Appendix 2G
Scoping Document & Cover Letter

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Consultee Name
Address

2nd November 2016 **Our Ref:** 121004

Re: Lower Lee (Cork City) Drainage Scheme – EIA Scoping

A Chara,

Ryan Hanley, in association with McCarthy Keville O'Sullivan, have been appointed by the Office of Public Works to carry out an Environmental Impact Assessment of the proposed Lower Lee (Cork City) Drainage Scheme. Following the initial Public Consultation and Information Gathering Event, more detailed surveys and modelling of the River Lee and Cork City areas have been completed and a Constraints Study identifying key environmental issues was prepared. This information was subsequently used to identify and analyse a number of drainage options as part of the proposed Scheme and a preferred option has been identified and preliminary public consultation on the scheme has been undertaken.

The design of the preferred drainage option is being constraints-led, with a view to minimising environmental impacts, and has been informed by the constraints study and public consultation to date. As part of the EIA process, the project team would appreciate any comments that you might have in relation to the proposed drainage scheme. In order to facilitate this, a scoping pack providing details of the proposed scheme is enclosed with this letter. If you require more details or have any queries, please contact us. Comments can be issued by return to:

By Post to: **John Staunton,**
McCarthy Keville O'Sullivan Ltd.
Block 1, GFSC, Moneenageisha Road, Galway
or by email to: jstaunton@mccarthykos.ie

A final public consultation event will take place this December, following preparation of the Environmental Impact Statement for the scheme, where the public will be given a further opportunity to make observations.

We would appreciate that you would forward this documentation to the most appropriate person within your organisation, if it has been issued to you in error.

Yours sincerely,

John Staunton

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John Staunton BSc PhD,
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Lower Lee (Cork City) Drainage Scheme

EIA Scoping Document

Table of Contents

1. Introduction and Background

1.1. Overview

The Office of Public Works (OPW) is progressing a proposed flood relief project for Cork City.

The Office of Public Works (OPW) in partnership with Cork City and Cork County Councils carried out a Catchment Flood Risk Assessment and Management (CFRAM) Study for the Lee Catchment. The Catchment Flood Risk Management Plan (CFRMP) was published in January 2014.

This project is a follow on project from the Lee Catchment Risk Assessment and Management Study (CFRAMS). The project will assess and develop a viable, cost-effective and sustainable Flood Relief Scheme to alleviate flooding on the Lower River Lee in Cork City, based on preferred options already identified in the Lee CFRAM Study.

Ryan Hanley in association with McCarthy Keville O'Sullivan has been appointed by the Office of Public Works as the Project Environmental Team to carry out an Environmental Impact Assessment of the proposed Lower Lee (Cork City) Drainage Scheme.

ARUP and JBA Consulting have been appointed by the Office of Public Works as the Project Engineering Team to provide engineering services and develop the detailed proposals for the proposed Lower Lee (Cork City) Drainage Scheme. The scheme will be designed to provide protection to properties in the study area from the 1 in 100 year fluvial / 1 in 200 year tidal flood events. It has been developed in close co-operation with all key stakeholders, in particular; Cork City Council, Cork County Council and the ESB.

