Mater Misericordiae University Hospital



Waste and Waste Water Treatment Plant Planning Application

November 2019



TOBIN
Patrick J. Tobin & Co. Ltd.

REPORT

PROJECT: **WWTP Planning Application**

CLIENT: **Mater Misericordiae University Hospital,**
Eccles St
Dublin 7

COMPANY: **TOBIN Consulting Engineers**
Block 10-4
Blanchardstown Corporate Park
Blanchardstown
Dublin 15

www.tobin.ie

DOCUMENT AMENDMENT RECORD

Applicant:	Mater Misericordiae University Hospital (MMUH) Ltd
Operator:	MMUH
Project:	IED Application - Waste and WWTP
Aspect:	Waste and Wastewater EIAR
Title:	Environmental Impact Assessment Report

PROJECT NUMBER: 7657				DOCUMENT REF: 7657-01			
B	Issued for Submission	JD	30-11-19	DG	30-11-19	DG	30-11-19
Revision	Description & Rationale	Originated	Date	Checked	Date	Authorised	Date
TOBIN Consulting Engineers							

TABLE OF CONTENTS

1 INTRODUCTION 1-1

1.1 BACKGROUND 1-1
1.2 IED LICENCE, PLANNING AND ENVIRONMENTAL IMPACT ASSESSMENT 1-3
1.3 SCOPING OF THE EIA 1-3
1.4 AN OVERVIEW OF THE STRUCTURE OF THE EIAR 1-6
1.5 TECHNICAL DIFFICULTIES AND AVAILABILITY OF DATA 1-7
1.6 STUDY TEAM AND CONTRIBUTORS TO THE EIAR 1-7

2 DESCRIPTION OF THE DEVELOPMENT 2-12

2.1 SITE CONTEXT 2-12
2.2 PLANNING HISTORY 2-13
2.3 OPERATIONAL PLANT REQUIREMENTS 2-17
2.4 SUSTAINABILITY AND NEED FOR TREATMENT PLANT 2-19
2.5 FACILITIES DESCRIPTION 2-24
2.6 SITE OPERATING INFRASTRUCTURE 2-29
2.7 OPERATIONS 2-29
2.8 MAJOR ACCIDENTS /DISASTERS 2-31
2.9 STATEMENT OF AUTHORITY 2-31

3 ALTERNATIVES 3-32

3.1 BACKGROUND 3-32
3.2 *ALTERNATIVE TREATMENTS* 3-34
3.3 DO NOTHING SCENARIO 3-35
3.4 ALTERNATIVE SITE LOCATION 3-35
3.5 NEED FOR THE SCHEME AND POTENTIAL ALTERNATIVES 3-36

4 POPULATION AND HUMAN HEALTH 4-38

4.1 INTRODUCTION 4-38
4.2 STUDY METHODOLOGY 4-38
4.3 RECEIVING ENVIRONMENT 4-38
4.4 DESCRIPTION OF THE DEVELOPMENT 4-50
4.5 IMPACTS OF THE DEVELOPMENT 4-50
4.6 MITIGATION MEASURES 4-51
4.7 MONITORING 4-51
4.8 DO NOTHING SCENARIO 4-51
4.9 REINSTATEMENT AND RESIDUAL IMPACTS 4-51

5 BIODIVERSITY -FLORA AND FAUNA 5-53

5.1 INTRODUCTION 5-53
5.2 METHODOLOGY 5-53
5.3 DESK STUDY 5-55
5.4 EXISTING ENVIRONMENT 5-56

5.5 Potential Impacts 5-64
5.6 Mitigation Measures 5-66
5.7 Do nothing scenario 5-67
5.8 Conclusions 5-67
6 SOILS AND GEOLOGY 6-68
6.1 Introduction 6-68
6.2 Study Methodology 6-68
6.3 Receiving Environment 6-69
6.4 Characteristics of the Development 6-75
6.5 Potential Impacts 6-75
6.6 Do Nothing Scenario 6-75
6.7 Mitigation Measures 6-75
6.8 Predicted Impact 6-76
6.9 Monitoring 6-76
6.10 Reinstatement and Residual Impacts 6-76
7 HYDROLOGY AND DRAINAGE 7-77
7.1 Introduction 7-77
7.2 Study Methodology 7-77
7.3 Receiving Environment 7-78
7.4 Characteristics of the Development 7-84
7.5 Potential Impacts 7-84
7.6 Do Nothing Scenario 7-84
7.7 Mitigation Measures 7-84
7.8 Predicted Impacts 7-85
7.9 Monitoring 7-85
8 AIR EMISSIONS 8-86
8.1 Introduction 8-86
8.2 Study Methodology 8-86
8.3 Emissions Characteristics of the Development 8-86
8.4 Legislative Context - Air Quality Standards and Limits 8-86
8.5 Potential Impacts 8-88
8.6 Do Nothing Scenario 8-89
8.7 Mitigation Measures 8-89
8.8 Predicted Impacts 8-89
9 NOISE 9-90
9.1 Introduction 9-90
9.2 Methodology 9-90
9.3 Existing Environment 9-91
9.4 Potential Impacts and Mitigation Measures 9-95
9.5 Monitoring 9-97

9.6 CONCLUSION 9-97

10 LANDSCAPE AND VISUAL IMPACT 10-98

10.1 INTRODUCTION 10-98
10.2 STUDY METHODOLOGY 10-98
10.3 EXISTING ENVIRONMENT 10-99
10.4 CHARACTERISTICS OF THE DEVELOPMENT 10-101
10.5 POTENTIAL IMPACTS 10-101
10.6 DO NOTHING IMPACT 10-101
10.7 AVOIDANCE, REMEDIAL AND MITIGATION MEASURES 10-101
10.8 PREDICTED IMPACTS 10-102
10.9 MONITORING 10-102

11 CLIMATE 11-103

11.1 INTRODUCTION 11-103
11.2 POTENTIAL IMPACTS 11-103
11.3 DO NOTHING SCENARIO 11-105
11.4 PREDICTED IMPACT 11-105
11.5 MITIGATION MEASURES 11-105

12 CULTURAL & ARCHAEOLOGICAL HERITAGE 12-106

12.1 INTRODUCTION 12-106
12.2 METHODOLOGY 12-106
12.3 BASELINE DATA: THE EXISTING CULTURAL HERITAGE ENVIRONMENT 12-108
12.4 IMPACTS 12-114
12.5 SIGNIFICANT IMPACTS 12-118
12.6 MITIGATION MEASURES 12-119
12.7 REFERENCES 12-120

13 TRAFFIC 13-121

13.1 INTRODUCTION 13-121
13.2 EXISTING ENVIRONMENT 13-121
13.3 PREDICTED IMPACTS 13-121
13.4 MITIGATION 13-122

14 IMPACT INTERACTIONS AND CUMULATIVE IMPACTS 14-123

14.1 INTRODUCTION 14-123
14.2 ASSESSMENT OF INTERACTIONS AND CUMULATIVE IMPACT 14-125
14.3 DO NOTHING SCENARIO 14-127
14.4 MITIGATION MEASURES 14-127
14.5 MONITORING 14-127
14.6 REINSTATEMENT AND RESIDUAL IMPACTS 14-127
1.2 CONCLUSION 14-128

Tables

- **Table 1-1 Contribution to EIAR 1-8**
- **Table 4-1 Risk Management 4-41**
- **Table 4-2 Quarterly National Household Survey, Q4 2016 ..... 4-45**
- **Table 4-3 Average Number of Persons on Live Register in Dublin 4-45**
- **Table 5-1 Criteria for establishing Receptor Importance (NRA, 2009) 5-58**
- **Table 5-2 Designated conservation areas located within 15 km of the site 5-60**
- **Table 5-3 Protected or Rare Plants 5-62**
- **Table 6-1 Geological formations within study area 6-70**
- **1. Table 6-2 Aquifer Classification (GSI) 6-71**
- **Table 7-1 Q Rating Table 7-81**
- **Table 7-2 Surface Water Monitoring Locations 7-85**
- **Table 8-1 Relevant Air Quality Standards and Guidelines 8-87**
- **Table 9-1 Guidance Note for Noise in relation to Scheduled activities, 2nd Edition, EPA 2006 ..... 9-91**
- **Table 9-2 Noise survey locations 9-94**
- **Table 9-3 Noise measurement at N1 ..... 9-94**
- **Table 9-4 noise measurement at N2 ..... 9-94**
- **Table 9-5 noise measurement at N3 ..... 9-94**
- **Table 9-6 Noise measurement at N4 ..... 9-94**
- **Table 13-1 Average HGV Trips Generated from proposed development 13-121**

Figures

- **Figure 1-1 Regional Site Location Map 1-2**
- **Figure 2-1 Existing facility in The Netherlands 2-12**
- **Figure 2-2 Facility at Terneuzen, The Netherlands 2-13**
- **Figure 2-3 Site Location Map (Including waste and wastewater facility) 2-16**
- **Figure 2-4Model of an existing proprietary system WWTP facility 2-27**
- **Figure 4-1 Waste Management H&S 4-42**
- **Figure 5-1 Designated Conservation Sites 5-61**
- **Figure 6-1 Subsoil Map 6-73**
- **Figure 6-2 Vulnerability Map 6-74**
- **Figure 7-1 Regional Surface Water Network 7-80**
- **Figure 7-2 Flood Risk map – Source - www.myplan.ie 7-84**
- **Figure 9-1 Noise Monitoring Locations 2015 ..... 9-96**
- **Figure 11-1 National CO_2 Emissions 11-104**
- **Figure 12-1 The study area superimposed on the Historic Environment Viewer maintained by the Department of Arts, Heritage, Rural Regional and Gaeltacht Affairs. The application area is indicated by the red line. Protected structures are indicated with green circles. 12-107**

Appendices

Appendix 1.1 Responses from this consultation
Appendix 3.1 Process description and Pills Report
Appendix 5.1: Screening for Appropriate Assessment
Appendix 7.1 Water Quality and Stormwater calculations
Appendix 9.1 Air Modelling
Appendix 12.1: Conservation Assessment (Slattery Conservation)



Plate 1 – Standard Pharmafilter installation- The Netherlands

1 INTRODUCTION

1.1 Background

The activities at the proposed Waste and Waste Water Treatment Plant will be in accordance with the Fourth Schedule Part I of the Waste Management Act (Facility Permit and Registration) Amendment Regulations S.I No. 86. The principal activity to be carried out at the facility will be:

R 3 Recycling/reclamation of organic substances which are not used as solvents (including composting and other biological transformation processes), which includes gasification and pyrolysis using the components as chemicals

Other activities include

D8 Biological treatment not specified elsewhere in this Annex which results in final compounds or mixtures which are discarded by means of any of the operations numbered D1 to D12

It is intended to apply for an EPA IED licence for the site.

It is proposed to treat the following at the site

Food waste	60 tonnes/annum
General Waste	914 tonnes/annum
Human Healthcare Risk Waste	407 tonnes/annum
Total	1,380.5 tonnes /annum or 3.7 m^3/day

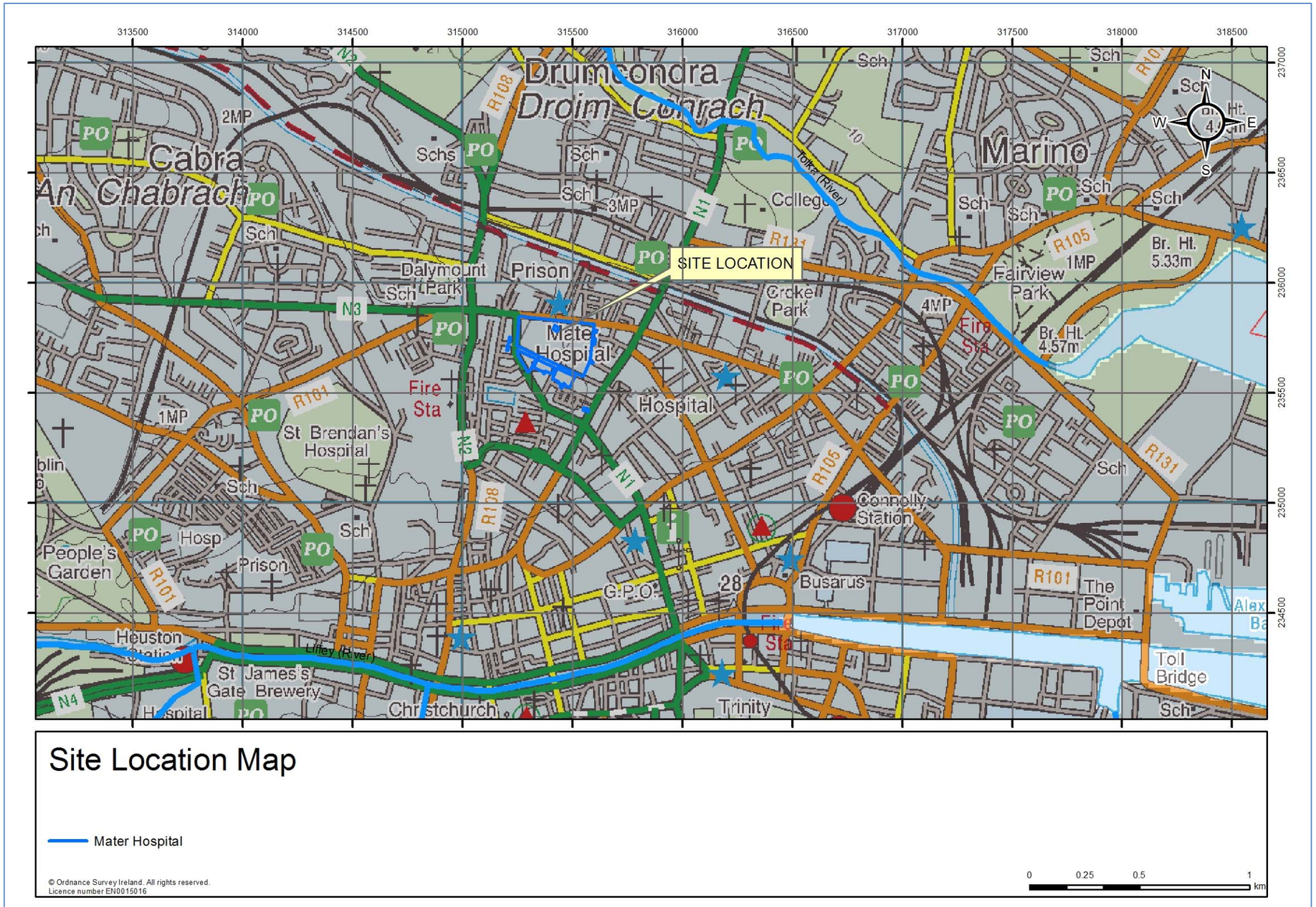
Wastewater treatment of 392.2 m^3 per day or 143,177 m^3/annum. It is proposed to apply to the EPA for an IED licence in relation to the facility. The maximum treated effluent discharge rate is determined by the treatment capacity of 25 m3/hr or 7l/s.

A number of items are classified as hazardous under the EU List of Waste criteria due to the wastes potentially infectious properties.

The location of the proposed development site in relation to the surrounding region is shown on Figure 1-1. As part of the waste proposed development, approval is now sought from the EPA, for the waste and wastewater treatment proposed development.

This Volume of the Environmental Impact Assessment Report (EIAR), details the environmental characteristics of the proposed development and the potential impact resulting from the planned Waste and Wastewater treatment. Mitigation measures are outlined to ameliorate impacts where possible. An assessment of the residual impacts of the development is also outlined. This Volume of the EIAR for the extraction of waste at proposed development, together with the EIAR appendices, Screening for Appropriate Assessment and the Non Technical Summary (Appendix A of the IED Licence application), completes the EIAR prepared in respect of the proposed development.

Figure 1-1 Regional Site Location Map



1.2 IED licence, Planning and Environmental Impact Assessment

A total of 0.08 hectares of will be developed by MMUH.

Environmental Impact Assessment (EIA)
An EIA is a process that examines the environmental consequences of development actions, in advance. The emphasis is on prevention with the resulting information taken into account by the appropriate authority when forming their judgements on the application.

In the case of significant impacts being identified, appropriate recommendations for the prevention and/or mitigation measures are highlighted. Where it is found that an impact cannot be prevented or mitigated against, or where additional monitoring is deemed necessary, this is also highlighted. The outcome of the Environmental Impact Assessment process is an Environmental Impact Assessment Report (EIAR) and an accompanying Non-Technical Summary. The EIAR was previously known as EIS however changes have been made to the format to align with the Department of Housing, Planning, Community and Local Government Circular letter PL 1/2017.

Planning
Planning permission was sought and granted from Dublin City Council (file no. 16/2107) in 2016 for the current proposal. Permission was sought for the development at site c.0.08ha consisting of the minor reconfiguration of the layout, alterations to the existing surface water and waste water drainage systems on site, the installation of an additional concrete hardstanding area,.

1.3 Scoping of the EIA

Prior to the commencement of the EIA process, a scoping exercise was conducted to identify the key issues of concern at an early stage in the process. Scoping also aids site selection and identifies possible alternatives. The results of scoping determined the scope, depth and terms of reference to be addressed within the Environmental Impact Assessment Report. In accordance with Section 4 of the *Guidelines on the Information to be contained in Environmental Impact Statement (EPA, 2002)*, the consultation process consisted of engagement with competent bodies, statutory bodies and interested parties (Responses from this consultation process are included in Appendix 1.1). A pre application meeting was held with the EPA in 2016.

The following lists the various parties consulted to-date.

Competent Authorities
Dublin City Council (Planning, Roads, Environment, Sanitary and Water, Community and Enterprise)
Irish Water
Environmental Protection Agency
Department of Communications, Energy and Natural Resources

Prescribed Bodies / Statutory Consultees

Developments Application Unit, Dept. of Environment, Heritage and Local Government (DOEHLG)
National Parks and Wildlife Service of the DOEHLG
The National Roads
Authority
Health Services

Executive
Health and Safety
Authority

Interested Parties
HSE Dublin Mid-Leinster
Local residents groups

Consultee	Summary of Consultee Response
Dublin City Council as part of Application 16/2107	Pre application meeting in 2015, meeting with waste section and water sections in Dublin City Council during planning application 2107/16. 2107/16 granted in 2016. Local Authority noted the following; Consideration of relevant existing and proposed development surrounding the site; proposed development should be described in terms of the nature and extent of the proposal - duration of operations, cumulative impacts etc; Completion of Conservation assessment as part of the application due to presence of Water – queries in relation to discharge quality and monitoring Waste – queries in relation to waste generated as part of the development and the use of biodegradable materials. Queries were addressed during the planning application process.
Transport Infrastructure Ireland	No response
Environmental Protection Agency	Teleconference in June 2015 and 1 No. meetings have been held with the EPA, in Johnstown, County Wexford on the December 2016. The main points raised by the EPA relative to the content of the EIS include the following: • Waste Hierarchy • Classification of waste schedules – recovery and disposal • Food regulations • Air and noise emissions from the facility • BAT and waste handling procedures
Department of Arts, Heritage and Gaeltacht; National Monuments Service (NMS) DAU coordinate	The scoping response from the DAU included the following general scoping comments for EIS, appropriate assessment screening/appropriate assessment, and for licencing requirements. Reference should be made to the National Biodiversity Plan and any relevant County Biodiversity Plan. Alien invasive species The EIS should also address the issue of invasive alien plant and animal species, such as Japanese Knotweed, and detail the methods required to ensure they are not accidentally introduced or spread during construction. Bats Bat roosts may be present in trees, buildings and bridges. Bat roosts can only be destroyed under licence under the Wildlife Acts and a derogation

	under the Birds and Natural Habitats Regulations and such a licence would only be given if suitable mitigation measures were implemented. Water quality Ground and surface waters quality should be protected during construction and operation of the proposed development and if applicable the applicant should ensure that adequate sewage treatment facilities are or will be in place prior to any development. The applicant should also ensure that adequate water supplies are present prior to development. A construction management plan should be implemented as part of the development
Irish Water	1 No. meetings have been held with the Irish Water, in Corvill House in Nov 2014. The scoping response from Irish Water included the following: • Impacts of the development on the capacity of water services (do existing water services have the capacity to cater for the new development if required). • The alignment of the proposal with the proximity principle and polluter pays principal • In relation to the management of surface water; the potential impact of surface water discharges to combined sewer networks & potential measures to minimise/stop surface waters from combined sewers. • Where a development proposes to connect to an IW network and that network either abstracts water from or discharges waste water to a "protected"/sensitive area, consideration as to whether the integrity of the site/conservation objectives of the site would be compromised.
Health Service Executive	The following aspects that should be assessed during the EIA process; • Assessment of Principle & description of the Project. • Assessment of Public Consultation & Non Technical Summary. • Assessment of Consideration of Alternatives. • Assessment of Description of Physical Environment. The EIA process the following topics should be assessed and documented in the EIS with regards to construction and operation of the proposed development; • Water: • Human Beings; • Waste; • Air Quality/Traffic; • Noise/traffic; • Material Assets In Addition, the following should be assessed; • The Interaction of Impacts • The Cumulative Effects of Impacts • Environmental and Health submissions • Decommissioning
IFI	None (at 12/06/2017)
HSA	None (at 12/06/2017)

GSI	None (at 12/06/2017)
Berkeley Environmental Group Blend residents Association Leo Street and District Residents Association	1 No. meeting have been held with the residents group, on 27th July 2015. Presentation by Pharmafilter with discussion of proposed system. Subsequent visit by resident representatives to Pharmafilter facility in the Reiner de Graff Hospital, Netherlands. Meeting discussed emissions and management of the facility under EPA licence. Ongoing liaison with residents associations including updates on project.

1.4 An overview of the structure of the EIAR

The EIAR for the waste and wastewater IED development is divided into the following:
Volume 1 - Waste and WWTP NTS and EIAR;
Volume 2 - Waste and Wastewater EIAR - Appendices;

The minimum information that must be contained in an EIAR is specified in Part X of the *Planning and Development Acts, 2000-2007* and Schedule 6 of the Planning and Development Regulations, 2001-2008. The structure and content of this EIAR has been based on the legislative requirements as set out in Part X of the *Planning and Development Acts, 2000-2007* and Part 10 of the *Planning and Development Regulations, 2001-2008* and the following documents, as published by the Environmental Protection Agency:

- Advice Notes on Current Practice (in the preparation of Environmental Impact Assessment Reports) (2003).
- Guidelines on the information to be contained in Environmental Impact Assessment Reports. (2002).
- Draft Guidelines on the information to be contained in Environmental Impact Assessment Reports (EIAR), 2017.

To allow for ease of presentation and consistency when considering the various elements of the environment, a systematic structure has been adopted for the main body of the statement. This structure is known as a “Grouped Format”. The structure is used for each particular environmental aspect as given below.

Receiving Environment
In describing the receiving environment, an assessment is made of the context into which the waste and wastewater activity will fit. This takes account of any other proposed and existing developments.

Characteristics of the Development
Consideration of the “Characteristics of the Development” allows for a projection of the “Level of the Impact” on any particular aspect of the environment.

Potential Impact of the Development
This section allows for a description of the specific, direct and indirect impacts, which the waste and wastewater activity may have. This is done with reference to Receiving Environment and Characteristics of the Development, while also referring to the magnitude, duration, consequences and significance of the development during both construction and operational phases.

Do Nothing Scenario

In order to provide a qualitative and equitable assessment of the activity, it is imperative to consider the impacts should the development not take place.

Mitigation Measures
This includes a description of any remedial, or mitigation measures that are either practicable or reasonable having regard to the potential impacts.

Predicted Impacts
This section allows for a qualitative description of the resultant specific, direct and indirect impacts, which the waste and wastewater activity may have, if all mitigation measures are applied. This is done with reference to both *Potential Impact of the Development* and *Mitigation Measures*, producing a definitive and concise statement of impact for the development.

Monitoring
This involves a description of monitoring required during the development and post development phase, if required. It also addresses the effects, which require monitoring, along with the methods and the appropriate agencies that are responsible for such monitoring.

Reinstatement and Residual Impacts
While not applicable to every aspect of the environment considered within this EIAR, certain measures need to be proposed to ensure that in the event of the proposal being discontinued, there will be minimal impact to the environment.

1.5 Technical difficulties and availability of data

No significant technical difficulties or lack of data were experienced in preparing the Environmental Impact Assessment Report for the proposed development.

1.6 Study Team and Contributors to the EIAR

This Volume of the EIAR for the proposed development has been prepared by a team of consultants co-ordinated by TOBIN Consulting Engineers. The relevant inputs of the various members of the Study Team are as follows:

Table 1-1 Contribution to EIAR

Field of Expertise	Company	Contact Name	Qualifications	No. of Years' Experience
· **Introduction**	**TOBIN Consulting Engineers**	Damien Grehan	Honours Degree in Engineering (1992), UCD Masters' Degree in Engineering Science (1994), UCD Chartered Engineer	24
		Description of Proposed Development Reasonable Alternatives		24
Lands, Soil and Geology,	**TOBIN Consulting Engineers**	Siobhán Tinnelly	Postgraduate Diploma in Management, Irish Management Institute (IMI), 2017	18
			MSc. Applied Hydrogeology, University of Newcastle-upon-Tyne, 2013	
		Lands, Soil and Geology,	Post Graduate Diploma in Environmental Engineering, Trinity College Dublin, 2004	
			B.A. (Mod) Natural Sciences (Env. Science), Trinity College Dublin, 1996-2000	
			Professional Geologists, P.Geo. Institute of Geologists of Ireland (IGI)	
Climate	**TOBIN Consulting Engineers**	**Allison Austin**	**B.A Geography (University of Liverpool, 2003)**	10
			M.Sc Environmental Resource Management (University College Dublin, 2004)	
			Post Grad. Cert. in Biological Recording and Species Identification (University of Birmingham, 2008)	
			Certificate in Renewable Energy (Dundalk IT, 2012)	
Biodiversity Preparation of EIAR, AA Screening, Natura Impact Statement, EIAR Sections:	**TOBIN Consulting Engineers**	**Padraig Cregg**	**B. Sc Zoology (National University of Ireland, Galway, 2007)**	10
			M.Sc Evolutionary and Behavioural Ecology (University of Exeter, 2008)	
		Biodiversity		
	TOBIN Consulting Engineers	**Alan Booth** Biodiversity Preparation of	**B.Sc., Zoology (University College Cork)**	8

Field of Expertise	Company	Contact Name	Qualifications	No. of Years' Experience
		EIAR, AA Screening, Natura Impact Statement, EIAR Sections:	**M.Sc., Environmental Science (Trinity College Dublin)**	
Water -flooding, traffic	**TOBIN Consulting Engineers**	Robert Hunt	BEng (Hons) in Civil Engineering MSc in Environmental Engineering Associate Certificate in Environmental Management	12
Drawings	**TOBIN Consulting Engineers**	Michael Nolan	City & Guilds in Computer Aided Design, Griffith College Dublin 2001	15
GIS	**TOBIN Consulting Engineers**	Fergal Healy	MSc in Resource Management and Sustainability, National University of Ireland, Galway/University of Limerick, 2016 B.A in History and Geography, National University of Ireland, Galway, 2011 CPD Cert (10 ECTS Credits) in Geographical Information Systems, Dublin Institute of Technology	2
Planning	**TOBIN**	John Dillon	BSc MSc DIC	15
		Alan Kelly	BA (MIPI)	18
Water -flooding, traffic	**TOBIN**	Cathal Kelly	B.E, MIEI, MICE	10
Lands, Soil and Geology, Site Investigations	**TOBIN Consulting Engineers**	John Dillon	BSc in Environmental Science (2001), NUIG	15
Project Direction and Management, Scoping and Consultation, Preparation of EIAR, AA Screening, Natura Impact Statement, EIAR Sections:			MSc and Diploma in Environmental Engineering (2003), Imperial College London	
			Professional Geologist (PGeo)	

Field of Expertise	Company	Contact Name	Qualifications	No. of Years' Experience
Human health, project description, System design	Pharmafilter	Nico Wortal	M.Sc. Civil Engineering Environmental & Health Technology	15
		Peter McKeown	CEng	20
Air Modelling	**AWN Consulting/TOBIN**	Dr Avril Challoner/Alisson Austin	BEng (Hons), HDip TCD, PhD (Air Quality) in Trinity College Dublin. Member of the Institute of Air Quality Management	10
Noise	**DPA /TOBIN**	Peter Gellen	BSc, MSc D. Acoustics	20
Landscape and Visual Impact	David Slattery Conservation Architects Limited	David Slattery	Dip Arch Fellow of Royal Institute of Architects Ireland	20
Archaeology and Cultural Heritage	**Charles Mount**	Charles Mount	M.A., Ph.D., M.B.A., Dip. EIA & SEA Mgmt., M.I.A.I.	20
	TOBIN Consulting Engineers	Fergal Healy	MSc in Resource Management and Sustainability, National University of Ireland, Galway/University of Limerick, 2016 B.A in History and Geography, National University of Ireland, Galway, 2011	2
Planning	**TOBIN**	John Dillon Alan Kelly	BSc MSc DIC BA MRUP (MIPI)	15 18
Water -flooding, traffic	**TOBIN**	Cathal Kelly	B.E, MIEI, MICE	10
Project Direction and Management, Scoping and Consultation, Preparation of EIAR, AA Screening, Natura Impact Statement, EIAR Sections:	**TOBIN Consulting Engineers**	John Dillon	BSc in Environmental Science (2001), NUIG MSc and Diploma in Environmental Engineering (2003), Imperial College London Professional Geologist (PGeo)	15
Human health, project description, System design	Pharmafilter	Nico Wortal Peter McKeown	M.Sc. Civil Engineering Environmental & Health Technology CEng	15 20

Field of Expertise	Company	Contact Name	Qualifications	No. of Years' Experience
Air and Noise	**AWN Consulting/TOBIN**	Dr Avril Challoner/Alisson Austin	BEng (Hons), HDip TCD, PhD (Air Quality) in Trinity College Dublin. Member of the Institute of Air Quality Management	10
Landscape and Visual Impact	David Slattery Conservation Architects Limited	David Slattery	Dip Arch Fellow of Royal Institute of Architects Ireland	20
Archaeology and Cultural Heritage	**Charles Mount**	Charles Mount	M.A., Ph.D., M.B.A., Dip. EIA & SEA Mgmt., M.I.A.I.	20

2 DESCRIPTION OF THE DEVELOPMENT

2.1 Site Context

MMUH is required to apply to the Environmental Protection Agency (EPA) for an Industrial Emissions Directive Activity (IED) Licence under the Environmental Protection Agency Acts 1992 as amended and EU (Industrial Emissions) Regulations 2013.

The principal environmental considerations undertaken by the operator MMUH involve ecology, air emissions, archaeology and surface water discharges arising from the sites operational activities. The potential impacts are minimised through the implementation and deployment of Best Available Techniques (BAT).

Waste water from hospitals is a source of potential health risks inside as well as outside the hospital, particularly due to the pharmaceutical substances and microbiology present. The Pharmafilter system has been designed and devised to resolve these problems. The core of this solution is the collection and cleansing of waste water to which other hospital waste streams have been added and includes the use of single use biodegradable products.

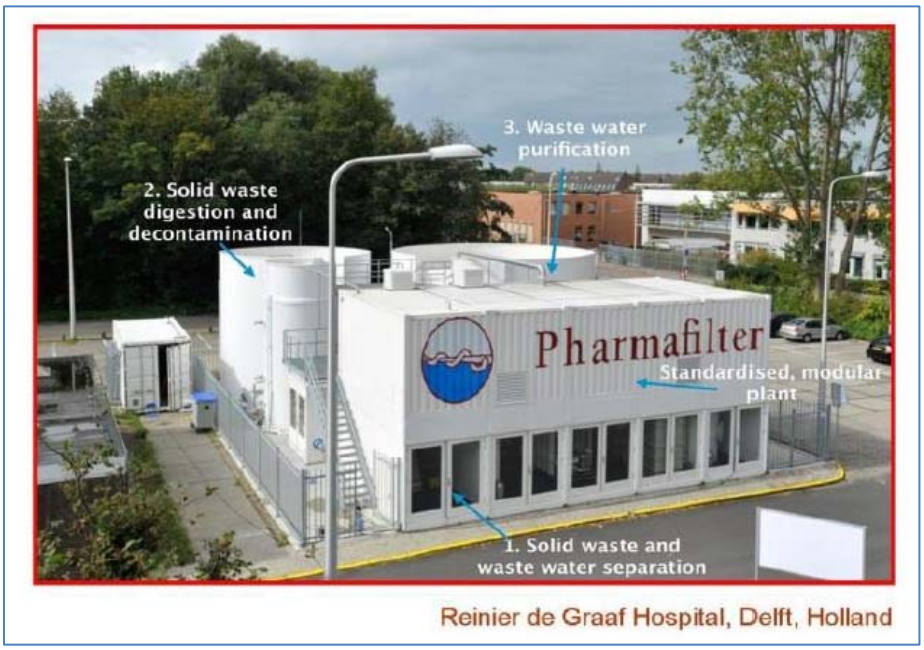


Figure 2-1 Existing facility in The Netherlands



Figure 2-2 Facility at Terneuzen, The Netherlands

2.2 Planning history

There is significant planning history on the site.

Reg Ref 16/2107
The existing facility was granted in 2016. A revised area is included in the current application.

Reg Ref 4929/03: Permission granted for the upgrading and extension of the existing Mater Misericordiae University Hospital including demolition and new build and also the relocation of the Children's University Hospital from Temple Street to the Mater Complex to be accommodated in a new building including 800 space new two storey basement car park accessed via Eccles Street etc. An environmental Impact Statement was attached to the application.

Reg Ref 2563/05: Permission granted for additional two floors ward accommodation (2,223 sq.m.) to provide new four storey over basement adult ward accommodation; also new basement area (2,909 sq.m.) under this block for future hospital facilities, and also new rooftop plant (541 sq.m); also additional one floor (1,281 sq.m) for laboratory space to approved four storey pathology and technical services building facing North Circular Road and linking to the new adult hospital building; also new basement area (144 sq.m) under this block for plant and services; also additional one floor (804 sq.m) to approved phase 1a ward block for administration use; site development, landscaping and ancillary site works. An Environmental Impact Assessment Report was attached to the application.

Reg Ref 5449/07: Permission granted for revisions to previous planning permissions granted under planning register reference no. 4929/03, as modified by planning permission register reference no. 2563/05. Revisions to the permitted development will enable the development of the Adult Hospital element of the permitted proposal as a stand-alone facility. This planning application also includes the following additions to the permitted development to comprise: an additional floor (3,024sqm approx.) to the permitted five storey Adult Hospital Building facing onto the North Circular Road, for use as future hospital facilities, to replace previously permitted roof plant and balustrade; new roof plant (1,318.7sqm approx.) at sixth storey level located behind aluminium louvres and rain screen panels, plus a stainless steel parapet balustrade; two additional floors to the public lifts core facing onto the

North Circular Road comprising stairwells, elevators and access lobby to be added above existing third floor stairwell and access lobby creating a new five storey public lifts core structure; additional basement area at two basement levels (5,992.7sqm approx.) for technical/support services use, beneath the permitted Adult Hospital; height of Adult Hospital, including plant, will be increased from 35.66 m (Ordnance Datum) to 39.46 m (Ordnance Datum) to create a six REP1letter storey building facing onto the North Circular Road; a new five storey (four storey over basement) entrance concourse (2,163.9sqm approx.) facing onto the car park to the south, with externally illuminated signage above entrance, to replace permitted nine storey central concourse structure (this new concourse will also be linked to existing Phase 1A Building and the building height of the new proposed concourse, including plant, will be 37.36 m Ordnance Datum); the relocation of the permitted ground floor pedestrian entrance on the North Circular Road approximately 12 m to the west of its current permitted location (the North Circular Road entrance will now serve as the main entrance to the new Adult Hospital). Planning permission register reference no. 4929/03 and as amended by register reference no. 2563/05, also includes permission to demolish a number of structures on site. However, of the structures permitted to be demolished, this planning application now proposes to retain the existing entrance ramp from Eccles Street and its accommodation beneath (340sqm approx.). This proposal also includes site development, landscaping and ancillary site works. The gross floor area added to the Adult Hospital as part of this proposal will be 11,202.6sqm. The new total gross floor area for the permitted development as a result of this proposal will be 42,742sqm approx. Therefore, this proposal will result in a net reduction of 42,430.4sqm from the previously permitted gross floor area of 84,903sqm as per register reference no. 4929/03 and no. 2563/05.

