OPW
Oifig na nOibreacha Poiblí
Office of Public Works

River Bride (Blackpool) Certified Drainage Scheme

Environmental Impact Assessment Report Addendum

November 2020

MKO

RYAN HANLEY

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1 INTRODUCTION

This Chapter of the Environmental Impact Assessment Report (EIAR) Addendum provides supplementary information in relation to the introduction of the proposed Scheme and is to be read in conjunction with Chapter 1 of the River Bride (Blackpool) Certified Drainage Scheme EIAR.

The following supplementary information pertaining to Chapter 1 of the EIAR was requested by the Department of Public Expenditure and Reform on 07th May 2020 and is provided in this section of the EIAR Addendum:

1. *Competency details for all personnel and firms who provided significant inputs to the EIAR.*

The request for supplementary information and general comments in relation to Chapter 1 of the EIAR have been addressed in the subsequent sections of this Chapter.

Unless otherwise specified, any text provided below supersedes the text provided in the relevant section of the EIAR. In some instances, it has been necessary to reproduce text from the original EIAR. This text is shown in grey for ease of reference.

1.6 PROJECT TEAM

1.6.1 Protect Team Responsibilities

The companies and staff listed in Table 1.3 were responsible for completion of the EIA of the proposed development. Further details regarding project team members are provided below.

Table 1.3 Project Team

Consultants	Principal Staff Involved in Project - specifying whether involved in EIAR, EIAR Addendum (EIAR-A) or Both	EIAR Input
Ryan Hanley Consulting Engineers Sherwood House, Sherwood Avenue, Taylor's Hill, Galway	Jonathan Reid – Both Sinead Gavin – EIAR Sarah Mullen – EIAR Kathy Carney – Both Raymond Brennan – Both Nicholas Duff – EIAR-A Eoin Gilson – EIAR-A Grace Kilbane – EIAR-A Maebh Grace – EIAR-A	EIAR Project Managers, Co-ordination and editing of EIAR, Scoping and consultation, EIAR Sections 3, 5, 6, 7, 10 & 11
McCarthy Keville O' Sullivan Ltd. Block 1 GFSC, Moneenageisha Road, Galway	Brian Keville - Both Michael Watson - Both Evelyn Sikora - EIAR John Staunton - EIAR Owen Cahill – EIAR-A	EIAR Sections 1, 2, 4, 8, 9 & 12: Introduction, Background, Human Beings, Population & Human Health, Air & Climate, Noise & Vibration, and Interaction of Foregoing
ARUP Consulting Engineers One Albert Quay, Cork	Clifford Killeen – EIAR-A Ken Leahy - EIAR Alan Leen - EIAR Darragh Ryan - EIAR Emer Kennedy – EIAR-A	Traffic & Transportation Scheme Design

Consultants	Principal Staff Involved in Project - specifying whether involved in EIAR, EIAR Addendum (EIAR-A) or Both	EIAR Input
JBA Consulting 24 Grove Island Corbally, Limerick, Co Limerick	Jonathan Cooper – Both Matthew Hemsworth – EIAR-A	Scheme Design
John Cronin & Associates 3a Westpoint Trade Centre, Link Road, Ballincollig, Cork	John Cronin - Both Tony Cummins – Both	Cultural Heritage Section
Damian Brosnan Acoustics Shronagreehykealkill, Bantry, Co. Cork	Damian Brosnan – Both	EIAR Section 9: Noise & Vibration
Proviz Courthouse Rd., Kinvara, Co. Galway	Mel Durkan - EIAR	Photomontages

1.6.2 Protect Team Competencies

Ryan Hanley Consulting Engineers

Jonathan Reid - Jonathan qualified with a BE (Hons) Bachelor of Engineering (Civil) from National University of Ireland Galway, is a Chartered Engineer (CEng), a Member of Engineers Ireland (MIEI) and a Member of the International Association of Hydrological Sciences (MIAHS). Jonathan has 17 years' experience in the management, design, planning and development of major civil engineering projects, including flood relief schemes. Jonathan has led Ryan Hanley's team in the preparation of EIARS and EISs on several flood schemes including River Deel (Crossmolina), the Lower Lee (Cork City) and Bandon. Jonathan was responsible for the management of the EIAR and completion of the Description Chapter (Ch.3). He was also responsible for the management of the EIAR Addendum.

Sinead Gavin - Sinead qualifications include a BSc Environmental Biology from Staffordshire University and an MSc Environmental Resource Management from University College Dublin (2005). Sinead is also a Chartered Ecologist (CEcol) and Member of Institute of Ecology and Environmental Management (MCIEEM). Sinead has 13 years' experience as an environmental scientist and ecologist. She has undertaken environmental assessments for a wide range of large and small-scale infrastructural projects. Sinead has been responsible for the management and writing of a number of EISs/ EIARs, Strategic Environmental Assessment (SEA) and Appropriate Assessment (AA) (Screenings and Natura Impact Statements) for development of schemes close to and within Natura 2000 sites (SAC/SPA). Sinead has been involved in Oral hearings for road schemes, been responsible for the management of expert witnesses and acted as expert witness for EIS/EIA Reports. Sinead has been responsible for the review of EIS/EIARs for flood schemes, as well as the review of EIS on behalf of DPER. Sinead was responsible

for the Flora and Fauna Chapter (Ch.5) of the EIAR in conjunction with Sarah Mullen and the Water – Hydrology & Hydrogeology Chapter (Ch.7)

Dr. Sarah Mullen - Sarah Mullen is an Ecologist, holding a B.Sc. (Hons) in Botany, an M.Sc. in Biodiversity and Conservation and a Ph.D. in Botany, in which she investigated the role of biodiversity in the functioning of plant-pollinator interactions in semi-natural grassland habitats. Sarah has extensive experience in multidisciplinary ecological surveys, ecological impact assessment and appropriate assessment. Sarah has experience working with Indigo Development and Change, a conservation focused NGO in South Africa and with the German branch of the Global Biodiversity Information Facility (GBIF) in the Museum für Naturkunde in Berlin. Sarah's key strengths and areas of expertise are in terrestrial flora and fauna ecology, including vegetation surveys, habitat mapping, invasive species surveys, mammal surveys, Appropriate Assessment and Ecological Impact Assessment. Sarah is a member of the Chartered Institute of Ecology and Environmental Management. Sarah was responsible for the Biodiversity, Flora and Fauna Chapter (Ch. 5) in conjunction with Sinead Gavin.

Dr. Kathryn Carney – Kathryn's qualifications include a Bachelor of Engineering (Civil), from National University of Ireland Galway (2008) (BE (Hons)) and a PhD Civil Engineering, National University of Ireland Galway (2012), in addition to being a Member of Engineers Ireland (MIEI). Kathryn is a civil engineer with 8 years' post graduate experience in the field of civil and environmental engineering. Kathryn has undertaken environmental impact assessments for a number of flood relief schemes including River Deel (Crossmolina), the Lower Lee (Cork City) and Bandon. Kathryn was responsible for the Soils and Geology Chapter (Ch.6) and Material Assets Chapter (Ch.11) in conjunction with Raymond Brennan. Kathryn was also responsible for the Description of the Proposed Development (Chapter 3) and Material Assets (Chapter 11) of the EIAR Addendum.

Dr. Raymond Brennan – Raymond's qualifications include Bachelor of Engineering (Civil), National University of Ireland Galway (2008) (BE (Hons)) and a PhD in Civil Engineering from National University of Ireland Galway (2012). Raymond is also a Chartered Engineer (CEng) and a Member of Engineers Ireland (MIEI). Raymond is a civil engineer with 8 years' post graduate experience in the field of civil and environmental engineering. Raymond was responsible for the Soils and Geology Chapter (Ch.6) and Material Assets Chapter (Ch.11) in conjunction with Kathryn Carney.

Nicholas Duff – Nick has 38 years' experience of ecological work, nature conservation and impact assessment. His qualifications include a BSc in Ecology from, University of Limerick and a Diploma in E.I.A. Management from University College Dublin. His experience extends into agriculture and development at home and in Africa. He has undertaken environmental assessments for a wide range of large and small-scale infrastructural projects concerning wind energy development, housing, waste, landfills and tourism. Nick has been responsible for the management and writing of a number of EISs/ EIARs, Strategic Environmental Assessment (SEA) and Appropriate Assessment (AA) (Screenings and Natura Impact Statements) for development of schemes close to and within Natura 2000 sites (SAC/SPA). Nick is the environmental lead in the preparation of EISs on several flood schemes including the Ballinasloe FRS, Lifford FRS, and Athea FRS. He was responsible for the completion of the Biodiversity, Flora and Fauna Chapter (CH. 5) of the EIAR Addendum.

Eoin Gilson – Eoin qualified with a BSc (Hons) Bachelor of Science (Microbiology) from National University of Ireland Galway (2010) and a Master of Science (MSc) in Applied Environmental Science

from Halmstad University, Sweden (2017). Eoin is an Environmental Scientist with over 2 years' post graduate experience in the field of environmental consultancy. Eoin was responsible for the Addendum Water – Hydrology & Hydrogeology Chapter (Ch.7) and Addendum Schedule of Mitigation Chapter (Ch.13) in conjunction with Dr. Kathryn Carney.

Grace Kilbane – Grace's qualifications include a BSc (Hons) Science from National University of Ireland, Galway and an MSc (Hons) in Ecological Management and Conservation Biology from Queen's University Belfast. Grace is also an Associate Membership of the Chartered Institute of Ecology and Environmental Management (ACIEEM). Grace has 4 years' experience in the preparation of technical environmental reports such as Appropriate Assessment Screenings, Natura Impact Statements, Environmental Impact Assessment documents and EIAR Chapters. Grace was responsible of the Natura Impact Statement (NIS) Addendum.

Dr. Maebh Grace – Maebh's qualified with a BE (Hons) Bachelor of Engineering (Environmental), National University of Ireland, Galway. (2012) followed by a PhD (Civil Engineering), National University of Ireland, Galway (2016). She is also a Chartered Engineer (CEng) and a Member of Engineers Ireland (MIEI). Maebh has 7 years' post graduate experience in research and industry, including 4 years' experience in water services infrastructure projects at planning, design and construction stages. She was responsible for completion of the Construction and Environmental Management Plan (OCEMP).

MKO

Brian Keville - Brian is the Environmental Director of MKO and has over 20 years' professional experience as an environmental consultant having graduated from the National University of Ireland, Galway with a first-class honours degree in Environmental Science. Brian was one of the founding directors of environmental consultancy, Keville & O'Sullivan Associates Ltd., prior to the company merging in 2008 to form McCarthy Keville O'Sullivan Ltd. MKO). Brian's professional experience has focused on project and environmental management, and environmental impact assessments. Brian has acted as project manager and lead-consultant on dozens of environmental impact assessments, across various Irish counties and planning authority areas. These projects have included large infrastructural projects such as roads, ports and municipal services projects, through to commercial, mixed-use, industrial and renewable energy projects. The majority of this work has required liaison and co-ordination with government agencies and bodies, technical project teams, sub-consultants and clients. Brian oversaw the preparation of all MKO chapters of the EIAR and inputs to the chapters 1, 2, 4 and 9 of the EIAR Addendum.

Michael Watson - Michael is Project Director and head of the Environment Team in MKO. Michael has over 18 years' experience in the environmental sector. Following the completion of his Master's Degree in Environmental Resource Management, Geography, from National University of Ireland, Maynooth he worked for the Geological Survey of Ireland and then a prominent private environmental & hydrogeological consultancy prior to joining MKO in 2014. Michael's professional experience includes managing Environmental Impact Assessments, EPA License applications, hydrogeological assessments, environmental due diligence and general environmental assessment on behalf of clients in the public infrastructure, energy, waste management, commercial and industrial sectors nationally. Michael also has a Bachelor of Arts Degree in Geography and Economics from NUI Maynooth, is a Member of IEMA, a Chartered Environmentalist (CEnv) and Professional Geologist (PGeo). Michael oversaw the preparation of all MKO chapters of the EIAR.

Owen Cahill - Owen is an Environmental Engineer with McCarthy O'Sullivan Ltd. with over 10 years of experience in the environmental management and construction industries. Owen holds BSc. (Hons) and MSc. in Construction Management and a master's in environmental engineering. Owen's wide ranging multi sector experience has provided him with specialist knowledge and understanding of the challenges in the planning and delivery of developments with the minimum environmental impact and with practicality and constructability in mind. Owen's key strengths and areas of expertise are in project management, environmental impact assessment, wind energy & solar energy construction & environmental management planning and waste permit management. Since joining MKO Owen has been involved as a Project Manager on a range of energy infrastructure, commercial, residential, waste facility and quarry projects as well as managing the licensing requirements of a number of EPA licensed facilities. Within Owen has project managed the Environmental Impact Assessment of a range of development projects across the Ireland and is a Full Member of the Institute of Environmental Management & Assessment and is a Chartered Environmentalist. Owen prepared the MKO inputs to the Chapter 8 (Air Quality & Climate / Noise & Vibration) of the EIAR Addendum.

Evelyn Sikora - The Landscape chapter of the EIAR was prepared by Evelyn Sikora, a qualified Landscape Architect who also holds Corporate Membership of the Irish Landscape Institute. Evelyn has since moved on from MKO to take up another role elsewhere. Evelyn graduated from Edinburgh College of Art with a degree in Landscape Architecture and also holds a Masters in Planning and Sustainable Development from University College Cork (2010. Evelyn had over five years' experience as a Landscape Architect at the time the report was prepared and had worked on landscape and visual impact assessments for a variety of infrastructure projects of various scales throughout Ireland. Evelyn's professional experience spanned a range of other projects including road schemes, flood relief works, quarries, harbour developments, and residential developments. Evelyn was responsible for the landscape and visual impact assessment in Chapter 9 of the EIAR.

John Staunton – During the preparation of the EIAR, John Staunton was a Project Environmental Scientist with MKO having over 11 years of postgraduate experience in both research and private consultancy. Evelyn has since moved on from MKO to take up another role elsewhere. John holds both a BSc (1st class Hons) and a PhD in Environmental Science. Prior to taking up his position with MKO in October 2014, John worked as a research assistant for several soil and hydrogeological contamination research projects being undertaken by the Earth and Ocean Sciences department in NUI Galway. John also carried out research as part of a PhD, is lead author on four international peer-reviewed scientific papers, and presented at numerous national and international conferences. During his time with MKO, John was involved as a Project Environmental Scientist on a significant range of infrastructure projects, hydrological and ecological monitoring, report writing of Environmental Reports (ER), Environmental Impact Statements/Environmental Impact Assessment Reports (EIS/EIAR) & Strategic Environmental Assessments (SEA) and carrying out research/literature reviews. John was responsible for the introductory chapters of the EIAR in addition to the human beings chapter (Chapter 9) of the EIAR.

Damian Brosnan Acoustics

Damian Brosnan - Damian has been working in acoustics since 1996, having graduated from University College Cork with a B.Sc. (Honours) in 1993. He holds a Postgraduate Diploma in Acoustics & Noise Control from the Institute of Acoustics, and an MSc in Applied Acoustics from the University of Derby.

Damian is a member of the Institute of Acoustics (MIOA) and is secretary of their Irish branch. He is also a member of Engineers Ireland, and a member of Association of Acoustic Consultants of Ireland, a recently formed association of Irish professional acoustic consultants. Damian has worked on several hundred noise projects to date, including a number of large scale infrastructure, residential, commercial and industrial developments. Damian was responsible for the noise and vibration assessment in Chapter 8 of the EIAR.

John Cronin & Associates

John Cronin – John qualifications include a Batchelor of Arts (Hons) – Archaeology from University College Cork, (1991), a Master of Regional and Urban Planning, University College Dublin (1993) and a Master of Urban and Building Conservation, University College Dublin, 1999. John has each amassed over twenty years' experience in archaeological and cultural heritage assessments, including EIA assessment for flood relief schemes in Bandon and Cork City. John was jointly responsible for the production of the Cultural Heritage Chapter (Ch.10).

Tony Cummins – Tony holds a Batchelor of Arts (Hons) – Archaeology from University College Cork (1992) and a Master of Arts (Hons)- Archaeology from University College Cork (1994) and has been a licence-eligible Archaeologist in the Republic of Ireland since 1998. Tony has amassed over twenty years' experience in archaeological and cultural heritage assessments, including EIA assessment for flood relief schemes in Bandon and Cork City. Tony was jointly responsible for the production of the Cultural Heritage Chapter (Ch.10).

ARUP

Clifford Killeen - Clifford is a Senior Engineer within the Arup Transportation & Urban Design Team, with 15 years' experience in transportation including planning, design and analysis. Clifford qualified from University College Cork in 2004 with a BEng, Civil (Hons), and is a Chartered Engineer (accredited 2014). Relevant project experience includes preparation of a number of EIAR traffic chapters for a wide range of development types, including the Glashaboy FRS, the Lower Lee FRS, the Indaver Resource Recovery Centre application and 2019 update of same for submission for a Waste Management License, the Indaver Duleek Expansion Project and the Apple Athenry Data Centre Project. Clifford was responsible for the traffic impact assessment as part of Chapter 11 EIAR addendum

O'Donnell Environmental

Tom O'Donnell – Tom O'Donnell is a Chartered Environmentalist and a full member of the Chartered Institute of Ecology and Environmental Management. He was awarded a BSc in Environmental and Earth System Science [Applied Ecology] in 2007 and an MSc in Ecological Assessment in 2009, both from UCC. Tom has over 10 years professional experience in the environmental industry, including working on projects including windfarms, overhead power lines, roads, cycleways and residential developments. Tom is licensed by NPWS for roost disturbance (Ref: DER/BAT 2019-58) and to capture bats (C185/2019). Tom prepared the Bat Survey Report for the EIAR Addendum.

JBA Consulting

Jonathan Cooper – Jonathan Cooper (BEng; MSc; DipCD; CEng; C.WEM; C Dir F Inst D MICE; MCIWEM; MIEI) has over 36 years' experience in river engineering and restoration, environmental consultancy, strategic catchment management, water resources and hydropower.
Technical lead and project director on numerous strategic flood risk management studies for EA, local authorities and OPW, considering economic, social and environmental objectives in the development of sustainable long-term plans.
He directed JBA's portfolio of 12 catchment flood management plans in England and Wales, using strategic environmental assessment to aid objective led multi-criteria appraisals. He has pioneered the assessment of non-structural responses to flood risk in the Thames Estuary strategy. He led the Western CFRAM project and developed an MCA/CBA tools for World Bank for Cycle 2 of the Floods Directive.

Matthew Hemsworth
Matt Hemsworth (BSc; MSc; FRGS; MCIWEM; C.WEM) is a Technical Director and is JBA's Lead Geomorphologist. Matt manages the Fluvial Geomorphology team. Matt has over 13 years professional Geomorphology experience and has worked at JBA for 11 years. Matt has specialist skills in geomorphology / hydromorphology, river restoration, hydraulic modelling, sediment management, weir removal, WFD assessment and restoration optioneering and design. Matt is an experienced project manager, team leader and technical leader, managing various multi-disciplinary teams. Matt has a BSc (Hons) degree in Geography and a Masters (MSc) degree in Environmental Dynamics from Loughborough University.
Matt has utilised his skills by leading numerous geomorphic assessments for various projects throughout the UK, Europe (including Ireland and Romania) and Africa.
Matt's work has focused upon river restoration design, geomorphology fluvial audits, sustainable sediment management, weir removal, weir modification and WFD compliance assessments (including for bridge construction, de-culverting, sediment management, channel re-alignment and weir removal). Matt has led projects for a number of clients including Network Rail, the Rivers Agency (Northern Ireland), the Environment Agency in the UK, NRW in Wales, the Coal Authority, OPW in Ireland, the World Bank, local councils (UK and Ireland), several Rivers Trusts and many private clients.
Matt leads JBA's Geomorphology and River Restoration training courses for both internal and external clients. Matt is also a course tutor on the JBA / Lancaster University Flood and Coastal Risk Management Postgraduate course, where he leads the Sustainable Floodplain Management and River Restoration module.

Proviz

Mel Durkan – Mel Durkan is the managing director of Proviz Limited, a 3D visualisation company specialising in the provision of verifiably accurate photomontages for planning, public consultations and visual impact assessments. With over 17 years' experience, Proviz have evolved techniques in line with new technologies to ensure faithfully accurate visualisations for private, commercial and public works nationwide. Mel prepared the 3D photomontages for the proposed scheme that are included in Chapter 9 (Landscape) of the EIAR.

2 BACKGROUND TO THE PROPOSED DEVELOPMENT

This Chapter of the Environmental Impact Assessment Report (EIAR) Addendum provides supplementary information in relation to the introduction of the proposed Scheme and is to be read in conjunction with Chapter 2 of the River Bride (Blackpool) Certified Drainage Scheme EIAR.

The following supplementary information pertaining to Chapter 2 of the EIAR was requested by the Department of Public Expenditure and Reform on 07th May 2020 and is provided in this section of the EIAR Addendum:

2. *Further information to clearly show how environmental considerations were taken account of during consideration of alternatives. This should cover the reasonable alternatives considered at different hierarchical stages from catchment level alternatives to alternatives to specific works elements. Where identified constraints influenced the selection of alternatives, this should be clearly explained. Where issues raised during consultation were taken account of during consideration of alternatives, this should also be clearly explained. The information provided should include a comparison of the environmental effects of alternatives at each hierarchical level.*

The request for supplementary information and general comments in relation to Chapter 2 of the EIAR have been addressed in the subsequent sections of this Chapter.

Unless otherwise specified, any text provided below supersedes the text provided in the relevant section of the EIAR. In some instances, it has been necessary to reproduce text from the original EIAR. This text is shown in grey for ease of reference.

2.6 CONSIDERATION OF ALTERNATIVES

This section of the EIAR outlines how environmental considerations were taken account of during the consideration of alternatives. A detailed explanation is provided in the below as to how reasonable alternatives were considered at a catchment level, in terms of scheme options considered, and finally in terms of individual interventions or proposals that form part of the proposed scheme, with information to allow the comparison of environmental effects of these alternatives being provided at each hierarchical level.

2.6.1 Catchment Level Alternatives

Environmental considerations were first taken into account during the consideration of alternatives through an initial screening exercise of potentially viable flood risk management measures was in terms of their 1) environmental criteria, 2) their applicability to the area, 3) economic criteria, 4) social criteria and 5) cultural criteria. The potentially viable measures included both non-structural and structural measures, as well as the "do nothing" and "do minimum" scenarios.

The non-structural potentially viable measures screened initially included:

- Planning control
- Building regulations
- Flood forecasting
- Public awareness
- Land use management.

The structural potentially viable measures screened initially included:

- Upstream storage
- Direct flood defences
- Diversion channels or culverts
- Conveyance improvements
- Relocation
- Individual property protection
- Pumping
- Sediment management
- Debris control.

The environmental criteria used to assess each potentially viable measure included consideration of whether the measure could give rise to environmental impacts or benefits. Where it was considered that environmental impacts or benefits could arise from any of the potentially viable measures, and the screening exercise also confirmed that the measures met the 1) applicability 2) economic 3) social 4) and cultural criteria, those measures were considered "potentially viable" in the initial screen exercise and brought forward for technical assessment.

The flood risk management measures considered non-viable were not carried forward for further technical assessment, and the reasons each was considered non-viable are set out in Section 3.2 of the 2016 Options Report. A total of nine (9) measures were considered to be potentially viable, as listed below:

- Upstream storage
- Direct Flood Defences
- Culverting Open Watercourses
- Diversion Channels (or Culverts)
- Conveyance Improvements
- Debris Control
- Sediment Management
- Pumping
- Combination of the above

Section 4 of the January 2016 Options Report describes each of the potentially viable measures in detail, including multiple options and variations of each measure. The descriptions are primarily technical in nature, referencing the hydrology of the river and catchment. The descriptions also identify potential constraints or limitations that may influence the effectiveness of the proposed measures or their individual design.

2.6.2 Scheme Options

Five separate scheme options were then developed, comprising various combinations or variations of the viable measures previously described, as follows:

- Option 1 – 'Do-Minimum'
- Option 2 – Ballincrokig flood storage, combined with conveyance improvements and direct defences at Common's Road/Blackpool.
- Option 3 – Conveyance improvements and direct defences (with high walls in Orchard Court).
- Option 4 – Conveyance improvements and direct defences (with culvert through Orchard Court).
- Option 5 – Conveyance improvements & direct defences (culvert replacement from Orchard Court to Madden's Building).

All options were also to include debris control and sediment management measures, as listed amongst the viable measures. Specifically addressing sediment management, various options were considered in terms of their hydromorphological implications and conclusions in terms of their feasibility, as outlined in Table 2.1 below.

Table 2.1 Summary of sediment management options considered

Option	Hydromorphological implication	Conclusion
Do minimum - continue to maintain existing culvert system	Continued disruption to sediment and river continuity in the Lower Bride catchment will occur, due to the existing modified nature of the river, which includes modified river channels and culverts. The do minimum option, will include ongoing maintenance and sediment removal from culverts in order to reduce flood risk. This will continue to impact key hydromorphological quality elements (such as sediment continuity and the quality of bed substrate) leading to a degraded hydromorphological condition.	Unfeasible due to flood risk implications and health and safety risk accessing culverted system for maintenance
Upstream reservoir (in upper catchment) to attenuate flooding	Installation of a large upstream reservoir to store flood water will disrupt river and sediment continuity. This will lead to downstream hydromorphological degradation and changes to the river bed and substrate throughout the catchment, due to reduced sediment transport.	Unfeasible due to wider catchment hydromorphological and ecological effect.
Installation of a Sediment Trap and commitment to long term maintenance	Installation of a sediment trap will impact hydromorphological conditions in the Lower Bride catchment. This may include river bed incision which may be created due to bed erosion as a result of the reduced sediment supply. Although, this is likely to be only a risk in limited areas due to the hard engineered nature of the channel (i.e. concrete bed). The trap will act to capture coarse sediment, leading to a disruption in sediment continuity.	Feasible, with a planned monitoring and maintenance regime in place.
Retain natural channel at Orchard Court and install high walls	Installation of a sediment trap will impact hydromorphological conditions in the Lower Bride catchment. This may include river bed incision which may be created due to bed erosion as a result of the reduced sediment supply. The trap will act to capture coarse sediment, leading to a disruption in sediment continuity. This could lead to negative impacts in the retained section of "natural" watercourse at Orchard	The retained channel at Orchard Court would need to have positive geomorphic features included which would be hydraulically inefficient and need to be maintained and require

	Court. Loss of bed material would occur and possible erosion of the banks.	access within the channel.
Improve the size of the culverts to reduce the flood risk associated with sedimentation	Upsizing of the culverts, with installed soft beds and gravel features in the Lower Bride system would allow sediment continuity to occur (i.e. sediment transport into the Lee without disruption from structures). This option would lead to hydromorphological improvements over existing conditions.	This proposal introduces maximum hydromorphological benefit, however is likely to be too costly and disruptive on traffic in Blackpool village during construction.