1.2. Location & Study Area

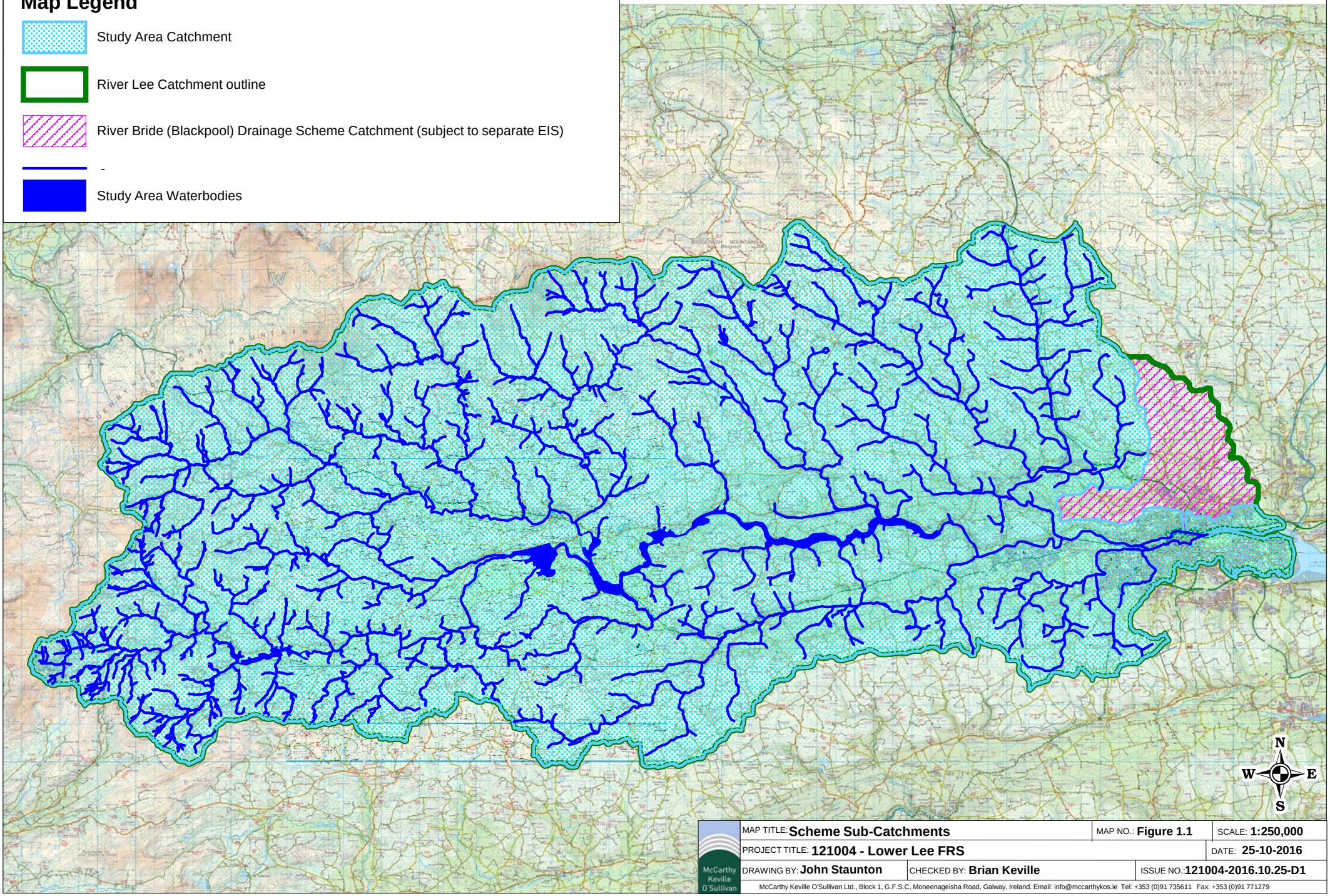
The study area for the Lower Lee (Cork City) Drainage Scheme encompasses the catchment of the River Lee upstream of Cork City. The River Lee catchment extends from where it rises near Gougane Barra in the east to Cork city in the west where it discharges into Cork Harbour. The Lee has large dams at Carrigadrohid and Inishcarra. The total catchment area upstream of Cork City is 1,259 km^2. The proposed works area for the current scheme will be covers from Inniscarra dam through predominantly greenfield areas west of the city through to the urbanised areas of Carrigrohane Road and Victoria Cross. From here it covers the North Channel as far as and including Horgan's Quay and the south channel as far as Victoria Road. It includes the tributaries of the Bride (West), Shournagh, Curraheen, Glasheen, and Kiln in so far as flood levels on these watercourses are affected by the backwater effect from the design event on the Lee.

The topography of the entire catchment varies between 649mOD on Mullaghanish and 5mOD in Cork City.

Figure 1.1 shows the entire catchment of the River Lee catchment that is draining through Cork City. Also shown in Figure 1.1 is the catchment of the River Bride (Blackpool) Drainage Scheme. Although this is a sub-catchment of the current scheme,

Map Legend

- Study Area Catchment
- River Lee Catchment outline
- River Bride (Blackpool) Drainage Scheme Catchment (subject to separate EIS)
- -
- Study Area Waterbodies



MAP TITLE: **Scheme Sub-Catchments**	MAP NO.: **Figure 1.1**	SCALE: **1:250,000**	
PROJECT TITLE: **121004 - Lower Lee FRS**		DATE: **25-10-2016**	
DRAWING BY: **John Staunton**	CHECKED BY: **Brian Keville**	ISSUE NO.: **121004-2016.10.25-D1**	

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this has been subject to a separate EIS which was produced in December 2015. The study area of the current scheme is sown for clarity.

