7 HYDROLOGY

7.1 Introduction

This section of the Environmental Impact Statement (EIAR), prepared by JJ Campbell and Associates Consulting Engineers, assesses and evaluates the likely significant effects of the proposed development on the water environment, including freshwater bodies, surface water drainage, foul water drainage, water supply etc. during the construction and operational phases of the proposed development. In that context, this chapter provides a baseline assessment of the receiving environment in terms of Hydrology (Hydrogeology is assessed in chapter 6; Lands, Soils, Geology, Hydrogeology and Utilities) and identifies potential impacts, mitigation measures and residual effects arising from the development at St Catherine's Lands, Temple Hill, Blackrock, Co Dublin.

The key objectives are:

- Describe the baseline of the existing water environment in the area of the proposed development.
- Identify potential impacts of the proposed development on surface water during construction and operational phases of the development.
- Identify mitigation measures to avoid, remediate or reduce significant negative effects
- Assess residual effects of the proposed development and cumulative impacts of the proposed development along with other plans and projects.

7.1.1 Relevant Legislation & Guidelines

The EIAR has been prepared having had regard to the relevant provisions of the following legislation and guidelines:

Environmental Impact Assessment Directive, i.e., Directive 2011/92/EU of the European Parliament and of the Council of 13 December 20113 on the assessment of the effects of certain public and private projects on the environment as amended by Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014

Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy

Planning and Development Act, 2000, as amended;

Planning and Development Regulations 2001, as amended;

European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2001 - 2018

S.I. No. 293 of 1988: Quality of Salmon Water Regulations, resulting from EU Directive 78/659/EEC on the Quality of Fresh Waters Needing Protection or Improvement in order to Support Fish Life;

S.I. No. 272 of 2009: European Communities Environmental Objectives (Surface Waters) Regulations 2009, as amended and S.I. No. 722 of 2003 European Communities (Water Policy) Regulations 2003, as amended – which implement EU Water Framework Directive (2000/60/EC) and provide for implementation of Groundwater Directive (2006/118/EC).

S.I. No. 272 of 2009: European Communities Environmental Objectives (Surface Waters) Regulations 2009, as amended;

S.I. No. 9 of 2010: European Communities Environmental Objectives (Groundwater) Regulations 2010, as amended; and

S.I. No. 296 of 2009: European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009, as amended.

European Commission (2017), Environmental Impact Assessment of Projects Guidance on the preparation of the Environmental Impact Assessment Report.

Circular Letter PL 1/2017: Implementation of Directive 2014/52/EU on the effects of certain public and private projects on the environment (EIA Directive);

Environmental Protection Agency (2017): Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports;

Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (August 2018) PPG1 - General Guide to Prevention of Pollution (UK Guidance Note);

PPG5 – Works or Maintenance in or Near Watercourses (UK Guidance Note);

CIRIA (Construction Industry Research and Information Association) 2006: Guidance on 'Control of Water Pollution from Linear Construction Projects' (CIRIA Report No. C648, 2006); and,

CIRIA 2006: Control of Water Pollution from Construction Sites - Guidance for Consultants and Contractors. CIRIA C532. London, 2006.

7.2 Methodology

7.2.1 Desk Study

A desk study of the area of the proposed development was completed prior to the undertaking of surveying and site walk round. The desk study involved collecting all relevant geological, hydrological and meteorological data for the area of the proposed development. The desk study also included a review of the Main Drainage Report by JJ Campbell and Associates and Site-Specific Flood Risk Assessment prepared by JBA Consulting, both of which have been submitted with the application documentation. The following data sources were reviewed:

Dun Laoghaire-Rathdown County Council 2014 water quality test results for Carysfort/Maretimo Stream

Irish Water record drawings of surface water, foul sewers and water mains

Environmental Protection Agency database (www.epa.ie);

Environmental Protection Agency River Catchment Mapper (www.catchments.ie);

Geological Survey of Ireland - National Draft Bedrock Aquifer map;

Geological Survey of Ireland - Groundwater Database (www.gsi.ie);

Met Eireann Meteorological Databases (www.met.ie);

National Parks & Wildlife Services Public Map Viewer (www.npws.ie);

Water Framework Directive Map Viewer (www.catchments.ie);

Geological Survey of Ireland - Groundwater Body Characterisation Reports;

OPW Indicative Flood Maps (www.floodinfo.ie);

Environmental Protection Agency – "Hydrotool" Map Viewer (www.epa.ie);

CFRAM Preliminary Flood Risk Assessment (PFRA) maps (www.cfram.ie);

Department of Environment, Community and Local Government on-line mapping viewer (www.myplan.ie).

Hydrological survey data associated with historical projects on the site

Site Specific Flood Risk Assessment Report by JBA Consulting

Main Drainage Report by JJ Campbell and Associates

7.2.2 Site Investigations

The site was walked over and a photographic survey was conducted in January 2018 to confirm the location of manholes within the site and the location of the recently constructed flood defence wall along the Carysfort Maretimo Stream at the north east corner of the site, see figure 7.8. The likely route of potential floodwaters and key features of the site were also investigated to help with site specific Flood Risk Assessment, FRA.

Three geotechnical site investigations were carried out by Ground Investigations Ireland Limited:

February 2018:
13 Soakaways to determine a soil infiltration value to BRE digest 365
Report with recommendations

December 2018:
2 No rotary core boreholes
2 No groundwater monitoring

Report with recommendations

December 2020:
Additional site investigation was required to determine the depth to rock for the basements under proposed units A1, B1, B2, B3 and B4. A walk round visual survey at the locations for the proposed site investigation was conducted on the 24th September 2020.

6 No trial pits
6 No slit trenches
3 No cable percussion boreholes
2 No rotary core boreholes
Geotechnical and environmental laboratory testing
Report with recommendations

A full drainage survey was carried out Murphy Surveys which included all the drainage within the site and the public drainage along Temple Road along the northern boundary of the site.

7.2.3 Impact Assessment Methodology

The guidelines criteria (EPA, August 2017) for the assessment of likely significant effects require that likely effects are described with respect to their extent, magnitude, type, probability, duration, frequency, reversibility, and transfrontier nature (if applicable).

In addition to the above methodology, the sensitivity of the water environment receptors was assessed on completion of the desk study and baseline study. Levels of sensitivity which are defined in the table below are used to assess the potential effect that the proposed development may have on them.

