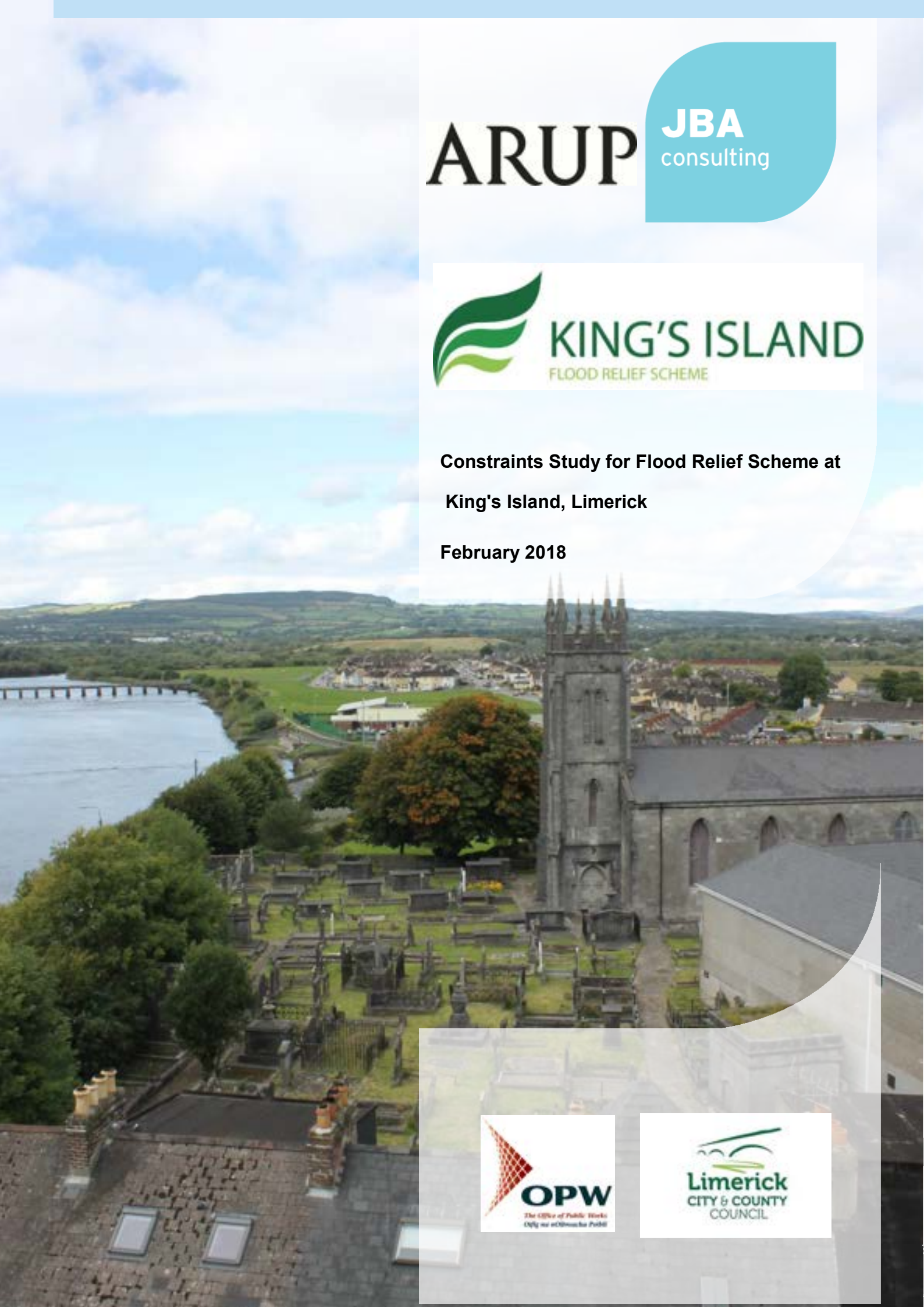

ARUP

JBA consulting

KING'S ISLAND
FLOOD RELIEF SCHEME

Constraints Study for Flood Relief Scheme at King's Island, Limerick

February 2018

OPW
The Office of Public Works

Limerick
CITY & COUNTY
COUNCIL

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Contract

This report describes work commissioned by Limerick City & County Council , on, November 2015. The Limerick City & County Council representative for this work is Mr. Robert Gallegher. Declan Egan, Tom Sampson, Anne Murray, Catalina Herrera, Marie Largerwall of JBA Consulting and Sinead Whyte, Niall Harte and Maeve McElligott, of Aurps who carried out this work.

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Purpose

This document has been prepared as a Final Report for Limerick City & County Council. JBA Consulting accepts no responsibility or liability for any use that is made of this document other than by the Client for the purposes for which it was originally commissioned and prepared.

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- Moore Group Consultancy for the cultural heritage and archaeology assessment.
- Anne Murray and Niamh Sweeny from JBA Consulting for the ecology and fisheries assessment.
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- Maeve McElligott, Arups for the geology and hydrogeology assessment

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Executive Summary

Key Constraints

A summary of the key constraints identified for each of the headings above is described in the following section of this Executive Summary.

Human Beings
King's Island social and economic problems affect the ability of residents to respond efficiently to extreme flooding events.
Land use zoning and planning proposed by LCCC could create limitations for the construction of flood relief infrastructure. Must ensure that goals for the FRS align with those of LCCC, the Limerick City Regeneration Plan and the wider community.
Ensure that areas of commercial or tourist potential maintain their aesthetic and public attractiveness both during construction and operation of the scheme.
King's Island has a high rate of local authority owned properties, a high percentage of derelict housing and poor quality housing, well below current and previous building standards. Ensuring that the FRS guarantees the protection of these defenceless areas. Both LCCC and King's Island FRS must work in conjunction to ensure the improvement of living conditions on the Island and reduce the risk of further damage of property and disturbance of local residents due to extreme flooding.
Any work carried out in close proximity to areas of historical, archaeological, and cultural importance must follow appropriate measures or guidelines to ensure the conservation and maintenance of the area.
The complex and unorganised road network in King's Island allows for isolation of the island and limits access to the northern region (St. Mary's Park) of the Island. The limited access and movement may cause a constraint during the construction phase of the scheme. It is important to ensure that the connectivity and road network situation is not compromised with the works.
The FRS must take into considerations ways to enhance public amenities including active and passive green spaces. The FRS must ensure that within its measures that all parks, recreational areas (soccer pitches), and passive and active spaces have been protected from potential floods. The FRS must ensure the continuity of the public walkway around the Island. Access to the rivers for recreational purposes must be maintained.
Potential disruptions on tourism and recreation should be recognised, precautions should be taken to minimise disturbances during the construction of the scheme.
Residents perceptions of King's Island FRS are centred on the timeline of the construction and the visual impact of flood relief infrastructure

Material Assets
LCCC and the National Roads Authority should be consulted with in relation to the potential impact of a flood relief scheme on the existing or future road networks
Fouls and Storm water sewers
King's Island has a combined sewer system. Those involved in the scheme should examine the effect of flooding and sewage capacity of the system in order to determine the potential amount of CSO discharge (raw sewage) that could enter the river system in case of extreme flooding.
Following identification of drainage routes, the FRS team must ensure that these sewer systems will not interfere with the construction of any flood defence mechanisms (flood walls etc). The constraint may be in the actions needed (identification, upgrading, replacement, or diversion) to facilitate construction, as well as assessing the preferred location for the defence infrastructure. If construction is being carried out nearby combine sewer or surface water sewer, special precaution should be taken.

Electricity
Any construction work that takes place in close proximity to underground electrical cables should be in line with the health and safety precautions. This could be seen as a constraint because extra attention and precautions will have to be given to simple routine operations making the planning and execution process longer, however, the health and safety of personnel working on the project is crucial.
During the construction stage, special measure would have to be taken in order to ensure the construction does not interfere in any of the undergroundservices. In addition, if constriction takes place in close proximity to ESB lines, some areas may have to be cut-off for the remainder of the work. This could cause a constraint to local residents and business.
These underground lines that are in close proximity of the rivers may be at risk of flooding in extreme weather conditions causing power outages in areas of King's Island. It is important to take into consideration the location of the underground cable routes in the planning and construction stages of the scheme.
It is important to take into consideration the location of the underground cable routes in the planning and construction stages of the scheme. If lines
Contacting ESB if there is a need for lines to be turned off for a period of time and to determine if the affected residences could be back fed from elsewhere.
In the case that there are any overhead lines in close proximity to the construction of flood defence walls, they will have to be temporarily turned off and altered (higher pole or insulated lines).
Gas Nerwork
Similarly to the underground electricity lines, the gas network pipes could create a constraint for the FRS due to the need to plan and work sensibly around it.
Special precautions must be taken in the planning, development, and construction phase to ensure that the wall structure will not be restricted due to the presence of the pipes and similarly that the construction of the flood defence walls will not hinder the gas network system in place.

Water
The surface water surrounding the study area (Shannon and Abbey River) is a Transitional Waterbody classified as Limerick Dock. The waterbody is currently at WFD status of moderate and is not likely going to achieve 'Good' status by 2015. The waterbody also failed the chemical status assessment due to the presence of priority and priority hazard substances. Given the current state of the waterbody it is important not to worsen its status. Therefore all possible risks of point source pollution or runoff should be assessed and prevented.
The construction phase of the development of flood relief infrastructure could pose a threat to the water quality in the River Shannon. - Release or run-off of excessive amounts of suspended solids from site preparation or development of construction. - Accidental escapement of bulk liquid cement or contaminated leachate from the site to the Shannon or Abbey River. - Unintentional discharge of oil from the site to the Shannon or Abbey River. A Construction Environmental Management Plan will be required for the construction work.
The flood relief scheme should ensure that sewer overflows do not enter the waterbody. Therefore avoid flood alleviation scheme that would impound water in the harbour because there is a possibility that effluent from treatment plants and sewages could be impounded. The effluent may increase the levels of nutrients in the harbour and may add to its trophic status.
The current water and drainage infrastructure problem in King's Island is a constraint for the flood relief scheme because it increases the risk of point source pollution in a flooding

event
The fissured bedrock poses constraints for the flood relief scheme due to the increased risk of slippage failure and seepage through the gravel layer underneath. This will be investigated during the site investigation works and mitigation measures put in place.
The design and operation of any flood alleviation scheme must not compromise the requirements of the Habitats Directive or the Birds Directive And in particular the SAC on the Island.

Ecology and Fisheries
The FRS works may result in significant effects on the Lower River SAC in the absence of mitigation. A Stage 2 Appropriate Assessment (AA) under Article 6(3)) of the Habitats Directive will be required to assess the impact of the works on the Natura 2000 sites and a Natura Impact Statement will be required to inform the AA.
The loss of habitat or fragmentation of the SAC, which covers a portion of the eastern side of King's Island, would be classed as a significant impact on the SAC.
The surrounding habitat of King's Island proves to be appropriate for otter breeding or resting places. Once the details of the works option is decided upon (nature, scale, and extent), if an area may be affected, it should be surveyed to determine the level of otter activity or if any breeding or resting places are present within and adjacent to the footprint of the works. Derogation licences will need to be applied for from the Department if otters may be impacted upon by the works or the scheme.
Since the River Shannon is an important river for salmonid, lamprey, and eel populations. In-channel works or permanent modification of channel banks or bed, could have an impact on aquatic vegetation. Timing constraints will apply to any in-channel work to avoid salmonid spawning season (usually between November and March). Appropriate measure should be used in the design of the selected work option to ensure fish passage is maintained, fish do not get stranded, and habitat value is not reduced. Appropriate measure should be required to prevent pollution incidents and silt mobilisation and agreed with the Inland Fisheries Ireland in advance.
King's Island and its surroundings is important for wintering and migrating winterfowl, in particular Whooper Swan. Mitigation will be require to minimise disturbance.
Nesting birds may be present in the riverine corridor and vegetated fringe of King's Island since it is suitable habitat, as well as, the river walls and bridges that provides cracks and crevices suitable for nests. If possible, vegetation clearance associated with the works should be conducted between breeding bird season (March to September). If this is not possible, other precautions should be taken.
The scattered mature trees along King's Island walkway, river walls, and bridges could provide potential roosting opportunities for bats, with the surrounding habitat providing good foraging and commuting routes. Options that require the removal of mature trees or works to riverine structures with the potential to support roosting bats shall be assessed for bat potential. Bat surveys shall be conducted on any features with medium or high potential for roosting bats.
Japanese Knotweed, Himalayan balsam, and Giant Hogweed are listed as invasive plants under the EC (Birds and Natural Habitats) Regulations 2011 (S.1. 477/2011). There regulations prohibit the introduction or dispersal of invasive species. Therefore, any work associated with the FRS in areas where invasive species are present must use appropriate measures.

Geology and Soils
The marine/estuarine soil deposits, which underlie the constraint study area are soft and compressible soils and will require detailed site investigation to engineer a suitable flood defence for the site. All site investigation works will require a CEMP. The presence of such material restricts the type of equipment, construction techniques and engineering design that is appropriate for such soft ground conditions. The FRS should be designed so as to minimise the impacts of the scheme on the hydromorphology of the rivers on both sides of the Island.
Depending on the proposed flood defence, the made ground which is uncompacted and highly variable may require to be excavated and replaced with suitable founding material. This material may also be a possible a source of contamination. As this material will be excavated during construction, it will require contamination testing which will be undertaken during the detailed site investigation.
The area around St. Mary's Park has a history of dumping and burning of waste. Recently as part of the Regeneration Programme for King's Island, this site has been cleaned up, however it is still considered a high risk area for contaminated soil.
Given local experience in this area and the lack of recorded karst features in the GSI data base, it is unlikely that karst features will be encountered on the site. However, it is prudent to consider that karst features such as caves, swallow holes, weathered rock and dolines can lead to ground surface and ground instability and are a constraint to be considered in the engineering design of the scheme.

Landscape and Visual
Protection of residential views out to the river, river bank and open spaces within King's Island, the SAC as well as Limerick City landmarks beyond, from housing within St Mary's Park, where protection from flood is proposed to take the form of an embankment to replace temporary flood protection in the form of sand bags currently to be found on site
Protection of recreational and residential views in to King's Island and associated landmarks from open spaces and housing on the west bank of the River Shannon.
Protection of residential views out to the river and river bank from housing along Verdant Place, where flood protection is likely to take the form of a flood wall to supplement the existing stone wall along this stretch
Protection of residential and civic views out to the river and river bank from housing and public spaces located around King John's Castle, City Hall and surrounding areas south of Thomond Bridge to Abbey Bridge to the south-east, where flood protection is likely to be provided through infilling gaps in existing stone walls.
Protection of recreational views in to the wetland north-east of King's Island, part of the Lower River Shannon SAC
Protection of recreational and residential views in to King's Island and associated landmarks from open spaces and housing on the west bank of the River Shannon
Protection of civic views in to King's Island and associated landmarks from locations such as Clancy's Strand on the west bank of the River Shannon across from King John's Castle, or Sarsfield Bridge and Honan's Quay south-west of the island

Archaeology and Cultural Heritage
Kings Island has a rich and varied archaeological, architectural and historical past with multi period monuments ranging from humble sites of local interest to large complexes (King John' Castle and St. Mary's Cathedral) of international significance.
All of the features both above and below ground have varying degrees of statutory protection and the guiding principle should be their continued preservation in situ and to minimise any impacts on their character or setting.
Statutory protections and sensitivities vary depending on the cultural heritage site

classifications. National monuments, potential national monument, sites subject to preservation orders, records of monuments and places, record of protected structures, national inventory of architectural heritage, demesne landscape and historic gardens are all subject to different conservations measures that must be acknowledge and followed.

Traffic
The N7 Route through King's Island has existing traffic congestion. During construction of any flood scheme the traffic could pose problems for deliveries and access. A traffic management plan will be required during construction works.
There is a potential for construction to make traffic issue worse, which could impact upon a wider area in Limerick City.
Any Construction works as part of the King's Island Flood Relief scheme will have to be mindful of maintaining access for both pedestrians and cyclists as well as public transport via Island Road.
The traffic associated with the construction works for the King's Island Flood Relief scheme will need to be mindful of the tourist and retail trades on the Island.

Air and Noise
The main impacts on air and noise will arise during the construction of the scheme. Traffic noise generated by trucks accessing the island will be one source of noise. The CEMP for the construction of the scheme should include mechanisms to reduce noise generated during the construction period.
Air emissions, both traffic and construction sources, will arise. Dust will be the main component of these air emissions. Specific measures will be employed to reduce the dust emissions.

Contents

Contents

List of Figures

List of Tables

Abbreviations

AA……Appropriate Assessment
AADT……..Annual Average Daily Traffic
ACA..... Architectural Conservation Areas
AFA ..... Area for Further Assessment
ASPC……..Area of Special Planning Designation
ATC…….Automatic Traffic Counter
CFRAM ..... Catchment-based Flood Risk Assessment and Management
CFRMP ..... Catchment-based Flood Risk Management Plan
CORINE ..... Coordination of Information on the Environment
CSO ..... Central Statistics Office
DoAHG……Department of Art Heritage & the Gaeltacht
DLHG……..Demense Landscape and Historic Gardens
ED……Electoral Division
EIA ..... Environmental Impact Assessment
EIS……..Environmental Impact Statement
EPA..... Environmental Protection Agency
EPO……Environmental Protection Objectives
EREP ..... Environmental River Enhancement Programme
EU ..... European Union
GIS……...Geographic Information System (mapping software)
GWB……Groundwater Body
HSE……Health Service Executive
FRMP..... Flood Risk Management Plan
FRS……Flood Relief Scheme
ICPSS……Irish Coastal Strategy Study
LCCC……..Limerick City and County Council
LCDP……..Limerick City Development Plan
LRFIP……..Limerick Regeneration Framework Implementation Plan
IPPC..... Integrated Pollution and Prevention Control`
OSI……..Ordinance Survey Ireland
OPW ..... Office of Public Works
NIAH……National Inventory of Architectural Heritage
NHA ..... Natural Heritage Areas
NIS ..... Natura Impact Statement
NPWS ..... National Parks and Wildlife Service
NRA ..... National Road Authority
NSS……National Spatial Strategy
PCD……Public Consultation Day
PCU……Passenger Car Units

PFRA ..... Preliminary Flood Risk Assessment
pNHA ..... Proposed Natural Heritage Areas
RBD ..... River Basin District
RMBP..... River Basin Management Plan
RMP ..... Record of Monuments and Places
RPS……Record and Protected Structures
SAC..... Special Area of Conservation
SAG……Stakeholder Advisory Group
SEA..... Strategic Environmental Assessment
SEAI..... Sustainable Energy Authority of Ireland
SMR ..... Sites and Monuments Record
SPA..... Special Protection Area
RLO……Resident Liaison Officer
WFD..... Water Framework Directive
WMU ..... Water Management Unit
WWTP……Waste Water Treatment Plant
WQ……..Water Quality
ZAP ..... Zones of Archaeological Potential

1 Introduction

The purpose of King's Island Constraints Study is to inform the feasibility study through the identification of the general baseline environmental conditions of the study area together with the potential environmental constraints and opportunities associated with the proposed flood scheme. The study will inform the design process. The Constraints Study has been prepared by JBA Consulting Ltd (hereafter JBA).

1.1 History of Flooding in King's Island

King's Island is surrounded by the waters of the River Shannon and Abbey River. Both rivers are tidal making King's Island susceptible to both fluvial and coastal flood risk. There is a history of flooding in King's Island, the most recent events recorded in 1999, 2002, 2009, and 2014. Prolonged rainfall, spring tides, and storm surges have been the source of severe flooding.

During the most recent severe flood event in Limerick City in February 2014, King's Island was one of the most affected areas due to the failure of existing local defences resulting in overtopping and breaching of water onto the island and surrounding areas. The result was displacement of residents and extensive property damage.

1.2 Scope of the Constraints Study

The Constraints Study is the first step in the preparation of an environmental impact statement (EIS) for the King's Island Relief Scheme. The purpose of the Constraints Study is to determine what constraints (physical, procedural, legal, environmental etc.) exist that could affect the design of the scheme, could delay the progress of the scheme and could influence the cost of the scheme.

The scope of the Constraints Study has followed the headings prescribed in the Environmental Protection Agency's Guidelines 'Advice Notes on the Current Practice in the Preparation of Environmental Impact Statements', 2003. The prescribed headings are as follows:

- Human Beings
- Air Quality
- Noise and Vibration
- Traffic
- Landscape
- Soils & Geology
- Archaeology & Cultural Heritage
- Water
- Ecology
- Material Assets.

For this study we have combined the human beings and socio-economic sections together. Similarly other sections of the Constraints Study e.g.noise, air quality, traffic etc. are also applicable to human beings.

1.3 The Study Area

The proposed scheme is to provide a flood management scheme for King's Island in Limerick City. King's Island is situated between the River Shannon and the Abbey River putting the island at risk of fluvial and coastal flooding.

The Study Area for the Constraints Study covers the region outlined in **Figure 1-1: Constraint Study Area**. The study area is bounded on the east by the River Abbey and on the west by the River Shannon. It includes the earth embankments around the north, east, and west, as well as, the stone wall along Sir Harry's Mall and George's Quay. It also includes the currently undefended areas behind the castle, City Hall, and the court house. In addition, there is a particular interest in Verdant Place because although it has low level walls, it is vulnerable to flooding from high tides.

The study area is located at the north-east of Limerick City centre. It is a valuable asset to the city due to its historical importance, its ecological and archaeological significance, and its tourism

potential. The island also contains a residential and community area with a large housing estate (St. Mary Park) to the north and various terraces of houses to the south.

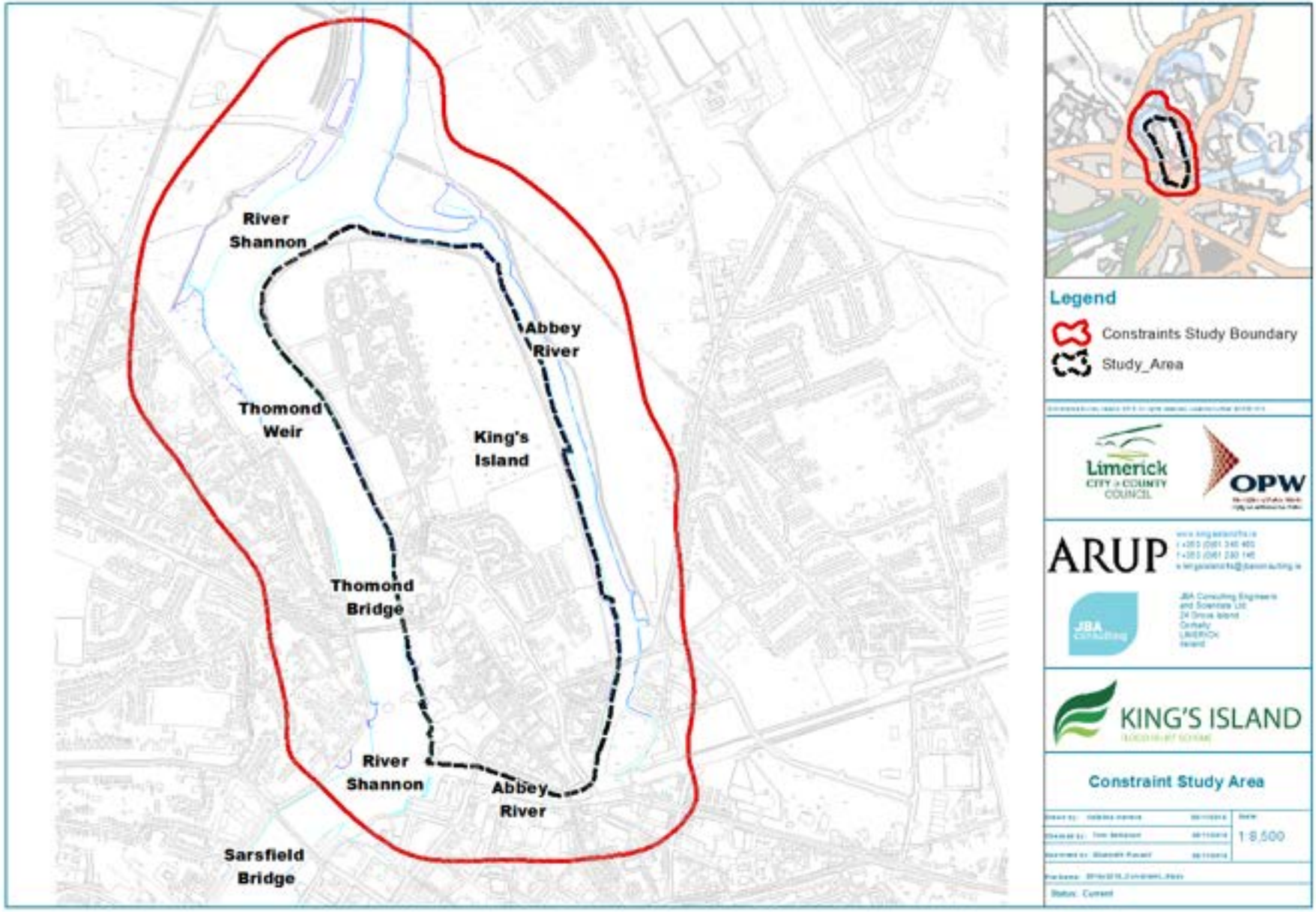
The landscape of the study area is urban with a low lying area of wetland edging the north western part of the island. The urban area consists of a combination of residential, administrative, commercial, educational, ecclesiastical, and tourism elements. In terms of the built environment the north of the island is predominantly residential and due to poor transportation connections, it is somewhat disconnected from the rest of the city. The southern part of the island has a wider range of land uses, retail opportunities, and is located in close proximity to the King John's Castle. King's Island has a community centre in the south-west region, two pitches to the east of the Island and three educational facilities in the south of the island (one mixed primary school and two Gael Scoileanna). There is a Garda Station, the County Courthouse, and District Court on the Island, they are located near City Hall which houses all the offices for Limerick City and County Council (LCCC).

King's Island is located in the Shannon river catchment area and the Shannon River Basin District. King's Island and the River Shannon are covered by part of the Lower River Shannon Special Area of Conservation (SAC) and downstream from the Island is the River Fergus Estuaries Special Protection Area (SPA). Important habitats in King's Island include riparian woodland (alluvial woodland), wet grassland, and tall-herb swamps. These are protected under national legislation and EU Habitats Directive (Discussed in more detail in **Section 7; Ecology and Fisheries**). Also, of note is the high occurrence of invasive species on the island.

King's Island has 28 structures listed for protection in the Records and Protected Structures (RPS). In addition, there are 10 structures currently recognised on the National Inventory of Architectural Heritage (NIAH) of Limerick City. There are currently no Architectural Conservation Area (ACA) in place in King's Island, however, the southwestern part of the King's Island has been included in the Area of Special Planning Designation (ASPD) (Cultural and heritage constraints are discussed in further detail in **Section 19: Heritage and Archaeology** of this report).[i]

[i] Limerick City & Council. (2013). Limerick Regeneration. Framework Implementation Plan. http://www.limerick.ie/council/limerick-regeneration-framework-implementation-plan

Figure 1-1. Constraint Study Area



1.4 Background to the Project

King's Island and its surrounding area was severely flooded in early 2014, when extremely high tides overtopped the embankments causing them to fail, allowing severe flooding onto the island. In the wake of the worst flooding experience in the area, the Office of Public Works (OPW) allotted funding for LCCC to invest in assessing the risks of flooding and develop a viable flood relief scheme. ARUP and JBA were appointed to assess, develop, and design a viable, cost-effective and sustainable flood relief scheme that aims to minimise the risk to the existing community, social amenity, environment, and landscape character. In summary, the objectives of this study are to:

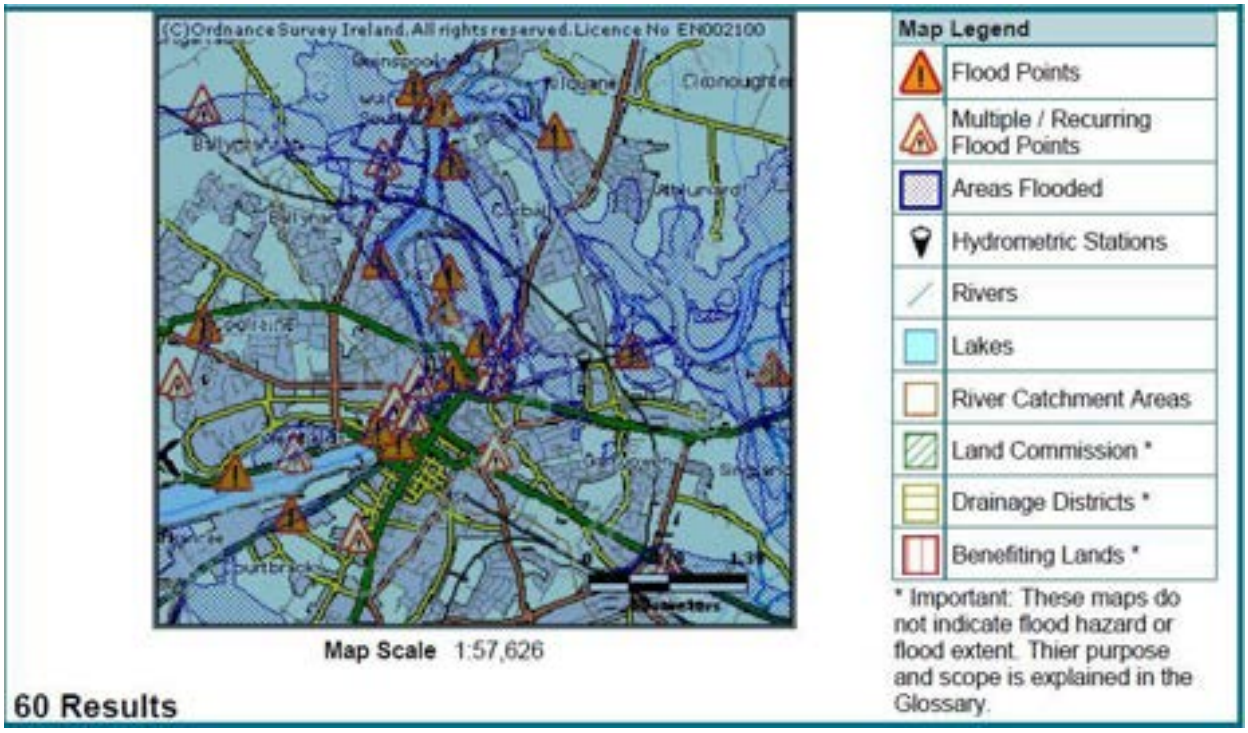
- Identify and map existing and potential flood hazards;
- Assess and map the existing and potential flood hazards;
- Assess a number of options to alleviate flooding on the island and to identify a preferred option.
- Conduct an Environmental Impact Assessment and Appropriate Assessment for the preferred option

ARUP has been retained by LCCC to progress the engineering options and the design of the preferred option and a preliminary design for the preferred option. JBA has been retained by LCC to progress the King's Island Flood Relief Scheme (FRS) through Constraints Study (this report), Preferred Options Selection and the Environmental Impact Assessment and Appropriate Assessment. .

1.5 Need for the Development

Limerick City, especially, King's Island, has been known to be susceptible to flooding due to its location. The OPW National Flood Hazard Mapping Summary Local Area Report summarises all flood events within a 2.5 kilometre distance from King's Island (**Figure 1-2**). It lists 60 results of flooding in and around the area, going as far back as 1990, highlighting flood points, multiple/reoccurring flood points and areas flooded, along with other features such as; hydrometric stations and river catchment areas.

Figure 1-2. OPW National Flood Hazard Mapping Summart



The Limerick City Development Plan (LCDP), 2010-2016, Flood Risk Map highlights that King's Island is at risk of flooding indicating that it is within Flood Zone A (high probability of flooding). As a result, all proposed developments are required to follow a newly introduced guidance document: 'The Planning System and Flood Risk Management' (2009) developed by the Department of the Environment Community and Local Government and the OPW. These guidelines were included as policy statements in the LCDP.

> *Limerick City Development Plan: Policy WS8. Flood Protection*
>
> *"It is the policy of Limerick City Council to continue to work toward reducing flooding within the City and ensure that all new development proposals comply fully with the requirements of 'Planning Systems & Flood Risk Management Guidelines for Planning Authorities' 2009, and any other guidance during the lifetime of the Development Plan".*

These guidelines require planning systems at a national, regional, and local level to avoid planning in areas of flooding risk and mandated an adaptation approach to flood risk management when assessing new development. According to the Limerick City Council, as mentioned in the Limerick Regeneration Framework Implementation Plan (LRFIP), there was a lack of substantive flooding data within the regeneration King's Island area. In 2013, there had been no official publishable Catchment Flood Risk Assessment and Management Studies (CFRAMS). However, the OPW commissioned a study to assess coastal flooding and erosion extents in Ireland, known as the Irish Coastal Protective Strategy Study (ICPSS). The ICPSS produced flood maps and levels for flood events with various probabilities of occurrences but the information was not yet published by 2013.

It is stated in the Limerick City Development Plan (2010-2016):

> *"Until such time as comprehensive information and guidance is available on flooding in the City, a flexible approach is required to take account of flood risk to ensure that appropriate measures are taken wherever the need arises".*

The need for a more firm and structured flood management strategy became evident after the February 2014 floods, when LCCC petitioned for funding for a King's Island FRS.

Other policy documents published by the Government in recent years that cover issues relevant to flooding include:

- The National Climate Change Strategy, 2000;
- National Biodiversity Plan, 2002 – 2006;
- A Framework for Major Emergency Management, 2006;
- National Climate Change Strategy 2007-2012.

1.6 Stage of the Process

Various stages are needed in the completion of a FRS. There are five statutory phases of work and the progression of one stage heavily depends on the outcome of the previous stage (Stages of the process are outlined in Table 1-1**).**

The following stages will be completed for the King's Island FRS:

- To bring a scheme from preliminary design (Stage I), assessing various options available, through public consultation, detail design and environmental procedures (environmental impact assessment and Appropriate Assessment) to planning application to An Bord Pleanala Public (Stage II). Subject to successfully satisfying An Bord Pleanala requirements, the scheme will then be tendered (Stage III), constructed (Stage IV) and delivered in completed state to the client (Stage V).
- To develop a scheme which prevents flooding during flood events with a 1% (for fluvial floods) and 0.5% (for tidal / coastal floods) annual exceedance probability (AEP), often referred to as 100-year and 200-year floods respectively.
- To investigate the feasibility of carrying out advanced works at Verdant Place.

The Constraints Study forms part of the first stage in the process of preparing an Environmental Impact Statement (EIS) for King's Island FRS. This study is running in tandem with various other specific studies for the scheme, which will all inform each other in the end. The findings of the Constraints Study will be used to help formulate a number of engineering designs for the scheme. These designs will be subject to an options appraisal which will ultimately be subjected to a Multi-Criteria Assessment (MCA). In summary the MCA will assess the technical, social, environmental and economic elements of each of the proposed options and a preferred option will emerge from this process. An Environmental Impact Assessment (EIA) of the preferred scheme will be conducted along with an Appropriate Assessment. These documents will support the planning application to An Bord Pleanala for the scheme Based on the results of the environmental assessment, a number of mitigation measures will be employed to reduce or remedy any significant environmental impacts identified.

Table 1-1. King's Island FRS Stages

Stage	Environmental Impact Assessment	Specific Studies
I	Scheme Development	Data Gathering and review Ecology Surveys Archaeological Investigation Hydrology Study & Hydraulic Modelling Geotechnical Surveys Flow Velocity Surveys Topographic Surveys Site Investigations and site walkovers Conduct Flood Risk Assessments Prepare a number of Flood Risk Management Options Carry out a Cost Benefit Analysis Selection of a Preferred Option Flood Risk Management Plan Interference Notices Public Exhibition
	Constraint Study	
	Screening for Appropriate Assessment	
	Initial Consultation with Stakeholders	
	Scoping for Environmental Impact Assessment	
II	Detailed Design	
	Public Consultation	
	Preparation of Environmental Assessment of Options Report	
	Public Consultation on Preferred Scheme	
	Preparation of Appropriate Assessment	
	Environmental Impact Statement for Preferred Option	
	Submission of a Part X Planning Application to An Bord Pleanála	
III/IV	Tender and Construction	
V	Handover to Client	

1.7 Consultation

The purpose of the consultation is to obtain feedback on the proposals. The feedback will be taken seriously and will influence decisions on the FRS. The hope is to ensure the public's opinion is taken into consideration when developing the plan and that people are informed of the influence they had. The methods of consultation will include but are not limited to Public Consultation Day (PCD), technical workshops, face-to-face meetings, emails, newsletters, and social media.

Detailed consultation planning for the project will be developed stage-by-stage and in partnership with the Technical Advisory Group (TAG) and Stakeholder Advisory Group (SAG). The project team hopes to engage stakeholders using the Building Trust with Communities Approach. **Table 1-2** displays the various levels of engagement at different points in the project and it shows how people and organisation may transfer between these levels. The project team aims to involve all stakeholders in shaping the direction and outcome of the FRS.

Table 1-2. Building Trust with Communities Approach: Hierarchy Breakdown

Building Trust hierarchy	Level of influence
Partnership	Stakeholders will share responsibility for reaching final decisions because they have the relevant authority and/or responsibility (e.g. statutory consultees). Without their full agreement a decision cannot be taken.
Involve	Stakeholders will be regularly engaged in the process because although decisions can be taken without their full agreement (i.e. they are not a decision-sharing partner), an ongoing influence will be critical to making informed, lasting and acceptable decisions.
Consult	Stakeholders will have their views and concerns actively sought because there may be particular issues on which we would like to know their views before we make decisions.
Inform	Stakeholders will be informed about the project and we will be open to receive their views and concerns because they will be interested in aspects of the project and its outcomes. They need the opportunity to know how things are developing and how and when to give their views.

1.7.1 Ongoing Consultation

Comprehensive communication and engagement plans have been developed and adopted by the team such as a project website, direct emails, newsletters, local media, and public consultation among other approaches listed in **Table 1-3** below. Imperative elements of the project include the establishment of social media such as a Facebook project page and a King's Island Scheme Twitter account. The purpose of social media accounts is to maintain communication flow and continuous updates for all interested stakeholders that have access to it. It is a faster and more efficient way to keep the public informed of the progress of the project.

A Scoing Report will be prepared for the EIS and Statutory Bodies, non-statutory bodies and interested stakeholders will be consulted with. Their views will be considered in the preparation of the EIS.

Table 1-3. King's Island FRS Communication and Consultation Approaches

Communication Activity	Purpose
Project website	To promote and provide information to stakeholders about the project. The website will provide regular updates. To provide a source of information that stakeholders and members of the public can download and review. To provide a means of consultation and allow stakeholders to ask questions or submit information
Direct email	Where stakeholders have supplied their contact details we will notify project updates, invitations to consultation events via email. Names and addresses must be held securely in compliance with the Data Protection Act 1998.
Local authority / community publications such as parish newsletters	Stories in local authority / community group newsletters are likely to reach a wide range of citizens. King's Island newsletter is published quarterly by St Mary's Aid and has a wide circulation (hand delivered to all properties)

Communication Activity	Purpose
LCCC website	News headlines, links to project website, publicise consultation events.
Local Media TV, radio, newspapers, magazine or publications	Press releases are prepared in advance of public meetings and distributed to the media. Photo calls and media interviews can also be arranged. Podcasts / webinars can provide an opportunity to reach a wider audience.
Paid for Advertising - in a media publication	There are various options for advertising available – such as online, radio, television, outdoor, transport, press and more.
Public Consultation Days / workshops - held at a community venue.	Consultation exhibitions / events offer a more extensive and open form of engagement on a personal basis. They provide opportunities for members of the public to express views on the consultation subject area, ask questions, take on board the information at their leisure, discuss any concerns, provide a view and receive feedback on the issues they raise. The event will be geared to a specific issue, based on consultation stage of the project programme. The consultation events can be held in community facilities – providing an environment conducive to actively seeking views in the relevant communities. These events can combine the presentation of information, visual displays, verbal presentations, computer presentations (eg video loop) and other details whilst giving people the opportunity to provide views and opinions. Members of the design team and environmental team will be available on the day to answer any specific queries that may arise. Events must be held in venues that are accessible for disabled users or users with special needs to maximize possible attendance. One factor which can determine the success of a public event is how well it has been publicised.
Community groups and forums	Community groups provide opportunities to reach a wider community. Meetings can be used as an opportunity to promote a project event. Engagement through SAG will ensure the primary groups are involved / represented in the project.
Community centres	Community centres can act as a focal point for the community and can be used to post information for citizens, eg. Posters publicising consultation events. Community centres have notice boards, displays, reception areas and information points that can alert people to events.
Council meetings	Council meetings are usually held on a monthly basis with agendas controlled by the clerk to the council. Can provide opportunities to promote the study and website via meetings and newsletters. Key councillors are invited to the SAG so may already provide and outlet to the wide council body.
Social Media	Twitter account are set up and linked to the project website and other relevant feeds. Social media sites, such as Facebook Groups, may provide opportunities to promote messages and information about the Study.

