication of an on-site manager (nominated by the Contractor) who will supervise the implementation of the plan and regularly liaise with and update the supervising Resident Engineer team on the operation of the plan and any proposed improvements. All site personnel will be charged with following good practice and will be encouraged to provide feedback and suggestions for improvements. Site personnel will also be required to ensure compliance with the requirements of the site's CTMP.

8.1.3 Document Revision

The CTMP will be subject to on-going review throughout the construction phase of the scheme, and regular auditing and site inspections.

All of the information required to further develop the CTMP will be highlighted in the specification for the construction contract. The Contractor will be required to include further details and/or confirmation, as described below.

8.2 Construction Traffic Generation

8.2.1 Overview

The potential impacts of the scheme on the road network are as follows:

- Temporary impacts during construction due to the excavation of materials in order to facilitate construction, and the associated movements of excavation vehicles;
- Temporary impacts associated with the importing of construction materials to the works areas, and the relevant movements of delivery and construction vehicles and construction workforce; and
- Temporary impact during construction due to the works elements that are on or adjacent to the existing road network, including culverts, bridges, flood defence walls, pumping stations, etc, which may require full or partial road closures.

8.2.2 Traffic Generation from Scheme

The volumes of traffic associated with the construction activities have been estimated on the basis of the requirements of each individual area of works. It is important to mention that the construction traffic volumes have been based on a worst-case scenario in terms of the various construction activities. It is estimated that these account for as much as 20% higher volumes than what is likely to be the case.

The volumes have been calculated for the entirety of the activity and, based upon the works programme, the daily and hourly volumes were estimated. For this, we have assumed a 6-day working week and an 8-hour working day.

To ensure robustness in the assessment, the daily average was doubled to reflect a potential busier construction period and the hourly average volume has been factored by 20% to reflect a peak within each day.

Table 10 Construction Traffic Volumes.

Area	Roads	Daily Traffic and Impact			Peak Hour Traffic and Impact		
		Background	Construction Trips	Impact	Background	Construction Trips	Impact
1A	L2973	236	4	1%	151	3	2%
1B	R639	1091	116	7%	790	15	2%
	L2973	236	116	33%	151	15	10%
1C	L2973	236	116	33%	151	15	10%
	R639	1091	116	7%	790	15	2%
1D	R639	1091	33	2%	790	4	1%
	L2973	236	33	9%	151	4	3%
1E	L2973	236	33	9%	151	4	3%
	R639	1091	33	2%	790	4	1%
1F	R639	1091	13	1%	790	2	0%
1G	R639	1091	20	1%	790	3	0%
1H	R639	1091	20	1%	790	3	0%
1I	R639	1091	33	2%	790	4	1%

Area	Roads	Daily Traffic and Impact			Peak Hour Traffic and Impact		
		Background	Construction Trips	Impact	Background	Construction Trips	Impact
1J	R639	1091	33	2%	790	4	1%
1K	R639	1091	33	2%	790	4	1%
1L	R639	1091	33	2%	790	4	1%
1M	R639	1091	22	1%	790	3	0%
1N	R639	1091	22	1%	790	3	0%
2A.1	Hazelwood	590	1	0%	375	1	0%
2A	R639	958	7	0%	572	5	1%
	R615	412	7	1%	302	5	2%
2B	R639	958	2	0%	572	2	0%
	R615	412	2	0%	302	2	1%
2C	R639	958	3	0%	572	3	0%
	Hazelwood	608	3	0%	375	3	1%
	L2966	888	3	0%	658	3	0%
2D	R639	958	10	1%	572	1	0%
	Hazelwood	608	10	1%	375	1	0%
	L2966	888	10	1%	658	1	0%
2E	R639	958	13	1%	572	2	0%
	Hazelwood	608	13	1%	375	2	0%
	L2966	888	13	1%	658	2	0%
2E.1	R639	958	2	0%	572	2	0%
	Hazelwood	608	2	0%	375	2	0%
	L2966	888	2	0%	658	2	0%
2F	R639	958	29	2%	572	4	1%
	Hazelwood	608	29	3%	375	4	1%
	L2966	888	29	2%	658	4	1%
2G	R639	958	13	1%	572	2	0%
	Hazelwood	608	13	1%	375	2	0%
	L2966	888	13	1%	658	2	0%
2H	R639 (North of L3010)	979	4	0%	753	4	0%
	L3010	490	4	1%	314	4	1%
2I	R639 (North of L3010)	979	9	1%	753	7	1%
	L3010	490	9	1%	314	7	2%
2J	R639 (North of L3010)	979	2	0%	753	2	0%
	L3010	490	2	0%	314	2	0%
2K	R639 (North of L3010)	979	4	0%	753	3	0%

Area	Roads	Daily Traffic and Impact			Peak Hour Traffic and Impact		
		Background	Construction Trips	Impact	Background	Construction Trips	Impact
	L3010	490	4	1%	314	3	1%
3A	Brooklodge Grove (east of M8)	517	21	3%	295	3	1%
3B	Brooklodge Grove (east of M8)	517	7	1%	295	6	2%
3C	Brooklodge Grove (east of M8)	517	7	1%	295	6	2%
3D	Brooklodge Grove (west of M8)	517	1	0%	295	1	0%
3E	Brooklodge Grove	517	12	2%	295	1	0%
	L3010	519	12	2%	260	1	1%
3F	Brooklodge Grove	517	9	1%	295	8	3%
	L3010	519	9	1%	260	8	3%
3G	Brooklodge Grove	517	15	2%	295	2	1%
	L3010	519	15	2%	260	2	1%
3H	Brooklodge Grove	517	7	1%	295	6	2%
	L3010	519	7	1%	260	6	2%
3I	Brooklodge Grove	517	9	1%	295	8	3%
	L3010	519	9	1%	260	8	3%
3J	Brooklodge Grove	517	3	0%	295	2	1%
	L3010	519	3	0%	260	2	1%
3K	L3010	519	30	4%	260	4	1%
3L	L3010	519	3	0%	260	2	1%
3M	L3010	519	5	1%	260	4	2%
3N	L3010	519	5	1%	260	4	2%
	East Cliff Road	654	5	1%	372	4	1%
4A	R639 (south of L3010)	777	2	0%	667	1	0%
4B	R639 (south of L3010)	777	1	0%	667	1	0%
4C	R639 (south of L3010)	777	2	0%	667	1	0%

8.2.3 Envisaged Construction Equipment

Construction equipment and vehicles required for each construction element/operation will be delivered to site by appropriate vehicles. Specific equipment and vehicles which are deemed to be required for the scheme by the principal contactor, suppliers and staff are to be confirmed and included in the CTMP.

8.3 Matters to be Addressed in More Detail

The Contractor will be contractually required to ensure that the contents of this CTMP are further developed prior to the commencement of works. The Contractor will implement monitoring measures to confirm the effectiveness of the mitigation measures outlined in the CTMP. Contents of the CTMP will address the following issues (including all aspects identified in this CTMP):

- Site/Works area Access and Egress;
- Traffic Management Signage;
- Timings of Material Deliveries to Site;
- Traffic Management Speed Limits;
- Road Cleaning;
- Vehicle Cleaning;
- Road Condition;
- Road Closures;
- Enforcement of Traffic Management Plan;
- Emergency Procedures during construction; and
- Communication.

These items are explained in detail in the remainder of this section of the report.

8.3.1 Site Access and Egress

The proposed site access locations will be identified and the Contractor will provide advanced warning signs, in accordance with Department of Transport's 'Traffic Signs Manual, Chapter 8: *Temporary Traffic Measures and Signs for Roadworks*' (August 2019), on the approaches to proposed site access locations, a minimum of one week prior to construction works commencing at that location.

8.3.1.1 National Road Network

The following national primary and national secondary roads are anticipated be utilised as haul routes during the construction period. Where possible higher order roads will be the preference for haul routes. This does not apply to construction personnel.

- National Roads:
  - N8/M8 (north of Dunkettle Interchange);
  - N8 (west of Dunkettle Interchange);
  - N25 Cork-Waterford Road;
  - N40 Cork South Ring Road; and
  - N28 Cork-Ringaskiddy Road.

8.3.1.2 Regional and Local Road Network

The following regional and local roads are also likely to be utilised as haul routes during the construction period:

- Regional Road Network
  - R615 – Old Youghal Road; and
  - R639 – Watergrasshill Road.
- Local Road Network
  - L-3010 Old Court Road;
  - Hazelwood;
  - Brooklodge Grove; and
  - L2998 Richmond.

8.3.1.3 Construction Compounds

Three potential locations for the construction compounds, in the immediate vicinity of the works, have been identified.

The construction compounds will be located within the areas identified in Figures 15, Figure 16, and Figures 17 of **Chapter 5** (Appendix B). The final selection of the compound(s) will be made by the Contractor appointed to construct the works in consultation with the OPW, Cork City Council and the Contractor's Ecologist. Due to the length of channel involved, the Contractor may choose to move the compound during the construction period, in which case the same selection process will apply.

8.3.2 Traffic Management Signage

The Contractor will undertake consultation with the relevant authorities for the purpose of identifying and agreeing signage requirements. Such signage will be installed prior to works commencing on site.

Proposed signage will include warning signs to provide warning to road users of the works access/egress locations and the presence of construction traffic. All signage will be provided in accordance with the Department of Transport's 'Traffic Signs Manual, Chapter 8: *Temporary Traffic Measures and Signs for Roadworks* (August 2019).

In summary, the Contractor will be required to ensure that the following elements are implemented:

- Consultation with the relevant authorities for the purpose of identifying and agreeing signage requirements;
- Provision of temporary signage indicating site access route and locations for Contractors and associated suppliers; and
- Provision of general information signage to inform road users and local communities of the nature and locations of the works, including project contact details.

8.3.3 Timings of Material Deliveries to Site

In order to reduce impacts on local communities and residents adjacent to the sites, it is proposed that:

- The Contractor will liaise with the management of other construction projects in the area and the local authorities to co-ordinate deliveries;
- The Contractor will schedule deliveries in such a way that construction activities and deliveries activities do not run concurrently, where practicable, e.g. avoiding pouring of concrete on the same day as material deliveries in order to reduce the possibility of numbers of construction delivery vehicles arriving at each site/works area location simultaneously, resulting in build-up of traffic on road network;
- The Contractor will schedule deliveries to and from any proposed temporary construction materials storage yards or compounds such that traffic volumes on the surrounding road network are kept to a minimum;

- A construction phase programme of works will be developed by the Contractor in liaison with the relevant local authorities, specifically taking into account potential road repair works that are included in the local authority's road works schedule;
- HGV deliveries to specific areas of the site will be suspended on the days of any major local events, etc. that have the potential to cause larger than normal traffic volumes in the overlap areas;
- The Contractor will interact with members of the local community to ensure that construction-related traffic will not conflict with sensitive events such as funerals;
- Specific construction moratoria (for example, in the pre-Christmas shopping period) as indicated by the Local Authority will be respected and incorporated into the construction phasing programme;
- HGV deliveries will avoid passing schools at opening and closing times where it is reasonably practicable; and
- Construction activities will normally be undertaken during daylight hours for all construction stages. It is anticipated that at critical certain stages of the construction works night-time and weekend work will be required (for example during culvert or bridge replacements), subject to agreement and approval with the Local Authority and An Garda Síochána.

8.3.4 Traffic Management Speed Limits

Adherence to posted / legal speed limits will be emphasised to all staff and suppliers and Contractors during induction training. Drivers of construction vehicles and HGVs will be advised that vehicular speeds in sensitive locations, such as local community areas, will be restricted to appropriate levels.

Special speed limits (for example, of 30km/h) will be implemented for construction traffic in sensitive areas such as school locations. Such recommended speed limits will only apply to construction traffic and not to general traffic.

8.3.5 Road Cleaning

It will be a requirement of the works contract that the Contractor carry out periodic road sweeping/cleaning operations to remove any scheme related dirt and material deposited on the road network by construction / delivery vehicles. Road Sweepers will dispose of material following sweeping of road network, to licensed waste facility.

8.3.6 Vehicle Cleaning

It will be a requirement of the works contract that the Contractor will provide wheel washing facilities where appropriate, and any other necessary measures to remove mud and organic material from vehicles exiting sites or works areas.

8.3.7 Road Condition

The extent of the heavy vehicle traffic movements and the nature of the payload may create problems of:

- Fugitive losses from wheels, trailers or tailgates,
- Localised areas of subgrade and wearing surface failure.

The Contractor will ensure that:

- Loads of materials leaving each site will be evaluated and covered if considered necessary to minimise potential dust impacts during transportation.
- The hauliers will take all reasonable measures while transporting waste or any other materials likely to cause fugitive losses from a vehicle during transportation to and from site, including but not limited to:
  - Covering of all waste or material with suitably secured tarpaulin/ covers to prevent loss; and
  - Utilisation of enclosed units to prevent loss.

- The roads forming part of the haul routes will be monitored visually throughout the construction period and a truck mounted vacuum mechanical sweeper will be assigned to roads along the haul routes as required.
- In addition, the Contractor will, in conjunction and through agreement with the local authority:
  - Undertake additional inspections and reviews of the roads forming the haul routes prior to the construction phase to record the condition of these roads at that particular time; and
  - Such surveys will comprise, any recording or documentation processes as determined necessary by the Local Authority.
- Where requested by the local authority prior to the commencement of construction operations, pavement condition surveys will also be carried out along roads forming part of the haul routes. These will record the baseline structural condition of the road being surveyed immediately prior to construction.
- Throughout the course of the construction of the scheme, on-going visual inspections and monitoring of the haul roads will be undertaken to ensure any damage caused by construction traffic is recorded and that the relevant Local Authority is notified. Arrangements will be made to repair any such damage to an appropriate standard in a timely manner such that any disruption is minimised.
- Upon completion of the construction of the scheme, the surveys carried out at pre-construction phase will be repeated and a comparison of the pre and post construction surveys carried out.

8.3.8 Road Closures

It is likely that temporary road closures will be required during the construction phase of the works at the following locations:

- On the access road into Cúil Chluthair;
- On the R615 and R639 at the Springhill Stream;
- Within and in the vicinity of Hazelwood Shopping Centre;
- On the R639 at the Springmount Stream
- On the L3010 Old Youghal Road in the vicinity of Meadowbrook;
- On the access to Copper Valley off Brooklodge Grove;
- On New Line, off Brooklodge Grove; and
- On the R639 north of the L2999 Glanmire Bridge.

Localised traffic disruption will occur at locations of works on, or in the immediate vicinity of the road network. These works include the replacement of existing bridges, upgrading of existing culverts, construction of flood defence walls, utility diversions and drainage upgrades. In many instances it may be possible to complete works elements in phases, thus necessitating a partial road closure only. However, for a small number of locations a full road closure will be required to facilitate the works.

Replacement of existing culverts will be possible in phases, which will only necessitate partial road closures. There are also a number of pumping stations to be constructed, although the majority of these are located offline. Localised road re-grading will also be possible in phases, again only necessitating partial road closures.

8.3.9 Enforcement of Traffic Management Plan

All project staff and material suppliers will be required to adhere to the CTMP. The Contractor will agree and implement monitoring measures to confirm the effectiveness of the CTMP and compliance will be monitored by the supervising Resident Engineer. Regular inspections / spot checks will also be carried out to ensure that all project staff and material supplies follow the agreed measures adopted in the CTMP.

8.3.10 Emergency Procedures During Construction

The Contractor will ensure that unobstructed access is provided to all emergency vehicles along all routes and site accesses.

The Contractor will provide to the local authorities and emergency services, contact details of the Contractors' personnel responsible for construction traffic management.

In the case of an emergency the following procedure will be followed:

- Emergency services will be contacted immediately by dialling 112,
- Exact details of the emergency / incident will be given by the caller to the emergency line operator to allow them to assess the situation and respond in an adequate manner
- The emergency will then be reported to the Contractor's site team supervisors and the site Safety Officer,
- All construction traffic will be notified of the incident (where such occurs off site),
- Where required, appointed site first aiders will attend the emergency immediately,
- The Safety Officer will ensure that the emergency services are directed to and arrive at the emergency site.

8.3.11 Communication

The Contractor will ensure that close communication with the relevant local authorities and the emergency services is maintained throughout the construction phase. Such communications will include:

- Submissions of proposed detailed traffic management measures for comment and approval,
- Ongoing reporting relating to the condition of the road network and updates to construction programming,
- Information relating to local and community events that could conflict with proposed traffic management measures and construction traffic in order to implement alternative measures to avoid such conflicts.

The Contractor will also ensure that the local community is informed of proposed traffic management measures in advance of their implementation. Such information will be disseminated by posting advertisements in local newspapers and delivering leaflets to houses in the affected areas. Such information will contain the Contractor's contact information for members of the public to obtain additional information and to provide additional knowledge such as local events, sports fixtures etc. which may conflict with proposed traffic management measures.

8.4 Conclusions

This CTMP will form part of the construction contract and is designed to reduce possible impacts which may occur during the construction of the scheme.

The CTMP will be further developed by the Contractor following consultation with An Garda Síochána and the Local Authorities.

The Employer will be responsible for ensuring that the Contractor manages the construction activities in accordance with this CTMP and will ensure that any conditions of planning are incorporated into the site specific CTMP.

9. Communication Procedure

9.1 Public Communication

9.1.1 Community and Stakeholder Engagement

The Contractor will take all reasonable steps to engage with stakeholders in the local community, focusing on those who may be affected by the construction works including residents, businesses, community resources and specific vulnerable groups.

Communication with the local community and other relevant stakeholders will be undertaken at an appropriate level and frequency throughout construction.

The Employer's Representative will establish a Communications Management Plan, which in addition to the construction contract, will specify obligations in relation to community and stakeholder engagement which the Contractor must adhere to.

9.1.1.1 Community Liaison

Cork City Council and the OPW recognise the importance of effective community liaison in order to reduce nuisance to residents, to ensure public safety and welfare and to help ensure the smooth running of construction activities. Important issues in ensuring good relations are:

- Providing information for the public during the construction phase, (particularly nearby sensitive receptors);
- Providing the correct points of contact and being responsive; and
- Ensuring good housekeeping in all aspects of the operations.

A 'good neighbour' policy will be implemented, as far as possible. Key aspects of this policy include:

- Early implementation of the policy i.e. from the commencement of construction;
- Reduction of nuisance factors;
- Maintaining access to neighbouring premises;
- Clear and concise information; and
- Undertaking timely liaison with stakeholders.

The Contractor will be required to prepare a Community Liaison Plan, which will include details of how the local community, road users and affected residents will be notified in advance of the scheduling of major works, any temporary traffic diversions and the progress of the construction works. A dedicate website will be established for the scheme, which will describe the progress and will be kept up to date with bulletins from the Contractor.

This Plan will typically include details of the following:

- Contractor's community relations policy;
- Personnel nominated to manage public relations;
- A methodology for recording and addressing observations, queries and complaints from the general public, relevant authorities, the media and emergency services; and
- The strategy for project- wide liaison with all relevant parties.

9.1.2 Regular Consultation and Public Communications

The Communications Management Plan will also specify obligations in relation to regular consultation and public communications activities required during the construction of the scheme.

The Contractor will facilitate regular consultation in accordance with the specifications and cooperate with this Plan. Where communications are related to environmental issues the Safety, Health, Environment and Quality (SHEQ) Manager and the Contractor's ecologist will be informed and engaged with, as appropriate

Details of the available communication channels/points of contact for members of the public to contact the supervising Resident Engineer and the Contractor during construction will be established in advance of the commencement of construction and displayed around working areas.

9.1.3 Advance Notice of Works

The Contractor will ensure that local residents, businesses, occupiers, general users of the area and stakeholders are informed in advance of construction activities that may affect them. Relevant obligations and procedures in relation to advance notice of works will be identified in the Communications Management Plan.

All notifications will detail the nature, estimated duration and working hours. All notifications will include a project-specific contact number to which any enquires can be directed. The Contractor will be responsible for preparing and issuing the notifications subject. Prior to the commencement of construction works in proximity to the Eurofins laboratory facility, discussions will be held with management of the facility to confirm the optimum time to carry out the works.

The Employer's Representative and the Contractor, in consultation with statutory stakeholders, will decide whether to arrange any further targeted consultation with the public or relevant stakeholders in advance of specific construction activities on a local basis.

9.1.4 Emergency Contacts

An emergency contact list will be established and made available to all construction staff. The contact list will be displayed prominently on site as well as at suitable locations where construction activity is being carried out around working areas. The contact list will include key environmental representatives that may need to be contacted in the event of an incident.

9.1.5 Enquiries and Complaints

The Contractor will establish a process for handling all enquires including complaints. All enquires will be recorded and a log will be maintained to include details of the response and action taken. This will be available upon request for inspection to statutory stakeholders. All enquiries, whether a query or a complaint, will be dealt with in a timely manner. The Contractor will inform the supervising Resident Engineer of all enquires, including complaints.

The supervising Resident Engineer will be immediately informed of any environmental-related issues that have been raised. Where appropriate, the supervising RE will be responsible for informing relevant stakeholders and statutory bodies.

9.2 Internal Communication

The Contractor will put in place an Internal Communication Strategy which will include procedures for effective internal communications. The strategy, which will be finalised by the Contractor will include measures such as the following:

- The site management meeting will include environmental issues on the agenda
- Weekly site safety meetings will include environmental issues on the agenda
- The SHEQ Manager will report on environmental issues to the site management meetings
- The SHEQ Manager will attend the weekly meetings

10. Environmental Management Procedures

10.1 Training, Awareness and Competence

The Contractor and sub-contractors will be selected with due consideration of relevant qualifications and experience. The Contractor will be required to employ construction staff with appropriate skills, qualifications and experience appropriate to the needs of the works to be carried out during construction.

A site induction will be provided to all construction staff before they commence work on site. Where appropriate, the Contractor will identify specific training needs for the construction workforce and will ensure that appropriate training requirements are fulfilled.

The Contractor will establish an Environmental Training and Awareness Programme and ensure that all personnel receive adequate training prior to the commencement of construction activities. A baseline level of environmental awareness will be established through the site induction programme. Key environmental considerations and objectives will be incorporated into this induction. Specifically, site inductions will cover the following as a minimum:

- Introduction to the SHEQ Manager.
- Description of the CEMP and consequences of non-compliance.
- The requirements of due diligence and duty of care.
- Overview of conditions of consents, permits and licences.
- Requirements associated with community engagement and stakeholder consultation.
- Identification of environmental constraints and notable features within the site.
- Procedures associated with incident notification and reporting including procedures for dealing with damage to the environment.
- Nobody will work on site without first receiving environmental induction. Site personnel will be made aware of their responsibilities and liabilities with reference to protection of water quality, ecology and site-specific environmental protection during daily pre task talks. All relevant employees will be trained on the use of spill kits materials, silt fencing installation and maintenance, and the relevant response procedures. Signed records of environmental training will be established, maintained and made available to the Employer's Representative. Where a site-specific method statement/plan has been devised for a works activity (e.g. working in an area where non-native invasive species are present or carrying out instream works), all site personnel involved in that activity will be given an in-depth toolbox talk outlining the particular environmental commitments and control measures which are appropriate to the works being carried out.
- Site briefings and toolbox talks will be carried out on a regular basis to ensure that construction staff have an adequate level of knowledge on environmental topics and community relations and can effectively follow environmental control procedures throughout construction.

10.2 Monitoring, Inspections and Audits

For the duration of the contract the environmental performance of the Contractor will be monitored through site inspections and audits. The programme for monitoring, inspections and audits will be specified in the contract and it is likely to be a combination of internal inspections by the Contractor's own team and audits by the RE's ecologist that may be either random or routine.

Records of all inspections carried out will be recorded on standard forms and all actions to be closed out in a reasonable time.

10.2.1 Monitoring

Mitigation and monitoring will be carried out in accordance with Section 5 so that construction activities are undertaken in a manner that does not give rise to significant negative effects. Suitable monitoring programmes will be developed, implemented, documented, and assessed (with potential follow up). In addition to the monitoring measures described in Table 11 below, the contract documents, the conditions and/or modifications imposed by MPER, environmental legislative requirements, the provisions of licences and the results of consultations with contractually or legally prescribed third parties may require the execution of additional types of monitoring.

The results of all environmental monitoring activities will be reviewed by the SHEQ Manager on an ongoing basis to enable trends or exceedance of criteria to be identified and corrective actions to be implemented as necessary. The Contractor will be required to inform the Employer's Representative of any continuous exceedances of criteria.

Table 11 Monitoring during Construction

Environmental Discipline	Monitoring Measures
Biodiversity (including Water Quality)	• Earthworks will be undertaken by the Contractor and the sub-contractors in accordance with good construction management practices and will be monitored by a Resident Engineer's team to ensure that they conform to the methodologies described in the EIAR and subsequent addendum. • During instream works the Employer's Representative / Resident Engineer will complete daily checks to ensure that work is progressing as designed. All instream works will be overseen by the Contractor's Ecologist and supervised by the RE Ecologist, as required. • All instream works for construction and maintenance activities will be advised and overseen by Contractor's Ecologist. Additionally, the Contractor's Ecologist will be responsible for assuring that ecological and water quality mitigation measures are implemented onsite and that maintenance activities are legally compliant and that all the necessary paperwork (e.g. licences) are complied with. The Contractor's Ecologist will also provide on-site ecological advice to teams completing the works. • Monitoring of fine sediment and turbidity is proposed in order to ensure that the levels of fine sediment are not elevated above those which would be deleterious to aquatic life. • Two instream water quality sondes will be installed in the river, one upstream of the works and the second not more than 100m downstream in the river where works are taking place. The sondes will be capable of recording at minimum pH, temperature, electrical conductivity, dissolved oxygen and suspended solids with real time data available via telemetry system. • The telemetry system will include alarm trigger levels as outlined below (note that this impact will be measured through disparities in upstream and downstream water quality rather than due to the effects of weather events): – The level of suspended solids in any discharges to fisheries waters as a consequence of construction works (i.e. difference in concentration from upstream to downstream) will not exceed 25 mg/l nor result in deposition of silts on gravels (IFI, 2016). – The pH from all discharges made from and during construction works will be in the range 6.0 to 9.0[6] units and will not alter the pH of any receiving fisheries waters by more than +/- 0.5 pH units (IFI, 2016). • In the event that either a water quality alarm is triggered by the instream monitoring system or if the Resident Engineer or RE Ecologist observe unacceptable impacts on water quality, the works will cease until the cause of the issue has been identified. Following a site visit by the RE and/or RE Ecologist the appropriate mitigation measures will be implemented or where these measures are deemed insufficient additional site-specific mitigation measures will be put in place. In addition, the downstream river water quality will be assessed to determine if there has been any significant impact using the trigger levels set out above. Appropriate remedial measures will be designed by the Contractor's Ecologist in conjunction with the RE Ecologist based on the nature and scale of any impact identified to restore the river water quality and aquatic habitat. • Upon completion of the works, in-stream (aquatic) vegetation will be allowed to re-colonise naturally, however, this will be monitored and if deemed necessary additional planting of suitable aquatic plant species will be undertaken; • Monitoring for re-emergence of non-native invasive species will be undertaken by the Contractor's Ecologist. **Hydromorphology:** • Hydromorphology walkovers will be undertaken following major high-flow events and on an annual or bi-annual basis. Such walkovers will document any change in the sediment and flow dynamics in the system, as a result of the scheme construction. • Any points of note will be communicated to the Employer's Representative and recommendation for remedial action (such as bank reinforcement, in channel feature installation or others, where appropriate) will be made.

[6] Assuming water within the river body upgradient of the works is naturally within this range.

Environmental Discipline	Monitoring Measures
	• **Birds:** Nesting activity will be monitored by the Contractor's Ecologist. If nesting activity is not observed, ensuring the allowance for a late clutch and/or double clutch, works may proceed during the later months of the breeding bird season. • **Otter:** Monitoring in advance of the commencement of work will be required to establish the relative occupancy of the identified holt structures. The findings will be reported and method statements for the temporary closure of the holts in consultation with NPWS, will be prepared, if required • **Bats:** Acceptance of boxes by bats is less predictable than those for birds. Therefore, it is essential to monitor their use over a period of time. – A total of 8 bat boxes and 12 bat tubes will be installed at a range of specified locations throughout the footprint of the scheme, to account for the loss of bat habitat and tree loss. – Bat boxes/ bat tubes will be inspected, by bat licence holder (Bat Specialist), at least once within 12 months of erection at appropriate season in order to monitor bat use and the species using boxes. This will be followed up with another inspection within 24 months of setting up. At this point, any bat boxes not used will be re-located to a new site. Bat boxes will also be checked in wintertime for general wear and tear and to remove droppings from the previous summer use. – Any bats found will be counted and identified to species level. All data collected will be submitted to Bat Conservation Ireland. Additionally, the bat box scheme will be registered with Bat Conservation Ireland and monitoring will be undertaken annually for 2 years. – Monitoring and inspection of any bridge works, post construction will be undertaken by a Bat Specialist.
Landscape and Visual	• Upon completion of the scheme, monitoring will be carried out to determine the success of the tree protection and landscape planting/seeding measures employed within the first-year post construction, during the defects liability period, to ensure that planting and seeding works establish as designed, and any failures will be replaced.
Noise	• Prior to the commencement of construction works, baseline noise monitoring will be carried out by the Contractor to determine the existing noise environment. During the works, noise monitoring will take place at the nearest sensitive receptors to the works. A minimum of ten number noise monitoring locations are to be set up to monitor construction noise levels at sensitive locations throughout the scheme. Construction noise limits are: 70 LAeq, dB for day-time (07:00-19:00hrs); 60 LAeq, dB for evening (19:00-23:00hrs) and 50 LAeq, dB for night-time (23:00-07:00hrs) • Furthermore, noise monitoring will take place at the two nearest sensitive receptors to each of the works areas. In the event of elevated noise levels being measured during construction, a review of the implemented mitigation measures will take place to ensure no defects have occurred, and they are functioning properly.
Vibration	• The Contractor will be required to monitor ground vibrations at selected locations to the approval of the Employer's Representative during the progress of the works. Each vibrograph will be certified as being in proper working order and will unless otherwise approved, record vibrations in three directions simultaneously with print-out showing the amplitude and frequency of the vibrations. • Vibration measurements will be taken at the base of buildings, on the side facing the source of vibration. Where feasible, the measurements should be taken on a hard surface on the ground outside the building. • A pre-condition survey will also be undertaken of all properties potentially affected by the works (within a 10m radius of works areas). Crack monitoring will be installed on such affected properties and monitored throughout the works. • Regular inspections will be undertaken to ensure that the noise and vibration minimising methods, plant and mitigation identified in the specimen design stage are adopted on site and are working effectively.
Dust Monitoring	• Dust monitoring will be carried out at the site boundary adjacent to the works throughout the construction phase. Dust deposition monitoring will be conducted at the nearest sensitive receptors in the vicinity of the scheme. Monitoring will be carried out using the Bergerhoff method, i.e. analysis of dust collecting jars left on-site (German Standard VDI 2119, 1972). Results will be compared to the TA Luft limit of 350 mg/m^2/day. • In the event of elevated dust levels being measured during construction, a review of the implemented mitigation measures will take place to ensure no defects have occurred, and that they are functioning properly or additional mitigation measures, for example more regular spraying of water, will be implemented.

Environmental Discipline	Monitoring Measures
Soils, Geology and Hydrogeology	• Earthworks will be undertaken in accordance with good construction management practices and will be monitored by a Resident Engineer to ensure that they conform to the methodologies described in the EIAR and the addendum.
Archaeology	• All construction works, i.e. construction of flood defence walls along the riverbanks; construction and replacement of culverts; removal and replacement of bridges; construction of embankments and pumping stations; conveyance improvements (river channel widening and deepening), and localised regrading of ground levels will be subject to archaeological monitoring. • A monitoring method statement will be agreed with the UAU of the NMS for all works carried out during construction to include licenced archaeological monitoring, testing and metal detection and any further mitigation measures required. • The monitoring program will be reviewed in consultation with the NMS and modified depending on the quantity of archaeological material recovered. If quantities of archaeological material recovered are small, scaling back of monitoring at particular locations will be recommended. • All monitoring works will be carried out under the supervision of a professional underwater archaeologist. This includes preparatory or temporary works in advance of full works and includes the clearance of topsoil and subsoil stripping of riverbanks, green field areas, areas for works compounds etc. • Similarly, the excavation for all culverts that will impact subsurface levels beneath the existing culvert, will be subject to archaeological monitoring. • Any archaeological features identified during archaeological testing/monitoring will be fully resolved to professional standards of archaeological practice. Such material will be preserved in situ or preserved by record, as appropriate, as outlined in Policy and Guidelines on Archaeological Excavation – Department of Arts, Heritage, Gaeltacht and the Islands.

10.2.2 Inspections

Routine inspections of construction activities will be carried out by the SHEQ Manager daily to ensure all necessary environmental measures relevant to the construction activities are being effectively implemented by construction staff, ensuring legal and contractual conformity.

More detailed inspections will be undertaken by the SHEQ Manager on a weekly basis.

The weekly inspections will be appropriately documented by the SHEQ Manager and copies of these records and any action required to be undertaken will be made available to the Employer's Representative.

Each month one of the weekly inspections will include a review of environmental documentation and records. The monthly inspection will be recorded on a standard form and reported to the Employer's Representative within five days of the inspection taking place. This standard form will address the following as a minimum:

- Summary of compliance/non-compliance with the CEMP;
- Results and interpretation of the monitoring programme;
- Key issues noted in inspections and/or audits;
- Summary record of non-conformities, incidents and corrective actions, in accordance with Section 11 below;
- Summary of environmental complaints and queries received in relation to environmental matters; and
- Summary record of environmental training undertaken by staff.

10.2.3 Audits

The Resident Engineer's ecologist will carry audits during the construction phase and will advise on compliance with applicable environmental regulatory requirements, the effectiveness of the environmental commitments used, and recommendations for reducing identified environmental risks (if considered appropriate).

Further, regulatory and statutory bodies may undertake site visits to monitor compliance with legislative and regulatory requirements. These site visits may occur randomly throughout the construction period. The Contractor will facilitate these visits and the SHEQ Manager will be available to provide information as required and deal with any issues that may arise during, or as a result of, these visits.

Planned and documented audits aimed at evaluating the conformance of the CEMP will also be carried out by the SHEQ Manager. The schedule and frequency for internal audits will be prepared by the SHEQ Manager and subsequently made available to the Employer's Representative. These environmental audits will be scheduled at least once every three months.

The Contractor will be required to prepare standard forms for reporting and auditing. Items will include but not be limited to the following activities:

- Review of environmental documentation to establish if relevant requirements are being achieved and if continual improvement is occurring;
- Site inspection and interviews with onsite personnel; and
- Reporting with recommendations.

For any environmental nonconformities found, a Corrective Actions Report (refer to Section 11.1) will be prepared and will describe and record the findings of the non-conformance. The verification of previous Corrective Action Reports will be also recorded.

Upon completion of an audit, the Employer's Representative will review all Corrective Action Reports and prepare an Audit Report to summarise:

- Corrective action requests raised;

- Previous corrective action requests closed; and
- Observations made during the audit.

The SHEQ Manager will be entitled to participate in all audits. Notwithstanding this, the Employer's Representative will produce and provide the Contractor with a copy of each audit report within five working days of the audit. Each audit report will detail the findings from the auditor, specify non-conformances identified and outline the proposed corrective actions.

10.2.4 Environmental Monitoring Group

As discussed in 1.1.2 above and as per Condition 2 of the decision to confirm the scheme by the Minister, the Environmental Monitoring Group (EMG) has been established for the scheme.

Condition 2 relates to the establishment of an Environmental Monitoring Group (EMG) to include representatives of the OPW, Cork County Council and Cork City Council. The EMG is responsible for:

- *"Reviewing all updates to the CEMP and granting such changes subject to a formal written agreement*
- *Review all environmental audit results*
- *Ensure all remedial actions are agreed and implemented to address any environmental compliance issues on a timely basis*
- *Ensure all impacts during construction of the scheme are managed as required by this order and do not exceed the envelope of effects predicted in the EIAR and NIS including their addenda."*

Since the decision to confirm the Scheme a number of changes were proposed by the Commissioners to facilitate the construction and maintenance of the Scheme. These design changes were reviewed and the 'test' for any changes proposed is whether the environmental effects of the changes would exceed the envelope of those residual effects described in the Environmental Impact Assessment Report (EIAR) and as described in the Natura Impact Statement (NIS).

11. Incident Response

11.1 Corrective Actions

Corrective actions are measures to be implemented to rectify any non-conformances (i.e. exceedance of criteria or targets) identified during monitoring, inspections and/or audits.

In the first instance, an investigation should be undertaken by the SHEQ Manager to identify the cause of any non-conformances. Appropriate remedial measures will be identified and implemented as soon as practicable to prevent further exceedances. If necessary, the appropriate statutory authority and stakeholders will be notified.

Where new or amended measures are proposed, the CEMP will be updated accordingly by the SHEQ Manager and the Employer's Representative should be informed at the earliest opportunity.

11.1.1 Corrective Action Reports

A Corrective Action Report is prepared on foot of any non-conformances identified during environmental monitoring, inspections and/or audits on site. The Corrective Action Report will describe in detail the cause and effect of a non-conformance on site and describe the recommended corrective action that is required to remedy it.

An appropriate timeline for closing out the corrective actions will be identified by the Contractor as well as arrangements for the SHEQ Manager verifying the Corrective Actions Report and informing appropriate authorities and stakeholders in a timely manner.

11.2 Emergency Response Plan

11.2.1 Overview

Emergencies are those occurrences that give rise to significant negative environmental effects including but not limited to the following:

- Any malfunction of any mitigation measure and/or environmental protection system;
- Any emission that does not comply with the requirements of the contract and relevant licences;
- Any circumstance with the potential for environmental pollution; or
- Any emergency that may give rise to environmental effects (e.g. significant spillages or fire outbreak).

The focus of including all of the stringent measures in this CEMP is on prevention of an incident arising in the first place. However, an Emergency Response Plan will be prepared to ensure that in the unlikely event of an emergency, response efforts are prompt, efficient, and suitable for particular circumstances. This plan will be a live document and will be updated by the Contractor following appointment and prior to commencing works on site.

11.2.2 Implementation

The likelihood of an incident or emergency can be minimised by effective planning through the development of an Emergency Response Plan (ERP). The Plan will be reviewed and updated regularly so that it continues to apply to construction activities. The Plan will identify the on-site risks and appropriate responses.

It will be the responsibility of the Contractor to maintain and change the ERP as required. The ERP will be reviewed on an on-going basis and immediately amended, as necessary, when applicable regulations are revised or when amendments are required by a regulatory authority.

The Emergency Response Plan will contain emergency phone numbers and the method of notifying local authorities, statutory authorities and stakeholders. Contact numbers for key personnel will also be included therein. The Contractor will be required to adhere to and implement these procedures and ensure that all staff and personnel on site are familiar with the emergency arrangements.

Contact details will be obtained for the following:

- Radio/mobile contacts for site management and trained staff,
- Out-of-hours contacts,
- Environmental regulators (hotline or local contact),
- Uisce Éireann (formerly Irish Water) (for spills to foul sewer),
- Cork City Council
- Cork County Council,
- Inland Fisheries Ireland,
- National Parks and Wildlife Service,
- Environmental Protection Agency and
- Spill response and clean-up Contractors.

11.2.3 Environmental Emergency Response Procedures

The best way to manage pollution incidents is to prevent them. Emergency procedures will be developed – either project specific, site specific or activity specific and all personnel on site will be required to know these procedures.

The Emergency Response Plan will be based on the following elements:

- Identification of all possible emergency scenarios
- Effective planning, e.g. availability of booms, spills kits at appropriate locations
- Identification of receptors/pathways (e.g. surface water drains/river)
- Identification and dissemination of contact numbers
- Definition of site-based staff responsibilities
- Appropriate site-based staff training
- Exercise of incident scenarios – spill drills
- Availability of suitable spill kits at appropriate locations on the site
- Implement lessons learnt from previous incidents
- Ensure that all appropriate site staff are aware of the site emergency procedure(s) (e.g. spillage, leakage, fire, explosion and flooding), that drain covers and spill kits are available, and they know how to use them

In terms of pollution spill response procedures, these will vary depending on the sensitive receptor and nature of construction activities. However, the following information will be included as a minimum and displayed at appropriate locations:

- Instruction to stop work and to switch off sources of ignition,
- Contain the spill; location of spill clean-up material,
- Name and contact details of responsible staff (these staff will assess the scale of the incident to determine whether the environmental regulator needs to be called)
- Measures particular to that location or activity (for example, close pond outlet valve)

Emergency equipment will be obtained from a reputable supplier and site staff will be trained in its correct use. Material Safety Data Sheets and best practice assessments will be used for advice on appropriate spill measures. The type of equipment required will depend on the activity taking place.

Emergency access routes will be maintained throughout construction and identified in partnership with the emergency services.

11.2.3.1 Spill Response

Every effort will be made to prevent pollution incidents associated with spills during the construction of the scheme. The risk of oil/fuel spillages will exist on the site and any such incidents will require an emergency response procedure. Given the scale and extent of the scheme the Contractor will have spill kit materials in the cabins and mobile plant and machinery will be accompanied by a spill kit. The minimum materials to be included in the spill kit include:

- Terrestrial oil booms (80mm diameter x 1000 mm; - 10no)
- Water booms and attachment clips (130mm diameter x 3000mm – 10no)
- Plastic sheeting upon which contaminated soil can be placed to prevent leaching into the ground
- Oil soak-up granules (minimum 10 no. 20 litre bags)

In the event of an oil/fuel spill occurring on site the following steps are to be adhered to:

- Identify and stop the source of the spill and alert people working in the vicinity;
- Notify the SHEQ Manager immediately giving information on the location, type and extent of the spill so that they can take appropriate action;

- If applicable, eliminate any sources of ignition in the immediate vicinity of the incident;
- Contain the spill using the spill control materials, track mats or other material as required. Do not spread or flush away the spill;
- If possible, cover or bund off any vulnerable areas where appropriate such as drains, watercourses and/or sensitive habitats;
- If possible, clean up as much as possible using the spill control materials;
- Contain any used spill control material and dispose of used materials appropriately using a fully licensed waste Contractor with the appropriate permits so that further contamination is limited;
- The SHEQ Manager will inspect the site as soon as practicable and ensure the necessary measures are in place to contain and clean up the spill and prevent further spillage from occurring; and
- The SHEQ Manager will notify the Employer's Representative who will notify the Employer and appropriate stakeholders such as National Parks and Wildlife Service, Inland Fisheries Ireland, EPA.

11.2.3.2 Reporting and Recording

Environmental incidents are not limited to just fuel spillages. Therefore, any environmental incident will be reported, recorded and investigated in accordance with the following steps.

- The SHEQ Manager will be immediately notified.
- The SHEQ Manager will inform the Employer's Representative who will notify appropriate regulatory authority, if necessary.
- The details of the incident will be recorded on an Environmental Incident Form will include the following, as a minimum:
- A description of the incident, including location, the type and quantity of contaminant and the likely receptor(s);
  - Contributory causes;
  - Negative effects;
  - Measures implemented to mitigate adverse effects; and
  - Any recommendations to reduce the risk of similar incidents occurring.
- In the very unlikely event of an incident occurring which may impact on a sensitive receptor, the relevant persons/authorities will immediately be informed (such as the Contractor's Archaeologist, Contractor's Ecologist, NPWS, IFI and EPA)
- A record of all environmental incidents will be kept on file by the Contractor and will be made available for inspection to the Employer's Representative and the relevant authorities, if required
- The SHEQ Manager will be responsible for any corrective actions required as a result of the incident e.g. an investigative report, formulation of alternative construction methods or environmental sampling, and will advise the Contractor as appropriate
- By carrying out the above steps, a proper system will be in place to investigate, record and report any potential accidents or incidents

Emergency access routes will be maintained throughout construction and identified in partnership with the emergency services.

11.2.4 Fire Control Measures

Every effort will be made to prevent the outbreak of a fire during the construction phase of the scheme. Fire extinguishers and first aid supplies will be available in the works areas. In the event of such an incident, the

health and safety of all personnel will be a priority. All relevant legislation and guidance on health and safety of people and in particular fire safety will be complied with.

11.2.5 Extreme Weather Events

The effects of extreme weather events and related conditions during construction will be considered. Short to medium range weather forecasting service from Met Eireann or other approved meteorological data and weather forecast provider will be used to inform short to medium term programme management, environmental control and mitigation measures.

All measures deemed necessary and appropriate to manage extreme weather events will be taken, including training of personnel and prevention and monitoring arrangements for staff. As appropriate, method statements will also consider extreme weather events where risks have been identified, e.g. construction works within the Glashaboy River.

11.2.6 Unexpected Discoveries

Appropriate procedures will be put in place, to be employed in the event of encountering unexpected archaeological or cultural heritage assets or subsurface contamination during intrusive ground works.

Appropriate procedures will be developed and the SHEQ Manager will ensure that specialists (e.g. archaeologist) are facilitated to ensure management in accordance with industry best practice and effective compliance with the relevant legislation. All unexpected discoveries will be documented in an appropriate manner and reported to the Employer's Representative who will inform the appropriate authorities.

12. Reporting and Record Management

12.1 Environmental Compliance Report

The Contractor will be required to submit a monthly report to the Employer's Representative for review and approval. The report will address the following as a minimum:

- Summary of compliance with the CEMP including identification of any non-conformances;
- Interpretation of the results of ongoing monitoring;
- Detailed description of any issues and/or non-conformances identified during inspections and/or audits;
- Record of incidents and corrective actions (including Corrective Actions Reports as appropriate);
- Synopsis of environmental complaints received / queries raised by stakeholders; and
- Records of environmental training undertaken (as appropriate).

12.2 Incident Investigation Reports

The Contractor will inform the Employer's Representative of all emergency incidents immediately and prepare an initial report within 24 hours setting out the details of the incident and cause(s) if known.

The Contractor will be required to complete the Environmental Incident Report and any further documentation requested by the Employer's Representative in relation to the incident within 7 days of the incident occurring. The Contractor will respond to all comments made by the Employer's Representative on any incident.

The Environmental Incident Report will contain details of the incident including the location, known and suspected causes and weather conditions. It will define the scale and effects (short, medium, long term, temporary/permanent) as well as required corrective actions and mitigation/ remediation/compensation measures (as appropriate).

12.3 Environmental Records

Records of all environmental documentation will be maintained including monitoring, test results, method statements and plans. All records will be kept up to date and be made available for audits, inspections and periodical reporting. The Contractor will maintain the following environmental records (as a minimum) that will be made available for inspection to the Employer's Representative and the relevant authorities, if required:

- CEMP;
- Records of environmental incident forms;
- Monthly environmental reports;
- Records of environmental training;
- Register of environmental complaints;
- Corrective Action Reports;
- Environmental inspection and audit reports;
- All monitoring data;
- Waste and chemical inventories; and
- Health and Safety records.

Appendix A

Chapter 4 Description of the Proposed Development & Maintenance Activities (EIAR Addendum) and Chapter 3 Description of the Proposed Development (2018 EIAR)

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J.3 Letter from Triturus Environmental Ltd. to NPWS

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N.2 February 2023: Batch No. 23-26489

N.3 March 2023: Batch No. 23-27277

N.4 April 2023: Batch No. 23-27967

N.5 May 2023: Batch No. 23-28969

N.6 June 2023: Batch No. 23-30328

Appendix A

Chapter 4 Description of the Proposed Development & Maintenance Activities (EIAR Addendum) and Chapter 3 Description of the Proposed Development (2018 EIAR)

Cork County Council and Office of Public Works

Glashaboy River (Glanmire/Sallybrook) Drainage Scheme

Environmental Impact Assessment Report

EIAR

Issue | May 2018

Job number 234334-00

Ove Arup & Partners Ireland Ltd

One Albert Quay
Cork
T12 X8N6
Ireland

ARUP

Contents

3 Description of the Proposed Development

3.1 Project Overview

As discussed in **Chapter 1 Introduction**, Cork County Council, on behalf of and as Agents of the Commissioners of Public Works in Ireland (Office of Public Works), intends to develop the proposed Glashaboy River (Glanmire/Sallybrook) Drainage Scheme in accordance with the provisions of the Arterial Drainage Acts of 1945 and 1995, (as amended).

This scheme is being undertaken for the purpose of preventing or substantially reducing the periodical localised flooding of lands and properties in the area of this watercourse.

The proposed Glashaboy River (Glanmire/Sallybrook) Drainage Scheme will include the construction of direct flood defences and conveyance improvement measures along the Glashaboy River and its tributaries. The direct defences proposed include flood walls and embankments with the conveyance improvements consisting of channel widening, localised channel widening and deepening and the introduction of or replacement of culverts.

The overall location of the proposed scheme is presented in **Figure 1.1** Site Location and Drainage Scheme Overview and **Figure 1.2** Site Location Overview. The details of the proposed scheme are presented in the Confirmation Drawings. Refer to **Drawings No. GR101 – GR503** in **Appendix 3.1**.

The Drawings are organised as follows:

- Series 100 (**Drg No.'s GR_101** to **GR_108**) drawings present an overview of the scheme extent, flooding extent and benefitting areas;
- Series 200 (**Drg No.'s GR_201** to **GR_217**) present the proposed flood defences;
- Series 300 (**Drg. No.'s GR_301** to **GR_308**) present proposed sections;
- Series 400 (**Drg. No.'s GR_401** to **GR_403**) present proposed works finishes; and
- Series 500 (**Drg. No.'s GR_501** to **GR_503**) present proposed access routes and works areas.

This chapter describes the main aspects of the proposed development in detail.

3.2 Main elements of the drainage scheme

The main aspects of the drainage scheme comprise construction works entailing the following:

- Replacement of a number of existing culverts with either new culverts or bridges and culvert extensions;

- Replacement of Hazelwood Shopping Centre bridge;
- New flood relief channel and culvert at Hazelwood Avenue;
- Replacement of existing flood defence walls and construction of new flood defence walls;
- Construction of a new earthen flood defence embankment at Sallybrook;
- New surface water pumping stations and one foul pumping station;
- Localised in-channel conveyance improvements at culvert/bridge structures;
- Local channel widening, deepening, realignment and regrading of river channel;
- Provision of civil works such as road/footpath re-grading at a number of locations;
- Protecting drainage outlets along the line of flood defence works with non-return flap valves;
- Retaining walls;
- Flow control structure on a millrace;
- Removal of vegetation and trees to facilitate construction works;
- Reinstatement of boundary walls and fences and landscaping and replanting of trees on completion in agreement with landowners; and
- Once construction is completed, ongoing maintenance of the river channel.

There will be a number of trees and vegetation which will require removal to facilitate the works throughout the drainage scheme area. The trees to be removed are shown in **Figures 1 (Appendix 3.2b) to Figure 5 (Appendix 3.2b)** detailed in **Appendix 3.2** of this EIAR.

It is noted that Cork County Council (CCC), as part of its responsibilities for ongoing river maintenance and flood prevention (which includes removing degrading, unstable and unsafe trees on the river edge) will be undertaking distinct separate works along the Glashaboy river and its tributaries between December 2018 and February 2019. The proposed works will comprise the removal (and/or crowning) of trees by suitably qualified personnel along the Glashaboy River and its tributaries, with the Glashaboy catchment. Some of the trees identified for removal as part of those separate CCC works are also required to be removed to facilitate the Glashaboy River Drainage scheme. Further details on those particular trees are provided in **Appendix 3.2**.