Any potentially viable measures not forming part of one of the five options that were developed, was not considered a "reasonable alternative" as is required to be described by Article 5(1)d) of the EIA Directive.

All five options were deemed to be cost beneficial by way of a cost benefit analysis, and were taken forward for multi-criteria analysis (MCA) to evaluate the performance of each option in terms of predefined objectives.

Environmental considerations were taken into account in the MCA, with 'Environmental' being one of four categories of flood risk management objectives used along with Technical, Economic and Social. A total of six separate environmental objectives were used in the MCA, as outlined below:

- Water Framework Directive Objective - Support the objectives of the WFD.
- Habitats and Birds Directives Objectives - Support the objectives of the Habitats and Bird Directives.
- Flora and Fauna - Avoid damages to, and where possible enhance, the flora and fauna of the catchment
- Fisheries - Protect and where possible enhance fisheries resource within the catchment
- Landscape character - Protect and where possible enhance, landscape character and visual amenity within the zone of influence.
- Cultural heritage - Avoid damage to or loss of features of cultural heritage importance and their setting and improve their protection from extreme floods.

Each environmental objective was supported by a sub-objective, a basic requirement and an aspirational target.

Each flood risk management objective was given a global and local weighting. Global weighting (ranging between 5 and 30) applied a weighting, fixed by the OPW at a national level, to each objective used. Local weightings (ranging between 0 and 5) were applied and considered specific to the importance of each objective in the location where the option was being considered. Finally, each option was then scored relative to the present-day situation (baseline condition), based on how well they met the objectives.

A rationale for the selection of the local weightings is provided for every environmental objective, for each of the four Options 2, 3, 4 and 5 subjected to the MCA. Global and local ratings, and rationale for the selection of local weightings are similarly applied to the technical, economic and social objectives for all four options. In the case of all objectives, further rationale is provided for the scores applied to each objective.

Every objective, including the six environmental objectives, for all four options under consideration, was then scored relative to the (then) present-day (2016) situation (baseline condition), based on how well each option met the objective. A further rationale was provided for every score applied, which then resulted in an overall MCA score for each objective, and a sub-total "Environmental Score" and similar sub-total scores for technical, economic and social categories. The total of the environmental, technical, economic and social scores gave rise to a 'Option Selection Benefit Score', which was further factored into the final MCA benefit/cost ratio and economic benefit/cost ratio.

The rationale for applying environmental scoring to each objective across the four options (excluding the 'Do-Minimum' option), are set out in Table 2.2 below. Table 2.2 demonstrates how the environmental effects of each of the scheme options, were considered and compared as part of the MCA.

The sub-total Environmental Score for the selected option, Option 4 (Conveyance improvements and direct defences with culvert through Orchard Court), was -175, compared to -175 (Option 2), -250 (Option 3) and -190 (Option 5), but the other differing technical, economic and social scores across the options, in addition to use of professional judgement, resulted in Option 4 being progressed as the proposed option.

Environmental considerations, and specifically the environmental objectives used across all OPW MCAs formed an integral part of the consideration of alternatives process from which the proposed scheme emerged.

Table 2.2 Rationale for scoring applied to environmental objectives for scheme options

Environmental Objective	OPTION 2 - Ballincrokig flood storage, combined with conveyance improvements and direct defences in Common's Road/Blackpool	Scoring	OPTION 3 - Conveyance improvements and direct defences (with high walls in Orchard Court)	Scoring	OPTION 4 - Conveyance improvements and direct defences (with culvert through Orchard Court)	Scoring	FRS OPTION 5 - Conveyance improvements & direct defences (culvert replacement from Orchard Court to Madden's Building)	Scoring
Support the objectives of the WFD	Possible improvement in water quality and the main objectives of the Water Framework Directive River Basin District Management Plan (RBDMP). No significant impact of permanent works during operation, however there is potential for temporary impact during construction stage.	1	Possible improvement in water quality and the main objectives of the Water Framework Directive River Basin District Management Plan (RBDMP). No significant impact of permanent works during operation, however there is potential for temporary impact during construction stage.	1	Possible improvement in water quality and the main objectives of the Water Framework Directive River Basin District Management Plan (RBDMP) will be enhanced by limiting potential for dumping in river. No significant impact of permanent works during operation, however there is potential for temporary impact during construction stage.	2	Possible improvement in water quality and the main objectives of the Water Framework Directive River Basin District Management Plan (RBDMP). No significant impact of permanent works during operation, however there is potential for temporary impact during construction stage.	1
Support the objectives of the Habitats and Birds Directives	Potential for construction related water-quality impacts on water dependent Annex I habitats and Annex II species as a result of instream works. Potential for disturbance/loss of Kingfisher nest sites (low potential). Potential for change in water levels on the Glenamought River during the operational stage which may impact on Annex II water dependent species. Potential for loss of bat (Annex IV species) roosting sites. Potential for habitat loss for Annex II water dependant species e.g. Lamprey. This score was selected on the basis that very little work would be required downstream of the storage area.	-1	Potential for construction related water-quality impacts on water dependent Annex I habitats and Annex II species as a result of instream works. Potential for disturbance/loss of Kingfisher nest sites (low potential). Potential for loss of bat (Annex IV species) roosting sites. Potential for habitat loss for Annex II water dependant species e.g. Lamprey.	-2	Potential for construction related water-quality impacts on water dependent Annex I habitats and Annex II species as a result of instream works. Potential for permanent loss of habitat for Annex II water dependent species as a result of river bed excavation. Potential for habitat loss for Annex II water dependant species e.g. Lamprey. Potential for obstruction to migration of Annex II species.	-3	Potential for construction related water-quality impacts on water dependent Annex I habitats and Annex II species as a result of instream works. Potential for disturbance/loss of Kingfisher nest sites (low potential). Potential for loss of bat (Annex IV species) roosting sites. Potential for habitat loss for Annex II water dependant species e.g. Lamprey.	-2
Avoid damages to, and where possible enhance, the flora and fauna of the catchment	Potential for loss of hedgerow/woody vegetation during construction works with impacts on native bird species. Potential for disturbance and spread of invasive Japanese Knotweed and other non-native/invasive species during bankside construction works.	-1	Potential for loss of hedgerow/woody vegetation during construction works with impacts on native bird species. Potential for disturbance and spread of invasive Japanese Knotweed and other non-native/invasive species during bankside construction works.	-1	Potential for loss of hedgerow/woody vegetation during construction works with impacts on native bird species. Potential for disturbance and spread of invasive Japanese Knotweed and other nonnative/invasive species during bankside construction works.	-1	Potential for loss of hedgerow/woody vegetation during construction works with impacts on native bird species. Potential for disturbance and spread of invasive Japanese Knotweed and other non-native/invasive species during bankside construction works.	-1
Protect and where possible enhance fisheries resource within the catchment	Potential for construction related water-quality impacts on fish species as a result of instream and bankside works. Potential for change in water levels on the Glenamought River during the operational stage which may impact on fish species. One of the biggest issues will be potential siltation during construction. There will need to be very stringent mitigation measures in place and an ecologist on site to supervise. Swim speeds of fish and hydrobreak operation will determine resistance to entrainment. The inclusion of a hydrobreak has the potential to significantly impact on fishpass from upstream to downstream of the storage area.	-3	Potential for construction related water-quality impacts on fish species as a result of instream and bankside works. Potential for habitat loss for fish species. Potential for obstruction to migration of fish species.	-1	Potential for construction related water-quality impacts on fish species as a result of instream and bankside works. probability of permanent habitat loss for fish species along route of proposed culvert. Potential for obstruction to migration of fish species. Score reflects concerns raised by IFI.	-4	Potential for construction related water-quality impacts on fish species as a result of instream and bankside works. Potential for habitat loss for fish species. Potential for obstruction to migration of fish species.	-1
-1Protect and where possible enhance, landscape character and visual amenity within the zone of influence.	Potential for construction related and operation visual impacts on completion, based on introduction of new man-made structure in existing agricultural setting. Reduction in any visual impact likely possible through landscaping and screening. Elsewhere, potential for some local but no significant visual impacts, based on limited views from public spaces and location within largely urban and industrial area.	-2	Proposed Option C wall height of 2.1m would represent significant visual intrusion in the residential area of Orchard Court. Visual impact likely to be significant. Elsewhere, potential for some local but no significant visual impacts, based on limited views from public spaces and location within largely urban and industrial area.	-4	Potential for positive visual impact in Orchard Court by creation of a maintainable landscaped area. Elsewhere, potential for some local but no significant visual impacts, based on limited views from public spaces and location within largely urban and industrial area.	-1	Potential for some local but no significant visual impacts, based on limited views from public spaces and location within largely urban and industrial area.	-2
Avoid damage to or loss of features of cultural heritage importance and their setting, and improve their protection from extreme floods.	The Church of the Annunciation (Blackpool Church) to south is listed in NIAH and no significant impacts are foreseen. Area to be impacted construction works is within the site of a former flax mill listed in RMP (CO074-115). While this site appears to have been demolished, it is recommended that consultation be undertaken with NMS and City Council heritage staff to determine appropriate assessment and mitigation. Any in-channel works may impact on unrecorded riverine archaeological features. Underwater Archaeological Unit should be consulted in relation to appropriate assessment and mitigation.	-4	The Church of the Annunciation (Blackpool Church) to south is listed in NIAH and no significant impacts are foreseen. Area to be impacted construction works is within the site of a former flax mill listed in RMP (CO074-115). While this site appears to have been demolished, it is recommended that consultation be undertaken with NMS and City Council heritage staff to determine appropriate assessment and mitigation. Any in-channel works may impact on unrecorded riverine archaeological features. Underwater Archaeological Unit should be consulted in relation to appropriate assessment and mitigation.	-2	The Church of the Annunciation (Blackpool Church) to south is listed in NIAH and no significant impacts are foreseen. Area to be impacted construction works is within the site of a former flax mill listed in RMP (CO074-115). While this site appears to have been demolished, it is recommended that consultation be undertaken with NMS and City Council heritage staff to determine appropriate assessment and mitigation. Any in-channel works may impact on unrecorded riverine archaeological features. Underwater Archaeological Unit should be consulted in relation to appropriate assessment and mitigation.	-2	It is noted that works are in vicinity of 19 Watercourse Rd (listed in NIAH) and Madden's Buildings (RPS 491). No significant impacts are foreseen. The Church of the Annunciation (Blackpool Church) to south is listed in NIAH and no significant impacts are foreseen. Area to be impacted construction works is within the site of a former flax mill listed in RMP (CO074-115). While this site appears to have been demolished, it is recommended that consultation be undertaken with NMS and City Council heritage staff to determine appropriate assessment and mitigation. Any in-channel works may impact on unrecorded riverine archaeological features. Underwater Archaeological Unit should be consulted in relation to appropriate assessment and mitigation.	-3

2.6.3 Specific Works Elements

For the individual work elements that make up the proposed scheme, the numbers of options or variations for interventions were limited, largely due to the hydrological, engineering and technical design requirements and constraints. The specific interferences were designed on a pragmatic basis with a holistic consideration of environmental, technical, economic and buildability considerations. In particular areas, identified constraints influenced the selection of alternative specific interventions as follows:

1. Upstream of Fitz's Boreen, to the rear of the properties which face out onto the N20 (approximately 270m on Bride, approximately 85m on side channel). Alternatives considered were;
    a) L-shaped retaining walls, or;
    b) sheetpiles.

    The environmental constraints which shaped this design were seepage issues and the objective to limit in-stream works where possible. As such sheetpiling rather than L-shaped walls has been specified to mitigate seepage risk and reduce in channel works.
2. Dulux Paint Factory: The existing channel walls are generally high enough to contain the 1 in 100-year event including 500mm freeboard thus only local repairs are necessary. Alternatives considered were:
    a) to limit works to repairing the walls, or;
    b) to repair the walls and provide fisheries enhancements.

    Option b was progressed thus a natural channel is specified in the Confirmation submission as an environmental enhancement.
3. Blackpool Retail Park – existing pedestrian footbridge: Alternatives considered were:
    a) Remove the existing pedestrian footbridge;
    b) Maintain a footbridge. This would necessitate a break in the flood defence wall and installation of a demountable. Further, the footbridge would be underwater in a flood event.

Two environmental considerations shaped the selection of the alternative; these were the amenity value of the footbridge and associated walking route weighted against the risk to human health in the event of failure of the demountable. The demountable would have maintained the loop walking route however it would not be passive. The footbridge is in a private area without passive surveillance there is a high residual risk. With regard to the amenity value, it was noted that post scheme, with the bridge removed access to both sides of the watercourse is maintained via the footways albeit the loop would be broken. Thus, the specific intervention; i.e. the removal of the bridge was chosen as the preferred solution.

The full suite of specific interventions is described in the Options Report and the Confirmation Schedules. In addition to the considerations highlighted above, the environmental considerations which shaped the selection of specific interventions are expanded upon in Table 2.3 below.

Table 2.3 Conveyance improvements and direct defences (with culvert through Orchard Court) Summary of Specific Interventions

Area	Measure category	Chainage	Location (and Total Length of Channel Affected)	Description	Alternatives considered & selection rational
Commons Road Area	Defence Embankment	C06_2542 to C06_2590	Lower Kileens Road	New flood defence wall, approximately 110m long, average 0.8m high	Additional defence added to the scheme. Minimise intervention in this area. No viable alternative identified.
	Conveyance Improvement	C08_0160	Upstream of North Point Business Park (Approximately 7m)	Replace existing masonry bridge with a new RC bridge, 10m wide x 1.5m high	None considered, removal of arch is critical
	Conveyance Improvement	C08_0000	North Point Business park (Approximately 20m)	Replace existing 3no pipe culverts with a new RC bridge 9m wide by 1.7m high	Maximise flow area. Bridge design allows reinstatement of riverbed and a naturalised channel. Alternative of direct defences was considered however it would be more environmentally impactful and costly.
	Defence Embankment	C06_2053 to C06_2001	Commons Inn (upstream end of property) (Approximately 52m)	Construction of a new 0.6m high, 85m long flood defence embankment along right bank.	N/A
	Sediment Management	C06_2150 to C06_2100	North Point Business park (Approximately 50m)	Provisional Natural Sedimentation Area	
	Conveyance Improvement	C06_1845 to C06_1785	Commons Inn (downstream end of property) (approximately 60m)	Creation of a compound "winter channel", facilitating higher flows to remain in bank. Measure involves reducing ground levels on the right bank by approximately 1.5m - 2m over a 60m length to create the enlarged compound channel section.	N/A

Area	Measure category	Chainage	Location (and Total Length of Channel Affected)	Description	Alternatives considered & selection rational
Commons Road Area	Defence Walls	C06_1855 to C06_1490	Upstream of Fitz's Boreen, to the rear of the properties which face out onto the N20 (approximately 270m on Bride, approximately 85m on side channel)	Construction of a new 1.3m high (maximum height), 355m long, RC defence wall along right bank of the Bride River and a side channel of the Bride.	Walls were changed from L-shaped to piled as site investigation indicated seepage issues. Sheetpiles mitigate seepage issue and are environmentally favourable as it minimises construction in channel.
	Measure category	Chainage	Location (and Total Length of Channel Affected)	Description	Environmental consideration
	Conveyance Improvement	C06_1425 to C06_1420	Fitz's Boreen Arch Bridge.	Replace existing 1m wide by 1.5m high twin masonry arch bridge with new RC rectangular bridge (cross section dimensions approximately 7.4m x 2.4m high)	Maximise flow area. Bridge design allows reinstatement of riverbed and a naturalised channel.
	Defence Walls	C06_1327 to C06_1010	Dulux Paints Factory (Approximately 317m)	Existing channel walls are generally high enough to contain the 1 in 100-year event including 500mm freeboard. Local concrete repairs/joint sealing will be required over the full 317m length of the existing walls on both banks. Local reconstruction of the existing parapet wall may also be required over approximately 20% of the length. Construction of natural channel features within the Dulux site and Sunbeam sites	L-Shaped walls at the back of existing walls to minimise works in-channel. Natural channel installed as a compensation measure for the culverting of Orchard Court culvert.

Area	Measure category	Chainage	Location (and Total Length of Channel Affected)	Description	Alternatives considered & selection rational
Commons Road Area	Defence Walls	C06_1340 to C06_1327	Dulux Paints Factory upstream bridge	Extend existing RC parapets by approximately 200mm	This measure will ensure that water does not overtop the bridge.
	Defence Walls	C06_1175 to C06_1167	Dulux Paints Factory downstream bridge	Extend existing RC parapets by approximately 300mm	This measure will ensure that water does not overtop the bridge.
	Conveyance Improvement	C06_1072	Sluice structure at Dulux Paints	Permanent removal of steel sluice structure	This measure will reduce blockage risk at this location.
	Debris Control	C06_1077 to C06_1015	Dulux Paints Factory (Approximately 62m)	Creation of a sedimentation trap, on the left bank of the Bride River immediately upstream of Sunbeam Industrial Estate	Slight alteration from exhibition to confirmation; the sediment trap at this location is proposed as the only sediment trap on the scheme and has been sized as such. This localises maintenance activities and thereby reduces future works in-channel. The channel approaching the sediment trap is naturalised form current form to improve fisheries value.
	Measure category	Chainage	Location (and Total Length of Channel Affected)	Description	Environmental consideration
	Conveyance Improvements	C06_915 to C06_1015	Sunbeam Industrial Estate (approximately 100m)	Removal of the existing Sunbeam culvert and replace with new re-aligned walled open channel 100m long x 8.5m wide	
	Defence Walls	C06_915 to C06_876	Sunbeam Industrial Estate (approximately 39m)	Proposed reinforced concrete flood defence wall to be constructed to a flood defence level of 15.12mOD on	

Area	Measure category	Chainage	Location (and Total Length of Channel Affected)	Description	Alternatives considered & selection rational
				both banks. All drainage outfalls to be fitted with non-return valves.	
Commons Road Area	Conveyance Improvements	C06_876 to C06_855	Sunbeam Industrial Estate (approximately 21m)	Replace existing concrete bridge with a new reinforced concrete bridge. Bridge to be of 10.50m clear span and 20m wide deck. Soffit level of new bridge to be 14.85mOD. Construct new access ramps to bridge, incorporating new reinforced concrete retaining walls where necessary.	Maximise flow area. Bridge design allows reinstatement of riverbed and a naturalised channel.
	Defence Embankment	C06_855 to C06_740	Blackpool Retail Park (approximately 115m)	Proposed flood defence embankment to be constructed typically 12m wide and to a height of 1.15m above existing ground levels to flood defence level (14.65mOD). Flood defence embankment to tie into high ground downstream of Sunbeam Industrial Estate bridge and into the proposed flood defence wall at Blackpool Retail Park.	Embankment ties into parklands and acts as a route for maintenance vehicles.
	Debris Control	C06_810 to C06_770	Blackpool Retail Park (approximately 40m)	Proposed trash screen to be constructed adjacent to Blackpool Retail Park.	
	Defence Walls	C06_756 to C06_546	Blackpool Retail Park (approximately 210m)	Proposed reinforced concrete flood defence wall to be constructed to a height typically 1.2m above existing ground levels to flood defence level	From Exhibition to confirmation a precast concrete coping added to the proposed wall adjacent to the retail park at landholder request to improve visual impact.

Area	Measure category	Chainage	Location (and Total Length of Channel Affected)	Description	Alternatives considered & selection rational
				(14.65mOD). All drainage outfalls to be fitted with non-return valves.	Wall is on mini-piles to avoid digging out the bank and minimise excavation in river.
Commons Road Area	Measure category	Chainage	Location (and Total Length of Channel Affected)	Description	Environmental consideration
	Conveyance Improvements	C06_629	Blackpool Retail Park (approximately 2m)	Existing pedestrian footbridge to be removed.	Bridge would be rendered inaccessible due to finished ground levels on the retail side of the bank. A demountable could have been installed to maintain the loop walking route however it would not be passive and as it is in a private area without passive surveillance there is a high residual risk. Post scheme, access to both sides of the watercourse is maintained.
	Defence Walls	C06_526 to C06_483	Blackpool Shopping Centre (approximately 47m)	Existing river wall to be raised to a height typically 1.53m above existing ground levels to flood defence level (13.80mOD). All drainage outfalls to be fitted with non-return valves.	Wall is behind existing gabions; gabions will be only temporarily removed where required. Design to minimise excavation in the watercourse.
Blackpool	Conveyance Improvement	C06_0435 to C06_0093	Orchard Court (Approximately 342m)	Installation of a new RC culvert through Orchard Court. Culvert size to be 5.5m x 2.1m	A significant amount of Japanese knotweed is present along the channel in this reach. Compensation measures include lightwells, mammal ledges throughout culvert. Naturalised channel provided upstream of Sunbeam by way of compensation/offset.
	Conveyance Improvement	C06_0190 to C06_0180	Orchard Court (Approximately 10m)	This measure involves the removal of the existing vehicular access bridge to Orchard Court and constructing a new access road over the new culvert.	N/A

Area	Measure category	Chainage	Location (and Total Length of Channel Affected)	Description	Alternatives considered & selection rational
Blackpool	Conveyance Improvement	C06_0115 to C06_0110	Orchard Court (Approximately 5m)	This measure involves the removal of Orchard Court Pedestrian Bridge and reinstating pedestrian access over the new culvert.	N/A
	Conveyance Improvement	C06_0093 to C06_0084	Orchard Court Culvert inlet (Approximately 9m)	Reconstruction of the existing culvert inlet to remove flow constriction on the Bride. New inlet to be 5.5m x 2.1m.	N/A
	Conveyance Improvement	C06_0055 to C06_0000	Blackpool Church (Approximately 55m)	Installation of a new 5.5m x 2.1m RC culvert section to replace existing open channel adjacent to Church.	Commitment to reinstating the church railings. Opportunity for public realm enhancements here to improve amenity value to community.
	Conveyance Improvement	C01_1171 to C01_1157	Blackpool Church (Approximately 20m)	The existing inlet to the culvert just downstream of the church is to be reconstructed as a 5.5m x 2.1m culvert, tapering to the dimensions of the existing culvert downstream (i.e. 4.8m x 1.6m).	N/A
	Conveyance Improvement	C01_0960 to C01_0900	Madden's Buildings (Approximately 60m)	Reconstruction of the existing culvert junction to minimise head losses for the Bride flow passing through the junction into the Kiln culvert.	Mammal ledges to retrofitted downstream as far as Maddens Junction.

2.6.4 Amendments to exhibited scheme

The scheme exhibited to the public on 29th July 2014 showed an "emerging preferred option" including flood defence walls along the River Bride through Orchard Court, with those proposed walls varying in height from 1.2m to 2.5m. The July 2014 public exhibition was attended by approximately 180 people, and of these, more than 40 indicated that they either lived in or were employed in Blackpool.

Comments received during and following the July 2014 public exhibition were reviewed before finalising the preferred option. The comments and submissions received highlighted the high walls solution proposed at Orchard Court as being unacceptable to many stakeholders. The concerns raised in the submissions were considered by the project steering group in the context of the following:

- The high walls option having the potential to cause significant, permanent, irreversible local landscape and visual effects, through the insertion of a localised visual barrier which would create a sense of enclosure and confinement for the residents of and visitors to the Orchard Court estate. The proposed walls in Orchard Court would have ranged in height from 1.2 metres in the northern end of the estate to 2.3 metres where the access bridge over the River Bride forms the entrance to the estate. The higher walls would have prevented or severely restricted views to the west from within the estate and reduced the visual and residential amenity of the Orchard Court estate.
- The high walls option having the potential to cause significant, long-term, residual social effects, through the further isolation and marginalisation of the Orchard Court estate and its residents. The estate is presently only accessed by the vehicular bridge from Common Road to the west and two narrow pedestrian entrances from the south, one from Commons Road and another from Thomas Davis Street, with the River Bride forming the western boundary of the estate. The estate is a low-income area that has suffered socio-economic deprivation and experienced problems with anti-social behaviour in the past. The proposal for high walls had the potential to further isolate and marginalise the residents by creating a sense of them being walled-in and hidden away behind the high walls, and potentially exacerbating anti-social behaviour.
- The high walls option would not fully eliminate a persistent problem of illegal dumping of rubbish into the River Bride's channel in the Orchard Court area, which could lead to blockages in the channel and reduced channel conveyance. Although the walls originally proposed were high in places, with heights of 1.2 metres in the north of Orchard Court, rubbish and other items could still be discarded over the wall into the channel, which has been a persistent problem recorded over many years. The proposed high walls would make it more difficult to see dumped rubbish building up over time and remove such rubbish and clear potential blockages in flood periods. Any blockage or reduced channel conveyance could give rise to overtopping of the defence walls in Orchard Court, which would be a dangerous scenario. Therefore, the high walls had the potential to cause ongoing operational risks and difficulties for the operation and effectiveness of the scheme.

The above considerations were balanced against the impacts of the proposed culvert option through Orchard Court as described in the EIAR, including on the ecological value of the river habitat, the visual amenity value of the river to the residents of Orchard Court and the houses on the Commons Road, privacy and security concerns of residents on the Commons Road through the installation of the culvert and the creation of the public amenity area over the current river channel. When reviewed holistically in comparison with the option of high walls through the Orchard Court area, the culvert option through Orchard Court was selected as the preferred option.

In addition to the change from a high walled to a culverted defence flood defence intervention through Orchard Court, a number of additional significant changes to the scheme were made between the public exhibition and the date of scheme confirmation, as outlined in Table 2.4 below.

Table 2.4 Summary of Significant Changes to the Scheme since Exhibition

Related Interference Ref (as per Confirmation Drawings)	Confir-mation Drawing Number	Description of Change to the Exhibited Scheme	Reason for Change
N/A	RB_104	Amendments to the predicted flood extent and benefitting land at the upstream end of the scheme (River Glennamought)	This change is associated with the addition of flood defences at two existing properties to the scheme post-exhibition
C06_B04	RB_208, RB_209	Increase the security of the boundary between Orchard Court and the Commons Road properties: • Plant thorny shrubs along the base of the proposed boundary wall on the Orchard Court side. • Increase the height of the proposed wall. • Specify a round-top coping to hinder climbing. • Add an anti-climb detail to the top of the wall on the Orchard Court side. • Install CCTV cameras in Orchard Court	Alleviation of security and privacy concerns.
C06_B04, C06_C02, C06_C04	RB_206, RB_207, RB_208, RB_209	• Implement fisheries measures upstream of the proposed Orchard Court culvert, including construction of natural channel features within the Dulux site and Sunbeam sites • Install small light wells in Orchard Court culvert	Enhancement measures for fisheries.
C06_B04, C06_B06, C06_B07, C06_B08, C06_B09, C01_B01, C01_B02	RB_208, RB_209, RB_211	Install mammal ledge within proposed culvert, and retrofit mammal ledge downstream as far as Maddens Junction.	Mitigation measures for potential impact of proposed Orchard Court culvert on mammal life.