Reg Ref 2080/08: Permission granted for revisions for the increased accommodation requirements to the permitted Adult Hospital to allow it to function as a stand-alone ache me by adding additional floors to the permitted structure. These revisions take into account the restrictions placed on the development area available to the Adult Hospital by the future adjoining proposals for a National Paediatric Hospital and Metro Station also within the Mater Hospital Campus. The permitted six storeys Adult Hospital (five storeys plus level of roof-top plant rooms - max height +39.46 m Ordnance Datum) facing onto the North Circular Road will be increased in height by three floors plus an additional lift core level (which also includes plant area). This will create a new nine storey (eight storeys plus level of plant rooms) plus an additional lift core level. (This equates to ten storeys in total, including the lift core level, with levels numbered from 0 to 9). The gross floor area added to the permitted Adult Hospital as part of this proposal will be 12,430sqm. Additionally, 11,405sqm of internal changes to the permitted structure are proposed. This equates to a total of 23,835sqm of revisions/additions to the permitted development. Therefore 31,068sqm of the permitted floor area as per register references 4929/03 and 2563/05 will remain unchanged. The new total gross floor area for the permitted development as a result of this proposal will be 54,903sqm approx. This will result in a net reduction of 30,000sqm from the maximum previously permitted gross floor area of 84,903sqm as per register reference no. 4929/03 and as amended by register reference no. 2563/05.

Reg Ref 3013/10: Permission granted for an enclosed three storey high level circulation link bridge connecting levels 5, 6 and 7 of the existing Phase 1A building with the permitted development as register reference no. 4929/03, 2563/05, 5449/07 and 2080/08, with supporting structure. The overall height of the circulation link bridge will be approx +47.26 m (Ordnance Datum). The elevational treatment of the three storey link bridge consists of double-glazed aluminium capped curtain walling floor-to-floor, aluminium powder coated to RAL7030 with 1 m high translucent fritting at each level and automated glass louvers adjoining the main building for ventilation purposes. The parapet, soffit and spandrel panels of the link will be clad in aluminium to RAL7030. The structural steel supports will be painted to RAL7030. The gross floor area added to the permitted adult Hospital as part of this proposal will be 283sqm. The new gross floor area for the permitted development as a result REP1letter of this proposal will be 55,186sqm approx.

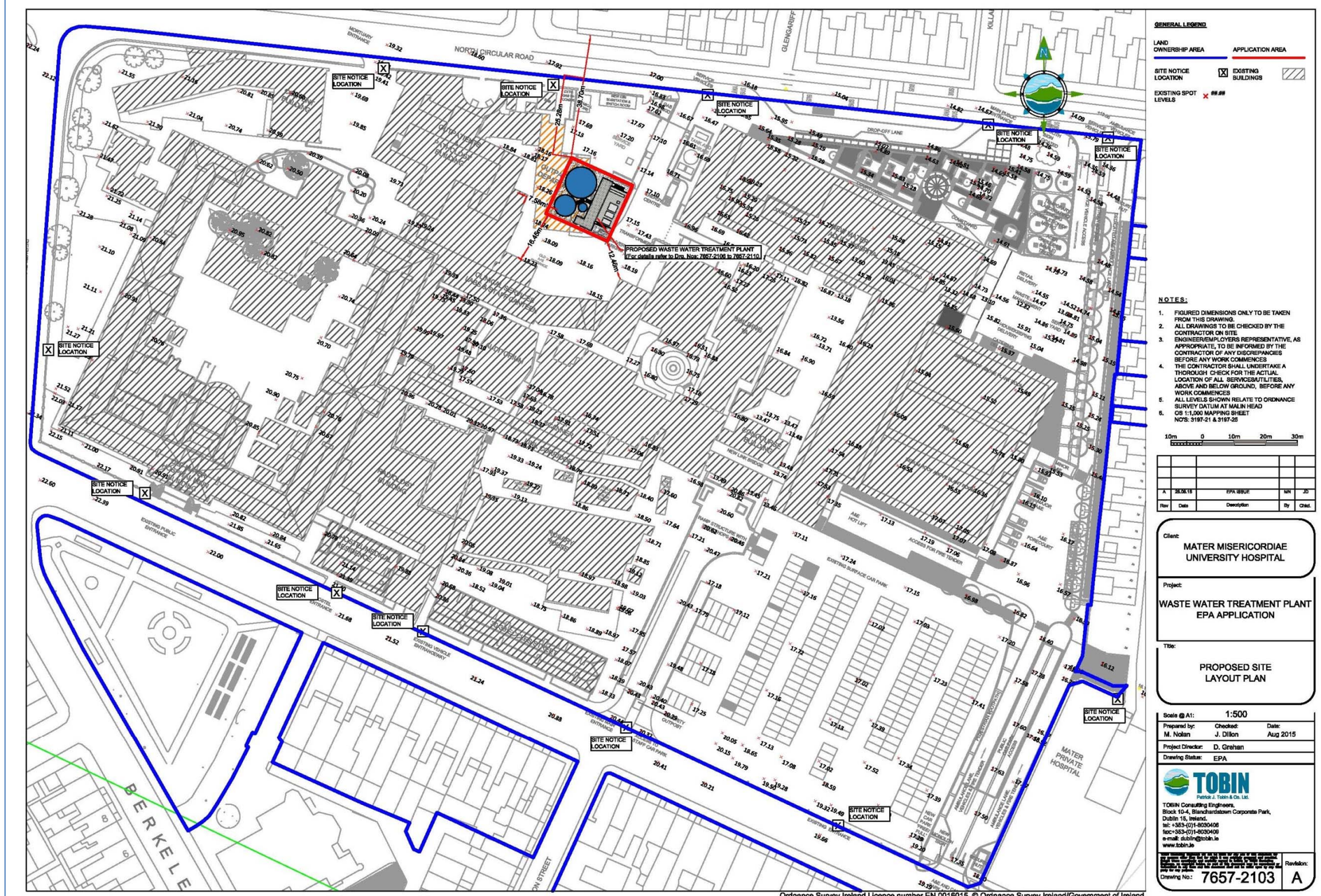
Reg Ref 3655/10: Permission granted for the widening / redesign of the permitted Mater Adult Hospital vehicular access ramp off Eccles Street, adjacent to the boundary with the Mater Private Hospital (from 7.1 metres wide to 12 metres wide), to include the e provision of an additional vehicular access lane and two bicycle lanes to the two permitted vehicle lanes. The revised ramp will provide access into the permitted Mater Adult Hospital basement car park at Level - 1 and will be covered by a widened pergola, as per the permitted ramp design. The lanes at either side of the widened ramp will provide ambulance access and egress to the permitted ambulance yard to the north of the ramp. This proposal includes related amendments to part of the permitted Mater Adult Hospitals Level -1 car park. Permission is also sought for related relocation of the permitted security hut (gross floor area of 17sqm) which will remain at the entrance to the revised ramp, and all associated site development and ancillary works. There is no increase in car parking spaces as permitted under register reference nos. 4929/03, 2563/05, 5449/07 (An Bord Pleanála ref PL29N.226878) and 2080/08 and no other change to the permitted development save for the revisions identified.

Reg Ref 3666/13: Permission granted for wrap up' application for the new Adult Mater Hospital. The retention of changes of the permitted external cladding of the southern lift/stair core from ceramic to insulated render and the 2 m wide access gate for a gas skid were refused for visual amenity reasons.

Reg Ref 3671/14: Permission granted on appeal for the retention of a number of external works including new access gate (2 metre wide approx.) from the North Circular Road to the permitted gas skid, adjacent to the western delivery yard; An electricity isolation transformer enclosed in a 25 sq.m (approx.) partially louvered plant structure, located in the western delivery yard at level 0; Modification of external cladding of the southern lift/ stair core (levels 0 to 8) from permitted ceramic, cladding to an insulated render system; Replacement of part of the permitted glazed side wall of the North Circular Road entrance foyer (north eastern side) with a granite clad wall.

MMUH:

Figure 2-3 Site Location Map (Including waste and wastewater facility)



The entrances from the R101 North Circular Road (NCR) (including associated security gates), access road and hardstand are in-situ and ready for use.

The existing drainage infrastructure within each area comprises of surface water and wastewater drains within the boundaries of the site.

2.3 Operational Plant Requirements

It is proposed to recover and recycle a number of specific wastes within the applicant's existing landholding. No waste material will be transported to the site during the operational phase as the treatment plant will only treat waste generated on site. The integrated approach to waste and waste water will be integral to patient care.

Solid waste will be separated from waste water in the plant. The solid waste will be reduced by anaerobic digestion, producing biogas. This gas will be re-used for powering the plant. The waste and waste water will be decontaminated and all harmful substances such as medicines, bacteria, viruses, cytostatics, contrast liquids and endocrine disruptors will be eliminated. The purified water can be re-used as process water within the Mater Campus. The facility will reduce waste generated at the site by 80% and ultimately recycle 50% of the waste water at the site. It is not proposed to reuse waste water until full testing and approval has been completed

The digesting waste will contain non-digestible materials, such as common plastic and fibres. Having undergone thermophilic anaerobic digestion i.e. (in excess of 60 degrees Celsius), these materials are sieved out of the digestate and decontaminated using a conic heat exchanger at 120 ^{0}C for 0.5-1.0 hours to decontaminate the non digestible materials. The decontaminated material will be sold as a high calorific value fuel to licenced waste-to-energy facilities.

Review of the Eastern Region Waste Management Plan and Circular Economy

While the Eastern waste management plan has limited references to hospitals or human health care risk waste, the following is noteworthy:

In our daily lives we produce non-hazardous, hazardous and sometimes toxic wastes. These wastes have the potential to impact negatively on our communities, our health, our environment and future generations if not managed appropriately. Effective management systems are needed to ensure that we continue to live in healthy communities and protection is afforded to our environment. In the region we have a collective responsibility to improve our behaviours in response to this ongoing problem. This is necessary if we are to rethink the waste challenge and ignite the opportunities which waste as a resource offers.

As outlined in the Eastern and Midlands Waste management Plan, *'Under the WFD, the recycling of waste is defined as "any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes" and "includes the reprocessing of organic material". Biological treatment is clearly an activity which sits on the recycling tier of the hierarchy.*

The proposed facility will effectively manage the waste from the hospital and meet the requirement of the Eastern Waste management plan and circular economy. The European Commission adopted in July 2014 the Communication 'Towards a circular economy: a zero waste programme for Europe' in order to establish a common and coherent EU framework to promote the circular economy.

Turning Europe into a circular economy means: Boosting recycling and preventing the loss of valuable materials; Creating jobs and economic growth; Showing how new business models, eco-design and industrial symbiosis can move us towards zero-waste; and reducing greenhouse emissions and environmental impacts.

The former waste streams from the hospital will eliminate the requirement for offsite disposal of Health Care Risk waste (HCRW), reduce potential pollutants to the sewerage network and convert waste into biogas for use within the treatment facility.

MMUH will continue to reduce and other forms of waste generation at the Mater Hospital Campus in accordance with the principles of the Waste Management Plan and the Hospital Environmental Policy.

The system and working method are an integrated approach to healthcare generated wastes, waste waters and service delivery that achieves better outcomes for the hospital, its patients, staff *and* the environment. The system underwent its extensive research and development program in cooperation with Reinier de Graaf Gasthuis and ZorgSaam (Hospitals), The Delfland District Water Board (the Netherlands), The Foundation for Applied Water Research- S.T.O.W.A. (the Netherlands), the European Environment and Nature Policy Program- *Life+* and the innovation program Water Framework Directive of the Ministry of Infrastructure and Environment (the Netherlands). A number of fully scale operational facilities are in use across Europe at present.

In light of the 2013 amendment to the Water Framework Directive concerning specific discharges/contaminants to the environment and the ongoing research both nationally and internationally informing the amendment of the WFD, the Mater Misericordiae University Hospital has decided to apply for the relevant permissions to enable the Hospital to deploy appropriate pre-treatment(s) of the Mater Misericordiae University Hospital's waste water and sewage. The Hospital's interest in addressing its own discharges prior to entering the public infrastructure is in keeping with the Mater Misericordiae University Hospital's leadership role in Irish and international healthcare.

The proposed installation will align the Mater Misericordiae University Hospital with, not only state of the art approaches to environmental protection, but also with what is emerging best practice in healthcare internationally. Indeed, there is significant supporting evidence demonstrating the overlap between environmental protection and healthcare particularly in relation to the rise of antibiotic resistant bacteria and the role of municipal waste water treatment plants interactions with healthcare, in their proliferation. Therefore, the Mater Misericordiae University Hospital wishes to align itself with a solution-based approach that delivers a better outcome for all stakeholders.

Food Waste Regulations

In December 2009, John Gormley, Minister for the Environment, published the Food Waste Regulations (SI 508 of 2009) heralding national legislation for the source separation of food waste from major commercial premises. These regulations are designed to promote the segregation and recovery of food waste in the commercial sector. They will facilitate achieving the targets set out in the European Commission's Landfill Directive 99/31/EC for the diversion of biodegradable municipal waste (BMW) from landfill sites to composting and anaerobic digestion plants, and to other forms of biological treatment. The proposed development will use food waste as an energy source to power the WWTP and recover heat and energy from the facility thereby complying with SI 508 of 2009.

2.4 Sustainability and need for treatment plant

Sustainability and the better management of development in harmony with the environment should be a fundamental aspiration of any development consent system. Environmental impact assessment1 (EIA) is recognised as a key support tool for sustainable development. Detailed below are the areas identified

2.4.1 Hospital Wastewater

There is a growing understanding that hospital wastewater has unique characteristics and impacts on municipal and public infrastructure. In their day to day business hospitals discharge waste water containing large amounts of pharmaceuticals and their metabolites, cleaning agents, contrast media, cyto-toxins as well as pathogenic contaminants include antibiotic resistant bacteria, viruses etc. The interaction between these discharges, local waste water treatment plants and the broader environment is an area of growing concern particularly in the context of eco-toxicity and anti-biotic resistant bacteria.

A growing body of research is demonstrating a direct link between hospital effluent and the spread of anti-microbial resistant genes (ARG's) to bacterial populations down steam from hospitals;

- "Antimicrobial activity was present at biologically significant levels only in hospital effluent samples and in municipal sewage downstream of the hospital effluent discharge point" (M. Cormican et al. 2005) and,

- "Waste water treatment plants (WWTPs) are a hotspot for resistance gene transfer between bacteria from different origins due to mixing of urban, industrial, clinical and agricultural waste" (Rizzo et al., 2013)

Appearance of what were once antibiotic resistant bacteria specific to hospitals in these environments reinforces the link between health care effluent and the dissemination of ARG's to the environment at large.

"Multiresistant Enterobacteriaceae, like carbapenemase-producing strains, have their primary reservoir in medical institutions. They can also be found with increasing tendency in other reservoirs. One possible way for entrance of multiresistant Enterobacteriaceae into the environment is via waste water."- Furthermore the recent study from Austria states, "Three isolates harboured carbapenemase genes, one Klebsiella pneumoniae harboured KPC-2 and one K. pneumoniae and one Escherichia coli harboured OXA-48. This is the first report of carbapenemase-harbouring Enterobacteriaceae isolated outside medical institutions in Austria and the first detection of KPC-harbouring K. pneumonia MLST ST 1245." (Galler et al., 2013)

Note; carbapenemase is the resistance to carbapenems. Carbapenems are a family of antibiotics classified as lifesaving drugs or "antibiotics of last resort". (Papp-Wallace et al., 2011)

An outbreak of KPC in a hospital, even where infection prevention standards are high, would be a major issue as no antibiotic is currently effective against this infection. Its appearance outside a health care institution should be of equal concern as;

> *"Rivers are a vital part of the ecosystem and provide an essential source of drinking water for wild animals as well as being used for crop irrigation and recreational activities. High levels of antibiotic resistance in rivers resulting from WWTP pollution may explain why an increasing number of studies are reporting resistance genes in both wild and domestic animals "(E. Wellington et al, 2014)*

Concerns around pharmaceutical inputs have contributed to the EU amending the Water Framework Directive where;

"Diclofenac (CAS 15307-79-6), 17-beta-estradiol (E2) (CAS 50-28-2) and 17-alpha-ethinylestradiol (EE2) (CAS 57-63-6) shall be included in the first watch list, in order to gather monitoring data for the purpose of facilitating the determination of appropriate measures to address the risk posed by those substances." And,

"Pursuant to Article 16(9) of Directive 2000/60/EC, and where appropriate on the basis of the outcome of its 2013 study on the risks posed by medicinal products in the environment and of other relevant studies and reports, the Commission shall, as far as possible within two years from 13 September 2013 develop a strategic approach to pollution of water by pharmaceutical substances. That strategic approach shall, where appropriate, include proposals enabling, to the extent necessary, the environmental impacts of medicines to be taken into account more effectively in the procedure for placing medicinal products on the market. In the framework of that strategic approach, the Commission shall, where appropriate, by 14 September 2017 propose measures to be taken at Union and/or Member State level, as appropriate, to address the possible environmental impacts of pharmaceutical substances, particularly those referred to in Article 8b(1), with a view to reducing discharges, emissions and losses of such substances into the aquatic environment, taking into account public health needs and the cost-effectiveness of the measures proposed." See article 8b of the 2013 Amendment to the Water Framework Directive.

This first time pharmaceutical substances have been included on WFD watch list and the amendment clearly sets out the considerations under which future policy will be developed.

Pharmafilter's wastewater treatment removes all micro pollutants, pharmaceutical and biological to below the detectable limit. As mentioned earlier, the system is self-funding and therefore represents a complete solution to hospital effluent be discharged to public sewer. The removal of these contaminants at source is far more desirable than decontamination at existing municipal facilities where the associated costs would be prohibitive. As the hospital wastewater is rendered reusable and is available for reuse within the hospital for grey water purposes reduces the demand on water supply (and therefore production) to the hospital.

2.4.2 Weaknesses re source segregation of waste in hospital setting

The Pharmafilter system eliminates the need for wastes to be manually transported off wards through the hospital and stored in advance of transport offsite for treatment and ultimate disposal/recovery. This process involves significant handling, staffing and space. Given that human involvement is required at every step in this process, from initial generation of waste to offsite decontamination and disposal, the exposure to health and safety risk factors and opportunities for human error are not inconsiderable. The possibility of infectious waste, for example, being inadvertently, placed in the wrong container in an emergency or high pressure clinical procedure should not be underestimated. The contents of that bin are now, by default, infectious but not identified as such and therefore treated inappropriately. The avoidance of risks such as these requires ongoing management, education and investment; resources, as mentioned earlier, that are under increasing pressure in the health care system.

The Pharmafilter upstream or decentralized waste and wastewater treatment system offers significant benefits to the host hospital, the local community/municipality and the environment at large. The treatment unit is designed to meet the full decontamination requirements of the specific wastes generated in hospitals. This purpose built system has none of the gaps or potential failures of more general designs or methods. This provides the hospital with the ability to eliminate the hazardous element of all waste exported offsite. Therefore, hazardous material is neither transported through the

local community nor exported out of the country, as is currently the case with some healthcare risk wastes.

Given that most Irish hospitals are publically funded and are obliged to meet government commitments in relation to carbon emissions opportunities to reduce the carbon footprint of operations are being actively sought. As the system includes an anaerobic digestion element any organic fraction included in the waste stream is digested with the resulting biogas converted to energy. This digestion process coupled with the shredding of material has a dramatic effect on the physical volume of the remaining residue. As a result, the frequency of truck movements, servicing waste is reduced significantly. The effect on transport, both national and international contributes to the hospitals carbon emission targets.

Waste management is also a constant concern as it poses a significant infection control risk. With the replacement of the bedpan washer with the shredder unit the hospital has enabled a disposal method local to the point of waste generation. Together with Pharmafilter's single use biodegradable items this has significant advantages in relation to infection control. Simply put nothing returns for use in the ward from the Tontos. This is not the case with conventional bedpan washers. The removal of cross contamination moments through the use of single use bio-plastic products allied with waste no longer being transported through the corridors and elevators, mitigates against the risk of the spread of hospital acquired infection in the first instance.

In the event of an outbreak, bedpan washers and macerators come under more demand and some protocols may include quarantining the ward. In cases like this, bedpans back up at the bedpan washer, significantly increasing the risk of cross contamination at a time of already heightened risk. Moreover, neither the bedpan washer nor a macerator removes water borne pathogens such as norovirus. These pathogens therefore persist in wastewater streams of hospitals where an outbreak is occurring. Movements in and out of the ward are restricted at these times resulting in either wastes building up on the ward or staff and the rest of the hospital exposed to an elevated risk of infection through the removal of these materials. The Pharmafilter system provides the hospital with operational resilience at times of crisis.

By removing, in as much as possible, human contact from these process opportunities for human error, contact or cross contamination (both inside and outside the hospital) and therefore an adverse event is dramatically reduced. Limiting human contact to these materials also aligns work practices more closely with Health and Safety guidelines;

Standard precautions require all healthcare employees to:

(a) Assume that every person is potentially infected or colonised with an organism that could be transmitted in the healthcare setting.

(b) Apply a set of work practices to blood, all bodily fluids except sweat, mucous membranes and non-intact skin. These work practices should include:

- · Hand hygiene
- · Use of personal protective equipment
- · Management of spillages of blood and bodily fluids
- · Appropriate patient placement
- · Management of sharps
- · Safe injection practices
- · Respiratory hygiene and cough etiquette
- · Management of needle-stick injuries

- · Management of waste
- · Management of laundry
- · Decontamination of reusable medical equipment
- · Decontamination of the environment

(Health and Safety Authority, 2013);

Moreover, EU health and safety legislation sets a hierarchy for exposure control measures (in relation to bio agents in the work place) to be applied if a risk assessment reveals risks; namely:

- Elimination of the hazard by changing the process or product is at the top of the hierarchy. If elimination is not possible, then the dangerous substances or the process should be substituted with another, non-hazardous or less dangerous one.

- Where the risks to workers are not prevented, control measures should be implemented to remove or reduce the risks to workers' health. The following control hierarchy should be followed:

- Design work processes and controls and use adequate equipment and materials to reduce the release of dangerous substances.

- Apply collective protection measures at the source of the risk, such as ventilation and appropriate organisational measures.

- Apply individual protection measures including personal protective equipment where exposure cannot be prevented by other means.

(European Agency for Safety and Health at Work (EU-OSHA)

2.4.3 Economic justification for the Pharmafilter approach as a sustainable long term intervention

The Pharmafilter approach delivers benefits for stakeholders across the whole hospital management spectrum: clinical, executive & financial, operations & facilities, the environment and sustainability. Proposing a value proposition that empowers hospitals to develop robust economic and clinical justification for investment in sustainable, clean technology.

The Pharmafilter System is designed to: -

· Substantially reduce waste and eliminate associated waste management costs.
· Decontaminate and recycle water used by the hospital.
· Process and decontaminate all hospital-originating hazardous substances/materials, with none entering the environment.
· Automate the transport and decontamination of hospital arising waste material.
· Enable cleaner, safer more efficient working practice.
· Create a platform to develop new approaches for reducing the risk of hospital-acquired infections.
· Prevent the discharge of anti-microbials, pharmaceuticals and all other healthcare specific contaminants micro-pollutants and pathogens in hospital waste water to public infrastructure.

When fully optimised, hospitals are supported and empowered to make real progress towards meeting

carbon reduction targets and progressively improve both their carbon and environmental footprint. The entire costs are offset against the cost of the system. Given that contracts are typically for 20 to 15 years this renders the supply of the Pharmafilter system and its operation and maintenance self-funding- at a minimum.

Description of the system and approach as a waste prevention measure in the context of the efficient use of existing capacity

The Pharmafilter system has been shown to reduce the prevalence of hospital acquired or nosocomial infection. Clostridium difficile, Norovirus and similar communicable nosocomial infections are positively impacted by the introduction of the Tonto to the ward sluice room and the working methods this enables. Conservative estimates put hospital acquired infection (HAI) rates between 5% and 6%. This is a global problem generating backlogs and blockages in many if not all developed health care systems. The prevalence of HAI is not only a risk of an adverse event for patients, staff members and visitors it is also a substantial cost to the entire health system in monetary terms and in terms of capacity.

Capacity is impacted by; a) the amount available b) the demand on the available capacity and c) how efficiently is that capacity utilized. In the context of resource efficiency, the efficient use of existing capacity is an explicit focus of hospitals and their management. These efforts can be assisted by a) reducing the need for hospitalization in the first instance and b) the successful and timely treatment of patients and reducing HAI. In achieving this efficiency, demand can be limited and with that the need to build additional capacity is offset against better performing, existing resources. This aligns with preventative policies in the context of environmental impacts whether in terms of emissions, water conservation or waste generation

The Pharmafilter system is healthcare infrastructure, protecting the environment and therefore the environmental needs of modern healthcare. In preventing many of the associated negative impacts that arise around hospital waste and waste water the system contributes to the prolonging and increasing the effectiveness of current healthcare infrastructure, drugs and resources where alternatively new infrastructure, drugs and resources would have to be developed, incurring the corresponding environmental impacts

2.5 Facilities Description

In light of the 2013 amendment to the Water Framework Directive concerning specific discharges/contaminants to the environment and the ongoing research both nationally and internationally informing the amendment of the WFD, the Mater Misericordiae University Hospital has decided to apply for the relevant permissions to enable the Hospital to deploy appropriate pre-treatment(s) of the Mater Misericordiae University Hospital's waste water and sewage. The Hospital's interest in addressing its own discharges prior to entering the public infrastructure is in keeping with the Mater Misericordiae University Hospital's leadership role in Irish and international healthcare.

The proposed installation will align the Mater Misericordiae University Hospital with, not only state of the art approaches to environmental protection, but also with what is emerging best practice in healthcare internationally. Indeed, there is significant supporting evidence demonstrating the overlap between environmental protection and healthcare particularly in relation to the rise of antibiotic resistant bacteria and the role of municipal waste water treatment plants in their proliferation. Therefore, the Mater Misericordiae University Hospital wishes to align itself with a solution-based approach that delivers a better outcome for all stakeholders.

It is proposed to recover and recycle a number of specific wastes within the applicant's existing landholding. No waste material will be transported to the site during the operational phase as the treatment plant will only treat waste generated on site. The integrated approach to waste and waste water will be integral to patient care.

A number of shredders will be connected to the existing sewer system. Together with the effluent from toilets, sinks and showers, the shredded waste will be transported through the existing hospital sewer infrastructure, to a purification plant on the hospital site.

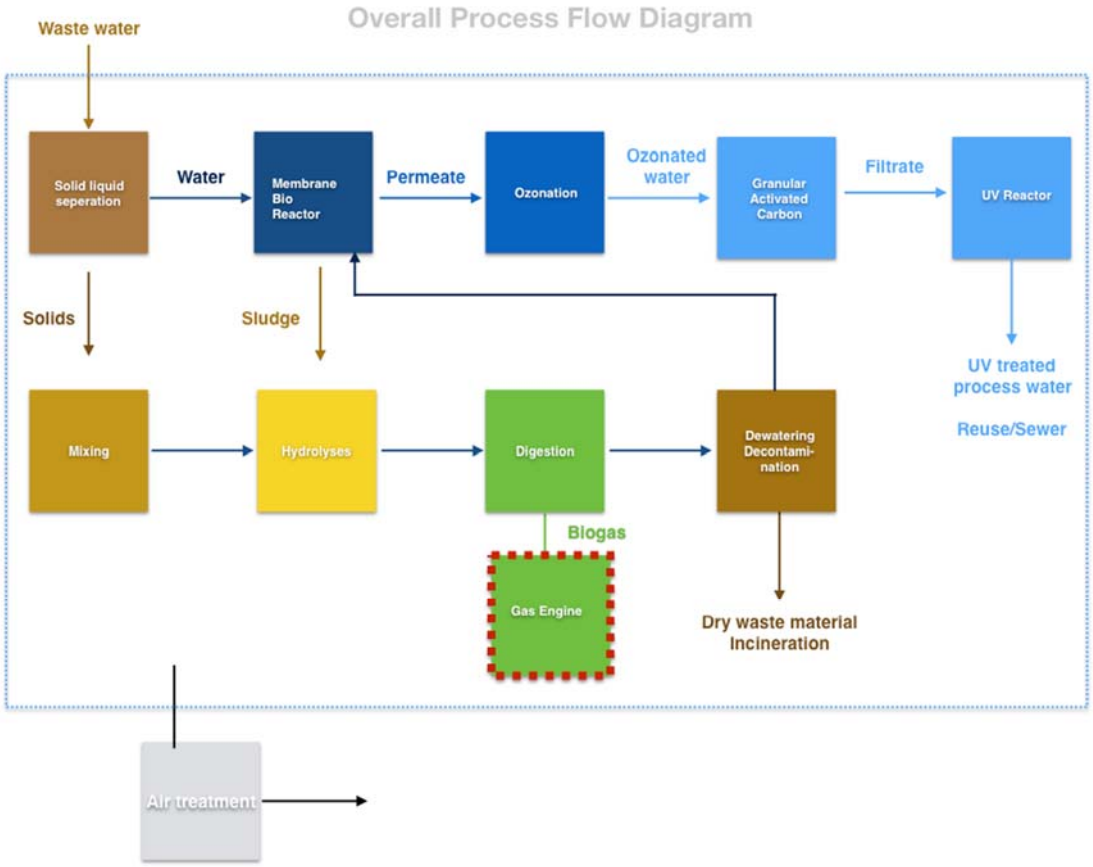
Solid waste will be separated from waste water in the plant. The solid waste will be reduced by anaerobic digestion, producing biogas. This gas will be re-used for powering the plant. The waste water will be purified and all harmful substances, medicines, germs, cytostatics, contrast liquids and endocrine substances will be eliminated. The purified water can be re-used as process water within the Mater Campus. The facility will reduce waste generated at the site by 80% and ultimately recycle 50% of the waste water at the site. It is not proposed to reuse waste water until full testing and approval has been completed.

The installation consists of a number of process components, which are selected based on research of proven technology and 9 years of practical experience in multiple installations. The result is a maximally effective installation comprising the following processes: -

- Shredding (2nd stage)
- Separation of solids and fluids
- Mixing/hydrolysis and fermenting
- Production of biogas and conversion to power and heat in a Combined Heat and Power plant
- Separation and decontamination of non-digestible materials

- Low-load membrane bioreactor
- High flux ozone installation
- Activated carbon filtration
- Filtrate storage and UV disinfection
- Waste gas treatment using fine filtration, UV light disinfection, and active carbon
- Air purification
- Hydrophore
- UV installation
- Thermal Waste decontamination

After the solid and liquid wastes have been separated, the wastewater flows through the membrane biological reactor where air is introduced, and bacteria remove the organic substances thoroughly. Large parts of the nitrogen and phosphorus compounds are also removed. The water is then further purified by means of ozonation and filtration through activated carbon. In this way, the values of the classic wastewater pollution parameters are reduced to at least the same levels as in conventional sewage systems.



#

Surfhvv#Iorz#Gldjudp#

2.5.1 Monitoring and control

The total quantity of water to be reused will be up to 50% or 70,000 m^3/per annum. A detailed explanation of the process is included in Appendix 3.1.

The process will produce high quality (reusable) effluent free from microbiological contamination and all pharmaceutical packages tested for resulting values below the detectable limit. The development will ensure that best practice in healthcare and high end environmental solutions are used at the site. The proposed system will result in a greatly reduced number of contact points with Human Healthcare Risk Waste, thereby reducing the potential for infections within the hospital.

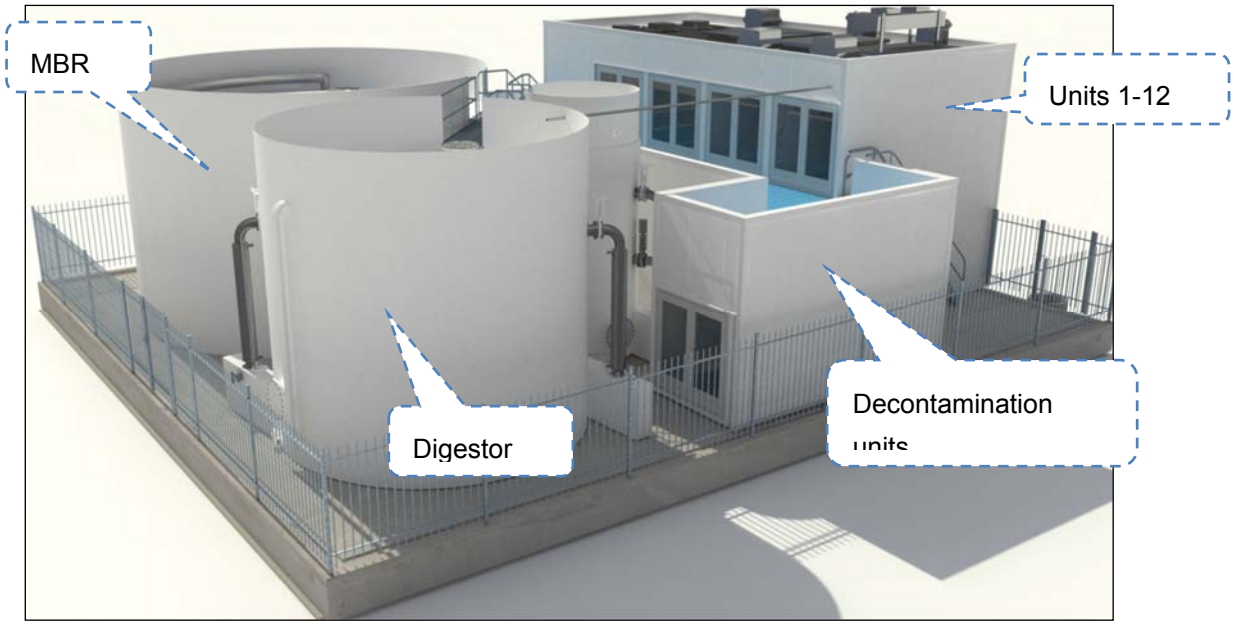


Figure 2-4Model of an existing proprietary system WWTP facility

Treatment System Principles

Hospital wards will be supplied with individual waste shredders, which will be capable of processing healthcare risk waste, domestic waste, food wastes and disposable bedpans and urinals. The waste will be shredded and, along with waste water from showers, sinks and toilets, transported via the existing sewer system to the digestion and treatment installation located on the hospital site. The system will have a positive impact on infection control, service delivery while also providing significant, logistical and financial benefits. Since hospital waste water will now be combined with shredded wastes, it can no longer be discharged directly to the public sewer system. The installed system will separate solid waste from the water and then further purify and process it on site. Importantly, this process will eliminate environmentally damaging substances such as pharmaceuticals, cytotoxins, mutated microbiological contamination and hormone disruptors, which are not adequately eliminated in standard sewage treatment plants.