1.7.2 Public Consultation Workshop

When the project was at an early stage, stakeholders sought to take the opportunity to interact with the people that may be directly or indirectly affected by the FRS. The project team also sought the opportunity to listen to the views of those living or working in areas near the scheme. The goal of the workshop was to elicit these views, as well as, start to build a relationship with members of the local community. The target audience was open to any and all interested parties, including political stakeholders.

The public consultation workshop took place on **October 7th, 2015** from 12pm to 7pm. It was carried out in the small exhibition room in City Hall (LCCC building) in Merchant's Quay, Limerick City. The event was set-up in a drop-in format, the exhibition room had information stands and posters, a registration table, one-to-one small group discussions, and questionnaires to be completed or taken away for later submission.

The promotion of the public consultation workshop was carried out through various means such as posters, social media, traditional media (newspaper, radio), leaflet drop, pavement stands, word of mouth, meetings with local groups and publicity through SAG (Stakeholder Advisory Group).

Four members of the JBA project team and ARUP's project manager were present. The Resident Liaison Officer (RLO) was also present to welcome attendees, manage sign-ins, and to provide introductions to the project team. The RLO is a new and crucial role undertaken by an active member of the community, who facilitates a two-way flow of communication between the project team and local residents.

The feedback provided on the day will be very useful in the development of the FRS. There is a lot of genuine interest in the works and in particular the timeline of the construction. For the most part, attendees agreed that a solution was needed and although many expressed their concern in terms of visual impact, they understood that it was more important to provide flood protection in a timely manner. The full day report is provided in **Appendix B,** these include the summarised responses for the questionnaires.

1.8 Potential Flood Risk Management Measures

The constraints identified in this report will be used by the engineers to inform their selection of a flood risk management option. **Figure 1-3** illustrates the range of options which may be considered:

- Flood defence walls: new flood defence wall alignment, strengthening and raising existing quay walls; and localised demountable defences required at various locations along George's Quay and the boardwalk.
- Flood embankments along existing embankments or a new embankment around the area of the SAC.
- New bridges

Figure 1-3. Potential Flood Management Measures

2 Environmental Constraints

The following sections of this Constraints Study address the constraints in relation to:

- Section 3 – Human Beings
- Section 4 – Material Assets
- Section 5 – Water
- Section 6 - Ecology & Fisheries
- Section 7 - Soils and geology
- Section 9 - Landscape and visual amenity
- Section 10- Heritage and archaeology
- Section 10 - Traffic
- Section 11 - Air and Noise
- Section 12 – Cumulative Impacts

Each section the Constraints Study evaluates the baseline for a variety of environmental aspects and contains the following information:

- Introduction to the topic(s) to be discussed
- Existing environment within the Study Area for that environmental aspect
- Potential constraints.

The Constraints Study also contains a number of appendices that address the public consultations to date and specialist standalone reports such as the cultural heritage report.

While the Constraints Study is not a statutory document we have used the EPA's Guidelines on the Preparation of Environmental Impact Assessments as a template for our study. Methodology and Guidelines

2.1.1 Methodology

The information necessary to identify existing conditions in the study area has been gathered from:

- Desktop studies of existing and historical information;
- Consultations with statutory and non-statutory bodies. Initial discussions regarding archaeology were carried out with the Department of Arts, Heritage and the Gaeltacht in a request for a Ministerial Consent under the National Monuments Act (2004 Amendment). A public consultation workshop was held in October, 2015. Further consultations will be carried out with the statutory bodies during the Scoping Stage of the Environmental Impact Assessment.
- Specific surveys

Although most of the information was obtained from the desktop study, a number of on-site surveys were also carried out as follows; ecology habitat mapping, invasive species mapping, bird identification, cultural heritage and archaeological walkover survey, landscape and visual assessment .

This Constraints Study is the first stage in the preparation of an Environmental Impact Statement (EIS) for the King's Island FRS. The information gathered for each of the topics is current and was sourced from a number of data bases that are referenced in each section of the report. The topics discussed meet the requirements of the topics outlined in the draft EPA's 'Advise Notes on Current Practice in the Preparation of Environmental Impact Statements' 2015, guidance notes.

2.2 Constraints Study Team

JBA Consulting retained the services of Moore Consultancy to undertake the archaeological and cultural heritage assessment of the island. Sarah McCutcheon, Executive Archaeologist with Limerick City & County Council kindly provided information on Verdant Place and prepared the application for Ministerial Consent for the project. Arup personnel prepared other sections of the Study including Sinead Whyte (noise), Niall Harte (traffic) and Maeve McElligott (Soils and Geology).

All of the remaining disciplines were provided in-house by JBA.

3 Human Beings

3.1 Introduction

Kings Island is in the heart of Limerick City surrounded by the Shannon River and the Abbey River. It contains residential, administrative, ecclesiastical, educational, retail, business, and tourism elements. The Island also contains some cultural heritage features such as remains of Limerick City Walls and various 12th and 13th century buildings including King John's Castle and St. Mary's Cathedral. Unfortunately, the area is also known for its high levels of deprivation, social and economic exclusion. The southern portion of King's Island is regarded as the historic core of Limerick City and consequently has strong tourism potential; however, the northern portion of the Island is home to St. Mary's Park, an area of deprivation, in terms of health, education, employment, and housing conditions and standards.

In an effort by LCCC to introduce a strategic vision and framework plan for the future of communities with social and economic difficulties, they prepared the 'Limerick Regeneration Framework Implementation Plan' in 2008. These neighbourhoods were labelled as regeneration areas. King's Island, along with Moyross and Southill in Limerick City are undergoing the regeneration process by LCCC. The council is promoting more social inclusion to facilitate access to employment, education, transport, suitable housing, social and cultural activities in the regeneration areas. The hope of LCCC is to promote the attractiveness of Limerick City centre and its surrounding areas (King's Island) and encourage people to want to visit or even migrate into Limerick City.

The economic and social problems in King's Island can become a constraint for the King's Island FRS, if they are not recognised and addressed in the preliminary stages of the FRS. This chapter will look at the impacts of flooding on the Island, the existing environment (population, education, employment etc), planning projects, and finally the benefit and constraints of the FRS in King's Island.

3.2 Flooding and its economic and social consequences

King's Island has experienced significant flooding in recent years: 1999, 2002, 2009, and 2014. The location of the Island makes it vulnerable to floods due to the susceptibility of experiencing both spring tides and storm surges at the same time. One of the highest water levels observed in King's Island occurred in December 1999, where water levels were reported to have reached 4.4 metres in the Abbey River. However, in February 2014, the most extreme flooding event experience in King's Island occurred. The existing flood defences in King's Island failed locally, due to the overtopping and breach of both the River Shannon and Abbey River, allowing flood waters onto the Island and surrounding areas. **Figure 3-1** displays the areas within and around King's Island that are prone to flooding: Flood Zone A is at highest risk area.

According to the local Limerick Leader Newspaper, King's Island was not the only area affected by the flood in 2014, however, it was certainly one of the worst affected locations with around 300 houses damaged, and multiple cars washed away and even reports of horses drowned around St Mary's Park. Dock Road, Condell Road, Corbally Road, Honan's Quay, and long pavement were all closed to traffic as a result of the flooding. Over a dozen people were allocated temporary accommodation, especially those from the Island Field/ St. Mary's Park area. City Hall, the adjacent courthouse, parts of the Corbally, the quays, and the Potato Market at Merchants' Quay were all flooded. The waters in the worst affected areas remained high for several days' post-prolonged rainfall.

The Emergency response crew, Red Cross, Limerick Marine Search and Rescue and even the Army were called to the scene in Limerick to the help deal with the flooding and assist residents in evacuating their homes. Volunteers and other residents in the affected areas were contributing in the rescue and mobilising of people who were stranded in the flooded grounds. The northside estate (King's Park) in King's Island was under four feet of water and several vulnerable and elderly people had to be evacuated from their homes. The total damage in Limerick affected approximately 2,000 people living in 200-300 homes. The worst hit areas covered approximately 200 acres in St. Mary's Park and King's Island.

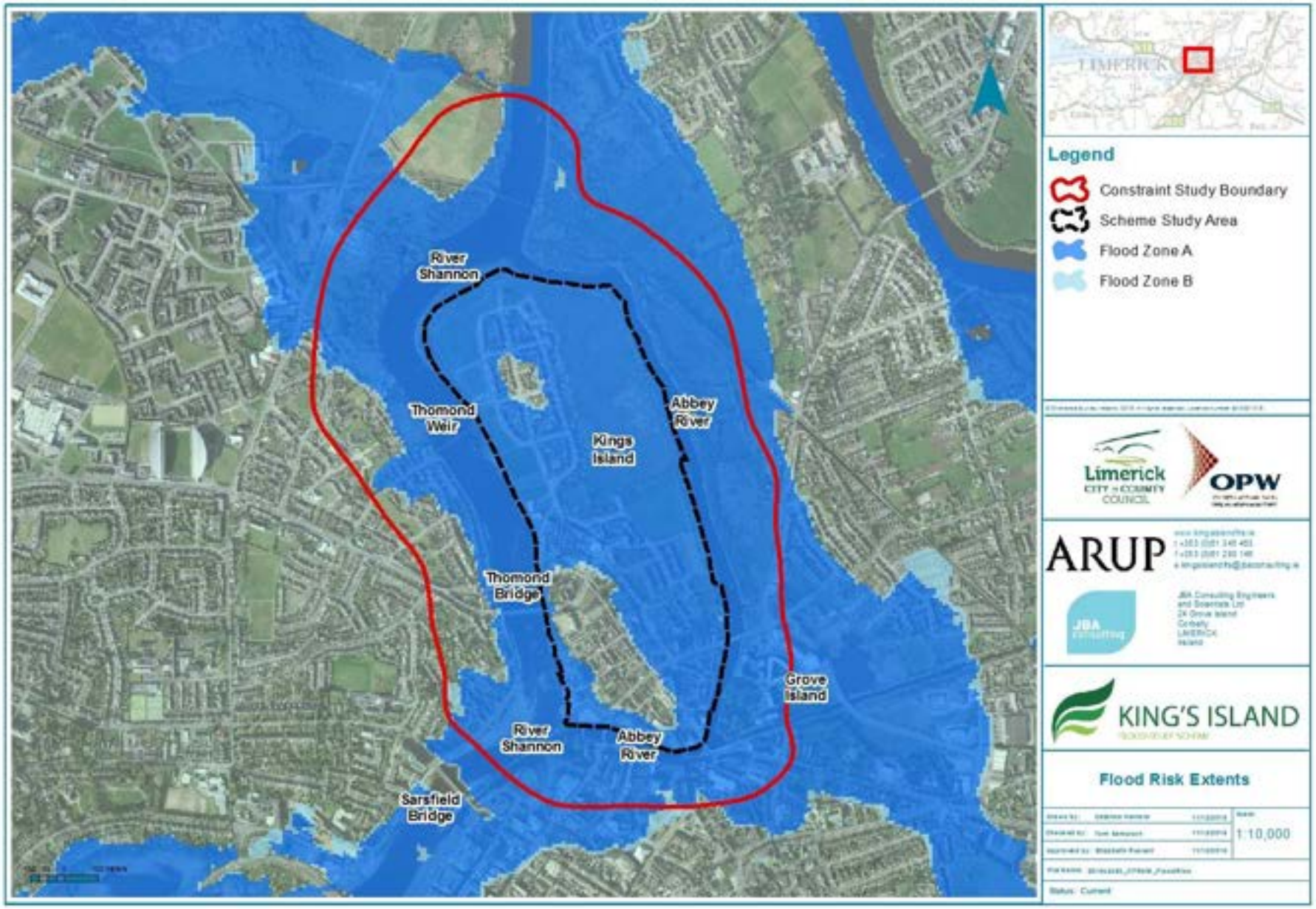
60 people were evacuated from their residences and a few hundred received assistance from the response teams. According to Limerick City Council's director of transport and travel Paul Crowe, the cost of the damage was "very extensive". Mr. Crowe continued to say that due to the

extent of the damages and the potential size of continued flooding, a new relief scheme was beyond the resources of the Council, therefore, they were looking for assistance from the government. An approximation of the total damage was over €100,000 has been given in relief payment to stricken flood relief residents.

The reason the flooding was so extensive and damaging in King's Island was because the existing defences were not strong enough to sustain both the River Shannon and the Abbey River from breaking the banks. The sand banks defence was limited and the warning system was not efficient enough at informing all the residents and certainly did not give people enough time to prepare or evacuate their premises. 'Proactive' measure were lacking. Also, most of the population were not socially mobile, the majority did not own a car, which would make any sort of preventative evacuation difficult. Finally, most of the people were long-term residents of King's Island, this restricted the option of temporary relocation for many residents, who had the rest of their family also living on the Island.

Following flooding events, LCCC put funds towards cleaning and improving the existing system. Since most of the properties were uninsured, it was the responsibility of the local authority and national government to pay for the recoveries and repairs.

Figure 3-1. King's Island Flood Risk

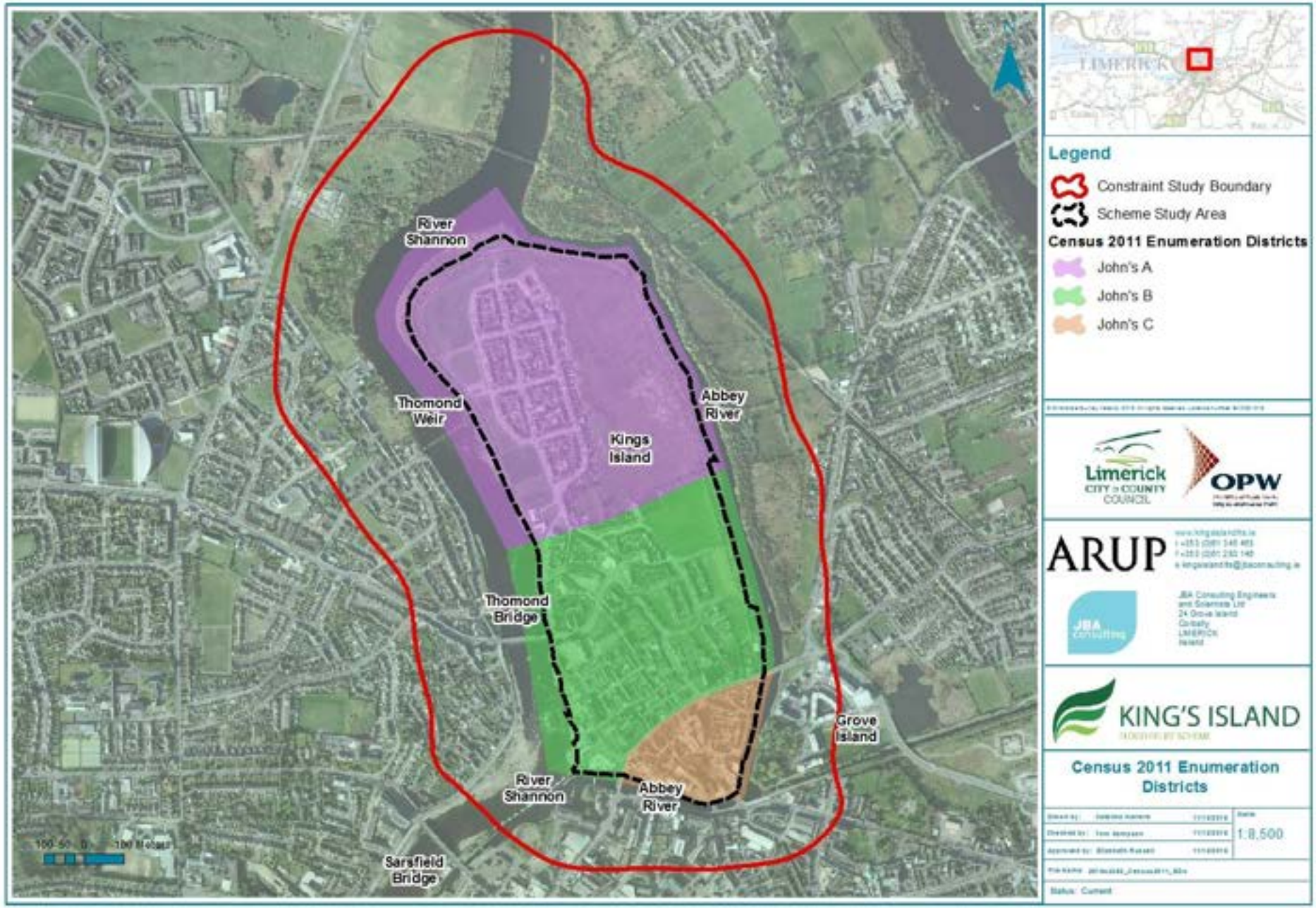


3.3 Existing environment

King's Island is located in the centre of Limerick City, surrounded by the Shannon and Abbey River. The Island is made up of two distinct areas: Englishtown and St. Mary's Park. Englishtown is a historical region of Limerick city, located in the south of the Island, while St. Mary's Park is a local authority housing estate located at the north end of the Island. Nicolas Street, St. Mary Street, Athlunkard Street, and Island Road are in the centre of Limerick City and connect the Island with the rest of the city centre. The streets have tourist and commercial potential, yet the presence of various empty and underused sites and buildings along it, degrade the area aesthetically. Despite that, King's Island still retains some significant architectural and archaeological heritage such as the remains of the Limerick City Walls, King John's Castle, Thomond Bridge and St. Mary's Cathedral. Unfortunately, due to continuous isolations economically and socially between the north and south portion of the Island, the levels of deprivation have increased significantly. According to the HSE, St. Mary's Park Estate has received a deprivation score of 10 (scale 1-10), 10 being considered very high deprivation. Although the most disadvantaged area is St. Mary's Park at the north of the Island, the south end of the Island still faces economic and social constraints. St. Mary's Park only has one road that connects it to the rest of Limerick City, this has resulted in its physical, social, and economical isolation. There are multiple vacant and derelict houses in the estate, most which do not have appropriate insulation and majority which would not meet current building standards. The physical condition and state of the residences in St. Mary's Park are a direct correlation of living conditions in this area. At the east of Munchin's Street, the unfortunate practices of some residents has turned a strip of land into a landfill site of illegal domestic waste that has become a severe environmental blackspot. This illegal landfill site has now been removed by Limerick City Council. Unfortunately, the difficulties in King's Island has been reflected in the census. Population of Limerick City and King's Island has slowly been declining. The Limerick Regeneration Framework Implementation program aims at reversing the pattern. King's Island is divided into three Electoral Divisions (**Figure 3-2**):

- **John's A** (Oliver Plunkett Street, St. Brendan's Street, St. Bridget's Avenue, St. Ita's Street, St. Munchins Street, St. Patrick's Avenue, St. Senan's Street),
- **John's B** (Island View Terrace, Assumpta Park, Verdant Crescent, Lee Estate, Old Dominic Street, Church Street, Castle Street, the Parade, Abbey View, Island Road, Convent Street, Castle Lane, Newgate Lane, St. Peter Street, Crosbie Row, Exchange Street, Merchant Quay),
- **John's C** (Key Row, Sir Harry's Mall, Long Lane, Sheep Street, Mary Street, Bridge Street).

Figure 3-2. King's Island Census (2011) Enumeration District



The tables below (Table 3-1, Table 3-2, Table 3-3) display the population change of King's Island by Electoral Divisions (ED): John's A, B, and C.

Table 3-1. John's A ED, Population and actual percentage change 2006 and 2011 by Electoral Division, Statistical Indicator and Year

Year	Total	Male	Female
2006	1,211	n/a	n/a
2011	874	442	432
Actual change in population 2006-2011 (number)	-337	n/a	n/a
Percentage change in population 2006-2011 (%)	-27.8	n/a	

Table 3-2. John's B ED. Population and actual percentage change 2006 and 2011 by Electoral Division, Statistical Indicator and Year

Year	Total	Male	Female
2006	1,053		
2011	976	460	516
Actual change in population 2006-2011 (number)	-77	n/a	n/a
Percentage change in population 2006-2011 (%)	-7.3	n/a	

Table 3-3: John's C ED. Population and actual percentage change 2006 and 2011 by Electoral Division, Statistical Indicator and Year

Year	Total	Male	Female
2006	438		
2011	368	174	194
Actual change in population 2006-2011 (number)	-70	n/a	n/a
Percentage change in population 2006-2011 (%)	-16	n/a	

The population of King's Island John's A ED according to Central Statistics Office (CSO) in 2006 was 1,211 and in 2011 it was 874. There was a noticeable percentage change in population with a decrease of 28% (-337 people). The decline of population is a serious concern and could be as a result of inadequate work and educational opportunities, limited transportation routes, and continued flooding of commercial and residential properties. Similarly, John's B and C experienced a decline in population, however not as drastic as John's A. It could be suggested that since John's A and B are located in the southern end of the Island, residents have better access and connectivity to the rest of the city, making their homes more desired and conveniently located. The small decrease of population could be slightly allotted to the general constraints in the Island but could also be connected to property turnover rate.

3.3.1 Employment

The residents of King's Island have experienced social and economic exclusion, which has become evident in the CSO employment statistics for 2006 and 2011. The tables below (3-4,3-5, 3-6) show the employment status of people in Limerick County, Limerick City, and King's Island (John's A, B, C ED). According to the HSE and CSO, the population of John's A ED that were working in 2006 was only **27%** (See **Table 3-4**). John's A was below the State and Limerick City's employment average and above in the unemployment averages. John's A has a higher percentage of students (8.5%) and persons looking for their first job (5.3%), yet it has 1 ½ times more people than the state and twice more people than Limerick city with no formal education. They have also surpassed the average of people leaving school at primary level and secondary level and they are below average (state and Limerick City) in relation to enrolment into third level education. Lack of education has resulted in further deprivation in employment and health. Extensive scarcity in King's Island means that people may be less capable of responding to and recovering from flooding.

The CSO 2006 presented that **64%** of households in John's A had no cars, which limited the residents' employment and educational options. This also meant that the population was not socially mobile and most were likely long-term residents, therefore evacuation would prove to be a difficult task.

Table 3-4. John's A ED. Employment percentage. (CSO 2006)

Geographical Area	Working %	Looking for first job%	Student %	Unemployed%	Looking After Home%	Retired%	Unable to Work%	Other%
State	57.1	0.87	4.4	10.3	11.4	11.0	4.1	0.3
Limerick City	48.4	1.4	6..8	12.1	11.0	12.0	6.9	1.1
John's A	27.5	5.3	8.5	15.1	17.4	11.1	14.7	0.22
John's B	-	-	-	-	-	-	-	-
John's C	-	-	-	-	-	-	-	-

Table 3-5: King's Island population, males, type of employment (CSO 2006)

Geographical Area	Agriculture, forestry and fishing	Building &Construction	Manufacturing Industries	Commerce &trade	Transport & Communication	Public Administration	Professional Services	Other	Total
State	17,822	145,273	165,442	209,591	60,106	56,627	66,500	129,231	850,592
Limerick City	27	1,148	2,977	2,445	861	467	793	1,482	10,200
John's A	0	26	27	25	8	8	7	18	119
John's B	0	27	41	27	6	8	13	32	154
John's C	0	12	40	37	9	5	8	21	132

Table 3-6 King's Island population, females, type of employment (CSO 2006)

Geographical Area	Agriculture, forestry and fishing	Building &Construction	Manufacturing Industries	Commerce &trade	Transport & Communication	Public Administration	Professional Services	Other	Total
State	4,599	10,501	73,954	23,522	25,286	43,727	235,849	136,569	765,712
Limerick City	3	60	1,220	2,989	356	299	2,270	1,590	8,787
John's A	0	0	20	36	5	2	33	21	117
John's B	0	0	17	53	2	4	47	33	156
Johns' C	0	0	21	31	2	3	20	19	96

According to CSO (2006), majority of the male residents from King's Island worked in building and construction, manufacturing, and the trade sector (see **Table 3-5**). In contrast, most of King's Island females worked in commerce and trade areas, professional services, and manufacturing industry (see **Table 3-6**). Most of these jobs would earn a salary of approximately €25,000 to €35,000 per year, which would be a constricted budget for a family, especially if that was the only income.

There are various local businesses based in King's Island, these are summarised in the table below **(Table3-7).** Most of these business are located on major roads such as Nicholas Street, Island Road, Verdant Crescent, Athlunkard Street, and Church Street, in the southern end of the Island.

Table 3-7. Summary of King's Island Local Business. *This list does not include all businesses.*

Local Business Name	Address	Phone number
O'Donoghue's Shop	King's Island, Island view terrace	(061)313592
Limerick Civic Trust, Builders	Bishops Palace, Church Street, King's Island, Co.Limerick	(061) 313 399
King's Island Community Centre	King's Island, Co. Limerick,	(061) 316 808
King's Island Medical Centre	Island Road, King's Island, Limerick	(061) 311 811
Limerick City Museum	Castle Lane, off Nicholas Street, King's Island, Co.Limerick	(061) 407377
Island Theatre Company	Church St, King's Island, Co.Limerick	(061) 410 433
Skip Hire	King's Island, Co.Limerick	(061) 452 101
Limerick Landscaping	6 Verdant Cres, King's Island, Co.Limerick	(061) 313 102
Expand Stand, Architects	17 Nicholas Street, King's Island, Co.Limerick	(061) 317 858
Aegis Archaeology	32 Nicholas St, King's Island, Co.Limerick	(061) 634 375
Traceys Daybreak	27 Nicholas St, Limerick	(061) 415 729
The Locke Bar	3 George's Quay, Limerick	(061) 413 733
AZUR	8 George's Quay, Limerick	(061) 314 994
Amber Restaurant	4 George's Quay, Limerick	(061) 400 990
Jody's Coffee	The Potato Market, Merchant's Quay,	(083) 452 3705
The Potato Market Car Park	The Potato Market, Merchant's Quay,	
Barringtons Hospital	George's Quay, Limerick	(061) 490 500
Lilac Rose	George's Quay, Limerick	(087) 687 3651
Absolute Hotel Limerick	Sir Harry's Mall, Limerick	(061) 463 600
St Marys Parish Credit Union	47 Athlunkard St, Limerick	(061) 410 422
Paddy McMahon & Son Butchers	9 Athlunkard Street Limerick	(061) 417868
F&G Motor Factors Limited	1 Athlunkard St, Limerick	(061) 418 555
Post office	Mary Street Limerick	(061) 414383
Bambury Bookmakers	43 Nicholas St, Limerick	(061) 410 766
The Cauldron Bar	33 Nicholas Street, Limerick	(061) 418 586
Polski Sklep	Nicholas Street Limerick,	
Sunflower Take-Away	34 Nicholas st Limerick	(061) 416 869
Stix Arcade & Snooker Hall	Nicholas st Limerick	(061) 412 072
Katy Daly's Pub	12 Castle Street, Limerick	
Cowhey Pat Pub	32 Sandmall Limerick	

3.4 Planning

The King's Island Flood Relief Scheme and the Limerick Regeneration Framework Implementation Plan proposes to increase opportunity in King's Island by expanding retail function and promoting its tourism potential. The minimisation of flood risk will enable the continued expansion and development of the Island. It will permit businesses, especially those in southern portion of the Island, to continue to function without risk of relocation. Both the FRS and the LRFIP encourages the planning of better access routes into the Island and within the Island, which are important both socially and economically, as well asin case of potential evacuation. The deprivation in King's Island has been recognised and targeted in the LRFIP as renovations of residences have been proposed. The King's Island FRS will aim to reinforce the improvement of St. Mary's Park, by significantly reducing the risk of flood-induced problems such as damage of properties and goods.

There are various planning opportunities for King's Island suggested in the Limerick Regeneration Framework Implementation Plan:

- Restructure the existing layout to address gap sites
- Develop existing poor quality frontage sties and vacant land to improve visual quality
- Consider intensive intervention to remove units to improve legibility and permeability.
- Address poor housing conditions
- Address the lack of integration between areas of new and existing housing
- Remove environmental black spots to the rear of blocks
- Develop Streetscape improvements to enhance the public realm and create pedestrian friendly environments
- Provide additional, soft landscaping to soften the existing hardness of the public realm
- Introduce new frontage development to non-overlooked routes.
- Enforce the Flood Risk Management Guideline (2009) for proposed development in King's Island.
- Encourage the recognition of King's Island historical character.

3.4.1 Land Use Zoning

Under a do-minimum scenario, the principal threat imposed by continued flooding is the limitation on the islands development, increased deprivation due to property damage, lack of access to the rest of the city, and limited amenities in the north portion of the Island. LCCC have several land use zoning plans for the Island as part of the regeneration of King's Island and St. Mary's Park area (Figure 3-3). The zoning of King's Island has been planned in a flexible manner in order to enable change. In St. Mary's Park, the land zones consist of mostly **2A Residential** and **6A Public open area**. Also, some of that public open area has received Area of Special Development Control designation. The southern part of the Island has been categorised into two land use zonings: Zone1 (B) City Centre Commercial Area (CCCA) and Zone1 (C) Inner City Residential Neighbourhood.

- The Zone1 (B) CCCA has been assigned as an area of opportunity, where retention and expansion of a wide range of commercial, cultural, leisure, and residential uses in the commercial core area.
- The objectives of Zone 1 (C) Inner City Residential Neighbourhood is to reinforce the residential environment and character of the area while supporting and maintaining local services.

The City Development Plan specified the importance of ensuring the protection of Natura 2000 sites on the Island, meaning that all planned developments must be subject to Appropriate Assessments. In addition, the importance of an FRS for King's Island was highlighted in the LCDP. Flood remediation in King's Island may encourage future development areas subject to HHDA and Strategic Environmental Assessment. The hope is to develop a strategy that more directly links King's Island to Limerick City Centre through redevelopment and improved connections, access roads, cycle and pedestrian paths.

The FRS measures will aim to lift the pressure of renovation and development of residential, community, and tourist areas, in addition to providing safety and insurance to local residents and businesses. Finally, the study and upcoming publication on the "Development and Archaeological Study of King's Island and Limerick" (DASKIL) will be an essential tool in the planning and zoning of King's Island, since it will suggest and acknowledge areas or sites of historical and cultural importance. The publication will also outline good practices and objectives for the enhancement and protection of archaeology in King's Island, which would likely enhance tourism and help the rebuild King's Island image.

3.4.2 Built Environment and Heritage

King's Island is recognised for having a range of land uses, from residential and commercial to architectural and historical heritages. St. Mary's Park is the oldest (1935) yet largest residential complex on the Island. The area is run-down and certain residences do not even meet certain essential building standards. However, it remains a big part of the Island and it has been targeted as an area for refurbishment and regeneration.

King's John Castle, St. Mary's Cathedral, and Thomond Bridge are the most recognised buildings in King's Island. They are located in the oldest part of the city, also known as the 'medieval core'. Other remaining buildings or structures that have survived from previous centuries include stretches of City Wall, the ruins of Fanning's Castle (on Mary's Street) and the house containing a carved stone fireplace (on Nicholas Street), and an old Military Cemetery (Near St. Mary's Park) from the 1800's. Unfortunately, the medieval character of King's Island has slowly diminished due to lack of maintenance and conservation. However, according to the LCCC there are currently 28 structures on the Record of Protected Structures (RPS) and 10 structures on the National Inventory of Architectural Heritage (NIAH) of Limerick City. The Development Plan and Limerick Regeneration Programme recognises the unique architectural heritage of the town, its contribution to the town's identity and to tourism. It also declares its intention to enhance the public realm, to extend pedestrianisation and to develop open space amenity. There were several policies mentioned in the Limerick City and County Council development plan aimed directly at the renovation and appraisal of the cultural heritage structures and buildings in Limerick City, which includes development of King's Island & St. Mary's Park (for more detail see **Section10.Hertigae and Archaeology**). The policies and their applicability are listed below:

- *Policy ACT8.8 (Requirement for Art and Cultural Infrastructure): LCCC wants to invest in the "redevelopment of key sites in the city centre, including the Georgian Quarter, the Medieval Quarter, the Riverside area, in or near John's Square, the Railway Area, and the Docklands".*
- *Policy ACT .22 (Maritime Heritage): LCCC wants to "promote the maritime heritage of the city".*
- *Policy BHA.4 (Protection of Limerick's Historic Street Pattern & Medieval Plot Widths): LCCC want to "protect Limerick's historic street pattern, and in particular seek to conserve and enhance the laneways setting of the streetscape and seen to retain and protect historic building lines and traditional plot widths where these derive from medieval origins".*
- *Policy BHA.5 (Survey of Medieval Remains): LCCC require "a detailed Archaeological Survey of buildings proposed for demolition, where in the opinion of the City Council, medieval fabric may be present".*

Figure 3-3. Limerick City Development Plan (2010-2016) Zoning

3.4.3 Road Network

King's Island is located north of Limerick City Centre. The road connection from the Island to the rest of Limerick City are located on the southern half of the Island, there are four main access routes, one from Thomond, one from Corbally and two from the City Centre. The Island Road and Castle Street form part of the N7 route through the area. The route is heavily trafficked and divides the north of the island from the south. Most of the island has a one-way vehicular system. The medieval quarter has very narrow streets, maintaining a traditional medieval look.

There is limited access to St. Mary's Park with only one main entrance from the Island Road Roundabout, as well as, three old access roads. The access point to the residential complex is through St. Its's Street, which leads to a large cul-de-sac.

The Limerick Regeneration Framework Implementation Plan has several objectives to improve movement and connectivity in King's Island. Some of the points in the Movement and Connectivity Strategy include:

- New streets from Beechgrove Avenue to Crecora Avenue.
- Remove the community wall (to the side of church) on Hyde Avenue to allow for physical and visual access.
- Construct new pedestrian crossing/connections around the St. Mary's Park and the rest of the Island.
- Introduce vehicular connection from Clarina Avenue to Byrene Avenue.
- Upgrade existing lane ways to allow better access to the north.
- Provide direct and convenient access between amenities.

  Traffic is discussed in more detail in Section 10 of this report.

3.4.4 Public Realm

King's Island has extensive passive open spaces with potential for a variety of functions, which also provide a valuable visual setting. Unfortunately, these areas are underused and underdeveloped, which offer little in terms of recreational facilities. However there are areas along the northern part of the Island where flood defences have been breached and/or removed to allow access to the locals for swimming, fishing and boating purposes.

A Sli na Slainte is a 3.3 km route which starts at King John's Castle. The walk passes by Bishop's Palace, St. Munchin's Church and Villier's Almhouses. The walk continues along the King's Island Walkway, passes the ESB salmon weir and continues through the large wetland Special Area of Conservation (SAC). The walk passes close to the old military cemetery, along Athlunkard Street, past St. Mary's Church to return to the castle.

There is also a river side walkway on 3 sides of the Island which has been upgraded from Verdant Place along the western, northern and eastern shores of the Island.

The southern part of King John's Castle is an area of landscaped green space and it is commonly used for picnics, meeting spots, and other passive recreational activities.

In terms of active area, it has been suggested that King's Island is significantly underdeveloped and under-resourced in terms of active recreational facilities. At the moment, the island is limited to a handball alley set (rarely used for its purpose) and a soccer pitch located to the east of the island. There is also a walk around the Island. Although at the moment, there is no official legislation suggesting how much outdoor space and recreational facilities should be available, LCCC have acknowledged the "Guidelines for best practice in the design of childcare facilities" and they hope to discuss potential development in 'Volume 2, Open Space Strategy' of the Limerick Regeneration Framework Implementation Plan.

The Island hosts the annual Thomond Swim which starts at the slipway at St. Michael's Rowing Club, follows up the River Shannon parallel to O' Callaghan's Strand as far as Thomond Bridge before following the same route back to the slipway.

In 2011, a Maritime Project at St. Mary's Park saw a number of anglers teach younger groups of fishermen the art of fly fishing.

King's Island also has St. Mary's Scouts which are part of the Limerick 2nd and 6th Limerick troop and sea scouts.

There are areas of well-maintained and attractive hard surface public spaces along King's Island including:

- Church Street and its surrounding area features attractive Georgian Houses.
- Castle Lane to the rear of City Hall offers railings along river, green spaces, and public sculptures.
- St. Mary's Cathedral offer large stone step features leading to Merchant Quay,
- Mathew Bridge to Baal's bridge provides an attractive pedestrian route with a nice riverside view, treelines, and mixed architecture.

Limerick City and County Council introduced a policy specifically aiming at the improvement of open spaces is Policy ACT.25 (Creative spaces), where they aim to "facilitate the establishment of incubators for start-up creative businesses within the city in conjunction with all interested bodies".

3.4.5 Tourism and Amenity

King's Island is an area with a lot of potential for tourism with significant architectural and cultural heritage. There are still remains of the Limerick City Walls and various buildings from the 12th and 13th century including King John's Castle, Thomond Bridge and St. Mary's Cathedral. The area in the south of King's Island has been recognized as the historic core of Limerick or the Medieval Quarter. There is also an Old Military Cemetery at the southern edge of St. Mary's Park that is likely to date back to the mid-Nineteenth Century. King's John Castle is the main attraction in King's Island welcoming over 40,000 visitors from Ireland and overseas. In addition to the cultural heritage, King's Island offers a pathway along the riverside, which goes around the whole Island surrounded by treelines and wetlands. There are SACs within the Island which may attract nature enthusiasts (bird watchers), as well as, runners and cyclists. The Limerick City and County Council has put a number of policies in place to encourage tourism and amenities.

- *Policy ACT.31 (King John's Castle): LCCC want "to facilitate the redevelopment of King's John Castle and Nicholas Street as a tourist destination".*
- *Policy ACT.36 (Cultural Quarters): LCCC aim "to promote and develop cultural quarters in the city and in particular, John's Square, the Georgian Quarter, the Commercial Core, the Medieval Quarter and the docklands".*

The island has 3 rowing clubs namely the Shannon Rowing Club, St. Michael's Rowing Club and Athluckard Boat Club.

The reader is referred to section 10.5.3 of this report which provides details on the Limerick City Cycle Network Strategy.

The overall image and perception of King's Island as an area of deprivation and social and economic problems could have an effect on tourism. The cultural heritage and archaeology of King's Island should be enhanced and promoted in order to attract more local and international visitors. The renovation of King John's Castle alone, doubled the number of tourists in a matter of months. The aim is that the redevelopment and promotion of tourist attractions in King's Island will entice more people to visit.

3.5 Benefits of Flood Relief Scheme

A do-minimum scenario with regard to the flood management scheme would likely only involve the maintenance of existing flood walls within the Island. However, flood walls have proven to be insufficient in successfully preventing previous flooding, therefore it is evident that a wholesome and comprehensive FRS for King's Island is needed for an appropriate appraisal and proposal for the island. It is likely to include more than one type of measure due to the risk of both fluvial and tidal flooding. In addition, serious local pluvial flooding has occurred requiring improvements to drainage in the town outside of the remit of the OPW.

Major improvement to the flood defences in King's Island are needed to prevent the re-occurrences of such flood events. The OPW in conjunction with Limerick City and County Council, ARUP, and JBA will assess, develop, and design an appropriate viable, cost effective

and sustainable flood relief scheme which would aim to minimise risk to residents, existing community, businesses, social amenities, environment and landscape character. The King's Island FRS will complement the LRFIP at making the Island a more appealing place for both the residents and visitors.

3.6 Constraints

3.6.1 Land Use Zonings

Land use zoning and planning in King's Island as proposed by the LCDP and the LRFIP could pose a constraint on the FRS because it could create limitations for construction of flood relief infrastructure. Any construction and development plans must be in accordance to the goals of LCCC and be cognisant of the concerns of the local community. Access to the River Shannon for swimming, boating and fishing should, if possible, be retained. To ensure that the FRS does not interfere in these strategies could be time consuming because it would require continuous meetings with the SAGs and TAGs. Any strategies for the FRS will have to be approved by all stakeholders in order to ensure they do not interfere with any current land use zoning plans. Areas that have been recognized to have tourism, commercial, or retail potential will be reluctant to allow anything which may take away from the aesthetics of the area. The current land use zoning for King's Island can be used to determine the potential type of FRS infrastructure in certain areas.

3.6.2 Insurance

Most of the residential areas in King's Island are not-owner occupied or insured. Therefore, King's Island has a high rate of local authority owned properties, a high rate of derelict housing, poor quality housing well below current and previous building standards. The fact that there are numerous uninsured properties means that local authorities and national governments are responsible of paying recovery and repairs of any major flooding event. The recent floods in King's Island resulted in high financial implications for local authorities, while residents likely incurred little financial damages. Although the flood relief scheme is a large investment, it is envisaged as an insurance policy for King's Island as a whole, to prevent further damage of property and disturbance of local residents.

3.6.3 Built environment and heritage

The presence of various areas of historical, archaeological, cultural importance in King's Island add a constraint to the FRS because any work around these areas has to be limited and must follow specific guidelines. Any structure or building identified as an RPS or NIAH are entitled to a buffer of a few hundred meters around them in order to ensure their conservation. Any work within the buffer zone of a structure or building of architectural or cultural importance must be subject to an appraisal stage, in order to assess the extent of potential damage. The aesthetics of the area and/or views are protected for tourism purposes. Since King's Island has 28 RPS structure and 10 NIAH structures of Limerick City, as well as contains various areas of archaeological potential (Englishtown -Historic town and Bastioned Fort), they pose a constraint for the planning and construction of the King's Island FRS (for more detail see **Section10.Hertigae and Archaeology**). The Special Area of Conservation (SAC) along the eastern side of the Island is protected under European law. The flood risk management options considered for the Island will need to have cognisance of this unique wetland habitat. The sources of water that maintain this habitat will need to be investigated to determine the source of the water ie. tidal or groundwater and the flood control measures will need to ensure that this is maintained.