Related Interference Ref (as per Confirmation Drawings)	Confir-mation Drawing Number	Description of Change to the Exhibited Scheme	Reason for Change
C06_G02, C06_G04, C02_G02	RB_204, RB_205, RB_212	Construct otter habitat enhancement measures at three locations in the catchment	Mitigation measures for potential impact of proposed Orchard Court culvert on mammal life
C06_L07, C06_L08, C06_L11, C06_L12, C06_L15	RB_206, RB_207	The proposed flood defence wall will now be constructed behind the existing wall, rather than being an extension of the existing wall.	Proposal to extend the existing wall as per the exhibition was found to be unfeasible following detailed structural analysis
C06_L07, C06_L12	RB_206, RB_207	Allow for raising existing gas service pipe attached to river wall at Dulux.	Landowner request
C06_L05, C07_L02	RB_205, RB_206	Remove the exhibited timber fencing on top of proposed flood defence wall at Bride Villas.	Landowner request
C06_L05	RB_205, RB_206	Add stairs access over the top of the flood defence wall at Bride Villas.	Landowner request
C06_L05, C07_L02	RB_205, RB_206, RB_401	Change of proposed flood defence wall at Bride Villas from a reinforced concrete section to a sheet pile section.	This decision was taken as part of the design development in order to provide appropriate seepage cutoff.
C08_E02, C08_E03, C08_L04, C08_R02, C08_R03, C08_T01	RB_203, RB_401, RB_501	Incorporate changes at the Woodpark property as follows: • Amendments to the alignment of the proposed flood defence embankment, and provision of a short length of flood defence wall to facilitate access at the side of the property. • Relocation of the proposed roughing screen to a new position upstream of Kilnap viaduct • Construction of a pull-in area on the existing access track from the Old Mallow Road • Provide safety barriers along the northern side of the existing access track	Landowner requests

Related Interference Ref (as per Confirmation Drawings)	Confir-mation Drawing Number	Description of Change to the Exhibited Scheme	Reason for Change
C06_L21	RB_207	Added a proposed retaining wall at Millfield Industrial Estate	During detailed design stage, this wall was found to be necessary to retain the proposed raised ground levels associated with the proposed reconstruction of the adjoining bridge (C06_B02).
C06_L22	RB_207, RB_208	• Add a precast concrete coping to the proposed wall adjacent to the retail park. • Specify that the proposed railing is to match the style of the existing railing.	Landowner requests
C06_L22	RB_207, RB_208	The proposed wall will now include a piled foundation	Piled foundations were found to be required following detailed geotechnical analysis of the existing river bank
C06_L03	RB_203	Reconstruction of existing permeable boundary wall at the southern side of Rose Cottage in order to minimize the risk of excess surface water runoff entering the property.	Required to minimize the risk of surface water runoff entering the property through the existing wall, as has reportedly occurred in the past.
C06_L01	RB_204, RB_401	Change of proposed flood defence wall at Rose Cottage from a reinforced concrete section to a sheet pile section.	This decision was taken as part of the design development for constructability reasons
C06_B01a	RB_203, RB_501	Reconstruction of the existing pipe culvert under the N20 slip road at North Point Business Park.	This element was added to the scheme as part of the design development, in order to minimise the risk of fluvial flooding at Gateway Business Park.
C08_L02, C08_L03	RB_202, RB_401, RB_501	New flood defence walls added at O'Shea's Builders property	During the detailed development of the scheme, this defence was found to be necessary to ensure that this property will be protected to the design standard of the scheme.
C08_L01, C08_E01	RB_201, RB_401, RB_501	New flood defence wall and embankments added at Collins' property.	During the detailed development of the scheme, this defence was found to be necessary to ensure that this property will be protected to the design standard of the scheme.

Related Interference Ref (as per Confirmation Drawings)	Confir-mation Drawing Number	Description of Change to the Exhibited Scheme	Reason for Change
C04_L01	RB_209, RB_210, RB_401, RB_502	New flood defence wall were added along the River Glen at Spring Lane.	During the detailed development of the scheme, the existing masonry wall was found to be insufficient to act as a flood defence, necessitating a new defence wall
C04_R01	RB_209, RB_210, RB_502	Proposed ramp relocated. This will necessitate the demolition of an existing derelict building.	Landowner request
C04_G02, C04_G05	RB_210, RB_502	Extent of new fencing along the River Glen was reduced	Original measures were specified to limit access to existing channel to minimise the risk of illegal dumping causing a blockage downstream. However on further review it is felt that the existing dense brush and existing fencing substantially addresses this risk already.
C04_G06	RB_210	Security gate added	Measure required to limit accessibility of Glen channel and therefore minimise risk of illegal dumping causing a blockage downstream
C06_B01	RB_206, RB_501	Extended working area associated with service diversions required for the proposed reconstruction of Fitz's Boreen bridge	This increased working area was found to be necessary based on discussions with the relevant utility providers during detailed design stage.
C06_P07	RB_209, RB_502	New pumping station added at the southern end of Orchard Court.	During the detailed development of the scheme, this measure was found to be necessary to cater for pluvial flows from the existing surface water drainage during a fluvial flood event
C06_P01, C06_L05	RB_206, RB_501	The proposed pumping station and defence wall was locally relocated/realigned in the vicinity of chainage 123 to 182.	Landowner request
N/A	RB_204, RB_205, RB_501	Provisionally proposed sediment trap, deposition area, geomorphic features and associated access road upstream of Common's Inn was removed. (Exhibition reference C06_C01a, C06_C01b, C06_C01c, C06_R03a, C06_R03b)	During the detailed design development, the design team formed the view that the proposed sediment trap at Sunbeam will be a sufficient response to sediment management issues in the short term.
N/A	RB_205	The proposed pipe culvert was omitted from the scheme. (Exhibition reference C07_B01)	During the detailed design stage, this measure was found to be

Related Interference Ref (as per Confirmation Drawings)	Confir-mation Drawing Number	Description of Change to the Exhibited Scheme	Reason for Change
			unnecessary, as the relevant section of channel is already piped.
C06_C03	RB_207, RB_501	The proposed sediment trap at the Sunbeam site was increased in size.	This was found to be necessary as part of the detailed design development
C06_P06	RB_209, RB_502	The proposed pumping station to the west of the Orchard Court culvert was relocated further south	It was found that there was insufficient space available for the pumping station at the exhibited location
C06_R03	RB_207, RB_501	Alignment of proposed road altered	During the detailed design stage, this was found to be necessary due to the larger size of the proposed sediment trap (C06_C03)
N/A	RB_211, RB_502	Construct new surface water drain at Foley's Row	Landowner request
N/A	RB_204, RB_501	Proposed road regrading at Gateway Business Park removed. (Exhibition reference C09_R01)	During the detailed development of the scheme, this measure was found to be unnecessary due to the addition of the proposed N20 culvert (C06_B01a)

Other minor changes or commitments agreed with Stakeholders between the exhibition and confirmation stages include:

- Local construction programme constraints at particular sites
- Local changes to details and finishes
- Commitment to put measures in place at construction stage to minimise impact on spawning of lampreys and eels
- Commitments to provide inspection facilities to particular landowners during construction,
- Commitment to reinstate the existing church railings on completion of the works.
- Commitment to engage in further ongoing consultation in advance of the construction stage
- Commitment to maintain access to local businesses and properties at all times during construction
- Further proposed environmental mitigation measures are outlined in the Environmental Impact Assessment Report.

3 DESCRIPTION OF THE PROPOSED DEVELOPMENT

This Chapter of the Environmental Impact Assessment Report (EIAR) Addendum provides supplementary information in relation to the description of the proposed Scheme and is to be read in conjunction with Chapter 3 of the River Bride (Blackpool) Certified Drainage Scheme EIAR.

The following supplementary information pertaining to Chapter 3 of the EIAR was requested by the Department of Public Expenditure and Reform on 07th May 2020 and is provided in this section of the EIAR Addendum:

3. *Details of extent of instream works including maximum extents of silt and gravel excavation in river bed and of any channel widening. 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.*
4. *Details of proposed pumping station kiosks including plans, sections and elevations and including information on finishes.*

The request for supplementary information and general comments in relation to Chapter 3 of the EIAR have been addressed in the subsequent sections of this Chapter.

Unless otherwise specified, any text provided below supersedes the text provided in the relevant section of the EIAR. In some instances, it has been necessary to reproduce text from the original EIAR. This text is shown in grey for ease of reference.

3.1 PROPOSED WORKS

3.1.10 Drainage Works

The following paragraph is in addition to section 3.1.10 of the EIAR. There is no other change to the text in Section 3.1.10.

The location of the pumping station kiosks along with plan and section details are provided in Appendix 3B. The kiosks will be GRP weatherproof kiosks and representative photos have been provided in Appendix 3B.

3.1.11 Fisheries Enhancement Measures

The measures outlined in Appendix 5E will be implemented in full as part of the Scheme.

3.1.12 Maintenance Regime

Full details regarding the maintenance works associated with the Scheme are provided in Appendix 3C.

3.2 ANTICIPATED CONSTRUCTION METHODS

3.2.1 New Culverts

Construction of new culverts will form the most significant aspect of the new scheme. Approximately 480m of new culvert will be constructed in Blackpool, some of which will be constructed along the route of the River Bride. Construction of the new culvert will take place as follows:

- The works area will be isolated and traffic management set up as required. Temporary road closures will be required for the culvert replacement in the vicinity of Blackpool Church and Madden's Buildings. Alternative access routes may be required for Orchard Court during construction works if it does not prove possible to maintain one lane of the existing bridge open at all times/ maintain access in the vicinity of the existing bridge.
- Temporary works will be put in place, including silt barrages, and flow diversions/ over pumping where in stream works are required at Blackpool Church and between the Old Commons Road and the N20 culvert (upstream of Orchard Court). Service diversions will also be required in advance of culvert construction, particularly at Blackpool Church and Madden's Buildings.
- The following measures will be implemented where instream works are required:
    - Measures to minimise the suspension and transfer of sediment downstream will be implemented. These measures are likely to include the use of silt barriers downstream of the works areas and removal of any accumulated silt, construction of silt sumps downstream of the works areas, cofferdamming and dewatering of works areas where concrete and other building works are proposed.
    - Works will only be undertaken during normal working hours (8:00 – 18:00) thus allowing the river to run clean for 14 hours per day. Night works will be required in limited circumstances for specialist activities (such as lifting of pre-cast bridge beams etc.). Where additional or alternative working hours are required, these will be agreed in advance via written agreement with Cork City Council.
    - All cofferdams, or other structure installed within the river channel, to allow working in dry conditions 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). During any working with cofferdams the following will be adhered to:
        - The cofferdam will be inspected daily for any movement, leakage and general deterioration; any defects found will be remedied immediately.
        - The working area will not be de-watered directly into the river; the removed water must receive treatment before discharge.
        - Before removal of the cofferdam at completion of the works all materials, debris, tools, plant and equipment will be removed from the work area and any potential sources of pollution/contamination within the cofferdam will be cleaned up.
        - The de-watered area will be re-watered before the cofferdam is removed to avoid the sudden ingress of water which may cause erosion of the replaced substrate.
        - When re-watering is undertaken, the pump inlets will be screened appropriately to prevent the intake of fish or other aquatic animals.
    - During all works the weather forecast will be monitored and a contingency plan developed to prevent damage or pollution during extreme weather and high flow events.

- In channel working will be minimised, where possible, method statements will identify access routes and works areas prior to commencement in consultation with the Project Ecologist.
- In-channel working during the salmonid spawning season will not be permitted (November to March inclusive).
- During the construction phase, fish passage will be maintained in areas of in-channel working.
- Working in areas identified as being suitable for fish spawning will be avoided, where practicable.
- Runoff from works, stockpile and compound areas will be monitored and observed daily to ensure that it is not impacting on any local watercourses. Silt release results in discolouration to water and so is easy to visually monitor for its presence.
- Alarmed Sondes will be employed to measure turbidity in the River Bride upstream and downstream of the works area during construction of the drainage scheme. If an increase in turbidity of 20% is identified downstream of the works, all works will cease immediately until the source of the increased turbidity is identified and rectified (if caused by the construction works). If necessary, water sampling and monitoring of the local water courses will also be completed to test for Total Suspended Solids (TSS) and tested against the baseline water quality identified in Chapter 7, section 7.2.3.1.

- The foundations will be excavated down to formation level. Utilities and drainage pipes will be diverted as required. Excavated material will be transported off site to a licenced facility or stored for reuse on site. Blinding will be poured.
- Any stockpiling of material will be greater than 10 metres from the river bank.
- All works undertaken on the banks will be fully consolidated to prevent scour and run off of silt. Consolidation may include use of protective and biodegradable matting (coirmesh) on the banks and also the sowing of grass seed on bare soil.
- Reinforced concrete culverts will be placed in position. Utilities and drainage pipes will be diverted into permanent positions as required.
- The excavation will be backfilled, the area reinstated, and the works area reopened. In the case of culverts constructed under the public road, permanent reinstatement may be required approximately six months following reopening of the road.
- An otter ledge will be integrated into the existing and proposed culvert network. The otter ledge will traverse the entire length of the new proposed culverted areas and will follow the specifications of the National Roads Authority Guidance in relation to otters (NRA, 2008). The ledge will tie into the adjoining riverbanks and will be screened with trees to provide seclusion for otter entering and exiting the culvert network. The detailed design of the tie in areas will be undertaken in conjunction with an ecologist with knowledge of otter usage of the area. Furthermore, the detailed design of the final ledge layouts should be agreed in conjunction with the NPWS.

- Light wells will be provided within the culvert periodically to provide natural light for otters and aquatic organisms using the structure.

3.2.2 Bridge Replacement

The replacement of existing bridges is likely to comprise the following proposed works:

- The works area will be isolated and traffic management set up as required. Temporary road closures may be required if it does not prove possible to maintain one lane of the existing bridge open at all times/ maintain access in the vicinity of the existing bridge, or if an alternative convenient access route is available.
- Temporary works will be put in place, including silt barrages, and flow diversions/ over pumping. Service diversions may also be required in advance of culvert construction.
- Where instream works are required the measures relating to instream works as specified in section 3.2.1 will be implemented.
- The existing bridge/ culvert structure will be dismantled/ demolished and removed off site.
- The foundations will be excavated down to formation level. Excavated material will be transported off site to a licenced facility or stored for reuse on site. Blinding will be poured.
- The new bridge/culvert will be constructed using either precast units or reinforced concrete placed in situ. Utilities and drainage pipes will be diverted into permanent positions as required during/ following construction. Construction of an in-situ reinforced concrete bridge would involve
    - Fixing of reinforcement for abutments and piers,
    - Placing of formwork for abutments and piers,
    - Placing of cast in-situ concrete for abutments and piers,
    - Stripping of formwork,
    - The placing and fixing of a precast concrete bridge deck, and
    - Construction of bridge parapets.
- The following measures will be implemented in where concrete works are required:
    - All concrete works will be carried out in dry conditions with no in-stream pouring of concrete.
    - Ready mixed wet concrete will be used and where possible pre-cast sections will be used. There will be no batching of wet-concrete products on site.
    - Chute cleaning will take place in designated, lined concrete washout areas.
- The excavation will be backfilled, the area reinstated, and the works area reopened. Permanent reinstatement of road surfaces may be required approximately six months following reopening of the road.

3.2.3 Bridge Parapets

New/ upgraded bridge parapets will be constructed as follows:

- Isolation of works area, including traffic management.
- One lane of the bridge will be closed at a time where possible. Where sufficient space is not available to accommodate a working area and live traffic, a road closure will be acquired and alternative access put in place.
- The existing bridge parapet/ railings will be removed where these exist.
- The underlying concrete will be scabbled and starter bars dowelled into the concrete.
- Formwork will be set up from the bridge deck for the construction of the reinforced concrete bridge parapet.
- Scaffolding will be set up as required. The parapet will be poured following steel fixing.
- The following measures will be implemented for concrete works:
    - All concrete works will be carried out in dry conditions with no in-stream pouring of concrete.
    - Ready mixed wet concrete will be used and where possible pre-cast sections will be used. There will be no batching of wet-concrete products on site.
    - Chute cleaning will take place in designated, lined concrete washout areas.
- Once the concrete has cured, the formwork will be stripped and the scaffolding removed.
- The lane will be opened, the second lane closed and the plant and equipment will be relocated to the location of the second parapet.

3.2.4 Flood Defence Walls

The construction of the reinforced concrete flood defence walls is likely to be carried out by traditional methods comprising 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,
- Where instream works are required the measures relating to instream works as specified in section 3.2.1 will be implemented.
- excavation for foundations,
- blinding of formation,
- fixing of reinforcement,
- placing of formwork,
- placing of concrete,
- The following measures will be implemented for concrete works:
    - All concrete works will be carried out in dry conditions with no in-stream pouring of concrete.

- Ready mixed wet concrete will be used and where possible pre-cast sections will be used. There will be no batching of wet-concrete products on site.
- Chute cleaning will take place in designated, lined concrete washout areas.

- stripping of formwork, and
- reinstatement of works area.

In certain locations, where there is a possibility of flood water passing underneath the flood defence wall foundations, either sheet piles or grouting techniques will be required to provide a cut-off. The sheet piles may be metal or plastic and will be driven to the required depth using a piling hammer or similar.

A hoarding will be erected along the boundary of the works zone for flood defence wall construction operations downstream of the Commons Inn, at the Killeens off-ramp dwelling, and at the Glennamought Bridge dwelling in order to mitigate against potential noise impacts as detailed in Chapter 8. In each case, the hoarding will extend to a height of 2.4 m, and should consist of plywood boarding on both sides of timber framework, with waterproofed cavity to be filled with mineral wool or similar. Gaps at partition interfaces will be boarded.

3.2.5 Earthen Embankments

The construction of the earthen flood defence embankments is likely to comprise the following activities:

- Temporary works,
- Excavation for formation. Excavated subsoils will be reused as fill, or for the construction of flood defence embankments where possible. Any remaining volumes of unsuitable materials will be transported to the closest suitably licensed facility to be processed and reused in other construction projects in the vicinity, where possible
- Placing and compaction of suitable clay material, and
- Reinstatement of area, including seeding with an appropriate species of rich grass and wild flower seed mix. Hedgerow/tree line planting will be undertaken to replace hedgerow/treeline lost to accommodate the new flood embankment. Hedgerows will be replanted as close to the existing alignment and location as possible and will use native, locally sourced species

3.2.8 Other Instream Works

Other proposed works which will be carried out partially or wholly instream include:

- Local channel widening of the River Bride (referred to as a 'Winter Channel' on the scheme drawings in Appendix 3A);
- Construction of a sedimentation trap on the left bank of the River Bride;
- Construction of roughing screens and a new trash screen;
- Removal of existing trash screens on the River Bride (North) and Glen River;
- Removal of an existing sluice structure in the channel of the River Bride to the rear of the Dulux factory; and
- Fisheries enhancement measures will be provided at interference number C06 C02, downstream of McDonalds to the area adjacent to Blackpool Shopping Centre and will include 4 channel

meanders with a low flow wetted area and stone deflectors and the provision of riparian zones including window boxes.

In general, these works will involve:

- Isolation of works area, and temporary works including silt barrages, flow diversions or over-pumping;
- The measures relating to instream works as specified in section 3.2.1 will be implemented.
- Dismantling/ demolition and removal of the existing structure (in the case of sluice structure at Dulux and the screens on the River Glen and Bride North) and removal off site;
- Excavations. Estimated volumes of excavated material during construction associated with instream works are set out in Table 3.2

Table 3.2 Estimated volume of excavation from instream works area during construction

Scheme Element	Interference Number	Estimated Volume of Excavation
Flood Defence Walls	C08.L01, C08.L02, C08.L03, C08.L04, C07.L01, C06.L16, C04.L01	794 m^3
Bridge	C08.B01, C08.B02, C06.B01, C06.B02	698 m^3
Embankment	C06.E02/T02	4,472 m^3
Culvert	C06.B04	2,052 m^3
Wall/ Sediment Trap	C06.L17/L18/L19	1,800 m^3
	Total	**9,816 m^3**

- Blinding of formation (as required);
- Construction of sedimentation trap/ screen; following which
- The excavation will be backfilled, the area reinstated, flow redirected, and the works area reopened.

3.3 Construction Programme and Sequencing of Proposed Works

The construction works will be preceded by geotechnical investigations, which will consist of a mixture of shell and augur boreholes, cable percussive boreholes, rotary drilled boreholes, trial pits and slit trenches at the locations of the proposed structures. A preliminary construction programme is provided in Appendix 3E. The construction works themselves will last approximately 2.5 years and will be subject to the following programme constraints:

- Instream works (include preparatory work) on all watercourses supporting salmonids shall be undertaken from April to October (inclusive) and in consultation with Inland Fisheries Ireland to avoid accidental damage or siltation of spawning beds.
- To avoid impacting on bird nesting sites, the vegetation removal within the defined working area will not be carried out during the peak bird nesting season of March to September (inclusive) prior to the onset of works.
- Christmas non-working time is from the beginning of the second week of December to the end of the second week of January.

3.4 TEMPORARY CONSTRUCTION WORKS FACILITIES

Provision has been made within the temporary working area for location of temporary site compounds. The site compounds will be bound by the mitigation measures identified within this EIAR. An indicative site compound layout is shown in Appendix 3D, the location of which is outside of the floodplain. Should the need to identify alternative or additional temporary site compounds emerge in advance of or in the course of the construction phase, such compounds will only be used where all the above proposed elements can be provided and all design measures intended to prevent any environmental effects can be incorporated.

The site compounds will be surfaced with a hard standing to prevent generation of mud. A silt fence will be erected on all sides of the compounds to prevent any run off from the perimeter of the compounds. The compounds will be adequately buffered to prevent any surface water run off or will incorporate a surface water collection and treatment system if required. The compound areas will be monitored and observed daily to ensure that they are not impacting on any local watercourses.

The compounds will comprise the following elements:

- temporary site offices, portaloo toilets, facilities for staff and car-parking areas.
- storage areas for construction materials.
- bunded containment areas for plant refuelling, maintenance, washing and for the storage of fuels and site generators. The bunded area shall have sufficient volume to contain any spills.
- a dedicated waste storage area for any construction waste generated. Skips or bays will be provided for recyclable material.
- wheel wash area for construction and delivery vehicles and a designated wash out tank for wash out of concrete trucks following concrete pours.

4. HUMAN BEINGS, POPULATION & HUMAN HEALTH

This Chapter of the Environmental Impact Assessment Report (EIAR) Addendum provides supplementary information in relation to human beings, population and human health and is to be read in conjunction with Chapter 4 of the River Bride (Blackpool) Certified Drainage Scheme EIAR.

The following supplementary information pertaining to Chapter 4 of the EIAR was requested by the Department of Public Expenditure and Reform (DPER) on 07th May 2020 and is provided in this section of the EIAR Addendum:

7. *A quantified summary of information on the benefits of the scheme, including an overview of the numbers and types of properties which will benefit.*

The request for supplementary information and general comments in relation to Chapter 4 of the EIAR have been addressed in the subsequent sections of this Chapter. It has not been necessary to further update to this chapter to take account of information requested elsewhere in the DPER request that would have resulted in changes to assessments of likely significant eimpacts, mitigations measures, monitoring proposals, etc.

Unless otherwise specified, any text provided below supersedes the text provided in the relevant section of the EIAR. In some instances, it has been necessary to reproduce text from the original EIAR. This text is shown in grey for ease of reference.

4.3.12 Land and Property

The proposed development will safeguard lands within the River Bride catchment from the risks of flooding up to the design level of the flood defence scheme. The lands in question extend from the industrial areas of the River Bride catchment in the north of the study area, to the heavily populated and core urban area in the Blackpool village area in the south of the study area.

Land

A total of 14.75 hectares of land will benefit from the proposed flood scheme, as shown on the Flood Benefit Area maps included in Appendix 2A of the EIAR. These lands benefitting from the proposed flood scheme span a number of land use zones as identified in the Cork City Development Plan 2015-2021.

3. Inner City Residential Neighbourhood
4. Residential, Local Services and Institutional Uses
7. Business and Technology
8. District Centres
9. Neighbouring Centres
12. Landscape Preservation Zones

The proposed development is intended to eliminate the risk of flooding up to the design level of the scheme, which will allow new development and redevelopment proposals be brought forward in line with the land use zoning categories and development objectives of the Cork City Development Plan.

Properties

A total of 206 residential properties will be safeguarded from flooding as a result of and benefit from the proposed development. These range from single one-off detached residential properties in the north of the scheme area, to housing estates such as Orchard Court in the central area and more densely concentrated residential properties in the southern end of the scheme area including Madden's Buildings and terraced dwellings and apartment buildings along Watercourse Road.

A total of 87 non-residential properties will benefit from the scheme. The 87 non-residential properties include a number of individual properties that provide essential services in the Blackpool community, including:

- Garda station
- Medical centres
- Pharmacies
- Church of the Annunciation, Blackpool
- Credit Union

In the northern area study area, six primary commercial and industrial areas accommodating dozens of businesses that employ hundreds of people, will benefit from the flood protection afforded by the proposed development, including in the following locations:

- Gateway Business Park
- North Point Business Park
- Commons Road business area
- Sunbeam Industrial Estate
- Thomas Davis Street area
- Watercourse Road area

A number of large individual commercial and industrial premises, which are significant employers in the local area, will also directly safeguarded as a result of the proposed development, including:

- Dulux Paints (AkzoNobel), Commons Road
- Heineken Ireland, Shandon
- T&A DIY & Building Supplies, Watercourse Road

The number of properties benefitting from the proposed scheme varies depending on the various flood scenarios within the scheme design envelope. The greater the flood event, the greater the potential for flood damage to occur and the greater the number of properties that will be protected from the proposed flood scheme. The numbers of properties benefitting from the scheme in various flood return periods are outlined in Table 4.1 below

Table 4.1 Summary of flood damages costs

Flood Return Period	Residential Properties	Non-Residential Properties	Total
10 year	10	11	21
20 year	138	68	207
50 year	175	78	253
100 year	206	87	293

4.3.13 Flood Damage Avoidance

The benefit to be derived from the flood protection works is the reduction in risk of flooding to property. This risk is quantified as the expected damage to property that would occur over the lifetime of the scheme.

The calculation of the monetary cost of flood damage to residentisl and non-residential properties that would be avoided as a result of the proposed development can be classified into two broad categories, tangible damages and intangible damages.