Digestion

During anaerobic/aerobic thermophilic digestion, organic matter in waste water will be broken down in a hydrolysis mixing tank followed by the digester. This will include kitchen waste, particulate fraction, biodegradable bioplastics etc. Hydrolysis and mixing of waste will take place before the slurry will be pumped into the digester. Thus, the thermophilic digestion will be minimally disrupted. The aim is to digest bioplastics together with kitchen waste and primary sludge from the main sewer under thermophilic conditions in order to remove micro contaminants from waste water.

The bioplastics are derived from waste products from the food industry including dairy and distilleries. The bioplastics conform to ASTM D5511 -Standard test method for determining anaerobic biodegradation of plastic materials under high-solids anaerobic-digestion conditions and ASTM D 5338 - Standard test method for determining aerobic biodegradation of plastic materials under controlled composting conditions, incorporating thermophilic Temperatures.

MBR

A membrane bioreactor is a compact facility (up to 5 times more compact than a conventional activated sludge plant, the membrane module replacing the clarification tank) that produces significantly less excess waste. In the bioreactor, an activated sludge process treats sieved wastewater where the organic load together with nitrogen and phosphorous is removed in order to protect and optimize the operation of the downstream techniques. The Ultrafiltration (UF) membrane process segregates liquids that filter through a membrane into a permeate, which passes through the membrane; the resulting, and solids concentrate, is retained.

The system will be divided into three compartments (anaerobic, anoxic, and aerobic), in order to continuously treat the waste water and, through adequate recirculation, to make biological phosphate and nitrogen removal possible.

The main environmental and operational benefits of MBR application are as follows:
1) High removal efficiency of organic matter and nutrients (COD < 500 mg/l, NH3-N < 10 mg/l, phenols < 1 mg/l, hydrocarbons < 6 mg/l, PO4-P < 6 mg/l).
2) Zero solids discharge in the final effluent.
3) Low waste production.
4) Flexibility in hydraulic and organic loading.
5) Reduced chemical consumption.
6) Small foot print.
7) The membranes can be easily cleaned in situ.
8) The membranes can be easily removed for inspection/replacement.
9) Cross-flow membranes can be retrofitted. Existing MBR systems can be extended by adding further modules.
10) The MBR system does not require significant operational attention.[1]

Ozonation

Permeate from the MBR will be relatively clear and free of all suspended matter and bacteria. Some micro contamination will still present and it is the intention to reduce these concentrations even further. For this purpose, an oxidation stage using ozone has been chosen as the next step.

Activated Carbon

Prior to discharge to sewer, additional activated carbon will be used to absorb the remnants of micro pollutants after the ozonation stage. The activated carbon system consists of up to four downflow fixed bed stainless steel filters that are filled with different types of carbon.

-

[1] Draft Best Available Techniques for the Waste Treatment 2015 (WT D1);

Ultra Violet (UV treatment

As a final step, the extracted water will be treated by an advanced UV treatment system. The treated water will be stored in a process water tank within the installation. The treated water will be continuously re-circulated within a UV-unit in order to prevent the growth of bacteria. Water flows at least once through the UV unit. The UV irradiation system causes microbial inactivation thereby producing high quality treated water, suitable for grey water use within the hospital.

2.6 Site Operating Infrastructure

2.6.1 Extent and Life of proposed operations

As discussed above, this WWTP Planning Application will provide for treatment and recycling of waste water produced at the site. The quantity of material treated will be up to 1,380 tonnes per annum of waste and 143,000 m^3/annum of waste water.

The operation will carry on thereafter, as long as acceptable waste materials are available in sufficient quantities to support the activity.

2.6.2 Access and Site Entrance

Access to the application site will be via the existing entrances into the Mater Misericordiae University Hospital. The North Circular Road runs to the north of the site. Following construction works there will be reduced requirement for waste related traffic to or from the site by 50%. Any residual waste will be disposed of at a licenced waste facility in accordance with the Waste Management Act 1996 as amended. Once constructed, the facility will remove traffic from the road network containing Human Health Care Risk Waste (HCRW). An existing internal access road runs along the eastern boundary of the site.

The site will be securely fenced and security barriers will restrict access to the treatment area at all times. All visitors must report to the Mater site office.

2.7 Operations

2.7.1 Working Hours & Employment

The wastewater treatment plant will operate on a 24 hr basis, however any traffic to the site will operate between 07:00 hours to 18:00 hours on working days (Monday to Friday) and 08:00 hours to 15:00 hours Saturday. No traffic operations at this facility will be carried out on Sundays or public holidays.

It is envisaged that all operatives and drivers working at the proposed re-cycling facility will use the existing canteen, changing room and toilet facilities provided for the Hospital site by the Applicant.

Proposed Traffic Movements
It is currently envisaged that up to 50 % of waste will be recycled at this facility with 276 m^3 of waste requiring disposal.

2.7.2 Site Preparation Works

The facility requires the removal of an existing prefab building on the footprint of the site. The proposed ground level at the site is 16.4 m OD. While the area under construction is relatively small, earthworks and building works can pose a risk of pests if mitigation measures are not put in place. A pest control plan will be in place at the construction phase.

2.7.3 Disposal, Recovery and Recycling Activities

The main aim of the facility is to reduce transport and handling of solid waste. Disposal, Recovery and re-cycling activities at the application site will involve the reduction in waste generated at the site, production of biogas and recycling of water as process water.

The waste and waste water treatment plant will produce clean high quality effluent which will be suitable for reuse based on the parameters measured. The digestion process for organic waste, faeces and bioplastics has functioned well and the digestate is effectively and comprehensively decontaminated and can be removed as grey waste. The values of the macro parameters COD, BOD and Kj-N have been reduced by more than 99% and more than 75% of the N and P are removed biologically. See Appendix 1.1 for details of the proposed system.

Waste to be effectively treated in the system includes: -

- 18 01 03 wastes whose collection and disposal is subject to special requirements in order to prevent infection
- 20 01 08 biodegradable kitchen and canteen waste
- 20 03 01 mixed municipal waste
- 20 03 99 municipal wastes not otherwise specified

Healthcare waste streams have chemical/biological hazards that result in their classification as hazardous waste. Infectious healthcare risk waste or potentially infectious healthcare risk waste is typically classified according to the following European Waste Catalogue (EWC) code: 18 01 03 ‘wastes whose collection and disposal is subject to special requirements in order to prevent infection’ and 18 01 08 ‘cytotoxic and cytostatic medicines’.

Some treated wastewater will still discharge to the existing 600mm combined sewer on the North Circular Road however water quality would meet reuse standards. No new sewer connections are required on the North Circular Road.

2.7.4 Quality Control

The purpose of the proposed operation is to recover and recycle waste and waste water at the application site. The objective of the Mater Misericordiae University Hospital is to do this in a manner that is sustainable and environmentally friendly, in line with the high environmental standards set for all of its operations. Safeguards to ensure that only suitable material will be received at the onsite treatment plant include but are not limited to: -

- Training and education of staff
- Implementation of safe working procedures
- Remote monitoring of systems
- Weekly maintenance of equipment

To ensure that waste is being handled and treated in the most effective manner and with the least

health risk to employees and the community, the hospital will undertake a comprehensive appraisal of the activities associated with the generation, handling, and disposal processes. A "medical waste audit" requires the following steps: Generation profile to identify origination points, categories or types of waste, and associated generation rates.

Waste audits would be undertaken on 3 month basis to provide detail on the composition of waste both before and during the operation of the facility. An inventory of handling practices, procedures and protocols, training programs, definitions regarding waste segregation, and documentation will be undertaken at the hospital. The audits will be benchmarked against the current waste practise at the Hospital.

2.8 Major Accidents /Disasters

As part of the requirements of the new EIA Directive, the applicant is requested to consider the "Expected Significant Adverse Effects of the project on the environment deriving from the vulnerability of the project to risks of major accidents and/or disasters which are relevant to the project concerned."

It is clear from the directive that a major accident and/or natural disaster assessment should be mainly applied to COMAH sites or nuclear installations. The propose project is not a COMAH or nuclear installation, however the assessment is included for completeness. The starting point for the scope and methodology of this assessment is that the Proposed Development will be designed, built and operated in line with best international current practice and the type of project, as such, major accidents will be extremely unlikely. The management of any potential environmental accidents will be managed through the adoption of site best practises. The site is not located in a flood zone and is not at risk from extreme flooding. The potential for a significant spillage of hydrocarbons is negligible. Notwithstanding the negligible risk of serious spillage, additional spillage protection measures are included in the Proposed Development. During a spillage event, the spill will be managed within the site boundary where it can be safely removed and treated/disposed. Section 8 outlined mitigation measures in relation to potential contaminants.

It can be concluded that the risk of accidents associated with this development is very low and would not cause unusual, significant or adverse effects on human health or the environment during the construction or operational phase.

2.9 Statement of Authority

TOBIN Consulting Engineers (TOBIN) have completed this chapter. TOBIN engineers and scientists are intimately familiar with the site characteristics set in similar conditions and environment. This EIAR has been completed by Mr. John Dillon (BSc, MSc, MCIWM, PGeo), TOBIN Consulting Engineers. John has 15 years of experience in hydrogeological/hydrological assessment for EIS/EIAR. The author is appropriately experienced and capable of undertaking this assessment having worked on wastewater and waste projects in similar water environments. Please see table 1-1 for associated qualifications.

3 ALTERNATIVES

3.1 Background

Waste water from hospitals is a source of potential health risks inside as well as outside the hospital, particularly due to the pharmaceutical substances and microbiology present. The Pharmafilter system has been designed and devised to resolve these problems. The core of this solution is the collection and cleansing of waste water to which other hospital waste streams have been added and includes the use of single use biodegradable products.

Waste water from hospitals contains high concentrations of pharmaceutical substances, such as cardiovascular medicines, painkillers, antibiotics, cytostatics and X-ray contrast fluids. These enter the waste water from urine and faeces. As traditional sewage treatment systems are not designed to remove (organic) micro contamination, only a part of this contamination is removed. Surface water is therefore contaminated by that part of these substances that is not removed.

After the solid and liquid waste has been separated, the waste water flows through the biological reactor where air is introduced and where bacteria remove the organic substances thoroughly. A large part of the nitrogen and phosphorus compounds are also removed. The water is then further purified by means of ozonation and filtration through activated carbon. In this way, the values of the classic waste water purification parameters are reduced to the same levels as in a conventional sewage system.

This chapter addresses the alternatives considered in the development of the Mater waste and wastewater treatment plant proposal. In addition, the main alternative waste management options and technologies considered are described, and the environmental consequences of the alternatives, are also considered.

The National Hazardous Waste Management Plan recommends that Ireland strives for greater self-sufficiency in hazardous waste management, but emphasises that it must be strategically advisable, and technically and economically feasible to do so. The co-treatment of both clinical waste and non-hazardous waste makes the proposed development feasible for the mater hospital.

Regulation of healthcare risk waste at a facility or installation Facilities or installations used for the storage or treatment of healthcare risk waste will generally require a licence from the EPA.

A number of different technologies exist for the treatment and disposal of clinical waste. Currently waste and wastewater are treated separately at the hospital. The proposed development would address a number of concerns in relation to the waste and wastewater treatment at the hospital

In relation to wastewater, the characteristics of the wastewater are a cause for concern in the wastewater treatment industry. Recent developments in Europe and the United states have moved towards treatment of wastewater with high quantities of pharmaceutically active substances present in the wastewater at source. About 3,000 pharmaceutical active substances have permits in Europe. These products are, however, in many cases not completely absorbed and metabolized by the patient but partially excreted. Therefore, traces of the products reach the water cycle. Many substances it is unclear what effects these residues have on the water habitat – for example on microorganisms. Other micropollutants are already known as harmful for the environment.

The EU published the new draft annex for the Water Framework Directive in Jan. 2012 and if this WFD annex passes the Council and Parliament, all member states' surface waters have to meet the environmental quality standards for the priority substances by 2021 – for the first time including

pharmaceutical substances as well.

Research was undertaken as part of the EU Life Programme to find answers to these questions the work focussed on the following project components:

- Characterisation of waste water from point sources (hospital waste water) including chemical analysis in order to investigate the concentration and load of selected pharmaceuticals in the waste water and bioassays for the evaluation of the ecotoxicological potential and the relevance of antibiotic resistance bacteria of the point source waste water.
- Design, construction and operation of waste water treatment plants at hospital locations which incorporate advanced treatment technologies. Advanced treatment techniques (activated carbon, ozone, UV/ozone, UV/H2O2, (UV)/ H2O2/Fe2+ or Fe3+, UV/TiO2, reversed osmosis, ferrate (Fe(VI)) were tested after the biological waste water treatment in membrane bioreactors.
- Assessment of different advanced treatment technologies regarding the elimination efficiency of pharmaceuticals and the reduction of ecotoxicological effects and antibiotic resistant bacteria as well as the evaluation of the costs and the overall environmental impacts (using a life-cycle assessment methodology).

Hospitals can be seen as a “hot-spot” of pharmaceutical emission because here there is a high load of pharmaceuticals used and emitted through hospital waste water into the municipal sewerage. However, the fraction of the total pharmaceuticals distributed in hospitals compared to what is distributed in the communities is relatively low (and estimated by around 20%). But, certain pharmaceuticals (X-ray contrast media, cytostatics and some antibiotics) are distributed in much higher amounts in hospitals than at home.

Health-care waste contains potentially harmful microorganisms which can infect hospital patients, health workers and the general public. Other potential infectious risks may include the spread of drug-resistant microorganisms from health facilities into the environment. (WHO, factsheet 253)[2].
Health risks associated with waste and by-products also include:

- radiation burns;
- sharps-inflicted injuries;
- poisoning and pollution through the release of pharmaceutical products, in particular, antibiotics and cytotoxic drugs; and
- Poisoning and pollution through waste water.

3.1.1 Economic justification for the Pharmafilter approach as a sustainable long term intervention

The Pharmafilter approach delivers benefits for stakeholders across the whole hospital management spectrum: clinical, executive & financial, operations & facilities, the environment and sustainability. The proposed system offers a value proposition that empowers hospitals to develop robust economic and clinical justification for investment in sustainable, clean technology.

The Pharmafilter System is designed to: -

- · Substantially reduce waste and eliminate associated waste management costs.
- · Decontaminate and recycle water used by the hospital.
- · Process and decontaminate all hospital-originating hazardous

[2] http://www.who.int/mediacentre/factsheets/fs253/en/

substances/materials, with none entering the environment.

- · Automate the transport and decontamination of hospital arising waste material.
- · Enable cleaner, safer more efficient working practice.
- · Create a platform to develop new approaches for reducing the risk of hospital-acquired infections.
- · Prevent the discharge of anti-microbials, pharmaceuticals and all other healthcare specific contaminants micro-pollutants and pathogens in hospital waste water to public infrastructure.

When fully optimised, hospitals are supported and empowered to make real progress towards meeting carbon reduction targets and progressively improve both their carbon and environmental footprint. The entire costs are offset against the cost of the system. Given that contracts are typically for 20 to 15 years this renders the supply of the Pharmafilter system and its operation and maintenance self funding- at a minimum.

Influencing Factors in the Technology Selection when examining the types of technology that would be most appropriate for the Mater waste and wastewater treatment plant, MMUH considered a number of factors, which are set out below.

3.1.2 Characteristics of the Irish Waste Market

The Irish market for clinical waste disposal is relatively small by international standards and is also varied in its composition. Because of this, the design of the facility, and of the technology to be chosen, must be sustainable, with sufficient robustness and flexibility. The proposed facility is over designed to allow for an increase in waste generation as additional beds and theatres come on stream. There is no technical impediment to operating the facility significantly below its nominal design capacity. All hospitals in Ireland currently export untreated clinical waste contrary to the proximity principal.

The BREF on Waste does not include any BAT for the treatment of clinical waste or wastewater from clinical facilities. In the absence of any standards or data, it is difficult to compare this technology with conventional thermal treatment technology (autoclaving). However, indications are that advanced technologies proposed have the potential to produce lower environmental emissions, heat recovery and can treat both the pharmaceutical in the healthcare risk waste, organics and waste water wastes.

Some of the advantages of proposed system include a reduction in needle stick injuries, reduce contact points and infections are a result of repeated handling of infectious waste. Needle stick injuries are a significant waste management and health and safety issue within hospitals. Approximately 140 Needle Stick Injuries occur each year at MMUH.

The proposed high technology approach ensures that the environmental criteria are consistent with the objectives of the Waste Framework Directive 2008/98/EC, namely:

- “The protection of public health and the environment;
- The establishment of an adequate network of appropriate installations;
- Disposal installations (taking into account the Best Available Technology (BAT); and
- The proximity and polluter pays principle

3.2 *Alternative Treatments*

Autoclaving involves the addition of heat into a container at high pressures. Autoclave and steam disinfection treatment methods can also pose potential hazards that need to be managed. In particular, good maintenance and operation should be undertaken to avoid physical injuries from high operating

temperatures and steam generation. Post-waste treatment water contains organic and inorganic contaminants. In addition, autoclaving is inadequate for anatomical, pharmaceutical, and chemical waste and waste that is not readily steam-permeable. An EPA licence is required for the installation of any Autoclaving facility dealing with HHRW in Ireland. To date no facility exists. While autoclaving would treat some HHRW, it would be applicable to the proposed treatment which addresses waste and wastewater at the hospital.

Incineration
The distinct advantage of incineration technology in HHRW management is that it greatly reduces the volume of the waste while rendering the waste unrecognizable. Conversely, incineration releases a variety of pollutants, including dioxins and furans, heavy metals (such as lead, mercury, and cadmium), acid gases (hydrogen chloride and sulphur dioxide), carbon monoxide, and nitrogen oxide. The current disposal route for hospital wastewater is the combined sewer on the North Circular Road. The high levels of pharmaceuticals in the hospital wastewater are diluted but not treated in the Ringsend wastewater treatment plant.

Other Treatment technologies
Various treatment technologies can treat the proposed waste and wastewaters were investigated as part of the Pills Project (see Attachment 3.1). A biological waste water treatment using membrane bioreactor (MBR) and digestor, yields a good wastewater quality in terms of COD, nutrients and bacteria. Further advanced treatment is necessary to eliminate most pharmaceuticals from waste water as biological treatment alone is not enough. Advanced treatments with ozone and/or activated carbon or UV/H2O2 or reverse osmosis are effective to achieve this elimination. Through the research and refinement of the treatment process and system learning in the Netherlands the proposed solution offers the optimum solution for the treatment of the waste and wastewater.

3.3 Do nothing scenario

The Mater waste and wastewater treatment would be disposed of through the current streams.
The current disposal route for HHRW is incineration. The current disposal route for wastewater is the public sewer network and Ringsend Wastewater treatment plant.

3.4 Alternative Site Location

Given the proposed development will treat only waste and wastewater within the grounds of the Mater Hospital, no alternative locations are available on the site. The site of the proposed development at Dublin is within the hospital grounds designated for development with the Mater Master Plan.

In addition, the layout of the proposed development is sensitively located away from the listed building within the Mater Campus. Landscaping will aid in absorbing the development into the existing landscape. There are no protected geological heritage features on the proposed development site.

The site is not designated as a natural heritage area, a proposed natural heritage area, a Statutory Nature Reserve or a Refuge for Fauna. There are no Annex 1 habitats on the site. The potential impact of the project on designated sites, including the proposed natural heritage area, is assessed in Chapter 6 and 7, Soils, Geology, Hydrogeology, and Hydrology of this EIAR. The flora and fauna on site is minimal given the existing hard landscaped and industrial nature of the site. There are no rivers, streams or watercourses on the site of the proposed development. Sustainable Drainage System "Ensure that a Sustainable Drainage System (Suds) is applied to any development and that site-specific solutions to surface water drainage systems are developed, which meet the requirements of the Water Framework Directive and associated River Basin Management Plans;" The site of the proposed development is suitable for a Suds approach to surface water drainage and a site-specific

Suds solution will be applied, subject to the requirements of industrial emissions licensing.

The surface water drainage will be designed to meet the requirements of the Water Framework Directive and the River Basin Management Plan for the Eastern River Basin District "Avoid development of waste management infrastructure in flood risk areas. Reference should be made to the Planning System and Flood Risk Management for Planning Authorities (DoEHG/OPW 2009) and National Flood Hazard Mapping (OPW) and the relevant Flood Risk Management Plan (FRMP);" It is worth noting that the site is classified as "Flood Zone C" according to the OPW Planning Guidelines (2009).

A composite Screening Report has been submitted with the application for permission in relation to the proposed development, which provides information to the Board (as competent authority) to undertake Stage One Screening and, as required, a Stage Two Appropriate Assessment. "Where a significant effect on a European Site, either alone or in combination with other plans or projects, is identified, or where there is uncertainty with regard to effects, the competent authority will seek a Natura Impact Statement to inform an AA. In so doing, the implications for any European Site in light of the site's Conservation Objectives shall be considered." An Appropriate Assessment Screening and NIS has been prepared for the proposed development and has been submitted with the application for permission.

From a waste and planning policy perspective, and consistent with Ireland's National Planning Policy Statement 2015, the proposed Facility in Dublin is plan-led, for the following reasons:

- National and regional waste policy advocates self-sufficiency and the proximity principle in the provision of waste management infrastructure for the State.

3.5 Need for the Scheme and Potential Alternatives

The disposal of hospital waste is an issue due to possible contamination and spread of disease hazard. The current practice involves multiple potential contact points with waste and carries the risk of needle stick injuries. The current means of disposal involves the incinerator of waste. In addition, wastewater with high microbial and pharmaceutical concentrations is discharged to sewer along with

On-site treatment of hospital waste offers a large quantity of advantages: minimum handling hazard, reduction of transportation and storage, as well as lower operating cost. Different processes aiming a partial or total sterilization have been considered, and some of them are already operational in health structures. The sterilization processes can be divided into two general categories: chemical and thermal processes.

The Pharmafilter system has been designed and devised to resolve the waste and wastewater issues at the hospital. The core of this solution is the collection and cleansing of waste water to which other hospital waste streams have been added, and includes the use of single use biodegradable products.

Waste water from hospitals contains high concentrations of pharmaceutical substances, such as cardiovascular medicines, painkillers, antibiotics, cytostatics and X-ray contrast fluids. These enter the waste water from urine and faeces. As traditional sewage treatment systems are not designed to remove (organic) micro contamination, only a part of this contamination is removed. Surface water is therefore contaminated by that part of these substances that is not removed.

After the solid and liquid waste has been separated, the waste water flows through the biological reactor where air is introduced and where bacteria remove the organic substances thoroughly. A large part of the nitrogen and phosphorus compounds are also removed. The water is then further purified

by means of ozonation and filtration through activated carbon. In this way, the values of the classic waste water purification parameters are reduced to the same levels as in conventional sewage systems.

4 POPULATION AND HUMAN HEALTH

4.1 Introduction

This section discusses the key issues affecting population and human health, and the potential impacts of the proposed development within the existing site. The issues discussed include population, language and culture, employment and economic climate, tourism and health and safety.

4.2 Study Methodology

A desk study was carried out in order to examine all relevant information pertaining to Population and Human Health in the area. The Dublin City Development Plan 2016-2022 and was examined, along with relevant census data from the Central Statistics Office (CSO).

In addition, Ordnance Survey maps were used to identify land use and possible amenity and tourist sites located in proximity to the proposed waste and wastewater site. Site visits were undertaken in January and April 2017.

4.3 Receiving Environment

4.3.1 Human Health

Hospitals can be seen as a “hot-spot” of pharmaceutical emission because here there is a high load of pharmaceuticals used and emitted through hospital waste water into the municipal sewerage.

Comparing hospital and municipal wastewaters, no big differences were observed for the “classical” wastewater parameters, but higher concentrations of antibacterial and contrast media occurred in hospital wastewater. For the WWTPs, hospitals and specific compounds investigated, hospital contributions to the total load of pharmaceutical in the WWTP are highest for X-ray contrast media, cytostatics and some antibiotics. The highest contribution is for contrast media (40-100%), lidocaine (56-62%), and antibacterials, in particular ciprofloxacin (12-100%) and clarithromycin (12-60%). Hospital contributions for compounds for other treatment groups were below 20%.

Health-care waste contains potentially harmful microorganisms which can infect hospital patients, health workers and the general public. Other potential infectious risks may include the spread of drug-resistant microorganisms from health facilities into the environment. (WHO, factsheet 253)[3].
Health risks associated with waste and by-products also include:

- radiation burns;
- sharps-inflicted injuries;
- poisoning and pollution through the release of pharmaceutical products, in particular, antibiotics and cytotoxic drugs; and
- Poisoning and pollution through waste water.

Sharps-related injuries

Worldwide, an estimated 16 billion injections are administered every year. Not all needles and syringes are disposed of safely, creating a risk of injury and infection. Approximately 140 Needle Stick Injuries

-

[3] http://www.who.int/mediacentre/factsheets/fs253/en/

occur each year at MMUH.

A person who experiences one needle stick injury from a needle used on an infected source patient has risks of 30%, 1.8%, and 0.3% respectively of becoming infected with HBV, HCV and HIV[4] (Bell, 1997).

Minimising Contact with HHRW

Waste management is also a constant concern as it poses a significant infection control risk. With the replacement of the bedpan washer with the shredder unit the hospital has enabled a disposal method local to the point of waste generation. Together with Pharmafilter's single use biodegradable items this has significant advantages in relation to infection control. Simply put nothing returns for use in the ward from the Tontos. This is not the case with conventional bedpan washers. The removal of cross contamination moments through the use of single use bio-plastic products allied with waste no longer being transported through the corridors and elevators, mitigates against the risk of the spread of hospital acquired infection in the first instance.

In the event of an outbreak, bedpan washers and macerators come under more demand and some protocols may include quarantining the ward. In cases like this bedpans back up at the bedpan washer, significantly increasing the risk of cross contamination at a time of already heightened risk. Moreover neither the bedpan washer nor a macerator removes water borne pathogens such as norovirus. These pathogens therefore persist in wastewater streams of hospitals where an outbreak is occurring. Movements in and out of the ward are restricted at these times resulting in either wastes building up on the ward or staff and the rest of the hospital exposed to an elevated risk of infection through the removal of these materials. The Pharmafilter system provides the hospital with operational resilience at times of crisis.

By removing, in as much as possible, human contact from these process opportunities for human error, contact or cross contamination (both inside and outside the hospital) and therefore an adverse event are dramatically reduced. Limiting human contact to these materials also aligns work practices more closely with Health and Safety guidelines;

Standard precautions require all healthcare employees to:

(a) Assume that every person is potentially infected or colonised with an organism that could be transmitted in the healthcare setting.

(b) Apply a set of work practices to blood, all bodily fluids except sweat, mucous membranes and non-intact skin. These work practices should include:

- Hand hygiene
- Use of personal protective equipment
- Management of spillages of blood and bodily fluids
- Appropriate patient placement
- Management of sharps
- Safe injection practices
- Respiratory hygiene and cough etiquette

[4] Bell DM. Occupational risk of human immunodeficiency virus infection in healthcare workers: an overview. Am J Med 1997;102(suppl 5B):9–15.

- Management of needle-stick injuries
- Management of waste
- Management of laundry
- Decontamination of reusable medical equipment
- Decontamination of the environment

(Health and Safety Authority, 2013);

Moreover EU health and safety legislation sets a hierarchy for exposure control measures (in relation to bio agents in the work place) to be applied if a risk assessment reveals risks; namely:

- Elimination of the hazard by changing the process or product is at the top of the hierarchy. If elimination is not possible, then the dangerous substances or the process should be substituted with another, non-hazardous or less dangerous one.

- Where the risks to workers are not prevented, control measures should be implemented to remove or reduce the risks to workers' health. The following control hierarchy should be followed:

- Design work processes and controls, and use adequate equipment and materials to reduce the release of dangerous substances.

- Apply collective protection measures at the source of the risk, such as ventilation and appropriate organisational measures.

- Apply individual protection measures including personal protective equipment where exposure cannot be prevented by other means.

(European Agency for Safety and Health at Work (EU-OSHA)

(European Agency for Safety and Health at Work (EU-OSHA)In catering to the toilet function of a patient who cannot use the lavatory, staff must observe strict protocols in relation to hygiene and infection control. With conventional stainless steel bedpans there is a constant elevated risk of cross contamination given the contents of the bedpan and it's reusable nature. Any hand contact moment or spill invokes a cleaning procedure involving chemicals and hot water so cleaner more simple hygienic work practices are not only clinically desirable but also have a positive environmental impact.

Pharmafilter offers a range of single use biodegradable bio plastic products. Items such as Pharmafilter's Olla™ (Bedpan) and Botta™ (urinal) have been developed together with health care professionals to meet the needs of patients. With the "life cycle thinking" approach that is central to Pharmafilter philosophy, these products strike a balance between optimal clinical outcomes and environmental stewardship. (see note on circular economy)The design of the Olla allows for faeces and urine held in separate compartments which is important when sampling is required. Hygienic sampling is further facilitated by a lid that seals the Olla but has two permeable eyelets to allow a syringe extract samples as required, further reducing the risk of spillage,spash or contact.

The Botta is a once in 24-hour solution to the urine requirements of a patient. This eliminates much of the work associated with reusable urinals, which must be decontaminated after each use requiring hot water, chemicals and energy.

Table 4-1 Risk Management

RISK	Category	CONVENTIONAL EFFECT	PHARMAFILTER EFFECT
Inappropriate segregation of waste	Environmental Hygiene, Infection control, Health & Safety	Cross contamination Waste mis-handled Inappropriate Treatment. Inaccurate recording	Uniform disposal method for wastes Potential for mishandling limited to clinical staff. Uniform treatment for all waste Measurement and recording greatly simplified 100% Waste diverted from Landfill
Accidental Spillages	Environmental Hygiene, Infection control, Health & Safety	May occur at any point in the waste management process	No issue after disposal in the Tonto
Needle stick injuries	Infection control, Health & Safety	Ongoing concern throughout the process	No issue after disposal in the Tonto
Damage to property	Maintenance, Infection control	Bins causing damage to walls doors & lifts as they are moved through the hospital.	No buffering required No large bins required No impact on the fabric of the building
Blockages and Leaks in sewage system	Environmental Hygiene, Infection control, Health & Safety, Maintenance	No Impact on existing leaks or	Full management, monitoring and risk mitigation procedures in place.
System Failure	Environmental Hygiene, Infection control, Health & Safety, Maintenance	Cross contamination, waste mis-handled, inappropriate treatment.	Full management, monitoring and risk mitigation procedures in place including redundancies and failsafe's staff and remote monitoring See risk mitigation document
Transport of Hazardous Materials off site	Environmental, Infection control, Health & Safety, Public Health	Road accident, spillage Accident at sea	No hazardous waste exported from the hospital site.

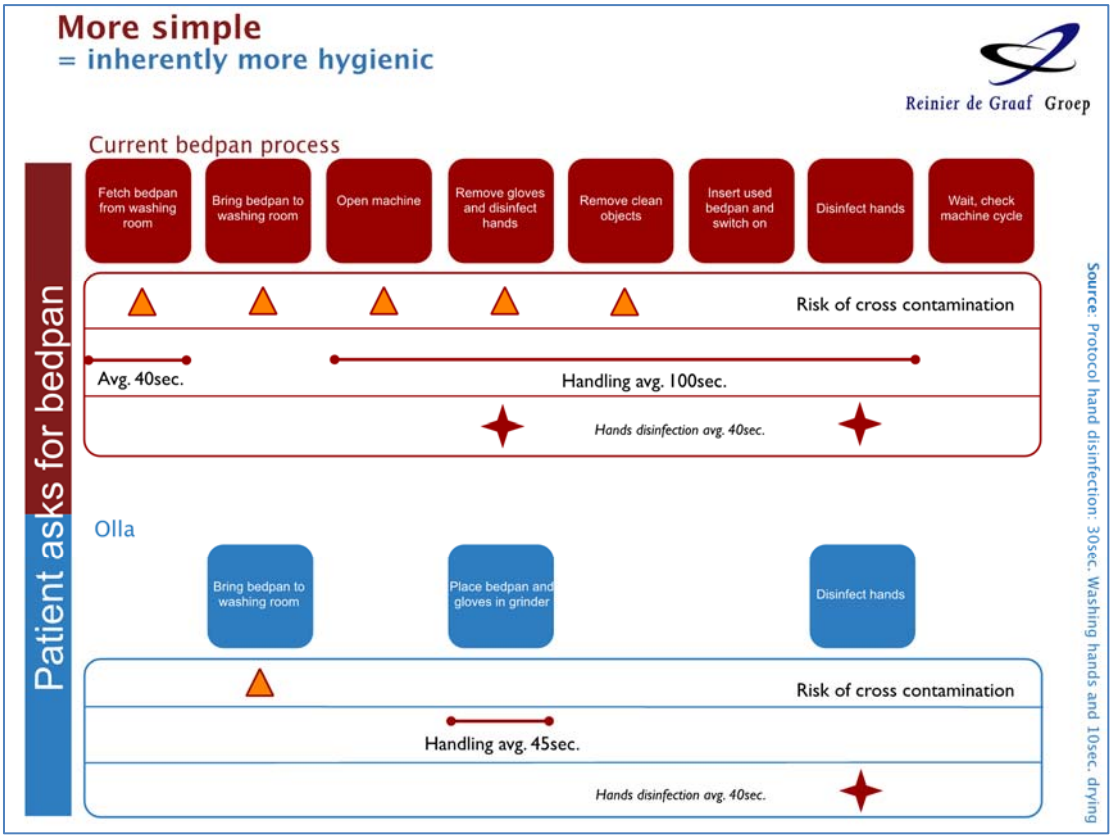


Figure 4-1 Waste Management H&S

Antimicrobial resistance

Pharmaceuticals can be classified into numerous therapeutic classes, including anti-inflammatories, antibiotics, antipsychotics, antihypertensives, antidiabetics, antihistamines, lipid regulators, anticonvulsant, β-blockers, stimulants and statins. The amount of pharmaceutical production, consumption and, ultimately, discharge into the aquatic environment is steadily increasing (EEA, 2010, Santos et al., 2010)[5].

Some antibiotics find their way into water sources. Antibiotics that have been found in water in Europe include penicillin's, cephalosporins, macrolides (e.g. erythromycin) and quinolones (e.g. ciprofloxacin). Antibiotics in water are a potential problem for two reasons. First, antibiotics as chemical contaminants have the potential for direct effects on human health. Second, there is potential for indirect harm if they change the microbes in the water.[6]

There is also a growing understanding that hospital wastewater has unique characteristics and impacts on municipal and public infrastructure. In their day to day business hospitals discharge waste water containing large amounts of pharmaceuticals and their metabolites, cleaning agents, contrast media, cyto-toxins as well as pathogenic contaminants include antibiotic resistant bacteria, viruses

[5] Santos, I. H. M. L. M., Araújo, A. N., Fachini, A., Pena, A., Delerue-Matos, C. & Montenegro, M. C. B. S. M. 2010. Ecotoxicological aspects related to the presence of pharmaceuticals in the aquatic environment. *Journal of Hazardous Materials,* 175**,** 45-95.