Sensitivity of Receptor	
Not sensitive	Receptor is of low environmental importance (e.g. surface water quality classified by EPA as A3 waters or seriously polluted), fish sporadically present or restricted). Heavily engineered or artificially modified and may dry up during summer months. Environmental equilibrium is stable and is resilient to changes which are considerably greater than natural fluctuations, without detriment to its present character. No abstractions for public or private water supplies. GSI groundwater vulnerability "Low" – "Medium" classification and "Poor" aquifer importance.
Sensitive	Receptor is of medium environmental importance or of regional value. Surface water quality classified by EPA as A2. Salmonid species may be present and may be locally important for fisheries. Abstractions for private water supplies. Environmental equilibrium copes well with all natural fluctuations but cannot absorb some changes greater than this without altering part of its present character. GSI groundwater vulnerability "High" classification and "Locally" important aquifer.
Very sensitive	Receptor is of high environmental importance or of national or international value i.e. NHA or SAC. Surface water quality classified by EPA as A1 and salmonid spawning grounds present. Abstractions for public drinking water supply. GSI groundwater vulnerability "Extreme" classification and "Regionally" important aquifer

Table 7.1: Impact Characterisation Table

7.3 Receiving Environment (Baseline)

7.3.1 Site Description and Topography

The subject site extends to c. 3.9ha with 2 no. Protected Structures in a mature landscaped setting adjoining Rockfield Park. The site is bounded to the north by Temple Road, with mature residential development to the East and the Alzheimer's Society of Ireland to the West. The site is within 1km of Blackrock Village and has high accessibility to public transport. The N31 (Temple Road) is designated as a proposed QBC and both Blackrock and Seapoint DART stations are within easy walking distance.

The topography of the site and general area slopes from south to north towards Temple Road. There is approximately 5m of a fall through the site which has existing ground levels of 21m on the southern boundary, down to 16m on the northern boundary along Temple Road.

The existing site is approximately 90% parkland and 10% building / roads. The site has a number of existing school and accommodation building which were demolished in 2021. St Catherine's House which is a protected structure is to be converted into accommodation. The existing gate lodge located at the entrance into the development is to be dismantled and relocated at a new location within the site boundary.

The CarysfortMaretimo Stream runs outside the north west boundary of the proposed development

Historic OSI 6" 1831 – 1836 mapping indicates that the site was previously parkland / fields.

Figure 7.1 : OSI Historic 6" 1831 – 1836 Map

7.3.2 Water Balance

Greenfield runoff rates for the site have been calculated using HR Wallingford Greenfield Runoff Tool on WWW.uksuds.com and are shown in JJ Campbell and Associates "Main Drainage Report". Only the existing positively drained areas were used to calculate the allowable discharge for the whole site, Qbar(net): 8.17l/s using a Soil Type 3 and a Standard Percentage Runoff, SPR of 0.37.

7.3.3 Regional Hydrology

The proposed development site lies within the Liffey and Dublin Bay Catchment (Hydrometric Area 09) and River Dodder sub-catchment (WFD name: Dodder_SC_010, Id 09_16) (EPA, 2021).

Figure 7.2 : EPA Hydrometric Map – Site is within area 09, shown with red cross on the map

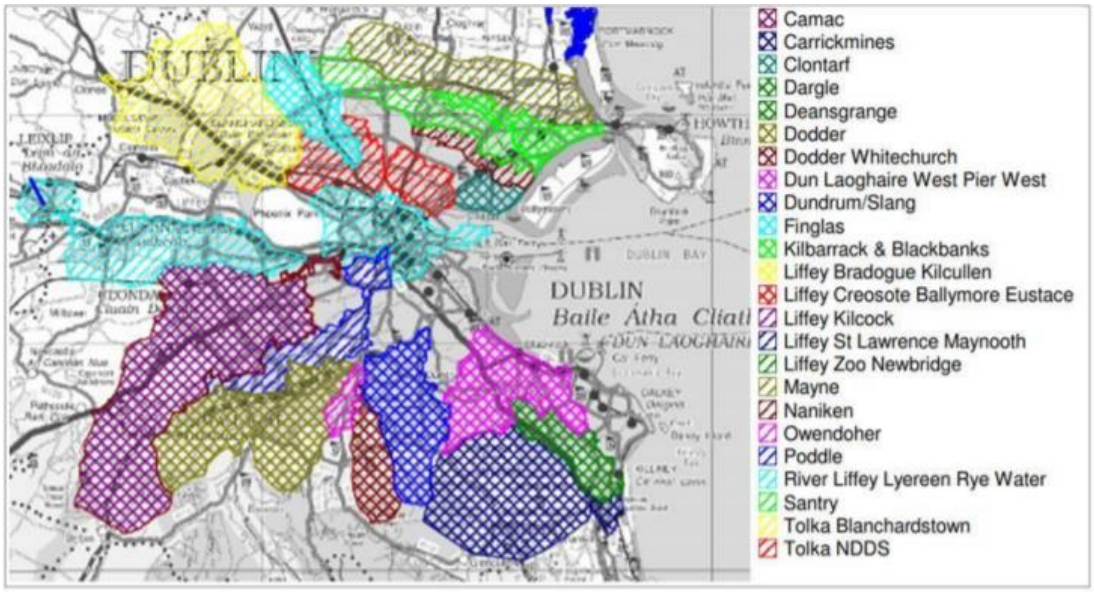

Figure 7.3 : Dublin City and Greater Region Catchment Areas – GDSDS website

7.3.4 Local Hydrology

EPA water flow network dataset shown in Figure 7.3 contains an integrated flow network that includes known flow connections through rivers, lakes and groundwater aquifers in the locality of the site

Figure 7.4 : EPA Local Water Flow Map – Site location shown with red cross on the map

7.3.5 Existing Site Drainage

The main surface water bodies in the vicinity of the proposed development lands comprise the following:

- Carysfort/Maretimo Stream which is culverted under Temple Road but is open along the western boundary of the site, the stream discharges to the sea 350m north of the development.
- 900Ø combined sewer on the western side of the site and a 1200Ø combined sewer on the north west side of the site.
- 225Ø / 300Ø public surface water sewer in Temple Road on the northern boundary which discharge to the Carysfort/Maretimo Stream.
- Increased rainfall due to climate change could cause additional flooding of Carysfort-Maretimo stream at the north west corner of the site.
- Strom water also discharges to the Irish Water combined network, over time and with increased rainfall could contribute to flooding of the combined sewer networks system.
- As there is no interception, all pollutants get washed into the Carysfort-Maretimo stream and existing combined Irish Water network.

Caryfort/Maretimo Stream:
The main watercourse is identified as the CarysfortMaretimo Stream which is located c. 10m from the site's western boundary. The Carysfort-Maretimo Stream runs predominantly in a north-easterly direction in the area and discharges to Dublin Bay c. 300m north of the site.
Flood defences are in place along the Carysfort-Maretimo in the vicinity of the development, see figure 7.8

The stream is culverted under Temple Road on the north western boundary. Other watercourses in the area have been identified as the Priory Stream which is located c. 650m northwest and the Stradbrook Stream which is located c. 850m to the southeast.

Existing surface water and foul water from building and hard standing areas within the boundary line all discharge to the existing Irish Water 1200Ø combined sewer on Temple Road. Storm water is unattenuated and there is no flow control on the storm water outfall manhole.