3.6.4 Road network

The complex and unorganised road network in King's Island allows for isolation of the island and limits the access to areas of historical and cultural interest. One of the biggest reasons for deprivation in King's Island is poor connectivity between the Island (St. Mary's Park) and the rest of Limerick City. Movement and access are under constraint. The southern portion of the Island has good road networks and is connected, which is the reason that most business are located

here. St. Mary's Park, on the other hand, only has one road into it, and very few pedestrian and cycle links. There are also visual constraints such as fences and barriers, which affect the connectivity and aesthetics of the Island. This is a constraint for the flood relief scheme because it is important in the planning of the flood relief scheme that the situation is not worsened. On the contrary, it is an opportunity to improve connectivity of the Island as part of the flood defences, such as the introduction of walking paths, improved river walks, and new roads. (See **Section 11: Traffic)**

3.6.5 Public realm

The FRS must take into considerations ways to enhance public amenities including active and passive green spaces. King's Island has the potential for a variety of functions and provide a valuable visual setting. The constraint for the FRS is recognising these public areas and ensuring that they are covered by the flood protection measure. The FRS must ensure that within its measures that all parks, recreational areas (soccer pitches), and passive and active spaces have been protected from potential floods and the flood management defences. The FRS must ensure the continuity of the walkways around the perimeter of the Island, the continuity of access to the rivers for fishing and swimming and access to the rivers for boating. The flood management defences must also ensure the continuity of the Sli na Slainte on the Island.

The FRS must also consider the visual impacts of the scheme on the locals and flood defences where possible should be designed to limit their visual impacts and intrusions.

3.6.6 Tourism and amenity

The aim of the FRS is to protect the areas that have tourism potential from flooding, as well as, complementing the LRFIP goals in hopes of bringing more local and international tourism to King's Island. A constraint for the scheme is the potential negative effects that the construction of potential flood relief mechanism could pose on tourism of the Island during the construction and development stage of the scheme. The planners should be aware of the tourism hot spots and ensure that minimum disturbance does occur. When developing the scheme these tourism and amenity areas (swimming areas, harbour, fishing, paths etc) should be recognised and if work is carried out around them, special precautions should be taken. These special precautions may take more time to plan, get approved, and executed, which may add to the overall costs of the project, if they are needed.

3.6.7 Residents' perceptions

Residents' expectations and concerns may pose a restraint on the overall acceptance of a new flood relief scheme.

There is a widespread perception that the risk of flooding, and therefore the risk to property and economic activity, will be effectively removed by a variety of flood management measures. There is local awareness of these potential amenity benefits and also a perception that environmental concerns can be accommodated, however, some disadvantages of the flood relief option may exist. The common perception witnessed during the PCD was the timeline of the construction because people are genuinely concerned that another event like the February 2014 flood would take place again. They want to make sure that flood relief measure will be in place promptly. However, it is important that members of the public realise that an FRS is a project which is executed in stages. Although there was a common concern for the visual impact caused by the FRS, most attendees understood that a solution is needed and some option may not be the most appealing (visual impact).

3.7 References

Limerick City & Council. (2013). Limerick Regeneration. Framework Implementation Plan. http://www.limerick.ie/council/limerick-regeneration-framework-implementation-plan

National Children's Nurseries Association. (200-2016).We like this place: Guidelines for Best Practice in Design of Childcare Facilities.

CSO. (2006 & 2011). Central Statistics Office. [Accessed October 2015]. http://www.cso.ie/en/index.html

Limerick City Council. (2010-2016).The Limerick City Development Plan. Planning & Economic Development Department [Adoption date November, 2010).

Health Service Executive. (2010). Community Profile of the Northside and Southside Regeneration Areas of Limerick City.

4 Material Assets

This section of the report addresses the material assets in King's Island and surrounding areas. The material assets within the study area were assessed by consultation with a number of documents including:

- The Limerick City Development Plan 2010-2016
- The Limerick Regeneration Framework Implementation Plan (2013)
- Community Profile of Northside and Southside Regeneration Areas of Limerick City
- EPA data base on IPPC and waste licenced facilities within the study area.
- EPA Focus on Urban Waste Water Discharges in Ireland 2012
- A drawing of ESB services within the Study Area supplied by Limerick County Council
- Consultation with UPC, Eircom, ESB and Bord Gais.

The reader is also directed to **Section 3: Human Beings,** of this report for additional information on material assets in the town.

4.1 Waste Water Treatment Plant

According to Limerick City Council, there are 20,000 households within Limerick City and 6,000 households in Counties Clare and Limerick which use the city sewage system. It has been estimated that each household generated approximately 380 litres of wastewater per day.

There are two main water waste treatment plants (WWTP) in the Limerick agglomeration boundary, these are listed in **Table 4-1 (see Figure 4-1**).

Table 4-1. Water Waste Treatment Plants (WWTP) in the Limerick Agglomeration boundary

WWTP	Local Authority	Treatment Type	Status
Castletroy WWTP	Limerick City Council	Secondary Treatment with NR	Pass
Limerick City WWTP	Limerick City Council	Secondary Treatment Only	Pass

The main sewage system in St. Mary's Park is only considered adequate by the Limerick City Council. The main future goal of the system is to provide a high quality sanitary wastewater collection and treatment system to meet current and future plans. The WWTP treats 11 million litres of wastewater per day to eliminate the discharge of raw sewage into the Shannon River.

4.2 Foul and storm water sewers

Data collated from the Limerick City Council, Water Services team was used to identify existing infrastructure including water mains, and sewers. The Limerick City and County Council aims at reducing the amount of water infiltration into the foul network. It hopes to extend the network, as well as, continue sewer maintenance in the City and repair, replenish, or update existing wastewater collection systems including the separation of foul and storm water. According to the LCDP, Limerick City Council hope to focus on volume control, surface water networks and aim to convey surface water runoff to underground pipes. However, flood-prone areas such as King's Island must take additional measures to ensure a sustainable and efficient system, in which case, designers and planners must take consideration to 'The Planning System & Flood Risk Management-Guidelines for Planning Authorities (2009). The levels of water leakages in King's Island, especially, St. Mary's Park Estate is above 200%, significantly over Limerick City's average of 46% and the target level of 30%. According to Limerick City Council, they are 'committed to upgrading and sustainably developing the water and drainage infrastructure for St. Mary's Park, subject to availability of finance'. The existing water network in St. Mary's Park is serviced by 3 inch cast iron water main network.

Leakage will place an extra pressure on surface water drainage as well as the lack of surface water sewers could create a risk for runoff and potential pollution. In fact, since there is a large system of combined sewers in place in King's Island, there is a high risk for potential water

pollution problems, if flooding resulted in combined sewer overflow (CSO). Combined sewers are sewers that are designed to collect rainwater runoff, domestic sewage, and industrial wastewater in the same pipe. They were initially introduced as a cost-effective approach to sewage drainage. Combined sewers are intended to transport all the wastewater to the WWTP, where it is treated and then discharged to the waterbody. However, during periods of heavy rainfall, the wastewater volume in a combined sewage system can exceed its capacity and causes pluvial flooding. For that reason, they were built to overflow occasionally and discharge excess wastewater directly into the waterbody. The problem is that CSOs contain not only storm water but also untreated human and industrial waste, toxic materials, and debris, which in times of flooding could be discharged directly into the River Shannon or Abbey River or directly into the homes of flooded houses.

The Limerick Drainage Scheme has encouraged the upgrading of the existing sewer network and pumping stations. The completion of Limerick's Main Drainage Scheme, Phase 1, ensured that the city and the surrounding areas were served by a modern sewage treatment infrastructure. The drainage system was designed in 1999 to fulfil the demand of the city and surrounding areas, however, it is evident that updates to the system will be needed on both the foul and surface water drainage systems. Phase 2 of the of Limerick's Main Drainage Scheme will ideally aim at assessing the current capacities of the plant, reducing quantity of surface water infiltration.

According to the Limerick City Council Water Services, Drainage Layout.

- There are four outfalls on the west and southwest edge of King's Island which discharge into the Shannon River (two on Verdant Place, one a few metres upstream of Thomond Bridge, and one located just downstream of the Limerick City Museum). Three of the outfalls are connected to combined sewers and one is connected to a surface water sewer.
- There are six outfalls located on the south of King's Island discharging into the Abbey River. One is located on George's Quay, along Creagh Lane. There is one outfall located close to the Absolute Hotel, on the southeast portion on the Island. There are three outfalls around Baal's Bridge (two on the south portion of the bridge which connects to Limerick City and one on the north portion of the bridge which connects to King's Island). Finally, there is one located on Plais an Bhainc (Bank Place). All the outfalls are connected to combine sewers.
- There is an outfall located on the southeast of the Island, located beside the Sir Harrys Mall, the outfall is connected to a combined sewer that goes along Long Lane.
- There is one pumping station in the northern part of the Island located beyond St. Mary's Park, north of the junction of St. Munchin's Street and Oliver Plunket Street.
- There is a surface water sewer connected to the pumping station, as well as a combined sewer. There are only a few surface water sewers on the Island, they are mostly located in the central area of King's Island and none are connected to each other, they all connect to a combined sewer pipe.
- The Island is made up of predominately-combined sewers, but the sewer systems seem to be split into two.
- The north portion of the Island (St. Mary's Park) has a combined sewer system that discharges at to outfall along Verdant Place.
- The southern portion of the Island has a combined sewer system that continues towards Limerick City Centre.
- There is an overflow drainage surrounding the whole island edge, however, the junction points between the combines sewer and the overflow drainage are limited.
- There is also no direct connection between surface water sewers and overflow sewers.

4.3 Drinking Water

Limerick City Council has made potable water a priority under 'Policy WS.1 Potable Water', where Limerick City Council makes themselves responsible for continuously providing high

quality drinking water to meet local demands. Limerick City Council is producing over 60,000m3 per day of drinking water at the Water Treatment Plant in Clareville. From that production, 40,000m3 is transported to Limerick City and approximately 20,000m3 is delivered to other consumers in County Limerick and County Clare respectively. The source for water abstraction is the River Shannon. The Water Treatment Plant (WTP) in Clareville has been experienced ongoing renovations in order to meet present and future demands. The plant has the capacity of 87 million litres per day (MLD) water production levels, the aims is to extend facility to 140MLD.

St. Mary's Park is currently being serviced by 3 inch cast iron water main network, unfortunately, the network is not sufficient to meet the current demands and fire flow standards. Water usage in St. Mary's Park was estimated by using an average consumption rate of 135 litres per person per day, there are approximately 459 houses in St. Mary's Park (from 2-5 inhabitants per house), this resulted in an estimated expected usage of 400-600 m3/day in the estate and approximately 183m3/d per person (Limerick Regeneration Framework Implementation Plan, 2013).

4.4 Electricity

The following information was sourced from information provided by ESB network on the electricity services provided on King's Island.

4.4.1 Underground MV/LV (10kV & 400V/230V) underground cable route

There are only underground lines present at on the southwest of the Island. The underground cable routes can be found on the following roads:

- Mary Street
- Bridge Street
- George's Quay
- Athlunkard Street
- Oliver Plunket Street
- St.Columcille Street
- St.Ita's Street
- Island View Terrace
- Thomond Bridge: located over the centre of each arch, the cable is only 25cm from the surface and covered by steel plate 3m long.

Southeast of the Island

- Island Road
- Bridge Street
- Geroge's Quay
- Mary Street
- Sir Harry's Mall
- Abbey Lane

The southern portion of the Island has an extensive network of underground electricity lines, therefore any work around these areas should follow special precautions and safety measures.

4.4.2 Overhead MV (10KV/20KV) Overhead lines and LV (400 V/230V) Overhead Lines

There are low voltage overhead lines scatted around St. Mary's Park estate, on the following streets:

- St. Munchins Street
- St.Ita's Street
- Oliver Plunkett Street
- St.Columcille Street
- Bishop Street

These overhead lines should not pose any serious constraint to the scheme, since they are located within St. Mary's Park estate and there are no FRS works proposed there.

Some of these underground cable routes are located underneath roads that are in close proximity to either the Abbey or Shannon River such as on George's Quay, Sir Harry's Mall or Abbey Lane, among others. These could pose constraints to the scheme both in the construction phase and implementation phase.

There is one medium voltage overhead line at the northern section of the Island which moves across the north east section, over the Abbey River and towards Mail Road. This overhead line may pose a constraint if work on the embankment or north wall is carried out around it. Several things must be considered if work is proposed around the MV overhead line:

- Whether the height of pole is appropriate and allows for work to be carried out without obstacle.
- Whether height of wire is appropriate,
- Stability of ground
- The possibility of resident being back fed from elsewhere if overhead line must be powered off.
- The possibility of insulating wire

Finally, if work is carried out on Thomond Bridge (ESB Cable over centre of arch), the location, materials and equipment (non-conductive), as well as, a safe means of access must be considered because the work would entail being in close proximity to water.

In areas where there may be some power disruptions as a result of works, the possibility of back feeding power to the residents from other lines should be considered. Ensure that when staff is checking for the presence of underground cables, they are following 'Avoidance of Electrical Hazards when digging' safety document (ESB, 2005).

4.5 Gas Network

The following information was sourced from Bord Gais Networks who provided drawings on the gas networks on King's Island. Most of the gas pipes follow a path around the St. Mary's Park estate in the north portion of the island and surrounds the commercial and retail areas in the southern section. These are below the following streets on King's Island:

St. Mary's Park is surrounded by underground low pressure inserted pipes and underground abandoned distribution pipes. The inserted pipes run along the following streets:

- Oliver Plunkett Street
- St.Ita's Street
- St.Munchin's Street
- St. Columcille Street
- St. Senan's Street

The mid-section of the Island, from the beginning of Verdant Place and Island Road to Athlunkard Street is surrounded by underground low and medium pressure inserted pipes, along the following streets:

Low Pressure

- Verdant Place
- Island View Terrace
- Assumpta Park
- Lee Estate
- Barrak Street
- Convent Street
- Nicholas Street
- Francis Place
- Newgate Lane
- St. Peter Street
- Bishop Street

- Exchange Street

High Pressure

- Thomond Bridge
- Castle Street
- Island Road
- Brian Boru Square
- St. Augustinian Place

The southern portion of the Island from Bridge Street/Athlunkard Street to the end of Bridge Street, Mary Street, and Island Road is surrounded by underground low and high pressure inserted pipe and an underground low pressure distribution pipe:

Low Pressure

- George's Quay (Low pressure distribution pipe)
- Mary Street
- Emily Place
- Creagh Lane
- Sir Harry's Mall
- Abbey Lane
- River Lane
- Keyes Row

High Pressure

- Island Road
- Bridge Street

4.6 Broad Band

The following information was sourced from Virgin Media. It became evident that broadband was only available in the southern part of the Island (closest to the city centre), however, no connection was available for the residences in the St. Mary's Park Estate.

4.7 Agriculture

Although there is some open space in King's Island, none of it is used for agriculture. Some local residents raise horses and keep them in the open area, while allowing them to graze the grass. However, this practice is carried out at a small scale (no more than a few horses per owner).

4.8 Waste Management

The waste management in place in the Limerick/Clare/Kerry region, complies the Waste Management Act 1996. Limerick city does not operate a working landfill, therefore all municipal waste from the city is collected by private waste contractors with waste collection permits. The waste is taken to landfills in other parts of the country. A 2007 Limerick City Annual report stated that 77% of municipal waste was being landfilled, a value significantly higher than the target of 14%. The closest licenced Waste Facilities to King's Island is the Longpavement Landfill Site in Monabraher managed by Limerick City and County Council and, a waste transfer station, located in Ballykeefe Townland and operated by Starrus Eco-Holding Limited (See **Figure4-1**).

There is a lack of recycling facilities for construction and demolition waste, as well as a lack of biological waste treatment plants in County Limerick, however, this is also a national problem. A number of private waste contractors (Mr.Binman, Recycle Right, O'Reilly Brothers Environmental, Fitzgerald Waste Management Ltd, and Derry White Skip Hire Ltd) have waste collection permits and operate as waste collection services in Limerick City and Council.

King's Island, especially, St. Mary's Park Estate do not have a sustainable waste management strategy. There is a big street littering problem, due to limited number of public bins and lack of education. There is a strip of land on Munchin's street that was used as an illegal landfill site, where local residents have been dumping domestic refuse. The houses on Munchin's street back

onto the landfill, providing limited surveillance but also adding an aesthetically displeasing view and odour. This illegal dump has now been remediated by Limerick City Council.

4.9 IPPC Licenced Facilities

A review of the EPA data base found two IPPC licences in the area. The first IPPC licence (P0329-01) was issued to James McMahon Limited for the manufacturing and supply of timber and other construction materials. The second IPPC licence (PO436-01) was issued to Atlas Aluminium Limited for their metal production, metal coating treatment, and aluminium die casting.

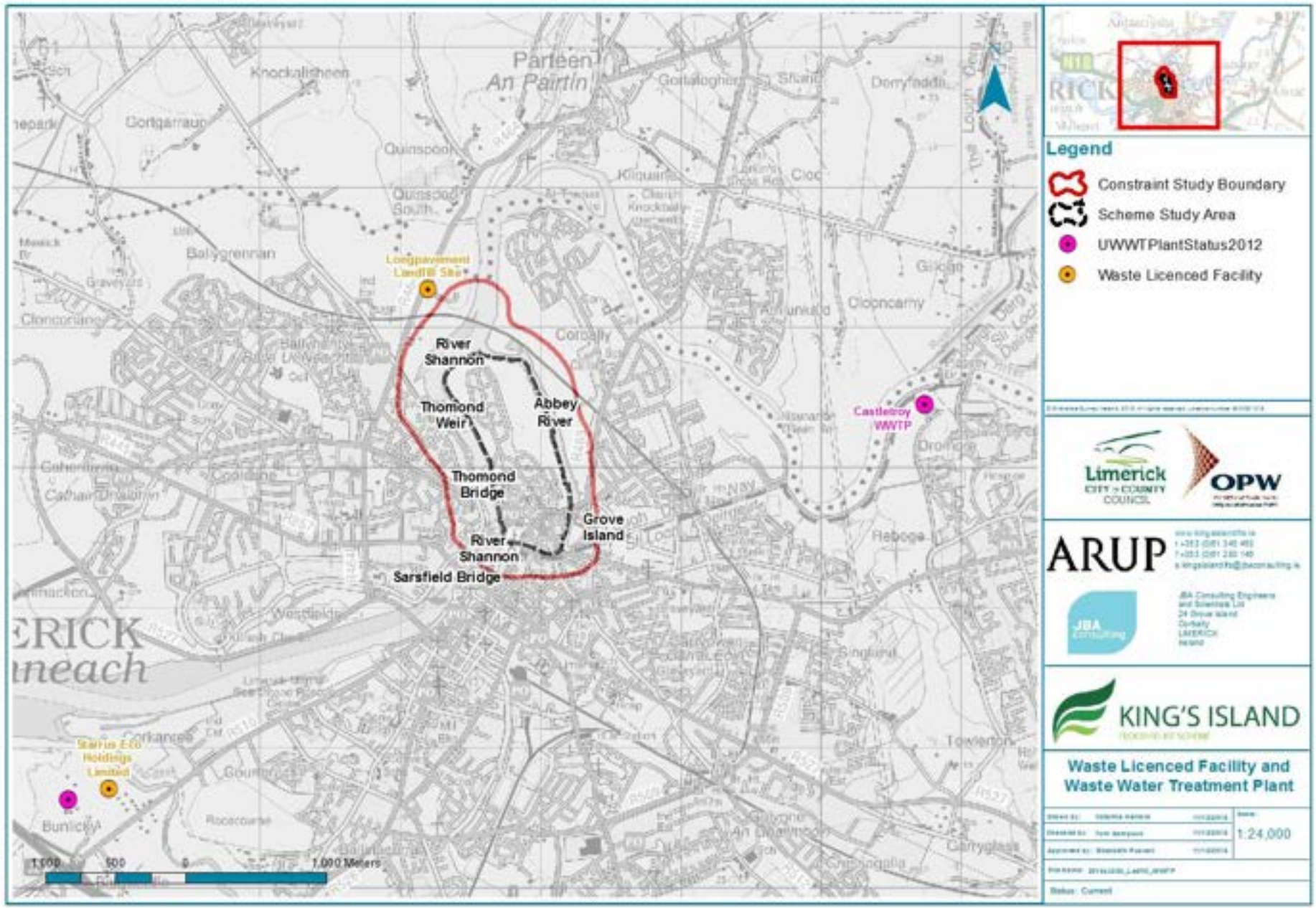
4.10 Car Parks

King's Island has public car parks located on:

- Island Road
- George's Quay
- Sheep Street

There is also parking in King John's Castle and St. Mary's Church.

Figure 4-1. Waste licenced facilities and Waste Water Treatment Plants (WWTP) around study area



4.11 Constraints

The key restraints with regard to material assets are:

- The presence of the underground and underwater cables should be clearly identified before any excavations on land or in-river works are commenced.
- LCCC and the National Roads Authority will be consulted with in relation to the potential impact of a flood relief scheme on the existing or future road networks

4.11.1 Fouls and Storm water Sewers

- Any flood relief scheme should examine the likelihood of flooding and the effect of the flooding in combined sewers (ie. Amount of raw sewage that could potentially enter the river system).
- The out-of-date sewer system in King's Island poses a constraint in the development of a FRS because even if flood prevention infrastructure were introduced, the combined sewer system may not have the capacity to withstand an extreme flooding event, therefore the risk of CSO discharge into the Shannon or Abbey River and flooded houses remains.
- Following identification of drainage routes, the FRS team must ensure that these sewer systems will not interfere with the construction of any flood defence mechanisms (flood walls etc). The constraint may be in the actions needed (identification, upgrading, replacement, or diversion) to facilitate construction, as well as assessing the preferred location for the defence infrastructure. Identifying the location of the outfalls and the overflow pipes (located along the edge of all of King's Island) is also crucial for the planning and construction phases of the scheme. If construction is being carried out nearby combine sewer or surface water sewer, special precaution should be taken.
- Consideration should be given to connecting all of the existing storm water discharge points into a single adequately sized or a number of discrete discharge locations. The final design of the outfalls should ensure no ingress of seawater into the pipes.

4.11.2 Electricity

- Any construction work that takes place in close proximity to underground electrical cables should be in line with the health and safety precautions that must be followed because underground electrical cables can cause fatal or severe injuries. The HSE suggests four elements when working near buried cables: 1) planning the work 2) using cable plans 3) cable locating devices 4) safe digging procedures. This could be seen as a constraint because extra attention and precautions will have to be given to simple routine operations making the planning and execution process longer, however, the health and safety of personnel working on the project is crucial.
- During the construction stage, special measure would have to be taken in order to ensure the construction does not interfere in any of the underground routes. In addition, if constriction takes place in close proximity to ESB lines, some areas may have to be cut-off for the remainder of the work. This could cause a constraint to local residents and business.
- These underground lines that are in close proximity of the rivers may be at risk of flooding in extreme weather conditions causing power outages in areas of King's Island. It is important to take into consideration the location of the underground cable routes in the planning and construction stages of the scheme.
- EBS provides some guidelines on safe digging in their manual 'Avoidance of electrical hazard when digging' (ESB, 2005).

4.11.3 Gas Network

- Similarly to the underground electricity lines, the gas network pipes could create a constraint for the FRS due to the need to plan and work sensibly around it.
- Similar measure like the ones suggested by the HSE (ESB underground lines) apply to construction work around underground gas pipes.
- The pipes along Verdant Place and Sir Harry's Mall are the closest pipes to the surrounding rivers which is a major constraint for the FRS because there are flood walls

proposed along Verdant Place (Verdant Place Flood Wall) and along Sir Harry's Mall (Sir Harry's Mall Flood Wall). Special precautions must be taken in the planning, development, and construction phase to ensure that the wall structure will not be restricted due to the presence of the pipes and similarly that the construction of the flood defence walls will not hinder the gas network system in place.

4.12 References

1. Limerick City Development Plan (2010-2016) (http://www.limerick.ie/council)
2. Limerick Regeneration Framework Implementation Plan (2013) (http://www.limerick.ie/council)
3. CSO Agricultural Census, 2000
4. EPA website (www.epa.ie)
5. ESB Network Website (http://www.esb.ie/main/home/index.jsp)
6. Bord Gáis Energy Website (http://www.esb.ie/main/home/index.jsp)
7. Virgin Media:(https://www.virginmedia.ie/?CMP=sbr&gclid=CMni85L2l8kCFWgYcgodGq4HYw&gclsrc=ds)

5 Water

5.1 Introduction

This section of the Constraints Report describes the hydrological environment within the study area. The term hydrological environment includes freshwater (rivers, lakes and groundwater), transitional waters and coastal waters.

The study area is located in the Shannon River Basin District and surrounded by the Limerick Docks Transitional Waterbody. Limerick Docks is part of the Shannon Estuary, which extends from the Atlantic Ocean up to Limerick and has a length of 97 kilometres. The Shannon Estuary is divided into various transitional waterbodies: Lower Shannon Estuary, Fergus Estuary, Upper Shannon Estuary and **Limerick Docks**.

The principal surface water bodies within the study area are:

- The Shannon River
- The Abbey River

Both the Shannon and Abbey Rivers are within **Limerick Docks** Transitional Waterbody that extends across 3.03Km2. Figure 5-1 outlines the water features within the Study Area.

Groundwater is present within the Study Area.

5.2 Methodology

A desk top assessment of the study area was undertaken to gather data on the quality of freshwater and estuarine water. Recent publications (referenced at the end of this section) were reviewed and data from the following sources:

- European Communities Environmental Objectives (Surface Waters) Regulations, 2009 (S.I.272 of 2009)
- Water Quality in Ireland 2007-2009 (EPA)
- Water Matters-Water Maps Viewer
- Water Matters: Shannon River Basin Management Plan (2009-2015)
- Limerick City Development Plan
- EPA water quality Envision data base
- Geological information on the Geological Survey of Ireland’s data base

5.2.1 Baseline Evaluation Criteria

The EU Water Framework Directive (WFD) 2006/60/EC was adopted by the European Parliament Council in 2000. The WFD was introduced to establish a legal framework for the protection, improvement and sustainable management of inland surface waters, transitional waters, coastal waters, and groundwater. The goal is to maintain continuous monitoring of waterbodies in order to prevent deterioration in the existing status of waters and to ensure that all waterbodies achieve at least a 'Good Status' by 2015. When the WFD was introduced in Ireland in 2003, eight River Basin Districts (RBDs) were established. The European Communities Environmental Objectives (Surface Waters) Regulations, 2009 (S.1. 272 of 2009) outline the criteria and standards used to classify surface waters in agreement with the ecological objectives of the WFD.

The regulations set for biological quality elements and physiochemical conditions are the following: temperature, oxygen balance, pH, salinity, nutrient concentrations, and specific pollutants. These parameters make up the **'Ecological Status'** of the waterbody. The **'Chemical Status'** is determined by different thresholds for specific chemical pollutants recognized as priority and priority hazardous substance. A waterbody must receive a score of 'good ecological status' and 'good chemical status' in order to be recognised to have an overall 'good status'.

5.3 Transitional Waterbody

Limerick Dock is considered a heavily modified transitional waterbody (HMWB) for uses such as navigation (example ports) (Figure 5-1; Figure 5-2; Figure 5-3). The close proximity to Limerick City and the surrounding urban areas, as well vessel and boat traffic could increase the risk of

runoff containing dangerous substances produced by combustion of hydrocarbon fuels or harmful toxics from everyday households, constructions sites and water or wastewater treatment plants.

5.3.1 Water Framework Directive (WFD) Status and Risk

The Environmental Protection Agency (EPA) is the body tasked with sampling and reporting on water quality around Ireland. The EPA has carried out continuous monitoring of waterbodies around Ireland from 2007-2012 with the help of various organisations such as Marine Institute Ireland and Inland Fisheries Ireland. Transitional waters were monitored, assessed, and classified. Limerick Docks (Water Body Code IE_SH_060_0900) was recorded in the 2010-2012 assessment as a Transitional Waterbody of overall **Moderate status** (interim classification) with an overall risk result of **1a At Risk (See Table 5-1 and Table 5-2).**

Table 5-1. WFD Risk Value Table

Risk Value	WFD Status
1a	At risk of not achieving good Status
1b	Possibly at risk of not achieving good status
2a	Expected to achieve good status
2b	Strongly expected to achieve good status

The EU has identified priority and priority hazard substances which include certain metals, pesticides, hydrocarbons, volatiles and hormone-disrupting compounds. In the assessment of the Shannon River Basin water quality status, two estuaries **failed** in relation to certain Specific Pollutants and Chemicals: the lower Shannon estuary and **Limerick Dock** waterbody. Although the Limerick Dock water quality status has been classified as **unpolluted**, under the EPA water quality assessment, the transitional waterbody **failed** the **chemical status** due to the breach of levels of brominated diphenlyethers, antracence, chloroalkenes and polyaromatic hydrocarbons. Assessments are underway to determine the sources of pollution and determine suitable strategies to lower the chemical pollution.

The Limerick Dock waterbody is classified as part of a Special Area of Conservation (SAC) and a Special Protection Area due to the diverse and valuable flora and fauna present (See **Section 7: Ecology and Fisheries**). For that reason, the current objective for Limerick Docks transitional waterbody is to restore water quality to 'good status' by 2021.

The most recent status update on the Limerick Dock transitional waterbody Water Quality (WQ) was December 2014, where it received a status of unpolluted waterbody. The WFD status 2010-2012 score and the Criteria used by EPA in determining the WFD classification for Limerick Dock are displayed in **Table 5-2** below.

Table 5-2. Limerick Dock Transitional Waterbody Status

Eco-Status	DIN	MRP	DO	BOD	OOA	PHY	Fish	OOAO	Hydro-morphology
Moderate	Good	High	High	High	High	High	Good	Moderate	Moderate (pHMWB)

DIN: Dissolved Inorganic Nitrogen
MRP: Molybdate Reactive Phosphate
BOD: Biochemical Oxygen Demand
OOA: Open Ocean Aquaculture
PHYTO: Macroalgae-Phytobiomass status
OOAO: One-out-All-Out Status Classification
HMWB: Heavily Modified Waterbody

5.3.2 Q-Rating

The WFD status was used to determine the Q-value for Limerick Docks using the EPA's Q-Rating system. The EPA uses the Q-Rating system for the biological classification of water systems by using macro-invertebrate sensitivity, abundance, and diversity as indicators of water

quality. The Q Rating system condenses the biological information into a simple 5 point biotic index (the Q value). **Table 5-3** below illustrates the rating system and water quality.

Table 5-3: EPA Q-Rating System

Q Value	WFD Status	Pollution Status	Condition
Q5, Q4-5	High	Unpolluted	Satisfactory
Q4	Good	Unpolluted	Satisfactory
Q3-4	Moderate	Slightly Polluted	Unsatisfactory
Q3, Q2-3	Poor	Moderately Polluted	Unsatisfactory
Q2, Q1-2, Q1	Bad	Seriously Polluted	Unsatisfactory

Limerick Docks is classified as a Transitional Water Body (Water Body Code IE_SH_060_0900) of WFD **Moderate Status** and within the Shannon International River Basin District (SIRBD) from 2010-2012. The Q-value of Limerick Dock (2010-2013) is Q3-Q4 with an unpolluted/slightly polluted status, making its condition satisfactory. The physiochemical quality elements (ecological status) and chemical pollutants (chemical status) threshold applicable for transitional waters, as specified by the *European Communities Environmental Objectives (Surface Waters) Regulations, 2009 (S.1. 272 of 2009)* are displayed in **Appendix (X).**

The Shannon River Basin District Transitional and Coastal Action Plan (2008) carried out a Pressure Based Risk Assessment and determined that Limerick Dock is at risk of land-based point source pressures such as combined sewer overflows, treatment plant overflows and direct licensed discharges. These risks are heightened by the potential fluvial and tidal floods that are probable in the area. Various mechanisms have been identified and recommended in order to restore Good Status of Limerick Dock waterbody, these include:

- Better monitoring and management of point source pollution (Licensed discharge, WWTPs and nutrient inputs)
- Flow amelioration work in the Abbey River
- Flood relief measure and infrastructure
- Control of urban waste discharges
- Control of unsewered waste water discharges

Figure 5-1.Shannon Estuary System

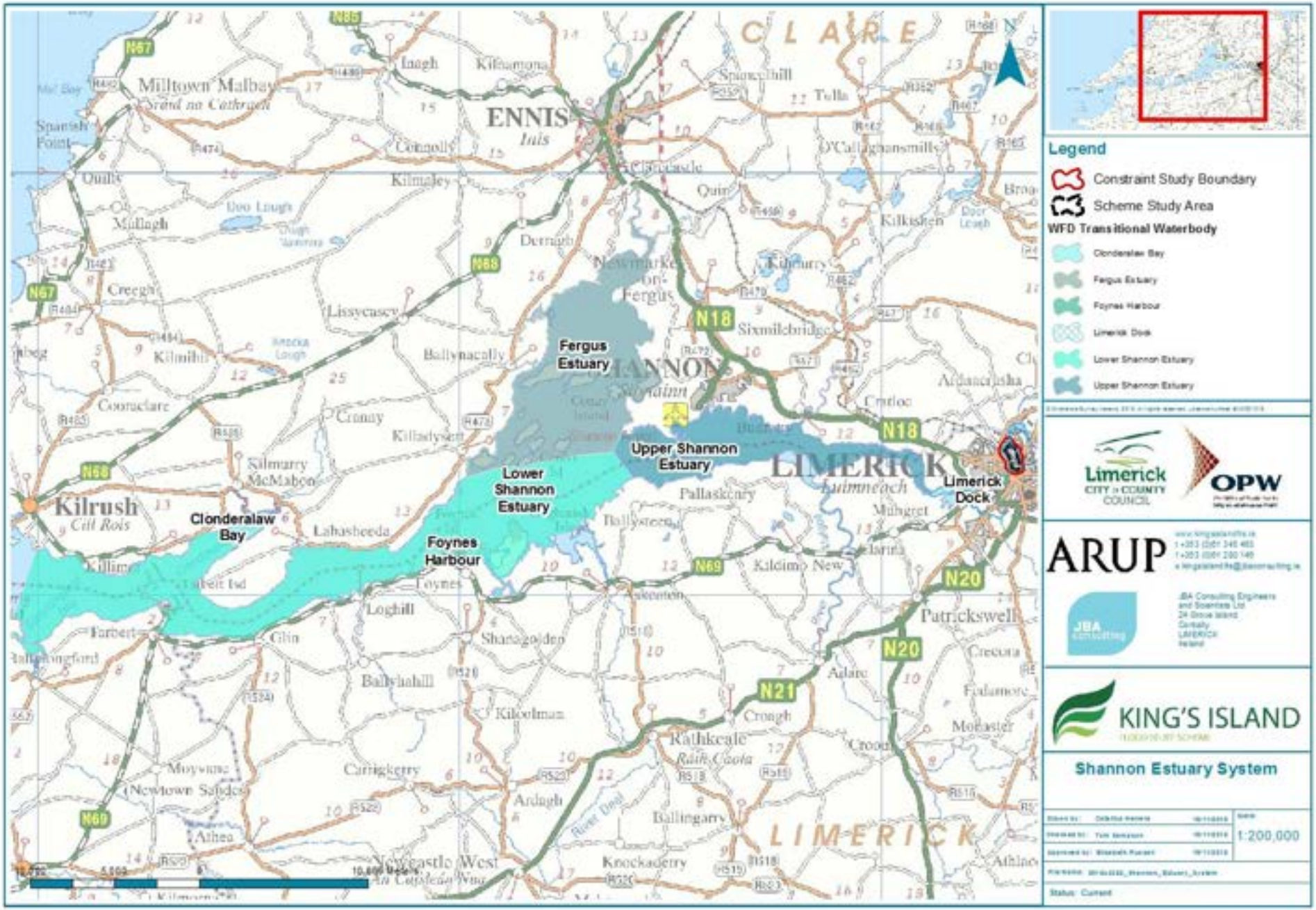


Figure 5-2.Transitional Waterbody WFD Status (2010-2012)

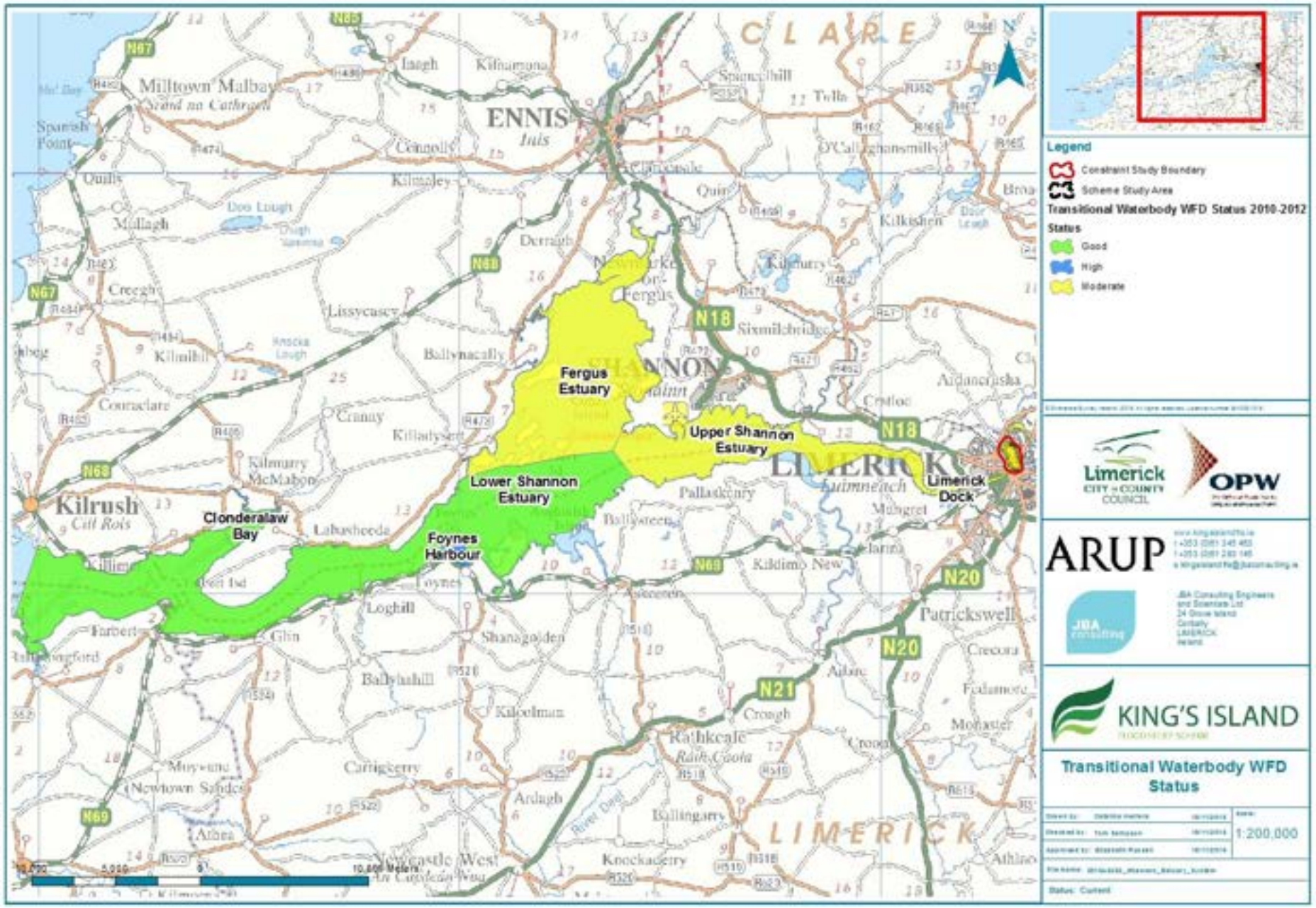
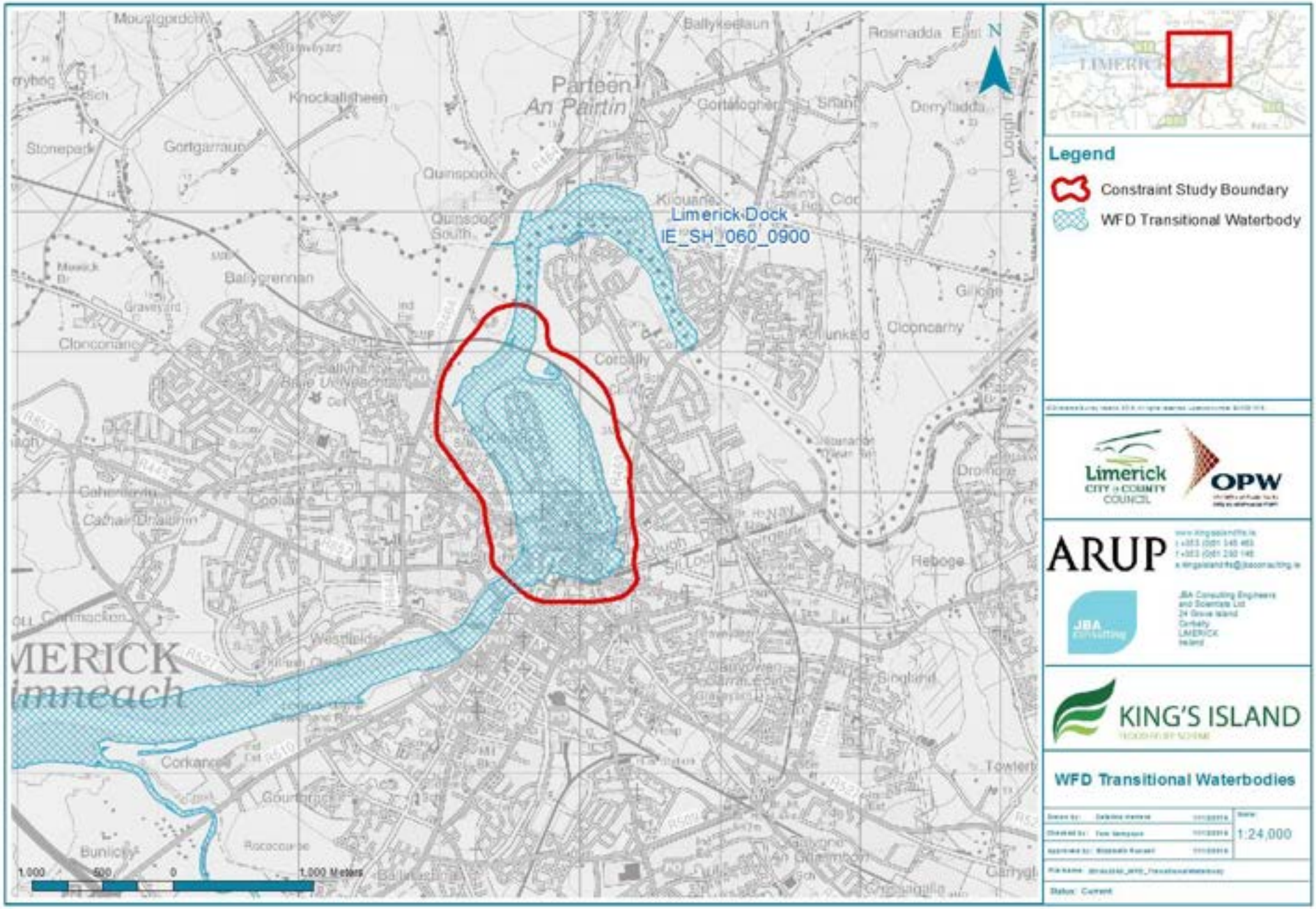


Figure 5-3. Limerick Dock WFD Transitional Waterbody



5.4 Rivers in the Study Area

5.4.1 Abbey River

It is believed that King's Island formed from the distributary of the River Shannon (Abbey River). It is a heavily modified waterbody that diverts from the Shannon River at the northeast edge of King's Island and continues along the eastern side of the Island before it meets the Shannon at a confluence at the southwest of the Island (the Potato Market). The Abbey River is considered to be part of the Limerick Docks transitional waterbody of the Shannon Estuary.