[6] Morris, D., Harris, S., Morris, C., Commins, E., & Cormican., M. (2015) Hospital effluent: impact on the microbial environment and risk to human health. EPA Report No. 162.

etc. The interaction between these discharges, local waste water treatment plants and the broader environment is an area of growing concern particularly in the context of eco-toxicity and anti-biotic resistant bacteria.

Research has found antibiotic resistance genes as far as 1 km downstream of the WWTPs, which suggests resistance genes can persist in the environment even in the absence of an additional pollution source, perhaps due to the 'drift' of antibiotic-resistant bacteria or resistance genes in the water flow[7].

A growing body of research is demonstrating a direct link between hospital effluent and the spread of anti-microbial resistant genes (ARG's) to bacterial populations down steam from hospitals;

- "Antimicrobial activity was present at biologically significant levels only in hospital effluent samples and in municipal sewage downstream of the hospital effluent discharge point" (M. Cormican et al. 2005) and,

- "Waste water treatment plants (WWTPs) are a hotspot for resistance gene transfer between bacteria from different origins due to mixing of urban, industrial, clinical and agricultural waste" (Rizzo et al., 2013)

Appearance of what were once antibiotic resistant bacteria specific to hospitals in these environments reinforces the link between health care effluent and the dissemination of ARG's to the environment at large. One possible route for the entrance of multiresistant Enterobacteriaceae into the environment and so into the food chain is via waste water. Several studies demonstrate the presence and increase of (multi)resistant bacteria in the aquatic environment caused by human waste water.

"Multiresistant Enterobacteriaceae, like carbapenemase-producing strains, have their primary reservoir in medical institutions. They can also be found with increasing tendency in other reservoirs. One possible way for entrance of multiresistant Enterobacteriaceae into the environment is via waste water[8]."-

Furthermore the recent study from Austria states, "Three isolates harboured carbapenemase genes, one Klebsiella pneumoniae harboured KPC-2 and one K. pneumoniae and one Escherichia coli harboured OXA-48. This is the first report of carbapenemase-harbouring Enterobacteriaceae isolated outside medical institutions in Austria and the first detection of KPC-harbouring K. pneumonia MLST ST 1245." (Galler et al., 2013)

An outbreak of KPC in a hospital, even where infection prevention standards are high, would be a major issue as no antibiotic is currently effective against this infection. Its appearance outside a health care institution should be of equal concern as;

- *"Rivers are a vital part of the ecosystem and provide an essential source of drinking water for*

---

[7] Proia, L., von Schiller, D., SànchezMelsió, A., Sabater, S., Borrego, C.M., RodríguezMozaz, S. & Balcázar, J. (2016). Occurrence and persistence of antibiotic resistance genes in river biofilms after wastewater inputs in small rivers. Environmental Pollution, 210, pp.121–128.

[8] Note; carbapenemase is the resistance to carbapenems. Carbapenems are a family of antibiotics classified as life saving drugs or "antibiotics of last resort". (Papp-Wallace et al., 2011)

> *wild animals as well as being used for crop irrigation and recreational activities. High levels of antibiotic resistance in rivers resulting from WWTP pollution may explain why an increasing number of studies are reporting resistance genes in both wild and domestic animals "(E. Wellington et al, 2014)*

Concerns around pharmaceutical inputs have contributed to the EU amending the Water Framework Directive where;

"Diclofenac (CAS 15307-79-6), 17-beta-estradiol (E2) (CAS 50-28-2) and 17-alpha-ethinylestradiol (EE2) (CAS 57-63-6) shall be included in the first watch list, in order to gather monitoring data for the purpose of facilitating the determination of appropriate measures to address the risk posed by those substances." And,

"Pursuant to Article 16(9) of Directive 2000/60/EC, and where appropriate on the basis of the outcome of its 2013 study on the risks posed by medicinal products in the environment and of other relevant studies and reports, the Commission shall, as far as possible within two years from 13 September 2013 develop a strategic approach to pollution of water by pharmaceutical substances. That strategic approach shall, where appropriate, include proposals enabling, to the extent necessary, the environmental impacts of medicines to be taken into account more effectively in the procedure for placing medicinal products on the market. In the framework of that strategic approach, the Commission shall, where appropriate, by 14 September 2017 propose measures to be taken at Union and/or Member State level, as appropriate, to address the possible environmental impacts of pharmaceutical substances, particularly those referred to in Article 8b(1), with a view to reducing discharges, emissions and losses of such substances into the aquatic environment, taking into account public health needs and the cost-effectiveness of the measures proposed." See article 8b of the 2013 Amendment to the Water Framework Directive.

This first time pharmaceutical substances have been included on WFD watch list and the amendment clearly sets out the considerations under which future policy will be developed.

Pharmafilter's wastewater treatment removes all micro pollutants, pharmaceutical and biological to below the detectable limit. As mentioned earlier, the system is self-funding and therefore represents a complete solution to hospital effluent be discharged to public sewer. The removal of these contaminants at source is far more desirable than decontamination at existing municipal facilities where the associated costs would be prohibitive. As the hospital wastewater is rendered reusable and is available for reuse within the hospital for grey water purposes reduces the demand on water supply (and therefore production) to the hospital.

4.3.2 Population

Census 2016 results show that Ireland's population stood at 4,761,865 in April 2016, an increase of 173,613 (3.8%) since April 2011. The 2016 population is the highest recorded population in Ireland since 1861(CSO, 2016). The population of County Dublin experienced an increase of 4.8% between 2011 and 2016. The population of County Dublin experienced an increase of 14.5% between 2006 and 2011.

This regional trend of population increase will inevitably place further demands on existing infrastructure capacities; hospitals included. Capacity is impacted by; a) the amount available b) the demand on the available capacity and c) how efficiently is that capacity utilized.

In the context of resource efficiency, the efficient use of existing capacity is an explicit focus of

hospitals and their management. These efforts can be assisted by a) reducing the need for hospitalization in the first instance and b) the successful and timely treatment of patients and reducing HAI. In achieving this efficiency, demand can be limited and with that the need to build additional capacity is offset against better performing, existing resources. This aligns with preventative policies in the context of environmental impacts whether in terms of emissions, water conservation or waste generation

The Pharmafilter system is healthcare infrastructure, protecting the environment and therefore the environmental needs of modern healthcare. In preventing many of the associated negative impacts that arise around hospital waste and waste water the system contributes to the prolonging and increasing the effectiveness of current healthcare infrastructure, drugs and resources where alternatively new infrastructure, drugs and resources would have to be developed, incurring the corresponding environmental impacts.

4.3.3 Employment

Strong employment growth is a feature of the economic development and there is a correlation between this measure and the state of the region's infrastructure, labour force participation rates and moderate rates of inward migration. The population of the local Electoral Division area, Innes Quay A, reduced slightly from 3,951 to 3,920.

The level and growth in employment in the Dublin is shown in Table 4.1 and gives a context within which to view the employment performance of County Dublin and Dublin. Between 2011 and 2016, the region experienced an increase in employment, the level of unemployment in Dublin city fell from 18.5% to 6%, which is below the national average of 6.7%.

The Quarterly National Household Survey (QNHS), published by the Central Statistics Office, provides details of unemployment on a regional level. County Dublin and Dublin are located in the NUTS2 Region, which had an unemployment rate of 6.3% and a participation rate of 63% in Q4 of 2016. The participation rate is the number of persons in the labour force expressed as a percentage of the total population (over the age of 15 years). The figures show that the NUTS2 Region has a low unemployment rate than the State.

Table 4-2 Quarterly National Household Survey, Q4 2016

	Unemployment Rate	Participation Rate
State	6.7%	60.1%
Dublin City	6%	63.5%

Source: CSO, 2013

An examination has been carried out of the recent Live Register figures for the Dublin/Dublin area, which is representative of the population in the vicinity of the Phibsborough Area. These figures show an overall decrease in the number of persons claiming unemployment benefit over a three-year period 2013 to 2016 (See Table 4.2), however numbers on the live register had increased in previous years of 2008-2012.

Table 4-3 Average Number of Persons on Live Register in Dublin

Year		2013	2017
Average No. Of Persons	Dublin	102087	65367
Average No. Of Persons	Kings inn	7530	4254

(Source: Central Statistics Office, M01 2013, M01 2017)

4.3.4 County Development Plan (CDP) policies

The Dublin City Development plan has a number of polices relevant to hospitals, waste and wastewater.

Dublin City Development Plan 2016-2022

- CEE20: To recognise that hospitals and the wider healthcare sector are crucial to the wellbeing of the city, including as major sources of employment, economic development and innovation; and to promote and facilitate their development and expansion.

- CEE21: (i) To recognise the strategic role of the hospital complexes in the city including the proposed National Paediatric Hospital and the proposed new National Maternity Hospital and to support the provision of the appropriate volume of floor space and associated facilities necessary to secure the delivery of their services and potential; having regard to their national medical function, their role as a major employer in the city, as a generator of significant economic benefits for the economy of Dublin's inner city and a promoter of the knowledge economy through research and education links with third-level colleges in the city.

- SN22: To facilitate the provision of hospital, local and other healthcare facilities in accordance with the requirements of the relevant healthcare authorities and to facilitate the consolidation or enhancement of these facilities within the city as an important resource for the city, region and State
- Wastewater

It is the Policy of Dublin City Council:

- SI1: To support and facilitate Irish Water in the provision of high-quality drinking water, water conservation, and in the development and improvement of the water and wastewater systems to meet anticipated demands for clean and resilient water supplies and wastewater requirements for the city and region, all in accordance with the recommendations set out in the 'Greater Dublin Water Supply Strategic Study' and 'The Greater Dublin Strategic Drainage Study'.

- SI2: To support and facilitate Irish Water to ensure the upgrading of wastewater infrastructure, in particular the upgrading of the Ringsend Wastewater Treatment Plan, and to support the development of the Greater Dublin Regional Wastewater Treatment Plant, the North Docklands Sewage Scheme, the Marine Outfall and orbital sewer to be located in the northern part of the Greater Dublin Area to serve the Dublin region as part of the Greater Dublin Strategic Drainage Strategy.

- SI3: To ensure that development is permitted in tandem with available water supply and wastewater treatment and to manage development, so that new schemes are permitted only where adequate capacity or resources exists or will become available within the life of a planning permission.

The CDP indicated the requirement to expand and upgrade of the Ringsend Wastewater Treatment Plan is an urgent priority for Irish Water. It is intended to upgrade and expand the treatment works to a capacity of c. 2.1 million PE from its current 1.64 million PE. The upgrade must also achieve

improved treated effluent quality in order to conserve good water quality in the Liffey Estuary and Dublin Bay.

It is an Objective of Dublin City Council:

- SIO1: To support Irish Water in the implementation of the 'Water Services Strategic Plan – A Plan for the Future of Water Services'
- SIO2: To work closely with Irish Water to identify and facilitate the timely delivery of the water services required to realise the development objectives of this plan.
- SIO3: To require all new development to provide a separate foul and surface water drainage system and to incorporate sustainable urban drainage systems.
- SIO4: To minimise wastage of water supply by requiring new developments to incorporate water conservation measures, and to promote water conservation by all water users.
- SIO5: To protect existing wayleaves and buffer zones around public water service infrastructure.

It is a Policy of Dublin City Council:

- SI4: To promote and maintain the achievement of at least good status in all water bodies in the city.
- SI5: To promote the enhancement of aquatic ecosystems and, with regard to their water needs, terrestrial ecosystems and wetlands directly depending on the aquatic ecosystems.
- SI6: To promote the protection and improvement of the aquatic environment, including through specific measures for the progressive reduction or cessation of discharges and 128 emissions.
- SI7: To promote the progressive reduction of pollution of groundwater and prevent its further pollution.
- SI8: To mitigate the effects of floods and droughts subject to environmental assessments.

It is an Objective of Dublin City Council:

- SIO6: To implement the European Union Water Framework Directive through the implementation of the appropriate River Basin Management Plan and Programme of Measures.
- SIO7: To take into consideration the relevant River Basin Management Plan and Programme of Measures when considering new development proposals.

It is the Policy of Dublin City Council:

- SI19: To support the principles of good waste management and the implementation of best international practice in relation to waste management in order for Dublin city and the region to become self-reliant in terms of waste management.
- SI20: To prevent and minimise waste and to encourage and support material sorting and recycling.
- SI21: To minimise the amount of waste which cannot be prevented and ensure it is managed and treated without causing environmental pollution.
- SI22: To ensure that effect is given as far as possible to the "polluter pays" principle. It is the Objective of Dublin City Council:

SIO19: To implement the Eastern-Midlands Waste Management Plan 2015-2021 and achieve the plan targets and objectives

LAP
The Draft Phibsborough Mountjoy LAP has a number of relevant policies including:

- C1 Support the development of the Mater Hospital to provide world class general hospital services with a local and national function

Mater Hospital

- MH1. Provide an appropriate level of floorspace in order to facilitate the development of the Mater Hospital as a world class medical institution.
- MH2. Support the development of a metro station as per the Metro North Railway Order.
- MH3. Develop a campus-style urban environment with a series of internal amenity spaces.
- MH4. Reinstate the historic quadrangle of the original hospital building as an open and accessible landscaped space.
- MH5. Enhance the setting and landscaping around the Mater Misericordiae and allow for improved vistas from the street.
- MH6. Provide for enhanced pedestrian linkages north-south and east-west.
- MH7. Buildings fronting onto Eccles Street shall respect the Georgian Character of this street in terms of form and building height.
- MH8. Ensure the preservation of the amenity of adjoining residences, business and conservation buildings, with regard to issues as overshadowing, light spillage and noise.

The development is located within a “Potential Redevelopment Sites” zone as shown on Figure 22 pg 64 of the LAP. It is stated in the LAP “Within the grounds of the Hospital there are also a number of buildings which are perhaps nearing the end of their life-span and are considered suitable for future redevelopment, including the former Outpatients Department”.

Infrastructure and Water Management Objectives
In order to deliver a sustainable and adequate water and service infrastructure, the following objectives shall apply to the LAP area:

- IW1. Enable the delivery of key infrastructure including water supply and waste water within the Phibsborough LAP area.
- IW2. Ensure that development is permitted in tandem with available water supply, waste water treatment and network capacity.
- IW3. Require all large development proposals to include water conservation and demand management measures.
- IW4. Ensure the implementation of a storm water management system in the detailed design of the plan lands, following the principles of Sustainable Urban Drainage Systems (SUDS).
- IW5. Encourage provision of suitably high quality strategic telecommunications including fibre optic, broadband links and utilities (gas and electricity) infrastructure.
- IW6. Promote the achievement of good ecological status, good ecological potential and good chemical status for the Royal Canal.
- IW7. Ensure that surface water quality is protected in the construction of enhanced drainage works to meet requirements of the Water Frame work Directive.
- IW8. Ensure the protection of surface and ground water quality in the plan area and surrounding areas and the protection of protected habitats and species.

- IW9. Require all relevant proposed developments to carry out a site specific Flood Risk Assessment in accordance with the Departmental Guidelines on Flood Risk Management.

4.3.5 Review of the Eastern Region Waste Management Plan and Circular Economy

While the Eastern waste management plan has limited references to hospitals or human health care risk waste, the following is noteworthy:

In our daily lives we produce non-hazardous, hazardous and sometimes toxic wastes. These wastes have the potential to impact negatively on our communities, our health, our environment and future generations if not managed appropriately. Effective management systems are needed to ensure that we continue to live in healthy communities and protection is afforded to our environment. In the region we have a collective responsibility to improve our behaviours in response to this ongoing problem. This is necessary if we are to rethink the waste challenge and ignite the opportunities which waste as a resource offers.

As outlined in the Eastern and Midlands Waste management Plan, 'Under the WFD, the recycling of waste is defined as "any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes" and "includes the reprocessing of organic material". Biological treatment is clearly an activity which sits on the recycling tier of the hierarchy.

The proposed facility will effectively manage the waste from the hospital and meet the requirement of the Eastern Waste management plan and circular economy. The former waste streams from the hospital will eliminate the generation of HCRW, reduce potential pollutants to the sewerage network and convert waste into biogas for use within the treatment facility.

MMUH will continue to reduce and other forms of waste generation at the Mater Hospital Campus in accordance with the principles of the Waste Management Plan and the Hospital Environmental Policy.

In transitioning from reusable items to utensils designed for single use, obvious sustainability questions around the materials used in these items arise.

Olla and Botta (bedpan and urinal) are made of bioplastics derived from secondary feed stocks (waste organics from dairy and agriculture) therefore adding no further pressure on food supply or land usage. In partnership with an Irish company Cellulac, Pharmafilter has developed materials that continue their functionality even as they biodegrade. These biopolymers act as an energy source for the methanogenic bacteria that are present in the anaerobic digestion phase of the treatment. Thus, amplifying the amount of biogas produced by the process and the amount of energy produced.
Pharmafilter has identified over 150 healthcare products that when made from these materials can vertically integrate with hospitals hygiene and infection control procedures and the Pharmafilter treatment itself. Through this commercial partnership, valued at 35 million euros, Cellulac will produce, in Ireland, up to 90% of the core ingredients for disposable single use items and personal hygiene products compatible with the Pharmafilter recovery system in hospitals.

This partnership is a template for collaboration, development and implementation of end-to-end solutions for the bio-economy.

4.4 Description of the Development

4.4.1 Introduction

This Volume of the EIAR is prepared for a development comprising the waste and wastewater treatment facility. The proposed development is located to the north of the Mater Campus, 30m south of the North Circular Road.

The Wastewater Treatment Plant and associated infrastructure will treat human health care risk waste and hospital wastewater for an estimated to 4,000 Population Equivalent (PE) on a 0.08 Ha site. The proposed development comprises (a) 1 No. Hydrolysis tank, 5 sq.m., with a maximum height of 6 m; (b) a 78 sq.m, Membrane Bioreactor Building with a maximum height of 6; (c) an Anaerobic Digestor, 37 sq.m with a maximum height of 6 m (c) 1 No. Treatment Building 180 sq.m., with a maximum height of 7 m and other works necessary to facilitate the proposed development.

4.4.2 Environmental Emissions

The environmental emissions from the development may have the potential to negatively impact on humans include air, noise and water traffic. The nature and extent of the environmental emissions during its continued operation, together with appropriate mitigation measures, are discussed in detail in the relevant sections of this Volume of the EIAR.

4.5 Impacts of the Development

4.5.1 Construction and Operational Effects

Health and Safety
Waste and WWTP activities will be subject to MMUH Health and Safety procedures carried out according to best practice guidelines. The proposed system represents a change that can positively enhances the work environment, patient and staff safety.

It is a thoroughly integrated waste and wastewater management system that at every interface delivers a significant improvement in the handling, removal and treatment of waste streams arising in hospitals.

In relation to clinical waste, an environmental professional would describe these weaknesses in terms of inappropriate disposal or failure to segregate a clinician or infection control professional would describe the same event as a cross contamination or infection risk moment.
By removing, in as much as possible, human contact from these process opportunities for human error, contact or cross contamination (both inside and outside the hospital) and therefore an adverse event is dramatically reduced. The system limits human contact to these materials also aligns work practices more closely with Health and Safety guidelines.

Population, Employment and Economic Impacts
It is estimated that the manning requirement for the waste and wastewater activity would positively contribute to maintaining employment for 2 people for the duration of the activities. The work at the waste and wastewater facility also supports 3 indirect jobs in the local area.

Architectural Heritage
With reference to the Dublin City Development Plan 2016-2022 and the conservation report included in appendix 10.1, there are no protected structures that will be affected by the proposed Waste and

Wastewater treatment on the site. There will be no significant effect on the architectural heritage of the area as a result of the proposed development of the site.

Tourism
A number of tourism centres have been identified in the county. However, major attractions are remote from the existing proposed development. It is not envisaged that the local fishing industry and angling attractions will be disturbed by the waste and wastewater operation however a slight positive impact will be realised.

The operation of this facility will not affect any known recreational routes. The site is partially visible from North Circular Road. However, this activity will be enclosed and landscaped.

Recreation and Sport
The site is currently not used for any form of recreational activity. In this regard, it is not expected that there will be any significant negative impact on local recreation or sporting facilities, as a result of the proposed facility.

Environmental Emissions
The impact of the environmental emissions from the waste and wastewater area is discussed individually in each of the relevant chapters of this EIAR. Each individual section discusses the likely impacts during the operational phase of emissions on humans, flora and fauna and the environment, where relevant.

Recreation and Sport
Given the nature of the development, it is not expected that there will be any significant negative impact on local recreation or sporting activities or facilities as a result of the proposed facility.

4.6 Mitigation Measures

There are no mitigation measures required in relation to Waste and Wastewater treatment at the subject site, except for the implementation of design measures outlined in other sections and standard operation procedures. MMUH safety procedures will be implemented during the Waste and Wastewater treatment.

4.7 Monitoring

There will be no need for monitoring over and above that identified elsewhere in this Volume of the EIAR. Environmental Monitoring will continue on site in line with the requirements of the future IED licence.

4.8 Do Nothing Scenario

If the proposed Waste and Wastewater treatment does not occur the site will remain as is. The Mater waste and wastewater treatment would be disposed of through the current streams. The current disposal route for HHRW is incineration. The current disposal route for wastewater is the public sewer network and Ringsend Wastewater treatment plant. The existing risks including needle stick injuries and the unmitigated dissemination of pharmaceutical and microbiological pollutants as outlined earlier, would remain in place.

4.9 Reinstatement and Residual Impacts

No reinstatement having regard to population and human health is required as a result of this development.

4.9.1.1 Conclusion

This chapter has examined the prevailing population and human health pertaining to proposed development. Based on experience in The Netherlands, the proposed development will have a positive impact on human health by reducing contact with clinical waste, reduce needle stick injuries and remove the storage and transport of clinical waste.

The population, employment and tourism and amenity context show that there has been and continues to be a need for jobs and investment in the local area but that waste and wastewater must not harm the local landscape, environment or residential amenities, as specified in the Regional Planning Guidelines and Dublin City Development Plan among other policy documents. There are no significant adverse in combination impacts on population or human health.

With regard to the local community, Pharmafilter has operated identical waste and wastewater treatment facilities in densely populated urban areas for over 5 years in accordance with the company's own Environmental Management System. The waste operations to date and the continued operation of the waste operations have had no direct negative impact on any tourism and amenity sites and will have assisted in boosting local employment figures. All air emissions with be in compliance with national air standards.

5 BIODIVERSITY -FLORA AND FAUNA

5.1 Introduction

This chapter presents a Biodiversity Impact Assessment of the proposed development and should be read in conjunction with the site layout plans and project description section (Chapter 2) of the Environmental Impact Assessment Report (EIAR). Details of the existing site conditions are presented, potential impacts are assessed and mitigation measures are recommended, where required. The aims of this impact assessment are to:

- obtain baseline ecological data for the proposed development site;
- determine the ecological value of the identified ecological features;
- assess the impact of the proposed development on ecological features of value;
- recommend mitigation measures to avoid, reduce and remedy potential impacts; and
- Identify any residual impacts post mitigation.

The proposed WWTP is to be located within the existing Mater Misericordiae University Hospital at Eccles Street, Dublin 7. The proposed WWTP will comprise an area of approximately 380 m^2 within the overall hospital land holding. The maximum height is 7 m. It is to be located to the north of the hospital campus, which is approximately 2 km north of Dublin City centre.

A description of the proposed development is detailed in Chapter 2 and is broadly outlined as follows:

- The hospital wishes to construct a Waste Water Treatment Plant (WWTP) to deploy appropriate pre-treatment(s) of the Mater Misericordiae University Hospital's waste water and sewage, before it enters the public infrastructure.
- It is proposed to recover and recycle a number of specific wastes within the applicant's existing landholding.
- A number of shredders will be connected to the existing sewer system. Together with the effluent from toilets, sinks and showers, the waste will be transported through the existing hospital sewer infrastructure, to a purification plant on the hospital site.
- Solid waste will be separated from waste water in the plant. The solid waste will be reduced by anaerobic digestion, producing biogas. This gas will be re-used for powering the WWTP. The waste water will be purified and all harmful substances, medicines, germs, cytostatics, contrast liquids and endocrine substances will be eliminated. The purified water can be re-used as process water within the Mater Campus.
- The facility will reduce waste generated at the site by 80% and ultimately recycle 50% of the waste water at the site.

5.2 Methodology

5.2.1 Legislations & Guidance

The following legislation has been considered in this impact assessment:

- EC Birds Directive 2009/147/EC;
- EC Habitats Directive 92/43/EEC;
- EC Water Framework Directive 2000/60/EC;
- European Communities (EC) (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477/2011; hereafter referred to as the Birds and Habitats Regulations);

- European Communities Environmental Objectives (Surface Waters) Regulations, 2009 (S.I. No. 272 of 2009);
- Convention on the conservation of European wildlife and natural habitats (Bern Convention) (Adopted in Ireland 01/08/1982);
- European Communities (EIA) Regulations, 1989 (as amended);
- Wildlife Act, 1976 and Wildlife (Amendment) Act (2000). In this document, the legislation is referred to collectively as the Wildlife Acts;
- Fisheries (Consolidation) Act, 1959;
- Flora (Protection) Order, 2015;
- Planning and Development Act, 2000 and Planning and Development (Amendment) Act, 2010; and
- National Biodiversity Plan, 2011 – 2016.

The potential for impacts on nature conservation interests has been assessed taking into consideration habitats and the species that are likely to be affected by the proposed development. The approach included consideration and review (as appropriate) of the following guidance documents:

- A Guide to Habitats in Ireland (Fossitt - The Heritage Council, 2000);
- Guidelines on the information to be contained in Environmental Impact Assessment Reports (EPA, 2002);
- Advice Notes on Current Practice in the Preparation of Environmental Impact Assessment Reports (EPA, 2003);
- Habitat Survey Guidelines: A Standard Methodology for Habitat Survey and Mapping in Ireland (The Heritage Council, 2005);
- Best Practice Guidelines for Habitat Survey and Mapping in Ireland (The Heritage Council 2011);
- Guidelines for Assessment of Ecological Impacts of National Roads Schemes (NRA, 2009);
- Guidelines for the Crossing of Watercourses During the Construction of National Road Schemes (NRA, 2005);
- Guidelines for the Treatment of Badgers prior to the Construction of National Road Schemes (NRA, 2006);
- Guidelines for the Treatment of Otters prior to the Construction of National Roads Schemes; (NRA, 2006);
- Best Practice Guidelines for the Conservation of Bats in the Planning of National Road Schemes; (NRA, 2006);
- Guidelines for the Treatment of Bats during the Construction of National Roads Schemes (NRA, 2006);
- Guidelines for Surveillance and Monitoring of European Bats (EUROBATS, 2010);
- Guidelines for Ecological Impact Assessment (Institute of Ecology and Environmental Management (IEEM, 2006);
- Requirement for the Protection of Fisheries Habitat During the Construction and Development Works at River Sites (Eastern Regional Fisheries Board); and

- National Biodiversity Data Centre (www.biodiversityireland.ie)

5.2.2 Consultation

Consultation was carried out with the Local Authority in relation to this project. This is outlined in Chapter 3.

5.3 Desk Study

The ecological desk study for this project included the following steps:
Identification of all sites designated for nature conservation within 15 kilometres (km) of the proposed development;

A review of all National Parks and Wildlife Service (NPWS) site synopses for designated sites within 15 km of the proposed development, regarding potential impacts;

A species list for the Mater study area was generated using the National Biodiversity Data Centre (www.biodiversityireland.ie) in order to determine if any rare or protected species have been recorded in this area and the likelihood of any such species being present at the proposed development site. A species list for National Grid 10 km square O13 was also generated to determine if any rare or protected species occur in the wider Dublin area;

- Review of Ordnance Survey maps and aerial photography in order to determine the broad habitats that occur within the study area and
- Review of relevant ecological reports and EIARs previously completed for the study area.

5.3.1 Field Survey

TOBIN Ecologists undertook a site visit on the January 2016 and March 2017 to collect survey data as part of the ecological impact assessment for the proposed development.

5.3.2 Habitats and Flora

A habitat survey was undertaken in accordance with "*The Heritage Council's Best Practice Guidance for Habitat Survey and Mapping*"[1]. Habitats were classified according to The Heritage Council's A Guide to Habitats in Ireland[2] and following the EU Habitats Interpretation Manual for Annex I Habitats. A review of aerial photography of the study area assisted with habitat delineation and interpretation.

5.3.3 Fauna

Birds
Birds present during the site visit were recorded by sight and/or by song/call. While all birds present were recorded, the focus was to record any species of conservation concern, including species listed on Annex I of the EU Birds Directive and Red and Amber listed species of High and Moderate

- _____

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

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

conservation concern, respectively[3].

Mammals
The mammal survey primarily involved searching the study area for evidence/signs of mammals (e.g. tracks, scats, dwellings and occasionally direct sightings) during the ecological site visit. An assessment of the habitats, in terms of their importance for mammals, was also undertaken.

Bat species are protected under Annex II and Annex IV of the Habitats Directive and the Irish Wildlife Acts. The study area was assessed for bats by a TOBIN Ecologist, who looked for any roosting/ foraging potential within the site.

5.4 Existing Environment

5.4.1 Baseline Evaluation Criteria

Site Evaluation Criteria
Ecological resources/receptors are evaluated following NRA (2009) guidelines (refer to **Error! Reference source not found.**) which set out the importance of the resource/receptor in a geographic context. These guidelines are consistent with the approach recommended in the Guidelines for Ecological Impact Assessment in the United Kingdom (IEEM, 2006).

The IEEM (2006) guidelines define an ecologically significant impact as an impact (negative or positive) on the integrity of a defined site or ecosystem and/or the conservation status of habitats or species within a given geographic area. The integrity of a site is the coherence of its ecological structure and function, across its whole area, which enables it to sustain the habitat, complex of habitats and/or the levels of populations of the species for which it was classified.

The following parameters are described when characterising impacts (following IEEM [2006] EPA [2002] and NRA [2009]):

- **Direct and Indirect Impacts:** An impact can be caused either as a direct or as an indirect consequence of a proposed development;
- **Magnitude:** Magnitude measures the size of an impact, which is described as high, medium, low or very low;
- **Extent:** The area over which the impact occurs – this should be predicted in a quantified manner;
- **Duration:** The time for which the impact is expected to last prior to recovery or replacement of the resource or feature;
- Temporary: Up to 1 Year;
- Short Term: The effects would take 1-7 years to be mitigated;
- Medium Term: The effects would take 7-15 years to be mitigated;
- Long Term: The effects would take 15-60 years to be mitigated;
- Permanent: The effects would take 60+ years to be mitigated;
- Likelihood:
- Certain/Near Certain: >95% chance of occurring as predicted;
-

[3] Colhoun K. & Cummins S. (2013). Birds of Conservation Concern in Ireland 2014-2019. Irish Birds 9:523-544 (2013)

- Probable: 50-95% chance as occurring as predicted;
- Unlikely: 5-50% chance as occurring as predicted and
- Extremely Unlikely: <5% chance as occurring as predicted.

Table 5-1 Criteria for establishing Receptor Importance (NRA, 2009)

Importance	Ecological Valuation
International Importance	• European Site including Special Area of Conservation (SAC), Site of Community Importance (SCI), Special Protection Area (SPA) or proposed Special Area of Conservation. • Proposed Special Protection Area (pSPA) – site that fulfils the criteria for designation as a 'European Site' (see Annex III of the Habitats Directive, as amended). • Features essential to maintaining the coherence of the European Network. • Site containing 'best examples' of the habitat types listed in Annex I of the Habitats Directive. • Resident or regularly occurring populations (assessed to be important at the national level) of the following: • Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; and/or • Species of animal and plants listed in Annex II and/or IV of the Habitats Directive. • Ramsar Site (Convention on Wetlands of International Importance Especially Waterfowl Habitat 1971). • World Heritage Site (Convention for the Protection of World Cultural & Natural Heritage, 1972). • Biosphere Reserve (UNESCO Man & The Biosphere Programme). • Site hosting significant species populations under the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals, 1979). • Site hosting significant populations under the Berne Convention (Convention on the Conservation of European Wildlife and Natural Habitats, 1979). • Biogenetic Reserve under the Council of Europe. • European Diploma Site under the Council of Europe. • Salmonid water designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988, (S.I. No. 293 of 1988).
National Importance	• Site designated or proposed as a Natural Heritage Area (NHA). • Statutory Nature Reserve. • Refuge for Fauna and Flora protected under the Wildlife Acts. • National Park. • Undesignated site fulfilling the criteria for designation as a NHA. • Statutory Nature Reserve; Refuge for Fauna and Flora protected under the Wildlife Acts; and/or a National Park. • Resident or regularly occurring populations (assessed to be important at the national level) of the following: • Species protected under the Wildlife Acts; and/or

Importance	Ecological Valuation
	• Species listed on the relevant Red Data list. • Site containing 'viable areas 'of the habitat types listed in Annex I of the Habitats Directive.
County Importance	• Area of Special Amenity. • Area subject to a Tree Preservation Order. • Area of High Amenity, or equivalent, designated under County Development Plan. • Resident or regularly occurring populations (assessed to be important at the County level) of the following: • Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; • Species of animal and plants listed in Annex II and/or IV of the Habitats Directive; • Species protected under the Wildlife Acts; and/or • Species listed on the relevant Red Data list. • Site containing area or areas of the habitat types listed in Annex I of the Habitats Directive that do not fulfil the criteria for valuation as of International or National importance. • County important populations of species or viable areas of semi-natural habitats or natural heritage features identified in the National or Local Biodiversity Action Plan (BAP), if these have been prepared. • Sites containing semi-natural habitat types with high biodiversity in a county context and a high degree of naturalness, or populations of species that are uncommon within the county. • Sites containing habitats and species that are rare or are undergoing a decline in quality or extent at a national level.
Local Importance (Higher Value)	• Locally important populations of priority species or habitats or natural heritage features identified in the Local BAP, if this has been prepared. • Resident or regularly occurring populations (assessed to be important at the Local level) of the following: • Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; • Species of animal and plants listed in Annex II and/or IV of the Habitats Directive; • Species protected under the Wildlife Acts; and/or • Species listed on the relevant Red Data list. • Sites containing semi-natural habitat types with high biodiversity in a local context and a high degree of naturalness, or populations of species that are uncommon in the locality; • Sites or features containing common or lower value habitats, including naturalised species that are nevertheless essential in maintaining links and ecological corridors between features of higher ecological value.

Importance	Ecological Valuation
Local Importance (Lower Value)	• Sites containing small areas of semi-natural habitat that are of some local importance for wildlife. • Sites or features containing non-native species that is of some importance in maintaining habitat links.

5.4.2 Designated Conservation Sites

There are no sites designated under the EU Habitats Directive and EU Birds Directive, i.e. Special Areas of Conservation (SACs) and Special Protection Areas (SPAs), located within the footprint of the proposed development (**Error! Reference source not found.**). The Royal Canal (pNHA) is not currently designated but for planning purposes it is treated as a designated site. This is the closest site at 0.3 km.

A Screening Statement for Appropriate Assessment and NIS (as per EU Habitat Directive requirements) was completed and the Screening Statement has been submitted alongside the planning application.

Error! Reference source not found. illustrates the location of designated conservation sites within 15 km of the proposed development site. Distances from each designated conservation site to the proposed development are provided in **Error! Reference source not found.** 5-2.