1.3. Brief Flood History

There is a long history of flooding in Cork City and the River Lee valley. A number of severe floods have affected the city in the past. Since construction of the two dams at Inniscarra and Carrigadrohid in the 1950's, fluvial flooding in Cork has generally been less severe although there has been frequent flooding of land, roads and small numbers of properties. The event of November 2009 was an exception, with major damage caused to commercial and residential buildings in Cork City.

Tidal flooding in the east of Cork City centre is more frequent, with some flooding of the lowest lying parts occurring at least every other year with more significant tidal flooding occurring on average every ten years. Notable recent tidal floods occurred in 1994, 2004 and 2014.

2. Lower Lee (Cork City) Drainage Scheme

The project has been progressed to-date by the Project Engineering and Environmental teams as follows:

- Review of published literature and site surveys;
- A Public Information Day (17th July 2013) attended by OPW, Cork City Council, Cork County Council and the Engineering and Environmental Teams;
- Preparation of a Constraints Study by the Environmental Team to inform Options Report, in advance of second Public Information Day
- A second Public Information Day (29th July 2014) attended by OPW, Cork City Council, Cork County Council and the Engineering and Environmental Teams;
- Preparation of an Options Report to assess all of the possible flood relief options that could be implemented in the study area and to outline the procedure for how the preferred option was developed and selected.
- Preparation of detailed design drawings for the River Bride (Blackpool), including the preparation of an Environmental Impact Statement for these works, and the use of Public Exhibitions (24th November 2015; 3rd and 10th December 2015) held in Blackpool Community Centre.

A number of options were considered under their technical, social, environmental and economic viability. On the basis of the preliminary assessment, one option was chosen. The process for the selection of the preferred flood relief option is outlined below:

- An initial screening of a long list of possible flood risk management measures against a predetermined set of criteria, was carried out in order to determine their viability;
- A technical assessment of the viable flood risk management measures was undertaken;
- Potential flood relief options were developed using combinations of those flood risk management measures which were determined to be technically viable;

- These flood relief options were then subjected to economic, environmental, and multicriteria assessments, allowing preferred flood relief options to be selected.

Key Features of Proposed Scheme

The following are the key constituent parts of the proposed Scheme:

- A new Fluvial Flood Forecasting system based on both predictive and real time rainfall, and real time river flows and reservoir level data, to be utilised in combination with the existing harbour tidal flood forecasting system.
- A new flood warning system to more effectively disseminate warnings and information to landowners and river users during major flood events.
- Designation of floodplains (washlands) upstream of Cork City. This along with the Flood Forecasting system will facilitate the use of revised dam operation procedures resulting in a more aggressive lowering of reservoir levels in advance of a predicted flood event to maximise available reservoir storage and thus provide increased attenuation to reduce the peak flow during major flood events
- Direct defences (walls and embankments) from downstream of Inniscarra Dam through to Cork Harbour to defend against the design flood event
- Flow Control chamber at the upstream end of the South Channel to divert a greater proportion of flood flow along the higher capacity North Channel, thus minimising the extent of required direct defences on the Curraheen River and western end of the South Channel
- Demountable flood gates (tidal) at a limited number of key bridges and critical locations within the eastern part of Cork City.
- Re-grading of ground and road ramping at a number of locations
- Associated groundwater cut off walls and back-of-defence drainage infrastructure to intercept and manage groundwater seepage
- Associated drainage infrastructure (including non-return valves on drainage outlets) and pumping stations to manage surface water/groundwater at back of defences
- Associated services/utility diversions

Scale and Phasing of the Scheme

It is envisaged that the construction value of the scheme is likely to be circa €60m to €80m excluding VAT. It is proposed to undertake the scheme in a number of phases as follows:

- Phase 0 – Morrison's Island Advance Contract (Morrison's Quay, Fr. Mathew Quay, Trinity Footbridge) – This will provide greater protection against high frequency tidal events and will raise the threshold of flooding for South Mall, Oliver Plunkett Street etc, from circa 1 in 2 years to 1 in 10 years.