5.4.2 Shannon River

River Shannon is the longest river in Ireland, it begins in County Cavan and extends to Limerick along 370 kilometres of waterways. It drains in the Shannon River Basin which is an area of 17,000 kilometres sq. The study area, King's Island, Limerick City, is located at the head of the Shannon Estuary (Limerick Dock Transitional Water Body) where the Shannon River begins to get wider before flowing into the Atlantic Ocean. The Lower Shannon is a valuable watercourse for fish including some protected Annex II species, as well as, being a migratory route for Atlantic Salmon (**See Section 7: Ecology and Fisheries).**

The Q-Score and WFD Status of the River Shannon surround study area can be found under the Transitional Waterbody Section **(Section 5.3).**

There are a few tributaries **upstream** of the study area, along the Shannon that may be affected by the introduction of flood relief infrastructure. The Shannon (Lower) and its tributaries, as well as, North Ballycannan River. The change in water levels or flow rates could have an effect upstream, therefore it is important to consider these waterbodies and their current status.

The Shannon (Lower) (006) is River Waterbody WFD Risk Score 2010-2012 received an overall risk value of **1a At Risk,** at risk of not achieving good status and the River waterbody WFD Status 2010-2012 was unassigned.

The North Ballycannan River (010) River Waterbody WFD Risk Score 2010-2012 received an overall risk value of **1a At Risk,** at risk of not achieving good status and the River waterbody WFD Status 2010-2012 was unassigned.

The consideration of the river system surrounding the study area will allow for a larger scope when it comes to planning and developing the flood relief scheme measures.

5.5 Lakes in the Study Area

Lough Derg is located northeast of King's Island and Limerick Dock transitional waterbody but it is outside the Study Area.

5.6 Coastal Waters within the Study Area

There are no coastal waters present in the study area.

5.7 Groundwater within the Study Area

There are two Groundwater bodies (GWB) within the study area that are of significant importance to the study: Limerick City North (IE_SH_G_139) and Limerick City East (IE_SH_G_138) (See **Figure 5-4**). They belong to the hydrometric area local authority of Shannon Estuary (25), Co. Limerick. The GWB is low-laying, with elevations ranging from <10mAOD to about <40mAOD. Groundwater recharge occurs over most of the groundwater via rainfall, soaking though the subsoil and directly to the aquifer via outcrop. Urban and paved areas inhibit groundwater recharge. These GWB (Limerick City North and East) sustain flows into the surrounding rivers and streams the flow through the GWB (Shannon and Abbey River).

Table 5-4. Groundwater bodies within study area

GWB Name	Chemical Status	Quantitative Status	WFD Status
Limerick City North	Good	Good	Good
Limerick City East	Good	Good	Good

Limerick City North and East GWBs are used for drinking water. They both extend throughout Shannon District and have been described to have productive fissured bedrock. The existence of boreholes imply that the ground conditions are usually circa 2-7 metres depth of soft to very soft clays(SPT<10) over gravel. (**See: Section 8: Soils and Geology**).

The WFD Risk Score for both Limerick City East and West GWB are **1a At Risk** (**see Table 5-1, in Section 5.3.2).** This means that the GWBs are at high risk of not achieving good status.

A review of the Geological Survey of Irelands data base (www.spatial.dcenr.gov.ie/) identified that there is a range of groundwater vulnerable areas within King's Island alone (See **Figure 5-5**). Most of the island has a vulnerability level of **moderate**, however it has pockets of **high** vulnerability and **X** vulnerability (Rock at or near surface). The areas surrounding King's Island (Limerick City) are variable as well, being dominated by moderate and high levels of groundwater vulnerability.

According to the GSI characterisation, both GWBs are unconfined with the rivers and streams in hydraulic continuity with the aquifer, which means that if GWBs become contaminated, the rivers will also be affected.

There are various groundwater pressures present that should be identified. Groundwater is vulnerable to seepage though the gravel layer underneath, due to the fissured bedrock. Interactions across the embankment in terms of hydraulic continuity with water levels in the Abbey River should be reviewed and understood. The aim is to not interfere with groundwater connections or even worse, contaminate the groundwater body during the construction of flood defence mechanisms (flood defence wall, embankment etc). Point source pollution poses the greatest threat to groundwater through septic tank effluent, sinking streams, leakages, and leachate from waste disposal sites. There was some illegal dumping sites on Islands Fields, St. Mary's Park in King's Island, but this has been removed by Limerick City Council.

Figure 5-4. WFD Groundwater Bodies

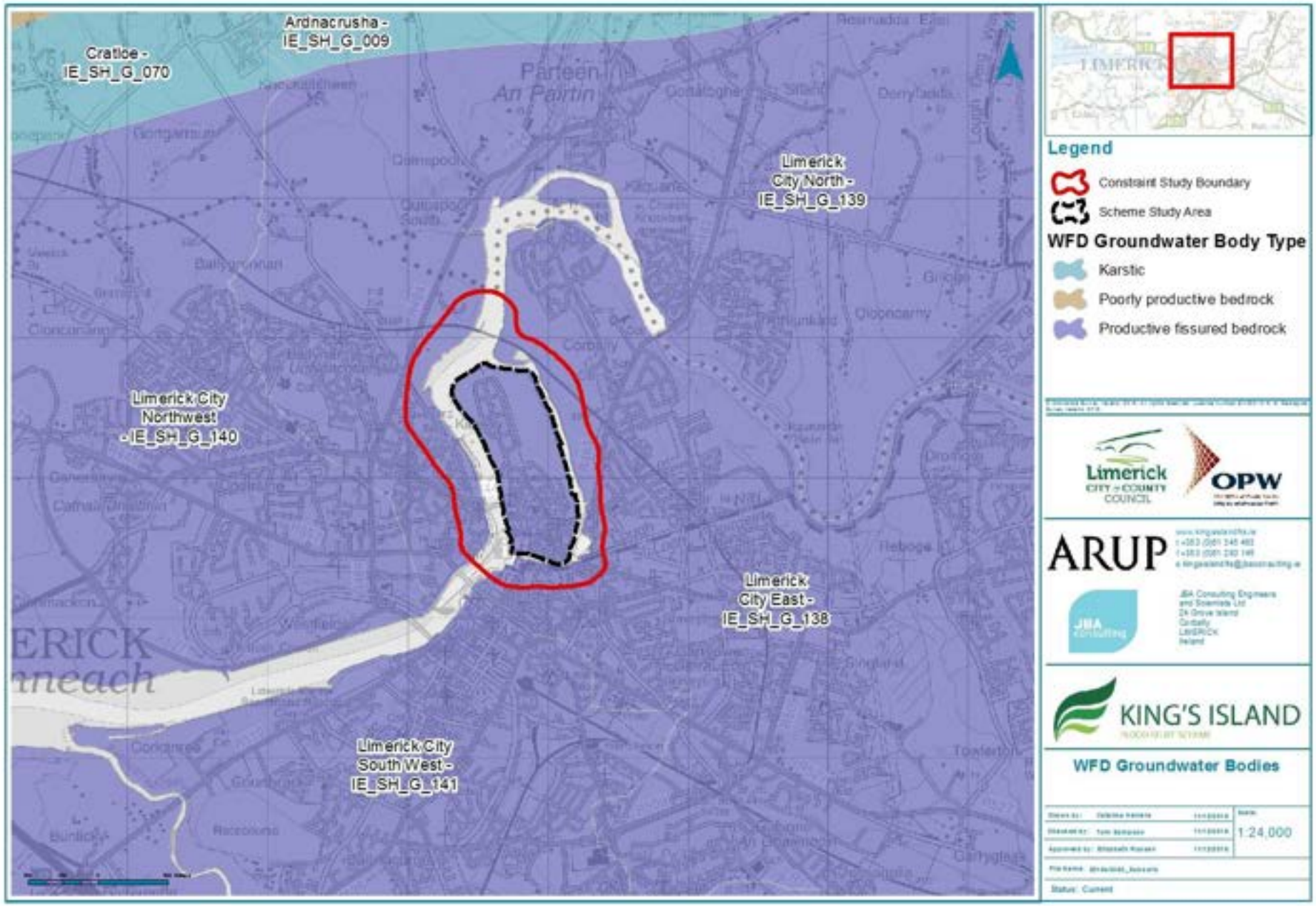
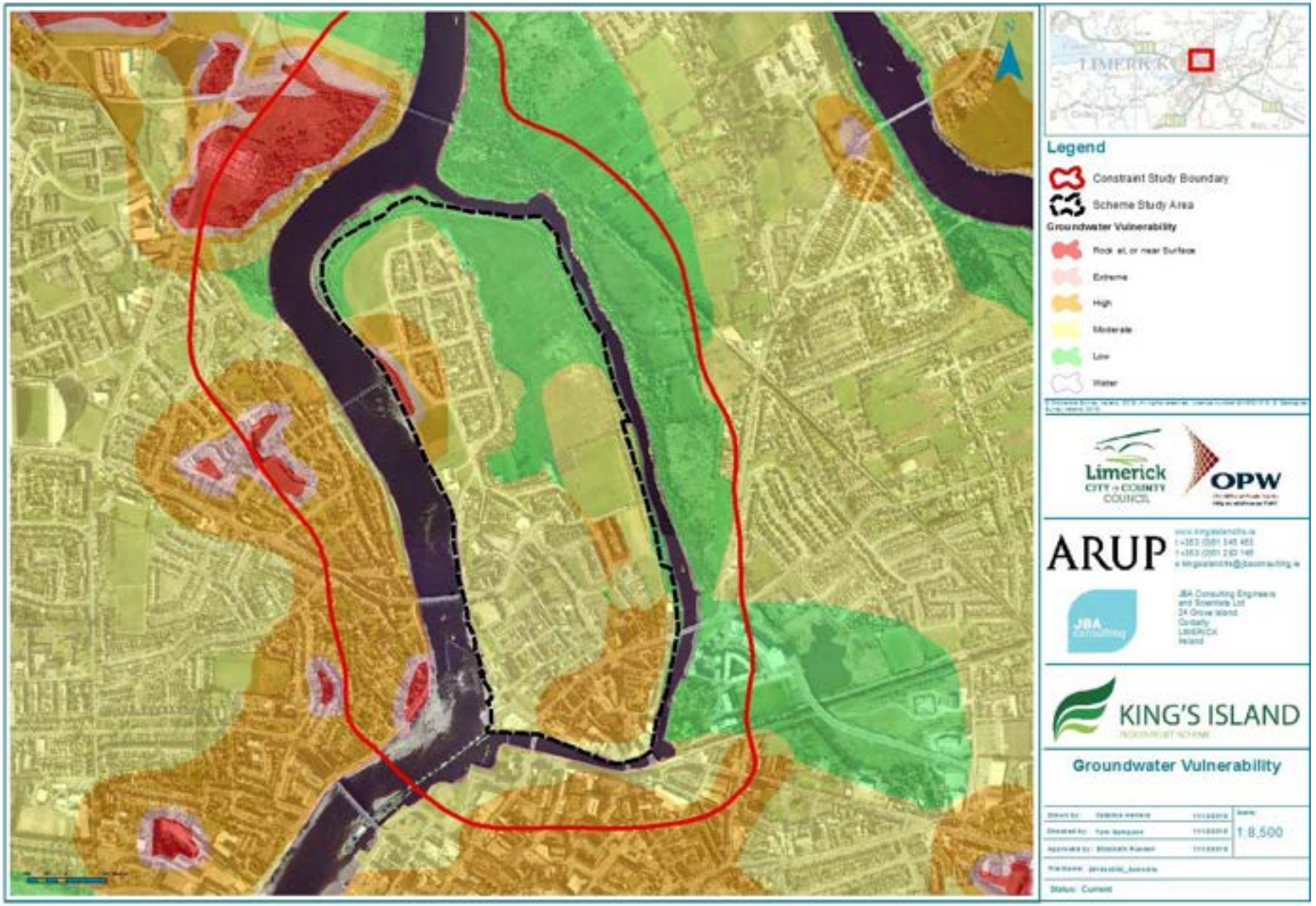


Figure 5-5. Groundwater Vulnerability



5.8 Summary of Constraints

- The surface water surrounding the study area (Shannon and Abbey River) is a Transitional Waterbody classified as Limerick Dock. The waterbody is currently at WFD status of moderate and is not likely going to achieve 'Good' status by 2015. The waterbody also failed the chemical status assessment due to the presence of priority and priority hazard substances. Given the current state of the waterbody it is important not to worsen its status. Therefore all possible risks of point source pollution or runoff during the construction of the FRS should be assessed and prevented.
- The construction phase of the development of flood relief infrastructure has the potential to pose a threat to the water quality in the River Shannon.
    - Release or run-off of excessive amounts of suspended solids from site preparation or development of construction.
    - Accidental escapement of bulk liquid cement or contaminated material from the site to the Shannon or Abbey River.
    - Unintentional discharge of oil/diesel from the site to the Shannon or Abbey River.
    - A Construction Environmental Management Plan will be required before commencement of any construction works. This should be approved in advance with the NPWS and IFI.
- The flood relief scheme should ensure that sewer overflows do not enter the waterbody. Therefore avoid flood alleviation scheme that would impound water in the harbour because there is a possibility that effluent from treatment plants and sewages could be impounded. The effluent may increase the levels of nutrients in the harbour and may add to its trophic status.
- The current water and drainage infrastructure problem in King's Island is a constraint for the flood relief scheme because it increases the risk of point source pollution in a flooding event. According to the Limerick Regeneration Framework Implementation Plan (2013), the levels of water leakage in the St. Mary's Park Estate is over 200%. The scheme must consider mitigation strategies to improve water drainage in King's Island as part of the assessment, this could increase the planning and construction stages. The Limerick City Drainage scheme should address the current problems with combined sewers on the Island
- Appropriate sewer infrastructure is crucial for the flood scheme to reduce discharge and also avoid surface water infiltrating into the foul network. Ensuring that suitable infrastructure is in place may be a constraint since it may be time consuming and require additional proposals. Considering and mitigating erosion will definitely be a constraint of the study.
- There is evidence of significant erosion on the embankment. On top of the damage caused by the 2014 flood, there is historical evidence of the existence of timber toe piles to address the erosion problem.
- The fissured bedrock poses constraints for the flood relief scheme due to the increased risk of slippage failure and seepage through the gravel layer underneath.
- The design and operation of the proposed scheme should be cognisant of the existing water quality and flora and fauna, particularly the SAC within the Study Area and the need to maintain same.
- The design and operation of any flood alleviation scheme must not compromise the requirements of the Habitats Directive or the Birds Directive and an Appropriate Assessment will need to be carried out. In the event that the Appropriate Assessment identifies adverse impacts on the Limerick Docks waterbody or the SAC on King's Island then alternative option will need to be considered. If these options have an adverse impact on the SAC then the scheme can progress in the interest of overriding public interest (IROPI). If this scenario is realised then compensatory measure will need to be put in place and approved before construction can commence. The process of identifying and characterising the adverse impacts will have significant time constraints associated with it and this will significantly slow down the construction programme.

- The design and operation of the proposed scheme must not conflict with the objectives of the Water Framework Directive (WFD), the River Basin Management Plans, the Programme of Measures and Environment Fisheries.
- The removal and disposal of any river/estuarine sediment should following the guidelines for handling waste under the Waste Management Acts as amended. A strict chain of custody must accompany all excavated materials taken off site for disposal.

5.9 References

8. Limerick City and County Council Development Plan 2010-2015
9. EPA Envision website (http://gis.epa.ie/Envision). Viewed 28/10/2015
10. Geological Survey of Ireland data base (www.spatial.dcenr.gov.ie/). Viewed 28/10/2015
11. Limerick City East GWB: Summery of Initial Characterisation. Geological Survey of Ireland data base. http://spatial.dcenr.gov.ie/GSI_DOWNLOAD/All_GWB_PDF/Limerick%20E.PDF (Viewed 29/10/15).
12. Shannon River District Management Plan (2009-2015)
13. South Western River Basin District website (www.swrbd.ie). Viewed 28/10/2015
14. Water Quality in Ireland 2007-2009. Environmental Protection Agency Ireland
15. Deakin, J., Daly, D. and Coxon, C. (1998) County Limerick Groundwater Protection Scheme. Geological Survey of Ireland Report to Limerick Co. Co., 72 pp.

6 Ecology and Fisheries

This section assesses data on flora, fauna and habitats within the Study Area in order to identify receptors potentially sensitive to flood risk management options, or which may constrain the implementation of certain options.

6.1 Methodology

6.1.1 Desk-based Assessment

A desk-based assessment was carried out to collate information regarding protected/notable species and statutorily designated nature conservation sites in, or within close proximity to, the study area.

Data has been collected from a range of sources, including:

- NPWS website (www.npws.ie)
- National Biodiversity Data Centre website (www.biodiversityireland.ie/)
- Water Maps (www.watermaps.wfdireland.ie)
- BirdLife International (www.birdlife.org)
- BirdWatch Ireland (www.birdwatchireland.ie)
- Limerick County Development Plan (www.limerick.ie/council/county-development-plan)
- Limerick Regeneration Framework Implementation Plan (www.limerick.ie/council/limerick-regeneration-framework-implementation-plan)
- National Otter Survey (Bailey et al., 2006)
- Water Framework Directive Fish Stock Survey of Transitional Waters in the Shannon International River Basin District (Kelly et al., 2015)
- Whooper Cygnus Cygnus and Bewick's C. columbianus Swans in Ireland (Bolland et al., 2010).

Information for statutory designated sites including Special Protection Areas (SPAs), Special Areas of Conservation (SACs), Ramsar Sites, Natural Heritage Areas (NHAs) and proposed NHAs (pNHA) was collected from the online resources provided by the National Parks and Wildlife Service (NPWS) (NPWS, 2015).

6.1.2 Ecological Walkover Survey

An ecological walkover survey was conducted by an experienced ecologist on the 9th September 2015. The survey encompassed the areas likely to be impacted upon by implementation of possible flood alleviation options.

As part of the ecological walkover survey, the following were conducted:

• Mapping of habitats present within and alongside the river in accordance with Fossitt's Guide to Habitats in Ireland (Fossitt, 2000) and Best Practice Guidance for Habitat Survey and Mapping (Smith et al, 2011). Within each general habitat type the dominant flora was recorded in order to determine general species composition and distribution. However, it should be noted that September is a sub-optimal period for conducting botanical surveys, but it is still possible to record the habitat type and dominant species present.

• Recording and mapping of any evidence of non-native invasive species, such as Japanese Knotweed (Fallopia japonica), Giant Hogweed (Heracleum mantegazzianum), and Himalayan Balsam (Impatiens glandulifera).

6.2 Results

6.2.1 Natura 2000 sites

Best practice guidance (DoE, 2009) recommends that all Natura 2000 sites within 15km of a project be initially screened for impacts. There are seven SACs and one SPAs that are within a 15km radius of the flood relief project at King's Island, Limerick;

- Lower River Shannon SAC
- Slieve Bernagh Bog SAC
- Askeaton Fen Complex SAC
- Glenomra Wood SAC
- Ratty River Cave SAC
- Danes Hole Poulnalecka SAC
- River Shannon and Fergus SPA

Only two of the Natura 2000 sites listed above are within the 5km zone of impact and are hydrologically linked to the plan at King's Island;w

- Lower River Shannon SAC (002165)
- River Shannon and Fergus SPA (004077)

Details of their designations and qualifying features are given below, with their location shown on Figure **6-1** and Figure 6-2.

Figure 6-1. Designated Natura 2000 sites

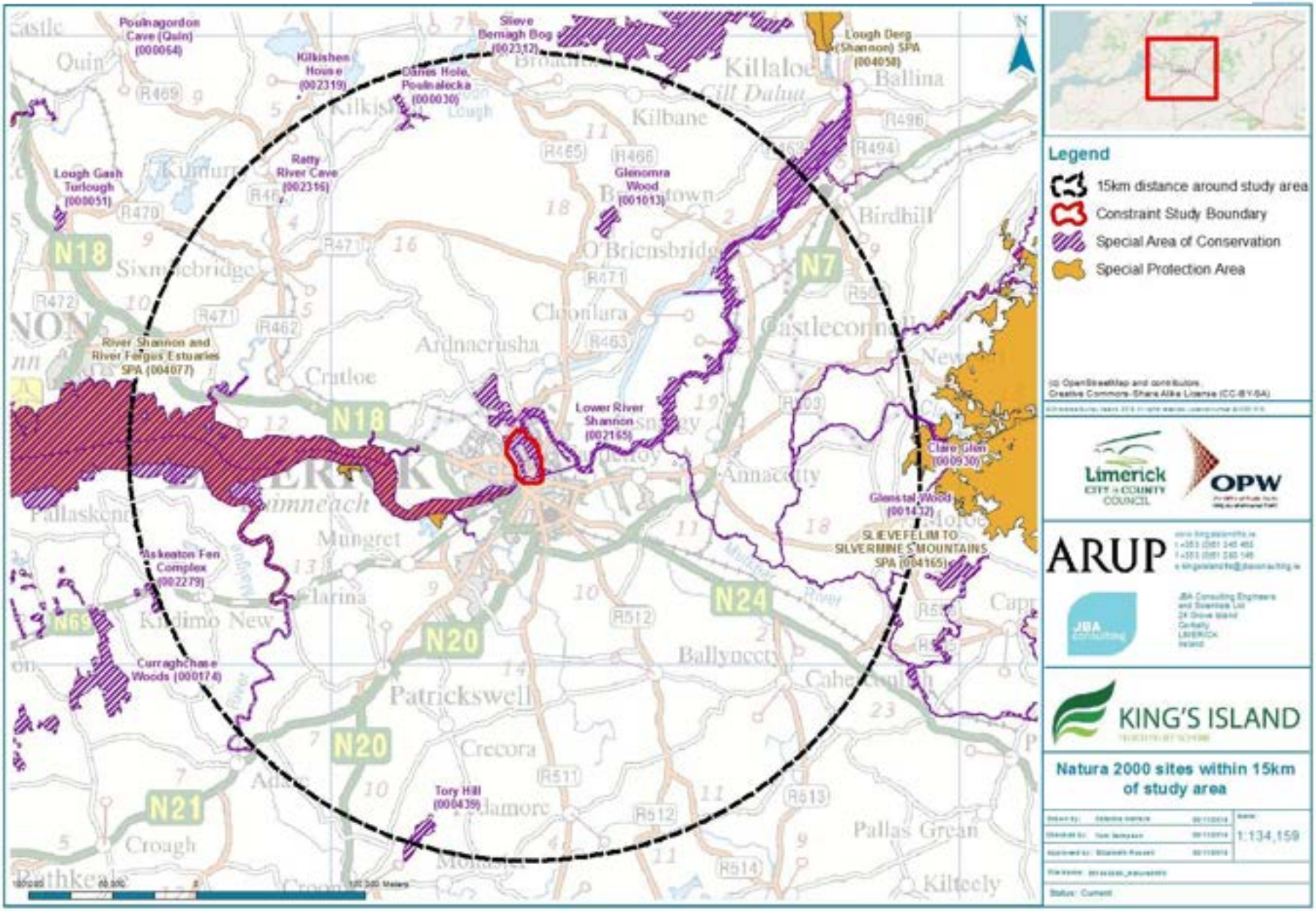
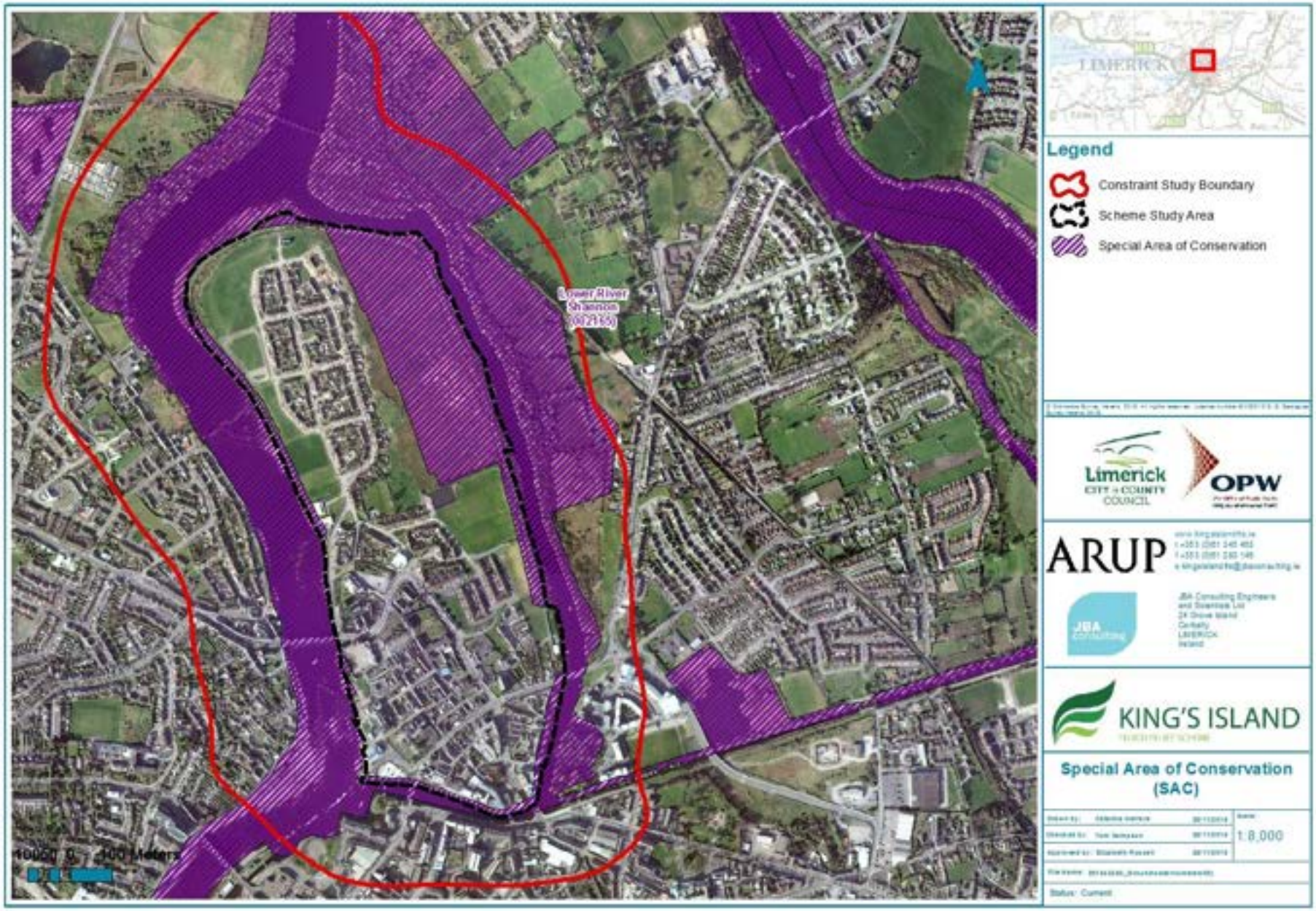


Figure 6-2. Special Area of Conservation



Lower Shannon SAC (002165)

The Lower River Shannon SAC encompasses the River Shannon and areas of adjacent habitat. The River Shannon flows around King's Island and the eastern portion of King's Island is included within the SAC designation. The site contains many Annexed habitats, including the most extensive area of estuarine habitat in Ireland. A good range of Annexed species are also present, including the only known resident population of the Common Bottle-nosed Dolphin (*Tursiops truncatus*) in Ireland, all three Irish species of lamprey, and a good population of Atlantic Salmon (*Salmo salar*). A number of birds listed on the EU Birds Directive either winter or breed in the site. The site is internationally important for waterfowl with more than 50,000 individuals occurring in winter. Several species listed in the Irish Red Data Book are present, perhaps most notably the only known Irish populations of Triangular Clubrush (*Scirpus triqueter*).

Table 1-1Table 6-1 below displays the habitats and/or species listed on Annex I / II of the E.U. Habitats Directive selected for the site (* = priority; numbers in brackets are Natura 2000 codes):

Table 6-1. Lower Shannon SAC (002165) Annex I/II EU Habitat Directive Habitat and Species

Natura 2000 Code	Habitat and Species Annex I / II of the E.U. Habitats Directive
Annex I Habitat	
[1110]	Sandbanks
[1130]	Estuaries
[1140]	Tidal Mudflats and Sandflats
[1150]	Coastal Lagoons*
[1160]	Large Shallow Inlets and Bays
[1170]	Reefs
[1220]	Perennial Vegetation of Stony Banks
[1230]	Vegetated Sea Cliffs
[1310]	Salicornia Mud
[1330]	Atlantic Salt Meadows
[1410]	Mediterranean Salt Meadows
[3260]	Floating River Vegetation
[6410]	Molinia Meadows
[91E0]	Alluvial Forests
Annex II Species	
[1029]	Freshwater Pearl Mussel (*Margaritifera margaritifera*)
[1095]	Sea Lamprey (*Petromyzon marinus*)
[1096]	Brook Lamprey (*Lampetra planeri*)
[1099]	River Lamprey (*Lampetra fluviatilis*)
[1106]	Atlantic Salmon (*Salmo salar*)
[1349]	Bottle-nosed Dolphin (*Tursiops truncatus*)
[1355]	Otter (*Lutra lutra*)

The Status of EU Protected Habitats and Species in Ireland (NPWS, 2008) publishes the status and distribution of Annex I habitats and Annex II species in Ireland. It shows that of the habitats and species listed above, only the following are present in the 10km square (R55) within which King's Island is located (**See** Table 6-2 **and** Figure 6-2**).**

Table 6-2. Annex I/II Habitat and/or Species present in the 10km square (R55).

Natura 2000 Code	Habitat and Species Annex I / II of the E.U. Habitats Directive
Annex I Habitat	
[1130]	Estuaries
[1140]	Tidal Mudflats and Sandflats
[1160]	Large Shallow Inlets and Bays
[1330]	Atlantic Salt Meadows
[3260]	Floating River Vegetation
[6410]	Molinia Meadows
[91E0]	Alluvial Forests
Annex II Species	
[1095]	Sea Lamprey (*Petromyzon marinus*)
[1096]	Brook Lamprey (*Lampetra planeri*)
[1099]	River Lamprey (*Lampetra fluviatilis*)
[1106]	Atlantic Salmon (*Salmo salar*)
[1355]	Otter (*Lutra lutra*)

This list (Table 6-2) does not refer to Annex I habitats or Annex II species not listed as qualifying interests for the site but may be present within this portion of the SAC. The range of Bottle-nosed Dolphin does not extend to the upper tidal reaches of the River Shannon (Berrow et al., 2010).

Figure 6-3. National Biodiversity Data Centre (NBDC) 2km Grid Cell [R55]

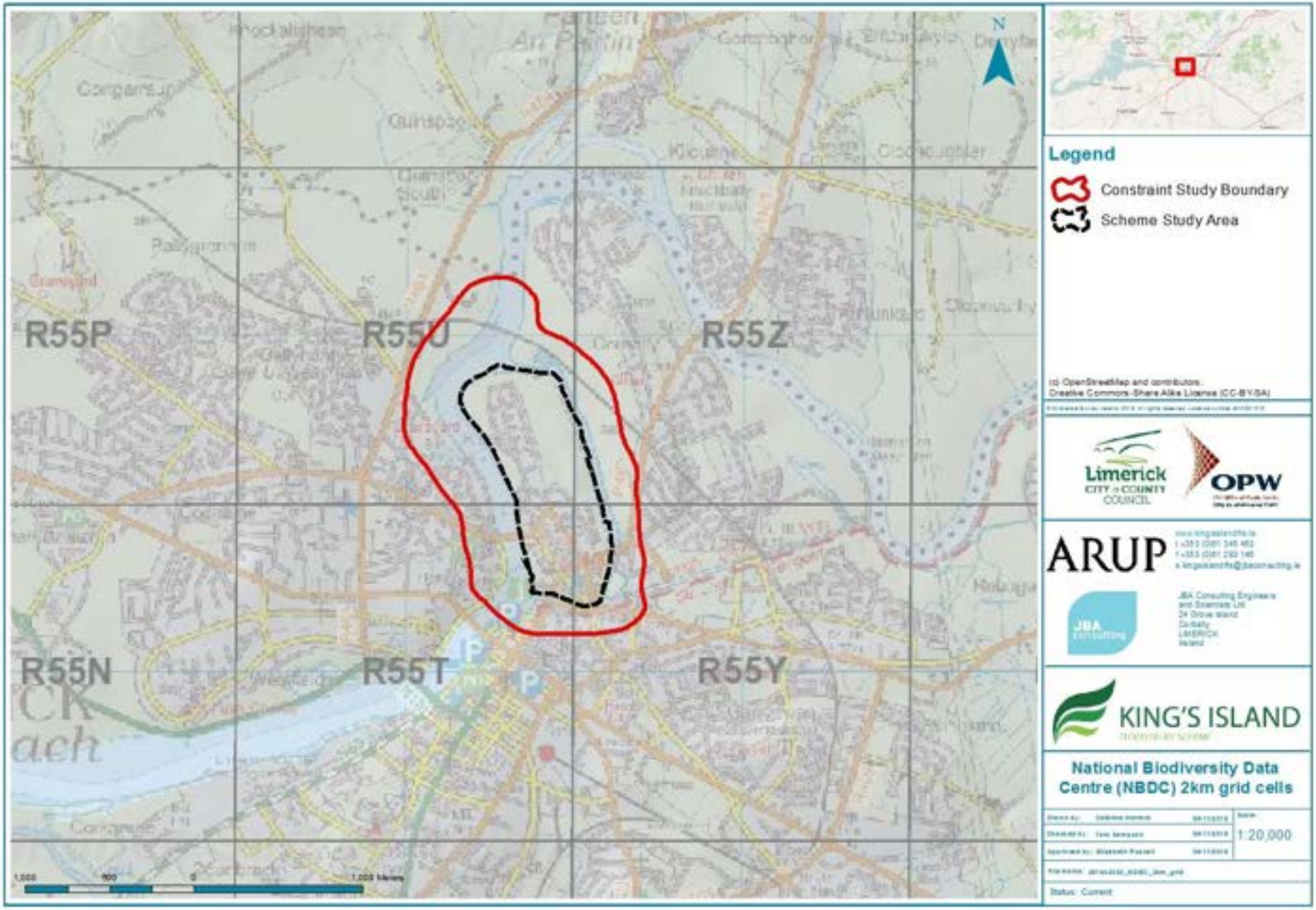
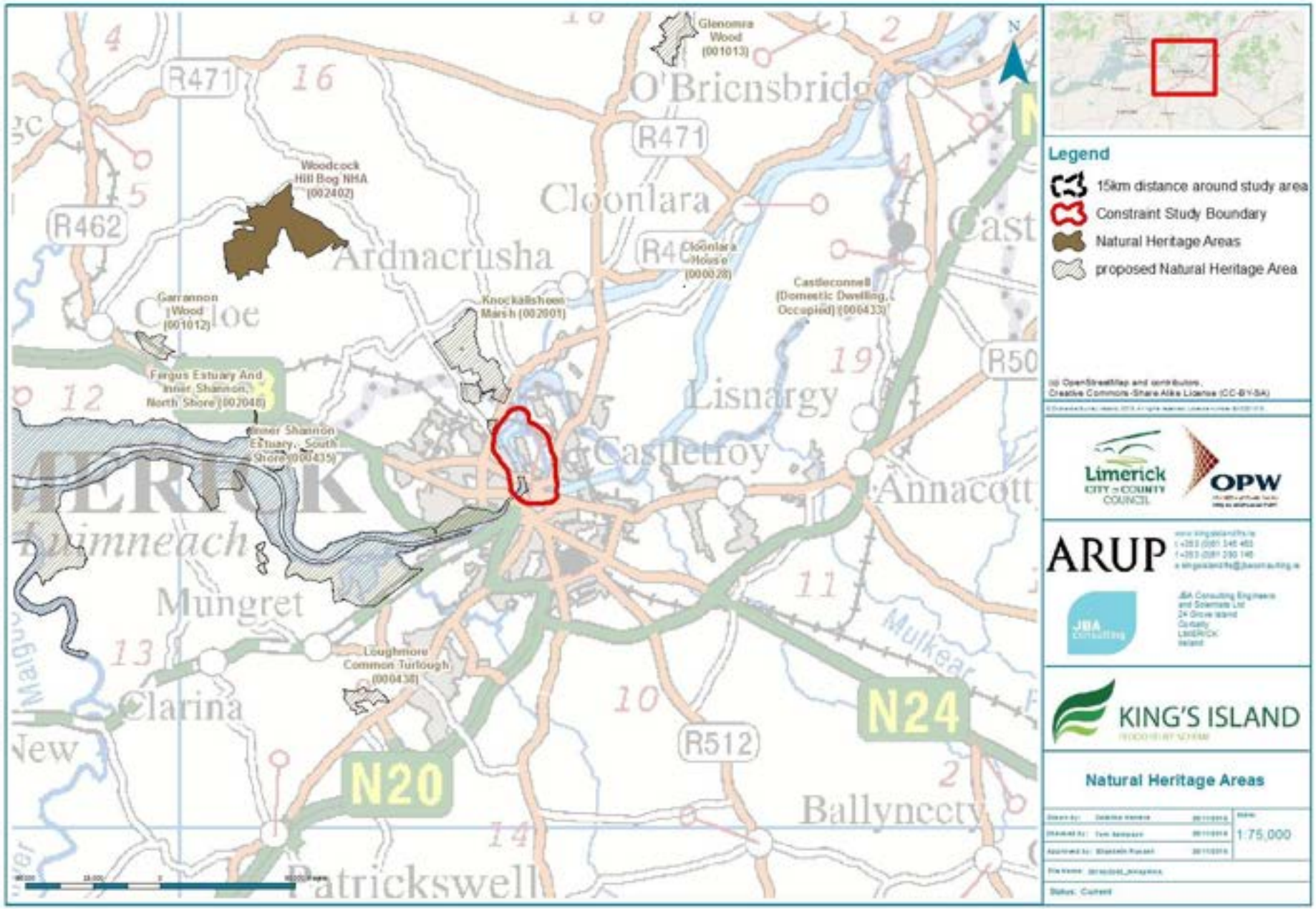


Figure 6-4. Natural Heritage Areas



6.2.2 Nationally Protected Sites

There are three nationally protected sites within 5km of King's Island, listed below

(Figure 6-4). Site details and conservation objectives are not listed for these sites on the NPWS website.