Tangible Damages

Tangible damages can be quantified in monetary terms, such as the reduction in flood damage costs from improvements in the standards of flood protection. Tangible damages are divided into the direct and indirect.

Direct tangible damages result from the physical contact of flood water with property. The damage magnitude may be taken as the cost of the property restoration to its condition prior the flood event, or its loss in market value if restoration is not worthwhile. Direct damages are a function of many variables including the physical make-up of the property and the characteristics of the flood event, including the depth and duration of flooding.

Indirect tangible damages are losses caused by disruption of physical and economic linkages to the local/national economy. Examples include the costs of emergency services of a flood event, and the interruption of traffic flows. The cost of emergency services are estimated as between 5.6% and 10.7% of the direct tangible damages. OPW guidance directs that an allowance of 8.1% of the Principal Direct Damages (PDD) be included in the damages assessment to account for emergency services. OPW guidance states that this allowance is deemed to include evacuation costs.

An allowance of 20% of the PDD has been included to account for damage to infrastructural utility assets.

The cost of interruption of traffic flows is more difficult to determine, therefore as a conservative assumption this element of the indirect tangible damages has been ignored.

As per OPW guidance, loss of business costs for commercial properties, damage to roads, damage to parked cars, environmental damage, personal evacuation costs, temporary accommodation and extra heating costs have also been ignored.

The damage costs associated with risk to life have also been excluded as per OPW guidance. This has been excluded as loss of life due to flood events is very rare in Ireland.

Intangible Damages

Intangible damages are difficult to quantify in monetary terms as they include human stress and anxiety, inconvenience and ill health associated with frequent, repeat flooding.

In accordance with OPW guidance, the flood damage assessment undertaken for the scheme has used the PDD as a guide to estimating the Intangible Damages. The guidance distinguishes between residential and non-residential properties as follows:

- For residential properties the intangible flood damages are set equal to the total direct property damage;
- For commercial premises that are not family owned such as office spaces, retail outlets and chain stores, the intangible flood damages have been taken as zero. In the context of Blackpool, this category includes Dulux, Blackpool Retail Park, Blackpool Shopping centre and Heineken Brewery.
- For small family owned business, the intangible flood damages have also been set equal to zero with agreement from OPW. This a conservative approach as in Blackpool many local businesses downstream of Orchard Court appear to be family owned. It is estimated that if allowance were to be made for intangible damage at these properties, the present value benefit would be increased by circa €1.3m.

Flood Damage Costs

A cost of the flood damages that would be avoided as a result of the proposed development, were calculated in a Cost Benefit Assessment (CBA) for the proposed development prepared by ARUP in 2018, the summary table of which is set out in Table 4.2 below

Table 4.2 Summary of flood damages costs

	Damage for 1%AEP Fluvial Event (€m) (uncapped)	Annual Average Damage (€m) (uncapped)	Do Nothing Present Value Damage (50 year time horizon) (uncapped) (€m)	Do Nothing Present Value Damage (50 year time horizon) (capped) (€m)
Direct residential	€3.87m	€0.22m	€4.92m	€4.79m
Direct Non-residential	€10.57m	€0.76m	€17.1m	€16.21m
Principal Direct Damages	**€14.44m**	**€0.98m**	**€22.0m**	**€21.0m**
Intangible (Residential)	€3.87m	€0.22m	€4.92m	€4.79m
Emergency Services	€1.17m	€0.08m	€1.78m	€1.78m
Utilities	€2.89m	€0.19m	€4.40m	€4.40m
Total	**€22.37m**	**€1.5m**	**€33.14m**	**€31.98m**

4.3.14 Cost Benefit Analysis

A Cost Benefit Assessment (CBA) for the proposed development was prepared by ARUP in 2018. The CBA includes a cost estimate, benefit assessment and cost benefit analysis. The final result of the assessment is

set out in Table 4.3 below, including a baseline result based on a test discount rate of 4%, and sensitivity analysis of a further three scenarios to investigate the least credible level of benefits.

Table 4.3 Cost benefit analysis summary

	Baseline Result	Sensitivity Analysis		
	4% Discount Rate	3% Discount Rate	5% Discount Rate	4% Discount Rate, 5% Reduction in Benefit
Present Value Costs (PVc)	€18.37m	€18.89m	€17.99m	€18.37m
Present Value Benefit (PVb)	€25.18m	€30.03m	€21.40m	€23.92m
Net Present Value (NPv)	€6.81m	€11.14m	€3.41m	€5.55m
Benefit Cost Ratio (BCR)	1.37	1.59	1.19	1.30

The cost benefit ratio of the scheme is greater than 1 in all test scenarios.

4.3.15 Operational Phase

Human Health and Safety

Flooding poses a risk to human health and safety. The OPW document 'The Planning System and Flood Risk Management: Guidelines for Planning Authorities' (OPW, 2009) states that flooding can cause physical injury, illness and loss of life. Deep, fast flowing or rapidly rising flood waters can be particularly dangerous, with increased risk if the floodwater is carrying debris. Some of these impacts may be immediate, the most significant being drowning or physical injury due to being swept away by floods. Floodwater contaminated by sewage or other pollutants (e.g. chemicals stored in garages or commercial properties) can potentially cause illness, either directly as a result of contact with the polluted floodwater or indirectly as a result of sediments left behind. Flood water may also hide other hazards for wading pedestrians, such as manhole openings where the covers have been lifted by flood flows.

The impact on people and communities as a result of the stress and trauma of being flooded, or even of being under the threat of flooding, can be immense. Long-term impacts can arise due to chronic illnesses and the stress associated with being flooded and the lengthy recovery process. The ability of people to respond and recover from a flood can vary. Vulnerable people, such as those who are old, disabled or have a long-term illness, are less able to cope with floods than others. Some people may have difficulty in replacing household items damaged in a flood and may lack the financial means to recover and maintain acceptable living conditions after a flood. **The proposed relief scheme will have a long-term significant positive impact.**

Employment and Investment

The flood relief scheme will provide increased protection to residential and commercial premises and businesses in Blackpool and surrounding areas. This will be likely to encourage future inward investment in the area, creating further employment and a stronger local ecomony. **The proposed relief scheme will provide a long-term significant positive impact.**

Land-use

The construction of culverts over sections of the river will result in increased land area to use for recreational purposes. **This will have a long-term slight positive impact.**

Tourism

The operational phase of the proposed development will have **no negaitive impact** on tourism in the area.

Property Values

The flood relief scheme will provide increased protection to residential and commercial premises in Blackpool and surrounding areas. This will be likely to increase the value of properties in the area. **The proposed scheme will provide a long-term significant positive impact.**

Benefitting Properties

The flood relief scheme will provide directly protect from flooding 206 residential properties and 87 non-residential properties in the benefitting lands, including properties providing essential services, community facilities, residential dwellings, commercial premises and industrial facilities providing large-scale employment. This will remove the risk of flooding from these properties, directly benefitting the residents, owners, occupiers, businesses and employers occupying these premises. **The proposed scheme will provide a long-term significant positive impact in this regard.**

Flood Damage Avoidance & Cost Benefit

In the four scenarios tested in the cost benefit analysis undertaken for the proposed scheme, the scheme was proven to have a very positive cost benefit ratio, with a €25.18m benefit for a €18.37m cost in a baseline scenario with a 4% discount rate. **The proposed scheme will provide a long-term significant positive impact in this regard.**

5. BIODIVERSITY, FLORA AND FAUNA

This Chapter of the Environmental Impact Assessment Report (EIAR) Addendum provides supplementary information in relation to the assessment of impacts on Biodiversity and is to be read in conjunction with Chapter 5 of the River Bride (Blackpool) Certified Drainage Scheme EIAR.

The following supplementary information pertaining to Chapter 5 of the EIAR was requested by the Department of Public Expenditure and Reform on 07th May 2020 and is provided in this section of the EIAR Addendum:

8. Updates to the assessment of impacts on biodiversity to include:

- *bat roost surveys in accordance with the Bat Conservation Trust guidelines*
- *alignment with the findings of the assessments of impacts on hydromorphology and water quality*

10. Provision of updates to assessment of impacts in all other specialist sections of the EIAR, insofar as required to ensure that:

- *The EIAR takes due account of all information requested in this request for further information.*
- *assessments of likely significant impacts on each environmental factor take account of relevant findings of assessments of impacts on other factors (impact interactions);*
- *Impact predictions address all likely significant impacts during both the construction and the future maintenance stages; and*
- *Impacts are predicted in accordance with the EPA Guidelines.*

11. Mitigation measures and monitoring proposals are to be revised and augmented, as required to ensure that they are:

- *adequate to mitigate and monitor the specific effects of the scheme.*
- *practicable; and*
- *enforceable (for example by means of audit) and that their details are clear to all stakeholders.*

12. Monitoring proposals should be accompanied by appropriate and clear remedial or other actions which will be implemented in event of exceedances of trigger levels, to ensure that acceptable limits are not exceeded.

The request for supplementary information, including the Invasive Species Management Plan and updates to Chapter 3 of the EIAR, along with the general comments in relation to Chapter 5 of the EIAR have been addressed in the subsequent sections of this Chapter. It has not been necessary to further update this chapter to take account of information requested elsewhere in the DPER request that would have resulted in changes to assessments of likely significant impacts, mitigations measures, monitoring proposals, etc.

Unless otherwise specified, any text provided below supersedes the text provided in the relevant section of the EIAR. In some instances, it has been necessary to reproduce text from the original EIAR. This text is shown in grey for ease of reference.

5.2.2 Field Survey

Table 5.1 is amended as follows

Table 5.1: Targeted surveys undertaken along the River Bride (North) and Glenamought

Survey Type	Dates of Survey
Windshield habitat survey	18th June 2013
Walkover Survey /Habitat mapping	April/May 2014, April 2015, September 2017
Invasive species survey	August-September 2014
Otter Survey (including camera surveys)	October/November 2014, April-October 2015, November 2016, September 2017
Kingfisher Survey	August – October (end) 2014, May-June 2015, September 2017
Electrofishing Survey	September 2014
Floating River Vegetation Survey	August and September 2014, June 2015.
Fisheries Habitat and Enhancement Suitability Survey	February and April 2016
Otter Survey to inform derogation license	March and April 2018
Bat Survey	July – October 2020

5.3 FIELD SURVEYS

The following paragraph is in addition to the introductory Section 5.3 of the EIAR. There is no other change to the introductory text in Section 5.3.

A bat assessment was conducted for the proposed works areas commencing in July and concluding in October 2020. The assessment consisted of a desktop assessment, visual roost survey and bat activity survey, further detail of which is provided in the Bat Survey Report in Appendix 5G.

5.3.3.2 Mammals

Bats

The following text is in addition to section 5.3.3.2 of the EIAR under the subheading 'bats'. There is no other change to the text in Section 5.3.3.2.

This section of Chapter 5 has been updated on the basis of a Bat survey undertaken from July to October 2020; the report is contained in Appendix 5G. The assessment of impacts on bat species was carried out by a licenced and accredited bat surveyor, Tom O'Donnell of O'Donnell Environmental, according to Bat Conservation Trust guidelines (Collins, 2016). A survey was carried out along the rivers corridor and the working area of the scheme, involving review of existing data (historic, records and survey data), habitat suitability surveys, potential roost site surveys, active and passive bat surveys employing ultrasonic bat detectors for dusk/dawn roost emergence/return as well as bat dispersion, commuting and foraging activity and passive detection. The data has been presented in clearly collated tables and maps; impacts identified and assessed to EPA 2017 and NRA 2009 criteria and ratings.

Here follows a summary of current bat status as revealed in the study. Species diversity was highest in the Glenamought Valley where seven (possibly eight) species were recorded during active and passive surveys. This valley is considered to present more foraging opportunities and ecological niches than other areas of the scheme. The following species were recorded in the Glenamought Valley:

- Soprano Pipistrelle
- Brown Long-eared Bat
- Common pipistrelle
- Leisler's Bat
- Whiskered Bat
- Daubenton's Bat
- Natterer's Bat

In the Orchard Court area of the scheme, where it is proposed to replace the open river with culverted channel, the number of bat registrations recorded was relatively high but species diversity was lower, reflecting the lower quality habitat available and a lesser number of ecological niches. Here the following species were recorded:

- Soprano Pipistrelle
- Common Pipistrelle
- Leisler's Bat
- Daubenton's Bat
- Brown Long-eared Bat

A survey of habitat features along the river included potential roost sites for bats, namely (mature) trees, and structures such as walls, bridges and buildings. Some of the old stone bridges to be demolished and replaced as necessitated by the scheme were found to have moderate potential suitability. It was noted that the potential for some structures as winter roost sites is beyond the scope of the study (elsewhere studies have shown bridges returned a c.15% incidence of bat usage as roost sites). A maternity bat roost of Soprano Pipistrelle (ref S04 in report) was discovered near a wooded section of the Glenamought River from which 145 bats were counted on emergence. The building visible in Plate 9.49 referred to in the CAAS

review as having bat potential, was searched and not found to contain bats or evidence thereof. This is documented in Table 3.3 of the Bat Survey Report, referenced S06.

5.4.2 Impact on Loss of Habitat

Slight to Moderate Negative Impact

5.4.2.1 Impact of loss of instream habitat

The following text is in additional to Section 5.4.2.1 of the EIAR:

The culverting of 342m of the river at Ochard Court will cause a loss of open water and overhanging vegetation which was found to provide valuable foraging habitat for bats, Soprano and Common Pipistrelles in particular. The habitat appears to be utilised mostly in the earlier part of the night and likely provides an early 'staging-post' from where bats move out to forage in other less sheltered areas as night falls. Loss of this habitat is likely to affect the distribution of Soprano and Common Pipistrelles and Daubenton's Bats locally. The loss of areas of existing vegetation is likely to reduce the quality of foraging habitat locally, but is not likely to be significant in the context of the overall landscape.

5.4.2.2 Terrestrial Habitat

Terrestrial works are largely confined to the Bride (North), Glen and Glenamought River banks and adjoining areas as well as temporary construction compounds and access routes. Amenity grassland (local importance (lower level) conservation interest) is common along the Glenamought River and the Bride (North) with occasional mature trees lines of Local (higher) level Importance conservation interest. A small area of mixed broadleaved woodland will be lost as a result of the construction of the winter channel (Local (higher) level Importance) while small areas of scrub (Local (higher) level) will also be lost.

The felling and removal of trees is considered to represent a loss of some low to moderate value potential roosting and foraging habitat for a range of bat species. This represents a loss of roosting opportunities to bats and is likely to reduce the quality of foraging habitat locally, but is not likely to be significant given the relatively small amount of habitat loss involved in the context of the overall landscape.

Japanese knotweed is frequent along the length of the Bride (North) and within the footprint of the works. The majority of works proposed are located on artificial surfaces with occasional strips of grassy verge. A loss of treelines, woodland and scrub is considered to be the most significant impact on terrestrial habitat resulting in a **slight negative** permanent Impact.

5.4.2.3 Mitigation Measures

This section has been updated to take account of the information provided in Chapter 3 of the EIAR Addendum pertaining to the operation of the Scheme.

- A Project Ecologist will be appointed for the duration of the works. The appointed ecologist may carry out the role of ECoW (or may work alongside the ECoW) to ensure that all avoidance and mitigation and monitoring during construction are carried out according to the details specified in the final CEMP in the correct manner and to expected standards to ensure their effectiveness. The ECoW and Project Ecologist will report to the Environmental Manager.

- The footprint of works will be identified at the onset and will be demarcated to avoid unnecessary disturbance to habitats outside the works area. Method Statements detailing the construction footprint and access routes to the proposed works will be approved prior to construction.
- Upon completion of the works channel vegetation will be allowed to recolonise naturally.
- Introduce spawning gravels at morphologically/hydraulically appropriate locations i.e. where removal of culvert is proposed. This will involve ongoing maintenance outside of the spawning season when material accumulated in the sediment trap will be re-distributed in this channel to create clean gravel spawning substrate free of silt.
- 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 wildflower seed mix.
- Hedgerow/tree line planting will be undertaken to replace the length of hedgerow/treeline lost to accommodate the new flood embankment. Hedgerows will be replanted as close to the existing alignment and location as possible and will use native, locally sourced species.
- Works will only be undertaken during normal working hours (8:00am – 6:00pm). Night works will be required in limited circumstances for specialist activities (such as lifting of pre-cast bridge beams etc.). Where additional or alternative working hours are required, these will be agreed in advance via written agreement with Cork City Council.
- All works undertaken on the banks will be fully consolidated to prevent scour and run off of silt. Consolidation may include use of protective and biodegradable matting (coirmesh) on the banks and also the sowing of grass seed on bare soil.
- Appropriate mitigation measures will be implemented prior to the construction phase to ensure that water quality is not adversely affected through pollution incidents and silt mobilisation. This mitigation will include:
    - All material including oils, solvents and paints will be stored within temporary bunded areas or dedicated bunded containers;
    - Where possible refuelling will take place in a designated bunded area away from surface water gullies, drains and water bodies, in the event of refuelling outside of this area, fuel will be transported in a mobile double skinned tank;
    - All machinery and plant used will be regularly maintained and serviced and will comply with appropriate standards to ensure that leakage of diesel, oil and lubricants is prevented.
    - Spill kits and hydrocarbon absorbent packs will be available and drip trays will be used during refuelling;
    - All relevant personnel will be fully trained in the use of this equipment;
    - Where soil/made ground and subsoil stripping occur, the resulting excavated soil fractions will be segregated into inert, non-hazardous and /or hazardous fractions (in accordance

with Council Decision 2003/33/EC, the EPA water classification criteria at certain licensed landfills in Ireland);

- The excavation and handling of inert material will be carefully managed in such a way as to prevent any potential negative impact on the receiving water environment;
- Where possible the excavated spoil would not be stored beyond the working day, however in the event that this is not practical appropriate precautions in relation to the material will be taken. These precautions will include appropriate storage and covering;
- All associated hazardous construction waste will be stored within temporary bunded storage areas prior to removal by an appropriate EPA or Local Authority approved waste management contractor;
- The guidelines provided by the Department of the Marine and Natural Resources, with respect to concrete wash waters, CIRIA, the UK Environment Agency and Environment and Heritage Service, the UK Department of the Environment and Inland Fisheries Ireland will be adhered to in order to ensure that there is a neutral impact on the water environment during the construction phase of the proposed development.
- All cofferdams, or other structure installed within the river channel, to allow working in dry conditions 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). During any working with cofferdams the following will be adhered to:
  - The cofferdam will be inspected daily for any movement, leakage and general deterioration; any defects found will be remedied immediately.
  - The working area will not be de-watered directly into the river; the removed water must receive treatment before discharge.
  - Before removal of the cofferdam at completion of the works all materials, debris, tools, plant and equipment will be removed from the work area and any potential sources of pollution/contamination within the cofferdam will be cleaned up.
  - The de-watered area will be re-watered before the cofferdam is removed to avoid the sudden ingress of water which may cause erosion of the replaced substrate.
  - When re-watering is undertaken, the pump inlets will be screened appropriately to prevent the intake of fish or other aquatic animals.
- During all works the weather forecast will be monitored and a contingency plan developed to prevent damage or pollution during extreme weather and high flow events.

- The sediment trap, as a pre-defined intervention of the scheme design, will limit the intrusiveness of maintenance operations by focusing works on a strategic removal of course sediment at one location and immediately downstream. Maintenance will be carried out once annually, or as necessitated by major storm event. Refer to Appendix 3c for more details.

- Channel maintenance work is carried out as much as possible from the riverbank without in stream tracking. 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.
- 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.
- Removal sediment material build up will be carried out during low flow periods to minimise the risk of siltation and material transport downstream.
- Typically, this will be carried out on average every 4-6 years but should be assessed on an annual basis by means of a site walkover survey.
- The sediment trap will not be fully emptied each time, and some material in the low flow channel will be retained, to retain continuity of natural bed materials.

5.4.3 Impact on Floral Species

Permanent Slight Negative Impact

No protected flora, rare or flora of conservation interest have been identified within the study area, therefore impact on flora is considered negligible.

5.4.3.1 Invasive Species

Construction activities in areas infested with non-native invasive species have the potential result in their spread to locations previously un-infested. The Japanese Knotweed stands recorded on the Glenamought River and in several locations along the Bride (North) within the footprint of the works. Consequently, this species could be spread should appropriate measures not be followed; this could have a negative impact, if the plant is transferred to a habitat of high ecological value. An Invasive Species Management Plan is provided in Appendix 5F.

5.4.3.2 Mitigation

An Invasive Species Management Plan has been put in place by the OPW for the Rivers Bride and Glenamought in Blackpool which outlines the strategy that will be adopted during the construction and operation of the Scheme and taking into consideration the ongoing treatment of the site in order to prevent the spread of invasive species. The schedule of treatment for invasive species within the proposed Scheme will be implemented for up to three years post construction.

The following measures will be implemented to avoid the spread of invasive species:

- A pre-construction/pre-operational maintenance survey for invasive species will be conducted at the earliest stage possible to update and inform on the status of invasive plant species in or near the scheme/maintenance works area. These surveys should be undertaken during the appropriate botanical season (April to September).
- Wash down all machinery and equipment using power washers to ensure the removal of all organic plant and soil mater before leaving the site. This material will be washed into a dedicated and contained area away from watercourses and will require appropriate treatment with other contaminated materials on site.
- Ensure all organic material removed from personal equipment and clothing including footwear

- Use of machinery with tracks should, where possible, be avoided within infested areas.
- 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.
- Areas infested with invasive species shall be fenced off prior to and during construction works where possible in order to avoid spreading plant fragments to areas free from infestation. For Japanese knotweed a buffer distance of 7m minimum is required.
- Areas identified to be fenced off shall clearly be identified and marked out with signs to inform contractors of the risk.
- Treatment and control of invasive alien species will follow Guidelines for the Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads (NRA 2010) and Environmental Guidance: Drainage Maintenance & Construction (OPW 2019), and any other best practice guidance which may become available in the interim.
- Treatment will be carried out by a suitably qualified person and will involve the use of herbicides approved for working in proximity to an aquatic environment. All staff involved in the application of herbicides must have received appropriate training.
- All construction staff will receive training in the identification and management of invasive species, including identification of knotweed rhizomes, through "toolbox talks" and be made aware of the invasive species management plan before works begin on site.
- Areas where contaminated soil is to be stockpiled on site shall be clearly identified and cannot be within 50m of any watercourse or within a flood zone.
- For any material entering the site, including all fill material, the supplier must provide an assurance that it is free of non-native invasive species.

Advanced treatment of the site has been undertaken using chemical treatment methods and given the physical site boundaries and flooding risk in the area the ISMP identified further chemical treatment as the most suitable method for future treatment at the site. The Invasive Species Management Plan is available in Appendix 5F.

5.4.4 Impact on Fauna

Terrestrial Animals

Permanent Very Significant Negative Impact

There will be a potential impact on mammals and birds as a result of the proposal and during the construction phase in particular otter, bats and birds.

5.4.4.6 Bats

Permanent Significant Negative Impact

A long-established Soprano Pipistrelle maternity roosting site was identified at Woodpark during surveying and this roost is of high conservation importance. The roost is categorised as being of 'County' importance following the ecological valuation scheme outlined in NRA (2009). Tree group 'T32' is proximal to the proposed embankment (Item C08_E03) and these trees are likely to play a role in the avoidance of predators by emerging bats. The trees are the closest to the roost, and the bats were observed flying towards this tree cover upon emergence; and are contiguous with the larger wooded riparian habitat of

the Glenamought River where the bats forage. Owing to the presence of a pair of Kestrels, which may attempt to prey upon the bats as they emerge from the roost in the evening, the trees may provide essential cover to emergent bats that protect them from the threat of predation. See bat survey report in Appendix 5G.

Consultation will be undertaken with NPWS to liaise about the roost conservation during and beyond the course of works.

Removal of features (manmade structures) identified as having 'low' or 'moderate' potential for roosting bats will take place during the bat activity season. For both manmade structures (e.g. bridges) and trees, these features will be surveyed by a bat ecologist in advance of works to attempt to confirm that no bats are present and any guidance from the ecologist will be followed. A bat ecologist will be present to supervise removal/felling works. In the event that bat(s) are found to be present during works, works will be stopped and may only proceed with a roost derogation license issued by NPWS. The loss of these potential roost features of moderate potential for bats may adversely affect the bat population and habitat quality overall.

Removal of existing trees and other vegetation to facilitate the culverting of 342m of river corridor between the Blackpool Bypass and Blackpool Church will permanently reduce habitat connectivity for bats locally. This will reduce the ability of bats to commute and move through the habitat, and there will be a loss of foraging habitat including the relatively insect-rich water and vegetation of the channel.

Inappropriate or excessive illumination of tree-lines or woodland areas at night can cause disturbance to roosting, commuting and foraging bats.

5.4.4.7 Bats Mitigation

- See also mitigation measures for protection of habitats (Section 5.4.2)
- Tree group 'T32' (see Appendix 5G) is likely to play a role in the success and viability of the roost and these trees will be removed as part of the scheme. However, the footprint of the proposed embankment (C08_E03) will be modified locally to allow for the retention of trees such that landscape connectivity offered by the Tree group T32 is not significantly impacted. This will ensure that bats continue to benefit from protective cover that lessens the threat of predation.
- The primary impact of the proposed scheme in terms of loss of foraging habitat will occur as a result of the culverting of 342m of the River Bridge in Blackpool. It is not possible to mitigate this impact within the scope of work proposed. While some replacement tree planting and other landscaping will occur, the primary purpose of this area will be amenity, and required public lighting will significantly reduce its value to foraging bats.
- In advance of commencement of construction in the above area the works area will be demarcated in consultation with an Ecologist and vegetation to be retained will be appropriately fenced off. This fencing and exclusion area will be maintained for the duration of the construction period. Measures in relation to the protection of trees are outlined below. Outside of emergency works, there will be no night working during the construction phase.
- Removal of existing trees and other vegetation to facilitate the proposed works will be minimized in all areas and particularly in the following areas:
    - The river corridor between the Blackpool Bypass and Blackpool Church (Item C06_B04)

- Upstream of Kilnap Bridge (Item C08_T01)
- Rose Cottage (Item C06_R01; Tree group T35)
- Commons Inn (Item C06_C01; Tree group T36).