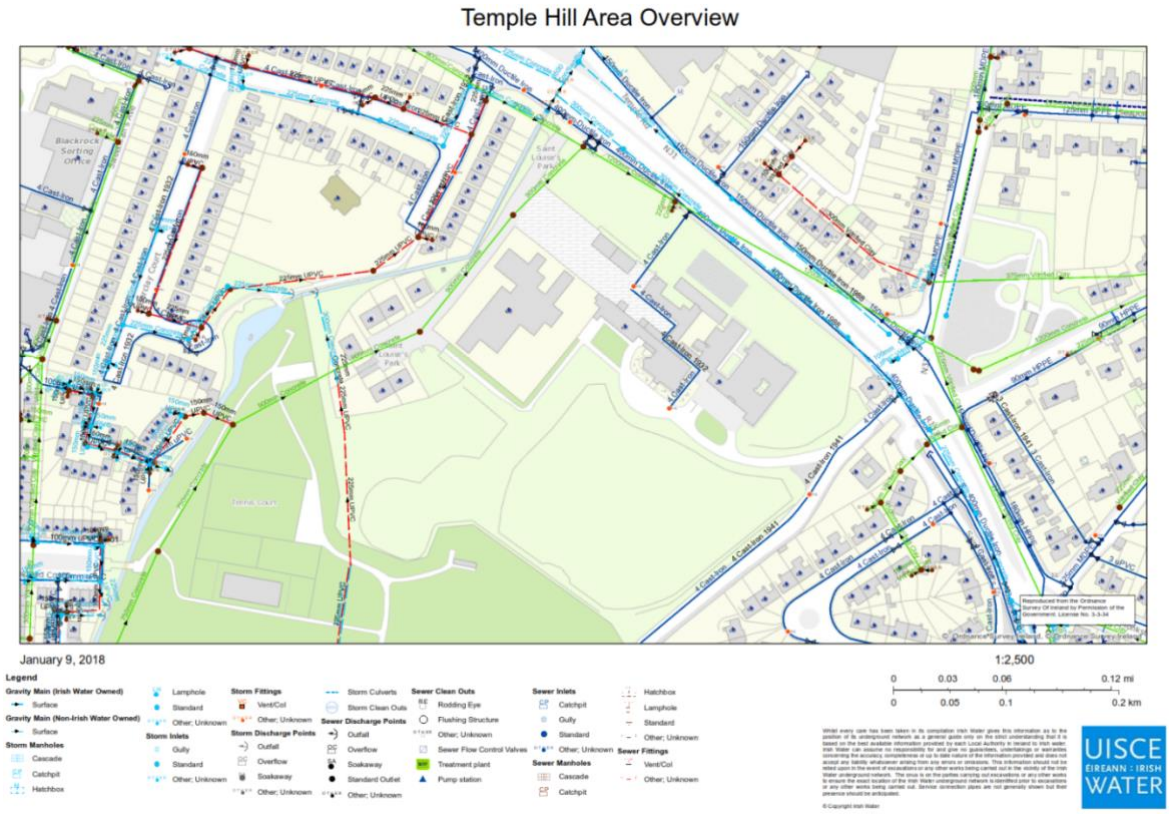

Figure 7.5: Irish Water Existing Foul and Watermain (See JJ Campbell and Associates Main Drainage Report for full size map)

7.3.6 Flood Risk Identification

JBA Consulting Engineers have completed a Site Specific Flood Risk Assessment [SSFRA] which is included in JJ Campbell and Associates Main Drainage Report, Annex H.

To identify those areas at risk of flooding, OPW's indicative river and coastal flood map (www.floodinfo.ie), the Eastern CFRAM Study is the most detailed mapping undertaken in the Dublin region. It commenced in June 2011 with final flood maps issued during 2016. The Eastern CFRAM Study involves detailed hydraulic modelling of rivers and their tributaries, including the Carysfort-Maretimo, which is the nearest watercourse to the site. Following the detailed hydraulic modelling, flood maps were produced for the 10%, 1% and 0.1% AEP flood events.

The available flood maps have been reviewed and confirm that the most northern extent of the site, and directly adjacent to the Carysfort-Maretimo, is located within Flood Zone A (defended) & B. The flood defences along the Carysfort-Maretimo stream provides flood protection up to the 1% AEP flood event.

Flooding appears to originate from Carysfort-Maretimo system following surcharging of the culvert system underneath the Temple Road, directly downstream of the site. The stream overtops its right bank which results in inundation of c. 40m into the site.

Review of the available data confirms that the 0.1% AEP flood level flood depth within the site is ranges from 0-250mm in the affected area.

Coastal flooding does not impact on or in the vicinity of the proposed development. Review of the Eastern CFRAM data indicates a 0.5% AEP and 0.1% AEP flood level of 3.04mOD and 3.25mOD respectively.

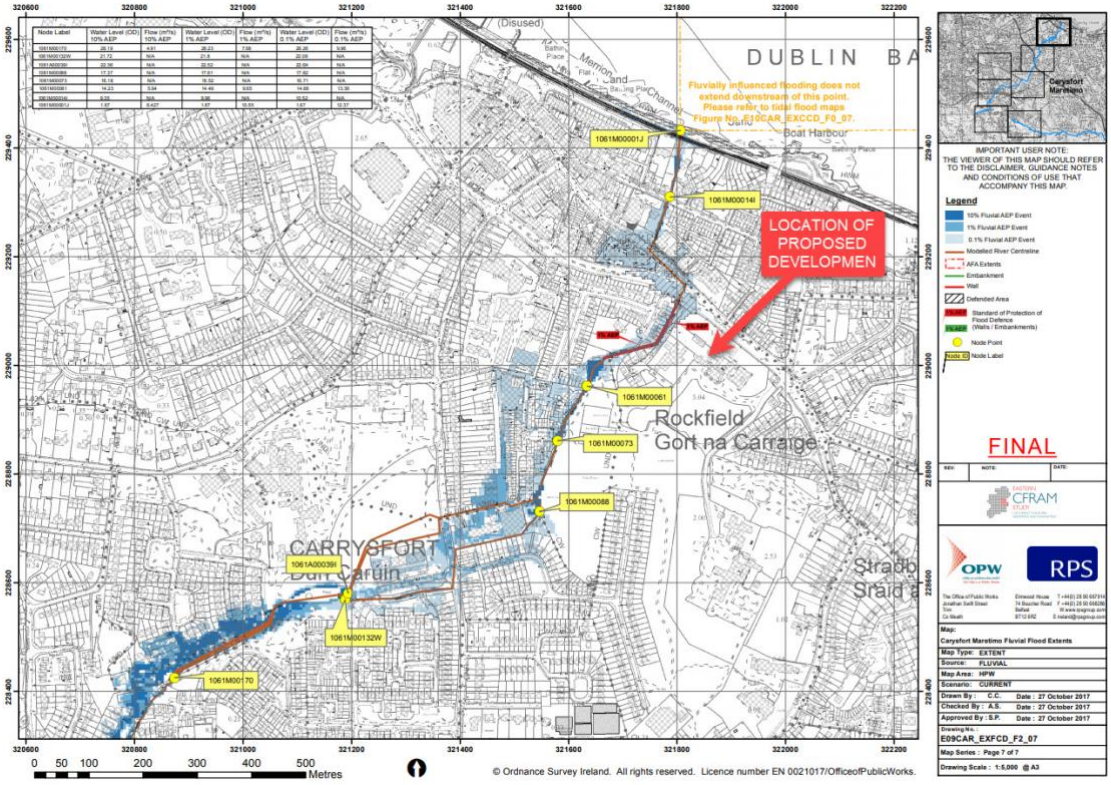

Figure 7.6: OPW Eastern CFRAM Study, Final Carysfort/Maretimo Fluvial Flood Extents mapping