- Knockalisheen Marsh NHA
- Fergus Estuary and Inner Shannon Estuary North pNHA
- Inner Shannon Estuary South pNHA

Waterbodies

The River Shannon and River Abbey flow around King's Island. The main channel of the Shannon lies to the west of King's Island. The River Abbey is a distributary arm of the River Shannon that flows around the northeastern, eastern, and southern shores of King's Island. The River Abbey rejoins the Shannon at Hellsgate Island, which is only visible at low tide. Both rivers in the vicinity of King's Island are part of the transitional waterbody of Limerick Dock and are freshwater tidal. The Limerick Dock waterbody is heavily modified and is classed as being of 'moderate' status under the Water Framework Directive (Appendix A). The overall objective for Limerick Dock is 'Restore' by 2021, in particular the chemical status of the water. The Limerick Dock waterbody extends downstream to where the River Fergus enters the Shannon estuary. Both the Fergus estuary and Lower Shannon estuary waterbodies are of 'moderate' status (Water Maps, 2015).

Protected and Notable Species

King's Island spans across four 2km national grids on the National Biodiversity Data Centre's map viewer; R55U, R55T, R55E and R55Y (See Figure 6-3). The most recent records and locations of protected and notable species received from the National Biodiversity Data Centre for these 2km gird areas (See below Table 6-3, Table 6-4,Table 6-5, Table 6-6)

Table 6-3. Protected and Notable Species within gird square R55U. (Data from National Biodiversity Data Centre, 2015)

Grid square	Scientific name	Common name	Record	Designation
Birds				
R55U	*Alcedo atthis*	Common Kingfisher	2011	Wildlife Acts, EU Birds Directive, Birds of Conservation Concern - Amber List
R55U	*Anas crecca*	Eurasian Teal	2011	Wildlife Acts, EU Birds Directive, Birds of Conservation Concern - Amber List
R55U	*Anser anser*	Greylag Goose	2011	Wildlife Acts, EU Birds Directive, Birds of Conservation Concern - Amber List
R55U	*Aythya fuligula*	Tufted Duck	2011	Wildlife Acts, EU Birds Directive, Birds of Conservation Concern - Amber List
R55U	*Columba livia*	Rock Pigeon	2013	Wildlife Acts, EU Birds Directive.
R55U	*Cygnus olor*	Mute Swan	2011	Wildlife Acts, Birds of Conservation Concern - Amber List
R55U	*Haematopus ostralegus*	Eurasian Oystercatcher	2013	Wildlife Acts, Birds of Conservation Concern - Amber List
R55U	*Larus fuscus*	Lesser Black-backed Gull	2013	Wildlife Acts, Birds of Conservation Concern - Amber List
R55U	*Larus ridibundus*	Black-headed Gull	2013	Wildlife Acts, Birds of Conservation Concern - Red List
R55U	*Mergus merganser*	Goosander	2011	Wildlife Acts, EU Birds Directive, Birds of Conservation Concern - Amber List
R55U	*Phalacrocorax carbo*	Great Cormorant	2011	Wildlife Acts, Birds of Conservation Concern - Amber List

Grid square	Scientific name	Common name	Record	Designation
R55U	*Sturnus vulgaris*	Common Starling	2013	Wildlife Acts, Birds of Conservation Concern - Amber List
R55U	*Tachybaptus ruficollis*	Little Grebe	2011	Wildlife Acts, Birds of Conservation Concern - Amber List
Flowering Plants				
R55U	*Buddleja davidii*	Butterfly-bush	2013	Invasive Species
R55U	*Fallopia japonica*	Japanese Knotweed	2013	Invasive Species
R55U	*Impatiens glandulifera*	Indian Balsam	2013	Invasive Species
R55U	*Lemna minuta*	Least Duckweed	2010	Invasive Species
R55U	*Schoenoplectus triqueter*	Triangular Club-rush	1999	Flora Protection Order, Endangered
Insect				
R55U	*Bombus (Psithyrus) rupestris*	Hill Cuckoo Bee	1895	Endangered

Table 6-4. Protected and Notable Species within gird square R55U. (Data from National Biodiversity Data Centre, 2015)

Grid square	Scientific name	Common name	Record	Designation
Birds				
R55T	*Anas clypeata*	Northern Shoveler	2012	Wildlife Acts, EU Birds Directive, Birds of Conservation Concern - Red List
R55T	*Anas crecca*	Eurasian Teal	2011	Wildlife Acts, EU Birds Directive, Birds of Conservation Concern - Amber List
R55T	*Anser anser*	Greylag Goose	2011	Wildlife Acts, EU Birds Directive, Birds of Conservation Concern - Amber List
R55T	*Apus apus*	Common Swift	2011	Wildlife Acts, Birds of Conservation Concern - Amber List
R55T	*Aythya ferina*	Common Pochard	2012	Wildlife Acts, EU Birds Directive, Birds of Conservation Concern - Amber List
R55T	*Aythya fuligula*	Tufted Duck	2013	Wildlife Acts, EU Birds Directive, Birds of Conservation Concern - Amber List
R55T	*Aythya marila*	Greater Scaup	2011	Wildlife Acts, EU Birds Directive, Birds of Conservation Concern - Amber List
R55T	*Bucephala clangula*	Common Goldeneye	2011	Wildlife Acts, EU Birds Directive, Birds of Conservation Concern - Amber List
R55T	*Columba oenas*	Stock Pigeon	2011	Wildlife Acts, Birds of Conservation Concern - Amber List
R55T	*Cygnus cygnus*	Whooper Swan	2011	Wildlife Acts, EU Birds Directive, Birds of Conservation Concern - Amber List
R55T	*Cygnus olor*	Mute Swan	2013	Wildlife Acts, Birds of Conservation Concern - Amber List
R55T	*Delichon urbicum*	House Martin	2011	Wildlife Acts, Birds of Conservation Concern - Amber List
R55T	*Fulica atra*	Common Coot	2013	Wildlife Acts, EU Birds Directive, Birds of Conservation Concern - Amber List
R55T	*Gallinago gallinago*	Common Snipe	2011	Wildlife Acts, EU Birds Directive, Birds of Conservation Concern - Amber List

Grid square	Scientific name	Common name	Record	Designation
R55T	*Haematopus ostralegus*	Eurasian Oystercatcher	2011	Wildlife Acts, Birds of Conservation Concern - Amber List
R55T	*Hirundo rustica*	Barn Swallow	2013	Wildlife Acts, Birds of Conservation Concern - Amber List
R55T	*Larus argentatus*	Herring Gull	2013	Wildlife Acts, Birds of Conservation Concern - Red List
R55T	*Larus canus*	Mew Gull	2013	Wildlife Acts, Birds of Conservation Concern - Amber List
R55T	*Larus fuscus*	Lesser Black-backed Gull	2013	Wildlife Acts, Birds of Conservation Concern - Amber List
R55T	*Larus marinus*	Great Black-backed Gull	2013	Wildlife Acts, Birds of Conservation Concern - Amber List
R55T	*Larus melanocephalus*	Mediterranean Gull	2011	Wildlife Acts, EU Birds Directive, Birds of Conservation Concern - Amber List
R55T	*Larus ridibundus*	Black-headed Gull	2013	Wildlife Acts, Birds of Conservation Concern - Red List
R55T	*Mergus merganser*	Goosander	2011	Wildlife Acts, EU Birds Directive, Birds of Conservation Concern - Amber List
R55T	*Passer domesticus*	House Sparrow	2011	Wildlife Acts, Birds of Conservation Concern - Amber List
R55T	*Phalacrocorax carbo*	Great Cormorant	2013	Wildlife Acts, Birds of Conservation Concern - Amber List
R55T	*Rallus aquaticus*	Water Rail	2011	Wildlife Acts, Birds of Conservation Concern - Amber List
R55T	*Riparia riparia*	Sand Martin	2014	Wildlife Acts, Birds of Conservation Concern - Amber List
R55T	*Sturnus vulgaris*	Common Starling	2012	Wildlife Acts, Birds of Conservation Concern - Amber List
R55T	*Tachybaptus ruficollis*	Little Grebe	2012	Wildlife Acts, Birds of Conservation Concern - Amber List
R55T	*Tringa totanus*	Common Redshank	2011	Wildlife Acts, Birds of Conservation Concern - Red List
Plants				
R55T	*Azolla filiculoides*	Water Fern	2010	Invasive Species:
R55T	*Elodea nuttallii*	Nuttall's Waterweed	2007	Invasive Species
R55T	*Erucastrum gallicum*	Hairy Rocket	1999	Invasive Species
R55T	*Fallopia japonica*	Japanese Knotweed	2013	Invasive Species
R55T	*Schoenoplectus triqueter*	Triangular Club-rush	1999	Flora Protection Order, Endangered
Insects				
R55T	*Bombus (Melanobombus) lapidarius*	Large Red Tailed Bumble Bee	2014	Near threatened
Mammals				
R55T	*Lutra lutra*	European Otter	1980	Wildlife Acts, EU Habitats Directive
R55T	*Nyctalus leisleri*	Leisler's bat	2013	EU Habitats Directive, Wildlife Acts
R55T	*Pipistrellus pipistrellus sensu lato*	Pipistrelle	2013	EU Habitats Directive, Wildlife Acts
R55T	*Pipistrellus pygmaeus*	Soprano Pipistrelle	2007	EU Habitats Directive, Wildlife Acts

Table 6-5. Protected and Notable Species within gird square R55E. (Data from National Biodiversity Data Centre, 2015)

Grid square	Scientific name	Common name	Record	Designation
Birds				
R55Z	*Alcedo atthis*	Common Kingfisher	2011	Wildlife Acts, EU Birds Directive, Birds of Conservation Concern - Amber List
R55Z	*Anas crecca*	Eurasian Teal	2011	Wildlife Acts, EU Birds Directive, Birds of Conservation Concern - Amber List
R55Z	*Anser anser*	Greylag Goose	2015	Wildlife Acts, EU Birds Directive, Birds of Conservation Concern - Amber List
R55Z	*Apus apus*	Common Swift	2015	Wildlife Acts, Birds of Conservation Concern - Amber List
R55Z	*Aythya ferina*	Common Pochard	2011	Wildlife Acts, EU Birds Directive, Birds of Conservation Concern - Amber List
R55Z	*Aythya fuligula*	Tufted Duck	2011	Wildlife Acts, EU Birds, Birds of Conservation Concern - Amber List
R55Z	*Aythya marila*	Greater Scaup	2011	Wildlife Acts, EU Birds Directive, Birds of Conservation Concern - Amber List
R55Z	*Cygnus cygnus*	Whooper Swan	2011	Wildlife Acts, EU Birds Directive, Birds of Conservation Concern - Amber List
R55Z	*Cygnus olor*	Mute Swan	2011	Wildlife Acts, Birds of Conservation Concern - Amber List
R55Z	*Egretta garzetta*	Little Egret	2011	Wildlife Acts, EU Birds Directive
R55Z	*Fulica atra*	Common Coot	2011	Wildlife Acts, EU Birds Directive, Birds of Conservation Concern - Amber List
R55Z	*Larus argentatus*	Herring Gull	2011	Wildlife Acts, Birds of Conservation Concern - Red List
R55Z	*Larus canus*	Mew Gull	2011	Wildlife Acts, Birds of Conservation Concern - Amber List
R55Z	*Larus fuscus*	Lesser Black-backed Gull	2011	Wildlife Acts, Birds of Conservation Concern - Amber List
R55Z	*Larus ridibundus*	Black-headed Gull	2015	Wildlife Acts, Birds of Conservation Concern - Red List
R55Z	*Mergus merganser*	Goosander	2011	Wildlife Acts, EU Birds Directive, Birds of Conservation Concern - Amber List
R55Z	*Phalacrocorax carbo*	Great Cormorant	2011	Wildlife Acts, Birds of Conservation Concern - Amber List
R55Z	*Riparia riparia*	Sand Martin	1991	Wildlife Acts, Birds of Conservation Concern - Amber List
R55Z	*Sterna sandvicensis*	Sandwich Tern	1991	Wildlife Acts, EU Birds Directive, Birds of Conservation Concern - Amber List
R55Z	*Sturnus vulgaris*	Common Starling	2015	Wildlife Acts, Birds of Conservation Concern - Amber List
R55Z	*Tachybaptus ruficollis*	Little Grebe	2011	Wildlife Acts, Birds of Conservation Concern - Amber List
R55Z	*Vanellus vanellus*	Northern Lapwing	1991	Wildlife Acts, EU Birds Directive, Birds of Conservation Concern - Red List
Plants				
R55Z	*Azolla filiculoides*	Water Fern	2006	Invasive Species
R55Z	*Elodea nuttallii*	Nuttall's Waterweed	2005	Invasive Species
Invertebrates				
R55Z	*Anodonta anatina*	Duck Mussel	1993	Threatened Species: Vulnerable
Mammals				
R55Z	*Nyctalus leisleri*	Leiser's bat	2009	EU Habitats Directive, Wildlife Acts
R55Z	*Pipistrellus pipistrellus*	Pipistrelle	2009	EU Habitats Directive, Wildlife Acts
R55Z	*Pipistrellus pygmaeus*	Soprano Pipistrelle	2009	EU Habitats Directive, Wildlife Acts

Table 6-6. Protected and Notable Species within gird square R55E. (Data from National Biodiversity Data Centre, 2015)

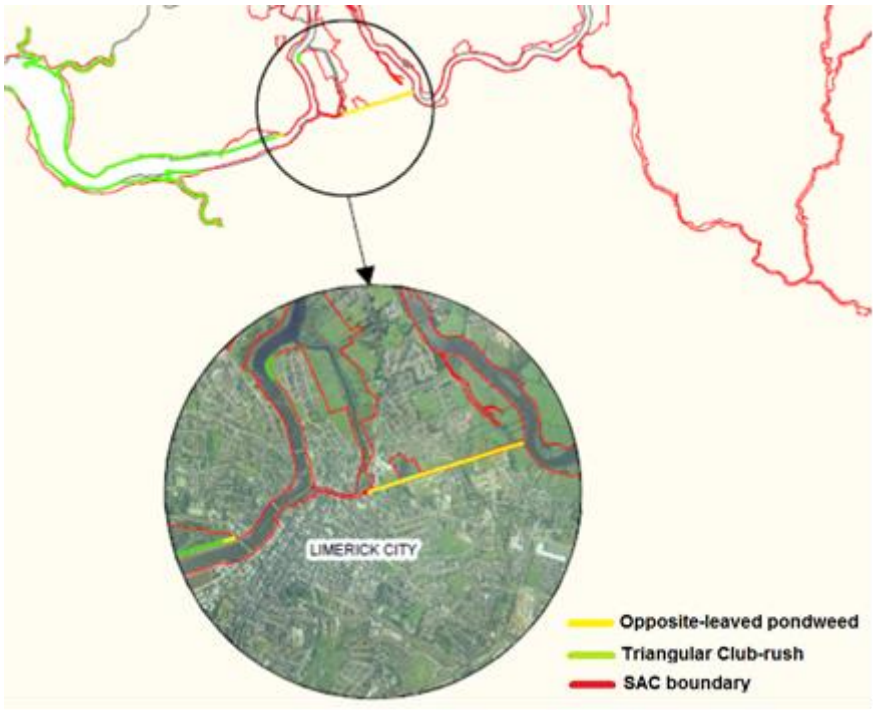
Grid square	Scientific name	Common name	Record	Designation
Amphibians				
R55Y	*Rana temporaria*	Common Frog	1972	EU Habitats Directive, Wildlife Acts
Birds				
R55Y	*Anas platyrhynchos*	Mallard	2013	Wildlife Acts, EU Birds Directive
R55Y	*Asio flammeus*	Short-eared Owl	2011	Wildlife Acts, EU Birds Directive, Birds of Conservation Concern - Amber List
R55Y	*Cygnus olor*	Mute Swan	2014	Wildlife Acts, Birds of Conservation Concern - Amber List
R55Y	*Delichon urbicum*	House Martin	2014	Wildlife Acts, Birds of Conservation Concern - Amber List
R55Y	*Fulica atra*	Common Coot	2013	Wildlife Acts, EU Birds Directive, Birds of Conservation Concern - Amber List
R55Y	*Hirundo rustica*	Barn Swallow	2014	Wildlife Acts, Birds of Conservation Concern - Amber List
R55Y	*Larus canus*	Mew Gull	2013	Wildlife Acts, Birds of Conservation Concern - Amber List
R55Y	*Larus ridibundus*	Black-headed Gull	2013	Wildlife Acts, Birds of Conservation Concern - Red List
R55Y	*Phalacrocorax carbo*	Great Cormorant	2014	Wildlife Acts, Birds of Conservation Concern - Amber List
R55Y	*Riparia riparia*	Sand Martin	2014	Wildlife Acts, Birds of Conservation Concern - Amber List
R55Y	*Sturnus vulgaris*	Common Starling	2014	Wildlife Acts, Birds of Conservation Concern - Amber List
R55Y	*Tachybaptus ruficollis*	Little Grebe	2013	Wildlife Acts, Birds of Conservation Concern - Amber List
R55Y	*Tyto alba*	Barn Owl	2013	Wildlife Acts, Birds of Conservation Concern - Red List
Plants				
R55Y	*Azolla filiculoides*	Water Fern	2006	Invasive Species
R55Y	*Buddleja davidii*	Butterfly-bush	2013	Invasive Species
R55Y	*Fallopia japonica*	Japanese Knotweed	2010	Invasive Species
R55Y	*Groenlandia densa*	Opposite-leaved Pondweed	1986	Flora Protection Order, Endangered
R55Y	*Heracleum mantegazzianum*	Giant Hogweed	2013	Invasive Species
R55Y	*Lemna minuta*	Least Duckweed	2006	Invasive Species
R55Y	*Schoenoplectus triqueter*	Triangular Club-rush	1969	Flora Protection Order, Endangered
Mammals				
R55Y	*Crocidura russula*	Greater White-toothed Shrew	2015	Invasive Species
R55Y	*Myotis daubentonii*	Daubenton's Bat	2013	EU Habitats Directive, Wildlife Acts
R55Y	*Nyctalus leisleri*	Leisler's bat	2013	EU Habitats Directive, Wildlife Acts
R55Y	*Pipistrellus pipistrellus sensu lato*	Pipistrelle	2013	EU Habitats Directive, Wildlife Acts

6.3 *Habitats and Flora*

An ecological study was conducted by Mr Roger Goodwillie, which focused on the eastern section of King's island that is within the SAC boundary (Goodwillie, 2007). This study divided the study area into three zones; an upper and drier area; a middle area that was wet and species poor; and a lower area that was wet and species rich. The influence of human activities, e.g. housing developments, land drainage and the embankment construction around the island, has resulted in this degree of variation in the habitat within the SAC boundary. The study carried out by Goodwille concludes that with the exception of the lower zone, the area is of low floristic diversity and of low ecological value. The report states that alluvial wet woodlands (code: 91E0) is present, which is a priority habitat type and a qualifying feature of the SAC. However, the exact location and extent of the priority habitat is not described or mapped.

The conservation objectives of the SAC note the presence of the endangered species Triangular Club-rush (*Scirpus triqueter*) and Opposite-leaved pondweed. Triangular Club-rush has been recorded to the north west of the island and Opposite-leaved pondweed is present in the Limerick Canal (Figure 6-5). Both species are protected under the Flora Protection Order 1999. There are also recordings of Opposite-leaved pondweed from 1984 and 1998 at O'Dwyers Bridge on the River Abbey (NPWS, 2015), which lies to the east of King's Island.

Figure 6-5. . Location of Opposite-leaved pondweed and Triangular Club-



Otter

The river Shannon is home to the Otter (*Lutra lutra*), which is listed on Annex II of the Habitats Directive and is one of the qualifying interests of the SAC. Goodwille (2007) notes that the wet area of the eastern side of the island, which is within the SAC boundary, may be used as a foraging area for otter. As listed in Table 7-2, otter was recorded in square R55T in 1980 by Chapman and Chapman. The presence of otter in this area was not recorded during the national otter survey (Bailey et al., 2006) however this does not confirm its absence. The 2010/2012 national otter survey (Reid et al., 2013) did not include the lower reaches of the river Shannon in its study area, just those of the upper Shannon catchment and Lough Derg.

Fisheries

The river Shannon at the point surrounding King's Island is tidal freshwater and therefore, would not provide suitable habitat for breeding Atlantic salmon. However, all migratory fish that spawn in the catchment, upstream of Limerick City, must pass through the river at this point. All three

Lamprey species are known from the lower Shannon catchment and spawn in tributaries upstream of Limerick city (Kurtz & Costello, 1999). A recent study by Inland Fisheries Ireland of the Limerick Dock area, in which King's Island is situated, recorded 13 fish species, these are listed in Table 6-7 (Kelly et al, 2015) . Lamprey and Salmon, which are qualifying interests of the Shannon SAC, have been recorded in the Limerick Dock area. European eel, listed as critically endangered in the Irish Red Data Book (King et al., 2011), was also recorded during this survey.

Table 6-7. Number of fish species in Limerick Dock in 2008 and 2014 (Kelly et al., 2015).

Common Name	2008	2014
Flounder	42	274
Smelt	-	138
Three-spined stickleback	8	51
Roach	29	38
European eel	21	30
Sprat	-	25
Dace	-	15
Perch	1	11
Sand goby	1	10
Brown trout	1	2
Lamprey sp.	-	2
Plaice	-	1
Thick-lipped grey mullet	-	1
Common goby	34	-
Pike	3	-
Salmon	3	-

Birds

The Shannon and Fergus estuaries, which includes the estuary inland as far as Limerick city, is an Important Bird and Biodiversity Area (IBA). The site is one of the most important sites in Ireland for wintering and migrating waterfowl, supporting 10 species in numbers of international importance (See Table 6-8) and a further 13 species that occur in numbers of national importance (BirdLife International, 2015). Many protected waterbirds have been recorded within the locality of King's Island, as detailed in the tables above. Goodwille (2007) recorded that the island is a habitat for a number of wetland bird species, including the Whooper swan (*Cygnus cygnus*). The Whooper Swan is a bird listed under Annex I of the Birds Directive, an Amber species under the Birds of Conservation Concern, and a listed species of the Shannon and Fergus SPA. A national census of Whooper swan in 2010 showed that the wintering population had increased by 6% since the previous count in 2005 and deemed the Shannon and Fergus estuary to be of international importance for Whooper Swan (Boland et al., 2010).

Table 6-8. Wintering bird species in numbers of international importance (BirdLife International, 2015).

Species		IUCN Category
Brent Goose	*Branta bernicla*	Least Concern
Whooper Swan	*Cygnus cygnus*	Least Concern
Greater Scaup	*Aythya marila*	Least Concern
Eurasian Golden Plover	*Pluvialis apricaria*	Least Concern
Common Redshank	*Tringa totanus*	Least Concern
Black-tailed Godwit	*Limosa limosa*	Near Threatened
Bar-tailed Godwit	*Limosa lapponica*	Least Concern
Eurasian Curlew	*Numenius arquata*	Near Threatened
Red Knot	*Calidris canutus*	Least Concern
Dunlin	*Calidris alpina*	Least Concern

Although not amber or red listed birds, the Dipper and Grey wagtail have been recorded within the 2km grid squares mentioned above. The Dipper and Grey wagtail are both associated with aquatic environments, as both feed on aquatic insects and bred in built structures or features of rivers. Kingfisher, an EU Annex I bird species are also known to occur along the Shannon and Abbey rivers in the vicinity of Kings Island.

Bats

All species of bat in Ireland are protected under the Wildlife Protection Act of 1976, the Wildlife (Amendment) Act 2000, and under Annex IV of the EC Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (Habitats Directive, 1992). A number of bat species have been recorded within the 2km grids of King's Island; Daubenton's Bat (*Myotis daubentonii*), Leisler's bat (*Nyctalus leisleri*), Common Pipistrelle (Pipistrellus pipistrellus) and Soprano Pipistrelle (*Pipistrellus pygmaeus*). The River Shannon is of suitable size to support the feeding and commuting of Daubenton's bats, which are water based foragers. Common pipistrelles feed in a wide range of habitats comprising woodland, hedgerows, grassland, farmland, suburban and urban areas, while Soprano pipistrelles usually feed in wetland habitats and also around woodland edge, tree lines or hedgerows, and in suburban gardens and parks. Leisler's bat is more tended towards wooded areas and roosting in tree holes (BCT, 2015). The presence of mature trees and woodland in the vicinity of King's Island provide potentially high value foraging habitat and good connectivity between local habitats and other foraging areas for bats.

Invasive species

A previous habitat survey, which formed part of a Natura Impact Report (Openfield Ecological Services, 2013), noted the presence of Japanese Knotweed and Giant Hogweed on King's Island. The European Communities (Birds and Natural Habitats) Regulations 2011 make it an offence to plant, disperse, allow dispersal or cause the spread of Japanese knotweed. Giant Hogweed is covered under the Wildlife (Amendment) Act 2000, under which it is an offence to cause its growth and spread in the wild. Giant Hogweed also poses a human health issues, as its sap it a severe skin irritant. The ecological survey carried out for this study of King's Island recorded and mapped invasive species, which is detailed below in section 6.3.1. Ecological Walkover Survey (See Figure 6-7)

Figure 6-6. King's Island Habitat Map (Fossit, 2000)

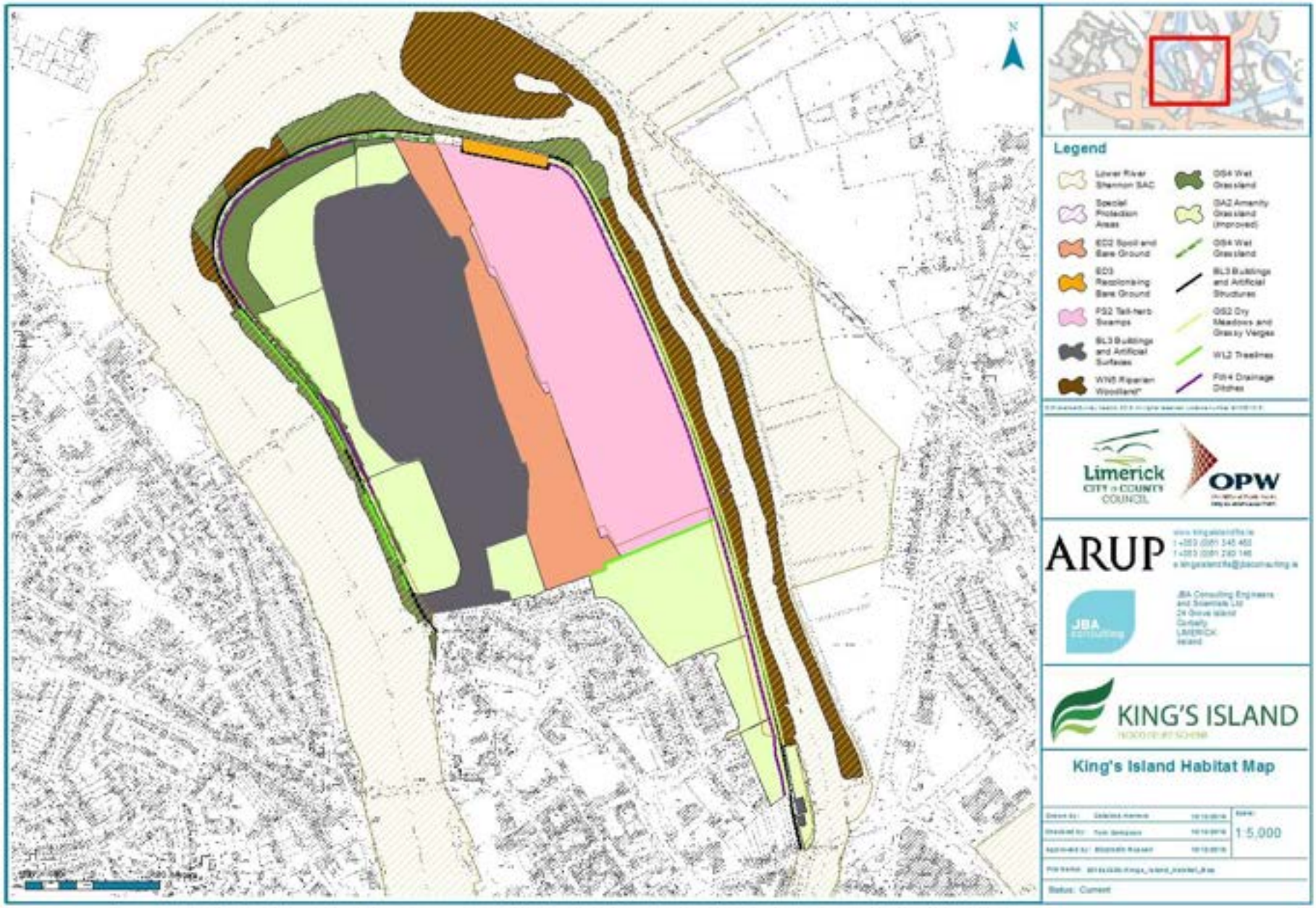
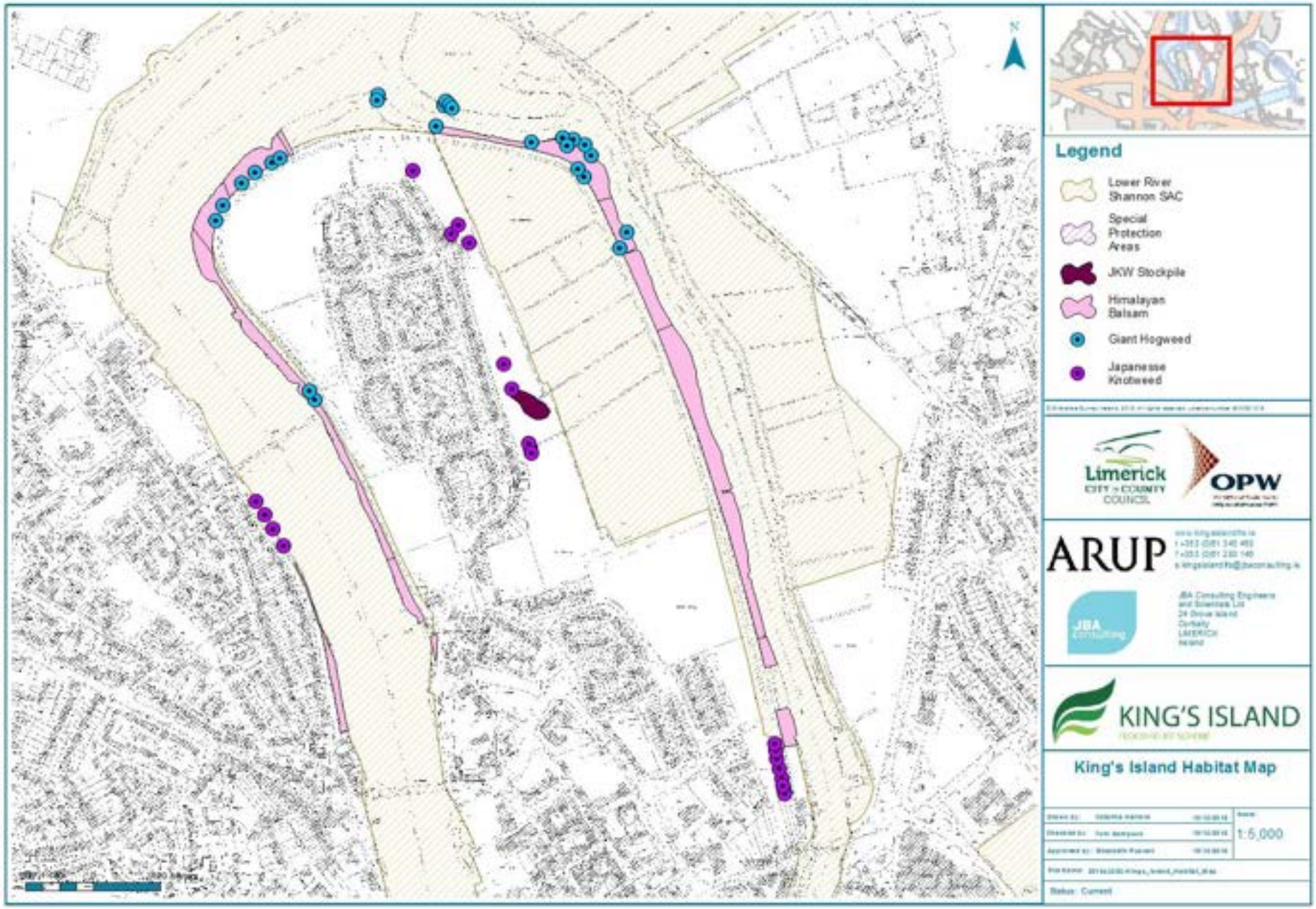


Figure 6-7. Invasive Species



6.3.1 *Ecological Walkover Survey*

Refer to Figure 6-6 .

Habitats and Flora

Riparian Woodland (WN5)

This habitat category includes wet woodlands of river margins (gallery woodland) and low islands that are subject to frequent flooding, or where water levels fluctuate as a result of tidal movement, which usually occurs in the lower reaches of rivers. This habitat category includes the Annex I habitat Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-padion, Alnion incanae, Salicion albae) (91E0) (Fossitt, 2000).

Riparian woodland fringes the edge of King's Island. This habitat extends northwards along the eastern margin, from O'Dwyers Bridge to the north western edge. This riparian woodland is dominated by stands of willows (*Salix sp*.) with occasional Alder trees (*Alnus glutinosa*). The understory contains taxa such as Reed Canary-grass (*Phalaris arundinacea*), Nettle (Urtica dioica), Meadowsweet (*Filipendula ulmaria*), Club rush (*Schoenoplectus sp*.), Bindweed (*Calystegia sepium*), Bramble (*Rubus fruticosus agg*.) and Willowherbs (*Epilobium sp*.). Himalayan Balsam (*Impatiens glandulifera*), which is an introduced and invasive species, is abundant throughout the riparian woodland habitat.

Tall Herb Swamps (FS2)

Tall-herb swamps are stands of herbaceous vegetation that occur in wet areas where the water table is above the ground surface for most of the year, or where water levels fluctuate regularly as in the case of tidal sections of rivers (Fossitt, 2000). The tall herb swamp lies within the SAC designation on the eastern side of King's Island. Access to this area was limited, which was viewed from the footpath at a higher elevation to the tall herb swamp. Taxa which dominated this area were Reed sweet grass (*Glyceria maxima*), Yellow Iris (*Iris pseudacorus*), Water-plantain (*Alisma plantago-aquatica*), Water Horsetail (*Equisetum fluviatile*), Branched Bur-reed (*Sparganium erectum*), Bulrush (*Typha latifolia*) and Water Mint (*Mentha aquatica*). The understorey of wetland plants in this habitat could not be assessed due to access restrictions.

Wet grassland (GS4)

Wet grassland habitat occurs on wet or waterlogged mineral or organic soils that are poorly-drained or, in some cases, subjected to seasonal or periodic flooding. On sloping ground, wet grassland is mainly confined to clay-rich gleys and loams, or organic soils that are wet but not waterlogged (Fossitt, 2000). The wet grassland habitat is mainly located to the north of the island. A narrow strip of wet grassland habitat exists along the western edge of the island, which is bordered by a treeline. This wet grassland habitat was dominated by grasses such as Yorkshire-fog (*Holcus lanatus*) and Creeping Bent (*Agrostis stolonifera*). Rushes (*Juncus sp*.), Horsetails (*Equisetum spp*.), Yellow Iris (*Iris pseudacorus*) and Reed sweet grass (*Glyceria maxima*) were abundant in patches within the wet grassland habitat. Broadleaved herbs such as Creeping Buttercup (*Ranunculus repens*), Spearwort (*Ranunculus flammula*), Marsh Thistle (*Cirsium palustre*), Meadowsweet (*Filipendula ulmaria*), Water Mint (*Mentha aquatica*), Ribwort Plantain (*Plantago lanceolata*), Dock (*Rumex sp*.), Figwort (*Scrophularia sp*.) and Clover (*Trifolium sp.)* and Willowherbs (*Epilobium sp*.). Himalayan Balsam (*Impatiens glandulifera*) is abundant in the wet grassland habitats to the east of the island.

Treelines (WL2)

The treelines within the island consist of Ash (*Fraxinus excelsior*), Sycamore (*Acer pseudoplatanus*), Horse Chestnut (*Aesculus hippocastanum*), Elder (*Sambucus nigra*), willows (*Salix sp*.) and limes (*Tilia spp*.).

Invasive species

The invasive species Himalayan Balsam (*Impatiens glandulifera*), Japanese knotweed (*Fallopia japonica*) and Giant Hogweed (*Heracleum mantegazzianum*) were recorded at various locations on King's Island. Himalayan balsam is abundant along the edges of the island within the riparian woodland and wet grassland habitats. Numerous stands of Japanese knotweed are located along the boundary line of the SAC and adjoining housing estate. The location of Giant Hogweed was contained to the outer fringe of the island, among the riparian woodland and wet grassland

areas. Giant Hogweed was in die back at the time of surveying and therefore some Giant Hogweed plants may not have been recorded (Refer to Figure 6-7).

Tidal Rivers (CW2) and Estuaries (MW4)

The River Shannon and River Abbey are tidal rivers that surround King's Island. The Shannon Estuary is located downstream of King's Island.

Amenity Grassland (GA2)

Amenity grassland is situated around the areas of residential housing on King's Island. These areas include greens to the west of the island and playing pitches to the east.

Dry meadows and grassy verges (GS2)

A thin strip of GS2 exists either side of the footpath on the eastern side of King's Island. This grassy verge is slight wet in nature given its location on King's Island. This is dominated by Nettle (*Urtica dioica*), Common Knapweed (*Centaurea nigra*), Willowherbs (*Epilobium sp*.), Bramble (*Rubus fruticosus agg*.), clovers (*Trifolium spp.)* and ragworts (*Senecio spp*.). The only grass that was discernible was Cock's-foot (*Dactylis glomerata*).

Recolonising bare ground (ED3) and Spoil and bare ground (ED2)

At the time of the ecological survey areas of bare and recolonising ground existed between the residential housing and SAC boundary. Construction works were taking place within this area.

Drainage ditches (FW4)

A drainage ditch runs along the inside of the embankment on King's Island. This drainage ditch does not seem to be connected to the River Shannon or River Abbey and appears to be for land drainage purposes. Vegetation within and on the banks of the drainage ditch included Reed sweet grass (*Glyceria maxima*), Yellow Iris (*Iris pseudacorus*), Water Horsetail (*Equisetum fluviatile*) and Bulrush (*Typha latifolia*).

Buildlings and artificial surfaces (BL3)

This category is dominated by residential housing on King's Island. A tarmac footpath runs around the perimeter of the Island, inside the embankment, and steel pile sheeting has been erected on the north of the Island to stabilise the embankment.

6.4 Key Constraints

A portion of King's Island is designated as the Lower River Shannon SAC and is situated upstream of the River Shannon and River Fergus SPA. These sites are protected under the EU Habitats Directive and is of international importance for its intertidal and estuarine habitats and wader and wildfowl populations. The flood relief scheme options will be subject to an Environmental Impact Assessment.

6.4.1 Habitats and Flora

The flood relief scheme works may result in significant effects on the Lower River SAC in the absence of mitigation. A Stage 2 Appropriate Assessment (AA) under Article 6(3)) of the Habitats Directive will be required to assess the impact of the works on the Natura 2000 sites and a Natura Impact Statement will be required to inform the AA. If adverse impacts on the integrity of Natura 2000 sites are identified, and mitigation cannot be satisfactorily implemented, alternative ways of achieving the objectives of the flood relief scheme project that avoid adverse impacts will need to be considered. The loss of habitat or fragmentation of the SAC, which covers a portion of the eastern side of King's Island, would be classed as a significant impact on the SAC. As noted by NPWS in previous correspondence regarding Kings Island, if alternative options cannot be found any loss of SAC habitat, especially the priority alluvial woodland habitat, will result in the appropriate assessment process progressing to Stage 4 where the works can only proceed for Imperative Reasons of Overriding Public Interest (IROPI). This must be done in consultation with the Minister for the Environment, Heritage and Local Government, be accompanied by compensatory measures to maintain the overall coherence of the Natura 2000 network, and can only proceed with the approval of the European Commission. It must be demonstrated that all alternative options have been considered, which includes not proceeding with the works. Any loss of priority habitat will require the works to proceed as IROPI under Article 6(4) of the

Habitats Directive. An application for IROPI may take a considerable amount of time to process and this would inevitably impact on the construction programme for the scheme.

6.4.2 Otter

Otters are protected under the Wildlife Act 1976/2000, EU Directive 92/43 Annex II and IV and the Bern Convention Appendix III. The breeding and resting places of otters are also protected, even if there are no animals present. Under the above legislation it is an offence to kill or injury an otter and to damage or destroy a breeding or resting place.