It is also noted that many of the linear defences will require the temporary removal of boundary walls and fences to facilitate construction access (generally parallel with watercourses). These boundary walls/fences will be reinstated on completion in agreement with the landowners.

3.3 Drawing Index

The Confirmation drawings are presented in **Appendix 3.1** of this EIAR.

Refer to **GR_102 Index Sheet** which lists all of the Confirmation drawings.

Refer to **GR_103 Channel Codes** which shows the location of the Glashaboy River and the relevant tributaries where works are proposed and the corresponding Channel codes. The upstream extent of the drainage scheme for each channel is also shown on this drawing. The river and tributaries are listed as follows:

C01 – Glashaboy River;

C02 – Mill Race 1;

C03 – Mill Race 2;

C04 – Butlerstown Stream;

C05 – Glenmore Stream;

C06 – Springmount Stream;

C07 – Cois na Gleann Stream;

C08 - Mill Race 3;

C09 – Bleach Hill Stream; and

C10 – Sallybrook Stream.

Channel centreline, Channel Reference (e.g. C0X) and Chainage (e.g. XXX) is shown on each drawing.

Drg. No.'s GR_104 to **GR_106** detail the existing flood extents (1 in 100 year fluvial / 1 in 200-year tidal) and the lands which will benefit from the proposed scheme (benefitting lands) whilst **GR_107** lists the various flood defence restrictions (interferences) proposed for the drainage scheme. **Drg. No GR_108** provides an overview plan of the drawings.

The drainage scheme is described from north to south where possible. The plan layout is presented in **Series 2 (GR_201** to **GR_217)** and is referred to throughout this chapter whilst the Sections are presented in **Series 3** (**Drg. No.'s GR_301** to **GR_308**).

The proposed flood defence works finishes are presented in **Series 4 (Drg. No.'s GR_401 to 403)** whilst the proposed access routes and works areas are presented in **Series 5 (Drg. No.'s GR_501 to GR_503)**.

Figures 1 (Appendix 3.2b) to Figure 5 (Appendix 3.2b) present the trees to be removed throughout the scheme.

The location of a proposed artificial otter holt is presented in the **Figure 6.3b**. Refer to **Appendix 6.3**.

The location of the surveyed existing otter holt locations were disclosed to the National Parks and Wildlife Service (NPWS) as part of the derogation licence but are not shown in this EIAR for otter safety reasons. Refer to **Chapter 6 Biodiversity**.

As presented on **Figure 1.1**, the scheme is geographically divided into a number of Areas as follows:

Area 1 Sallybrook Industrial Estate

Area 2 Hazelwood

Area 3 Meadowbrook

Area 4-1 Butlerstown Stream

Area 4-2 Glenmore Stream

Area 5 O'Callaghan Park to Glanmire Bridge

Area 6 Downstream of Glanmire Bridge

The proposed flood defences are described Area by Area in the sections below. The left and right banks are described as one looks downstream. Future channel maintenance is also described below. Flood defence levels, structure dimensions etc. are all shown on the relevant drawings.

As noted previously, there will be a number of trees and vegetation which will require removal to facilitate the works throughout the drainage scheme area. Every effort will be made to carry out vegetation clearance works and site preparatory works outside of the bird nesting season (March to September inclusive). However, there may be some limited cases where this is not practical. Therefore, a nesting bird survey will be carried out by a qualified ecologist in advance of the works. The trees to be removed are shown in **Figure 1 (Appendix 3.2b) to Figure 5 (Appendix 3.2b)**, detailed in **Appendix 3.2** of this EIAR.

A number of photomontages have been prepared so as to better fully illustrate the physical and visual nature of aspects of the proposed development. These have been prepared to convey a time period of c. 5-7 years following construction, including planting maturity. The photomontages, which are included in **Appendix 7.1**, are from/of the following locations:

- View 1 – View from Hazelwood Centre commercial complex at Riverstown (**Figure 7.1.1.1** and **7.1.1.2**);
- View 2 – View from Hazelwood Centre near Basketball Court (**Figure 7.1.2.1** and **7.1.2.2**);
- View 3 – View from within Meadowbrook Estate (**Figure 7.1.3.1** and **7.1.3.2**);
- View 4 – View of Riverstown Bridge from L3010 approaching Riverstown Bridge (**Figure 7.1.4.1** and **7.1.4.2**); and
- View 5 – View east along Brooklodge Grove (**Figure 7.1.5.1** and **7.1.5.2**).

3.4 Area 1 - Sallybrook Industrial Estate

Flood defences proposed in Area 1 are described as follows:

3.4.1 Bleach Hill Stream

Refer to **Drg.** No. **GR_201**.

There are existing twin 0.9m diameter culverts located beneath the access road into the Cúil Chluthair residential estate. It is proposed to replace these culverts with a new 2.6m wide by 2.4m high rectangular culvert. Service diversions associated with the culvert reconstruction will be required locally. Refer to Interference No. **C09_B01** on **Drg.** no **GR_201**. Refer also to **Drg No. GR_301** which shows the cross section of the proposed culvert (**C09.1**).

Regrading of the existing ground will be required to facilitate the construction of the proposed new culvert. Ground levels will tie into existing levels on either side of the proposed culvert. Refer to Interference No. **C09_R01** on **Drg. GR_201**.

3.4.2 Glashaboy River

Refer to **Drg. No.**'s **GR_201, GR_202, GR_203** and **GR_204**.

There is an existing embankment along the left bank of the Glashaboy River. The existing embankment will be replaced with a new flood defence embankment. A minimum buffer of approximately 2m will remain between the edge of the river channel and the toe of the embankment to facilitate the installation of a silt fence. The proposed flood defence embankment will tie into high ground upstream and will tie into a proposed flood defence wall at the downstream end. Refer to Interference No. **C01_E01** on **Drg. No.**'s **GR_201** and **GR_202**. Refer also to **Drg. No. GR_301** which shows the cross section of the proposed embankment (**C01.1**). Some trees will require removal to facilitate construction. These are shown in **Figure 1 (Appendix 3.2b)** in **Appendix 3.2**.

Further downstream, a proposed flood defence wall (**C01_L01)** will tie into the proposed flood defence embankment (**C01_E01**) at its upstream end. The northern section of the flood defence wall will be a steel sheet pile whilst the southern section of the flood defence wall will be a reinforced concrete wall. Refer to Interference No. **C01_L01** on **Drg. No.**'s. **GR_202** to **GR_204**. All drainage outfalls will be fitted with non-return valves. Refer also to **Drg. No. GR_302** which shows the cross section of the proposed wall (**C01.2**).

It is proposed that there will be a local surface water pumping station, collector drain, manhole and rising main to be installed for operation during a flood event at Chainage **C01_5300.** All outlets will be fitted with non-return valves. Refer to Interference No. **C01_P01** on **Drg. No. GR_203.**

Further downstream, near Grandons car sales, there will be a proposed flow control structure constructed, to restrict peak flows in the Mill Race. The structure will be fitted with a penstock to facilitate maintenance of the mill race. A base flow will be maintained in the millrace at all times.

Refer to Interference No. **C08_SL01** on **Drg. No. GR_203**. Refer also to **Drg No. GR_302** which shows the cross section of the proposed structure (**C08.1**). A local surface water pumping station is proposed with a collector drain, manhole and rising main to be installed for operation during a flood event at Chainage **C08_850**, on the right bank of the Mill race at Grandons car sales. All outlets will be fitted with non-return valves. Refer to Interference No. **C08_P01** on **Drg. No. GR_204**.

3.4.3 Sallybrook Stream

Refer to **Drg. No.**'s **GR_202** and **GR_203.**

The Sallybrook stream (Channel C10) is located in the Sallybrook Industrial Estate. It consists of an open channel at the downstream end where it meets the Glashaboy River. The open channel section is referred to as **C10_B01** in the drawings. The stream is culverted further upstream for a distance of approximately 100m. The culverted section is referred to as **C10_C02**. There is then a short reach of open channel referred to as **C10_C03** in the drawings, which connects into a culverted reach (**C10_C04).** This culvert ties into another culvert near the R639 at the upstream end of **C10_C04**. A row of mature trees line the existing open channel as well as the culverted section.

During flood events, water from the Glashaboy River backs up the Sallybrook Stream and overflows the channel.

It is proposed that the existing stretch of open channel along the Sallybrook stream is culverted and will outfall into the Glashaboy River at Chainage **C01_5311**. All drainage outfalls will be fitted with non-return valves. The upstream flow will be diverted through the new culvert **C10.1_B01** to minimise flooding in the area.

The purpose of the new alignment is to minimise tree removal along the existing channel alignment. The stream will be culverted from chainage zero at the outfall into the Glashaboy River at chainage **C01_5299** which will be a free flowing outlet. The culvert will extend as far back as works chainage **C01_165** where it will tie into the culvert which crosses under the R639 regional road. All drainage outfalls within the culvert will be fitted with a non-return valve.

Refer to Interference No. **C10_C02** through to **C10_C04** on **Drg. No. GR_202 & G203**. Refer also to **Drg No. GR_301** which shows the cross section of the proposed culvert (**C10.1**). Some trees will require removal to facilitate construction. These are shown on **Figure 1** in **Appendix 3.2**.

A boundary fence will be provided around the proposed culvert. The proposed fence is shown as **C01_F01** on the drawings. The fence will be 1.2m above ground level and will tie in with the flood defence wall at the western end. Refer also to **Drg No. GR_301** which shows the cross section of the proposed fence (**C10.1**).

3.5 Area 2 – Hazelwood

Flood defences proposed in Area 2 are described as follows:

Refer also to the photomontages, which are included in **Appendix 7.1** from/of the following locations:

- View 1 – View from Hazelwood Centre commercial complex at Riverstown (**Figure 7.1.1.1** and **7.1.1.2**);
- View 2 – View from Hazelwood Centre near Basketball Court (**Figure 7.1.2.1** and **7.1.2.2**);

3.5.1 Cois na Gleann Stream

Refer to **Drg.** No. **GR_206.**

The Cois na Gleann Stream is currently culverted beneath the R615 and R639 regional roads with a narrow open section in between the culverted sections of the river. There is a trash screen just upstream of the culvert on the R615. Refer to **Drg. No. GR_206**.

It is proposed that the two culverts are replaced with a single culvert (**C07_B01**). The new culvert will be a 2.75m wide by 0.9m high rectangular culvert. The existing trash screen upstream will be removed from the culvert. Service diversions associated with the culvert construction will be required locally. Refer also to **Drg No. GR_302** which shows the cross section of the proposed culvert (**C07.1**).

Road regrading and a new boundary wall (**C07_L01**) will be constructed adjacent to the R639 regional road. It is proposed to regrade the R639 road (**C07_R01**) to facilitate the construction of the replacement Cois Na Gleann Stream culvert under the R639 road.

3.5.2 Glashaboy River – Hazelwood Avenue

Refer to **Drg. No. GR_207.**

It is proposed that a reinforced concrete flood defence wall (**C01_L02**) will be constructed adjacent to the R639 and will curve around onto Hazelwood Avenue and across Hazelwood Avenue Bridge. The proposed flood defence wall will mostly be constructed in the field (known locally as the Circus Field) parallel to the east side of the R639. It will cross over the Glashaboy River on the north side of Hazelwood Avenue bridge. The flood defence wall will have a sandstone finish on both sides of the wall. All drainage outfalls will be fitted with non-return valves. Some trees will require removal to facilitate construction. These are shown on **Figure 3 (Appendix 3.2b)** in **Appendix 3.2**.

It is proposed that a flood relief channel approximately 6.2m wide will be constructed with engineered grassed slopes parallel to the Glashaboy River on the north side (**C01_R01**) of Hazelwood Avenue bridge and on the south side (**C01_R02**) of the bridge.

The flood relief channel will facilitate the movement of water through the area during high flows. The channel will cross underneath Hazelwood Avenue via a proposed 6.2m wide by 1.75m high rectangular flood relief culvert (**C01_B02**). Some trees will require removal to facilitate construction. These are shown on **Figure 3 (Appendix 3.2b)** in **Appendix 3.2**.

Fencing and an access gate will be provided around the open channel for safety/security both on the north side (**C01_F02**).

Refer also to **Drg No. GR_303** which shows the cross sections at Hazelwood Avenue bridge (**C01.3**, **C01.4** and **C01.5**). Refer also to photomontages, **Figure 7.1.1.1** and **7.1.1.2** in **Appendix 7.1**.

Service diversions associated with the construction works in this area will be required. In particular, the existing gas main (180PE-80 4 bar / 4 In ST 4 bar) which is attached to the upstream face of the existing Hazelwood bridge is required to be diverted to facilitate construction of a flood defence bridge parapet wall and reinforced concrete flood relief culvert. Due to cover constraints within the existing bridge, the gas main is proposed at present to be diverted underneath the Glashaboy River channel approximately 3-5m upstream of the existing bridge.

The diversion will be undertaken in line with Gas Network Ireland's standard ditch and stream crossing details and requirements. See **Figure 3.1** for more details on the location of the existing gas main.

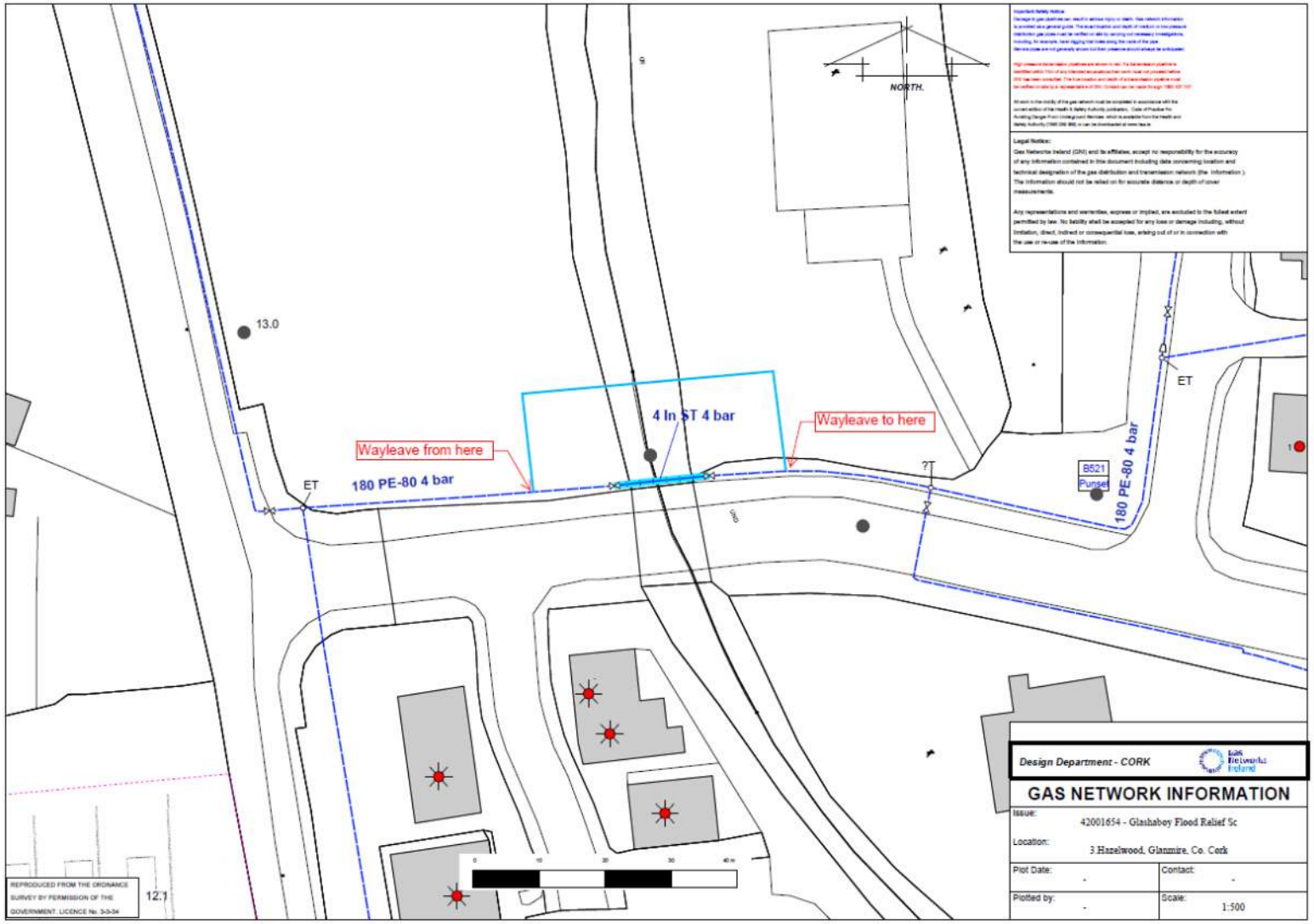

Figure 3.1: Gas network information at Hazelwood Glanmire. Drawing to be confirmed with Gas Networks Ireland prior to works. Source: Design Department Cork, Gas Networks Ireland (GNI).

It is proposed that a new reinforced concrete flood defence wall (**C01_L03a**) is constructed across the south side of Hazelwood Avenue bridge. This wall will have a sandstone finish on both sides of the wall. A new reinforced concrete flood defence wall (**C01_L03**) will extend along the right bank (looking downstream) of the Glashaboy River from Hazelwood Avenue as far as Hazelwood Shopping Centre Bridge. This wall will have a concrete textured finish on both sides. There will be a bridge parapet on the downstream end where it ties into the new Hazelwood shopping centre bridge. Closer to the replacement Hazelwood shopping centre bridge, there will be a sandstone finished wall which will extend above the flood defence wall (typically 0.5m) to provide a barrier along the side of the road ramp to access the bridge crossing. All drainage outfalls will be fitted with non-return valves. Refer also to **Drg. No. GR_304** which shows the cross section of the flood wall (**C01.8**).

Some trees will require removal to facilitate construction. These are shown on **Figure 3 (Appendix 3.2b)** in **Appendix 3.2**.

A new reinforced concrete retaining wall (**C01_L10**) will be located at Hazelwood Shopping Centre Bridge. **C01_L10** will typically be 0.5m to 2m high above existing road levels.

3.5.3 Glashaboy River – Hazelwood Shopping Centre Bridge

Refer to **Drg. No. GR_207.**

It is proposed to replace the existing Hazelwood shopping centre bridge with a new reinforced concrete bridge (**C01_B03**). The existing bridge connects the commercial centre (including Supervalu) on the east of the river (left bank) to the commercial centre on the west of the river (right bank). Both the commercial centre on the east and that on the west can be accessed separately via Hazelwood Avenue to the north. The proposed new bridge will be 13.5m clear span. The existing surrounding ground will be regraded (**C01_R03**) to facilitate the construction of the proposed new bridge. The ground levels will tie into existing levels on either side of the proposed bridge. Service diversions associated with road regrading will be required. Some trees will require removal to facilitate construction. These are shown on **Figure 3 (Appendix 3.2b)** in **Appendix 3.2**.

Refer also to **Drg. No. GR_304** which shows the cross sections at Hazelwood shopping centre bridge (**C01.6**, **C01.7** and **C01.8**). Refer also to the photomontages**, Figure 7.1.1.1** and **7.1.1.2** in **Appendix 7.1**.

It is proposed that a new reinforced concrete flood defence wall (**C01_L04**) is constructed along the right bank of the Glashaboy River just downstream of Hazelwood shopping centre bridge. The flood defence wall will tie into the proposed Hazelwood shopping centre bridge at the upstream end and into another new wall (**C01_L06**) at the downstream end.

It is proposed that a short section of new reinforced concrete flood defence wall (**C01_L10a**) will be constructed along the left bank of the Glashaboy River just downstream of Hazelwood shopping centre bridge.

All drainage outfalls will be fitted with non-return valves. The flood defence wall will have a concrete fair finish on both sides. Some trees will require removal to facilitate construction. These are shown on **Figure 3 (Appendix 3.2b)** in **Appendix 3.2**.

There will be a proposed local surface water pumping station (**C01_P02**), collector drain, manhole and rising main installed for operation during a flood event at **C01_3804**. All outlets will be fitted with non-return valves. Refer also to **Drg. No. GR_208**.

3.5.4 Springmount Stream

Refer to **Drg.** No. **GR_208.**

The Springmount Stream flows east into the Glashaboy River just south of Hazelwood commercial centre and north of Meadowbrook Estate.

The Springmount Stream is currently culverted (twin culverts) beneath the R639. It is proposed to replace the existing twin 0.4m diameter culverts with a new 32m long, 1.75m wide by 0.9m high, rectangular culvert (**C06_B01**). Refer also to **Drg. No. GR_305** which shows the cross sections along the R639 at this location (**C06.1**).

Localised road regrading (**C06_R01**) will take place to facilitate the construction of the replacement Springmount Stream culvert across the R639 road.

The existing boundary wall will be replaced with a reinforced concrete retaining wall (**C06_L04**) to retain raised road levels. The proposed retaining wall will incorporate vehicular access gates.

A proposed reinforced concrete retaining wall (**C06_L02**) will also be constructed parallel to the R639 in the same area. The wall will have a sandstone cladding finish on both wall faces.

A proposed reinforced concrete flood defence wall (**C06_L03**) will be constructed on the left bank of the Springmount stream and will tie into **C01_L04** at the confluence of the Springmount stream and Glashaboy River. The flood defence wall (**C06_L03)** will tie into high ground to the west. All drainage outfalls to be fitted with non-return valves.

It is proposed to construct a reinforced concrete flood defence wall (**C06_L01**)) on the right bank of the Springmount stream before its confluence with the Glashaboy River. All drainage outfalls are to be fitted with non-return valves. The flood defence wall will have a concrete textured finish on the dry side. At the confluence of the Springmount Steam and the Glashaboy River, it will be necessary to remove any in-channel flow obstruction and level the channel bed.

Some trees will require removal to facilitate construction. These are shown on **Figure 3 (Appendix 3.2b)** in **Appendix 3.2**.

3.6 Area 3 – Meadowbrook

Flood defences proposed in Area 3 are described as follows:

Refer to Drawing No. **GR_208**.

Refer also to the photomontages, which are included in **Appendix 7.1** from/of the following locations:

- View 3 – View east of Meadowbrook Estate adjacent to the right bank of Glashaboy River (**Figure 7.1.3.1** and **7.1.3.2**); and
- View 4 – View east approaching Riverstown Bridge (**Figure 7.1.4.1** and **7.1.4.2**).

3.6.1 Meadowbrook Estate

It is proposed to construct a reinforced concrete flood defence wall (**C01_L05**) on the right bank of the Glashaboy River along the entire length of the Meadowbrook Estate. There is an existing wall along the same stretch of river.

At either end of the proposed wall, the existing wall will be replaced with the new flood defence wall on the same alignment. Along the middle reach of the proposed new wall, the wall will be constructed inside the existing wall, along the Meadowbrook estate side ("dry side") in order to minimise tree removal in the area. All drainage outfalls will be fitted with non-return valves. The proposed flood defence wall will have a textured concrete finish on both sides, with planting on the dry side. The levels are shown on **Drg. No. GR_208**.

Refer also to **Drg. No. GR_305** which shows the cross sections at Meadowbrook Estate (**C01.9** and **C01.10**). Refer also to the photomontage **Figure 7.1.3.1** and **7.1.3.2** in **Appendix 7.1**.

It is also proposed to construct a steel sheet pile flood defence wall (**C01_L06**) on the left bank of the Glashaboy River opposite Meadowbrook Estate, close to Riverstown Bridge. The proposed wall will be approximately 83m in length. All drainage outfalls will be fitted with non-return valves. A security fence will be constructed on the dry side of the flood defence wall. In general, the proposed flood defence wall will have planting on the dry side. Some trees will require removal to facilitate construction. These are shown on **Figure 3 (Appendix 3.2b)** in **Appendix 3.2**.

It is proposed to construct a local surface water pumping station (**C01_P03**), collector drain, manhole and rising main to be used for operation during a flood event at **C01_3444** just at the entrance of the Meadowbrook Estate near Riverstown Bridge. All outlets will be fitted with non-return valves.

In the same general area, a proposed foul water pumping station (**C01_P04**), with overflow, manhole and rising main will also be installed for operation when required to pump foul wastewater trapped in Meadowbrook Estate into the foul sewer network downstream of the estate in John O'Callaghan Park. Some trees will require removal to facilitate construction. These are shown in **Figure 3 (Appendix 3.2b)** in **Appendix 3.2**.

3.6.2 Riverstown Bridge

Refer to **Drg No. GR_208**.

Refer also to the photomontage **Figure 7.1.4.1** and **7.1.4.2** in **Appendix 7.1**.

Refer also to **Drg No. GR_306** which shows the cross sections of Riverstown Bridge (**C01.11**) and at Meadowbrook Estate in the same area (**C01.12**).

It is proposed that the existing Riverstown Bridge parapet wall will be modified (including localised minor stonework repairs) to provide guarding height protection to pedestrians (**C01_F04**). Localised regrading of the road and footpath will take place in the same area (**C01_R04**). Re-cambering of the road will also take place to divert surface water runoff, during a flood event, southwards into the Glashaboy River via O'Callaghan Park, downstream of Riverstown Bridge (**C01_R04**). A hand rail will be constructed adjacent to the parapet wall. Refer to the cross sections of Riverstown Bridge (**C01.11**) and at Meadowbrook Estate in the same area (**C01.12**).

At Riverstown Bridge on the left bank of the Glashaboy River, the existing bridge arch will be cleared by removing built up silt and vegetation (**C01_C01**). Similarly, on the right bank of the river, the existing Riverstown bridge arch will be cleared by removing built up silt and vegetation. The existing manhole in the bridge arch is to be removed and services diverted (**C01_C02**). Some trees will require removal to facilitate construction. These are shown on **Figure 3 (Appendix 3.2b)** in **Appendix 3.2**.

3.7 Area 4-1 - Butlerstown Stream

Flood defences proposed in Area 4-1 are described as follows:

Refer to **Drg. No. GR_209**.

South of Sarsfield GAA Club, in the Lidl parking area, it is proposed to modify the existing boundary wall to allow overland flow to discharge into the Butlerstown Stream (**C04_F01**). It is also proposed to regrade the road and footpath (**C04_R02**) at this location. It is also proposed to regrade the road and footpath (**C04_R01**) along Brooklodge Grove.

3.8 Area 4-2 - Glenmore Stream

Flood defences proposed in Area 4-2 are described as follows:

Refer to **Drg No.'s GR_210, GR_211**, **GR_216** and **GR_217**.

It is proposed to carry out minimal landscaping and regrading of ground levels, to facilitate overland flow from the Butlerstown stream back into the Glenmore Stream (**C05_R04**). Refer to **Drg No. GR_210.**

Refer to **Drg. No. GR_211.** Refer also to the photomontage, which is included in **Appendix 7.1** from/of the following location:

View 5 – View east along Brooklodge Grove (**Figure 7.1.5.1** and **7.1.5.2** in **Appendix 7.1**).

Refer also to **Drg. No. GR_307** which shows the cross section (**C05.1**), (**C05.2**) and (**C05.3**).

There is an existing wall on the left bank of the Glenmore Stream along Brooklodge Grove. All drainage outfalls along the wall will be fitted with non-return valves (**C05_L01**).

It is proposed to replace the three existing culverts, (2.32m span arch culvert, 2.95m wide by 0.68m high culvert and 2.95m wide by 0.67m high culvert) with two rectangular culverts each 5m wide by 1.95m high (**C05_B01**) along Brooklodge Grove.

It is proposed to deepen (**C05_C01**) the Glenmore stream channel (upstream of **C05_B01**) by 0.30m at the inlet to facilitate the installation of the proposed replacement culvert at Brooklodge Grove. It is also proposed to regrade Brooklodge Grove road to facilitate the construction of the proposed replacement culvert (**C05_R01**) including minimum regrading and landscaping to adjoining gardens and driveways.

It is proposed to construct a local surface water pumping station (**C05_P01**), collector drain, manhole and rising main to be used for operation during a flood event.

Further downstream along the Glenmore stream, at the Copper Valley Vue entrance, the existing bridge will be replaced with a new reinforced concrete clear span bridge (**C05_B02**). The entrance to Copper Valley Vue will be regraded (**C05_R02)**.

The Glenmore stream channel will be widened by and deepened (**C05_C02**) from the proposed bridge under the entrance to Copper Valley Vue (**C05_B02**) to the proposed culvert under Brooklodge Grove (**C05_B01**). Refer to **Drg. No. GR_211**.

The Glenmore stream channel will be widened and deepened (**C05_C03**) downstream of the proposed bridge at Copper Valley Vue (**C05_B02**).

Some trees will require removal to facilitate construction in the Brooklodge area. These are shown on **Figure 4 (Appendix 3.2b)** in **Appendix 3.2**.

Refer to **Drg. No GR_216**.

The Glenmore Stream flows westwards along Brooklodge Grove, through a culvert beneath the slip road to the M8 (referred to as the New Line) and beneath the M8 underbridge. Between the M8 underbridge and the New Line, it is proposed to strengthen the existing wall on the left bank of the Glenmore stream (**C05_L02**). All drainage outfalls will be fitted with non-return valves. Sandstone cladding will be provided to the dry side of the strengthened wall, with a concrete fair faced finish provided to the wet side.

West of the New Line, it is proposed to construct a new reinforced concrete flood defence wall on the left bank of the Glenmore stream (**C05_L03**).

These works will require the removal of some vegetation and trees to facilitate the wall construction. Refer to **Figure 4 (Appendix 3.2b)** in **Appendix 3.2**. All drainage outfalls to be fitted with non-return valves. Sandstone cladding will be provided to the dry side of the new flood defence wall, with a concrete fair faced finish provided to the wet side.

It is proposed to replace the existing culvert beneath the New Line with a new reinforced concrete clear span bridge (**C05_B03**). In addition, it is proposed that the New Line, Brooklodge Grove and the junction between the two roads will be regraded (**C05_R05**).

Refer to **Drg. No. GR_217.**

Future channel maintenance activities (**C05_G01**) are proposed as and when are necessary on this section of the Glenmore Stream which extends to Brooklodge East, chainage **C05_1865**.

3.9 Area 5 - O'Callaghan Park to Glanmire Bridge

Flood defences proposed in Area 5 are described as follows:

Refer to **Drg. No**. **GR_214**.

The Grove is located along the R639. The Glashaboy River is located to the east of the Grove. There are residential properties located on the west side of the R639.

Along the east side of the R639 in this area, it is proposed to construct a reinforced concrete flood defence wall (**C01_L08**). All drainage outfalls will be fitted with non-return valves. An uninhabited dwelling in considerable disrepair will require removal to facilitate construction. Some trees will require removal to facilitate construction. These are shown on **Figure 5 (Appendix 3.2b)** in **Appendix 3.2**. Refer also to **Drg. No. GR_308** which shows the cross section in The Grove area (**C01.13**).

It is proposed that a local surface water pumping station (**C01_P05**), collector drain, manhole and rising main are to be installed for operation during a flood event. All outlets will be fitted with non-return valves.

3.10 Area 6 - Downstream of Glanmire Bridge

No construction works are proposed in this area. Only channel maintenance is proposed at this location. Refer to **Drg. No. GR_215**.

3.11 Future Channel Maintenance

Under Section 37 of the Arterial Drainage Act 1945, the Office of Public Works (OPW) is statutorily obliged to maintain all rivers, embankments and urban flood defences on which it has executed works since the 1945 Act, in "*proper repair and effective\ condition*".

Channel and embankment maintenance operations can encompass a variety of activities, including silt and vegetation management, aquatic vegetation cutting, bank protection, bush cutting/branch trimming, tree cutting, mulching, mowing and structure maintenance (Ryan Hanley, 2014). Channel maintenance operations are defined as follows by the OPW (2011):

> "*channel maintenance normally involves removing the build-up of foreign or natural material that impedes the free flow of water. Predominately this consists of the removal of water-entrained silt and associated vegetation from the bed of the channel by suitably rigged hydraulic excavators. In most cases, no alterations to the bank are required and in some cases the channel is not disturbed at all if no build-up of material is present."*

This is a responsibility of the Office of Public Works (OPW). All OPW maintenance work is undertaken in accordance with Environmental Management Protocols and Standard Operating Procedures (OPW, 2011) along with additional measures where the Standard Operating Procedures (SOPs) show deficiencies, to ensure adverse impacts on the environment are considered and minimised. OPW drainage maintenance activities will also be subject to a separate Ecological and Appropriate Assessment process to ensure no adverse impacts arise.

The proposed pumping stations will require regular maintenance and it will be necessary to jet the surface water sewers to maintain the hydraulic capacity to drain flood waters.

Other measures will include regular inspections of flood walls and embankments, regular scheduled maintenance of the river channel and pruning of trees (including removal of tress where necessary), planning and control measures. The inspection regime will ensure that there is no deterioration in the structural integrity of the defences which may occur as a result of a vehicular collision for example. It is expected that the flood defences will otherwise be relatively maintenance free. In general, maintenance will typically consist of the following activities:

- The channels will be monitored by means of a walkover survey from the banks on a regular basis (likely quarterly, and also following a flood event). The walkover surveys would aim to identify issues with implications for flood risk (e.g. fallen trees, excessive vegetation build-up, overgrown trees, illegal dumping, accumulation of granular deposits, etc.). In-channel debris will typically be removed by a long reach excavator working from the banks. Excessive overhanging vegetation will typically be pruned back or removed by hand using a cherry picker, depending on access.
- The structures will be monitored by means of a walkover survey from the banks on a bi-annual basis. The walkover surveys would aim to identify issues with implications for flood risk (e.g. damage to structures, settlement of embankments, etc.).
- Culverts will be inspected following a significant flood event. Any debris present in the culvert will be cleared by hand. A full CCTV survey and clearing of silt/sediment from the culvert is expected to take place approximately every five years. Removal of debris will be carried out as required.

Future channel maintenance will apply to the Glashaboy River (Glanmire/Sallybrook) Drainage Scheme. The location of channel maintenance is shown as general interferences on the drawings from **GR_201** to **GR_217**.

A channel maintenance programme will be required throughout the reach of the watercourses impacted by the proposed works. The channel maintenance programme will pay particular attention to locations where silt, gravel and debris are likely to accumulate, such as at structures, sharp bends, culvert inlets, blockages from trees etc.

At this stage, the exact nature and scale of channel and embankment maintenance work likely to be required for the Glashaboy River Drainage Scheme is unknown, however Inland Fisheries Ireland (IFI) has indicated that dredging is to be avoided in the Glashaboy River. The purpose of any channel maintenance is to ensure that the scheme elements are kept in "proper repair and effective condition". Channel maintenance to that end will include the removal of silt/gravel build-ups and vegetation to maintain the as-designed channel cross section but this will not require removal of material below the existing bed. This removal of silts to maintain the designed cross section is not considered dredging. The following measures will also be incorporated into the channel maintenance method statement as requested by the IFI:

a) This work is carried out as much as possible from the river bank without in stream tracking,

b) Any unavoidable in stream work is carried out between May and September,

c) Tree removal is limited to fallen trees or overhanging branches

d) Tree roots are not pulled from the river bank.

Consultation will be required with the relevant stakeholders as necessary during the planning of these maintenance works including landowners, IFI, the National Monuments Service (NMS), Cork County Council (CCC) and National Parks and Wildlife Service (NPWS) to ensure that the works are carried out with minimal environmental impact.

3.12 Resilience of the proposed drainage scheme to climate change

In the design of any flood relief scheme, it is important that flood mitigation measures are considered in the context of a long term strategy which is flexible and adaptive to changes in climate and its potential impact on flood risk. The proposed scheme has been designed to ensure it is readily adaptable to climate change.

The proposed scheme includes proposed works on the Glashaboy River and its tributaries in Glanmire/Sallybrook which includes the Butlerstown Stream, Glenmore Stream, Springmount Stream, Cois na Gleann Stream, Bleach Hill Stream, Sallybrook Stream and mill races. The proposed scheme is designed to provide protection to properties in the study area from the 1 in 100 year fluvial/1 in 200-year tidal flood events.

An allowance for freeboard has also been incorporated into the design. This standard is in line with the OPW national standard for constructing flood defence schemes in Ireland.

The scheme incorporates conveyance improvements and the construction of direct defences along the Glashaboy River and its tributaries. As described previously, proposed works include flood defence walls, culvert and bridge replacement, drainage improvements (including construction of foul and surface water pumping stations), and localised channel regrading and widening through the Sallybrook and Glanmire areas. To allow for future climate change adaptability, hard flood defences have been designed to facilitate future increases in height without imposing a significant impact on environmental and landscape features. These measures will facilitate an increase in capacity of river channels and allow for greater conveyance through the Glashaboy River and its tributaries.

The geomorphic processes and response to any flood relief scheme are important to understand due to the direct impact that they can have on altering flood capacity and changing flood risk levels. A geomorphic audit was carried out for the proposed scheme and is presented in **Appendix 6.2** of the EIAR. The results of the audit have been taken into account in the design of the proposed drainage scheme.

Cork City Council, Cork County Council and Office of Public Works

Glashaboy River (Glanmire/Sallybrook) Drainage Scheme

EIAR Addendum - Request for Further Information

EIAR RFI

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Contents

4 Description of the Proposed Development and Maintenance Activities

4.1 Guidance for the Reader

This chapter of the EIAR addendum taken together with **Chapter 5 (Construction Activities and Implementation of Maintenance Activities)** of this addendum provide the further details requested in RFI No. 3.

In particular, RFI No. 3 requires *"Further details of proposed widening, deepening, realignment and regrading of river channels and of future maintenance works. These details should include the outermost, or 'worst-case', extents of these elements of the proposal.*

Therefore, whilst Chapter 3 of the original EIAR comprehensively addresses all facets of the proposed Scheme, this addendum focuses on providing supplementary detail on the in-channel works, whether during construction or long term maintenance.

Notwithstanding this, the opportunity has been taken to update the description of the proposed development. This to reflect some minor changes to the design that have taken place since submission of the EIAR in September 2018, during the detailed design process and following further consultation with various stakeholders and landowners, taking account of further project constraints, receipt of additional survey information to aid detailed design (including site investigation data etc.), advanced design works and other factors.

The EIAR that was submitted to DPER in September 2018 is referred to as the "2018 EIAR" in this addendum. Where practicable, any reference in this EIAR addendum to a chapter in the 2018 EIAR is in *italics* to distinguish it from a chapter of the EIAR addendum, which is in normal text format and "**bold**". For example, *Chapter 12* of the 2018 EIAR, which addresses Hydrology, is indicated in this EIAR addendum as **Chapter 12 Hydrology**, while Chapter 4 of the 2018 EIAR is indicated as *Chapter 4 Construction Activities*.

The CAAS EIAR Review (page 33) states "*All information shall be presented in format which ensures that the whole EIAR, including the further information, is clear and accessible*".

Accordingly, this **Chapter 4** is to be read as an addendum to and in conjunction with the equivalent *Chapter 3* of the original EIAR, entitled '*Description of the Proposed Development'*

Section 3 of the original EIAR was broken down into 12 subsections from *3.1* to *3.12*.

Sections 3.1 to *3.3* of the original EIAR provided a general overview, a summary of the main elements of the drainage scheme and a drawing index. These sections remain unamended.

Sections 3.4 to *3.10* of the original EIAR addressed in more detail the proposed development in seven discrete geographical subsets of the proposed Scheme Area as follows:

- Area 1 - Sallybrook Industrial Estate,
- Area 2 - Hazelwood,
- Area 3 - Meadowbrook,
- Area 4-1- Butlerstown Stream,
- Area 4-2 - Glenmore Stream, and
- Area 5 - O'Callaghan Park to Glanmire Bridge and
- Area 6 - Downstream of Glanmire Bridge

The following subsections of this addendum address on an individual basis, each of these geographical areas with respect to the following:

- Additional information on any minor changes to the proposed scheme arising out of detailed design since production of the original EIAR,
- 'Further details' of the in-channel works proposed during construction which is intended to augment the description already provided in the original EIAR.

Section 3.11 of the original EIAR addressed the Future Maintenance of the scheme. This section is replaced in its entirety by **Chapter 4.11** of this Addendum and is outlined in further detail in **Chapter 5**.

Section 3.12 of the original EIAR addressed resilience to climate change. This section remains unamended.

The information provided hereunder is supplementary to the information provided in *Chapter 3* of the original 2018 EIAR *Description of the Proposed Development* and should be read in conjunction with one another. References are also made to the confirmation drawings (*Appendix 3.1* of the original EIAR) to provide additional clarity where required.

4.2 Overview of the Main Elements of the Drainage Scheme and construction works required

The main aspects of the drainage scheme comprise construction works entailing the following:

- Replacement of a number of existing culverts with either new culverts or bridges;
- New flood relief channel and culvert at Hazelwood Avenue;
- Replacement of Hazelwood Shopping Centre bridge with a new bridge;
- Construction of new flood defence walls;
- Construction of a new earthen flood defence embankment at Sallybrook;

- New 4 no. surface water pumping stations and 1 no. foul pumping station;
- Localised in-channel conveyance improvements at culvert/bridge structures;
- Local channel widening, deepening, realignment and re-grading of river channel;
- Provision of civil works such as road/footpath re-grading at a number of locations;
- Protecting drainage outlets along the line of flood defence works with non-return flap valves;
- Retaining walls;
- Flow control structure on a millrace;
- Removal of vegetation and trees to facilitate construction works;
- Reinstatement of boundary walls and fences;
- Landscaping and replanting of trees on completion in agreement with landowners; and
- Once construction is completed, ongoing maintenance of the drainage scheme.

An outline of the methodology to construct the major elements of the works is described below.

As presented on *Figure 1.1* of *Chapter 1* the 2018 EIAR, the scheme is geographically divided into a number of Areas as follows:

Area 1 Sallybrook Industrial Estate

Area 2 Hazelwood

Area 3 Meadowbrook

Area 4-1 Butlerstown Stream

Area 4-2 Glenmore Stream

Area 5 O'Callaghan Park to Glanmire Bridge

Area 6 Downstream of Glanmire Bridge

The construction aspects of drainage scheme are described from north to south and area by area where possible. The plan layout for the drainage scheme is presented in **Series 2 (GR_201** to **GR_217)** (*Appendix 3.1* of 2018 EIAR) whilst the Sections are presented in **Series 3** (**Drg. No.'s GR_301** to **GR_308**) (*Appendix 3.1* of 2018 EIAR). The proposed flood defence works finishes are presented in **Series 4 (Drg. No.'s GR_401 to 403)** (*Appendix 3.1* of 2018 EIAR). The proposed access routes and works areas are presented in **Series 5 (Drawing No.'s GR_501 to GR_503)** (*Appendix 3.1* of 2018 EIAR).

4.3 Summary of Proposed Works

A summary of the proposed activities is included in Table 4.1 below with further detail on the proposed works and envisaged construction methodology outlined in **Chapter 5**. This table should be read in conjunction with *Chapter 3* of the 2018 EIAR.

Table 4.1: Summary of Proposed Works.

Area	Location	Proposed Works	Confirmation Drg. Reference (Plan and Sections)
Area 1 - Sallybrook Industrial Estate	Bleach Hill Stream Culvert	Replacement of existing twin 0.9m dia. undersized culverts with a larger single precast concrete box rectangular culvert of 2.6m wide by 2.4m high (**C09_B01)**. Proposed rough cut stone slabs are to be placed on the culvert bed as substrate which is outlined in further detail in section 4.4.1 below. Works will include site clearance and vegetation removal, utility and drainage diversions, road regrading **(C09_R01)** and reinstatement and landscaping works.	GR_201, GR_301
	Sallybrook Flood Defence Embankment	Construction of a new flood defence embankment **(C01_E01)** approximately 342m long which will tie into higher ground to the north and a proposed flood defence wall to the south **(C01_L01).** The flood defence embankment will be approximately 9m wide and 1.4m high above existing ground level (varies over its full extent). The works will include site clearance and vegetation removal, utility and drainage diversions, reinstatement and landscaping works.	GR_201, GR_202, GR_301
	Sallybrook Flood Defence Walls (Steel sheet pile and reinforced concrete	Construction of a new steel sheet pile flood defence wall (**C01_L01)** and reinforced concrete capping beam at 2 no. locations i.e. to the rear of Sallybrook Industrial Estate and to the rear of Eurofins Ltd. over a combined approximate length of 94m with an approximate average height of 1.4m (varies) above existing ground level. Short duration works will be required in stream on a temporary causeway/haul road and will be carried out within the appropriate in-stream fisheries window in accordance with IFI guidelines. Further details are outlined in **Chapter 5**. A proposed reinforced concrete flood defence wall **(C01_L01)** will be constructed over an approximate length of	GR_202, GR_203, GR_204, GR_301, GR_302

Area	Location	Proposed Works	Confirmation Drg. Reference (Plan and Sections)
		482m along the left bank with an approximately average height of 1.3-1.4m above existing ground level (varies). Works to construct the RC wall will be carried out from the dry side. The works will include site clearance and vegetation removal, utility and drainage diversions, reinstatement and landscaping works.	
	Flow Control Structure – Grandons	A flow control structure **(C08_SL01)** is proposed at Grandon's Car Sales to restrict peak flows in the Mill Race (C08). A penstock will be installed to the flow control structure to facilitate dewatering of the Mill Race to carry out routine maintenance. Refer to **Chapter 5** for further detail on future maintenance activities within the defined channel extents. Localised in-stream works will be required to construct the flow control structure and will be carried out during the appropriate instream period in accordance with IFI guidelines. The works will include site clearance and vegetation removal, utility and drainage diversions, reinstatement and landscaping works.	GR_203, GR_302
	Sallybrook Pumping Station	A proposed surface water pumping station **(C01_P01)** including associated drainage networks is to be constructed to operate during a flood event. The main pumping station works will be constructed offline away from the Glashaboy River. The works will include site clearance and vegetation removal, utility and drainage diversions, reinstatement and landscaping works.	GR_203
	Sallybrook Stream	Proposed construction of a new 900mm diameter culvert to tie into the existing culvert to the north of the R639 over an approximate length of 165m. To the south, the proposed culvert will discharge through the proposed flood defence wall **(C01_L01)** via a non-return valve. The works will include site clearance and vegetation removal, utility and drainage diversions, reinstatement and landscaping works. All drainage outlets will be fitted with non-return valves.	GR_202, GR_203, GR_301

Area	Location	Proposed Works	Confirmation Drg. Reference (Plan and Sections)
Area 2	Cois na Gleann Stream	Replacement of two. no sections of existing undersized culvert and informal trash screen with a larger single precast concrete culvert (2.75m wide by 0.9m high) (**C07_B01)**. The existing trash screen upstream will be removed as it will no longer be necessary due to installation of the proposed larger culvert. Proposed rough cut stone slabs are to be placed on the culvert bed as substrate which is outlined in further detail in section 4.5.1 below. Works will include site clearance and vegetation removal, utility and drainage diversions, road regrading **(C07_R01)** and reinstatement and landscaping works. All drainage outlets will be fitted with non-return valves.	GR_206, GR_302
	Hazelwood Avenue	**C01_L02:** Proposed replacement of the existing masonry boundary wall along the R639 (bounding the area known locally as the Circus Field) with construction of reinforced concrete flood defence approximately 1.3m above existing ground levels. The proposed flood defence will curve around Hazelwood Avenue and will tie into higher ground to the east over an extent of approximately 156m. Works will be undertaken from the dry side. To the north, the proposed flood defence wall will tie into higher ground and proposed boundary wall **C07_F01.** **Proposed Gas Diversion:** To facilitate construction of the proposed flood defence wall along Hazelwood Avenue Bridge, an existing gas service (currently secured to the existing bridge upstream parapet) is to be diverted underneath the river bed approximately 3-5m upstream of the bridge. This is due to cover constrains within the existing bridge and has been discussed and agreed with Gas Networks Ireland. Temporary works in stream will be required to construct the proposed gas diversion and will be carried out during the appropriate fisheries period. **C01_R01, C01_R02 and C01_B02:** Proposed construction of a flood relief channel and culvert (6.2m wide by 1.75m high) to the east of Hazelwood Avenue bridge. As the culvert is designed to activate infrequently (during high flows	GR_207, GR_303

Area	Location	Proposed Works	Confirmation Drg. Reference (Plan and Sections)
		only), a hard bed is to be maintained within the culvert which has been agreed through ongoing consultation with IFI. Upstream and downstream of the culvert, engineered grass side slopes with erosion protection membranes and locally placed rock armour will ensure riverbank integrity and bed stability is maintained during high flows. Local works in stream will be required to locally tie in the upstream and downstream flood relief channels and will be carried out during the appropriate fisheries period in accordance with IFI guidelines. A vehicle access track with surrounding fencing and accessed via a lockable gate will be constructed to facilitate access to the flood relief culvert for maintenance activities. **C01_L03a, C01_L03:** Proposed reinforced concrete flood defence wall **C01_L03a** is to be constructed to the south of Hazelwood Avenue Bridge typically 1.2m above existing ground levels and will tie into proposed flood defence wall **C01_L03.** Proposed reinforced concrete flood defence wall **(C01_L03)** will be constructed along the right bank of the Glashaboy River between Hazelwood Avenue Bridge to Hazelwood Shopping Centre and will tie into the proposed Hazelwood Shopping Centre Bridge parapet **(C01_B03)** and will range in height from 1.2-1.45m approx. above existing ground levels over its extent. Proposed flood defence wall **(C01_L03)** will require instream working (from ch41-83m approx.) and is to be carried out during the appropriate instream period in accordance with IFI guidelines. Proposed rock armour and river gravels will be placed on the reinstated river bank following construction of the wall in order to maintain river bed and bank stability. On the eastern bank, proposed reinforced concrete retaining wall **C01_L10** is to be constructed to retain proposed road regrading **(C01_R03 –** see below**)** and will be typically 0.5 to 2m above existing road levels. All drainage outlets will be fitted with non-return valves.	