- Any loss of trees or tree cover will be mitigated in so far as possible through replacement planting within the Scheme boundary, as close as possible to the area where trees may have to be removed to accommodate the proposed works.
- Any new lighting required as part of the project will be of as low a wattage as possible and will be directed away from the surface of the water.
- Prior to the commencement of site clearance, tree surveys will be carried out on trees identified as potential for bat roosts. If roosts are found or their potential cannon be ruled out, an appropriate mitigation strategy will need to be devised and a derogation licence will need applied from NPWS.
- Removal of trees with bat roost potential will be carried out in September/ October and under the supervision of a bat ecologist.
- A Bat box scheme will be put in place to mitigate for loss of trees and suitable foraging habitat for bats. Approximately 10 bat boxes will be provided for on stone walls faces or mature trees (as deemed appropriate). Bat boxes will be woodcrete bat boxes such as those manufactured by Schwelger and will be put in place as per the recommendations identified in NPWS Irish Wildlife Manual (2006) Bat Mitigation Guidelines for Ireland. Recommendations are made in the bat survey report (Appendix 5G).
- During construction works, generators or other machinery which create noise, vibration and air emissions, will not be located within 20m of sensitive habitats or any features with potential for bat roosting. Excessive noise and vibration will be avoided in as much as possible.

Monitoring

- Monitoring will be carried out to evaluate the effectiveness of proposed mitigation or where possible to modify or improve the measures in the light of further assessment and thereby contribute to understanding of the impact of future development projects on bats in Ireland.

5.4.4.8 Residual Impacts on Terrestrial Fauna

Permanent Significant Negative impact

With mitigation measures in place there is no significant risk to birds, or mammal populations (excluding other than otters and bats within the study area). Loss of foraging habitat and prey species will result in some loss of terrestrial species using the area. During construction, there will be temporary disturbance to dipper and grey wagtail nesting habitat where they currently use culverts/bridges and seasonal restrictions to the works may apply. In the long term, the impact is considered moderate.

However, there is a significant level of otter activity within the study area. Therefore, there is potential for loss of foraging habitat for otter. The introduction of a new culvert at Blackpool has the potential to result in increased risk of severance of this species from the River Lee and the River Bride (although it is considered that the two-populations identified on the Bride may not cross over). This extension of culverted river may result in reduced success of otters in an already urbanised system. Mitigation in the form of artificial holts,

ledges and fisheries enhancement will minimise as much as possible the impact on otters. The residual impact on Otters and bats, in particular Soprano Pipistrelle is considered Significant.

5.4.5.1 Fisheries Mitigation

Mitigation has been proposed in Chapter 6 and Chapter 3 of the EIAR Addendum with regard to limiting and controlling sediment runoff due to exposure of soils and works near or in the river. Actions for mitigation are written into the works methods in Chapter3, section 3.2

- See also Fisheries Enhancement Proposals – North Bride in Appendix 5E of this EIAR.
- See also mitigation measures for protection of habitats (Section 5.4.2).
- All works will be carried out in consultation with Inland Fisheries Ireland.
- In channel working will be minimised, where possible, method statements will identify access routes and works areas prior to commencement in consultation with the Project Ecologist and/or ECoW.
- In-channel working during the salmonid spawning season will not be permitted (November to March inclusive).
- During the construction phase, fish passage will be maintained in areas of in-channel working.
- Measures are outlined in Chapter 3 of the EIAR and EIAR Addendum regarding the management of sediment through isolation of instream works, pumping out with controls and treatment of water and the use of silt traps. Likewise there will be high level attention to concrete formworks being carried out in isolated dry conditions when weather is stable and predictable. The ECoW and project ecologist will monitor the river downstream for any issues (such as turbidity from instream sediment and suspension) that indicates a failing of the mitigation and corrective will be taken or works suspended)
- Any pumps used for over-pumping must be 'fish-friendly' and fitted with appropriate screens.
- The removal of the culvert near Sunbeam will include the regrading of the river to ensure removal of the existing weirs.
- Works will involve managing of spawning gravels upstream of Sunbeam Industrial Estate where culvert is to be removed. This will involve a re-distribution of gravels removed during the maintenance of the sediment trap Leaving sufficient gravel of the appropriate qualities to retain spawning habitat within the open channel. Details for enhancement in Appendix 5E.
- The winter channel will be constructed as such that there is no risk of fish being retained in the channel as flood water subsides. This will be ensured out by appropriate grading of the channel.
- Ensure that the proposed trash screens have an appropriate mesh size to allow for movement of salmonid species and that culverts and trash screen are designed and installed in line with published best practice (e.g. Armstrong et al 2010; Turnpenny & O'Keefe 2005).
- Compensation measures for permanent loss of riverine habitat will be carried out in agreement with Inland Fisheries Ireland. Enhancement measures have been identified for the Bride and the recommendation of O'Grady (2016) *Draft Fisheries Enhancement Proposals* will be carried out as part of the scheme. The proposal includes rehabilitation of the River Bride immediately downstream

of McDonalds to the location of the proposed trash screen adjacent to Blackpool Shopping Centre. It is the opinion of the author (O'Grady) that the works will significantly improve the rivers capacity to support a brown trout population and the net gain in fish stock terms will more than offset the permanent loss caused by culverting in the lower reaches of the proposed drainage scheme.

- The scheme will be accompanied by a programme of fish habitat and species monitoring, including the management of sediments and prior to removal of sediment during maintenance procedures. Relevant generic measures are set out in the OPW environmental guidelines (OPW Brew and Gilligan 2019). Lamprey and Eel will be monitored in relation to sediments of value for spawning. The river enhancement measures will include monitoring of spawning habitat improvements for salmonids, Brown Trout, to assess the condition of introduced gravel beds and determine the success of the measures and identify additional management ongoing. The various hydromorphological features required in the channel to maintain optimal conditions, including pools, runs and riffles will be monitored according to a 'Life Cycle Unit Score' assessment which will inform future management and enhancement requirements in accordance with the IFI and OPW approach to maintenance.

7 WATER – HYDROLOGY & HYDROGEOLOGY

This Chapter of the Environmental Impact Assessment Report (EIAR) Addendum provides supplementary information in relation to the assessment of impacts on water, hydrology and hydrogeology and is to be read in conjunction with Chapter 7 of the River Bride (Blackpool) Certified Drainage Scheme EIAR.

The following supplementary information pertaining to Chapter 7 of the EIAR was requested by the Department of Public Expenditure and Reform on 07th May 2020 and is provided in this section of the EIAR Addendum:

> *7. A quantified summary of information on the benefits of the scheme, including an overview of the numbers and types of properties which will benefit.*
> *10. Provision of updates to assessment of impacts in all other specialist sections of the EIAR, insofar as required to ensure that:*
> - *The EIAR takes due account of all information requested in this request for further information.*
> - *assessments of likely significant impacts on each environmental factor take account of relevant findings of assessments of impacts on other factors (impact interactions);*
> - *Impact predictions address all likely significant impacts during both the construction and the future maintenance stages; and*
> - *Impacts are predicted in accordance with the EPA Guidelines.*
>
> *11. Mitigation measures and monitoring proposals are to be revised and augmented, as required to ensure that they are:*
> - *adequate to mitigate and monitor the specific effects of the scheme.*
> - *practicable; and*
> - *enforceable (for example by means of audit) and that their details are clear to all stakeholders.*
>
> *12. Monitoring proposals should be accompanied by appropriate and clear remedial or other actions which will be implemented in event of exceedances of trigger levels, to ensure that acceptable limits are not exceeded.*

The request for supplementary information and general comments in relation to Chapter 7 of the EIAR have been addressed in the subsequent sections of this Chapter. It has not been necessary to further update this chapter to take account of information requested elsewhere in the DPER request that would have resulted in changes to assessments of likely significant impacts, mitigations measures, monitoring proposals, etc.

Unless otherwise specified, any text provided below supersedes the text provided in the relevant section of the EIAR. In some instances, it has been necessary to reproduce text from the original EIAR. This text is shown in grey for ease of reference.

7.2.4 Impacts and Mitigation for Surface Water Quality

Construction Phase

7.2.4.1 Generation of Silt-Laden Run-off & Increase in Suspended Solids

Short-term Moderate Negative Impact

The preparation phase, site clearance and preparatory groundworks including site compound set-up etc. will lead to exposure of bare ground and the potential for the generation of silt-laden run-off in works areas along the river bank. The potential for the generation of silt-laden surface run-off on the adjacent banks and along access and egress routes is likely to continue through the construction phase of the works and until the ground has consolidated. Stockpiled excavated material also poses an increased threat of increased siltation in the watercourse.

Excessive suspended sediment in the water column can clog and cause abrasions to fish gills, interfere with fish navigation and feeding, affect egg and fry development, while also affecting populations of aquatic invertebrates, on which the fishes' diet is based. Once deposited, excessive amounts of silt may damage fish habitat by clogging interstices between gravels in spawning grounds, resulting in diminished flow of oxygenated water to eggs and rendering these gravels unsuitable for egg incubation. Deposited sediment may also impact on the habitat of bottom dwelling aquatic invertebrates and damage nursery habitat for young fish (See also Chapter 5, Flora and Fauna).

Mitigation Measures

- Measures to minimise the suspension and transfer of sediment downstream will be implemented. These measures are likely to include the use of silt barriers downstream of the works areas and removal of any accumulated silt, construction of silt sumps downstream of the works areas, cofferdamming and dewatering of works areas where concrete and other building works are proposed. Any stockpiling will also be greater than 10 metres from the river bank.
- All works undertaken on the banks will be fully consolidated to prevent scour and run off of silt. Consolidation may include use of protective and biodegradable matting (coirmesh) on the banks and also the sowing of grass seed on bare soil.
- Works will only be undertaken during normal working hours (8:00 – 6:00) thus allowing the river to run clean for 14 hours per day. Night works will be required in limited circumstances for specialist activities (such as lifting of pre-cast bridge beams etc.). Where additional or alternative working hours are required, these will be agreed in advance via written agreement with Cork City Council.
- Measures specified in the Construction Environmental Management Plan (CEMP) (Appendix XX) will be adhered to in order to ensure all works are carried out in a manner designed to avoid and minimise any adverse impacts on the receiving environment.

Monitoring

- Runoff from works, stockpile and compound areas will be monitored and observed daily to ensure that it is not impacting on any local watercourses. Silt release results in discolouration to water and so is easy to visually monitor for its presence.
- Alarmed Sondes will be employed to measure turbidity in the River Bride upstream and downstream of the works area during construction of the drainage scheme. If an increase in turbidity of 20% or greater is identified downstream of the works, all works will cease immediately until the source of

the increased turbidity is identified and rectified (if caused by the construction works). If necessary, water sampling and monitoring of the local water courses will also be completed to test for Total Suspended Solids (TSS) and tested against the baseline water quality identified above in section 7.2.3.1.

Residual Impact - Temporary Slight Negative Impact

With the abovementioned mitigation measures and monitoring in place, the residual impact on water resulting from the generation of silt-laden run-off and increase of suspended solids during the construction phase of the scheme is anticipated to be a Temporary Slight Negative Impact. The impact for the Generation of Silt-Laden Run-off & Increase in Suspended Solids during the construction phase remains unchanged at "temporary Slight Negative Impact" in consideration of the EIAR and the information supplied as part of this EIAR Addendum.

7.2.4.2 Use of Potential Water Contaminants

Potential Temporary Moderate to Significant Negative Impact

Numerous substances used on construction sites have the potential to pollute both ground and surface water if not properly managed and treated. Such substances include fuels, lubricants, cement, mortar, silt, soil and other substances which arise during construction. The washing of construction vehicles and equipment also poses a pollution risk to watercourses. The spillage or leaking of fuel or oil from fuel tanks or construction vehicles has the potential to contaminate soils, groundwater and surface water. Such substances entering the River could damage the habitat of local populations of fish and aquatic invertebrates and also cause direct harm to aquatic fauna.

Mitigation Measures

- All concrete works will be carried out in dry conditions with no in-stream pouring of concrete.
- Ready mixed wet concrete will be used and where possible pre-cast sections will be used. There will be no batching of wet-concrete products on site.
- Chute cleaning will take place in designated, lined concrete washout areas.
- There will be no refuelling of machinery within the river channel. Refuelling will take place at by trained personnel at designated locations at distances of greater than 30 metres from the watercourse.
- No vehicles will be left unattended when refuelling and a spill kit including an oil containment boom and absorbent pads will be on site at all times.
- Any fuel that is stored on the site will be in a double skinned, bunded container that will be located within a designated works compound at a location that is removed from the river. All other construction materials and plant will be stored in this compound. The compound will also house the site offices and portaloo toilets. This compound will either be located on ground that is not prone to flooding or will be surrounded by a protective earth bund to prevent inundation.
- All vehicles will be regularly maintained and checked for fuel and oil leaks.

Residual Impact – Neutral Impact

It is likely that, with proper implementation of the above mitigation this impact will constitute a slight negative short-term impact and a Neutral long-term Impact.

Operational Phase

7.2.4.3 Generation of Silt-Laden Run-off & Increase in Suspended Solids from Maintenance works

A channel maintenance program will be required throughout the reach of the watercourses impacted by the proposed works. 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. The removal of silt/ gravel build-ups and vegetation removal has the potential to generate Silt-Laden Run-off.

Excessive suspended sediment in the water column can clog and cause abrasions to fish gills, interfere with fish navigation and feeding, affect egg and fry development, while also affecting populations of aquatic invertebrates, on which the fishes' diet is based. Once deposited, excessive amounts of silt may damage fish habitat by clogging interstices between gravels in spawning grounds, resulting in diminished flow of oxygenated water to eggs and rendering these gravels unsuitable for egg incubation. Deposited sediment may also impact on the habitat of bottom dwelling aquatic invertebrates and damage nursery habitat for young fish (See also Chapter 5, Flora and Fauna).

Mitigation Measures

All OPW maintenance work is undertaken in accordance with Environmental Guidance:

Drainage Maintenance & Construction (OPW, 2019) along with additional measures where the Environmental Procedures (EPs) 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.

Any removal of material within the channel will be 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. Typically, this material would be deposited on the riverbanks subject to space constraints or may be disposed offsite 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.

Residual Impact – Neutral Impact

It is likely that, with proper implementation of the above best practice mitigation this impact will constitute a slight negative short-term impact and a Neutral long-term Impact. The impact for the Generation of Silt-Laden Run-off & Increase in Suspended Solids during the operational phase remains unchanged at "temporary Slight Negative Impact" in consideration of the EIAR and the information supplied as part of this EIAR Addendum.

7.3.3 Potential Impacts on Hydrogeology

Potential Temporary Slight Negative Impact

There are numerous substances that will be used during the construction phase such as fuel, oil, lubricants, cement, silt, soil and other hydrocarbons which have the potential to pollute ground water. Washing of

construction vehicles and machinery also poses a risk of polluting ground water. The impacts to hydrogeology as a result of the River Bride (Blackpool) Certified Drainage Scheme are temporary and not significant. Any impacts associated with the scheme will occur during the construction or maintenance phase.

As set out in Section 7.3.2 above, the aquifers in the study area are classified as highly to extremely vulnerable to infiltration but are very poor aquifers. Should any of the above-mentioned substances contaminate the ground water in the study area presence of a poor aquifer means that there is limited risk to any ground water supply.

Mitigation Measures

A bunded area will be constructed within the site compound, three preliminary site compound layouts are shown in Appendix 3D, the locations of which are outside of the floodplain. In order to avoid any polluting substances infiltrating the ground water during the construction and operation phase of the Scheme. All plant refuelling, maintenance and washing will be carried out within the bunded area. Spill kits will be available at the bunded area in order to ensure the quick and effective cleaning of any substances.

Residual Impact - Potential Negligible Impact

Taking into account the abovementioned mitigation measures, it is considered that the impact will constitute a Negligible Impact.

7.4.3 Potential Impacts on Flooding

Construction Phase

7.4.3.1 Impact of flooding on works areas and potential release of water contaminants

Numerous substances used on construction sites have the potential to pollute both ground and surface water. Such substances include fuels, lubricants, cement, mortar, silt, soil. If such substances were to enter the River as a result of a flood event reaching the works areas or construction compounds, it could damage the habitat of local populations of fish and aquatic invertebrates and also cause direct harm to aquatic fauna.

Mitigation

Best practice mitigation measures described above in section 7.2.4.2 outline the measures that will be taken to ensure there will be no release of contaminants to watercourses as a result of construction activities or flood waters encroaching on construction works areas.

Mitigation by Design

The construction compounds for the project are located outside flood zones for the river Bride to limit any chance of flood waters reaching the compounds and any potential of contaminants being released.

Residual Impact

As a result of the construction compounds locations and proven and effective mitigation measures to mitigate the risk of releases of contaminants outlines above, The residual effect is considered to be - Negative, imperceptible, indirect, short term, unlikely impact to surface water quality.

Operational Phase

7.4.3.2 Impact on Flooding

Permanent Significant Positive Impact

The River Bride (Blackpool) Certified Drainage Scheme improves flood protection with the provision of a suite of measures including replacement of culverts, embankment works and defence wall improvements and thereby reducing the risk of water levels overtopping the bank and flooding streets and properties in Blackpool. The number and type of properties effected by the 1% AEP flood in Blackpool are presented in Table 7.7.

	Total Count	Non-Residential	Residential
Q100	293	87	206

Table 7.7 Properties flooded in 1% AEP

In flood events, there is a risk to water quality where pollution may arise from damage to waste or sewerage infrastructure or other sources such as chemicals or other potential pollutants within basements or buildings which become inundated during flood conditions.

Mitigation by design

Flooding in Blackpool is primarily fluvial (i.e. flood waters flow directly from the River Bride) In order to prevent pluvial flooding, particularly during flood events, it will be necessary to modify the surface water and combined drainage network in the town. Initially, existing outfalls will need to be sealed against backflow from rising flood waters, where this has not already taken place.

Eight Pumping stations will be installed so that surface water run off can be pumped to the river channel during flood events and on occasions when the new non-return valves malfunction. In addition to substructure, pumping stations will incorporate a surface mounted kiosk in close proximity to the underground substructure.

New collector drains will be installed to connect the new and old collection networks. Surface water will be pumped into the river channel/ new culvert at these locations through new rising mains fitted with non-return valves.

In addition to the above, it will be necessary regrade impermeable areas (roads, footpaths) at certain locations along the route of the River Bride, in order to redirect overland flow towards the river or other surface water drainage networks.

Residual Impact

The residual impact on flooding in Cork city will be a permanent significant positive impact.

Impact on Water Levels Upstream and Downstream of Proposed Works

Permanent Negligible Impact

The Flood improvements works will not affect the water levels upstream and downstream of the proposed scheme during normal flow conditions. During a storm event the flood defence measures will prevent waters flooding the surrounding area and therefore water levels downstream of the proposed flood defence walls may increase slightly over short stretches.

Mitigation Measures

All flood defences for the River Bride Drainage Scheme including the proposed additional flood defence walls have been designed to mitigate the potential increase in upstream levels.

Residual impact - Potential Permanent Imperceptible Impact

The residual impact of the proposed additional works, on upstream and downstream water levels will be imperceptible.

8 AIR QUALITY & CLIMATE / NOISE & VIBRATION

This Chapter of the Environmental Impact Assessment Report (EIAR) Addendum provides supplementary information in relation to air quality and climate, noise and vibration, and is to be read in conjunction with Chapter 8 of the River Bride (Blackpool) Certified Drainage Scheme EIAR.

The request for supplementary information and general comments in relation to Chapter 8 of the EIAR have been addressed in the subsequent sections of this Chapter. It has not been necessary to further update this chapter to take account of information requested elsewhere in the DPER request that would have resulted in changes to assessments of likely significant impacts, mitigations measures, monitoring proposals, etc.

Unless otherwise specified, any text provided below supersedes the text provided in the relevant section of the EIAR. In some instances, it has been necessary to reproduce text from the original EIAR. This text is shown in grey for ease of reference.

8.4.2 Construction Phase

8.4.2.1 Air Quality

Material handling activities on site may typically emit dust. Dust is characterised as encompassing particulate matter with a particle size of between 1 and 75 microns (1-75 µm). Deposition typically occurs in close proximity to each site and potential impacts generally occur within 500 metres of the dust generating activity as dust particles fall out of suspension in the air. Larger particles deposit closer to the generating source and deposition rates will decrease with distance from the source. Sensitivity to dust depends on the duration of the dust deposition, the dust generating activity, and the nature of the deposit. Therefore, a higher tolerance of dust deposition is likely to be shown if only short periods of dust deposition are expected and the dust generating activity is either expected to stop or move on.

The potential for dust to be emitted will depend on the type of activity being carried out in conjunction with environmental factors including levels of rainfall, wind speed and wind direction.

As indicated, dust generation rates depend on the site activity, particle size (in particular the silt content, defined as particles smaller than 75 microns in size), the moisture content of the material and weather conditions. Dust emissions are dramatically reduced where rainfall has occurred due to the cohesion created between dust particles and water and the removal of suspended dust from the air. It is typical to assume no dust is generated under "wet day" conditions where rainfall greater than 0.2 mm has fallen. Information collected from Cork Airport Meteorological Station (1962-1991) identified that typically 204 days per annum are "wet". Thus for greater than 55% of the time no significant dust generation will be likely due to meteorological conditions.

Large particle sizes (greater than 75 microns) fall rapidly out of atmospheric suspension and are subsequently deposited in close proximity to the source. Particle sizes of less than 75 microns are of interest as they can remain airborne for greater distances and give rise to the potential dust nuisance at the sensitive receptors. This size range would broadly be described as silt. Emission rates are normally predicted on a site-specific particle size distribution for each dust emission source.

Whilst construction activities are likely to produce some level of dust during earth moving and excavating phases of the project, these activities will mainly be confined to particles of dust greater than 10 microns. Particles of dust greater than 10 microns are considered a nuisance but do not have the potential to cause

significant health impacts. For instance, bulldozing and compacting operations release 84% of particles which are greater than PM10 with only 16% of particles being less than 10 microns.

Mitigation Measures

A dust minimisation plan will be formulated for the construction phase of the project, as construction activities are likely to generate some dust emissions. The potential for dust to be emitted depends on the type of construction activity being carried out in conjunction with environmental factors including levels of rainfall, wind speeds and wind direction. The potential for impact from dust depends on the distance to potentially sensitive locations and whether the wind can carry the dust to these locations. The majority of any dust produced will be deposited close to the potential source and any impacts from dust deposition will typically be within several hundred metres of the construction area.

In order to ensure that no dust nuisance occurs, a series of measures will be implemented. Site roads shall be regularly cleaned and maintained as appropriate. Hard surface roads shall be swept to remove mud and aggregate materials from their surface. Furthermore, any road that has the potential to give rise to fugitive dust must be regularly watered, as appropriate, during dry and/or windy conditions.

Speeds shall be restricted on hard surfaced roads as site management dictates. Vehicles delivering material with dust potential shall be enclosed or covered with tarpaulin at all times to restrict the escape of dust.

Worst-case truck movements during the peak construction period would be about 4 inward and 4 outward / hour. Construction traffic of this level will lead to dust emissions of the order of 3 g/m2 each hour along the haul roads based on no mitigation being implemented. However, provided vehicle speeds are restricted to less than 40 km/hr, this level of construction traffic will lead to dust emissions of the order of 2 g/m2 each hour along the haul roads. Thus, it is unlikely that the emissions of this magnitude will lead to dust deposition levels at the site boundary which exceed the TA Luft limit value for dust nuisance of 350 mg/(m2*day).

It is envisaged that the construction of the development will occur in distinct phases. As such, the potential for dust nuisance and significant levels of PM10 & PM2.5 concentrations will vary both temporally and spatially as the construction develops.

Public roads in the vicinity of the site shall be regularly inspected for cleanliness, and cleaned as necessary.

At all times, the dust mitigation measures put in place will be strictly monitored and assessed. In the event of dust nuisance occurring outside the site boundary, movement of materials will be immediately terminated and satisfactory procedures implemented to rectify the problem before the resumption of the operations.

The dust minimisation plan shall be reviewed at regular intervals during the construction phase to ensure the effectiveness of the procedures in place and to maintain the goal of minimisation of dust through the use of best practice and procedures.

Monitoring

The dust mitigation measures put in place will be strictly monitored and assessed throughout the construction phase to ensure their effectiveness. It is proposed to install Bergerhoff dust gauges which will be placed at various locations around the site to monitor the level of dust being generated during the construction phase. The monitoitng locations will be identified once the phasing of the works has been established and will be subject to baseline analysis prior to works commenceing in each particular area. The Bergerhoff dust monitoring apparatus comprises a collection vessel in the form of a glass/plastic container located on top of a stand approximate 1.5m above the ground. These dust gauges will quantify the deposition of dust during the construction phase of the project enabling the comparison between the measured data and the max

compliance level of 350mg/m²/day. The section above lists various dust control measures which will be carried out during the construction phase of the development in order to ensure that the dust emissions on site will not exceed the 350mg/m²/day. This limit is set out in the EPA Environmental Management Guidelines – Environmental Management in the Extractive Industry (Non-Scheduled Minerals) 2006 which are guidelines specific to a commercial quarry. The proposed development is not comparable to such a commercial operation due to the temporary duration of the works however, in Ireland there are currently no statutory limits for total dust deposition therefore this limit will be adopted. Where it can be demonstrated that the level of dust generation is minimal and that the receptors at or adjacent to the locations are not being impacted by dust levels, a reduction or cessation of this monitoring may be proposed

Remedial Mitigation

The propovidion of temporary screening measures around works aras which have be established as activities which have identified as significant emitters of dust.

Increased implementation of dust suppression measures using water to dampen dry areas which have the been identified as being a source of dust.

Where a works activity is found to be a continuous or unmanageable source of dust during prolonged periods of dry weather, suspension of a particular activity during such weather conditions may be necessary.

Residual Impact

With effective implementation of a dust minimisation plan, the proposed development is expected to have a negligible impact on air quality during the construction phase. Due to the size, nature and location of the development, which will lead to no increase in road traffic emissions, the proposed development is expected to have an imperceptible impact on air quality once it is operational.

Significance of Effect

Based on the assessment above there will be no significant effects.

8.4.2.2 Climate

The construction of the proposed development will require the operation of construction vehicles and plant on site. Greenhouse gas emissions, e.g. carbon dioxide (CO2), associated with vehicles and plant will arise as a result of the construction and demolition activities. This potential impact will be slight only, given the insignificant quantity of greenhouse gases that will be emitted, and will be restricted to the duration of the construction phase. Therefore, this is a short-term slight negative impact.

Mitigation Measures

All construction vehicles and plant will be maintained in good operational order while onsite, thereby minimising any emissions that arise.

All raw materials including aggregate materials for the construction works and all associated infrastructure will all be locally sourced, where possible, which will further reduce potential emissions

Remedial Mitigation Measures

As there is no specific monitoring proposed and no trigger levels that can be considered specific to the proposed project, there are no remedial mitiation proosed as it is considered that if the proposed mitigation outlined above is adequate.

Residual Impact

Short-term Imperceptible Negative Impact on Climate as a result of greenhouse gas emissions.

Significance of Effect

Based on the assessment above there will be no significant effects.