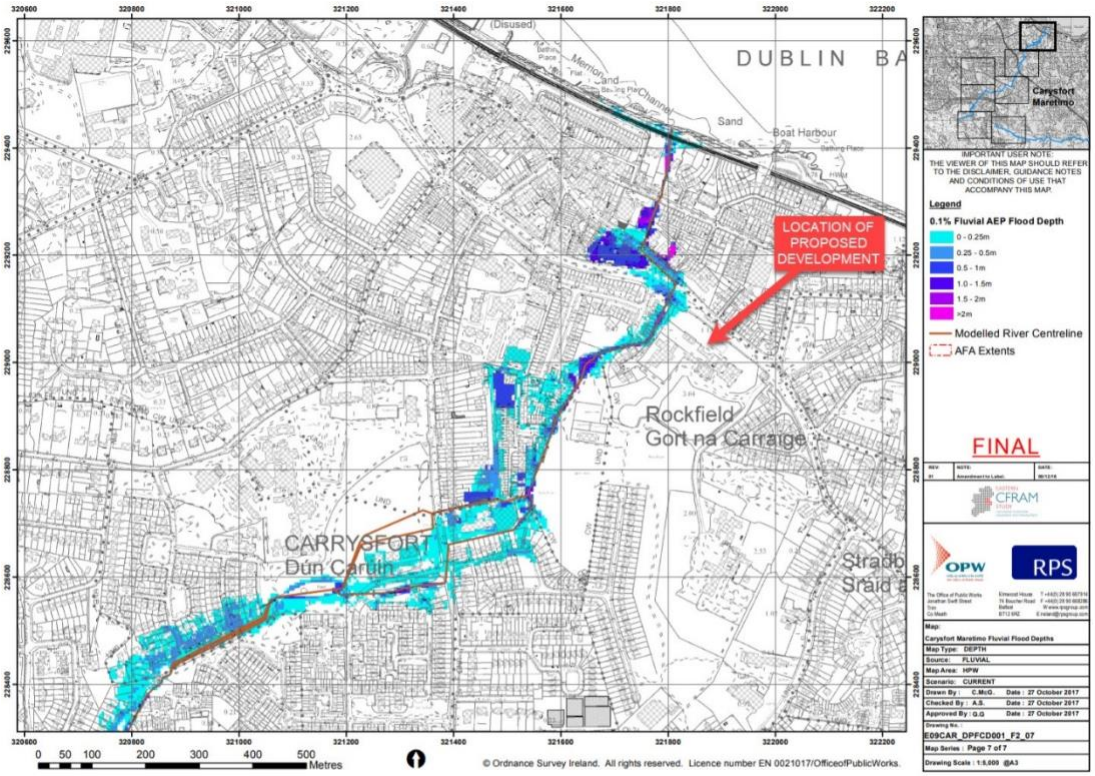

Figure 7.7: OPW Eastern CFRAM Study, Final Carysfort/Maretimo Fluvial Flood Depth mapping

Figure 7.8: Photo of flood defence wall at North West corner of the site.

7.3.7 Surface Water Quality

No EPA Biological Q-rating status data is available for the Carysfort/Maretimo stream.

7.4 Characteristics of the Proposed Development

The proposed development comprises 493 residential units delivered in a combination of new apartment buildings (ranging in height from 3- 10 storeys overall in height) and a relocated St. Teresa's Lodge.

St. Teresa's House provides for 6 apartments, comprising 5 no. 2-bed units and 1 no. 3-bed unit. The new build element of 487 units is set out in 11 no. residential development blocks (Blocks A1-C2 and D1 – E2) ranging in height from 3-10 storeys over basement comprising:

- Block A1 (5 storeys) comprising 37 no. apartments (33 no. 1 bed units and 4 no. 2 bed units)
- Block B1 (10 storeys) comprising 55 no. apartments (37 no. 1 bed units, 10 no. 2 bed units and 8no. 3 bed units)
- Block B2 (8 storeys) comprising 42 no. apartments (28 no. 1 beds, 9 no. 2 beds and 5 no. 3 beds)
- Block B3 (8 storeys) comprising 42 no. apartments (28 no. 1 beds, 9 no. 2 beds and 5 no. 3 beds)
- Block B4 (5 storeys) comprising 41 no. apartments (4 no. studio units, 4 no. 1 bed units, 27 no. 2 bed units and 6 no. 3 bed units).
- Block C1 (3 storeys) comprising 10 no. apartments (1 no. studio unit, 3 no. 1 bed units and 6 no. 2 bed units).
- Block C2 (3 storeys) comprising 6 no. apartments (2 no. 1 bed units, 4 no. 2 bed units,) together with a creche facility of 392 sq. m at ground floor level and outdoor play area space of 302sq.m
- Block C3 (1 storey plus basement level) comprising residential amenity space of 451 sq. m.
- Block D1 (6 storeys) comprising 134 no. apartments (12 no. studio units, 22 no. 1 bed units, 90 no. 2 bed units and 10 no. 3 bed units).
- Block E1 (6 storeys) comprising 70 apartment units (34 no. 1 bed units, 26 no. 2 bed units and 10 no. 3 bed units).
- Block E2 (6 storeys) comprising 50 units (1 no. studio unit, 29 no. 1 bed units, 18 no. 2 bed units and 2 no. 3 bed units).

Each residential unit has associated private open space in the form of a terrace/balcony.

Resident amenity space c. 451 sq. m. accommodating a gym and studio space at basement level; residents' lounge/café, work booths/meeting room and reception/foyer/parcel store at ground floor.

Crèche facility of 392. sq. m

252 no. residential car parking spaces (161 no. at basement level and 91 no. at surface level) and 20 motorcycle spaces at basement level are proposed. 8 no. car parking spaces for creche use are proposed at surface level.

1056 no. bicycle parking spaces (656 no. at basement level and 400 no. at surface level).

15,099.7 sq. m. public open space in the form of a central parkland, garden link, woodland parkland (incorporating an existing folly), a tree belt, entrance gardens, plazas, terraces, gardens, and roof terraces for Blocks B2 and B3.

A full description of the proposed development is included in chapter 2 of the EIAR.