The surrounding habitat, with tall herb swamps, riparian woodland, treelines and the adjacent Shannon and Abbey Rivers, provide extensive potential habitat for breeding or resting locations. When the details of the works option is decided upon (nature, scale and extent), the areas to be affected shall be surveyed to determine the level of otter activity and if any breeding or resting places are present within and adjacent to the footprint of the works. Otter surveys can be conducted at any time throughout the year, provided weather conditions are suitable. Works could result in the damage or destruction of resting places and appropriate mitigation will be required to ensure that no long-term adverse impacts on the local otter population arise. Appropriate licences may also be required from NPWS in relation to any works on or around otter breeding or resting places. An application and granting for an appropriate licence for works around otters or otter resting places may take some time and the licences would need to be applied for in advance of any works.

6.4.3 Fisheries and water quality

The Shannon is an important river for salmonid, lamprey and eel populations. In-channel works, or permanent modification of channel banks or bed, could have an adverse impact on aquatic populations and water quality. This could arise directly through damage to in-channel habitats or indirectly through impacting upon water quality. Timing constraints will apply to any in-channel working to avoid the salmonid spawning season (usually between November and March) and Inland Fisheries Ireland must be consulted during the design stage, prior to works commencing. Appropriate measures shall be included in the design of the selected working option to ensure fish passage is maintained, fish do not get stranded in any storage areas created and habitat value within the existing channel is not reduced. Appropriate measures shall also be required to prevent pollution incidents and silt mobilisation.

6.4.4 Wintering Birds

King's Island and its surrounding area is important for wintering and migrating waterfowl, in particular Whooper Swan. Mitigation will be required during the wintering bird season to minimise disturbance to these species.

6.4.5 Nesting birds

The riverine corridor and vegetated fringe of King's Island provides suitable habitat for nesting birds and also within the river walls and bridges that provide a number of cracks and crevices suitable for nesting birds. If possible, vegetation clearance associated with the works and any works to existing walls and bridges, should be conducted outside of the breeding bird season (March to September inclusive) to protect any nests that may be present. If this is not possible, working areas should first be searched by a suitably qualified ecologist for the presence of any nests. If found, the nests should not be disturbed until the chicks have fledged and the nest is deemed inactive. A possible ecological opportunity as part of these works will be to include nesting boxes.

6.4.6 Bats

The scattered mature trees along the King's Island walkway, river walls and bridges provide potential roosting opportunities for bats, with the surrounding habitat providing good foraging and commuting routes. Options that require the removal of mature trees or works to riverine built structures with the potential to support roosting bats shall be assessed for bat potential. Bat surveys shall be conducted on any features with medium or high potential for roosting bats. The optimum time to carry out bat surveys is May-August inclusive, as this is when bats are most active (BCT, 2012). If bats are found to be present the surveys will determine the species, numbers, access points and type of roost. The hibernation period for bats is temperature dependant, but is generally from October/November to February/March. Young bats are typically

born in June/July with maternity roosts being active from June to August. If a hibernation roost or maternity roost is found, they shall not be disturbed during the hibernation or maternity periods.

6.4.7 Invasive species

Japanese Knotweed, Himalayan balsam and Giant Hogweed are listed as invasive plants under the EC (Birds and Natural Habitats) Regulations 2011 (S.I. 477/2011). These regulations prohibit the introduction and dispersal of these species. Therefore, the works associated with the flood relief scheme in areas where invasive species are present must use appropriate measures to ensure their containment. A task specific method statement must be compiled to implement these measures.

The spread of Japanese knotweed can seriously damage buildings, hard surfaces and infrastructure. Once established underneath or around the built environment, it can be particularly hard to control, growing through concrete and tarmac and other hard-standings. When Japanese knotweed colonises riverbanks, it can damage flood defence structures and reduce the capacity of channels to carry flood water. Soils containing Japanese knotweed rhizomes should not be re-used on site unless the soil has been treated and screened. If possible, the infested soils should be left undisturbed and treated. There are a number of methods for the management of this weed outlined in the Code of Practice - Managing Japanese Knotweed on Development Sites (EA, 2013).

6.5 References

Bailey, M. and Rochford J. 2006. Otter Survey of Ireland 2004/2005. Irish Wildlife Manuals, No. 23. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.

BCT (2012) Bat Surveys - Good Practice Guidelines. 2nd Edition. Bat Conservation Trust, London

BCT (2015) Bat Conservation Trust. Available online: http://www.bats.org.uk/. Accessed 07/10/2015.

Berrow, S., O'Brien, J., Groth, L., Foley, A. and Voigt, K. (2010) Bottlenose Dolphin SAC Survey 2010. Report to the National Parks and Wildlife Service. Shannon Dolphin and Wildlife Foundation. pp.24.

BirdLife International (2015) Important Bird Areas factsheet: Shannon and Fergus Estuaries. Downloaded from http://www.birdlife.org on 06/10/2015

Birdwatch Ireland (2013). Birds of Conservation Concern in Ireland (2013). Available online: http://www.birdwatchireland.ie/Ourwork/SurveysProjects/BirdsofConservationConcern/tabid/178/Default.aspx. Accessed: 17/04/2014

Boland H., McElwaine J.G., Henderson G., Hall C., Walsh A. & Crowe O. 2010. Whooper Cygnus Cygnus and Bewick's C. columbianus Swans in Ireland: results of the International Swan Census, January 2010. Irish Birds Volume 9 Number 1 pg1-10.

Chanin, P. (2003) Monitoring the Otter Lutra lutra. Conserving Natura 2000 Rivers Monitoring Series No.10. English Nature, Peterborough

EA (2013) Managing Japanese knotweed on development sites. Environment Agency, Bristol, England.

EPA (2015) EPA Maps. Available online: http://gis.epa.ie/Envision. Accessed: 06/10/2015

Fossitt, J. A. (2000) A Guide to Habitats in Ireland. The Heritage Council, Dublin

Goodwillie R. 2007. St. Mary's Park, King's Island, Limerick: Ecological Assessment

Kelly, F.L., Connor, L., Matson, R., Coyne, J., Feeney, R., Morrissey, E. and Rocks, K. (2015) Water Framework Directive Fish Stock Survey of Transitional Waters in the Shannon International River Basin District – Shannon Estuary, Fergus Estuary and Limerick Docks 2014. Inland Fisheries Ireland, Dublin 24, Ireland.

King, J.J., Marnell, F., Kingston, N., Rosell, R., Boylan, P., Caffrey, J.M., Fitzpatrick, Ú., Gargan, P.G., Kelly, F.L., O' Grady, M.F., Poole, R., Roche, W.K. and Cassidy, D. (2011) Ireland Red List No. 5: Amphibians, Reptiles and Freshwater Fish. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.

Kurz I. & Costello M.J. (1999) An outline of the biology, distribution and conservation of Lampreys in Ireland. Irish Wildlife Manual no. 5. Dúchas, The Heritage Service.

National Biodiversity Data Centre (2015). Live Maps. Available online: http://maps.biodiversityireland.ie/#/Map. Accessed: 06/10/2015

National Parks and Wildlife Service. 2008. The Status of EU Protected Habitats and Species in Ireland. Department of Environment, Heritage and Local Government.

Reid, N., Hayden, B., Lundy, M.G., Pietravalle, S., McDonald, R.A. & Montgomery, W.I. (2013) National Otter Survey of Ireland 2010/12. Irish Wildlife Manuals No. 76. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.

Smith, G.F., O'Donoghue, P., O'Hora, K. and Delaney E. (2011) Best Practice Guidance for Habitat Survey and Mapping. The

7 Soils and geology

7.1 Methodology

The information necessary to identify the soils, geological and hydrogeological constraints on the Site (King's Island) and extended constraints study area has been compiled from a desk study assessment of published information from the sources listed throughout this chapter, together with additional in-house sources of information included as references. Two site walkovers were undertaken by Arup on 6th October and 10th November 2015.

Available information was obtained from the sources below:

Soils, Geology and Hydrogeology

- Heritage Section of the Geological Survey of Ireland (GSI) for Sites of Special Specific Interest (www.gsi.ie)
- Karst Database, Geological Survey of Ireland (www.gsi.ie)
- Geological Survey of Ireland, Geology of the Lower Shannon Estuary Bedrock Series Map 1:1000 Sheet 17
- Teagasc Soil and Subsoil Database (www.gsi.ie)
- Groundwater Mapping (www.gsi.ie)
- Historic and Current Maps, Ordnance Survey Ireland (OSI) (www.osi.ie)
- Google maps aerial photography
- National Parks and Wildlife Services (NPWS) (www.npws.ie)
- Natural Heritage Areas (NHA) and Proposed Natural Heritage Areas (pNHA)
- Special Areas of Conservation (SAC)
- Special Protection Areas (SPA)
- Environmental Protection Agency (EPA) online 'Envision' mapping (www.epa.ie)
- Limerick City and County Council (LCCC).

Hydrogeology

- Water Frame Work Directive (WFD) Groundwater Bodies (GWBs), GSI. Rainfall data, Met Éireann.
- Drinking Water Protection Areas, GSI and EPA.

The following reports were provided by LCCC.

7.2 Receiving Environment

Information from historic site investigations, the Teagasc soils maps and GSI bedrock geology maps were compiled to provide information on the soils, geology and hydrogeology for the Site and extended constraints area.

7.2.1 Bedrock geology

The available information for the presence of geological heritage areas, mines and quarries were checked. There are no records showing the presence of any of these within the constraints area.

7.2.2 Superficial deposits (soils)

Made ground is encountered in the urban/populated areas of the Site and west of the constraints area. Site investigations completed in the area revealed that the made ground was made up of silty clay and clayey sand with loose ash, red brick, gravel, shells and occasional glass and wood. The thickness of the made ground on the Site varies between 1.0m to 5.5m thick in places. The made ground is generally thickest in the south, along George's Quay and Sir Harry's Mall. Along the riverside walkway, the thickness of made ground is approximately 2.2m. Site investigation information for the eastern section of the constraints area suggests there is 0.40m to 4.0m of made ground, with the stratum generally thickening from north to south.

Agricultural and Sub Soils

The overburden/subsoil geology is heavily influenced by the River Shannon and Abbey River. The agricultural/topsoils of the Site and the constraints area comprise Marine/Esturine Silts to the east and northwest, poorly drained mineral soils and peaty mineral soils further inland to the northwest on the Site and made ground everywhere else (Refer to Figure 7-1).

The subsoils in the constraints study area on the Teagasc Soil Map of Ireland comprise estuarine/alluvial deposits of soft clays and silts to the north and east of the constraints area, Limestone derived till to the north and northwest of the Island and made ground everywhere else. Bedrock outcrops are mapped in the north west of the Site and west and northwest of the constraints area (refer to Figure 7-2). These outcrops are labelled 'karstified bedrock outcrops' and are the only karst features mapped on the constraints area.

Historic site investigation information indicates the presence of very soft to firm brown/grey sandy gravelly SILT and CLAY on the Site and the constraints area. These are likely to be highly variable, interlayered and to contain organic material. The alluvial silts and clay are generally underlain by medium dense to very dense estuarine/alluvial very silty SAND and GRAVEL, although these coarser grained deposits may be interlayered with pockets or lenses of clay and silt.

Glacial till was encountered in a number of exploration holes overlying the bedrock in the south of the Site and also in boreholes in the eastern section of the constraints area.

The overburden thickness varies across the Site from 3.0m and 11.0m, generally increasing in a south west to north east direction. In the north east of the Site, one rotary corehole indicated the presence of overburden to 22.2m below ground level (bgl). Site investigation information for the eastern section of the constraints area, reveals overburden thickness from 3.40m to 10m, fluctuating from north to south in depth in no particular pattern.

There is an existing unlicensed landfill to the east of St Mary's Park on the Site as detailed in Figure 7-2, which is currently being remediated.

Figure 7-1. Agricultural Soil

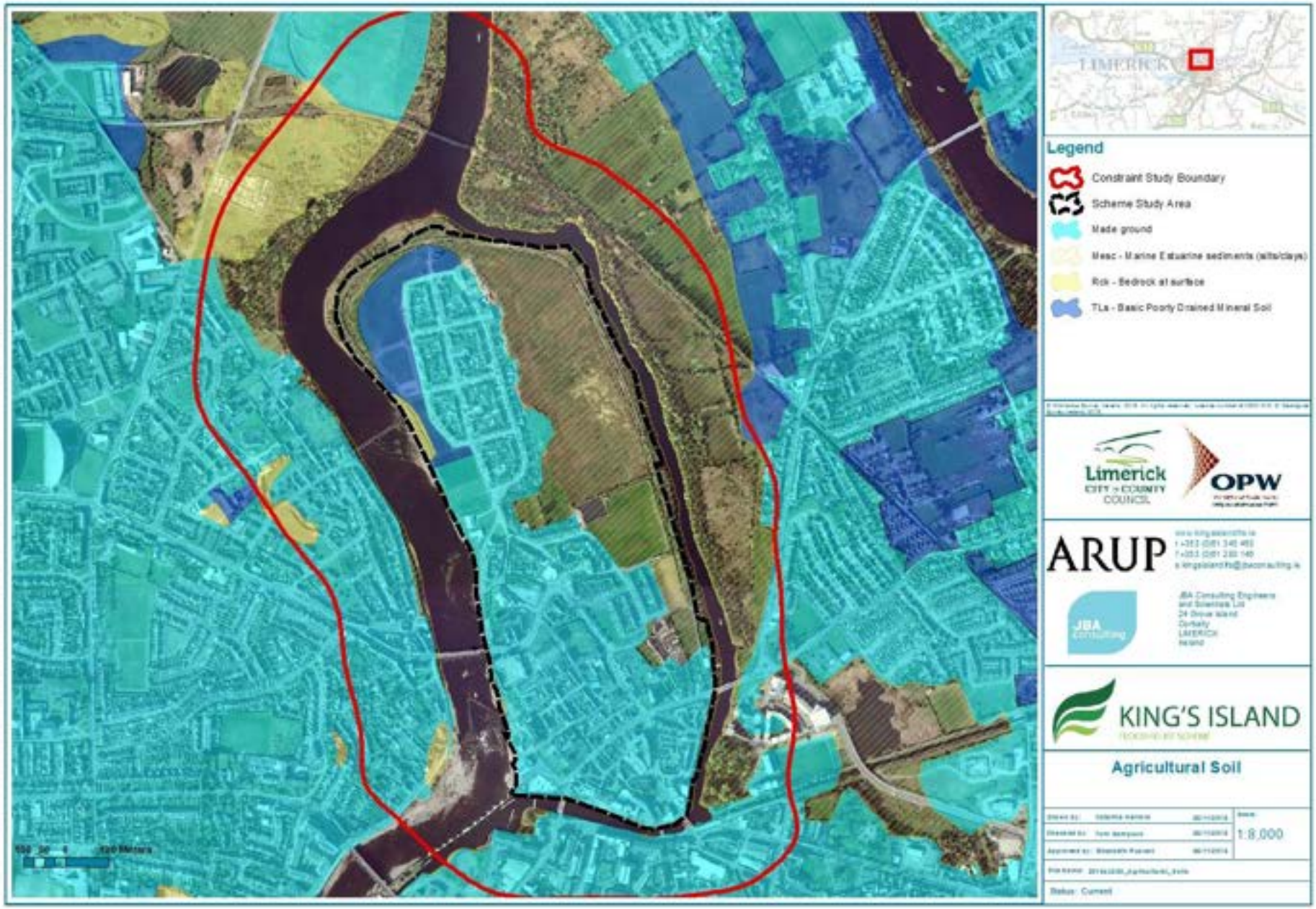
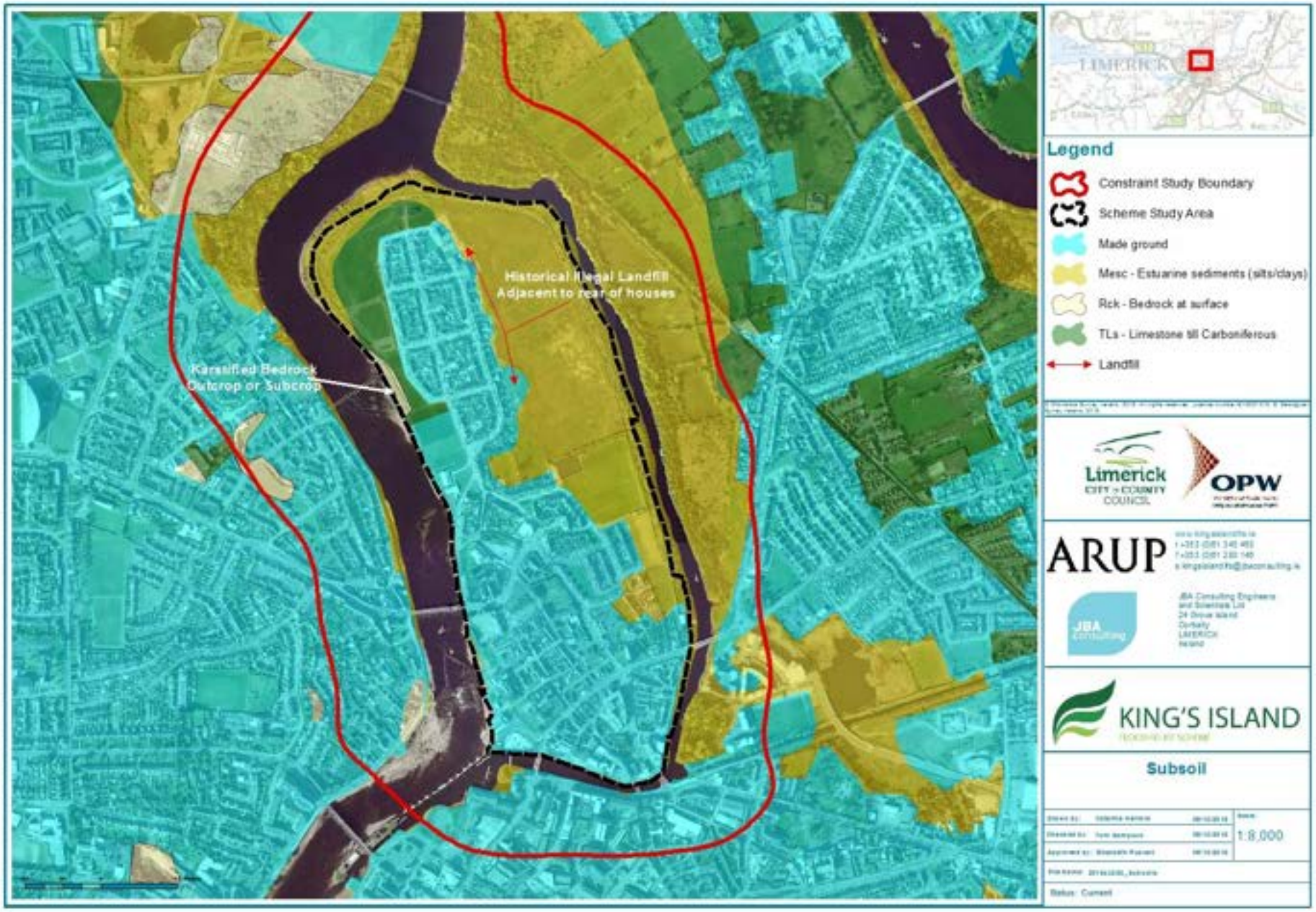


Figure 7-2.Subsoils

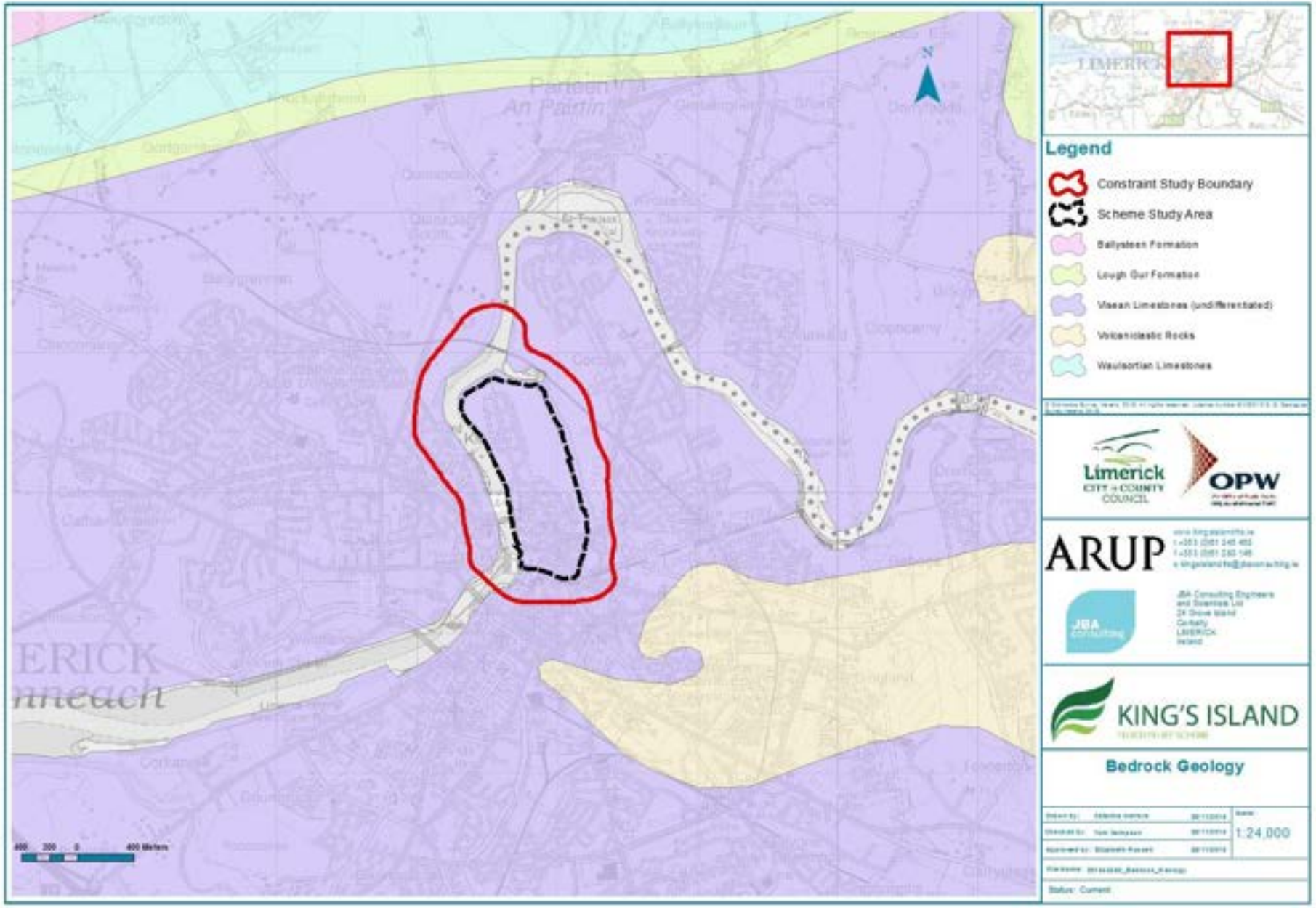


7.2.3 Bedrock Geology

The GSI 1:1,000 bedrock map for the study area is Sheet 17. The constraints study area is underlain by Visean Limestones (undifferentiated) (refer to Figure 7-3). The available site investigation data for the Site generally noted 1.5m to 3.5m thick beds of cobbles, boulders and weathered rock overlying strong light to dark grey LIMESTONE BEDROCK. The thickness of the weathered rock layer is generally variable across the site based on the available site investigation data. Depth to weathered bedrock is generally approximately 3.0m to 11.0m bgl across the Site, increasing in depth in a southwest to northeast direction, with one rotary corehole in the north east of the site showing the depth to weathered bedrock to be 22.2m bgl. Site investigation information for the far eastern section of the constraints area reveals fluctuating depths of weathered bedrock. There are no records of bedrock in the north and south of the constraints area, however in between, the bedrock varies from 8m to 4m bgl and 3m to 7m in thickness.

The limited rotary corehole information available for the constraints study area reveals the solid bedrock is fresh, locally slightly weathered, strong to very strong thick to thinly bedded fossiliferous light to dark grey LIMESTONE. Discontinuities are closely to widely spaced, sub horizontal to sub vertical, rough, planar, open, clean to sediment in filled.

Figure 7-3. Bedrock Geology



7.2.4 Karst

A rock bedrock on surface is noted on the GSI maps in the north west of the Site (Figure 7-1 and Figure 7-2) and in the west and north west of the constraints area. Figure 7-2 refers to the outcrop as 'karstified bedrock outcrop', however the GSI karst database indicates that there are no karst mapped features in the constraints study area. However, the fluctuating depths of weathered and solid bedrock as revealed in the available site investigation data records are typical of karst topography. The detailed site investigation to be undertaken on the Site will investigate the presence of Karst further.

7.3 Hydrogeology

7.3.1 Aquifer Type and Classification

The Site is located within the Lower Shannon Water Basin District and the Limerick City East Groundwater Body. It underlain by Visean Limestones (undifferentiated) (Figure 7-3).

The Geological Survey of Ireland has devised a system for classifying the aquifers in Ireland based on the hydrogeological characteristics, size and productivity of the groundwater resource. The three main classifications are Regionally Important Aquifers (RI), Locally Important Aquifers (LI) and Poor Aquifers (P).

Table 7-1. Summary of the GSI Aquifer Classification for Lithologies present summarises the bedrock geology present on the site and in the surrounding constraints area based on the GSI aquifer classification (Refer to Figure 7-4). It also presents the Importance of each of these aquifers, based on the criteria presented in Table 7-2. Criteria for Rating Site Importance of Hydrogeological Features (NRA,2008) below.

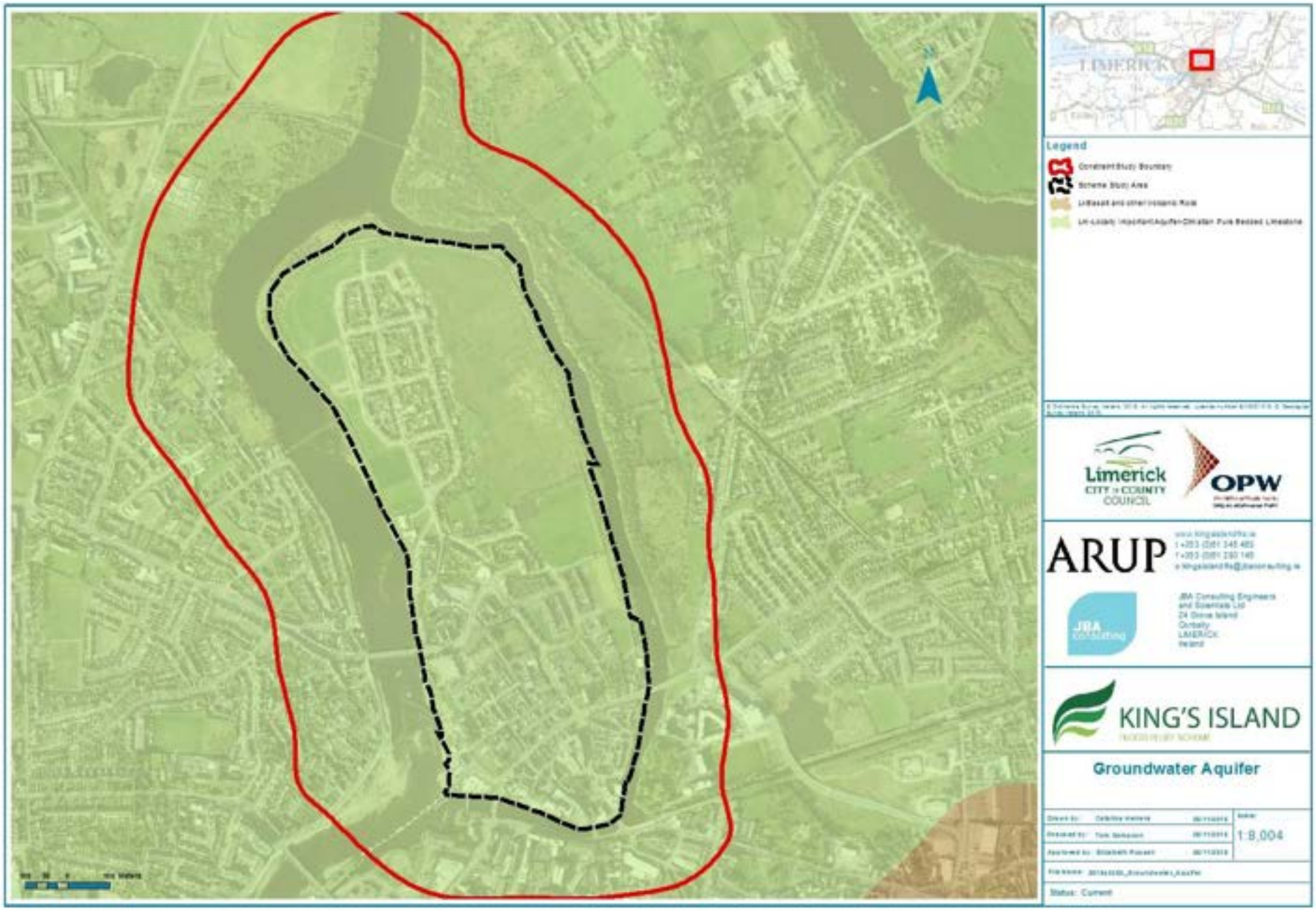
Table 7-1. Summary of the GSI Aquifer Classification for Lithologies present

GSI Aquifer classification	Rock Unit	Lithology	Location	Importance	
				Ranging	Justification
Lm: Locally Important aquifer	Dinantian Pure Bedded Limestones	Undifferentiated Visean Limestone	Constraints Study Area	Medium	Locally Important Aquifer

Table 7-2. Criteria for Rating Site Importance of Hydrogeological Features (NRA,2008)

Importance	Criteria	Typical Example
Extremely High	Attribute has a high quality or value on an international scale	Groundwater supports river, wetland or surface water body ecosystem protected by EU legislation e.g. SAC or SPA status
Very High	Attribute has a high quality or value on a regional or national scale	Regionally Important Aquifer with multiple wellfields.
High	Attribute has a high quality or value on a local scale	Groundwater supports river, wetland or surface water body ecosystem protected by national legislation – e.g. NHA status.
Medium	Attribute has a medium quality or value on a local scale	Regionally important potable water source supplying >2500 homes
Low	Attribute has a low quality or value on a local scale	Inner source protection area for regionally important water source.

Figure 7-4. Groundwater Aquifer



7.3.2 Vulnerability

Vulnerability is defined by the GSI as the geological and hydrogeological characteristics that determine the ease with which groundwater may potentially be contaminated by human activities. The vulnerability depends upon:

- The time taken by infiltrating water and potential contaminants to reach the saturated zone, i.e. below the water table.
- The relative quantity of the contaminants that can reach the groundwater having being attenuated through the overlying sub-soils.

The travel time, quantity of the contaminants and the attenuation depend on the following geological and hydrogeological attributes:

- The sub-soils that overlie the groundwater.
- The recharge type, i.e. whether point or diffuse.
- The thickness and permeability of the unsaturated zone through which the contaminant moves.
- In general, little attenuation of contaminants occurs in the bedrock in limestone because flow is almost wholly via the weathered, fissured and blocky limestone and, in some cases, conduits. Consequently, the sub-soils on the site - sands, gravels and glacial tills- are the single most important natural feature influencing groundwater vulnerability. Groundwater is most at risk where the sub-soils are absent or thin or where karst landforms are present.
- The GSI uses five groundwater vulnerability categories – Rock at or near surface or Karst (X), Extreme (E), High (H), Moderate (M) and Low (L) for mapping purposes and in the assessment of risk to ground waters. The classifications are based on the thickness and permeability of the sub-soils overlying the aquifer.

  The GSI Ground Water Vulnerability Map for the Site (Refer to **Figure 5-5** in **Section 5:Water**).shows that the vulnerability ranges from 'Extreme' (E) to 'Rock at or near surface or Karst' (X). The vulnerability of the aquifer in the constraints area is classified by the GSI as having a range of vulnerability, from Low to Extreme. The rock outcrop at or near surface in the north west of the Site and north and north west of the constraints area is classed as moderate to extreme vulnerability. The north east of the Site and east of the constraints area is classified as Low vulnerability, with vulnerability increasing to moderate to the south of the Site. (Refer to **Figure 5-5** in **Section 5:Water**).

7.3.3 Local Hydrogeology

Groundwater data obtained from historic site investigations reveal groundwater to be 0.20m bgl to 1.80mbgl in the north of the Island and in the south of the Island at the Potato Market groundwater was recorded initially between 3.0m bgl and 5.3m bgl, rising to between 1.5m bgl and 2.5m bgl. Allowing for seasonal variations in groundwater levels and given that the site is bounded by rivers, it is assumed that the groundwater level is likely to be close to the existing ground level and river level.

Groundwater flow beneath the Site is likely to be radially from the centre outwards with a surging effect close to the river reflecting tidal cycles. Rain water will infiltrate through the ground and drain towards the closest surface water feature, however its ability to drain into the river will be limited by the tidal influence of groundwater levels rising and falling, particularly around the boundary of the site.

The permeability of the overburden will influence how quickly the groundwater level responds to changes in the river level. In areas with thicker sand and gravel, the groundwater levels are likely to see a more rapid response than areas where there are silts and clays. Local influences such as the presence of quay walls will also influence the extent to which groundwater levels change with river levels.

7.3.4 Historic Landfill

An existing historic unregulated landfill lies to the east of St Mary's Park and is currently being remediated. Anecdotal evidence suggests that this landfill was use for domestic waste. There were no other details available for this landfill at the time of writing this report.

7.4 Summary of Key Constraints

7.4.1 Soil and Geology

Soft Ground

The marine/estuarine soil deposits, which underlie the constraints study area are soft compressible soils and will require detailed site investigation to engineer a suitable flood defence for the Site. The presence of such material restricts the type of equipment, construction techniques and engineering design that is appropriate for such soft ground conditions. The detailed site investigation will profile and establish the engineering properties of the soft soil deposits to inform both the engineering design and appropriate construction techniques to be employed when building the flood defence for the Site.

Made Ground

The populated/urban areas of the site are underlain with made ground (Figure 7-1 and Figure 7-2) which comprises silty clay and clayey sand with loose ash, red brick, gravel, shells and occasional glass and wood. Depending on the proposed flood defence, the made ground which is uncompacted and highly variable may require to be excavated and replaced with suitable founding material. This material may also be a possible a source of contamination. As this material will be excavated during construction, it will require contamination testing which will be undertaken during the detailed site investigation. The material will be screened, classified and appropriate measures specified for its excavation, storage and disposal during construction of the flood defences.

Historic Landfill

The area around St. Mary's Park has a history of dumping and burning of waste. A site to the back of the estate on the east is a known illegal dumping site. Recently as part of the Regeneration Programme for King's Island, this site has been cleaned up, however it is still considered a high risk area for contaminated soil.

7.4.2 Ecologically Sensitive Area

The presence of The Lower River Shannon Special Area of Conservation (SAC) (Refer to Figure6.2 in Section 6: Ecology and Fisheries) which surrounds the entire Site and is within the site boundary to the north east, constrains the location and the design of the flood defence. The flood defence alignment and foot print will need to mitigate against causing minimal disruption to the SAC with regards to removal of vegetation, the horizontal and vertical extent of excavation of in-situ soils and minimising encroaching on the SAC. Construction activities will be specific to working in ecologically sensitive environments.

7.4.3 Archaeological Sensitive Area

The Site is in an archaeologically sensitive area given its proximity to St. Johns Castle and historic city defence walls. The upper soil profile under the footprint of the proposed flood defence could be archaeologically significant and therefore minimising, where possible, the disruption to the in-situ soils on the site should be a design consideration. A detailed archaeological investigation will be undertaken in the study area to target specifically archaeological sensitive areas.

7.4.4 Karst

Given local experience in this area and the lack of recorded karst features in the GSI data base, it is unlikely that karst features will be encountered on the site. However, it is prudent to consider that karst features such as caves, swallow holes, weathered rock and dolines can lead to ground surface and ground instability and are a constraint to be considered in the engineering design of the scheme.

7.4.5 Hydrogeology

Groundwater Flooding

Groundwater flooding may occur in areas where there is shallow rock or very permeable soil deposits, as ground water may move under flood barriers. Existing available information on the ground conditions on the site reveal shallow rock in the north east of the site, and sand and gravel deposits are located to the north of St. Mary's Park and in some isolated spots in the

south of the Site. The topographic survey undertaken on the site will identify the low points on the Island which may be vulnerable to groundwater flooding. Targeted SI will investigate the ground conditions at these locations and also in areas identified during the desk study comprising shallow bedrock.

Groundwater and surface water level monitoring should also be undertaken simultaneously to allow correlation between groundwater level and river level changes.

Construction of Flood Defences

The design of the flood defence should consider the water flow regime into and out of the site where the defences are being installed. The ground/tidal water interaction will heavily influence the flood defence type(s) that will be recommended for the Site. In some locations the defences may need to go to a depth underground to delay tidal water flow under the defence to ensure that groundwater flooding does not occur on the Island. Alterations to groundwater flow may also impact the unregulated landfill and cause mobilisation of contaminates which may discharge to the SAC.

The construction of a flood defence earth embankment may cause ground compression in the underlying soft marine/estuarine soil deposits and possibly alter the water flow regime into and out of the site which may impact the SAC. Compression of the soft material under the embankment will reduce the soils permeability, causing flow to divert around it. While it is likely that this will be a localised issue, an ecologist will be required to investigate the impacts of this further.

Detailed site investigation should be undertaken on the Site to characterise the nature, compressibility and permeability of the ground under the proposed flood defences. Surface water features should be surveyed and flow monitored to highlight the existing surface water drainage network in the marsh and allow water balance calculations to be completed. River and surface water levels should also be undertaken. Groundwater quality should be monitored adjacent to the unregulated landfill.

Ecologically Sensitive Area

Groundwater dependent habitats may be impacted by the proposed flood defences through accidental contamination and alteration to base-flow to the SAC causing an area to dry out or flood out of season. The design of the proposed flood defences should mitigate these impacts via a detailed understanding of the water flow though the site and measures such as monitoring put in place to minimise impacts.

Karst

Alteration to the surface water drainage and groundwater flow within the constraints area could lead to reactivation of the existing karst features and initiate ground surface and/or ground instability. Design and implementation of good construction practices can mitigate against this.

7.5 Hydrogeomorphology

Hydromorphology can be described as the hydraulic interaction between channel form and channel flows to define physical habitat. This also demonstrates the link between hydromorphological forms and processes and ecological conditions and habitats. A hydromorphological response to a physical modification within a watercourse needs to be understood to determine the impact on the hydromorphological conditions but also the impacts on habitats and species that live therein.

The introduction of the Water Framework Regulations in Ireland saw the requirement to improve water quality in all sources of water.

It set the platform for the creation of River Basin Management Plans in Ireland whose function was to integrate the management of water bodies within catchments. Hydromorphology is a key aspect of these River Basin Management Plans.

The Water Framework defines 'hydromorphology' as the flow, shape and physical characteristics of a watercourse. Any in-channel works for the proposed flood scheme could impact on one of these variables and the natural process that occurs within the river, including:

- Flow patterns
- Width and depth of the channel

- Features such as pools, bars and bank slopes
- Sediment transport and availability
- Interaction between the river and the floodplain
- Ecology supported by the aquatic environment

7.5.1 Assessment Methodology

A desktop assessment was carried out as part of this report to determine the potential constraints associated with a flood management scheme on the hydromorphology of the River Shannon and Abbey River. The existing morphology of both rivers is largely supplied by the deposits been reworked from the bank erosion and transportation of sediments from the tides and upper reaches of the rivers. There are a number of barriers that exist to sediment transport (such as bridges, quay walls, dams and slipways) on both rivers. Within the southern parts of the Island the channel has been modified to accommodate developments on the Island. The presence of flood protection in the form of sand banks around the eastern and northern sections of the Island has prevented the natural flooding of the flood plain in these areas. This has had the effect of modifying the river at these locations.

A river velocity survey of the rivers is been carried out as part of this work and when the data is available a hyrdomorphological audit of the rivers will be conducted. The findings of this assessment will be used to determine the impacts of the proposed flood defence scheme on the hydromorphology of the river systems. The FRS will need to be cognisant of the marine/estuarine soft deposits that are found on the Island. The FRS should be designed to minimise the impacts of the hydrogeomorphology in the rivers.

8 Landscape and visual amenity

This chapter provides a review of constraints relating to landscape and townscape character alongside visual amenity. It includes a review of planning policy and guidance where relevant to the study area and the issues that may arise through construction and implementation of the scheme.

8.1 Methodology

8.1.1 Desk-based Assessment

A review of relevant planning policy and related publications was carried out, including the following:

- National Spatial Strategy (NSS) and National Guidelines
- National Landscape Strategy for Ireland 2015-2025
- Mid-West Regional Planning Guidelines 2010-2022
- Mid-West Area Strategic Plan 2012-2030
- Limerick City Development Plan 2010-2016
- Limerick 2030: An Economic and Spatial Plan for Limerick (2014)
- Strategic Environmental Assessment of Proposed Variation No. 4 to the Limerick City Development Plan 2010-2016 – Incorporation of the Limerick 2030 Economic and Spatial Plan (2014)
- Limerick Regeneration Framework Implementation Plan (2013)

The site survey (Section 8.1.2) was supported by aerial and street photography from publically available services such as Google Maps, and online mapping services such as the National Inventory of Architectural Heritage.