8.4.2.3 Noise and Vibration

Noise sources

The proposed development will not give rise to audible noise emissions following commissioning. While seven underground pumping stations will include pumps which will operate during high flow events, noise emissions from these are expected to be entirely negligible at the nearest receptors. Occasional maintenance works following commissioning, including sediment trap cleaning, will not be audible beyond their immediate vicinity due to masking by road traffic noise. Accordingly, operational noise emissions may be discounted.

Construction phase emissions, albeit occurring over a confined period, have greater potential to cause local noise intrusion. The construction phase will involve installation of a number of flood defence measures, the final design and positioning of which will be determined at detailed design stage. The measures will include the following, proposed at various positions:

- Channel cleaning, including debris removal and dredging where required.
- Bridge and culvert replacement or reconstruction.
- Construction of new walls and repairs to existing parapet walls.
- Construction of flood embankments.
- Sluice removal.
- Installation of sediment trap and trash screens.
- Construction of winter channel above existing watercourse.

Implementation of the above works is likely to require the following activities:

- Where debris/sediment removal is required, this typically involves use of bankside excavators which transfer material to HGVs or dump trucks.
- Embankment construction works, involving use of 1-2 midsized tracked excavators, and possibly a small number of dumpers or dump trucks. Such works are proposed at the Commons Inn, at Blackpool Retail Park, adjacent to the secluded dwelling near the railway bridge, and adjacent to a dwelling at Glennamought Bridge.
- Concrete breaking may be required at several locations, involving either hydraulic breakers on tracked excavators, or handheld pneumatic breakers powered by compressors. Concrete saws may also be required.
- Wall and parapet wall repair and construction works are proposed between North Point Business Park and Blackpool Shopping Centre, adjacent to the dwelling at the end of the Killeens off-ramp, at the commercial premises downstream of Glennamought Bridge, and adjacent to the dwelling upstream of the bridge. Such works are likely to involve a number of activities, including blockwork and concrete pours. Plant such as telescopic handlers and mini-excavators may be required. Various

activities are likely to require mobile generators to power equipment, lights and pumps. Larger works areas are likely to be surrounded by temporary hoarding to a height of 2.4 m.

- The construction method for the proposed sediment trap at Sunbeam will involve sheet piling, as will the proposed wall near Commons Inn. While unlikely, sheet piling may also be required at other works zones. The specific requirements for piling, and selection of piling method, will not be determined until site specific investigations are undertaken in due course. Sheet piling may involve use of driven or pressed-in piles, or use of vibro-displacement techniques.
- Removal of dredged material, rubble and spoil, and deliveries of concrete and other materials will require a large number of HGV movements throughout the project. These will be concentrated at specific areas where easements are available.

The overall duration of the construction phase is expected to be approximately 18 months. However, activities at each of the proposed works zones are expected to last no more than several months, depending on the works involved.

Noise impacts

The proposed construction works will be finalised following detailed site inspections, environmental assessment and public review. Although the works required at each location are unlikely to change significantly, the methodologies, plant and timeframes may only be determined by the appointed contractor(s). It is therefore not possible to accurately predict noise impacts at surrounding receptors at this stage. Moreover, prediction of noise impacts associated with the construction phase of any project is complicated by several additional factors:

- The timing, duration and amplitude of emissions associated with activity in each works zone will vary considerably.
- Construction details and plant requirements will alter on a daily basis as construction progresses.
- Plant requirements and activities may vary considerably due to unforeseen changes in the construction program.
- There will be extended periods when little or no construction noise emissions arise eg. during concrete drying periods.
- Each individual source may be relocated frequently eg. excavators.
- The overall construction period will be relatively short. The duration of individual stages will be limited, lasting days or weeks at most eg. excavation.

Due to the foregoing, it is not possible to accurately calculate the noise output which will arise onsite throughout the construction phase at each receptor across the study site. An alternative approach here is to calculate likely noise levels expected to arise in the vicinity of work zones. The calculation is presented in Table 8.1, based on typical plant sound pressure levels at 10 m provided by British Standard BS 5228:2009 Code of practice for noise and vibration control on construction and open sites Part 1: Noise (2009). The worst case scenario assumed in each zone is unlikely to occur routinely, if at all. With respect to sheet piling, it is assumed that pressed-in piles will be used where possible.

Table 8.1: Expected sound pressure level (SPL) in work zones.

Activity	Worst case scenario	SPL at 10 m	Total SPL at 10 m

Dredging	Long-reach tracked excavator x1 Dump truck x1	78 dB (178 kW) 78 dB (187 kW)	81 dB
Embankment construction	Tracked excavators x2 Dump trucks x2	75 dB (134 kW) 78 dB (187 kW)	83 dB
Concrete breaking	Hydraulic breaker x1 Consaw x1	72 dB (143 kW) 91 dB (3 kW)	72-91 dB
Wall construction	Telescopic handler x1 Discharging mixer truck x1 Generator x1	71 dB (60 kW) 75 dB 65 dB	77 dB
Sheet piling	Pressed-in piling rig x1	60-70 dB	60-70 dB

Noise impacts at receptors associated with emissions presented in Table 8.1 are assessed in Table 8.2 in light of the 70 dB daytime LAeq 1 h criterion discussed above. The table does not take into account screening provided by possible hoarding panels around each work zone.

Table 8.2: Noise impacts at receptors.

Activity	Total SPL at 10 m	Impacts
Dredging	81 dB	LAeq 1 h will reduce to 75 dB at 20 m, and 69 dB at 40 m where operations progress continuously over 1 h. A number of dwellings immediately upstream of North Point Business Park, and several dwellings on Old Commons Road and at Orchard Court, may receive LAeq 1 h levels above 70 dB.
Embankment construction	83 dB	Proposed at the Commons Inn, at Blackpool Retail Park, adjacent to the secluded dwelling near the railway bridge, and adjacent to the dwelling at Glennamought Bridge. All except Blackpool Retail Park lie within 10 m of proposed embankments, and will thus be subject to LAeq 1 h levels which exceed 70 dB.
Concrete breaking	72-91 dB	Where required, concrete breaking is unlikely to exceed the 70 dB criterion. Cutting of concrete using a consaw will reach 91 dB LAeq 1 h at 10 when undertaken continuously over 1 h. Any NSLs within approximately 100 m of consaw operations will receive emissions over 70 dB.
Wall construction	77 dB	Proposed between North Point Retail Park and Blackpool Shopping Centre. The only NSLs here are located immediately downstream of the Commons Inn. Most of these are sufficiently removed from the proposed flood defence wall, and noise levels will not exceed 70 dB. However, LAeq 1 h levels at the most northerly dwellings may exceed 70 dB during certain operations. At the hotel itself, there are no bedrooms in the vicinity of the proposed wall. Works proposed immediately adjacent to the dwelling at the end of the Killeens off-ramp may also give rise to noise levels above 70 dB at the dwelling. Wall construction proposed adjacent to the dwelling at Glennamought Bridge may exceed the 70 dB criterion at certain times. While wall

		construction is proposed at the commercial premises downstream of the bridge, this premises is not considered to be a NSL.
Sheet piling	60-70 dB	Sheet piling will not give rise to levels which exceed the 70 dB criterion at any receptor where pressed-in piles are used.

On the basis of the foregoing, the 70 dB criterion may be exceeded in the following cases:

- A number of dwellings immediately upstream of North Point Business Park, and several dwellings on Old Commons Road and at Orchard Court, may be exposed to LAeq 1 h levels above 70 dB if channel dredging is undertaken within approximately 40 m.
- The secluded dwelling near the railway bridge, the dwelling at Glennamought Bridge (and a nearby dwelling on the opposite bank of the river), and bedrooms at the Commons Inn are likely to be subject to LAeq 1 h levels which exceed 70 dB during local embankment construction.
- Any dwelling within approximately 100 m of consaw operations, and with a direct line of sight, may be exposed to levels above 70 dB.
- During construction of flood defence walls, a small number of dwellings immediately downstream of the Commons Inn, one dwelling adjacent to the Killeens off-ramp, and the dwelling at Glennamought Bridge (and a dwelling on the opposite bank of the river), may receive LAeq 1 h levels above 70 dB during certain operations.

With respect to 70 dB exceedances identified above, consaw operations may be readily controlled by erecting a hoarding around the cutting area. In addition, the flood defence wall construction operation downstream of the Commons Inn, at the Killeens off-ramp dwelling, and at the Glennamought Bridge dwelling, may be similarly treated by erecting a hoarding along the boundary of the works zone. In each case, the hoarding should extend to a height of 2.4 m, and should consist of plywood boarding on both sides of timber framework, with waterproofed cavity to be filled with mineral wool or similar. Gaps at partition interfaces should be boarded. If such measures are installed, consaw and wall construction operations are expected to meet the 70 dB LAeq 1 h criterion.

Given the size of plant associated with dredging, and the proximity of receptors at certain locations, use of hoarding to screen noise emissions is unlikely to be practical. In this case, it is considered more suitable to notify residents in advance of operations. The affected NSLs consist of three dwellings upstream of North Point Business Park, and a number of dwellings along Old Commons Road and at Orchard Court.

Like dredging, embankment construction is similarly unsuitable for treatment using hoarding. A more practical solution is to liaise with the affected receptors (the secluded dwelling near the railway bridge, the Glennamought Bridge dwelling, the dwelling on the opposite side of the river at Glennamought, and the Commons Inn) in advance.

In addition to the sources discussed above, noise emissions will also arise from HGV movements across the study area associated with import of materials and export of soils, etc. HGV access to work zones will be facilitated using the local road network, and through privately owned access points by agreement. The number of HGV movements required has not been accurately quantified at this point. On the basis of experience with other large scale construction projects, the number of movements at most work zones is unlikely to exceed two per hour. Where civil engineering works are required, such as embankment construction, this may increase to five per hour.

Noise levels attributable to HGV movements may be determined using:

$L_{Aeq\ 1\ h} = L_{AE} + 10\log N - 10\log T$

L_{AE} Sound exposure level from vehicle pass. Truck L_{AE} will vary. Typical L_{AE} value of 83 dB at 5m is assumed, based on experience at other sites.

N: Number of passes.

T: 1 hour.

On this basis, $L_{Aeq\ 1\ h}$ levels associated with up to five movements per hour will be 54 dB at 5 m. It follows that $L_{Aeq\ 1\ h}$ levels will be significantly lower than the 70 dB criterion at all receptors. Given the dominance of existing traffic noise in the local environment, HGV movements are highly unlikely to alter existing traffic noise levels.

During the construction phase, noise impacts at all receptors will be temporary and localised. At most of these, impacts will be imperceptible. At a small number of dwellings, particularly those immediately adjacent to dredging or embankment construction works, impacts will range from slight negative to noticeable negative. Given the benefit which will accrue to these dwellings in particular, the overall long term impact is expected to be positive.

Vibration impacts

Three potential sources of ground borne vibration may arise during the construction phase: vibratory compaction, concrete breaking, and sheet piling.

Vibratory compaction of infill may be required over small areas prior to the laying of finished surfaces. This source is unlikely to be significant offsite due to the small areas involved and the limited time present. Moreover, the fluidic nature of infill when vibrated tends to attenuate ground vibration; most of the vibration energy is lost through particle settlement before reaching underlying strata. Low peak particle velocity (PPV) levels in the order of 1.5 mm/s have been reported at a distance of 25 m at some sites. At the nearest receptors, PPV levels are therefore likely to be significantly lower than criteria presented in Tables 8.11 and 8.12.

Concrete breaking, where required, will involve hydraulic breaker units fitted to tracked excavators, or pneumatic handheld units. Although this activity may give rise to high levels of ground vibration in proximity to the breaking area, the vibration tends to contain relatively little energy in the lower frequencies at which buildings and occupants are most vulnerable. In addition, higher frequencies attenuate more rapidly than low frequencies, thus minimising the impact zone. For this reason, most vibration guidance documents such as British Standard BS 5228-1:2009 Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration ignore concrete breaking vibration. Table 8.3 lists various PPV levels reported in literature at sites where hydraulic rock breaking has been undertaken. The range in levels noted reflects variations in equipment power and rock type.

Table 8.3: Reported rock breaking vibration levels.

Distance	5 m	10 m	20 m	50 m
PPV	0.2-4.5 mm/s	0.06-3.0 mm/s	0.02-1.5 mm/s	0.1-0.3 mm/s

The highest PPV level presented in Table 8.3 is 4.5 mm/s, measured at 5 m from the breaking operation. This level is considerably lower than criteria presented in Tables 8.11 and 8.12. It should be noted that levels presented in Table 8.3 relate to rock breaking. PPV levels associated with concrete breaking are likely to be lower.

Sheet piling will be required when constructing the proposed sediment trap and downstream of Commons Inn. Although unlikely, piling may also be required when constructing or repairing other bank defences. Traditional piling methods such as driven piling may generate high levels of ground borne vibration. Vibo-displacement piles may also give rise to elevated PPV levels. If either of these is deemed necessary, it is recommended that real time monitoring of PPV levels is undertaken at surrounding receptors. It is also recommended that prior test piling be undertaken, with concurrent PPV measurement, to determine piling parameters required to meet criteria presented in Tables 8.11 and 8.12.

It is noted that the piling method most likely to be used at the study site will be pressed-in piling where ground conditions allow. British Standard BS 5228:2009 Code of practice for noise and vibration control on construction and open sites Part 2: Vibration (2009) notes that vibration levels associated with pressed-in piling are minimal. The document refers to PPV levels measured in the vicinity of two separate pressed-in piling projects where the following levels were measured: 2.5-4.3 mm/s at 4.5 m, 0.3-0.7 mm/s at 7.1 m, and <0.5 mm/s at 24 m.

In summary, vibration impacts are expected to be imperceptible where pressed-in piles are used. Any other piling methods are likely to result in temporary community-wide impacts, ranging from noticeable negative to substantial negative depending on separation distance.

Mitigation Measures

Following completion of the proposed flood relief works, noise emissions are expected to be satisfactory, and no specific mitigation measures are required.

Noise emissions associated with the construction phase will in general be satisfactory at most receptors. At each work zone, operations will be confined to a relatively short period, extending to several months at most. Apart from a small number of exceptions, noise emissions at each zone will comply with the daytime 70 dB LAeq 1 h criterion. The exceptions are as follows:

- Three dwellings immediately upstream of North Point Business Park, and several dwellings on Old Commons Road and at Orchard Court, may be exposed to LAeq 1 h levels above 70 dB if channel dredging is undertaken within approximately 40 m. It is recommended that the contractor liaises with the occupants of these dwellings prior to undertaking works.
- The Glennamought Bridge dwelling (and a dwelling on the opposite bank of the river), the secluded dwelling near the railway bridge, and bedrooms at the Commons Inn may be subject to LAeq 1 h levels which exceed 70 dB during local embankment construction. It is again recommended that the contractor liaise with the occupants of these dwellings prior to undertaking works.
- Any dwelling within approximately 100 m of consaw operations, and with a direct line of sight, may be exposed to levels above 70 dB. This may be readily mitigated by erecting hoarding between the operations area and nearby receptors.
- During construction of flood defence walls, a small number of dwellings immediately downstream of the Commons Inn, one dwelling adjacent to the Killeens off-ramp, and the Glennamought Bridge dwelling (and a dwelling on the opposite bank of the river) may receive LAeq 1 h levels above 70 dB during certain operations. As above, this may also be readily mitigated if required by erecting hoarding.

Where hoarding is required, it is recommended that hoarding panels should extend to a height of 2.4 m, and should consist of plywood boarding on both sides of timber framework, with waterproofed cavity to be

filled with mineral wool or similar. Gaps at panel interfaces should be boarded. If such measures are installed, consaw and wall construction operations are expected to meet the 70 dB LAeq 1 h criterion at receptors.

Installation of hoarding will be less suitable for control of dredging and embankment construction works. At the affected properties, it is recommended that the contractor liaises with the occupants of these dwellings prior to commencing works. It is noted that the dwellings lie in close proximity to the channel, and are therefore vulnerable to flooding. The proposed works will eliminate the possibility of flooding at these receptors. In this light, short term construction works are likely to be considered acceptable.

It is recommended that appointed contractor(s) be required to adopt practices set out in British Standard BS 5228:2009 Code of practice for noise and vibration control on construction and open sites Part 1: Noise and Part 2: Vibration (2009). Measures recommended in the standard include:

- Appointing a project representative responsible for noise and vibration issues, and for liaising with local representatives. A clear communication channel should be established between all parties prior to project commencement.
- Requiring that contractors ensure that site personnel are familiar with potential noise and vibration issues, and that personnel apply a common-sense approach to eliminating unnecessary noise emissions.
- Use of quieter plant and methods where possible.
- Installation of temporary barriers or enclosures around local sources such as compressors and generators.
- Limiting times of activities which may generate elevated noise or vibration emissions.

With respect to sheet piling, no mitigation measures are considered necessary where pressed-in piles are used. If ground conditions require an alternative piling method, it is recommended that real-time monitoring of PPV levels is undertaken at surrounding receptors. It is also recommended that prior test piling be undertaken, with concurrent PPV measurement, to determine piling parameters required to meet criteria presented in Tables 8.11 and 8.12.

The assessment above relates to daytime operations. No routine evening or night-time construction activities are anticipated in the course of the proposed work, but if required in exceptional circumstances, any such night time works will be subject to the noise limits set out in Table 8.12 of the EIAR for the 2300-0700 time periods.

Noise Monitoring

Noise monitoring will be undertaken during the groundworks stage of the construction works involving any excavation, rock breaking, demolition or piling, in parts of the works area where these activities are ongoing. Monitoring will be carried out in accordance with *British Standard BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 1: Noise* (2014) and the National Roads Authority document *Good practice guidance for the treatment of noise during the planning of national road schemes* (2014) guidance. At each monitoring location, measured data will be used to assess compliance with limits recommended in Table 8.12 above, or any other limits imposed. During each survey, $L_{Aeq\ 1\ h}$ and L_{ASmax} limits will be measured by a competent person using calibrated equipment. Competency requirements are set out in EPA document *NG4 Guidance note for noise: Licence applications, surveys and assessments in relation to scheduled activities* (2016).

Remedial Mitigation

Where a survey shows that construction operations exceed Table 8.12 limits, or any other limits imposed, all construction operations will be immediately halted. Works will not resume until appropriate mitigation measures have been designed and implemented. Such measures may include use of hoarding/enclosures, replacement with quieter plant, altered works timing so as to coincide with higher background levels/limits, and other measures set out in BS 5228. Measures will be specific to local conditions.

Vibration Monitoring

Where piling other than pressed-in piles are used, monitoring of groundborne vibration levels will be carried out at the nearest buildings in accordance with *British Standard BS 5228-2:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration* (2014). Data measured during such monitoring shall be used to assess compliance with PPV limits set out in Table 8.15 above, or any other limits imposed. Monitoring will be undertaken by competent personnel using calibration equipment.

Remedial Mitigation

Where PPV levels due to piling exceed Table 8.15 criteria or other applicable limits, all works will be immediately stopped. Appropriate mitigation measures will be designed and implemented prior to proceeding. Such measures include alterations to the piling method, and installation of tell-tales on buildings of interest.

Residual Impact

Noise and vibration impacts during the construction phase, inclusive of mitigation, are expected to be temporary, localised and imperceptible at most locations. At dwellings close to proposed works zones, particularly adjacent to dredging and embankment construction areas, impacts are likely to be slight negative to noticeable negative. Impacts may increase to noticeable negative or substantial negative where piling methods other than pressed-in piles are used. However, it should be noted that these impacts will be entirely short term in nature, lasting several days or weeks locally in most cases. Implementation of mitigation measures described above will further reduce impacts. Moreover, the long term impact is expected to be positive, given the elimination of flood risk in these areas. Impacts are summarised in Table 8-19.

Table 8.19: Summary of noise & vibration effects.

Factor	Determination
Probability of effects	Noise emissions are likely to arise. Likely effects are as described above. Vibration effects are likely to arise in proximity to piling works. No unplanned effects are likely.
Quality of effects	Negative/adverse at some positions while works are underway. Neutral at most locations during works. Neutral at all locations once works are complete, although the removal of flood risk is expected to generate an overall positive effect.
Significance of effects	While underway, impacts are likely to be imperceptible at most locations. At certain positions, noise impacts may be locally significant adverse during certain operations. Once complete, such impacts will cease.
Extent of effects	Local only.

Context of effects	Where audible, effects will be greatly mitigated by (a) local urban context, where road works and sewerage/drainage works occur at intervals, and (b) the perceived benefit which will accrue i.e. flood risk removal.
Duration of effects	Effects will be short term during works, expected to last several weeks at most at any particular location. Resulting positive effects will be permanent.
Reversibility of effects	Short term effects will be reversible i.e. emissions will cease once works are complete. Positive long term effects will be irreversible.
Frequency of effects	Where audible, impacts will arise at intervals during construction working hours. In some cases, emissions may arise almost continuously throughout the working day. These impacts will last several weeks at most.
Indirect effects	During the works, indirect effects may arise at receptors adjacent to roadways due to HGV traffic. Such impacts are likely to be negligible in the context of existing road traffic. Long term reductions in noise emissions may arise at some receptors following the construction of embankments due to screening of sources such as traffic and watercourse flow.
Cumulative effects	None expected. The possibility that some receptors may be affected by simultaneous construction emissions from the proposed development and other non-related projects cannot be discounted, particularly in urban areas.
Do nothing effects	Noise emissions associated with periodic flood clean up projects may continue to arise if the project does not proceed.
Worst case effects	Most serious potential impact: Iniital works indicate that extensive piling is required close to receptors. Liaison with local residents will be required here.
Indeterminable effects	None identified.
Irreversible effects	Positive long term effects following completion of the project will be irreversible.
Residual effects	Noise and vibration impacts likely to be neutral once construction is complete. However, removal of flood risk is expected to render to overall impact significantly positive.
Synergistic effects	None identified.

Significance of Effect

Based on the assessment above there will be no significant effects.

9 LANDSCAPE

This Chapter of the Environmental Impact Assessment Report (EIAR) Addendum provides supplementary information in relation to landscape, and is to be read in conjunction with Chapter 9 of the River Bride (Blackpool) Certified Drainage Scheme EIAR.

The request for supplementary information and general comments in relation to Chapter 9 of the EIAR have been addressed in the subsequent sections of this Chapter. It has not been necessary to further update this chapter to take account of information requested elsewhere in the DPER request that would have resulted in changes to assessments of likely significant impacts, mitigations measures, monitoring proposals, etc.

Unless otherwise specified, any text provided below supersedes the text provided in the relevant section of the EIAR. In some instances, it has been necessary to reproduce text from the original EIAR. This text is shown in grey for ease of reference.

9.6.3.8 Other Works

There are a number of other works which have been considered. These include the re-grading of ground levels at various locations, which are considered to have a **Permanent Imperceptible to Slight Impact.**

Other works with potential landscape and visual impacts include the construction of pumping stations in seven locations, which may include an above ground element likely to resemble a kiosk. This is subject to confirmation, but in these locations the pumping stations are considered to have a **Permanent Imperceptible Negative Impact.**

Certain other works described in Chapter 3 such as below surface works and minor works were assessed and these in general have potential **Permanent Imperceptible to Slight Neutral to Negative impacts.**

9.6.3.9 Future Maintenance

The ongoing and periodic maintenance that will be required to keep the flood defence scheme operating to its design standard, will require intermittent works and maintenance measures to be employed, as described in Section 3 and Appendix 3C. All maintenance works and requirements will be short-term, periodic and temporary in nature, and are considered to have a **Temporary, Imperceptible, Neutral, Residual, Effect.**

10 CULTURAL HERITAGE

10.1 INTRODUCTION

This Chapter of the Environmental Impact Assessment Report (EIAR) Addendum provides supplementary information in relation to the assessment of impacts on cultural heritage and is to be read in conjunction with Chapter 10 of the River Bride (Blackpool) Certified Drainage Scheme EIAR.

The request for supplementary information and general comments in relation to Chapter 10 of the EIAR have been addressed in the subsequent sections of this Chapter. It has not been necessary to further update this chapter to take account of information requested elsewhere in the DPER request that would have resulted in changes to assessments of likely significant impacts, mitigations measures, monitoring proposals, etc.

Unless otherwise specified, any text provided below supersedes the text provided in the relevant section of the EIAR. In some instances, it has been necessary to reproduce text from the original EIAR. This text is shown in grey for ease of reference.

Appendices that were provided with the River Bride (Blackpool) Certified Drainage Scheme EIAR are to be superseded by the Addendum appendices that are included in this Environmental Impact Assessment Report (EIAR) Addendum.

10.5 MITIGATION AND MONITORING

Archaeological test trenching will be undertaken in dryland areas to be impacted by ground reduction works within the environs of Kilbarry Mill (HAN 1), Kilnap Mill (HAN 3) and Sunbeam sites (HAN 4) during the pre-construction phase. In the event that any unrecorded features of archaeological significance are encountered the Archaeologist will consult with the OPW Project Archaeologist, the Cork City Council Archaeologist and the NMS in order to determine further mitigation measures. A report detailing the results of the archaeological site investigations will be submitted to the NMS and the completion of works as part of the process of monitoring potential impacts during the scheme.

Archaeological mitigation measures proposed for the features identified during the river surveys are tabulated in Table 10.5 which also presents monitoring strategies to be enacted to ensure that mitigation systems are operating as intended. However, archaeological monitoring is required where direct impacts are to take place which includes the removal of HAN 14 (Kilnap House access bridge), Feature HAN 16 (Masonry Bridge, Fitz's Boreen), HAN 17 (River Walling), HAN 18 (Bridge Section), and HAN 19 (Masonry Culvert). The removal of these features will be undertaken in a systematic manner, under archaeological supervision, allowing the archaeologist to obtain additional information and undertake supplementary recording. In addition, key masonry elements from these structures, including any other pieces identified as being of interest by the monitoring archaeologist, will be retained as part of that process. Drawn and photographic records of Bridges HAN14 and HAN 16 have been compiled by ADCO as part of the impact assessment and are presented in Appendix 10.2. Archaeological monitoring will be carried out during other riverbed and bankside disturbances associated with the proposed flood relief scheme. In the event that any previously unrecorded archaeological features are uncovered during monitoring of ground works then they will be recorded and securely cordoned off while the OPW Project Archaeologist, the Cork City Council Archaeologist and the NMS are consulted to determine appropriate further mitigation

measures, which may entail preservation *in situ* (by avoidance) or preservation by record (archaeological excavation). These measures will ensure that any sub-surface remains of archaeological or historic value are dealt with in an appropriate archaeological manner.