Area	Location	Proposed Works	Confirmation Drg. Reference (Plan and Sections)
		All works will include site clearance and vegetation removal, utility and drainage diversions, reinstatement and landscaping works.	
	Hazelwood Shopping Centre	Proposed replacement of the existing Hazelwood Shopping Centre bridge with a larger 13.5m single span reinforced concrete bridge **(C01_B03).** Proposed regrading **(C01_R03)** of the nearby Hazelwood Shopping Centre car park to the west and access road to east of the river channel will be required to tie into the new raised footpath and road levels. Proposed reinforced concrete retaining wall **(C01_L10a)** is to be constructed on the left bank and will tie into the replacement bridge to the north and the existing bank to the south. On the right bank, a proposed reinforced concrete flood defence wall **(C01_L04)** will be constructed over an approximate extent of 92m and will be approximately 1.3 to 1.4m above existing ground levels**.** The proposed wall will tie into the proposed replacement Hazelwood Shopping Centre bridge to the north and a separate proposed flood defence wall **(C06_L03)** immediately to the south. This wall will be constructed from the dry side. At channel chainage **C01_3804**, a proposed surface water pumping station **(C01_P02)** including associated drainage connections is to be constructed to operate during a flood event only. The main pumping station works will be constructed offline away from the Glashaboy River to the rear of the existing funeral home. All drainage outlets will be fitted with non-return valves. All works will include site clearance and vegetation removal, utility and drainage diversions, reinstatement and landscaping works.	GR_207, GR_208 GR_304
	Springmount Stream	Replacement of existing twin 0.4m dia. undersized culverts underneath the R639 with a larger single precast concrete box rectangular culvert 1.75m wide by 0.9m high (**C06_B01)** over a length of 32m. Proposed rough cut stone slabs are to be placed on the culvert bed as substrate	GR_208, GR_305

Area	Location	Proposed Works	Confirmation Drg. Reference (Plan and Sections)
		which is outlined in further detail in section 4.5.4 below. Works will include site clearance and vegetation removal, utility and drainage diversions, road regrading **(C06_R01)** and reinstatement and landscaping works. To the east, a proposed reinforced concrete retaining wall will be constructed to retain proposed regraded ground **(C06_R01)** which will be approximately 1.9m above existing ground level (varies). To the west, an existing boundary wall **(C06_L04),** will be replaced in order to retain proposed raised ground levels **(C06_R01).** Downstream of the proposed replacement culvert, a proposed reinforced concrete flood defence wall (**C06_L03**) will be constructed on the left bank of the Springmount stream and will tie into **C01_L04** at the confluence of the Springmount stream and Glashaboy River. The proposed flood defence wall (**C06_L03)** will tie into high ground to the west. On the right bank of the Springmount Stream, it is proposed to construct a reinforced concrete flood defence wall **(C06_L01)** over an extent of 82m approximately 1.3m above existing ground levels (varies). At the confluence of the Springmount Stream and the Glashaboy River, existing instream obstructions to flow are to be removed. All works will include site clearance and vegetation removal, utility and drainage diversions, reinstatement and landscaping works.	
Area 3	Meadowbrook Estate	**C01_L05:** Proposed reinforced concrete flood defence wall to be constructed on the right bank over an approximate extent of 329m which will vary in height from 1.5m to 2.45m above existing ground levels. The proposed flood defence wall (**C01_L05**) will tie into proposed wall **(C06_L01)** to the north and into high ground to the south (Riverstown Bridge). The proposed flood defence wall **(C01_L05)** will be constructed from the dry side. On the left bank, a proposed steel sheet pile wall **(C01_L06)** will be constructed over a length of 84m approximately 1.1m above existing ground levels. Works in	GR_208, GR_305

Area	Location	Proposed Works	Confirmation Drg. Reference (Plan and Sections)
		stream will be required to construct the flood defence wall and will be carried out during the appropriate instream period in consultation with IFI. To the south, a proposed water pumping station **(C01_P03)** including associated drainage networks is to be constructed to operate during a flood event. A proposed foul water pumping station **(C01_P04)** is to be constructed to operate during a flood event in order to minimise the risk of foul/combined flooding to Meadowbrook Estate. The main pumping station works will be constructed offline away from the Glashaboy River. All drainage outlets will be fitted with non-return valves. All works will include site clearance and vegetation removal, utility and drainage diversions, reinstatement and landscaping works.	
	Riverstown Bridge	Proposed removal of silt build-up and vegetation (**C01_C01** and **C01_C02)** upstream and downstream and within the existing bridge arches of Riverstown Bridge to improve conveyance. Proposed works also include localised repair **(C01_F04)** of the existing bridge parapet and re-cambering of the existing road **(C01_R04)** to direct overland flow runoff away from Meadowbrook Estate towards John O'Callaghan Park. All works will include site clearance and vegetation removal, utility and drainage diversions, reinstatement and landscaping works.	GR_208, GR_306
Area 4-1	Butlerstown Stream	Localised modifications to an existing boundary wall **(C04_F01)** at the Lidl parking area to facilitate runoff back into the Butlerstown Stream. At Sarsfield GAA Club, local modifications, including ground regrading **(C04_R02)** to the existing entrance are proposed to restrict overland flow from entering the building. Further east, localised footpath regrading is proposed to guide overland runoff back into the Butlerstown Stream **(C04_R01).**	GR_209
Area 4-2	Glenmore Stream	At Copper Valley Vue, an existing undersized culvert will be replaced with a larger single span bridge **(C05_B02).** Road and footpath levels will be regraded	GR_210, GR_211, GR_216,

Area	Location	Proposed Works	Confirmation Drg. Reference (Plan and Sections)
		(C05_R01 and C05_R02) to facilitate access over the new raised bridge. Works in stream will be required to construct the flood defence wall and will be carried out during the appropriate instream period in consultation with IFI. Proposed reinforced concrete retaining wall **(C05_L11)** will be constructed to retain raised road levels and will tie into the new Copper Valley Vue Bridge and the proposed replacement Brooklodge Grove Culvert **(C05_B01).** The existing 3 no. undersized culverts at Brooklodge Grove **(C05_B01)** will be replaced with a larger twin box culvert each 5m wide by 2.06m high. Proposed rough cut stone slabs are to be placed on the culvert bed as substrate which is outlined in further detail in section 4.8 below. This will include removal of a small weir immediately upstream of the culvert to facilitate smooth transition of flow to the new culvert. This culvert will tie into proposed reinforced concrete retaining wall **C05_L01** at the upstream extent and will tie into proposed reinforced concrete retaining wall **(C05_L11)** at the downstream extent. Repair and strengthening works to existing masonry wall **(C05_L01)** will be undertaken over an approximate extent of 150m. Over an approximate extent of 101m, localised regrading **(C05_C02)**, 0.3-0.4m river bed reduction, on average of the Glenmore Stream including cutting back of the left bank to improve flow conveyance will be carried out. To the east of the M8, repair and strengthening works to existing masonry wall **(C05_L02)** will be undertaken over an approximate extent of 26m. A new reinforced concrete retaining wall will be constructed in place of the existing masonry river boundary wall to retain raised road and footpath levels (**C05_R05**) over an approximate extent of 37m. To the east of this, replacement of the existing undersized culvert at the New Line **(C05_B03)** with a new larger single span bridge will be undertaken. Proposed	GR_217, GR_307

Area	Location	Proposed Works	Confirmation Drg. Reference (Plan and Sections)
		reinforced concrete wall (**C05_L03)** will be constructed to retain raised road levels over an extent of 43m approximately. Replacement of existing boundary walls **C05_F02** and **C05_F03** due to raised ground levels will be required. All works will include site clearance and vegetation removal, utility and drainage diversions, reinstatement and landscaping works.	
Area 5	O'Callaghan Park to Glanmire Bridge	At the Grove area, replacement of the existing river masonry wall with a new reinforced concrete flood defence wall **(C01_L08)** will be required over an approximate extent of 184m. This will include strengthening and repair works to the existing river wall over approximate channel chainage 1900m to 2000m. A proposed surface water pumping station **(C01_P05)** including associated drainage networks is to be constructed to operate during a flood event. The main pumping station works will be constructed offline away from the Glashaboy River. The works will include site clearance and vegetation removal, utility and drainage diversions, reinstatement and landscaping works.	GR_214, GR_308
Area 6	Downstream of Glanmire Bridge	No proposed works. Only channel maintenance is proposed at this location	GR_214, GR_215

4.4 Area 1 - Sallybrook Industrial Estate (2018 EIAR Section 3.4)

4.4.1 2018 EIAR Section 3.4.1 Bleach Hill Stream

The following subsections shall be added at the end of *Section 3.4.1:*

Section Reference	Description
3.4.1.1	**Detailed Design Alterations to Proposed Culvert Bed** Following further consultation with Inland Fisheries Ireland (IFI), and to promote fish passage and enhance the aquatic environment, the proposed reinstatement of natural river gravels as shown on the confirmation drawings is to be replaced by the addition of 600 x 600 x 200mm rough cut stone slabs substrate to the base of the proposed Bleach Hill Stream Culvert (C09_B01)

	with rock armour added to the entrance and exit of the culvert to maintain bed stability. Refer to Drg. No. **GR_201** of the Confirmation Drawings of *Appendix 3.1* of the 2018 EIAR and **Figure 4.1** below.  **Figure 4.1 - Proposed Typical Stone Slabs on Culvert Bed**
3.4.1.2.	**Further Details of In-channel Works** The proposed in-channel works at this location is limited to circa 13m length of the Bleach Hill Stream (between chainage 132 and 145) of which circa 8m is currently culverted through 2 No. 900mm diameter pipes, which impede flood flow and act as a potential blockage risk. It may also slightly impede fish passage. These undersized culverts are being replaced by a larger flat-bottomed rectangular culvert measuring 2.6m wide and 2.4m high. The bottom of the culvert will be sunken to allow a 200mm thick stone bed (described above – **Figure 4.1**) to be reinstated which will tie in with the existing natural bed upstream and downstream. It will also incorporate suitably sized rock armour at its entrance and exit to prevent scour and to ensure a sustainable and stable transition from the open channel section through the short culverted section and back to the open channel. The proposed singular larger rectangular culvert will provide increased conveyance, reduced blockage risk and improved fish passage. The construction methodology is addressed in the next chapter of this addendum.

4.4.2 2018 EIAR Section 3.4.2 Glashaboy River

The following subsections shall be added at the end of *Section 3.4.2:*

Section Reference	Description
3.4.2.1	**Detailed Design Alterations – Sallybrook House Biocycle Treatment System** At Sallybrook House, the existing domestic foul sewer currently discharges largely untreated to the Glashaboy at circa chainage 5340 via an existing septic tank which is noted to be unfit for purpose in its current condition. As part of the Scheme, both to facilitate the preferred alignment of the proposed flood defence wall and to improve local water quality, it is now proposed to install a biocycle treatment system and percolation area to replace the existing

	arrangement. The proposed treatment system is to be designed to the relevant environmental standards (IS EN 12566-3).
3.4.2.2	**Detailed Design Alterations – Removal of surface water pumping station** At the time of preparing the confirmation documents and EIAR, it was envisaged that a surface water pumping station may be required to manage local surface water issues behind the defences when the Glashaboy is in flood. Accordingly, provision was made on a preliminary basis for a proposed pumping station (C08_P01) to discharge at approximately chainage 5300. However, following further investigation and design, it has been possible to design out this pumping station, with the local surface water drainage now being optimised and being drained by gravity via an overflow to be redirected to existing Mill Race, i.e. The pumping station (C08_P01) indicated on Drg. No. **GR_204** (of *Appendix 3.1* of the original EIAR) has been removed. This has the benefit of providing passive drainage, reducing operational risk, reducing the carbon footprint of the scheme and reducing operational noise pollution.
3.4.2.3	**Further Details of In-channel Works** Between chainage 5420 and 5781 on the Glashaboy river, a proposed flood defence embankment (C01_E01) is to be constructed on the left bank. It will be largely constructed inwards of the existing lower embankment set back a minimum of 2m from the existing top of bank to allow space for installation of a silt fence during construction. Accordingly, no construction work is required within the channel along this reach. Equally all inspection and maintenance of the embankment can be undertaken without the need for in-channel works. Between chainage 4869 and 5424, a flood defence wall is proposed on the left bank. This intermittently takes the form of either a sheet pile wall or a reinforced concrete (RC) wall with the RC wall favoured in the majority of cases. In general, both methods will not require work within the river channel for the majority as the work can be undertaken from the higher ground at or near top of bank level. However, there are a number of discrete short sections which will require some temporary working in the river channel. These are summarised below: • For approximately 40m between chainage 5384 and 5424, and again for a 50m length between chainage 5222 to 5272, sheet piled walls are proposed on the left bank. Due to the close proximity of existing buildings, it will be necessary to install the sheet piles from the river side, using a piling rig on a temporary rockfill causeway. More detail of the construction methodology is provided in **Chapter 5**. This in-channel work will be temporary. The sheet pile itself will be generally inboard of the existing vegetated bank which will be retained where stable to provide a natural bank at normal river levels. The sheet pile will require minimal maintenance on the river side and with low intervention manual maintenance expected every 10 year period for repainting works. The causeway will be removed after construction to restore the existing natural bed. Any in-channel impact is considered to be minor and

	temporary. Installation of the causeway and the piling will be undertaken in close collaboration with IFI. • In the vicinity of the proposed sluice gate at the head of the Mill Race (C08_SL01) at chainage 5030 approx., localised works will be required in channel at the offtake from the Glashaboy to the Mill Race to facilitate construction of the flood defence structure, and integrated sluice gate. It should be noted that in this reach, it is not proposed to widen or deepen or in any way alter the existing profile or cross section of the Glashaboy River. Any in-channel works are limited to short term temporary works during construction only. This is evidenced by the cross section included on the confirmation drawings.

4.5 Area 2 – Hazelwood (2018 EIAR Section 3.5)

4.5.1 2018 EIAR Section 3.5.1 Cois na Gleann Stream

The following subsections shall be added at the end of *Section 3.5.1:*

Section Reference	Description
3.5.1.1	**Detailed Design Alterations to Proposed Culvert Bed** Following further consultation with Inland Fisheries Ireland (IFI), and to promote fish passage and enhance the aquatic environment, the proposed reinstatement of natural river gravels as shown on the confirmation drawings is to be replaced by the addition of 600 x 600 x 200mm thick rough cut stone slabs substrate to the base of the proposed Cois na Gleann culvert (C07_B01) with rock armour added to the entrance and exit of the culvert to maintain bed stability. Refer to Drg. No. GR_206 of the Confirmation Drawings of *Appendix 3.1* of the EIAR and **Figure 4.1** above.
3.5.1.2	**Further Details of In-channel Works** The proposed in-channel works at this location is limited to circa 26m length of the Cois na Gleann Stream (between chainage 100 and 74) of which circa 22m is currently culverted through 2 no. undersized culverts of varying geometry, which impedes flood flow and act as a potential blockage risk. It may also slightly impede fish passage. These undersized culverts are being replaced by a larger flat-bottomed rectangular culvert measuring 2.75m wide and 0.9m high. The bottom of the culvert will be sunken to allow a 200mm thick stone bed (described above) to be reinstated which will tie in with the existing natural bed upstream and downstream. It will also incorporate suitably sized rock armour at its entrance and exit to prevent scour and to ensure a sustainable and stable transition from the open channel section through the culverted section and back to the open channel. The proposed singular larger rectangular culvert will provide increased conveyance, reduced

	blockage risk and improved fish passage. The construction methodology is addressed in **Chapter 5** of this addendum. It should be noted that in this reach, it is not proposed to widen or deepen or in any way alter the existing profile or cross section of the Cois na Gleann Stream. Any in-channel works are limited to short term temporary works during construction only. This is evidenced by the cross section included on the confirmation drawings.

4.5.2 2018 EIAR *Section 3.5.2 Glashaboy River – Hazelwood Avenue*

The following subsections shall be added at the end of *Section 3.5.2:*

Section Reference	Description
3.5.2.1	**Further Details of In-channel Works** In the vicinity of the Circus Field near the existing Hazelwood Avenue bridge, it is proposed to place suitable sized rock armour on both left and right banks at chainage C01_4000 (refer to GR_207). This will ensure that high flows do not adversely impact on the stability of the existing river banks in close proximity to the existing bridge. The proposed rock armour will line the full length of the proposed flood relief culvert upstream and downstream channels on the left river bank and will ensure that high flows do not result in scour pockets developing. Similar to the proposed culverts above, rock armour will be placed upstream and downstream of the proposed culvert to ensure a sustainable and stable transition of flow through the flood relief culvert and back into the Glashaboy River. On the right bank at the downstream extent of the culvert, suitably sized rock armour will be placed at the proposed flood defence wall (C01_L03) to prevent scour.

4.5.3 2018 EIAR *Section 3.5.3 Glashaboy River – Hazelwood Shopping Centre Bridge*

The following subsections shall be added at the end of *Section 3.5.3:*

Section Reference	Description
3.5.3.1	**Detailed Design Alteration of Proposed Otter/Mammal Ledge** In order to enhance otter and mammal passage through the stretch of channel at Hazelwood Shopping Centre, it is proposed to construct an otter ledge to the western abutment of the proposed replacement Hazelwood Shopping Centre bridge 150mm above the 1 in 5 year water level whilst also maintaining 600mm headroom. The otter ledge will ramp up and down to the required level at upstream and downstream extents to river bed level. The

	proposed otter ledge will be constructed of lightweight steel rather than the concrete ledge indicated on Confirmation drawing GR_208 and GR_304. The proposed otter ledge will be constructed of lightweight steel rather than the concrete ledge typically indicated on Confirmation drawings GR_304 and GR_307. This is advantageous as it will marginally increase the cross sectional area of the channel through the structures thus maximising conveyance capacity when compared to the larger previously proposed concrete ledge. This is outlined in further detail in **Chapter 5**. To minimise the risk of waterborne material snagging on the ledge during a flood event, it is proposed to fully enclose the structural supports and fixings for the proposed ledge. The otter ledge has been designed in accordance with TII Guidelines for the Treatment of Otters Prior to the Construction of National Road Schemes and in consultation with NPWS, Cork County Council, Cork City Council and OPW. The proposed otter ledge is shown in further detail in **Chapter 5**.

4.5.4 2018 EIAR Section 3.5.4 Springmount Stream

The following subsections shall be added at the end of *Section 3.5.4:*

Section Reference	Description
3.5.4.1	**Detailed Design Alterations to Proposed Culvert Bed** Following further consultation with Inland Fisheries Ireland (IFI), and to promote fish passage and enhance the aquatic environment, the proposed reinstatement of natural river gravels as shown on the confirmation drawings is to be replaced by the addition of 600 x 600 x 200mm rough cut stone slabs substrate to the base of the proposed Springmount Stream (C06_B01) with rock armour added to the entrance and exit of the culvert to maintain bed stability. Refer to Drg. No. GR_208 of the Confirmation Drawings of *Appendix 3.1* of the EIAR and **Figure 4.1** above.
3.5.4.2	**Further Details of In-channel Works** The proposed in-channel works at this location is limited to circa 32m length of the Springmount Stream which is currently culverted through 2 No. 400mm diameter pipes, which impede flood flow and act as a potential blockage risk. It may also slightly impede fish passage. These undersized culverts are being replaced by a larger flat-bottomed rectangular culvert measuring 1.75m wide and 0.9m high. The bottom of the culvert will be sunken to allow a 200mm thick stone bed (described above) to be reinstated which will tie in with the existing natural bed upstream and downstream. It will also incorporate suitably sized rock armour at its entrance and exit to prevent scour and to ensure a sustainable and stable transition from the open channel section through the short culverted section and back to the open channel. The proposed singular larger rectangular culvert will provide increased conveyance, reduced blockage risk and improved fish passage. The construction methodology is addressed in the next chapter of this addendum.

4.6 Area 3 – Meadowbrook (2018 EIAR Section 3.6)

4.6.1 2018 EIAR Section 3.6.1 Meadowbrook Estate

The following subsections shall be added at the end of *Section 3.6.1:*

Section Reference	Description
3.6.1.1.	**Detailed Design Alterations – Relocation of proposed foul/combined water pumping station** Relocation of the proposed foul pumping station C01_P04 approximately 30m directly to the east to be located beside the proposed surface water pumping station (C01_P03). This ensures that the construction footprint for excavation and construction is minimised and ensures that existing mature trees located directly to the main entrance to Meadowbrook Estate are maintained. As an additional contingency measure, in response to the historic foul/combined flooding issues at Meadowbrook, it is proposed that a high level overflow from the foul/combined pumping station is connected to the proposed surface water pumping station. This will only operate during a flood exceedance event, which is considered to be unlikely, and has been documented in consultation with Irish Water, Cork County Council, Cork City Council and OPW. In the very unlikely event that this overflow is activated, water level and flow in the river will be high and will facilitate dilution of any combined flows resulting in negligible impacts to water quality.
3.6.1.2	**Further Details of In-channel Works** Between approximate chainage 3420 and 3530, a proposed steel sheet pile flood defence wall is proposed on the left bank. In order to construct the flood defence, in channel works will be required. This is summarised below: For approximately 84m between chainage 3420 and 3530, sheet piled walls are proposed on the left bank. Due to the close proximity of existing buildings and resultant access difficulties, it will be necessary to install the sheet piles from the river side, using an excavator/piling rig. Further detail of the construction methodology is provided in **Chapter 5**. In-channel works will be temporary. The proposed steel sheet pile will be located as close as possible to the existing river bank in order to maximise the cross sectional area of the channel. The sheet pile will require minimal maintenance on the river side and with low intervention manual maintenance expected every 10 year period for repainting works. Any in-channel impact is considered to be minor and temporary. Installation of the causeway and the piling will be undertaken in close collaboration with IFI.

4.6.2 2018 EIAR Section 3.6.2 Riverstown Bridge

The following subsections shall be added at the end of *Section 3.6.2:*

Section Reference	Description
3.6.2.1.	**Further Details of In-channel Works** In order to improve the conveyance capacity at Riverstown Bridge, existing silt build up (approximately 510m^3) and vegetation is to be removed and disposed of to an appropriately licenced waste facility or reused on site as appropriate. This is indicated on Confirmation Drawings GR_208 and GR_306. This will require access to the Glashaboy River locally to carry out instream works which must be carried out during the July to September window in accordance with IFI guidelines. The removal of silt is intended to restore the conveyance capacity of Riverstown Bridge which has been limited in recent times due to sustained silt build up. No additional deepening of the channel will occur at this location. Existing drainage outfalls will be removed from the western arch and relocated downstream. This will increase the cross sectional area of the bridge and will facilitate improved conveyance capacity. Engineered grass slopes will be constructed on both banks on completion of the works with erosion protection matting overlain with seeded topsoil installed. This is described in further detail in **Chapter 5** including proposed maintenance activities.

4.7 Area 4-1 – Butlerstown Stream (2018 EIAR Section 3.7)

No design alterations or in channel works proposed. Refer to Confirmation Drawing GR_209.

4.8 Area 4-2 – Glenmore Stream (2018 EIAR Section 3.8)

The following subsections shall be added at the end of *Section 3.8.1:*

Section Reference	Description
3.8.1.1	**Detailed Design Alterations to Proposed Culvert Bed** Following further consultation with Inland Fisheries Ireland (IFI), and to promote fish passage and enhance the aquatic environment, the proposed reinstatement of natural river gravels as shown on the confirmation drawings is to be replaced by the addition of 600 x 600 x 200mm rough cut stone slabs substrate to the base of the proposed twin box Brooklodge Grove Culvert (C05_B01) with rock armour added to the entrance and exit of the culvert to maintain bed stability. Refer to Drg. No. GR_211 of the Confirmation Drawings of *Appendix 3.1* of the 2018 EIAR. In addition, a low flow channel

	is to be maintained through one the culverts to aid fish passage during normal flow conditions. This will be carried out by placing 600 x 600 x200mm stone slabs in the eastern culvert section which will tie into proposed river bed levels while the western culvert bed level will be slightly elevated above this level by using deeper stone slabs of 600 x 600 x 400mm geometry. Further detail is outlined in **Chapter 5** and **Figure 4.1** above.
3.8.1.2.	**Further Details of In-channel Works (upstream of Brooklodge Grove Culvert)** It is proposed to deepen (C05_C01) the Glenmore stream channel (upstream of C05_B01) by approximately 0.30m locally at the inlet to facilitate the installation of the proposed replacement culvert at Brooklodge Grove. This will encompass removal of a small existing weir in order to provide a smooth transition in bed level and will also remove any impediment to fish passage along this reach of the watercourse. Suitably sized rock armour will be placed upstream and downstream of the proposed replacement culvert at this location in order to maintain river bed stability.
3.8.1.3	**Further Details of In-channel Works (downstream of Brooklodge Grove Culvert)** Downstream of the proposed Brooklodge Grove culvert outlet, regrading of the river channel is proposed over an approximate 105m stretch with an average drop in bed level of approximately 0.3-0.4m over this extent of channel. The left bank of the river is proposed to be cut at a higher level above the reduced bed level and constructed with engineered side slopes to improve conveyance capacity of the river channel by creating a two stage channel. Approximately 820m^3 of material is to be removed as part of the permanent works and will be either reused on other parts of the scheme or disposed of to a suitably licenced waste facility if deemed unsuitable. Erosion protection matting overlain with seeded topsoil will be installed on the grassed side slopes. Suitably sized rock armour is to be placed locally at the toe of the river to ensure stability of the riverbank. A low flow channel will be maintained to provide a healthy aquatic environment for micro invertebrates and fish passage during normal flow conditions. Refer to **Chapter 5** for further details. Any material removed from the riverbed and river bank at this location will either be reused on site or disposed of to an appropriately licenced facility.
3.8.1.4	**Detailed Design Alterations – Removal of surface water pumping station** At the time of preparing the confirmation documents and 2018 EIAR, it was envisaged that a surface water pumping station may be required to manage local surface water issues at Copper Valley Vue (C05_P01). Accordingly, provision was made on a preliminary basis for a proposed pumping station (to discharge at approximately chainage 640. However, following further investigation and design, it has been possible to design out this pumping station, with the local surface water drainage now being optimised and being drained by gravity to the Glenmore Stream, i.e.

	The pumping station (C05_P01) indicated on Drg. No. GR_211 (of *Appendix 3.1* of the original EIAR) has been removed. This has the benefit of providing passive drainage, reducing operational risk, reducing the carbon footprint of the scheme and reducing operational noise pollution.
3.8.1.5	**Detailed Design Alteration of Proposed Otter Ledge (Brooklodge Grove Culvert, Copper Valley Vue Bridge and The New Line Bridge)** In order to enhance otter and mammal passage through the stretch of channel at Brooklodge Grove Culvert, Copper Valley Vue Bridge and The New Line Bridge, it is proposed to construct otter ledges to each of these structures. This will involve installing an otter ledge to the eastern culvert wall of the proposed replacement Brooklodge Grove culvert, to the southern abutment to the Copper Valley Vue bridge and to the northern abutment of The New Line Bridge. The ledges will be installed 150mm above the 1 in 5 year water level whilst also maintaining 600mm headroom. The otter ledges will ramp up and down to the required level at upstream and downstream extents to river bed level. The proposed otter ledge will be constructed of lightweight steel rather than the concrete ledge typically indicated on Confirmation drawings GR_304 and GR_307. This is advantageous as it will marginally increase the cross sectional area of the channel through the structures thus maximising conveyance capacity when compared to the larger previously proposed concrete ledge. To minimise the risk of waterborne material snagging on the ledge during a flood event, it is proposed to fully enclose the structural supports and fixings for the proposed ledge. The otter ledge has been designed in accordance with TII Guidelines for the Treatment of Otters Prior to the Construction of National Road Schemes and in consultation with NPWS, Cork County Council, Cork City Council and OPW. The proposed otter ledge is shown in further detail in **Chapter 5**.

4.9 Area 5 – O'Callaghan Park to Glanmire Bridge (2018 EIAR Section 3.9)

The following subsections shall be added at the end of *Section 3.9.1:*

Section Reference	Description
3.9.1.1.	**Detailed Design Alterations – Repair of masonry wall** To the north of The Grove, a short discrete section (approximately 15m) of existing masonry wall is to be strengthened and repaired at channel chainage 2220 approximately. As the existing wall is located a offline away from the Glashaboy River, works to repair the wall will be carried out from the dry side. Works will include pointing and repairing of existing masonry wall. Further details are outlined in **Chapter 5**.

4.10 Area 6 – Downstream of Glanmire Bridge (2018 EIAR Section 3.10)

No construction works are proposed in this area, only channel maintenance. Refer to Confirmation Drawing GR_215.

4.11 Maintenance (2018 EIAR Section 3.11)

Maintenance of the proposed development was discussed in *Section 3.11* of *Chapter 3 Description of the Development* of the 2018 EIAR. In order to address **RFI 5**, *Section 3.11* has been replaced with **Section 5.9** in **Chapter 5 Construction Activities** of this Addendum. **Section 5.9** describes the proposed maintenance works and details how these maintenance works will be carried out.

4.12 Resilience of the proposed drainage scheme to climate change (2018 EIAR Section 3.12)

Resilience to of the proposed drainage scheme to climate change was discussed in *Section 3.12* of *Chapter 3* of the original EIAR and is unchanged.

Appendix B

Chapter 5 Construction Activities and Implementation of Maintenance Activities (EIAR Addendum 2020)

Cork City Council, Cork County Council and Office of Public Works

Glashaboy River (Glanmire/Sallybrook) Drainage Scheme

EIAR Addendum - Request for Further Information

EIAR RFI

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Contents

5 Construction Activities and Implementation of Maintenance Activities

5.1 Introduction

This chapter of the EIAR addendum along with **Chapter 4 Description of the Proposed Development and Maintenance Activities** addresses **RFI 3**.

RFI 3 states:

"Further details of proposed widening, deepening, realignment and regrading of river channels and of future maintenance works. These details should include the outermost, or 'worst-case', extents of these elements of the proposal. It should be ensured that this information meets the requirements of Annex IV of the EIA Directive as sufficient basis to support the Minister in carrying out the Environmental Impact Assessment of the scheme."

Chapter 5 addresses the construction aspects of **RFI 3** during the main construction stage and during future maintenance works.

5.1.1 Guidance for the reader

The information in this EIAR chapter is presented in a format which ensures that the whole EIAR, including the further information is clear and accessible.

The EIAR that was submitted to DPER in September 2018 is referred to as the "2018 EIAR" in this addendum. Where practicable, any reference in this EIAR addendum to a chapter in the 2018 EIAR is in *italics* to distinguish it from a chapter of the EIAR addendum, which is in normal text format and "**bold**". For example, Chapter 12 of the 2018 EIAR, which addresses Hydrology, is indicated in this EIAR addendum as **Chapter 12 Hydrology**, while Chapter 4 of the 2018 EIAR is indicated as *Chapter 4 Construction Activities*.

It is noted that in general, the information provided in this EIAR addendum supplements the information provided in the 2018 EIAR and both should be **read together as a whole**. Generally, each chapter of this EIAR addendum provides the additional information on a specialist topic required to address the RFI and the reader is directed back to the specialist chapter in the 2018 EIAR for the remaining sections which remain unchanged.

There are some cases however where chapters/sections/appendices presented in the 2018 EIAR have now been replaced by chapters/sections/appendices in this EIAR addendum in order to avoid confusion with substantial cross-referencing and integration. In these cases, the original EIAR chapters/sections/appendices have been updated, incorporating both the 2018 information and the RFI information and are presented all together here in this EIAR addendum. In relation to construction works, this is relevant for the following chapters/sections of the 2018 EIAR:

- *Chapter 4 Construction Activities* has been replaced by **Chapter 5 Construction Activities and Implementation of Maintenance Activities** of this EIAR addendum.
- **Appendix 5.1 Outline Invasive Species Management Plan addendum** provides further information on invasive species in response to RFI. Read in conjunction with *Appendix 4.1 Outline Invasive Species Management Plan*
- *Appendix 4.2 CEMP* has been replaced by **Appendix 5.2 CEMP** in this EIAR addendum in order to address both **RFI 9** and in response to **RFI 3**

This chapter describes the construction activities and sequencing required for the proposed drainage scheme during both the initial construction works stage and later during the ongoing future maintenance. This chapter considers how the proposed scheme will be constructed and maintained, including specific construction methodologies required for in-stream works, works duration, site preparation and layout, and construction environmental management. It should be noted that proposed construction methodologies outlined within this chapter are those envisaged by the design team, however alternative methodologies may be proposed by the contractor should they be proven to have the same or lower environmental impacts.

The description of the proposed drainage scheme generally follows a convention of describing it geographically from north to south, where possible. The plan layout is presented in **Series 2 (GR_201** to **GR_217)** (of *Appendix 3.1* of the 2018 EIAR) and is referred to throughout this chapter whilst the Sections are presented in **Series 3** (**Drawing No.'s GR_301** to **GR_308**) (of *Appendix 3.1* of the 2018 EIAR). The proposed construction access routes and works areas are presented in **Series 5 (Drawing No.'s GR_501 to GR_503)** (of *Appendix 3.1* of the 2018 EIAR).

An updated Construction Environmental Management Plan (CEMP) has been prepared and is included in **Appendix 5.2** of this addendum. This CEMP covers the environmental management which will take place during the main construction works stage and later during the ongoing future maintenance. The CEMP will be further developed and finalised by the Contractor prior to construction commencing and prior to maintenance activities. The CEMP comprises all of the mitigation measures which are set out in the EIAR (and EIAR addendum) and NIS for both the construction and maintenance stages. It will be updated (if necessary) with any additional measures which are required by any conditions imposed of the Minister for Public Expenditure and Reform (DPER) as part of the statutory confirmation of the Scheme under the Arterial Drainage Acts. The CEMP is discussed further in **Section 5.12** below of this addendum.

5.2 Overview of the Main Elements of the Drainage Scheme and construction works required

The main aspects of the drainage scheme comprise construction works entailing the following:

- Replacement of a number of existing culverts with either new culverts or bridges;
- New flood relief channel and culvert at Hazelwood Avenue;
- Replacement of Hazelwood Shopping Centre bridge with a new bridge;
- Construction of new flood defence walls;
- Construction of a new earthen flood defence embankment at Sallybrook;
- New 4 no. surface water pumping stations and 1 no. foul pumping station;
- Localised in-channel conveyance improvements at culvert/bridge structures;
- Some discrete sections of localised channel widening, deepening, realignment and re-grading of river channel;
- Provision of associated civil works such as road/footpath re-grading at a number of locations;
- Protecting drainage outlets along the line of flood defence works with non-return flap valves;
- Retaining walls;
- Flow control structure on a millrace;
- Removal of vegetation and trees to facilitate construction works;
- Reinstatement of boundary walls and fences;
- Landscaping and replanting of trees on completion in agreement with landowners; and
- Once construction is completed, ongoing maintenance of the drainage scheme.

An outline of the methodology to construct the major elements of the works is described below.

As presented on *Figure 1.1* of the 2018 EIAR, the scheme is geographically divided into a number of Areas as follows:

Area 1 **Sallybrook Industrial Estate**

Area 2 **Hazelwood**

Area 3 **Meadowbrook**

Area 4-1 **Butlerstown Stream**

Area 4-2 **Glenmore Stream**

Area 5 **O'Callaghan Park to Glanmire Bridge**

Area 6 Downstream of Glanmire Bridge

The construction aspects of drainage scheme are described from north to south and area by area where possible. The plan layout for the drainage scheme is presented in *Series 2 (***GR_201 to GR_217***) (Appendix 3.1* of 2018 EIAR) whilst the Sections are presented in *Series 3 (***Drg. No.'s GR_301** to **GR_308***) (Appendix 3.1* of 2018 EIAR). The proposed flood defence works finishes are presented in *Series 4 (***Drg. No.'s GR_401** to **403***) (Appendix 3.1* of 2018 EIAR). The proposed access routes and works areas are presented in Series 5 (Drawing No.'s **GR_501** to **GR_503**) *(Appendix 3.1* of 2018 EIAR). It should be noted that the proposed access routes drawings are for the purpose of indicating to the relevant landowner where access to facilitate works for construction and maintenance is to be required. Any alteration to access during the construction or maintenance of the scheme would be subject to discussion and agreement with the relevant landowner.

A summary of the discrete areas through the scheme which will be subject to proposed widening, deepening, realignment and regrading of river channels is included in the table below. Additional detail is provided within relevant **Sections 5.3** to **5.8** of this document in relation to the proposed construction works;

Table 5.1: RFI 3 Summary of proposed widening, deepening, realignment and regrading of river channels

Structure	Proposed Works	Confirmation Drawing
Hazelwood Flood Relief Culvert and Channel (C01_R01, C01_B02)	Construction of a proposed flood relief culvert on the left bank to the immediate east of Hazelwood Avenue Bridge to improve the conveyance capacity at the bridge. This will include cutting back of the existing riverbank, removal of material and installation of a flood relief culvert and channel over a 67m length of the channel. Rock armour is to be placed at upstream and downstream extents of the channel with erosion protection matting and seeded topsoil installed on the engineered slopes and flood relief channel.	**GR_207, GR_303**
Springmount Stream (C06_C01)	Proposed minor clearance works to be undertaken within the existing Springmount Stream channel. This includes removal of an existing timber weir approximately 0.4m high by 2m long.	**GR_208**
Riverstown Bridge (C01_C01 and C01_C02)	Proposed clearance works to the existing Riverstown Bridge to remove sediment from the existing arch bridge (approximately 510m^3 of material to be removed) both upstream and downstream at the bridge. Existing material to be reused in other elements of the scheme or disposed off site to an appropriately licenced waste facility as necessary.	**GR_208**
Glenmore Stream (C05_C01, C05_C02, C05_C03)	Proposed riverbed regrading and widening of the existing river channel. This will include lowering the riverbed by approximately 0.3-0.4m over a channel length of approximately 105m. Additionally, the left bank of the river will be cutback and reconstructed with engineered side slopes to facilitate improved local conveyance during flood events. Approximately 820m^3 of material is	**GR_211**

Structure	Proposed Works	Confirmation Drawing
	anticipated to be removed locally at this location. Existing material to be reused in other elements of the scheme or disposed off site to an appropriately licenced waste facility as necessary. A low flow channel will be maintained within the river for fish passage and other aquatic species. Rock armour and erosion protection membrane (with seeded topsoil) on the proposed engineered side slopes will be installed. River gravels will be reinstated on completion of the works. Upstream of the proposed Brooklodge Grove culvert, a small weir (3.5m long x 0.5m high) will be removed and disposed of to facilitate a smoother transition in bed level to the proposed larger replacement culvert.	

5.3 Construction Methodology proposed for Area 1 - Sallybrook Industrial Estate

The construction of the flood defences proposed in Area 1 are described below for three watercourses (Bleach Hill Stream, Glashaboy River and Sallybrook Stream) as follows:

5.3.1 Bleach Hill Stream

The specific works proposed in this location of Area 1 consist of:

- Replacement of existing undersized culvert with a new larger precast concrete culvert
- Removal of vegetation and trees to facilitate construction works;
- In-stream works to facilitate construction
- Traffic management
- Re-grading of road
- Reinstatement of boundary walls and fences
- Landscaping and replanting of vegetation on completion in agreement with landowners; and
- Once construction is completed, ongoing maintenance of the drainage scheme (Refer to **Section 5.9** below for details on future maintenance).

These construction works are described in further detail below.

The proposed access routes and works areas are presented in Series 5 (Drawing No.'s **GR_501** to **GR_503**) which is presented in *Appendix 3.1* of the 2018 EIAR.

As noted previously in *Section 3.4.1* of the 2018 EIAR, existing twin undersized 0.9m diameter culverts located beneath the access road into the Cúil Chluthair residential estate are proposed to be replaced with a single larger rectangular

precast box culvert 2.6m wide by 2.4m high (clear height). Refer to Interference No. **C09_B01** on **Drg. No GR_201**. Refer also to **Drg No. GR_301** *(Appendix 3.1* of 2018 EIAR) which shows the cross section of the proposed culvert (**C09.1**).

As detailed design has advanced since submission of the Confirmation documents, additional cross-sectional detail is now available and is as indicated on **Figure 5.1** below.

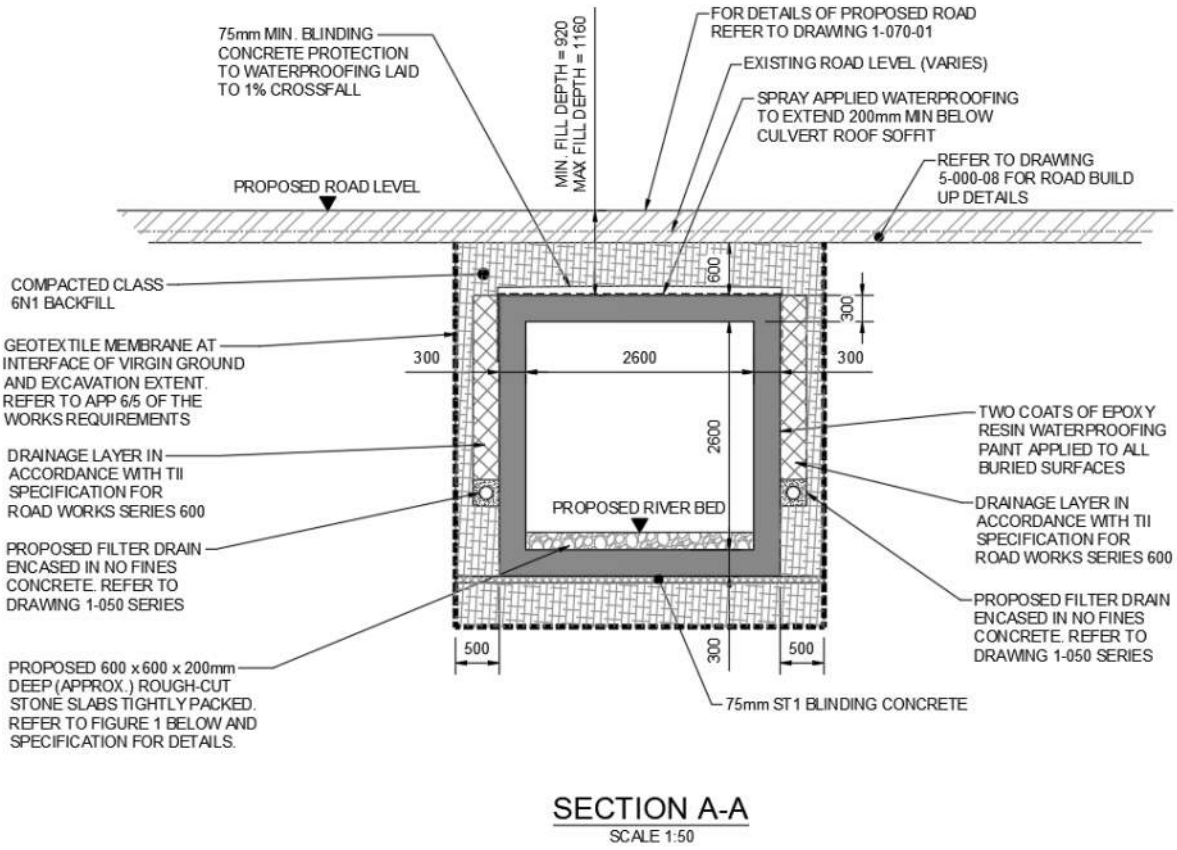


Figure 5.1 - Proposed Bleach Hill Stream Culvert Replacement

The works area will be cordoned off with safety fencing and traffic management set up as required. The construction works are required along the access road into the Cúil Chluthair residential estate and therefore specific traffic management measures will be required to ensure vehicular and pedestrian access is maintained. Traffic measures such as a stop-go system, temporary one-way traffic systems or similar will be implemented to facilitate excavation for the culverts and utility diversions to be constructed and at the same time to manage traffic along the length of the drainage scheme. In this particular case, one lane of traffic (including pedestrian access) to the estate will be maintained at all times with a temporary stop-go system in place. The finer detail of the Traffic management and access routes will be agreed with Cork County Council, Cork City Council and An Garda Síochána.

As the Bleach Hill Stream passes through the existing twin culverts, temporary over pumping of the Bleach Hill stream watercourse will be required to facilitate the construction of the replacement culvert sections. A temporary diversion

channel was considered, but was not considered a reasonable option, due to the steep sided nature of the valley and the lack of space at this location, as well as the desire to minimise the footprint of excavation, and complete the works as expediently as possible. The temporary over pumping of the stream will enable the culvert replacement works to be carried out in the dry and will reduce the risk of siltation and or pollution entering the watercourse overall.

The instream works required for the temporary over pumping of the Bleach Hill stream will be undertaken in a window from July to September (inclusive) and will be carried out under the supervision of a suitably qualified and experienced ecologist and in accordance with the IFI 2016 *Guidelines on protection of fisheries during construction works in and adjacent to waters*. Stilling basins will be required for over pumping with appropriate fish control measures (i.e. electrofishing or similar methods) in place which will be established with consultation with IFI. Specific mitigation measures for instream works are detailed in *Chapter 12 Hydrology and Chapter 6 Biodiversity* of the 2018 EIAR and **Chapter 6 Hydrology** and **Chapter 7 Biodiversity** of this EIAR addendum.

Once the working area is dewatered, enabling and site clearance works will be carried out to facilitate service and drainage diversions and demolition of the existing culvert which will be undertaken in two halves in order to maintain one lane of vehicular and pedestrian access to the estate.

Some trees and vegetation will require removal to facilitate the works at the culvert. The trees likely to be removed are shown in *Figures 1* to *Figure 5* as detailed in *Appendix 3.2b* of the 2018 EIAR. Where possible, tree roots will not be pulled from the river bank. Silt controls during vegetation/tree removal will be put in place to minimise silt escaping into the river channel and banks will be stabilised. Specific mitigation measures for sedimentation control are detailed in *Chapter 12 Hydrology and Chapter 6 Biodiversity* of the 2018 EIAR and **Chapter 6 Hydrology** and **Chapter 7 Biodiversity** of this EIAR addendum.

All vegetation clearance works and site preparatory works will be conducted outside of the bird nesting season (1 March to 31 August inclusive) where possible. However, in the event that vegetation clearance works and/or site preparatory works are required during the bird nesting season, these will only be carried out once an advance survey has been carried out to establish whether there is any evidence of nests present, and the area proposed for clearance has been approved by a suitably qualified and experienced ecologist.

The replacement of the existing twin culverts will generally be undertaken by excavating, demolishing and removing the existing culverts - further detail of the proposed construction methodology is outlined below. Regrading of the existing road to a higher elevation will be required to facilitate the construction of the proposed new culvert.

The dewatered area will be excavated to a depth of approximately 600mm below existing bed level to facilitate installation of the new culvert. Excavated material will be transported off site to a licenced facility or stored for reuse on site, where appropriate. Service diversions associated with the culvert reconstruction will be required locally. Proposed river bed levels will tie into existing bed levels

upstream and downstream of the culvert replacement. Refer to Interference No. **C09_R01** on **Drg. No**. **GR_201** of *Appendix 3.1* of the 2018 EIAR.

In-situ concrete blinding will be poured to provide a level foundation surface to the required level and precast concrete culvert sections will be craned into position. Short sections of pre-cast culvert (1.5m units) have been designed to facilitate quick installation of the culvert which minimises the period of temporary dewatering and minimise the disruption to the Cúil Chluthair estate. Pre-cast headwalls will then be positioned upstream and downstream of the culvert to retain surrounding ground and will tie into the proposed culvert units. The works will be carried out within the dry isolated section of river.

Large irregular proposed heavy stone slabs with dimensions of approximately 600mm x 600mm x 200mm will be placed into the culvert as substrate to aid fish passage. This detail has been developed in consultation with IFI. Finished bed levels will tie into existing river bed levels upstream and downstream of the culvert to ensure no barrier to fish passage is created. Typical details of the proposed stone slabs is shown on **Figure 5.1** above and **Figure 5.2** below

Figure 5.2 - Typical stone slabs to be placed within the proposed replacement culvert

Rock armour (2 layers of Dn50 = 0.3m) will be placed over a geotextile membrane locally at the upstream and downstream extents of the culvert to maintain the integrity and continuity of the river bed and minimise the risk of scour. Utilities and drainage pipes will be diverted into permanent positions as required. The excavations will then be backfilled and road surfaces reinstated.

Boundary walls/fences reinstatement and landscaping and replanting reinstatement will take place in agreement with landowners.

Every effort will be made to carry out the works as quickly as possible in order to minimise impacts on the residents in the area and the duration of the proposed culvert replacement works will be approximately 4-6 weeks Refer to *Chapter 14 Roads and Traffic* of the 2018 EIAR and **Chapter 14 Roads and Traffic** of this

EIAR addendum and for further details on construction traffic and traffic management.

5.3.2 Glashaboy River

The works required along this watercourse in Area 1 consist of:

- Replacement of existing flood defence walls and construction of new flood defence walls;
- Construction of a new earthen flood defence embankment at Sallybrook;
- New surface water pumping station and associated drainage;
- Flow control structure on a millrace;
- In-stream works to facilitate construction;
- Removal of vegetation and trees to facilitate construction works;
- Traffic management;
- Reinstatement of boundary walls and fences
- Landscaping and replanting of trees and vegetation on completion in agreement with landowners; and
- Once construction is completed, ongoing maintenance of the drainage scheme (Refer to **Section 5.9** below for details on maintenance).

These construction works are described below. Refer also to **Drg. No.'s GR_201**, **GR_202, GR_203** and **GR_204** *of Appendix 3.1* of the 2018 EIAR. The proposed access routes and works areas are presented in Series 5 (Drawing No.'s **GR_501** to **GR_503***) of Appendix 3.1* of the 2018 EIAR.

5.3.2.1 Removal of vegetation and trees to facilitate construction

Some trees and vegetation will require removal to facilitate the works along the Glashaboy River in Area 1. The trees likely to be removed are shown in *Figures 1* to *Figure 5* as detailed in *Appendix 3.2b* of the 2018 EIAR. Where possible, tree roots will not be pulled from the river bank in order to minimise the risk of siltation of the river. Silt controls during vegetation/tree removal will be put in place to minimise silt escaping into the river channel and banks will be stabilised. Mitigation measures for sedimentation control are detailed in *Chapter 12 Hydrology and Chapter 6 Biodiversity* of the 2018 EIAR and **Chapter 6 Hydrology** and **Chapter 7 Biodiversity** of this EIAR addendum.

All vegetation clearance works and site preparatory works will be conducted outside of the bird nesting season (1 March to 31 August inclusive) where possible. However, in the event that vegetation clearance works and/or site preparatory works are required during the bird nesting season, these will only be carried out once an advance survey has been carried out to establish whether there is any evidence of nests, and the area proposed for clearance has been approved

by a suitably qualified and experienced ecologist. Specific details on removal of vegetation and trees are provided in the locations below where necessary.

5.3.2.2 New flood defence embankment along Glashaboy River at Sallybrook

As noted previously in *Section 3.4.2* of the 2018 EIAR, there is an existing embankment along the left bank of the Glashaboy River. However, it is of poor quality and therefore needs to be substantially replaced with a new flood defence embankment. The design of the embankment alignment has ensured that a minimum buffer of approximately 2m is retained between the edge of the river channel and the toe of the embankment to facilitate the implementation of siltation controls. The proposed flood defence embankment will tie into high ground upstream and will tie into a proposed flood defence wall at the downstream end. Refer to Interference No. **C01_E01** on **Drg. No.'s GR_201** and **GR_202** *(Appendix 3.1* of 2018 EIAR*).* Refer also to **Drg. No**. **GR_301** *(Appendix 3.1)* which shows the cross section of the proposed embankment (**C01.1**).

Construction will be carried out during the summer months when river levels are low. The works will be carried out under the supervision of a suitably qualified and experienced ecologist and in accordance with the IFI 2016 *Guidelines on protection of fisheries during construction works in and adjacent to waters*. Specific instream works mitigation measures are detailed in *Chapter 12 Hydrology and Chapter 6 Biodiversity* of the 2018 EIAR and **Chapter 6 Hydrology** and **Chapter 7 Biodiversity** of this EIAR addendum.

A silt fence will firstly be installed along the edge of the river channel before earthworks commence. As noted above, a minimum buffer of approximately 2m will be retained between the edge of the river channel and the toe of the embankment to facilitate the installation of the silt fence.

Trees located in close proximity to the riverside (within 2m of edge of river channel) will be cut with the root ball retained in order to minimise siltation risk to the river. Outside this extent away from the river edge, trees will be cut and root ball removed in order to create sufficient space for the proposed flood defence embankment.