The development will be constructed in a phased manner. It is anticipated that the main characteristics of the development with potential to impact the water elements are:

- Removal of topsoil, made ground, fill, soil, sub-soil and clay just above the weathered rock for the construction of basements. Approximate quantity of material to be excavated for basements at Blocks A1 to B4 is 34,000m³ and 11,000m³ for Block D1.
- Installation of main services and utilities to serve the site
- Provision of large underground surface water storage areas to satisfy run-off attenuation requirements.
- Provision of approximately 4075m² of extensive type green roofs and new road network.
- Installation of new surface water drainage and foul sewer layout to serve the development.
- Increase in foul discharge to 17.24l/s and an increase in peak water demand of 253,125 l/d

The basement will be excavated into clay about 1m to 2m above the weathered bedrock and the development will create additional impermeable surface areas.

7.4.1 Proposed Site Infrastructure and Drainage Management

STORM WATER NETWORK:

THE STORM WATER NETWORK FOR THE PROPOSED DEVELOPMENT HAS BEEN DESIGNED USING CAUSEWAY SOFTWARE.

IT IS PROPOSED TO SEPARATE THE STORM RUNOFF FROM THE EXISTING AND PROPOSED BUILDINGS AND TO USE SUDS TECHNIQUES, AS PER THE GREATER DUBLIN STRATEGIC DRAINAGE STUDY (GDSDS), TO CONTROL STORMWATER DISCHARGE FROM THE SITE. A STORM WATER CARRIER PIPE WILL BE PROVIDED AROUND THE SITE TO INTERCEPT RUNOFF AND, WHERE LOCATED WITHIN FILTER DRAINS, WILL BE PERFORATED PIPE.

BECAUSE OF THE SLOPING TOPOGRAPHY OF THE SITE, IT IS PROPOSED TO MAKE TWO SURFACE WATER CONNECTIONS SERVING TWO ZONES EACH COMPRISING APPROXIMATELY 50% OF THE SITE AREA.

SURFACE WATER CONNECTION NO 1 IS FOR ZONE 1 (EAST SIDE OF THE SITE) AND CONNECTS TO THE EXISTING PUBLIC SEWER 9002 ON THE NORTH EAST SIDE OF THE SITE.

SURFACE WATER CONNECTION NO 2 IS FOR ZONE 2 (WEST SIDE OF THE SITE), 50% OF THE PROPOSE DEVELOPMENT AND CONNECTS TO THE EXISTING PUBLIC SEWER MANHOLE ON THE NORTH CORNER OF THE SITE.

THE COLLECTION SYSTEM HAS BEEN DESIGNED WITH A VIEW TO MINIMIZING EXCAVATION DEPTHS, IN CIRCUMSTANCES WHERE, DUE TO THE NATURE OF THE SITE, SOME DEEP PIPE RUNS ARE NECESSARY. INVERT LEVELS HAVE BEEN SET TO MINIMIZE TRENCH DEPTHS WHILE MAINTAINING PIPE VELOCITIES.

Fully dimensioned attenuation tanks are shown on JJ Campbell and Associates civil drawings C6-1 and C6-2.

SURFACE WATER FROM THE SITE DIRECTED TO SEWERS WILL PASS FIRSTLY THROUGH SILT TRAPS (SUMP MANHOLES) AND THEN THROUGH ATTENUATION TANKS PRIOR TO DISCHARGING TO THE EXISTING PUBLIC STORM WATER NETWORK ON TEMPLE ROAD.

X Y – ITM SETTING OUT FOUL/COMBINED WATER

No	COVER	INVERT	X	Y
FMH F17	16.8	15.77	724620	728913
FMH F16	17.5	15.23	724663	728920
FMH F15	19.0	14.69	724706	728928
FMH F14	19.55	14.18	724740	728906
FMH F13	19.5	13.56	724770	728946
FMH F12	19.5	13.23	724793	728929
FMH F11	19.5	12.7	724793	728929
FMH F9	19.3	12.43	724851	728900
FMH F8	19.0	12.2	724868	728899
FMH F7	16.4	11.59	724889	728946
FMH F6	15.5	11.45	724888	728957
FMH F5	14.69	10.68	724839	728995
FMH F4	14.27	9.89	724786	729036
8002	13.52	8.82	724786	729036
FMH F2	14.27	9.97	724783	729037
FMH F1	13.0	11.4	724762	729053
FMH F11	19.5	12.9	724815	728912
FMH F25	19.5	17.52	724809	728901
FMH F26	19.5	18.0	724784	728880
FMH F27	19.5	18.18	724783	728870
FMH F22	19.5	18.0	724759	728893
FMH F18	20.3	TBC	724714	728871
FMH F18A	20.3	TBC	724717	728864
FMH F18B	20.2	TBC	724713	728843
FMH F19	21.0	TBC	724738	728824
FMH F20	18.5	15.0	724842	728934
FMH F21	19.0	15.4	724833	728952
FMH F22	18.85	15.7	724816	728966
CMH 7902	14.11	10.98	724658	728969
CMH 7008	12.4	10.15	724699	729034
CMH C1	12.4	10.07	724702	729037
CMH C5	12.51	9.41	724720	729075
CMH C4	12.51	9.29	724726	729072
CMH 8003	12.7	8.99	724739	729066
CMH C2	12.2	9.24	724733	729077
CMH C3	12.8	8.93	724766	729052

X Y – ITM SETTING OUT SURFACE WATER SEWERS

No	COVER	INVERT	X	Y
SMH S2	12.25	10.60	724722	729086
SMH S3	12.25	10.675	724726	729081
SMH S4	12.2	10.82	724727	729079
SMH S6	13.35	11.25	724784	729035
SMH HBZ2	16.3	11.44	724765	729012
ACCESS 01	16.15	11.46	724764	729010
SMH S9	17.4	11.65	724785	728981
SMH S10	18.5	13.61	724764	728955
SMH S11	18.5	13.76	724761	728936
SMH S12	19.55	13.92	724739	728908
SMH S13	18.1	14.08	724708	728929
SMH S14	16.0	14.55	724616	728913
SMH S27	19.5	16.05	724766	728916
SMH S28	19.5	16.07	724776	728930
SMH S29	19.2	16.12	724796	728935
SMH S30	18.6	16.19	724819	728918
SMH S31	19.0	16.31	724871	728893
SMH S32	19.74	17.1	724861	728875
SMH S33	20.3	18.0	724844	728861
SMH S34	21.3	20.1	724795	728820
SMH S35	21.3	20.2	724777	728831
SMH S44	21.3	20.3	724764	728826
SMH S36	17.5	16.45	724887	728930
SMH S41	19.6	16.05	724747	728908
SMH S42	19.6	16.05	724745	728905
SMH S43	20.0	18.05	724777	728880
SMH HBZ1	19.5	16.0	724757	728922
SMH S25	19.55	15.97	724761	728926
SMH S24	19.5	15.9	724791	728935
SMH S23	14.7	13.7	724836	728996
SMH S22	14.4	13.5	724814	729012
SMH 9002	14.1	12.77	724814	729012
SMH S38	19.2	17.775	724808	728974
SMH S37	18.6	16.6	724838	728948
SMH S39	19.5	16.85	724812	728902
SMH S40	20.0	17.9	724790	728883
SMH 9005	18.42	15.71	724909	728960
SMH 9003	12.71	12.28	724819	729042
SMH 8004	12.7	11.31	724761	729067
ATTENUATION TANK ZONE 1				
			724757	728923
			724792	728898
			724746	728908
			724780	728883
ATTENUATION TANK ZONE 2				
			724763	729012
			724793	728989
			724786	728979
			724756	729002

Figure 7.9: Setting out of Foul and Surface Sewers

STORM WATER FLOW CONTROL:

At the request of DLRCC Drainage Department, allowable discharge, Qbar (net) and not Qbar (whole site) in accordance with CIRIA Report C753 was used to calculate the allowable discharge from the positivity drained areas such as roads, roofs, all in accordance with CIRIA Report C753.