Table 10.5: Mitigation measures and monitoring of process for Heritage Assets

HAN	Feature Type	Intervention	Mitigation	Monitoring of Process
1	Kilbarry Mill	Embankment within property	Pre-construction test trenching	Testing to be carried out under licence issued by NMS. A report will be compiled and submitted to NMS and OPW Project Archaeologists
2	Glen Mill/Distillery	None	No additional mitigation required	None required
3	Kilnap Glen House	Flood defences within garden	Pre-construction test trenching	Testing to be carried out under licence issued by NMS. A report will be compiled and submitted to NMS and OPW Project Archaeologists
4	Kilnap Mill	Re-instatement of existing access road	Archaeological Monitoring; extant remains to be cordoned off during construction phase	Monitoring to be carried out under licence issued by NMS. A report will be compiled and submitted to NMS and OPW Project Archaeologists
5	Former mill (Sunbeam)	Access road	Pre-construction test trenching of any areas to be subject to ground reduction works	Testing to be carried out under licence issued by NMS. A report will be compiled and submitted to NMS and OPW Project Archaeologists
6	Church of Annunciation	None	No additional mitigation required	None required
7	Madden's Buildings	None	No additional mitigation required	None required
8	Masonry Road Bridge (Kilnap Bridge)	None	No additional mitigation required	None required
9	Weir/Dam Structure	None	No additional mitigation required	None required
10	Railway Bride (Kilnap Viaduct)	None	No additional mitigation required	None required
11	RiverWalling/Revetment; five sections	None	No additional mitigation required	None required
12	Weir Structure	None	No additional mitigation required	None required
13	Millrace	None	No additional mitigation required	None required
14	Masonry Bridge (Kilnap Glen House Access Bridge)	Removal of structure	Archaeological Monitoring; structure to be removed under archaeological supervision.	Monitoring to be carried out under licence issued by NMS. Drawn and photographic record of structure has been compiled and submitted to NMS. A report on supervision of works will be compiled and submitted to NMS and OPW Project Archaeologists
15	River Walling / Revetment	None	No additional mitigation required	None required

HAN	Feature Type	Intervention	Mitigation	Monitoring of Process
16	Masonry Bridge (Fitz's Boreen)	Removal of structure	Archaeological Monitoring; structure to be removed under archaeological supervision.	Monitoring to be carried out under licence issued by NMS. Drawn and photographic record of structure has been compiled and submitted to NMS. A report on the supervision of works will be compiled and submitted to NMS and OPW Project Archaeologists
17	River Walling	Replace existing channel with concrete culvert	Archaeological Monitoring; structure to be removed under archaeological supervision. This is to include the recovery cut stone CS17.	Monitoring to be carried out under licence issued by NMS. A report on the supervision of works will be compiled and submitted to NMS and OPW Project Archaeologists
18	Bridge Section	Replace existing channel with concrete culvert	Archaeological Monitoring; structure to be removed under archaeological supervision.	Monitoring to be carried out under licence issued by NMS. Drawn and photographic record of structure has been compiled and submitted to NMS. A report on the supervision of works will be compiled and submitted to NMS and OPW Project Archaeologists
19	Masonry Culvert	Replace existing culvert with reinforced concrete culvert	Archaeological Monitoring; structure to be removed under archaeological supervision.	Monitoring to be carried out under licence issued by NMS. A report on the supervision of works will be compiled and submitted to NMS and OPW Project Archaeologists
20	Masonry Culvert	Replace existing open channel with concrete culvert;	No additional mitigation required	None required
21	Masonry Culvert	Local Masonry Repairs to culvert be carried out	No additional mitigation required	None required
22	River Walling /Revetment; two opposing sections	None	No additional mitigation required	None required
23	Masonry Culvert	Local Masonry Repairs to culvert be carried out	No additional mitigation required	None required
24	Millpond	Neutral	No additional mitigation required	None required
25	River Walling/ Revetment	Neutral	No additional mitigation required	None required
26	Weir	Neutral	No additional mitigation required	None required
27	Tailrace (mill)	Neutral	No additional mitigation required	None required
28	River Walling (north side of channel)	Neutral	No additional mitigation required	None required
29	River Walling (south side of channel)	Neutral	No additional mitigation required	None required
30	Mill Boundary Wall (masonry)	Neutral	No additional mitigation required	None required

HAN	Feature Type	Intervention	Mitigation	Monitoring of Process
31	River Walling/Revetment	Removal to facilitate new flood defence wall	Additional archaeological recording and archaeological supervision of removal process.	Monitoring to be carried out under licence issued by NMS. A report on the supervision of works will be compiled and submitted to NMS and OPW Project Archaeologists
32	Masonry Wall (part of former mill building)	Removal to facilitate new flood defence wall	Additional archaeological recording and archaeological supervision of removal process.	Monitoring to be carried out under licence issued by NMS. A report on the supervision of works will be compiled and submitted to NMS and OPW Project Archaeologists
33	Masonry Bridge	Tie-in to bridge impacted by tie-in for flood defence wall	No additional mitigation required	None required
34	River Walling	Neutral	No additional mitigation required	None required
35	Weir (site of)	Neutral	No additional mitigation required	None required
36	River Walling/ Revetment	Neutral	No additional mitigation required	None required
37	Masonry Bridge (road)	Neutral	No additional mitigation required	None required

10.7 CUMULATIVE IMPACTS

A review of a number of developments and development plans identified by Ryan Hanley Consulting Engineers for assessment of cumulative impacts was undertaken. This included a consideration of the combined direct/indirect impacts of the proposed scheme, consulting with the Cork City Council online planning enquiry system to determine if any cultural heritage assessments of the identified developments were undertaken and a review of the Excavations Database to ascertain if any previously cultural heritage features were impacted at any of the identified subject sites. No potential accumulation of impacts resulting in a combined significant adverse cumulative impact on the cultural heritage resource was identified during this review. In addition, the proposed scheme will result in an alleviation of flooding events in Blackpool village which will result in an indirect positive impact on the cultural heritage resource within the settlement.

There are no predicted adverse Cumulative Impacts on the Cultural Heritage resource associated with the proposed flood relief scheme.

Accordingly, based on the assessment of all elements of the proposed Scheme, no significant cumulative effects are anticipated.

11 MATERIAL ASSETS IMPACT ASSESSMENT

This Chapter of the Environmental Impact Assessment Report (EIAR) Addendum provides supplementary information in relation to the material assets impact assessment and is to be read in conjunction with Chapter 11 of the River Bride (Blackpool) Certified Drainage Scheme EIAR.

The following supplementary information pertaining to Chapter 11 of the EIAR was requested by the Department of Public Expenditure and Reform on 07th May 2020 and is provided in this section of the EIAR Addendum:

9. *Review of assessment of impacts on traffic in s11 to include further detail of impacts of road closures and partial road closures on pedestrian and vehicular traffic insofar as required to ensure clear and robust assessment of the likely significant impacts of these closures.*
10. *Provision of updates to assessment of impacts in all other specialist sections of the EIAR, insofar as required to ensure that:*
    - *the EIAR takes due account of all information requested in this request for further information;*
    - *assessments of likely significant impacts on each environmental factor take account of relevant findings of assessments of impacts on other factors (impact interactions);*
    - *impact predictions address all likely significant impacts during both the construction and the future maintenance stages; and*
    - *impacts are predicted in accordance with the EPA Guidelines.*
11. *Mitigation measures and monitoring proposals are to be revised and augmented, as required to ensure that they are:*
    - *adequate to mitigate and monitor the specific effects of the scheme;*
    - *practicable; and*
    - *enforceable (for example by means of audit) and that their details are clear to all stakeholders.*
12. *Monitoring proposals should be accompanied by appropriate and clear remedial or other actions which will be implemented in event of exceedances of trigger levels, to ensure that acceptable limits are not exceeded.*

The request for supplementary information and general comments in relation to Chapter 11 of the EIAR have been addressed in the subsequent sections of this Chapter. It has not been necessary to further update this chapter to take account of information requested elsewhere in the DPER request that would have resulted in changes to assessments of likely significant impacts, mitigations measures, monitoring proposals, etc.

Unless otherwise specified, any text provided below supersedes the text provided in the relevant section of the EIAR. In some instances, it has been necessary to reproduce text from the original EIAR. This text is shown in grey for ease of reference.

11.2 TRAFFIC AND ROADS

11.2.2 Existing Traffic

Details in relation to existing traffic are provided in the Traffic Impact Assessment Report (Appendix 11B).

11.2.4 Potential Impacts on Traffic and Transport Infrastructure

11.2.4.2 Potential Impact of Construction Traffic

The impacts of construction traffic are provided in the Traffic Impact Assessment Report (Appendix 11B).

11.2.4.4 Potential Impact of Road Closures

The potential impacts of road closures are provided in the Traffic Impact Assessment Report (Appendix 11B).

11.4 WASTE MANAGEMENT DURING CONSTRUCTION

11.4.1 Background Information

Best Practice Guidelines sets thresholds to ascertain which projects require the preparation of C&D plans. The proposed development, exceeds the following threshold and therefore requires a C&D Waste Management Plan;

- Civil Engineering projects producing in excess of 500m3 of waste, excluding waste materials used for development works on the site.

The construction and demolition waste plan for the scheme is provided in Section 3 of the Construction and Environmental Management Plan (CEMP) Appendix 3F.

As outlined in Chapter 6, excavated material will be reused on site as much as practicable. Where this is not possible, the recycling rates for the C&D waste produced throughout the construction of the River Bride (Blackpool) Certified Drainage Scheme should be maintained at or above 85%, if possible, as outlined in the Waste Management (Planning) Regulations 1997.

11.4.2 Classification Of Waste

The following text is in addition to the text provided in Section 11.4.2 of the EIAR.

Invasive Species have been identified in the proposed works area; Gunnera (Giant Rhubarb) and Japanese Knotweed species. Therefore, any soil removed from any effected areas must be managed in accordance with the Invasive Species Management Plan as set out in Appendix 5F.

11.4.3. Potential Impact during Construction Phase

The following text is in addition to the text provided in Section 11.4.3

Potential Permanent Moderate *Negative* Impact

Poor management of excavated waste could lead to the disposal of waste deemed unsuitable for reuse or recycling in facilities that do not carry the appropriate licenses.

In addition, if waste is not managed and stored correctly on site, it has the potential to cause nuisance and environmental impact, particularly due to the presence of invasive species in the proposed working areas. Mismanagement of soil removed from these areas could lead to the spreading of the invasive alien species in other areas.

Litter may be generated from packaging taken from materials, mixed waste produced by the construction workers (lunches, cigarette waste etc.), or from debris from leftover/damaged construction materials. Poor management of waste may also result in water and ground pollution on the site or adjacent to the site.

Fuels and hydraulic oils/lubricants that will be used during the construction phase are classed as hazardous. There will be fuels stored on site for machinery and construction vehicles along with oils and lubricants. Should any spillages, waste or surplus liquids be disposed of incorrectly it could cause serious harm to the surrounding environment.

The potential impacts of construction and demolition waste on the environment, given the presence of invasive species in the proposed works area, are predicted to be permanent and moderate.

Mitigation Measures

Soil/Subsoil

All works carried out in areas where invasive species (Gunnera and Japanese Knotweed) have been identified will be managed in accordance with the measures set out in the Invasive Species Management Plan (Appendix 5F).

Soils generated from excavations which is not in a Japanese Knotweed infested area will be stored separately from the gravels and bedrock and will be transported to an appropriately licensed facility by permitted contractors.

Soils generated from excavations carried out throughout the scheme, which are not in an infested area, will be stored separately from the gravels and bedrock and will be transported to an appropriately licensed facility by permitted contractors. It not considered likely that these materials will be hazardous, but should a portion of it be deemed to be contaminated they will be stored separately to the inert material. Samples will be taken and tested in order to appropriately classify the material as non-hazardous or hazardous to establish the criteria for the acceptance of waste at landfills. They will then be transported to an appropriately licensed facility by permitted contractors.

Residual Impacts – Neutral Impact

Taking into account the abovementioned mitigation measures the residual impact of the construction phase will be imperceptible.

11.4.4 Potential impact during the Operational Phase

Potential Temporary Slight Impact

The operational phase of the proposed scheme is unlikely to produce any waste of significant volume. Periodic maintenance of flood defences, pumping stations and trash screen will be carried out which could generate very small volumes of litter, packaging, concrete, scrap metal, bitumen products or soils that if not disposed of correctly could adversely affect the local environment.

Operational maintenance works could disturb stands of invasive plants and/or soils contaminated with invasive plant material.

Mitigation Measures

For maintenance and repair work, all maintenance teams involved will take all waste generated on site back to their compounds to be placed in appropriate waste streams designated for recycling, reuse or disposal. No waste will be left at the site of the repair or maintenance.

All maintenance works carried out in areas where invasive species (Gunnera and Japanese Knotweed) have been identified will be managed in accordance with the measures set out in the Invasive Species Management Plan (Appendix 5F).

Residual Impacts – Neutral Impact

Taking into account the abovementioned mitigation measures the residual impact of the operational phase will be imperceptible.

13 SCHEDULE OF MITIGATION AND MONITORING

The mitigation and monitoring measures for the River Bride (Blackpool) Certified Drainage Scheme are set out in each chapter of the EIAR and EIAR Addendum and are summarised in this Chapter.

The measures that will be implemented are set out in Table 13.1 and have been grouped under the following phases of the Scheme:

- Pre-commencement Phase
- Construction Phase
- Operational Phase

Furthermore, the measures will be grouped under the following subheadings:

- Construction management
- Biodiversity, Flora and Fauna
- Soils and Geology
- Water
- Air Quality & Climate, Noise and Vibration
- Landscape
- Cultural Heritage
- Material Assets
- Traffic

The mitigation proposals presented below are laid out in a tabular format that is clear and provides an audit list that can be reviewed and reported on during the construction and operational phases of the proposed Scheme.

Ref No.	Reference Heading	Location	Mitigation Measure	Audit Result	Action Required
Pre-Commencement Phase					
MM1	Traffic	EIAR Chapter 4	A traffic management plan (such as rolling traffic management) will be prepared and implemented for the duration of the works in order to ensure that any impacts on traffic mobility are minimised.		
MM2	Invasive species	EIAR Chapter 5	A pre-construction/pre-operational maintenance survey for invasive species will be conducted at the earliest stage possible to update and inform on the status of invasive plant species in or near the scheme/maintenance works area. These surveys should be undertaken during the appropriate botanical season (April to September).		
MM3	Dust	EIAR Chapter 8	A dust minimisation plan will be formulated for the construction phase of the project		
MM4	Archaeology	EIAR Chapter 10	Archaeological test trenching will be undertaken in dryland areas to be impacted by ground reduction works within the environs of Kilbarry Mill (HAN 1), Kilnap Glen House (HAN 3) and Sunbeam sites (HAN 4) during the pre-construction phase. In the event that any unrecorded features of archaeological significance are encountered the Archaeologist will consult with the OPW Project Archaeologist, the Cork City Council Archaeologist and the NMS in order to determine further mitigation measures. A report detailing the results of the archaeological site investigations will be submitted to the NMS and the completion of works as part of the process of monitoring potential impacts during the scheme.		
Construction Phase					

Ref No.	Reference Heading	Location	Mitigation Measure	Audit Result	Action Required
Construction Management					
MM5	Existing underground services	EIAR Chapter 4, EIAR Chapter 11	Prior to excavation, the Contractor will assess record drawings and the results of the Site Investigation in order to determine the exact depth and location of the existing service networks within the works area.		
MM6	Existing Watermains	EIAR Chapter 11	The Employer's Representative (Consulting Engineer) will assess the water distribution network drawing and detailed site investigation in order to determine the locations of watermains relative to the proposed works as part of the Design Phase. Any anticipated clashes between the water distribution network and the proposed works will be identified during the design phase and any diversions necessary to avoid accidental clashes during the construction phase will be designed, planned and agreed with Irish Water in advance of the construction phase of the Scheme.		
MM7	Existing Gas network	EIAR Chapter 11	The locations of the gas pipelines relative to the proposed works will be confirmed as part of the Design Phase. The Employer's Representative (Consultant Engineer) will assess the gas network drawings and result of the detailed site investigation in order to determine the exact depth and location of the existing gas pipelines within the works area. Should it be anticipated that the excavation for the proposed works will impact on this pipework, this will be taken into consideration at detailed design stage and any diversions necessary to avoid accidental clashes during construction phase will be designed, planned and agreed with Bord Gáis in advance of the construction phase. Prior to excavation the Contractor will carry out additional site investigation, including slit trenches, in order to determine the exact location of the gas pipelines in close proximity to the works area.		
MM8	Existing Electricity network	EIAR Chapter 11	The locations of the electricity network relative to the proposed works will be confirmed as part of the Design Phase. The Employer's Representative (Consulting Engineer) will assess the service drawings and results of the detailed site investigation in order to determine the exact depth and location of the existing electricity cables within the works area. Should it be anticipated that the		

Ref No.	Reference Heading	Location	Mitigation Measure	Audit Result	Action Required
			excavation for the proposed works will impact on the electricity network, this will be taken into consideration at detailed design stage and any diversions necessary to avoid accidental clashes during construction phase will be designed, planned and agreed with the ESB in advance of the construction phase. Prior to excavation the Contractor will carry out additional site investigation, including slit trenches, in order to determine the exact location of the electricity network in close proximity to the works area. This will ensure that the underground electricity network will not be damaged during the construction phase.		
MM9	Existing Broadband and telecommunications networks	EIAR Chapter 11	Prior to tendering Contract, the Employer's Representative (Consulting Engineer) will assess the broadband and telecommunications networks drawings and the detailed site investigation reports in order to determine the exact depth and location of the broadband and telecommunications networks within the works area. The locations of the drainage network pipework relative to the proposed works will be confirmed as part of the Design Phase. Should it be anticipated that the excavation for the proposed works will impact on this pipework, this will be taken into consideration at detailed design stage and any diversions necessary to avoid accidental clashes during construction phase will be designed, planned and agreed with the service provider in advance of the construction phase.		
MM10	Health and Safety	EIAR Chapter 4	During construction of the proposed development, all staff will be made aware of and adhere to the Health & Safety Authority's 'Guidelines on the Procurement, Design and Management Requirements of the Safety, Health and Welfare at Work (Construction) Regulations 2013'. This will encompass the use of all necessary Personal Protective Equipment and adherence to the site Health and Safety Plan.		
MM11	Health and Safety	EIAR Chapter 11	The Contractor must adhere to the ESB Code of Practice for Avoiding Danger from Overhead Electricity Lines, 2008 and the HSA Code of Practice for Avoiding Danger from Underground Services, 2010.		
MM12	Health and Safety	EIAR Chapter 4	Harris fencing will be erected around any excavations to prevent uncontrolled access to this area. Appropriate health and safety signage will also be erected on this fencing and at locations around the site.		

Ref No.	Reference Heading	Location	Mitigation Measure	Audit Result	Action Required
MM13	Potential Release of Hydrocarbons	EIAR Chapter 6, EIAR Chapter 7	• Fuels, chemicals, liquids and solid wastes will be stored on impermeable surfaces • Plant refuelling shall be undertaken on impermeable surfaces within a suitably constructed bund in accordance with best practice guidelines. No refuelling will be permitted in or near soil or rock cuttings. • All hydrocarbons and other potential contaminants will be stored within suitably constructed bunds in accordance with best practice guidelines. • Spill kits will be provided at refuelling areas and at high risk/sensitive sites. • There will be no refuelling of machinery within the river channel. Refuelling will take place at designated locations at distances of greater than 30 metres from the watercourse. • No vehicles will be left unattended when refuelling and a spill kit including an oil containment boom and absorbent pads will be on site at all times. • Any fuel that is stored on the site will be in a double skinned, bunded container that will be located within a designated works compound at a location that is removed from the river. All other construction materials and plant will be stored in this compound. The compound will also house the site offices and portaloo toilets. This compound will either be located on ground that is not prone to flooding or will be surrounded by a protective earth bund to prevent inundation.		
MM14	Concrete Products	EIAR Chapter 7	• All concrete works will be carried out in dry conditions with no in-stream pouring of concrete. • Ready mixed wet concrete will be used and where possible pre-cast sections will be used. There will be no batching of wet-concrete products on site.		

Ref No.	Reference Heading	Location	Mitigation Measure	Audit Result	Action Required
			• Chute cleaning will take place in designated, lined concrete washout areas.		
MM15	Vegetation	EIAR Chapter 9	Trees and vegetation are to be retained where possible and replanting will occur where possible.		
MM16	Waste Management	EIAR Chapter 11	All current and applicable waste management legislation will be applied and adhered to. Contractors that are engaged in the transport of waste off-site will comply with the provisions of the Waste Management Act (1996) (as amended), associated Regulations and the Waste Management Plan prepared in accordance with 'Best Practice Guidelines for the Preparation of Waste Management Plans for Construction and Demolition Projects (2006)'. As such, the Contractor must handle, transport and dispose of waste in a manner that ensures that no adverse environmental impacts occur as a result of any of these activities. A collection permit to transport waste must be held by the relevant contractor which has been issued by the Local Authority where the waste has been generated i.e Cork City Council and Cork County Council.		
MM17	Waste Management	EIAR Chapter 11	Waste receiving facilities must also be appropriately licensed or permitted for the waste being received		
MM18	Waste Management	EIAR Chapter 11	The construction compound for the proposed scheme should have a dedicated Waste Storage Area (WSA) for any construction waste generated. Receptacles/skips or bays will be provided for each recyclable material. Dedicated waste bins should also be provided on any water going vessel/platform to prevent litter from contaminating the River.		
MM19	Segregation of waste	EIAR Chapter 11	All waste generated on site will be segregated and placed in appropriate waste streams designated for recycling, reuse or disposal.		
MM20	Hazardous material	EIAR Chapter 11	If hazardous materials are used/encountered on site, i.e. timber with paint, asbestos concrete pipes, a specialist contractor will be employed to carry out an environmental clean-up to remove all traces of contaminated material from the		

Ref No.	Reference Heading	Location	Mitigation Measure	Audit Result	Action Required
			site. The specialist contractor will be licensed under the 'Waste Management (Collection Permit) Regulations, 2007' (as amended). This will be disposed of at an appropriately licensed facility. In order to avoid any hazardous materials infiltrating the ground water during construction and operation phase there will be a bunded area constructed within the site compound with sufficient volume to contain any spills. All plant refuelling, maintenance or washing will be carried out within the bunded area. Spill kits will also be available at this area to facilitate the quick and effective cleaning of any substances.		
MM21	Waste Documentation	EIAR Chapter 11	Waste will be weighed, either by weighing mechanism on the truck or at the receiving facility, and these records will be kept by the contractor (both hard and soft copies). A copy of all waste collection permits, for all waste contractors will be kept by the Waste Manager, working on behalf of the Contractor, on site. If the waste is being transported to another site, a copy of the waste permit or EPA Waste License for that site must be provided and kept by the Waste Manager. If the waste is being shipped abroad, a copy of the Transfrontier Shipping (TFS) document must be obtained from Dublin City Council (as the relevant authority on behalf of all local authorities in Ireland) and kept on site along with details of the final destination (permits, licenses etc). A receipt from the final destination of the material will be kept as part of the on-site waste management records. All information will be entered into the waste management system to be maintained on site.		
Flora and Fauna					
MM22	Biodiversity	EIAR Chapter 5	• A Project Ecologist will be appointed for the duration of the works. The appointed ecologist may carry out the role of ECoW (or may work alongside the ECoW) to ensure that all avoidance and mitigation and monitoring during construction are carried out according to the details specified in the final CEMP in the correct manner and to expected		

Ref No.	Reference Heading	Location	Mitigation Measure	Audit Result	Action Required
			standards to ensure their effectiveness. The ECoW and Project Ecologist will report to the Environmental Manager. • The footprint of works will be identified at the onset and will be demarcated to avoid unnecessary disturbance to habitats outside the works area. Method Statements detailing the construction footprint and access routes to the proposed works will be approved prior to construction. • Upon completion of the works channel vegetation will be allowed to recolonise naturally. • Introduce spawning gravels at morphologically/hydraulically appropriate locations i.e. where removal of culvert is proposed. This will involve ongoing maintenance outside of the spawning season when material accumulated in the sediment trap will be re-distributed in this channel to create clean gravel spawning substrate free of silt. • 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 wildflower seed mix. • Hedgerow/tree line planting will be undertaken to replace the length of hedgerow/treeline lost to accommodate the new flood embankment. Hedgerows will be replanted as close to the existing alignment and location as possible and will use native, locally sourced species. • Works will only be undertaken during normal working hours (8:00 – 18:00) thus allowing the river to run clean for 14 hours per day. Night works will be required in limited circumstances for specialist activities (such as lifting of pre-cast bridge beams etc.). Where additional or alternative working hours are required, these will be agreed in advance via written agreement with Cork City Council.		