The construction of the embankment will be undertaken from the river bank with no in channel works being required. The existing topsoil will be removed and will include excavation of a shallow trench to construct the embankment central key with low permeability cohesive soils then placed to the required flood defence level. Refer to cross-section **C01.1** in **Drg No. GR_301** *(Appendix 3.1).*

Topsoil will be placed on top of the embankment and seeded. All excavated material will be reused where feasible. Any material that is not suitable for use elsewhere in the scheme will be disposed of off-site to an appropriately licenced waste facility. It is likely that it will be necessary to import most of the cohesive soils required to construct the embankment as it is unlikely that sufficient quantities of suitable excavated soil will be available from elsewhere in the project.

Any utility diversions necessary to facilitate the construction of the embankment will be completed prior to the construction of the embankment

In order to minimise the risk of sediment run off, the proposed flood defence embankment will be undertaken on a phased basis with shorter more manageable sections being constructed to mitigate the risk from sediment runoff. The low permeability imported material used to construct the core of the embankment will be stored within a controlled buffer zone, located a minimum distance of 10m away from the river edge to prevent overland sediment run off during stockpiling. In addition to silt control barriers (such as silt fences), straw bales or similar materials will be used to act as an additional control measure to minimise the risk of siltation to the river.

The proposed flood defence embankment will be constructed from the dry side using excavators and built up in 0.3m layers (typically) with each layer appropriately compacted using a mechanical roller. In advance of forecasted wet weather overnight or during a site closure, the embankment is to be covered with an appropriately selected geotextile to minimise the risk of sediment run off occurring during wet periods of weather.

Once the embankment core is constructed, an erosion protection membrane will be installed on the wet side slope of the embankment and tied into anchor trenches consisting of cohesive material at the toe and crest of the proposed embankment. Seeded topsoil will be placed on top. The biodegradable erosion protection membrane is to provide stability to the wet side slope of the embankment in the interim period while grass coverage establishes on the embankment. A reinforcement geogrid will be installed on the crest of the embankment with seeded topsoil placed on top. This is to ensure that future maintenance vehicles can safely track along the crest of the proposed embankment whilst carrying out grass maintenance (mowing etc.) without causing rutting or damage to the embankment crest. On the dry side of the embankment, seeded topsoil will be installed on the side slope. This is indicated in further detail on **Figure 5.3** below

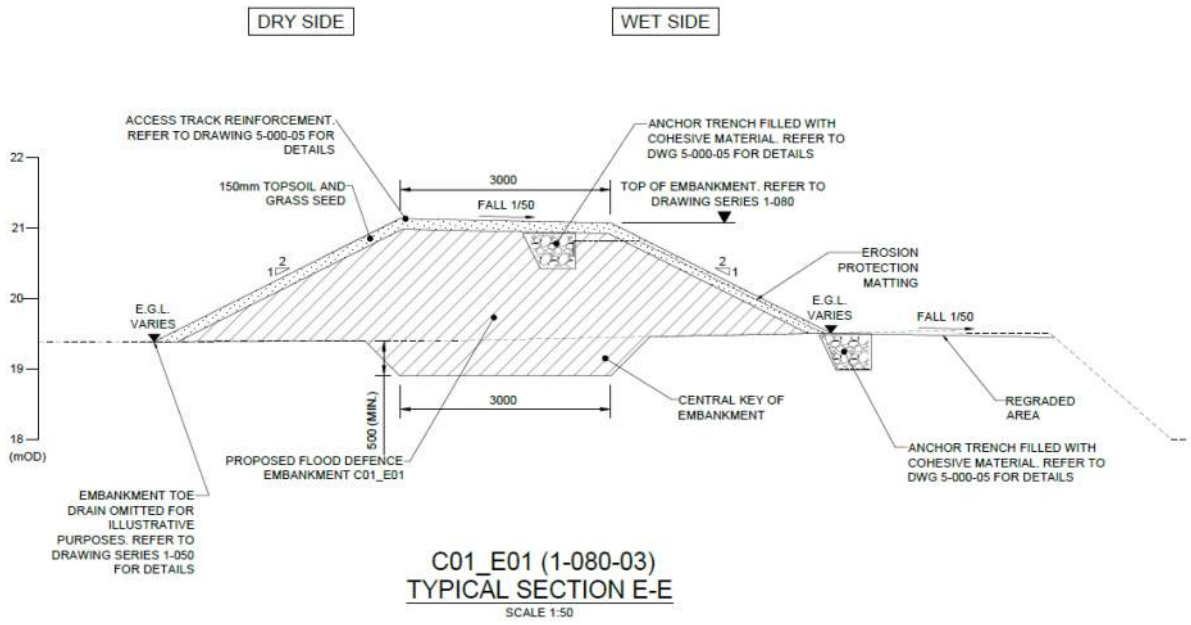


Figure 5.3 - Proposed Sallybrook Flood Defence Embankment Typical Section

Surface water filter drains will be constructed at the toe on the dry side of the embankment, and over its full extent, to allow discharge by gravity to the main river channel.

Headwalls and non-return valves will be constructed on the wet side of the embankment to facilitate the gravity discharge from the surface water system, whilst preventing backing up of the system during high river flows. Rock armour will be placed locally around drainage outfalls to prevent against river bank erosion.

An overflow pipework system will operate only during periods of high river flow. It will intercept surface water flow in the surcharged drainage system and convey it to the proposed surface water pumping station, located downstream to the rear of Sallybrook Industrial Estate, where it will be pumped over the proposed flood defence wall to the river. Refer to **Section 5.3.2.5** for further details.

5.3.2.3 New reinforced concrete/sheet piled flood walls along Glashaboy River at Sallybrook

A proposed flood defence wall (**C01_L01)** will tie into the proposed flood defence embankment (**C01_E01**) at its upstream end. The northern section of the flood defence wall will be a steel sheet pile whilst the southern section of the flood defence wall will be a reinforced concrete wall. Refer to Interference No. **C01_L01** on **Drg. No's. GR_202** to **GR_204** (*Appendix 3.1 of* 2018 EIAR). All drainage outfalls will be fitted with non-return valves. Refer also to **Drg. No. GR_302** (*Appendix 3.1 of* 2018 EIAR) which shows the cross section of the proposed wall (**C01.2**).

Reinforced concrete flood walls will be constructed using industry standard techniques including excavation of foundations, fixing of steel reinforcement,

pouring concrete and reinstatement of the works area. The construction of the reinforced concrete flood defence walls is likely to comprise the following activities:

- Cordon off of works area, including traffic management where the work area will overlap with a public road / pedestrianised area;
- Temporary works including silt barrages where in stream works are required (the vast majority of new walls along the drainage scheme do not require any in-channel works however they are required near Eurofins in the Industrial Estate due to existing space constraints and construction access issues – see below);
- Excavation for foundations;
- Blinding of formation;
- Fixing of reinforcement;
- Placing of formwork;
- Placing of concrete; and
- Striking of formwork

It is expected that any utility diversions required for the construction of the walls will be completed prior to excavating the foundations. Any excavated material that cannot be reused in the works will be transported to a suitable licensed facility.

Due to space constraints at two discrete locations in Sallybrook Industrial estate and at Eurofins Ltd, both over relatively short lengths (50m approx.), steel sheet pile flood walls are proposed. they will tie into reinforced concrete flood defence walls at their extremities. In-stream works will be required at these discrete locations to facilitate installation of the proposed sheet piles. A specialist vibratory piling hammer operated from a moderate to large excavator will be used to install the sheet piles. This technique relies on using the weight of the excavator to essentially press the sheet piles into the ground while gently vibrating soil particles to aid installation. The requirement to minimise noise disruption to surrounding landowners was considered in the design and specification of the piles and piling technique with alternative traditional methods such as hydraulic ramming of sheet piles considered undesirable due to noise and vibration sensitivities at these locations.

To facilitate discrete in-channel entry, a short access/haul road and causeway, comprising of washed granular material will be constructed to provide a piling platform for areas where piles cannot be installed from the dry side atop of the river bank. This will ensure that the excavator/piling rig has a level and secure platform, from which to install the piles safely and efficiently. The excavator/piling rig would use the temporary access road and causeway to track up and down short lengths of river channel, immediately adjoining the left bank. The causeway will be installed above normal river levels, typically 1m in height but subject to the contractor's temporary works design and the requirement to manage flood risk appropriately during construction. The temporary haul road

will be approximately 4/4.5m in width to facilitate tracking of the excavator. It is noted that the river is approximately 7-8m wide at this location. Any obstructions that are met during piling would either require pre-augering or the sheet pile realigned slightly to avoid obstructions.

The above instream works required for the construction of the proposed sheet pile wall will be undertaken during the July to September period (inclusive) and will be carried out under the supervision of a suitably qualified and experienced ecologist and in accordance with the IFI 2016 *Guidelines on protection of fisheries during construction works in and adjacent to waters.* Specific mitigation measures for instream works are detailed in *Chapter 12 Hydrology and Chapter 6 Biodiversity* of the 2018 EIAR and **Chapter 6 Hydrology** and **Chapter 7 Biodiversity** of this EIAR addendum.

Tree and vegetation removal (including pollarding of overhanging branches) will be required to facilitate the works. Rock armour will be placed at strategic sections of the proposed sheet pile wall to maintain the long term integrity of the riverbed and bank from the risk of scour.

At Sallybrook Industrial Estate, a standard L-shape RC flood defence wall is proposed downstream of the steel sheet pile flood defence wall. The construction of this wall will follow the standard methodology as outlined above and is to be installed from the dry side. Once constructed, rock armour is to be placed at strategic sections of the proposed flood defence wall to maintain the integrity of the riverbed and bank. This is typically indicated on **Figure 5.4** below.

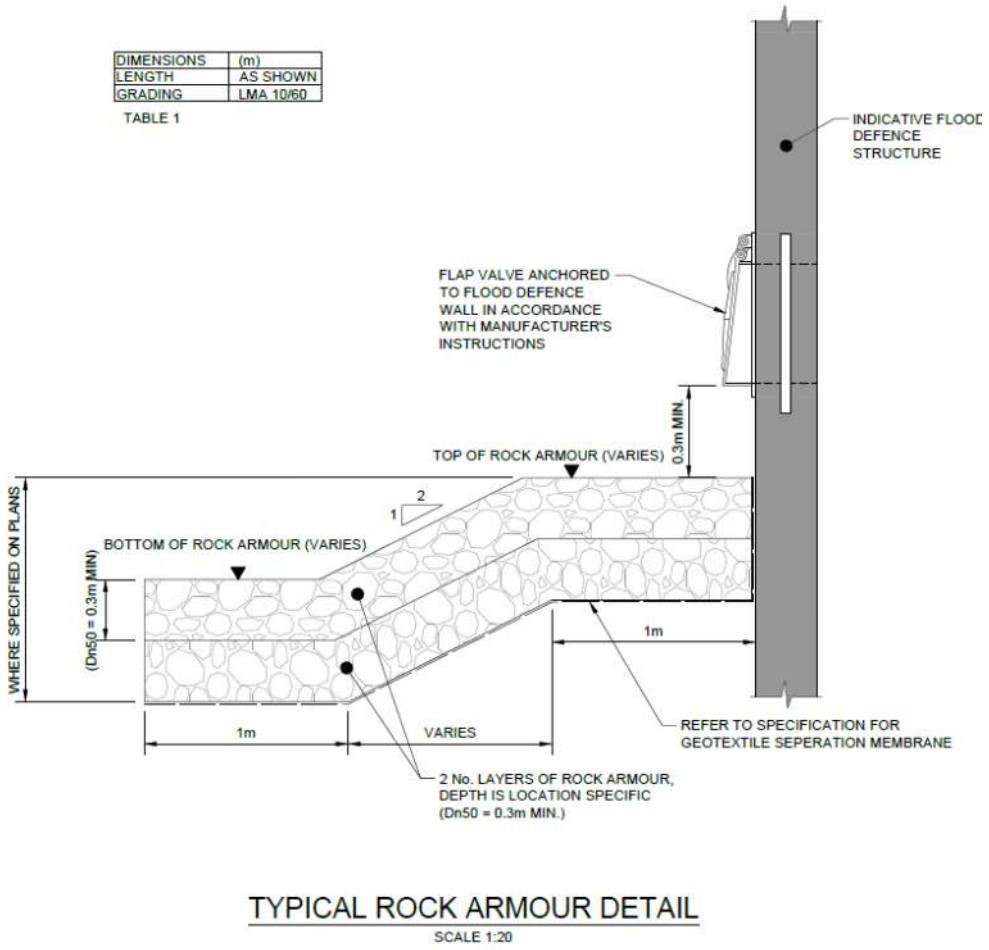


Figure 5.4 - Typical Rock Armour Detail

Further downstream, at Grandon Car Sales, the existing rock armour will be maintained and upheld during construction of the proposed reinforced concrete flood defence wall.

5.3.2.4 Flow control structure on Mill Race at Grandon's car sales

There will be a proposed flow control structure constructed near Grandon's car sales to restrict peak flows in the mill race (ref. **C08 Mill Race 3** on **Drg. No GR_203** and **GR_204**) (*Appendix 3.1* of 2018 EIAR). The structure will be fitted with a penstock to facilitate maintenance of the mill race. A suitable base flow will be maintained in the Mill Race at all times. Manual operation of the penstock is not required in order to form a flood defence function as part of the scheme. The sole purpose of the penstock is to facilitate future routine infrequent maintenance by dewatering the mill race at Grandon's as required. Refer to **Section 5.9** below for details on typical maintenance activities.

Construction of the flow control structure will require excavation and demolition of the existing offtake structure. The area will be isolated from inflow from the Glashaboy River for the duration of the works to facilitate construction in the dry.

This may be carried out by installation of a cofferdam, most likely in the form of sheet piles.

A sweetener flow is to be maintained for the duration of the works locally. This will be provided by way of over pumping from the main Glashaboy channel to ensure that the Mill Race does not dry out. This will be carried out under the supervision of a suitably qualified and experienced ecologist and in accordance with the IFI 2016 *Guidelines on protection of fisheries during construction works in and adjacent to waters.* Specific mitigation measures for instream works are detailed in *Chapter 12 Hydrology and Chapter 6 Biodiversity* of the 2018 EIAR and **Chapter 6 Hydrology** and **Chapter 7 Biodiversity** of this EIAR addendum.

Rock armour overlain with river gravels will be reinstated on completion of the works to ensure the continuity and integrity of the riverbed is maintained. The existing rock armour on the left bank at Grandon's will be upheld and maintained throughout the works.

Refer to Interference No. **C08_SL01** on **Drg. No. GR_203**. Refer also to **Drg No. GR_302** which shows the cross section of the proposed structure (**C08.1**).

5.3.2.5 Surface water pumping stations and drainage

It is proposed that there will be a local surface water pumping station, kiosk, collector drain, overflow manhole and rising main to be constructed for operation during a flood event to the rear of Sallybrook Industrial Estate. This is to be located approximately 90m north of the proposed location which was previously indicated on Confirmation drawing No. **GR_203** (*Appendix 3.1* of 2018 EIAR). All outlets will be fitted with non-return valves. Refer to Interference No. **C01_P01** on **Drg. No. GR_203** (*Appendix 3.1* of 2018 EIAR).

Instream works are not required for the construction of pumping stations.

The footprint of the pumping station will be set out. Where the proposed excavation is located in a paved area, the pavement will be saw cut or paving setts removed carefully for reinstatement later. Where the proposed excavation is located in a grassed area, the topsoil will be removed and stored in close proximity to the excavation but with a minimum buffer away from the watercourse (at least 10m away) to minimise the risk of overland run off during wet periods of weather. The excavation will take place to the required depth. Temporary works in the form of sheet piling will be required in order to facilitate construction of the deep excavations whilst minimising the construction footprint.

Any excavated material which is unsuitable for use as backfill material, will be disposed of to an approved licenced waste management facility.

Lean mix concrete blinding will be placed, followed by formwork and steel fixing. Once concrete has been poured and has cured, the formwork will be stripped and the area around the pumping station will be backfilled. Excavations will be backfilled with granular material and reinstated to their original condition. Mechanical and electrical fit out of pumping stations will then take place. Refer to **Section 5.3.2.1** above in relation to vegetation clearance and tree removal.

As described in *Section 3.4.2* of the 2018 EIAR, a local surface water pumping station **(C08_P01)** with a collector drain, manhole and rising main was proposed to be constructed at Chainage **C08_850**, on the right bank of the Mill Race at Grandon's car sales. This was indicated on **Drg. No. GR_204** *(Appendix 3.1* of 2018 EIAR). However, as detailed design advanced, it became possible to design out this pumping station, which is now, no longer required. Instead, the proposed back of wall surface water drainage will now be redirected to **C08 Mill Race 3** which will allow free discharge to the Mill Race even during flood events. Petrol interceptors will be installed on surface water drainage collector drains at this location before the discharge point to the Mill Race. This will ensure that the risk of hydrocarbons entering the watercourse is minimised as the area is used extensively for car parking.

5.3.3 Sallybrook Stream

The Sallybrook stream (**Channel C10**) passes through the Sallybrook Industrial Estate before discharging to the Glashaboy River. Refer to **Drg. No.'s GR_202** and **GR_203** *(Appendix 3.1* of 2018 EIAR)**.** It consists of both an open channel section at the downstream end, and is culverted further upstream. The open channel section is referred to as **C10_B01** and **C10_C02** (chainage 3-55m) in the drawings. It is culverted further upstream for a distance of approximately 100m with the existing culvert being in a poor state of repair with cracks to pipe joints and vegetation and tree roots evident within the culvert. The existing culverted section is referred to as **C10_C02** (chainage 55-153m). Immediately upstream of this, there is a short reach of open channel referred to as **C10_C03** in the drawings, which connects into a section of culvert (**C10_C04)** underneath the R639 road. A row of mature trees line both the existing open channel and culverted sections.

During flood events, water from the Glashaboy River can presently back up the Sallybrook Stream, overflowing its banks, resulting in flood risk in the area.

The existing stretch of open channel along the Sallybrook stream to the front of Sallybrook House will be maintained to function as a local surface water drainage system, collecting local surface water only. It will discharge through the proposed flood defence wall **(C01_L01)** via a new outfall fitted with a non-return valve. A proposed surface water collector drain to the rear of Sallybrook House will discharge through gravity during normal flow events. However, during a flood event, surface water will be directed via an overflow manhole to the proposed pumping station **(C01_P01)** located immediately north.

Upstream of this point at **C10_C03**, the main flow from the Sallybrook Stream will be diverted through a new 900mm diameter pipe culvert **(C10.1_B01)** which will discharge to the Glashaboy River at chainage C01_5300 via a new headwall and non-return valve. As this new culvert will be sealed between its outlet to the Glashaboy and higher ground at the R639, it will back up during a flood in the Glashaboy and function as a surcharged line.

The proposed culvert alignment minimises tree removal along the existing channel alignment.

The methodology for the construction of the culvert will be as follows:

Construction of the new main culvert will be carried out offline in the dry while flow is maintained through the existing culvert and open channel. Localised in-stream works will be required at the downstream discharge point through the proposed flood defence wall **(C01_L01)** to the Glashaboy River and will be undertaken in a window from July to September (inclusive) and at the same time as the works to construction proposed flood wall (C01_L01). The works will be carried out under the supervision of a suitably qualified and experienced ecologist and in accordance with the IFI 2016 *Guidelines on protection of fisheries during construction works in and adjacent to waters*. Specific mitigation measures for instream works are detailed in *Chapter 12 Hydrology and Chapter 6 Biodiversity* of the 2018 EIAR and **Chapter 6 Hydrology** and **Chapter 7 Biodiversity** of this EIAR addendum.

Temporary flow diversion works will be required for a short period of time to facilitate tie in of the new culvert to the existing road culvert at the R639 as per **GR_202** *(Appendix 3.1* of 2018 EIAR**).** This will involve over pumping of the stream upstream of the works area immediately east of the R639 and is to be carried out under the supervision of a suitably qualified ecologist as outlined above.

Refer to Interference No. **C10_C02** through to **C10_C04** on **Drg. No. GR_202** & **G203** *(Appendix 3.1* of 2018 EIAR). Refer also to **Drg No. GR_301** *(Appendix 3.1* of the 2018 EIAR) which shows the cross section of the proposed culvert (**C10.1**). A small number of trees will require removal to facilitate construction. These are shown on *Figure 1* in *Appendix 3.2* of the 2018 EIAR.

A proposed fence will be provided around the proposed culvert to maintain the property boundary line and is shown as **C01_F01** on the drawings. The fence will be 1.2m above ground level and will tie in with the flood defence wall at the western end.

5.4 Construction Methodology proposed for Area 2 - Hazelwood

The construction of the flood defences proposed in Area 2 are described below for three relevant watercourses (Cois na Gleann stream, Glashaboy River and Springmount Stream) as follows:

5.4.1 Cois na Gleann Stream

The specific works required along this watercourse in the location of Area 2 consist of:

- Replacement of existing 2 no. undersized culverts with a new single precast rectangular culvert
- Removal of vegetation and trees to facilitate construction works;
- In-stream works to facilitate construction

- Traffic management
- Reinstatement of boundary walls and fences
- Landscaping and replanting of vegetation on completion in agreement with landowners; and
- Once construction is completed, ongoing maintenance of the drainage scheme (Refer to **Section 5.9** below for details on maintenance).

As described in *Section 3.5.1* of the 2018 EIAR, the Cois na Gleann Stream is currently culverted beneath the R615 and R639 regional roads with a narrow open section located approximately halfway between the culverted sections of the river. There is an existing informal trash screen just upstream of the culvert on the R615. Refer to **Drg. No. GR_206** *(Appendix 3.1* of 2018 EIAR).

It is proposed that the two existing culverts are replaced with a single culvert (**C07_B01**). This will also include culverting the short open sections between the two regional roads. The new culvert will be a 2.75m wide by 0.9m high rectangular culvert. The existing trash screen upstream will be removed as it will no longer be necessary due to the larger culvert being installed. Service diversions associated with the culvert construction will be required locally. Refer also to **Drg No. GR_302** *(Appendix 3.1* of 2018 EIAR) which shows the cross section of the proposed culvert (**C07.1**).

Road re-grading and a new boundary wall (**C07_L01**) will be constructed adjacent to the R639 regional road. It is proposed to regrade the R639 road (**C07_R01**) to facilitate the construction of the replacement Cois Na Gleann Stream culvert.

The following construction methodology is outlined;

The works area will be cordoned off and traffic management set up as required. It is proposed that traffic measures such as a stop-go system, temporary one-way traffic systems or similar will be implemented to allow the trenches for the culverts and utility diversions to be constructed and at the same time to manage traffic along the length of the drainage scheme. Additionally, temporary road closures and diversions may be required for short discrete periods, particularly for the extent of culvert located on the R615, as it may not be practicable to maintain one lane of the existing road open at all times. Any temporary lane/road closure will be for a short duration only and will take place during the summer months or at other suitable times, i.e. long weekends or mid-term school holidays to minimise the impact on traffic in the area. One lane is to be maintained open for vehicle and pedestrian traffic during construction of the proposed culvert section under the R639. Traffic management and access routes will be agreed with Cork City Council, Cork County Council and An Garda Síochána.

Temporary over pumping of the watercourse will be required to facilitate the construction of the culvert sections. Appropriate fish rescue mitigation measures (i.e. electrofishing or similar mitigation methods) will be required to be implemented during over pumping works. By implementing over pumping, the works will be carried out in the dry, which will reduce the risk of siltation and or pollution entering the watercourse overall. The instream works requiring

temporary over pumping will be undertaken in a window from July to September (inclusive) and will be carried out under the supervision of a suitably qualified and experienced ecologist and in accordance with the IFI 2016 *Guidelines on protection of fisheries during construction works in and adjacent to waters*. Stilling basins will be required with appropriate fish control measures in place and will be established with consultation with IFI. Specific mitigation measures for instream works are detailed are detailed in *Chapter 12 Hydrology and Chapter 6 Biodiversity* of the 2018 EIAR and **Chapter 6 Hydrology** and **Chapter 7 Biodiversity** of this EIAR addendum.

Once the working area is dewatered, enabling works and site clearance will be carried out to facilitate service and drainage diversions and demolition of the existing culverts.

Removal of some trees and vegetation will be required to facilitate the works at the culvert. The trees to be removed are shown in *Figure 1 (Appendix 3.2b)* to *Figure 5 (Appendix 3.2b),* detailed in *Appendix 3.2* of the 2018 EIAR. Where possible, tree roots will not be pulled from the riverbank. Silt controls will be put in place during vegetation/tree removal, to minimise silt escaping into the river channel, and banks will be stabilised. Mitigation measures for sedimentation control are detailed in *Chapter 12 Hydrology and Chapter 6 Biodiversity* of the 2018 EIAR and **Chapter 6 Hydrology** and **Chapter 7 Biodiversity** of this EIAR addendum. All vegetation clearance and site preparatory works will be conducted outside of the bird nesting season (1 March to 31 August inclusive) where possible. However, in the event that vegetation clearance works and/or site preparatory works are required during the bird nesting season, these will only be carried out once an advance survey has been carried out to establish whether there is any evidence of nests present, and the area proposed for clearance has been approved by a suitably qualified and experienced ecologist.

The replacement of the existing culverts will generally be undertaken by excavating and removing the existing culverts before craning in new precast culvert units in short lengths. Regrading of the existing ground will be required to facilitate the construction of the proposed new culvert.

The foundations will be excavated to formation level approximately 600mm below existing river bed level to facilitate installation of the new culvert. In-situ concrete benching will be poured to specified levels to provide a suitable foundation surface for the proposed culvert sections.

Short sections of pre-cast culvert (1.5m units) have been designed to facilitate efficient installation of the culvert which minimises the period of temporary dewatering and minimise the disruption to traffic. Pre-cast headwalls will be positioned upstream and downstream of the culvert to retain surrounding ground and will tie into the proposed culvert units. The works will be carried out within the dry isolated section of river.

Large irregular proposed heavy stone slabs with dimensions of approximately 600mm x 600mm x 200mm (**Figure 5.2**) will be placed into the culvert as substrate to aid fish passage. This detail has been developed in consultation with IFI. Finished bed levels will tie into existing river bed levels upstream and downstream of the culvert to ensure no barrier to fish passage is created

Rock armour (2 layers of Dn50 = 0.3m) will be placed over a geotextile membrane locally at the upstream and downstream extents of the culvert to maintain the integrity and continuity of the river bed and minimise the risk of scour. Utilities and drainage pipes will be diverted into permanent positions as required. The excavations will then be backfilled and road surfaces reinstated. Typical detail of the proposed rock armour is shown on **Figure 5.4** above.

Utilities and drainage pipes will be diverted into permanent positions as required. The excavations will then be backfilled and road surfaces reinstated. Boundary walls/fences reinstatement and landscaping and replanting reinstatement will take place in agreement with landowners.

Every effort will be made to carry out the works as quickly as possible in order to minimise impacts on the residents in the area. The duration of the proposed culvert replacement works will be approximately 4-6 weeks Refer to *Chapter 14 Roads and Traffic* of the 2018 EIAR and **Chapter 14 Roads and Traffic** of this EIAR addendum for further details on construction traffic and traffic management.

Excavated material will be transported off site to a licenced facility or stored for reuse on site, where appropriate. Service diversions associated with the culvert reconstruction will be required locally. Road and footpath levels will be regraded at this location over an extent of approximately 95m and typically 1.2m above existing road levels (at the highest point) in order to get over the proposed larger culvert.

Proposed road and footpath levels will tie into existing levels on either side of the proposed culvert to the north and south. Refer to Interference No. **C09_R01** on **Drg. No. GR_201** *(Appendix 3.1* of the 2018 EIAR). As detailed design has advanced since lodgement of the Confirmation documents, additional cross-sectional detail is now available, and so is provided as indicated on **Figure 5.5** below.

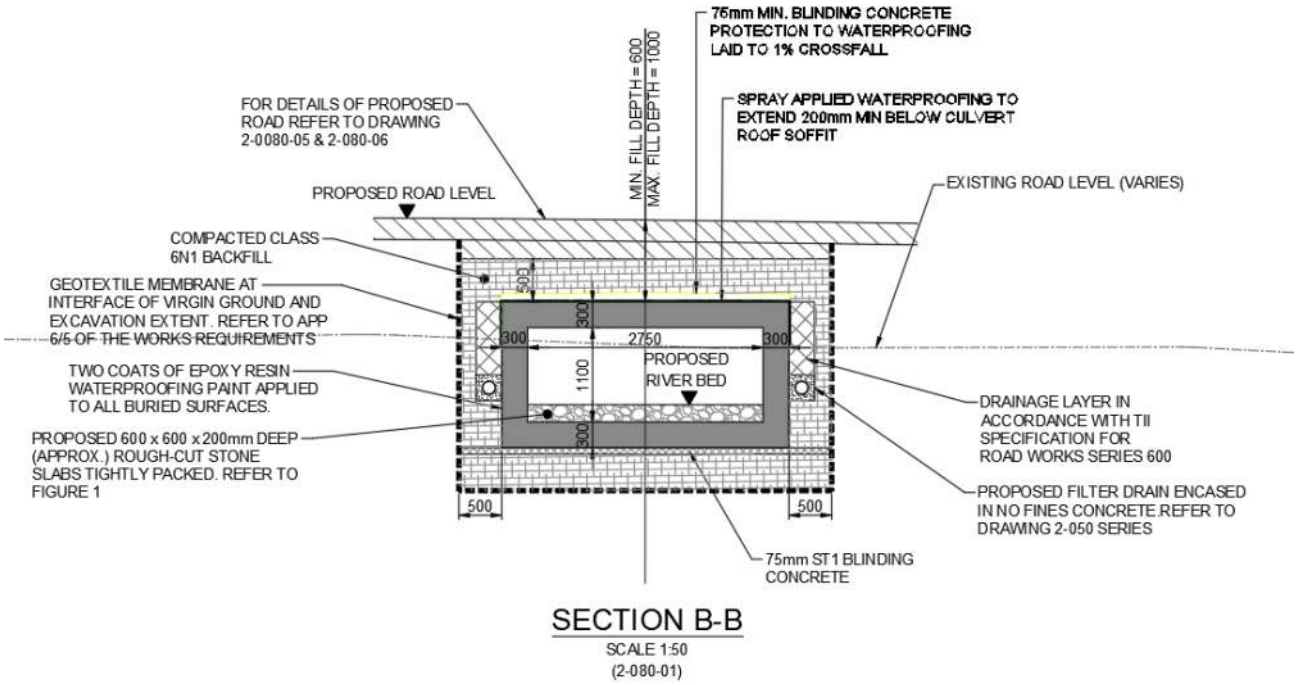


Figure 5.5 Cois na Gleann Culvert Typical Cross Section

Every effort will be made to carry out the works as quickly as possible in order to minimise impacts on the residents in the area. Refer to *Chapter 14 Roads and Traffic* of the 2018 EIAR and **Chapter 14 Roads and Traffic** of this EIAR addendum for further details on construction traffic and traffic management.

5.4.2 Glashaboy River – Hazelwood Avenue

The specific works required along this watercourse near Hazelwood Avenue in Area 2 consist of:

- Replacement of existing flood defence walls and construction of new flood defence walls;
- New flood relief channel and culvert at Hazelwood Avenue;
- Removal of vegetation and trees to facilitate construction works;
- In-stream works to facilitate construction
- Traffic management
- Reinstatement of boundary walls and fences
- Landscaping and replanting of trees on completion in agreement with landowners; and
- Once construction is completed, ongoing maintenance of the drainage scheme (Refer to **Section 5.9** below for details on maintenance).

These construction works are described below.

Refer to **Drg. No**. **GR_207** *(Appendix 3.1* of the 2018 EIAR).

5.4.2.1 Removal of vegetation and trees to facilitate construction

Some trees and vegetation will require removal to facilitate the works along the Glashaboy River in Area 2. The trees likely to be removed are shown in *Figure 1 (Appendix 3.2b)* to *Figure 5 (Appendix 3.2b)*, detailed in *Appendix 3.2* of the 2018 EIAR. Where possible, tree roots will not be pulled from the river bank. Silt controls during vegetation/tree removal will be put in place to minimise silt escaping into the river channel and banks will be stabilised. Mitigation measures for sedimentation control are detailed in *Chapter 12 Hydrology and Chapter 6 Biodiversity* of the 2018 EIAR and **Chapter 6 Hydrology** and **Chapter 7 Biodiversity** of this EIAR addendum.

All vegetation clearance works and site preparatory works will be conducted outside of the bird nesting season (1 March to 31 August inclusive) where possible. However, in the event that vegetation clearance works and/or site preparatory works are required during the bird nesting season, these will only be carried out once an advance survey has been carried out to establish whether there is any evidence of nests present, and the area proposed for clearance has been approved by a suitably qualified and experienced ecologist.

5.4.2.2 New reinforced concrete flood wall adjacent to R639 and Hazelwood Avenue

It is proposed that a reinforced concrete flood defence wall (**C01_L02**) will be constructed adjacent to the R639 curving around onto the northern side of Hazelwood Avenue, incorporating a new northern parapet at Hazelwood Avenue Bridge. The proposed flood defence wall will mostly be constructed in the field (known locally as the Circus Field) parallel to the east side of the R639. It will cross over the Glashaboy River on the north side of Hazelwood Avenue bridge. The flood defence wall will be clad in cut sandstone on both sides and finished with a pre cast concrete coping. All drainage outfalls passing through the defence wall will be fitted with non-return valves.

Some trees will require removal to facilitate construction. These are shown on *Figure 3 (Appendix 3.2b)* of the 2018 EIAR.

Reinforced concrete flood walls will be constructed using industry standard techniques including excavation of foundations, fixing of steel reinforcement, pouring concrete and reinstatement of the works area. The construction of the reinforced concrete flood defence walls is likely to comprise the following activities:

- isolation of works area, including traffic management where the work area will overlap with a public road / pedestrianised area;
- temporary works including silt barrages where in stream works are required (in-stream works are not required for the majority of this wall except for the tie-in at the existing Hazelwood Avenue bridge – see section below for details);
- excavation for foundations;

- blinding of formation;
- fixing of reinforcement;
- placing of formwork; and
- placing of concrete.

Any utility diversions required to facilitate the construction of the walls will be completed prior to excavating the foundations. Any excavated material that cannot be reused in the works will be transported off site to a suitable licensed facility.

As the proposed flood defence wall is to be located off the main R639 roadway, two lanes of the existing roadway will be kept open for the duration of the works. Temporary local realignment of the existing footpath will be required for the duration of the works. This will involve temporary narrowing of the existing R639 roadway to accommodate the temporary footpath with reinstatement as existing on completion of the works.

5.4.2.3 Flood relief channel and culvert parallel to Glashaboy River at Hazelwood Avenue

It is proposed that a 6.2m wide flood relief channel with engineered grassed slopes will be constructed on the left bank of the Glashaboy River over a length extending from circa 30m upstream (**C01_R01**) of Hazelwood Avenue bridge to circa 25m on the downstream side (**C01_R02**) of the bridge.

The flood relief channels either side of Hazelwood Avenue will be connected via a proposed 6.2m wide by 1.55m high rectangular pre-cast concrete flood relief culvert (**C01_B02**) under Hazelwood Avenue.

The flood relief channel and culvert will provide increased conveyance of flood flows during major flood events in the Glashaboy River, significantly reducing the heading up of flood waters upstream of the bridge, allowing the heights of defences upstream to be limited to safe guarding height.

The preliminary design for Hazelwood Avenue has been agreed with Inland Fisheries Ireland (IFI) and NPWS and consultation will continue during the detailed design and construction stages.

Some trees will require removal to facilitate construction. These are shown on *Figure 3 (Appendix 3.2b)* in *Appendix 3.2* of the 2018 EIAR.

New fencing and an access gate will be provided around the open channel for safety/security both on the north side (**C01_F02**).

Refer also to **Drg No. GR_303** which shows the cross sections at Hazelwood Avenue bridge (**C01.3**, **C01.4** and **C01.5**).

The works will be phased such that work on the Hazelwood Avenue flood relief culvert will not be allowed at the same time as works in the Shopping Centre/Commercial Centre, to minimise temporary traffic impacts. Traffic

management and access routes will be agreed with Cork City Council, Cork County Council and An Garda Síochána.

The flood relief culvert will be constructed in advance of re-grading the flood relief channels at the upstream and downstream ends to ensure that the culvert can be constructed in the dry, thus minimising the requirement for instream works.

The culvert will be constructed in two halves along its length (in a north south direction), allowing a minimum of a single lane to remain open at all times, and for at least part of the duration, two lane traffic will be possible due to the generous width of the existing road. If feasible, it is intended that the culvert will be constructed during a period of school holidays when traffic volumes are reduced. A construction period of circa eight weeks to ten weeks will be required for the works impacting Hazelwood Avenue traffic.

Similar to the proposed culverts on the Bleach Hill Stream and Cois na Gleann, at this location, the precast reinforced concrete culvert units will be lifted into place in short units, maintaining at least one lane of traffic and pedestrian access at all times.

As detailed design has advanced since lodgement of the Confirmation documents, additional cross-sectional detail is now available, and so is provided as indicated on in **Figure 5.6**.

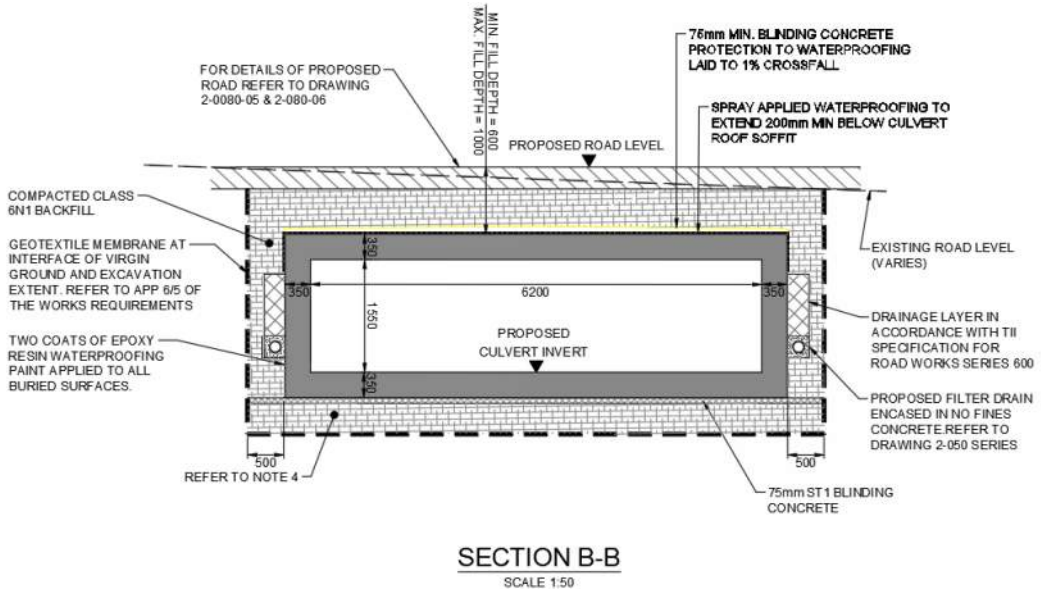


Figure 5.6 Hazelwood Flood Relief Culvert - Typical Cross Section

As the flood relief culvert will be normally dry, in agreement with IFI, a stone bed is not proposed.

Construction of the flood relief channel will consist of the excavation of the left bank of the river (looking downstream) both north and south of Hazelwood Avenue.

Refer to **Drg No. GR_303** (*Appendix 3.1* of the 2018 EIAR) which shows the cross sections at Hazelwood Avenue bridge (**C01.3**, **C01.4** and **C01.5**).

As the flood relief culvert and approach channels at Hazelwood Avenue are offline from the main Glashaboy River channel and proposed to be at a higher elevation, they can be constructed in the dry and are therefore not seasonally constrained aside from the tie-in points which will be seasonally constrained.

Connection of the flood relief channel to the Glashaboy River (via removal of sections of the bank) will only be carried out once all of the other works to the flood relief channel have been completed.

Specific mitigation measures for instream works for the tie-in are detailed in *Chapter 12 Hydrology and Chapter 6 Biodiversity* of the 2018 EIAR and **Chapter 6 Hydrology** and **Chapter 7 Biodiversity** of this EIAR addendum .

The entrance and exit channels to the proposed flood relief culvert have been designed with a gentle gradient to facilitate fish movement back towards the main river channel as flows and water levels decrease to more normal conditions after a flood event. Additionally, rock armour (2 layers of Dn50 = 0.3m) is to be placed immediately upstream and downstream of the proposed culvert and at strategic locations to protect the proposed engineered slopes from scour and erosion.

Erosion protection matting and seeded topsoil will be placed on the engineered slopes – see typical cross section detail below (**Figure 5.7**).

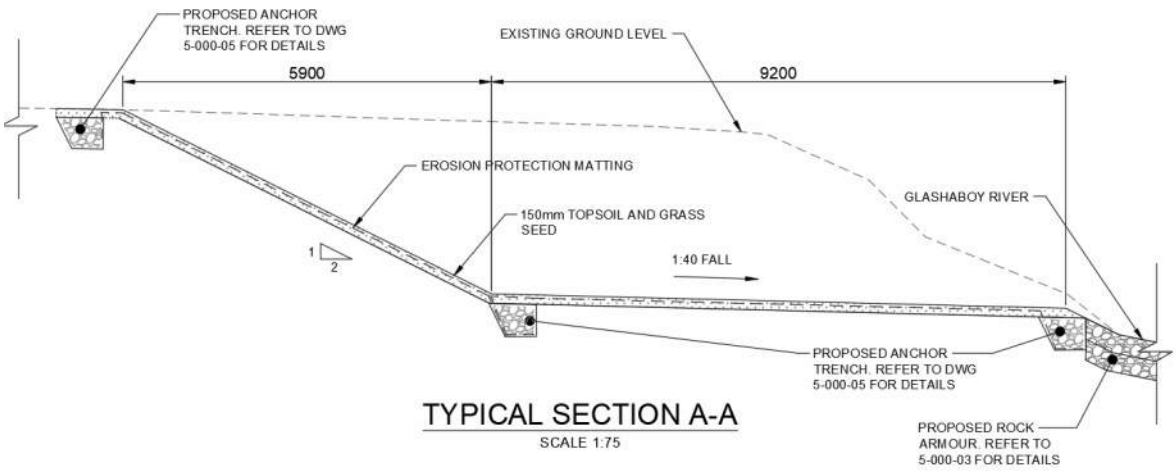


Figure 5.7 Hazelwood Flood Relief Channel Typical Cross Section

Some service diversions associated with the construction works will be required in this area. In particular, an existing gas main which currently crosses over the Glashaboy River attached to Hazelwood Avenue Bridge is to be diverted locally

underneath the Glashaboy River. Further details on the proposed diversion are provided in **Section 5.4.2.4** below.

5.4.2.4 Gas Diversion beneath Glashaboy River at Hazelwood Avenue

An existing gas main (180PE-80 4 bar / 4 In ST 4 bar) which is attached to the upstream face of the existing Hazelwood bridge will be diverted to facilitate construction of a flood defence bridge parapet wall and reinforced concrete flood relief culvert and flood relief channel. As Gas Networks Ireland do not allow for gas services to be attached to new structures and due to cover constraints within the existing bridge, the gas main is proposed to be diverted underneath the Glashaboy River channel approximately 3-5m upstream of the existing bridge. The diversion will be undertaken in line with Gas Network Ireland's standard ditch and stream crossing details and requirements.

The instream works required for the diversion will be undertaken in a window from July to September (inclusive), will be carried out under the supervision of a suitably qualified and experienced ecologist and in accordance with the IFI 2016 *Guidelines on protection of fisheries during construction works in and adjacent to waters*. Specific mitigation measures for instream works are detailed in *Chapter 12 Hydrology and Chapter 6 Biodiversity* of the 2018 EIAR and **Chapter 6 Hydrology** and **Chapter 7 Biodiversity** of this EIAR addendum.

The duration of the works to complete the diversion should take approximately two weeks. The diversion works will be undertaken in two phases for flood management purposes within the main channel. Site clearance, installation of trench sheeting/cofferdam and dewatering of half the river channel area will be undertaken to facilitate the first section of the gas diversion. Appropriate removal of fish will be undertaken during dewatering of the works area. Water removed during dewatering will be discharged via a filtration pond/other measure as appropriate.

A concrete sleeve (pipe) will be installed and covered by a precast reinforced concrete slab for cover/protection requirements, the excavation will be backfilled and river gravels reinstated. The remaining half of the concrete sleeve installation works will then be undertaken as described above. Some tree clearance will be required to provide sufficient space within the works area. The gas pipeline can then be installed by pulling it through the already installed concrete sleeve at a later date, without further disturbance to the riverbed. (Note that the concrete sleeve extends some distance beyond the banks of the river).

This avoids the need to form a connection in the gas pipeline in the bottom of a coffer-dammed trench in the middle of the river (preferable on safety grounds).

Once the diversion is installed and diverted through the new alignment, demolition and removal of the existing pipeline on the upstream face of the bridge will take place.

Gas Networks Ireland (GNI) have been consulted and a proposed diversion design has been submitted for GNI's review and approval. The final diversion design will

be based upon the drawings issued to GNI for final review and costing (refer to **Figure 5.8** below).

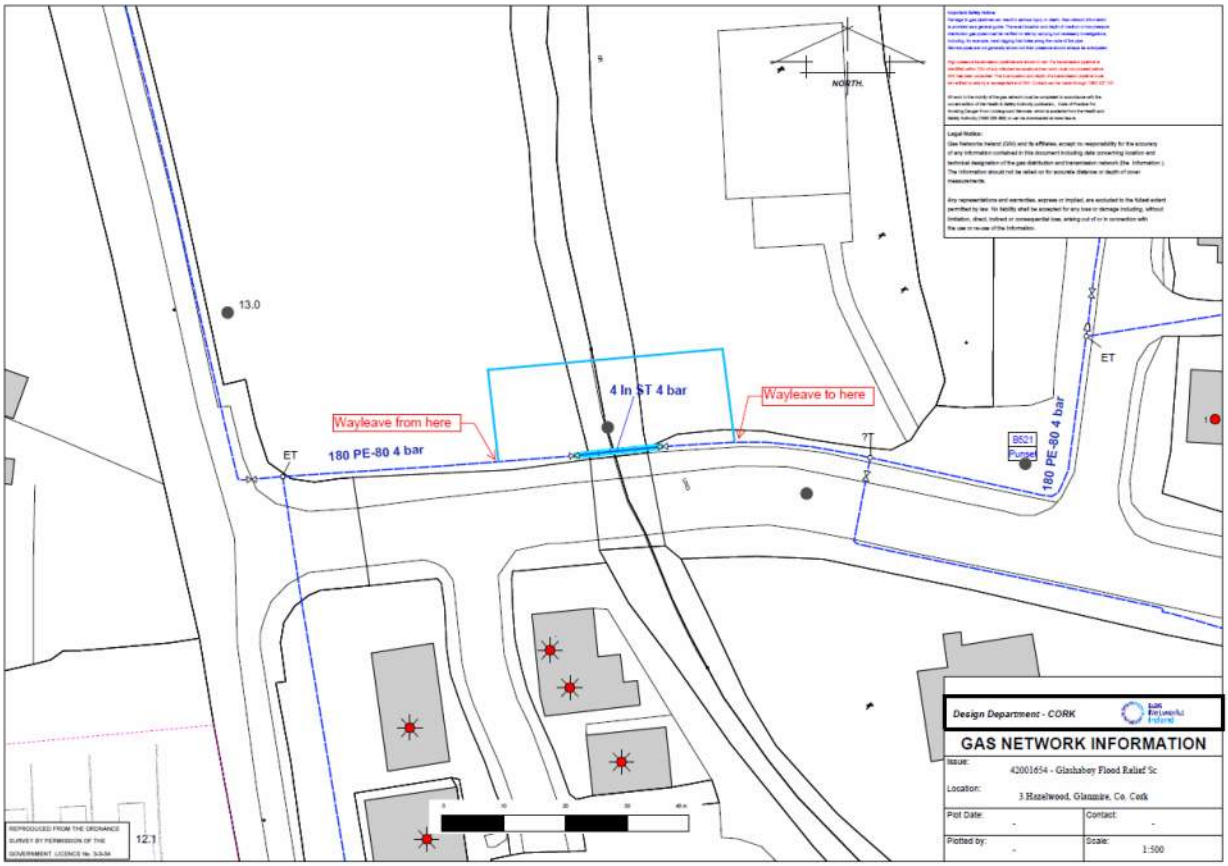


Figure 5.8 Gas network information at Hazelwood Glanmire. Drawing to be confirmed with Gas Networks Ireland prior to works. Source: Design Department Cork, Gas Networks Ireland (GNI).

5.4.2.5 New reinforced concrete flood wall adjacent to Hazelwood Avenue Bridge

A new reinforced concrete flood defence wall (**C01_L03a**) is to be constructed across the southern face of Hazelwood Avenue bridge. This wall will be clad with cut sandstone on both sides and will replace the existing bridge parapet to form the flood defence line.

To the south, a new reinforced concrete flood defence wall (**C01_L03**) will extend along the right bank (looking downstream) of the Glashaboy River from Hazelwood Avenue as far as Hazelwood Shopping Centre Bridge. This wall will have a textured concrete finish on both sides for the majority of its extent with the most southern extent at Hazelwood Shopping Centre to be clad in sandstone on the dry side only.

Due to existing space constraints, the toe of the proposed flood defence wall will be constructed within the river channel bed. The proposed construction methodology is as follows;

A continuous line of trench sheets (sheet piles) will be temporarily installed downstream of Hazelwood Avenue Bridge to create a dry working area at the right bank. Dewatering of the excavation will be carried out by over pumping and discharged back into the river via a siltation tank or stilling basin or similarly appropriate environmental method. Temporary works will be installed to retain the existing buildings in close proximity to the proposed flood defence wall.

The reinforced concrete flood wall will be constructed using industry standard techniques including excavation of foundations, fixing of steel reinforcement, pouring concrete and reinstatement of the works area. The construction of the reinforced concrete flood defence walls is likely to comprise the following activities:

- Site clearance and excavation for foundations;
- blinding of formation;
- fixing of reinforcement;
- placing of formwork; and
- placing of concrete.

The proposed wall will be backfilled with rock armour placed on top of the wall base and the river bed reinstated with the trench sheets removed. Refer to typical rock armour detail on **Figure 5.4.**

All drainage outfalls through the defence wall will be fitted with non-return valves. Refer also to **Drg. No. GR_304** *(Appendix 3.1* of the 2018 EIAR*)* which shows the cross section of the flood wall (**C01.8**).

Some trees will require removal to facilitate construction. These are shown on *Figure 3 (Appendix 3.2b)* in *Appendix 3.2* (2018 EIAR).

As detailed design has advanced since submission of the Confirmation documents, additional cross-sectional detail is now available on **Figure 5.9**.