8.1.2 Site survey

A site survey was carried out on 12-13 November 2015. This encompassed the key areas likely to be impacted upon by the scheme, including the following sites:

- Verdant Place north of Thomond Bridge.
- St Mary's Park and associated river bank from Verdant Place to the west to O' Dwyer's Bridge to the east.
- Sir Harry's Mall from O' Dwyer's Bridge to Abbey Bridge.
- City Hall, Court House and surrounding areas south of Thomond Bridge to Abbey Bridge.

8.2 Landscape Policy

8.2.1 National Planning Policy

The National Spatial Strategy 2002-2020: People, Places and Potential (NSS)

The NSS provides an overall framework for planning in Ireland. It provides strategic planning guidance for a range of government policies and plans at regional and local level (e.g. Development Plans), which must have regard to the NSS.

The NSS highlights the need for sustainable development and the need to avoid adverse environmental impacts on landscapes, as well as ensuring that the design of new development or refurbishment is of a high quality and appropriate to the scale and context of the surroundings.

The NSS identifies strategic tourism opportunities across the country, with Limerick described as a city that could develop as a destination for city breaks and the landscapes around the city as potential destinations for weekend leisure activities. More generally, the strategy recognises that attractiveness and integrity of landscapes and townscapes are central to Ireland's tourism industry.

The NSS states that environmental quality—the natural and cultural heritage—is most visibility evident in landscapes. The quality and character of Ireland's environment makes a major contribution to national identity and to the green image of the country. Historic buildings and structures also contribute to the overall picture. It contributes to recreational, economic, social and overall quality of life, providing the immediate surroundings of a home and the wider setting of neighbourhood and town.

However, it should be pointed out it is generally agreed the NSS has had limited impact, with partial implementation at best. In 2013, the Minister for Environment announced its scrapping, mainly as a result of an absence in investment required to support the strategy. It is intended to replace the NSS with a new National Planning Framework.

National Guidelines

The Department of Environment, Community and Local Government produces a number of guidelines designed to help planning authorities influence and encourage good development.

These include:

- Design Manual for Urban Roads and Streets (2013)
- Guidelines for Planning Authorities & An Board Pleanála on carrying out Environmental Impact Assessment (2013)
- The Planning System and Flood Risk Management (2009)
- Urban Design Manual: Best Practice Guide (2009)
- Landscape and Landscape Assessment: Consultation Draft of Guidelines for Planning Authorities (2000)

National Landscape Strategy for Ireland 2015-2025

The strategy is intended as a framework "for the protection of the many cultural, social, economic and environmental values embedded in the landscape" and was developed in response to the European Landscape Convention (2000) which was ratified by Ireland in 2002.

The strategy defines the following core objectives:

- "Recognise landscapes in law
- Develop a National Landscape Character Assessment
- Develop Landscape Policies
- Increase Landscape Awareness
- Identify Education, Research and Training Needs
- Strengthen Public Participation."

Furthermore, the strategy proposes a range of actions defined on the basis of these objectives and intended for implementation within 10 years of the publication of the strategy. One key set of actions is around the development of a National Landscape Character Assessment, to underpin other objectives and actions.

8.2.2 Regional Planning Policy:

8.2.3 Mid-West Regional Planning Guidelines 2010-2022

Regional Planning Guidelines are intended to support the implementation of the NSS to achieve effective planning strategies at a regional level. The country is divided into 10 Regional Authorities, each being a statutory body with the responsibility for strategic planning. The site is within the Mid-West Regional Authority.

The Mid-West Regional Planning Guidelines (2010-2022) is intended to work within the NSS framework and offer further guidance to the region. It includes chapters on:

- The Limerick Regeneration Project which focuses on areas referred to as "social-exclusion black spot(s)" with a range of measures such as physical regeneration to be deployed to tackle socio-economic problems;
- Limerick City, which is at the centre of the mid-west region. While the section highlights Limerick's excellent transport links, its enterprise and employment traditions, fine

architectural fabric, as well as the range of social and recreational facilities found in the city, issues surrounding the city's poor image, lack of vibrancy, loss of population, and the need for improvements in infrastructure, including water and wastewater facilities, are given attention.

- The landscape, which calls on a common approach to management that recognises landscape character across areas which may cross administrative boundaries, and also calls on landscape protection policies mindful of ecological sites and habitats.
- Flooding and flood risk, including flood risk in Limerick City, known to be vulnerable to tidal and fluvial flooding.

Mid-West Area Strategy Plan 2012-2030

- The plan is chiefly concerned with land use and transport across the region. It sets out a framework to assist decision making on spatial development to 2030 and aims "to achieve the maximum social, economic, health and cultural benefits for all its citizens." At its core, it is aligned with the National Spatial Strategy 2002-2020 and is closely related to the Mid-West Regional Planning Guidelines 2010-2022.
- In its Strategic Environmental Assessment Mitigation Measures, the plan defines the following:

  Regional level. The country is divided into 10 Regional Authorities, each being a statutory body with the responsibility for strategic planning. The site is within the Mid-West Regional Authority.

The Mid-West Regional Planning Guidelines (2010-2022) is intended to work within the NSS framework and offer further guidance to the region. It includes chapters on:

- The Limerick Regeneration Project which focuses on areas referred to as "social-exclusion black spot(s)" with a range of measures such as physical regeneration to be deployed to tackle socio-economic problems;
- Limerick City, which is at the centre of the mid-west region. While the section highlights Limerick's excellent transport links, its enterprise and employment traditions, fine architectural fabric, as well as the range of social and recreational facilities found in the city, issues surrounding the city's poor image, lack of vibrancy, loss of population, and the need for improvements in infrastructure, including water and wastewater facilities, are given attention.
- The landscape, which calls on a common approach to management that recognises landscape character across areas which may cross administrative boundaries, and also calls on landscape protection policies mindful of ecological sites and habitats.
- Flooding and flood risk, including flood risk in Limerick City, known to be vulnerable to tidal and fluvial flooding.

Mid-West Area Strategy Plan 2012-2030

The plan is chiefly concerned with land use and transport across the region. It sets out a framework to assist decision making on spatial development to 2030 and aims "to achieve the maximum social, economic, health and cultural benefits for all its citizens." At its core, it is aligned with the National Spatial Strategy 2002-2020 and is closely related to the Mid-West Regional Planning Guidelines 2010-2022.

In its Strategic Environmental Assessment Mitigation Measures, the plan defines the following:

MI-22 - "Any development proposed under the strategy should take full cognisance of the landscape character, landscape value and sensitive landscapes as identified in the relevant County Development Plans. Specifically, in Limerick City, the protection and preservation and Linear views, river prospects and approach road views should be considered as required in the draft City Development Plan 2010-2016."

The above mitigation measure is further linked to the Strategic Environmental Objective for Landscape whereby: "The Strategy should minimise impacts on the landscape character, and on designated, sensitive and protected landscapes…" The Mid-West Area Strategy Plan thus clarifies the importance it accords to landscape character, value and associated views.

8.2.4 Local Planning Policy

Limerick City Development Plan 2010-2016

The plan was adopted in 2010 and sets out strategies for economic development, retail, transportation, housing, regeneration, the community, the arts, the built heritage, the landscape, the environment, the city centre and other areas, land-use zoning, and development management.

Landscape, biodiversity & recreation

This chapter makes early reference to the importance of views to Limerick City, describing it as “an attractive physical setting formed by the Shannon River… (and) supplemented by a range of public open spaces and parks, walkways, public and private spaces…, views in and out of the City, biodiversity, trees and tree groups, which combine to form the natural backdrop for the built environment.” Policy LBR.1 is thus defined "to ensure that Limerick's landscape, biodiversity and recreational facilities are preserved and enhanced, and that the overall combined potential and value of the network of open spaces and related assets within the city is recognized, retained and enhanced." A large area surrounding the residential portion of St Mary’s Park, along the north-west and north-east of King’s Island from Verdant Place to the west to O’ Dwyer’s Bridge to the east, defined as Public Open Space on Map 1D: Open Space Provision.

The section on landscape further highlights the importance of views and the need to preserve these "prospects and the amenity value of places and features of natural beauty or interest", with Policy LBR.2 defined to "preserve and enhance Limerick's Landscape Assets and Key Landscape Sites (and) preserve and enhance Limerick's Views and Prospects of Special Amenity Value".

Important viewpoints are exemplified with views of "the River Shannon or panoramic views from vantage points both inside and outside the City", including views of "principle elements of the City skyline". The Development Plan goes on to define three view types:

- "linear views of landmark buildings, the city walls and city skyline" including either single or combinations of elements,
- "river prospects" of landmark buildings from bridges in particular, and
- "approach road views" as visitors near the city.

Policies LBR.5 and LBR.6 build on these considerations with the following respective statements:

- "It is the policy of Limerick City Council to protect the intrinsic character and scale of the City and the City skyline" and
- "(…) to protect key views and vistas and the visual prominence of important city landscape and townscape features such as areas of woodland, important tree groupings and areas of special architectural or heritage value."

In relation to landmarks and other landscape elements that may be held within a view, it is worth noting that Map 7A: Record of Protected Structures and Map 7B: Sites and Monuments Register highlight a large number of structures on King’s Island, mainly within the southern half of the island, with many coinciding with features recorded on the National Inventory of Architectural Heritage. In addition, Map 7C: Zone of Archaeological Potential encompasses the majority of the southern half of King’s Island within said zone.

On character, the Plan notes the distinctive nature of the city's landscape character and the contribution made by landscape elements and assets to this character, although no Landscape Character Areas are defined within the plan to formalise these assets. Policy LBR.3 is defined "to conserve and enhance the strongly distinctive landscape character of the City by protecting landscape elements of significance that are either intrinsically important or contribute to the general amenity of Limerick City. Landscape assets are a non-renewable resource that the City Council shall seek to protect." And Policy LBR.4 is defined " to explore the potential and benefits of designating one, or more, Landscape Conservation Areas under Section 204 of the Planning & Development Act 2000-2008 for the purposes of preserving Limerick's landscape character."

Within this chapter on landscape, biodiversity and recreation, the section on biodiversity and natural heritage makes reference to the following designated areas near to King's Island:

- The Lower River Shannon Special Area of Conservation (SAC), which coincides with a north-east portion of King's Island and otherwise surrounds the entire island.
- The proposed Fergus Estuary and Inner Shannon, North Shore Natural Heritage Area (NHA), located south-west of the island and coinciding with the river bank south of Thomond Bridge.
- The River Shannon and River Fergus Estuaries Special Protection Area (SPA), further south-west of the island from Shannon Bridge.

These designations are relevant in the context of this chapter insofar as "places and features of natural beauty or interest" are noted for their amenity value in relation to the landscape, although the environmental constraints that may be derived from these designations are to be covered in a separate chapter (see **Chapter 2 – Environmental Constraint**).

A section on rivers and waterways, aside from highlighting their biodiversity value, makes particular reference to these features as "very important assets of Limerick", playing "an important role in the layout and structure of the City" and forming "an integral element of the city's landscape character." Indeed Limerick's waterways are described as "[providing] important visual amenity for the city as a whole" and associated Policy LBR.9 states it is "to ensure that proposals along the River Shannon and other waterways associated with the River Shannon catchment within Limerick City will achieve an appropriate balance of uses…"

Land use zoning objectives

Landscape character is also referred to in the Plan's chapter on land use zoning, with Objective ZO.6 (B) on Environmental Preservation Zones defined "to preserve and enhance the special natural and/or visual character of the preservation zones…", where these zones are described as having "been identified by National, European and other designations or due to their sensitive landscape character… deemed to be in need of special protection." Associated Map 5: Environmental Preservation Areas highlights the Lower River Shannon SAC, the proposed Fergus Estuary and Inner Shannon, North Shore NHA and the River Shannon and River Fergus Estuaries SPA designations listed above.

Limerick 2030: An Economic and Spatial Plan for Limerick (2014)

This Plan is aimed at building a "framework for public sector action and private sector investment until 2030", setting out both an economic strategy and a spatial plan to steer improvements to the local economy and physical fabric of the city and city centre in particular.

Parts of King's Island fall within the City Centre as defined in the Plan, with the following waterfront and medieval core proposals worth noting in relation to the study area:

Streetscape investment along Bridge Street, Mary Street, Nicholas Street, St. Augustine Place, City Hall and over Thomond Bridge.

Introduction of a river walk into the Potato Market, along City Hall and around King John's Castle.

Renovation of City Hall, Court House, and Barrington Hospital along George's Quay.

Urban Open Space consolidation around the Potato Market, Court House, City Hall, and east of the island north of O' Dwyer's Bridge and Athlunkard Boat Club house.

Public Realm enhancement along George's Quay, Creagh Lane, Bridge Street, Mary Street, Nicholas Street, Exchange Street, Saint Peter Street, St. Augustine Place, Saint Francis Place, Crosbie Row the area around City Hall and King John's Castle including The Parade and a portion of Castle Street.

Strategic Environmental Assessment of Proposed Variation No. 4 to the Limerick City Development Plan 2010-2016 – Incorporation of the Limerick 2030 Economic and Spatial Plan

The section on the current state of the landscape acknowledges Limerick's rich urban fabric, featuring medieval street patterns as well as Georgian architectural tural heritage, and largely shaped by the city's riverside setting. Given this setting, it calls on "future developments… to be sympathetic to the river-scape in terms of design and building height" and refers to the 2008 city centre plan "promoting… the sensitive development of the river corridor… an important location for amenity and cultural use."

The document defines the following Environmental Protection Objectives (EPOs) of note in the context of this report:

In relation to cultural heritage, EPO C1 to “protect and conserve features of archaeological heritage and their setting.”

In relation to the landscape, EPO L1 to “protect and conserve the quality, character and distinctiveness of the Limerick cityscape.”

And in relation to material assets, EPO MA1 to “maintain sustainable access to assets such as open spaces, water resources and all other physical and social infrastructure.”

Under the landscape section concerning relevant environmental problems, the importance of city views such as along the River Shannon or from vantage points is highlighted, and the view typology defined in the Limerick City Development Plan, which consists of linear views, river prospects and approach road views, is included and described. Furthermore, the need for future development “to be sympathetic to the townscape in terms of design and building height” is reiterated, and supplemented by a call to “(ensure) integration of green infrastructure principles in development proposals along the waterway corridor”.

Limerick Regeneration Framework Implementation Plan (2013)

The Plan was published by Limerick City and County Councils in November 2013, and defines St Mary's Park, which occupies the northern portion of King's Island, as one of four regeneration areas alongside Moyross, Ballinacurra Weston and Southill.

Within its chapter on St. Mary's Park, the Plan describes King's Island as "an important asset to the city, particularly in terms of its ecological importance, archaeological significance, and tourism potential" as well as forming "an important residential and community environment", with St. Mary's Park housing estate to the north, terraces and apartment blocks to the south.

Of note in the context of this report are references to public realm issues within St. Mary's Park, including a "severe environmental black spot to the east of St. Munchin's Street where a strip of land has been used as a landfill site and filled with domestic refuse". While this illegal landfill has been cleared since publication of the Plan, widespread evidence of littering and dumping of domestic refuse was still found during site visits made in November 2015.

In common with the Limerick City Development Plan, the regeneration plan highlights the importance of views of "King's Island from the west bank of the River Shannon", also described as "the most frequently used image to represent Limerick City" and taking in such elements and assets as "King John's Castle, Thomond Bridge and St. Mary's Cathedral" or the city's so-called medieval core, which also includes stretches of the City Wall.

The Plan also highlights the presence of architectural and archaeological heritage in St Mary’s Park, some of which forms part of statutory mechanisms such as the Record of Protected Structures and the National Inventory of Architectural Heritage. The Area of Special Planning Control designation that covers a south-western portion of the island is likewise flagged within the plan as “an architectural conservation area… of special importance to… the civic life or the architectural, historical, cultural or special character of a city or town…”, as is the Zone of Archaeological Potential covering most of the southern half of King’s Island as noted previously.

In its section on existing open space and amenity, the Plan states the important “visual amenity (important landscape views)” afforded by open spaces. Of note in this respect is the riverside walkway marked red on the associated Figure 1.20 Open Space and Amenity map, a route offering views in and out of King’s Island, although a large section running north-east of the island was noted as closed and partially blocked during the November 2015 site visits, the result of measures deployed following the severe floods which affected the island in 2014.

8.3 Landscape Character

Limerick County Development Plan 2010-2016

The County Development Plan defines ten Landscape Character Areas for the County but excludes Limerick City from the characterisation.

Limerick City Development Plan 2010-2016

The City Development Plan makes reference to landscape character in its chapter on landscape, biodiversity and recreation, although the Plan does not specifically define Landscape Character

Areas for the city and this exercise does not appear to have been carried out or published elsewhere.

Of note within the plan is Policy LBR.3, defined to "seek to conserve and enhance the strongly distinctive landscape character of the City by protecting landscape elements of significance that are either intrinsically important or contribute to the general amenity of Limerick City." In the absence of defined Landscape Character Areas, the policy statement suggests that landscape elements should be given particular attention.

8.4 Existing Views

Refer to **Appendix C-** Landscape and Visual Amenity Existing Views

8.5 Key Constraints for Landscape in the Study Area

The key landscape and visual constraints for landscape have been identified as follows:

Views out

- **Protection of residential** views out to the river, river bank and open spaces within King's Island, as well as Limerick City landmarks beyond, from housing within **St Mary's Park,** where protection from flood is proposed to take the form of an embankment to replace temporary flood protection in the form of sand bags currently to be found on site. Illustrations 1 and 2.
- **Protection of recreational views out** to the river, river bank and Limerick City landmarks beyond from riverside footpaths. Illustration 3.
    - Evidence gathered during site visits suggest that the river bank and adjoining open spaces are used for recreation by local children, thus requiring clear views to be maintained for supervision. Where sandbags installed since the 2014 floods have obstructed views to the river bank, care should be taken that future works reinstate circulation (footpaths and cycle ways) that allows for such supervision to take place.
- **Protection of residential views out** to the river and river bank from housing along Verdant Place, where flood protection is likely to take the form of a flood wall to supplement the existing stone wall along this stretch. Illustration 4.

Protection of residential and civic views out to the river and river bank from housing and public spaces located around King John's Castle, City Hall and surrounding areas south of Thomond Bridge to Abbey Bridge to the south-east, where flood protection is likely to be provided through infilling gaps in existing stone walls. Illustration 5.

The flood wall to be built along Verdant Place and wall infills to be added along the south of King's Island should be in keeping with the existing character of the built environment found locally.

Views in

- **Protection of recreational views** in to the wetland north-east of King's Island, part of the Lower River Shannon SAC. Illustration 6.
- **Protection of recreational and residential views** in to King's Island and associated landmarks from open spaces and housing on the west bank of the River Shannon. Illustration 7.
- **Protection of civic views in** to King's Island and associated landmarks from locations such as Clancy's Strand on the west bank of the River Shannon across from King John's Castle, or Sarsfield Bridge and Honan's Quay south-west of the island. Illustration 8.
    - It should be reiterated that **Policy LBR.6** of the Limerick City Development Plan calls for river prospects and linear views encompassing city landmarks to be protected.

9 Heritage and Archaeology

9.1 Introduction

MOORE GROUP was commissioned by JBA Consulting to carry out a cultural heritage constrains report for the Kings Island Flood Relief Scheme. King's Island lies in the heart of Limerick City and is surrounded by the waters of the River Shannon and the Abbey River. Both Rivers are tidal and the island is susceptible to both coastal and fluvial flooding. There have been a number of flooding incidences in recent years. Limerick City and County Council have prepared the current brief to engage consultants to assess, develop and design an appropriate viable, cost-effective and sustainable flood relief scheme which aims to minimise risk to human beings, the existing community, social amenity, environment and the landscape character. This study provides an inventory of the recorded cultural heritage resource within Kings Island (For full Heritage Report refer to **Appendix C.1**).

Moore Group is a multi-disciplinary environmental, planning and heritage resource management consultancy. Our work includes Environmental Impact Assessments (EIS), surveys of terrestrial, freshwater and marine environments (in conjunction with Moore Marine), conservation management planning, ecological landscape design, built heritage and archaeological consultancy and fieldwork including archaeological excavation and other specialist services.

For the purposes of this report the definition of "cultural heritage" is taken broadly from the UNESCO Convention Concerning the Protection of the World Cultural and Natural Heritage, 1972, which considers the following to be "cultural heritage":

- Monuments: architectural works, works of monumental sculpture and painting, elements or structures of an archaeological nature, inscriptions, cave dwellings and combinations of features, which are of outstanding universal value from the point of view of history, art or science;
- Groups of Buildings: groups of separate or connected buildings which, because of their architecture, their homogeneity or their place in the landscape, are of outstanding universal value from the point of view of history, art or science;
- Sites: works of man or the combined works of nature and man, and areas including archaeological sites which are of outstanding universal value from the historical, aesthetic, ethnological or anthropological point of view.

9.2 Methodology

A desktop study of all the available Cultural Heritage inventories and cartographic sources that are considered relevant for the overall cultural heritage constraints report was undertaken. This information is included in light of the legislative protection afforded to the archaeological resource under the various National Monuments Acts (1930-2004) and the architectural resource under the Planning and Development Act 2000. Utilising the following information sources this chapter presents an overview of all the known archaeological, architectural, cultural and historical constraints within the study area.

9.2.1 Information Sources

All known cultural heritage sites were mapped along with Ordnance Survey Ireland (OSI) First Edition Mapping (Circa 1830). The following information sources were used for this chapter:

- UNESCO World Heritage Sites including the tentative list of candidate sites;
- National Monuments in State Care;
- Potential National Monuments in the Ownership of a Local Authority – a list made available from the Department of Arts Heritage and the Gaeltacht (DAHG);
- Sites subject to Preservation Orders a list available from the Department of Arts Heritage Gaeltacht (DAHG);
- Walled towns, information derived from www.archaeology.ie;
- Site and Monuments Record database from www.archaeology.ie;
- Architectural Conservation Areas, information received from the City Development Plan;
- Record of Protected Structures from Limerick City Council;

- National Inventory of Architectural Heritage (NIAH) from www.buildingsofireland.ie;
- Designed Landscapes and Historic Gardens indicated on the OSI First Edition Mapping; and
- Designated Landscapes, information received from the Development Plan.

All churches and graveyards which have the potential to be in the ownership of the local authorities were highlighted as potential National Monuments.

The Limerick City Development Plan (2010-2016) and other relevant documentary sources were scoped in the compilation and preparation of this constrain study.

9.3 Existing Environment

The following section examines both the archaeological and architectural heritage of the study area and provides an introduction to the various information sources and inventories highlighted in the accompanying Figures found in **Appendix C.3**

9.3.1 The Study Area

Kings Island in Limerick City is strategically located in a national context, positioned near a fording point and guarding the northern approaches to the Shannon. Given its context it is likely that the island was settled from earliest times. It has been convincingly argued that 'Regia' as feature on Ptolemy's map of Ireland (150 AD) is King Island. The Annals reference Limerick (meaning the Bare marsh) as being linked to the High King Cormac mac Airt and St. Patrick. In the ninth century the site was sufficiently large enough to become a target of Viking Attacks. These raids eventually led to a permanent Norse settlement. In the early 10th century Limerick was second only to Dublin as a regional power. In the 12th century the invading Normans under Prince John battled with the O'Brien's, Kings of Thomond for control of the town. Following the death of Domnall Mór Ua Briain, the last styled King of Limerick, the Normans completed their conquest and quickly began the construction of a castle bearing the kings own name. Under Norman rule the town developed its ports and grew in prosperity, Kings Island as the strategic core became 'English town', a settlement on the south bank was known as 'Irish town'. It was around these two settlements that Limericks town walls were erected, in plan the walls formed an hour glass shape connected by the historic Balls Bridge. Some of the City's most significant buildings date to the later medieval period, including King John's Castle at Thomond Bridge and St. Mary's Cathedral.

Limerick City played a pivotal role during the civil wars of the 17th century, these conflicts led to town defences being reinforced with the addition of stone bastions, earthen ramparts and ravelins. The town was besieged by Oliver Cromwell in 1651 and twice by the Williamites in the 1690s. The Jacobite force finally capitulated to William of Orange on 3 October 1691, the terms were reputedly signed on the Treaty Stone, an irregular block of limestone which once served as a mounting block for horses now displayed on Clancy Strand. The eighteenth century saw a change in the layout of Limerick when the town defences were largely demolished and a new brick city built outside the old walls. From the 1760's onwards various undertakings financed by Government grants upgraded the quays and built the embankments still visible today.

9.3.2 Archaeological Heritage

World Heritage Site

There are no World Heritage Sites in the study area nor are there any sites contained in the tentative list of candidate Sites.

National Monuments in State Care

There are two National Monuments in State Care within the subject area - King John's Castle and Fanning's Castle. It should also be noted that surviving sections of the town walls have the same statutory protection as National Monuments in state care and are thus included on the following list. Limericks town defences include walls, gates and towers both above and below ground. Thirteen extant stretches of the City Wall of Limerick, all in varying degrees of preservation have been identified. Further portions of the City Wall are known to exist below ground level, all extant (standing) stretches of the wall are Protected Structures, the non-extant (underground) sections are protected under the National Monuments Acts1930-2004 and the Planning & Development Acts (Table 9-1).

Table 9-1.National Monuments in King's Island

Nat. Mon. No	Legal Status	Name	Description	Address	SMR No.	ITM Reference (E,N)
288	Guardianship	King John's Castle	Castle	Castle Street/Nicholas Street	LI005-017014-	557691, 657821
383	Ownership	Fanning's Castle	Castle	Mary Street, Limerick City	LI005-017004-	557924, 657535
N/A	Guardianship	Town defences	Wall	Kings Island	LI005-017010	Various

Monuments in the Ownership of Local Authorities

For the purposes of the constraint study religious sites that were contained in a dataset obtained from the Sites and Monuments Database have been extracted and highlighted as Potential National Monuments in the Ownership of a Local Authority (Table 9-2).

Table 9-2. Potential Monuments in the Ownership of the Local Authority

SMR No	Classification	Townland Name	ITM Reference (E,N)	ITM Reference (E,N)
LI005-017121-	Burial Ground of St. Dominic's Abbey	Limerick City	557793	, 657940

Sites Subject to Preservation Orders

There is one site within King's Island that is subject to a Preservation Order

Table 9-3. Site Subject to Preservation Orders

PO No	Classification	SMR	ITM Reference (E,N)	ITM Reference (E,N)
4/1993 TPO	St. Dominic's Abbey	LI005-017--	557845	657897

Records of Monuments and Places (RMP)

Sites that are not in state care are listed in the Record of Monuments and Places. This inventory consists of nationwide set of 6" maps with an accompanying index which shows all the sites, monuments and zones of archaeological potential, recorded to date. The inventory concentrates on pre 1,700 AD sites.

There are 96 sites listed in the RMP for Kings Island. These range from monumental above ground sites like King John's Castle, Fanning's Tower House and St. Mary's Cathedral to Medieval structures and excavated human remains recovered from a variety of locations.

Notable in the context of the proposed project is the frequency of monuments found around the water's edge, particularly the town defences, mills, weirs, quays, a battery and Thomond and Balls bridge.

Not listed on the standard inventories but of Cultural Heritage value are the stone retaining embankments along both the Shannon and Abbey River. These cut stone walls date to the late eighteenth –mid nineteenth century (Table 9-4).

Table 9-4. Inventory of recorded monuments located within the study area

SMR No	Classification	ITM Reference (E)	ITM Reference (N)
LI005-017----	Historic town	557809	657730
LI005-017001-	Balls Bridge	558054	657423
LI005-017002-	Thomond Bridge	557575	657846
LI005-017003-	House – medieval, Athlunkard St.	557913	657634

SMR No	Classification	ITM Reference (E)	ITM Reference (N)
LI005-017004-	Castle – Fanning's tower house	557924	657535
LI005-017005-	House - medieval	557957	657569
LI005-017006-	House - medieval	557854	657702
LI005-017007-	House - medieval	557826	657685
LI005-017008-	House - medieval	557871	657534
LI005-017010-	Town defences	557639	657897
LI005-017014-	King John's Castle - Anglo-Norman masonry castle	557691	657821
LI005-017015-	St. Mary's Cathedral	557824	657645
LI005-017016-	St. Mary's Graveyard	557812	657608
LI005-017017-	Graveslab, Cathedral Grounds	557824	657645
LI005-017018-	Cross-slab, Cathedral Grounds	557824	657645
LI005-017019-	Wall monument, Cathedral Grounds	557824	657645
LI005-017021-	Graveslab, Cathedral Grounds	557824	657645
LI005-017022-	Graveslab, Cathedral Grounds	557824	657645
LI005-017024-	Memorial stone, Cathedral Grounds	557824	657645
LI005-017025-	Memorial stone, Cathedral Grounds	557824	657645
LI005-017026-	Graveslab, Cathedral Grounds	557824	657645
LI005-017027-	Graveslab, Cathedral Grounds	557824	657645
LI005-017028-	Armorial plaque, Cathedral Grounds	557824	657645
LI005-017029-	Tomb - effigial, Cathedral Grounds	557824	657645
LI005-017030-	Memorial stone, Cathedral Grounds	557824	657645
LI005-017031-	Graveslab, Cathedral Grounds	557824	657645
LI005-017032-	Graveslab, Cathedral Grounds	557824	657645
LI005-017033-	Graveslab, Cathedral Grounds	557824	657645
LI005-017034-	Graveslab, Cathedral Grounds	557824	657645
LI005-017035-	Memorial stone, Cathedral Grounds	557824	657645
LI005-017036-	Graveslab, Cathedral Grounds	557824	657645
LI005-017037-	Memorial stone, Cathedral Grounds	557824	657645
LI005-017038-	Memorial stone, Cathedral Grounds	557824	657645
LI005-017039-	Architectural fragment, Cathedral Grounds	557824	657645
LI005-017040-	Architectural fragment, Cathedral Grounds	557824	657645
LI005-017043-	St. Munchin's Church	557686	657922
LI005-017044-	St. Munchin's Graveyard	557686	657922
LI005-017045-	Memorial stone, St. Munchin's	557685	657922
LI005-017156-	Castle - unclassified	557713	657873
LI005-017164-	College	557788	657664
LI005-017165-	Religious house - Knights Hospitallers	557825	657563
LI005-017166-	House - medieval	557650	657960

SMR No	Classification	ITM Reference (E)	ITM Reference (N)
LI005-017167-	House - medieval	557736	657725
LI005-017168-	House - medieval	557730	657700
LI005-017169-	House - medieval	557760	657650
LI005-017170-	Town hall, Tholsol junction Mary St/Gaol Lane	557965	657545
LI005-017171-	Armorial plaque (present location)	557700	657870
LI005-017172-	Excavation - miscellaneous	557920	657814
LI005-017173-	Excavation - miscellaneous	557790	657827
LI005-017174-	Excavation - miscellaneous	557780	657990
LI005-017175-	Excavation - miscellaneous	557915	657670
LI005-017176-	Excavation - miscellaneous	558075	657510
LI005-017177-	Burial ground	558090	657475
LI005-017178-	Excavation - miscellaneous	558090	657605
LI005-017179-	Excavation - miscellaneous	557740	657930
LI005-017181-	Excavation - miscellaneous	558090	657520
LI005-018----	Bastioned fort, Site of Cromwellian Fort, Present location, St. Brendan's Street.	557570	658613
LI005-079----	Religious house - Franciscan friars	558054	657574
LI005-109----	Burial	557780	658053
LI005-110----	Weir - fish	557623	657656

Table 9-5 Inventory and Count of Archaeological Sites Located within Study Area.

Archaeological Sites	Count
World Heritage Sites	0
Candidate World Heritage Sites	0
National Monuments - In State Ownership or Guardianship	2
National Monuments - Archaeological Monuments Subject to Preservation Orders	1
Walled Towns/Town Defences	1
Sites & Monuments Record	96

Figure 9-1. Thomond Bridge (RMP LI005-01002)

Figure 9-2 Plaque on King's Island Embankment 1848

Figure 9-3. View along Curtin wall of King John's Castle

Figure 9-4. Former Site of Mill (RMP LI005-017075) near Civic Buildings

Figure 9-5. Former Site of Gun Battery (RMP LI005-017073), near boat club

Figure 9-6. Looking West to Mathew Bridge

Figure 9-7. Wall along Sir Harry's Mall

9.4 Architectural Heritage

The Architectural Heritage Protection – Guidelines for Planning Authorities was published in 2004 by the DEHLG and whilst primarily aimed at planning authorities, these guidelines are also of assistance to owners and occupiers of protected structures, proposed protected structures and buildings located in Architectural Conservation Areas Policy BHA.11 of The Limerick City Development Plan states

It is the policy of Limerick City Council to positively encourage and facilitate the careful refurbishment of the Structures of Architectural Heritage merit and Protected Structures for sustainable and economically viable uses.

9.4.1 Architectural Conservation Area

There are no designated Architectural Conservation Areas within Kings Island.

9.4.2 Record of Protected Structures (RPS)

The Limerick City Development Plan Record of Protected Structures lists 44 Structures within the study area (Table 9-6).

Table 9-6. Limerick City Development Plan Record of Protected Structures

RPS No	Name	Location
RPS 1	Villier's Alms Houses	Dominick Street & Old Verdant Place
RPS 2	Walls of Limerick - St Saviour's stretch	Island Road North
RPS 4	King Johns Castle	Castle Street adjoining River Shannon, Thomond Bridge
RPS 5	The Widow's Alms Houses	Nicholas Street
RPS 5	The Widow's Alms Houses	Nicholas Street
RPS 5	The Widow's Alms Houses	Nicholas Street

RPS No	Name	Location
RPS 5	The Widow's Alms Houses	Nicholas Street
RPS 5	The Widow's Alms Houses	Nicholas Street
RPS 6	Dominican Priory Wall and Nuns' graveyard (site of Saint Dominick's Abbey) and Walls of Limerick: St Saviour's stretch.	Barrack Street
RPS 7	Limerick City Walls: Peter's Cell Stretch.	Island Road & Peter's Cell
RPS 8	Parochial House	Athlunkard Street
RPS 9	Saint Mary's Church of Ireland Cathedral	Corner of Nicholas Street & Athlunkard Street
RPS 10	The Exchange	Nicholas Street
RPS 11	Bourke's Castle	Athlunkard Street
RPS 12	County Courthouse	Merchant's Quay
RPS 15	Fanning's Castle - Tower House	Off Mary's Street rear of St Anne's Technical Institute, backlands opposite Emily Place.
RPS 16	Barrington's' Hospital	George's Quay & Mary StreetDenis Cahalane
RPS 17	Walls of Dominican Chapel (Fish Lane).	Northern Relief Road, adjoining Fish Lane.
RPS 38	Thomond Bridge Toll House.	Verdant Place & Castle Street.
RPS 42	The Bishop's Palace.	Church Street & Castle Street.
RPS 43	Gerald Griffin Memorial Schools.	Bridge Street & Court House Lane.
RPS 47	Saint Munchin's Church of Ireland Church & Graveyard.	Church Street
RPS 48	Bannatyne Pyramidal Mausoleum c.1855 (protected under RPS052 Graveyard)	Located within the grounds of Saint Munchin's Church of Ireland churchyard, Church Street
RPS 49	Jones Mausoleum c.1850 (protected under RPS052 Graveyard)	Located within the grounds of Saint Munchin's Church of Ireland churchyard, Church Street
RPS 50	Remains of Medieval Mill, Undercroft Cellars and Bridge.	Within Civic Public Open space in front of City Hall.
RPS 52	Limerick City Wall s: Peter's Cell – Projecting Corbels & wall. Medieval City wall remnant.	Island Road & Peter's Cell.
RPS 53	Old Gaol – Medieval House.	37 Mary Street, corner of Goal Lane & Mary St.
RPS 55	2 Church Street - adjoining Bishops Palace.	2 Church Street.
RPS 56	3 Church Street.	3 Church Street
RPS 57	4 Church Street.	4 Church Street
RPS 58	City Hall Façade of former gaol to Crosbie Row Northwest elevation c.1811-1813	Crosbie Row
RPS 59	Limerick City Walls: Verdant Place Stretch	Verdant Place, adjoining Villiers Alms Houses (see RPS001)
RPS 301	Medieval Limerick City Wall – Exchange Lane Stretch (Extant)	South of St Ann's Court, Exchange Lane. Forms rear boundary of 7&8 Athlunkard Street.
RPS 302	Medieval Limerick City Wall Bishop St / Sheep St Stretch – (Extant) RMP Ref: LI005-017059	Rear of Abbey River Court Bishop St / Sheep St (Eastern side of Old Sheep Street)
RPS 314	Athlunkard Boat Club	Athlunkard Street
RPS 320	The Potato Market	Merchant's Quay
RPS 343	Saint Mary's National School	Bishop's Street
RPS 347	Former Garda Station	Corner of Mary Street and Meat Market Lane
RPS 410	Saint Mary's Roman Catholic	Corner of Athlunkard Street, Island Road,

RPS No	Name	Location
	Church	St Mary's Place
RPS 413	Boyd Mausoleum	Within the grounds Saint Mary's Cathedral, close to existing entrance on the southeast side elevation
RPS 428	Thomond Bridge	Spanning the River Shannon linking Castle Street and High Road
RPS 429	O'Dwyer's Bridge	Athlunkard Street spanning the Abbey River
RPS 432	Mathew Bridge	Connecting Rutland Street, Bank Place to the south with Merchant's Quay, Bridge Street and George's Quay to the north.
RPS 433	Baal's Bridge	Links Mary Street to the north in English Town with Broad Street to the south within Irish Town spanning the Abbey River.

9.4.3 National Inventory of Architectural Heritage (NIAH)

The NIAH Survey for Kings Island lists 31 sites within the subject area. Note there is a substantial degree of overlap with the Record of Protected Structures (see Table 9-7)

Table 9-7.National Inventory of Architectural Heritage (NIAH)

Reg No	Name	Address	ITM Reference (E)	ITM Reference (N)
21513031	Baal's Bridge	Mary Street	558054	657422
21508001	Thomond Bridge	Castle Street	557574	657845
21508002	Toll House	Verdant Place	557644	657862
21508003	The Bishop's Palace	Church Street	557710	657877
21508004	former almshouse	Church Street	557706	657888
21508005	almshouse	Church Street	557702	657895
21508006	almshouse	Church Street	557701	657901
21508007	Island Theatre Company	Church Street	557685	657921
21508008	Jones Mausoleum	Saint Munchin's Church of Ireland	557683	657883
21508009	Villiers Alms Houses	Old Dominick Street	557681	657977
21508010	Nuns' graveyard	Barrack Street	557843	657906
21508011	Saint Mary's National School	Bishop Street	557837	657836
21508012	The Widow's Alms Houses	Nicholas Street	557736	657763
21508013	City Hall	Crosbie Row	557766	657661
21508014	Saint Mary's Church of Ireland Cathedral	Nicholas Street	557829	657643
21508015	Parochial House	Athlunkard Street	558045	657783
21508016	Saint Mary's Roman Catholic Church	Athlunkard Street	558035	657745
21508017	Athlunkard Boat Club	Athlunkard Street	558162	657800
21508018	O'Dwyer's Bridge	Athlunkard Street	558205	657764
21508019	Bannatyne Mausoleum	Church Street	557675	657885
21508021	Attached school building	Nicholas Street	557834	657666
21513015	Mathew Bridge	Rutland Street	557815	657482
21513053	Barringtons' Hospital	George's Quay	557977	657479

Reg No	Name	Address	ITM Reference (E)	ITM Reference (N)
21513054	Clancy's Hut	River Lane	558081	657612
21513055	Former garda station	Mary Street	557954	657578
21513056	Gerald Griffin Memorial Schools	Bridge Street	557859	657558
21513057	The Exchange	Nicholas Street	557867	657635
21513059	Boyd Mausoleum	Nicholas Street	557838	657598
21513060	County Courthouse	Merchant's Quay	557725	657578
21513061	The Potato Market	Merchant's Quay	557770	657508
21513070	Limerick Institute of Technology - School of Art	George's Quay	557919	657502

Table 9-8. Inventory and Count of Architectural Sites Located within the study area

Architectural Sites	Count
ACA	0
Protected Structures	44
NIAH Site	31

9.5 Constraints

Based on the above research it is clear that Kings Island has a rich and varied archaeological, architectural and historical past with multi period monuments ranging from humble sites of local interest to large complexes (King John' Castle and St. Mary's Cathedral) of international significance. All of the features both above and below ground have varying degrees of statutory protection and the guiding principle should be their continued preservation in situ and to minimise any impacts on their character or setting.

The following advice notes have been compiled to inform the designers of statutory protections and sensitivities afforded to the various cultural heritage site classifications.

9.5.1 Notes for Designers

Archaeological Heritage

National Monuments -In the Ownership or Guardianship of the State

The pre-eminent archaeological sites in the Republic of Ireland, which are afforded statutory protection of all their amenities, including visual, often with public access facilitated many of these sites are particularly sensitive to impacts on their setting it is therefore recommended that any impacts on the setting of these sites be avoided.

Potential National Monuments - In the Ownership of a Local Authority

Not all these sites will be National Monuments, but a significant number may be. The National Monuments Service does not recognise any difference between these sites and National Monuments in the Ownership or Guardianship of the State as they have the same level of statutory protection. Many will consist of publicly accessible churches (many ruinous) and graveyards that are particularly sensitive to impacts on setting and avoidance is recommended.