Ref No.	Reference Heading	Location	Mitigation Measure	Audit Result	Action Required
			• All works undertaken on the banks will be fully consolidated to prevent scour and run off of silt. Consolidation may include use of protective and biodegradable matting (coirmesh) on the banks and also the sowing of grass seed on bare soil.		
MM23	Biodiversity	EIAR Chapter 5	• All material including oils, solvents and paints will be stored within temporary bunded areas or dedicated bunded containers; • Where possible refuelling will take place in a designated bunded area away from surface water gullies, drains and water bodies, in the event of refuelling outside of this area, fuel will be transported in a mobile double skinned tank; • All machinery and plant used will be regularly maintained and serviced and will comply with appropriate standards to ensure that leakage of diesel, oil and lubricants is prevented. • Spill kits and hydrocarbon absorbent packs will be available and drip trays will be used during refuelling; • All relevant personnel will be fully trained in the use of this equipment; • Where soil/made ground and subsoil stripping occur, the resulting excavated soil fractions will be segregated into inert, non-hazardous and /or hazardous fractions (in accordance with Council Decision 2003/33/EC, the EPA water classification criteria at certain licensed landfills in Ireland); • The excavation and handling of inert material will be carefully managed in such a way as to prevent any potential negative impact on the receiving water environment; • Where possible the excavated spoil would not be stored beyond the working day, however in the event that this is not practical appropriate		

Ref No.	Reference Heading	Location	Mitigation Measure	Audit Result	Action Required
			precautions in relation to the material will be taken. These precautions will include appropriate storage and covering;		
MM24	Biodiversity	EIAR Chapter 5	• All associated hazardous construction waste will be stored within temporary bunded storage areas prior to removal by an appropriate EPA or Local Authority approved waste management contractor; • The guidelines provided by the Department of the Marine and Natural Resources, with respect to concrete wash waters, CIRIA, the UK Environment Agency and Environment and Heritage Service, the UK Department of the Environment and Inland Fisheries Ireland will be adhered to. environment during the construction phase of the proposed development. • During any working with cofferdams the following will be adhered to: o The cofferdam will be inspected daily for any movement, leakage and general deterioration; any defects found will be remedied immediately. o The working area will not be de-watered directly into the river; the removed water must receive treatment before discharge. o Before removal of the cofferdam at completion of the works all materials, debris, tools, plant and equipment will be removed from the work area and any potential sources of pollution/contamination within the cofferdam will be cleaned up. o The de-watered area will be re-watered before the cofferdam is removed to avoid the sudden ingress of water which may cause erosion of the replaced substrate. o When re-watering is undertaken, the pump inlets will be screened appropriately to prevent the intake of fish or other aquatic		

Ref No.	Reference Heading	Location	Mitigation Measure	Audit Result	Action Required
			animals. • During all works the weather forecast will be monitored and a contingency plan developed to prevent damage or pollution during extreme weather and high flow events • The sediment trap, as a pre-defined intervention of the scheme design, will limit the intrusiveness of maintenance operations by focusing works on a strategic removal of course sediment at one location and immediately downstream. Maintenance will be carried out once annually, or as necessitated by major storm event. Refer to Appendix 3c for more details. • Channel maintenance work is carried out as much as possible from the riverbank without in stream tracking. 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. • 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. • Removal sediment material build up will be carried out during low flow periods to minimise the risk of siltation and material transport downstream. • Typically, this will be carried out on average every 4-6 years but should be assessed on an annual basis by means of a site walkover survey. • The sediment trap will not be fully emptied each time, and some material in the low flow channel will be retained, to retain continuity of natural bed materials.		
MM25	Invasive species	EIAR Chapter	An Invasive Species Management Plan has been put in place by the OPW for the Rivers Bride and Glenamought in Blackpool which outlines the strategy that will be		

Ref No.	Reference Heading	Location	Mitigation Measure	Audit Result	Action Required
		5, NIS	adopted during the construction and operation of the Scheme and taking into consideration the ongoing treatment of the site in order to prevent the spread of invasive species. The schedule of treatment for invasive species within the proposed Scheme will be implemented for up to three years post construction. The following measures will be implemented to avoid the spread of invasive species: • A pre-construction/pre-operational maintenance survey for invasive species will be conducted at the earliest stage possible to update and inform on the status of invasive plant species in or near the scheme/maintenance works area. These surveys should be undertaken during the appropriate botanical season (April to September). • Wash down all machinery and equipment using power washers to ensure the removal of all organic plant and soil mater before leaving the site. This material will be washed into a dedicated and contained area away from watercourses and will require appropriate treatment with other contaminated materials on site. • Ensure all organic material removed from personal equipment and clothing including footwear • Use of machinery with tracks should, where possible, be avoided within infested areas. • 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. • Areas infested with invasive species shall be fenced off prior to and during construction works where possible in order to avoid spreading plant fragments to areas free from infestation. For Japanese knotweed a buffer distance of 7m minimum is required. • Areas identified to be fenced off shall clearly be identified and marked		

Ref No.	Reference Heading	Location	Mitigation Measure	Audit Result	Action Required
			out with signs to inform contractors of the risk. • Treatment and control of invasive alien species will follow Guidelines for the Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads (NRA 2010) and Environmental Guidance: Drainage Maintenance & Construction (OPW 2019), and any other best practice guidance which may become available in the interim. • Treatment will be carried out by a suitably qualified person and will involve the use of herbicides approved for working in proximity to an aquatic environment. All staff involved in the application of herbicides must have received appropriate training. • All construction staff will receive training in the identification and management of invasive species, including identification of knotweed rhizomes, through "toolbox talks" and be made aware of the invasive species management plan before works begin on site. • Areas where contaminated soil is to be stockpiled on site shall be clearly identified and cannot be within 50m of any watercourse or within a flood zone. • For any material entering the site, including all fill material, the supplier must provide an assurance that it is free of non-native invasive species. • Advanced treatment of the site has been undertaken using chemical treatment methods and given the physical site boundaries and flooding risk in the area the ISMP identified further chemical treatment as the most suitable method for future treatment at the site. The Invasive Species Management Plan is available in Appendix 5F.		
MM26	Otter	EIAR Chapter 5	• Night-time working be restricted to emergency works only.		

Ref No.	Reference Heading	Location	Mitigation Measure	Audit Result	Action Required
			• To minimise the potential for Otters 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 either be covered securely or fitted with an escape ramp (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. • In order to compensate for loss of habitat it is proposed to provide artificial holts along the length of the scheme which will enhance suitable habitat available. o The artificial holt construction will follow the wooden box type design as utilized by IRD Duhallow given the successful evidence of usage (IRD Duhallow, 2015). The holt design used was that described by the Sussex Otters & Rivers Project. o Suitable locations for perspective holts have been identified on the north bank of the River Bride. Much of the south bank is readily accessible by dogs and people making it less suitable. The identified areas offer seclusion, have adjoining scrub, treelines and grassy embankment areas, are not readily accessible by the public and are above typical flood levels. Due to the sensitive nature of otter holts and their need for minimal disturbance the locations have not been identified within this report. In total 3 areas have been identified for the provision of artificial holts. o The design of the holt areas will be overseen by an ecologist with significant experience of an Ecological Clerk of Works role and otter ecology. The tailoring of the holt construction will be conducive to maximizing the naturalness and attractiveness of the constructed holts to otter.		

Ref No.	Reference Heading	Location	Mitigation Measure	Audit Result	Action Required
			○ Monitoring of the success of the holt construction in terms of otter utilization of the newly constructed habitat is essential to evaluate success of the compensatory habitat. This could be achieved by using remote trail cameras overtime. The detailed design of the otter holt constructions inclusive of their final positioning should be agreed in conjunction with the NPWS. • Otter Ledges will be provided within all culvert designs. The otter ledge will traverse the entire length of the new proposed culverted areas and will follow the specifications of the National Roads Authority Guidance in relation to otters (NRA, 2008). The culverted area will also extend into the historically culverted zones of the River Bride as far as Leitrim Street. The ledge will tie into the adjoining riverbanks and will be screened with trees to provide seclusion for otter entering and exiting the culvert network. (See Appendix 5E). • The detailed design of the tie in areas will be undertaken in conjunction with an ecologist with knowledge of otter usage of the area. Furthermore, the detailed design of the final ledge layouts should be agreed in conjunction with the NPWS. • Light wells will be provided within the culvert at intervals to provide natural light within the culvert and to provide as natural a condition as possible		
MM27	Bats	EIAR Chapter 5	• Tree group 'T32' (see Appendix 5G) is likely to play a role in the success and viability of the roost and these trees will be removed as part of the scheme. However, the footprint of the proposed embankment (C08_E03) will be modified locally to allow for the retention of trees such that landscape connectivity offered by the Tree group T32 is not significantly impacted. This will ensure that bats continue to benefit from protective		

Ref No.	Reference Heading	Location	Mitigation Measure	Audit Result	Action Required
			cover that lessens the threat of predation. • In advance of commencement of construction in the above area the works area will be demarcated in consultation with an Ecologist and vegetation to be retained will be appropriately fenced off. This fencing and exclusion area will be maintained for the duration of the construction period. Measures in relation to the protection of trees are outlined below. Outside of emergency works, there will be no night working during the construction phase. • Removal of existing trees and other vegetation to facilitate the proposed works will be minimized in all areas and particularly in the following areas: ▪ The river corridor between the Blackpool Bypass and Blackpool Church (Item C06_B04) ▪ Upstream of Kilnap Bridge (Item C08_T01) ▪ Rose Cottage (Item C06_R01; Tree group T35) ▪ Commons Inn (Item C06_C01; Tree group T36). • Any loss of trees or tree cover will be mitigated in so far as possible through replacement planting within the Scheme boundary, as close as possible to the area where trees may have to be removed to accommodate the proposed works • Any new lighting required as part of the project will be of as low a wattage as possible and will be directed away from the surface of the water. • Prior to the commencement of site clearance, tree surveys will be carried out on trees identified as potential for bat roosts. If roosts are found or their potential cannon be ruled out, an appropriate mitigation strategy will		

Ref No.	Reference Heading	Location	Mitigation Measure	Audit Result	Action Required
			need to be devised and a derogation licence will need applied from NPWS. • Removal of trees with bat roost potential will be carried out in September/ October and under the supervision of a bat ecologist. • A Bat box scheme will be put in place to mitigate for loss of trees and suitable foraging habitat for bats. Approximately 10 bat boxes will be provided for on stone walls faces or mature trees (as deemed appropriate). Bat boxes will be woodcrete bat boxes such as those manufactured by Schwelger and will be put in place as per the recommendations identified in NPWS Irish Wildlife Manual (2006) Bat Mitigation Guidelines for Ireland. Recommendations are made in the bat survey report (Appendix 5G). • In advance of commencement of construction in the above areas the works areas will be demarcated in consultation with an Ecologist and vegetation to be retained will be appropriately fenced off. This fencing and exclusion area will be maintained for the duration of the construction period. Measures in relation to the protection of trees are outlined above. • During construction works, generators or other machinery which create noise, vibration and air emissions, will not be located within 20m of sensitive habitats or any features with potential for bat roosting. Excessive noise and vibration will be avoided in as much as possible.		
MM28	Fisheries	EIAR Chapter 5	• All works will be carried out in consultation with Inland Fisheries Ireland • In channel working will be minimised, where possible, method statements will identify access routes and works areas prior to commencement in consultation with the Project Ecologist. • In-channel working during the salmonid spawning season will not be		

Ref No.	Reference Heading	Location	Mitigation Measure	Audit Result	Action Required
			permitted (November to March inclusive). • During the construction phase, fish passage will be maintained in areas of in-channel working. • Any pumps used for over-pumping must be 'fish-friendly' and fitted with appropriate screens. • There will be high level attention to concrete formworks being carried out in isolated dry conditions when weather is stable and predictable. The ECoW and project ecologist will monitor the river downstream for any issues (such as turbidity from instream sediment and suspension) that indicates a failing of the mitigation and corrective will be taken or works suspended).		
MM29	Fisheries	EIAR Chapter 5	• The removal of the culvert near Sunbeam will include the regrading of the river to ensure removal of the existing weirs. • Works will involve managing of spawning gravels upstream of Sunbeam Industrial Estate where culvert is to be removed. This will involve a re-distribution of gravels removed during the maintenance of the sediment trap Leaving sufficient gravel of the appropriate qualities to retain spawning habitat within the open channel. Details for enhancement in Appendix 5E. • The winter channel will be constructed as such that there is no risk of fish being retained in the channel as flood water subsides. This will be ensured out by appropriate grading of the channel. • Ensure that the proposed trash screens have an appropriate mesh size to allow for movement of salmonid species and that culverts and trash screen are designed and installed in line with published best practice (e.g.		

Ref No.	Reference Heading	Location	Mitigation Measure	Audit Result	Action Required
			Armstrong et al 2010; Turnpenny & O'Keefe 2005). • Compensation measures for permanent loss of riverine habitat will be carried out in agreement with Inland Fisheries Ireland. Enhancement measures have been identified for the Bride and the recommendation of O'Grady (2016) Draft Fisheries Enhancement Proposals will be carried out as part of the scheme. • The scheme will be accompanied by a programme of fish habitat and species monitoring, including the management of sediments and prior to removal of sediment during maintenance procedures. Relevant generic measures are set out in the OPW environmental guidelines (OPW Brew and Gilligan 2019). Lamprey and Eel will be monitored in relation to sediments of value for spawning. The river enhancement measures will include monitoring of spawning habitat improvements for salmonids, Brown Trout, to assess the condition of introduced gravel beds and determine the success of the measures and identify additional management ongoing. The various hydromorphological features required in the channel to maintain optimal conditions, including pools, runs and riffles will be monitored according to a 'Life Cycle Unit Score' assessment which will inform future management and enhancement requirements in accordance with the IFI and OPW approach to maintenance.		
Soils and Geology					
MM30	Bedrock	EIAR Chapter 6	Where it is necessary to remove bedrock to facilitate construction of the proposed scheme, suitable material will be reused elsewhere where possible. Material removed from site will be transported to the closest suitably licensed facility to be processed and used on other construction projects in the vicinity, where possible.		
MM31	Subsoils	EIAR Chapter 6	Excavated subsoils will be reused as fill, or for the construction of flood defence embankments where possible. Any remaining volumes of unsuitable materials will		

Ref No.	Reference Heading	Location	Mitigation Measure	Audit Result	Action Required
			be transported to the closest suitably licensed facility to be processed and reused in other construction projects in the vicinity, where possible		
MM32	Soil Stripping	EIAR Chapter 6	• Vegetation and soil will be left in place for as long as possible prior to excavation and stockpiling of soil to be minimised during wet weather periods. • Soil stockpiles will be shaped so as to shed water. • Surface water run-off from exposed soil surface will be intercepted and channelled to sumps and to silt traps thereafter. • Granular materials will be placed over bare soil, particularly in the vicinity of watercourses, to prevent erosion of fines and/or rutting by construction machinery.		
Water					
MM33	Water Quality	EIAR Chapter 7	• Measures to minimise the suspension and transfer of sediment downstream will be implemented. These measures are likely to include the use of silt barriers downstream of the works areas and removal of any accumulated silt, construction of silt sumps downstream of the works areas, cofferdamming and dewatering of works areas where concrete and other building works are proposed. Any stockpiling will also be greater than 10 metres from the river bank.		
MM34	Water Quality	EIAR Chapter 7	• All works undertaken on the banks will be fully consolidated to prevent scour and run off of silt. Consolidation may include use of protective and biodegradable matting (coirmesh) on the banks and also the sowing of grass seed on bare soil. • Works will only be undertaken during normal working hours (8:00 – 6:00)		

Ref No.	Reference Heading	Location	Mitigation Measure	Audit Result	Action Required
			thus allowing the river to run clean for 14 hours per day Night works will be required in limited circumstances for specialist activities (such as lifting of pre-cast bridge beams etc.). Where additional or alternative working hours are required, these will be agreed in advance via written agreement with Cork City Council.		
MM35	Safe storage of contaminants	EIAR Chapter 7	A bunded area will be constructed within the site compound, which is shown in Appendix 3D in order to avoid any polluting substances infiltrating the ground water during the construction and operation phase of the Scheme. All plant refuelling, maintenance and washing will be carried out within the bunded area. Spill kits will be available at the bunded area in order to ensure the quick and effective cleaning of any substances.		
MM36	Turbidity monitoring	EIAR Chapter 7	• Runoff from works, stockpile and compound areas will be monitored and observed daily to ensure that it is not impacting on any local watercourses. Silt release results in discolouration to water and so is easy to visually monitor for its presence. • Alarmed Sondes will be employed to measure turbidity in the River Bride upstream and downstream of the works area during construction of the drainage scheme. If an increase in turbidity of 20% or greater is identified downstream of the works, all works will cease immediately until the source of the increased turbidity is identified and rectified (if caused by the construction works). If necessary, water sampling and monitoring of the local water courses will also be completed to test for Total Suspended Solids (TSS) and tested against the baseline water quality identified above in section 7.2.3.1.		
Air Quality & Climate, Noise & Vibration					
MM37	Dust	EIAR Chapter 8	• Site roads shall be regularly cleaned and maintained as appropriate.		

Ref No.	Reference Heading	Location	Mitigation Measure	Audit Result	Action Required
			• Hard surface roads shall be swept to remove mud and aggregate materials from their surface. • Any road that has the potential to give rise to fugitive dust must be regularly watered, as appropriate, during dry and/or windy conditions. • Speeds shall be restricted on hard surfaced roads as site management dictates. Vehicles delivering material with dust potential shall be enclosed or covered with tarpaulin at all times to restrict the escape of dust. • Public roads in the vicinity of the site shall be regularly inspected for cleanliness, and cleaned as necessary. • In the event of dust nuisance occurring outside the site boundary, movement of materials will be immediately terminated and satisfactory procedures implemented to rectify the problem before the resumption of the operations. • The dust minimisation plan shall be reviewed at regular intervals during the construction phase to ensure the effectiveness of the procedures in place and to maintain the goal of minimisation of dust through the use of best practice and procedures. • All construction vehicles and plant will be maintained in good operational order while onsite, thereby minimising any emissions that arise. • Where a works activity is found to be a continuous or unmanageable source of dust during prolonged periods of dry weather, suspension of a particular activity during such weather conditions may be necessary.		
MM38	Dust Monitoring	EIAR Chapter 8	• Bergerhoff dust gauges will be placed at various locations around the site to monitor the level of dust being generated during the construction phase. The monitoitng locations will be identified once the phasing of the works		

Ref No.	Reference Heading	Location	Mitigation Measure	Audit Result	Action Required
			has been established and will be subject to baseline analysis prior to works commencing in each particular area. These dust gauges will quantify the deposition of dust during the construction phase of the project enabling the comparison between the measured data and the max compliance level of 350mg/m2/day. Where it can be demonstrated that the level of dust generation is minimal and that the receptors at or adjacent to the locations are not being impacted by dust levels, a reduction or cessation of this monitoring may be proposed		
MM39	Noise & Vibration	EIAR Chapter 4	• Sensitive location of equipment, taking account of local topography, existing structures (i.e. walls, buildings, etc.) and natural screening. • Working methods: construction noise will be controlled by prescribing that standard construction work will be restricted to the specified working hours. Any construction work carried out outside of these hours shall be restricted to activities that will not generate noise of a level that may cause a nuisance. The phasing of works has also been designed with regard to avoidance of noise impacts. • Plant will be selected taking account of the characteristics of noise emissions from each item. All plant and machinery used on the site shall comply with E.U. and Irish legislation in relation to noise emissions. The timing of on- and off-site movements of plant near occupied properties will be controlled.		
MM40	Noise & Vibration	EIAR Chapter 4	• Operation of plant: all construction operations shall comply with guidelines set out in British Standard documents 'BS 5338: Code of Practice for Noise Control on Construction and Demolition Sites' and 'BS5228: Part 1: 1997: Noise & Vibration Control on Construction and Open Sites'. The correct fitting and proper maintenance of silencers and/or enclosures, the avoidance of excessive and unnecessary revving of vehicle engines, and		

Ref No.	Reference Heading	Location	Mitigation Measure	Audit Result	Action Required
			the parking of equipment in locations that avoid possible effects on noise-sensitive locations will be employed. • Training and supervision of operatives in proper techniques to reduce site noise, and self-monitoring of noise levels, if appropriate.		
MM41	Hoarding	EIAR Chapter 8	With respect to 70 dB exceedances identified in section 8.4.2.3 in chapter 8 of this EIAR, consaw operations may be readily controlled by erecting a hoarding around the cutting area. In addition, the flood defence wall construction operation downstream of the Commons Inn, at the Killeens off-ramp dwelling, and at the Glennamought Bridge dwelling, may be similarly treated by erecting a hoarding along the boundary of the works zone. In each case, the hoarding should extend to a height of 2.4 m, and should consist of plywood boarding on both sides of timber framework, with waterproofed cavity to be filled with mineral wool or similar. Gaps at partition interfaces should be boarded. If such measures are installed, consaw and wall construction operations are expected to meet the 70 dB LAeq 1 h criterion.		
MM42	Noise & Vibration Standards	EIAR Chapter 8	It is recommended that appointed contractor(s) be required to adopt practices set out in British Standard BS 5228:2009 Code of practice for noise and vibration control on construction and open sites Part 1: Noise and Part 2: Vibration (2009). Measures recommended in the standard include: • Appointing a project representative responsible for noise and vibration issues, and for liaising with local representatives. A clear communication channel should be established between all parties prior to project commencement. • Requiring that contractors ensure that site personnel are familiar with potential noise and vibration issues, and that personnel apply a common-sense approach to eliminating unnecessary noise emissions. • Use of quieter plant and methods where possible. • Installation of temporary barriers or enclosures around local sources such		

Ref No.	Reference Heading	Location	Mitigation Measure	Audit Result	Action Required
			as compressors and generators. • Limiting times of activities which may generate elevated noise or vibration emissions.		
MM43	Noise Monitoring	EIAR Chapter 8	Noise monitoring will be undertaken during the groundworks stage of the construction works involving any excavation, rock breaking, demolition or piling, in parts of the works area where these activities are ongoing. Monitoring will be carried out in accordance with British Standard BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 1: Noise (2014) and the National Roads Authority document Good practice guidance for the treatment of noise during the planning of national road schemes (2014) guidance. At each monitoring location, measured data will be used to assess compliance with limits recommended in Table 8.12 of this EIAR, During each survey, LAeq 1 h and LASmax limits will be measured by a competent person using calibrated equipment. Competency requirements are set out in EPA document NG4 Guidance note for noise: Licence applications, surveys and assessments in relation to scheduled activities (2016). Where a survey shows that construction operations exceed Table 8.12 of this EIAR's limits, or any other limits imposed, all construction operations will be immediately halted. Works will not resume until appropriate mitigation measures have been designed and implemented. Such measures may include use of hoarding/enclosures, replacement with quieter plant, altered works timing so as to coincide with higher background levels/limits, and other measures set out in BS 5228. Measures will be specific to local conditions.		
MM44	Vibration Monitoring	EIAR Chapter 8	Where piling other than pressed-in piles are used, monitoring of groundborne vibration levels will be carried out at the nearest buildings in accordance with British Standard BS 5228-2:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration (2014). Data measured during such monitoring shall be used to assess compliance with PPV limits set out in Table 8.15 of this EIAR, or any other limits imposed. Monitoring will be undertaken by competent personnel using calibrated equipment.		

Ref No.	Reference Heading	Location	Mitigation Measure	Audit Result	Action Required
Landscape					
MM45	Vegetation	EIAR Chapter 9	Vegetation is to be retained where possible. Following the excavation, the surface is to be covered with a biodegradable membrane to protect the exposed soil while vegetation is re-established in the months following completion of works. Where PPV levels due to piling exceed Table 8.15 of this EIAR, criteria or other applicable limits, all works will be immediately stopped. Appropriate mitigation measures will be designed and implemented prior to proceeding. Such measures include alterations to the piling method, and installation of tell-tales on buildings of interest.		
Cultural Heritage					
MM46	Archaeological Monitoring	EIAR Chapter 10	Archaeological monitoring is required where direct impacts are to take place which includes the removal of HAN 14 (Kilnap House access bridge), Feature HAN 16 (Masonry Bridge, Fitz's Boreen), HAN 17 (River Walling), HAN 18 (Bridge Section), and HAN 19 (Masonry Culvert). The removal of these features should be undertaken in a systematic manner, under archaeological supervision, allowing the archaeologist to obtain additional information and undertake supplementary recording.		
MM47	Archaeological Monitoring	EIAR Chapter 10	Monitoring to be carried out at Han 4 (Kilnap Mill), HAN 31 (River walling) and HAN 32 (Masonry wall) under licence issued by NMS. A report on the supervision of works will be compiled and submitted to NMS and OPW Project Archaeologists.		
MM48	Archaeological Monitoring	EIAR Chapter 10	In the event that any previously unrecorded archaeological features are uncovered during monitoring of ground works then they will be recorded and securely cordoned off while the OPW Project Archaeologist, the Cork City Council Archaeologist and the NMS are consulted to determine appropriate further mitigation measures, which may entail preservation in situ (by avoidance) or preservation by record (archaeological excavation).		
Traffic					

Ref No.	Reference Heading	Location	Mitigation Measure	Audit Result	Action Required
MM49	Construction Traffic	EIAR Chapter 11	The localised traffic disruptions as a result of other proposed works throughout the scheme will be mitigated through the use of industry standard traffic management measures. These traffic management measures should be designed in accordance with the 'Guidance for the Control and Management of Traffic at Roadworks – Second Edition'.		
MM50	Construction Traffic and Traffic Management Measures	EIAR Chapter 11, EIAR Appendix 11B	• Works in particular zones/areas are to be scheduled to avoid overlap with adjacent areas where the impacts of these in parallel would be significant; • Works at Maddens junction to be undertaken in June/July/August and to avoid the Cork City Marathon; • Fitz's Boreen bridge replacement to be undertaken between September and November (inclusive); • Works at Blackpool Shopping Centre are not to be undertaken during November or December; • Night works to be undertaken for specific activities (such as lifting of pre-cast bridge beams, etc.); • Works in the area of the Dulux factory to be undertaken in the off-peak production period (timing to be coordinated with owners); and • Further liaisons will take place with Cork City Council, An Garda Síochána and impacted landowners for all works areas in order to minimise the impact on traffic flows at critical junctions and locations.		
MM51	Transport Infrastructure	EIAR Chapter 11	The construction of the reinforced concrete bridges will be carried out by a suitably qualified and experienced contractor who will be supervised to ensure that the works are carried out correctly. This will ensure that the bridges will be constructed safely and ensure the structural integrity of the structure.		

Ref No.	Reference Heading	Location	Mitigation Measure	Audit Result	Action Required
			Excavation and reinstatement of the Watercourse Road and Blackpool Bypass 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 designed and supervised by a suitably qualified and experience professional to ensure they are carried out correctly.		
MM52	Works in Vicinity of Roads Network	EIAR Chapter 11	The localised traffic disruptions as a result of other proposed works throughout the scheme will be mitigated through the use of industry standard traffic management measures. These traffic management measures should be designed in accordance with the 'Guidance for the Control and Management of Traffic at Roadworks – Second Edition'.		
Operational Phase					
MM53	Sediment removal	EIAR Chapter 7	Any removal of material within the channel will be 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. Typically, this material would be deposited on the riverbanks subject to space constraints or may be disposed offsite 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.		
MM54	Bats		Monitoring will be carried out to evaluate the effectiveness of proposed mitigation or where possible to modify or improve the measures in the light of further assessment and thereby contribute to understanding of the impact of future		

Ref No.	Reference Heading	Location	Mitigation Measure	Audit Result	Action Required
			development projects on bats in Ireland.		
MM55	Notifying Residents	EIAR Chapter 8	Given the size of plant associated with dredging and embankment construction, it is considered more suitable to notify residents in advance of operations.		
MM56	Debris Maintenance	EIAR Chapter 9	A trash screen is proposed within the River Bride in the open space in Blackpool Retail Park. The screen is to be maintained and debris removed on a frequent basis, once a month as a minimum, and more frequently if necessary.		
MM57	Debris Maintenance	EIAR Chapter 7	All OPW maintenance work is undertaken in accordance with Environmental Guidance: Drainage Maintenance & Construction (OPW, 2019) along with additional measures where the Environmental Procedures (EPs) show deficiencies, to ensure adverse impacts on the environment are considered and minimised. OPW drainage maintenance activities will also be subject to a separate Appropriate Assessment process to ensure no adverse impacts arise.		
MM58	Removal of material	EIAR Chapter 6, EIAR Chapter 7	Any removal of material within the channel will be 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. Typically, this material would be deposited on the riverbanks subject to space constraints or may be disposed offsite 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.		

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