As recommended by DLRCC, Qbar (allowable discharge) was assessed using the UK Suds online tool. Soil type 3, SAAR (Average Annual Rainfall) 900mm and an area of 2.1189Ha giving an allowable discharge for the positively drained areas of 8.17 l/s.

Storage volume was calculated using rainfall data provided by MET Eireann for the site.

An attenuation volume of 1600m3 is provided for the whole site. This storage is divided between a "stormtech" below-ground attenuation structure, situated adjacent to buildings E1 and E2, providing 800m3 of storage and a reinforced concrete tank beside B2 under the road, also providing 800m3 of storage. As these storage systems are connected independently to the local authority collection system, each connection is provided with a flow limiting device (Hydro-brake) set at 4.1 l/s so that the total flow from the site is 8.2 l/s.

Hydro International design tool was used for assessing hydro-brakes to restrict the discharge from the development.

Storm Water Sustainable Drainage Systems, SuDS Proposals:

The design proposals are based on the GDSDS guideline document and on the Development Plan 2016-2022 policy requirements, and in particular policy E18 in Section 5: Sustainable Drainage Systems;

A green roof is proposed on the apartment blocks, at a minimum of 60% of the flat roof surface area, and will be installed as per Appendix 16 in Dun Laoghaire Rathdown Development Plan 2016 – 2022.

Dry swales / infiltration trenches are used as treatment of the first 5mm of runoff. The widespread use of swales cannot be implemented as the necessary trenches would damage the tree root systems, but swales / infiltration trenches shall be installed where they do not damage existing mature trees

Permeable paving at car parking bays will also intercept the first 5mm of runoff from impermeable areas of the site.

Foul Water:

Foul water drains will be on a separate system to the storm water network. Foul drains are designed in accordance Irish Water guidance document Code of Practise for Wastewater Infrastructure (Ref: IW-CDS-5030-03 Dec 2016). Foul drains will discharge to IW combined sewer on Temple Road

Watermain:

A 200Ø MDPE pipe (type PE 80 and SDR 11) will be provided, looped around the development to serve each unit. The new 200Ø water main will be connected to an existing 400Ø watermain in the path that runs along Temple Road.

7.5 Potential Impact of the Proposed Development

Potential impacts of the proposed development with regard to the hydrology environment are assessed below for the construction and operational phases.

7.5.1 Construction Phase

Phase 1 of the development will involve demolition of remaining existing buildings and removal of impermeable hardstanding areas and all existing surface water and foul drains serving the existing buildings. This phase will have an initial temporary benefit to the environment by reducing impermeable areas and surface after run-off flows as the previous building and car-park was not attenuated.

Removal of trees, as identified in consulting arborists "The Tree File" report and drawings, will follow along with stripping of the existing topsoil from the site, including existing green-field and open space areas. Excavation of the made ground/fill and lower soil/subsoil layers will then follow for depths up to 5 metres at buildings A1 and B1 to construct the basements and attenuation tanks. The removal of the overburden and replacement with an impermeable basement will remove the ability of the lands to recharge and infiltrate surface water run-off from basements car parks under the footprint of building A1 to B4 and D1. Storm water will be collected on the green roofs of these blocks, attenuated and then discharged positively to the culverted section of the Carysfort/Maretimo stream.

The development will require new surface water drainage and foul drains to serve the development. These will all be gravity sewers laid in the road network and will be slung drains within the basements serving the buildings and podium areas. The development will also provide a number of surface water storage tanks to meet the attenuation requirements of the GDSDS to protect existing flooding regimes. Due to the type of tank and depth into the clay and low infiltration rates, it will not be possible to design them to infiltrate to the ground. The majority of surface water collected on the site will, therefore, be positively discharged from the site to the Carysfort/Maretimo Stream via attenuated outlets.

The development will require a new metered water supply connection to the Irish Water water-main network to replace the existing. Impact on the water supply and existing water-main network will be imperceptible. All old and possibly leaking water pipework will be replaced with fully welded and tested piupework.

The development's construction workers will generate additional foul effluent which will be discharged to the local foul sewer network. This will place minimal additional loading (assume 100 workers @ 0.0007l/s = 0.07l/s) on the network and downstream Irish Water treatment facility. This is off-set by the previous school buildings and accommodation buildings which are to be demolished.

The existing 900Ø and 1200Ø Irish Water combined sewers on the north west corner of the site will be diverted to allow construction of the basement under blocks A1 and B1.Diversion will have no impact on the water environment.

During construction there is increased risk of accidental pollution and contamination of the Carysfort/Maretimo Stream from spills relating to re-fuelling, oils from construction machinery/vehicles and construction materials/silted run-off and concrete/cement.

7.5.2 Operational Phase

The final constructed residential development and basement under blocks A1 to B4 and block D1 of the site will help act as a seal against further contamination risks to the groundwater below the site.

On completion of the construction phase, there will not be further direct impacts to the water environment from the type of residential development proposed.

During its operational phase, the proposed development will generate additional foul effluent which will be discharged to the local foul sewer network. This will place minimal additional loading on the network and downstream Irish Water treatment facility as this is off-set by the previous school buildings and accommodation which are to be demolished, the total foul discharge from the development is only 16.38l/s. The additional foul loading will not impact the water environment as it will be treated at the Irish Water treatment works in the normal way and within its designed capacity and treatment standards.