- Phase 1 – West of the City (everything west of Wellington Bridge) – will facilitate greater advance dam discharges at low tide and thus reduce fluvial flood risk
- Phase 2 – Wellington Bridge to Vincent's Bridge – eliminate fluvial flood risk for all but the most extreme flood events
- Phase 3 – Other city centre locations susceptible to high frequency tidal flooding
- Phase 4 – Complete remaining north channel defences (Full fluvial and tidal protection to the design standard to north channel)
- Phase 5 – Complete remaining south channel defences (Full protection to the design standard in study area)

The works are to be phased to ensure the following:

- Contract values of a scale that allows sufficient competition amongst suitable civil engineering contractors
- Manageable contract durations of circa 18 months to 24 months each
- Incremental reduction in flood risk (and increase in flood protection) as each phase is completed, with fast gains expedited.
- Mitigate impacts on residents, businesses, traffic etc. during construction
- Align with available State funding budgets

Flood Forecasting and Warning System

A flood forecasting and early warning system can play a significant role in flood defence, firstly as a means of avoiding loss of life, and secondly to provide a warning which allows authorities, property owners and river users to take measures to mitigate against the effects of a flood event.

In the case of the Lower Lee (Cork City) Drainage Scheme, the single most important facet of the flood forecasting system is to provide sufficient advance warning of the type and scale of rainfall/storm events which have the potential to cause significant flooding and thus to allow pre-emptive lowering of levels in Carrigadrohid and Inniscarra Reservoirs to maximise available storage ahead of and during major flood events.

A tidal flood forecasting system is already in place and provides forecasts of extreme sea levels within Cork Harbour taking account of astronomical tides, atmospheric pressure, and wind speed and direction. This forecast will be incorporated into the overall forecasting system for the Lower Lee.

A new Fluvial Flood Forecasting system has been developed based on both predictive and real time rainfall, and real time river flows and reservoir level data. The system will use rainfall predictions provided by Met Eireann and/or the European Centre for Medium-Range Weather Forecasts (ECMRF) in the lead up to a flood event as well as real time data from rain gauges in the upper catchment during the event.

The Flood Forecasting System will operate as follows:

- Operate continuously based on predicted rainfall data provided by Met Eireann/ECMRF, monitoring for potential extreme events. The data feed will be provided automatically and seamlessly directly into the forecasting system.
- The forecasting system will predict future peak flows at critical locations (including predicted inflows) based on the live status of the Lee system, including catchment wetness and predicted rainfall. Forecasts will extend for a period of greater than 4 days in advance,
- Provide an alarm to the operator, from over 4 days out, when a predicted significant rainfall event or a predicted tidal surge event is above a predefined threshold that may otherwise result in flooding;
- This would allow reservoir levels to be lowered at pre-defined spill rates which would not flood dwellings/buildings, in preparation for/anticipation of the extreme event; and
- Allow management of discharges in real time (if required) taking account of inflow from the Shournagh/Western Bride and tide levels.
- Provide sufficient warning time to close the flow control structure on the south channel and erect demountable defences in the east of the city if required.

The Flood Warning System would be utilised for a number of purposes:

- Warning of increased advance discharges for recreational users of river and floodplain amenities downstream of Inniscarra;
- Warning to landowners of downstream agricultural lands to allow livestock to be relocated;
- Warning to Cork City Council to erect demountable elements if necessary; and activation of the control structure on the South Channel
- Emergency Response Planning.
- Provide warning of a flood event which exceeds the 1 in 100 year standard of protection provided by the scheme.

The Flood Warning System dissemination would include the following:

- Direct notification to affected landowners (particularly agricultural lands);
- Sirens in public amenity floodplain areas;
- Local Authority websites and social media platforms;
- Local Authority 'text alert' system; and
- Radio and television public alerts if necessary.

Revised Dam Operation

For the vast majority of time, outside of flood events, the ESB will continue to operate the dams as at present, primarily as a hydroelectric enterprise.

Continuous monitoring and simulation of predicted rainfall using the new flood forecasting system will allow potentially significant flood events to be detected further in advance.