Table 5-2 Designated conservation areas located within 15 km of the site

Name	Site Code	Designation	Approximate distance from site/activity boundary (km)
South Dublin Bay	000210	SAC	4.6
South Dublin Bay and River Tolka Estuary	004024	SPA	4.6
North Dublin Bay	000206	SAC	5.6
Baldoyle Bay	000199	SAC	10.4
Baldoyle Bay	004016	SPA	10.3
Irelands Eye	004117	SPA	14
Irelands Eye	002193	SAC	14.2
Howth Head	000202	SAC	14.6
Howth Head Coast	004113	SPA	14.2
Rockabill to Dalkey Island	003000	SAC	11.9
Dalkey Islands	004172	SPA	14.6
Glenasmole Valley	001209	SAC	13.1
Wicklow Mountains	004040	SPA	13.6
Wicklow Mountains	002122	SAC	13.6
Malahide Estuary	000205	SAC	12.7
Broadmeadow/ Swords Estuary	004025	SPA	13.2
North Dublin Bay		pNHA	2.3
South Dublin Bay		pNHA	4.5
Santry Demesne		pNHA	4.4
Royal Canal		pNHA	0.3
Grand Canal		pNHA	2.8
Liffey Valley		pNHA	5.8
Malahide Estuary		pNHA	12.3

Feltrim Hill		pNHA	9.6
Baldoyle Bay		pNHA	9.8
Irelands Eye		pNHA	14.2
Howth Head		pNHA	11.4
Dalkey Coastal Zone and Killiney Hill		pNHA	11.9
Fitzsimons Wood		pNHA	10.3
Dingle Glen		pNHA	14.4
Dodder Valley		pNHA	9.1
Lugmore		pNHA	13.6

Note:
NHA = Natural Heritage Area (Nationally Designated Site)
pNHA = proposed Natural Heritage Area (not currently designated but recognised in County Development Plans)
SAC = Special Area of Conservation (European Designated Site)
SPA= Special Protection Area (European Designated Site)

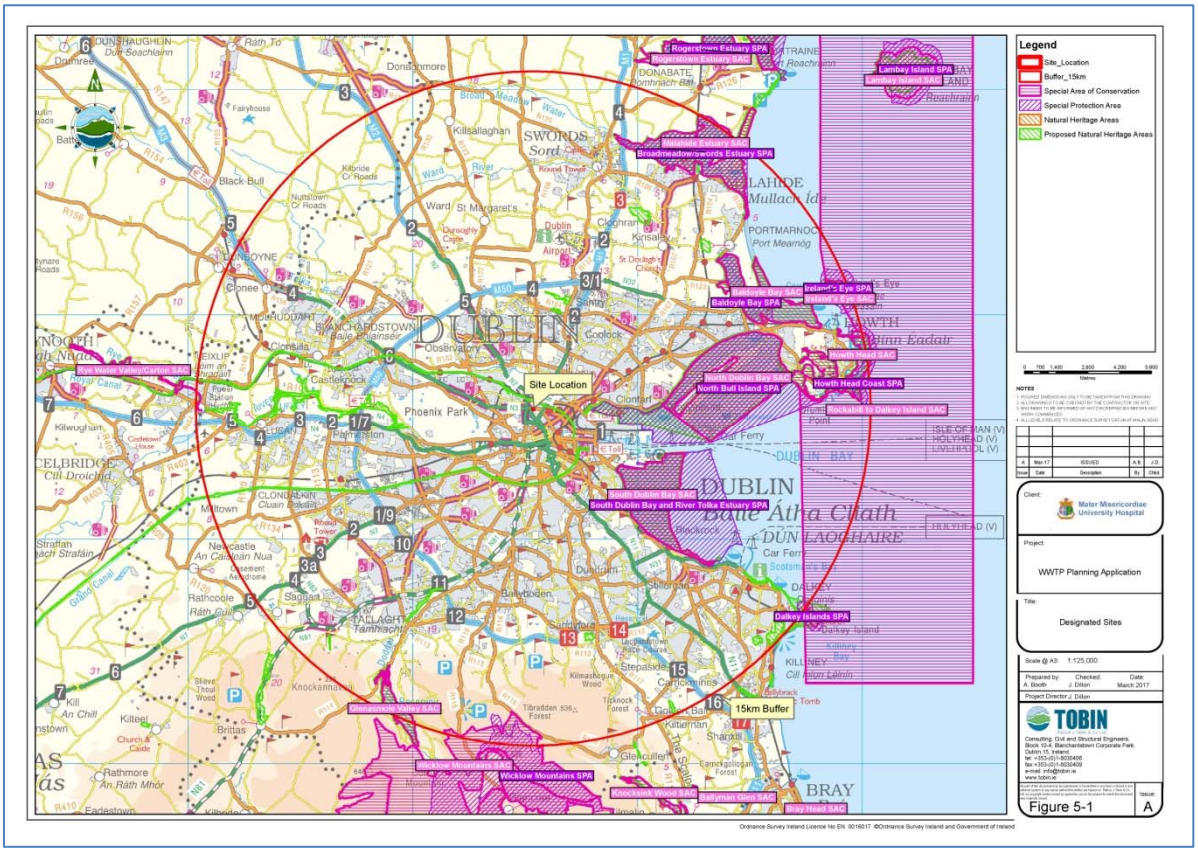


Figure 5-1 Designated Conservation Sites

5.4.3 Rare and Protected Flora

The proposed development site is located in the Ordnance Survey National Grid 10 km square O13.

A species list for the Mater area was generated using the National Biodiversity Data Centre (www.biodiversityireland.ie) in order to determine if any rare or protected species have been recorded in this area and the likelihood of their being present at the proposed development site. There are no historical records of rare or protected flora occurring within the proposed development area and no rare and protected flora were observed in the study area during surveys.

A species list for National Grid 10 km square O13 was also generated to determine if any rare or protected species occur in the wider Kildare area. Table 5-3 presents the protected or rare species recorded as occurring in this grid square.

Table 5-3 Protected or Rare Plants

Species	Status	Category
Opposite-leaved Pondweed, (Groenlandia densa)	Protected	Species considered Endangered
Meadow Barley (Hordeum secalinum)	Protected	Species considered Endangered
Great Burnet (Sanguisorba officinalis)	Protected	Species considered Endangered
Betony (Stachys officinalis)	Protected	Species considered Endangered
Hairy Violet (Viola hirta)	Protected	Species considered Endangered
Small Cudweed (Filago minima)	Protected	Species considered Vulnerable

None of these plant species were recorded during the site visit in March 2017. The proposed site is within the overall Mater Misericordiae University Hospital landholding and consists of mainly Buildings and artificial surfaces (BL3). There is therefore limited potential for these species on site,

5.4.4 Habitats within the Proposed Development Site

The proposed development will be situated within the existing Mater Misericordiae University Hospital at Eccles Street, Dublin 7.

Habitats on the proposed development site were classified in accordance with Fossitt (2000). Only one habitat was determined, which consisted of:

- Buildings and artificial surfaces (BL3);

This habitat is described below.

Buildings and artificial surfaces (BL3)
This habitat incorporates existing infrastructure including the entrance, car park and buildings. A number of hospital buildings are located on and adjacent to the proposed WWTP. An existing prefab building, formerly used as an outpatient clinic is located on the proposed footprint. The temporary planning has expired on this area and will be removed as part of this Planning Application.

5.4.5 Fauna

Breeding Birds

No confirmed breeding bird species listed on Annex I of the Birds Directive were recorded within the proposed development site boundary or in the wider environs of the site during the site visit.

No common bird species (green listed) were recorded within the proposed development site area. There was no suitable breeding habitat for bird species within the proposed development site, and no potential for nesting. The prefabs were checked for suitable nest locations for bird species such as Starlings (*Sturnus vulgaris*), but none were apparent.

Lesser Black-back gulls (*Larus fuscus*) were observed flying in the area and were noted on the roof of the Mater Misericordiae University Hospital to the south of the proposed development. This species is known to roost on rooftops in County Dublin[4], it is therefore possible that this species is nesting on the roof of Mater Misericordiae University Hospital to the south of the proposed development.

[4] http://www.birdwatchireland.ie/Default.aspx?tabid=349

Bats
During the Ecological survey, the site was assessed for any potential bat roosts. There was no potential found within the site area. It was also determined that there was no foraging potential within the area.

Other Mammals
No signs of protected mammals were recorded onsite.
Rat droppings were found within the disused prefab structure; however, this species does not possess any protective status.

5.4.6 Ecological Evaluation

There are no sites designated under the EU Habitats Directive and EU Birds Directive, i.e. SACs and SPAs located within the footprint of the proposed development. An Appropriate Assessment Screening Report has been submitted alongside the planning application and concludes that a Natura Impact statement is not required. The nearest site to the proposed development site designated for nature conservation is the Royal Canal (pNHA) at a distance of 0.3km.

No International, National or County significant habitats occur within the proposed development site. No rare or protected plants or protected mammal activity was recorded during the Ecological site visit. No bat roosts were identified on site.

No Annex I or red listed birds were recorded on site. Habitats present on site and in the surrounding area are not suitable for various common bird species and no nest sites or potential for nest sites were confirmed within the proposed development area during the site visit.

The proposed development site consists of Building and artificial surfaces habitat which is not considered to be of ecological importance.

Key ecological receptors requiring consideration in terms of potential impacts and necessary mitigation are summarised as follows:

- Designated sites;
- Listed habitats (above) – Local Importance (Higher Value);
- Badgers;
- Bats; and
- Breeding bird species.

5.5 Potential Impacts

5.5.1 Overview of Impacts

The potential impacts of the project relate mainly to the construction phase of the project. These potential impacts include noise and dust pollution.

Elements of the proposed works that may give rise to impacts are as follows:

- Movements of machinery and personnel within work areas;
- Works involving the transport of personnel, tools, materials to the site, deliveries, and removal of excavated material and construction materials within and from the works areas; and

- Construction activities within the works areas include excavation, infilling works, construction of the proposed development and stockpiling of materials.

Operational stage impacts may include minor disturbance to avian species. Potential impacts may result from activities related to the maintenance and operation of the facility (i.e. increased noise in proposed development area).

5.5.2 Potential Impacts during Construction Phase

Designated Conservation Areas
As mentioned earlier, the proposed development area does not lie within or adjacent to any site designated for nature conservation. The nearest site to the proposed development site designated for nature conservation is the Royal Canal (pNHA) at a distance of 0.3km.

No direct or indirect impacts on any site designated for conservation will arise through the construction of the proposed development, refer also to Screening Statement submitted with the planning application in relation to Natura 2000 sites).

No adverse impacts to designated sites as a result of the proposed development are likely to occur.

Rare and Protected Flora
No species of rare or protected flora were found within the proposed development site; therefore, it is unlikely that there will be any direct or indirect impact to rare or protected flora as a result of the proposed development.

Habitats:
The area for the proposed development currently consists of buildings and artificial surfaces. This habitat incorporates existing infrastructure including the entrance, car park and buildings. A number of hospital buildings are located on and adjacent to the proposed WWTP. An existing prefab building, formerly used as an outpatient clinic is located on the proposed footprint. The temporary planning has expired on this area and will be removed as part of this Planning Application. This habitat type has no ecological value, and therefore impacts will be imperceptible.

Water There are no rivers or streams within the proposed development site.

Birds
There were no protected bird species found within the proposed development area and no potential nesting sites. The predicted impacts will relate to temporary, indirect disturbance of bird species such as Lesser Black-backed gull in the surrounding areas during the construction phase. Given the baseline level of disturbance in this area is already high; these impacts are thought to be temporary and low impact.

Bats
The construction phase impacts will primarily comprise of daytime activities. As there were no bat roosts identified on site, the construction phase impacts are not expected to have significant effects on bat populations in the area. No potential bat foraging area was found within the study area. Potential impacts to bats are therefore evaluated as temporary, low impact and unlikely to occur.

Other mammals
There were no signs of protected mammals found within the proposed development area. As the

development area is composed of concrete, it is not possible for protected mammals such as badgers to abide in the area. There are no potential impacts during the construction of this development that will adversely impact any protected mammal species.

5.5.3 Operational Phase

The nature of the proposed development may attract wildlife including pest species (e.g. rodents) which may require pest control activities. Indirect impacts from possible control procedures to predator species (e.g. birds of prey and protected mammals) will require consideration to minimise indirect impacts to species in the wider local area.

The operation of the proposed development is unlikely to increase disturbance to bird species, which would already have acclimatised to localised disturbance from the existing local housing, traffic and businesses.

5.6 Mitigation Measures

5.6.1 Site Clearance/ Construction Phase

The following mitigation measures are recommended to limit the direct and indirect impacts of works associated with the proposed development on the local ecological environment:

- All construction works on site will be guided by best ecological practice guidance such as those listed in Section 5.2.1 above.
- The site clearance phase of the proposed development will only take place during daylight hours to minimise potential disturbance risks to nocturnal mammal species.

Extensive site works, such as site excavation, will not take place during extended periods of heavy rain in order to minimise soil and silt water runoff.

Soil storage will be arranged in a manner which avoids impacts to surface waters or which generates stability issues.

Spill kits will be retained on site during the construction phase. These kits will be equipped with suitable materials for the appropriate cleanup and storage of any contaminants which are accidently released into the environment.

- Pouring of concrete will only take place in designated areas. Washings will not be discharged to surface water and poured concrete will be allowed to cure for a minimum 48 hours in dry weather.

5.6.2 Operational Phase

- Vermin control measures should be implemented and an ecological expert should be consulted to determine suitability and control (e.g. spread of poisons) in the context of protected species in the wider surrounding areas.

5.6.3 Residual Impacts

Following the implementation of the mitigation measures presented above, predicted residual impacts for the key ecological receptors are not expected to be significant. Only minor short-term effects to fauna species on site are expected. As the existing site and entrance road are operational daily, fauna species will already be acclimatised to an extent with regards to noise, traffic and human activity in

the area.

5.7 Do nothing scenario

If the proposed Waste and Wastewater treatment does not occur the site will remain as is. The Mater waste and wastewater treatment would be disposed of through the current streams. The current disposal route for HHRW is incineration. The current disposal route for wastewater is the public sewer network and Ringsend Wastewater treatment plant.

5.8 Conclusions

The proposed development will be approximately 380m^2 within the overall hospital landholding. The existing entrance will be utilised during the construction and operational phases of the development.

The proposed development will not have any impacts on any sites designated for conservation or protected flora.

The proposed development area currently consists of buildings and artificial surfaces. This habitat incorporates existing infrastructure including the entrance, car park and buildings. A number of hospital buildings are located on and adjacent to the proposed WWTP. An existing prefab building, formerly used as an outpatient clinic is located on the proposed footprint. The temporary planning has expired on this area and the prefabs will be removed as part of this Planning Application. There are no adverse effects anticipated with the construction of the proposed development as buildings and artificial surfaces have no ecological value. There are no significant in combination effects as a result of the development.

No confirmed bird nesting sites were recorded on site, and the habitat does not provide suitable nesting conditions.

There were no protected mammals recorded onsite. As there was no suitable foraging or resting habitat present in the study area, there should be no impact on these species. Mitigation measures have been recommended to minimise as far as possible the potential impacts to protected mammals.

There was no bat potential within the site for roosting and foraging purposes. The proposed development is not predicted to have any adverse effects on bat species.

As the existing hospital and entrance are in daily operation, other local fauna species will already be acclimatised to an extent with regards to noise, traffic and human activity in the area.

In general, local populations of fauna will not be significantly impacted as larger areas of similar alternative habitat are present surrounding the proposed development site within the local area. Proposed mitigation measures outlined in this chapter will seek to reduce any potential impacts of the proposed development during the construction and operational phases on the ecological environment within the wider landholding.

6 SOILS AND GEOLOGY

6.1 Introduction

The information contained below is concerned with a description of the existing geological character of the proposed development. This section also addresses the hydrogeological character of the site, as the groundwater environment is intrinsically linked to the geological material through which it flows.

The geological material existing within the site has been generated by the deposition of detritus over millions of years. The geological material underlying the site, both the Quaternary glacial mineral soil and the bedrock, are concealed. The nature, extent and complexity of the geological material, from the surface downwards through the mineral subsoil to the bedrock, is detailed below based on available published information and site specific investigation data.

The hydrogeological environment, in terms of the hydraulic characteristics of the bedrock and the subsoil, are also discussed, as such details are intrinsically linked to the geological environment.

6.2 Study Methodology

This report has been prepared using the recommendations set out in the Environmental Protection Agency (EPA) document 'Guidelines on Information to be contained in Environmental Impact Statements' (2002) and the Draft Guidelines on Information to be contained in Environmental Impact Assessment Reports' (2017). The guidelines and recommendations of the Institute of Geologists of Ireland (IGI) publication 'Geology in Environmental Impact Assessment Reports – A Guide' (2002) was also taken into account in the preparation of this section.

This section describes the geological material existing within the site, from the surface downward, through the mineral subsoil to the bedrock. The composition and the extent of these deposits are discussed. Groundwater and the hydrogeological setting of the site are also discussed in this section, as is the nature of the existing geological material and the hydraulic characteristics of the various materials through which the groundwater flows.

In the preparation of this section the following protocol was used in order to assess the regional and site specific context and character of the site:

The site was assessed using regional geological publications and maps;

- All available information was collected from the Geological Survey of Ireland (GSI);
- A site investigation programme was designed and undertaken within the site, that included topographic surveys, probing of soils/subsoils; and
- Preparation of this geological report was undertaken following the collation of all available information.

The available geological information provided in this section is considered sufficiently detailed to adequately characterise the geological setting of the site. The information included in this section is considered to meet the data requirements suggested in the IGI publication 'Geology in Environmental Impact Assessment Reports - A Guide".

All projects and developments that require an EIAR are of a scale or nature that they have the potential

to have an impact on the environment. In this section the potential impact on the geological environment resulting from development is assessed and mitigation measures provided to reduce such impacts. Based on the mitigation measures provided, the significance of the predicted impact on the geological environment is determined. A programme of monitoring is provided to demonstrate that development is not impacting the surrounding geological environment.

6.3 Receiving Environment

6.3.1 Soil

Reference to the General Soil Map of Ireland (published by National Soil Survey, An Foras Talúntais in 1980 at a scale of 1:5126,000) indicates that the entire site comprised of made ground. Based on visual assessment of the sites, the site is covered in concrete with some small areas of tarmac.

6.3.2 Subsoil Geology/Superficial deposits

During previous site investigations at the mater hospital, boreholes were installed and continued to sufficient depth so that at all locations the mineral subsoil was encountered. This allowed the nature and composition of the subsoil material to be examined.

Mineral subsoil was encountered in all locations. The uneven elevation of the interface between the made ground and the mineral subsoil is a function of the uneven elevation of the topography prior to the formation of the hospital.

The mineral subsoil encountered in each location was recorded and logged. The dominant subsoil is described as predominantly light grey, slightly sandy gravelly SILT with angular to rounded cobbles and boulders of limestone.

6.3.3 Bedrock Geology

Reference to Sheet No. 18 – Geology of Meath -Wicklow, published by the Geological Survey of Ireland (2003), indicates that the bedrock underlying the site is recorded as belonging to a succession of the Carboniferous rock types. The Carboniferous rocks are composed entirely of Dinantian Impure Limestones rocks. The geology is summarised below in Table 6.1.

Table 6-1 Geological formations within study area

Age	Rock Formation name	Rock type
Lower Carboniferous (Visean)	Lucan Formation	Dark limestones & shales ("Calp")
	Waulsortian Limestones	Pure unbedded limestones

Waulsortian Reef Limestone (WA)
The Waulsortian Limestone tends to comprise relatively clean, sometimes-cherty limestones interbedded with thin shaly bands that display a distinct nodular texture. The Waulsortian Reef limestone is located to the north east. It conformably overlies the Ballysteen Formation, though there often is a transition sequence from the very argillaceous limestones to the clean Waulsortian (c.99% $CaCo_3$). The Waulsortian Reef consists of poorly bedded, dense, pale grey micrites and grainstones.

Calp Limestone (CP)
The underlying bedrock is comprised on the Calp Limestones. Calp limestone was deposited after the Waulsortian Limestones depositional succession. The term 'Calp' is used to refer to the various basinal limestone and shales occurring in these successions. The Calp units generally consist of dark grey, fine grained, impure limestone with interbedded black pyritic shales and veins of white calcareous spar. The variation in bed thickness, grain size, colour and proportion of shale is a feature of the depositional environment in which these sediments were deposited in the basin.

The rock encountered underlying the site, as described from the site visits, is fully consistent with the description of the Carboniferous rock types described in the GSI Sheet 18 – Geology of Meath and Wicklow.

6.3.4 Aquifer Classification

The Geological Survey of Ireland (GSI) has classified the geological formations into the aquifer categories as listed in Table 6-2.

Table 6-2 indicates that the rock types underlying the study area which are classified as a Locally Important Aquifers which are moderately productive in localised zones (GSI Aquifer Code: Ll).

1. **Table 6-2 Aquifer Classification (GSI)**

Age	Rock Formation name	Rock unit	Aquifer Classification
Lower Carboniferous (Visean)			
	Lucan Formation	Dark limestones & shales (“Calp”)	Locally Important generally moderately productive in local zones (Ll)
	Argillaceous Limestones	Dark limestones & shales, chert	Locally Important generally moderately productive in local zones (Ll)

6.3.5 Piezometry and Groundwater Flow Direction

All boreholes drilled during the previous SI. Based on the borehole logs groundwater is >5 mbgl. This is consistent with the dry excavation/car park to the south of the main building. No significant water inflows were encountered during the development of the main hospital building to the east of the proposed development.

MMUH:

Groundwater Vulnerability

Groundwater vulnerability is a term used to represent the intrinsic geological and hydrogeological characteristics that determine the ease with which groundwater may be contaminated by human activities. The vulnerability category is based on the relative ease with which infiltrating water and potential contaminants may reach groundwater in a vertical or sub-vertical direction. The permeability and thickness of the subsoil, which influence the attenuation capacity of subsoil, are important aspects in determining the vulnerability of groundwater.

The groundwater vulnerability rating, as published by the GSI is Low in the study area - See Figure 6-1.

MMUH:

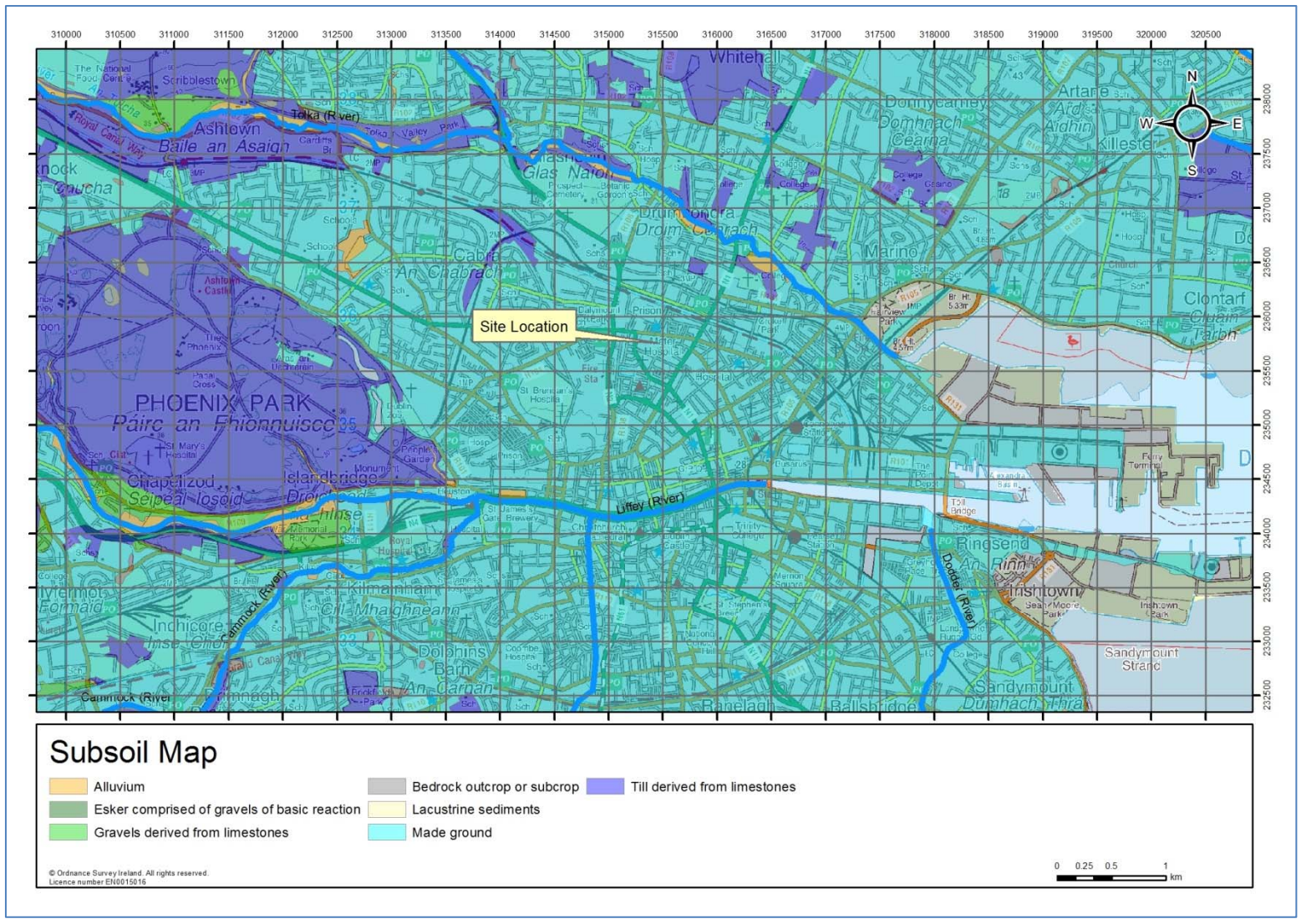


Figure 6-1 Subsoil Map

TOBIN
Patrick J. Tobin & Co. Ltd.

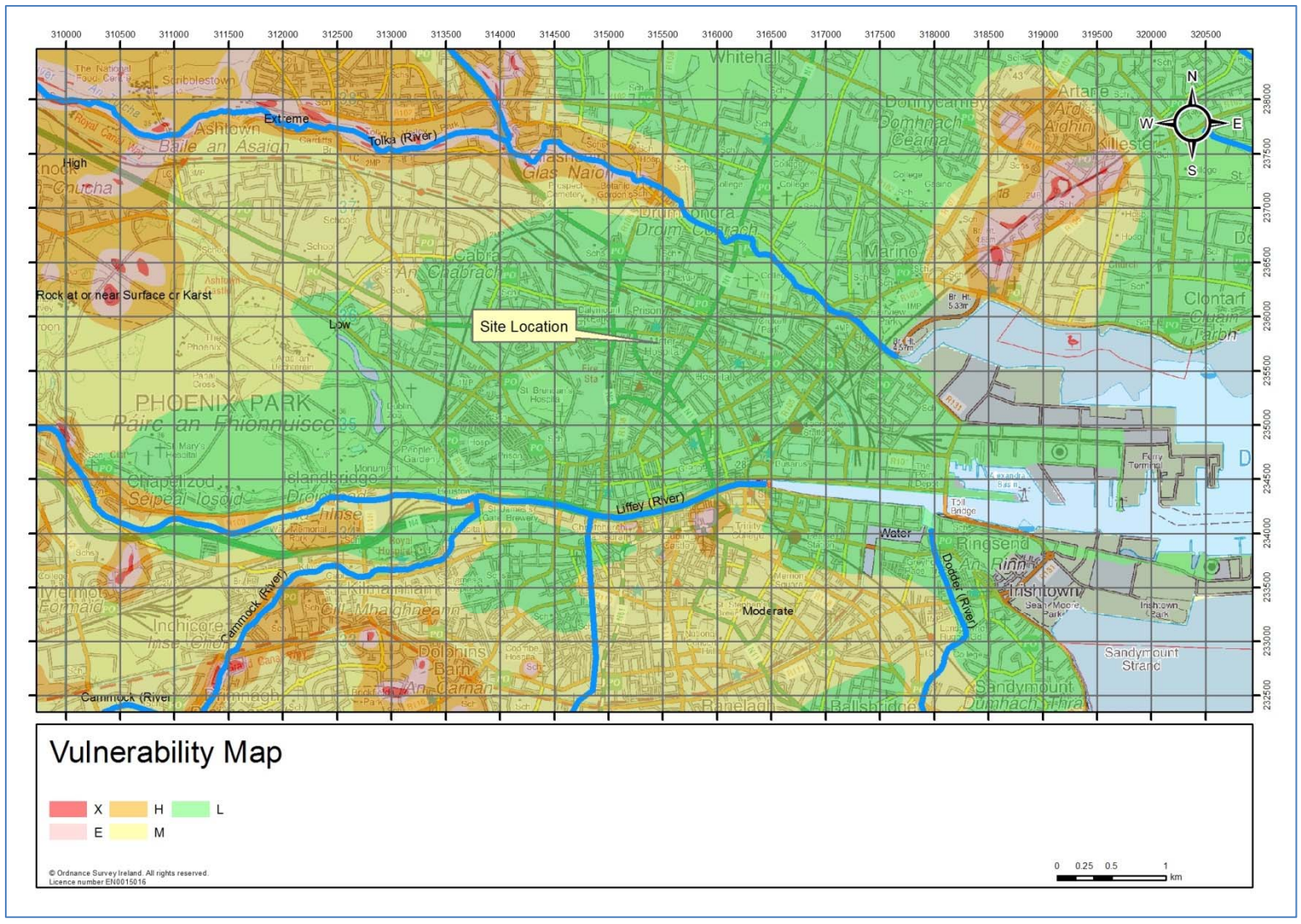


Figure 6-2 Vulnerability Map

6.4 Characteristics of the Development

It is proposed to treat the following at the site

Food waste	60 tonnes/annum
General Waste	914 tonnes/annum
Human Healthcare Risk Waste	407 tonnes/annum
Total	1,380.5 tonnes /annum or 3.7 m^3/day

Wastewater treatment of 392.2 m^3 per day or 143,177 m^3/annum. It is proposed to apply to the EPA for an IED licence in relation to the facility. A number of items are classified as hazardous under the EU List of Waste criteria due to the wastes potentially infectious properties.

The location of the proposed development site in relation to the surrounding region is shown on Figure 1.

6.5 Potential Impacts

In order to minimise any potential impact on the environment, including the soil and geological environment, 'Avoidance of Impact' was incorporated into the design of the development. MMUH and Pharmafilter have extensive experience of Waste and Wastewater treatment. The experience gained through this operation will be used to ensure that the proposed works are undertaken in an environmentally sound manner.

Due to the nature of the development, i.e. Waste and Wastewater treatment, there is the potential for impacting the shallow soil and geology environment within the site. The magnitude of the impact is considered low.

The aquifer potential of the mineral subsoil and the bedrock is poor. The Waste and Wastewater treatment material within areas of made ground would be considered to pose a negligible impact to hydrogeology of the area. All tanks are tanks will be bunded and the monitored during the lifetime of the development.

Based on the water levels recorded from previous SI within the proposed development, the watertable is > 5 m bgl. The proposed development is likely to lower the water levels by a few mm to maintain drainage within the waste areas. There are no public water supplies boreholes within 200m of proposed facility or within source protection areas.

6.6 Do Nothing Scenario

Under the do-nothing scenario, the proposed development will not significantly alter from current conditions. The Mater waste and wastewater treatment would be disposed of through the current streams. The current disposal route for HHRW is incineration. The current disposal route for wastewater is the public sewer network and Ringsend Wastewater treatment plant.

6.7 Mitigation Measures

The sediment control measures constructed on and adjacent to the reception area, comprising a sediment trap and oil interceptors, will be utilised to reduce the risk to the surrounding environment. All surface water draining from the site will gravity flow to site drains and discharge via attenuation tank. This settlement devices are designed to provide a low energy environment and high residence times to allow suspended solids to fall out of suspension. During current operations, this infrastructure has proven highly effective in minimising discharges to the receiving environment. Details of the water control measures are included in Section 7 (Hydrology and Drainage).

All potentially polluting materials, including hydraulic fluid, engine oil and fuel, is stored in specified areas, which is bunded to ensure total containment in the unlikely event of total failure of the storage facility. This reduces the risk of soil contamination due to activity of plant and equipment.

Due to the minimal disturbance of the geological environment, the mitigation measures are restricted to the stabilisation of exposed soil surfaces.

6.8 Predicted Impact

The predicted impact due to the Waste and Wastewater treatment, will represent a negligible predicted impact on the existing geological environment. This predicted permanent impact is not considered significant and does not represent a risk to the soil and geology environment.

6.9 Monitoring

During the operation it is proposed to continue the monitoring programme, in compliance with the requirement of the future IED licence.

6.10 Reinstatement and Residual Impacts

As a result of the Waste and Wastewater treatment facility, there is no potential for reinstatement to the original environment in the short to medium term. There are no significant in combination effects as a result of the development.

The timescale of construction activities within the site is relatively short in duration, and thereafter, the only activities will be associated with operation and monitoring of the waste and wastewater facility.

7 HYDROLOGY AND DRAINAGE

7.1 Introduction

This section is prepared for a development comprising the waste and wastewater treatment facility. The information contained below is concerned with a description of the surface water and groundwater environment of the subject site and the wider catchment area. Localised drainage details are provided together with water quality data.

The existing hydrological setting of the site is addressed, as it occurs at present, together with details of the drainage system employed within the proposed development by MMUH.

7.2 Study Methodology

This report has been prepared using the recommendations set out in the Environmental Protection Agency (EPA) document 'Guidelines on Information to be contained in Environmental Impact Statements' (2002). The guidelines and recommendations of the Institute of Geologist of Ireland (IGI) publication 'Geology in Environmental Impact Assessment Reports – A Guide' (2013) was also taken into account in the preparation of this section, whereby groundwater issues are included in the Hydrology and Drainage Section.

This section describes the hydrological setting of the site and refers to the information available from a number of published sources, including Dublin City Council, the EPA and the OPW. An assessment of the artificial drainage of the proposed development has also been addressed.
The information contained in this section has been divided into sub-sections, so as to describe the various aspects pertaining to water environment. In the preparation of this section the following protocol was used in order to assess the regional and site specific context and character of the site:

The assessment of the potential impact of the proposed development on the water environment was carried out according to the methodology specified in the following guidance documents:

Draft Environmental Protection Agency (EPA) Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (2015);
Environmental Protection Agency (EPA) Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (2002); and
EPA Advice Notes on Current Practice (in the Preparation of EIAR) (2003), and
The guidelines and recommendations of the National Roads Authority (NRA) *Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes* (2009) were also considered in the preparation of this chapter.
The following sources of information were utilised to establish the baseline environment:

The Geological Survey of Ireland (GSI) groundwater records for the area were inspected, with reference to hydrology and hydrogeology;
Office of Public Works (OPW) flood mapping;
Catchment Flood Risk Assessment and Management (CFRAM) and Preliminary Flood Risk (PFRA) Map data;
EPA water quality monitoring data for watercourses in the area;
EPA Water Framework Directive Monitoring Programme;
Information from the River Basin Management Plan for the Eastern River Basin District (ERBD); and

Site visits of the study area.

The data available of the site is considered sufficiently detailed to adequately characterise the surface water and groundwater characteristics of the site.