A summary of the proposed development's potential impacts and their levels and significance of the water environment are outlined in table 7.2 below:

Nature of Impact	Impact Level	Significance Criteria
Construction		
C1 – Removal of existing impermeable areas/building and un-attenuated surface water drains.	Slight	Direct
C2 – Removal of significant volume of top-soil/sub-soils/ above the weathered layer of drainable bedrock from site and its impact on sub-surface drainage.	Slight	Direct
C3 – Reduction of site area capable of recharging groundwater and infiltration of surface water run-off.	Slight	Direct
C4 – Provision of new attenuated surface water collection system for development discharging to Carysfort/Maretimo Stream.	Slight	Direct
C5 – Impact of additional daily loading from residential workers on foul network, downstream treatment works and final discharge to WWTP.	Imperceptible	Secondary
C6 – Impact on water-main network and treatment facility of development's additional daily water supply demand.	Imperceptible	Secondary
C7 – Removal of long-term flood volume storage and re-design with attenuation/storage tanks.	Slight	Secondary
C8 – Potential existing contaminated ground on site.	Slight	Secondary
C9 – Risk of accidental spills impacting groundwater and existing surface waters/stream.	Moderate	Direct
Operational 01 – Contamination risks arising from development use/leaking pipes./contaminated surface water run-off	Imperceptible	Direct

Table 7.2: Impact Characterisation Table

7.6 Mitigation Measures

7.6.1 Construction Phase Mitigation Measures

To minimise the impact of the construction phase on the water environment, mitigation measures will be effectively implemented. These construction phase mitigation measures include the following:

- Good construction practices – such as using wheel washes and dust suppression on site roads, and regular plant maintenance – will ensure minimal risk to the water environment. The Construction Industry Research and Information Association (CIRIA) provides guidance on the control and management of water from construction sites (Control of Water Pollution from Construction Sites, guidance for consultants and contractors, CIRIA 2001). This will ensure that surface water arising during the course of construction activities will contain minimum sediment.

- The construction phase shall be monitored, in particular in relation to the following:
  - Management of run-off from the site including pumping/dewatering
  - Adequate protection measures implemented to prevent contamination of run-off prior to discharge as listed below;
  - Prevention of oil and petrol spillages

- Oil and fuel stored on site for construction will be stored within the site compound. The location of the site compound and the tanks are set out in the Construction and Environmental Management Plan [CEMP] which is appended to this EIAR. The tanks shall be proprietary self-bunded twin wall tanks.
- Only designated trained and competent operatives will be authorised to refuel plant on site.
- Mobile measures such as drip trays, spill kits and fuel absorbent mats will be used during all refuelling operations.

- Refuelling of construction machinery shall be undertaken in designated areas within the site compound (which is located away from surface water drainage in order to minimise potential contamination impacts on the water environment).

- Spill kits shall be kept in these areas in the event of spillages.

- No washing out of any plant used in concrete transport or concreting operations will be allowed on site.

- Where concrete is delivered on site, only the chute is to be cleaned, using the smallest volume of water possible. No discharge of cement-contaminated waters to the construction phase drainage systems or directly to any artificial drain or watercourse will be allowed. Wash down of chute shall be at the bunded area in the site compound.

- No batching of wet-cement products will occur on site. Ready-mixed supply of wet concrete products and where possible, emplacement of pre-cast elements will take place.

- Surface water runoff during the construction works that may become contaminated with silt or other materials shall be treated/separated before disposal by discharging into proprietary silt traps.

- Dewatering measures shall only be employed where necessary.

- Basement excavations shall be kept to a minimum to reduce impacts to the groundwater. To allow the excavation of the basements, watertight secant piles or trench fill construction shall be used which will prevent the ingress of ground water into the excavations.

- In the unlikely event of groundwater being encountered during the construction phase, mitigation measures will include dewatering by pumping to silt trap prior to discharge.

- Other measures will include excluding contaminating materials such as fuels and hydrocarbons from vulnerable groundwater areas.

- No pumped construction waste water / storm water will be discharged directly into any local watercourse.

- A discharge monitoring inspection programme shall be put in place, which will safeguard water quality.

- Surface water collecting in excavations shall be pumped to proprietary silt traps, where silt removal will be facilitated prior to discharge to further reduce the possibility of contaminants entering the local water system. Periodic testing of the surface water of contaminants entering the local water system.

- Any hazardous construction materials shall be stored appropriately in the site compound to prevent contaminating run-off or groundwater.

- The extent of sub-soil and top-soil stripping shall be minimised to reduce the rate and volume of the run-off during construction until the topsoil and vegetation are replaced

- Removal of existing long-term flood storage above ground and part replacement with managed storage in tanks and tank sewers to provide the same quantum of flood storage volume at 30 year and 100 year return events.
-

7.6.2 Operational Phase Mitigation Measures

To minimise the impact of the development's operational phase on the water environment, the following mitigation measures should be implemented:

- Surface water system shall incorporate SuDS and designed in accordance with the Greater Dublin Strategic Drainage Study (GDSDS) to reduce impact of the development on the existing environment.

- Surface water discharge rates shall be limited to existing Green-field run-off rates (i.e., Qbar Net, 8.17l/s) to prevent increased flood risk.

- Water conservation methods, such as the use of low flush toilets and low flow shower heads, shall be incorporated into the development to reduce water resource volumes and related treatment.

- A regular maintenance and inspection programme of the flow control devices, attenuation storage facilities, gullies and petrol interceptor will be implemented during the Operational Phase, so as to ensure the proper working of the development's networks and discharges.

- All waste generated by the operation of the development shall be securely stored within designated collection areas with positive drainage collection systems to collect potential run off.

- Operational waste shall be removed from site using licensed waste management contractors. A project specific OWMP has been prepared and is included as an appendix to Chapter 13, Waste Management.

- The Operator / Buildings Manager of the Site during the operational phase will be responsible for ensuring – allocating personnel and resources, as needed – the ongoing implementation of the OWMP, ensuring a high level of recycling, reuse, and recovery at the Site of the proposed Development.

  In addition, the following mitigation measures will be implemented:

  Site segregation of all waste materials into appropriate categories, including (but not limited to):
  Organic waste;
  Dry Mixed Recyclables;
  Mixed Non-Recyclable Waste;
  Glass;
  Waste electrical and electronic equipment (WEEE);
  Batteries (non-hazardous and hazardous);
  Cooking oil;
  Light bulbs;
  Cleaning chemicals (pesticides, paints, adhesives, resins, detergents, etc.);

  All waste materials will be stored in colour coded bins or other suitable receptacles in designated, easily accessible locations. Bins will be clearly identified with the approved waste type to ensure there is no cross contamination of waste materials;
  All waste collected from the site of the proposed development will be reused, recycled, or recovered, where possible, with the exception of those waste streams where appropriate facilities are currently not available.
  All waste leaving the site will be transported by suitable permitted contractors and taken to suitably registered, permitted, or licensed facilities.

  The effective implementation of these mitigation measures will ensure the waste arising from the proposed development during the operational phase is dealt with in compliance with the provisions of the Waste Management Act 1996, as amended, and Regulations made thereunder, the Litter Pollution Act 1997, the EMR Waste Management Plan 2015 – 2021 and the DLRCC waste bye-laws. It will also ensure optimum levels of waste reduction, reuse, recycling and recovery are achieved.

- Foul effluent to be collected and discharged from the site via properly constructed sewers to the public foul sewer system.