When a potentially significant event is detected by the forecasting system, the 'flood protocol' would be triggered.

This would advise the implementation of optimised procedures developed as part of the flood scheme that would suggest that reservoir levels be safely drawn down to create storage in advance of the event. This would be achieved by allowing for greater discharges in advance of a forecasted event. This greater discharge will not result in the flooding of properties other than those washlands designated by the scheme due to creation of downstream defences. In principle, the revised operation of the dams before and during a flood event will consists of the following stages:

- From 4 to 2 days out, safely draw both reservoirs down to pre-determined levels (which are being termed FRL (Flood Relief Level), whilst not exceeding the safe maximum draw down rate at Carrigadrohid and unless needed, limiting discharges to the current advance discharge limit of 150m3/s from Inniscarra
- In the period on the run up to a flood event, from 2 days out to the start of the event, make increasingly large releases from Carrigadrohid and Inniscarra at discharge rates based on pre-determined rules; The rates will depend on the scale and nature of the forecasted event but could be up to 350m3/s.
- Closer to and during the main event, use best endeavours to trim the peak off the Lee flows to maintain a flow less than design flow in Cork city (taking account of contributions from the Bride and Shournagh).
- Restrict dam releases to pre-determined rates during extreme tidal events, so long as dam safety is not a concern

The optimised procedures have been developed taking account of the following considerations.

- The normal range of operating levels in the dams are not amended (i.e. outside of 'flood protocol' times, ESB will continue to operate as normal)
- Minimum and maximum reservoir levels and/or seasonal variations in same, have not be amended so as to avoid impacting existing environmental receptors/constraints such as levels in the Gearagh, water supply requirements, fish life etc.
- Dam safety rules are not impacted, i.e. once levels in the reservoirs exceed ESB's safety thresholds, dam safety takes precedence and greater discharges will occur. In this scenario, emergency procedures will be put in place and warnings will be issued to advise of flooding as a result of a design exceedence event.
- The maximum draw down rate limit at Carrigadrohid remains for road embankment safety reasons.

Designation of floodplains (Washlands) upstream of Cork City

In creating washlands by pre-emptive advance spilling of water from the reservoirs at higher rates, 'artificial' or 'early' flooding of existing floodplains will occur. This will predominantly affect agricultural land to the west of the city. These lands will benefit from the scheme in terms of a reduction in the peak flows and thus magnitude of flooding from extreme events. However, as a result of the pre-emptive spilling of higher flows from the dams, these lands will be subject to a greater frequency of lower or medium flooding events. In addition, the proposed scheme will result in peak flows extending for a longer duration during a given flood event. The works will therefore impact on the use of these lands. The scheme documentation will demonstrate the likely change in frequency of lesser events, the extent to which pre-emptive spilling from the dam will extend, and will demonstrate the difference that the proposed changes would have had on the affected lands over the last 8 to 10 years.

Direct Defences

Direct defences on the scheme consist of the following:

- Circa 6,420m of new earthen embankments generally between 1m and 2m in height at a number of locations within the study area but predominantly in rural areas to the west of Cork City at Inniscarra, north of Ballinacollig, Inchaggagin, the Lee Fields and to a lesser extent in the green areas from Fitzgerald's Park to Presentation College on the North Channel. Embankments will generally have 1 in 3 sides slopes, a 4m crest and be topsoiled and grassed. The embankment crests will be reinforced to accept vehicular and pedestrian loading and some will be used as public amenity walks.
- Circa 3,075m of new reinforced concrete walls (suitably clad where relevant) with heights ranging up to circa 2m at various locations
- Circa 1,815m of new sheet pile wall (suitably clad where relevant) with heights ranging up to circa 2m at various locations
- Circa 3,000m of new parapet flood defence walls (suitably clad where relevant) built upon refurbished existing quay walls. All such defences on the lines of existing quay/river walls within the city centre are of heights at or less than guarding height of 1.2m so as to maintain the social connection with the river. This was a key constraint of the design.
- Circa 555m of glass flood defences in particularly sensitive amenity areas such as north of the Kingsley Hotel, the approach to Daly's Bridge, Fitzgerald's Park, Sundays Well Boating & Tennis Club, Lapp's Quay and shorter discrete sections along Union Quay, Georges Quay and Wandersford Quay.
- 115m of Demountable Flood Gates at 26 No. locations taking the form of both 'tilt-up' barriers and 'lift-hinge' gates.
- Circa 535m of modifications/strengthening of existing bridge parapets on Griffith Bridge, Christy Ring Bridge, Brian Boru Bridge, Clontarf Bridge, St. Finbarre's Bridge, Lancaster Bridge and The River Lee Hotel bridge.