All projects and developments that require an EIAR are of a scale or nature that they have the potential to have an impact on the environment. The potential impact on the surface water and groundwater environment resulting from the Waste and Wastewater treatment is assessed and mitigation measures are proposed to reduce any significant impacts. Based on the mitigation measures proposed the significance of the predicted impact on the hydrological environment is determined.

7.3 Receiving Environment

7.3.1 Catchment Area

The proposed WWtP is located in the Hydrometric Area No. 09 (Liffey). There are four principal rivers that discharge to Dublin Bay; the Liffey, the Dodder, the Tolka and the Camac. The Poddle River as well as the Royal Canal and the Grand Canal also discharge to the Liffey. In addition several small streams flow from the surrounding areas into the bay.

The River Liffey has a catchment size of approximately 1,300 km^2. It rises in the Liffey Head Bog between Kippure and Tonduff in the Wicklow mountains and the upper part of the catchment is fairly steep and is characterised by agricultural lands. The lower catchment is relatively flat and characterised by urban land use. The current discharge from MMUH is to a combined sewer to the north within the North Circular Road. The combined sewer discharges to Ringsend WWTP.

The River Liffey flows approximately 2km to the south of the nearest edge of the Waste and WWTP facility (Figure 13). The drainage pattern of the proposed development is shown on Figure 14 to Figure 15.

The site surface water and foul water ultimately discharges to the Regional Wastewater Treatment Plant at Ringsend; a Plant which is currently at capacity. The existing treatment works at this Plant has a capacity of 1.65 million population equivalent (PE) but is currently receiving and treating a daily load of approximately 1.75 million PE. To increase the treatment works capacity to accommodate current loads and to allow for future growth of the Dublin region it is necessary to increase the capacity to at least 2.1 million PE. In addition to an increase in capacity, the treatment works must also be upgraded to treat effluent to a higher standard than the original design.

Irish Water has inherited the Capital Investment Plan for Ringsend from Dublin City Council, from 1st January 2014, and is committed to developing the plant at Ringsend as an urgent national priority. Work is currently progressing in a phased programme:

- Upgrading of the existing plant to improve process stability and consistency is underway and is expected to be completed in 2015.
- Expand the plant based on advanced process technologies (to be agreed with the EPA), to take place in 2015-2016.
- Upgrade the existing plant to meet a capacity of up to 2.1 million PE capacity at the required discharge limits in the new EPA license. This is due to be implemented in 2016-2018.

The scale and phasing of all new development will need to be cognisant of and in keeping with the capacity available at Ringsend Treatment Plant and be compatible with local sewer capacity constraints. The 2007 Waste Water Discharge (Authorisation) Regulations requires the Water Service Authority to satisfy itself that there is drainage capacity available in the network prior to

granting a planning permission for any development, and to restrict discharges from the wastewater network into rivers and waters.

The area is currently drained on the single pipe, combined, system, with both rainfall run-off and wastewater discharging to the one pipe. South of the canal, this area drains via large sized culverts and pipes, along the Phibsborough Road and Constitutional Hill to the City Centre Catchment.

The combined nature of the drainage means that in times of extreme rainfall events all the run-off from the paved surfaces discharges to a single pipe creating a risk of flooding and also a risk for pollution of waters. Under the Eastern River Basement Management Plan approved by Dublin City Council in 2010, all waters are to achieve good status. This places statutory requirements on Dublin City Council to improve the status of the rivers within the city.

In accordance with best international practice, the proposed developments will be required to separate their drainage with storm water going to a separate pipe within the site. The proposed development with implement storm water attenuation and sustainable drainage features. This will mitigate the risk of flooding and result in decreased peak flows to the public system.

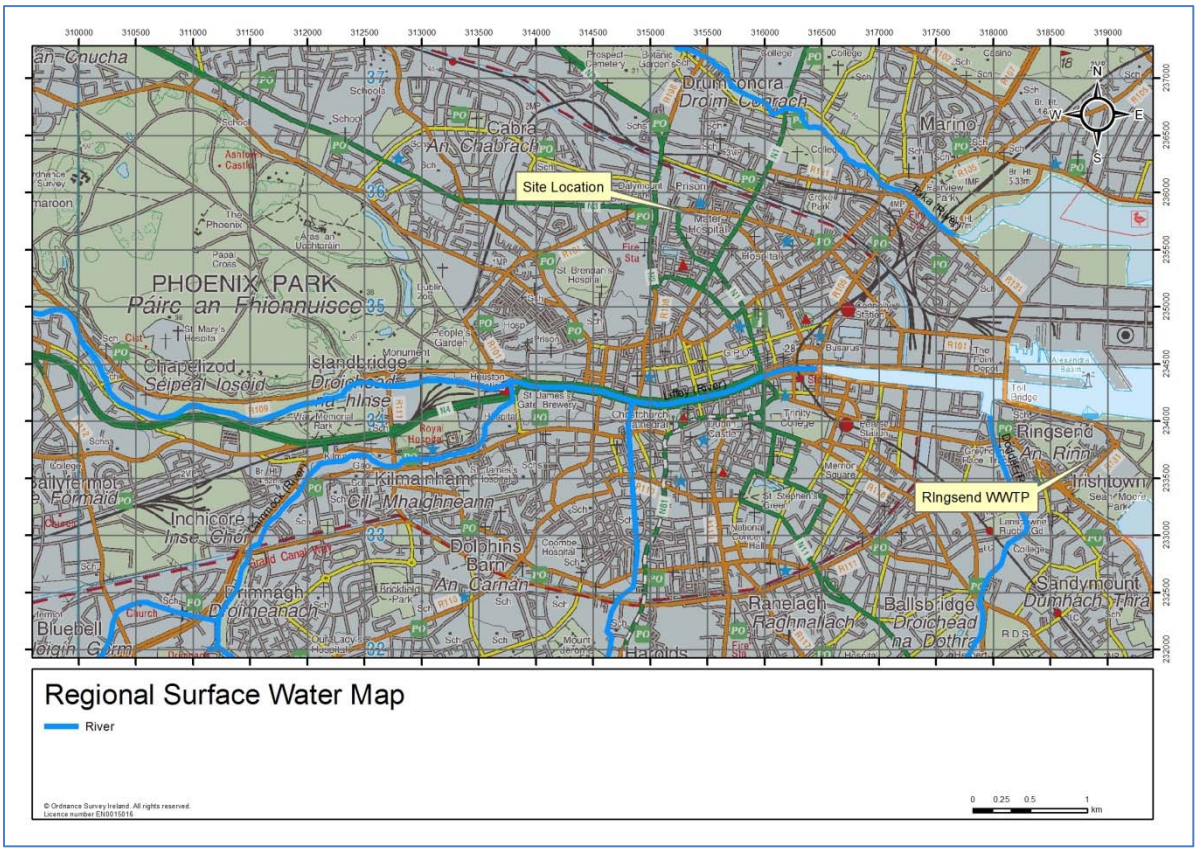


Figure 7-1 Regional Surface Water Network

7.3.2 Surface Water Quality

Regional Surface Water Quality

The water quality of the major rivers in Ireland is monitored continuously by the EPA. The monitoring programme was established under the Environmental Protection Act 1992. The objectives of the programme include the following:

a) To establish the ongoing quality status of our rivers and streams;
b) To monitor quality changes and trends over time;
c) To assess the performance of pollution control and abatement measures;
d) To provide feedback to the responsible control agencies; and
e) To inform the general public.

Q Values are used by the EPA to express biological water quality, based on changes in the macro invertebrate communities of riffle areas brought about by organic pollution. See Table 7-1 for an explanation of the ratings. Q1 indicates a seriously polluted water body; Q5 indicates unpolluted water of high quality. Appendix 7.1 shows a more detailed description of the Biological Quality Classes.

Table 7-1 Q Rating Table

Quality Ratings	Quality Class	Pollution Status	Condition
Q5, Q4-5, Q4	Class A	Unpolluted	Satisfactory
Q3-4	Class B	Slightly Polluted	Unsatisfactory
Q3, Q2-3	Class C	Moderately Polluted	Unsatisfactory
Q2, Q1-2, Q1	Class D	Seriously Polluted	Unsatisfactory

Available information for the River Liffey catchment was referenced to determine the existing quality of the surface water environment. Reference to information obtained from the EPA and ERBD indicates that the River Liffey and its tributaries, support both salmonid and cyprinid fish populations.

The Liffey Estuary from Islandbridge weir to Poolbeg Lighthouse, including the River Tolka basin and South Bull Lagoon, is designated a nutrient sensitive area.

Nutrient reduction is required for all discharges from agglomerations with a population equivalent of more than 10,000. Where discharges to sensitive water bodies occur, the UWWT Regulations specify emission limit values for total phosphorus and/or total nitrogen in addition to values for BOD (Biochemical Oxygen Demand), COD (Chemical Oxygen Demand) and TSS (Total Suspended Solids), which apply to discharges generally.

There are a number of protected areas within Dublin Bay and the surrounding areas which form part of the Natura 2000 network. These areas required assessment in terms of their conservation objectives and site integrity as part of the ecological assessment. The discharge point from the WWTP will flow to Ringsend WWTP and eventually discharge to Dublin Bay. There would also be an improvement in the water quality in the Protected Areas in Dublin Bay particularly in terms of pharmaceuticals and other hospital related pollutants. There will also be a decrease nutrient loading reaching the Ringsend WWTP however this would only comprise a small fraction of the overall nutrient load.

Thus, the discharge would help meet all water quality standards and be more protective of water

quality in Natura 2000 sites and bathing waters.

The recently granted Greater Dublin Drainage and 9C sewerage scheme will also reduce loading at Ringsend WWTP.

The site drainage infrastructure is designed to safely collect, store and regulate discharges from the site.
All discharges from the site to the receiving environment are regulated and controlled, as required by the future IED licence.

7.3.3 Physico-Chemical Surface Water Quality

The waste and wastewater treatment plant will produce clean high quality effluent which will be suitable for reuse based on the parameters measured. The digestion process for organic waste and the digestate will be effectively and comprehensively decontaminated and can be removed as grey waste. The values of the macro parameters COD, BOD and Kj-N will be reduced by more than 99% and more than 75% of the N and P are removed biologically. See Appendix C for details of the proposed system.

Parameter	Prior to treatment	As discharged	% Efficiency
	Max. hourly average (mg/l)	Max. hourly average (mg/l)	
COD	1500	20	98%
BOD	240	2	99%
Ammonia	80	1	99%
TON	130	40	70%
Orthophosphate	9	5	45%
E. Coli	80,000	0	100%
Faecal strep	>100,000	0	100%
Pseudomonas aeruginosa	1,000	0	100%
Diclofenac [1]	0.005	<0.00001	98%
Carbamazepine	0.005	<0.00001	98%

Parameter	Prior to treatment	As discharged	% Efficiency
Sulfamethoxazole	0.01	<0.0001	98%
Ciprofloxacin	0.005	<0.00001	98%
1[1] Note Pharmaceuticals are below detection limits of <0.0001			

7.3.4 Water Flow Measurements

Hydrological studies have been undertaken in other wastewater facility areas to determine the impact of waste and wastewater.

7.3.5 Flooding Data

The OPW 'Flood Hazard Database' was used in order to obtain information on historical flooding events within the waste and wastewater facility boundary. This information was used to establish the current baseline conditions and specifically if the waste and wastewater facility is liable to flood. No records of flooding were noted on the OPW website for the proposed development.

Data on historical flooding is limited but the MMUH records do not indicate that flooding occurred at the waste and wastewater facility. The site is not located in a flood prone area, based on the information provided in flood maps (www.floodmaps.ie) and the Preliminary Flood Risk Assessment maps. Previous planning applications (2808/08, Previous Flood risk assessments of the Mater Misericordiae University Hospital site have not identified flooding potential at the site.

Additional sources of information including historical maps, data from CFRAMs and PFRA and internet searches were also consulted. No incidents of flooding were noted at the site. The proposed development site is not located in a flood prone area (Flood Zone A or B) based on the preliminary flood risk assessment (PFRA) maps.

- _____

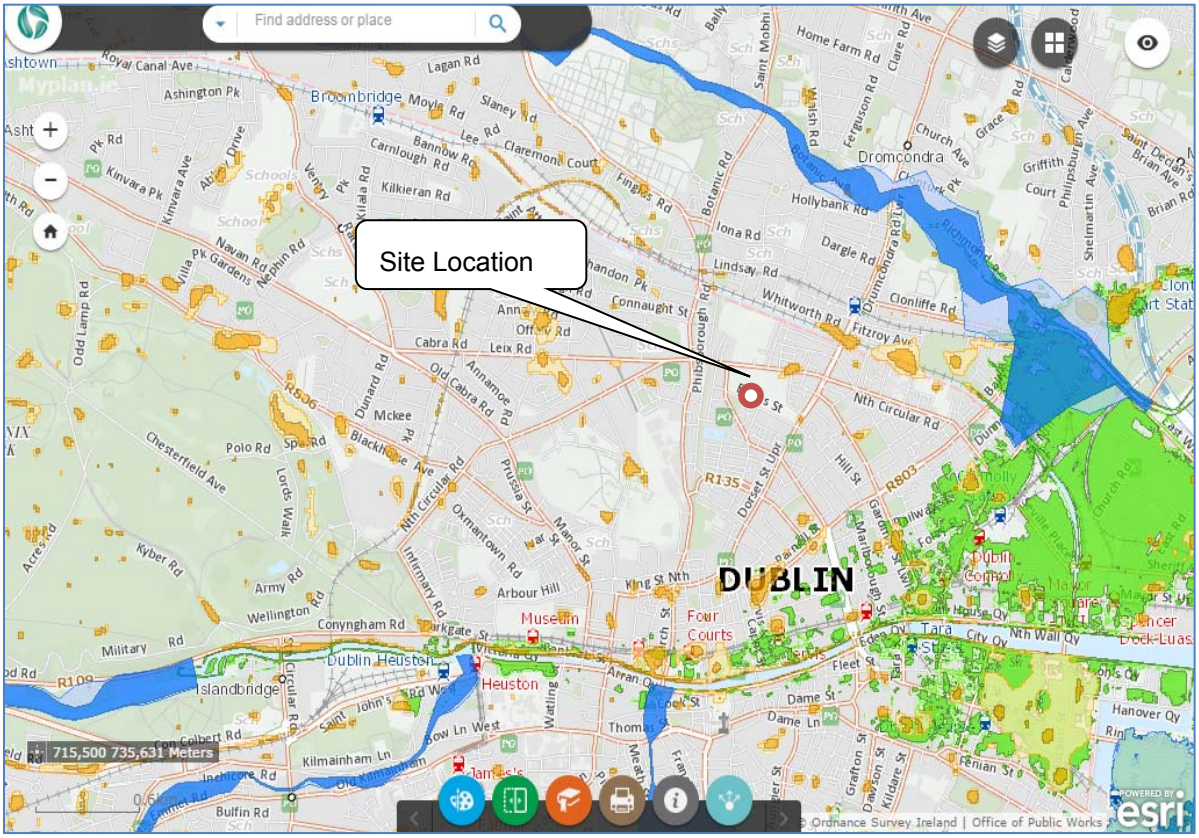


Figure 7-2 Flood Risk map – Source - www.myplan.ie

7.4 Characteristics of the Development

It is proposed that activities within the proposed development will be consistent with activities as detailed in section 2.

7.5 Potential Impacts

The principal potential impact as a result of proposed Waste and WWTP is considered to relate to impacts on water quality. The main impact of Waste and WWTP is considered to be as a result of treatment is the increase in water quality and decrease in surface water flow. The control, management and storage of waste within the site have the potential to impact the quality of water, through accidental spills. Mitigation measures are proposed to reduce the risk of such occurrences.

7.6 Do Nothing Scenario

If the proposed Waste and Wastewater treatment does not occur the site will remain as is. The Mater waste and wastewater treatment would be disposed of through the current streams. The current disposal route for HHRW is incineration. The current disposal route for wastewater is the public sewer network and Ringsend Wastewater treatment plant.

7.7 Mitigation Measures

The design of the facility has taken account of the potential impacts of the development and the risks to the surface water environment. The discharges from the site to the receiving environment will be

regulated. SUDs measures are incorporated into the design of the facility.

It is proposed to bund the hardstand such that surface water runoff is channelled towards an engineered drain. This drain is capable of taking all water accumulating on the hardstand area. All water captured in this drain will outfall to a settlement tank/grit trap. With respect to the wastewater, all wastewater generated will be collected in the influence sump and treated in the facility.

Spill kits are retained on site to ensure that all spillages or leakages are dealt with immediately and staff trained in their proper use.

7.8 Predicted Impacts

Based on the results of previous monitoring at existing facilities during the operation of the waste and wastewater operation, the risk to the surface water environment following treatment within the drainage infrastructure is a minor to moderate beneficial impact.

7.9 Monitoring

Monitoring within the site will be in compliance with the future IED licence for the facility. Regular sampling will be undertaken at the proposed facilities. It is proposed to monitor the following discharge points.

Table 7-2 Surface Water Monitoring Locations

Discharge Point	National Grid Ref	Discharge to
Sw1	E 228853, N263755	Main sewer

8 AIR EMISSIONS

8.1 Introduction

This section is prepared to determine the existing air quality characteristics of the proposed development and surrounds, and to assess the potential impact of continued use of the site resulting from the waste and wastewater treatment facility. AWN Consulting Ltd. has been commissioned to carry out an air dispersion modelling study of air and odour emissions from the Proposed development based on the design details. This chapter was completed Dr. Avril Challoner. She is a Senior Consultant in the Air Quality section of AWN Consulting. She holds a BEng (Hons) in Environmental Engineering from the National University of Ireland Galway, HDip in Statistics from Trinity College Dublin and has completed a PhD in Environmental Engineering (Air Quality) in Trinity College Dublin. She is a Member of the Institute of Air Quality Management and specialises in the fields of air quality, EIA and air dispersion modelling.

8.2 Study Methodology

This study aims to identify and assess the sources and potential impact of atmospheric releases from the transfer and Waste and Wastewater treatment.

8.3 Emissions Characteristics of the Development

Emissions to atmosphere potentially arise as a result of the Waste and Wastewater treatment and transfer of waste from the proposed developments.

8.4 Legislative Context - Air Quality Standards and Limits

Air quality standards have been developed and incorporated into Irish statute to protect human health and the environment. International agreements have also been drawn up to identify performance standards and limit the generation of air quality pollutants at a regional, national and global level. Relevant legislation and agreements have been discussed below:

8.4.1 Air Quality Standards and Guidelines

The European Commission (EC) has formally adopted the Air Quality Framework Directive (96/62/EC). The first daughter directive, 99/30/EC (adopted April 1999), set specific limits for four air pollutants: nitrogen dioxide, sulphur dioxide, PM_{10} and lead. There are no sources of lead associated with the development and lead is not described further. In December 2001, the EC adopted the second daughter directive, 2000/69/EC, relating to limit values for benzene and carbon monoxide (CO) in ambient air.

These directives have been transposed into Irish legislation by the Air Quality Standards Regulations, 2002 (SI No. 271 of 2002) and amended S.I. 180 of 2011. The original Air Quality Directives have been replaced by one over-riding European Directive (2008/50/EC) in May 2008, but the specified limits for the protection of human health remain unchanged from those specified in SI No. 271 of 2002. These limit values are presented in Table 8-1.

Table 8-1 Relevant Air Quality Standards and Guidelines

Pollutant	Averaging Period	Standard ($\mu g/m^3$)	Percentile	Maximum Exceedances per year	Status
NO_2	1 hour 1 hour Annual Annual (vegetation)	200 200 40 30	99.8th 98th	18 175	In Force In Force In Force In Force
SO_2	1 hour 24 hours Annual (ecosystems)	350 125 20	99.7th 98.9th	24 3	In Force In Force In Force
PM_{10} Stage 1	24 hours Annual	50 40	-	35	In Force In Force
PM_{10} Stage 2	24 hours Annual	50 20	-	7	In Force In Force
CO	8 hours	10,000	-	-	In Force
Benzene	Annual	5	-	-	In Force

Various international initiatives, Protocols and Directives exist to limit and reduce emissions at a national level including ensuring, for example, vehicles meet emission standards.

8.4.2 Background Air Quality Data

Air Quality

The EU Air Framework Directive requires Member States to categorise geographic areas, in terms of Zones and Agglomerations for Air Quality.

Dust Deposition

Effects of dust emissions are generally related to nuisance, however within the dust a certain fraction can have health impacts. Health effects are typically associated with fine particulate matter, generally below 10µm (i.e. PM_{10}). Dust and PM_{10} was assessed in the Air quality model.

8.4.3 CO_2 Emissions

8.4.4 Interactions with Other Sources in the Region

Other emission sources in the vicinity of the waste and wastewater area include road traffic. In relation to dust emissions, such emissions are generally a highly localised issue, with Deposition occurring close to its source. Therefore, significant interactions with other dust generating activities are not likely to be significant.

Fine dust with the potential to affect health (PM_{10}) can be generated from both vehicle emissions and dust generating activities.

Dust suppression techniques will minimise releases of PM_{10} and releases from vehicles are assessed later in this section. Background levels of PM_{10} where both of these sources are already present show very low levels in comparison to air quality standards.

8.5 Potential Impacts

The following section assesses the potential impact of the transport and Waste and Wastewater treatment.

The potential impacts are associated with the following:

- Generation of dust emissions during construction;
- While the Waste and Wastewater treatment has the potential to generate air emissions,

AWN Consulting Ltd were commissioned to carry out an air quality dispersion modelling study of emissions from a CHP and odour emissions from the proposed IED facility at the Mater Misericordiae University Hospital, Dublin 7.

Air dispersion modelling was carried out using the United States Environmental Protection Agency's regulatory model AERMOD (Version 16216r). The purpose of this modelling study is to determine whether the emissions from the site will lead to ambient concentrations which are in compliance with the relevant ambient air quality standards for NO_2, CO, SO_2 and PM_{10} / $PM_{2.5}$ and to identify the location and maximum of the worst-case ground level concentrations for each compound assessed. Stack height used for both odur and the CHP was 7m.

Construction dust has the potential to cause local impacts through dust nuisance at the nearest sensitive receptors (including hospital buildings). In addition to construction dust, there is the potential for Aspergillus impacts to occur. Construction activities such as excavation, earth moving and backfilling may generate quantities of dust, particularly in dry and windy weather conditions. While dust from construction activities tends to be deposited within 200 m of a construction site, the majority of the deposition occurs within the first 50 m. The extent of any dust generation depends on the nature of the dust (soils, peat, sands, gravels, silts etc.) and the nature of the construction activity. In addition, the potential for dust dispersion and deposition depends on local meteorological factors such as rainfall, wind speed and wind direction. Vehicles transporting material to and from the site also have the potential to cause dust generation along the selected haul routes from the construction areas. Due to limited area of construction, dust issues are not considered to pose a potential impact. However, a dust minimisation and an

Aspergillus prevention plan will further ensure no significant dust impact will occur at the facades of the hospital buildings on the current site.

Assessment Summary

For the maximum operational modelling scenario, it has been assumed that emission points are continually in operation for the full year as a worst-case assumption.

The scenarios modelled lead to emission concentrations of NO2, SO2, PM_{10}/$PM_{2.5}$ and CO which are in compliance with the relevant limit values at the worst case off-site location.

8.6 Do Nothing Scenario

In this scenario, the site would remain unchanged. No air emissions would be generated apart from ongoing traffic. The Mater waste and wastewater treatment would be disposed of through the current streams. The current disposal route for HHRW is incineration. The current disposal route for wastewater is the public sewer network and Ringsend Wastewater treatment plant.

8.7 Mitigation Measures

Dust impact will be mitigated by the continued application of best practice dust suppression and containment techniques including the prevention of dust accumulation. A dust minimisation and an Aspergillus prevention plan will further ensure no significant dust impact will occur at the facades of the hospital buildings on the current site.

Dust control measures which will be employed will include where necessary:

- Vehicles will preferentially have upward-directed exhausts to reduce disturbance;
- Existing trees and shrubs provide filtering of wind-borne dust and reduce near-ground wind speeds (and subsequent dust entrainment).

8.8 Predicted Impacts

For all operational modelling scenarios, it has been assumed that the CHP is continually in operation for the full year as a worst-case assumption. The scenarios modelled lead to emission concentrations of NO_2, SO_2, PM_{10}/$PM_{2.5}$ and CO which are in compliance with the relevant limit values at the worst case off-site location. In relation to odour all emission will be in compliance with the relevant limit values at the worst case off-site location. There are no significant in combination effects as a result of the development.

9 NOISE

9.1 Introduction

The development involves the proposed treatment of waste and wastewater. There is the potential for a noise impact generated by the proposed facility and movement within the site. This section assesses the noise impact in the context of current relevant standards and guidance and identifies any requirements or possibilities for mitigation.

9.2 Methodology

9.2.1 Noise Terminology

The primary noise measurement parameters used in this assessment are $L_{Aeq,T}$, $L_{Amax,T}$ and $L_{A90,T}$. These represent the average, maximum and minimum levels occurring during a given period, T, and are referred to as such elsewhere in this section. Comparisons between ambient prevailing values of these indices and those likely to be generated by the scheme are useful indicators of noise impact, as are benchmark comparisons against standards set as absolute values.

All references to sound pressure level are in decibels, related to the standard reference pressure of 20 μ Pa. Sound power level references are in decibels relative to the standard reference power level of 1pW.

9.2.2 Guidance and Policy

Published Irish standards and guidance are relied upon wherever possible, or in their absence suitable EU or UK documents have been used. This evaluation was prepared in accordance with the Environmental Protection Agency's (EPA) Guidelines on the information to be contained in Environmental Impact Assessment Reports (March 2002), Advice Notes on Current Practice (in the preparation of EIAR) (2003) and the EPA Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4) (2012).

The evaluation will focus on construction and operation aspects of the waste and wastewater.

9.2.3 Overview of Assessment Procedure

Various standards and guideline documents covering the impact of external noise sources and the introduction of industrial and construction noise have been used in this assessment. The standards and guidelines appropriate for this assessment are the: World Health Organisation's (WHO) *Guidelines for Community Noise (*1999), BS5228 *Code of Practice for Noise and Vibration Control on* Construction and Open Sites – Part 1: Noise (2009), and BS4142 Method of Rating Industrial Noise Affecting Mixed Residential and Industrial Areas (1997) and the EPA Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4).
The assessment procedure involves determining noise levels likely to be generated by the waste and wastewater facility, comparing these with measured baseline conditions, and with other sources of existing impact in the area, and assessing this effect in the context of the duration of the project and other relevant factors. To provide comparisons with baseline conditions, surveys of background noise levels around the site have been carried out. Baseline surveys and noise impact predictions for the main waste haul route, along with a road condition overview survey and observations of traffic movements, were carried out.

9.3 Existing Environment

9.3.1 Background Noise Survey

The measurement locations along the proposed line route represent individual properties or clusters of residential properties along the route. The dB LA90 noise levels presented in the table represent the existing 'background' noise levels within the area. The levels presented in terms of 'dB LA90' are defined as the background noise level at a location according to BS4142 (Method of Rating Industrial Noise Affecting Mixed Residential and Industrial Areas, British Standards Institute (1997)). A typical guide to environmental noise levels is presented in Table 9-1 below.

Attended noise measurements were recorded during day time and during night time at each noise monitoring location. The measurements taken were deemed to be representative of typical noise levels in the vicinity. The equipment used during this survey was a Bruel and Kjaer, 2250, Type 1 sound level meter.

Table 9-1 Guidance Note for Noise in relation to Scheduled activities, 2nd Edition, EPA 2006

Typical noise levels in our Environment	
Sound levels in decibels dB (A)	Description of Activity
0	Absolute silence
25	Very quiet room
35	Rural night time setting with no wind
55	Day time, busy roadway 0.5km away
70	Busy Restaurant
85	Very busy pub, voice has to be raised to be heard
100	Disco or rock concert
120	Uncomfortably loud, conversation impossible
140	Noise causes pain in ears

All measurements were carried out in accordance with the International Organization for Standardization's (ISO) *ISO 1996: Acoustics - Description and measurement of environmental noise*. Measurements were made placing the microphone at a height of 1.5 m above ground level and were free field, measured >2m from reflecting surfaces.

The site was screened in order to determine if it is to be located in or near an area that could be considered a 'Quiet Area' in open country according to the Agency publication *Environmental Quality Objectives - Noise in Quiet Area*. Based on the assessment and the site walkover the sites could not be considered as quiet areas due to the proximity to the N4, adjacent food processing plant and audible anthropogenic noise.

Before and after the survey, the measurement apparatus was checked and calibrated using a calibrator to an accuracy of +/- 0.3dB. Weather conditions during the surveys were in line with the conditions described within *ISO 1996, Acoustics - Description and Measurements of Environmental Noise*.

The measurement results were logged onto survey record sheets immediately following each measurement and also stored in the instrument's internal memory for subsequent analysis. Notes were also taken in relation to the primary contributors to audible noise at each monitoring location. Measurements were taken in 1/3 Octave Bands.

Environmental noise parameters were measured which are defined herein:

- L_{Aeq} is the A-weighted equivalent continuous steady sound level during the measurement period and effectively represents an average ambient noise value;
- L_{Amax} is the maximum A-weighted sound level measured during the measurement period;
- L_{Amin} is the minimum A-weighted sound level measured during the measurement period;
- L_{A10} is the A-weighted sound level that is exceeded for 10% of the measurement period and is used to quantify road traffic noise;
- L_{A50} is the A-weighted sound level that is exceeded for 50% of the measurement period and in this assessment is used to quantify noise from overhead power lines; and
- L_{A90} is the A-weighted sound level that is exceeded for 90% of the measurement period and is used to quantify background noise level.

A-weighting is the process by which noise levels are corrected to account for the non linearity of human hearing. All noise levels quoted are relative to a sound pressure of 2x10-5 Pa.

No tangible vibration was observed at any of the noise survey locations assessed as part of the waste and wastewater. Baseline conditions are established for the waste and wastewater facility.

This evaluation was prepared in accordance with the Environmental Protection Agency's (EPA) Guidelines on the information to be contained in Environmental Impact Assessment Reports (March 2002), Advice Notes on Current Practice (in the preparation of EIAR) (2003) and the EPA Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4) (2012).

'A' Weighting

The human ear can tolerate low frequencies more than middle to high frequencies and one must ensure that any measurement device elicits a numerical value, which matches the ear's response. This is achieved by introducing an electronic filter (called an 'A' weighted filter) into the measuring system. This weighting characteristic provides good correlation with loudness and since its maximum lies in the frequency region where the ear is most sensitive, it takes into account the hearing damage potential of the noise. For this reason environmental noise levels are generally measured in terms of 'A' weighted decibels, dB (A).

A noise level in excess of 85 dB (A) gives a significant risk of hearing damage. A noise level increase of 3 dB (A) is barely perceptible; while an increase in noise level of 10 dB (A) is perceived as a twofold increase in 'loudness'.

Where noise levels vary in time, statistical analysis of the variation can be carried out. The results are usually stated in the form L_N (L for level), where N is the percentage of time a level is equalled or exceeded. Hence if L_{90} = 40 dB (A), the noise level equals or exceeds 40 dB (A) for 90% of the time measured period i.e. background noise level is 40 dB (A).

In addition to the statistical units, the equivalent continuous level is also measured. The equivalent continuous level, L_{eq}, is measured in dB (A) and is a notional steady level that has the same sound energy as the real fluctuating sound over the same measurement period. It is measured using an integrating sound level meter (SLM). L_{eq} is often described as the total noise level for a specified period.

Baseline Survey

Baseline noise refers to the existing noise environment in an area that may be affected by the

construction and operation of the proposed development. The baseline noise survey was conducted to provide a context for the assessment of potential future noise impact associated with the proposed facility.

In order to assess the surrounding environmental noise levels, a daytime and night time noise survey was carried out on the 5th February 2015 at four noise sensitive locations, as shown on Figure 9-1.

Thirty minute measurements were recorded at each Monitoring Location during both the day time and night time surveys in accordance with the EPA Noise Survey Guidance Documents as per the IPPC Licence. The measurements taken were deemed to be representative of typical noise levels in the vicinity of the site. The equipment used during this survey was a Larson Davis Type 1, 824 sound level meter.

All measurements were carried out in accordance with ISO 1996: *'Acoustics- Description and measurement of environmental noise*'. Measurements were made placing the microphone at a height of 1.5 m above ground level and were free field, measured >2m from reflecting surfaces.

Before and after the survey the measurement apparatus was checked and calibrated using an acoustic calibrator to an accuracy of +/- 0.3dB. Weather conditions during the surveys were in line with the conditions described within ISO 1996, Acoustics '*Description and Measurements of Environmental Noise*', being dry and calm.

The measurement results were noted onto survey record sheets immediately following each measurement and also stored in the instrument's internal memory for subsequent analysis, notes were taken in relation to the primary contributors to noise build-up at each location.

Five environmental noise parameters were measured which are defined below.

LAeq is the A-weighted equivalent continuous steady sound level during the measurement period and effectively represents an average ambient noise value.

LAmax is the maximum A-weighted sound level measured during the measurement period.

LAmin is the minimum A-weighted sound level measured during the measurement period.

LA10 is the A-weighted sound level that is exceeded for 10% of the measurement period and is used to quantify road traffic noise.

LA90 is the A-weighted sound level that is exceeded for 90% of the measurement period and is used to quantify background noise level.

A-weighting is the process by which noise levels are corrected to account for the non-linearity of human hearing. All noise levels quoted are relative to a sound pressure of 2x10-5 Pa.

In addition, one third Octave Frequency analysis was carried out on all readings taken during the day and night surveys in order to identify any pure tones. In accordance with ISO 1996 – 2, a source is described as having a tonal element at a particular frequency when it is clearly audible or exceeds the level of the adjacent bands by 5dB or more

The descriptions of these locations are as per Table 9-2 below.

Location Map in Fig 7657-2501	Description
N1	10 m East of site boundary of the site, along North Circular Road.
N2	Northeast on North Circular Road
N3	Southern boundary of the site
N4	North west on North Circular Road

Table 9-2 Noise survey locations

N1

Time	Duration	L_{Aeq}	L_{AMax}	L_{AMin}	L_{A10}	L_{A90}
16:03	30	62	75.5	45	68.1	41.9
18:03	30	53.1	81.4	39.2	58.4	41.7
01:35	30	47.5	65.7	36.9	45.9	38.6

Table 9-3 Noise measurement at N1

Passing traffic on the North Circular Road was the dominant source of noise. Pedestrians and internal traffic were a source of noise during the day and evening time.

During the night time survey a road sweeper was travelling up and down the North Circular Road adjacent to the site.

Table 9-4 noise measurement at N2

Time	Duration	L_{Aeq}	L_{AMax}	L_{AMin}	L_{A10}	L_{A90}
16:37	30	54.2	72.8	38.7	57.8	42.7
19:09	30	51.8	63.6	38.4	53.1	40.7
01:02	30	48.5	66	39.2	52.9	41.1

Passing traffic on the North Circular Road was the dominant source of noise. Pedestrians and internal traffic were a minor source of noise during the day and evening time.

Table 9-5 noise measurement at N3

Time	Duration	L_{Aeq}	L_{AMax}	L_{AMin}	L_{A10}	L_{A90}
17:15	30	55.6	72.4	37.6	60.1	43
20:25	30	47.9	67.4	37.2	55.1	39.2
00:31	30	39.9	63.8	36.7	46.8	37.8

Passing traffic on the North Circular Road was the dominant source of noise. Pedestrians and internal traffic were a minor source of noise during the day and evening time.