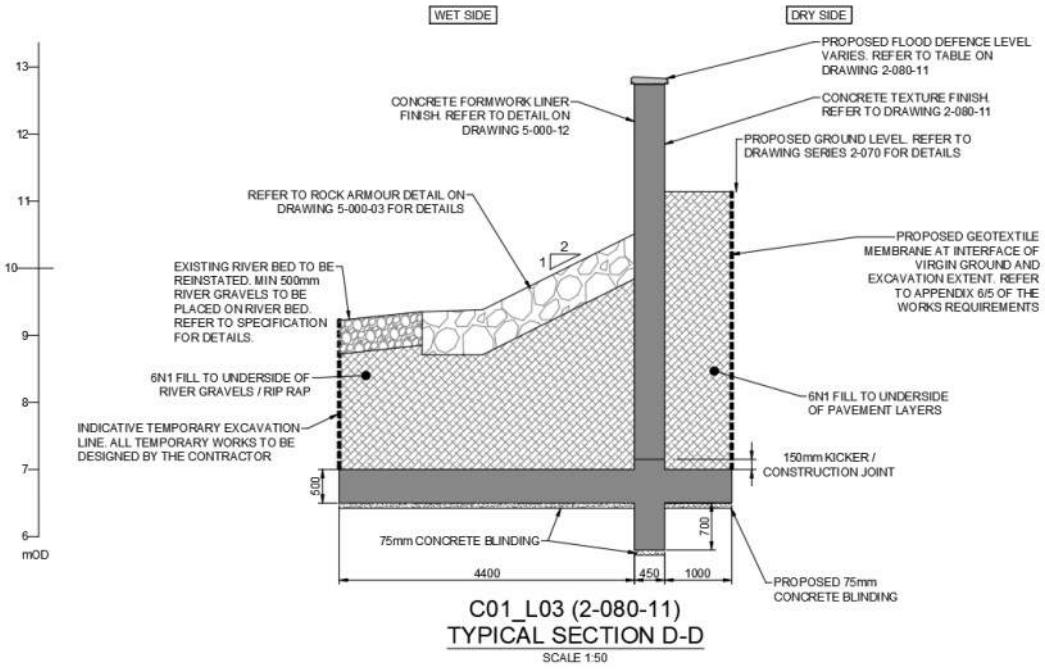


Figure 5.9 Proposed Cross Section of Flood Defence Wall (C01_L03)

Proposed flood defence wall (**C01_L03)** will tie into a proposed bridge parapet at Hazelwood Shopping Centre Bridge. Ground levels are proposed to be raised **(C01_R03)** to facilitate vehicular and pedestrian traffic over the new Hazelwood Shopping Centre Bridge (refer to **Section 5.4.3**).

A new reinforced concrete retaining wall (**C01_L10**) will be constructed to the east of Hazelwood Shopping Centre Bridge on the upstream side, to retain proposed raised ground levels. This will facilitate pedestrian and vehicular traffic to access the proposed replacement bridge which will be higher than the existing.

5.4.3 Glashaboy River – Hazelwood Shopping Centre

It is proposed to replace the existing Hazelwood shopping centre bridge with a new reinforced concrete bridge (**C01_B03**) in order to increase the conveyance of the Glashaboy River at this location. Refer to **Drg. No. GR_207** *(Appendix 3.1* of 2018 EIAR). The existing bridge provides connection for vehicular and pedestrian traffic between the commercial centre (including Supervalu) on the eastern side of the river (left bank) to the commercial centre on the western side of the river (right bank). Both sides of the commercial centres can be accessed separately via Hazelwood Avenue to the north. The proposed new bridge has a clear span of 13.5m. The ground level along the approaches to the bridge will be regraded (**C01_R03**) to tie into the higher deck level of the proposed new bridge and the existing levels on either side.

Service diversions associated with road regrading will be required. Some trees will require removal to facilitate construction. These are shown on *Figure 3 (Appendix 3.2b)* in *Appendix 3.2* (2018 EIAR).

As detailed design has advanced since submission of the Confirmation documents, additional cross-sectional detail is now available and is as indicated on **Figure 5.10** below;

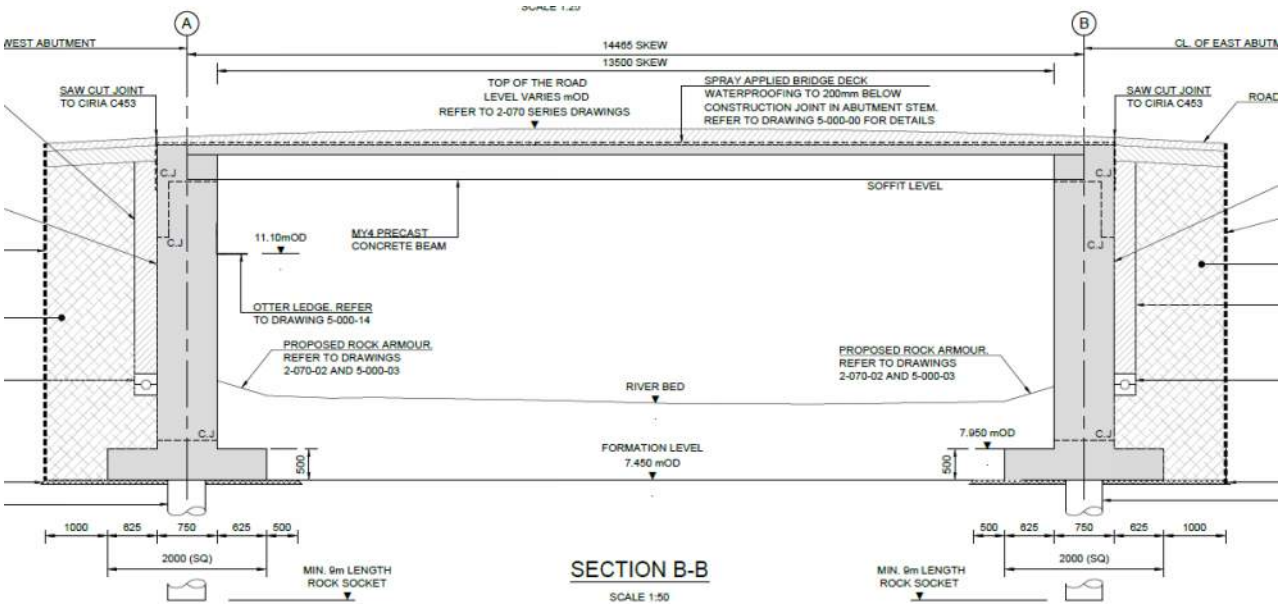


Figure 5.10 Hazelwood Shopping Centre Bridge Typical Cross Section

For the bridge to be constructed, the works area will first be cordoned off and traffic management set up as required. During the bridge replacement, both vehicular and pedestrian access between the shopping centre and the commercial centre will be maintained via the existing accesses along Hazelwood Avenue.

Access via the Hazelwood shopping centre bridge will be restricted for approximately 12 to 16 weeks to facilitate construction. Access will be fully restored on completion of the bridge replacement works. Refer to *Chapter 14 Roads and Traffic* of the 2018 EIAR and **Chapter 14 Roads and Traffic** of this EIAR addendum for further details on construction traffic.

As the watercourse supports salmonids species, the in-stream element of the works (including preparatory work) will be undertaken in a window from July to September (inclusive) and in consultation with IFI to avoid accidental damage or siltation of spawning beds. Temporary works will be put in place, including silt barrages.

The existing bridge deck will initially be dismantled/deconstructed, which will likely involve some in-channel temporary works, but these will be minimised and of short duration. Following this, a temporary cofferdam will be constructed around each of the existing bridge abutments, to allow for the existing abutments to be removed, and new abutments constructed in the dry, whilst maintaining the Glashaboy flow between the two cofferdams, and minimising pollution risk.

Installation of the bridge foundation will involve construction of bored concrete piles (8 no. total and 0.6m in diameter) using a piling rig seated at the higher ground level slightly set back from both left and right banks. The piles will be of reinforced concrete construction.

Once the piles are installed, any excess will be cut down, with insitu reinforced concrete pile caps constructed on top.

Standard construction practices will then be used to construct the reinforced concrete bridge abutments and typically involves:

- Fixing of reinforcement for abutments and piers;
- Placing of formwork for abutments and piers;
- Placing of cast in-situ concrete for abutments and piers; and
- Stripping of formwork.
- Structural backfilling behind abutments.

Once the abutments are in place, the temporary cofferdam will be removed, allowing the placing and fixing of a precast concrete bridge beams which will be full span and be craned in by a mobile crane situated on one of the banks.

Once the precast bridge beams are in place, they will serve as the working platform for the remainder of works to the deck and parapet.

The insitu concrete deck slab will be constructed on top of the precast bridge beams, followed then by the edge beams with the bridge parapets finally fixed in place.

Excavated material will be transported off site to a licensed facility or stored for reuse on site. The excavation will be backfilled, and the area reinstated. Initially temporary reinstatement of road surfaces will be carried out to allow the area to be reopened to traffic. Approximately six months later, the permanent road-surfacing will be completed once initial consolidation has occurred.

Any utility diversions necessary to facilitate the construction of the bridge will be completed prior to and after its construction.

In addition to the detail and construction methods outlined in *Section 4.3.9* of the 2018 EIAR, the following is noted;

To retain the existing ground on the left bank of the river, short sections of retaining walls will be constructed within the channel and shall be constructed in the dry as per the same methodology outlined for the new bridge.

An otter/mammal ledge will be constructed to the replacement bridge as part of the works in accordance with the TII Guidelines for the Treatment of Otters Prior to the Construction of National Road Schemes – refer to typical detail displayed on **Figure 5.11** below.

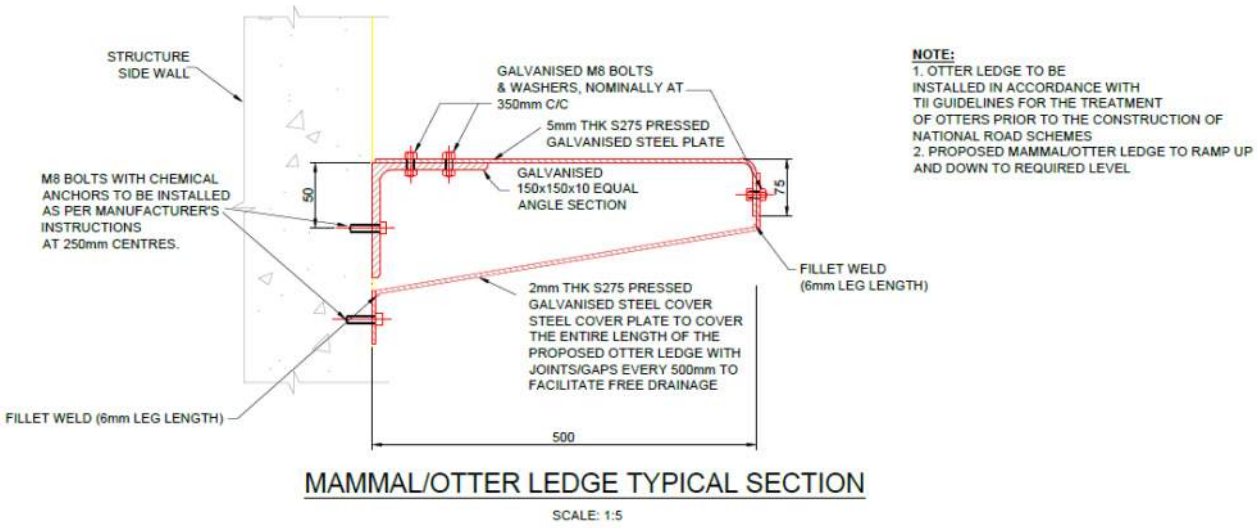


Figure 5.11 - Mammal/otter ledge typical section

A local surface water pumping station (**C01_P02**), collector drain, manhole and rising main will be installed in this area at, **C01_3804,** to manage surface water drainage during a flood event when the normal gravity system is unable to function.

All outlets through the defences will be fitted with non-return valves. Refer also to **Drg. No. GR_208** *(Appendix 3*.1 of 2018 EIAR). The construction of the pumping station will be the same as that proposed above in **Section 5.3.2.5** for **C01_P01.**

5.4.4 Springmount Stream

The specific works required along this watercourse in the location of Area 2 consist of:

- Replacement of existing culverts with new larger precast concrete culvert
- Removal of vegetation and trees to facilitate construction works;
- In-stream works to facilitate construction
- Traffic management
- Reinstatement of boundary walls and fences
- Landscaping and replanting of trees on completion in agreement with landowners; and
- Once construction is completed, ongoing maintenance of the drainage scheme (Refer to **Section 5.9** below for details on maintenance).

The construction works are described below. Refer to **Drg. No. GR_208** *(Appendix 3*.1 of 2018 EIAR).

The Springmount Stream flows east into the Glashaboy River just south of Hazelwood commercial centre and north of Meadowbrook Estate.

The Springmount Stream is currently culverted beneath the R639 in twin 0.4m diameter culverts. It is proposed to replace the pair of undersized culverts with a single new 32m long, 1.75m wide by 0.9m high, rectangular concrete culvert (**C06_B01**). Refer also to **Drg. No**. **GR_305** which shows the cross sections along the R639 at this location (**C06.1**).

As detailed design has advanced, further information is outlined in **Figure 5.12** below.

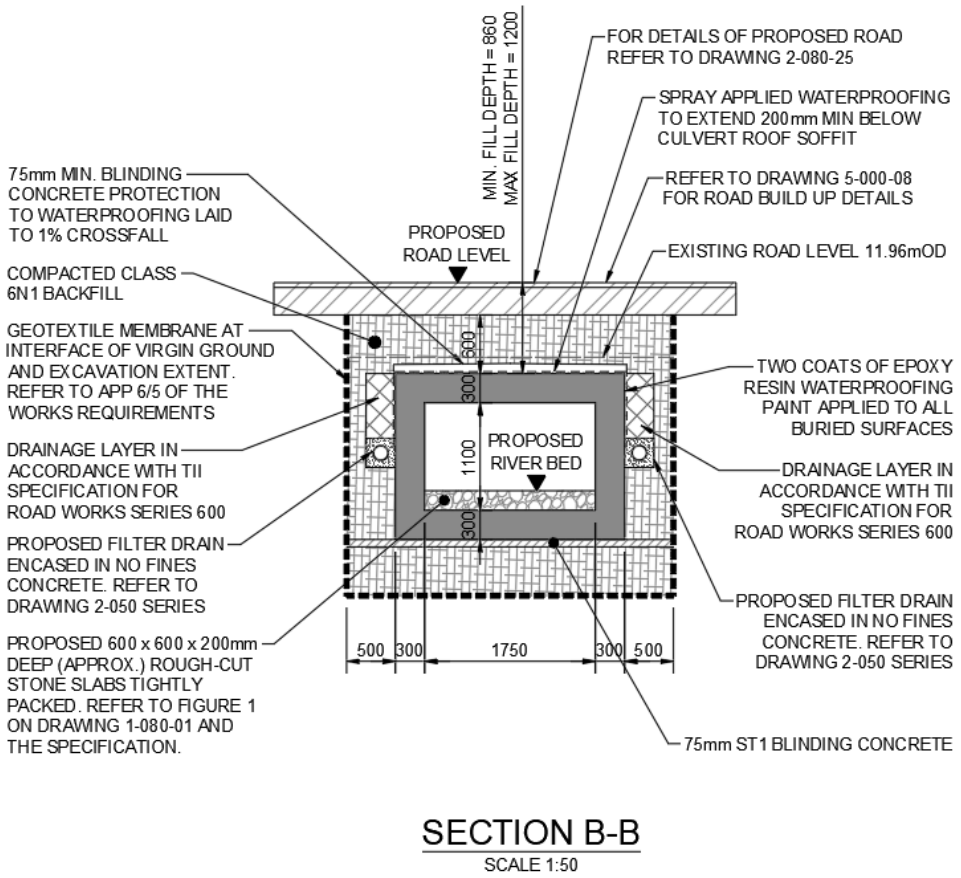


Figure 5.12 Springmount Stream Culvert Typical Cross Section

Some instream works will be required to facilitate the construction of the new culvert. In addition, minor localised clearance works are proposed to be undertaken locally within the existing open channel of the Springmount Stream. This includes removal of an existing timber structure approximately 0.4m high over the width of the watercourse (approx. 2m long). This structure had been placed in the watercourse by a third party in recent years for the apparent purposes of very small scale private hydro power generation. It is noted that the structure is now in a state of disrepair. This is indicated by reference **C06_C01** on **Drg. No. GR_208** *(Appendix 3.1* of 2018 EIAR).

The works area will first be cordoned off and traffic management set up as required. Traffic measures such as a stop-go system, temporary one-way traffic systems or similar will be implemented to allow the trenches for the culverts and utility diversions to be constructed and at the same time to maintain at least single

lane traffic along the R639. Traffic measures will be limited to taking place during the summer months or at other suitable times, i.e. long weekends or school holidays, to minimise the impact on traffic in the area. Traffic management and access routes will be agreed with Cork City Council, Cork County Council and An Garda Síochána.

As the Springmount stream flows through the existing culverts, temporary over pumping will be required to facilitate the construction of the replacement culvert. The over pumping will allow the works to be carried out in the dry and will reduce the risk of siltation and or pollution entering the watercourse overall.

The instream works will be undertaken in a window from July to September (inclusive) and will be carried out under the supervision of a suitably qualified and experienced ecologist and in accordance with the IFI 2016 *Guidelines on protection of fisheries during construction works in and adjacent to waters*.

Stilling basins with appropriate fish control measures will be put in place and will be established in consultation with IFI. Specific mitigation measures for instream works are detailed in *Chapter 12 Hydrology and Chapter 6 Biodiversity* of the 2018 EIAR and **Chapter 6 Hydrology** and **Chapter 7 Biodiversity** of this EIAR addendum of this addendum.

Once the working area is dewatered, enabling and site clearance works will be carried out to facilitate service and drainage diversions and demolition of the existing culverts.

Some trees and vegetation may require removal to facilitate the works at the culvert. The trees to be removed are shown in *Figure 1 (Appendix 3.2b) to Figure 5 (Appendix 3.2b)*, detailed in *Appendix 3.2* of the 2018 EIAR. Where possible, tree roots will not be pulled from the riverbank. Silt control measures will be put in place during vegetation/tree removal, to minimise silt escaping into the river channel, and banks will be stabilised. Mitigation measures for sedimentation control are detailed in *Chapter 12 Hydrology and Chapter 6 Biodiversity* of the 2018 EIAR and **Chapter 6 Hydrology** and **Chapter 7 Biodiversity** of this EIAR addendum. All vegetation clearance and site preparatory works will be conducted outside of the bird nesting season (1 March to 31 August inclusive) where possible. However, in the event that vegetation clearance works and/or site preparatory works are required during the bird nesting season, these will only be carried out once an advance survey has been carried out to establish whether there is any evidence of nests present, and the area proposed for clearance has been approved by a suitably qualified and experienced ecologist.

The timber weir structure will also be removed using a small excavator in the dry within the dewatered section of channel.

The replacement of the existing culverts will be undertaken by excavating and removing the existing culverts before craning in new precast culvert units in short lengths. Regrading of the existing ground will be required to facilitate the construction of the proposed new culvert. The dewatered area will be excavated approximately 600mm below existing bed level to facilitate installation of the new culvert and in-situ concrete blinding poured to provide a level founding surface.

Excavated material will be transported off site to a licenced facility or stored for reuse on site, where appropriate.

Service diversions associated with the culvert reconstruction will be required locally. Ground levels will tie into existing levels on either side of the proposed culvert.

Pre-cast headwalls will be constructed upstream and downstream of the culvert to retain surrounding ground and will tie into the proposed culvert units.

The works will be carried out within the dry isolated section of river. Short sections of pre-cast culvert (1.5m units) have been designed to facilitate fast installation of the culvert, minimising the period of temporary dewatering and minimising the traffic disruption.

Large irregular proposed heavy stone slabs with dimensions of approximately 600mm x 600mm x 200mm **(Figure 5.2)** will be placed into the culvert as substrate to aid fish passage. This detail has been developed in consultation with IFI. Finished bed levels will tie into existing river bed levels upstream and downstream of the culvert to ensure no barrier to fish passage is created

The culvert bed level will tie into existing river bed levels upstream and downstream of the culvert to ensure no barrier to fish passage is created. Rock armour (2 layers of Dn50 = 0.3m) will be placed over a geotextile membrane locally at the upstream and downstream extents of the culvert to maintain the integrity and continuity of the river bed and minimise the risk of scour. Typical details of the proposed rock armour is shown on **Figure 5.4**.

Utilities and drainage pipes will be diverted as required. All excavations will then be backfilled and road surfaces reinstated.

Localised road regrading (**C06_R01**) will take place to facilitate the construction of the replacement Springmount Stream culvert across the R639 road.

An existing boundary wall to a property immediately south of the Springmount stream will be replaced with a reinforced concrete retaining wall (**C06_L04**) with a rendered finish to match existing to retain proposed raised road levels. A proposed reinforced concrete retaining wall (**C06_L02**) will also be constructed parallel to the R639 to the west to retain proposed raised road levels. The wall will be clad with cut sandstone on both faces.

A reinforced concrete flood defence wall (**C06_L03**) will be constructed on the left bank of the Springmount stream and will tie into **C01_L04** at the confluence of the Springmount stream and Glashaboy River. The flood defence wall (**C06_L03)** will tie into existing high ground to the west. The proposed flood defence wall will be constructed in the dry, set back from the river channel. All drainage outfalls through the defence wall will be fitted with non-return valves.

It is proposed to construct a reinforced concrete flood defence wall (**C06_L01**)) on the right bank of the Springmount stream between the R639 and its confluence with the Glashaboy River. The flood defence wall will have a textured concrete finish on the dry side and a fair faced finish on the wet side. It will be constructed

within the temporarily dewatered section of the Springmount Stream. All drainage outfalls through the defences will be fitted with non-return valves.

Specific mitigation measures for instream works are detailed in *Chapter 12 Hydrology and Chapter 6 Biodiversity* of the 2018 EIAR and **Chapter 6 Hydrology** and **Chapter 7 Biodiversity** of this EIAR addendum.

5.5 Construction Methodology proposed for Area 3 - Meadowbrook

The specific works required along the Glashaboy in Area 3 consist of:

- Construction of new flood defence wall on both banks along Meadowbrook upstream of Riverstown Bridge;
- Clearance of blockages of existing bridge arches of Riverstown Bridge which includes vegetation and silt/natural material removal;
- Removal of vegetation and trees to facilitate construction works;
- In-stream works to facilitate construction;
- Traffic management;
- Reinstatement of boundary walls and fences ;
- Landscaping and replanting of trees on completion in agreement with landowners; and
- Once construction is completed, ongoing maintenance of the drainage scheme (Refer to **Section 5.9** below for details on maintenance).

The construction of the flood defences along the Glashaboy in Area 3 are described separately below for both Meadowbrook Estate and Riverstown Bridge.

5.5.1 Glashaboy River – Meadowbrook Estate

The primary component of the Scheme in Meadowbrook Estate is the replacement of an existing substandard flood defence wall, with a new reinforced concrete flood defence wall (**C01_L05**.), along the entire right bank of the Glashaboy River through the Meadowbrook Estate. No instream works are required for the construction of this flood defence wall.

Along the middle reach of this proposed new wall, the new wall will be constructed on the dry side of the existing wall, with a section of the existing wall being left insitu in order to minimise tree removal in the area.

Nonetheless, some trees will require removal in the Meadowbrook area to facilitate construction. These are shown in *Figure 3 (Appendix 3.2b)* in *Appendix 3.2* of the 2018 EIAR.

The approach for removing trees and vegetation is the same as that proposed elsewhere along the Glashaboy such as in **Section 5.3.2.1** above.

The proposed flood defence wall will have a textured concrete finish on both sides, with proposed hedgerow planting on the dry side. Details are shown on **Drg. No. GR_208**. Refer also to **Drg. No. GR_305** which shows cross sections of the defence wall at Meadowbrook Estate (**C01.9** and **C01.10**).

The reinforced concrete flood wall will be constructed using industry standard techniques including excavation of foundations, fixing of steel reinforcement, pouring concrete and reinstatement of the works area. The construction of the reinforced concrete flood defence wall is likely to comprise the following activities:

- cordoning of works area, including traffic management where the work area will overlap with a public road / pedestrianised area;
- excavation for foundations;
- blinding of formation;
- fixing of reinforcement;
- placing of formwork; and
- placing of concrete.

Any utility diversions required for the construction of the wall will be completed prior to excavating the foundations. Any excavated material that cannot be reused in the works will be transported offsite to a suitable licensed facility.

At the southern end of the Meadowbrook Estate near Riverstown Bridge at **C01_3444**, a local surface water pumping station (**C01_P03**) collector drain, manhole and rising main will be constructed to operate during a flood event when the normal gravity system cannot operate due to high river levels. All surface water outlets through the defence wall will be fitted with non-return valves.

As described in *Section 3.6.1* of the 2018 EIAR, in the same general area, a proposed foul water pumping station (**C01_P04**), with overflow, manhole and rising main is to be installed for operation when required to pump foul water trapped in Meadowbrook Estate into the foul sewer network downstream of the estate in John O'Callaghan Park. During detailed design, the proposed foul pumping station (**C01_P04**) has been relocated slightly to the east (approximately 30m) so that it is adjacent to the proposed surface water pumping station (ref. C01_P03). This design evolution is to protect and maintain the existing mature trees within the green area to the entrance of Meadowbrook Estate and minimise the construction footprint within the estate. For additional redundancy to the Meadowbrook Estate, a high-level overflow will be constructed from the foul pumping station to the surface water pumping station. This high-level overflow will only operate in exceptional circumstances and will act as a contingency measure in the unlikely event that a blockage may occur within the existing combined network resulting in backing up of flows to the pumping station. This will ensure that pollution risk to local properties within Meadowbrook is minimised and provides wider public health benefits to the Meadowbrook Estate.

The construction methodology for these pumping stations is the same as that proposed elsewhere along the scheme such as in **Section 5.3.2.5** above.

Opposite Meadowbrook Estate on the left bank of the Glashaboy and for a distance of 84m upstream of Riverstown Bridge, a steel sheet pile flood defence wall (**C01_L06**) will be constructed. All drainage outfalls through the defence wall will be fitted with non-return valves. A paladin style fence approximately 2m above ground levels will be constructed on the dry side of the flood defence wall over the for security purposes to the residential property. Hedgerow planting will be carried out inside this line to provide further shielding of the proposed flood defence in ongoing consultation with the landowner.

As the sheet pile installation will occur in the vicinity of the kingfisher nests in the Meadowbrook area, the works will be planned to be undertaken outside of the breeding bird season (1 March to 31 August inclusive). However, if this is not possible, strict noise and vibration restrictions will be imposed on the Contractor. Further details are provided in *Chapter 6 Biodiversity* of the 2018 EIAR and **Chapter 7 Biodiversity** of this EIAR addendum. Specific mitigation measures to minimise disturbance on birds and other fauna such as otter are detailed in the Biodiversity section of the 2018 EIAR.

The construction of the sheet piled wall will be similar to the sheet piled wall described at Sallybrook in **Section 5.3.2.3**. However, the installation of the proposed steel sheet piles on the left bank at Meadowbrook (refer to cross-section **C01.10** in **Drg. No. GR_305**) will require installation from the riverside as well as the land side due to the existing steep bank topography at that location and constricted working access from the north and west of the existing property hindering installation from the dry/land side.

Access to the river will be provided via a temporary ramp into the channel on the right bank immediately upstream of the existing Riverstown Bridge. At this location, a localised fording of the watercourse will be required to provide access to the works zone from Meadowbrook Estate, and thus will require temporary flow management within the river. It is possible that some limited construction access may be provided on the land/dry side via the front garden of the residential property on the left bank, but it is conservatively assumed that this may not be possible.

In order to minimise noise and vibration impacts on surrounding receptors and buildings, the steel sheet piles will be installed using a vibratory rig attached to a tracked excavator.

The instream works required for the sheet pile wall construction will be undertaken in a window from July to September (inclusive), will be carried out under the supervision of a suitably qualified and experienced ecologist and in accordance with the IFI 2016 *Guidelines on protection of fisheries during construction works in and adjacent to waters*. The duration of the sheet piling works will be approximately 4 weeks, therefore in order to avoid impacts on the breeding bird season, these works will be required to be carried out in September.

Specific mitigation measures for instream works are detailed in *Chapter 12 Hydrology and Chapter 6 Biodiversity* of the 2018 EIAR and **Chapter 6 Hydrology** and **Chapter 7 Biodiversity** of this EIAR addendum.

5.5.2 Glashaboy River – Riverstown Bridge

To better manage local surface water in the area of Riverstown Bridge, it is proposed to locally regrade and re-camber the roads and footpaths (**C01_R04**) in the area. Re-cambering of the road will also take place to divert surface water runoff, during a flood event, southwards into the Glashaboy River via O'Callaghan Park, downstream of Riverstown Bridge (**C01_R04**).

As a result of the required regrading, the existing Riverstown Bridge parapet wall will be modified (including localised minor stonework repairs) to provide guarding height protection to pedestrians (**C01_F04**) including the construction of an architectural handrail adjacent to the parapet wall to ensure that the intervention is sympathetic to the structure from an aesthetic perspective. Refer to the cross sections of Riverstown Bridge (**C01.11**) and at Meadowbrook Estate in the same area (**C01.12**).

Significant conveyance works are proposed at Riverstown Bridge. A number of the bridge arches have become ineffective due to the installation of some drainage infrastructure and build up of silt over a long period of time. On the left bank, the existing bridge arches will be cleared by removing built up silt and vegetation (**C01_C01**). Similarly, on the right bank of the river, the existing Riverstown bridge arches will be also cleared by removing built up silt and vegetation. In addition, an existing manhole under the bridge arch on the right bank (and which significantly restricts conveyance) will be removed with the drainage and services being diverted (**C01_C02**).

To undertake this silt removal work, tracked excavators will require local access to the Glashaboy channel at Riverstown Bridge from both upstream and downstream access points to ensure tracking within the channel is minimised. As mentioned above, fording of the watercourse is expected to be required. A smaller excavator is likely to be required to excavate material from within the existing bridge arches due to height clearance and space constraints of the bridge. Material removed from the river and both banks at this location will either be reused as part of the scheme or disposed of offsite to an appropriately licenced waste facility.

This work will be completed in two phases in order to isolate flow from the proposed excavation works areas to facilitate working in the dry to minimise the risk of siltation of the watercourse. This would likely include creating a cofferdam using trench sheets, silt control methods and over pumping to dewater the cofferdam (via stilling basins) as required with the works being undertaken first adjacent to the left bank and secondly adjacent to the right bank.

The instream works required will be undertaken in a window from July to September (inclusive) and will be carried out under the supervision of a suitably qualified and experienced ecologist and in accordance with the IFI 2016 *Guidelines on protection of fisheries during construction works in and adjacent to waters*. Specific mitigation measures for instream works are detailed in *Chapter 12 Hydrology and Chapter 6 Biodiversity* of the 2018 EIAR and **Chapter 6 Hydrology** and **Chapter 7 Biodiversity** of this EIAR addendum

It is estimated that approximately 510m^3 of excess built up of silt/river material will be required to be removed locally from Riverstown Bridge in order to restore

the conveyance capacity of the bridge to its original design intent. The main river bed level will be maintained as existing (typically 6.56mOD varies).

Engineered side slopes will be created on the left and right bank of the river upstream and downstream to guide flow through the bridge arches during high flow events. An erosion protection membrane is to be installed on the side slopes of the bank, and overlaid with seeded topsoil. A low flow channel will be maintained at two of the central arches of the bridge to facilitate fish passage during normal flow conditions within the river. This detail has been developed following detailed consultation with IFI.

As detailed design has advanced since submission of the Confirmation documents, additional cross-sectional detail is now available and is as indicated on in **Figure 5.13** and **Figure 5.14** below.

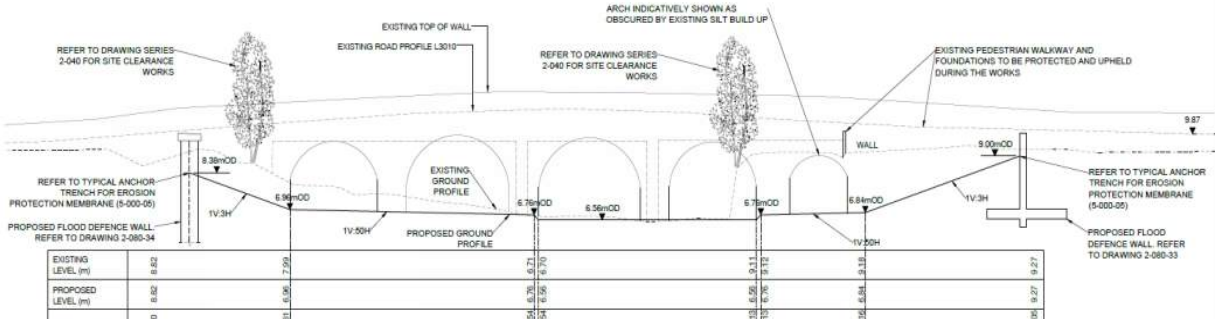


Figure 5.13 Riverstown Bridge Typical Elevation Indicating Proposed Bridge Arch Clearance Works (looking downstream)

The proposed engineered grass slopes both banks (typical cross-sectional detail) to be constructed is indicated in **Figure 5.14** below

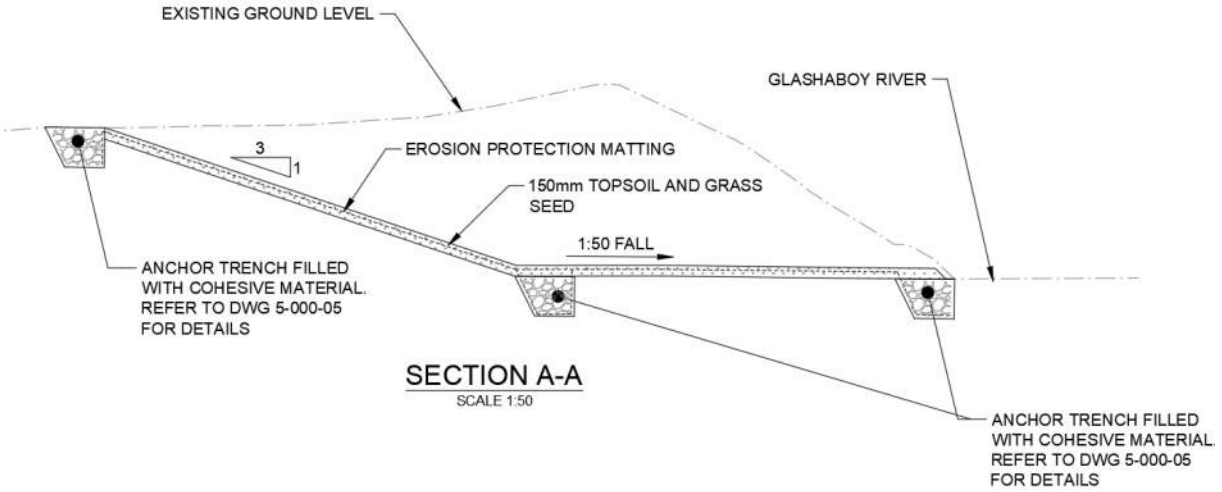


Figure 5.14 Riverstown Bridge Engineered Side Slopes Cross Section

Some trees will require removal to facilitate construction. These are shown on *Figure 3 (Appendix 3.2b)* in *Appendix 3.2* of the 2018 EIAR. The approach for

removing trees and vegetation is the same as that proposed elsewhere along the Glashaboy such as in **Section 5.3.2.1** above.

5.6 Construction Methodology proposed for Area 4 Butlerstown Stream and Glenmore Stream

The construction of the flood defences and channel conveyance improvement measures proposed in Area 4 are described below for the Butlerstown Stream and the Glenmore Stream and will consist of:

5.6.1 Butlerstown Stream

South of Sarsfield GAA Club, in the Lidl supermarket parking area, it is proposed to modify the existing boundary wall to allow overland flow to discharge into the Butlerstown Stream (**C04_F01**). It is also proposed to regrade the road and footpath (**C04_R02**) within the Lidl carpark and regrade the road and footpath (**C04_R01**) along Brooklodge Grove near the entrance to Sarsfield GAA club. Refer to **Drg. No. GR_209**. Localised traffic management will be required during the works. The works area will be cordoned off and traffic management set up as required. Traffic management measures such as a stop-go system, temporary one-way traffic systems or similar will be implemented to facilitate the construction works. Traffic management and access routes will be agreed with Cork County Council, Cork City Council, An Garda Síochána and the landowners. The duration of the works will be 2-3 weeks.

It is also proposed to carry out minimal landscaping and regrading of ground levels, to facilitate overland flow from the Butlerstown stream back into the Glenmore Stream (**C05_R04**) east of Sarsfield GAA club on the L3010 at channel chainage **C05_100** approximately. Refer to **Drg No. GR_210.**

5.6.2 Glenmore Stream

The construction works required along the Glenmore stream will include the following:

- Replacement of three existing culverts along Brooklodge Grove;
- Localised deepening of the Glenmore stream channel at Brooklodge Grove to facilitate culvert replacement;
- Replacement of existing bridge at Copper Valley Vue with new reinforced concrete clear span bridge;
- Localised widening and deepening of Glenmore stream channel between Copper Valley Vue and Brooklodge Grove;
- Strengthening of an existing wall along left bank of the Glenmore Stream east and west of the M8 (New Line) overbridge and construction of new reinforced concrete flood wall along left bank of Glenmore stream west of New Line;
- Replacement of culvert beneath New Line road with a new reinforced concrete clear span bridge;

- Replacement of existing masonry walls and construction of new flood defence walls;
- In-stream works to facilitate construction;
- Removal of vegetation and trees to facilitate construction works;
- Traffic management;
- Reinstatement of boundary walls and fences;
- Landscaping and replanting of trees/vegetation on completion in agreement with landowners; and
- Once construction is completed, ongoing maintenance of the drainage scheme (Refer to **Section 5.9** below for details on maintenance).

Refer to **Drg No.'s GR_210, GR_211**, **GR_216** and **GR_217**.

5.6.2.1 Brooklodge Grove

Refer to **Drg. No. GR_211.** Refer also to **Drg. No. GR_307** which shows the cross section (**C05.1**), (**C05.2**) and (**C05.3**).

The existing wall on the left bank of the Glenmore Stream along Brooklodge Grove is to be strengthen and repaired. All drainage outfalls along the wall will be fitted with non-return valves (**C05_L01**).

It is proposed to replace the three small existing culverts, (2.32m span arch culvert, 2.95m wide by 0.68m high culvert and 2.95m wide by 0.67m high culvert) with two larger rectangular precast culverts each 5m wide by 2.06m high (**C05_B01**) along Brooklodge Grove. The methodology for culvert construction will be the same as that proposed for the Bleach Hill stream as follows:

Temporary over pumping of the Glenmore stream will be required to facilitate the construction of the culvert sections. This will enable the culvert replacement works to be carried out in the dry and will reduce the risk of siltation and or pollution entering the watercourse overall.

The instream works will be undertaken in a window from July to September (inclusive), will be carried out under the supervision of a suitably qualified and experienced ecologist and in accordance with the IFI 2016 *Guidelines on protection of fisheries during construction works in and adjacent to waters*.

Appropriate fish rescue/mitigation measures will be required (i.e. electrofishing) during flow management works. Stilling basins and other measures will be put in place in consultation with IFI. Specific mitigation measures for instream works are detailed in *Chapter 12 Hydrology and Chapter 6 Biodiversity* of the 2018 EIAR and **Chapter 6 Hydrology** and **Chapter 7 Biodiversity** of this EIAR addendum.

Works will commence by cordoning off the site and setting up traffic management as required. Traffic management measures such as a stop-go system, temporary one-way traffic systems or similar will be implemented to allow the trenches for the culverts and utility diversions to be constructed and at the same time to

manage traffic along the road. In this particular case, the culverts have been designed and detailed in short units so that installation can be phased in order to maintain one lane of traffic (including pedestrian access) at all times. To minimise traffic disruption in this location, this work will not be undertaken at the same time as the works to construct the replacement bridge at the entrance to Copper Valley Vue estate. Traffic management and access routes will be agreed with Cork City Council, Cork County Council and An Garda Síochána.

Every effort will be made to carry out the works as quickly as possible in order to minimise impacts on the residents in the area.

Once the working area is dewatered, site clearance and enabling works will be carried out to facilitate services and drainage diversions. Service diversions associated with the culvert reconstruction will be required locally.

The replacement of the existing culverts will generally be undertaken by excavating and removing the existing culverts before craning in new precast culvert units in short lengths. The foundations will be excavated down to formation level, typically 0.6m below existing level. In-situ benching will be poured in position to ensure a level foundation for placement of the skew units.

Excavated material will be transported off site to a licenced facility or stored for reuse on site, where appropriate.

Cast in-situ reinforced concrete retaining walls and head walls will be constructed upstream and downstream of the culvert to retain existing ground. The works will be carried out within the dry isolated section of river. Due to the skew nature of the culvert and the requirement to maintain one lane of traffic during construction at this location, short bespoke shaped precast skew units will be required to be installed.

A low flow channel is to be created through the eastern culvert to ensure that fish passage is maintained during normal lower flow conditions. This will be carried out by placing 600 x 600 x 200mm rough cut stone slabs in the eastern culvert section which will tie into proposed river bed levels while the western culvert bed level will be slightly elevated above this level by using deeper stone slabs of 600 x 600 x 400mm geometry. As detailed design has advanced, further detail is now available, as indicated in **Figure 5.15** below;

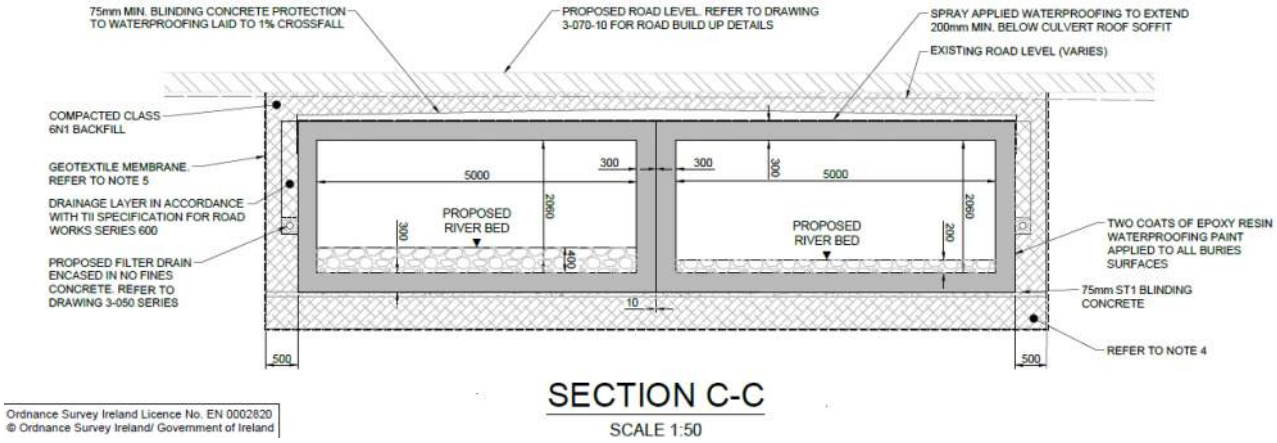


Figure 5.15 - Brooklodge Grove Typical Culvert Section Indicating Low Flow Channel

An otter/mammal ledge will also be constructed to the replacement culvert as part of the works in accordance with the TII Guidelines for the Treatment of Otters Prior to the Construction of National Road Schemes – refer to typical detail displayed in **Figure 5.11** outlined above.

Once the new culvert units are installed, the excavations will then be backfilled and road surfaces reinstated. Temporary reinstatement will take place initially after installation of the culverts with the final permanent reinstatement being undertaken approximately six months later when consolidation has occurred.

Regrading of the existing Brooklodge Grove road is required to facilitate the construction of the proposed new culvert (**C05 R01**). This includes minimum regrading and landscaping to adjoining gardens and driveways. Boundary walls/fences reinstatement and landscaping will take place in agreement with landowners.

Rock armour will be placed locally at the upstream and downstream extents of the culvert to maintain river bed integrity and protect against the risk of scour.

Immediately upstream of the proposed culvert, it is proposed to locally deepen (**C05_C01**) the Glenmore stream channel (upstream of **C05_B01**) by approximately 0.30m to facilitate the installation of the proposed replacement culvert at a lower invert level. This will encompass removal of a small existing weir in order to provide a smooth transition in bed level and to remove an unnecessary impediment to fish passage along this reach of the watercourse.

In order to avoid creation of a knickpoint due to bed gradient change as a result of removal of the existing weir, stepped pools will be created over a short length (approximately 14m) at this location (channel chainage 670 approximately). A typical schematic of this plan is indicated in **Figure 5.16** below and will provide a series of step pools to facilitate fish migration through this reach.

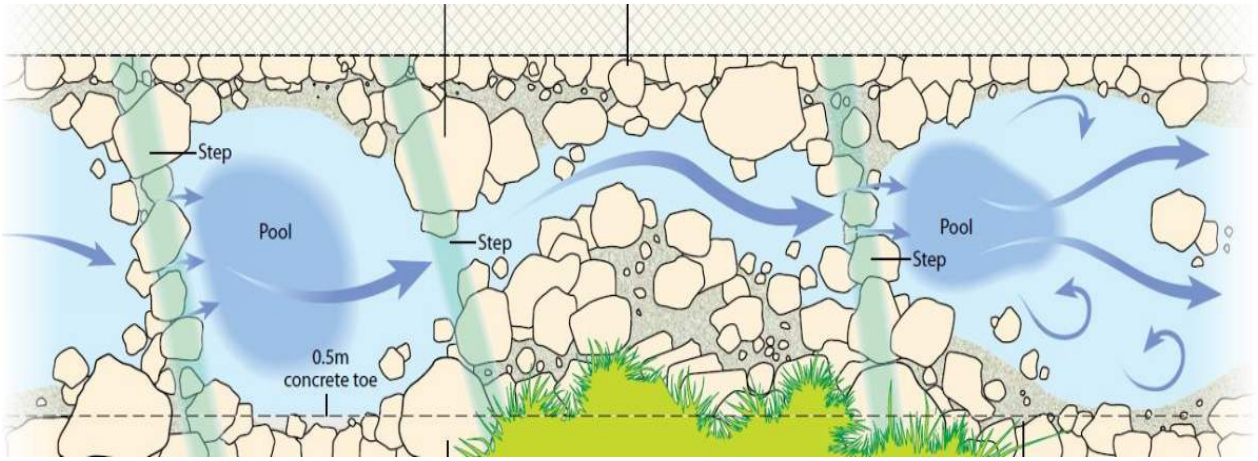


Figure 5.16 Plan of Proposed Typical Step Pool Arrangement

Downstream of the proposed culvert outlet, regrading of the river channel is proposed over an approximate 105m stretch with an average drop in bed level of approximately 0.3-0.4m over this length of channel. The left bank of the channel is proposed to be cut back and reconstructed with engineered side slopes to improve conveyance capacity of the river channel, and to facilitate the construction of a two stage channel. Erosion protection matting overlain with seeded topsoil will be installed on the grassed side slopes. Rock armour is to be placed locally at the toe of the river to ensure stability of the riverbank.

Approximately 820m^3 of material is to be removed from the riverbed and river bank at this location and either reused on site or disposed of offsite to an appropriately licenced facility. Further detail is indicated on **Figure 5.17** below which indicates the plan extent and **Figure 5.18** which indicates a typical cross section of the channel;

Figure 5.17 - Glenmore Stream Proposed Regrading Plan

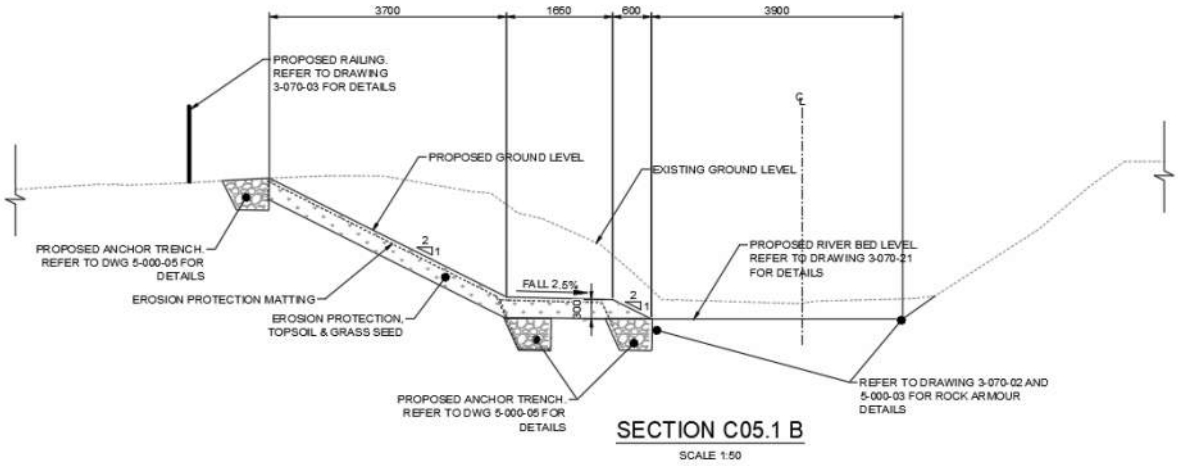


Figure 5.18 Proposed Glenmore Stream Typical Cross Section

Some trees and vegetation will require removal to facilitate the works at the culvert. The trees likely to be removed are shown in *Figure 1 (Appendix 3.2b) to Figure 5 (Appendix 3.2b)*, detailed in *Appendix 3.2* of the 2018 EIAR. Where possible, tree roots will not be pulled from the riverbank. During vegetation/tree removal, silt controls will be put in place to minimise silt escaping into the river channel and banks will be stabilised. Mitigation measures for sedimentation control are detailed in *Chapter 12 Hydrology and Chapter 6 Biodiversity* of the 2018 EIAR and **Chapter 6 Hydrology** and **Chapter 7 Biodiversity** of this EIAR

addendum. All vegetation clearance and site preparatory works will be conducted outside of the bird nesting season (1 March to 31 August inclusive) where possible. However, in the event that vegetation clearance works and/or site preparatory works are required during the bird nesting season, these will only be carried out once an advance survey has been carried out to establish whether there is any evidence of nests present, and the area proposed for clearance has been approved by a suitably qualified and experienced ecologist.

As detailed design has advanced, the requirement for a pumping station (**C05_P01**) as indicated on the Confirmation Drawings previously has been design out and so it is no longer required. Instead, surface water flow will be managed by gravity discharge. Non-return valves will be fitted to all drainage outfalls.

5.6.2.2 Copper Valley Vue

Further downstream along the Glenmore stream, at the Copper Valley Vue Estate entrance, the existing bridge will be replaced with a new reinforced concrete clear span bridge **(C05_B02)** to improve conveyance capacity. Regrading is required through this stretch of river to improve conveyance as outlined in **Section 5.6.2.1** above. The roadway entrance to Copper Valley Vue will be regraded **(C05_R02)** to allow vehicular and pedestrian traffic to access the bridge.

Temporary traffic management measures will be required at this location to facilitate demolition and construction of the replacement bridge. Alternative access to Copper Valley Vue estate will be required and will be provided through the existing green area to the east or via a 'bailey' type bridge upstream or downstream of the existing bridge location (the final details will be subject to the temporary works proposed by the contractor). As outlined previously, in order to minimise disruption to the local area, sequencing of the works is important at this location, and accordingly, the contractor will not to permitted to undertake this works package at the same time as Brooklodge Grove culvert replacement.

The Glenmore stream channel will be widened and deepened (**C05_C02**) from the proposed bridge under the entrance to Copper Valley Vue (**C05_B02**) to the proposed culvert under Brooklodge Grove (**C05_B01**). Refer to **Drg. No. GR_211**.