- Modifications to several of the existing stepped river accesses along the city quays.

Defence walls will be finished in one of the following ways; Fair faced concrete, timber cladding, (salvaged or new) random rubble masonry cladding, salvaged cut cork limestone, new cut limestone. Locations of treatments are shown on the exhibition drawings.

Flow Control Structure

A flow control structure is proposed to be located on the south channel of the River Lee, downstream of the Salmon Weir. The proposed control will be closed when the River Lee is in flood to prevent (or reduce) flow entering the south channel and divert a greater proportion of the flow to the North Channel which has greater capacity. This measures avoids the need for large lengths of visually intrusive high walls along the south channel and Curaheen.

The proposed structure will consist of two different elements. Approximately two thirds of its width will take the form of traditional penstock type sluices gates. Even in the open position, these will not extend above the level of the existing pedestrian bridge and therefore is unlikely to have a significant visual impact. The final third will consist of a 'bottom up' flap gate.

The flap gate will be anchored to a sill in the bed of the channel and is hinged along the upstream edge of the gate. It will be stored submerged and flat to the bottom of the channel. To close the gate, the downward edge of the gate is rotated upward. The gate can be rotated using a number of methods including hydraulic cylinders, air injection or the inflation of rubber bladders.

It will have low visibility as the barrier is stored in the river bed and is only visible when closed in operation during a flood event. This section is included to retain passage for canoeists, kayakers and similar amenity users. The overall solution whilst restricting high flows, will not significantly impact low flows and therefore will have a negligible impact on the spilt of flow between the north and the south channel at low flows and thus environmental habitat on the south channel will not be affected.

The moveable mechanical elements of the control structure will be automated with manual backup and will be remotely controllable as well as being linked to the flood forecasting system and river gauges on the Lee and Curaheen rivers.

The control structure will be capable of graduated opening to allow the flexibility of full or partial closure.

Ramps and Re-grading

At a number of locations, it is proposed to re-grade roads, footpaths of other areas of ground either to raise ground level above flood defence level (and so provide a direct flood defence) or in other instances reduce the effective height of a flood

defence wall relative to the dry side ground level to retain the social amenity relationship with the river.

Such re-grading is generally limited to changes in elevation of less than 1m.

Drainage and Pumping Stations

At a number of locations in the city centre, existing quays have no parapet and drainage is either overland over open quays or else through discrete regular outfalls through the quay walls. In addition, a number of major piped or culverted drains outfall to the channel. The construction of raised parapets and flood defence walls will prevent the existing drainage systems from functioning at present either permanently or more so in the majority of cases, in the temporary situation during a flood event. Therefore to ensure that pluvial flooding is not worsened on the dry side of flood defences, new 'collector' drains and pumping stations will need to be constructed to safely discharge surface water during a flood event thus prevent back of wall surface water flooding. Pumping stations will incorporate permanent submersible pumps in underground wet wells with only control kiosks as above ground elements. The greatest impact of these pumping stations is therefore likely to be in terms of traffic restrictions during construction as they will be require deep excavations of up to 5m in depth. Wet wells will typically be circa 3m to 4m internal diameter on plan. Currently, it is envisaged that circa 36 No. pumping stations could be required, although there may be opportunity to rationalise the solution and reduce this number at detailed design stage. The sites of pumping stations have been deliberately chosen to minimise disruption during construction and to provide access locations for maintenance that will require minimum future traffic management.

Services/Utility Diversions.

Like all similar civil engineering projects undertaken in large historic urban areas, it will be necessary to locate, uphold or divert numerous existing services/utilities. The full extent of such work cannot be known until detailed design stage, but every effort will be made to minimise the impact to existing services and the need for any diversions or outages. Such works will be particularly significant along the city quays on the central island.

Appendix 1 – Project Design Drawings

Appendix 2 – Project Access and Extent Drawings

Appendix 3 – Project Finishes Drawings