Table 9-6 Noise measurement at N4

Time	Duration	L_{Aeq}	L_{AMax}	L_{AMin}	L_{A10}	L_{A90}
16:28	30	56.9	76.2	40.3	65.8	47.4
21:29	30	51.4	72.4	39.8	57.9	41.7
23:02	30	49.7	70.8	39.8	55.3	40.8

Passing traffic on the North Circular Road was the dominant source of noise. Pedestrians and internal traffic were a minor source of noise during the day and evening time. Aircraft passed overhead during the survey period.

9.3.2 Day time measurements

The day time measurements exceed 55dB (A) 30 mins at all of the noise monitoring locations. No tonal or impulsive noise was detected at any of the noise sensitive locations during the day time surveys.

9.3.3 Evening and Night time measurements

The evening time measurements exceed 50dB (A) 30 mins at all of the noise monitoring locations. The nighttime measurements exceed 45dB (A) 30 mins at all of the noise monitoring locations. In all cases this was due to road noise sources and the noise levels observed are not attributable to the subject site, which was barely audible during this period and the noise climate was dominated by the other noise sources described above.

No tonal or impulsive noise attributable to the subject site was detected at any of the noise sensitive locations during night time surveys.

9.4 Potential Impacts and Mitigation Measures

During the treatment of wastewater equipment such as pumps and motors are used. These devices produce sound because they are all equipped with electric motor and most of them frequency control. The advanced

The proposed installation will have the following components that produce sound: -
Water pumps
Blowers and compressors (0.6 and 5.5 bar)
Ozone generator
Biogas engine

Silent compressors and low-speed pumps have been specified for proposed enclosed facility building. Noise-producing equipment will be encased in a sound insulating housing at the factory. It will then be placed in soundproof units where air is circulated by means of intake and outlet baffles. The units in the new installation will be constructed in stainless steel, as well as insulated sandwich panels (8-10 cm thick). The panels will be supplied with mineral wool as an added insulation medium (4-8 cm thick). Below we describe the specific measures to be implemented for each component group.

In-house sound measurements were carried out at the existing plant in Delft while it was in full operation. At one meter from all plant facades the volume was <50 dB (A). At a distance of 25 m the sound is calculated to be <40 dB (A), which corresponds to the sound of a quiet library. Based on these measurements we can conclude that during the day, as well as at night, the noise from the plant does not exceed standard ambient noise levels. No Tonal noise was detected at the facility. The nearest residential dwelling is located 38 m from the proposed facility.

Noise measurements were undertaken at the existing site and along the North Circular Road. All planning conditions for the site relating to noise generation will be complied with.

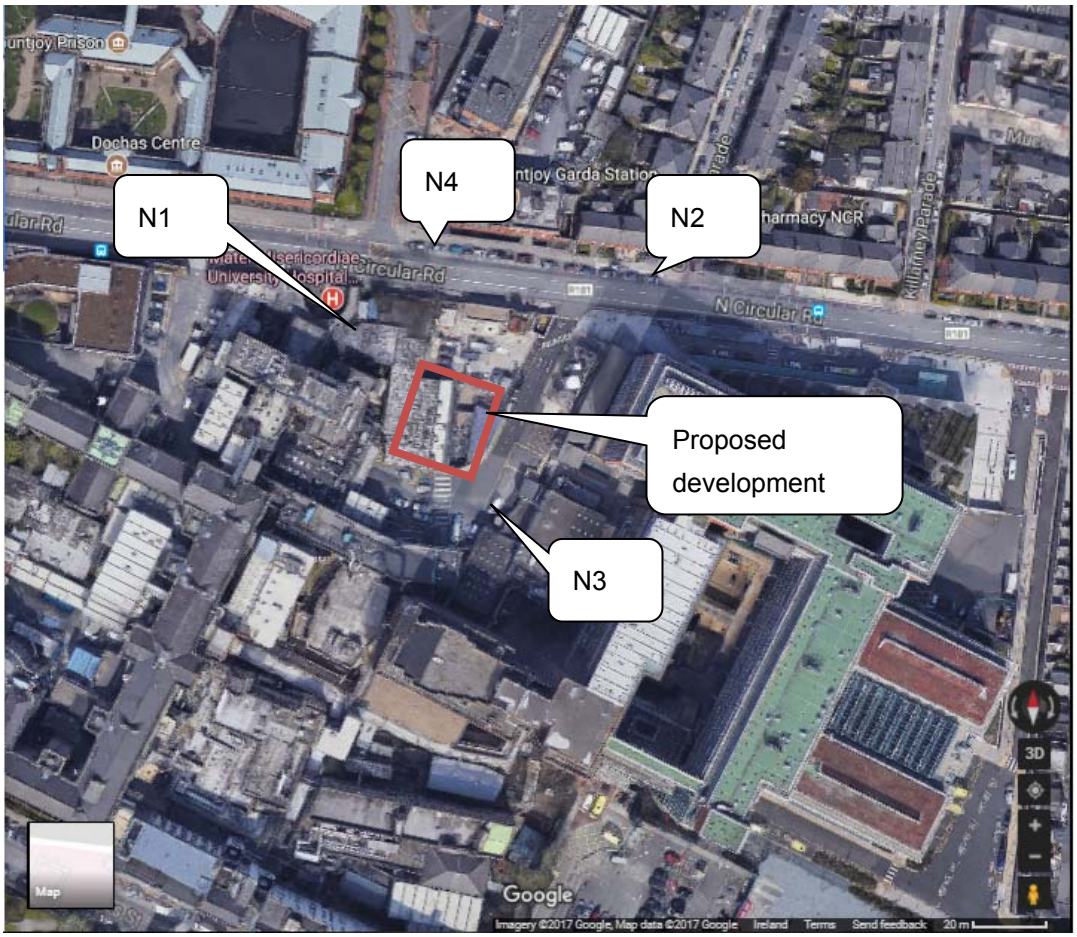


Figure 9-1 Noise Monitoring Locations 2015

9.5 Monitoring

The noise levels at the waste and wastewater activities shall not exceed a noise level of 55 dB(A) LAeq (30 minutes) by day; 50 dB(A) LAeq (30 minutes) in the evening time or 45 dB(A) LAeq(30 minutes) by night. The proposed operations will be in accord with these guidelines.

9.6 Conclusion

The waste and wastewater is not predicted to cause any significant noise and/or vibration impact to the surrounding climate. There are no significant in combination effects as a result of the development.

10 LANDSCAPE AND VISUAL IMPACT

10.1 Introduction

The first aspect to be considered is visual impacts focusing on the extent to which waste and wastewater facility will be seen, the potential loss of existing site features and the introduction of new site features. The second aspect is impacts on the character of the landscape, the changes the waste and wastewater will bring to the landscape in general, the impacts of those changes upon views from the surrounding area and examining responses which are felt towards the combined effects of the development. This latter topic is complex because it encompasses many other environmental topics such as ecology, archaeology and architectural history and because attempts to scientifically measure feelings and perceptions are not universally reliable.

10.2 Study Methodology

This Chapter of the EIAR has been carried out in accordance with the Guidelines on Information to be Contained in an Environmental Impact Statements (EPA 2002) and Advice Notes on Current Practice (in preparation of Environmental Impact Statements) (EPA 2003). It also draws upon best practice contained in the "Guidelines for Landscape and Visual Impact Assessment" (third edition, 2013) published by Institute for Environmental Management and Assessment (IEMA) in conjunction with the Landscape Institute. An initial desk study was undertaken to establish an understanding of the site and surroundings, its planning history and context and to make an initial assessment of the likely visual envelope i.e. areas from which the site might be seen. Relevant maps, development plans and other published documents were used for this purpose and are referenced at the end of this report.

The sites and their surroundings were the subject of a survey in April 2016, examining the nature of the local topography, vegetation, water bodies, land use, settlement patterns, transport corridors, and other features of the local landscape, considering the contribution that each component makes to local landscape character, and exploring the potential for views of the subject site from the surrounding area.

The potential impact of development on the landscape has been assessed with reference to the following landscape factors:

Context: This is a factual description of the site and its surroundings.

- Character: This identifies one or more distinct landscape units within the site and/or its surroundings and outlines the defining features of each landscape.
- Significance: Has any part of the local landscape been designated as 'high amenity' or something similar; is it a scarce or unique landscape; is it 'ordinary' or even 'derelict'?
- Vulnerability: How sensitive is the local landscape to changes? What type or extent of change is likely to be damaging to the landscape?
- Potential changes in character, visibility and land use patterns have been considered first, including indirect, secondary and cumulative impacts. This has given rise to proposed mitigation measures, and incorporated into the EIAR; these are included in the subsequent assessment of likely landscape and visual impacts.

Mitigating impacts on the landscape may include one or more of the following:

- Avoid, reduce or minimise development in sensitive or prominent landscapes;
- Avoid, reduce or minimise visually intrusive projects;
- Reduce and minimise the visibility of the project, avoid insensitive design;

- Development should seek to add value or character to a landscape.
-

Terminology

- 'Visual Intrusion': a proposed development may feature within in an existing view.
- 'Visual Obstruction': a proposed development may partly or completely obscure an existing view.

Degree of Impact:

- 'None': No material change to the landscape or view arises from the development.
- 'Imperceptible': Change is immeasurable with no bearing on a landscape or view.
- 'Low' ('Slight'): Measurable but insignificant change to the landscape or view.
- 'Moderate': Measurable change to the nature of a landscape or view.
- 'High' ('Significant'): Substantial change occurs to the landscape or view.
- 'Profound': The character or content of a view changes completely.

Nature of Impacts:

- 'Neutral' impacts arise where changes neither enhance nor detract from the landscape.
- 'Positive' impacts arise where changes improve or enhance the existing landscape.
- 'Negative' impacts arise where changes detract from the existing landscape.

Duration of impacts:

- 'Temporary': 1 year or less
- 'Short-term': 1-7 years
- 'Medium-term': 7-20 years
- 'Long-term': 20-50 years
- 'Permanent': 50+ years

The significance of impacts on the landscape depends on a broad range of objective factors as outlined above, but can also depend on more subjective value judgments about 'good design' and how much changes will matter.

10.3 Existing Environment

10.3.1 General description of site and environs

The proposed site is currently a disused area with the Mater Campus. Existing temporary buildings on site are of similar scale of greater height compared to the proposed development.

Development Plan Context

The county development plans are as follows: - Dublin City Development Plan 2016-2022 (hereafter 'the Dublin CDP'). The proposed development is not located on any proposed green route under the Dublin CDP.

The urban character consist of individual buildings, streets (both vibrant and sedate), urban spaces, neighbourhoods and landscapes. New development is required to respect the unique character of the city by taking account of the intrinsic value of the built heritage, landscape and natural environment. There are no protected views in the vicinity of the proposed development. The site is located in Z15: Institutional and Community Use.

MMUH:

The following are an indicative list of Permissible Uses
Buildings for the health, safety and welfare of the public, Childcare facility, Community facility, Cultural/recreational building and uses, Education, Medical and related consultants, Open space, Place of public worship, Public service installation, Residential institution.

Open for Consideration Uses
Bed and Breakfast, Car park ancillary to main use, Conference Centre, Funeral home, Guest house, Hostel, Hotel, Municipal golf course, Residential, Student accommodation, Training centre.

Landscape
Landscape Conservation Areas (LCAs) can be made by order for the preservation of the landscape. There are no LCAs within the city administrative area. However the Phoenix Park, the North Bull Island, the Botanic Gardens and St Anne's Park are under consideration for this designation.

10.3.2 Local Area Plan (LAP)

The waste and wastewater facility and MMUH are located in the Phibsborough Mountjoy LAP.

A number of dwellings are zoned residential conservation areas in the Development Plan, with an objective (Objective Z2) 'To Protect and/or improve the amenities of Residential Conservation Areas'. Good examples of early Victorian and late Georgian terraces along the main thoroughfares are also included on the Record of Protected Structures. Further protected Georgian terraces of three and four-storeys can be found where the Georgian city centre extends into the south-east section of the LAP area.

Most of these terraces on Blessington Street, Eccles Street and Synnott Place are zoned Z8 in the Development Plan, with an objective 'To Protect the existing architectural and civic design character, and to allow only for limited expansion consistent with the conservation objective'. No protected Georgian terraces are located in the vicinity of the proposed development or along the North Circular Road at the proposed development.

The following policies are relevant to the proposed development.

C1 Support the development of the Mater Hospital to provide world class general hospital services with a local and national function

10.3.3 Natural Heritage

The Dublin CDP also acknowledges that change in the landscape is necessary to accommodate needs while balance must also be sought to avoid detrimental effects on natural heritage and biodiversity. No natural heritage features are located in the vicinity of the proposed development.

10.3.4 Built Heritage & Archaeology

An Architectural Heritage assessment was undertaken as part of the EIAR. This is included in Appendix 10.1. Elsewhere, a small selection of houses, listed as protected structures are located in the area, though the waste and wastewater facility do not form part of the immediate environs of any of these and all appear to lie outside the visual influence of the proposed site.

10.3.5 Views & Prospects

There are no Scenic Routes or Views and Prospects identified in the Dublin CDP in the vicinity of the waste and wastewater facility, though policy is outlined in section 4 of the CDP with policies stated in GI07 and GI08.

10.4 Characteristics of the Development

This Volume of the EIAR is prepared for a development comprising the waste and wastewater treatment facility. The proposed development is located to the north of the Mater Campus, 30m south of the North Circular Road.

The Wastewater Treatment Plant and associated infrastructure will treat human health care risk waste and hospital wastewater for an estimated to 4,000 Population Equivalent (PE) on a 0.08 Ha site. The proposed development comprises (a) 1 No. Hydrolysis tank, 5 sq.m., with a maximum height of 6 m; (b) a 78 sq.m, Membrane Bioreactor Building with a maximum height of 6; (c) an Anaerobic Digestor, 37 sq.m with a maximum height of 6 m (c) 1 No. Treatment Building 180 sq.m., with a maximum height of 7 m and other works necessary to facilitate the proposed development.

10.5 Potential Impacts

This section provides a description of the potential specific, direct and indirect, impacts that the waste and wastewater facility may have on visual amenity and landscape character. This is provided with reference to both the Receiving Environment and Characteristics of the Development sections while also referring to the (i) magnitude and intensity, (ii) integrity, (iii) duration and (iv) probability of impacts. Impact assessment addresses direct, indirect, secondary, cumulative, short, medium and long-term permanent, temporary, positive and negative effects as well as impact interactions.

10.5.1 Impacts on Visual Amenity

Visual impacts may potentially arise from the waste and wastewater: mainly from the operational activities. Based on the limited view so the proposed facility within the hospital the visual impacts are not significant.

10.5.2 Impacts on Landscape Character

There is a high level of screening afforded between public vantage points; there is an established impact upon landscape character due to existing buildings on site. Therefore, the impact on landscape character is neutral. Therefore, upon final restoration, there is the potential for a significant positive impact upon landscape character.

10.6 Do Nothing Impact

If the proposed Waste and Wastewater treatment does not occur the site will remain as is. The Mater waste and wastewater treatment would be disposed of through the current streams. The current disposal route for HHRW is incineration. The current disposal route for wastewater is the public sewer network and Ringsend Wastewater treatment plant.

10.7 Avoidance, Remedial And Mitigation Measures

There is limited scope for avoidance of existing/ongoing impacts arising from the development. The principal means of avoiding landscape and visual amenity impacts or remedial measures are: - -

securing and maintaining existing vegetation/walls that screens the activities upon them from the surrounding area - identifying where the greatest visual impacts are likely to occur and providing screening (temporary or permanent) by way of planting and/or earthworks;.

10.8 Predicted Impacts

The high level of screening afforded by surrounding walls and existing buildings, allow the proposed waste and wastewater operations to occur with very few negative impacts upon the visual amenity of the surrounding areas. There are no significant in combination effects as a result of the development.

10.9 Monitoring

No monitoring is proposed in terms of impacts on landscape character and visual amenity.

11 CLIMATE

11.1 Introduction

This section describes the meteorological conditions and potential emissions associated with the waste and wastewater activities that have the potential to affect on the climate, through the release of 'greenhouse' gases (GHGs).

Examination for potential emissions from the waste and wastewater has been assessed in Chapter 5.

No other releases are anticipated that can lead to other regional or global climatic impact issues such as ozone depletion.

11.2 Potential Impacts

11.2.1 Meteorological Conditions

The landscapes in the environs of the proposed development are flat lying. The prevailing wind is from the southwest.

The nearest meteorological station in the area is the Met Éireann Synoptic Station in Dublin Airport which is 7.5km north of the proposed development.

The 30 year average (1981-2010) for the Dublin Airport Synoptic Station is presented below:
Mean Temperature: 9.7^0C;
Mean Relative Humidity (@ 0900UTC %): 82
Mean Daily Sunshine Duration (Hours): 3.9
Mean Annual Rainfall (mm): 758
Mean Potential Evapotranspiration (mm): 538
Mean Wind Speed (knots): 10

11.2.2 Global Warming

The main compounds considered to contribute to global warming are carbon dioxide (CO_2) and methane (CH_4). Other compounds have the potential to contribute to global warming but are generally released in much smaller quantities.

Global warming and the management of emissions with the potential to contribute to global warming are an increasingly important issue for Ireland. An international agreement was drawn up (the Kyoto Protocol) in response to rising emissions of the principal contributing compounds which has subsequently been ratified by the European Union.

Under the burden sharing agreement within the European Union to implement the Protocol, Ireland agreed to a limit of 13% above 1990 emission levels to be achieved between 2008 and 2012. By 2001, the level of global warming releases (CO_2 and CH_4) however had risen by 31% above the 1990 levels following a period of rapid economic growth.

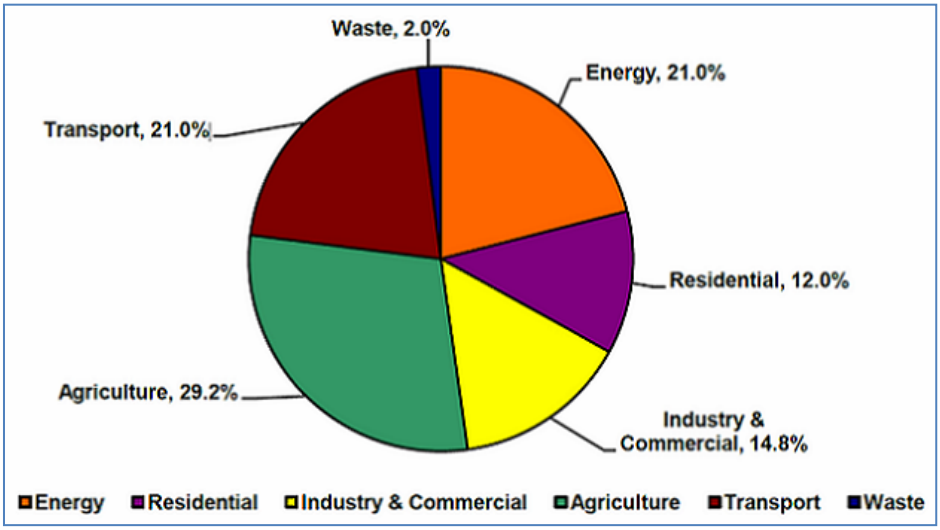


Figure 11-1 National CO_2 Emissions

In quantitative terms, Ireland's total allowable emissions in the period 2008-2012, known as the assigned amount, is 314.18 million tonnes (Mt) CO_2 equivalent, which corresponds to an average of 62.8 Mt annually for the five years. The latest data from the EPA shows that National greenhouse gas emissions were 7% over target in 2008 (i.e. 23% above 1990 levels). The EU has adopted a much more challenging reduction target for 2020. The European Union has committed itself to reducing its greenhouse gas emissions to 20% below 1990 levels by 2020. Ireland is unlikely to meet 2020 EU greenhouse gas emission targets for sectors including agriculture, transport, residential, commercial, non-energy intensive industry and waste.

Numerous initiatives are in place to reduce emission levels under the Government's National Climate Change Strategy and EU initiatives including the Emissions Trading Scheme.

Global warming has numerous potential implications for Irelands' environment including:

- Greater risk of seasonal flooding with an increased rainfall in winter and decrease in summer;
- Changes to habitats and ecosystems including the drying of peatlands; and
- Effects on sea and river levels and influence on water resources.

The Pharmafilter upstream or decentralized waste and wastewater treatment system offers significant benefits to the host hospital, the local community/municipality and the environment at large. The treatment unit is designed to meet the full decontamination requirements of the specific wastes generated in hospitals. This purpose built system has none of the gaps or potential failures of more general designs or methods. This provides the hospital with the ability to eliminate the hazardous element of all waste exported offsite. Therefore hazardous material is neither transported through the local community nor exported out of the country, as is currently the case with some healthcare risk wastes.

Given that most Irish hospitals are publically funded and are obliged to meet government commitments in relation to carbon emissions opportunities to reduce the carbon footprint of operations are being actively sought. As the system includes an anaerobic digestion element any organic fraction included in the waste stream is digested with the resulting biogas converted to energy. This digestion process coupled with the shredding of material has a dramatic effect on the physical volume of the remaining residue. As a result, the frequency of truck movements, servicing waste is reduced by approximately 50%.

The effect on transport, both national and international contributes to the hospitals carbon emission targets. In this context the Tonto's too have a positive impact on carbon emissions. Conventional bedpan washers are installed to sterilize reusable bedpans. A combination of hot water and chemical decontamination is used in bedpan washers and sluices. The Tonto shredder is a cold-water process only together with a relatively mild citric acid based disinfectant. It can take this approach as decontamination for reuse is not required.

11.3 Do Nothing Scenario

If the proposed Waste and Wastewater treatment does not occur the site will remain as is. The Mater waste and wastewater treatment would be disposed of through the current streams. The current disposal route for HHRW is incineration. The current disposal route for wastewater is the public sewer network and Ringsend Wastewater treatment plant.

11.4 Predicted Impact

The only predicted impacts will be associated with reduced emissions from HGVs and from onsite vehicles at the waste and wastewater site. This is addressed in Section 11 of this Volume of the EIAR.

11.5 Mitigation Measures

Vehicle emissions will be reduced by approximately 50%. At present the HHRW is exported for incineration in mainland Europe. Releases from HCV movements and the waste and wastewater area will therefore be reduced.

There are no significant in combination effects as a result of the development.

12 CULTURAL & ARCHAEOLOGICAL HERITAGE

12.1 Introduction

This Environmental Impact Assessment Report (EIAR) prepared on behalf of MMUH has been undertaken to assess the significant effects, if any, on the cultural heritage, archaeology and architecture which have occurred or are occurring or can reasonably be expected to occur because of Waste and Wastewater treatment carried out by the applicant. A wide variety of paper, cartographic, photographic and archival sources was consulted.

This study is an assessment of the known or potential cultural heritage resource within a specified area consisting of a collation of existing written and graphic information in order to identify the likely context, character, significance and sensitivity of the known or potential resource using an appropriate methodology (EPA 2002 and 2003).

The study involved detailed investigation of the cultural heritage including the archaeological, architectural and historical background of the areas. These areas were examined using information from the:

Record of Monuments and Places (RMP) of Counties Dublin and Dublin;
Archaeological Survey Database;
Dublin City development 2016-22 incl the Records of Protected Structures;
Aerial photographs;
Excavation reports;
Cartographic; and
Documentary sources.

12.2 Methodology

This Environmental Impact Assessment Report (EIAR) prepared on behalf of Mater Misericordiae University Hospital has been undertaken to assess the significant effects, if any, of a proposed development of a Waste Water Treatment Plant on land in the grounds of the Mater Misericordiae University Hospital in North City Dublin. The development consists of a Wastewater Treatment Plant and associated infrastructure to treat waste and wastewater for an estimated to 4,000 Population Equivalent (PE) on a 0.08 Ha site. The proposed development comprises: (a) 1 no. Hydrolysis tank, 5 sq.m, with a maximum height of 6 m. (b) a 78 sq.m, Membrane Bioreactor Building with a maximum height of 6; (c) an Anaerobic Digestor, 37 sq.m with a maximum height of 6 m (c) 1 no. Treatment Building 180 sq.m, with a maximum height of 7 m and other works necessary to facilitate the proposed development. This application relates to a development which will require an IPPC licence. The site is accessed from the North Circular Road with existing protected structures within the Mater campus. No works to any of the protected structures within the subject site are proposed. A wide variety of paper, cartographic, photographic and archival sources was consulted.

This study is an assessment of the known or potential cultural heritage resource within a specified area consisting of a collation of existing written and graphic information in order to identify the likely context, character, significance and sensitivity of the known or potential resource using an appropriate methodology (EPA 2002 and 2003).

The study involved detailed investigation of the cultural heritage including the archaeological,

architectural and historical background of the proposed development site and the surrounding area is indicated on Fig 12.1. This area was examined using information from the:

- Record of Monuments and Places (RMP) of Dublin County Borough;
- Dublin City County Development Plan 2016-22 including the Record of Protected Structures;
- Aerial photographs;
- Excavation reports;
- Cartographic; and
- Documentary sources.

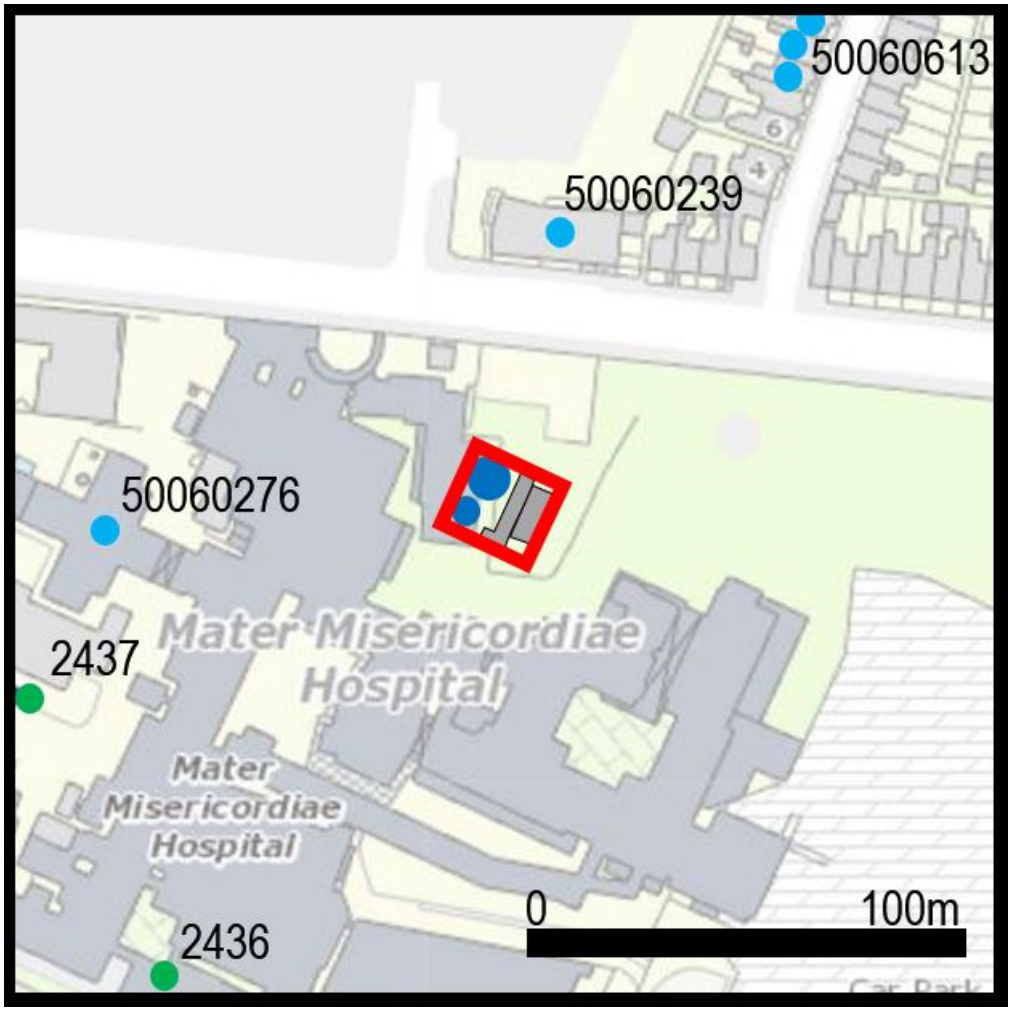


Figure 12-1 The study area superimposed on the Historic Environment Viewer maintained by the Department of Arts, Heritage, Rural Regional and Gaeltacht Affairs. The application area is indicated by the red line. Protected structures are indicated with green circles.

An impact assessment and mitigation strategy has been prepared. An impact assessment is undertaken to outline potential adverse impacts that the proposed development may have on the cultural resource, while a mitigation strategy is designed to avoid, reduce or offset such adverse impacts.

The assessment was prepared by Dr. Charles Mount who has more than twenty years of cultural heritage assessment experience. He holds B.A., M.A. and Ph.D. degrees in archaeology as well as a professional diploma in EIA and SEA Management and is a board member of the Institute of Archaeologists of Ireland.

12.3 Baseline Data: the Existing Cultural Heritage Environment

The Landscape
The application area is situated in North City Dublin on Eccles Street in the grounds of the Mater Misericordiae University Hospital. The application area has already been developed and the entire area is under buildings and tarmac.

12.3.1 Historical and archaeological development of the study area

The following is a brief summary of the archaeological and historical development of the study area and the main types of sites and monuments that are known from the surrounding area. The information is drawn from the assessment. It is intended to indicate the types of sites and monuments known to be present in the study area as well as the pattern of landholding and to place this material in its cultural heritage context. The application area is situated in Dublin North City, parish of St. George (originally St. Michans) and the barony of Coolock. Note the spellings of place names varied throughout history, the historical spellings are used here.

Prehistoric period
The nature of prehistoric activity in the area is unknown as there are no prehistoric sites known from the study area.

Early medieval period
In the Early Medieval period, the study area was situated in the Tuath of Tuirbe under the Ui Chormaic kings (MacCotter 2008, 165-66). Early Medieval settlement is usually associated with enclosed farmsteads known as Ringforts. There are no ringforts and no medieval settlement known in the study area.

The later medieval period
In the twelfth century the study area, which formed part of the Grange of Clonliffe, came into the hands of St. Mary's Abbey and was held by the Abbey as farmland until the sixteenth century (Ó Conbhuí 1961-3).

The post-medieval period
After the dissolution of St. Mary's Abbey in 1539 King Henry VIII leased the Grange of Clonliffe to Walter Pippard and soon after the lands came to the Earl of Desmond. In 1561 the Grange was leased by Matthew King and the lands were released to Henry King in 1611. In 1620 the lands passed to Sir Garret Moore Viscount Drogheda. In the Civil Survey of 1656 the Grange of Clonliffe is described as meadow, arable and pasture containing three stone houses and a water mill (Simington 1945, 179). The Moore's retained the Grange of Clonliffe until 1729-30 when the lands were purchased by Luke Gardiner. Gardiner's grandson, who became Lord Mountjoy in 1789, was killed at the battle of Ross in 1798 and the lands came to his son, the Earl of Blessington. After the Earl's death in 1829 the estate was encumbered with debt and was eventually auctioned in 1846 (Ó Conbhuí 1961-3, 31-2). Examination of John Rocque's 1757 map of Dublin indicates that the study area remained as farmland at that time. In the first edition Ordnance Survey mapping of 1836 the application area appears as a

long narrow undeveloped field. The Mater Misericordiae Hospital was subsequently built in fields of the south-west of the application area in 1855-61.

Buildings

Designated structures

The Dublin City Development Plan 2015-22 was examined as part of the baseline study for this section of the EIAR. The review established that there are no structures listed in the Dublin City Record of Protected Structures situated in the application area. There are two Protected Structures situated within the study area (see below).

No.	2437
Structure type	*Hospital*
Townland	-
Designation	Protected Structure RPS No. 2437
Data source	Dublin City Development Plan 2016-22
Perceived Significance:	National
Type of impact:	None. This structure is situated 39 m south-west of the application area.
Significance & quality of impact	None
Description	Detached multiple-bay two-storey hospital over raised basement, built c.1855-61, having advanced and pedimented entrance block with tetrastyle portico, advanced pavilions to end bays to front (south) elevation and bowed bay to rear elevation. East wing built c.1872. West wing comprising multiple-bay two-storey block over raised basement, with advanced breakfront to centre and advanced pavilions to end bays built c.1886. North wing and chapel built c.1937. Pitched slate and artificial slate roof hidden behind granite parapet, and granite coping and ashlar granite chimneystacks. Ashlar granite walls to front elevation with dressed granite string courses with corbelled eaves course to pavilions. Snecked limestone walls to west elevation with limestone string courses having ashlar granite walls with granite string courses and corbelled eaves course to central breakfront and advanced pavilions to end bays. Snecked limestone walls to courtyard. Segmental, square and round-headed window openings to front elevation, with moulded granite sills and timber sliding sash windows, basement openings having dressed granite voussoirs and reveals, ground floor having pediments with moulded granite surrounds and keystones, first floor having moulded granite surrounds and keystones. Openings to basement of pavilions have granite block-and-start surrounds and keystones and those to ground and first floor of pavilions have dressed granite voussoirs, reveals and aprons. Entrance block with raised portico having Ionic columns and Ionic pilasters to east and west ends supporting frieze with raised lettering and pediment with dentillated cornice, round-headed Venetian windows to raised ground floor with dressed granite voussoirs and reveals and continuous granite sill, square-headed window openings with moulded granite surrounds to first floor, recessed square-headed door opening with moulded granite surround, timber panelled double-leaf door with plain over-lights and granite perron. Sandstone balusters on granite plinth with dressed granite coping to front (south) and snecked limestone boundary wall with moulded limestone coping to west. Forms part of larger hospital complex which includes chapel and Nos 30-36 Eccles Street.
Mitigation proposal	No mitigation required
Illustration	-

No.	2436
Structure type	House
Townland	-
Designation	Protected Structure RPS No. 2436
Data source	Dublin City Development Plan 2016-22
Perceived Significance:	National
Type of impact:	None. This structure is situated 119 m south-west of the application area.
Significance & quality of impact	None
Description	Attached three-bay four-storey former house over basement, built c.1795, having single-bay two-storey addition with integral carriage arch, attached to east, linking with neighbouring building to east; formerly used as nursing home and now in use as clinic. Single-span pitched artificial slate roof. Cement rendered and brick chimneystacks with yellow clay pots. Rendered walls to upper floors with rendered string courses over channelled rendered walls to ground floor and granite plinth course over rendered walls to basement. Rendered quoins to east and west ends. Square-headed window openings with rendered reveals, granite sills and replacement timber casement windows, ground floor having channelled rendered surrounds and first floor having lugged and kneed rendered surrounds and keystones. Segmental-headed carriage arch with rendered voussoirs, parapet and having round-headed window opening with lugged and kneed rendered surround and keystone, granite sill and multiple-pane original timber window with stained glass to margins. Round-headed door opening with six-panelled timber door, flanked by rendered reveals, engaged Ionic columns on block bases supporting fluted frieze and cornice with cobweb fanlight over and channelled rendered surround. Limestone platform with cast-iron boot-scraper, and limestone steps. Wrought-iron railings on moulded granite plinth to basement area. Cast-iron coal-hole cover in granite slab to pavement. Part of coherent terrace with that abutting to east, forming part of Mater Hospital complex.
Mitigation proposal	No mitigation required
Illustration	-

Non-designated structures

The National Inventory of Architectural Heritage (NIAH) was examined. The review established that there are no additional structures listed in the NIAH situated within the application area. There are three additional structures listed within the study area.