Sites Subject to Preservation Orders

The National Monuments Service does not recognise any difference between sites subject to Preservation Orders and National Monuments in the Ownership or Guardianship of the State as they have the same level of statutory protection. Preservation Orders are issued to protect sites that have been damaged or are in the process of being damaged, to prevent further harm. These

sites in many instances will not be publicly accessible. Given their protected status efforts should be made to avoid impacts on the settings of these sites.

Record of Monuments and Places

Although the settings of archaeological sites are not formally protected in Irish legislation, most County Development Plans offer protection through their policies and/or objectives. At the pre-planning stage efforts should be made to avoid any direct impacts or impacts on the setting of such sites.

Architectural Heritage

Record of Protected Structures

Although the settings of Protected Structure are not formally protected in Irish legislation, most County Development Plans offer protection through their policies and/or objectives. As protected structures are generally upstanding features within the landscape efforts should be made to avoid impacts on these structures.

National Inventory of Architectural Heritage

Structures within the NIAH have been rated as being of local, regional, national or international importance. During the selection of preliminary route corridors the designers should use this rating information as a guide to ensure that the most important structures do not experience impacts on their setting.

Demesne Landscapes & Historic Gardens

Demesnes historically were the part of the manorial estate retained for its owner's own pleasure, use and occupation. By the 19th century they usually incorporated walled gardens, terraces, tree-lined avenues, ornamental woods and water features. Demesnes currently have no general statutory protection however many county councils have stated policy objectives requiring their preservation. The NIAH provides local authorities with information on the extant and condition of the estates in their functional area. As part of the constraint process all the demesnes within the study area were mapped. This data together with site fact sheet available on the Survey of Historic Gardens and Designed Landscapes should assist the designers in avoiding any significant features.

Legal Framework Cultural Heritage

The summary of Ireland's obligations as a signatory to a number of International and European conventions relating to the protection and conservation of cultural heritage sites are found in **Appendix C.2**. It also includes a synopsis of existing national legislation governing the care and protection of our cultural heritage.

It is important to note that an application for Ministerial Consent under National Monuments Act (2004 Amendments) for Site Investigations at Verdant Place, Limerick City was submitted by LCCC (Refer to **Appendix C.4**).

10 Traffic

The relevant documentation and plans for Limerick City and King' Island were reviewed in order to inform the Study. This note identifies potential transportation items that may present as constraints for the proposed King's Island Flood Relief Scheme. These are discussed in more detail in the following section.

10.1 Current Situation in King's Island

King's Island is connected to the rest of the city by four main access routes, all located in the south portion of the island.

The Island Road and Castle Street compose part on the N7 route through the city centre. This road is heavily transited and isolated from the north of the Island.

Thomond Bridge connects King's Island to the northwest side of Limerick City. Bridge Street joins the southernmost part of the Island into the heart of Limerick City Centre, past the Hunt Museum and onto O'Connell Street. Mary Street and Island Street attaches the southeast portion of the Island to routes towards the Milk Market, Johnsgate, and Pennywell. And finally, Bridge Street to the east of the Island turns into Route 465 towards Grove Island and Corbally. R465 is heavily trafficked in the morning and afternoon from people travelling towards and out of the City Centre.

St. Mary's Park has limited access from the rest of Limerick City, the main entrance is through the Island Road Roundabout and three other smaller access routes that all join into a large cul-de-sac. Most of the traffic in King's Island is from people entering and leaving Limerick City Centre using King's Island as a transitory route to get to the city centre.

Limerick City as a Gateway Town is well services with many connections to regional and national routes. Recently developed motorways include: Nenagh-Limerick Motorway, the M18 Ennis Road to Shannon; national primary roads such as the N7(Dublin Road), N24, N20, N21.

10.2 Transportation Constraints

For the purpose of identifying improvement, it is important to consider, traffic and movement together.

10.2.1 Access Constraints

King's Island is bounded by the River Abbey on the east side and the River Shannon on the west side. The confluence of these rivers bounds the island in the north. There are 5 access bridges to and from King's Island, however they are all located within close proximity to one another at the southern end of the island. Four of these bridges (Matthew Bridge, Baal's Bridge, Abbey Bridge and O' Dwyer's Bridge) serve a small area at the southern tip of the island, while Thomond Bridge allows access to and from High Road and Sexton Street North to the north-west of Limerick City Centre.

Island Road serves as the main artery between Thomond Bridge and the remaining four bridges, but also serves as the main access to the residential area to the north of the island (St. Mary's Park).

10.2.2 Pedestrian/Cycle Access

King's Island suffers from a degree of severance due to the layout of the residential streets, especially at the northern half of the island. There are good pedestrian routes around the extent of the island itself along the river, but connectivity to the mainland is restricted from the northern half of the island.

To the south, the island is accessed from the east via Bridge Street, and the south via Bridge Street and Island Road. From the west, the island is accessed via High Road. Pedestrian and cyclist access to the city and suburbs is therefore restricted to the south of the island, where there are connections to the mainland.

10.2.3 Public Transport Access

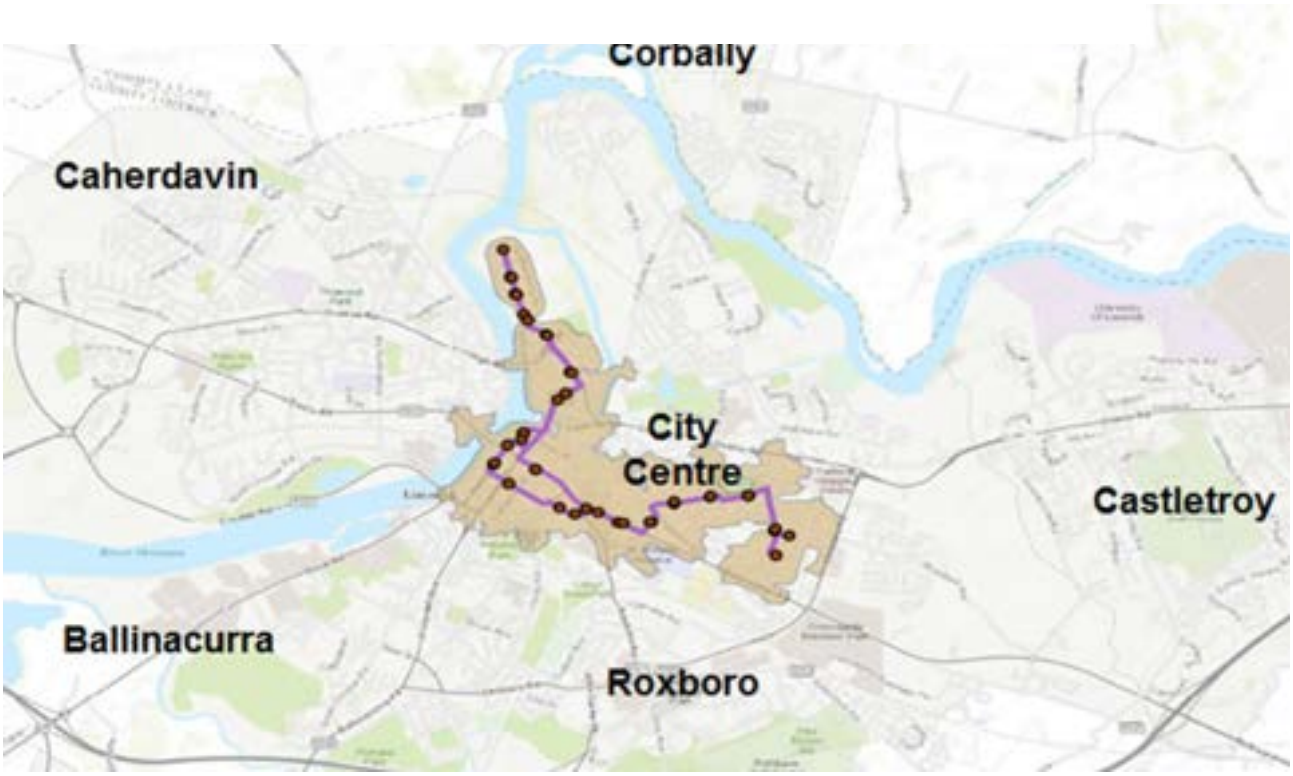
The LCCC highlighted in the Limerick City Development Plan (2010-2016) (Section 3.1.7 Transport of Section 3.0 Volume 1 Baseline Conditions and Analysis) that St. Mary's Park, along with other regeneration neighbourhoods display a low level of car usage with a high percentage of private households having no car (57%) and a reasonable use of public transport (6%), below city average (7%). Since King's Island and St. Mary's Park are located in close proximity to the city centre, the bus service provision is considered adequate.

The Bus Éireann No. 305 City Service route serves St. Mary's Park in King's Island and serves Lynwood Park to the east of the city centre. Although it is technically a cross-city service, it has a much smaller catchment as the route is restricted to the north by the extents of King's Island, and the route does not extend east of the city centre to any significant degree.

The route serves the residential lands on King's Island, and residential lands in the Kilmurry area. It shares a small portion of its route with the 301 and 304 services. The 305 benefits from a short section of the bus lane present on Ballysimon Road and Mulgrave Street. The route experiences delay in the city centre, particularly on Roxborough Road, and William Street, as well as approaching the city centre from King's Island. The main city centre termini are at William Street and Liddy Street. The 305 has a 60-minute frequency target.

Figure 10-1 below shows the catchment along the 305 City Centre Service. Further investigation of the 305's 500-metre catchment indicates that a total of 10,471 people live within 500m of a bus stop on this service, approximately 11% of the total population of the Limerick Metropolitan District.

Figure 10-1. Public Transport Access to King's Island Access



10.3 Road Designation

10.3.1 R445

Historically, the road through King's Island between Thomond Bridge and Abbey Bridge formed part of the Northern Ring Road of Limerick City on the N7 national road route. As a result it formed a strategic route through Limerick for traffic travelling on the east-west axis. Since the completion of the Southern Ring Road and the tunnel, the Northern Ring Road has been down-graded to a regional road (R445) as the majority of strategic traffic is now diverted via the M7 and the N18.

10.3.2 R463

The main roads on King's Island connecting Matthew Bridge with O'Dwyer Bridge are Bridge Street and Athlunkard Street which form part of the R463. The completion of the Southern Ring Road and the tunnel have had no impact on the designation of the R463.

10.3.3 Local Roads

The remaining roads on King's Island are local roads, the main links being:

- George's Quay
- Mary Street
- Bishop Street
- Island Road north of the R445.

10.4 Existing Traffic Volumes

Traffic Survey information for the following locations has been assessed to establish the traffic volumes in the vicinity of King's Island:

1. Thomond Bridge

2. Junction of Corbally Road and O' Dwyer's Bridge

10.4.1 Thomond Bridge

Traffic Survey Information is available from April 2015 on Thomond Bridge. This survey comprised an Automatic Traffic Counter (ATC) loop which counted two-way traffic in the AM peak traffic period. By using 24 hour data from the TII traffic counter nearby on the R445, we can expand the am peak traffic data to calculate an AADT on Thomond Bridge of 14,491 passenger car units (PCUs).

10.4.2 Junction of Corbally Road and O'Dwyer's Bridge

Traffic Survey Information is available from November 2013 on O'Dwyer Bridge. This survey comprised a Traffic Turning Movement survey which counted two-way traffic in the AM peak traffic period. By using 24 hour data from the TII traffic counter nearby on the R445, we can expand the am peak traffic data to calculate an AADT on O'Dwyer Bridge of 15,964 passenger car units (PCUs). This can be estimated to 2015 using Table 5.5.1 of the NRA Project Appraisal Guidelines, giving a 2015 AADT value of 16,382 PCUs.

10.4.3 General

Generally, any development which includes a percentage increase of 5% traffic or less in an urban area is considered not to have an impact. The above AADT information suggests that a 5% increase in traffic would be as a result of approximately 820 pcu's per day. This equates to 341 HGV's per day (based on a PCU conversion factor of 2.4). It is envisaged that the proposed King's Island Flood Defence works will not involve construction traffic which will breach the above threshold.

10.5 Other/Future Developments

10.5.1 Limerick Regeneration Framework Implementation Programme

St. Mary's Park to the north of King's Island is included within the Limerick Regeneration Programme notes the importance of Physical Regeneration from a visual perspective, but equally the Plan determines Physical Regeneration to be 'more of a means than an end'. Individual 'vision reports' have been developed for the north and south side regeneration areas. These include specific physical measures which are intended to form part of the overall regeneration programmes. It is stated that the facilities and amenities which form part of the physical regeneration are 'sustainable into the future'.

The St. Mary's site is unique in the sense that the area is bounded by the Shannon and Abbey rivers, with limited existing accessibility to the area at present. Thus there are significant existing issues associated with isolation to be overcome. The northern part of the King's Island area in particular has no vehicular access to the remainder of the Limerick area. The main access road

at the south, the R454, serves significant levels of Limerick-Clare traffic, increasing the connectivity problem.

Bridge connections are an aspirational target at the northern extent of King's Island to greatly increase linkage to Limerick City and thus open up the St. Mary's site to much-improved levels of connectivity and access. This, in turn, will allow for a more appropriate route hierarchy to be implemented within the St. Mary's area.

The location of the St. Mary's site within a short distance from Limerick City Centre itself means that the site is ideal to facilitate and prioritise walking and cycling.

The river frontages bounding King's Island can in turn then link on to other complementary proposals which link on to University Limerick along the Canal. A comprehensive network of pedestrian and cycle routes are therefore envisaged within the St. Mary's area. In addition, a much greater standard of public transport is proposed through the area. It is worth noting that the major new bridge connections which are proposed as part of the regeneration are aspirational at this stage.

Volume 2 of the Limerick Regeneration Framework Implementation Plan has outlined specific strategies to improve King's Island traffic and movement. LCCC aims to develop connections from St. Mary's Park to its surroundings by:

- Improving access from St. Mary's Park to the Medieval Quarter, Thomond Park, and Grove Island.
- Implementing new roads and footpaths in order to better the network surrounding the St. Mary's Park Community Centre (suggestions include a street linking Toll House to Verdant Place and Toll House and the Bridge).
- Providing street parking along the existing and new streets
- Introducing pedestrian and cyclist crossing to provide better access to local amenities
- Maintain and augment the existing embankment walkway.

10.5.2 Limerick City Noise Action Plan

Limerick City Council commissioned a Noise Action Plan for the Limerick City area in January 2009. This plan was developed to ultimately identify measures to help avoid, prevent or reduce the exposure to environmental noise, which includes road traffic and transportation noise (See **Section 12: Air & Noise**).

A number of the major national and non-national routes in Limerick City, which carried more than 6 million vehicle passages per year, were mapped in the context of their calculated noise levels, for both average night-time and average day-time noise levels. The following roads in Limerick were mapped:

- N18;
- R857 Ennis Road;
- Island Road;
- Old Dublin Road;
- R463 Corbally Road; and
- R509 Childers Road.

The residential areas adjacent to these routes are therefore sensitive to environmental noise, and the resulting areas for action were priorities in terms of highest population density and highest noise exposure (See **Section 12: Air & Noise**).

The Noise Action Plan provides Limerick City with a foundation on which to develop and implement noise-reduction measures in the various critical zones going forward.

However, it must be noted that the completion of the Limerick South Ring Road since the preparation of the Noise Action Plan will likely have had a resultant impact on traffic flows, and thus a commensurate impact on the ranking and prioritisation of the sensitive areas.

It is therefore envisaged, in accordance with the European Noise Directive Regulations, that Limerick City Council shall undertake a review and revision after a 5-year period of the City in order to re-evaluate the prevailing noise levels and to further develop mitigation measures for implementation. As of 2013, the threshold for investigation on roads has been lowered to 3

million vehicle passages per year, and agglomerations with a population of over 100,000.The Noise Action Plan therefore recommended that a review be undertaken following completion of the Southern Ring Road in order to identify any significant changes in the City.

In addition, regulations dictate that a revised plan is to be undertaken every 5 years on a rolling basis in order to re-appraise and update the plan and instigate mitigation measures where necessary. The traffic associated with the construction works for the King's Island Flood Relief scheme will need to be mindful of this Noise Action Plan.

10.5.3 Limerick City Cycle Network Strategy

King's Island Walking/Cycling Pathway

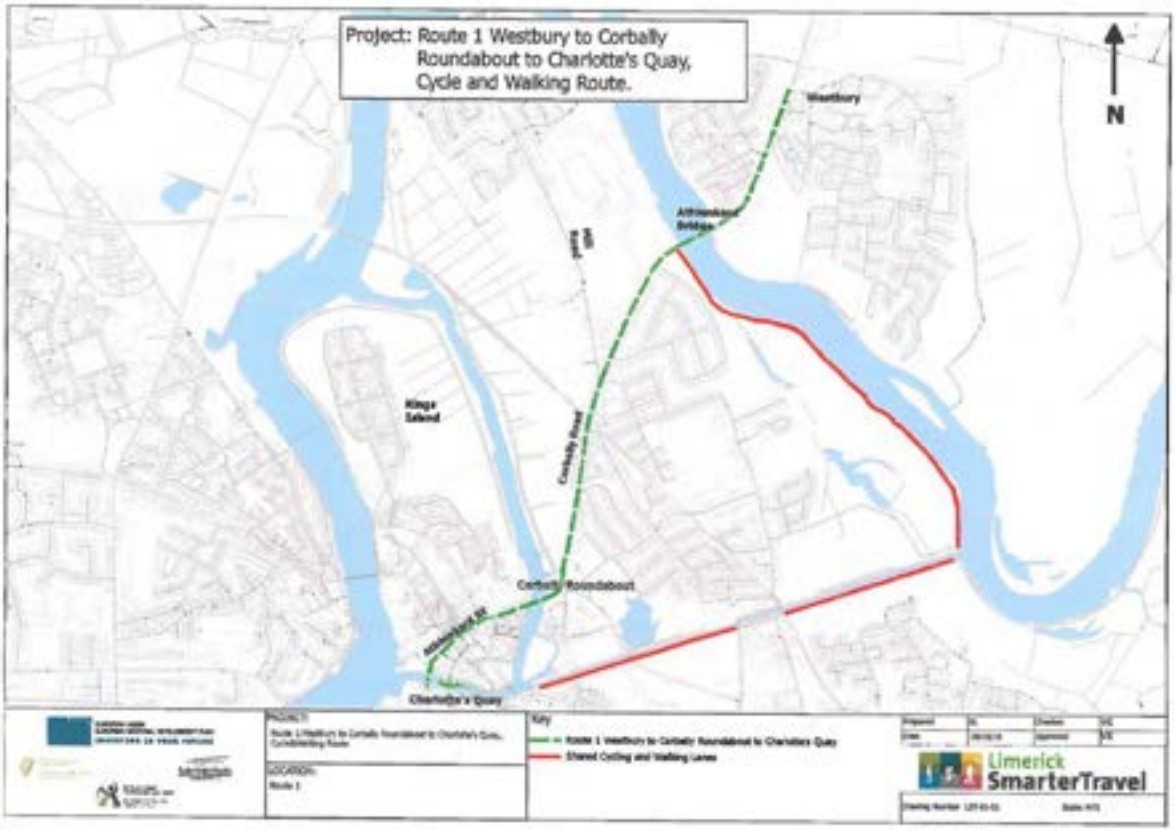
There is an existing shared pedestrian/cycle pathway along the perimeter of King's Island. While recent damage has severed the continuity of the walkway, it is envisaged that the facility will be upgraded and re-opened as part of the King's Island Flood Relief scheme.

Strategic Walking and Cycling Route 1

The Limerick City Cycle Network Strategy was launched in May 2004. The strategy sets out an envisaged network of cycle routes for Limerick City and its Environs. The strategy was formulated with a key focus on linking workplaces and educational centres with residential areas. Prior to the development of the Strategy, Limerick City Council had developed a number of cycle lanes as part of new road developments in the City, at three locations – the Childers Road/Carew Park access road, the Corbally Link Road (Phase 1), and the N7 realignment from Groody Bridge to Plassey Park Roundabout. These were incorporated into the Cycle Network Strategy.

At present, only a small number of dedicated cycle tracks or cycle ways have been constructed in Limerick City. In October 2015, Limerick City and County Council invited submissions from qualified consultants to carry put the preliminary and detailed design for the construction of the Westbury to City Centre Cycle Route along the Corbally Link Road and Athlunkard Street/Bridge Street. This is known as Strategic Walking and Cycling Route 1. It is envisaged that this route would be put forward for Part 8 Planning in 2016, with a view to construction commencing in late 2016. Details of the schematic proposals are presented in the following figure: Figure 10-2.

Figure 10-2. Proposed Strategic Walking and Cycling Route



10.6 Summary of Key Constraints

It is important to highlight that movement and traffic should be considered together.

- The N7 Route through King's Island has existing traffic congestion. During construction of any flood scheme the traffic could pose problems for deliveries and access.
- The design of the flood relief scheme should look to avoid making traffic worse or remove already identified opportunities to improve traffic flows.
- The design of the flood relief scheme should consider where it could contribute to traffic improvements.
- Any Construction works as part of the King's Island Flood Relief scheme will have to be mindful of maintaining access for both pedestrians and cyclists as well as public transport via Island Road.
- The traffic associated with the construction works for the King's Island Flood Relief scheme will need to be mindful of this Noise Action Plan.

11 Air & Noise

11.1 Introduction

This section of the Constraints Report identify the key air quality and noise impacts regarding the Kings Island Flood Management Scheme Study Area. This part of the study focuses on:

- Identification of the possible issues that may impact on air quality
- Identification of locations that are noise sensitive
- A qualitative description of the existing air quality in Kings Island and the surrounding environs
- A qualitative assessment of the existing noise climate on and around the island.

11.2 The Existing Air Quality

The Environmental Protection Agency (EPA) did conduct ambient air quality monitoring in Limerick city between January and November 2000. Monitoring included the determination of hourly values for a number of analytes (with the exception of PM10's) at a station located at Mulgrave Street which is south of King's Island. The purpose of the monitoring was to ensure compliance with various air quality standards. The range of analyses included; nitrogen dioxide/nitrogen oxides, carbon monoxide, PM10, sulphur dioxide, benzene and lead.

A total of 6,829 carbon monoxide levels were recorded during the measuring period. The mean hourly value was 0.3 mg/m3. The maximum 8 hourly mean was 1.8 mg/m3. The levels detected were less than the Irish Air Quality Standard Regulations 2002 (S.I. No. 271 of 2002).

6,812 measurements of sulphur dioxide were recorded throughout the measuring period. The mean hourly value for sulphur dioxide recorded was 10.4 ug/m3, the maximum 24 hour value was 51.2 ug/m3. All levels detected were less than the corresponding air quality levels.

Three hourly mean nitrogen dioxide levels exceed the lower assessment threshold for the protection of human health (100 ug/m3). The mean hourly nitrogen dioxide values (22 ug/m3) were below the annual lower assessment threshold for the protection of human health (26 ug/m3).

The average daily particulate matter (PM10) dust levels (24 ug/m3) was below the annual limit value of 40 ug/m3 for the protection of human health.

The levels of benzene (mean hourly value 0.5 ug/m3) was less than the lower assessment threshold for the protection of human health.

The EPA manages the National Ambient Air Quality Network around Ireland. The EPA has a station located in the Shannon Estuary (Rural West Region 3) which records real time levels of various analytes (www.epa.ie/air/quality/data). The Air Quality Index for Health during the preparation of this report was Good.

This area is also a coal restricted area.

11.3 The Existing Noise Environment

In July 2013, Limerick City and County Councils jointly produced a Noise Action Plan in accordance with the Environmental Noise Regulations (S.I. No. 140 of 2006). The Action Plan contains noise maps generated by the National Roads Authority (NRA) and subsequently presented to the European Commission by the EPA. This is the most recent and relevant source of noise data for the area. The maps are plotted in graphical form in terms of Lden (noise levels for daytime, evening and night) and Lnight. They are presented in 5dB contour bands beginning at 55-59dB and ranging up to 70-74dB. The maps also provide an indication of environmental noise levels which are greater than 75dB. The noise levels indicated are predictions attributed only to a specific source of noise i.e. road traffic.

To address the lack of legislative measures and unify the approach taken by Action Planning Authorities the EPA has issued guidelines for the assessment of noise exposure and prioritising areas for noise mitigation measures. The suggested onset of assessment levels relating to road traffic noise are given below.

EPA suggested onset levels for noise mitigation measures:

- 70dB Lden
- 57dB Lnight

EPA suggested onset levels for measures to preserve the existing noise situation (quiet areas):

- 55dB Lden
- 45dB Lnight

These levels reflect an annual average period. The Plan notes that the Lden and Lnight values outlined above do not represent desirable or recommended noise levels, they are merely a suggested threshold for prioritisation of assessment to see if mitigation measures may be required.

Figure 11-1 and Figure 11-2 illustrate the Lden and Lnight noise maps for the King's Island study area respectively.

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Figure 11-1. LDen noise map showing King's Island Area*. [Important to note the legend in Figure 11-1 and 11-2 are different]*

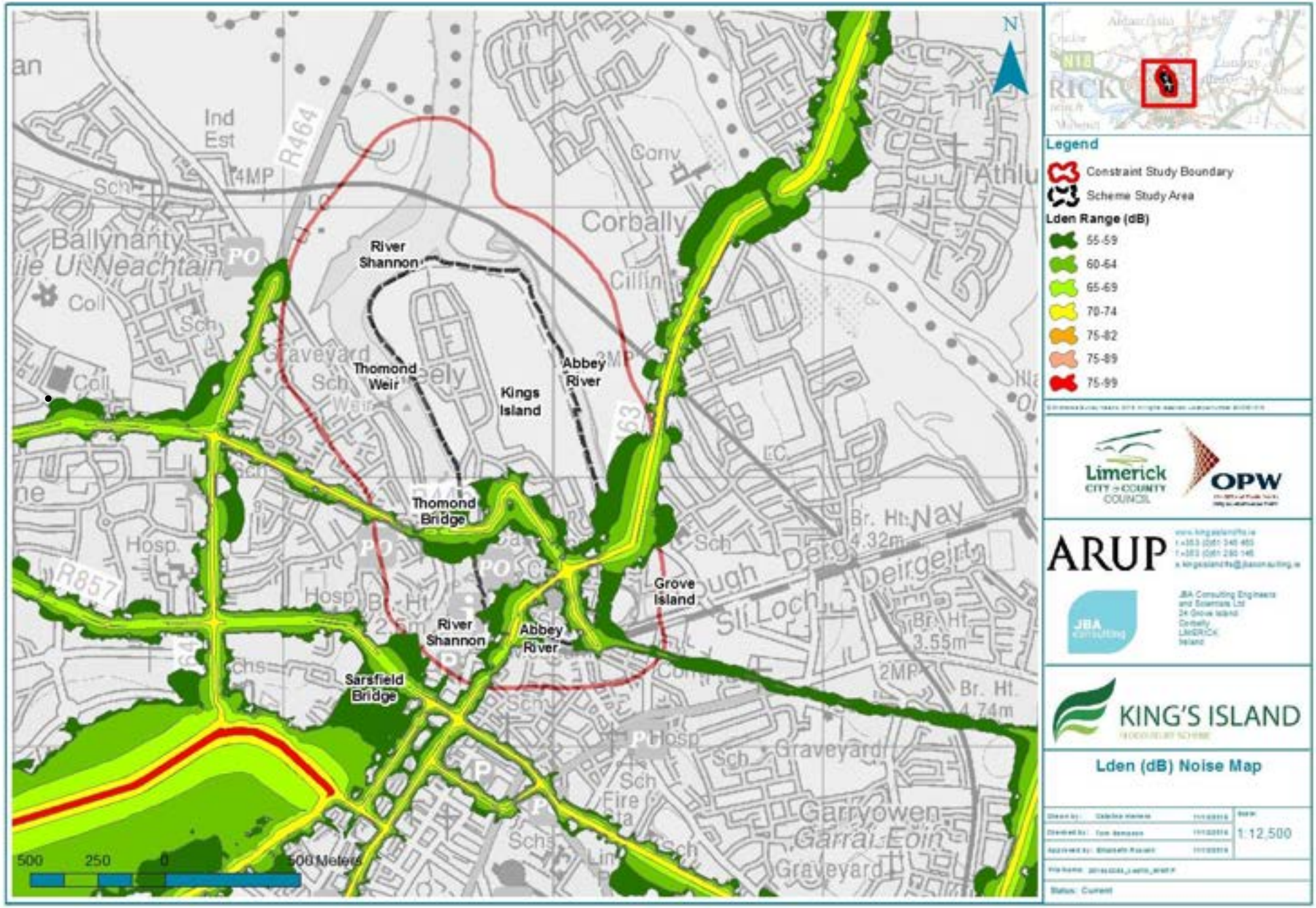


Figure 11-2. Lnight Noise Map showing the King's Island Area. . [Important to note the legend in Figure 11-1 and 11-2 are different]

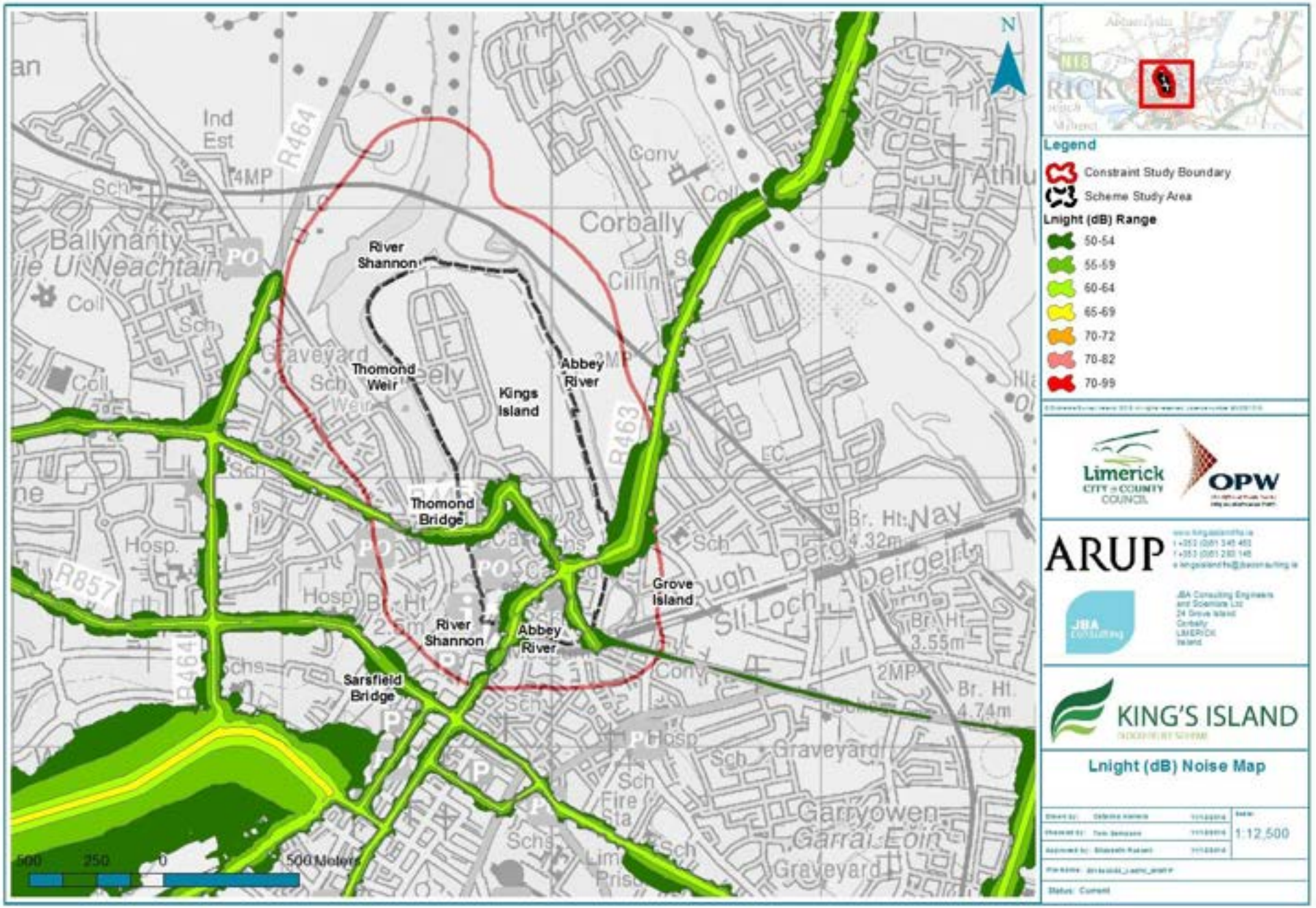


Figure 11 1 illustrates that the maximum Lden noise level experienced by sensitive properties is the 65-70dB noise band. No receptors are deemed to fall within the greater than 70dB band, this is the band that requires the provision of mitigation measures, in accordance with the EPA guidance.

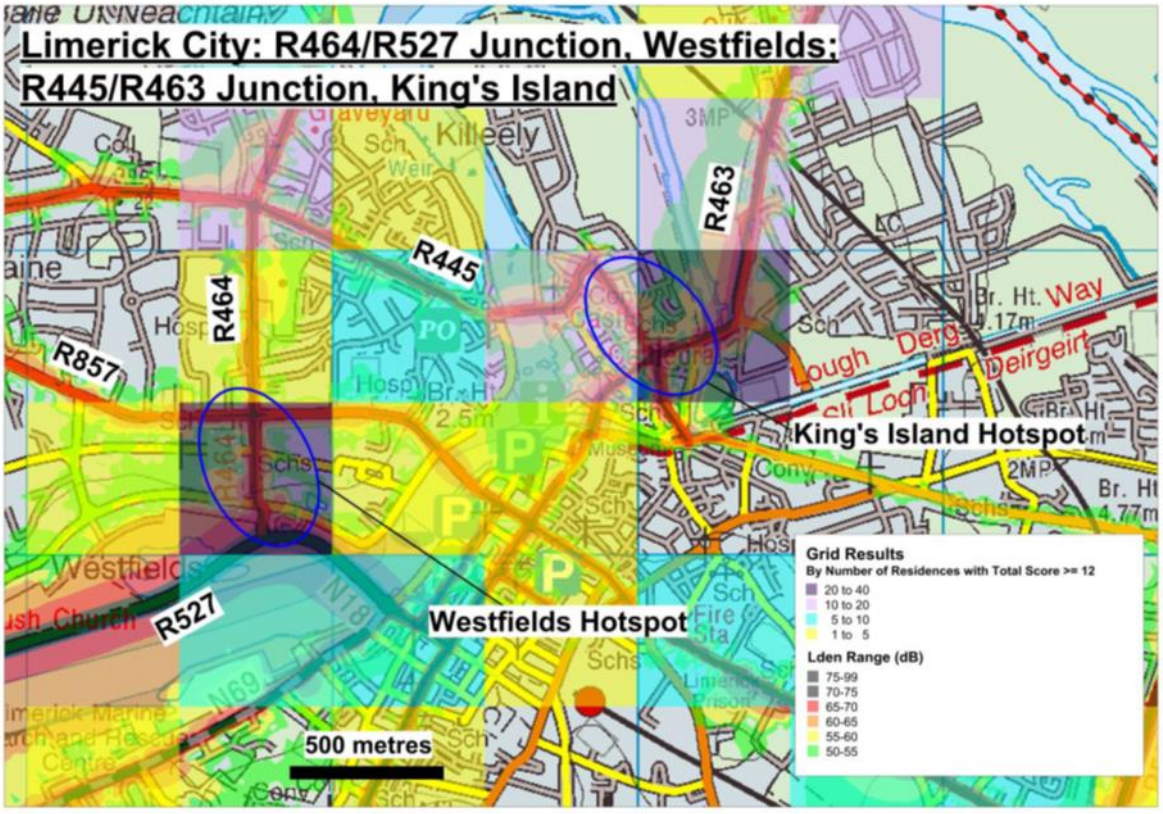
Figure 11-2 above illustrates that the maximum Lnight noise level experienced by sensitive properties is the 50-55dB noise band. No receptors are deemed to fall within the greater than 57dB band, this is the band that requires the provision of mitigation measures, in accordance with the EPA guidance.

Six hotspots are identified in the report with twenty, or more, dwellings within 0.25 km2. The R445/R463 Junction at King's Island is identified as a hotspot, refer to Figure 11-3. The report states that identified hotspots will be prioritised for further assessment and possible action during the period of this plan. The action plan proposes to assess certain areas where predicted levels are above the threshold levels as well as the hotspots. It states that the extent of environmental noise exposure at these locations will be evaluated by field surveys and noise levels are confirmed to be unacceptably high, the Councils will implement appropriate measures to reduce the effects of noise exposure on a prioritised basis, subject to resource availability. It is understood that noise monitoring has yet to take place in the area of King's Island in response to the Action Plan.

It is not expected that the proposed flood risk scheme will increase traffic volumes resulting in higher noise levels during the operational phase. No other significant noise sources are envisaged during the operational phase of the development.

There is the potential for an increase in traffic volumes during the construction phase generating higher noise levels. Measures will be taken to ensure that traffic generated during the construction phase is diverted away from the hotspot areas. Measures will be implemented during the construction works to ensure there is no significant noise impact on sensitive receptors, including ecological receptors.

Figure 11-3. King's Island Hot Spot



11.3.1 Noise Sensitive Locations

King's Island is an area of central Limerick, and consists of two distinct areas, Englishtown and St Mary's Park. The Island is dominated by residential properties. Two schools are located on the Island, St. Mary's Girls Primary School and Gaelscoil Sáirséal. A number of buildings of historical importance are present, including King John's Castle and St Mary's Cathedral.

11.4 Summary of Key Air and Noise Constraints

The key constraints and recommendations for the chosen flood relief scheme for the island is discussed below.

- The main impacts on air and noise will arise during the construction of the scheme. Traffic noise generated by trucks accessing the island will be one source of noise. However this source of noise will be for the duration of the construction only and in the longer term no noise will be generated during the operation of the scheme.
- Similarly air emissions will arise during the construction of the scheme both traffic induced air emission and air emission generated during the construction of the scheme. Dust will be the main component of these air emissions. Specific measures will be employed to reduce the dust emissions. Again these emissions will only arise during the construction phase of the scheme.

12 Cumulative impacts

12.1 Introduction

For the purposes of this Constraints Study this cumulative constraints section summaries the constraints identified in Limerick, King's Island and the environs. It takes it account the impacts that other projects may have on the implementation and construction of the flood alleviation scheme for the Island.

12.2 The Limerick City Development Plan and Limerick Regeneration Framework Implementation Plan

The Limerick Regeneration Framework Implementation Plan proposes to increase opportunity in King's Island by expanding retail function and promoting its tourism potential. The Plan has identified a number of priority themes including physical, social and economic development of the area. One of the goals of the Regeneration Plan is to meet the challenges of climate change and flooding. This flood relief scheme will help to realise these goals. Other goals of the Plan are to protect and improve historical assets in the area and to integrate St. Mary's Park to the rest of the Island. Both the Regeneration Plan and the Flood Relief Scheme for the Island should complement each other, and the design of the FRS must be cognisant of the goals of the Regeneration Plan.

12.3 Summary of Constraints

The following is a summary of the environmental constraints that may delay the project, change the design of the project or influence the cost of the scheme. For simplicity the constraints have been grouped into the following:

12.3.1 Time Constraints

- Any in-river works will need to be carried outside the salmon spawning season (October -March)
- Any in-river works will need to ensure compliance with the WFD
- The completion of the Limerick City Drainage Scheme
- There are a number of protected structures on the Island particularly on the southern portion of the island. A Ministerial Consent has been applied for the scheme and for all site investigation works pertaining to the scheme
- Approval of any in-river works by the IFI
- The designs of embankment within the SAC will require prior approval from the NPWS and IFI respectively
- The presence of previously un-recorded underwater archaeological artefacts may significantly slow down the construction programme
- The application for derogation licences should be applied for in advance of any works which may disrupt any protected species
- Replies to requests for further information/clarification from An Bord Pleanala.
- Any in channel work will need to avoid the Salmonid spawning season, which is usually between November and March. Inland Fisheries Ireland should be consulted in the design stages (prior to any work) in order to ensure appropriate measures are taken. Any work or vegetation clearance to existing walls or bridges should be conducted outside of bird breeding season (March to September).to protect any nests present
- Bat surveys must be conducted on any feature with medium and high potential for roosting maps. The optimal time to conduct map surveys are May and August, when bats are most active. If bats are found, they should not be disturbed during hibernation period (October/November to February/March) or maternity period (June to August)
- Japanese Knotweed, Himalayan balsam, and Giant Hogweed are listed as invasive plants under the EC (Birds and Natural Habitats) Regulations 2011 (S.1. 477/2011). There regulations prohibit the introduction or dispersal of invasive species. These invasive plants are present on the Island although they are currently part of Limerick City and County's invasive plant eradication programme

12.3.2 Engineering/Design Constraints

- The design of the final scheme will be subject to a number of site investigations and may change depending on the findings of these investigations.
- The made ground is uncompacted and highly variable may require excavation and replacement with suitable founding material

12.4 Legal Constraints

- A 3rd party challenge to the Part X application to An Bord Pleanala and a request for an oral hearing.