Works will be required to be carried out in the dry and overpumping of the channel will be required at this location. The methodology for construction the bridge will be similar to that outlined at Hazelwood Shopping Centre, except that piled bridge foundations are not required at this location.

The instream works will be undertaken in a window from July to September (inclusive), will be carried out under the supervision of a suitably qualified and experienced ecologist and in accordance with the IFI 2016 *Guidelines on protection of fisheries during construction works in and adjacent to waters*. Stilling basins and other appropriate fish control measures will be put in place in consultation with IFI. Specific mitigation measures for instream works are detailed in *Chapter 12 Hydrology and Chapter 6 Biodiversity* of the 2018 EIAR and **Chapter 6 Hydrology** and **Chapter 7 Biodiversity** of this EIAR addendum.

Some trees and vegetation will require removal to facilitate the works at the culvert. The trees to be removed are shown in *Figure 1 (Appendix 3.2b)* to *Figure 5 (Appendix 3.2b)*, detailed in *Appendix 3.2* of the 2018 EIAR. Where possible, tree roots will not be pulled from the riverbank. During vegetation/tree removal, silt controls will be put in place to minimise silt escaping into the river channel, and banks will be stabilised. Mitigation measures for sedimentation control are detailed in *Chapter 12 Hydrology and Chapter 6 Biodiversity* of the 2018 EIAR and **Chapter 6 Hydrology** and **Chapter 7 Biodiversity** of this EIAR addendum. All vegetation clearance and site preparatory works will be conducted outside of the bird nesting season (1 March to 31 August inclusive) where possible. However, in the event that vegetation clearance works and/or site preparatory works are required during the bird nesting season, these will only be carried out once an advance survey has been carried out to establish whether there is any evidence of nests present, and the area proposed for clearance has been approved by a suitably qualified and experienced ecologist.

5.6.2.3 The New Line

Further upstream on the Glenmore Stream, the stream flows through two culverts, one underneath the M8 and the other underneath the New Line. No works are proposed to the M8 culvert.

It is proposed to replace the existing culvert beneath the New Line with a new reinforced concrete clear span bridge (**C05_B03**).

In addition, it is proposed that the New Line, Brooklodge Grove and the junction between the two roads will be regraded (**C05_R05**).

Instream works will be required at this location which will involve dewatering the works area by over pumping to facilitate construction in the dry.

Appropriate environmental measures mentioned previously in this chapter (such as electro fishing etc.) will be required in order to mitigate the impact on the environment locally. The riverbed will be reinstated at a slacker gradient than existing and will improve the extent of channel from a fish passage perspective.

A full local road closure of the New Line road will be required with temporary diversions put in place by the contractor.

The instream works required will be undertaken in a window from July to September (inclusive), will be carried out under the supervision of a suitably qualified and experienced ecologist and in accordance with the IFI 2016 *Guidelines on protection of fisheries during construction works in and adjacent to waters*. Stilling basins and other appropriate fish control measures will be put in place in consultation with IFI. Specific mitigation measures for instream works are detailed in *Chapter 12 Hydrology and Chapter 6 Biodiversity* of the 2018 EIAR and **Chapter 6 Hydrology** and **Chapter 7 Biodiversity** of this EIAR addendum.

An otter/mammal ledge will be constructed to the replacement culvert as part of the works in accordance with the TII Guidelines for the Treatment of Otters Prior

to the Construction of National Road Schemes – refer to typical detail displayed on **Figure 5.11** outlined previously.

These works will require the removal of some vegetation and trees to facilitate the wall construction. Refer to *Figure 4 (Appendix 3.2b)* in *Appendix 3.2* of the 2018 EIAR.

For approximately 26m upstream of the M8, it is proposed to strengthen (point and repair) the existing wall on the left bank of the Glenmore stream (**C05_L02**). All drainage outfalls through the defence wall will be fitted with non-return valves. Refer to **Drg. No. GR_216.**

Prior to repair and repointing of the existing masonry wall, vegetation removal from the dry and wet side of the existing wall is required and is to be carried out manually. Any instream works are likely to be limited to scaffolding i.e. there is no anticipated requirement for machinery entering the channel. Repair works will involve cleaning out existing joints, infilling with matching stone and repointing the wall over the extents indicated with appropriate mortar.

Further east on the New Line, it is proposed to construct new reinforced concrete retaining walls on the left bank of the Glenmore stream (**C05_L02 & C05_L03**).

The construction of the proposed wall (**C05_L03)** will require works within the channel and will tie into the proposed adjoining replacement bridge (The New Line). The dry side of the new flood defence wall will be clad in cut sandstone, with a concrete fair faced finish provided on the wet side

The construction of the RC walls will follow traditional methods as outlined previously and will require temporary flow management works. The construction of the walls will to be carried out simultaneously with the replacement of the existing culvert under the New Line.

All drainage outfalls through the defence walls will be fitted with non-return valves.

5.7 Construction Methodology proposed for Area 5 O'Callaghan Park to Glanmire Bridge

The construction of the flood defences proposed in Area 5 are described as follows:

- Construction of reinforced concrete walls;
- Repair and repointing of existing river masonry walls;
- New surface water pumping station and associated drainage;
- Removal of vegetation and trees to facilitate construction works;
- In-stream works to facilitate construction;
- Traffic management;
- Reinstatement of boundary walls and fences;

- Landscaping and replanting of trees on completion in agreement with landowners; and
- Once construction is completed, ongoing maintenance of the drainage scheme (Refer to **Section 5.9** below for details on maintenance).

The Grove is located along the R639, just north of Glanmire Bridge. The Glashaboy River is located to the east of the Grove. A number of residential properties are located on the west side of the R639 at this location. Refer to **Drg. No**. **GR_214**.

Along the east side of the R639, it is proposed to replace an existing stretch of masonry wall with a reinforced concrete flood defence wall (**C01_L08**). All drainage outfalls through the defence wall will be fitted with non-return valves.

An uninhabited dwelling in considerable disrepair will require demolition and removal to facilitate construction at chainage **C01_2000**.

Replacement of the existing masonry wall with a new reinforced concrete flood defence wall will follow traditional methods of construction and will require temporary traffic management measures to be implemented for the duration of the construction works. As part of the existing wall at the northern most extent is located away from the Glashaboy River, works can be carried out without the need for instream works.

At the more southerly extent, an existing river wall is to be repaired by pointing and grouting of the wall at this location. This work will require a platform or scaffolding to be constructed in the river for access to the wet side of the wall. Cleaning and pointing of the wall will take place first followed by grouting. This is to ensure that grout does not flow through existing crevices and joints and inadvertently enter the watercourse and dewatered area. The contractor will be required to ensure that appropriate environmental mitigation measures are employed to minimise this risk of occurrence. This may include undertaking the works in shorter and more controllable sections.

Localised flow management will be required locally to create safe working room to point the existing wall to bed level. This may be carried out using modest interventions such as sandbagging localised areas and over pumping via stilling basins to create a dry working area.

As detailed design is advancing, further information can now be provided as presented in **Figure 5.19**. This includes reference to typical wall repairs and vegetation clearance required to carry out the proposed strengthening works.

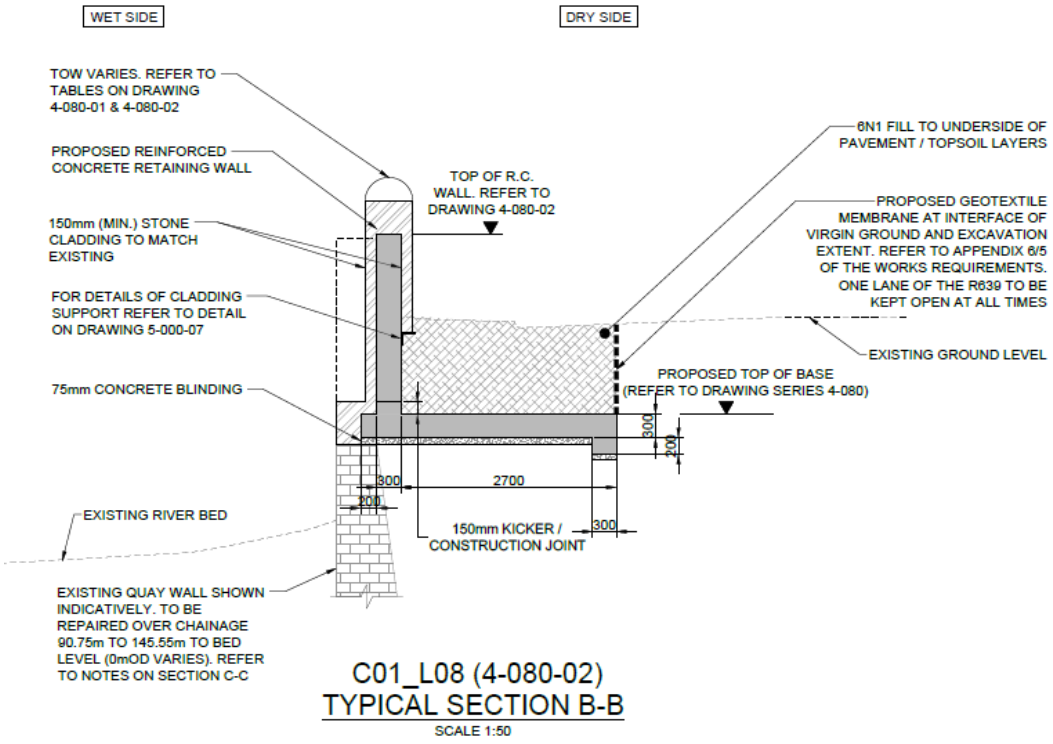
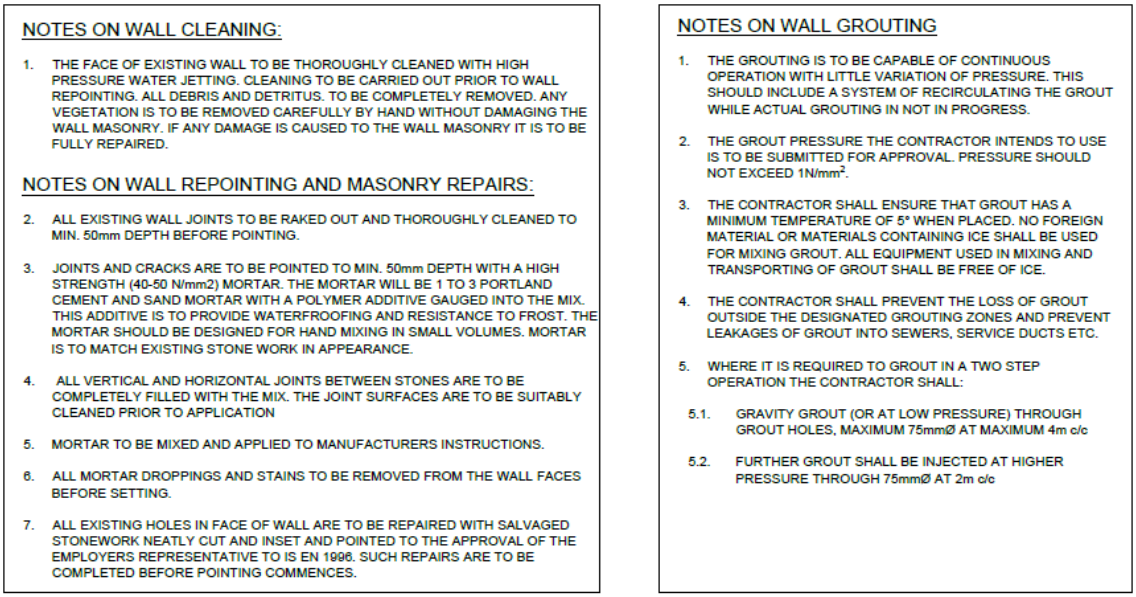


Figure 5.19 The Grove Proposed Reinforced Concrete Flood Defence Wall Typical Cross Section



NOTES ON WALL CLEANING:

1. THE FACE OF EXISTING WALL TO BE THOROUGHLY CLEANED WITH HIGH PRESSURE WATER JETTING. CLEANING TO BE CARRIED OUT PRIOR TO WALL REPOINTING. ALL DEBRIS AND DETRITUS. TO BE COMPLETELY REMOVED. ANY VEGETATION IS TO BE REMOVED CAREFULLY BY HAND WITHOUT DAMAGING THE WALL MASONRY. IF ANY DAMAGE IS CAUSED TO THE WALL MASONRY IT IS TO BE FULLY REPAIRED.

NOTES ON WALL REPOINTING AND MASONRY REPAIRS:

2. ALL EXISTING WALL JOINTS TO BE RAKED OUT AND THOROUGHLY CLEANED TO MIN. 50mm DEPTH BEFORE POINTING.
3. JOINTS AND CRACKS ARE TO BE POINTED TO MIN. 50mm DEPTH WITH A HIGH STRENGTH (40-50 N/mm2) MORTAR. THE MORTAR WILL BE 1 TO 3 PORTLAND CEMENT AND SAND MORTAR WITH A POLYMER ADDITIVE GAUGED INTO THE MIX. THIS ADDITIVE IS TO PROVIDE WATERFROOFING AND RESISTANCE TO FROST. THE MORTAR SHOULD BE DESIGNED FOR HAND MIXING IN SMALL VOLUMES. MORTAR IS TO MATCH EXISTING STONE WORK IN APPEARANCE.
4. ALL VERTICAL AND HORIZONTAL JOINTS BETWEEN STONES ARE TO BE COMPLETELY FILLED WITH THE MIX. THE JOINT SURFACES ARE TO BE SUITABLY CLEANED PRIOR TO APPLICATION
5. MORTAR TO BE MIXED AND APPLIED TO MANUFACTURERS INSTRUCTIONS.
6. ALL MORTAR DROPPINGS AND STAINS TO BE REMOVED FROM THE WALL FACES BEFORE SETTING.
7. ALL EXISTING HOLES IN FACE OF WALL ARE TO BE REPAIRED WITH SALVAGED STONEWORK NEATLY CUT AND INSET AND POINTED TO THE APPROVAL OF THE EMPLOYERS REPRESENTATIVE TO IS EN 1996. SUCH REPAIRS ARE TO BE COMPLETED BEFORE POINTING COMMENCES.

NOTES ON WALL GROUTING

1. THE GROUTING IS TO BE CAPABLE OF CONTINUOUS OPERATION WITH LITTLE VARIATION OF PRESSURE. THIS SHOULD INCLUDE A SYSTEM OF RECIRCULATING THE GROUT WHILE ACTUAL GROUTING IN NOT IN PROGRESS.
2. THE GROUT PRESSURE THE CONTRACTOR INTENDS TO USE IS TO BE SUBMITTED FOR APPROVAL. PRESSURE SHOULD NOT EXCEED 1N/mm^2.
3. THE CONTRACTOR SHALL ENSURE THAT GROUT HAS A MINIMUM TEMPERATURE OF 5° WHEN PLACED. NO FOREIGN MATERIAL OR MATERIALS CONTAINING ICE SHALL BE USED FOR MIXING GROUT. ALL EQUIPMENT USED IN MIXING AND TRANSPORTING OF GROUT SHALL BE FREE OF ICE.
4. THE CONTRACTOR SHALL PREVENT THE LOSS OF GROUT OUTSIDE THE DESIGNATED GROUTING ZONES AND PREVENT LEAKAGES OF GROUT INTO SEWERS, SERVICE DUCTS ETC.
5. WHERE IT IS REQUIRED TO GROUT IN A TWO STEP OPERATION THE CONTRACTOR SHALL:

5.1. GRAVITY GROUT (OR AT LOW PRESSURE) THROUGH GROUT HOLES, MAXIMUM 75mmØ AT MAXIMUM 4m c/c

5.2. FURTHER GROUT SHALL BE INJECTED AT HIGHER PRESSURE THROUGH 75mmØ AT 2m c/c

Figure 5.20 Typical Wall Cleaning and Repair Notes

Some trees will require removal to facilitate construction. These are shown on *Figure 5 (Appendix 3.2b)* in *Appendix 3.2* of the 2018 EIAR. Refer also to **Drg. No. GR_308** which shows the cross section in The Grove area (**C01.13**). The approach for removing trees and vegetation is the same as that proposed

elsewhere along the Glashaboy such as in **Section 5.3.2.1** above. As above vegetation removal is required to facilitate the works and it is noted that Japanese knotweed is noted to be present within the local area.

A local surface water pumping station (**C01_P05**), collector drain, manhole and rising main will be installed to operate during a flood event, when the normal gravity system cannot function. All surface water drainage outlets through the defence walls will be fitted with non-return valves.

The construction methodology for pumping stations is the same as that proposed elsewhere along the scheme such as in **Section 5.3.2.5** above.

5.8 Area 6 Downstream of Glanmire Bridge

No construction works are proposed in this area. Only channel maintenance is proposed at this location. Refer to **Drg. No. GR_215**. Channel maintenance works are described in detail within **Section 5.9** below.

5.9 Construction Works required for Future Maintenance

5.9.1 Introduction

Under Section 37 of the Arterial Drainage Act 1945 as amended, the Office of Public Works (OPW) is statutorily obliged to maintain all rivers, embankments and urban flood defences on which it has executed works since the 1945 Act, in "*proper repair and effective condition*".

Channel and embankment maintenance operations can encompass a variety of activities, including silt and vegetation management, aquatic vegetation cutting, bank protection, bush cutting/branch trimming, tree cutting, mulching, mowing and structure maintenance. Channel maintenance operations are defined as follows by the OPW (2018): *'channel maintenance operations normally involves removing the build-up of foreign or natural material that impedes the free flow of water. Predominately this consists of the removal of water-entrained silt and associated vegetation from the bed of the channel by suitably rigged hydraulic excavators. In most cases, no alterations to the bank are required and in some cases the channel is not disturbed at all if no build-up of material is present.'*

This is a responsibility of the Office of Public Works (OPW). All OPW maintenance work is undertaken in accordance with Environmental Management Protocols and Standard Operating Procedures (OPW, 2018) along with additional measures where the Standard Operating Procedures (SOPs) show deficiencies, to ensure adverse impacts on the environment are considered and minimised. OPW drainage maintenance activities will also be subject to a separate Ecological and Appropriate Assessment process to ensure no adverse impacts arise.

Future channel maintenance will apply to the Glashaboy River (Glanmire/Sallybrook) Drainage Scheme. The location of channel maintenance is

shown as general interferences on the drawings from **GR_201** to **GR_217** of the Confirmation Drawings (*Appendix 3.1* of 2018 EIAR).

Further details of maintenance activities are provided below.

5.9.2 Details of Proposed Maintenance Activities

Further detail of the proposed maintenance activities and requirements is described below and is separated into channel maintenance and flood scheme/structure maintenance. The extents of maintenance within the scheme is as outlined on the previously issued Confirmation drawings **(GR_201 to GR_217)** and has not changed since Confirmation issue.

Consultation will be required with the relevant stakeholders as necessary during the planning of these maintenance works including landowners, Inland Fisheries Ireland (IFI), the National Monuments Service (NMS), Cork County Council (CCoC), Cork City Council (CCiC), the Office of Public Works (OPW) and National Parks and Wildlife Service (NPWS) to ensure that the works are carried out with minimal environmental impact.

5.9.2.1 Channel Maintenance

A channel maintenance programme will be required throughout the reach of the watercourses impacted by the proposed works. The channel maintenance programme will pay particular attention to locations where silt, gravel and debris are likely to accumulate, such as at structures, sharp bends, culvert inlets, blockages from trees etc. At this stage, the exact nature and scale of channel and embankment maintenance work likely to be required for the Glashaboy River Drainage Scheme is difficult to predict with certainty. However, Inland Fisheries Ireland (IFI) has indicated that dredging is to be avoided in the Glashaboy River. The purpose of any channel maintenance is to ensure that the scheme elements are kept in “proper repair and effective condition”. Channel maintenance to that end will include the removal of silt/gravel build-ups and vegetation to maintain the as-designed channel cross section but this will not require removal of material below the existing bed. This removal of silts to maintain the designed cross section is not considered dredging. IFI has requested and OPW has agreed that the following measures will also be incorporated into the channel maintenance method statement:

a) This work is carried out as much as possible from the river bank without in stream tracking,
b) Any unavoidable in stream work is carried out between July and September,
c) Tree removal is limited to fallen trees or overhanging branches
d) Tree roots are not pulled from the river bank.

Other measures will include regular scheduled maintenance of the river channel and pruning of trees (including removal of tress where necessary close to the watercourse where they may be diseased or in poor condition and at risk of falling), planning and control measures. In general, channel maintenance will typically consist of the following activities:

- The channels will be monitored by means of a walkover survey from the banks on a regular basis (typically annually or in advance of a forecasted storm event where possible, and also following a significant flood event). The walkover surveys would aim to identify issues with implications for flood risk (e.g. fallen trees, excessive vegetation build-up, overgrown trees, illegal dumping, accumulation of granular deposits, blockages etc.). In-channel debris will typically be removed by a long reach excavator working from the banks. Excessive overhanging vegetation will typically be pruned back or removed by hand using a cherry picker, depending on access. In channel working would be limited to manual intervention and only when considered safe to do so and by following appropriate health and safety guidance and implementing method statements.
- Removal of build-up of foreign or natural material that impedes the flow of water within the watercourse or river channel in order to maintain the hydraulic conveyance capacity required to pass the design flood. This would include periodic removal of material within the channel by means of suitably rigged excavators or similar equipment. Where access is required to the watercourse, this will be carried out as close as practical to the area of channel subject to maintenance to minimise the length of tracking along the channel. Maintenance works are to be carried out from the bank/dry side where possible depending on flow conditions and other constraints. For example, maintenance activities to remove bed material build up would be ideally carried out during low flow periods to minimise the risk of siltation and material transport downstream. This would typically be carried out by a long reach excavator but due to space constraints within the scheme, this may not be possible within certain areas and in stream access would be required subject to health and safety grounds. Typically, this material would be deposited on the riverbanks a suitable distance away from the immediate channel subject to space constraints or may be disposed off site to an appropriately licenced waste facility.

  Typically, this would be carried out on average every 4-6 years but should be assessed on an annual basis by means of a site walkover survey. This would apply to all extents of the scheme watercourses as indicated on Confirmation Drawings **GR_201** to **GR_217**.

- Critical areas that this would be carried out include upstream and downstream of bridges, culverts and areas where local widening of the channel is proposed. Maintenance activities will include removal of fine materials. However, gravels will be left to facilitate re-establishment of any fisheries habitats. These areas are outlined in further detail as follows:

    - **Riverstown Bridge:** At the outside arches of the existing bridge and upstream and downstream of the bridge. This will also include the inside of meander bends where sediment is likely to deposit. Excavators will require local access to the channel at Riverstown Bridge at upstream and downstream access points to ensure tracking within the channel is minimised. A smaller excavator will be required to excavate material from within the existing bridge arches due to height clearance and space constraints at the bridge. Maintenance at

this location has been ongoing in the past on an infrequent basis and will be formalised post-scheme. This location is shown in **Figure 5.21**.

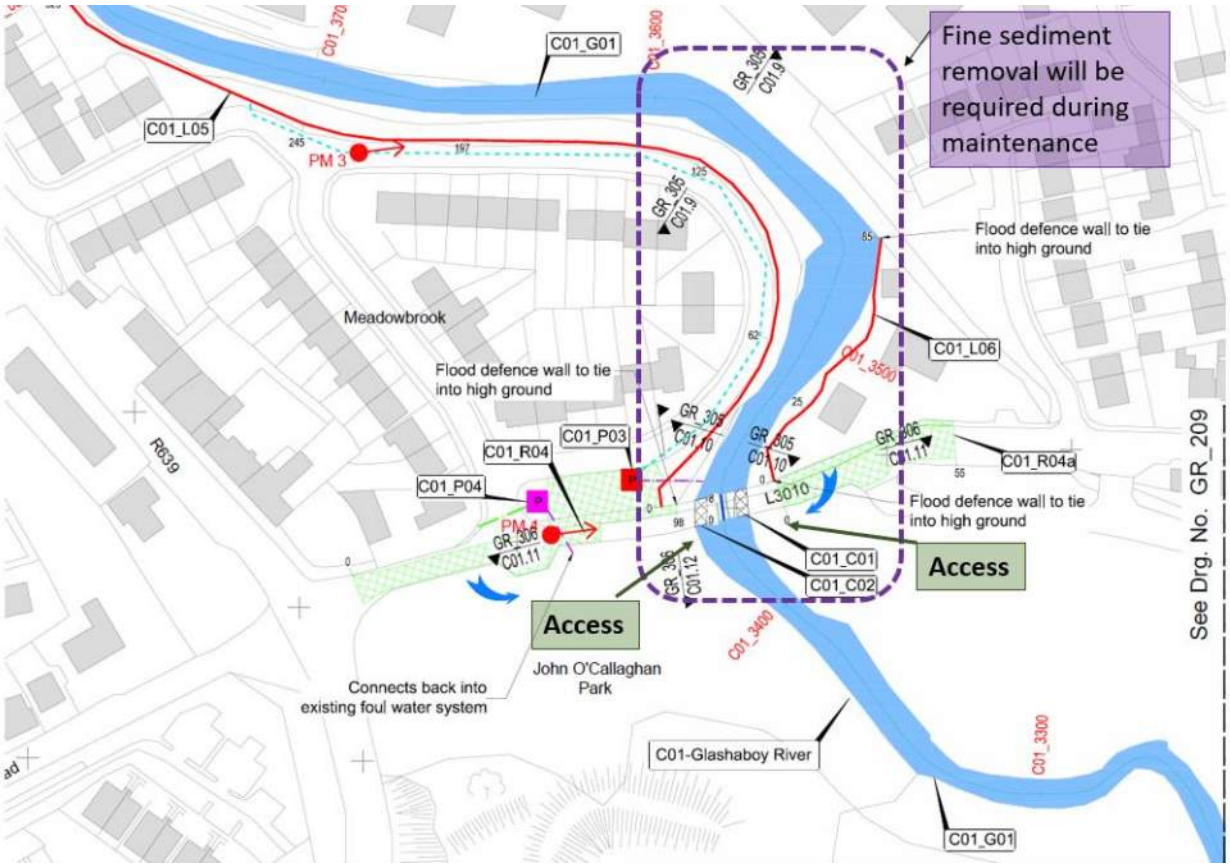


Figure 5.21 Fine sediment maintenance required around Riverstown Bridge (from Confirmation drawing GR_208)

- **John O'Callaghan Park:** Meander bends downstream of John O'Callaghan Park (south of channel chainage 3400), fine sediment removal should be completed where sediments enter from Glenmore/Butlerstown Stream confluence with the Glashaboy River. Access is to be provided via the park on the right and left banks, with maintenance operations completed via long-reach excavator. This is outlined in **Figure 5.22.**

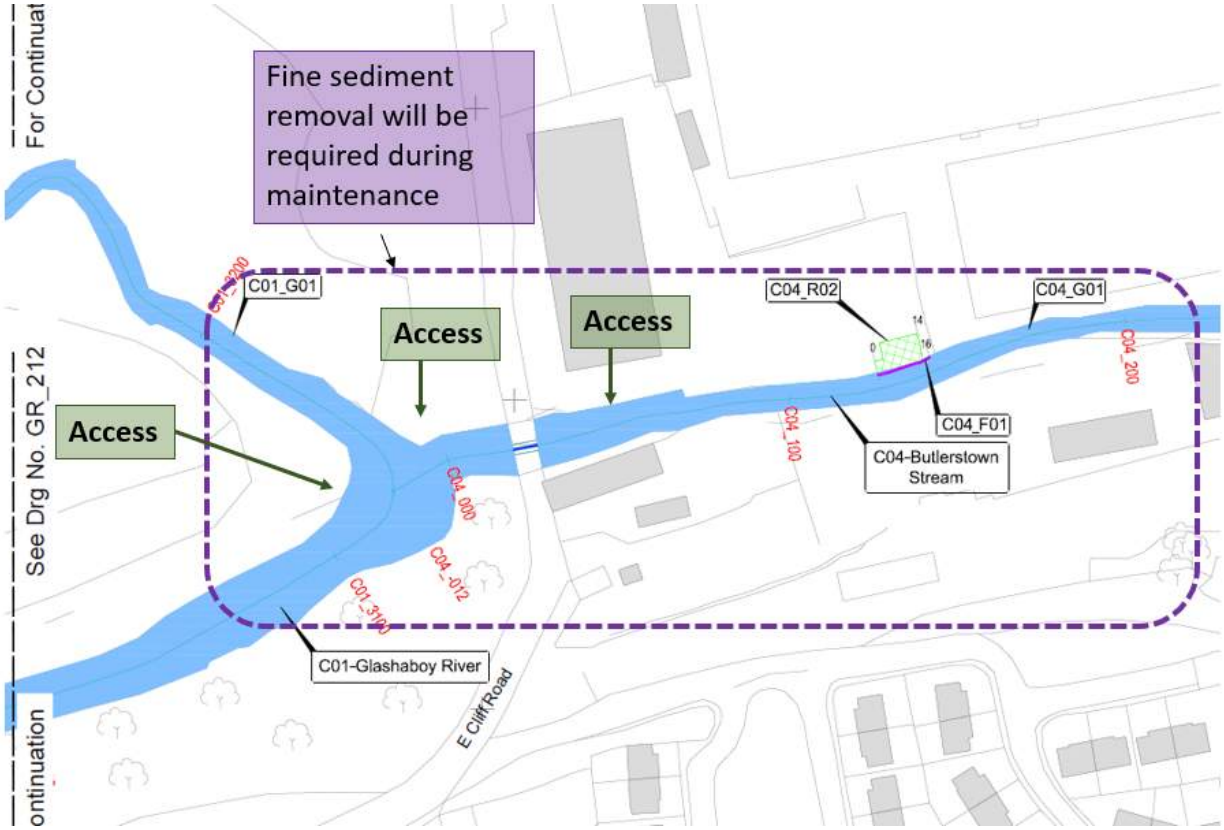


Figure 5.22 Fine sediment maintenance required through the confluence of Butlerstown Stream and Glashaboy near the John O'Callaghan Park (from confirmation drawing GR_209)

- **Glenmore Stream:** Where the Glenmore Stream channel is to be deepened and widened, particularly through the low-flow culvert, and through the upgraded Copper Vue Valley bridge. Fine sediment monitoring and maintenance will be specifically required. In addition, scour and channel incision monitoring is required upstream of the proposed bed lowering and widening. This is outlined in **Figure 5.23**.

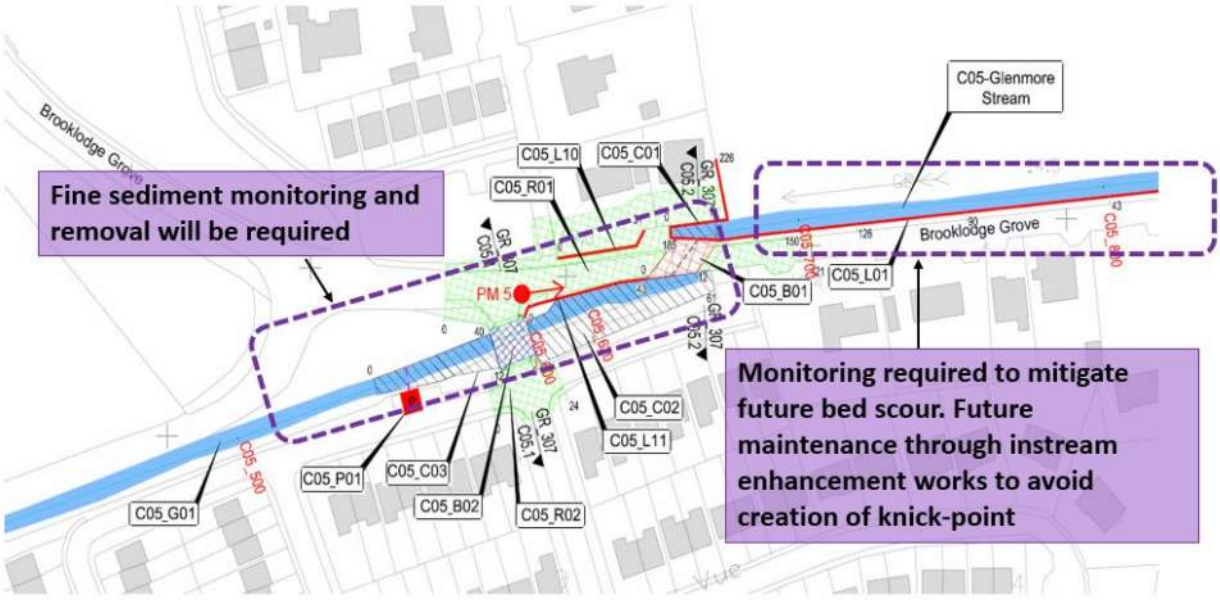


Figure 5.23 Fine sediment maintenance and scour monitoring will be required through this section of Glenmore Stream, where both deepening and widening of the channel are proposed

- **New Line Bridge** - Monitoring will be required to assess post-flood sediment transport and monitor potential effects of scour as a result of increased post-scheme velocities and altered gradient throughout this reach. Shown in **Figure 5.24.**

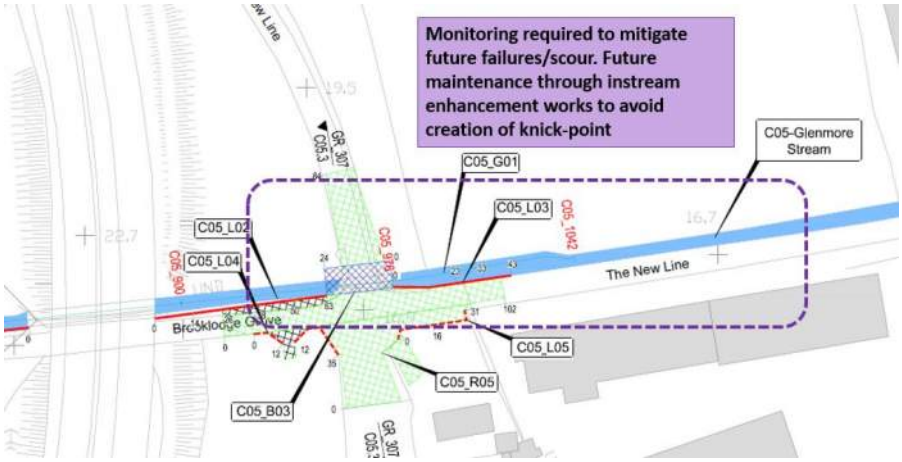


Figure 5.24 New Line Bridge - upstream monitoring of bed scour, with potential for instream enhancement if scour observed

- Be restricted to one crossing point and where feasible, traffic movements limited.
- The volume of future material to be removed from the scheme extents is difficult to predict and is dependent on the future flow regime within the river, climate change, regularity of flood events, nearby development and other factors. As outlined in the construction sections above, approximately 510m^3 and 820m^3 of material is estimated to be removed from Riverstown Bridge and the Glenmore Stream respectively as part of the permanent works (total of

1,330m^3 approximately). This build-up has occurred over a long period of little or no maintenance. Based on the judgement of the geomorphologists in the design team, it is conservatively assumed that approximately 10% of this volume of material would be required to be removed every 4-6 years (c133m^3). However, this is dependent on many factors such as vegetation control which may reduce this volume further i.e. regular vegetation control at key points within the river will likely minimise the potential for silt to accumulate (see below).

- Cutting back and removal of overgrowth and fallen trees. This prevents snagging of debris upstream or at hydraulic structures such as bridges and culverts which reduces the risk of blockages. Furthermore, removal of vegetation reduces the risk of material accumulation at these locations. This can be typically carried out by less invasive mechanical means such as using weed cutting boats or similar less intrusive equipment. During low flow events, manual intervention into the river may be possible subject to health and safety assessment and methods of working.

  Emergency removal of fallen trees may be required at intermittent periods or as required following regular inspection of the channel extent such as pre- and post-flood events. This is to be carried out during the appropriate environmental period (i.e. outside the breeding bird season) or if required as emergency works should be carried out in consultation with a suitably qualified ecologist. Approximately 100 no. trees were removed (including fallen trees) during a programme of tree removal works undertaken by Cork County Council during 2019 as part of ongoing maintenance. It should be noted that it is not known when such an extensive tree removal programme was undertaken prior to 2019.

  As a more formal maintenance programme would be in place as part of implementation of the flood scheme, it would appear reasonable to assume the need for removal of approximately 5% of that value of trees per year, i.e. circa 5 trees per year on average, from the channel maintenance extents indicated on the Confirmation Drawings. However, it is difficult to quantify with certainty as many variables will influence the number of trees removed (storm/flood events, upstream works in the catchment outside the extent of channel maintenance etc.)

- Inspection of watercourse for evidence of scour or riverbank erosion. This includes ongoing inspection of placed rock armour, erosion protection membranes, stone slabs in culverts (proposed as part of the scheme), existing river banks, existing in channel features and other in-stream features within the channel extents outlined on the Confirmation Drawings.

- Invasive species survey and treatment management plan: This includes annual survey and treatment (where required) of invasive species along the channel extent. An ongoing Invasive Species Management Plan is to be implemented as part of channel maintenance of the scheme in order to limit the spread of invasive species throughout the scheme extent. This will be a continuation of the Invasive Species Management work that has been ongoing for the last number of years during the developed of the design of the proposed Scheme.

- The following mitigation measures are to be followed during any instream works undertaken during routine in-channel maintenance described above:

1. To avoid spawning activity and minimise adverse impacts on fisheries all in-stream works will be carried out during the period of July to September inclusive (as per mitigation measures detailed in *Chapter 6 Biodiversity* of the 2018 EIAR and **Chapter 7 Biodiversity** of this EIAR addendum and IFI, 2016).
2. Silt pollution caused by working with surface water drainage networks will be minimised or prevented by working in dry conditions with water diverted during the construction period. Surface water will be managed using appropriate isolation techniques.
3. Measures to prevent the release of sediment due to run-off, will include (but not limited to) use of the use of silt fences, silt curtains, settlement lagoons, and filter materials.
4. Excavated material will be transported off site to a suitably licenced facility or stored for reuse on site where appropriate.
5. For the maintenance of culverts, machinery access to the watercourse is to be confined to a single bank, where possible to limit disturbance of ground.
6. All in-stream maintenance will be carried out under supervision of a suitably qualified and experienced ecologist and in consultation with IFI and in accordance with the IFI (2016) Guidelines on protection of fisheries during construction works in and adjacent to waters.
7. Operation of machinery in-stream is to be kept to an absolute minimum (worst case scenario of locations where it is expected instream works will be required are listed in **Chapter 7 Biodiversity** of this EIAR addendum).
8. All construction machinery operating in-stream is to be mechanically sound to avoid leaks of oils, hydraulic fluid etc. Machinery is to be steam-cleaned and checked prior to commencement of in-stream works (NRA, 2008).
9. Silt pollution caused by working in surface water will be minimised or prevented by keeping water out of the works area using appropriate isolation techniques, such as cofferdams and by-pass channels. Note, if water is diverted by over pumping, prior to commencement, it will be assessed by qualified ecologist to establish if a fish salvage operation via electrofishing under licence from the Department of Communications, Climate Action and Environment and in consultation with Inland Fisheries Ireland will be required.
10. Abstraction points are to be screened to ensure that fish and aquatic plants are not removed from waters in the abstraction process (IFI, 2016). Fish populations which become isolated during overpumping, will be salvaged via electrofishing under licence.
11. Fording of watercourses to gain access to the opposite bank is only to be considered where no alternative option exists and under approval of the IFI, and National Parks and Wildlife Service (NPWS) where species protected under the Wildlife Act, Habitats Directive or the Freshwater Fish Directive occur in significant numbers.

12. Any in-stream area (including works that run parallel to the riverbank on the 'wet side') which will be accessed by machinery must be effectively bridged prior to commencement of works.

    Where required, the temporary crossing or bridging will:

    a. Include the provision of temporary in-stream and bank-side preparation and rehabilitation of the area once the works are complete.

    b. Allow for safe crossing of the widest items of plant and equipment without cover material being dislodged and entering waters.

    c. Prevent the erosion of stream beds and banks.

    d. 'Bridge' material for machinery access be constructed of suitable material, both clean and inert, that will not give rise to silt run-off and the crossing fenced with terram or similar material to prevent wind blow carrying dusts etc. to water.

    e. Natural bank and riverbed stabilisation techniques such as willow-faggoting, stone armour, logs, conifer tops or composite protection using products such as coir-matting or geoweb can be used.

    f. Where in-stream bed material is to be removed, coarse aggregates, if present, will be stockpiled for replacement in the reformed or new channel.

    g. Provide for passage of fish and macroinvertebrates (where fording of river is required), as well as prevent erosion and sedimentation.

    h. Have capacity to convey the full range of river flows expected without the crossing being overtopped.

5.9.2.2 Maintenance of Structures and Equipment

The inspection regime will ensure that there is no deterioration in the structural integrity of the defences and other physical elements of the Scheme, which may occur for any number of reasons, e.g. as a result of a vehicular collision. It is expected that the flood defences will otherwise be relatively maintenance free.

- The structures will be monitored by means of a walkover survey from the banks on a twice yearly basis (See **Table 5.2** below). The walkover surveys would aim to identify issues with implications for flood risk (e.g. damage to structures, settlement of embankments, etc.).
- Culverts will be inspected on an annual basis and following a significant flood event. Any debris present in the culvert will be cleared by hand. A full CCTV survey and clearing of silt/sediment from the culvert is expected to take place approximately every five years. Removal of debris will be carried out as required.

Regular maintenance of the scheme elements is required and is outlined in further detail in **Table 5.2** which sets out the typical frequency required for maintenance tasks. It is noted that the scheme design life is 50 years. A simple risk matrix has been adopted to outline the probability, impact and risk of maintenance activities integral to the operation of the scheme as below.

Table 5.2 – Proposed ongoing routine maintenance

Structure/ Element	Outline Description	Frequency	Summary of Activity	Routine Maintenance Activities / Defect Resolution	Probability (High, Med, Low)	Impact (High, Med, Low)	Risk (High, Medium, Low)
Flood Defence Walls – Reinforced concrete	Structural inspection (including topographic/ level survey) and vegetation control	Annually or after flood loading or vehicle impact	Manual visual inspection (including in-channel inspection)	Repair/replacement of polyurethane joint sealant and close cell joint filler board every 20 years (typical) at movement and isolation joint locations. This would include removal of the old joint from the top of the wall (including coping) to existing ground level. The existing joint would be removed, replaced with a new joint and the local area reinstated as existing. For access to the wet side, this would involve light intervention into the channel through use of scaffolding and/or use of a cherry picker depending on access from the dry side which would negate the need for instream access. Any instream work would be carried out during the appropriate fisheries period in accordance with IFI	N/a – routine maintenance expected	N/a – routine maintenance expected	N/a – routine maintenance expected
Flood Defence Walls – Steel Sheet Piles	Structural inspection (including topographic/ level survey) and vegetation control	Annually or after flood loading or vehicle impact	Manual visual inspection (including in-channel inspection)	Repair/replacement of polyurethane joint sealant and close cell joint filler board every 20 years (typical) on the concrete capping beam at movement and isolation joint locations, as above. This work activity would typically be carried out by hand. The steel sheet piles have a design life of 50 years. Therefore, a suitable corrosion allowance in the form of section thickness loss has been accounted for through detailed design. Thus, painting of sheet piles is for aesthetic purposes	N/a – routine maintenance expected	N/a – routine maintenance expected	N/a – routine maintenance expected

Structure/ Element	Outline Description	Frequency	Summary of Activity	Routine Maintenance Activities / Defect Resolution	Probability (High, Med, Low)	Impact (High, Med, Low)	Risk (High, Medium, Low)
				only and would typically be carried out on average every 10 years or dependent on the selected paint manufacture requirements. This to be applied to both wet and dry sides of the sheet piles. For access to the wet side, this would involve light intervention into the channel through use of scaffolding and/or use of a cherry picker depending on access from the dry side which would negate the need for instream access. Any instream work would be carried out during the appropriate fisheries period in accordance with IFI.			
New/ existing masonry Walls	Structural inspection and vegetation control	Annually or after flood loading	Manual visual inspection (including in-channel inspection)	Repair of mortar joints every 20 years (typical). For existing masonry walls close to the river (i.e. The Grove), this would involve instream works (typically by hand) to remove the existing mortar to a specified depth and reinstatement with new mortar. Scaffolding within the river will be constructed or alternatively a cherry picker may be used. Appropriate flow diversion methods will be required, and appropriate environmental mitigation measures such as stray bales put in place to ensure that mortar does not enter the river channel. Works in river would be required to be undertaken during the appropriate instream period in accordance with IFI guidelines	N/a – routine maintenance expected	N/a – routine maintenance expected	N/a – routine maintenance expected
Embankments	Structural survey (including	Annual structural	Manual visual	Should localised consolidation of the embankment occur which is considered unlikely,	L	M	M

Structure/ Element	Outline Description	Frequency	Summary of Activity	Routine Maintenance Activities / Defect Resolution	Probability (High, Med, Low)	Impact (High, Med, Low)	Risk (High, Medium, Low)
	topographic/level survey) and vegetation control including regular grass mowing	survey or after flood loading with twice yearly grass/ vegetation control	inspection. Specialised embankment grass cutting machinery or appropriate plant	topping up of the embankment may be required. This would include topping up with topsoil and re-seeding. In the unlikely event that high flows may cause localised erosion of the embankment, repair would be required immediately. This would include excavating locally around the area of erosion as required and reinstating with impermeable material and replacement erosion protection membrane overlain with seeded topsoil. Should flow regimes change in future years, additional rock armour may be required at specific locations. This would involve placement from the dry side using a long reach excavator typically. Regular and ongoing site walkovers is essential in noting any changes in channel behaviour and/or geomorphological features which may impact on the stability of flood defence embankments.			
Pumping Stations (surface water)	As per manufacturer's recommendations which would include regular running of pumping stations, removal of any blockages,	Twice yearly testing	Manual inspection	Should a pump malfunction occur, a warning message will be automatically sent via the telemetry system to the scheme monitoring station. In order to investigate the issue, pumps may be physically raised from the chamber using the preinstalled rails which removes the requirement for confined space training. This maintenance activity would be undertaken away from the river/watercourse. A visual inspection	L	M	M

Structure/ Element	Outline Description	Frequency	Summary of Activity	Routine Maintenance Activities / Defect Resolution	Probability (High, Med, Low)	Impact (High, Med, Low)	Risk (High, Medium, Low)
	replacement of parts, condition assessment and repairs			would be undertaken, and pump remediation works carried out as required. Pumps on average would be required to be replaced every 20 years and it is considered normal practice for a service contract to be put in place for a pump specialist to service and maintain the pumping stations as part of the scheme operation. Regular inspection of the pumps is required and would involve raising the pumps from the chamber. All pump stations proposed as part of the scheme have a minimum of two no. pumps and the probability of two pumps or more not operating at the same time is considered extremely low due to malfunction or other issues. Should a power failure occur, generators may be brought to sight and connected to the pumping station kiosks located away from watercourse. Typical routine maintenance procedures would include regular checking of the pumping chambers and overflow manholes to remove any blockages or debris. This may be carried using suction pumps from outside the chamber without the need for confined spaces entry. All pumping stations are readily accessible and do not require entry to the watercourse.			

Structure/ Element	Outline Description	Frequency	Summary of Activity	Routine Maintenance Activities / Defect Resolution	Probability (High, Med, Low)	Impact (High, Med, Low)	Risk (High, Medium, Low)
				Test running of the pumps is typically carried out by manually filling the pump chamber with clean water from a tanker/bowser with the pumps manually switched off. The pumps are then switched on to check that each pump kicks in as required. This check also ensures that the float switches within the pumping chamber used to measure water level operate correctly. In the unlikely event that local entry to the chamber is required, this would be carried out by a suitably qualified person with appropriate confined spaces training and using a confined space permit system			
Pumping Station (Foul water – Meadowbr-ook Estate)	As per manufacturer's recommendations which would include regular running of pumping stations, removal of blockages, replacement of parts, condition assessment and repairs	Quarterly testing and typically before forecasted flood events	Manual inspection	As above. However, due to the historic foul/combined drainage flooding issues at Meadowbrook, the importance for enhanced inspection and operation of the proposed foul water pumping station at Meadowbrook is noted. This would involve more regular checking of pumps for any blockages which again is to be carried out offline away from the watercourse. It should be noted that maintenance of the foul pumping station and associated drainage network will be the responsibility of Irish Water and the local authority (Cork City Council and/or Cork County Council).	L	H	M

Structure/ Element	Outline Description	Frequency	Summary of Activity	Routine Maintenance Activities / Defect Resolution	Probability (High, Med, Low)	Impact (High, Med, Low)	Risk (High, Medium, Low)
Telemetry system and equipment	As per manufacturer's recommendations. This is to include inspection of ultrasonic gauges	Dry run at least twice yearly	Manual inspection	Regular ongoing testing of the telemetry systems which can be carried out remotely or at the pumping station kiosks. This ensures that warning signals are sent to the scheme operation centre when pump issues are detected (blockages, non-running of pumps etc.). As above, the importance of telemetry systems at proposed Meadowbrook foul pumping station is noted.	L	H	M
Riser pipework	Inspection to check for broken seals and blockages.	Quarterly and before and after heavy rainfall events	Manual inspection	Works would typically involve site walkover inspection to check for any signs of damage or blockages to outlet riser pipes. Regular painting of riser pipe work would typically be required every 5 years on average (depending on nature/type of paint used) to prevent against surface corrosion and for aesthetic reasons. Localised in stream works would be required to carry out routine maintenance operations but alternatively may be carried out from the dry side using a cherry picker or similar equipment.	L	L	L
Sallybrook Stream Culvert (tie-in to existing culvert	Inspection and removal of blockages	Annually Pre and post flood events (Sallybrook Chamber)	Manual inspection	Works would typically involve site walkover inspection to check for any signs of blockage. Debris would be removed from outside the chamber using a suction pump or similar device. In the unlikely event that local entry to the chamber is required, this would be carried out by	L	M	M

Structure/ Element	Outline Description	Frequency	Summary of Activity	Routine Maintenance Activities / Defect Resolution	Probability (High, Med, Low)	Impact (High, Med, Low)	Risk (High, Medium, Low)
underneath R639)				a suitably qualified person with appropriate confined spaces training.			
Penstock (Mill Race 03 (ref. C08), Grandons	Inspection to check for broken components or blockages. Inspection of seals. Inspection to check for full closure of penstocks.	Annually. It is noted that the scheme is designed as passive and does not require manual intervention to close penstocks in advance of a flood event. Penstock(s) are to facilitate maintenance operations only at Mill Race 03 (Ref. C08).	Manual inspection	Inspection of the penstock would be carried out manually. This would involve checking of the seals and gearing mechanism and checking for full seated closure of the penstocks. Clearance of any accumulation of silt and material from around the seals and frames would be carried out by hand. Penstocks have a design life of 25 years on average with replacement required after that. Works required to replace the penstock would include dewatering the working zone during the appropriate in-stream working period and in accordance with IFI guidelines. The penstock would be unfixed and replaced including spindles and gearing mechanisms. Once installed and checked for full seating closure, the watercourse would be reinstated as existing.	L	L	L
Non return valves	Inspection to check for broken components or blockages. Inspection of	Twice yearly	Manual inspection	Routine inspection of non-return valves is essential to the scheme operation. As a further contingency, should a proposed non-return valve malfunction or jam in the open position due to debris, a second line of defence in the form of a second non-return valve in a sealed chamber will	L	H	M

Structure/ Element	Outline Description	Frequency	Summary of Activity	Routine Maintenance Activities / Defect Resolution	Probability (High, Med, Low)	Impact (High, Med, Low)	Risk (High, Medium, Low)
	seals. Vegetation control.			be located on the dry side of the proposed flood defences. Typical inspection of non-return valves would be carried out through a site walkover or may involve use of a cherry picker to areas where access is more challenging. Typically, this would include clearing any silt or vegetation build up near the non-return valve in order to minimise the risk of blockage. Any damaged non-return valves would be replaced and may require limited temporary works in rivers. This would ideally be carried out during the appropriate instream fisheries period but may be required in an emergency situation outside of this window due to a flood event where waterborne debris was to damage the non-return valve. Typical plant to carry this would include small plant (such as a small crane or low loader) to lift the non-return valve into position (depending on size/diameter). On average, non-return valves have a design life of 25 years and would require replacement after this period.			