No.	50060276
Structure type	Chapel
Townland	Dublin City
Designation	None
Data source	NIAH No. 50060276
Perceived Significance:	Regional
Type of impact:	None. This structure is situated 60 m south-west of the application area.

Significance & quality of impact	None
Description	Attached Catholic chapel, built 1886 and modified 1935-7, with five-bay nave, shallow three-bay pedimented transepts and two-bay chancel. Pitched slate roof with cast-iron rainwater goods and base of crossing. Snecked limestone walls with dressed granite string course, plinth course and quoins. Ashlar granite to gable wall of transepts with engaged Doric pilasters on continuous granite string course supporting granite frieze and cornice over snecked limestone walls with granite quoins. Round-headed openings with dressed granite block-and-start surrounds and keystones, granite sills and nine-over-six pane timber sliding sash windows. Segmental-headed openings to lower level of chancel with dressed granite block-and-start surrounds and keystones, granite sills and six-over-six pane timber sash windows. Round-headed openings with chamfered granite surround, flush granite sill, carved granite swags and garlands over and timber sliding sash windows to gable walls of transepts. Segmental-headed door openings to transepts with dressed granite block-and-start surrounds and keystones, granite lintel, timber panelled doors and plain over-lights. Snecked granite wall with mild steel vehicular gates with ashlar granite piers to north. Forms part of larger hospital complex which includes Mater Hospital main building to south.
Mitigation proposal	No mitigation required
Illustration	-

No.	**50060239**
Structure type	Police Station
Townland	Dublin City
Designation	None
Data source	NIAH No. 50060239
Perceived Significance:	Regional
Type of impact:	None. This structure is situated 42 m north of the application area.
Significance & quality of impact	None
Description	Detached three-bay three-storey police station over raised basement, built c.1900. With lower single- and two-storey range with gabled end bays to west end. Now in use as Garda station Flat roof hidden behind brick parapet with concrete coping, stepped red brick chimneystacks with clay pots and cast-iron rainwater goods. Pitched slate roof with louvered lanterns to west end. Red brick walls laid in English Garden Wall bond with moulded brick string courses and dentillated cornice with granite plinth course over red brick walls to basement. Square-headed openings with red brick voussoirs and reveals and granite sills to basement. Segmental-headed window openings having bull-nosed brick voussoirs and reveals, granite sills and brick aprons to ground and first floor. Segmental-headed window openings with red brick voussoirs and reveals, granite sills to second floor. All with one-over-one pane timber sliding sash windows. Segmental-headed porch opening with bull-nosed brick surround with granite keystone, granite

	kneeler stones and pediment. Recessed square-headed opening with timber panelled door and plain glass sidelights and overlight. Granite platform and granite steps with cast-iron handrail. Cast-iron railings on moulded granite plinth to basement area to front. Round-headed openings with dressed granite block-and-start surrounds and keystones, granite sills and nine-over-six pane timber sliding sash windows. Segmental-headed openings to lower level of chancel with dressed granite block-and-start surrounds and keystones, granite sills and six-over-six pane timber sash windows. Round-headed openings with chamfered granite surround, flush granite sill, carved granite swags and garlands over and timber sliding sash windows to gable walls of transepts. Segmental-headed door openings to transepts with dressed granite block-and-start surrounds and keystones, granite lintel, timber panelled doors and plain over-lights. Snecked granite wall with mild steel vehicular gates with ashlar granite piers to north. Forms part of larger hospital complex which includes Mater Hospital main building to south.
Mitigation proposal	No mitigation required
Illustration	-

No.	**50060613**
Structure type	House
Townland	Dublin City
Designation	None
Data source	NIAH No. 50060613
Perceived Significance:	Local
Type of impact:	None. This structure is situated 97 m north-east of the application area.
Significance & quality of impact	None
Description	Terrace comprising seventeen two-bay single-storey over basement red brick houses, built c.1880, with returns and extensions to rear. M-profiled artificial slate roofs, south end-terrace hipped, with grey angled ridge-tiles, yellow brick corbels to eaves, and generally ogee cast-iron rainwater goods. Red brick chimneystacks with copings and clay pots, and some replacement pots and rebuilt chimneystacks. Walling is generally red brick laid to Flemish bond over offset painted and rendered granite plinth and basement. No. 24 façade rendered and painted. Full-height canted-bay windows with square-headed window openings, polychromatic brick voussoirs and continuous granite sills. Windows are replacement uPVC or timber sliding sash replacements; some original one-over-one pane and two-over-two sashes remain. Former diminutive opening to basement generally infilled; few have wire mesh or fixed timber window. Round-headed door openings with polychromatic/painted brick voussoirs, accessed via granite steps and platform. Doorcases generally comprise panelled pilasters, foliate consoles, with moulded cornice and fanlight; some have had elements removed or modern replacements inserted. Generally modern timber doors, with some bolection-moulded four-panelled timber doors remaining. Set back from pavement behind largely matching cast-iron railings over stone plinth, having some modern railing inserts. Later two-storey terrace abuts to

	southwestern end of street, plainer terrace of two-storey red brick houses to northeastern end.
Mitigation proposal	No mitigation required
Illustration	-

12.4 Impacts

All of the structures included in the Record of Protected Structures are situated more than 39 m away from the application area and are considered too far distant to be directly or indirectly impacted. All of the structures included in the NIAH are situated more than 40 m away from the application area and are considered too far distant to be directly or indirectly impacted. The application area contains disused temporary buildings which previously housed the former out patients Department. In his Conservation Report on the proposed development Slattery (2015) concluded that the existing buildings in the application area are not considered significant and that impacts on the Protected Structures are considered minimal. Impacts of the proposed development will have no direct or indirect impacts on any Protected Structures or any structures of heritage interest.

Archaeological Assessment

Recorded Monuments
Examination of the Record of Monuments and Places for Co. Dublin indicated that there are no Recorded Monuments situated within the application area. There are no Recorded Monuments situated within the study area.

Non-designated monuments
Examination of the Sites and Monuments Record (SMR) which is maintained by the Dept. of Arts, Heritage, Rural, Regional and Gaeltacht Affairs on 18 April 2017 indicated that there are no additional undesignated monuments located within the study area.

Cartographic Sources
John Rocque's map of 1757 and the Ordnance Survey 1st and 3rd edition six-inch maps of the area were examined. This analysis did not indicate any previously unrecorded archaeological sites or monuments in the application area.

Place Name Evidence
The place names were extracted from the cartography in order to facilitate the search for structures and monuments and small finds, to help identify any unrecorded monuments or structures, to search for any published papers and documents related to the study area and to assist in the study of the historical development of the area. The English translations of the townland names of the study presented below are based on the Placenames Database of Ireland. The placename refers to land use and there are no monuments indicated within the application area.

Clonliffe	The meadow of herbs

Aerial Photographs
Examination of the Ordnance Survey 1995, 2000 and 2005 imagery as well as Google Earth imagery from 2002, 2003, 2004, 2005, 2006, 2008, 2009, 2013, 2014, 2015 and 2016 and Microsoft Bing Imagery from 2011 did not indicate any additional cultural heritage sites.

Other sources
Examination of archaeological corpus works on prehistoric artefacts (Harbison 1969, Eogan 1965, 1983, 2000, Kavanagh 1991, Simpson 1990), and pottery (O' Ríordáin and Waddell 1993) and Iron Age material (Raftery 1984) did not reveal any additional archaeological material in the study area.

Excavations and investigations in the study area
Examinations of the Excavations Bulletin www.excavations.ie indicated that there have been five archaeological excavations and investigations carried out in the study area in and around the grounds of the Mater Hospital. No pre-17th-century material has been found in any of the investigations.

THE MATER HOSPITAL, NORTH CIRCULAR ROAD, DUBLIN 02E0960
Linzi Simpson
The assessment was carried out in the grounds of the Mater Hospital, on the North Circular Road side, after human bones were found during the excavation of an engineering test-pit against the base of a 19th-century limestone wall. The hospital was opened by the Sisters of Mercy in 1852 and is now one of the largest hospitals in Dublin. The remains were dated by ceramic evidence to the 19th century and consisted of long bones, at least two of which were sawn (suggesting that they were associated with the hospital). Three test-pits were then excavated along the base of the wall, each of which revealed additional bones, some of which were also sawn. Their location, however, was confined to the foundation trench of the wall, suggesting that they were dumped when the wall was under construction. Although the bones may have been the result of anatomical studies, they appeared to be mostly limbs and digits, which may suggest that they were the result of amputations.

MATER CAMPUS HOSPITAL DEVELOPMENT, ECCLES STREET, DUBLIN DU018–020 08E0970
Melanie McQuade, Margaret Gowen & Co. Ltd
Monitoring of geotechnical test-pits on the site of the proposed Metro North stop at the Mater Hospital and bulk excavation on the site of the Mater Campus Hospital Development were carried out under the same licence.

The Metro stop is located to the west of Leo Street and five geotechnical pits were dug there. The pits were 0.3 m by 0.3 m and were hand dug to a depth of 1.2 m. Made-ground and garden soils were exposed at the base of the pits. Closed cores were mechanically dug within these pits and subsoil was encountered between 1.7 m and 1.98 m below present ground. Fragments of late 19th-century ceramics were evident in the test-pits but no archaeological features were identified.
Monitoring of excavation works on the Eccles Street side of the Mater Campus Hospital Development recorded between 0.5–0.7 m of post-medieval fill overlying natural subsoil. The subsoil was tan brown silty clay. No archaeological features have been uncovered to date, but further monitoring is scheduled.

Bulk excavation works associated with the hospital development were monitored. A previously demolished nurses' home covered much of the northern end of the site and an underground service tunnel running east–west across the centre of the site and north–south from the northern end of the site was removed during the course of works. The energy centre building which occupied the north-eastern end of the site had a number of underground oil tanks beneath it. The foundations and basement floor levels of these buildings were cut into the subsoil at depths of between 0.8 m and 2 m below the existing ground level along North Circular Road and together with their associated services they had caused much ground disturbance and would have removed most of the archaeological material that may have existed on this part of the site. However, an area of post-medieval garden soil was identified on the southern end of the site and a series of north–south-orientated linear features were recorded on the north-western end of the site.

The garden soil on the southern end of the site occupied the garden area to the rear of the houses on Eccles Street and may pre-date the construction of these late 18th/early 19th-century structures. A series of four linear furrows, a drainage ditch and two large pits were identified cutting into that post-medieval garden soil c. 1 m below the existing ground level. The furrows and the drainage ditch on the southern end of the site were aligned along a similar north–south axis to the property boundaries evident on the historic maps, which may infer that they are contemporary, dating from the late 18th century. The furrows were an average of 0.3 m wide and were set at intervals of c. 4.5 m. The drainage ditch was set to the west of the furrows and was 13.5 m long, 0.8 m wide and 0.3 m deep. One of the large pits was cut into the garden soil and the other cut the drainage ditch. The ceramic finds recovered from these features date between the 17th and 19th centuries. The earlier pieces were found alongside 18th-century wares and it is likely that the 17th-century material represents a reworking of earlier deposits in the vicinity.

A north–south-orientated ditch on the north of the site was 1.45 m wide by 0.15 m deep. Its fill contained 18th/19th-century ceramics and glass. Two smaller linear drainage features were located towards the centre of the site. These were just 0.5 m wide.

No pre-17th-century finds were identified during the monitoring programme and there was no evidence for activity on the site prior to the post-medieval period. Thus the archaeological evidence corresponds with the cartographic information, indicating that the site was not developed prior to the late 18th/early 19th century.

MATER HOSPITAL, ECCLES STREET 11E0411
Eoin Halpin and Garrett Sheehan
The site under development is located within the grounds of the Mater Hospital, Eccles Street, Dublin City, and it is proposed to construct a ramp running from Eccles Street across the existing car park to connect to an existing underground car park. The ramp will measure 72 m long and 25 m wide and will have a maximum depth of 4.5 m. There are no recorded archaeological monuments in the immediate vicinity of the proposed works. The nearest monument is a house (DU018-023) of indeterminate date located 200m to the north-east of the proposed works.

Monitoring of these works commenced on 10 October 2011 and continued, periodically, into early 2012. Directly underlying the old car park surface was approximately 1–1.6 m of loose mixed overburden, containing large amounts of red brick and mortared stone, with frequent service trenches containing ducting cut through it. This overburden deposit, which was thickest towards the southern end of the site, clearly contained a large amount of building debris from demolished structures of 18th-, 19th- and 20th-century date. This overlay a 0.05–0.6 m-thick layer of light grey-brown silty clay soil, with occasional shell fragments, which contained pottery sherds of post-medieval date. The underlying natural subsoil consisted of light brown/yellow sandy clay.

A circular well was identified at the northern end of the old car park area, which was directly overlain by the foundations of two parallel, east–west-running concrete walls. The well was not previously backfilled and still contained standing water, although no covering was found. As soon as the well was uncovered during the demolition of the concrete wall foundations, however, it immediately began to fill with collapsed debris, rendering investigation by hand hazardous. From what could be determined, the well lining appeared to be of relatively evenly coursed drystone construction within a circular cut measuring 1.6 m in diameter and in excess of 2 m in depth. A thin deposit of light–mid-brown silty clay soil was visible between the well cut and lining, in which occasional small fragments of red brick were visible. The top of the well was uncovered at a height of 14.6 m OD. A broadly north–south-running drain of mortared red and yellow brick construction, with a slate covering, was identified, running from the north-western corner of the site, at the same height as the well surface. The drain, which was

traced along the length of the site running towards Eccles Street, measured 0.56 m in external width and approximately 0.6 m in depth.

MATER HOSPITAL, ECCLES STREET 11E0411
Eoin Halpin and Garrett Sheehan
Monitoring of groundworks associated with the construction of an access ramp was carried out intermittently between Oct 2011 and Feb 2012 (see also Excavations 2011, No. 193). The ramp measures 72 m by 25 m with maximum excavation at 4.5 m below present ground level and runs from Eccles Street across an existing car park to connect with an existing underground car park.

Immediately underlying the old carpark surface was a layer of loose mixed overburden, 0.6–1.5 m thick. This contained a large quantity of red brick and mortared stone – building debris from demolished structures of 18th–20th-century in date. This layer was criss-crossed with modern service trenches and a considerable quantity of cobblestones was noted amongst the debris, towards the northerly end of the site.

Underlying the overburden was a layer of light grey brown silty clay, 0.05–0.6 m thick. This contained occasional inclusions of shell and post-medieval pottery. In general, it immediately overlay subsoil.

Two subsoil-cut features were identified, a circular well and a north–south running drain as well as a number of east–west running plough marks.

The well was located at the northern end of the carpark, directly overlain with the foundations of two parallel, east–west running concrete walls. The well had not been filled in after falling out of use and still contained standing water, though no covering was found. As soon as the overlying concrete walls were being demolished, the well filled with collapsed debris rendering any close investigation extremely hazardous. From what could be determined was that the well was constructed from relatively evenly coursed dry stone walling within a cut some 1.6 m in diameter and in excess of 2 m deep. A thin deposit of light-mid brown silty clay was visible between the walling and well cut, containing occasional small fragments of red brick. The top of the well was uncovered at a height of 14.6 m OD.

The drain was identified below the overburden layer, cutting into subsoil. It was constructed from red and yellow brick, with a slate covering. It ran from the north-western corner of the site and could be traced for approximately half way along the area of construction, towards Eccles Street. The drain measured 0.56 m in external width, 0.32 m in internal width and c. 0.6 m in depth.

The well is likely to be of 18th-century date and would have been located in the rear plots of the buildings fronting onto what was then Stable Lane (now Eccles Place) or if it predated the mid-18th century, relates to the site when being used for agriculture.

The location of a concentration of cobbles in the overburden at the northern end of the site suggests that Stable Lane was originally of cobble construction.

The drain was aligned with the plot boundaries depicted on the 1st and 2nd edition OS maps and appears to follow a pathway marked in a rear garden of a house fronting onto Eccles Lane Lower, on the OS map of 1847.

MATER MISERICORDIAE HOSPITAL, ECCLES STREET, DUBLIN 11E0458
James Hession
Archaeological investigations (test trenching and monitoring) and an excavation were undertaken at

the Metro North Mater Stop Box Site (MN106), Mater Misericordiae Hospital Campus (Mater Hospital), Eccles Street, Phibsborough, Dublin 7. The work was undertaken to facilitate the construction of the diaphragm wall elements of the Metro North Mater Stop Box, in advance of the opening of the Mater Adult Hospital which is currently under construction. These works were undertaken for BAM Contractors Ltd. on behalf of the Railway Procurement Agency (RPA) between 9 January and 22 February 2012 in accordance with the Metro North Archaeological Strategy.

The proposed Metro North Mater Stop consists of an underground station structure (Box) constructed using diaphragm walls ('D-walls') that will be located beneath the proposed forecourt of the new Mater Adult Hospital (Mater Stop Box). The proposed Mater Stop Box will run south to north between Eccles Street and the North Circular Road. The underground structure will consist of two sections: the Main Box and the Second Entrance. On its western side the external wall of the Main Box will be located in close proximity to the building line of the Mater Adult Hospital. On its eastern side the external wall of the Main Box abuts the rear of the residential properties on Leo Street. The Second Entrance will be a subsidiary structure required to house the proposed southern pedestrian entrance to the Mater Stop Box and will be located within the future basement structure of the proposed National Children's Hospital of Ireland.

Test trenching was carried out between 9 and 12 January 2012. A total of six test trenches were excavated across the site. Two features of possible archaeological merit were identified and after consultation and agreement between the RPA Project Archaeologist and the National Monuments Service, Dept. of Arts Heritage and Gaeltacht, it was agreed that these features would be the subject of an excavation undertaken in parallel with the programme of monitoring at the site.

Monitoring of ground reduction works was undertaken between 10 January and 22 February 2012 as required by the construction programme at the site. This work was undertaken in tandem with both the testing and excavation and comprised the monitoring of site investigations test pits and the monitoring of bulk ground reduction works. No additional archaeological features or deposits, to those identified by the testing, were identified during the monitoring programme.

Full excavation of the features identified through testing was undertaken at the site between 25 January and 1 February 2012. The excavation confirmed that only one of the two features was of archaeological significance. This feature is interpreted as an 18th- or 19th-century culvert, and is believed to have functioned in the removal of water. The timber recovered from the culvert was identified as spruce, a non-native species to Ireland that was largely imported to the country during the 19th century; although this species was known to be included in private plantations from the early 18th century. The culvert is likely to be associated with a group of buildings depicted on the 1st edition OS map of 1837, which front onto a small laneway to the north of Stable Lane. The ceramic and glass assemblage recovered from the excavation supports an 18th- to 19th-century date for the construction and subsequent demolition of the culvert. The domestic nature of both these assemblages suggests that the area was largely residential during this period.

12.5 Significant Impacts

Direct impacts

There are no impacts on any known items of cultural heritage, archaeology or buildings of heritage interest in the application area or the vicinity.

Indirect impacts

There are no indirect impacts on any known items of cultural heritage, archaeology or buildings of

heritage interest in the application area or the vicinity. There are no significant in combination effects as a result of the development.

Interaction with other impacts
No interactions were identified during the assessment.

'Worst case' impact
No worst case scenario has been identified.

12.6 Mitigation Measures

Direct impacts
No direct impacts have been identified and no mitigation is required.

Indirect Impacts
No indirect impacts have been identified and no mitigation is required.

12.7 References

DAHGI 1998. Recorded Monuments Protected under Section 12 of the National Monuments (Amendment) Act, 1994. County Dublin.

Eogan, G. 1965. *Catalogue of Irish Bronze Swords.* Dublin.

Eogan, G. 1983. *Hoards of the Irish Later Bronze Age*. Dublin.

Eogan, G. 2000. *The Socketed Bronze Axes in Ireland*. Prähistorische Bronzefunde, abteilung IX, band 22.

EPA 2002. *Guidelines on the information to be contained in Environmental Impact Assessment Reports.*

EPA 2003. *Advice Notes on Current Practice (in the preparation of Environmental Impact Assessment Reports*).

Harbison, P. 1969. *The axes of the Early Bronze Age in Ireland.* Prähistorische Bronzefunde, abteilung IX, band 1.

Heritage Council 1999. *The role of the Heritage Council in the Planning Process.* Kilkenny.

Lewis, S. 1837. *Topographical Dictionary of Ireland.* London.

MacCotter, P. 2008. *Medieval Ireland.* Dublin.

Ó Conbhuí, C. 1961-3. The Lands of St. Mary's Abbey, Dublin. *Royal Irish Academy. Section C,* 21-86.

O'Flaherty, R. 1995. "An analysis of Irish Early Bronze Hoards containing copper or bronze objects." *Journal of the Royal Society of Antiquaries* 125, 10-45.

Ó Ríordáin, B and Waddell J. 1993. *The Funerary Bowls and vases of the Irish Bronze Age.* Galway.
Otway-Ruthven, A.J. 1980. *A History of Medieval Ireland*. London.

Raftery, B. 1984. *La Tène in Ireland*. Marburg.

Simington, R. C. 1945. *The Civil Survey of County Dublin.* Dublin.

Slattery, D. 2015. Conservation Report: Observations on the Architectural/Historic Significance the Mater Hospital, Eccles Street, Dublin 1 (a Protected Structure) and on the Impact of the Proposal to Demolish Former OPD Temporary Structures Construct a New Waste Water Treatment Plant. Unpublished report for Tobin Consulting Engineers.

Waddell, J. 1990. *The Bronze Age burials of Ireland*. Galway

Waddell, J. 1998. *The Prehistoric Archaeology of Ireland*. Galway.

13 TRAFFIC

13.1 Introduction

This chapter of this environmental impact statement presents a traffic assessment of the proposed waste and wastewater facility operated by Pharmafilter/MMUH. The proposed development will reduce the overall number of truck movements from the site.

In preparing this report, TOBIN has made reference to the following:

- The National Roads Authority 'Traffic and Transport Assessment Guidelines 2007';
- The National Roads Authority Design Manual for Roads and Bridges (NRA DMRB);
- The National Roads Authority Design Urban Roads & Streets (NRA DMURS);
- An Foras Forbartha - RT180 Geometric Design Guidelines; and
- Dublin City Development Plan 2016-2022.

13.2 Existing Environment

The site forming part of the operations is located to the south of the North Circular Road in Dublin 7. Access to this wastewater facility is via an existing access point to the North Circular Road (R101). The R101 road is approximately 10.2 m in width at the entrance location and the entrance is located within an 30km/hr speed zone. Visibility at the entrance from a 3 m setback is >150m looking left and 150m looking right. The desirable minimum visibility splay in a 30km/hr speed zone, as stipulated by the NRA Design Manual for Urban Roads & Streets (DMURS), is 49 m from a setback of 3 m.

The proposed site access will, at a minimum, maintain the existing visibility splays. There are currently no proposed road network improvements proposed in the vicinity of the proposed development.

13.3 Predicted Impacts

The proposed development means that Heavy Goods Vehicle (HGV) trips will be reduced over the operational phase of the development.

An estimate of the volume of HGV traffic generated by the wastewater facility annually is presented below. This estimate has been generated by taking the average number of loads generated by each site over the last 5 years. These volumes are presented in Table 13-1 below:

Table 13-1 Average HGV Trips Generated from proposed development

Average HGV Trips Generated from the proposed development			
Materials	Arrivals per annum	Departures per annum	Movements per week
Existing Scenario	25	25	<1
Proposed development	10	10	<1

Notes

(1) Traffic is distributed throughout the year i.e. 50 weeks.

As can be seen from the table above, the average number of HGV movements is not significant. In addition to the HGVs, there will be some generation of light vehicles at the sites due to staff and visitors. It is estimated that there is on average 1 light vehicles arriving per day, with a corresponding 1 departure (i.e. 2 movements). These movements will occur throughout the entire year and it is assumed that all staff will arrive during the morning and subsequently leave during the evening.

A threshold of development traffic exceeding 10% of the adjoining roads traffic flow is provided by the National Roads Authority Traffic and Transport Assessment Guidelines as an indication of when a junction capacity assessment is required. As the development generates <1% of the capacity of the R101, it is therefore considered unnecessary to carry out junction capacity assessments of the entrances to the waste and wastewater facility. Given the low volumes of traffic being generated, the MMUH Waste and Wastewater facility will cause a minor to negligible impact on traffic flows on the public road network.

Traffic generated by the proposed development will have adverse negligible impact on the pavements on the surrounding network. The low numbers of vehicles predicted suggest this impact will be slight in magnitude.

Collision data collated by the Road Safety Authority and made available at www.rsa.ie has been reviewed. No recorded fatalities or serious incidents have occurred at the entrance to the Waste and WWTP sites indicating that the entrances have been operating safely. A number of collisions have been recorded along the road network to the west of Phibsborough at the R147 /R101 road junction. A fatal collision occurred in 2007 along the N1 approximately 300m to the south of the junction with the R101.

A number of bus routes pass the Mater hospital on a daily basis. The buses that serve the site include the No. 3 from UCD to Larkhill, No. 4 Harristown to Monkstown Ave, No. 9 Charlestown to Limekiln Ave, No. 11 Wadelai Park to Sandyford Industrial Estate, No. 13 Harrsistown to Grange Castle, No. 16a Dublin Airport to Lwr. Rathfarnham, No. 38a from Baggot St to Damastown, No. 41 Lwr. Abbey Street to Swords manor, 46a Phoenix Park to Dun Laoghaire, No. 122 Ashington to Drimnagh Road and No. 140 Leeson Street to Finglas.

13.4 Mitigation

Visibility to the sites meet the NRA MURS standards required based on the speed limits. During a site visit, it was noted that the entrances do not have formal line markings and signage on the entrance to site.

Parking areas are currently provided within the site. This will be maintained to ensure vehicles associated with the site are not parking on the public road, causing hazardous obstructions.

13.4.1 Conclusion

The waste and wastewater facility will generate an average of <1 HGV movements per week during the peak operational phase. Staffing levels will result in a combined 2 staff vehicles being generated daily by the sites during peak season. This would have a minor to negligible impact on the public road network in terms of capacity and a slight impact to the pavement condition.

Based on a review of accident history at the entrances to the site, it has been determined that the entrances have been operating safely and without incident.

14 IMPACT INTERACTIONS AND CUMULATIVE IMPACTS

14.1 Introduction

Potential impacts of each aspect considered under the scope of the EIA, which culminated in this Volume of the EIAR, have been outlined individually in this report. Mitigation measures have been identified and outlined.

However, in any development with the potential for environmental impact there is also potential for interaction between impacts of each environmental aspect. The results of these interactions may either exacerbate the magnitude of the impact or may in fact ameliorate it.

The EIAR has considered and assessed cumulative effects arising from the construction and operation of the proposed development. A cumulative assessment has been undertaken based on best scientific knowledge in accordance with Part 5 of Annex IV of the EIA Directive:
“e) the cumulation of effects with other existing and/or approved projects, taking into account any existing environmental problems relating to areas of particular environmental importance likely to be affected or the use of natural resources;”
The assessment specifically considers whether any of the proposed and/or recently approved schemes in the local area have a potential to exacerbate (i.e. alter the significance of) effects associated with the proposed development based on best scientific knowledge.

For the shortlisted developments, all available information was compiled to inform the assessment of cumulative effects. The relevant data was sourced from websites of the relevant planning authorities (An Bord Pleanála / Dublin City Council/Fingal Council Council) and included information such as:

- The design and location of the existing and/or approved project;
- The proposed programme of construction, operation and decommissioning (if applicable);
- Compilation and review of relevant environmental assessments and planner reports that set out baseline data and effects arising from the other developments and;
- A review of the mitigation measures that will be applied to the Project to ensure they are sufficient to remove any cumulative effects when considered in combination with the other developments.

The assessment of cumulative impacts associated with the development; a number of other developments have been identified as likely to be in operation at the same time. Project considered included:

- The Greater Dublin Drainage Scheme - PL06F.301908
- 9C Sewerage scheme – Blanchardstown - PL06F.248959
- Development of Ringsend WWTP PL29S.301798
- Dublin Port Development Strategy 2040
- Alexandria Basin Redevelopment PL29N.PA0034
- The MMUH development strategy 2018-2021;
- The potential future development of Mountjoy.
- Phibsborough LAP and
- Dublin City Development Plan

While there is potential for the above impacts to interact and result in a cumulative impact, it is unlikely, as a result of the various mitigation measures proposed, that any of these cumulative impacts will result in significant environmental degradation in the environs of the proposed development. The waste and wastewater volume are relatively low, especially when compared to the quantum of waste

treated in the Dublin area. Most of the projects are removed from the development and will not interact with the site environment with the potential exception of wastewater treatment. Further improvement in the Wastewater network and treatment will have positive impacts on the discharges to Dublin Bay, no adverse cumulative impacts were identified. The level of cumulative impact on population and human health and the natural environment is assessed as low. A cumulative impact assessment of the waste and wastewater is slight beneficial and long term.

The interaction of environmental factors, with respect to the proposed development are summarised in Table 14-1 below. This table highlights where different aspects of the environmental inter-relate with each other. The table shows how one element of the environment can interact with, or have knock-on effect on, other specialist areas. These interactions and cumulative impacts range from localised in scale (i.e. internal to the proposed development) to regional in scale (i.e. external to the proposed development) and range in the level of impact.

All specialists' studies have had regard to the potential for interactions and cumulative impacts in their studies and preparation of reports. Cumulative impacts are discussed in the relevant sections of this Volume of the EIAR, however, in the interest of completeness these interactions are presented below.

The following sections summaries the main inter-relationships.

Interaction of Environmental Factors

	EFFECT									
CAUSE	Population and Human Health (Socio- Economic)	Flora/ Fauna	Soils / Geology	Water: Hydrology	Air	Noise and Vibration	Landscape and Visual Impact	Climate	Cultural Heritage	Traffic
Population and Human Health (Socio Economics)		●		●	●	●	●	●	●	●
Flora/Fauna			●	●			●			
Soils / Geology/Hydrogeology		●		●			●		●	●
Water	●	●	●							●
Air	●							●		●
Noise	●									●
Landscape & Visual Impact	●	●	●							
Climate					●					●
Cultural Heritage	●		●				●			
Traffic	●		●	●	●	●		●		

Below the anticipated principal interactions, together with mitigation measures have been summarised.

14.2 Assessment of Interactions and Cumulative Impact

14.2.1 Population/ Human Health and Socio-Economic

Overall, the waste and wastewater treatment facility will have a positive medium term impact on the socio economy and human health of this area. This will take the form of reduced needle stick injuries and safety of staff in the hospital. Direct and indirect job creation and retention during the waste and

wastewater activity.

14.2.2 Population and Human Health and Flora and Fauna

There are no potential negative impacts on terrestrial ecology and the overall cumulative impact on flora and fauna will be positive. The treatment will have a positive effect on the discharge water quality.

14.2.3 Population and Human Health, Traffic and Air Quality

The impact on human beings and air quality has been assessed specifically in Section 8 of this Volume of the EIAR. This assessment has concluded that the cumulative impact of waste and wastewater within the proposed development will have a positive impact on the receiving environment including humans.

Traffic from the proposed development will utilise the public road network. During operations all vehicles will adhere to road haulage guidelines.

14.2.4 Population and Human Health, Soils and Geology, Aquatic Ecology and Hydrology

Potential impacts of sediment laden run-off elevated suspended solids in waters and /or pollution incidents have been outlined in Section 7. The potential cumulative effect of uncontrolled discharges from the site could potentially increase water quality at Dublin Bay. This could in turn affect tourism and local enjoyment of the watercourses. The potential cumulative impact is considered to be minor positive to negligible.

14.2.5 Population and Human Health, Visual Impact and Traffic

There will be a temporary negative impact during the Waste and WWTP phase. Noise, traffic levels and visual impact caused by the haulage trucks may temporarily affect people locally.

The overall effect is to ensure no adverse landscape and visual impact from the waste and wastewater treatment facility.

14.2.6 Flora and Fauna, Soils and Geology, Hydrogeology and Hydrology

The Waste and Wastewater treatment within the proposed development will result in a cumulative impact on the soil and geological environment, flora and fauna environment, the hydrogeological environment and the hydrological environment if control measures are not imposed. However, the existing infrastructure and working methodology has been employed successfully previously and has demonstrated that waste and wastewater can be conducted in a controlled manner. Therefore, the risk of cumulative adverse impacts of the proposed development is considered negligible.

14.2.7 Population and Human Health, Noise, Traffic and Flora and Fauna

The potential for noise impacts arises from Heavy Commercial Vehicles on the public road network and activity of plant and equipment within the proposed development. The noise impact assessment indicates that the cumulative impact of the proposed facility will not be perceptible to existing receptors. There will be an overall decrease in HGVs as a result of the development.

Within the proposed development, there is anticipated to be no significant impact as a result of the noise and travel of machinery on fauna.

14.2.8 Traffic and Soil and Geology

The potential for impact on public roads as a result of haulage of waste material has been assessed. The traffic management proposals include preventative road maintenance and repair works and

operational controls to ensure the haulage of waste does not result in a cumulative adverse impact on the public road network. There will be a decrease in the overall number of HGVs as a result of the development.

14.3 Do Nothing Scenario

If the waste and wastewater did not proceed, there would be no cumulative impacts associated with the proposed development on other developments. The Mater waste and wastewater treatment would be disposed of through the current streams. The current disposal route for HHRW is incineration. The current disposal route for wastewater is the public sewer network and Ringsend Wastewater treatment plant.

14.4 Mitigation Measures

Extensive environmental studies and impact assessments have been undertaken for the various aspects including the proposed development. Extensive mitigation measures and operating procedures are proposed to ameliorate the impact of the development on the environment. With respect to the proposed development, environmental monitoring is established and on-going to assess the performance of the site, to review impacts and to assess other issues arising during the operation and restoration phases.

14.5 Monitoring

It is not proposed that any monitoring will be undertaken specifically for cumulative impacts. However, monitoring is and will be undertaken, where required. The monitoring of the environmental performance of the site will be submitted to the EPA in the form of an Annual Environmental Report.

14.6 Reinstatement and Residual Impacts

There will be no reinstatement undertaken specifically for cumulative impacts. Reinstatement measures will be implemented where required.

1.1.1 Positive Interaction of Elements

In addition to the interactions noted above, the proposed development has the potential to have positive impacts on the receiving environment, as follows:

Short Term

- Creation of up to 10 jobs during the construction phase and the use of local goods and services.

Long Term

- Creation of a sustainable treatment of waste and wastewater to address hospital related micropollutants; and
- A positive effect on human health for both i.e. staff and patients.

Furthermore, the development of the MMUH facility will enhance the reputation of a hospital as an

innovative and environmentally friendly place to visit. Any possible impact is counterbalanced by the benefits to staff and patients.

Where a potential impact as a result of the proposed development has been noted during the environmental impact assessment, relevant and appropriate mitigation measures have been identified and proposed.

1.2 Conclusion

All environmental factors are interrelated to some extent. However, the most common interactions are between human beings and water, air quality and ecological resources. Having studied the interaction of potential impacts during the construction, operational and decommissioning phases it has been determined that no amplification effect is anticipated. The proposed development will have some positive impacts on an regional and local level. There are no significant in combination effects as a result of the development.

MMUH: