8. Hydrology

8.1. Introduction

This Chapter provides a description of the existing hydrological and drainage environment and a statement of the likely significant impacts associated with both the construction and operational phases of the development of the National Maternity Hospital at St. Vincent's University Hospital campus, Elm Park, Dublin 4.

The proposed new National Maternity Hospital building will be located at the eastern side of the hospital campus and comprises the construction of a building that rises to 5 and 6 storeys above ground level, with one partial basement level, plus additional ancillary plant areas at the roof level. The proposed development also includes an extension to the existing multi-storey car park at the north of the campus. The proposed development will be constructed in a sequential manner that allows for the continual operation of the hospital campus and, as such, includes the phased demolition of existing buildings at St. Vincent's University Hospital campus to facilitate clearing the site for the proposed development and the construction of temporary accommodation to facilitate construction sequencing (including a single storey temporary canteen, catering staff changing facilities, household services store and carpenters workshop). The full detail of the nature and extent of the proposed development is set out in Chapter 2 of this EIS and the Draft Construction Management Plan is appended to same.

Measures to mitigate the likely significant impacts are outlined, and residual potential impacts described herein.

The potential flood risk has also been addressed in this assessment. A Flood Risk Assessment has been prepared and is appended as Appendix 8.1.

8.2. Methodology

8.2.1. Guidance

This Section of the environmental report was prepared in accordance with the following guidance documents:

- Environmental Protection Agency (EPA) '*Guidelines on the Information to be contained in Environmental Impact Statements*' (EPA, 2002), and taking regard of the revised draft guidelines published in 2015; and

- EPA *'Advice Notes on Current Practice (in the preparation of Environmental Impact Statements)'*, (EPA, 2003), and taking regard of the revised draft advice notes published in 2015.

Other reference documents used in the preparation of this assessment include the following:

- National Roads Authority *'Guidelines on Procedures for the Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes'*;
- *'Good practice guidelines on the control of water pollution from construction sites'* developed by the Construction Industry Research and Information Association; and
- Guidelines for Planning Authorities on *'The Planning System and Flood Risk Management'* published in November 2009, jointly by the Office of Public Works and the then Department of Environment, Heritage and Local Government.

Background information on the local and regional surface water and drainage network was obtained from an array of documents and online references including the following sources:

- Eastern River Basin District *'Catchment Characterisation Report'* (ERBD, 2005);
- Eastern River Basin District *'River Basin Management Plan, 2009-2015'* (ERBD, 2010a);
- Eastern River Basin District *'Programme of Measures, 2009-2015'* (ERBD, 2010b);
- Eastern River Basin District *'River Basin Management Plan - Strategic Environmental Assessment'* (ERBD, 2011);
- EPA online Water Quality Database and Envision Map Viewer (www.epa.ie);
- *'Rivers of Dublin'* (Sweeney, 1991);
- Dublin City Council Water and Drainage Department record drawings and discussions with Drainage Division Engineers;
- Irish Water;
- St. Vincent's University Hospital record drawings and discussions with Technical Services personnel;
- Arup Consulting Engineers drainage and watermain drawings;
- Utility services drawings;
- Topographical site survey; and
- All available information concerning the development including development plans and proposed drainage and watermain layouts as advised by Arup Consulting Engineers.

8.2.2. Legislation

A review of the following legislation was carried out as part of this assessment:

- Water Framework Directive 2000/60/EC;
- European Communities Environmental Objectives (Surface Waters) Regulations 2009 (S.I. No. 272 of 2009);
- European Communities Priority Substances Directive 2008;
- European Communities (Quality of Salmonid Waters) Regulations 1988 (S.I. No. 293 of 1988);
- Local Government (Water Pollution) Acts 1977 – 1990; and
- Water Quality Standards for Phosphorus Regulations 1998 (S.I. No. 258 of 1998).

An outline of the requirements of this legislation is provided in Table 8.1.

Table 8.1: Summary of Requirements of Current Water Legislation

Legislation	Requirements
Water Framework Directive 2000/60/EC as transposed by European Communities (Water Policy) Regulations 2003 (S.I. No. 722 of 2003)	This legislation provides a co-ordinated approach across Europe for all water policies, establishing a management structure for future water policy. The key objectives of the Directive are to: • Protect all waters, including rivers, lakes, groundwater, transitional and coastal waters; • Achieve "good status" in all waters by 2015, and maintaining "high status" where the status already exists; and • Have water management based on River Basin Districts. The strategies and objectives of the Water Framework Directive in Ireland have been influenced by a range of National and European Union legislation. In turn the implementation of the Water Framework Directive and its associated policies has necessitated the introduction of new regulations in Ireland including, the European Communities Environmental Objectives (Surface Waters) Regulations 2009.
European Communities Environmental Objectives (Surface Waters) Regulations 2009 (S.I. No. 272 of 2009)	These Regulations are a more complete and stringent set of surface water quality regulations addressing the requirements of the Water Framework Directive and the Dangerous Substances Directive. These new Regulations supersede previous water quality Regulations (both EU and national).
European Communities Priority Substances Directive 2008	These Regulations have been devised to assign a chemical status assessment for water bodies. Directive 2008/105/EC provides environmental quality standards in the field of water policy.
European Communities (Quality of Salmonid Waters) Regulations 1988 (S.I. No. 293 of 1988)	The Salmonid Regulations set water quality standards for salmonid waters, with identification of salmonid waters, water quality standards, and frequencies of sampling and methods of analysis and inspection.

Legislation	Requirements
Local Government (Water Pollution) Acts 1977 – 1990	The Act is the main legislation for the prevention and control of water pollution, including the general prohibition of polluting matter to waters. While this Act has largely been superseded by the 2009 Regulations, current impact assessment and monitoring methodologies must still be cognisant of this legislation.
Water Quality Standards for Phosphorus Regulations 1998 (S.I. No. 258 of 1998)	As part of the Water Pollution Acts, these Regulations require water quality be maintained or improved, with reference to the biological quality river rating system (Q Rating) as assigned by the Environmental Protection Agency between 1995 to 1997. While this Act has also largely been superseded by the 2009 Regulations, current impact assessment and monitoring methodologies must still be cognisant of this legislation.

8.2.3. Site Visits

Site visits were conducted as part of the impact assessment process to ascertain specific areas which may be at risk from impact.

8.2.4. Criteria for Rating of Impacts

8.2.4.1. Water Quality

An assessment of the water quality in the region of the proposed development was carried out which comprised a desk-top study examining water quality information gathered by the EPA and Dublin City Council.

Under current regulation the water quality of River Basin Districts is assessed biologically, physically and chemically. Assessment using surveys is predominately conducted by the EPA and local authorities, and complemented by other government bodies including the Central Fisheries Board and the Marine Institute. Table 8.2 summarises the quality classes used to establish and monitor the condition of rivers and streams in Ireland.

Table 8.2: River and Stream Water Quality Classes (EPA, 2012)

Q Value[1]	Water Framework Directive Status	Pollution Status	Condition[2]
Q5, Q4-5	High	Unpolluted	Satisfactory
Q4	Good	Unpolluted	Satisfactory
Q3-4	Moderate	Slightly polluted	Unsatisfactory
Q3, Q2-3	Poor	Moderately polluted	Unsatisfactory
Q2, Q1-2, Q1	Bad	Seriously polluted	Unsatisfactory

where: Biotic indices or Quality (Q) value indicates specified groups of macro-invertebrates sensitivity to pollution, with:

- Q5 = Mostly pollution sensitive, a few to numerous less pollution sensitive, a few pollution tolerant, and no very pollution tolerant or most pollution tolerant macro-invertebrate species.
- Q4 = At least one pollution sensitive, few to numerous less pollution sensitive, numerous pollution tolerant, and a few or no very pollution tolerant or mostly tolerant macro-invertebrate species.
- Q3 = No pollution sensitive, few or no less pollution sensitive, dominant in pollution tolerant, a few to common in very pollution tolerant, and few or no most pollution tolerant macro-invertebrate species.
- Q2 = No pollution sensitive or less sensitive, few or no pollution tolerant, dominant in very pollution tolerant, and few to common in most pollution tolerant macro-invertebrate species.
- Q1 = No pollution sensitive, less sensitive, and pollution tolerant, a few to no very pollution tolerant, and dominant in most pollution tolerant macro-invertebrate species.

Note 1: These values are based primarily on the relative proportions of pollution sensitive to tolerant macroinvertebrates resident at a river site.

Note 2: "Condition" refers to the likelihood of interference with beneficial or potential beneficial uses.

Table 8.3 describes in detail the classification system combined with the Biological Quality Q-Ratings, basic physico-chemical water quality, the status of the ecosystem and the human value associated with surface water systems.

In summary, quality classes relate to the potential beneficial use of a water body, with:

- Class A = Highest water quality, suitable for abstraction, game fisheries, very high amenity value, orthophosphate ~ 0.015 mg P/L, dissolved oxygen close to 100%, maximum BOD is < 3mg/L.
- Class B = Variable water quality, potential problems for abstraction, game fish at risk, considerable amenity value, orthophosphate ~ 0.045 mg P/L, dissolved oxygen <80% to >120%, maximum BOD is occasionally elevated.

- Class C = Doubtful water quality, advanced treatment of abstracted water, course fisheries, reduced amenity value, orthophosphate ~ 0.070 mg P/L, dissolved oxygen is very unstable with potential fish kills, maximum BOD is high at times.
- Class D = Poor to bad water quality, low grade to limited abstraction, fish usually absent, low or no amenity, orthophosphate >0.1 mg P/L, dissolved oxygen is low to zero, maximum BOD is usually high to very high.

Existing pollution has an impact on the value of surface waters and this has been taken into account when characterising individual surface water systems in the following Section. The existing adverse effects are reflected in the EPA Q-Value, which describes the biological status of the watercourse. In general, the higher the level of pollution in a watercourse, the lower the Q-value. The Q-value reflects impacts from surface water run-off (including run-off from agricultural land which may contain nutrients and urban run-off from roads and buildings which may contain solids, hydrocarbons and heavy metals).

Table 8.3: General Characteristics of the various Biological Quality Classes (DRA, 2006)

Quality Classes	Class A		Class B	Class C	Class D	
Quality Ratings (Q)	Q5	Q4	Q3-4	Q3	Q2	Q1
Pollution Status	Pristine, unpolluted	Unpolluted	Slight Pollution	Moderate Pollution	Heavy Pollution	Gross Pollution
Organic Waste Load	None	None	Light	Considerable	Heavy	Excessive
Maximum B.O.D.	Low (< 3 mg/l)	Low (< 3 mg/l)	Often elevated	High at times	Usually high	Usually very high
Dissolved Oxygen	Close to 100%	80%-120%	<80% to >120%	Very unstable.	Low to zero	Very low or zero
Annual Median ortho-Phosphate	~0.015 mg P/l	~0.030 mg P/l	~0.045 mg P/l	~0.070 mg P/l	usually > 0.1 mg P/l	usually > 0.1 mg P/l
Siltation	None	May be light	May be light	May be considerable	Usually heavy	Usually v. heavy and anaerobic
'Sewage Fungus'	Never	Never	Never	May be some	Usually abundant	May be abundant
Filamentous Algae	Limited development	Diverse communities	Cladophora may be abundant	Cladophora may be excessive	May be abundant	Usually none
Macrophytes	Good diversity Limited growths	Considerable growths	Reduced diversity Luxuriant growths	Limited diversity Excessive growths	Tolerant species only. May be abundant.	Usually none or tolerant species only.
Macroinvertebrates (from shallow riffles)	Diverse communities. Normal density. Sensitive forms usually numerous.	High diversity. Increased density. Sensitive forms scarce or common.	Very high diversity. Very high density. Sensitive forms scarce.	Sensitive forms absent. Tolerant forms common. Low diversity.	Tolerant forms only. Very low diversity.	Most tolerant forms. Minimal diversity.
Water Quality	Highest quality	Fair quality	Variable quality	Doubtful quality	Poor quality	Bad quality
Abstraction Potential	Suitable for all	Suitable for all	Potential problems	Advanced treatment	Low grade abstractions	Extremely limited
Fishery Potential	Game fisheries	Good game fisheries	Game fish at risk	Coarse fisheries	Fish usually absent	Fish absent
Amenity value	Very high	High	Considerable	Reduced	Low	Zero
Condition	Satisfactory	Satisfactory	Transitional	Unsatisfactory	Unsatisfactory	Unsatisfactory

8.2.4.2. Existing Hydrological Environment Categorisation

Characterisation of surface water systems is based on the identification of features of the baseline hydrological environment that are relevant and can be assigned a functional value. The functional value of each of these features is compiled through the relevance of three factors: the importance of the feature, the sensitivity of the feature and the existing adverse pressures affecting the feature. The assignment of functional values is also cognisant of technical standards, regulations and relevant legislation.

Importance

Surface water systems act as resources for both aquatic and terrestrial ecosystems and are an essential factor to sustain human life. Surface water floodplains can also act as a reserve or store for floodwaters during times of significant flooding and this can prevent floodwaters from impacting farther downstream. Table 8.4 indicates how the importance of surface water resources is evaluated using specific criteria that have been defined for the purpose of this hydrological baseline assessment.

Table 8.4: Hydrological Baseline Categorisation

Criteria	Functional Value
Surface Watercourses with Q-values of Q5 and/or Q4-5 or Q4, which are classified by the EPA as 'Class A - Unpolluted'. Surface Watercourses with flood plains that have significant storage capacity for potential floodwaters.	Very High
Surface Watercourses with Q-values of Q3-4, which are classified by the EPA as 'Class B -Slightly Polluted'. Surface Watercourses with flood plains that have significant storage capacity for potential floodwaters.	High
Surface Watercourses with Q-values of Q3 or Q2-3, which are classified by the EPA as 'Class C - Moderately Polluted'. Surface Watercourses with flood plains that have significant storage capacity for potential floodwaters.	Medium
Surface Watercourses with Q-values of Q2 or Q1-2 or Q1, which are classified by the EPA as 'Class D - Seriously Polluted'. Surface Watercourses with flood plains that have no storage capacity for potential floodwaters.	Low
Surface Watercourses that have been culverted. Surface Water Features solely used for visual amenity.	Very Low

Sensitivity

Surface water features are highly sensitive to culverting, which can alter flow conditions and affect light penetration to the watercourse. Surface water features are also at risk from discharges of surface water run-off which may contain polluting substances that can have a significant adverse impact on the biological and physico-chemical status of a watercourse such as a salmonid river or stream. Surface water features are also highly sensitive to morphological change through deepening, realignment or diversion of their natural channel which can also alter the hydrodynamic regime of the surface water feature. These factors were taken into account when defining the criteria to be used to assign a functional value to the baseline hydrological environment.

Existing Adverse Hydrological Pressures

Existing pollution has an adverse impact on the functional value of surface water features. Consequently, the definition of the functional value for each individual watercourse has been cognisant of the pressures from pollution both upstream of the study area and within the study area. The existing hydrological pressures are reflected in the EPA Q-Value, which describes the biological status of the watercourse. The higher the pollution level in a watercourse, the lower the Q-value. The Q-value reflects impacts from surface water run-off and includes run-off from agricultural land which may contain nutrients and run-off from roads and buildings which may contain solids, hydrocarbons and heavy metals. It is noted however that there is no agricultural land at our site. The existing pressures are also apparent in the physico-chemical status of the surface water feature with both organic and inorganic pollutants altering the physico-chemical status.

Functional Value

The functional value of the existing hydrological environment is evaluated through the assessment of surface water criteria and the importance and sensitivity of the surface water features. The surface water criteria are described below.

Significance Criteria / Impact Assessment

The source and type of all potential impacts is described in Section 8.5. The criteria and durations used to assess the different impacts associated with the project are shown in Table 8.5 and Table 8.6. The criteria have been defined in accordance with the aforementioned EPA and National Roads Authority Guidelines.

Table 8.5: Criteria for Assessment of Hydrological Impact Magnitude

Criteria	Impact Magnitude
Long-term to permanent change to a designated conservation site or designated salmonid river. Medium-term to permanent contamination of surface water over entire surface water catchment. Medium-term to permanent potential changes in drainage patterns over entire catchment.	Profound
Medium term change to a designated conservation site or a designated salmonid river. Temporary to short-term contamination of surface water over entire surface water catchment. Temporary to short-term potential changes in drainage patterns over entire catchment.	Significant
Temporary to short-term change to a designated conservation site or a designated salmonid river. Medium to long-term contamination of local surface water. Medium to long-term potential changes in local drainage patterns.	Noticeable
Short-term contamination of local surface water. Short term potential changes in local drainage patterns.	Slight
Temporary contamination of local surface water. Temporary potential changes in local drainage patterns.	Imperceptible

Table 8.6: Definition of Duration Criteria

Impact Description	Definition
Permanent Impact	Impact lasting over sixty years
Long-Term Impact	Impact lasting fifteen to sixty years
Medium-Term Impact	Impact lasting seven to fifteen years
Short-Term Impact	Impact lasting one to seven years
Temporary	Impact lasting for one year or less

8.2.4.3. Flood Risk

The proposed National Maternity Hospital site was assessed to determine whether the site was at risk with respect to flooding. A number of sources were considered including:

- Tidal/Coastal flooding;
- Fluvial flooding (from adjacent surface water bodies);
- Pluvial (direct rainfall) from localised stormwater runoff; and
- Groundwater flooding.

Construction water discharges and operational firefighting discharges are also acknowledged as potential sources of flooding.

'The Planning System and Flood Risk Management Guidelines for Planning Authorities' (2009) defines flood zones as follows:

- Flood Zone A – where the probability of flooding from rivers and the sea is highest (greater than 1% or 1 in 100 for river flooding or 0.5% or 1 in 200 for coastal flooding);
- Flood Zone B – where the probability of flooding from rivers and the sea is moderate (between 0.1% or 1 in 1000 and 1% or 1 in 100 for river flooding and between 0.1% or 1 in 1000 year and 0.5% or 1 in 200 for coastal flooding);
- Flood Zone C – where the probability of flooding from rivers and the sea is low (less than 0.1% or 1 in 1000 for both river and coastal flooding). Flood Zone C covers all areas of the plan which are not in zones A or B.

8.2.4.4. Water Supply and Drainage Infrastructure

Background information on the local and regional surface water and drainage network was obtained from an array of documents and references as provided in Section 8.2.

8.3. Receiving Environment

8.3.1. Hydrology

The site is located within Hydrometric Area 09 which is the EPA classification for the catchments flowing into Dublin Bay. This hydrometric area falls within the Eastern River Basin District. The principal catchments are the Liffey, Tolka and Dodder River catchments and their associated sub-catchments. Hydrometric Area 09 is 1,616 km² in size with a maximum elevation of 338 m OD and a mean slope of 2.9%.

It is the most densely populated hydrometric area in Ireland and contains the largest tract of continuous and discontinuous urban fabric in the country, which is approximately 21% of the hydrometric area while, agricultural land comprises more than 60% of the area. As the area is a rapidly expanding urban zone, the main driving forces are population growth, industrial production, agricultural production, transportation, and energy demand and consumption. Consequently, these driving forces cause a number of pressures to exert negative impacts on water bodies and the larger natural environment including the following:

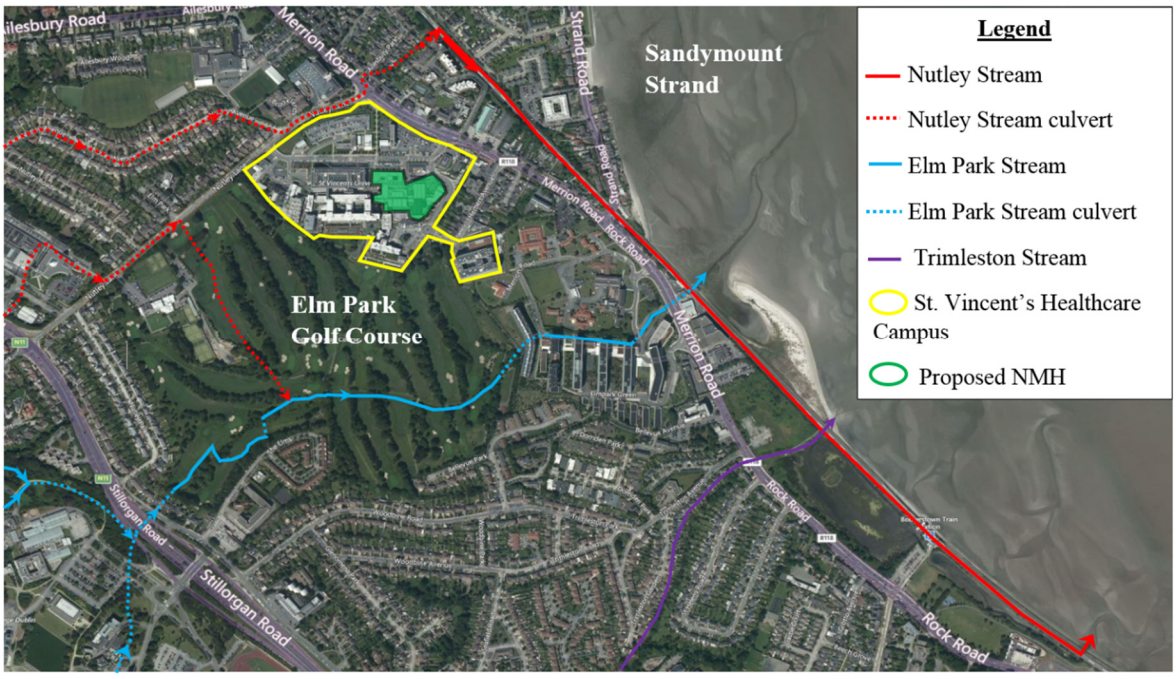
- Diffuse sources;
- Point sources;
- Transport;

- Waste management; and
- Recreation and tourism.

8.3.1.1. Surface Water Bodies

The following sub-sections outline the existing hydrological environment in the vicinity of the proposed development which includes one of the two principal catchments of Hydrometric Area 09; the River Dodder which is located approximately 1.5 km northwest of the and is discussed in the following Section. Other surface water bodies that are considered to be relevant to the proposed development, include the Elm Park Stream (also known as Brewery Stream), Nutley Stream and Trimleston Stream (see Figure 8.1). All of the streams run into South Dublin Bay, which is located <1km east of the proposed development and is designated as a Special Area of Conservation (SAC), a Special Protection Area (SPA) and a proposed Natural Heritage Area (pNHA) (Site Code 000210).

Figure 8.1: Surface Water Bodies in the Vicinity of the Site



For information regarding the existing aquatic ecology of the surface water systems, refer to Chapter 9, '*Flora and Fauna*'.

River Dodder

The River Dodder rises at Kippure Mountain in the Dublin Mountains. Its source is located at a height of 763m above sea level. The River is a total of 27km in length. The catchment

covers a total area of 12,080 ha. The River Dodder flows from its source in a North Westerly direction.

From Old Bawn in Tallaght it changes course of flow to a North Easterly direction. It flows through Milltown, Donnybrook and Ballsbridge and enters the River Liffey Estuary at Ringsend. The first 7.6km of the River has a gradient of 1 in 16 with the lower reaches having a gradient of 1 in 120.

The Bohernabreena reservoirs are located in the upper reaches of the River at an elevation of 180mOD approximately. Of the total river catchment approximately 28km^2 drains to the reservoirs. The upper reservoir provides water supply to Dublin.

The remaining 92.8km^2 of the catchment drains directly to the River Dodder downstream of the lower reservoir spillway. There are five main tributaries whose sub-catchments drain into the River Dodder as follows:

- The Dundrum Slang;
- The Little Dargle;
- The Owendoher;
- The Whitechurch; and
- The Tallaght Stream.

The River is tidal up to Ballsbridge. The Upper Catchment flows through bog, forestry and agricultural lands, while the lower reaches flow predominantly through residential and commercial areas and parkland.

The Eastern River Basin District Characterisation Report classifies the main River Dodder as overall "at risk" status. The lower reaches are considered to be at risk from a number of sources including morphological, diffuse and point source risks. In addition, the Lower River Dodder is the only River in Hydrometric Area 09 to be considered at risk from hydrological pressures i.e. abstraction.

The monitoring stations that are in closest vicinity to the proposed development are as follows:

- (0800) Milltown Bridge;
- (0900) Footbridge Beaver Row; and
- (1000) Ballsbridge.

Water quality sampled at these sampling points is presented in Table 8.7. The most recent EPA survey of the Dodder took place in 2013 and indicated that water quality in the area nearest the proposed development was considered 'Good' but 'at risk' of not maintaining this status.

Table 8.7: River Dodder Biological Quality Ratings (EPA, 2013)

Biological Quality Rating (Q Value)							
Station	Year						
	1996	1998	2002	2005	2007	2010	2013
0800	3	3	3	3	-	3-4	-
0900	-	-	-	-	3	4	4
1000	-	-	-	-	-	-	

Elm Park Stream

According to the records of rivers in Dublin the source of the Elm Park Stream is in Goatstown. However, from viewing the EPA maps it appears that the stream is culverted in part from Goatstown through UCD to just east of the Stillorgan Road where it appears to emerge in the south western extents of Elm Park Golf Course. From there it flows eastwards through the southern portion of the Golf Course passing underneath Merrion Road and the DART line to enter the sea at Merrion Strand.

The EPA does not collect water quality data for Elm Park Stream and it has not been assigned a score under the Water Framework Directive. However, as mentioned previously the stream flows into South Dublin Bay at Merrion Strand which is considered to be a '*nutrient sensitive area*'. Further, South Dublin Bay is designated as a Special Protection Area (SPA), Special Area of Conservation (SAC) and a proposed Natural Heritage Area (pNHA). Therefore the water quality of this stream could potentially impact on those areas.

Nutley Stream

The Nutley Stream rises in Clonskeagh and is largely culverted as it flows east through UCD, beneath Stillorgan Dual Carriageway. In the 1960s the culvert was diverted south eastward as it left the RTE grounds, to Nutley Lane and across the Elm Park Golf Course to join the channel of the Elm Park Stream.

Dublin City Council drainage drawings and the EPA River Network maps suggest that a culvert that was once a tributary of the Nutley Stream before it was diverted still conveys water along the former route of Nutley Stream i.e. via Nutley Avenue and Nutley Lane. The route of this culvert is indicated in Figure 8.1 and is referred to as Nutley Stream Tributary for the purpose of this EIS.

This culvert passes eastwards past the northern boundary of the site towards the DART line where it turns south. The stream comes to the surface to the rear of the Jacobs Engineering building on Merrion Road and continues south to feed Booterstown Marsh which is an area of salt marsh and is a Nature Reserve and Bird Sanctuary. It is also a proposed Natural Heritage Area (pNHA) (Site Code 001205). The stream continues south of Booterstown Marsh where it enters the sea at Merrion Strand approximately 400m south of Booterstown Dart Station.

The EPA does not collect water quality data for Nutley Stream and it has not been assigned a score under the Water Framework Directive. However, as mentioned previously the stream flows through Booterstown Marsh pNHA and flows into South Dublin Bay at Merrion Strand which is considered to be a 'nutrient sensitive area'. Further, as mentioned above South Dublin Bay is designated as a Special Protection Area (SPA), Special Area of Conservation (SAC) and a proposed Natural Heritage Area (pNHA). Therefore, the water quality of this stream could potentially impact on those areas.

Trimleston Stream

Trimleston Stream rises southwest of St. Helens and flows eastwards mostly in culvert to where it enters the sea at Merrion Strand north of Booterstown DART Station. It occasionally feeds Booterstown Marsh as it runs in a raised box culvert at the City end of the marsh.

The EPA does not collect water quality data for Trimleston Stream and it has not been assigned a score under the Water Framework Directive. However, as mentioned previously the stream feeds Booterstown Marsh proposed Natural Heritage Area (pNHA) and flows into South Dublin Bay at Merrion Strand which is considered to be a *'nutrient sensitive area'*. Further, as mentioned above South Dublin Bay is designated as a Special Protection Area (SPA), Special Area of Conservation (SAC) and a proposed Natural Heritage Area (pNHA). Therefore the water quality of this stream could potentially impact on those areas.

8.3.2. Flood Risk

The existing site is generally bounded by Merrion Road to the north, Elm Park Golf Club to the south, Nutley Avenue to the west and Herbert Avenue and St. Vincent's Private Hospital to the east.

Road levels along Merrion Lane range from circa 2.3mOD (Malin Head) at the Nutley Lane junction northwest of the site to circa 4.5mOD at the Herbert Avenue junction to the northeast of the site. The Road level at the Hospital Campus entrance to Nutley Lane is circa 6.3mOD while the entrance to Merrion Road is circa 4.25mOD.

There is approximately a 6m fall across the St. Vincent's University Hospital campus from Elm Park Golf Club in the south to Merrion Road in the north. The land use of the surrounding area is predominantly residential and commercial.

A Flood Risk Assessment has been carried out in accordance with the aforementioned *'The Planning System and Flood Risk Management: Guidelines for Planning Authorities'* (OPW and DoEHLG, 2009) and is attached in Appendix 8.1.

In broad terms the potential sources of flooding to the subject site can be categorised as Tidal/Coastal flooding, Fluvial flooding, Pluvial/Urban drainage flooding and Groundwater flooding.

There is no historic record of the site having flooded in the past. The absence of the historic record however does not mean that the site has not flooded in the past.

Draft predictive flood maps from the *'Eastern Catchment Flood Risk Assessment and Management Study'* and final flood maps from the *'Irish Coastal Protection Strategy Study'* were accessed to determine the risk of tidal flooding of the site. It is evident from the maps that the site is not located in the 1 in 1000 year tidal floodplain. The risk of tidal flooding of the site is therefore very low.

There are three minor watercourses of relevance in terms of flood risk in the vicinity of the site: The Elm Park Stream, The Nutley Stream and the Nutley Stream Tributary. Elm Park Stream is located approximatley 300m south of the site. Given the wide expanse of the floodplain and the relatively small flows in the catchment the risk of fluvial flooding to the subject site from the Elm Park Stream is considered to be very low.

The Nutley Stream lies approximatley 450m to the West of the site. Based on an inspection of the reach and discussions with Dublin City Council it can be concluded that the Nutley is fully culverted in the vicinity of the site. There are no open channel sections which offer a route for water to flood the surrounding area.

The risk of flooding from the culvert is therefore limited to the potential for surcharging at the culvert entrance and pressurised flow within the culvert forcing water out through any connecting back pipes, man holes or connecting culverts.

The risk of flooding to the site from surcharging of the culvert entrance is likely to be very low given the small area of contributing catchment at the upstream end of the culvert. The risk of flooding to the site from pressurised flow is also considered to be very low given the relatively wide expanse of the floodplain.

The Nutley Stream Tributary lies approximatley 150m to the North of the site and conveys flows along underneath Nutley Lane. Based on an inspection of the reach and discussions with Dublin City Council it can be concluded that the Nutley Stream Tribuary is fully culverted in the vicinity of the site. Dublin City Council have also confirmed to Arup that the flows conveyed by the Nutley Stream Tribuary are very minor.

The risk of flooding to the site from surcharging of the culvert entrance is likely to be very low given the small area of contributing catchment at the upstream end of the culvert. The risk of flooding to the site from pressurised flow within the culvert forcing water out through any connections is also considered to be very low given the relatively wide expanse of the floodplain and the low flows within the culvert.

Results of the Site Ground Investigation suggest groundwater is typically between 1.0m and 2.0m below ground level. Given the topography of the site and this relatively low ground water table, the risk of groundwater flooding to the site is considered low.

Results from the Preiminary Flood Risk Mapping undertaken by the OPW and published in 2012 suggest that there is minor risk of pluvial flooding at the site. Measures to address this risk are detailed in Section 8.6.2.2.

8.3.3. Water Supply and Drainage

8.3.3.1. Water Supply

The locations of existing public watermains have been sourced from public records maintained by Dublin City Council and Irish Water and included the following:

- A 100mm watermain on Merrion Road;
- A 225mm watermain on Merrion Road; and
- A 150mm watermain on Nutley Avenue.

The locations of the existing watermains on the hospital campus has been sourced from records provided by St. Vincent's University Hospital Technical Services Department and Arup.

The existing hospital campus is supplied from a 150mm metered branch off the 150mm main on Nutley Lane. There is a 150mm ring main around the Campus with sluice valves and hydrants. There is a secondary back up supply (which is blanked off) to the public main provided by a connection to the existing 225mm main on Merrion Road.

8.3.3.2. Foul Water

The existing public foul sewers have been sourced from public records maintained by Dublin City Council and Irish Water. These include:

- A 1080x770mm foul sewer on Merrion Road;
- A 300/375mm foul sewer on Nutley Lane; and
- A 900mm and 1350mm Dodder Valley trunk sewers on Nutley Lane which also traverse the hospital grounds west of the multi storey car park.

The existing foul drainage network on the hospital campus has been sourced from the drainage records maintained by the St. Vincent's University Hospital Technical Services Department, utility services drawings by Murphy Surveys and Arup drawings. These include:

- A 225mm foul drain east of the main hospital campus which outfalls to the Merrion Road sewer; and
- A 225mm foul drain west of the main hospital campus which outfalls to the Nutley Lane foul sewer.

8.3.3.3. Surface Water

The existing public surface water sewers have been sourced from the public records maintained by Dublin City Council. These include:

- A 300/375mm surface water sewer on Merrion Road;
- A 450mm surface water sewer on Nutley Lane; and
- A 1200mm surface water sewer south of DART line and outfall at the Merrion Strand.

8.4. Characteristics of the Proposed Development

There are two primary entrances to the existing hospital campus at Merrion Road and Nutley Lane. These are connected by a campus spine road which provides access to the main entrance to the hospital, service yard and the various car parks located around the campus. The public road levels at these entry/exit points are 4.25mOD at the Merrion Road junction and 6.3mOD at the Nutley Lane junction.

Elements of the proposed development that are relevant to this Chapter are outlined in the following sections:

8.4.1. Hydrology

Hydrological impacts arise from the quality of water discharged to surface water during construction and operation therefore management of such risks are of relevance to the proposed development.

8.4.2. Flood Risk

Surface water run-off from the new development including roofs and hardstanding areas will discharge by gravity to a new surface water drainage system and outfall to the surface water sewerage system on Merrion Road northeast of the site.

This surface water sewerage system discharges to Dublin Bay via a 1200mm surface water sewer outfall on Merrion Strand east of the Merrion Gates.

The key risk to the proposed development is the pluvial risk i.e. risk from direct rainfall/stormwater.

8.4.3. Water Supply and Drainage

8.4.3.1. Water Supply

The primary water supply to the hospital campus is the 150mm watermain on Nutley Avenue controlled by Dublin City Council and Irish Water. The existing watermain system on the campus traverses both the proposed National Maternity Hospital and Multi-Storey Car Park Extension sites and will be locally diverted outside the building footprints.

A new 150mm diameter main will be provided around the proposed developments. The new main will be connected back into the existing hospital system adjacent to the new

developments. The water consumption for the existing hospital campus is in the region of 470m^3/day.

8.4.3.2. Foul Water

The proposed development will result in additional discharges to the foul sewerage system from the Maternity Hospital. No new connections to the public sewerage system will be required as the existing hospital foul drainage system and outfall to the public sewer on the Merrion Road will be utilised.

8.4.3.3. Surface Water

The redeveloped site contributing to the Dublin City Council surface water sewer on Merrion Road is 10.5 hectares. An area of approximately 1.8 hectares will be demolished for the proposed National Maternity Hospital of which 95% is existing roof and hardstanding. Surface water peak flow rates from these existing redeveloped hardstanding areas will be dramatically reduced due to the requirement to restrict surface water outflows to the receiving surface water sewerage system.

Surface water discharges from the proposed development will be restricted in accordance with the '*Greater Dublin Regional Code of Practice for Drainage Works*'. Therefore, storm attenuation will be required on site. The allowable run-off rate from the site will be based on 2 litres/second/hectare in line with the Code of Practice and Dublin City Council Drainage Division's requirements. The developed site area is approximately 10.5 hectares however due to the limited extent of redevelopment within the developed site area the total allowable discharge rate agreed with Dublin City Council Drainage Division is 6 litres/second. Based on this outflow the required storage for a 1 in 100 year storm event for the proposed National Maternity Hospital would be approximately 915m^3, and 60m^3 for the proposed Multi-Storey Car Park Extension. A dual storm attenuation tank system will be incorporated into the Maternity Hospital drainage system which will see one attenuation tank located to the north of the new hospital building and existing campus access road and the second located between the North façade of the new building and the existing campus access road. The attenuation tank for the Multi-Storey Car Park Extension will be located under the lower ground floor slab.

Surface water run-off from the development will discharge by gravity into the new attenuation facilities on the campus. Run-off from roofs, roads, car parks, service yards and paved areas shall drain by gravity to the attenuation facilities. Discharges from these attenuation facilities shall be by gravity and discharge at a controlled outflow rate for each

attenuation tank of 2 litres/second, with a combined total discharge of 6 litres/second to the existing surface water sewer on Merrion Road.

Sedum greenroofs incorporating approximately 27% of the Maternity Hospital roof area will be provided as part of the proposed development.

8.5. Potential Impact of the Proposed Development

8.5.1. Construction Phase

8.5.1.1. Hydrology

As outlined previously, hydrological impacts arise from the quality of water discharged to surface water during construction.

Water will arise primarily from rainfall and process water such as groundwater dewatering. Any disposal of water generated during the construction phase will be to the surface water sewer system.

Surface construction activities pose a potentially significant risk to all watercourses as these sites will be exposed to rainfall which has the potential to produce run-off. Surface water run-off from surface construction activities has the potential to be mildly contaminated. The main contaminants arising from surface construction activities include:

- Suspended solids: arising from ground disturbance and excavation;
- Hydrocarbons: accidental spillage from construction plant and storage depots;
- Faecal coliforms: contamination from coliforms can arise if there is inadequate containment and treatment of on-site toilet and washing facilities; and
- Concrete/cementicious products: arising from construction materials.

These pollutants pose a significant short-term risk to surface water quality for the duration of construction if not properly contained and managed. Suspended solids, which can include significant quantities of silt, influence surface water turbidity and are considered to be the most significant risk to surface water quality from construction activities. Suspended solids can also reduce light penetration, visually impact the receiving water and damage the ecosystem. These suspended solids are likely to occur in:

- Water removed from surface excavations as a result of rainfall or groundwater seepage;

- Vehicle wheel wash water;
- Runoff from exposed work areas and excavated material storage areas; and
- Cement washdown areas: The potential for cement to increase the pH of water above a neutral range, that is typically pH 6 to 9, can pose a threat to aquatic species living in a watercourse.

Contamination of surface water systems by the other above pollutants may potentially occur due to:

- Inappropriate handling and storage;
- Leakage of temporary foul water services; and
- Solid (municipal) wastes being disposed or blown into watercourses or drainage systems.

8.5.1.2. Flood Risk

Surface water run-off from hard standing and roof structures has the potential to flood excavations during the construction period. In addition, the construction works will involve significant excavation thereby requiring groundwater to be controlled during construction.

The contractor is not required to divert or otherwise manage any watercourse as part of the construction phase given the absence of any watercourse from the site. The construction works will therefore not exacerbate the flood risk during the construction phase.

The risk of flooding to the site during the construction phase is therefore equivalent to the risk during the operational stage which is discussed in the following section.

8.5.1.3. Water Supply and Drainage

Water Supply

The Contractor will require a separate water supply connection to the campus ring main for the works. Diversion of the existing 150mm campus main to the east of the development will be required.

Foul Water

The Contractor's operations will result in the generation of effluent and sanitary waste from facilities provided for the work force on site.

There is potential for dust, noise and vibration during the construction of the drainage systems around the existing hospital grounds. Such impacts are addressed in Chapter 11, *'Noise and Vibration'* and Chapter 12, *'Air Quality and Climate'*.

Surface Water

Surface water run-off will occur from hardstanding and roof structures during the construction period. Surface water run-off from construction activities is likely to be contaminated.

There is potential for dust, noise and vibration during the construction of the drainage systems around the existing hospital grounds. Such impacts are addressed in Chapter 11, *'Noise and Vibration'* and Chapter 12, *'Air Quality and Climate'*.

8.5.2. Operational Phase

8.5.2.1. Hydrology

The construction of paved areas could result in rapid run-off of surface water. Surface water run-off from car parking areas is likely to contain mild non-point contamination. Surface water run-off from waste storage areas has the potential to be contaminated to some degree. The quality of surface water in proximity to the proposed development could potentially be impacted by a number of different sources in the absence of appropriate mitigation measures, these potential sources include:

- Urban Runoff: routine urban runoff generally contains a variety of contaminants. These arise from the degradation of urban surfaces and vehicles, vehicle exhaust combustion by-products, soil erosion and aerial deposition. The primary contaminants known to occur in routine road runoff include hydrocarbons, particulate matter and heavy metals; and
- Accidental Spillage: spillages arising from accidents involving goods transportation or fuel tank leakage are potentially the most serious source of contaminants to a watercourse.

8.5.2.2. Flood Risk

As mentioned in Section 8.3.2 the potential sources of flooding to the subject site can be categorised as Tidal/Coastal flooding, Fluvial flooding, Pluvial/Urban drainage flooding and Groundwater flooding. The potential for each of these to occur is outlined in the following sections.

Tidal/Coastal Flooding

As outlined previously, the draft predictive flood maps from the Eastern Catchment Flood Risk Assessment and Management Study and the final flood maps from the Irish Coastal Protection Strategy Study were accessed to determine the risk of tidal flooding of the site. The maps indicate that the site is not located in the 1 in 1000 year tidal floodplain and therefore it is considered that the risk of tidal flooding at the site is very low.

Fluvial Flooding

As outlined previously, Elm Park stream is located approximatley 300m south of the site. Given the wide expanse of the floodplain and the relatively small flows in the catchment the risk of fluvial flooding to the subject site from the Elm Park stream is considered to be very low.

The Nutley Stream and Nutley Stream Tributary are both culverted within the vicinity of the site and there are no open channel sections which offer a route for water to flood the surrounding area. The risk of flooding from the culverts is limited to the potential for surcharging at the culvert entrance and pressurised flow within the culvert forcing water out through any connecting back pipes, man holes or connecting culverts. It is considered that the risk of such flooding to the site is very low given the small area of contributing catchment at the upstream end of the culverts and the relatively wide expanse of the floodplain. This is further supported by the absense of historic flooding at the site.

Pluvial/Urban drainage Flooding

Results from the Preliminary Flood Risk Mapping undertaken by the OPW and published in 2012 suggest that there is a minor risk of pluvial flooding at the site.

Groundwater Flooding

Results of the Site Investigation suggest groundwater is typically between 1.0m and 2.0m below ground level. Given the topography of the site and this relatively low ground water table, the risk of groundwater flooding to the site is considered low.

8.5.2.3. Water Supply and Drainage

Water Supply

Completion of the development is expected to result in additional water demand on the existing public network. New connections will be required from the development to the existing hospital campus network. The estimated daily water consumption for the proposed

National Maternity Hospital is 125m^3. This is approximately a 25% increase in the existing daily consumption at the hospital. The expected peak flow demand for the proposed development would be in the region of 6.9 litres/second.

For fire-fighting purposes the pressure and flow characteristics of the water supply in the area may not be adequate to meet the requirements of the local Fire Prevention Officer from a direct feed from the mains.

Foul Water

An estimated 122m^3 per day of foul effluent will be generated on completion of the proposed new development. This is due to the increase in patient beds and staff numbers. This equates to an average flow of 1.41 litres/second (over 24 hour period) and a peak flow of 8.5 litres/second based on 6 DWF (Dry Weather Flow). The proposal is expected to result in additional demands on the existing sewerage infrastructure.

Waste drainage from laboratories will discharge into a separate waste system. Current best practice will be used to deal with all effluent waste discharges from laboratories at source. All discharges will comply with the hospital's Trade Effluent Discharge Licence requirements.

The removal of historical surface water run-off from the existing hospital campus foul drainage system will release capacity in the system and the receiving sewerage system to deal with increased foul discharges.

A new foul drainage system will be constructed around the proposed development. This will consist of a 225mm foul drain to the north, east and south of the new building discharging in a northerly direction to the existing sewerage system on Merrion Road via a new connection to the campus drainage system.

A foul drainage system will also be provided at basement level for toilets and plantrooms. This foul drainage will be pumped to the foul outfall manhole at ground level before discharge by gravity to the existing drainage system.

Surface Water

The construction of roofs, roads, car parks and paved areas could result in rapid run-off of surface water. Surface water run-off from roads / car parking areas and service yard is likely to contain mild non-point contamination. A new connection will be required to the existing hospital campus surface water drainage system before outfalling to the surface water sewer on Merrion Road.

8.6. Mitigation Measures

8.6.1. Construction Phase

8.6.1.1. Hydrology

Prior to construction, the Contractor will be required to finalise the Draft Construction Management Plan prepared as part of this EIS (refer to Appendix 2.1) to ensure that the mitigation measures detailed below are incorporated. These mitigation measures apply for the prevention of pollution to all waters during construction.

- Prepare an Emergency Response Plan detailing the procedures to be undertaken in the event of flooding, a spill of chemical, fuel or other hazardous wastes, a fire, or non-compliance incident. This plan will contain the following information:
  - Containment measures;
  - List of appropriate equipment and clean-up materials;
  - Maintenance schedule for equipment;
  - Details of trained staff, location, and provision for 24-hour cover;
  - Details of staff responsibilities;
  - Notification procedures to inform the relevant environmental authorities: Dublin City Council, the EPA and Inland Fisheries;
  - Audit and review schedule;
  - Telephone numbers of Dublin City Council Drainage and Pollution Control Divisions; and
  - List of specialist pollution clean-up companies and their telephone numbers.
- Ensure site staff are trained in the implementation of the Emergency Response Plan and the use of any spill control equipment as necessary;
- Prepare method statements for the control, treatment and disposal of potentially contaminated surface water;
- Prepare a site plan showing the location of all surface water drainage lines and proposed infiltration areas/discharge to combined sewer. This shall include the location of all existing and proposed surface water protection measures, including monitoring points and treatment facilities;
- Ensure that all appropriate licences required for construction are obtained from the relevant authorities;

- The Contractor will comply with the following guidance documents:
  - Construction Industry Research and Information Association – '*Guideline Document C532 Control of Water Pollution from Construction Sites'* (CIRIA, 2001) and
  - Construction Industry Research and Information Association – '*Guideline Document C624 Development and Flood Risk - guidance for the construction industry'* (CIRIA, 2004).

The following construction mitigation measures will be utilised to control the interaction of wash down water from concrete and cementitious material with surface water:

- All batching and mixing activities will be located in areas away from watercourses and drains;
- Surface water drainage around the batching plant will be controlled;
- There will be no hosing into surface water drains of spills of concrete, cement, grout or similar materials; and
- Washout from mixing plant or concrete lorries will be carried out in a designated, contained impermeable area.

As per the above listed guidelines, protection measures will be put in place to ensure that all materials used during the construction phase are appropriately handled, stored and disposed of in accordance with recognised standards and manufacturer's guidance.

Process water used during construction will be disposed of appropriately. Rainwater will also accumulate on the site during construction. This water will be discharged directly via suitable pollution control and attenuation measures either directly to ground within the site or to foul sewer systems via portions of the sewer network.

Where available proposed permanent connections to the public sewer systems required for the operational phase will be used temporarily for the construction phase, to optimise efficiencies and avoid the creation of new outfalls for temporary construction only.

The Contractor will ensure that any discharges to waterbodies will comply with the appropriate legislative requirements as addressed in Section 8.2.2.

8.6.1.2. Flood Risk

Excavation will be required to facilitate the works which will generate groundwater.

A secant pile cut-off has been identified as a suitable method of controlling groundwater control during construction. Any seepage/infiltration through the vertical face of the wall, together with ingress at designated weephole locations, and surface ponding from rainfall events will be gathered locally to facilitate pumping with subsequent discharge, under licence, to the local sewerage drainage network.

The pumping of groundwater, which has risen up due to excavation works, will only be required during the deeper phases of excavation. It is estimated that the required pumping rate will be low, of the order of c. 0.5-1.5 l/s.

8.6.1.3. Water Supply and Drainage

Water Supply

The Contractor will make all necessary arrangements for a temporary water supply in agreement with Irish Water and or Dublin City Council Water Division and St. Vincent's University Hospital Technical Services Department.

Foul Water

Effluent generated on the site from the Contractor's sanitary facilities will be discharged to the existing campus foul drainage system, in agreement with St. Vincent University Hospital Technical Services Department, or to a holding tank and removed off site by a certified waste removal contractor in accordance with the requirements of the Waste Management Act 1996 and 2011 as amended. Any other arrangements would be subject to agreement with Dublin City Council Environment Division and/or Irish Water. Temporary discharges utilising the existing foul drain outfall connection to the sewer on Merrion Road will be in agreement with the Dublin City Council Environment Division and Irish Water.

Incidental surface run-off from compactor units and waste service yard areas will be discharged into the foul drainage system. Grit/petrol/oil interceptors will be provided in all the above areas.

In order to ensure that no dust nuisance occurs during the construction of the drainage systems on the hospital grounds a Dust Minimisation Plan will be formulated and a series of measures will be implemented, see Appendix 12.3.

Site working hours shall be restricted to the hours specified in this EIS. Construction work shall not take place outside of these working hours.

A Traffic Management Plan will be prepared by the Contractor in agreement with St. Vincent's University Hospital, Dublin City Council Traffic Department and An Garda Síochana.

Continued access for pedestrians/patients/staff, private cars and service vehicles will be maintained to all hospital facilities and amenities during the construction of the foul drainage works.

All necessary health and safety measures will be undertaken to ensure the safety and welfare of patients, staff, pedestrian, the public, road users and construction personnel during construction of the foul drains.

Surface Water

Dewatering and surface water discharges on the site, during construction and prior to completion will be controlled and discharged to the existing Dublin City Council surface water sewerage system on Merrion Road at an agreed rate of flow in consultation with Dublin City Council Environmental Division and Pollution Control Section. All necessary facilities will be incorporated such as settlement ponds/tanks, oil/grit interceptors with shut down valves and bunded oil storage tanks adjacent to a petrol interceptor for storage of any recovered oil. A monitoring programme including sampling for water quality before discharge to the Local Authority sewer during construction will be carried out to ensure that only clean surface water is discharged to the receiving systems.

In order to ensure that no dust nuisance occurs during the construction of the drainage systems on the hospital grounds a Dust Minimisation Plan will be formulated and a series of measures will be implemented, See Appendix 12.3.

Site working hours shall be restricted to the hours specified in this EIS. Construction work shall not take place outside of these working hours.

A Traffic Management Plan will be prepared by the Contractor in agreement in agreement with St. Vincent's University Hospital, Dublin City Council Traffic Department and An Garda Síochana.

Continued access for patients/staff, pedestrians, private cars and service vehicles will be maintained to all Hospital buildings and amenities and other facilities on the Campus during construction of the surface water drainage works on site.

8.6.2. Operational Phase

8.6.2.1. Hydrology

Surface water drainage for the operational phase is outlined in Section 8.6.2.3.

8.6.2.2. Flood Risk

As the risk of flooding of the site from tidal, fluvial and groundwater sources is considered to be very low, it is not considered that remedial measures are required.

There is a minor risk of pluvial flooding at the site. Consequently, measures to address the risk of surface water entering the building are required. This risk will be mitigated by incorporating a fall away from the building entrances and a low-point within the landscaping external to the building which will be serviced by gullies draining into the attenuation tank under the landscaping.

Information is also available in the Flood Risk Assessment which is appended to this EIS, See Appendix 8.1.

8.6.2.3. Water Supply and Drainage

Water Supply

Water mitigation measures for the development include dual flush toilets with low flow rate fittings with basin taps separated by water saving self-closing timed flow fittings or infra-red detection. Passive Infra-Red control valves will be installed on urinals to regulate flushing. The installation of low flow fittings will reduce the demand on the existing water supply network.

There are three locations on the hospital campus were on site static water storage tanks are located to supplement the fire-fighting requirements with a total storage capacity of 465m^3. Any additional requirements would be agreed with the Local Fire Officer.

Foul Water

Shower and toilet facilities will use low water flow fittings to reduce the quantity of water discharging into the system.

Current best management practice will be used to deal with waste discharges from any laboratories at source. This will be achieved by the installation of dilution traps, catchpots and cooling water jackets at sinks before discharge to the internal pipework system.

External effluent monitoring chambers will be provided at outfall points before discharge to the sewers.

Proprietary grease separators will be provided at all areas of food production kitchens and canteens.

Surface Water

The provision of flow control with storm-water attenuation will ensure the rate of discharge of surface water is limited to run-off rates of 2 litres/second/hectare with a total allowable surface water discharge of 6 litres/second in line with the recommendations of the '*Greater Dublin Regional Code of Practice for Drainage Works'* and the '*Greater Dublin Strategic Drainage* Study'. The new peak flow rate is a 95% reduction in the existing peak flow rate of the redeveloped site. This will therefore reduce the quantity of surface water discharging into the receiving systems.

Sedum greenroofs will be provided to approximately 27% of the new Maternity Hospital roof area. Greenroofs will intercept and absorb the first 5-10mm of rainfall thereby reducing the volume of run-off into the receiving system. Greenroofs are effective in providing attenuation by absorbing rainfall within the substrate and the plant layers and releasing it back into the atmosphere by transpiration and evaporation thereby reducing the annual percentage run-off by up to 40%. Greenroofs also filter water as it passes through the layers thereby reducing pollutants and improving the quality of water discharging.

Proprietary surface water treatment systems like "Downstream Defenders" or "UpFlow Filters" including Class I petrol interceptors will be incorporated into the drainage design to intercept run-off and improve the quality of surface water discharging into the receiving systems in compliance with best drainage practice and Sustainable Urban Drainage System requirements. These systems will provide interception of run-off and deliver removal efficiency rates of up to 80% for oil and total suspended solids.

8.7. Predicted Impact of the Proposed Development

8.7.1. Construction Phase

8.7.1.1. Hydrology

A wide range of mitigation measures have been specified for the construction phase of the project. These mitigation methods seek to ensure that construction discharges are controlled to prevent potential pollution impacts to all receiving surface water systems and their downstream catchment areas. Consequently, the mitigation measures detailed will also prevent potential impacts to the downstream ecosystems. This is in compliance with the 2009 '*Surface Water Regulations*' and the objectives of the Eastern River Basin District River Basin Management Plan and the specific Programmes of Measures relating to all the river systems flowing into Dublin.

No negative residual impacts to water quality are anticipated with the implementation of the construction mitigation measures as stated in Section 8.6.1.

8.7.1.2. Flood Risk

It is considered that there will be no residual flood risk impact during the construction phase if the mitigation measures outlined in Section 8.6.1.2 are implemented.

8.7.1.3. Water Supply and Drainage

Water Supply

The volumes of water required during construction will be relatively small and will have a slight impact on the existing network.

Foul Water

All the Contractor's sanitary facilities will be discharged to a storage tank on site or as otherwise agreed with Dublin City Council Environment Division and or Irish Water. There will be an imperceptible impact on the receiving systems during construction.

Surface Water

De-watering operations and surface run-off discharge on the site during construction will be controlled and discharged to the existing Dublin City Council surface water sewerage system on Merrion Road at a rate of flow in agreed with Dublin City Council Environment Division.

All necessary facilities will be incorporated to ensure only clean surface water is discharged into the receiving Local Authority systems. Therefore the impact on the receiving sewerage system will be minimal.

8.7.2. Operational Phase

8.7.2.1. Hydrology

A wide range of mitigation measures have been specified for the operational phase of the project. These mitigation methods seek to ensure that operational discharges are controlled to prevent potential pollution impacts to all receiving surface water systems and their downstream catchment areas. Consequently, the mitigation measures detailed will also prevent potential impacts to the downstream ecosystems. This is in compliance with the 2009 '*Surface Water Regulations*' and the objectives of the Eastern River Basin District River Basin Management Plan and the specific Programmes of Measures relating to all the river systems flowing into Dublin.

No negative residual impacts to water quality are anticipated with the implementation of the operational mitigation measures as stated in Section 8.6.2.

8.7.2.2. Flood Risk

The proposed development will have no impact on floodplain storage and conveyance as it is located outside of the 1 in 1000 year tidal and fluvial floodplain.

8.7.2.3. Water Supply and Drainage

Water Supply

The installation of water saving devices will minimise the impact of the development on the existing water supply network. The proposed development will increase on the water demand on the existing systems.

The development will require new connections on the campus ring main system to meet the proposed National Maternity Hospital layout. These connections will have an imperceptible impact on the existing services infrastructure.

Consultations with Dublin City Council Water Division and Irish Water has confirmed that there are no known constraints on the watermains network that would suggest a difficulty in providing a connection to the development.

However, a more detailed analysis will be required to establish the specific effects of the development on the network to ensure the additional water demand can be supplied.

Foul Water

There is expected to be additional discharges to the sewerage systems as a result of the proposed development. Consultations with Dublin City Council Drainage Division has confirmed that there is capacity in the existing sewerage network to meet any increased discharges.

Surface Water

The provision of flow control with storm attenuation along with greenroofs, planted terraces, landscaped courtyards and proprietary surface water treatment systems will ensure a reduced quantity and improved quality of surface water discharging from the hospital campus to the existing Local Authority system on Merrion Road, therefore having a positive impact on the receiving systems.

8.7.3. 'Do Nothing' Scenario

Under a '*do-nothing*' scenario, there would be no change in the site's current use and the existing status would remain and the impact would be neutral.

8.8. Monitoring

The aforementioned Draft Construction Management Plan, see Appendix 2.1, will incorporate mitigation measures as outlined in Section 8.6, which will include monitoring of construction related activities during the construction phase. During the operational phase standard maintenance should ensure that the potential for blockages is reduced.

8.9. Reinstatement

There are no recommended reinstatement measures in respect of the water environment as covered within this Section.

8.10. Interactions and Potential Cumulative Impacts

8.10.1. Interactions

There are interactions between this chapter and Chapter 7, *Soils, Geology and Hydrogeology* with regard to groundwater dewatering and flood risk management. There

are also interactions between this chapter and Chapter 9, *Flora and Fauna* with regard to the potential impact of water pollution on aquatic habitats and species. These interactions have been addressed as required.

8.10.2. Potential Cumulative Impacts

A number of developments with planning consent in the vicinity of the proposed development were considered to determine potential for cumulative impacts, namely Elm Park, Bethany House, St. Johns House, RTE Campus, RDS Lands and AIB Bank Centre.

It is not considered that there will be any flood risk cumulative impacts associated with the proposed development as the site is located outside of the 1 in 1000 year fluvial and tidal floodplain.

Consultations with Dublin City Council Drainage Division have confirmed capacity in the receiving sewerage to meet the demands of the new development and other planned developments therefore the cumulative assessment is inherent in the design of the drainage system.

8.11. References

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- European Communities Priority Substances Directive 2008
- European Communities (Quality of Salmonid Waters) Regulations 1988 (S.I. No. 293 of 1988)
- Local Government (Water Pollution) Acts 1977 – 1990
- Water Quality Standards for Phosphorus Regulations 1998 (S.I. No. 258 of 1998)