Structure/ Element	Outline Description	Frequency	Summary of Activity	Routine Maintenance Activities / Defect Resolution	Probability (High, Med, Low)	Impact (High, Med, Low)	Risk (High, Medium, Low)
				It should be noted that maintenance of the surface water drainage network will be the responsibility of the local authority (Cork City Council and/or Cork County Council).			
Culverts and Bridges	Inspection from access points to identify and if necessary, remove debris and reinstate stone slabs (as necessary). Structural inspection to be also carried out. (Note: Confined space and other H&S procedures required). This includes inspection of otter ledges at specific structures (Hazelwood Shopping Centre Bridge. Brooklodge Grove Culvert	Annually	Manual inspection. Long reach excavator to remove debris etc. Small excavator may be required in areas of space constraints	All proposed bridges within the scheme are integral structures and do not contain bridge bearings. Therefore, the design life of the structures is 120 years. Notwithstanding the above, bridge and culvert waterproofing has a typical design life of 25 years. To replace the waterproofing, this would involve planing of the existing surfacing every 25 years and reapplying the waterproofing as per the manufacturer's instructions. All works will be carried out from the dry without the need to enter the river channel. It is noted that, where culverts and bridges are road structures, the local authority (Cork City Council and Cork County Council) are the responsible body for structural integrity, as OPW maintenance operations typically exclude bridge deck or arch repair works on roads bridges. The river bed will require annual inspection and any areas of scour, silt build up or movement of rock armour would require mitigation works	L	H	M

Structure/ Element	Outline Description	Frequency	Summary of Activity	Routine Maintenance Activities / Defect Resolution	Probability (High, Med, Low)	Impact (High, Med, Low)	Risk (High, Medium, Low)
	and The New Line Bridge)			which would involve instream working where required but may typically be carried out using a long reach excavator from out of the watercourse. Removal of silt would be carried out during the appropriate instream period in accordance with IFI guidelines. Should a blockage occur due to a storm and/or flood event, immediate removal would be required. This may involve using a long reach excavator or rubber tracked vehicle to remove the blockage from the river bank or bridge/culvert deck. For culverts where space is confined (Sallybrook Stream, Cois na Gleann and Sprinmount Stream), a CCTV survey inspection may be carried out to negate the need for confined space entry. Anti-graffiti coatings have a design life of 25 years and would require reapplication after this period.			
Flood Relief Channel (Hazelwood)	Inspection from formal access point to identify and if necessary, remove debris and sediment build up. This includes	Twice yearly (or pre and post flood events)	Manual inspection. Small excavator and 4x4 vehicle with trailer or	The flood relief channel will require regular inspection and any areas of scour, silt build up or movement of rock armour would require clearing works. Access to the flood relief channel will be via a formal vehicular access ramp with lockable gate located to the north of Hazelwood Avenue. As the proposed flood relief channel is offline to	N/a – routine maintenance expected	N/a – routine maintenance expected	N/a – routine maintenance expected

Structure/ Element	Outline Description	Frequency	Summary of Activity	Routine Maintenance Activities / Defect Resolution	Probability (High, Med, Low)	Impact (High, Med, Low)	Risk (High, Medium, Low)
	assessment of rock armour at upstream and downstream extents of the flood relief channel		similar to remove debris etc.	the main river channel, maintenance works may be carried out outside of the instream period.			
Otter holts, bat boxes and other environmental mitigation measures	Inspection of otter holts by suitably qualified ecologist/person	Annually	Manual inspection	Low intervention measures which would be typically carried out by hand. For example, should bat boxes become damaged where they are proposed to be attached to the roof of a culvert of bridge due to a waterborne debris strike or similar, scaffolding or similar low intervention measures (ladder access) would be required during periods of low flow and in accordance with IFI guidelines.	L	L	L
Surface, foul and combined manholes	Inspection to check the seals in surface, foul and combined manholes which form part of the flood relief scheme. Inspection to check that sealed manholes operate correctly	Annually	Manual inspection	CCTV surveys would be required on average every 5-10 years. In the unlikely event that a blockage occurs, jet washing will be undertaken to remedy the issue. It should be noted that maintenance of the surface and foul water drainage network will be the responsibility of Irish Water and the local authority (Cork City Council and/or Cork County Council).	L	M	M

Structure/ Element	Outline Description	Frequency	Summary of Activity	Routine Maintenance Activities / Defect Resolution	Probability (High, Med, Low)	Impact (High, Med, Low)	Risk (High, Medium, Low)
	including inspection of locking mechanisms where required.						
Surface water drains (including petrol interceptors)	Inspection of pipes/drains and removal of any blockages. CCTV survey to be undertaken at long term periods	Annually. Full CCTV (10 year period)	Manual inspection	This would typically involve cleaning of interceptors half-yearly and would involve use of a suction pump to clean hydrocarbon residue and oils from the interceptor tank. The extracted material would be transported off site for appropriate licensed disposal. It should be noted that maintenance of the surface water drainage network will be the responsibility of the local authority (Cork City Council and/or Cork County Council).	N/a – routine maintenance expected	N/a – routine maintenance expected	N/a – routine maintenance expected
Existing channel structures (existing river walls, structures, gabion baskets etc.)	Structural inspection and vegetation control	Annually	Manual inspection	Manual inspection of existing in-channel structures to ensure that any potential issues are recorded which may require further inspection or remediation works. This is essential to avoid any blockages occurring due to bank or structure failure/slippage as a result of scour or other issues.	L	M	M

5.10 Construction Site Layout

5.10.1 Construction Access

Where possible, access to the works area will be gained from the dry (land) side of the channel to minimise impact on the watercourse. In some locations however as previously discussed, due to a constricted working area or access issues, temporary in-stream access will be required to facilitate the construction of the works from within the river channel.

The proposed construction works will generally be limited to the areas shown in **Series 5** (**Drg No.'s GR_501 to GR_503**) of *Appendix 3.1* of the 2018 EIAR. Accommodation works for landowners may take place outside these areas with their agreement. Traffic management setups will be required outside these areas on the approaches to the works areas.

In general, the public will be excluded from entering these areas during the construction period for reasons of health and safety, however, it is acknowledged that some works will be located within residential areas such as in Cúil Chluthair, Meadowbrook, Brooklodge Grove and Copper Valley Vue, where vehicular and pedestrian access will need to be maintained to the residential properties and therefore construction access to these properties will need be discussed and agreed with residents prior to construction works commencing. Temporary access routes will be required outside of the construction works areas at some locations so that construction workers and construction vehicles can access certain areas. Refer to **Series 5 (Drawing No.'s GR_501 to GR_503)** of *Appendix 3.1* of the 2018 EIAR.

It is noted that many of the linear defences will require the temporary removal of boundary walls and fences to facilitate construction access (generally parallel with watercourses). These boundary walls / fences will be reinstated on completion in agreement with the landowners.

5.10.2 Construction Compounds

A number of potential locations for the construction compounds, in the immediate vicinity of the works, have been considered.

Construction compounds will be located within the 'Indicative Extent of Works' areas as shown in Drawings **GR_501** to **GR_503**.and are shown in **Series 5** (**Drawing No.'s GR_501** to **GR_503**) of *Appendix 3.1* of the 2018 EIAR. The final selection of the compound(s) will be made by the Contractor appointed to construct the works in consultation with the OPW, Cork City Council, Cork County Council and the project ecologist. Due to the length of channel involved, the Contractor is likely to establish more than one compound or may choose to move a compound during the construction period, in which case the same selection process shall apply. Site compounds will comply with the mitigation measures identified within this EIAR.

Three no. discrete locations have been identified for set up of construction compounds;

- To the north of Sallybrook Industrial Estate within the existing open space to the east of the proposed Sallybrook flood defence embankment. Refer to **Figure 5.25** below.

Figure 5.25 Sallybrook construction compound potential location

- At the Circus Field within the existing green area located immediately north of Hazelwood Avenue. Refer to **Figure 5.26** below.

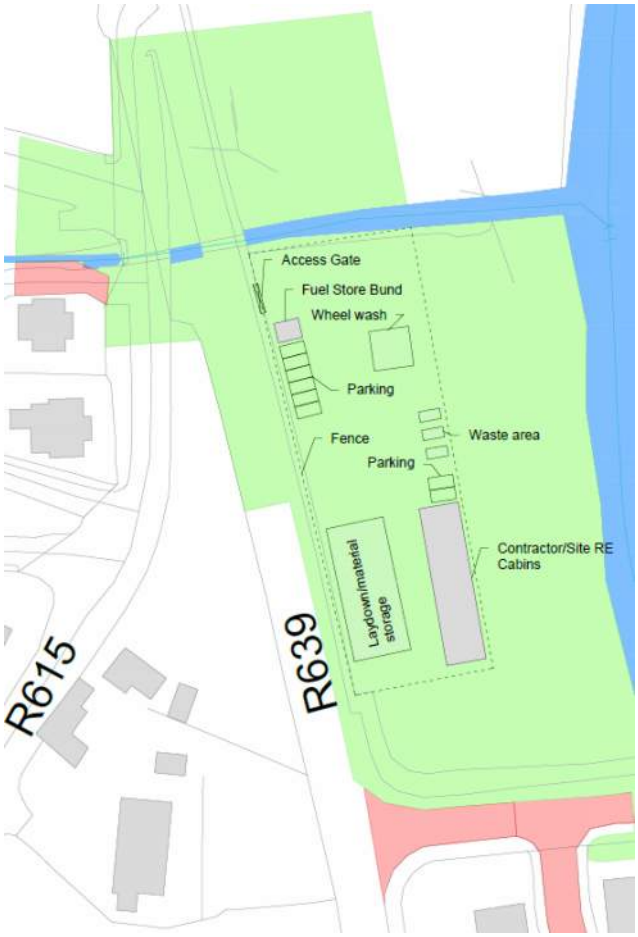


Figure 5.26 Circus Field construction compound potential location

- Within the green area at the entrance to Ashington Estate, off Brooklodge Grove. Refer to **Figure 5.27** below.

Figure 5.27 – Brooklodge Grove construction compound potential location

5.10.3 Utilities

Temporary planned utility diversions will be required in most of the working areas during the construction phase. The works are in built up areas which are serviced with utilities such as gas, water, electricity, telecoms, foul and surface water drainage etc. In particular, a gas main which currently crosses over the Glashaboy River parallel to Hazelwood Avenue Bridge will need to be buried and installed underneath the Glashaboy River. Refer to **Section 4.3.9** above for further details. The most likely impacts on utilities will be during the diversion works. It is possible that a short-term disruption to some services may occur when the diversion is being undertaken. However, it is not considered that these disruptions will result in significant negative impacts on customers. All utility diversions will be carried out in consultation with the relevant utility company. The Contractor will be required to submit diversion proposals to the relevant utility company for their approval prior to works being carried out. Refer to **Chapter 15 Material Assets** of this EIAR addendum for further details on utilities.

5.10.4 Hoarding

A site boundary in the form of hoarding or fencing or similar where appropriate (approx. 2.4m high) and of density 7kg/m2 (minimum), will be established around working areas before any significant construction activity commences.

Construction site hoarding is used to provide a secure site boundary to what can be a dangerous environment for people who have not received the proper training and are unfamiliar with construction operations.

Hoarding works will be of the same nature as that carried out for similar operations at most construction sites.

Site hoarding also performs an important function in relation to minimising some of the potential environmental impacts associated with construction, namely:

- Noise;
- Visual impact; and
- Dust minimisation.

Excavation for mounting posts for hoarding will be carried out by a mini-digger. The size and nature of the posts and hoarding will be dependent on the requirements for any acoustic mitigation as well as Contractor preference.

5.10.5 Site Lighting

Temporary construction lighting may be required at some locations especially during the winter months where daylight hours are short. Site lighting will generally be provided by tower mounted 1000W metal halide floodlights, which will be angled downwards to minimise spillage of light from the site. These will be powered by mains supplies in general. Lighting will be provided on the exterior of hoarding for walkways for public safety where required. Specific lighting requirements which are close to residential properties will be discussed with the residents and stakeholders in advance of the works commencing. Refer to

Chapter 6 Biodiversity of the 2018 EIAR and **Chapter 6 Biodiversity** of this EIAR addendum for further details.

5.10.6 Construction Compound Site Drainage

The construction site drainage within the construction compounds will be designed in such a manner so as to minimise the risk of contamination of the surrounding soil, surface water and groundwater. Rainwater run-off from the contractor's compounds will be controlled via a temporary surface water control system comprising measures such as swales (ditches) and settlement ponds (or similar system) which will minimise the risk of pollution to soil, surface water or groundwater. The temporary surface water control system will be subject to a daily visual inspection as well as routine maintenance. The inspection frequency will be increased during periods of exceptional high rainfall. Written procedures will be maintained, and a log recorded for the inspections.

The contractor facilities will contain toilets, canteen, construction containers and site office. A grease trap will also be installed at the canteen.

The disposal of sanitary effluent during construction will be via tankers to a suitable wastewater treatment facility.

Storm water will be managed carefully during construction. Any areas which will involve the storage of fuel will be paved and bunded and hydrocarbon interceptors installed to ensure no spillages will get into the surface water or groundwater.

Daily plant and machinery checks will be carried out as per contract requirements on all construction plant and machinery. Drip trays will be used both for refuelling and overnight parking and spill kits will be on hand at all times. Further details are provided below in **Section 5.15** below.

5.10.7 Construction Traffic

A detailed construction traffic management plan will be prepared by the main Contractor and agreed with Cork City Council, Cork County Council and An Garda Síochána in advance of any works taking place on site. Refer to *Chapter 14 Roads and Traffic* of the 2018 EIAR and **Chapter 14 Roads and Traffic** for further details on same.

As discussed previously, every effort will be made to carry out the works as quickly as possible in order to minimise impacts on the residents in the area. Traffic management measures such as a stop-go system, temporary one-way traffic systems or similar will be implemented to allow the construction works and utility diversions to be constructed and at the same time to manage traffic. It is proposed that the majority of the intense works on the public road will be programmed to be carried out in the summer months to avoid school traffic etc. It is not anticipated at this stage that full road closures will be required. However, if they are required, they will be for a very short duration only and will take place at night or other suitable times to minimise the impact on traffic in the area.

Traffic movement at the site will be planned to ensure traffic movements to and from site are managed efficiently and in accordance with

Health and Safety requirements. In addition, any impacts on the local environment including local residents, road users and pedestrians will be minimised.

The following provisions will be adhered to as a minimum;

- All trucks entering and exiting the site will be covered with tarpaulin;
- Adequate parking will be provided to avoid queuing at the site entrances and prevent disruption to neighbouring businesses;
- Deliveries of materials will be planned and programmed to ensure that the materials are delivered only as they are required on site. Works requiring multiple vehicle deliveries to site, such as concrete pours, will be planned so as to ensure there will no queuing on the public roadways. Deliveries will be limited to outside of peak hours;
- Trucks will not be allowed to park on the public road either outside the site or on any of the approach roads leading to the site;
- All trucks entering the site will be restricted to suitable speed limit and will be directed to the relevant area by the site manager;
- Trucks required to wait on site will switch off engines to avoid unnecessary fuel usage and noise;
- All trucks exiting the site will be required to pass through a wheel wash. All water from the wheel wash will be collected, treated to remove silt or other contaminants, and discharged via an approved discharge licence to a local water course or drainage network. A lance will be provided to clean down the bodies and sides of the truck prior to leaving site; and
- Roads outside the site will be visually inspected on a daily basis and power swept and washed as and when required.

5.10.8 Craneage

Some of the construction works will require the use of standard mobile cranes on site in order to install the pre-cast bridge and culverts.

The cranes will generally be required for the moving of building materials on site such as concrete pipes, formwork for concrete, reinforcement, precast concrete elements such as culverts and headwalls, plant and general building materials. Heavy machinery movements will be restricted to outside of peak hours.

5.11 Duration, Phasing and Employment

Construction works are expected to commence in Quarter 4 of 2021 subject to receipt of Ministerial Confirmation but may begin sooner. The proposed construction period is estimated at circa 18-24 months. The proposed construction period has been estimated to allow for poor weather over the winter months, mobilisation between sites and significant seasonal ecological restrictions, particularly with regard to bird nesting and fisheries windows. The estimated period for individual locations is presented in **Table 5.3** below.

Table 5.3: Estimated Duration of Construction Works. Refer also to *Figure 1.1* of the 2018 EIAR for location of works areas

Area of Works	General Location	Overview of Works	Estimated construction period (
1	Sallybrook Industrial Estate	Culvert replacement along Bleach Hill stream at Cúil Chluthair, direct defences (embankment & flood defence walls) along Glashaboy River, pumping station to the rear of Sallybrook Industrial Estate and provision of a new culvert at the Sallybrook stream. Flow control structure at Mill race at Grandons Garage.	50 - 60 weeks
2	Hazelwood	Culvert replacements at Cois na Gleann Stream (R615 & R639), flood defence wall along R639 and onto Hazelwood Avenue and across Hazelwood Avenue bridge. Flood relief channel and culvert parallel to Glashaboy river under Hazelwood Avenue, bridge replacement at Hazelwood Shopping Centre and flood wall along Glashaboy River, road re-grading and pumping station to the rear of the funeral home. Gas main diversion underneath Glashaboy River	32 – 40 weeks
3	Meadowbrook	Flood Walls along Glashaboy River, culvert replacement and extension along the Springmount stream (R639) and road re-grading works along Riverstown Bridge and approaches, removal of existing manhole from the bridge arch including surface water and foul pumping stations	32 – 40 weeks
4-1	Butlerstown Stream	Minimal landscaping and re-grading of ground levels, to facilitate overland flow from the Butlerstown stream back into the Glenmore Stream	3-4 weeks
4-2	Glenmore Stream	Culvert upgrades, road re-grading and new flood defence walls, channel modification flood walls along Glenmore Stream, re-grading of small area of land adjacent to Glenmore stream to facilitate overland flow	20-25 weeks
5	O'Callaghan Park to	Flood wall along Glashaboy River (parallel to R369) including repairs and strengthen to existing masonry and river wall	20-25 weeks

Area of Works	General Location	Overview of Works	Estimated construction period (
	Glanmire Bridge		
6	Downstream of Glanmire Bridge	No construction works proposed in this location. Only channel maintenance within this extent as indicated on the Confirmation drawings.	-

As discussed above, the construction works themselves will last approximately 18 to 24 months and will be subject to the following programme constraints:

- In-stream works (including preparatory work) on the Glashaboy River and its tributaries will be undertaken in a window from July to September (inclusive) and in consultation with Inland Fisheries Ireland (IFI) to avoid accidental damage or siltation of spawning beds. In-stream works associated with the drainage scheme will be carried out under the supervision of a suitably qualified and experienced ecologist. Further details are provided in *Chapter 6 Biodiversity* of the 2018 EIAR and **Chapter 6 Biodiversity** of this EIAR addendum.
- To avoid impacting on bird nesting sites, all vegetation clearance and site preparatory works will be conducted outside of the bird nesting season (1 March to 31 August inclusive) where possible. However, in the event that vegetation clearance works and/or site preparatory works are required during the bird nesting season, these will only be carried out once an advance survey has been carried out to establish whether there is any evidence of nests, and the area proposed for clearance has been approved by a suitably qualified and experienced ecologist. Specific details on removal of vegetation and trees are provided in the locations below where necessary.
- There are a number of otter holts in the vicinity of Sallybrook, Hazelwood and Meadowbrook on the Glashaboy River. Otter activity has been observed both on the Glashaboy River and on the Glenmore Stream. Consultation is ongoing with the NPWS in relation to a specific otter mitigation strategy in the form of a derogation licence for disturbance, temporary closure of holts, installation of artificial holts and seasonal restrictions of works. A derogation licence for otters from the NPWS is provided in *Appendix 6.3* of 2018 EIAR. A derogation licence for bats from the NPWS is also provided in *Appendix 6.4* of 2018 EIAR. Further details are provided in *Chapter 6 Biodiversity* of the 2018 EIAR **Chapter 6 Biodiversity** of this EIAR addendum.

The co-ordination of people and materials on site will be one of the key activities throughout the construction phase. In order to ensure that construction workers do not create undue disruption, there will be a requirement that the Contractor provide adequate site supervision to co-ordinate, monitor and implement site regulations.

Normal construction working hours will be observed. These are 08.00 – 19.00 Monday to Friday; 09.00 – 16.00 on Saturday. It may be necessary to work outside these hours, including at weekends and at night, at certain stages. Working outside normal hours may be necessitated through consideration of safety or weather and sub-contractor availability. Heavy or noisy construction activities will be avoided outside normal hours and the amount of work outside normal hours will be strictly controlled. Approval from Cork City Council and Cork County Council will be obtained for works outside normal hours.

The average number of construction personnel on site will be circa 30 personnel but this will vary depending on the construction activities required and seasonal constraints and will likely peak during the summer months when up to 50 construction personnel will be on site.

5.12 Environmental Construction Management

5.12.1 General

Every effort will be made to ensure that any detrimental environmental effects will be avoided, prevented or reduced during the construction phase of this project.

A Construction Environmental Management Plan (CEMP) has been prepared and is included in **Appendix 5.2** of this EIAR addendum**.** It will be updated and finalised by the Contractor prior to construction commencing. The CEMP comprises all of the construction mitigation measures, which are set out in this EIAR, and will be updated with any additional measures which are required by any conditions accompanying the Minister for Public Expenditure's statutory confirmation of the Scheme under the Arterial Drainage Acts.

Implementation of the CEMP will ensure disruption and nuisance are kept to a minimum. The plan has regard to the guidance contained in the handbook published by Construction Industry Research and Information Association (CIRIA) in the UK, *Environmental Good Practice on Site Guide, 4th Edition* (CIRIA 2015). The plan also has regard to the TII Guidelines for the Creation, Implementation and Maintenance of an Environmental Operating Plan.

A construction management team shall be appointed for the duration of the construction phase. This team will supervise the construction of the proposed road development, including monitoring the performance of the contractors to ensure that the proposed construction phase mitigation measures are implemented, and that construction impacts and nuisance are minimised. The construction management team will liaise with neighbours and the general community during the construction phase to ensure that any disturbance is kept to a minimum.

The Employer's Representative will have a construction management team on the project site for the duration of the construction phase which will include a project ecologist. The team will supervise the construction of the scheme including monitoring the contractors' performance to ensure that the proposed construction phase mitigation measures are implemented, and that construction impacts and nuisance are minimised. The construction management team will liaise with residents and the general community during the construction phase to ensure that any disturbance is kept to a minimum and to ensure that all anticipated nuisances are minimised and that the construction activity will have the lowest possible impacts on the residents and other properties.

5.12.2 Site Tidiness

The following are some of the measures that will be taken to ensure that the site and surroundings are maintained to a high standard of cleanliness:

- Daily site inspections will be undertaken to monitor site tidiness;
- A regular programme of site tidying will be established to ensure a safe and orderly site;

- Scaffolding will have debris netting attached to prevent materials and equipment being scattered by the wind;
- Food waste will be strictly controlled on all parts of the site.
- Mud spillages on roads and footpaths outside the site will be cleaned regularly and will not be allowed to accumulate;
- Wheel-wash facilities will be provided for vehicles exiting the site; and
- In the event of any fugitive solid waste escaping the site, it will be collected immediately and removed to storage on site, and subsequently disposed of in the normal manner.

5.13 Construction and Demolition Waste Management

Where waste material is generated on-site, including excavation material deemed unsuitable for re-use, it will be managed in accordance with the Construction and Demolition Waste Management Plan (C&D WMP). The C&D WMP has been prepared and is presented in **Section 7** of the **Construction Environmental Management Plan** (CEMP) in **Appendix 5.2** of this Addendum.

5.13.1 Excavation Material

The proposed works will require excavation to facilitate the flood relief elements. These works will generate approximately 48,800m^3 of material in total across all works. Excavated material as part of the construction works will generally consist of riverbank material, topsoil, subsoil and made ground.

It is anticipated that a significant amount if this excavated material will be uncontaminated soil and suitable for reuse on site. Where there is no on-site use for uncontaminated material generated on site, this material will need to be removed off site where the following options will be available to the Contractor:

- Re-use as a by-product on other sites subject to Article 27 under the Waste Directive Regulations 2011 (S.I. No. 126 of 2011) and EPA criteria1;
- Recovery at suitable waste permit facilities or licensed soil recovery facilities in accordance with relevant waste legislation; or
- Disposal at suitable authorised waste facilities.

Should soil containing Japanese knotweed or other non-native invasive plant species be excavated from site, it will be treated and managed in line with the appropriate remediation measures as described in **Appendix 5.1 Invasive Species Management Plan** of this addendum**,** to prevent the spread of non- native invasive species. It is estimated that approximately 1,600m^3 of the total excavation volume (approx. 48,800 m^3) will contain invasive plant material. This figure (1,600m^3) increases to approximately 5,800m^3 when a 7m radial zone of influence for rhizomes in applied laterally to the surveyed extent of the knotweed plants recorded. The extent of knotweed across the works area is based upon the

[1] EPA (2019) Guidance on Soil and Stone By-products, available at: http://www.epa.ie/pubs/advice/waste/product/Guidance_on_Soil_and_Stone_By_Product.pdf

2019 invasive species survey reports carried out by Japanese Knotweed Ireland Ltd, which is included in **Appendix 5.1**.

- Where any infested material (soil containing Japanese Knotweed) is to be taken off site, a license to transport the material will need to be sought from NPWS.
- A permitted landfill will need to be sourced to deposit excavated material which can accept such material. The landfill site operator will need to be informed of what the material contains.

5.14 Materials Source and Transportation

In so far as is feasible, all construction materials will be sourced from local suppliers if these are available within the Cork area. The selection and specification of construction materials will be informed by local availability of these materials. Within the necessary constraints of performance, durability and cost, construction materials will be sourced from local suppliers and manufacturers, where possible. The coordination and logistics of construction traffic will be captured within the construction traffic management plan which will be agreed with Cork City Council, Cork County Council and An Garda Síochána.

5.15 Construction Safety

As required by the Safety, Health and Welfare at Work (Construction) Regulations 2013, a Health and Safety Plan will be prepared which will address health and safety issues from the design stages through to the completion of the construction and maintenance phases. This plan will be reviewed as the scheme progresses. The contents of the Health and Safety Plan will comply with the requirements of the Regulations.

The Regulations require the developer of a project to appoint a “Project Supervisor Design Process” (PSDP) and “Project Supervisor Construction Stage” (PSCS). Cork County Council has appointed Arup as PSDP in accordance with the current legislation.

The PSDP will assemble the Safety File as the project progresses. The Safety File will be incorporated into the overall technical record system at the end of the project.

Safety on site will be of paramount importance. During the selection of the contractors and subcontractors, their safety records will be investigated. Only contractors with high safety standards will be selected.

Prior to working on site, each individual will receive a full safety induction and will be provided with all of the safety equipment relevant to the tasks the individual will be required to perform during employment on site.

Safety briefings will be held regularly and prior to any onerous or special task. ‘Toolbox talks’ will be held to ensure all workers are fully aware of the tasks to be

undertaken and the parameters required to ensure the task will be successfully and safely completed.

All visitors will be required to wear appropriate personal protective equipment prior to going on to the site and will undergo a safety briefing by a member of the site safety team.

Regular site safety audits will be carried out throughout the construction and the complied with at all times.

At any time that a potentially unsafe practice is observed, the site safety manager will have the right as well as the responsibility to halt the work in question, until a safe system of working is again put in place.

Appropriate site personnel will be trained as first aiders and fire marshals. In addition, appropriate staff will be trained in environmental issues and spill response procedures. Tanks and drums of potentially polluting materials will be stored in secure containers or compounds which will be locked when not in use. Secure valves will be provided on oil and fuel storage facilities. Equipment and vehicles will be locked, have keys removed and be stored in secure compounds.

The Main Contractor will be required to maintain an emergency response plan which will cover all risks i.e. fire, flood, collapse etc.

In preparing this plan the Contractor will be required to liaise with the emergency response services.

In addition to the above, the Contractor will be required to prepare a working with Covid 19 plan to ensure that appropriate safety and workplace measures are implemented for site personnel and visitors to site.

5.16 Community Liaison During Construction

Effective community liaison is essential in order to help ensure the smooth running of construction activities and in relation to residents and public welfare. Important key issues in ensuring good relations are:

- Availability of information for the public during the construction phase, (particularly nearby sensitive receptors);
- Having the correct points of contact and being responsive;
- The need for good housekeeping in all aspects of the operations;
- Due to the nature of construction works it is essential to operate ‘Good Neighbour’ policy in so far as possible. Key aspects of this policy include:
- Early implementation of the policy, i.e. from the commencement of construction;
- Reduction of nuisance factors;
- Access to amenity areas, walkways and cycle paths and for neighbouring premises;
- Clear and concise information; and

- Undertaking timely liaison with stakeholders.

A Community Liaison Officer (CLO) will be appointed by the contractor who will coordinate communications and liaise with the local community during the construction phase.

A Community Liaison Plan will be prepared, which will include details of how the local community, road users and affected residents will be notified in advance of the scheduling of major works, any temporary traffic diversions and the progress of the construction works.

This plan will typically include details of the following:

- Contractor's community relations policy;
- Personnel nominated to manage public relations (Community Liaison Officer, CLO;
- A methodology for processing observations, queries and complaints from the general public, relevant authorities, the media, emergency services and the like; and

The strategy for project wide liaison with all relevant parties.

Cork County Council's construction supervision team will also take an active role in community liaison and will work in close collaboration with the CLO.

5.17 Construction Site Decommissioning

On completion of construction, all construction facilities and equipment such as plant, materials, signage, contractors' offices and laydown areas, etc. will be removed from site.

Temporary entrances will be removed, boundary walls, fences and all roads reinstated as necessary. Construction site fencing will be removed and landscaping/replanting will be completed.

A full list and description of the RFIs are presented in **Table 1.1** in the **Chapter 1 Introduction** to this addendum.

Appendix C

Invasive Species Management Plan

Cork City Council, Cork County Council and Office of Public Works

Glashaboy River (Glanmire and Sallybrook) Drainage Scheme

Invasive Species Management Plan

EIAR Addendum Appendix 5.1

Issue | October 2020

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Contents

Appendices

1 Introduction

Invasive plant species have been identified and documented within proposed works areas that are included in the proposed Glashaboy River (Glanmire and Sallybrook) Drainage Scheme.

An Outline Invasive Species Management Plan was submitted as *Appendix 4.1* of the 2018 EIAR. Since 2018, the treatment of invasive species within the scheme has progressed and this Invasive Species Management Plan replaces the 2018 Plan (2018 EIAR *Appendix 4.1*) and is presented as **Appendix 5.1** of the EIAR Addendum and will be included in Construction Environmental Management Plan in Appendix 5.2 of the Addendum.

While other invasive plant species have also been identified in the area, such as Himalayan Balsam (*Impatiens glandulifera*) and White Heliotrope (*Petasites fragrans*), Japanese knotweed is of primary concern for the structural integrity of these proposed flood works and for the designated sites downstream, therefore the focus of this report is on the prevention of the spread of knotweed. However, the same principles will apply to other invasive species.

This Invasive Species Management Plan (ISMP) outlines the strategy that will be adopted during the construction and operation of the drainage scheme in order to prevent the spread of the Knotweed and other invasive species. This report will outline the steps that will be taken during construction and operation of the scheme. The ISMP is a working document. Following the appointment of the Employer's Representative and the Contractor, and prior to commencing works on site, the ISMP will be further developed by the Contractor's Ecologist.

The main objective of the ISMP for the scheme will be to:

- Prevent the spread of Japanese knotweed and other invasive species during the construction phase.
- Manage the growth of Japanese knotweed adjacent to flood defences so as to protect the integrity of the structures from the impacts of Japanese knotweed.
- Prevent the spread of Japanese knotweed during channel maintenance works in the future.

2 Methodology

This report applies the most relevant and current guidance in relation to the treatment and management of invasive plant species in construction projects. The following literature was referred to in preparation of this report.

- NRA Guidelines on The Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads (2008)
- Managing Japanese knotweed on development sites - The Knotweed Code of Practice produced by the Environmental Agency (2013)
- Best Practice Management Guidelines Japanese knotweed *Fallopia japonica*, Invasive Species Ireland (2015)

3 Legislation

The control of invasive species in Ireland comes under the Wildlife (Amendment) Act 2000 where it states that

'*Any person who— [...] plants or otherwise causes to grow in a wild state in any place in the State any species of flora, or the flowers, roots, seeds or spores of flora, ['refers only to exotic species thereof'][...] otherwise than under and in accordance with a licence granted in that behalf by the Minister shall be guilty of an offence*.'

Under the European legislation, the Birds and Natural Habitats Regulations 2011 (SI 477 of 2011) , Section 49(2) prohibit the introduction and dispersal of species listed in the Third Schedule (including Japanese knotweed) whereby "*any person who plants, disperses, allows or causes to disperse, spreads or otherwise causes to grow [….] shall be guilty of an offence."*

4 Invasive Species in the Study Area

The initial invasive species survey of the works area was undertaken in 2016 by Dixon Brosnan. These survey documents have been superseded with time. Since then advanced treatment works of Japanese knotweed has progressed. Since 2017, Japanese Knotweed Ireland (JKI) has been appointed by Cork County Council and has carried out surveys and advanced treatment works of the affected scheme areas. The most recent invasive species treatment works carried out on the Study Area were in September 2020 by Japanese Knotweed Ireland.

The following JKI reports are appended to this ISMP:

- JKI (2017) Survey Drawings 2017 (**Appendix A**)
- JKI (2019) Glashaboy FRS Japanese Knotweed Advanced Treatment Works – Treatment Report 2019 (**Appendix B**)

The 2020 treatment report by JKI was not available at the time of preparing this ISMP however the appointed Contractor will be able to request the most recent invasive species reports from Cork County Council.

During ecological site walkovers undertaken by JBA in September 2020, an occurrence of Himalayan Balsam (*Impatiens Glandulifera*) was also observed near John O'Callaghan park, in the southern part of the scheme. The location of the stand was close to the bridge at the L2999, just north of Monkey Maze at Glanmire. Refer to Figure 1 below from EIAR Addendum Chapter 7 Biodiversity.

While other invasive plant species were also identified, such as Himalayan Balsam (*Impatiens glandulifera*) and White Heliotrope (*Petasites fragrans*), Japanese knotweed is of primary concern for the structural integrity of these proposed flood works, therefore the focus of this report is on the prevention of the spread of knotweed.

Japanese knotweed is present in many areas within the Glashaboy catchment however for the purposes of this scheme, an Invasive Species Management Plan (ISMP) will only be put in place within the footprint of the construction works.

The key times during the scheme when the ISMP will be put in place will be during the construction and operation phases for the prevention of the spread of Knotweed during the works, management of Knotweed containing material during excavation works, the protection of flood defence structures and preventing the spread of Knotweed during channel maintenance activities by the OPW.

The drawings appended to the end of this report show the locations of invasive species, including Japanese Knotweed within the works area during the 2017 JKI survey in **Appendix B**.

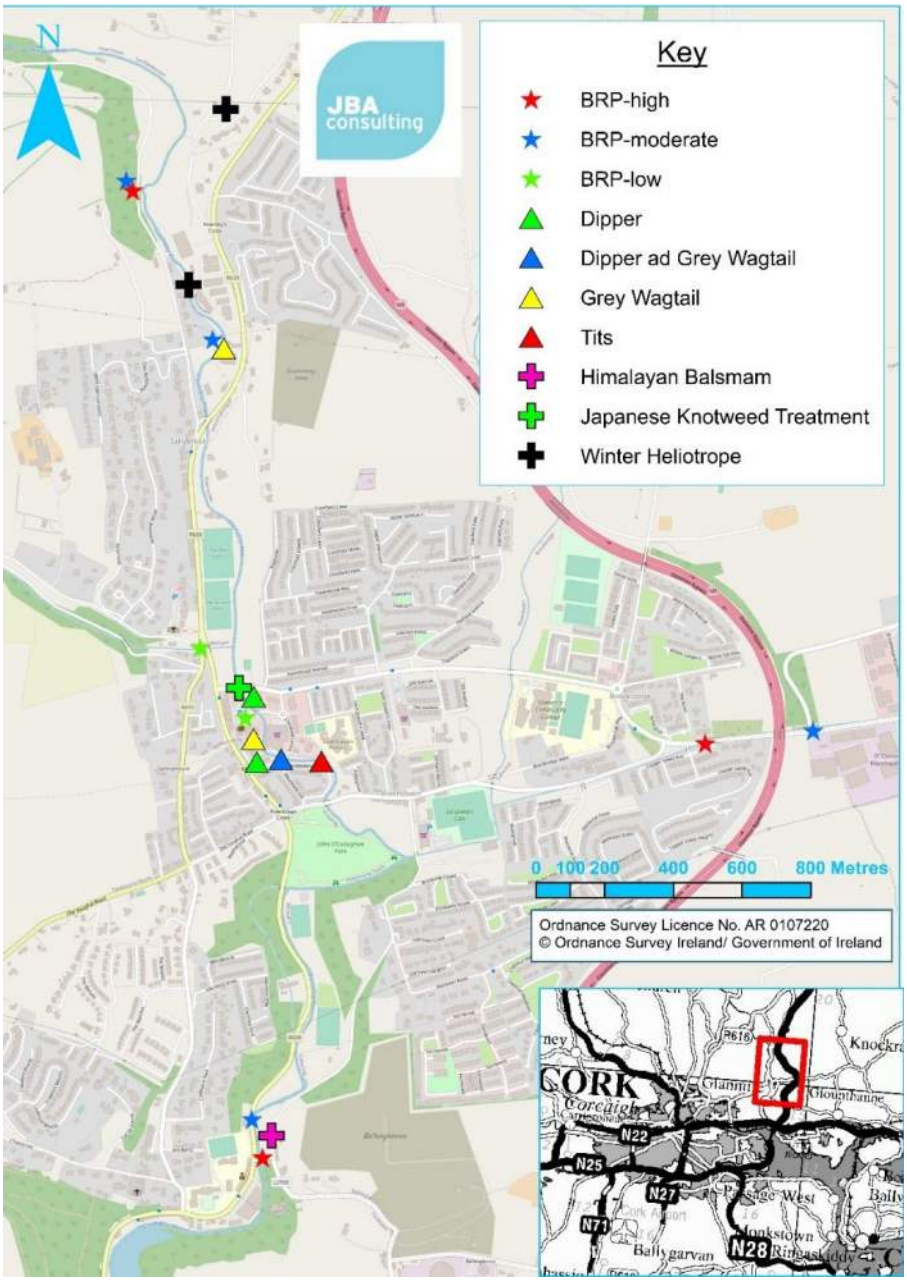

Figure 1 Locations of invasive plant species noted during the ecology site walkovers in September 2020.

5 Japanese Knotweed Management Plan During Construction Phase

The contractor will be required develop a Japanese Knotweed Management Plan prior to construction activities commencing. This purpose of this plan will be to:

- Identify the extent of the infestation on the site
- Ensure further growth and spread of the plant on the site does not occur,
- Ensure the plant is not spread to other sites either adjacent to the infested site or through transportation of contaminated soil to another site
- Identify the best method for managing and controlling Japanese knotweed on the site with regard to the proposed site works and construction methods
- Communicate the plan to all site operatives to ensure success of the plan
- Document and record the treatment and management methods carried out on site for future reference (future site owners, site users, avoid litigation etc.)

The plan shall be completed by a suitably qualified ecologist, made as simple as possible and should contain the following:

- Site background including proposed works
- Extent of the Japanese knotweed infestation
- Specific control plan to be put in place
- Site hygiene protocols
- Responsible individuals
- Follow up requirements
- Any other relevant information

Where flood relief structures are proposed at sites that contain Knotweed, root barrier membranes will be installed to protect the structures from the plant. The design of these membranes will form part of the detailed design stage.

Site hygiene protocols, like those listed in **Section 5**, will need to be implemented on all works sites.

5.1 Management Options

There are a number of management options that may be taken to control and prevent the spread of Japanese knotweed. In consultation with a qualified ecologist, the contractor will decide upon a suitable methodology. The proposed management plan will need to be agreed with the National Parks and Wildlife Service (NPWS), Inland Fisheries Ireland (IFI) and Cork County Council prior to the works being carried out. It should be noted that:

- Where any infested material (soil containing Japanese Knotweed) is to be taken off site, a license to transport the material will need to be sought from NPWS.

- A permitted landfill will need to be sourced to deposit excavated material which can accept such material. The landfill site operator will need to be informed of what the material contains.
- Where herbicide treatment will be used, consideration must be made as to where the herbicide will be located, the proximity to watercourses and other vegetation.
- For all management plans, site hygiene protocols will need to be implemented. These protocols should include sites which are infested with Knotweed and those where Knotweed is not growing to prevent contaminated material being brought to site. Site hygiene protocols are outlines in **Section 5.2** below.

Figure 2 provides an example of a simple flow chart that may be used in the process of forming a management plan.

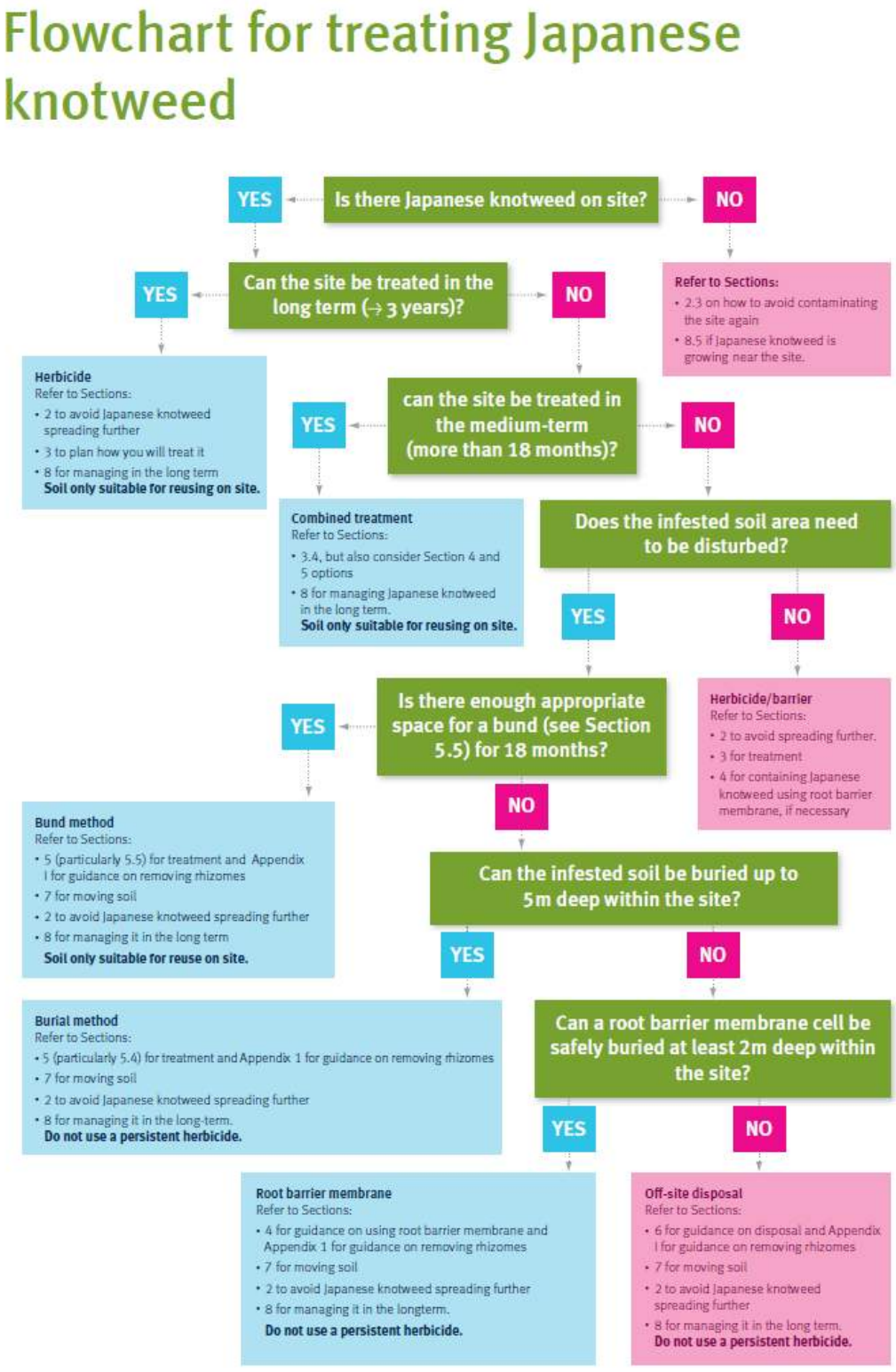

Figure 2 Flowchart for treating Japanese knotweed (Environment Agency, 2013).

5.2 Advance Treatment Works

As mentioned previously, advance chemical treatment works on the Knotweed species have commenced. The latest treatment works were in September 2020 by Japanese Knotweed Ireland Limited.

The most recent available Treatment Report from Japanese Knotweed Ireland (August 2019) is attached to **Appendix B** of this report. The specific treatment method is decided on a site by site basis. Details on the advance treatment (such as treatment locations, treatment methodologies etc) will be made available to the main Contractor before the construction works commence.

5.3 Site Hygiene

Maintaining site hygiene at all times in a Japanese knotweed affected area is essential to prevent further spread. It is also necessary on sites where Japanese Knotweed is not present but where there is risk of contaminated material being brought to site, for example, site machinery being used on multiple site, construction staff travelling between infested and not infested sites. Preventative measures must be taken. Construction equipment, vehicles and footwear may provide a vector for the spread of Knotweed.

The following site hygiene measures should be taken for each site where applicable:

- Understand the possible extent of the rhizome (root) system underground – up to 7m horizontally and 3 meters vertically.
- Where possible avoid the infested area and fence it off or clearly mark off the rhizome extent.
- Avoid if possible using machinery with tracks in infested areas.
- Clearly identify and mark out areas where contaminated soil is to be stockpiled on site and cannot be within 50m of any watercourse or within a flood zone.
- Create designated entry and exit points for operators on foot and for small mobile equipment. A delineated access track to be maintained free of Japanese knotweed should be established through the site to minimise the spread of Japanese knotweed by permitted vehicles accessing the site.
- Installation of a dedicated footwear & vehicular wheel wash down facility into a contained area within the site.
- Vehicles leaving the site should be inspected for any plant material and washed down into a contained area.
- Vehicles used in the transport of contaminated material will need to be visually checked and washed down into a contained area before being used for any other work, either on the same site or at a different site.
- Material gathered in dedicated wash down contained areas will need to be appropriately treated along with other contaminated soil on site.
- For any material entering the site, the supplier must provide an assurance that it is free of Japanese Knotweed.

- Ensure all site users are aware of measures to be taken and alert them to the presence of the Japanese knotweed Site Management plan.
- Erection of adequate site hygiene signage in relation to the management of non-native invasive material.

5.4 Management Options

In addition to the advance treatment works and pre-construction survey, when the works areas become available to the Contractor for fencing and commencement of site clearance, areas identified as requiring specific treatment will be demarcated and the designated control measures implemented at the earliest possible stage to reduce the risk of spread along the proposed scheme or beyond the land take.

There are a number of management options that may be implemented to control and prevent the spread of invasive species. These are presented in the sections below. It is also noted that it may not be possible to completely eradicate the invasive species before or during the construction phase. For example, where structures are proposed at sites that contain Japanese Knotweed, root barrier membranes may require to be installed to protect the structures from the plant. The design of these membranes will form part of the detailed design stage.

It should be noted that those involved in the application of herbicides/pesticides must be competent to do so and, consequently, must have sufficient training, experience and knowledge in the area of herbicides/pesticides application.

It is important that all staff involved in the application of herbicides/pesticides have received appropriate training, which may include achieving competency certification in the safe use of herbicides/pesticides through a National Proficiency Tests Council registered assessment centre or achieving an appropriate FETAC award in this area.

Given the constraints of the physical site boundaries and flooding risks in the area, it is likely that chemical treatment, as described in Section 5.4.1, will be the most suitable method for the identified invasive species.

5.4.1 Chemical treatment

The control of some species will require the use of herbicides (if not buried), which can pose a risk to human health, to non-target plants or to wildlife. In order to ensure the safety of herbicide applicators and of other public users of the site, a qualified and experienced Contractor will be employed to carry out all work. It is advised that the Contractor refer to the following documents, which provides detailed recommendations for the control of invasive species and noxious weeds:

- Chapter 7 and Appendix 3 of the TII Publication: The Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads (NRA, 2010)
- Invasive Species Ireland Best Practice Management Guidelines for Japanese Knotweed (2015)

- The Knotweed Code of Practice: Managing Japanese Knotweed on development sites (UK Environment Agency, 2013)

These documents include measures to aid the identification of relevant species, with details for the timing, chemicals and methodology for chemical control, and for measures to avoid environmental damage during the use of herbicides.

Chemical treatment involves the application of an herbicide to invasive species plant such as Japanese Knotweed stands without any excavation or removal of the plant material. The preferred types of herbicides to be used in the treatment of Knotweed are Glyphosate and 2,4-D Amine. Generally, if herbicide is applied as the treatment option, it will need to be reapplied for up to five years after the first application to ensure the plant control measures have been effective, or monitored for a minimum of two years during which no regrowth is recorded.

Glyphosate is non-persistent and can be used near water but it is not selective (i.e. it is a broad spectrum chemical - will impact all plant species) whereas 2,4-D Amine, can be persistent for up to one month, can also be used near water but is more selective on certain plants. The selection of chemical will depend on the site conditions, proximity to water, surrounding habitats etc.

The most effective time to apply Glyphosate is from July to September (or before cold weather causes leaves to discolour and fall). The majority of herbicides are not effective during the winter dormant stage because they require living foliage to take up the active ingredient. It is essential that a competent and qualified person carries out the herbicide treatment.

Reapplication rates will depend on site specific considerations including the extent of the infestation, its location, and the time of year treatment commences. Details of the proposed chemical treatment plan will be required in the site-specific invasive species management plan.

Foliar treatment (spraying) is usually applied with a sprayer such as a knapsack sprayer or a larger spray system. It is important to use a treatment dye to identify clearly all areas treated. It is an efficient way to treat large monocultures of invasive plants, or to spot-treat individual plants that are difficult to remove mechanically such as Japanese Knotweed.