A wastewater audit will be carried out by Irish Water to ensure the construction is fully in compliance with Irish Water Code of Practice and standard details prior to taking in charge. Areas to remain in the charge of the applicant (private side drainage) will be maintained on a scheduled basis as part of the building management plan.

- The development has been designed in accordance with Dublin City Council Drainage Department's guidelines for planning applications, the recommendations of the Greater Dublin Regional Drainage Study (GDSDS) and Ciria Guide C753 – The SUDS Manual, to incorporate best practice Sustainable Drainage Systems.

- Sustainable Drainage Systems are a collection of water management practices that aim to align modern drainage systems with natural water processes. Integration of SuDS make urban drainage systems more compatible with components of the natural water cycle such as storm surge overflows, soil percolation, and bio-filtration, mitigating the effect human development may have on the natural water cycle, particularly surface runoff and water pollution trends.

  In the context of this site, the provision of the sustainable drainage systems including, green and blue roofs to intercept, filter and attenuate surface water at roof level, tree pits to intercept, filter and attenuate surface water at grade and attenuation storage devices to limit peak discharge rates to the public surface water sewer to pre-development flows, as well as eliminate surface water discharge to the combined sewer network, will result in a significant improvement on the public drainage system, from existing conditions.

- All sustainable drainage systems will be regularly maintained. Regular maintenance of the SuDS systems will ensure the effective operation of their function of treating surface water prior to discharge. This will prevent silt build-up and other contaminant discharge to the surface water network. Regular maintenance of the attenuation storage and flow control device will maintain controlled discharge of stormwater in rainfall events and prevent inundation of the surface water system.

- Surface water run-off from the development to be collected by an appropriately designed system with contaminants removed prior to discharge e.g. via a light liquids separator.

  Collection networks shall be regularly monitored, maintained and serviced.

7.7 Residual Impacts

Following implementation of the mitigation measures above, the potential impact of the development on the water environment will be effectively minimised. The residual effects are predicted as follows:

- Removal of localised clay layer above the weathered bedrock will have an impact on the wider hydrological characteristics.
- The extent of the proposed development will reduce the existing local recharge potential to ground for the non landscaped areas of the site area. The residual impact will be imperceptible of the wider water environment
- The existing sewer network is combined, surface water and foul water both discharging to the existing Irish Water network. The new sewer system will be on separate system and no storm water will discharge to the foul network. The impact of the additional foul loading to the existing network will be negligible.
- The use of SuDS features will mitigate any potential impacts relating to changes in runoff rates and volumes whilst also maintaining quality of water quality discharging to the Carysfort-Maretimo stream. The effect of the additional run-off on the Carysfort-Maretimo Stream will be negligible.
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7.8 Do Nothing Scenario

In the short term if the proposed development did not proceed, the baseline will not change and there would be no additional impact on the existing hydrology of the site as the land use would remain unchanged being mostly green-field with some existing buildings and hard standing.

Over time if the development did not proceed, increased rainfall due to climate change could cause additional flooding of Carysfort-Maretimo stream at the north west corner of the site. Strom water also discharges to the Irish Water combined network, over time and with increased rainfall could contribute to flooding of the combined sewer networks system.

As there is no interception, all pollutants will continue to get washed into the Carysfort-Maretimo stream.

7.9 Potential Cumulative Impacts

This section considers the potential cumulative impacts on the water environment of the proposed development in combination with other plans or projects.

Existing buildings within the site boundary:
Existing school and accommodation buildings within the site boundary have been demolished. The only building to be retained within the site boundary is St Catherine's House, which is vacant. The Gate Lodge which is also vacant is to be dismantled, stored on site and reassembled at a new location.

Existing buildings / developments outside the site boundary:
The Alzheimer Society of Ireland is located on the western boundary, the Alzheimer building is located 15m to the west of the boundary line.

St Vincent's Park housing estate is located on the eastern boundary, rear gardens of the houses back onto the eastern boundary.

Rockfield Park which is a green space is located on the southern boundary.

Avondale Crescent housing estate is located 130m from the south west boundary and Daughter of Charity complex is located 140m from the south east boundary.

Carraig Tennis Club is located 25m from the south west boundary.

Houses on the opposite side of Temple Road are located 30m from the northern boundary line.

Planned developments outside the site boundary:
A planning search for developments in proximity to the proposed development:
D21A/0958 91 Residential Units 0.49Ha 150m from northern boundary
No other planned developments were identified in close vicinity.
All new developments have to incorporate SuDS measures and comply with the Greater Dublin Strategic Drainage Strategy, the combination of this development with other developments is considered to be neutral and of an imperceptible significance.

Hydrology:
Storm water management within the development incorporates a number of SuDS measure including green roofs, permeable paving and swales. Storm water discharge for the whole site is limited to 8.17 l/s and the 1:100 year storm event is attenuated with a 20% allowance for climate change. The cumulative impact is considered to be neutral and of an imperceptible significance.

Overall, the impact on hydrology environment as a result of the wider developments in the area are considered to be long term and imperceptible. Provided the mitigation measures identified in this chapter of the EIAR are effectively implemented, then the cumulative impact of the proposed St. Teresa's SHD with other projects in the vicinity is predicted to be neutral.

7.10 Conclusion

The proposed development is a high quality residential type development with extensive green opens areas with mature trees. The greatest impact on the hydrology is from the management of surface water run-off and potential contamination during the construction phases.

The existing buildings and hard standing areas are not attenuated and discharge to the public combined sewer in Temple Road. There is no interception of the first 5mm of rainfall which allows contaminates to discharge to the public sewer system.

The proposed development has been designed and will be constructed with the proper drainage systems (foul and surface water on separate systems), green roofs, extensive landscaping and attenuation. In these circumstances, it is considered that the proposed SHD will have only a slight impact on the water environment, which will be positively drained to the existing Carysfort/Maretimo Stream which discharges to the sea 350m to the north of the proposed development.

The site is separated from the Carysfort-Maretimo stream by the existing flood defence wall, see figure 7.8. Construction and operational mitigation measures will protect the stream from contaminates.

Notwithstanding this, during each phase of the proposed development (construction and operation) a number of activities will take place on the proposed development site, some of which will have the potential to affect the hydrological regime or water quality at the site or its vicinity. These potential impacts generally arise from sediment input from runoff and other pollutants such as hydrocarbons and cement based compounds, with the former having the most potential for impact during the construction phase.

Surface water drainage measures, pollution control and other preventative measures have been incorporated into the project design to minimise significant adverse impacts on water quality and downstream designated sites.

During the construction phase, the surface water drainage plan will focus on silt management to control runoff rates to the municipal sewer. The key surface water control measure is that there will be no direct discharge of development runoff into local watercourses. This will be achieved by avoidance methods and design methods (i.e. surface water drainage to sump and holding tank).

Preventative measures during construction include fuel and concrete management.

Overall, the proposed development will not result in significant impacts to surface water quality, provided the proposed mitigation measures are effectively implemented.

No significant cumulative impacts on groundwater or designated sites are predicted.