In the case of Knotweed, depending on weather and temperatures in the days following the initial treatment, and to ensure optimal uptake of herbicide into the rhizome system, a second similar treatment will be required usually within ten days, before the internal vascular system is no longer capable of translocating the herbicide to the root system. While the upper surface of the leaves will be easier to treat, it is also important to treat the leaf under surface as Knotweed possesses many stomata openings on the leaf under surface. Dead stems should be cut, removed and burned on/off site in accordance with the Waste Management Acts 1996 as amended and the Waste Management (Prohibition of Waste disposal by burning) Regulations 2009 (SI 286).

The stem injection method is sometimes used for Japanese Knotweed control. This treatment requires a higher concentration of the active ingredient than is used in foliar applications. It involves the use of a specialist herbicide injection tool

whereby the injection tool injects the herbicide directly into each of the canes approximately 20-30cms from the base of each cane (between the 1st and 2nd nodule).

Subsequently approximately 10 mL of herbicide mix is injected into each cane at a ratio of 5:1 through the use of a specialist stem injection tool. The application of glyphosate based products, are most effective when applied in the early Autumn (mid to late Sept). Regrowth will occur in subsequent years, albeit much less vigorously, which will require follow up treatment at the appropriate time of year. Spot treatment will be required each year until no regrowth is observed.

In order to ensure that the use of herbicides does not contravene legislation, the Contractor must comply with Circular Letter NPWS 2/08 dealing with the application on to non-target areas from the National Parks and Wildlife Service.

Similar chemical treatment can be used for Gunnera during active growth late in the growing season between late August to early September.

5.4.2 Excavation and chemical treatment on-site

This option employs both physical and chemical methods of treatment. This method is employed in situations where treatment of invasive species, in particular Knotweed, is required to be completed in a shorter timeframe. The Environment Agency suggest that by digging up the rhizomes and recultivating it stimulates plant growth and will result in more successful herbicide application and management.

In summary this management method requires cutting and killing of the surface plant. The cut material must be left on top of plastic sheeting until dried out and subsequently monitored for any sign of regrowth (this is not recommended for a river bank habitat where there is the possibility of flooding occurring). They should not be placed in a green waste recycling bin. Once dried out, the material should be burned on site in accordance with the Waste Management Acts 1996 as amended and the Waste Management (Prohibition of Waste disposal by burning) Regulations 2009 (SI 286). The surface of the affected area should be raked with tines to remove crowns and surface material, and in order to break up the rhizomes, bringing them to the surface, which will stimulate leaf production. This will make the plant more vulnerable to herbicide treatment. The more rhizomes that are brought to the surface, the more growth will occur and allowing for a more successful treatment. An excavator can be used to scrape the surface crowns and rhizomes into a pile and then cultivate the ground to stimulate rhizomes to produce higher density of stems for treatment. Reapplication of herbicide may be required for up to five years after initially application, subject to the site-specific management plan.

As the site for the proposed scheme is at risk of flooding, the excavation and chemical treatment is not deemed suitable for this project unless the Contractor can identify a suitable area that is not at risk of flooding and within the confines of the site boundary.

5.4.3 Excavation and burial

Excavated material containing Knotweed can also be buried on site. This will require burying the material at a depth of at least five metres. The contaminated material must be covered with a root barrier membrane before being backfilled with topsoil or other suitable fill material. The membrane must stay intact for at least 50 years. A manufacturer's guarantee is required. An accurate map and record of the location of the burial site to prevent any future accidental disturbance is required, and future owners shall be informed of its position. If soil containing Japanese Knotweed is stockpiled, the material must be stored in a manner that will not harm health or the environment. The stockpile should be on an area of the site that will remain undisturbed. The area should be clearly fenced and signed, and should be regularly treated with herbicide to prevent any regrowth or reinfestation.

As a precaution, the stockpiled material should be laid on a root barrier membrane and covered to avoid contaminating the site further.

As the site for the proposed scheme is at risk of flooding, the excavation and burial treatment is not deemed suitable for this project unless the Contractor can identify a suitable area that is not at risk of flooding and within the confines of the site boundary. The Contractor must also comply with all waste legislation.

5.4.4 Excavation and root barrier cell method

Excavated material containing Knotweed can also be buried on site within a root barrier membrane cell. Similar procedure to above.

This will require burying the material at a depth of at least two metres. The contaminated material must be within a contained cell consisting of a root barrier membrane before being backfilled with topsoil or other suitable fill material. The membrane must stay intact for at least 50 years. A manufacturer's guarantee is required. Stockpiling method as above.

Due to concerns over future land use, this method is not deemed suitable for this project. The Contractor must also comply with all waste legislation.

5.4.5 Excavation and bund method

Where there is not sufficient depth on a site for deep burial the Environmental Agency Guidelines set out another option whereby such excavated material is placed in a structured bund. The bund will comprise a raised area above ground level or a shallow excavation, no more than 0.5m deep, and lined with a root barrier membrane. The membrane must stay intact for at least 50 years and a manufacturer's guarantee is required. This method of treatment can also be used where Knotweed material needs to be moved from a location and there is another ideal area of the site available to contain it.

The aim of this method is to concentrate the rhizome material into the upper surface of the bund, where it will grow and be controlled by herbicide. If the rhizome is buried deep, it will become dormant when inside the bund and regrow

when the apparently clean soil is used for landscaping on the site. The bund location needs to be clearly signed and protected from potential accidental damage. Reapplication of herbicide may be required for up to five years after the initial application, subject to the site-specific management plan.

The appointed Contractor must comply with waste legislation if this method is to be considered.

5.4.6 Excavation and removal from site

Where the above treatment options are not possible (site is too small to contain excavated material, too shallow for burial, or where there is lack of space or where the infestation simply cannot be avoided by the construction works) removal of excavated material may be the only option. Where there are small amounts of Knotweed material to be removed it is possible to double bag the material and send to a fully licenced waste facility for disposal (i.e. landfill). Where the amount of material is larger in volume it will be necessary to haul from site to a suitably licenced waste facility. It should also be noted that in the process of excavating the Knotweed if it has been treated with a persistent herbicide, the excavated material will need to be classified as hazardous waste and there will need to be disposed of to a hazardous waste facility.

If any invasive species plant material is collected (e.g. by hand-pulling or mowing), it is important that its disposal will not lead to a risk of further spread. The movement of invasive plant material requires a licence from the National Parks and Wildlife Service (NPWS) under Section 49 of the European Communities (Birds and Natural Habitats) Regulations, 2011 (as amended).

Invasive species (particularly roots, flower heads or seeds) will be disposed of at licensed waste facilities or composting sites, appropriately buried, or incinerated having regard to relevant legislation. For example Section 32 of the Waste Management Act, 1996 to 2008; Section 4 of the Air Pollution Act, 1987; relevant local authority byelaws and any other relevant legislation). All disposals will be carried out in accordance with the relevant Waste Management legislation (as per guidance from NRA, 2010). It should be noted that some invasive species plant material or soil containing residual herbicides may be classified as either ‘hazardous waste’ or ‘non-hazardous waste’ under the terms of the Waste Management Acts, and both categories may require special disposal procedures or permissions. Advice will be sought from a suitably qualified waste expert regarding the classification of waste and the suitability of different disposal measures. As noted above, additional specific measures for the management of Japanese Knotweed cuttings or contaminated soil can be found in the UK Environment Agency document The Knotweed Code of Practice: Managing Japanese Knotweed on development sites (UK Environment Agency, 2013).

6 Japanese Knotweed Management – Operation Phase

6.1.1 Protecting Flood Defence Structures

As part of the operation phase there will need to be on-going treatment of knotweed at sites where it could potentially compromise the structural integrity of the flood defence structures. A management plan for the operational phase will need to be discussed with the relevant bodies i.e. OPW, NPWS, IFI, Cork City Council and Cork County Council.

Site hygiene protocols will need to be implemented.

6.1.2 Channel Maintenance Works

During channel maintenance works, a management plan will need to be put in place to prevent the spread of Japanese knotweed downstream during those works.

Site hygiene protocols will need to be implemented.

As discussed above, the management plan for the operational phase will need to be discussed with the OPW, NPWS, IFI, Cork City Council and Cork County Council.

7 Conclusion

The presence of Japanese Knotweed and other invasive plant species requires the proposed scheme to have an Invasive Species Management Plan. The Plan shall be written by a suitably qualified ecologist. Given the nature of the species and the rate of growth, each proposed works site will need to be re-surveyed prior to works. Site hygiene will be particularly important on sites where Knotweed is present but also ‘clean’ sites. Incoming vehicles, equipment and including footwear worn by contractors will need to be cleaned and inspected before coming on site to prevent the further spread of the plant.

Where possible material will remain on site and be reused. Any material that must be removed off site to landfill or other suitable facility will require a licence from the National Parks and Wildlife.

The Management Plan must be clearly communicated to all site staff and must be adhered to if it is to be implemented successfully.

8 References

Best Practice Management Guidelines Japanese knotweed *Fallopia japonica*, Invasive Species Ireland (2015)

Managing Japanese knotweed on development sites - The Knotweed Code of Practice produced by the Environmental Agency (2013)

NRA Guidelines on The Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads (2008)

Appendix A

Japanese Knotweed Ireland
Survey Drawings 2017

A1

Japanese Knotweed Ireland

GLASHABOY FRS JAPANESE KNOTWEED ADVANCE TREATMENT WORKS

Survey drawings 2017

CONSTRUCTION INDUSTRY FEDERATION

City & Guilds NPTC

PCA Property Care ASSOCIATION

NISO MEMBER

Japanese Knotweed Ireland

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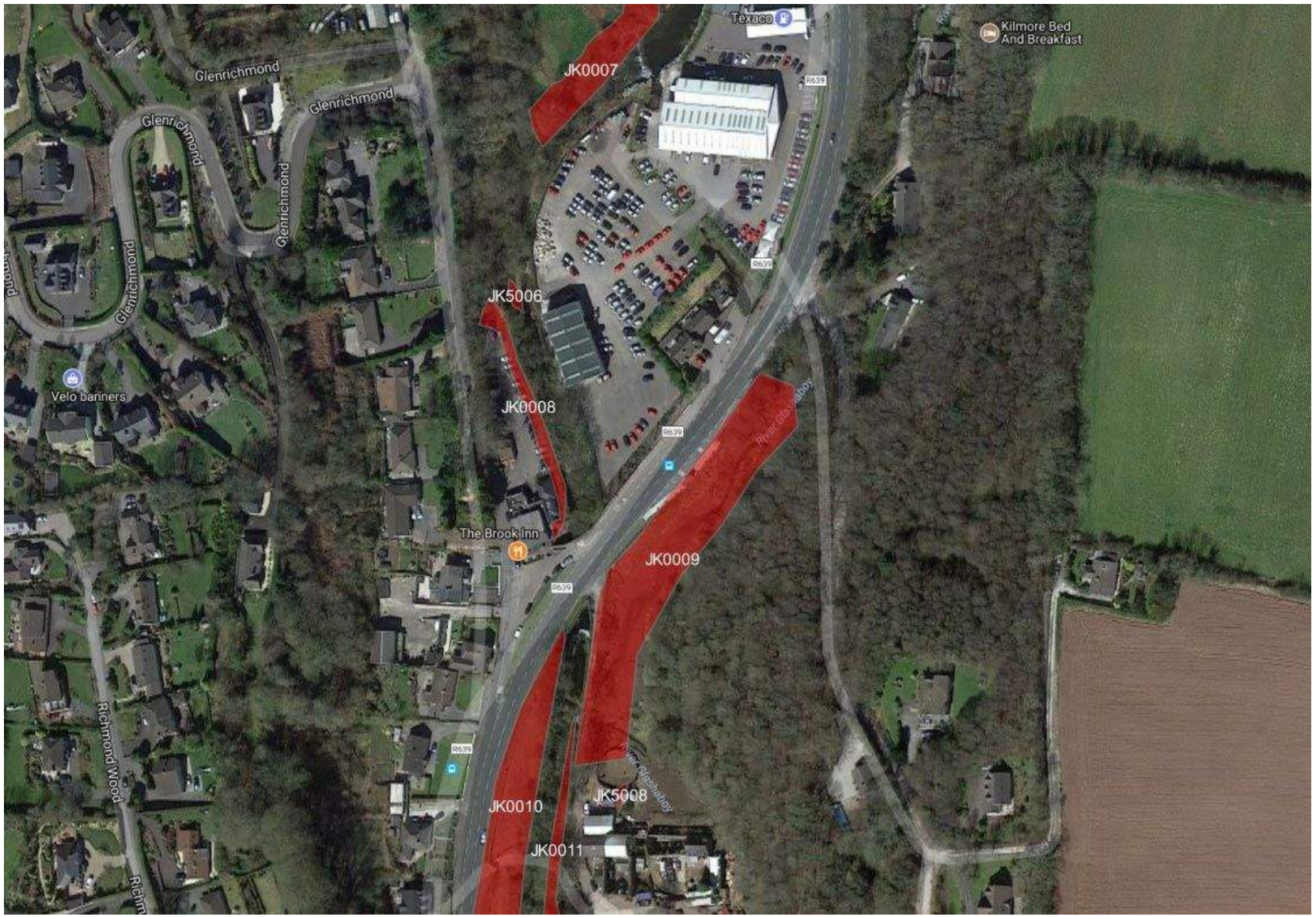
Japanese Knotweed Ireland



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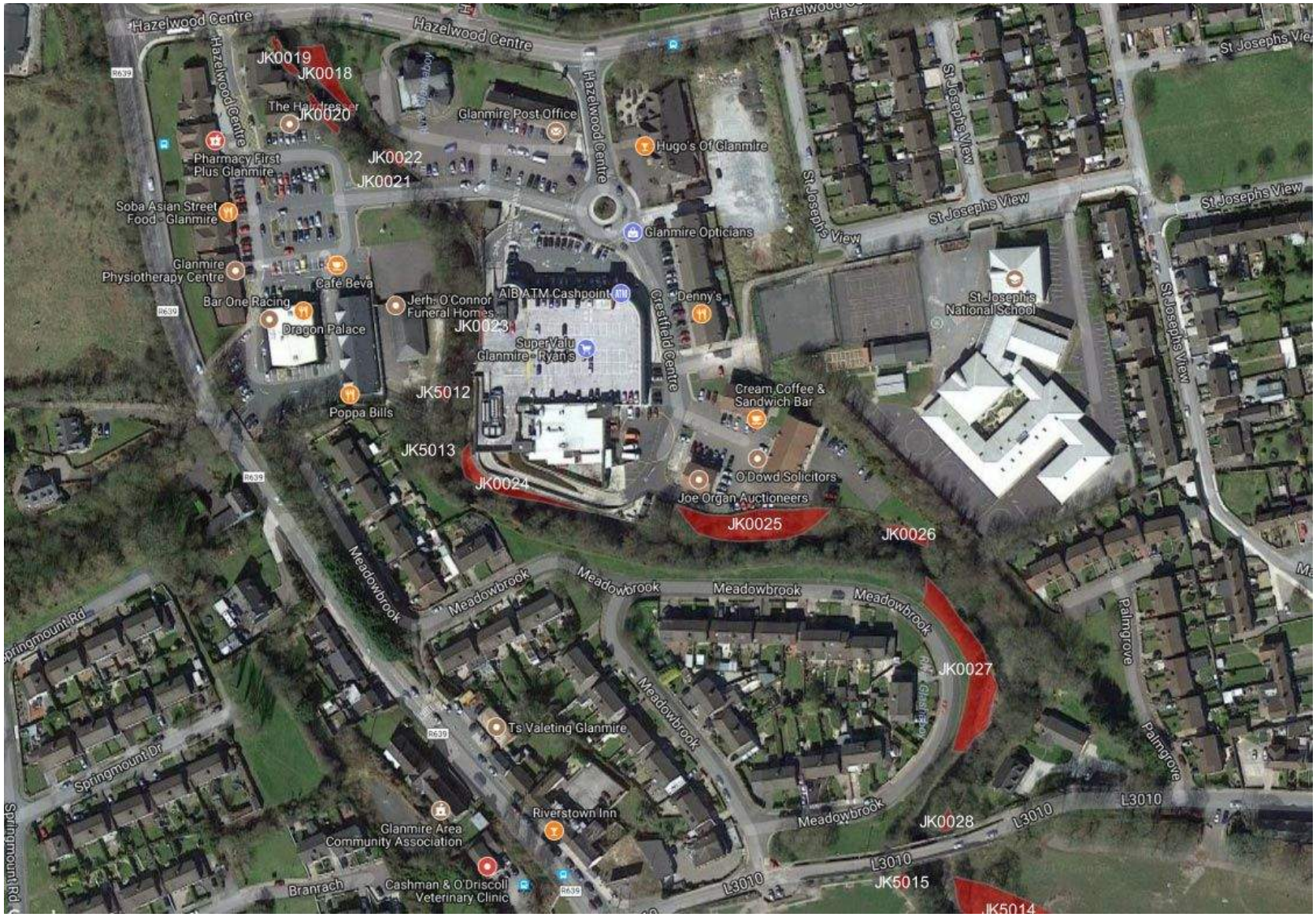
Japanese Knotweed Ireland



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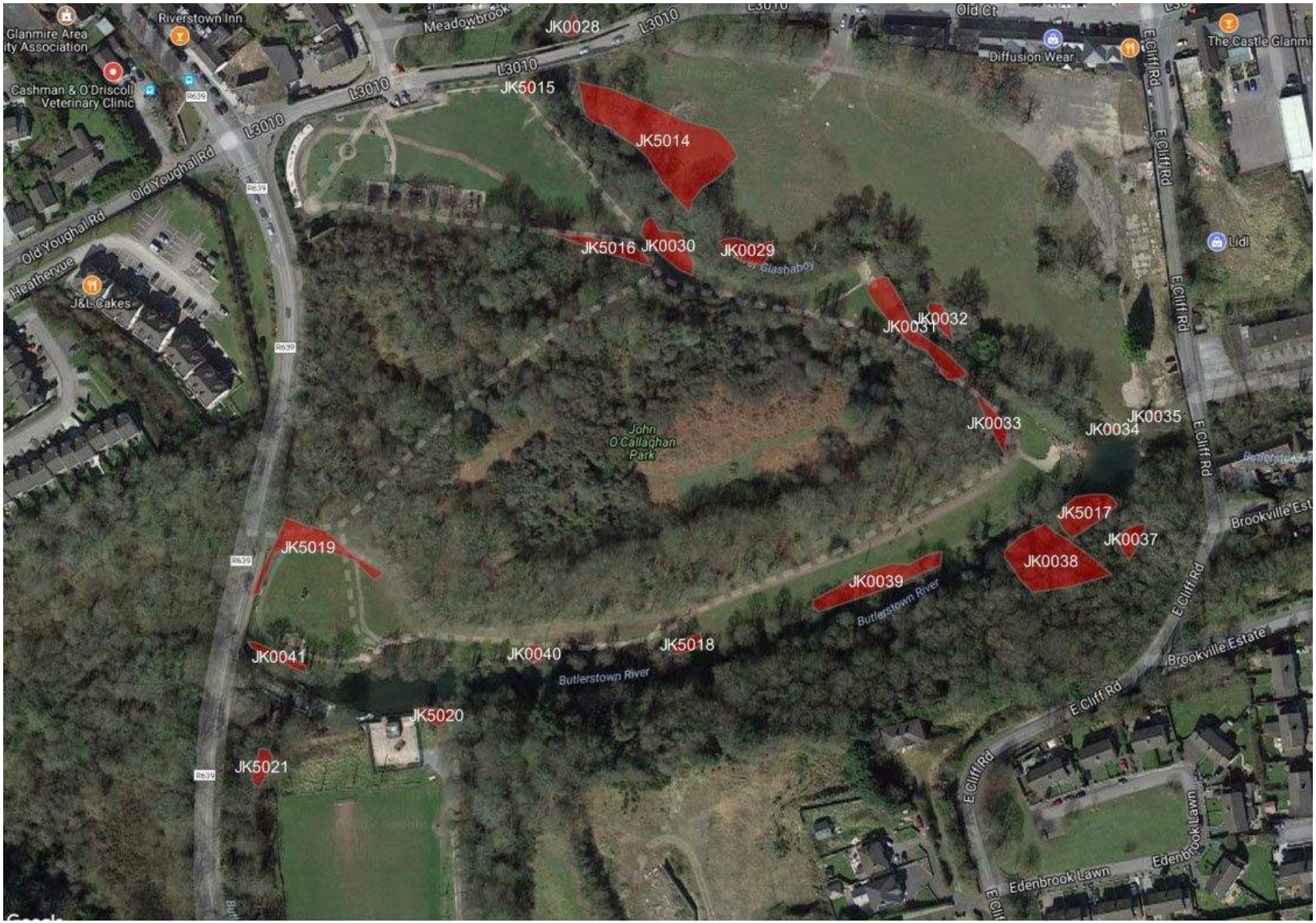
Japanese Knotweed Ireland



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Appendix B

Japanese Knotweed Ireland
Treatment Report 2019

B1

Japanese Knotweed Ireland

TREATMENT REPORT 2019

Glashaboy FRS Japanese Knotweed Advance Treatment Works

Japanese Knotweed Ireland

SiteID	JK0001
Treated by	John Walsh
Treatment date / time	15/08/2019 17:05:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	18 / 17 KPH W / 31-60 / 21-40 / Clear
Method of treatment	Foliar Spray
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	20.0000
Water volume used per hectare	1l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	John Walsh
Description	3-18" tall, Scattered individuals
Treatment notes	Small amount of regrowth present whole location has been treated and signage maintained

Supplementary photos	

Japanese Knotweed Ireland

SiteID	JK0001
Treated by	Noel Linehan
Treatment date / time	19/09/2019 08:24:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	11 / 15 KPH SE / 31-60 / 0-20 / Clear
Method of treatment	Foliar Spray
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	40.0000
Water volume used per hectare	2l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	Noel Linehan
Description	< 3" tall, 18-32" tall, > 32" tall, Scattered individuals
Treatment notes	Area treated and signage maintained some new growth emerging adjacent to original location all treated

Supplementary photos	

Japanese Knotweed Ireland

SiteID	JK0002
Treated by	John Walsh
Treatment date / time	15/08/2019 17:59:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	18 / 17 KPH W / 31-60 / 0-20 / Clear
Method of treatment	Foliar Spray
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	20.0000
Water volume used per hectare	1l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	John Walsh
Description	< 3" tall, Scattered individuals
Treatment notes	Very little regrowth present whole location has been treated and signage maintained

Supplementary photos	

Japanese Knotweed Ireland

SiteID	JK0002
Treated by	Noel Linehan
Treatment date / time	19/09/2019 08:31:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	11 / 15 KPH SE / 31-60 / 0-20 / Clear
Method of treatment	Foliar Spray
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	20.0000
Water volume used per hectare	1l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	Noel Linehan
Description	No growth present
Treatment notes	No growth present area treated signage maintained

Supplementary photos	

Japanese Knotweed Ireland

SiteID	JK0002A
Treated by	John Walsh
Treatment date / time	15/08/2019 17:43:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	18 / 17 KPH W / 31-60 / 0-20 / Clear
Method of treatment	Foliar Spray
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	100.0000
Water volume used per hectare	5l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	John Walsh
Description	3-18" tall, Scattered individuals
Treatment notes	Some new plants growing in location whole area has been treated and signage maintained

Supplementary photos	

Japanese Knotweed Ireland

SiteID	JK0002A
Treated by	Noel Linehan
Treatment date / time	19/09/2019 08:32:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	11 / 15 KPH SE / 31-60 / 0-20 / Clear
Method of treatment	Foliar Spray
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	40.0000
Water volume used per hectare	2l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	Noel Linehan
Description	< 3" tall, 18-32" tall, Scattered individuals
Treatment notes	Area treated and signage maintained

Supplementary photos	

Japanese Knotweed Ireland

SiteID	JK0003
Treated by	Aidan Lombard
Treatment date / time	15/08/2019 17:29:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	16 / 11SW / 76-90 / 0-20 / Overcast
Method of treatment	Foliar Spray
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	80.0000
Water volume used per hectare	4l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	Aidan Lombard
Description	No growth present
Treatment notes	No regrowth present.

Supplementary photos	

Japanese Knotweed Ireland

SiteID	JK0003
Treated by	Noel Linehan
Treatment date / time	19/09/2019 08:48:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	11 / 15 KPH SE / 31-60 / 0-20 / Clear
Method of treatment	Foliar Spray
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	30.0000
Water volume used per hectare	1.5l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	Noel Linehan
Description	< 3" tall, Scattered individuals
Treatment notes	Area treated and signage maintained

Supplementary photos	

Japanese Knotweed Ireland

SiteID	JK0004
Treated by	John Walsh
Treatment date / time	16/08/2019 13:16:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	18 / 17 KPH W / 61-75 / 0-20 / Clear
Method of treatment	Foliar Spray
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	120.0000
Water volume used per hectare	6l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	John Walsh
Description	< 3" tall, Scattered individuals
Treatment notes	Area treated regrowth present.

Supplementary photos	

Japanese Knotweed Ireland

SiteID	JK0004
Treated by	Aidan Lombard
Treatment date / time	19/09/2019 08:50:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	9 / 4ENE / 61-75 / 0-20 / Clear
Method of treatment	Foliar Spray
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	50.0000
Water volume used per hectare	2.5l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	Aidan Lombard
Description	3-18" tall, Scattered individuals, No growth present
Treatment notes	Area retreated and signage maintained

Supplementary photos	

Japanese Knotweed Ireland

SiteID	JK0005
Treated by	John Walsh
Treatment date / time	16/08/2019 14:13:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	18 / 17 KPH W / 61-75 / 0-20 / Clear
Method of treatment	Foliar Spray
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	1500.0000
Water volume used per hectare	75l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	John Walsh
Description	< 3" tall, Scattered individuals
Treatment notes	Area treated regrowth present .

Supplementary photos	

Japanese Knotweed Ireland

SiteID	JK0005
Treated by	Aidan Lombard
Treatment date / time	19/09/2019 08:36:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	9 / 4ENE / 61-75 / 0-20 / Clear
Method of treatment	Foliar Spray
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	100.0000
Water volume used per hectare	5l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	Aidan Lombard
Description	3-18" tall, Scattered individuals
Treatment notes	Retreated the area

Supplementary photos	

Japanese Knotweed Ireland

SiteID	JK0006
Treated by	John Walsh
Treatment date / time	16/08/2019 14:01:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	15 / 17 KPH W / 61-75 / 0-20 / Overcast
Method of treatment	Foliar Spray
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	100.0000
Water volume used per hectare	5l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	John Walsh
Description	3-18" tall, Scattered individuals
Treatment notes	Some regrowth present across location.Complete retretment. Signage maintained. Further monitoring and treatment required

Supplementary photos

Japanese Knotweed Ireland

SiteID	JK0006
Treated by	Aidan Lombard
Treatment date / time	19/09/2019 08:33:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	9 / 4ENE / 61-75 / 0-20 / Clear
Method of treatment	Foliar Spray
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	30.0000
Water volume used per hectare	1.5l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	Aidan Lombard
Description	3-18" tall, Scattered individuals
Treatment notes	Retreated the area and maintained the signage

Supplementary photos	

Japanese Knotweed Ireland

SiteID	JK0007
Treated by	Aidan Lombard
Treatment date / time	15/08/2019 18:06:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	16 / 11SW / 76-90 / 0-20 / Clear
Method of treatment	Foliar Spray
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	1000.0000
Water volume used per hectare	50l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	Aidan Lombard
Description	< 3" tall, Scattered individuals
Treatment notes	Sporadic young regrowth treated . Continued treatment and monitoring required

Supplementary photos	

Japanese Knotweed Ireland

SiteID	JK0007
Treated by	Noel Linehan
Treatment date / time	19/09/2019 09:08:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	11 / 15 KPH SE / 31-60 / 0-20 / Clear
Method of treatment	Foliar Spray
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	40.0000
Water volume used per hectare	2l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	Noel Linehan
Description	< 3" tall, 3-18" tall, > 32" tall, Scattered individuals
Treatment notes	Area treated.No signage required due to inaccessibility of location

Supplementary photos	

Japanese Knotweed Ireland

SiteID	JK0008
Treated by	John Walsh
Treatment date / time	15/08/2019 08:50:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	15 / 17 KPH W / 61-75 / 0-20 / Overcast
Method of treatment	Foliar Spray
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	100.0000
Water volume used per hectare	5l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	John Walsh
Description	3-18" tall, Scattered individuals
Treatment notes	Some regrowth present whole location has been treated and signage maintained further monitoring and treatment required

Supplementary photos	

Japanese Knotweed Ireland

SiteID	JK0008
Treated by	Aidan Lombard
Treatment date / time	19/09/2019 08:06:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	9 / 4ENE / 61-75 / 0-20 / Clear
Method of treatment	Foliar Spray
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	120.0000
Water volume used per hectare	6l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	Aidan Lombard
Description	3-18" tall, Scattered individuals
Treatment notes	Retreated the area and signage maintained

Supplementary photos	

Japanese Knotweed Ireland

SiteID	JK0009
Treated by	Noel Linehan
Treatment date / time	16/08/2019 17:05:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	19 / 21KPHWSW / 76-90 / 0-20 / Clear
Method of treatment	Foliar Spray
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	900.0000
Water volume used per hectare	45l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	Noel Linehan
Description	3-18" tall, Scattered individuals
Treatment notes	No signage required due to inaccessibility of area

Supplementary photos	

Japanese Knotweed Ireland

SiteID	JK0009
Treated by	Noel Linehan
Treatment date / time	19/09/2019 09:54:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	11 / 15 KPH SE / 31-60 / 0-20 / Clear
Method of treatment	Foliar Spray
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	120.0000
Water volume used per hectare	6l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	Noel Linehan
Description	< 3" tall, 18-32" tall, Scattered individuals
Treatment notes	Area treated and signage maintained

Supplementary photos	

Japanese Knotweed Ireland

SiteID	JK0010
Treated by	Aidan Lombard
Treatment date / time	15/08/2019 16:13:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	16 / 11SW / 76-90 / 0-20 / Overcast
Method of treatment	Foliar Spray
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	4000.0000
Water volume used per hectare	200l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	Aidan Lombard
Description	3-18" tall, Scattered individuals
Treatment notes	There is Japanese Knotweed growing sporadically throughout the area. The Knotweed in the field is behind spread by horses. Continued treatment and monitoring required

Supplementary photos

Japanese Knotweed Ireland

SiteID	JK0010
Treated by	John Walsh
Treatment date / time	19/09/2019 10:14:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	11 / 15 KPH SE / 31-60 / 0-20 / Clear
Method of treatment	Foliar Spray
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	300.0000
Water volume used per hectare	15l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	John Walsh
Description	< 3" tall, 18-32" tall, Scattered individuals
Treatment notes	Area treated and signage maintained

Supplementary photos

Japanese Knotweed Ireland

SiteID	JK0011
Treated by	Aidan Lombard
Treatment date / time	15/08/2019 16:23:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	16 / 11SW / 76-90 / 81-100 / Overcast
Method of treatment	Foliar Spray
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	3600.0000
Water volume used per hectare	180l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	Aidan Lombard
Description	3-18" tall, Scattered individuals
Treatment notes	Large area of Japanese Knotweed treated. The area is partly grazed by animals. Continued treatment and monitoring required.

Supplementary photos	

Japanese Knotweed Ireland

SiteID	JK0011
Treated by	John Walsh
Treatment date / time	19/09/2019 10:52:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	11 / 15 KPH SE / 31-60 / 0-20 / Clear
Method of treatment	Foliar Spray
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	160.0000
Water volume used per hectare	8l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	John Walsh
Description	< 3" tall, 18-32" tall, Scattered individuals
Treatment notes	Area treated and signage maintained

Supplementary photos	

Japanese Knotweed Ireland

SiteID	JK0012
Treated by	John Walsh
Treatment date / time	15/08/2019 14:57:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	20 / 17 KPH W / 31-60 / 0-20 / Clear
Method of treatment	Foliar Spray
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	80.0000
Water volume used per hectare	4l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	John Walsh
Description	3-18" tall, Scattered individuals
Treatment notes	Small amount of regrowth present whole location has been treated and signage maintained further monitoring and treatment required

Supplementary photos	

Japanese Knotweed Ireland

SiteID	JK0012
Treated by	John Walsh
Treatment date / time	19/09/2019 10:55:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	11 / 15 KPH SE / 31-60 / 0-20 / Clear
Method of treatment	Foliar Spray
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	40.0000
Water volume used per hectare	2l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	John Walsh
Description	18-32" tall, Scattered individuals
Treatment notes	Area treated and signage maintained

Supplementary photos

Japanese Knotweed Ireland

SiteID	JK0013
Treated by	Aidan Lombard
Treatment date / time	15/08/2019 15:18:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	16 / 11SW / 61-75 / 21-40 / Overcast
Method of treatment	Foliar Spray
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	150.0000
Water volume used per hectare	7.5l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	Aidan Lombard
Description	< 3" tall, Scattered individuals
Treatment notes	Juvenile plants of Japanese Knotweed treated. Damage being done by pedestrians. Continued monitoring required

Supplementary photos	

Japanese Knotweed Ireland

SiteID	JK0013
Treated by	John Walsh
Treatment date / time	19/09/2019 11:05:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	11 / 15 KPH SE / 31-60 / 0-20 / Cloudy
Method of treatment	Foliar Spray
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	10.0000
Water volume used per hectare	0.5l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	John Walsh
Description	< 3" tall, Scattered individuals
Treatment notes	Area retreated. Signage replaced

Supplementary photos	

Japanese Knotweed Ireland

SiteID	JK0014
Treated by	John Walsh
Treatment date / time	15/08/2019 15:15:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	20 / 17 KPH W / 31-60 / 0-20 / Clear
Method of treatment	Foliar Spray
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	0.0000
Water volume used per hectare	0l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	John Walsh
Description	3-18" tall, Scattered individuals
Treatment notes	Small amount of regrowth present whole location has been treated and signage maintained further monitoring and treatment required

Supplementary photos	

Japanese Knotweed Ireland

SiteID	JK0014
Treated by	John Walsh
Treatment date / time	19/09/2019 11:07:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	11 / 15 KPH SE / 31-60 / 0-20 / Cloudy
Method of treatment	Foliar Spray
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	20.0000
Water volume used per hectare	1l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	John Walsh
Description	No growth present
Treatment notes	Area treated and signage maintained

Supplementary photos	

Japanese Knotweed Ireland

SiteID	JK0015
Treated by	John Walsh
Treatment date / time	15/08/2019 15:35:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	20 / 17 KPH W / 31-60 / 0-20 / Clear
Method of treatment	Foliar Spray
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	40.0000
Water volume used per hectare	2l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	John Walsh
Description	3-18" tall, Scattered individuals
Treatment notes	Sporadic regrowth present throughout location whole area has been treated

Supplementary photos	

Japanese Knotweed Ireland

SiteID	JK0015
Treated by	John Walsh
Treatment date / time	19/09/2019 11:13:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	11 / 15 KPH SE / 31-60 / 0-20 / Cloudy
Method of treatment	Foliar Spray
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	20.0000
Water volume used per hectare	1l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	John Walsh
Description	< 3" tall, Scattered individuals
Treatment notes	Area treated no signage required

Supplementary photos	

Japanese Knotweed Ireland

SiteID	JK0016
Treated by	John Walsh
Treatment date / time	15/08/2019 15:34:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	20 / 17 KPH W / 31-60 / 0-20 / Clear
Method of treatment	Foliar Spray
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	60.0000
Water volume used per hectare	3l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	John Walsh
Description	3-18" tall, Scattered individuals
Treatment notes	Small amount of regrowth present whole location has been treated

Supplementary photos	

Japanese Knotweed Ireland

SiteID	JK0016
Treated by	John Walsh
Treatment date / time	19/09/2019 11:21:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	11 / 15 KPH SE / 31-60 / 0-20 / Cloudy
Method of treatment	Foliar Spray
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	100.0000
Water volume used per hectare	5l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	John Walsh
Description	< 3" tall, Scattered individuals
Treatment notes	Area treated and signage replaced

Supplementary photos	

Japanese Knotweed Ireland

SiteID	JK0017
Treated by	Aidan Lombard
Treatment date / time	15/08/2019 18:39:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	16 / 11SW / 76-90 / 0-20 / Clear
Method of treatment	Foliar Spray
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	20.0000
Water volume used per hectare	1l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	Aidan Lombard
Description	< 3" tall
Treatment notes	One juvenile plant present and treated. Continued treatment and monitoring required

Supplementary photos

Japanese Knotweed Ireland

SiteID	JK0017
Treated by	John Walsh
Treatment date / time	19/09/2019 11:32:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	15 / 15 KPH SE / 61-75 / 0-20 / Clear
Method of treatment	Foliar Spray, Clearance
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	40.0000
Water volume used per hectare	2l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	John Walsh
Description	Basal rosettes at ground level
Treatment notes	Area treated signage maintained

Supplementary photos	

Japanese Knotweed Ireland

SiteID	JK0018
Treated by	Colin Hayes
Treatment date / time	15/08/2019 10:36:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	16 / 11SW / 76-90 / 21-40 / Overcast
Method of treatment	Foliar Spray, Clearance
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	150.0000
Water volume used per hectare	7.5l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	Colin Hayes
Description	3-18" tall, Scattered individuals
Treatment notes	A small number of juvenile plants that were treated. Continued treatment and monitoring required.

Supplementary photos	

SiteID	JK0018
Treated by	Colin Hayes
Treatment date / time	15/08/2019 10:37:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	16 / 11SW / 61-75 / 0-20 / Overcast
Method of treatment	Foliar Spray, Clearance
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	60.0000
Water volume used per hectare	3l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	Colin Hayes
Description	3-18" tall, Scattered individuals
Treatment notes	A small number of juvenile plants were treated. Continued treatment and monitoring required.

Supplementary photos	

Japanese Knotweed Ireland

SiteID	JK0019
Treated by	Colin Hayes
Treatment date / time	15/08/2019 10:27:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	16 / 11SW / 76-90 / 21-40 / Overcast
Method of treatment	Foliar Spray, Clearance
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	20.0000
Water volume used per hectare	1l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	Colin Hayes
Description	No growth present
Treatment notes	No regrowth present. Continued monitoring required

Supplementary photos	

Japanese Knotweed Ireland

SiteID	JK0019
Treated by	John Walsh
Treatment date / time	19/09/2019 11:38:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	15 / 15 KPH SE / 31-60 / 0-20 / Clear
Method of treatment	Foliar Spray, Clearance
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	10.0000
Water volume used per hectare	0.5l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	John Walsh
Description	< 3" tall, Scattered individuals
Treatment notes	Area treated signage maintained

Supplementary photos	

SiteID	JK0020
Treated by	Colin Hayes
Treatment date / time	15/08/2019 10:32:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	16 / 11SW / 61-75 / 0-20 / Overcast
Method of treatment	Foliar Spray, Clearance
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	20.0000
Water volume used per hectare	1l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	Colin Hayes
Description	No growth present
Treatment notes	No regrowth present. Continued monitoring required

Supplementary photos	

Japanese Knotweed Ireland

SiteID	JK0020
Treated by	John Walsh
Treatment date / time	19/09/2019 11:44:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	15 / 15 KPH SE / 31-60 / 0-20 / Clear
Method of treatment	Foliar Spray
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	10.0000
Water volume used per hectare	0.5l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	John Walsh
Description	No growth present
Treatment notes	Area treated and signage maintained

Supplementary photos	

Japanese Knotweed Ireland

SiteID	JK0021
Treated by	Colin Hayes
Treatment date / time	15/08/2019 10:43:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	16 / 11SW / 76-90 / 21-40 / Overcast
Method of treatment	Foliar Spray, Stem Inject
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	20.0000
Water volume used per hectare	1l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	Colin Hayes
Description	< 3" tall, Scattered individuals
Treatment notes	A small number of juvenile plants were treated. Continued monitoring and treatment required

Supplementary photos	

Japanese Knotweed Ireland

SiteID	JK0021
Treated by	John Walsh
Treatment date / time	19/09/2019 11:47:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	N/A
Method of treatment	No treatment done
Herbicide Used	N/A
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	
Water volume used per hectare	N/A
Nozzle type	N/A
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	John Walsh
Description	No growth present
Treatment notes	No growth present further monitoring required

Supplementary photos	

Japanese Knotweed Ireland

SiteID	JK0022
Treated by	John Walsh
Treatment date / time	16/08/2019 11:40:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	15 / 15 KPH SE / 31-60 / 0-20 / Clear
Method of treatment	Foliar Spray
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	40.0000
Water volume used per hectare	2l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	John Walsh
Description	< 3" tall, 3-18" tall, Scattered individuals
Treatment notes	Area treated and signage maintained

Supplementary photos	

Japanese Knotweed Ireland

SiteID	JK0022
Treated by	John Walsh
Treatment date / time	19/09/2019 11:42:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	15 / 15 KPH SE / 31-60 / 0-20 / Clear
Method of treatment	Foliar Spray
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	20.0000
Water volume used per hectare	1l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	John Walsh
Description	3-18" tall, Scattered individuals
Treatment notes	Area treated and signage maintained

Supplementary photos	

Japanese Knotweed Ireland

SiteID	JK0023
Treated by	Colin Hayes
Treatment date / time	15/08/2019 10:11:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	16 / 11SW / 61-75 / 0-20 / Overcast
Method of treatment	Clearance, No treatment done
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	0.0000
Water volume used per hectare	0l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	Colin Hayes
Description	No growth present
Treatment notes	There is no Knotweed present. Continued monitoring required

Supplementary photos	

Japanese Knotweed Ireland

SiteID	JK0023
Treated by	John Walsh
Treatment date / time	19/09/2019 11:52:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	N/A
Method of treatment	No treatment done
Herbicide Used	N/A
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	
Water volume used per hectare	N/A
Nozzle type	N/A
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	John Walsh
Description	No growth present
Treatment notes	No growth present further monitoring required

Supplementary photos	

Japanese Knotweed Ireland

SiteID	JK0024
Treated by	John Walsh
Treatment date / time	15/08/2019 10:44:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	15 / 17 KPH W / 31-60 / 21-40 / Overcast
Method of treatment	Foliar Spray
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	30.0000
Water volume used per hectare	1.5l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	John Walsh
Description	3-18" tall, Scattered individuals
Treatment notes	Very little growth present whole location has been treated and signage maintained further monitoring and treatment required

Supplementary photos	

Japanese Knotweed Ireland

SiteID	JK0024
Treated by	John Walsh
Treatment date / time	19/09/2019 11:57:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	15 / 15 KPH SE / 31-60 / 0-20 / Clear
Method of treatment	Foliar Spray
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	30.0000
Water volume used per hectare	1.5l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	John Walsh
Description	> 32" tall, Scattered individuals
Treatment notes	Area treated and signage maintained

Supplementary photos	

Japanese Knotweed Ireland

SiteID	JK0025
Treated by	John Walsh
Treatment date / time	15/08/2019 10:16:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	15 / 17 KPH W / 31-60 / 21-40 / Overcast
Method of treatment	Foliar Spray
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	100.0000
Water volume used per hectare	5l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	John Walsh
Description	3-18" tall, Scattered individuals
Treatment notes	Sporadic regrowth present throughout location whole area has been treated and signage maintained further monitoring and treatment required

Supplementary photos	

Japanese Knotweed Ireland

SiteID	JK0025
Treated by	John Walsh
Treatment date / time	19/09/2019 12:03:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	15 / 15 KPH SE / 31-60 / 0-20 / Clear
Method of treatment	Foliar Spray
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	20.0000
Water volume used per hectare	1l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	John Walsh
Description	3-18" tall, 18-32" tall, Scattered individuals
Treatment notes	Area treated and signage maintained

Supplementary photos	

Japanese Knotweed Ireland

SiteID	JK0026
Treated by	John Walsh
Treatment date / time	15/08/2019 10:11:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	N/A
Method of treatment	No treatment done
Herbicide Used	N/A
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	
Water volume used per hectare	N/A
Nozzle type	N/A
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	John Walsh
Description	No growth present
Treatment notes	No evidence of regrowth present further monitoring required

Supplementary photos	

Japanese Knotweed Ireland

SiteID	JK0026
Treated by	John Walsh
Treatment date / time	19/09/2019 12:10:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	15 / 15 KPH SE / 31-60 / 0-20 / Clear
Method of treatment	Foliar Spray
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	40.0000
Water volume used per hectare	2l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	John Walsh
Description	3-18" tall, Scattered individuals
Treatment notes	Area treated and signage maintained

Supplementary photos	

Japanese Knotweed Ireland

SiteID	JK0027
Treated by	John Walsh
Treatment date / time	15/08/2019 18:20:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	18 / 17 KPH W / 31-60 / 21-40 / Clear
Method of treatment	Foliar Spray
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	60.0000
Water volume used per hectare	3l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	John Walsh
Description	> 32" tall, Scattered individuals
Treatment notes	Sporadic regrowth present throughout location whole area has been treated and signage maintained further monitoring and treatment required

Supplementary photos	

Japanese Knotweed Ireland

SiteID	JK0027
Treated by	John Walsh
Treatment date / time	19/09/2019 12:22:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	15 / 15 KPH SE / 31-60 / 0-20 / Clear
Method of treatment	Foliar Spray
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	80.0000
Water volume used per hectare	4l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	John Walsh
Description	3-18" tall, 18-32" tall, > 32" tall, Scattered individuals
Treatment notes	Area treated and signage maintained

Supplementary photos	

Japanese Knotweed Ireland

SiteID	JK0028
Treated by	John Walsh
Treatment date / time	15/08/2019 18:37:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	18 / 17 KPH W / 31-60 / 21-40 / Clear
Method of treatment	Foliar Spray
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	10.0000
Water volume used per hectare	0.5l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	John Walsh
Description	< 3" tall, Scattered individuals
Treatment notes	Small amount of regrowth present whole area has been treated and signage maintained further monitoring and treatment required

Supplementary photos	

Japanese Knotweed Ireland

SiteID	JK0028
Treated by	John Walsh
Treatment date / time	19/09/2019 12:30:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	15 / 15 KPH SE / 31-60 / 61-80 / Cloudy
Method of treatment	Foliar Spray
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	30.0000
Water volume used per hectare	1.5l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	John Walsh
Description	3-18" tall, Scattered individuals
Treatment notes	Area treated and signage maintained

Supplementary photos	

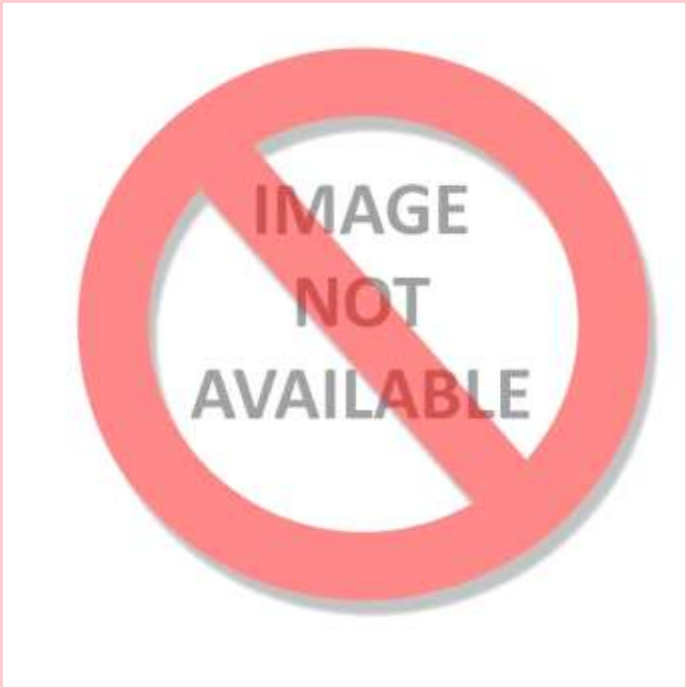
Japanese Knotweed Ireland

SiteID	JK0029
Treated by	Noel Linehan
Treatment date / time	15/08/2019 06:19:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	15 / 11 KPH S / 31-60 / 21-40 / Overcast
Method of treatment	Foliar Spray
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	50.0000
Water volume used per hectare	2.5l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	Noel Linehan
Description	3-18" tall, Scattered individuals
Treatment notes	Small amount of regrowth present in location whole area has been treated further monitoring and treatment required

Supplementary photos	

Japanese Knotweed Ireland

SiteID	JK0029
Treated by	Aidan Lombard
Treatment date / time	19/09/2019 07:01:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	9 / 4ENE / 61-75 / 0-20 / Clear
Method of treatment	Foliar Spray
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	25.0000
Water volume used per hectare	1.25l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	Aidan Lombard
Description	< 3" tall, Scattered individuals
Treatment notes	Retreated the area. Signage replaced.



Supplementary photos	

Japanese Knotweed Ireland

SiteID	JK0030
Treated by	John Walsh
Treatment date / time	15/08/2019 06:11:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	15 / 9S / 61-75 / 0-20 / Overcast
Method of treatment	Foliar Spray
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	100.0000
Water volume used per hectare	5l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	John Walsh
Description	< 3" tall
Treatment notes	A small number of juvenile plants present. Continued treatment required.

Supplementary photos	

Japanese Knotweed Ireland

SiteID	JK0030
Treated by	Aidan Lombard
Treatment date / time	19/09/2019 07:08:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	9 / 4ENE / 61-75 / 0-20 / Clear
Method of treatment	Foliar Spray
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	30.0000
Water volume used per hectare	1.5l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	Aidan Lombard
Description	< 3" tall, Scattered individuals
Treatment notes	Retreated the area and erected signage

Supplementary photos	

Japanese Knotweed Ireland

SiteID	JK0031
Treated by	Noel Linehan
Treatment date / time	15/08/2019 06:35:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	15 / 11 KPH S / 61-75 / 0-20 / Overcast
Method of treatment	Foliar Spray
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	100.0000
Water volume used per hectare	5l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	Noel Linehan
Description	3-18" tall, Scattered individuals
Treatment notes	Sporadic regrowth present throughout location whole area has been treated and signage maintained further monitoring and treatment required ,knotweed is being cut along fringe of location which is going to create further infestation

Supplementary photos	

Japanese Knotweed Ireland

SiteID	JK0031
Treated by	Aidan Lombard
Treatment date / time	19/09/2019 07:10:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	9 / 4ENE / 61-75 / 0-20 / Clear
Method of treatment	Foliar Spray
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	50.0000
Water volume used per hectare	2.5l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	Aidan Lombard
Description	< 3" tall, Scattered individuals
Treatment notes	Retreated the area and erected signage.

Supplementary photos	

Japanese Knotweed Ireland

SiteID	JK0032
Treated by	John Walsh
Treatment date / time	15/08/2019 06:50:00
Weather ConditionsTemp / Wind / Sky / Humidity % / Rain %	15 / 16 KPH W / 31-60 / 0-20 / Clear
Method of treatment	Foliar Spray
Herbicide Used	RoundUp Biactive
PCS Number	4660
Calibration rate per hectare	4.0l
Total conc. product used (ml)	50.0000
Water volume used per hectare	2.5l
Nozzle type	110º 0.3
Calibration used in accordance with SUD	Yes
Qualified and registered advisor	Yes
Qualified and registered PU	John Walsh
Description	3-18" tall, > 32" tall, Scattered individuals
Treatment notes	Small amount of regrowth present whole location has been treated and signage maintained

Supplementary photos	